



THE Prairie Climate Resilience PROJECT

Producer Coping and Adaptation Responses to Weather Shocks and Stresses in Southern Alberta

March 2008

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Executive Summary

Introduction

This project was part of two larger studies being conducted by the International Institute of Sustainable Development: The Prairie Climate Resilience Project and the Adaptive Policies Project. The specific objective of the field research reported in this document was to examine farm-level and organization-level experiences with and responses to extreme weather events in the Coaldale and Foremost regions of Alberta.

Methodology

Forty semi-structured interviews were conducted between November 2007 and February 2008. Twenty interviews (15 with agricultural producers and five with agricultural organizations) were conducted in each region for a total of 40. Interviews were carried out in person or over the telephone and ranged in length from 12 minutes to 1.5 hours with an average of 50 minutes.

Analysis and Results – Coaldale Region

Coaldale is located 12 kilometres east of the city of Lethbridge in Southern Alberta. Farmland in the Coaldale region is dominated by irrigated land, though some producers also work small numbers of dryland acres. Typical crops grown in the region are sugar beets, potatoes, beans, corn, wheat, canola and barley. As well, irrigation has supported the development of dairy, hog and cattle operations.

The five organizational representatives interviewed for the study represented the following groups: St. Mary River Irrigation District (SMRID), Alberta Irrigation Projects Association, Alberta Agriculture and Rural Development (AARD) (Technology and Development Branch, Lethbridge Research Station—the AgTech Centre) and Reduced Tillage Linkages (RTL). The 15 producer participants had operations of various types (livestock, fruits and vegetables, potatoes, sugar beets and mixed grains/pulses) and sizes 80 acres to 25,000 acres as part of a cooperative). Eleven were fully irrigated and four were mixed irrigation/dryland operations.

Identification of Extreme Weather Events

Interviewees were asked to identify extreme weather events that had taken place during 2000-2007. Four major weather events emerged from the analysis:

- 2001 drought conditions (entire season);
- 2002 heavy rains and flooding (June);
- 2005 heavy rains and flooding (June and September); and
- 2007 extreme heat and drought.

Non-weather Shocks and Stresses

Respondents were also asked to comment on shocks and stresses they've experienced that were not related to the weather. The main stresses identified were BSE, labour issues, energy costs, currency appreciation, disease and insect pressure and rising grain prices.

Dealing with Weather Extremes – Immediate Coping Mechanisms

The report provides an analysis of how interviewees responded in the short term to drought conditions, extreme heat and heavy rains and flooding.

In response to drought, two main coping strategies were identified:

1. diverting water to high-value crops; and
2. purchasing water rights from other sources.

Aiding in this response was that producers knew in advance of the season that water would be rationed and thus could make management decisions based on this knowledge. Heat extremes were always discussed in concert with drought conditions, and while there were mechanisms to deal with drought in the short-term, producers could only wait out the extreme heat.

After a series of heavy rains, the major coping mechanism reported by interviewees was to find ways to move the water off the land. The main strategies identified in the interviews were:

1. pumping the water out; and
2. digging ditches.

Dealing with Weather Extremes – Long-term Adaptation Mechanisms

There was general recognition among interviewees that the Coaldale area was prone to extreme weather events. One respondent said that, “we’re in an area where you know there’s going to be cropping disasters; you know there’s going to be deficits in moisture. We try to manage our farm on that basis because they are not a surprise by any stretch of the imagination.”

Producers must be willing and able to deal with both extreme drought and extreme moisture while not knowing when they will experience these conditions. With this in mind, producers have made many long-term adaptations to their farming operations. In the area of farm management techniques, participants discussed switching to reduced till/no-till or organic farming practices, using different seeding/harvesting schedules, building drainage systems and making different crop choices. Increasing efficiency was another long-term adaptation measure identified by participants in Coaldale. Areas of increased efficiency include reduced water use, reduced energy use, buying better equipment and building economies of scale. Study participants also reported using research expertise and producer networks as helping factors in dealing with extreme weather events. Specific sources of research expertise mentioned in the interviews were the Lethbridge Research Station, the Swift Current and Indian Head Agriculture and Agri-Food Canada (AAFC) Research Centres, the AgTech Centre, AARD, the Irrigation Districts (IDs) and (RTL).

Use of Government Programs

In general, the comments from interviewees regarding government programs were negative. Some felt that programs were designed to support producers who are poor managers. Others felt that there were no useful programs for producers outside of cattle or grain farming. More specifically, the Canadian Agricultural Income Stabilization (CAIS) program was seen as complicated and difficult to use (too much time and paperwork), and there was a lot of uncertainty related to whether a producer would receive funds or not.

Analysis and Results – Foremost Region

Foremost, Alberta is located 130 km southeast of Lethbridge and 100 km southwest of Medicine Hat. The county is approximately 7,200 km² in area and is known as an extremely dry and arid agricultural region. Organizational participants represented municipal government, farm retail supply outlets, farm groups and agricultural research and conservation organizations. Producers ran operations that ranged from 2,000 acres to 13,000 acres and included grain, mixed farming and ranching operations. Grains grown were wheat, durum, barley and pulses, as well as some canola, mustard and other oilseeds.

Operation Changes

Operation changes were primarily those that helped maintain soil moisture (such as switching to minimal and no-till equipment and related techniques). Numerous producers have increased the size of their operations in the recent past and many are currently looking to acquire more land.

Identification of Extreme Weather Event

The three major extreme weather events were a drought in 2000/2001, extreme rains early in 2002 and extreme heat in 2007. The persistent condition that producers have always had to face is the lack of moisture and the aridity of the region. These weather events have taught organizations to be more financially sound and to steer their research efforts toward adapting to drought and lack of moisture.

Non-weather Shocks and Stresses

Of the numerous non-weather related stresses in the region, changing global markets and commodity prices, increasing input costs, the increasing cost of land, the BSE crisis and the ineffectiveness of the Canadian Wheat Board (CWB) were commonly mentioned and criticized.

Dealing with Weather Extremes – Immediate Coping Mechanisms

Short-term coping mechanisms for producers have included the maintenance of crop insurance and already existing long-term adaptive farming techniques (for example, minimal tillage) and a lack of response (producers felt that there was nothing they could do in the short term to address these weather events). Coupled with this response was a sense of frustration and resignation. During extreme weather events, producers decreased their overall costs by reducing input (for example, not taking machinery out during extreme droughts), minimizing their movement on the fields during droughts and wet events, hiring more labour to harvest crops during short time windows, the relocation of livestock to other provinces, and a reliance on being financially sound and able to cope for a year or two with limited yields.

Dealing with Weather Extremes – Long-term Adaptation Mechanisms

Long-term adaptations implemented by producers were predominantly focused on in-field techniques such as continuous cropping their land to reduce soil erosion, rotation of crops and adjusting seeding times to take advantage of early season moisture. Minimal and no-till techniques such as one pass to spray, seed and fertilize, as well as the use of technological advances (such as seed drills), were common strategies that many producers had adapted in the past five to seven years. Global Positioning System (GPS) technology in the machinery was also used to improve

efficiency of work hours, and chemical and fuel use. Planting shelterbelts, installation of community pipelines, and long-term planning and stronger marketing strategies were also effective strategies adopted by participants as their operations evolved. Critical to the survival and ability of many operations to adapt to changing weather and stresses was the network of knowledge sharing. This occurred in various ways including participation in producer groups, regular gatherings at the farm supply store, information shared over a coffee in farm kitchens,

A range of factors has aided producers and organizations in their ability to cope and respond to weather and non-weather-related stresses. These included participation in educational opportunities, having crop insurance, networking, participation in producer and marketing groups and having widespread operations that could cushion the effects of local weather events.

Abetting factors included the fact that Foremost is in a relatively isolated area and this made it hard to compete for labour and generated the attitude of being forgotten by the rest of Alberta (for example, the government). The high cost of land, increasing costs of operations (for example, fuel and fertilizer), lack of technological support from the research centre and the inefficiency of some government programs (for example, crop insurance) also affected the ability of producers to respond adequately to some of the extreme weather events.

Use of Government Programs

Participants in general felt that programs that were meant to offer immediate aid or assistance were often inadequate and lacking (for example, CAIS). Programs that helped to establish long term adaptive measures (for example, community pipelines) and improve on methods and technologies on the farm were more satisfying and successful at achieving their objectives.

Producers did use CAIS, but overwhelmingly it was thought to be challenging and costly to use. Many participants had crop insurance, but many felt a major flaw was its use of regional averages and did not cater to their specific operations. Many participants felt that the National Environmental Farm Planning Initiative (NEFPI) (used by producers to develop environmental farm plans or EFPs) was effective and made them more aware of how they ran their operations. NISA was no longer running, but it was much preferred by participants compared to CAIS. Other programs used included the Shelterbelt Program, Ducks Unlimited (DU) programs, Canada-Alberta Farm Stewardship Program (CAFSP) and the Canada-Alberta Water Supply Expansion Program (CAWSEP).

Synthesis of Coaldale and Foremost Cases

A comparison of the two case study locations highlights common trends and approaches as well as unique features of each region.

Common to both regions were three major weather events—a drought in 2001, heavy rains and flooding in June of 2002 and extreme heat and dryness in 2007. Foremost participants commonly mentioned dealing with persistent winds, while Coaldale participants uniquely noted that heavy rains had taken place in 2005.

Common short-term coping mechanisms for drought and extreme heat included having crop insurance, crop diversification, crop rotation and minimal-till techniques. Coaldale participants were able to adjust their irrigation strategies to cope with drought and the heat, while Foremost producers

reduced input costs and became more financially sound. Long-term strategies included participation in market research groups, the use of technology, shelterbelts, community water pipelines and the dissemination of local knowledge between producers.

Coping with heavy rains and flooding, producers in both regions made use of crop insurance and incorporated long-term adaptation strategies such as crop rotation and shifted seeding and harvest times. Coaldale producers pumped water off the land, dug ditch and drainage systems and built more permanent drainage systems over the long term, while Foremost producers felt that there was little that they could do and simply reduced their disturbance of the land.

Factors that aided in producer ability to respond to stresses included participating in research and learning programs, having wide-spread operations, the use of government programs, organic practices, networking with other producers and adapting to the land. Unique to Coaldale were strategies related to irrigation including water-rationing agreements, implementing more efficient irrigation technologies and receiving help from SMRID with drainage during the flood. Aiding factors unique to Foremost included using personal savings, receiving rains, participating in management groups and having more machinery to increase efficiency.

Hindering factors common to both regions included the increasing costs of doing business, labour shortages, insufficient or poorly managed government programs, and increased insect and disease pressure. Coaldale participants further mentioned hindering factors such as the timing of the weather extremes, damaged machinery and the contamination of the water supply by livestock operation runoff. Respondents from Foremost identified a lack of technical support at the nearest research centre, a restriction on the use of certain fertilizers and a threat of bankruptcy as hindering factors.

Non-weather shocks and stresses were similar between Coaldale and Foremost. Common shocks stresses included, the BSE crisis, the changing commodity prices, increasing costs of business, rising land prices, labour shortages, lack of subsidies and the increasing value of the Canadian dollar. Unique to Foremost, some participants mentioned the CWB as a major stress, citing it as an organization that severely restricts marketing opportunities for producers.

Many programs were utilized in both regions. CAIS, crop insurance and the NEFPI were the most widely used and commented upon programs for both regions. Generally, participants made use of CAIS, but thought it overly complicated and difficult. Crop insurance was widely used by producers in both regions, and it was commonly thought that even though it wasn't perfect, it did offer some protection. The NEFPI was used widely by participants in both regions, and for the most part it was an effective and well-received program. Other programs common to both regions, but with limited participation, included the DU habitat programs, CAWSEP, the Shelterbelt Program and CAFSP.

1.0 Introduction

This project is part of a larger study (Adaptation as Resilience Building) with the broad research objective of producing a comprehensive policy analysis for agricultural adaptation to climate change on the Canadian Prairies. The specific objective of this project was to examine farm-level and organization-level experiences with and responses to extreme weather events in the Coaldale and Foremost regions of Alberta.

1.1 Study Methodology

Forty semi-structured interviews were conducted between November 15, 2007 and February 15, 2008. Twenty interviews were conducted in the Coaldale region and 20 interviews were conducted in the Foremost region, 15 with producers and five with agricultural organization representatives in each region.

Interviews were carried out in person or over the telephone and ranged in length from 12 minutes to 1.5 hours with an average of 50 minutes. Most of the interviews were digitally recorded. The interviews loosely followed a questionnaire (see Appendix 1), though this was used as a starting point and further questions/probes were added depending on the responses of the interviewee.

Recruitment for interviewees began with the researchers visiting Coaldale and Foremost to introduce the project and find contact names. The researchers visited the Chamber of Commerce and the community centre in Coaldale and attended an EFP meeting in Foremost. As well, they attended the Southern Alberta Conservation Association conference on Nov 27 to network with other potential interviewees and did online searches for farm directories. The “snowball” technique was also used after the first few interviews were completed.

Potential interviewees were contacted by telephone and further information on the project, along with the questionnaire and consent form, was sent by email or fax in advance of a scheduled interview. A copy of the consent form can be found in Appendix 2, and text from the email outlining further project details can be found in Appendix 3.

Note: All interviews were confidential. Each study participant has thus been given an identifying label. For the Coaldale case, the 15 producers are labelled C1, C2 or C3, through to C15. Organizational representatives are labelled C16 to C20. A similar format is used for the Foremost participants (F1 to F20).

2.0 Analysis and Results – Coaldale

2.1 Highlights of Agriculture in Coaldale

Coaldale, a town of 6,200 people, is located 12 km east of Lethbridge in Southern Alberta. A defining characteristic of agriculture in the area is irrigation. The broader Southern Alberta region contains 1.5 million acres of irrigated land, comprising two-thirds of the total number of irrigated acres in Canada. Farmland in the Coaldale region is thus dominated by irrigated land, though some producers also work small acreages of dryland as part of their operations. Typical crops grown in the region are sugar beets, potatoes, beans, corn, wheat, canola and barley. As well, irrigation has supported the development of dairy, hog and cattle operations. Coaldale is located within the SMRID, one of a network of 13 IDs within the province. Figure 1 shows a map of the IDs in Alberta (from the AAFRD website).

Also important to the context of farming in Coaldale is the presence of three large processing plants within a half-hour's drive of the town centre. Rogers Sugar has a long-standing sugar beet processing plant in Taber and contracts with approximately 400 local sugar beet producers. As well, two potato processing plants were built in 1999, one by McCain's in Coaldale and one by Lamb-Weston in Taber.

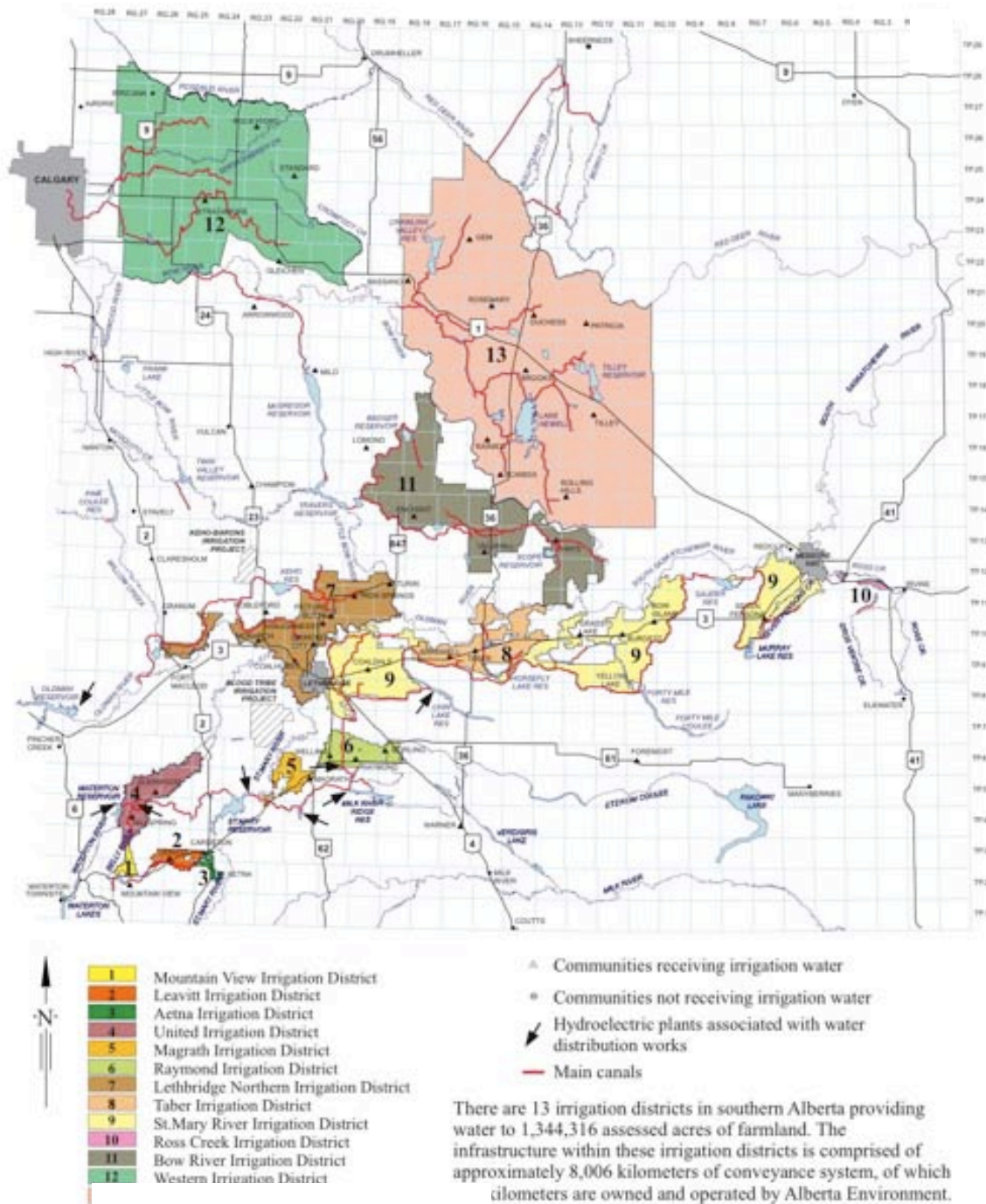


Figure 1: Alberta's Irrigation Districts.

