INSTITUTIONAL ADAPTATIONS TO CLIMATE CHANGE PROJECT

Report on the Community Vulnerability Assessment of Outlook, Saskatchewan

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February 2008

Introduction

The Institutional Adaptations to Climate Change (IACC) Project's main objective is to understand the present vulnerability of rural communities in dry land areas to climate and water stressors in order to understand their adaptive capacity to climate change. To do this, the IACC project implemented a process of community vulnerability assessment of several rural communities. This report presents and discusses the fieldwork activities and results of the vulnerability assessment of the rural community of Outlook, Saskatchewan.

The report is divided into four sections. The first two sections provide the general framework that defines the nature and process of the community vulnerability assessment. The first section provides a short description of the IACC project and its goals, while the second section discusses the concept of vulnerability for the community assessment. The next three sections cover in detail the process and results of the community vulnerability assessment. The first provides a general description of the community of Outlook and its surroundings. The following section covers the main results of the assessment, providing a detailed discussion of the exposures and an analysis of the adaptive strategies undertaken by community members in light of the exposures identified. The last section provides conclusions. An appendix listing all past, present and future exposures and adaptive strategies follows.

The Institutional Adaptation to Climate Change (IACC) Project

The IACC project aims to develop an understanding of the capacities of the regional institutions to formulate and implement strategies of adaptation in communities to climate change risks and the forecasted impacts of climate change on the supply and management of regional water sources. This goal is addressed through a comparative study of two river basins: the South Saskatchewan River Basin (SSRB) in western Canada and the Elqui River Basin (ERB) in north-central Chile.

The IACC project is funded by the Social Sciences and Humanities Research Council of Canada (SSHRC) and is administered by the Canadian Plains Research Centre (CPRC) located at the University of Regina. This multi-disciplinary project has three main objectives:

1) To identify the current social and physical vulnerabilities of the rural communities related to water resource scarcity in the Elqui (Chile) and South Saskatchewan (Canada) river basins;
2) To examine the effects of climate change risks on these vulnerabilities;
3) To assess the technical and social adaptive capacities of the regional institutions to address the vulnerabilities of rural communities to current water scarcity and climate change risks.

This task requires the cooperation and integration of experts and findings from numerous disciplines. There are approximately 30 researchers and research assistants from differing disciplines working together in order to meet the project's objectives. Five Canadian universities are involved in this project (the University of Guelph, the University of Saskatchewan, the University of Regina, Athabasca University, and the University of British Columbia) and one Chilean university (Universidad de la Serena). Project partners, including public organizations, are also involved in this project. For more information, please see the project's website at: www.parc.ca/mcri.

A central research component of the project has been the vulnerability assessment of a group of rural communities in Chile and Canada. Six rural communities were chosen as case studies by the IACC project in Canada: Outlook, Cabri and Stewart Valley in Saskatchewan, and the Blood Tribe, Taber and Hanna in Alberta. These six communities were selected due to their specific characteristics. The community of Outlook stands out because of its location in an irrigated area, a characteristic that explains its selection as a case study in the IACC project. Outlook's unique situation allows researchers to gain insights into what irrigation can mean to a community in the SSRB, how it can serve to limit climatic exposure, how it can affect adaptive capacity, and how institutions play a role in facilitating irrigation.

The concept of vulnerability

Vulnerability is a function of exposure and adaptive capacity (Smit and Wandel, 2006). Exposures are conditions that affect the community and whose severity is related to the nature and characteristics of the external stressor (different forms of climate in this case), and the sensitivity of the community and its members to the impacts of that stressor (Smit and Wandel., 2006). Adaptive capacity refers to the ability of the community and its members to cope with different exposures (Smit and Wandel, 2006). An adaptive strategy is the way in which the community uses and applies its strengths in order to cope with exposures. These strengths are related to both its internal capacities, or resources, and external forms of support. However, it is possible that the community does not possess the resources that an adaptive strategy might require.

Communities are vulnerable not simply because of their exposure to various climate stimuli (e.g. droughts, floods, tornados, etc) but because of the exogenous (external) and endogenous (internal) social and economic circumstances of the community. Vulnerability is related to wealth distribution, social marginalization, access to resources and other social factors, which increase the sensitivity of the community to a variety of stressors and/or help define the coping capacities of its people to deal with these stressors. Climate stressors serve to exacerbate, rather than create, the vulnerabilities of communities. In this way, communities are usually exposed to multiple stimuli at once, referred to as multiple exposures (Belliveau et al., 2006), climate being just one of them.

Adaptive capacity is related to the ability of the community to combine and use different conditions or resources available to the community. These include, but are not limited to, technological resources, demographic variables, economic resources, governance institutions, social networks, political situations. In light of these multiple exposures, the community members choose various adaptive strategies to cope with the plethora of exposures they are faced with. They rely on their adaptive capacity to help alleviate the stresses they encounter.

Community assessments are an essential component of a vulnerability methodological approach (see Figure 2), which informs and guides the activities of the IACC project. The approach provides insights about the present and past vulnerabilities that characterize the community. In light of these current vulnerabilities, the future vulnerability under forecasted climatic conditions can be better understood, and viable adaptation strategies to manage risks and opportunities can be developed.

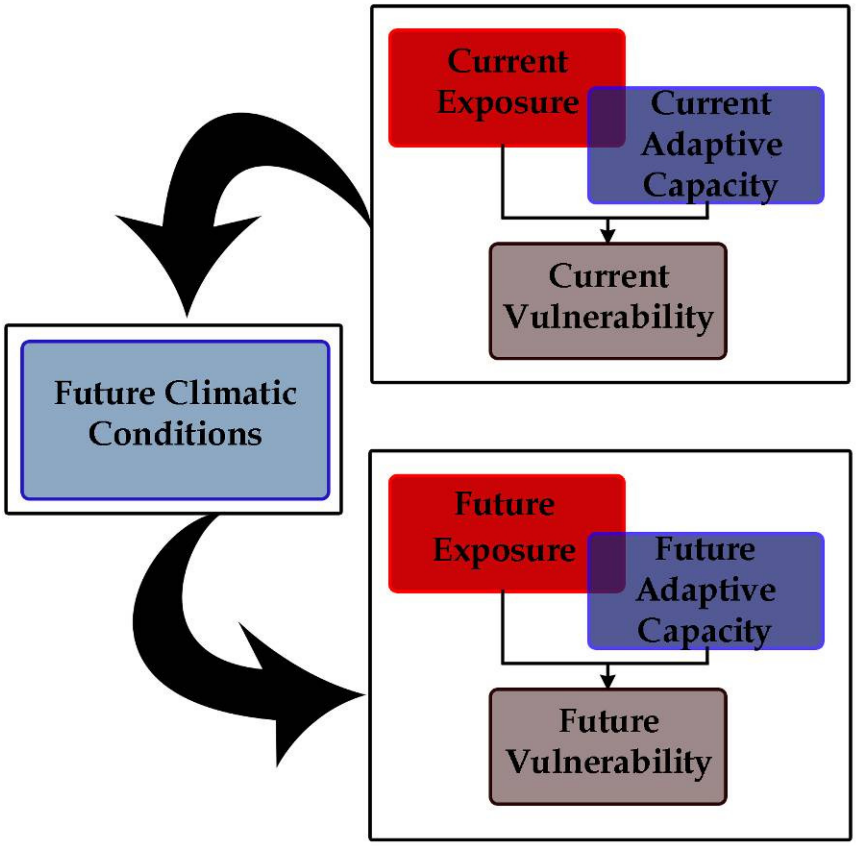

Figure 2. The vulnerability approach (Smit and Wandel, 2006).

With these concepts in mind, the community vulnerability assessment of several communities was carried out. Interviews were conducted with community members in order to document their exposures and adaptive strategies. This data was used to analyze the capacities for adaptation that exist within the community.

Description of the Community of Outlook

Outlook, the "irrigation capital of Saskatchewan", is located in the heart of the Canadian Prairies, 90 kilometers southwest of Saskatoon in the South Saskatchewan River (see Figures 3 and 4). This progressive prairie town is the first settlement downstream of the Gardiner Dam and is located in the Rural Municipality of Rudy No. 284. It was chosen as a study for the IACC project due to its unique characteristics, specifically its rural location, agricultural economic base and its access to irrigation. Outlook is located on Highway 15 and people in the area can access Saskatoon via Highway 219. There is a hay dehydration plant that markets its product internationally as livestock feed and an extraction plant for essential oils from mint and dill. According to the Canadian Land Inventory, Outlook is surrounded by land capable for agriculture, forage, and recreation (see Figure 5).