2.2 Overview of Coaldale Participants

Five agricultural organization representatives and 15 producers were interviewed for this study. The five organizational representatives represented the following groups: SMRID, Alberta Irrigation Projects Association, AAFRD (Technology and Development Branch, Lethbridge Research Station), and RTL. Table 1 provides details of the farm size (acres of

irrigated and non-irrigated land) and farm type (for example, crops and/or livestock) for each of the 15 producers interviewed.

Table 1: Overview of Coaldale Producer Operations

Farm Size		Farm Type
Irrigated Acres	Non-irrigated Acres	
3,000	300	Mixed (cereals, pulses, oilseeds).
75	2,625	Mixed (cereals, pulses, oilseeds), cow/calf.
350	0	Dairy, (mixed) feed for cows.
3,000	0	Potatoes.
2,250	250	Feedlot, silage (corn/barley).
1,300	0	Mixed (alfalfa, corn silage, grains) cattle-feeding, dairy.
80	0	Fruit and vegetables.
80	0	Fruit and vegetables, lamb, beef, chickens, turkeys, grains, hay, alfalfa.
3,000	0	Mixed (sugar beets, potatoes, pulses, grains).
2,200	0	Mixed (potatoes, pulses, grains, corn).
2,700	0	Mixed (potatoes, cereals, pulses).
8,500	16,500	Mixed (cereals, potatoes, pulses) plus range cows, chickens.
1,200	0	Mixed (grains, sugar beets, pulses) plus feedlot.
80	0	Vegetables (cabbage, squash, zucchini).
10	0	Fruit and vegetables.

Important highlights from the table are:

Farm Size		Irrigation		Farm Type	
0-350 acres	5	Fully irrigated	11	Livestock	5
350-1000 acres	1	Fully dryland	0	Mixed grains/pulses	10
> 1000 acres	9	Mixed	4	Fruit and vegetables	4
				Potatoes	4
				Sugar beets	2

2.3 Changes to Operations in Last Five Years

Producers and organizational representatives were asked to describe changes in farming operations in the last five years. From an organizational perspective, the major changes that have taken place in the Coaldale region are that producers are increasing the size of their operations and are specializing in particular crops. Specifically, there has been a large shift to potatoes because of the McCain's and Lamb-Weston plants being built in the area. Producers need larger acreages when they are growing potatoes because they rotate each field only once in every three to four years. They also need an economy of scale for equipment and storage to be financially competitive. As well, organizational representatives noted that there is a regular generational turnover in farming operations (older producers are retiring and newer generations of the family take over) or the farms are bought by younger producers.

Four producers reported making no major changes to their operations in the last five years, four streamlined their operations to focus on potatoes (with some switching from sugar beets), five increased the size of their operations (more cattle or expanding total acreage), three changed farming practices (for example, switching to no-till farming or organics) and one switched to a more efficient irrigation pivot. See Table 2 for a detailed list of reported changes.

Table 2: Reported Changes to Operations in Previous Five Years

Producers	Organizations
<ul style="list-style-type: none"> • No major changes (C1, C2, C13, C14). • Fine-tuned operation (C2, C3). • Changed feed for dairy cows (C3). • Streamlined to only growing potatoes (C4), started growing potatoes (C9), switch from sugar beets to more potatoes (C10), quit sugar beets to specialize in potatoes (C11) • Increased cattle numbers (C5). • Expanded acreages (C4, C9 and C11). • Built a greenhouse and started a café (C7). • Switched to more efficient irrigation pivots (C6). • Switched to organic farming (C8). • Switched to no-till (C12). • Used wood mulch on row crops to retain moisture (C15). 	<ul style="list-style-type: none"> • Generational turnover/retirement was the major change in last five years (C16, C20). • Significant increase in water use efficiency (new pivots, low pressure for efficiency and drop-tube technology)—converting from side-wheel systems to centre-pivot systems (C18). • Dryland producers are moving to no-till practices (C19). • Producers are specializing more and getting larger areas of land (especially for potatoes)—building economy of scale (C18, C19 and C20). • Land prices increased (mostly due to demand for potatoes) (C20).

2.4 Timeline of Extreme Weather Events

A timeline is provided in Table 3 below that outlines the extreme weather events identified by the participants in the study. The year and the kind of weather extreme are given, along with a list of the participants that talked about the extreme in bold, italic text.

Table 3: Timeline of Extreme Weather Events

Year	Extreme Weather Event
2000	Drought conditions (entire season) (C2 and C11)
2001	<i>Drought conditions (entire season) (C2, C3, C4, C5, C6, C8, C9, C10, C11, C13, C18 and C20)</i>
2002	Strong winds—“Black Monday” (C8)
2002	<i>Heavy rains and flooding (June) (C2, C4, C5, C6, C8, C9, C10, C11, C13, C17 and C19)</i>
2003	Extreme heat—more than 30°C for eight days straight (C1)
2005	<i>Heavy rains and flooding (June and September) (C1, C2, C3, C4, C5, C7, C9, C12, C13, C14, C17, C18 and C20)</i>
2006	Strong winds (spring and fall) (C1 and C20) Heavy rains (June) (C9, C14)
2007	<i>Extreme heat and drought (C4, C7, C8, C9, C10, C14, C15, C16, C19 and C20)</i>
2007	Hail (August) (C4 and C9)

Emerging from this timeline are four major extreme weather events (identified by a majority of the interviewees and shown in bold and italics in the timeline). Descriptions of each of these four weather extremes are provided below, along with the impacts of the extreme on farming operations.

2.4.1 2001 Drought Conditions

The year 2001 was reported by an organizational representative to be the driest ever in the region—or at least since records started being kept (C18). In the fall of 2000, the reservoir storage of water was at 26 per cent capacity, whereas in typical years, it was usually around 55-60 per cent (C18). Forecasts suggested that the area would have 50 per cent of normal water supplies for the 2001 irrigation season, though this was revised to 60 per cent after an early spring rains (C17). Because of the water shortfall, the St. Mary River Irrigation District (SMRID), along with other IDs that take water from the three main tributaries that supply the Oldman River from the south, instituted a water ration to begin the season for the first time in its history.

Irrigation producers were notified by the SMRID that there would be limited volumes of water available, giving them the opportunity to modify their operations accordingly, for example by using the available water for high value crops and converting other fields to dry land for the season (strategies will be discussed in more detail below). One organization rep (C16) commented that the, “producers were stressed out,” and you could see it in their attitudes and how they were interacting. However, many participants in the study took it in stride, saying things like, “we’re lucky having irrigation because you have the capability of still growing a crop” (C5) and being aware of the ration, “allowed us to manage the water allocation that we had... we just had to sacrifice” (C3). The immediate impacts of the drought and water rationing on producers included:

- reduced yields—(anywhere from 10-30 per cent reductions were reported) (C4, C5, C9, C10);
- spending more time irrigating—less time with the family and more time out in the field (C12) and moving irrigation sets every three to four hours right through the night instead of every seven to 12 hours (C13); and
- higher energy costs for irrigation pumping (C6).

2.4.2 2002 – June Rains and Flooding

Overall, the 2002 growing season was described as cold and wet. Participants reported a sustained early frost that year (C4 and C11) and snow in August (C2). The dominant weather event of that year was heavy rains during the month of June. The heavy rains brought flooding and heavy runoff, causing washed out roads, eroded fields and drowned crops. Below are comments from interviewees about the June rains:

- participant C5 – received 9" of rain in a week, "There was just a lot of rain in quite a short period of time that was hard for a feedlot to accommodate";
- participant C6 – land received 6" of rain in June and there was quite a bit of yield loss from flooding and nutrient leaching;
- participant C8 – land received nine inches of rain in 65 hours, "More rain in three days than we had in our normal year of rainfall";
- participant C9 – land received 10" of rain in the month of June, "We had lakes in the field";
- participant C10 – land received 12" of rain in May and June. He noted that the land was able to hold the first six inches of rain, but then came the downpour, 1" fell in 20 minutes;
- participant C11 – had over 16" of water in the fields;
- participant C13 – land received six to seven inches of rain in a few days;
- participant C17 – land received 11" of rain between June 6 and 9, "In the Coaldale area, the drainage systems that are part of the roadways, as well as our irrigation system, which act as a drainage system, were forced to carry a profound amount of water because of the flooding."
- participant C19 – reported that there was 17" of rain in Coaldale that month, "It was like one of those one-in-a-thousand-year events; more than one in a hundred."

Despite the high amount of rain that fell in such a short period of time, participants reported that the impact on crop production was minimal:

- participant C17 – "reduced production, but wasn't profound;"
- participant C8 – he didn't lose a lot and wouldn't consider it a disaster;
- participant C10 – lost at least 5 per cent to flood outs, but just in potatoes; and
- participant C11 – parts of the fields were completely lost; some they were able to recoup but were not able to do a proper job.

Further, participant C2 (a mostly dryland no-till producer) commented that, "there are pluses and minuses to any rainfall event." On one hand, it reduces the need for irrigation and if a crop is already seeded, it will achieve higher yields. On the other hand, more time will be spent fencing near the river. For this producer, the biggest effect of the rain was water

coming from their neighbour's land. The neighbour does not use 100 per cent no-till. The impact was reduced crop yields (for example, peas, which can't withstand a lot of standing water for long). Participant C2 felt that diverse crop rotation was the key to managing heavy rains so that even though the pea yield was reduced, the wheat and canola crops will take advantage of the water. C9 made similar comments, noting that for his potato crops, "once you start pumping, it's too late." After 24 hours in the water, the crop was gone, but their cereal crops were able to withstand the water and turned out "beautifully."

Hindering the situation was that it had been a cold, wet year with little evaporation, and the crop didn't take up the water and it had nowhere to go (C9). Also, participant C11 felt that some of the impacts from the flooding were due to poor drainage infrastructure.

2.4.3 2005 – Heavy Rains in June and September

Participant C18 remembered 2005 as the wettest year he could remember in Southern Alberta. Thirteen of the 20 interviewees discussed the heavy rains in 2005 with some specifically mentioning a rain event in June, others noted rains around harvest (September), and some reported a combination of the two. For the season as a whole, interviewees commonly discussed the extreme amount of precipitation received:

- Participant C4 – During that season, "we found out in the end that too much water is just as bad as no water at all." His land received 12" of rain in June, which supersaturated the soil and rotted roots. He never got healthy plants and so had crop quality issues. It started to dry up and it looked like it could be salvaged, but at the end of September he got 6" of rain in one day.
- Participant C5 – His land received 6-7" in a week and 24" over the summer. He noted that on average the area receives about 9" of moisture annually.
- Participant C9 – His land received 10" of rain in June and 5.6" in September.
- Participant C18 – The Alberta Demo Farm (www.demofarm.ca) had 25" of rain during the growing season where it normally gets 7-10".
- Participant C18 – "The drainage systems of the municipalities were tested to the limit in 2005."
- Participant C20 – The area received 28" of rain between June 1 and September 15.

The June rains were cited as more extreme than that in September, but the rain in September was seen as more detrimental to agriculture operations because it happened when the crops were more mature and also during harvest time (C17). The severe flooding that accompanied the rains in 2005 (and 2002) prompted many interviewees to describe them as once-in-a-lifetime events, and sometimes they happened multiple times:

- Participant C3 – "We've had two one-in-a-100-year floods in eight years."
- Participant C4 – "Over the past 10 years, we got basically three 100-year storms."
- Participant C5 – "We have catch-basins for our feedlot that are supposed to hold enough water to accommodate a 30-year flood. This was more of a 100-year flood."
- Participant C7 – "We've had some once-in-a-lifetime floods here. There were a couple of them in a row."

Compared to the rains in 2002, the extreme level of precipitation in 2005 was reported to have had much more of a detrimental impact on farming operations. Rain that occurred

around harvest time had a large impact on crop yields and even on the ability to harvest any crop. Many crops could not be harvested because they were in standing water. Participant C17 said that the water was 12-14' deep in some places. Participant C1 reported having grain on the ground with 12" of water on it, and he lost 5,000 bushels compared to the average 500 bushels. Participant C7 lost yield for some of his fruits and vegetables, and noted, "That's what I would call weather extremes; when you have 2' of water in the fields." Participant C4 remarked that he was 4,000 tons short of a 10,000-ton potato contract. Participant C18 observed that, "the water table had come up so high that we weren't able to farm the land." Other impacts included sunk and damaged machinery (C12, C4), the production of less quality feed for the operation's dairy cows (C3) and contamination of water supplies due to sewage lagoons overflowing (C5, C17).

The impacts of the rain were not limited to the 2005 season. Some interviewees reported that the extreme moisture impacted their operations into 2006 and 2007 (C12, C13, C17, C18). For cattle operations, the wet years affected the growth rates of the cattle, and there was standing water in some of the fields as late as the spring of 2007.

2.4.4 2007 – Hot and Dry Conditions

Ten interviewees reported very dry and hot conditions for the summer of 2007 (C4, C7, C8, C9, C10, C14, C15, C16, C19 and C20). More specifically, the month of July was cited as especially hot. Participant C15 reported that the average temperature for July was 31° C while participant C4 said that it was the hottest July on record. Participant C10 experienced five weeks of over 30° C, which he cited as a rare event in the Coaldale area. Compounding the heat in July and August was a lack of precipitation (C9, C16, C19 and C20).

The major impact of the hot and dry conditions was a yield reduction, reported by four interviewees (C7, C9, C10 and C20). Participant C7 discussed his strawberry yield, noting that plants don't set flower buds when it's over 30°C, and it was a situation he had never experienced before. Participant C9 lost yield on his cereal crop, but did mention that the crop he seeded early (end of March) turned out well and planned to seed early in the future. Participant C10, a potato producer, described how the potatoes need cool nights to bulk up below the soil and when it's hot the plants keep growing above ground but not below.

2.5 References to Climate Change

Interviewees were not asked to comment directly on climate change (global warming), but during the interviews many referred specifically to climate change issues or to generally perceived shifts in climate. Four participants referred to an overall shift to a warmer climate over the last 10-20 years. Participants C7 and C16 believe that the winters are milder and warmer than in the past. Participant C1 claimed that the climate was generally wetter, but hotter. Participant C4 talked about starting harvests earlier because of the increased heat units his crop received during the growing season.

Seven participants reported more weather extremes in recent years or anticipating more in the coming years. Three participants addressed weather extremes this way:

- Participant C9 – "I think we're going to have more weather events with global warming... more extremes."

- Participant C11 – Since 2000, he felt there had been quite a fluctuation in weather compared to the previous 20 years.
- Participant C19 – Events are, “more extreme than what we’re used to in the 70s, 80s and 90s.”

At the same time, however, there was ambivalence about whether to attribute weather shifts to climate change/global warming:

- Participant C7 – “People talk about global warming, but we can’t say that every summer was that extreme; we just had it this year.”
- Participant C8 – “Is it climate change? It seems like it, but do we know for sure; definitely we’ve got erratic weather.”
- Participant C9 – For 2007, “I don’t want to say that it’s global warming... [laugh]... it comes in cycles. In 1870, when Palliser came around, it was dry here, too.”
- Participant C15 – He wondered if global warming was to blame for weather problems or was it another phase or stage of weather cycles.
- Participant C19 – “Whether we blame it on global warming or just natural phenomena, we’ve had some extremely dry and wet events.”

2.6 Non-weather Shocks and Stresses

Respondents were asked to comment on shocks and stresses they’ve experienced that are not related to the weather. The main stresses identified were BSE, labour issues, energy costs, currency appreciation, disease and insect pressure and rising grain prices. Each of these will be discussed in turn, along with any short and long-term coping strategies identified by interviewees.

2.6.1 BSE

The BSE crisis was identified by six of the seven producers who have livestock as part of their operations (C2, C3, C5, C6, C12 and C13) and by one organizational representative (C18) as a significant stress both financially and emotionally. Two (C5, and C18) believe it to be the biggest stress, weather or non-weather related, faced by cattle owners. Participant C13 said that it had a “monster effect” on his operation resulting in losses in the \$300,000 to \$400,000 range. Participant C18 said that it was the biggest hit that the cattle industry has taken. Participant C12 summed up his situation as, “Financially, BSE affected us all... we used to get \$500 to \$600 per cow, but now it is like Klein said, ‘shoot, shovel and shut up.’ They are actually worth nothing..., but we can afford to eat our own beef.” The stress felt by producers went beyond the financial losses. Participant C3 said, “Morally, I think BSE was brutal. A lot of people felt really demoralized by the whole process... morally and emotionally it was a much bigger hurdle to overcome than people realized.”

To respond to the BSE situation, participant C2 reduced the number of head he carried because the return was just not high enough to justify keeping them. Participant C3 said that BSE regulations forced him to change his feed (he moved to more natural products and away from rendered meat products) and noted that, as an unintended consequence, “the cows are doing better than ever.” Participants C6 and C13 cited government compensation as a major coping mechanism. Participant C6 said that the federal and provincial aid reduced

his losses to \$400,000 from \$800,000, and added that because he was fiscally able to stay in the market, he benefited by later being able to buy more cattle at lower prices.

2.6.2 Labour Issues

The economic boom in Alberta due to oil and gas development has made labour shortages common across many industry sectors and agriculture is no exception. Five producers (C6, C7, C10, C11 and C12) named labour shortages and/or increased labour costs as significant stresses in running their operations.

Producers have used various techniques to mitigate the effects of the labour situation in Alberta, Participants C6 and C7 subsidize housing for workers on the farm. Participant C7 has also used the federal/provincial government Foreign Workers Program to deal with his employee shortage. “We actually have four workers from Thailand. It’s fantastic. We were forced into it, and I’m happy because they’re such good workers.” Participants C10 and C11 increased wages to compete with the energy industry. Participant C11 said that his labour costs have increased 25 to 40 per cent and further suggesting that some of his peers needed to double the wages of workers to keep them on the farm.

2.6.3 Grain Prices

A global shortage of grains has resulted in a sharp increase in grain prices in the last year. Participants felt the shortage was attributed to droughts in other grain-producing countries (for example, Australia and the Ukraine) (C5 and C13), and an increased demand for biofuels (for example, ethanol from corn) (C13, C18 and C20). The resulting increase in feed costs for livestock owners has affected the competitiveness of some producers (C5, C13 and C18). Two interviewees (C2 and C10) cited U.S. protectionism as compounding the price issue. Specifically, participant C2 discussed the subsidization of corn and that he was talking with the federal minister responsible for trade who said Canada wouldn’t try to object or counter the subsidies because it could interfere with softwood lumber negotiations. Participant C20 felt grain prices were at an ongoing and future issue of enormous proportions:

“The increase in grain commodity prices will affect us from here on as opposed to just affecting us this past year, and this has all just happened in the past year... It’s the global grain supply, and whether grain is used for fuel or food, these are some of the highest grain prices that we have seen since the early 70s.”