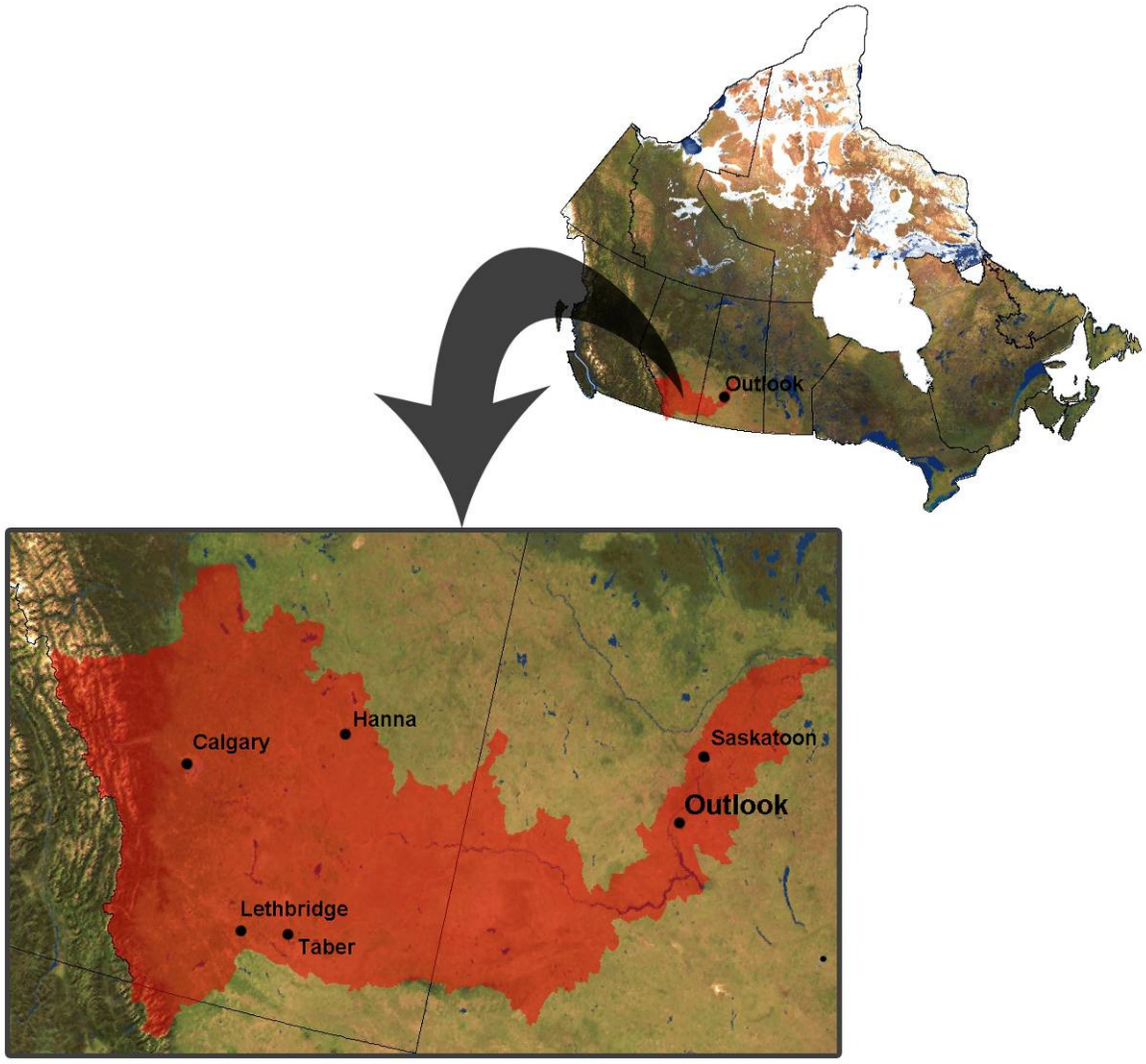

Figure 3. Location map of Outlook, SK (Red = South Saskatchewan River Basin)

Figure 4. Map of Outlook, SK (Google Maps, 2008)

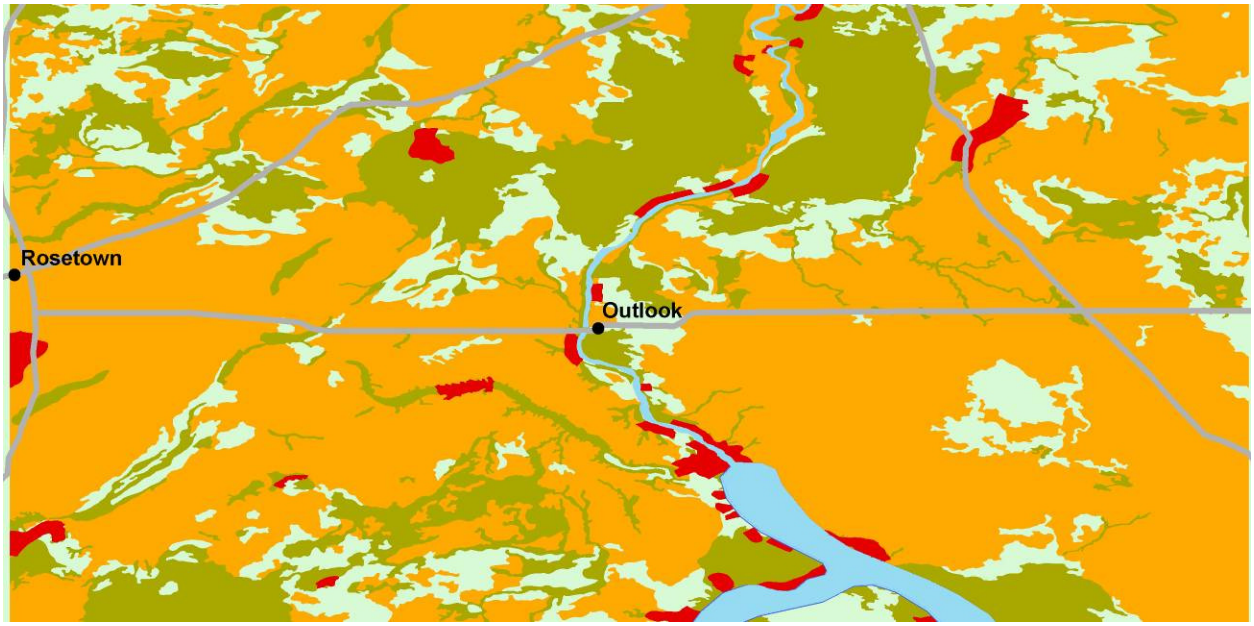

Figure 5. Land capabilities surrounding Outlook - Orange = agriculture, Green = forage, Red = recreation, Blue = South Saskatchewan River and Lake Diefenbaker (Canadian Land Inventory, 1999).

In 1966, the provincial government started the South Saskatchewan River Irrigation Project (SSRIP) in the area. The Gardiner Dam was completed in 1968, which resulted in the formation of the Diefenbaker Lake. By 1978, there were 11,450 irrigated acres in the district.

A. Socio-economic characteristics

Outlook's population grew 0.6% from 1996 to 2001 but then decreased 9% from 2001 to 2006 (Statistics Canada, 2006; 2001). The median age of the population increased from 46.3 in 2001 to 49.7 in 2006 (Statistics Canada, 2006; 2001). To compare, the median age in Saskatchewan in 2006 was 38.7, significantly lower than that of the community (Statistics Canada, 2006). Table 1 shows that people below the age of 45 are moving out of the town at fairly high rates. The number of people 45 to 64 years of age increased and number of people over 65 decreased between 2001 and 2006. These statistics illustrate what people in the area were saying - young people in the area are leaving.

Table 1. Age distribution of Outlook's population (Statistics Canada, 2006; 2001).

	2006			2001			Percent change from 2001 to 2006		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Total	1940	900	1040	2130	1005	1125	-8.92	-10.45	-7.56
0 to 14 years	290	150	140	345	170	175	-15.94	-11.76	-20.00
15 to 44 years	540	275	265	680	345	330	-20.59	-20.29	-19.70
45 to 64 years	520	260	265	490	240	255	6.12	8.33	3.92
65 years and older	585	215	370	620	250	375	-5.65	-14.00	-1.33

Table 2. Number of people employed in different industries in Outlook, SK (Statistics Canada, 2006; 2001).