Very few respondents discussed how to respond to this issue. Participants C5 grows his own silage (corn and barley) to feed his cattle. But during drought years, his yields were low and he had to buy more feed from external sources. Participant C6 identified growing his own forages as a factor helping him to control costs.

2.6.4 Energy Prices

Four producers cited energy prices as a significant financial stress for their operations (C7, C11, C12 and C15). Increased energy prices led to higher costs for producers including electricity for irrigation (C11 and C12), fertilizer (as a product of the petroleum industry—C11 and C12), heat for greenhouses (C7) and gas for customers to drive to the farm for on-site sale of fruits and vegetables (C15). Participant C11 said that the cost of fertilizer has doubled in the last year and a half (from \$133,000 to \$282,000), and that overall his total

operation costs had gone up by 30 to 40 per cent. Increasing energy efficiency was the major response to this stress and will be discussed in detail in the section below (Long-term Adaptation Mechanisms).

2.6.5 Currency Appreciation

The rise in the value of the Canadian dollar relative to the U.S. dollar was raised by four interviewees as a significant stress (C5, C6, C13 and C18). For example, participant C5, a feedlot owner, regarded currency appreciation as a more significant issue than BSE. His input costs have risen significantly, but with the change in currency value, the increase was relatively higher than his competitors in the U.S., making it very difficult to compete. Participants C6 and C13 cited the high Canadian dollar as an issue because of their dependence on export markets for their products. Everything exported takes “real dollars out of our pocket” (C13).

2.6.6 Disease and Insect Pressure

Six producers mentioned diseases and insects as a source of stress on their operations (C1, C2, C4, C8, C14 and C15). Specific examples include: yellow aster’s disease in carrots, pea leaf weevil, cabbage seedpod weevil, flea beetles and cabbage maggots (and mosquitoes which drive human customers away from the U-pick farm). Further, participant C4 suggested that there was more disease pressure on potatoes because of the Lamb-Weston plant built in 1998 and the McCain’s plant built in 1999. Strategies for dealing with insect and disease pressure included crop rotation, using environmentally friendly sprays that don’t take out beneficial bugs (like ladybugs) and using research expertise from the diagnostic field schools in Lethbridge.

2.6.7 Availability and Price of Rental Land

Two producers (C4 and C14) discussed the difficulties of finding rental land in the Coaldale area. Participant C4 said that the McCain’s and Lamb-Weston potato processing plants have, “put rotational pressure on our potatoes because a lot more people started growing potatoes in the area, so it was tougher to find rotation acres and to rent land.”

2.7 Short-term Coping Mechanisms

This section provides analysis of how interviewees responded in the short term to drought conditions, extreme heat and heavy rains and flooding.

2.7.1 Coping with Drought

Interviewees identified two main coping strategies for the drought:

- diverting water to high-value crops; and
- purchasing water rights.

Diverting Water to High-value Crops

Five producers identified the strategy of diverting water from low-value crops such as cereals to high-value crops like potatoes and sugar beets (C9, C10, C11, C13 and C14). An organizational representative (C18) put it this way: “When we have to ration the water...,”

producers will find ways to get the water that they need for their high-value crops... They'll put the water on their potatoes or sugar beets and not on the barley." This management strategy was based on simple economics—if there isn't enough water to go around, then what is available will be used on the more profitable crops. On top of this, potatoes are particularly susceptible to drought (more so than grains and cereals) because they need water consistently throughout the growing season. "For us to finish our potatoes, we need the water" (C4). Some producers decided not to irrigate their grains/cereals, while others just lessened the amount of water for those crops.

Purchasing Water Rights

The second main coping strategy identified in the interviews was purchasing water rights from other sources (mostly during the 2001 ration year). Of the five producers (C4, C5, C10, C11 and C13) that said they had implemented this strategy, four were potato producers and one ran a feedlot. One further participant mentioned this strategy, but said he had not invested the money. Potato producers felt especially pressured to buy water rights. "It's tough for potatoes [to do anything else to cope]; they need water. It's a quality issue... they [McCain's] just say they don't want your potatoes" (C4).

In terms of total costs, P\participant C4 reported spending \$75-150/acre for the season, whereas participant C10 bought \$100,000 of water rights in 2001 and participant C11 invested \$50,000. Participant C10 also bought more rights for the 2002 season, but, "then it rained like hell." One organizational representative (C20) commented that now that there was a water trading system, and if a drought situation happens again, this "tool" was in place for them to use. Hindering producers in this strategy, according to participant C10, was that water rights were being treated like a commodity, and some people were buying rights and then reselling them for a profit.

Helping Factor – A Water Sharing Agreement

The water rationing of 2001 was unprecedented and presented a huge challenge to all water users (irrigation or not) in the Southern Alberta region. According to participant C18, a major factor in dealing with the water shortage was a water sharing agreement that was made between seven IDs (including the SMRID), municipal water users (including the town of Coaldale), commercial and industrial water users (for example, Rogers Sugar, Lamb-Weston, Husky Oil and Shell), recreation users (such as golf courses) and other private licence holders.

The provincial government regulates the management and delivery of water through the *Irrigation Districts Act*. A prime component of irrigation policy in Alberta is that the right to divert and use water is prioritized under a "first-in-time, first-in-right" principle. In other words, the rights of "senior" licence holders (for example, holders of licenses granted earlier in time) trump those of more "junior" license holders. The IDs hold the majority of the senior licenses, giving them priority access to available water.

The water sharing agreement put aside the 'first-in-time, first-in-right' doctrine that underpins the Alberta irrigation regulation and instead implemented an equal sharing of water regardless of the dates on the licenses (C17). This prevented senior licence holders from using all of the available water and leaving none for junior holders.

Mechanisms were then developed to monitor and equitably distribute the available water. The Irrigation Branch of the Alberta government (within AAFRD) along with the ID, calculated for each producer how many days of irrigation he/she was entitled to, taking into account factors such as the total area irrigated and the method of irrigation used. Therefore, producers knew in advance that there would be rationing of irrigation water, making the above short-term coping mechanisms possible. The IDs have been commended for their work in creating an equitable water management strategy by the International Irrigation Association, the provincial and federal governments, the U.S. government and the World Committee on Irrigation and Drainage (C17).

2.7.2 Coping with Heat

In the interviews, heat extremes were always discussed in concert with drought conditions, and while there were mechanisms to deal with drought in the short-term, producers could only wait out the extreme heat. For example, participant C10 talked about potatoes not being able to bulk up without cool nights and that there was nothing he could do to compensate. With respect to hot weather, participant C1 said that you have to “wait it out” and that there was “not much to do during the season” to mitigate its effects. Participant C14 cited increased irrigation as a response to hot weather, but that when there were concurrent drought conditions, this no longer was an option, and he has been forced to sacrifice one crop for another.

2.7.3 Coping with Heavy Rains and Flooding

After a series of heavy rains, the major coping mechanism reported by interviewees was to find ways to move the water off the land. Excess moisture was more of a problem for irrigation producers than dryland producers because it’s harder to remove the water. The main strategies identified in the interviews were:

- pumping the water off the land; and
- digging ditches.

Pumping the Water Off the Land

An organizational representative (C18) summed up the major response to heavy rains as, “What can producers do to respond to that situation? A lot of producers were pumping...; it was all they could do faced with those kinds of extreme events.” Ten producers described pumping as their main (and often only) strategy for dealing with the rain (C4, C5, C6, C7, C8, C9, C10, C11, C13 and C14). Participant C4 said he lost 20 pounds during harvest time, while participant C11 worked every day for two weeks on a pumping and drainage project. Rental pumps were rare commodities and participant C7 said that he was fortunate to own a couple of pumps because he would not have been able to rent one during the post-flooding period.

Digging Ditches

Five producers (C10, C11, C12, C13 and C14) reported digging ditches as a coping mechanism to move the water off their land. During the flooding, participant C13 learned

where the low spots on his land were and figured out where the water could drain to, and was able to build ditches to enhance the drainage.

Other short-term coping strategies include:

- Participant C2 – started harvest of durum wheat earlier and left the winter wheat standing because he would not lose as much if left in the rain.
- Participant C5 – moved cattle out of pens because their bedding mounds had become saturated with water and they wouldn't lie on them.
- Participant C6 – bought more corn silage (because his supply had flooded out).
- Participant C7 – put sawdust/straw between rows of strawberries on his U-pick farm to make soil less sticky for pickers. They also invited Hutterite colonies in to pick strawberries at a really good price because there were a low fewer public pickers.
- Participant C12 – put down more fertilizer because he thought there might be nutrient leaching (and ended up using too much).
- Participant C1 – had to re-spray fields which added a lot of expenses, but in the end the yield also went up and the, “yield advantage outweighed re-spraying” leading him to comment that, “extreme weather is sometimes a positive thing,” and it's something that producers can sometimes use to their advantage.

From an organizational perspective, a representative of the SMRID (C17) described how the ID assisted in dealing with the rain in June 2005: “Basically, we sat and watched it until it quit raining, and then we went out to assist the drainage and we made sure that culverts and road crossing were open. We made sure that the water could flow because we have reservoirs in the vicinity of Coaldale..., and they hold a fair amount of water so we were able to get that water away from the flooded fields and into reservoirs where we it could be utilized.”

Hindering the immediate response to the rain were a water pump shortage (C10), getting rain right after irrigating (C18), leaching of fertilizer has economic implications (C18), the need to pump water out of cattle pens meant that fields that were already saturated flooded (C5), and the runoff from livestock operations contaminating the water supply and leading to a boil-water warning (C20).

2.7 Long-term Adaptation Mechanisms

There was general recognition among interviewees that the Coaldale area is prone to extreme weather events. For example, when discussing precipitation levels, Participant C9 said, “there is no average, just extreme highs and lows” and that he always just prepares for the worst. Participant C2 managed his operations from this perspective of, “We're in an area where you know there's going to be cropping disasters; you know there's going to be deficits in moisture. We try to manage our farm on that basis because they are not a surprise by any stretch of the imagination.” This means that producers have to be willing and able to deal with both extreme drought and moisture while not knowing when they will experience these conditions. As a result, producers have made many long-term adaptations to their farming operations that are beneficial no matter what the weather.

2.7.1 Farm Management Techniques

Reduced Tillage/no-till Practices

Reducing the amount of tillage on farmland has produced wide-ranging benefits for the producers in this study. Participant C2, a producer who transitioned from a conventional farm in the 1970s to a zero-till (no-till) regime, remarked that no-till was his adaptation response to “all extreme events” and, along with crop diversification, was the, “biggest thing to mitigate risk in his operation.” He believes no-till reduces evapotranspiration and wind erosion, has a moisture-absorbing effect, allows him to seed earlier and to seed a variety of crops. In the same vein, participant C1 talked about no-till practices as being, “good for dealing with no rain or heavy, heavy rains,” as well as providing better soil water infiltration and disturbing the soil less. Participants C9 and C19 also mentioned reduced tillage as a beneficial practice overall.

Influence of No-till on Wind

An interesting corollary to the use of no-till practices was how respondents talked about wind during the interviews. Only three participants mentioned a wind event as an extreme weather stress, though historically soil erosion from wind has been an issue for the area. Participant C19 referred the evolution of wind management as, “I think our producers have done a phenomenal job [with reduced tillage]. If this was 1982, we’d be screaming and hollering because of all of the wind erosion.” Participant C2 also mentioned that wind used to be a big issue for him, but since moving to no-till it was not nearly as serious a problem. He said there was a “night and day” difference with no-till, and specifically credits Rob Dunn, a soil conservation specialist with AAFRD, for helping to advance knowledge of no-till and reduced tillage practices. Further, participant C9 commented that reduced tillage has lessened soil drifting on his farm.

However, he also noted that for potato producers (like him) it was impossible to go no-till. In fact, potatoes are a very invasive crop, requiring producers to dig right into the soil to get the potatoes out, leaving the soil quite pulverized. With the new potato processing plants, potato producers are renting more tracts of land in the Coaldale area, and the owners of the land are now saying that they want the potato producers off the land by September 1 so that they have time to put in a cover crop (C19).

Organic Farming

Two participants mentioned organic practices as a method for dealing with extreme weather events (C8 and C12). Participant C8 believed that organic farming makes the soil more resilient, and, “whether it’s too wet, too hot or too dry, [organic practices] will moderate it.” Participant C12 mentioned the use of organic fertilizers in both wet and dry years and that the practice leads to more efficient incorporation of the fertilizer. participant C8 also talked about the wind being a non-issue since switching his operation to organic production methods. He said that, “the wind’s always been extreme here,” and on an extremely windy day he could lie down in his wheat field and not get dirt in his eyes.

Crop Choices

Producers report choosing crops to grow based on their susceptibility to both weather and non-weather shocks and stresses. Participant C6 cited alfalfa as an example of a crop that’s

less susceptible to weather extremes, while Participant C9 started growing winter wheat because it doesn't need as much water (and takes water early in the spring). Further, he put dry beans into his crop rotation because it's a low water use crop and also good for the soil. In response to insect pressures, participant C1 reported that he stopped growing canola, and participant C12 grows sawfly-resistant wheat in dry years because the sawfly is more persistent in dry years.

Beyond the choice of crops, producers also talked about crop rotation as a strategy for dealing with extreme events. Participant C2 said that he uses crop rotation partly as a response to the risk factor that different crops will perform differently each year; it's a double hedge for weather and for market prices.

Building Drainage

A major long-term adaptation mechanism to deal with heavy rains and flooding was "finding a place for the water to go" (C9). Eight interviewees (C2, C5, C6, C7, C9, C13 and C17) identified building drainage in response to past flooding and to prepare for future rain events. Producers constructed new pipelines and dugouts, increased the size of their catch basins, built drain spillways and levelled land. Some also purchased pumps, "because we know this can happen" (C7). Participant C2 said that at least these measures were now in place for the future.

Different Seeding/harvest Schedules

Another long-term adaptation strategy identified by interviewees was changing the timeline of seeding and harvesting crops (C1, C4, C9 and C13). This strategy was discussed mostly in terms of dealing with the increased number of heat units producers get during hotter growing seasons, but was also mentioned as a response to rain events. Participant C13 learned from experience that beans would survive if out of the ground during extreme rain, so he started seeding earlier and earlier, being less afraid of frost and more afraid of early rains.

2.7.2 Use of Policies and Programs

Interviewees mentioned the use of various policies and programs as adaptation responses to both weather and non-weather stresses. The CAIS program, and its predecessor, NISA, along with crop insurance were most often mentioned by interviewees and will be discussed in more detail below. For irrigation systems, two programs were identified as important to long-term adaptation—the Irrigation Rehabilitation Program (IRP) and the SMRID's development of an emergency management plan.

IRP

The IRP is a cost-sharing project between the Alberta government (75 per cent) and the 13 IDs (25 per cent). It is not a direct-to-producer program since the money goes to the IDs to complete rehabilitation projects on the main canals and infrastructure that moves the water through the districts. Producers are responsible for the water infrastructure once it reaches their land. Currently, the government is funding the IRP at a level of \$24 million/year (C3), though this is being revisited in the next few months (C18). Decisions on how to disburse the funds are made by the Irrigation Council, a body made up of seven members appointed by the Minister of Agriculture and Agri-Food, five public representatives and two

government representatives (Alberta Environment and AAFRD). The Council examines proposed projects from the IDs and is responsible for granting approval. Funds for the IRP are distributed based on an allocation formula, such that every district gets an equal distribution based on total number of acres and the infrastructure setup.

Participant C18 described how the IRP has been used to replace many canals in the irrigation system with pipelines (up to 48" in diameter), which has reduced evaporation and seepage losses. Participant C6 commented that the main canal near him has been rehabbed with concrete which has extensively reduced seepage losses. He also described the IRP as the best program available because it leads to long-term sustainability (though admitting that he has been associated with the Council and therefore might be biased). Participant C4, another producer, has contacted the Area Director in his ID to express his opinions on what projects should be adopted.

Role of the St. Mary River Irrigation District (SMRID)

The SMRID has played a key role in helping producers in the Coaldale region adapt to weather extremes. The water-sharing agreement (described above), brokered in 2001 to deal with the drought conditions, is a prime example. The SMRID was an influential player in negotiating, communicating and implementing the mitigation plan, which was an unprecedented sharing of water resources for the common good.

The SMRID has also been integral to helping producers cope with heavy rains. Directly after the rains in 2002, the SMRID assisted the county in cutting roads, helped producers pump water, and worked with Alberta hail and crop insurance providers to recognize flood areas. From a long-term perspective, they have worked with the counties to make, “sure that our channels and waterways are now set up better; we supervise them better to make sure we don’t run into the same problem” (C17). Storage ponds have been built in Coaldale to handle sewer backup and to reduce the risk of overflowing sewage lagoons.

Three similar rainfall extremes have taken place in the month of June in Coaldale (1995, 2002 and 2005) (C17). After the 1995 event, the SMRID (in conjunction with other IDs, affected towns and villages, water coops and others), began developing a disaster communication plan. The dry season of 2001 extended the plan to include responses to both drought and flooding. The 2002 and 2005 rains tested the various components of the plan. Participant C17 believes that, “we now have a much better idea what can happen and we’re better prepared.” For example, in preparation for an extreme rainfall event, SMRID staff is prohibited from taking holidays between June 1 and June 15. They are all available in case they need to declare an emergency. The plan also calls for the SMRID to hire vehicles, backhoes, pumps, trucks and whatever else might be needed to help drain flooded areas. Similarly, a long-term emergency plan is in place for drought and, “if we get to a situation where it looks like we’re going to need to ration, [the SMRID is] prepared to put the plan into action” (C17). The SMRID plan is also co-ordinated with similar emergency response plans in the Town of Coaldale, the City of Lethbridge, and the County of Lethbridge.