	2006			2001			Percent change from 2001 to 2006		
	Total	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**
Total experienced labour force	885	475	405	990	525	470	-10.61	-9.52	-13.83
Agriculture and other resource-based industries	170	145	20	330	250	80	-48.48	-42.00	-75.00
Manufacturing and construction industries	60	45	10	45	40	10	33.33	12.50	0.00
Wholesale and retail trade	140	80	60	135	70	65	3.70	14.29	-7.69
Finance and real estate	45	20	25	50	10	35	-10.00	100.00	-28.57
Health and education	250	60	195	165	20	150	51.52	200.00	30.00
Business services	55	40	15	85	50	35	-35.29	-20.00	-57.14
Other services	160	75	85	180	85	95	-11.11	-11.76	-10.53
Employment rate	54.4	65.2	45.1	57.7	64.8	51.1	-5.72	0.62	-11.74
Unemployment rate	3.4	3.1	3.7	5.8	5.5	5.2	-41.38	-43.64	-28.85

Agriculture, health and education are the major employers in the area (see Table 2 above). The number of people employed in agriculture in the area decreased from 2001 to 2006, while the number of people employed by health and education increased. This is reflective of the trend of farm differentiation noted by respondents. Other significant changes in employment during this period occurred in the manufacturing and business services sectors, with the number of people in manufacturing increasing and those in business services decreasing. In general, the labour force in the area decreased over this period.

b. Water Resources

"We're pretty lucky with Diefenbaker Lake right there, I mean, you won't find a better source of water in western Canada as far as…you know, for irrigating or household use, whichever you want to talk about."
- Respondent

The community is dependent upon the South Saskatchewan River for water. Lake Diefenbaker, the reservoir created by the Gardiner Dam, is the main source of water for the community and the surrounding areas. This reservoir supplies both water for human consumption to the community and for irrigation. The water for human consumption is treated and then pumped through pipelines to the community and surrounding farms. Irrigation water is moved to the fields through a system of canals. Many farmers in the area also use dugouts to catch surface water and some have even dug their own wells. Water from dugouts and wells is most often used for livestock operations, not for potable water.

c. Climate

According to the 1961 to 1990 climate normals, Outlook observes an annual average daily temperature of 3.2°C and receives 239.5mm of rainfall and 842mm of snowfall per year (Canadian Climate Normals 1961-1990, 2006). The bulk of the snowfall occurs from November to March and the bulk of the rainfall from April to October, as illustrated by Figure 4. Average daily temperature peaks in July and reaches its minimum in January.

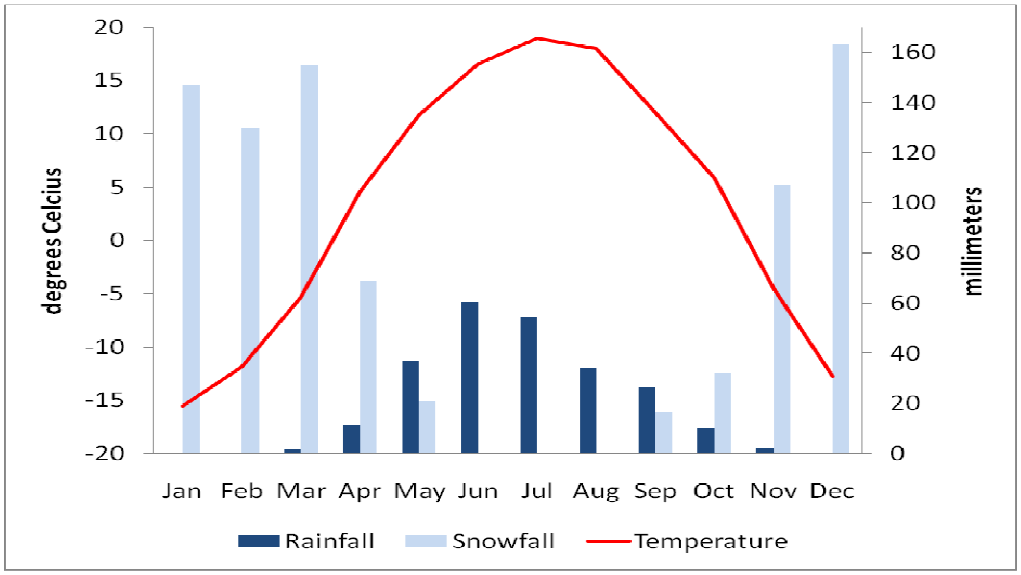

Figure 5. 1961 to 1990 Climate normals for Outlook, SK (Canadian Climate Normals 1961-1990, 2006)

Climate change is expected to result in significant variations from these trends. By the 2050s, there may be an increase of 2 to 3.5 degrees Celcius in the area and a 10 to 20 percent increase in precipitation (Sauchyn et al., 2007). In addition, Pietroniro et al. (2006) predict an 8.5% decrease in stream flow of the South Saskatchewan River at Lake Diefenbaker by the 2050s.

The Community Assessment

The objective of the community vulnerability assessment was to gain insights into the vulnerabilities and adaptive capacities that exist for the community of Outlook, by assessing its sensitivity and adaptations to different exposures. The vulnerability assessment requires information from a variety of sources,

including the census, previous studies, historical documents, instrumental records, and other secondary information sources, as well as direct information from community members; for example, their perceptions about their vulnerabilities. Information regarding community perceptions' of vulnerabilities was collected during several months of fieldwork, which involved several visits to the community.

The field work started in the summer of 2006, but was largely completed from the beginning of October 2006 to the end of January 2007[1]. Although many of the farming respondents were out of the field, some were still very busy selling and transporting their product. This made it difficult to schedule appointments. Most respondents saw the importance of the project, however, and made time in their busy schedules to accommodate the interviews. The community in general was very cooperative and receptive, which made it relatively easy to obtain high quality interviews and complete the fieldwork on schedule.

The fieldwork was completed following the community-level fieldwork guide developed by the IACC project for the community vulnerability assessment. The guide is a reference for obtaining respondents, employing proper semi-structured interviewing techniques, and what information is essential to collect during interviews (www.parc.ca/mcri/training.php). Thirty-four face to face interviews were completed with different members of the community and surrounding areas. Figure 6 provides the profile of the people interviewed. Respondents included males and females, youth, elderly, farmers, business people, irrigation researchers and employees of the local municipality. Interviews were digitally recorded and later transcribed in order to be coded using the qualitative analysis software package, NVivo.

The mayor was informed with respect to the purpose of this work and what would be involved in data collection at the beginning of the assessment. The local PFRA (CSIDC) was contacted in order to gain insights into local conditions and establish a list of potential respondents. A stakeholder meeting was held on January 25, 2007 and a Public Participatory Geographic Information Systems (PPGIS) workshop is scheduled for April 21, 2008. The results of the community vulnerability assessment will be disseminated back to the community on this date.

Ethics approval was obtained from the University of Regina Research Ethics Board for the ethnographic work conducted in the community. The approval covers personal interviews with key informants and community members and includes a statement of confidentiality – the names of respondents are only known by the researchers conducting the interviews.

[1] The fieldwork was started by Stephanie Jeanes in the summer of 2006, but was largely completed by Jeremy Pittman from October 2006 to January 2007 with support from Susana Prado and Paula Haygarth.

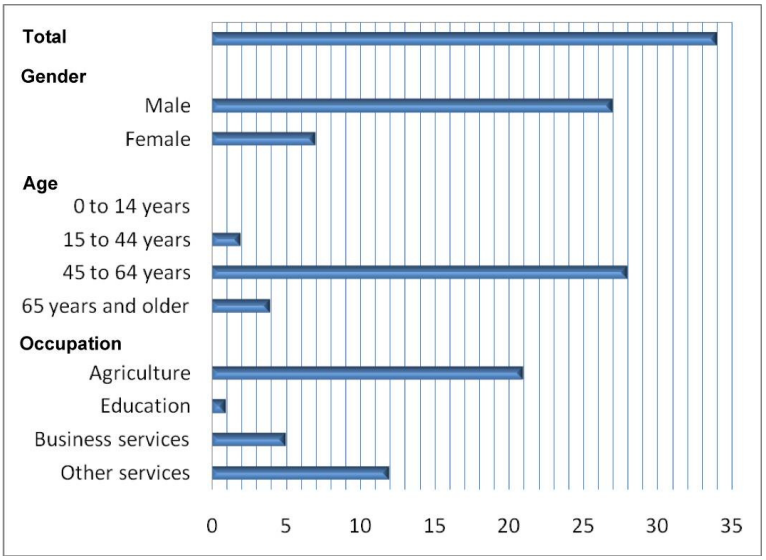

Figure 6. Respondents profile.

Fieldwork Results

As previously stated, the purpose of the fieldwork was to obtain information directly from the Outlook residents about their vulnerabilities. This involved several questions about the degree of exposure/sensitivity of the respondents and their coping capacities. This section describes the responses to these questions.

Current/Past Exposures/Sensitivities

This section provides a general description of the current and past exposures that the community has experienced. For a complete list of the current and past exposures see Table A1 in the Appendix.

Climate Exposures

"The reason we've got irrigation in this area is because of the climate. This area was next to desert prior to irrigation." - Respondent

Drought is a familiar phenomenon on the Canadian prairies. No other economic activity on the prairies is more directly affected by drought than farming. Numerous periods of drought, including those that took place in the 1930s, 1961, 1980, 1988, and 2001-02, were mentioned by the respondents. Dry land farming is always the most affected during periods of water scarcity. Dry land farmers can be devastated, especially if drought lasts for an extended period of time. The abundance of dry land agriculture and the lack of irrigated acres on the prairies mean that the majority of farmers are highly vulnerable to periods of droughts, which often results in significant decreases in yields and reduced incomes. On the other hand, farmers with access to irrigation, as is the case of most farmers in the Outlook area, are significantly less vulnerable to periods of water scarcity. Irrigation assures farmers

they will have a crop. During a drought, their yields may be slightly lower or their quality affected, but they will still produce some commodities that could be sold at a good price.

On the flip side, farmers can also be adversely affected if it is too wet. Too much rain at the wrong time can cause significant losses for a farming operation. Vegetable crops can be destroyed by heavy rains in the spring after planting, or these rains could wash away the seeds. For grain, excessive rains during seeding or harvest can delay operations, causing decreases in the quality and/or quantity of the crop.

In addition to droughts there are other climate related stressors that influence the vulnerability of the community. The agricultural industry in Outlook is sensitive to a number of temperature related exposures. Crop yields and quality can be significantly affected by temperature. An abundance of heat when the crop is young can stunt its growth. Similarly, too much heat when the heads are filling with seeds can affect their quality. Some farming practices are sensitive to temperature as well. Extreme temperatures can sometimes delay certain operations, pesticide and herbicide application for example. The timing of these operations, however, is often crucial and losses result from their delay. Frosts are also problematic for farmers. Dry land farmers and vegetable producers are sensitive to frosts in August; frosts at this time come before the bulk of the crop has been harvested, sometimes destroying, but always damaging, the crop. Irrigation farmers are sensitive to frosts at this time as well, but their sensitivity extends later in the season because irrigated crops develop and ripen at a slower rate than dry land crops. Irrigation provides the crop with adequate moisture to continue growing and to stave off ripening longer. Crops ripen in part due to stress on the plant, and irrigation alleviates some of this stress. Harvest thus comes later for irrigated crops. Frosts in September can cause damage to irrigated crops after dry land crops have already been harvested.