2.7.3 Increasing Efficiency

Irrigation producers have higher land prices, higher energy costs (so that increases in fuel and energy costs are more significant), and a greater investment in technology and equipment than non-irrigation producers. A major source of long-term adaptation for irrigation producers cited in the interviews was increasing operation efficiency. Areas of increased efficiency include reduced water and energy use, buying better equipment and building economies of scale. Higher efficiency was achieved through more sophisticated irrigation technologies (C5, C6, C7, C10, C13, C15 and C20). Producers are moving toward systems that spoon-feed water to the fields (sprinkler systems) versus the older surface irrigation systems that flood the fields with massive amounts of water. Other changes in technology include:

- A shift away from spray irrigation to low-pressure drop-tube irrigation which reduces evaporation losses by decreasing the distance between the sprinkler and the crop and also reduces energy costs for moving the water; and
- A shift from wheel-line systems to centre-pivot systems (pivot systems can fine-tune the delivery of water by putting only 1" of water down at a time versus wheel-line systems that put 5-6" down at a time).

Participant C5 reported that the infrastructure (pipelines and canals) to deliver the water has also become more efficient.

Implementation of GPS Systems

Participant C12 says that GPS systems on tractors and other equipment can reduce fuel and labour costs by enabling the producer to cover more ground in a day (for example, he no longer covers ground twice).

Buying more Efficient Equipment

Participant C11 purchased larger equipment to respond to labour shortages, noting that he basically doubled equipment size for cereal farming to compensate for the labour shortages. Participant C12 changed the way he moved grain by making use of trailers that can haul 2,000 bushels at a time (versus 500 bushels), and also switched to diesel pumps (from electric) to reduce energy costs.

Building Economies of Scale

Three organizational representatives (C18, C19 and C20) talked about producers increasing efficiency by specializing in certain crops (particularly potatoes) and farming larger acreages. In the case of potatoes, a larger operation affords an economy of scale for equipment and storage and helps secure contracts with McCain's and Lamb-Weston.

2.7.4 Knowledge Sharing

Study participants report using research expertise and producer networks as helping factors in dealing with extreme weather events (C1, C2, C10, C12 and C19). Specific sources of research expertise mentioned in the interviews were the AAFRD Lethbridge Research Station, AAFC Swift Current and Indian Head Research Centres, the AgTech Centre, Alberta Agriculture, the IDs, and RTL. Research expertise has helped producers by proving

the advantages of no-till, sprayer recommendations (by testing them in wind tunnels), results of seeding experiments, providing methods of dealing with strong winds and soil erosion, information on the number of irrigation days available and help with adopting new technologies. Related to this, networking was also mentioned as a key long-term strategy. Participants C1 and C19 specifically mentioned the “producer-to-producer” network through the RTL organization. This network is composed of producers who are using similar reduced tillage techniques. Along with an email newsletter, there is a database that allows producers to be matched with others who are using similar seeding systems and have similar soil types (among others) to share knowledge on best practices. From another perspective, participant C12 commented that the resourcefulness from working in a cooperative adds creativity and ingenuity to farming solutions. As well, participant C1 cited family experience and prior knowledge and the “mindset of being flexible” as an aid in dealing with extreme weather.

2.8 Factors Aiding and Hindering Response to Stresses

Emerging from the analysis above are factors that aided and hindered producers in responding to weather and non-weather related shocks and stresses. The factors are presented in Tables 4 and 5, the first looking at aiding factors, and the second looking at hindering factors.

Table 4: Factors Aiding Response to Stresses

Factor	Comments
Reduced tillage and no-till practices	Cited as useful practices to deal with any weather extreme. “Good for dealing with no rain or heavy, heavy rains” (C1). “The biggest thing to mitigate risk” in his operation” (C2).
Research expertise	Cited as useful for dealing with all weather extremes. Specific sources cited include: AAFRD Lethbridge Research Station; AAFC Swift Current, Indian Head Research Centre; AgTech Centre; AARD, ID offices; and RTL (C1, C2, C10, C12 and C19).
Individual knowledge and experience	Helps to work in a cooperative because it allows you to draw on more resources (C12). Relies on family experience and knowledge and a “mindset of being flexible” (C1).
Diverse crop rotation	Double hedge for weather and market prices (C2).
Water sharing agreement	SMRID brokered a water sharing agreement with municipal, industrial and private water users to share available water during the drought years.
Calculation of water rationing	The government of Alberta and the ID calculated the amount of water each producer would get during the drought year to plan. Accordingly.
ID helping with drainage	During the extreme rains, the SMRID ensured that culverts and road crossings were open.
More efficient irrigation technologies	Shift from surface flood-irrigation systems to systems that spoon-feed water to the fields means less water use. Also, irrigation infrastructure has become more efficient.
Niche markets	Enables producers to get high prices for crops (C7).
Slope of land	If land slopes away from crops, it can aid in water drainage.
Dispersed land	Participant C9 discussed how hail will hit one part of land, but not others.
Greenhouse growing	More easily able to control growing conditions.
Previously built drainage system	Suffered fewer losses than other producers (C1).
Mental strength	“You have to fight your way through it [extreme weather in general]” (C7).
Growing own silage	Helps to defray costs of buying grain externally, but less of an aiding factor in times of

	drought (C5 and C6).
Government programs	Examples given include crop insurance, IRP (C4, C6 and C12).
Organic farming practices	Makes the soil more resilient, “whether it’s too wet, too hot, or too dry, [organic practices] will moderate it.”
Producer networks	Example given was the RTL “Producer-to-Producer Network” (C1, C12 and C19).

Table 5: Factors Hindering Response to Stresses

Factor	Comments
Timing of extreme	September rains were less extreme than June rains, but had a more detrimental effect because it was harvest time (C1, C17 and C18). Rains came during a colder, wetter year in general so there was little opportunity for evaporation (C9, and C17). Rain came after irrigating (C18).
Increasing costs of doing business	Cost of new technologies (C1). Increasing labour costs (C6, C7, C10, C11 and C12). Increasing grain prices (C5, 13 and C18). Energy prices (C7, C11, C12 and C15). Higher Canadian dollar (C5, C6, C13 and C18). Increasing land prices (C14).
Labour competition	Economic boom has made labour shortages and costs a major issue (C6, C7, C10, C11 and C12).
Government programs	Programs designed to support producers who don’t manage well (C2, C4, C13 and C20). Programs not available for fruit and vegetable producers (C14 and C15). CAIS program—uncertainty about payments and difficult to navigate.
Water treated as commodity	In water-rationing year, some people were buying water rights and selling them at a profit (C10).
Sunk and damaged machinery	During the extreme rains, equipment got stuck in the vast amount of mud (C4 and C12).
Contamination of water supply	Sewage lagoons overflowed during flooding leading to a boil-water warning (C5, C17 and C20).
Water pump shortage	Shortage occurred during flooding in 2002 (C10).
Pumping water out of cattle pens	Cattle needed to be dry and warm, but pumping water out of pens meant that the fields became even more saturated (C5).
Neighbours	Neighbour who has not switched to no-till sends water onto his land (C2).
Lack of drainage infrastructure	Infrastructure not seen as being maintained over time (C11).
More disease pressure	More potato growing in the area has increased presence of disease (C4).

2. 9 Public Policy/Government Programs

The final portion of the interview questionnaire asks participants to comment on the usefulness of specific provincial and federal government programs.

2.9.1 Government Programs in General

Many participants provided opinions of government programs in general. The vast majority of the comments were negative, either criticizing how programs work or providing examples of areas that should be funded by programs but aren’t. Four participants (C2, C4, C13 and C20) made comments about government programs being designed to support producers who are poor managers. Participants C2 and C20 believe that ad hoc programs and

payments don't work, and that in the end they hurt those producers that are good managers, and bail out those that don't manage well. Participant C2 went on to say that "to manage your farm on the basis of government programs is foolish," and that it's not a good long-term financial strategy (C2). Participant C13 commented that "they penalize you if you are diversified; we really have very little hope of seeing any benefits from a lot of these programs just because we need a complete and total disaster before any of them will kick in." Finally, participant C4 linked the use of government programs with a lack of self-sufficiency, noting, "We're not huge program people. We'd like to make it on our own and have pride."

Two interviewees (C14 and C15), both fruit and vegetable producers, feel that there are no programs designed for producers outside of cattle or grain farming. Participant C15 said that in Alberta, producers not tied to grain or cattle or oil are not eligible for any assistance programs. Participant C14 commented that no government programs specifically address the issues and challenges associated with vegetable farming. Participant C3 talked about dairy producers being excluded from some programs and that it was an injustice because, although he doesn't have catastrophic losses, his fuel and other expenses are up, too, like other producers. Other general comments made about government programs include:

- The government wants too much information: There is "lots of stuff we could apply for in here, but to be frank, I don't want the government nosing around in my production" (C2);
- The federal government doesn't understand the issues in Southern Alberta: The "government will do what they do, and we are going to have to live with whatever changes they decide to make I think... to influence a federal government that is based out of Ontario... it is hard for them to deal with our issues out here" (C10); and
- There needs to be incentives for young producers to get a start in agriculture and also incentives for the older generation to exit farming and pass it along to the next generation (C10).

2.9.2 References to Specific Government Programs

By far, the most talked about programs were the CAIS, NEFPI, and crop insurance. Discussion of these three programs will form the bulk of this section, but it will also refer to other programs including the Canada Alberta Farm Water Program (CAFWP), DU, and the Prairie Shelterbelt Program (PSP).

CAIS Program

The CAIS program, introduced in December 2003, replaced previous safety net programs available to agricultural producers (Farm Income Disaster Program or FIDP, Canadian Farm Income Program or CFIP, and NISA). It is to be replaced by two programs, AgriStability and AgriInvest for the 2007 program year. Just one interviewee (C12) had only positive things to say about CAIS. He had used it regularly over the last five years and commented that it was effective and did its job. Participant C4 was also positive, saying that he used it in 2005 and had one-third of his losses covered, bringing his income back to average. However, he went on to talk about the uncertainty related to the program. He was told that he was to get a payment and then told he was not, but in the end he finally did get one. Three other interviewees also talked about issues related to uncertainty:

- participant C2 – the switch from NISA to CAIS didn't surprise him because the income programs are always changing so quickly;
- participant C5 – he claimed it's not predictable, not responsive and that he had no idea how much he was going to get back, if any; and
- participant C13 – said that the rules are not well laid out—they are a moving target with the program.

The program is also complicated and difficult to use (C6, C8, C9, C10, C13 and C14). The feeling was that there was too much paperwork and that it was very expensive to administer (for example, needing to hire accountants). Participant C8 does not participate, noting that he was told that unless you're doing a big commodity crop, it's not worth participating. Participant C13 said that the rules don't make a lot of sense and that "it really seemed as though producer input was not taken into account" when designing the program. NISA, the predecessor to CAIS, was viewed more favourably (being seen as predictable and more straightforward) by some respondents (C2, C9 and C13).

Related to the CAIS program is the Alberta Farm Recovery Plan (AFRP), a short-term, \$165 million assistance program from the provincial government, created in response to the rising costs of fuel, feed and fertilizer. Funds received are based on CAIS payments. This program, too, was not well received. Participant C6 said that it's another one that's "hard to get a straight answer out of." Participant C2 says that he's not eligible, but feels he is subsidizing those who do receive it through his tax dollars. Participant C5 says that he received a cheque for \$3800 from the program, which equates to only one-tenth of one per cent of his total losses.

National Environmental Farm Plan Initiative

The objective of this program is to help producers identify and address environmental risks and opportunities in their operations. Nine out of the fifteen producers from the Coaldale region have completed environmental farm plans or in the midst of completing them. In general, it is perceived as a useful program, increasing awareness of environmental issues and providing incentives to implement more environmentally sound practices. Participant C9 sums up the long-term nature of the program goals: "I'm in there for the long run. The government, they want to keep the land for the next generation, too. They stick the money into it." Generally, the environmental issues highlighted are not unknown to producers, but the program helps bring them to the forefront of producers' minds, so that when they are walking around the farm, they think about them. Seven producers have applied for funding from the companion CAFSP (C1, C2, C4, C7, C8, C9 and C11) for things such as double-walled fuel tanks, water dugouts, chemical buildings, GPS and corral drainage. Participant C4 put up double-walled fuel tanks and got 30 per cent of the cost back. This enabled him to get "the Cadillac" of tanks, whereas without the funding, he would have "cheaped out." Two interviewees would like to see the program provide more financial incentives (C11, C20).

Crop Insurance

Of the 12 producers who made comments about crop insurance, 6 have full crop insurance (C1, C9, C10, C11, C13, C14), 3 carry only hail insurance (C5, C6, C15) and 3 don't carry any crop insurance at all (C2, C3, C8). Participant C11 says that he lectures young producers about not buying enough insurance and tells them "I have made money through insurance

[that allowed me] to continue farming at a level that I was able to operate.” Participant C15 only takes hail insurance because the premiums are too high for his vegetable crops to be worth it. Finally, Participant C2 says that he hasn’t carried crop insurance for years because when you have it you “give up management control to a certain extent.” For example, he said that in the 2000/2001 drought years his canola froze out and the insurers would have wanted him to re-seed, but to do so would have dried it out again and led to soil erosion. He thinks that the insurers ask producers to do things that aren’t necessarily smart for the climatic conditions of their particular area.

Other programs: Awareness of DU was high among interviewees, though only two reported being involved in any of DU’s programs. Participant C1 expanded his acreages of winter to accommodate the ducks traveling through the area in the spring. Participant C4 built a goose pit. Participant C10 said that with the rising land prices, he doesn’t have the luxury of setting aside land for habitat. The PSP was used by five producers to plant trees in farmyards and/or on the fields. Finally, the CAFWP was used by four interviewees to receive funding for water lines, cisterns, fences drainage systems, dugouts and wells.

3.0 Analysis and Results – Foremost

3.1 Highlights of Agriculture in Foremost

Foremost, Alberta, a community of 524, is the county seat for Forty Mile County, and is located 130 km southeast of Lethbridge and 100 km southwest of Medicine Hat. The county is approximately 7,200 km² and is located in the very southeast part of the province—an extremely dry region. There are approximately 750 farm operations within the county with half over 1,000 acres and half less than 1,000 acres in size. Primarily these operations are involved in grain and cereal production, but some producers in the region have a mixture of cattle and grains, as well as some cattle only operations. Approximately one quarter of the county is irrigated in the Bow Island area, and these producers are able to grow a wider variety of crops that have higher water requirements, including potatoes, corn, canola and mustard. To date though, the producers that have been interviewed are not within this area of the county and do not participate in irrigation programs. Producers interviewed to date produce oilseeds, cereals (barley, durum wheat), pulses, peas and native grassland for cattle. Some interviewees have participated in livestock production in the past (cattle and sheep), but have since switched to crops.

3.2 Overview of Foremost Participants

Five agricultural organization representatives and 15 producers were interviewed for this study. The five organizational representatives represented the following groups: municipal government in the Foremost region, local agricultural supply retail operation, farm groups (Alberta Barley Growers Association), agricultural research and conservation organizations in southern Alberta (Western Grains Research Foundation, Southern Alberta Conservation Association (SACA) and the Southern Alberta Agricultural Research Association (SAARA).

Table 6 provides details of the farm size (acres of irrigated and non-irrigated land) and farm type (for example, types of crop and livestock) for each of the 15 producers interviewed.

Table 6: Participant Farm Types and Sizes

Farm Size (acres)	Farm Type
/	
4,800	Wheat, barley and some peas.
2,180	Canola, barley, peas, chickpeas, durum and spring wheat
9,600	Red spring wheat, durum, barley, some oilseeds, some pulses and a very small area was irrigated.
7,300	Peas, spring wheat, barley, durum and some canola.
9,000	Mixed farm—some irrigated land, ranching, pedigree seed operation for forage seed, thinly traded crops (such as millet, sorghum) and a cow-calf operation.
4,300	1,500 acres of native pasture, durum and some chickpeas.
8,300	Mostly grain (spring wheat, durum, barley), plus yellow field peas, 160 acres of pasture and 80 acres of hayland.
3,800	Mainly chickpeas, barley, wheat, lentils and peas.
7,500	Cow-calf operation of approximately 400 cows.

10,000	Dryland grain farming (wheat, durum and barley), pulses and peas.
4,000	Oilseeds and a pulse seed operation.
3,200	Peas and cereals.
3,000	Cereals, peas and occasionally mustard and canola.
8,500	Mostly cropland—spring and winter wheat, canola, durum, some mustard and chickpeas, and perennial foliage such as alfalfa.
13,000	Spring wheat, durum, barley, canola, chickpeas, lentils and field peas.

3.3 Changes to Farm Operations Over Past Five to Seven years

3.3.1 Producers

Here are the changes seen by participating farms over the past five to seven years:

- a refinement of operations, altering types of crops grown to adapt to weather conditions (F5, F1, F8 and F15);
- increases in size of operations (F15, F14, F6, F8 and F7);
- change in type of techniques and equipment used (F15, F11, F10, F4, F6 and F14);
- changes to shipping and transportation of product (F3 and F13);
- change in type of operation—switching out of mixed to strictly grain operations (F13) and from mixed to strictly ranching operations (F9);
- implementation of continuous cropping with one year chemical fallow—over a four-year rotation (F11);
- increased marketing/market research for crops (F10 and F8);
- little or no major changes (F5, F6, F2 and F1); and
- increased acquisition of farm infrastructure/machinery (F10 and F3).

Changes to farming operations over the past five to seven years largely consisted of operators adapting their practices and equipment that they used to minimize soil disturbance and retain as much soil moisture as possible. These changes have included the use of air drills to place the seed and fertilizer directly into the soil with minimal soil disturbance, the use of disk openers to minimize soil disturbance during seeding and the use of herbicides in fallow fields instead of tilling the land to kill weeds.

A number of producers have also increased farm size with some participants running 10,000-acre operations, and still looking to acquire more land. Although these changes may not have occurred strictly in the last five to 7 years, there has been an ongoing trend toward larger operations.

3.3.2 Farm Organizations

- many producers in the region have been switching back and forth between cattle and crops depending on market conditions (F16);
- producers are more concerned about soil moisture conservation—a reduction in the amount of time/effort spent working the soil (F17);
- better planning of organization and budgets to deal with extreme weather events (F19);
- funding of research of more drought-resistant and pest-resistant crops (F19); and

- acquisition of additional funding from the government for research and development of area-appropriate crops and farming techniques (F20).

3.4 Timeline of Weather-Related Shocks and Stresses

Even though the timelines for the survey referred to the events of the past five to seven years, many participants provided information about weather events that occurred as far back as 15 to 20 years ago (Tables 7 and 8). These years provide context for the large degree of weather variability that this region experiences.