Hail is a common threat on the prairies. Hail storms occur throughout the summer months, as the high temperatures during the day cause the formation of towering thunderhead clouds. These massive clouds potentially reach heights capable of facilitating hail stone formation. If this hail falls, it usually spells out disaster for farmers. Vegetable farmers are sensitive to a hail throughout the season, but particularly in July since the bulk of their crops are still out in the fields. Cereal farmers are sensitive throughout the season, as long as their crops are in the field.

High winds produced by the prairie thunderstorms also cause problems for farmers. Winds can reach speeds high enough to cause considerable damage to buildings and machinery. Irrigation equipment, such as pivots, are especially sensitive to wind damage, as they are light weight (when not full of water) and have enough surface area to catch a lot of wind. Lightning from these storms is also capable of damaging irrigation equipment.

Soil salinity has affected farmers in the Outlook area. Improper irrigation practices in the past created salinity issues for many farmers in areas under flood irrigation or around unlined canals. Salinity threatens the productivity of the land, as crops are often unable to grow on areas prone to over salination.

By products of certain climate conditions, such as disease and fungal infections of crops, are also a concern for the respondents. Legumes and vegetables seem to be affected the most by these. An

abundance of moisture usually facilitates these infections. Spraying with chemicals is the usual treatment, but this is very costly, further decreasing the margins on these crops. Insects can be a problem in all types of crops. Grasshoppers and wheat midge are the main concern for cereal farmers, whereas vegetable farmers are affected by a wide array of insect species. Spraying is again the main treatment for infestations.

Disease has been a problem for ranchers over the past few years. Foot and mouth disease and the Bovine spongiform encephalopathy (BSE) significantly limited the marketing options available to local ranchers in recent years. As a result, cattle prices plummeted and many ranchers were faced with financial hardships.

Institutional exposures

> *"...government programs, inadequacies, crop insurance being one of them. It's a good program but falling very short since they've taken spot loss hail out. It has been ridiculous, costly." - Respondent*

Insurance has always been a form of institutional adaptation that reduces the exposure of farmers to climate stress. Many respondents, however, expressed discontent with the way crop and hail insurance programs are delivered. These programs, ironically, were developed to deal with the unexpected consequences of climate extreme events. The insurance industry's need for increasing profits has led to increasing premiums yet decreasing coverages, which has become a major concern for farmers in the area. Some even stated that the insurance pay-outs do not adequately cover the costs of production anymore. The cost and variety of inputs has been rising over the years and the crop insurance program has not adjusted in light of these changes. In this way, a mechanism of adaptation has become a form of maladaptation because it is unable to reduce the exposure of farmers to extreme climate events.

Not only have premium increases been an issue for local farmers, but changes to the insurance procedures (rules) have also been an issue. The removal of the spot-loss hail portion of crop insurance has also been a "sore spot" for many farmers. Spot-loss hail provided insurance on different sections of a farm that were damaged by hail. If forty acres of durum were devastated by a hail storm, then the farmer received compensation for those forty acres. The removal of this coverage leaves the farmers with only regular crop insurance to place claims through. Crop insurance is administered based on yields calculated over the entire acreage of a farm. Yields must be below a certain threshold for the entire farm in order to receive a payout. Hail losses could occur on significant acres but the operation receives no compensation if yields remained high on the rest of the farm. Acres lost to hail have already incurred significant input and production costs, not to mention the loss of commodity from these acres. Farmers can then be left with bills but no cheques for parts of their farm. These losses are increased as farms get bigger and spread over larger areas. It becomes more and more unlikely that a complete farm will be hailed out because it is spread over such a large area, and prairie hail storms can be extremely localized. Even within the same eighty acre plot it is not uncommon to only receive hail damage on portions of it. Spot-loss hail coverage was designed to account for these losses. The removal of it does not properly account for the nature of a prairie hail storm or for the current trend in farm organisation.

Crop insurance being averaged over the entire acreage of the farm also does not work in favour of those farmers who practice both irrigation and dry land agriculture. There is no division between dry land acres and irrigated acres under the crop insurance program. Irrigated acres of durum are then averaged together with dry land acres of durum. In dry years, the irrigated durum yields will obviously be higher than those on the dry land. Dry land acres could potentially have yields low enough to warrant a payout. When these yields are averaged with the irrigated acres, however, the farmer could lose out on any compensation. In light of this, farmers try not to grow the same crops on both dry land and irrigation. It seems easy enough, but this can in turn cause problems. With the practice of continuous cropping, this can cause breaks in the crop rotation patterns that are healthiest for the land, resulting in nutrient depletion. Also, diversification options are difficult to plan out. The crop insurance program does not necessarily suit dry land and irrigation combination farming operations.

Another concern of many respondents was the abundance of organisations. Respondents stated that they observed poor cooperation among the numerous organisations that were created to deal with things like water management, resulting in inefficiency of programs. With the case of rural municipalities, it was stated that the abundance of municipalities causes each individual one to be weak. In general, the respondents believed that these organisations would do a better job if they work together to accomplish their goals.

The grain transportation system has undergone some major changes in recent times. Historically, the federally administered Crow's Nest Freight Rate (Crow rate) subsidized the transportation of grain from the prairies and provided farmers with a more economical means of transporting their commodities. This policy was implemented in 1897 to facilitate the development of the railway through the Crow's Nest Pass by the Canadian Pacific Railway (CPR). The phasing out of subsidized transportation that occurred from the mid-1980s to the mid-1990s sparked major changes in the ways that grain is handled on the prairies. Soon after the Crow rate was abolished, it was no longer economical to transport grain on many of the secondary rail lines. Elevators on these lines were closed, and eventually the lines themselves were closed. Inland terminals opened on the primary rail lines. Transportation to the terminals occurs on the highways. There are no subsidies for the trucking of grain on the highways. One-time payments to assist farmers in making the transition from subsidized to non-subsidized transportation were implemented through the Western Grain Transition Payment Program.