Table 7: Timeline of Weather-Related Shocks and Stress—1990 through to 2000

1992/1993	Received large rains of 25 to 30" (F11).
1994-2000	Dry growing seasons on the farm (F11).
1995	One of the best years, lots of rain, good crops with custom combining used to get all the crops off.
1996	Snow in late August of 1996 which flattened crops.
1997	A bad drought year (F9).
1999	Extreme drought year (F1).

Table 8: Timeline of Weather-Related Shocks and Stress—2000 through to 2007

2000 and 2001	Extreme drought years, worst two years on the farm (some participants noted it was a dry spring in 2001, but had 8" of rain in June of 2001 (F1, F2, F4, F6, F8, F11, F12, F13, F6, F9, F7, F5, F17, F19 and F18).
2002	Extremely dry through until July, then region received approximately 12" in one weekend in June, (F1, F2, F5, F6, F11, F17, F1, F8 and F18), extremely dry July (F6) and frost in mid-August (F1).
2003	No rain through July of this year (F6).
2004	Little rain in July and two bad hailstorms in the summer hit much of the crops (F2).
2005	Dry spring, wet start of summer and dry July (F6).
2006	Hot and dry July (F6 and F18).
2007	Spring started with lots of moisture, but by June, the moisture stopped; several weeks of hot, dry conditions with daily temps around 40°C producing poor crop yields (F1, F2, F4, F8, F11, F16, F14, F17 and F18) wet May and June and an extremely hot July (F6).

3.5 Details of Extreme Weather Events

Comments on extreme weather events for the Foremost region have been categorized three ways. There were three extreme weather events in the past five to seven years that were commonly identified and stood out for a majority of the interviewees. Additionally, some of the participants were able to provide specific details of extreme weather conditions that stood out for them during specific years or months. Finally, participants provided general comments about weather conditions or factors that commonly plague the area.

3.5.1 Extreme Drought – 2000 and 2001

A majority of the interviewees identified 2000 and 2001 as years with some of the worst conditions for drought that they have ever seen on the farm (F2, F4, F11 and F6).

“It was very severe [during these four years] combined with high temperatures, winds and rapid evaporation. In the long-term record, it was much drier than the dirty 30s... but people have adapted to prevent the dirty part... because they are direct seeding, no tillage...” (F9).

“In 2000 and 2001, we had the driest growing season I have experienced on this farm in my entire farming career... extreme drought... we were working with 2 to 2.5" of rain for the entire growing season” (F11).

“In talking with my dad, who has lived and worked on this farm all his life, from what he remembers his father telling him about the 30s, what he saw in 2000 and 2001 was way drier than it ever was in the dirty 30s...” (F9).

Interestingly enough, there was one producer who noted that even though 2000 was an extreme drought year, 2001 was a year of extreme rain. On June 12 of that year, his area received approximately 8" of rain that flooded out most of the low-lying areas, but ultimately produced excellent growing conditions (F7).

3.5.2 Impacts on Producers

One of the most common impacts upon producers during these drought years was the reduced crop yields. While average production for cereals and other grains was often in the neighbourhood of 35 to 40 bushels per acre, for many the yields were cut in half, and crop production was in serious decline (F12 and F5).

“In 2001, it got dry, and I mean hot and dry. We combined some peas, and our wheat only averaged around 10 to 12 bushels per acre, but it was drier than 1961...” (F12).

“We had 18 months with no measurable precipitation... less than 0.20" over that period.... It wasn't enough, the grass didn't even turn green that year; it just burnt right up...” (F8).

“We never even seen a crop... we were cutting just to get seed for the next year. It was the worst drought that I have ever seen” (F4).

3.5.3 Impacts on Organizations

Interviewees from the organizational perspective noted the severity of the impact of the drought throughout the region. It wasn't just that yields were low and crops were blowing away, but the limited generation of income on farms had a ripple effect through small communities, villages and the region in general. Poor yields in the fields translated directly into a significant decrease in cash flow through the local economy, and many local businesses suffered (F16).

Some organizational representatives also noted that the quality of farm life was strongly affected by drought conditions. There was little discretionary money left over (F15).

One interviewee noted rather optimistically that participation in different organizations and boards has provided him with the opportunity to learn and share information about better and more suitable farming strategies. Even though drought events were highly damaging, the improvement on farming techniques since the 60s enabled people to at least get something off of their fields. A yield of 10 to 12 bushels/acre is far better than watching the soil blow off their fields.

3.5.4 Heavy Rains and Flooding – 2002

In contrast to the drought of the previous two years, participants noted that in 2002 they experienced heavy amounts of rain over a very short time period in the month of June. Most participants were able to specifically identify it as rain in the amount of 8 to 12" over a three-day period during rodeo weekend in June (F2, F5, F11, F17, F1 and F8).

“In 2002, we got 10" of rain in June... we have never seen that happen before. That amount of rain affected what you did and made it difficult to move around the farm...” (F17).

3.5.5 Impacts on Producers

Such large amounts of rain over a very short period of time had a variety of impacts. Natural drainage systems were overloaded and land took time to drain. For some producers, it made little sense to pump water out of these fields because there was nowhere for the water to drain (F7).

“In the wet years, you lost crops in the low-lying wet areas, but what stays out of the water, usually gives good yields... so you do make up for it... there is not a lot that you can do... you recognize where those low spots are and what types of crop you see in those areas... I don't seed oilseeds or pulse crops in those areas because they are too expensive...” (F11).

For others, crops growing in these areas were lost, amounting to a 5 to 10 per cent loss of total yield (F7). One of the important lessons learned was where the low-lying areas of their operations were located for future reference (F11). Some producers noted that row crops such as potatoes were heavily hit by the rain, whereas the cereals and other grains seemed to be able to handle the rain better (F5).

In a typical year, there needs to be time for crops to dry out before harvesting them. In this particular year, moisture continued until late fall, and producers were combining their crops until December.

“So that shows you the extremes, in 2001 we were done harvesting in the middle of August, and here in 2002 we were combining into December... we just didn't get enough drying weather [in 2002] and then we got snow, to get the crops off the fields in time...” (F11).

3.5.6 Impacts on Organizations

One organizational representative noted that five to 10 years ago, it had often rained during harvest, and meant decreased quality and yields for producers in the region (F16). In the last five years, spring rains that may initially have had negative effects, often led to very good harvest conditions and yields.

3.5.7 Extreme Heat and Dryness – 2007

The summer of 2007 was identified as being extremely dry and hot. Five consecutive days above 35°C is considered a heat wave and this region endured 14 consecutive days above 35°C. The hope of a good growing year quickly diminished and the resulting yields were low.

“July just cooked us” (F4). “We’ve never had a July so hot” (F4).

3.5.8 Impacts on Producers

At the start of the year, producers felt that they had the beginnings of a good crop year. However, with a hot July and little moisture through the summer, there was a significant negative effect on crops and the yields at the end of the season.

“We were looking at a \$35/bushel crop, and if we’d had even 1" of rain and a little cooler temperatures it would have been a great crop... . We could have participated in the high market prices that were happening at the time... [but] as it was, it turned to over 40°C and a 40 mph wind for two weeks straight” (F4).

“We started out the year really well... it was the most beautiful crop that we had seen in years [and we] thought that we had enough subsoil moisture to get us through... . We weren’t totally ‘droughted out,’ we did get a crop in the bins” (F4).

3.5.9 Hail

Even though hail events are an irregular event in the region, they happen often enough for some participants to buy hail insurance. One participant was hit by a hailstorm four years ago that affected half of his operation (4,000 acres) and ruined half of his crops (F12). With the hail insurance program, not only is the producer paid up front in the event of hail damage, but producers can vary the amount of coverage they put on the crop, versus company-set rates for crop insurance. One interviewee had grown up with his father never buying hail insurance, but he made claims on it each of the first three years when he did buy the insurance (F4).

Other producers noted that rain often came with the hail. In years when the hail events came early, there was still time for the crops to recover somewhat, and crops had a sufficient supply of moisture in the soil to overcome any dry spells. In most cases, the crops were not entirely ruined and producers were able to harvest the fields (F2 and F6). Another producer mentioned that the size of an operation can be a buffering factor. His 9,600 acres were spread throughout the region and he never suffers large losses due to hail (F3).

3.5.10 Wind

Participants mentioned that they have always had to deal with wind in this region. Little can be done and it is part of daily life. Some producers felt that the amount of wind had increased recently, while others stated that it had always been the same and hadn’t really changed (F14).

“Wind is wind, there has always been wind. It is not uncommon here to get a good spring rains, and then the winds blow for two weeks straight and dry the soil right out” (F10).

3.5.11 Impact on Producers

Hot, dry winds blowing across wide-open fields remove moisture from the soil through evaporation. Wind is one of the major weather factors that producers in this region contend with; it dries their soils and causes soil erosion. Many of the long-term coping strategies have been designed to address the effects of wind. If the moisture does not come, there is little that producers can do. However, many of the strategies have been developed to reduce the drying and erosive effects of wind.

“[The effect of wind is] not as bad an affect as the early years—better seeding equipment leaves stubble in the fields. This reduces the movement of air along the ground and gives a better microclimate for seedlings to emerge” (F3).

“The dry wind is one of the major factors ... most of us farm with that in mind, but people forget after a while and they start making their strips wider again...” (F17).

If conditions are extremely dry, winds have also been known to blow through the area, shattering stems and blowing swathed canola away (F3).

3.6 General Comments on Weather

3.6.1 Producers

One producer summarized the overall conditions in this region as the “land of extremes” (F10). The most commonly discussed weather attribute was the lack of moisture and the near drought-like conditions that producers have to deal with each and every year (F15).

“ I think the big thing here is the drought... in the last 10 years, we have had at least four very severe drought years and at least a couple that were droughty, and in that time maybe a couple of years of above average precipitation... you know it has been a dry time...” (F9).

“They like to say around here that we raise our crops on the dew” (F 3).

Producers in this region are well aware of these conditions, and as the long-term coping strategies section discussion will reveal, they have been changing their operations to adapt accordingly.

“With this corner down there that we farm in, you pretty much have to say, okay, we wake up in the morning and you think you’ve got to farm like it’s going to be a dry year. And if we happen to get the rain, well then that’s just a bonus for us.” (F1).

Over time, the direct effect on producers has been that many of them are not overly optimistic about yields and they have learned not to build their hopes on bumper crop yields.

“... we do have quite significant fluctuations... [it is] not uncommon to see yields in the low 20s to low 50s [bushels/acre], so we run quite wide extremes...” (F3).

Some producers noted that they didn’t feel as though they really knew enough about what the weather was really like in this region and throughout southern Alberta. Operations and

practices could be adopted and changed from year to year, based on the conditions that were predicted, but really not enough long-term information was known in order to develop the most suitable and appropriate operational practices.

“We just haven’t been keeping track of the weather patterns long enough to really know what it is like around here... We have been around southern Alberta, in isolated places they have been keeping track of the weather for maybe 100 years... so does that really tell us what the climate is like here or is that just a snapshot of what things are like?... We have to keep in mind that we don’t have much of a time reference for what it is really like out here with respect to weather...” (F14).

“Nothing is written in stone anymore and it is getting hard to predict, and that is where we are really lacking, in that nobody can give you a definitive answer or even a guess... We are still going by the producer’s almanac that we used 100 years ago... [and that doesn’t really work because you can read it six different ways and get six different answers...]” (F13).

3.6.2 Organizations

One of the organizational interviewees at the county level felt that their role has not been significantly changed or altered by the persistence of extreme weather events over the past five to seven years. He did note that in the previous five to 10 years, weather conditions had been much more challenging and that there seemed to be more drought and untimely and unexpected heavy rains that had dramatic effects on producers and the economy. Conversely, the past five years of weather have stabilized with regular spring rains and good growing seasons that have led to a more optimistic producer attitude and more movement in the local economies (F16).

Other organizational representatives have used extreme weather events over the past 10 to 15 years as a lesson to adapt the planning strategies of their organizations for times when there is limited funding available for producers.

“Extreme weather events, if anything, made us become more aware of what was going on and probably made us more businesslike in putting a plan together to address those critical situations when they appeared” (F19).

Other organizational interviewees, who were also producers, stated that they are constantly learning from both perspectives, which enables them to adapt and apply this information to new situations in the running of their operations (F20).

“[In the Palliser Triangle] you have cycles; you have good years and you have bad years, and the people who are there have learned to adapt to it... but still it is tough...it has driven a lot of people to the next thing to crazy, especially if there is no rain and there is a wind blowing... We are always appreciative of the rain down here...” (F17).

3.7 Non-weather Related Shocks and Stresses

In addition to the extremes of weather, participants were also asked about non-weather related shocks and stresses that had affected their operations in the past five to seven years. Participants repeatedly identified and mentioned commodity prices, global markets, the

CWB, the ever increasing costs associated with fuel and chemicals and the increasing cost of land as some of the key stresses that for many were beyond their control, but had a significant impact on their operations. Here's a summary of the non-weather related events participants mentioned:

- changing commodity prices and global markets (F10, F11, F3, F15, F7, F6, F5, F9, F13, F14 and F16);
- CWB restricting marketing for producers (F7, F8, F2 and F14);
- increasing input costs—fuel, chemicals (F10, F13, F14 and F15);
- increased competition and cost of land (F10, F11 and F13)
- shortage of farm labour (F4 and F10);
- lack of subsidies for producers (F14 and F13);
- the improved Canadian dollar on the global stage (F7, F6 and F8);
- BSE crisis (F6, F13, F14 and F16); and
- new pests (F5, F19, F20, F18 and F13).

3.7.1 Commodity Prices and Global Markets

Commodity prices for grains have historically been low, and have just started to improve in the last year or so (F13). The biggest single rise in grain prices over the past 15 years occurred in 2007, and they are double now what they were in 1999/2000 (F5). Last year, prices for some grains were 4\$/bushel and this year the same crops are getting 11\$/bushel. Prices are being driven higher primarily because of increased demand worldwide for grains, and a corresponding depletion of global grain supplies. Southeast Asia is demanding a better diet from global markets, and with such powerful economies, they are in a very strong position to acquire it (F9). Additionally, countries such as Australia have had bad weather years recently, contributing to lower crop production worldwide.

Not surprisingly, the price of oil directly affects global grain supplies with respect to the demand for biodiesel. Grains are used to produce ethanol and biodiesel, and as cost and risk associated with obtaining and processing oil reserves continue to rise, globally, many countries are looking for cheaper and more available alternatives.

All of these factors work concurrently to benefit many of the producers in the Foremost region. However, cattle producers and cow-calf operators are negatively affected by the increase in these prices. While it costs the cattle producer more to buy grain, the asking price for cattle may not necessarily reflect this increase and the producer then has to absorb the cost. Feedlot operators have to pay higher costs for grains and they take these costs off what they are willing to pay for calves (F9).

3.7.2 Input Costs for Operations (fuel/chemical/fertilizer)

Participants noted repeatedly that the costs of fuel, chemicals and fertilizers have all increased dramatically. Many of the chemical inputs are offshoots of the petroleum industry, and as oil prices increase, the cost of farm chemicals rise (F14). Fertilizer costs last year (2007) were \$395/ton, and are now over \$600/ton for this coming year (F13).

Due to the fact that the productivity of this area is lower than other parts of the province, producers in this region run large operations to survive. The cost of inputs (for example, fuel and fertilizer) for these large operations is getting too expensive (F10).

Organizational representatives have noted that the full impact of these costs was felt in the years that start off really well and then encounter challenging weather events. Producers perceive it to be a good year, and in turn purchase large amounts of inputs for their fields. But when conditions turn for the worse, and the yields simply are not there, it becomes challenging for producers to pay for these inputs (F18).

3.7.3 Labour Shortage

Competition for labour, particularly in Alberta, is difficult due to the competition from the oil industry. Skills required on farming operations are highly transferable and desired in the oil patch (F4). The younger generation, including their own children, has left the farm and farming community to make a career in oil-related industries, which pay much higher wages than they can achieve working on the farm (F13). Workers from Mexico are applying and coming to work on some of these operations in the Foremost region (F4). Alternatively, producers are buying more machinery to work larger tracts of land (F10 and F4).

3.7.4 BSE

BSE had a direct catastrophic effect (F9). Cattle producers began losing money immediately, and for some producers, the ripple effects of the crisis carry on right through to the present day. Feedlots and cattle producers were unwilling and unable to pay higher prices for grain to feed the cattle, and the profit margins of grain producers were decreased (F14). The negative effects of BSE were also felt throughout the economy and attitude of the farming community in the region. Some producers and operators were forced to leave the agricultural sector and the region, taking their support for small town businesses and services with them (F16). Current high grain prices, and cattle prices being lower than they were during the BSE crisis, cattle producers are still suffering from its cumulative effects (F9 and F6).

3.7.5 Insect Pests and Research Effort

Changes in weather patterns have introduced new insect pests. Insects that were normally killed by cold temperatures are now able to survive and persist from one year to the next (F13 and F18). Pea weevils and wheat mites were two species that participants noted they hadn't seen before and now have to control. Wheat mites were transported by winds from the U.S., and both pests survived due to warm winters (F13). According to one organizational representative, an indicator of the increased insect problems was a rapid increase in insecticide sales over the past three to four years (F18).

One of the organization representatives noted that pests such as pea weevil were resistant to current insecticides. One organizational participant believed that more effort must be put into developing pest-resistant crop species and that industry must be more responsive to the needs of the producer. It was thought that if research efforts and monies were better utilized, more effective research could be done (F20).

3.7.6 Canadian Dollar

The recent increase in the exchange rate of the Canadian dollar was perceived as good by one producer and as having a negative effect by other producers. When the Canadian dollar was on par with the American dollar, one producer noted that this was the last time that he had been offered decent prices for his grains. One producer acknowledged that when the Canadian dollar was trading at 70 cents, it was much easier to live in that economic environment (F8). Big-ticket items such as machinery were more costly and difficult to purchase, but daily expenses, such as food, were much lower. One producer's experience was that as the dollar improved, market prices for some crops went down (F8).

3.7.7 Canadian Wheat Board

The CWB also had an effect on their operations and the crop profits (F7, F8, F14 and F2). Producers can only sell their grain to the CWB, and they in turn dictate the price that it is sold for on international markets. The disadvantage to producers is that grain and crop producers from other countries are able to sell their product at higher rates than what the CWB is asking, and in current markets these producers are able to sell at higher prices (F14).

Producers felt that there are few incentives that enable them to make decisions about what to grow (F14). The overall impression of the CWB was that it often made bad marketing decisions and producers would much rather have the opportunity and responsibility for marketing their wheat and barley (F8 and F14).

3.7.8 Lack of Grain Subsidies

Producers interviewed also identified the lack of subsidies, versus the subsidy programs that producers in Europe and the U.S. receive, as having a negative effect on their operations. One producer suggested that European producers get subsidies of approximately \$110/acre, producers in the U.S. get about \$45/acre and Canadian producers get nothing (F13).

“Canada has just let producers go it on their own—they are trying to convince other countries and they are not getting rid of them (subsidies). That is why they cut the Crow Rate. They cut it just so they could go to the world meetings and tell the world that they were not subsidizing their producers...trying to make a statement to the world...” (F13).

The Crow Rate was established as a subsidy agreement between the government and the railroads. The railroads would be guaranteed certain lands and benefits within each small town, as long as they provided an established rate for the shipment of crops out of the small towns. As a result, many small towns across Alberta were serviced by railway lines that provided local producers with an economical way to get their crops to market. However, eight to nine years ago, Canada removed the Crow Rate, and producers no longer got the subsidy in the form of inexpensive shipping costs for their crops. As a result, the cost of shipping their crops to market jumped from \$30/ton to upwards of \$120/ton. In the words of one producer, it was one of the biggest changes in the past 10 years that had a dramatic negative effect (F13). Producers are now responsible for shipping their crops to market centres that are four to five hours away by road and with higher fuel costs, it is a significant cost increase.

3.7.9 Land Prices

Lower productivity rates of this region, increasing costs of inputs and a history of low commodity prices have led to larger operations. Many producers have grown substantially in size since they began farming. It has been a common trend over the past 15 to 20 years, that to survive and make a living, there has been the need to increase operation size (F13, F7, F6, F10, F11, F4 and F14).

One of the main factors that has driven land prices higher and increased the competition for land in this region has been the increased presence of large Hutterite colonies. Most of these farming cooperatives are diversified and include hog, dairy and chicken operations, as well as farm-based industries that can guarantee profitable years regardless of shifts in crop prices. Chicken and dairy sectors, built on a quota system, are relatively immune to changes in crop prices. Additionally, once these cooperatives purchase the land it stays within the cooperative. For independent producers, their retirement funds are often contingent upon the selling of their operations for a profit, making it difficult for younger producers to get into farming. Automatically they are in heavy debt, and it is difficult for them to purchase more land when they are competing with the cooperatives (F11 and F13).

3.8 Short-term Coping Mechanisms

When faced with extreme weather events, producers and organizations find ways to cope immediately and over the short term. Many of these strategies are reactive and are implemented or used in an effort to minimize the impacts of the impending weather events. For non-weather impacts and stresses, such as the strong Canadian dollar and competing with subsidized foreign markets, there was little that interviewees could do in the short or long term.

3.8.1 Crop and Hail Insurance

Hail events have occurred throughout the Foremost study region, and although they are infrequent and unpredictable, they have a significant impact on operations. Single hail events can flatten hundreds of acres of crop in a matter of minutes and there is little that producers can do in response. Producers felt that their only response to hail was to buy hail insurance. At least with hail insurance there is the provision of some coverage for hail events (F13). One producer stated that hail insurance pays up front, providing some return at the beginning of the season for an early hail event he encountered. The crop was able to recover somewhat, and with the hail insurance adjustments and the returns on the crop, total returns were better than average years (F6). Another producer mentioned that even though hail affected some of his crops, sufficient rain accompanied the hail and helped to compensate for the usual lack of moisture in July. As a result, the crops that did survive produced good yields (F2).

“We had crop insurance so that kept us alive. It wasn’t much coverage, but it did help.” (F4)

However, crop insurance has been identified as being woefully inadequate and an ill-suited program for providing producers with any sort of assistance or aid (see the programs and policies section for details).

3.8.2 Long-term Adaptive Farming Techniques

In response to short-term coping strategies, many interviewees stated that many of the long-term adaptive strategies that they had applied to their operations were also helpful in minimizing and buffering the impacts of extreme weather events (F2, F13, F15, F13, F1 and F14).

Techniques such as minimum or no-till and direct seeding disturbed the soil less than conventional techniques and help retain more soil moisture. The presence of trash (organic matter) in fields, generated during fallow years from stubble and material left over from harvesting or from not harvesting a crop greatly aided in reducing the loss of soil through wind erosions.

“[We] left as much stubble and trash cover on the land as [we] could because [we] didn’t know how long the drought would last...” (F13).

3.8.3 Lack of Response and a Sense of Frustration

For many producers, with the onset of extreme drought or wet events, there was the attitude that there was little that could be done in response over the short term. Even though many of the long-term adaptive strategies are meant to retain soils and soil moisture, if it doesn’t rain, nothing can be done to improve the situation (F14, F10, F2, F8, F7, F13, F11, F2, F7, F6 and F5).

“You just watch it happen... maybe drive to Montana and sit near the water so that you don’t have to watch it happen around you. You are better off somewhere else because it is so depressing” (F8).

“There is nothing you can do; drought is drought. Mother nature is one thing that God can’t control” (F7).

“There isn’t a lot that you can do when the weather turns to 40°C for weeks on end and there is a lack of rain throughout the summer” (F10).

The same attitude prevails for extreme wet events or heavy rain. Some producers attempted to ditch their land to redirect the drainage, but in reality, the natural drainage systems were overloaded and there was nowhere for the water to go (F7, F6 and F5).

This attitude of no-response, accompanied by a feeling of frustration, was common with respect to some of the non-weather related impacts and stresses including the CWB, rising land prices, competition on the global stage and the cost of inputs.

3.8.4 Decreased Input of Chemicals and Fertilizers

High input costs and greatly reduced returns during the drought years provided financially sound reasoning for not removing crops from the soil or taking machinery out onto the fields (F14 and F13). Interestingly, one producer noted in the second year of the drought, he reduced the amount of fertilizer used because there was already organic matter left over from the previous year’s crops (F14).

3.8.5 Reduced Movement on the Land

Through wet events, one producer learned a lot about his land—where the low-lying areas were and which areas to avoid if there had been a heavy rain. This reduced the amount of time and effort dealing with stuck machinery, as well as learning which areas to avoid seeding with expensive crops. Crops often didn't do well in these wet areas, and it made little sense to waste money and effort seeding, fertilizing and applying chemicals to these areas (F11).

Long-term adaptive techniques that many producers implement also reduce the amount of movement on the land. Seed, fertilizer (and sometimes chemicals) are applied in one sweep through the fields to minimize soil disturbance.

3.8.6 Hiring Additional Labour

Wet years often mean that harvest windows for crops are reduced. Crops require time to dry in the fields before they are harvested, and if it is excessively wet during the harvest season, producers have to be able to get their crops off the field over short time frames. To do so, one producer hired additional help to take advantage of the best harvest window that would maximize the quality and quantity of his yield (F3).

3.8.7 Relocation of Cattle

In response to extreme drought, one cattle producer moved his cattle herd to northern B.C. where weather conditions were better and more feed was available. This move was made at considerable cost to the producer, and in the end there were considerable complications and extensive court costs in getting the cattle back to the Foremost region (F5).

3.8.8 Financial Strategies

One producer identified being financially sound as possible as an effective short-term coping strategy. Wise money management helped to build up a financial buffer that enabled him to weather out years when yields and profits were low (F14). The effectiveness of this strategy was countered by another interviewee who noted that with current high operating costs that a year of poor returns could bankrupt the operation. Another producer stated that during years when commodity prices were low, under the CWB, he had the option to roll his shares into the next pool of grain sales (F3).

3.9 Long-term Adaptation Measures

Over the long term, interviewees have developed strategies that enabled their farms and organizations to be better able to address and cope with weather extremes. In many instances, the practices that were developed have evolved over the past 20 to 30 years in response to the region's weather. Some participants are known to be regional pioneers for some of the minimum and no-till practices that have gained widespread acceptance throughout the region. Other strategies, such as participation in farm marketing groups, have aided producers in addressing some of the non-weather related stresses and impacts and include:

- earlier seeding times (F4, F16, F13, F6 and F12);
- adapting to surrounding land (F9);
- shelterbelts;
- community water pipelines;
- continuous cropping;

- marketing/long term planning;
- changing/rotation of crops adapted to regional conditions;
- improved use of technology (F14);
- minimum/no-till farming techniques (for example, chemical fallowing and direct seeding); and
- local knowledge systems.

3.9.1 Earlier Seeding Times

Many producers noted that one of the most effective strategies that they have implemented in the recent past was a shifting of the in-the-field work window so that activities occur a month earlier than they did when they were kids on the farm. Seeding was one activity that many participants noted as happening earlier. In the 50s and the 60s, if seeding was complete by the May long weekend, then the year had started off well. Now, producers are getting into the fields by early April.

The reason behind this shift is to get the crops growing earlier, in the hopes that they will be well along in their growth once the heat and dryness associated with July arrives. Crops are much better suited to cope with these conditions if they are well into their growing stage and starting to develop seed heads or flowers. If crops are in the initial growth stages when the heat hits, they can be severely damaged (F13).

Part of the reason why producers are seeding earlier is that they can. Winters in the past 10 to 20 years have not been as harsh and producers are able to get onto fields earlier (F16). Other producers were also choosing to grow crops that were better suited to earlier seeding (F4). Earlier seeding has also resulted in earlier harvest. Harvest ran from September through October but now begins in mid to late August and is completed by the first week of October.

One producer mentioned that there was interest and research going into the development of crops that can be seeded in the fall. In part, that would be contingent on the warmer and less severe winters that have been happening over the recent past, but would allow crops to get even more of a head start in the spring.

3.9.2 Adaptation to the Land

In a true adaptive approach, one interviewee stated that his guiding principles for operating his ranch came from working within the boundaries of the local natural environment. He tries to minimize the use of diesel-based inputs and activities, and exemplifies this by not using a lot of large machinery. He acknowledges that where he lives and works was a very dry, hot and arid environment and that winters can be just as punishing as the summers. Employing such strategies as choosing a medium-sized breed of cattle with cows that can become fertile on fewer “groceries,” and by putting his cattle down in the sheltered coulees for the winter, he runs his operation on the premise that “nature knows best,” and that it was much easier to adapt to local conditions than to work against them with multiple external inputs (F9).

3.9.3 Planting of Shelterbelts

A few participants have been planting windbreaks with trees for many years. One participant combined the planting of tree windbreaks at every 40 acres with planting his crops in 20-acre strips (F1). Such techniques provide a variegated ground surface and are very effective at breaking up the winds that shear across flat fields—the primary reason for the soil erosion and moisture evaporation. Another producer planted seven miles of trees to provide his cattle with shelter during the harsh winters (F9).

3.9.4 Community Water Pipelines

The development of regional water pipelines has removed some of the daily stress of needing to conserve water on farmsteads. These pipelines connect rural farmsteads to large regional water reservoirs and are co-funded through government and farm operators. Producers put up some of the cost for developing and installing the pipelines, and they pay a fixed rate to have a specific volume of water available to them every day. The water has been used primarily for day-to-day life (for example, personal consumption), as well as providing point sources for farm operation (for example, the watering of a vegetable garden or supplying water to limited numbers of livestock) (F9 and F17).

3.9.5 Continuous Cropping and Crop Rotation

One producer identified the process of continually seeding all of his land. From his perspective, this gave him the advantage that if it was good year, he got a better yield overall, but if it was a bad year, because all his land was cropped, he was better suited to take advantage of crop insurance. Since crop insurance is determined in part on regional/area averages, total acreage seeded and total acreages either lost or with reduced yields, he had determined that having all of his land seeded gave him a better return for insurance during poor yield years (F2).

Another producer mentioned that he continually rotated his crops through fields on a four-year cycle. In one year, three-quarters of his total acreage was cropped, and the remaining one-quarter was left fallow and chemicals used to control weeds. From here, different crops were grown in different fields each year to take advantage of different growing strategies of each crop and the available nutrients and water moisture in the soil (F17).

3.9.6 Marketing and Long-term Planning

Producers identified that farming is becoming a business and is no longer a lifestyle with a majority of the time spent in their fields.

“Farming as a way of life is gone; the small time farm way of life is gone; now it is a business... just like any other business... there is no lifestyle now; that is all gone...” (F13).

Two producers belonged to an agricultural marketing and management group that provided access to extensive marketing, research and development programs. The management group organized agricultural conferences, brought in guest speakers, provided mentoring partnerships with producers in other provinces, and offered a wealth of marketing information and resources. Membership was by recommendation and there was a substantial fee membership. One producer felt that belonging to this group had given producers a “leg-up” in the industry over the past 20 years and felt that producers are giving back as well as benefiting from the agricultural community (F10 and F8).

Organizational participants made an effort to host meetings for producers on crop-insurance and brought representatives in from the chemical companies to answer questions and help producers in being better prepared to deal with current and future weather and non-weather stresses (F18).

Due to the retirement of his marketing agent, one producer worked jointly with three or four producers in southern Alberta to develop and operate a marketing group specific for the safflower industry. Safflower seed is sold for birdseed, and with few operations producing it, these producers had to put together their own marketing program. They wrote the book on how to grow safflower in southern Alberta, and were responsible for supplying customers from the lower mainland of B.C. to southern Ontario. The benefit of being the producer and the marketer is that they get much closer to their customers and there is no expense associated with a middle man (F11).

3.9.7 Changing Types of Crop/crop Rotation

With a warming trend in the winters and moisture coming at different times of the year, producers have chosen to seed crop types that are better suited to changing conditions. Crops are chosen or removed from rotation based in part on their ability to accommodate these changing weather patterns (F5). One producer stated that he had moved out of pulses because they don't do well in the heat (F6), while another producer noted that he paid a lot of attention to growing crops that were more drought resistant (for example, durum, winter wheat) and rotated these with oilseeds, which also leave a good amount of trash on the ground (F11). One rancher has adapted his crop selection by seeding with drought-resistant grasses and by looking to the natural environment for species of native grass for grazing his cattle (F9).

3.9.8 Technological Advances

Technological advances in farm equipment and infrastructure have been valuable in enabling producers to adapt to changing weather conditions. Producers mentioned the use of Global Positioning Systems (GPS) in their tractors as being very beneficial. The operator inputs geographical coordinates that determine, among other things, the position of rows, the spacing between rows and turning points at the end of each row. Precise coordinates greatly reduce overlapping rows with spray, seed or fertilizer, and also reduce the amount of fuel used. Operators can also work for longer stretches of time and the preciseness of the systems enables them to work into the dark. This is especially critical in the spring, when there are not enough daylight hours to complete field work (F10 and F11).

Producers have also switched to more efficient seeding systems. These include the use of an air drill that deposits the seed directly into the soil with minimal disturbance, the application of fertilizer with the seed and the use of various types of low disturbance blade implements that are placed ahead of the air drill. These blades cut the root systems out from weeds, and leave the green matter on the surface to retain the organic material. Such seeding systems greatly reduce the number of passes and equipment required to get the crop into the ground (F11, F17 and F4).

One producer mentioned that he had switched his harvesting operation to a stripper head to mimic a process that he had observed in a neighbour's fields. Suffering from an extreme weather event in the previous year, crops had been left in the field because it wasn't worth harvesting them. However, this material contributed to the trash levels. These fields were better prepared to cope with the dry periods in the following year. Recognizing that this trash had helped to retain snow through the winter, and built up the soil moisture levels, he chose the stripper head to mimic this process. The stripper head only removes the heads of cereal crops, and leaves the majority of the plant material in the soil (F14).

Changes to infrastructure on the farm also helped producers adapt to some of the non-weather stresses that resulted indirectly from changes in weather. As discussed previously, warmer temperatures and milder winters have led to a marked increase in the number of pests in the region. Storing grain in bins often presents excellent conditions for pest infestations. To counter this, one producer switched to much larger bins with aeration to condition his grains, making conditions unfavourable for pests (F11).

3.9.9 Adaptive Farming Techniques

The primary focus of adaptive farming techniques centres on minimal or no-till disturbance of the soil (F2, F11, F17 and F6). Producers in the region recognize the most limiting factor to farming has been the retention of soil and soil moisture. Minimal soil disturbance reduces the exposure of the soil to persistent evaporative winds, and if the soil is light enough or there is insufficient organic matter retaining the soil, these winds also erode the soils.

Many producers make use of chemicals for fallowing their fields. Instead of using a cultivator to physically remove weeds, chemicals are sprayed on to kill them. This process serves a few purposes. It leaves green material on the fields that will contribute to the organic matter content of the soil. Because the weeds are not physically removed from the soil, their root systems remain and retain the soil. Lastly, the trash on the soil surface breaks the wind and reduces the impact of wind erosion and the evaporation of soil moisture. (F17, F6 and F11) Other producers identified the technique of direct seeding to reduce soil disturbance (F2 and F11).

One producer described in vague detail the directing of tractor exhaust back into the soil. Carbon is fed back into the soil to improve the soil condition and reduce the amount of fertilizer required (F7).

3.9.10 Local Knowledge Sharing/awareness of Local Knowledge

Producers stated that the informal network for sharing local knowledge was critical to their survival in light of a wide array of weather and non-weather related stresses. If one person was dealing with a pest infestation or flooded fields, there were others in the region facing the same situation. Participants identified the importance of daily coffee at the farm cooperative or farm supply store, where they often passed and traded recent news, events, conditions of fields, and new twists on old dilemmas and their solutions. Industry consultants, farm supply personnel, producer meetings and commodity group meetings were also effective ways of sharing and addressing local problems, issues and solutions. One participant noted that it was necessary to surround yourself with knowledgeable people as well as cooperate and share with your neighbours.

One organizational representative stated that the sharing of information and experiences over a cup of coffee was a key strategy for producers in dealing with weather extremes. The sharing of their collective past history better prepared them all for being better equipped and aware of how to cope and adapt when the scenarios were encountered again (F18).

More formalized and complex versions of local knowledge systems come in the form of the farm marketing and management groups that were discussed under the earlier heading of Marketing and Long-term Planning.

3.9.11 Maintained Insurance

Crop insurance was identified by a couple of producers as being useful as part of their long-term coping strategies for stresses to their operations. Although the program has one or two major flaws that are discussed below, some producers felt that it did offer them some form of recompense if there were large-scale crop failures during the year. As costs for operations on the farm increase exponentially, and the risk of losing crops due to weather or other uncontrolled events was still very real, then a few producers felt that taking out crop insurance was very much an accepted cost and part of running the farm (F4 and F13).