Farmers are given a small window of opportunity to deliver their commodity to the terminals. There is no terminal in Outlook and no major, well maintained highway connecting Outlook to a terminal. The closest terminal is approximately 70km away and the roads used to transport grain are not always in good shape. Like everything else in farming, the farmer also must contend with the weather, as wet conditions or an abundance of snow can limit access to storage yards. In order to take advantage of these opportunities, farmers must also organize a means of transporting the grain, as many farmers do not own a truck and trailer big enough for long distance hauls. The current system usually results in the farmers neglecting other work in favour of hauling grain or missing their opportunities to haul grain.

Respondents also noted a general lack of infrastructure in the area. The road and transportation networks are causing their operations undue stress that could easily be alleviated if more and better

direct roads were built. A highway capable of supporting heavy trucks hauling grain into Saskatoon was one particular piece of infrastructure that was noted as missing. Irrigation infrastructure was also perceived by some respondents as not being developed to its full potential.

Economic Exposures

"Costs of inputs are just a huge problem on the farm. We can't figure out how to make any money." - Respondent

Almost all respondents expressed their discontent with the economic state of farming. Low returns and high input costs –"the cost-price squeeze"— were noted by most respondents as being one of the most pressing issues facing their operations. High costs of fuel, fertilizers, sprays and other inputs all eat away at a farmers' profit margin. Low commodity prices decrease margins even further, and the farmer is left with minimal profits. In order to remain viable, a farmer must be prepared to stretch their profit to the limit. Machinery maintenance or purchase is not cheap, the family must be provided for, and the bills must be paid.

One respondent referred to the lack of baseline commodity pricing as causing a significant impact on their operation. The constant fluctuation in commodity pricing makes it difficult to complete financial plans for the operation. Commodity prices can fluctuate drastically from year to year or even throughout the year. Farmers often struggle with deciding the best time to sell different crops or which crops should be grown next year in order to secure the best returns. There are many uncertainties that could be reduced with baseline commodity pricing.

Farming is often a hard and thankless occupation. Farmers are required to work many hours in the field for many days in a row. There is no union regulating a farmer's schedule and nobody is paying them for each hour of their time. Their schedule is regulated by the weather and their rewards are earned through persistence. With the decrease in the amount of young people interested in farming and the general outmigration in the prairies, the weight of the family farm is being supported by fewer and fewer people.

Many respondents in Outlook noted the difficulty they have faced in finding adequate labour for their operation. Given the uncertainties of the agricultural economy, the farmers' sons and daughters are not interested in taking over the farm and, in some cases, farmers themselves will not let their children adopt this lifestyle. The younger generation is leaving the farm and the workforce in this rural prairie town is getting smaller and smaller. There are less people available to fill positions on and off the farm.

With poor commodity prices and high input costs, some farmers are forced to seek employment off the farm in search of extra income. Farming and the day to day grind of a 9 to 5 do not mesh. Farm work is time – sensitive and must be done weather permitting. Off-the-farm jobs often have regular hours and must be attended on a regular basis. This can result in conflicts in schedule between the off-the-farm job and farm work, usually forcing the farmer to fall behind in his/her farm work. Yields and qualities of the harvested crop can be affected by this.

Social

"...and then we got beat up in the 80s... 1988 we didn't take a combine out. We were pretty young. We survived it, but just. So we didn't put a whole lot of effort into making our kids continue in the path. I want something far better for my kids." - Respondent

As with many prairie towns, Outlook is faced with the loss of its younger people. Outlook's senior population is increasing, yet its young people are leaving. Young adults graduate high school and then move away and on with their lives in directions that seldom bring them back to Outlook. They leave to continue their formal education or to seek work elsewhere.

Some respondents noted that the generations leaving have also been less active than previous generations in the farming operation while they were living at home. There are other things that preoccupy their time. They do not learn the ins and outs of the farming operation first hand as their mothers and fathers did, and they do not build a deep rooted interest and attachment to the lifestyle.

Although Outlook has an art gallery and museum, one respondent also pointed out the lack of cultural and educational opportunities beyond the formal school system within the community. The respondent pointed to the fact that art openings or lectures rarely take place. This part of culture has been neglected and left to fall by the wayside. These facets of learning and expression are underdeveloped within the town, and those interested are forced to journey to Saskatoon in order to obtain exposure. There are, however, many sports teams in the community, and participants can choose from a wide range of sporting activities. As with most of rural Saskatchewan, hockey is by far the favourite.

Current and Past Adaptive Strategies

This section provides a list of the types of measures that were taken by the community in the past and present to deal with the exposures listed above. For a complete list of these adaptive strategies see Table A2 in the Appendix.

Financial Management

"We were growing everything. The only thing we haven't been growing is potatoes. It was a mixed farm, cattle and all kinds of different grains. There was a time we were even in spearmint oil production." - Respondent

Adaptations in terms of financial management are widespread throughout the agricultural community. Farmers often have to struggle to make their operation viable and have developed their financial management strategies accordingly.

Securing enough income to ensure survival can be somewhat challenging in the community and requires skill and flexibility in terms of financial management. Some farmers choose to sell anything that is not absolutely necessary to their operation. They sell off their old machinery and anything else that anybody is interested in. They remove insurance, not only crop and hail insurance, but also vehicle insurance on some of the older vehicles around the farm.