3.10 Factors Aiding and Hindering Responses to Stress

In addition to short-term coping mechanisms and long-term adaptive strategies employed by producers, there were factors that producers noted as affecting their ability to respond to weather and non-weather related stresses. In most cases, the factors that aided in their response to weather stresses were similar or related to the previously discussed short-term and long-term coping strategies. Understandably, the reason why producers had adopted or implemented a strategy was primarily for the fact that it aided them in their response to extreme weather events. Similarly, many of the factors that hindered their ability to respond to weather stresses on the farm were linked to non-weather related stresses that were previously discussed. For many producers, factors such as isolation, labour competition and the high price of land put stress on their operations and in doing so, hindered their ability to adapt to and respond to weather events. Tables 9 and 10 look at the factors that have aided and hindered producers' responses to stresses.

3.10.1 Factors that Aided in Response to Stresses

Table 9: Factors Aiding Response to Stresses in Foremost

Factors	Comments
Education	<ul style="list-style-type: none"> • Courses on how to use machinery effectively and efficiently around their operations (F3 and F5) and getting smarter—learning through time (F7).
Personal savings	<ul style="list-style-type: none"> • Saved enough of their own money over the years (F5).
Geographical spread of operations	<ul style="list-style-type: none"> • Spread out over large distance minimizes impact of regional or localized weather events—for example, hail and localized geography that minimizes or amplifies weather events (F4).

Factors	Comments
Crop insurance	<ul style="list-style-type: none"> • Aided in handling rain and hail events (F7).
Rain events	<ul style="list-style-type: none"> • Helped to fill up dugouts for cattle—lasts the season (F8).
Online research and computer programs	<ul style="list-style-type: none"> • Solving problems/looking for solutions through the internet (F13) and use of computer programs for planning and research (F11).
Organic practices	<ul style="list-style-type: none"> • Better suited to the land (F1).
Adaptation to the land	<ul style="list-style-type: none"> • Running the ranch within the limitations and conditions of the surrounding landscapes (F9).
Networking	<ul style="list-style-type: none"> • Sharing information with other producers through informal networks (F13).
Soil testing services	<ul style="list-style-type: none"> • Participation and membership in soil testing group in Saskatchewan (F8).
Management groups	<ul style="list-style-type: none"> • Participation in Pike Management Group (F10).
More machinery	<ul style="list-style-type: none"> • With more machinery producers were able to work larger farms more efficiently—less labour (F10).

3.10.2 Factors that Hindered Response to Stresses

Table 10: Factors Hindering Response to Stresses in Foremost

Factors	Comments
Isolation	<ul style="list-style-type: none"> • Foremost is an isolated location—hard to attract outside labour (F4).
Labour competition	<ul style="list-style-type: none"> • Competition oil and gas industry—for example, Fort McMurray (F4).
Government programs	<ul style="list-style-type: none"> • Inefficient government programs—not suited to producer needs (F7). • CAIS program—when program came in it was tied to five-year average income, but previous five years were not great. • Crop insurance a complete wreck (F14, F11 and F7).
Bankruptcy	<ul style="list-style-type: none"> • Facing bankruptcy—had to approach family for loans (F7).
Expenses	<ul style="list-style-type: none"> • high cost of inputs—fertilizers, chemicals and fuel
High Canadian dollar	<ul style="list-style-type: none"> •
High cost of land	<ul style="list-style-type: none"> • Tough to get land—high competition from farm cooperatives and increasing cost of land due to competition (F10 and F11).
Lack of technical support	<ul style="list-style-type: none"> • Lack of tech support at research centre—used to be a District Agriculturalist—now only two people exist and usually requires booking an appointment weeks in advance (F13).
Grain prices	<ul style="list-style-type: none"> • Low grain prices until very recently have made it very difficult to turn any sort of profit (F6).

Factors	Comments
Pests	<ul style="list-style-type: none"> • Seeing new pests and uncertain as to how to deal with them.
Fertilizer types	<ul style="list-style-type: none"> • 9/11—restricted the use of a stable fertilizer (had to switch to a more volatile fertilizer that degrades quickly after application) and to be useful its application had to be timed closely with precipitation events (F11).

3.11 Programs and Policies

The following comments and recommendations were generated from participants when they were asked whether or not they had made use of the suite of programs included in the interview package, and whether or not there were specific programs that had assisted or worked against them during extreme weather events. Of all of programs that were listed on the reference sheet (14), participants were able to speak in detail to eight of them. Generally speaking, participants felt that programs that were meant to offer immediate aid or assistance were often inadequate and lacking (for example, CAISP), while those programs that helped to establish long-term adaptive measures (for example, community pipelines) and improve on methods and technologies on the farm were more satisfying and successful at achieving what they were meant to do.

Participants also provided comments and recommendations in general about government programs and policies. Although not tied to specific programs, these comments reveal participants true feelings and opinions of government efforts to implement and offer assistance programs. These are provided after the brief discussions of the programs.

3.11.1 CAIS

CAIS was meant to replace NISA and FIDP in an effort to become the comprehensive government assistance program for producers nationwide. However, from a Foremost perspective, it is one of the most cumbersome and inefficient programs to be established by the government (F17, F14, F1, F6, F12, F15, F9, F5 and F18). Of all participants interviewed, only two had marginally good comments about the program, suggesting that over the years it had offered them some assistance (F2 and F11). Overwhelmingly, comments from participants pointed out that the program was not suited to their needs, and that for whatever reasons, it seemed to change from year to year (F2 and F1). Given such changes, it became difficult to figure it out from one year to the next, and it was not suited to mixed operations or those producers who seemed to be doing well over the long term and all of a sudden happened upon a bad year (F6). One of the most consistent messages was that the program was so complicated to figure out that many producers found they had to hire accountants to make claims (F17, F4, F9, F15 and F5). However, in the words of one interviewee, it is little wonder that the program doesn't work for the most part because it is next to impossible for a federal government to develop a nationwide aid program for over 100,000 producers (F5). This was one of the most telling and summary comments, suggesting that for a comprehensive aid program to be effective, the program needs to be more regionally relevant, understandable to producers and relatively inexpensive to use.

3.11.2 Crop Insurance

Many participants commented that even though they had crop insurance, and it did provide some assistance, it was not as effective and suited to serve local operations as it could be (F4, F12 and F15). One producer felt that the program should be set up to respond to specific events such as hail or drought, and not respond to poor farm management and planning decisions made by the producer (for example, seeding too late or harvesting too early) (F14). One of the major complaints was its inconsistency with regards to how different people qualified for the program. Some participants, who had been contributing and participating for years, were receiving less or qualifying at a lower level than those people who had been in and out of the program for the same number of years (F12 and F15). Another complaint was that returns were calculated on regional averages compared to basing calculations on what was actually happening on each operation. This often meant that even though a producer may have lost a large portion of his crops due to weather, the use of regional averages may have reduced or cushioned the full impact of his localized losses. Subsequently, his returns are often much less than what he should receive for very real losses (F9 and F11). Many producers carry crop insurance simply because it offers some sort of protection and a return of sorts if crops fail and it is a truly bad year on the farm (F1, F2, F8 and F16). A few producers seem to swear by the program, stating that in today's day and age, where input costs are so high, that it is necessary to have the program to guarantee there is a certain degree of protection in place if things go badly (F7, F9 and F14). It was mentioned that the program seems to be changing this year, and there is the possibility that it will be more specific to each operation versus using area averages (F11).

3.11.3 National Environmental Farm Plan Initiative

Overall, this program was consistently praised and many producers participated and took advantage of it (F17, F2, F4, F6, F7, F15 and F8). For many, it made them more aware of how they ran their operations with respect to the surrounding environment, and they often found the implementation of the environmental farm plan influenced and altered their general thinking and approach to decisions on the farm (F2, F17 and F10). The program also offered substantial assistance in purchasing new equipment that helped to reduce the cost and amount of inputs (for example, GPS systems for machinery), as well as equipment that helped to reduce soil disturbance and retain soil moisture (F4, F6 and F7). The detracting features of the program often had to do with getting timely financial assistance for the purchase of equipment. Some of the rebates only came after producers had first put up the full amount for the equipment that they were purchasing, while other purchases had to be pre-approved and often took time to get approved (F4, F7 and F18).

3.11.4 Net Income Stabilization Account

Even though the NISA program was no longer being offered, some participants made a point of stating that this was a good and effective program for them (F17, F1, F2, F13 and F8). It was a savings program set up between the producer and the federal government, where the government would match contributions by the producer, and the producer could then use the savings down the road when the producer was facing challenging times. The overall feeling was that NISA was a preparatory program that enabled the producer to put some money aside for future and unforeseen disasters. Some participants felt that they would be happier if they brought it back again compared to what they were currently getting through CAIS (F17). Literally, it allowed producers to build their own disaster relief fund. Compared to CAIS, it was more of a preparatory aid program and effective in that the

money was readily available (F17). Organic operators felt that NISA was better suited to assisting them compared to the current CAIS program. On the flipside, one producer was somewhat dubious as to where the money put into the NISA program actually went (F10).

3.11.5 Additional Programs

A variety of other programs were used to a limited degree by a fewer participants. The CAFSP aided one producer in purchasing GPS technology for his tractors to improve efficiency in the field (F10). Some participants made use and were involved in the DU programs, where producers received assistance to improve areas of aquatic habitat and plant grass seed on their acreages for migratory duck species (F9, F5 and F3). Producers also made use of the PSP to put windbreaks of trees throughout their farms and in their farmyards (F3, F5 and F10). The CAWSEP also assisted some producers with the installation of rural water pipeline systems that brought water from distant reservoirs right to their farmyards (F10). Another participant stated that drought conditions led to the development of his own water cooperative that in turn brought piped water right to the farmyard from a source 55 km away (F1). From the organizational perspective, one participant stated that his company provided access to a virtual weather station over the internet and at the company office. Producers could subscribe to the service over the web, and it provided them with extensive and up-to-date weather conditions and forecasts (F18).

3.12 General Comments on Programs and Policies

“Take your lumps and prepare for the events on your own type of attitude. I don’t believe it is the government’s responsibility to look after me; I need to do that on my own... too much of a socialistic attitude... the role of government is that when it comes to trade policies (some of the umbrella issues world trade organizations), that is where government should be looking after us, not on the micro level, but more on the macro level...” (F14).

“If you look at Europe and the U.S., they subsidize their producers, but Canada won’t subsidize its producers... . Canada keeps going to all of these meetings wanting no subsidies on food and Canada won’t subsidize its producers; Canada is trying to convince the other countries not to subsidize their producers as well... . Canada has just let producers go it on their own...” (F13).

“Farming as a way of life is gone; the small-time farm way of life is gone; now it is a business... just like any other business... there is no lifestyle now; that is all gone...”(F13).

“There needs to be specific disaster relief type planning, programs and policies for places like Foremost. This area gets much lower yields than many other areas of the province, but the producers down here still have to pay highly inflated prices for fertilizers, chemicals and fuels. Crop insurance won’t kick in and it will be a very long time before they get CAISP. There needs to be specific programs down here that respond to the conditions as they are happening versus some sort of reactionary program that takes a long time to get some sort of return to the producer” (F15).

“There is the need to educate urban areas. People in urban areas don’t understand what producers are doing with respect to environmental stewardship on the farm. [I] still believe that a lot of people in the city think that producers are mining the land and working against

the environment... so there needs to be an education effort on behalf of the general public in urban centres”(F11).

The mobility of society now, with producers having to travel further afield and longer distances to meet the needs of their farms, means that they lose the direct contact with their markets and their market dealers. We no longer have the coffee shop/grain elevator relationship that you had in the local community... now communications are done over the phone and you miss the face-to-face interaction and the sense of community” (F11).

“I’m very leery of how the government operates. I think a lot of producers are nowadays. There’s not a lot you can do. You have to work within the confines of what they have” (F8).

“...and the disappointing thing is, that when programs are developed, they are developed for all of Alberta... programs are not that useful to us... . We take part in them because what if we have a disaster... but it would take a disaster for many of these programs to be really useful to us...” (F10).

“I could make this real short. The government is our worst enemy; plain and simple” (F7).

Programs are always changing... they change stuff halfway through... and often you don’t know why... (F12).

“Eventually you will see the need for a compensation program that will pay producers to put property/acreages into wilderness habitat or natural environment; right now, the worldwide demands on grains and for crops is too high and the incentives too low for producers to do this; would rather make money and feed humans than lose the use of land and provide habitat” (F9).

“...I think they always need some practical input from the producers that are there, people who have been on the land most of their life... . I am not saying that we should have any more power than them, but I don’t think they should have too much more power than us... We can bring a practical side to it and a lot of us are well educated and we recognize the issues and we are open to discuss them and to look at them, but I don’t think we should ever be on the outside looking in on something that really directly affects us like that...” (F9).

4.0 Synthesis of Coaldale and Foremost Cases

This final section of the report compares results from the two study locations, highlighting similarities and differences. More specifically, it will examine the reporting of extreme weather and non-weather stresses in Coaldale and Foremost, mechanisms for short-term coping and long-term adaptation, factors aiding and impeding response to stress, and the use of government policies and programs.

4.1 Reporting of Extreme Weather Events

Table 11 provides a comparison of extreme weather events in Coaldale and Foremost as reported by interview participants. The extremes that were identified by a large number of participants are in bold and italicized text.

Table 11: Comparing Extreme Weather Events in Coaldale and Foremost

Year	Coaldale Events	Foremost Events
2000	Drought conditions (entire season) (C2 and C11).	<i>Drought conditions (F1, F2, F4, F6, F8, F11, F12, F13, F6, F9, F7, F5, F17, F19 and F18).</i>
2001	<i>Drought conditions (entire season) (C2, C3, C4, C5, C6, C8, C9, C10, C11, C13, C18 and C20).</i>	<i>Drought conditions.</i>
2002	<i>Heavy rains and flooding (June) (C2, C4, C5, C6, C8, C9, C10, C11, C13, C17 and C19).</i>	<i>Heavy rainfall and flooding (June) (F1, F2, F5, F6, F11, F17, F1 and F8).</i> Extremely dry July. (F6) Frost event in mid-August. (F1)
2003	Extreme heat—more than 30°C for eight days straight (C1).	No rain through July of this year (F6).
2004		Hail (July) (F2).
2005	<i>Heavy rainfall and flooding (June and September) (C1, C2, C3, C4, C5, C7, C9, C12, C13, C14, C17, C18 and C20).</i>	Dry spring, wet start of summer, dry July (F6).
2006	Strong winds (spring and fall) (C1 and C20). Heavy rains (June) (C9, C14).	Hot and dry July (F6).
2007	<i>Extreme heat and drought (C4, C7, C8, C9, C10, C14, C15, C16, C19 and C20).</i> <i>Hail (August) (C4 and C9).</i>	<i>Extreme heat and drought (F1, F2, F4, F8, F11, F16, F14 and F17).</i>

From Table 11 it can be seen that three major weather extremes are common to both areas: the drought conditions in 2001; the heavy rains in flooding that took place in June of 2002 and the extreme heat and dryness reported in 2007 (especially in July). Furthermore, the drought conditions of 2000 that were described by a majority of Foremost interviewees were also mentioned by two of the interviewees in Coaldale. The single extreme weather event that seems to be distinct to Coaldale was the heavy rains that took place in June and September of 2005. This was not mentioned by any Foremost respondents.

4.2 Short-term Coping and Long-term Adaptation Mechanisms

4.2.1 Coping with Drought

Crop insurance was commonly used by producers in both regions to cope with drought over the short term, while minimal and reduced tillage techniques, crop diversification, crop rotation and the selection of crops that were suited better to drought conditions were some of the common longer term strategies (Tables 12 and 13). Unique to Coaldale were

irrigation-related strategies and the ability to divert water, purchase more water rights and the use of efficient irrigation technology. In the Foremost region, producers could do little about obtaining more water so over the short term they made efforts to reduce their input costs and become more financially sound. Long-term strategies included participation in market research groups, the use of technology that minimized soil disturbance and moisture loss, shelterbelts, community water pipelines and the dissemination of local knowledge between producers.

Table 12: Coping with Drought in Coaldale

Coping with Drought – Coaldale			
Short-term Coping Strategies	Long-term Adaptation Mechanisms	Helping Factors	Hindering Factors
<ul style="list-style-type: none"> • Diverting water to high-value crops • Purchasing water rights • Crop insurance 	<ul style="list-style-type: none"> • Reduced tillage (no-till) practices • Organic farming • Crop diversification and rotation • Crop choices specifically targeted for drought • Changing seeding and harvest schedules • Use of government programs • More efficient irrigation technologies 	<ul style="list-style-type: none"> • Water-sharing agreement between SMRID, municipal water users and industrial water users • Knowledge of specific amounts of water rationing 	<ul style="list-style-type: none"> • Water treated like a commodity • Potatoes particularly susceptible to drought and need consistent water

Table 13: Coping with Drought in Foremost

Coping with Drought – Foremost			
Coping Strategies	Long-term Adaptation	Hindering Factors	Aiding Factors
<ul style="list-style-type: none"> • Crop insurance helped in some cases. • Reduced level of inputs—lowered costs of operation. • Financially stable—in relatively good condition beforehand. 	<ul style="list-style-type: none"> • Minimal/no-till methods. • Chemical fallowing reduced soil disturbance. • Participation in market research groups. • Changing types of crops to those that are better suited to the heat. • Use of technology—for example, air drills that minimize soil disturbance. • Shelterbelts. • Local knowledge systems—networking between producers. • Community water pipelines. • Crop rotation and continually having organic matter on fields. 	<ul style="list-style-type: none"> • Bankruptcy—high cost of inputs—see influence of non-weather stresses. 	<ul style="list-style-type: none"> • Geographical spread of operations. • Financial savings. • Over time have adapted operation to mimic natural environment.

4.2.2 Coping with Heavy Rains and Flooding

In coping with heavy rains and flooding, producers in both regions made use of crop insurance to cope over the short term and incorporated longer term adaptation strategies such as crop rotation and shifted seeding and harvest times (Tables 14 & 15). In Coaldale, producers pumped water off the land, dug ditch and drainage systems, bought more silage for their cattle, re-plowed their fields and put sawdust between the rows of crops in U-pick operations. Long-term adaptations unique to this region included more permanent drainage systems such as the use of water pumps and reduced tillage practices, and the selection of crops that were suited to wet conditions. In Foremost, some producers felt that they couldn't do anything to respond to wet conditions over the short term and simply reduced their movement and disturbance on the land. Long-term adaptations such as crop rotation of less expensive crops through wet areas and changing seeding times were similar to techniques employed in Coaldale.

Table 14: Coping with Heavy Rains and Flooding in Coaldale

Coping with Heavy Rains and Flooding – Coaldale			
Short-term Coping Strategies	Long-term Adaptation Mechanisms	Helping Factors	Hindering Factors
<ul style="list-style-type: none"> • Pumping water off the land. • Digging ditches. • Moved cattle out of pens. • Bought more 	<ul style="list-style-type: none"> • Reduced tillage (no-till) practices. • Organic farming. • Crop diversification and rotation. • Crop choices specifically. 	<ul style="list-style-type: none"> • SMRID aided in building drainage. • Re-spraying fields increased yield. 	<ul style="list-style-type: none"> • Water pump shortage. • Getting rain after irrigating. • Pumping water out of cattle pens further flooded fields. • Contamination of water supply and a boil-water warning.

silage to feed cattle. <ul style="list-style-type: none"> • Put sawdust between rows of crops (for U-pick). • Used more fertilizer. • Re-sprayed fields. • Crop insurance. 	targeted for extreme moisture. <ul style="list-style-type: none"> • Changing seeding and harvest schedules. • Use of government programs (for example, IRP). • Building drainage systems. • Purchasing water pumps. 		
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Table 15: Coping with Heavy Rains and Flooding in Foremost

Coping with Heavy Rains and Flooding – Foremost			
Coping strategies	Long-term Adaptation	Hindering Factors	Aiding Factors
<ul style="list-style-type: none"> • Lack of response—not really a lot that can be done. • Avoiding fields—reduces damage and input costs. • Reduced movement on the land. • Crop insurance. 	<ul style="list-style-type: none"> • Crop rotation—planting of less expensive crops in low-lying and areas prone to flooding. • Earlier seeding times to take advantage of early moisture—enables crops to make it through remainder of season even if it was dry later on. 	<ul style="list-style-type: none"> • Labour shortage—difficulty getting labour to get crops off fields, helping with draining the fields. • Isolation—hard to hire labour to work in the region during shortened harvest windows. 	<ul style="list-style-type: none"> • Rain events helped to top-up water supplies on farm. • More machinery—able to harvest large areas during shortened harvest windows.

4.2.3 Coping with Extreme Heat

In coping with extreme heat, there were many similarities in the strategies used by the two regions in their response to drought events (Tables 16 and 17). Over the short term, producers in both regions employed crop insurance and waited out the extreme temperatures. Many felt that there was simply nothing they could do in the immediate sense. Over the long-term, adaptation strategies included the implementation of crop rotation techniques, alteration of seeding and harvesting times to take advantage of early season moisture and the selection of crops specifically suited to the given conditions. Coaldale producers were able to increase and shift their irrigation operations, employ organic farming techniques and made use of government programs to help them cope with the heat. Foremost producers tended more toward adapting over the long term to the extreme heat. Continuous covers of organic matter, either through chemical fallow or leaving trash from the harvest in the fields, are effective in retaining as much moisture in the soil as possible. The use of improved technology that reduced the disturbance of the soil and minimized moisture loss were also key strategies for Foremost producers. Over the long term, preparation of shelterbelts and community water pipelines offered further assistance in coping with extreme heat.

Table 16: Coping with Extreme Heat in Coaldale

Coping with Extreme Heat – Coaldale
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Short-term Coping Strategies	Long-term Adaptation Mechanisms	Helping factors	Hindering factors
<ul style="list-style-type: none"> • Wait it out. • Increase irrigation. • Crop insurance. 	<ul style="list-style-type: none"> • Reduced tillage (no-till) practices. • Organic farming. • Crop diversification and rotation. • Crop choices specifically targeted for extreme heat. • Changing seeding and harvest schedules. • Use of government programs. 		<ul style="list-style-type: none"> • Can't increase irrigation when also in a drought situation.

Table 17: Coping with Extreme Heat in Foremost

Coping with Extreme Heat – Foremost			
Coping Strategies	Long-term Adaptation	Hindering Factors	Aiding Factors
<ul style="list-style-type: none"> • Lack of response—not really a lot that can be done. • Avoiding of fields—reduces damage and input costs. • Reduced movement on the land. • Crop insurance. • Sound financial strategies—saved own money over time. 	<ul style="list-style-type: none"> • Selection of crops that are better suited to the heat. • Earlier seeding times to take advantage of early moisture—enables crops to make it through remainder of season even if it was dry later on. • Crop rotation and continually having organic matter on fields leads to more organic soil and better moisture retention. • Leaving trash on fields retains snow—increases soil moisture content. • Changing crop types to those that are better suited to the heat. • Use of technology—for example, air drills that minimizes soil disturbance. • Planting of shelterbelts. • Community water pipelines—aids in day-to-day living. 	<ul style="list-style-type: none"> • Wind. • Increased input costs—higher cost of production. • Strong Canadian dollar—recent improvement in dollar made daily living more expensive—some producers found crop prices to be lower as well. • CWB—controls where grains are sold—make less money than could if producers were selling it by themselves. • High land prices—tougher to expand to get more land to make up for reduced yields. 	<ul style="list-style-type: none"> • Commodity prices—better prices even though yields may be low. • Maintained crop insurance. • Education • Geographical spread of operations. • Adaptation to the environment.

4.3 Comparison of Aiding and Hindering Factors

4.3.1 Aiding Factors

Respondents from Coaldale and Foremost named many common factors that aided them in responding to weather and non-weather stresses:

- research and learning—including using individual learning (taking courses, expertise gained over time or from family members and online research)—and information received from external organizations (for example, Lethbridge Research Station, Alberta Agriculture, ID offices, RTL, among others);
- geographic spread of operations—being spread out means that different parts of the operation will get hit with different weather patterns;
- government programs—crop insurance and the IRP were given as examples;
- organic practices—these farming methods were seen as helpful for all weather extremes;
- networking—sharing information with other producers through formal and informal networks; and
- adaptation to the land—learning what works well on the land and what doesn't.

Aiding factors unique to Coaldale respondents included many that are related to irrigation, such as the water rationing agreement, calculation of water rations during the 2001 drought year, implementing more efficient irrigation technologies and receiving help from SMRID with drainage during the flood. Other factors mentioned by one or two respondents include growing for a niche market, growing in a greenhouse, using diverse crop rotation, using reduced till or no-till practices and growing their own silage. Aiding factors reported only by Foremost participants include using personal savings, receiving rain events, participating in management groups and having more machinery to increase efficiency.

4.3.2 Hindering Factors

All of the hindering factors common to both Coaldale and Foremost interviewees are related to the non-weather stresses that were reported in the study. The increased costs of doing business were a major hindrance for producers (energy, grain, land and labour prices were all cited). As well, the booming Alberta economy and the related labour shortage were mentioned in both case study locations. Finally, insufficient or poorly run government programs and increased insect and disease pressure were also discussed.

Other hindering factors cited by Coaldale participants include the following the timing of the weather extreme (for example, whether the rain came after irrigation or during harvest), sunk and damaged machinery (due to flooding), a water pump shortage and the contamination of the water supply by livestock operation run-off. An irrigation-related factor that hindered coping in Coaldale was that water rights started to be treated as a commodity and some people were using them to make a profit. Respondents from Foremost identified a lack of

technical support at the nearest research centre, a restriction on the use of certain fertilizers and a threat of bankruptcy as hindering factors.

4.4 Reporting of Non-weather Shocks and Stresses

Reporting of non-weather shocks and stresses was remarkably similar between participants in Coaldale and Foremost. All stresses mentioned in one location were also mentioned in the other with the exception of one (the CWB). The common stresses reported are:

- the BSE crisis;
- changing commodity prices, including the influence of global markets;
- increased costs of business (fuel, energy, labour and land);
- increased competition for land;
- increased value of the Canadian dollar;
- labour shortages;
- more disease and insect pressures; and
- lack of subsidies compared with other countries (especially the U.S.).

Four participants from Foremost also mentioned the CWB as a major stress. The CWB was seen as an organization that severely restricts marketing opportunities for producers.

4.5 Policies and Programs

For the most part, many of the programs and policies referenced and discussed in the report for southern Alberta were common to both regions (Table 18). Even though the NISA program is no longer operating, participants in both regions commented on the fact that it was a more preferred program to CAIS, which it replaced. One Foremost participant also mentioned the formation of Water Cooperatives in light of the drought of 2000/2001. Few details were provided on this organization and its purpose, but its establishment was unique to the Foremost area.

Table 18: Comparison of Programs in Coaldale and Foremost

Program	Coaldale	Foremost
CAIS	<ul style="list-style-type: none"> • One interviewee thought it was good. • Remainder thought the program was difficult and complicated to use. 	<ul style="list-style-type: none"> • Two participants thought it helped out and was good program. • Majority thought it was difficult to use and trigger, and complex and always seemed to be changing.
NEFPI	<ul style="list-style-type: none"> • Widely used in region, perceived as useful to producers. • Producers already aware of many of the environmental issues that it highlights. 	<ul style="list-style-type: none"> • Positive program for producers. • Downside was that it takes time to get money from the program and doesn't really tell them anything they didn't already know.
NISA	<ul style="list-style-type: none"> • Viewed more favourably by some participants—seen as more predictable and straightforward. 	<ul style="list-style-type: none"> • Used by some producers and many thought it was the best program going. • Aided producers by setting aside money that could be used to deal with tough times.

Crop Insurance	<ul style="list-style-type: none"> • Roughly half of the participants have crop insurance every year. • One participant stated that it has allowed him to keep farming. • Other participants find it too controlling of their operations in order to be eligible to make claims. 	<ul style="list-style-type: none"> • Mixed reviews—some producers always have it and feel it is the only useful program. • Others felt it is a mess and not set up to really help producers address crop loss. • Complicated and difficult to get adequate returns from the program.
DU Programs	<ul style="list-style-type: none"> • Some involvement in program—awareness was high, but participation limited. 	<ul style="list-style-type: none"> • Assisted in some grass seeding and environmental enhancement.
CAWSEP	<ul style="list-style-type: none"> • Some participants made use of program to expand water retention and delivery infrastructure. 	<ul style="list-style-type: none"> • Limited participation in program in region—some expansion of community pipelines.
Water Cooperatives	<ul style="list-style-type: none"> • No comment. 	<ul style="list-style-type: none"> • Drought situations led to the development of Southeast Alberta Water Cooperative.
Shelterbelt Program	<ul style="list-style-type: none"> • Used by five participants to develop shelterbelts on operations and plants trees in farmyards. 	<ul style="list-style-type: none"> • Limited participation by producers in region—has been used extensively by some producers to greatly increase shelterbelts on whole operation.
CAFSP	<ul style="list-style-type: none"> • Used by more than half of the participants to improve infrastructure on farm and improve technology—double-walled fuel storage tanks, GPS systems and chemical storage buildings. 	<ul style="list-style-type: none"> • Limited use, has helped with the purchase and use of some new technology—for example, GPS for machinery.

In many ways, the attitude and participation in each of the programs was similar for both Coaldale and Foremost. The only real variance between the regions occurred in the number of producers participating in the programs. CAIS, crop insurance and the NEFPI were the most widely used and commented upon programs for both regions. Participants made use of CAIS, but the general attitude was that it was an overly complicated and difficult program to use. Participant comments point to the fact that it was poorly designed, that there was high costs associated with submitting claims through the program, and it always seemed to be changing. In the words of one producer, it is understandable that it was so complex, because how can a program be designed to suit the needs of over 100,000 producers nationwide. Crop insurance was widely used by producers in both regions, and the common feeling was that even though it might not provide sufficient returns for losses incurred, it does provide some protection. One producer in Coaldale stated it has allowed him to continue farming. The feeling in Foremost about the program was more negative. Many producers felt that crop insurance did not allow them to make claims on the unique conditions and occurrences on their operations, and it was difficult to get adequate returns for their losses. The NEFPI was used widely by participants in both regions and for the most part it was an effective and well-received program. There were limited criticisms in both regions regarding the fact that it

identified environmental issues that many producers were already aware of and that it could take time to the financial support through the program.

Other programs common to both regions, but with limited participation, included the DU habitat programs, CAWSEP, the Shelterbelt Program and the CAFSP. Of these, there was more participation in the Shelterbelt Program by Coaldale producers than in Foremost. The stewardship programs under CAFSP have been used by producers in both regions. Coaldale participants have used the program more for the addition of physical infrastructure as well as GPS, while Foremost participants have used it to improve operational machinery (for example, air seeders) and incorporate GPS into seeding and harvesting machinery). In Coaldale, the water expansion programs under CAWSEP were used to build infrastructure on the farm that was used to retain water, while in Foremost, CAWSEP was used to establish pipeline systems to deliver water to farmyards from distant reservoirs.

Appendix 1: Questionnaire

International Institute of Sustainable Development – Prairie Resilience Project

Farm-Level Interview Questions

1. Please briefly describe your operation including location, type and size.
2. Have there been any large changes to your operation in the last five years?
3. List any weather extremes which have impacted you in the last five years.
(When it occurred, how long it lasted, how often it happened, if applicable).
4. List any other events which have impacted you in the last five years.
(When it occurred, how long it lasted, how often it happened, if applicable)

Questions 5-9 will be repeated for each extreme event.

6. 5. Please describe how (insert event) impacted your operation and quality of life in general. How did you respond to (insert event)?
7. What aided you in your response?
8. What impeded you in your response?
9. What measures and policies were useful for improving your ability to respond to the weather events we have discussed?
10. Have you heard of the (insert policy/program*)? If so, did you apply, or consider applying?
11. What government policies or programs would have been useful for improving your ability to respond to the weather events discussed?

*see list of appended policies and programs

Appendix 2: Government Policies and Programs

Canadian Agricultural Income Stabilization Program (CAIS)

<http://www1.agric.gov.ab.ca/general/progserv.nsf/all/pgmsrv22?opendocument>

The CAIS program replaces previous safety net programs available to agricultural producers (FIDP, CFIP, and NISA).

National Environmental Farm Planning Initiative

<http://www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1181579114202&lang=e>

The NEFPI will help Canada's agricultural producers develop and implement environmental farm plans (EFPs) through provincially delivered EFP programs. In Alberta, this program is run through the Alberta Environmental Farm Plan Company (<http://www.albertaefp.com/index.html>).

National Farm Stewardship Program (NFSP)

<http://www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1181580600540&lang=e>

As part of NEFPI, the National Farm Stewardship Program (NFSP) will provide technical and financial assistance to support adoption of beneficial management practices by agricultural producers and land managers. Measures specific to Alberta are run through the Canada Alberta Farm Stewardship Program (<http://www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1182886480906&lang=e>): The CAFSP provides eligible producers in Alberta with financial and technical assistance to develop and implement viable and environmentally sustainable practices.

Alberta Farm Recovery Plan

http://www.gov.ab.ca/home/NewsFrame.cfm?ReleaseID=/acn/200710/22291A59D06D6_CB45-C8E1-07A03EB5CBFEB4CB.html

The new AFRP addresses the economic strain brought on by the rising costs of fuel, feed and fertilizer. Alberta producers will receive \$165 million in transitional assistance to help offset rising costs facing the livestock sector. Funding received is based on CAIS payments.

Crop Insurance

Provided by Alberta Financial Services Corporation.

Enviro-Loan

http://www.fcc-sca.ca/en/products/lending/enviro_loan_e.asp

This program is run by Farm Credit Canada (largest provider of business and financial services to agribusiness and farms) and provides credit/loans for environmentally related projects.

Canada Alberta Farm Water Program

<http://www1.agric.gov.ab.ca/general/progserv.nsf/all/pgmsrv232>

The purpose of CAFWP is to provide financial and technical assistance towards the cost of long-term on-farm water supply developments completed during the period April 1, 2006 to December 31, 2007. This supply can relate to domestic use, livestock watering, fish farming and small scale irrigation.

Canada-Alberta Water Supply Expansion Program

http://www.agr.gc.ca/env/index_e.php?section=h2o&page=ab

Through this initiative, Alberta agricultural groups and communities have access to support, both technical and financial, for the planning and development of projects that will improve their ability to develop and enhance long-term, sustainable agricultural water supplies.

Partners in Habitat Development

<http://www.pheasantsforevercalgary.com/phd.htm>

This program is designed to redevelop and enhance wildlife habitats in the cultivated regions of Alberta's IDs

Greencover Canada

http://www.agr.gc.ca/env/greencover-verdir/index_e.phtml

The Greencover Canada program is a five-year, \$110-million Government of Canada initiative to help producers improve grassland-management practices, protect water quality, reduce greenhouse-gas emissions, and enhance biodiversity and wildlife habitat. Greencover Canada focuses on four components:

- land conversion—converting environmentally sensitive land to perennial cover;
- critical areas—managing agricultural land near water;
- technical assistance and regional technical assistance—helping producers adopt beneficial management practices; and
- shelterbelts—planting trees on agricultural land.

DU Canada Programs

www.ducks.ca

- Uses funds from AAFC's Greencover program for "Natural Advantage" program.
- There are still openings for Alberta's Natural Advantage on-farm habitat program.
- This free program helps producers build a more comprehensive plan for their habitat resources. In the process, they will have the opportunity to build a greater understanding of biodiversity on their land.
- Participation in the EFP program is a prerequisite

Prairie Shelterbelt Program

<http://www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1180103439791&lang=e>

As a component of the AAFC-PFRA Agroforestry Division, the PSP provides technical services and tree and shrub seedlings for establishment of shelterbelts and other agroforestry, conservation and reclamation projects on agricultural and eligible lands in Manitoba, Saskatchewan, Alberta and in the Peace River region of British Columbia.

National Land and Water Information Service (NLWIS)

http://www.agr.gc.ca/nlwis/index_e.cfm?s1=help_aide&page=intro

A program through AAFC to make environmental information and decision support tools available to land use managers to support local and regional agricultural land use planning and management.

Canada Alberta BSE Surveillance Program

<http://www1.agric.gov.ab.ca/general/progserv.nsf/all/pgmsrv187?opendocument>

The guidelines for this program are currently under review.