Farmers are often required to sell more commodities than they normally would. When the price of one commodity is low, it is necessary to sell higher quantities of a different commodity. This includes cattle and other livestock, as well as crops. Having a diversified commodity base, in this respect, is useful to the farmer and reduces their vulnerability to certain commodity prices being low. Producing many different commodities, however, often requires a lot more work and even a lot more machinery or infrastructure.

Another means of reducing vulnerability to fluctuating grain prices is to forward contract commodities. In this manner, commodities are sold before they have been produced. It ensures that the farmer meets his production costs.

It is always preferential to grow the highest priced commodities, and farmers in the Outlook area have tried a wide range of crops since irrigation in the area allows for a lot of "non-traditional" crops to be grown. Many farmers in the area have taken full advantage of this, at least on a trial basis. Mint, timothy and potatoes are three of the main cropping industries that farmers have tried to develop in the area. Each one has had their growing pains and has resulted in huge losses.

Commodity diversification has taken a different route as well. Some farmers chose to convert their crop land into forage land and then raise a grazing herd. There is a lot of talk in the area that this might be the way to go in the future. Farmers see this as a return of the prairies to a more natural state. They are sick of fighting with the climate to produce crops and believe that grazing could be a more suitable economic activity.

Other types of adaptive activities undertaken by farmers in the area involve diversification of their labour and the selling of their services. Some farmers choose to seek employment off the farm. Off-the-farm jobs are often a stable means of securing income, but they bring other benefits as well. They allow the farmer to earn money throughout the season, as opposed to just after harvest. This helps farmers avoid going too deeply in debt in order to produce the crop, as they can pay for inputs at the time of purchase. There is no extra interest accumulated this way and the bills do not pile up. The extra income also takes the pressure off the farmer to sell commodity. The farmer is not in a bind to sell their commodity in order to pay bills. They can wait to sell until commodity prices are higher, thus increasing their gains.

A major disadvantage of having an off-the-farm job is the added time commitment of the farmer. Farming requires a lot of time, and weather dependent operations and an additional job reduces the time that is available for farm operations. Thus, many farmers cannot complete their farm work or end up neglecting their farming practices, causing their crops to suffer.

Custom farming is a means of working while farming without placing as much added stress on the individual's farming operation. Custom farming is the sale of an agricultural service, including labour, machinery and implement use, to another farmer. It allows a farmer to use their expensive equipment for more than just their own operation, adding the extra benefit of generating an additional income by selling his/her services to other farmers that either lack this equipment or do not have time to complete this task. This income can be applied back towards the cost of the equipment, or can be rolled into the

farming operation. Custom farmers can take advantage of the inability of farmers with off-the-farm jobs to complete their work. They also have a steady flow of income throughout the season, and if they do their own work before that of their customers, their operation does not fall under as much stress.

Furthermore, some farmers choose to go one step beyond the diversification of their labour or their service and leave the farm altogether in search of work. They become fed up with the struggle and challenge of farming and decide to pursue other occupations. Their land goes up for sale or is rented to other farmers in the area. Farmers that are left in the business end up farming more land than their parents did. The choice to buy or to rent more land depends on the economic situation at any given time. If margins are low, farmers may choose not to rent land simply because this further decreases the margin. Buying land is preferential, but land is not cheap. Often this purchase requires going deep into debt. Farmers must look carefully at their operations and decide whether or not they are sustainable with the increased debt and land payments that purchasing land causes. These adaptations have lead to a process of social differentiation between the farmers that are acquiring land and those that are selling it. These changes are illustrated by the figures in Table 3. The total number of farms decreased from 2001 to 2006 in Saskatchewan and in the Outlook area. Farms with acreages above 1600 increased in both cases and farms in other acreage classes decreased.

Table 3. Change in farm size for the Outlook area (Census Division no. 11) and for Saskatchewan (Statistics Canada Census of Agriculture, 2006; 2001)

	Division no. 11			**Saskatchewan**		
	2006	**2001**	**% change from 2001 to 2006**	**2006**	**2001**	**% change from 2001 to 2006**
Total farms	3273	3564	**-8.16**	44329	50598	**-12.39**
less than 180 acres	804	860	**-6.51**	7216	8269	**-12.73**
180 to 1599 acres	1603	1878	**-14.64**	23677	29345	**-19.32**
1600 acres and above	866	826	**4.84**	13436	12984	**3.48**

There may be another form of economic sustainability in the area that is very different from agriculture and is yet to be tapped; this is the recreation industry. The regional economic planners in the area are opening up to the possibility of developing Outlook into a recreational center. The proximity to the South Saskatchewan River and to the city dwellers of Saskatoon makes recreational economic development a likely possibility for the area. Figure 4 shows the tracts of land that are capable for recreational use. Fishing, boating, swimming, and camping are all possible in the area. There is also the potential for action sports, like wakeboarding, water skiing and wakeskating, to attract a younger group of people. Outlook also already has an abundance of services that can facilitate this transformation. Outlook's downtown core is full of restaurants, coffee shops, and grocery stores to provide food and an atmosphere for tourists. They have a hospital in case of injury and the highway between Outlook and Saskatoon is proposed to be upgraded and repaired to allow for easy access. Recreation could develop into a viable economic activity for the area.

Social

After the displacement of the First Nations people that used the land around Outlook, the area was settled in much the same way as the rest of the prairies. People came from their respective European countries and settled in groups that reflected these original ethnic ties. Originally, as noted by one respondent, there were some dividing lines amongst the population due to these ethnic barriers. These barriers faded within a few generations, however, to produce the population of today. Intermarriage was noted by one respondent as the main mechanism for this change.

Since then, the area has developed a well maintained social network of support that people can fall back on. Equipment is readily borrowed or rented from neighbours or family members. This is reflective of the trust that exists within the community. Equipment and tools are highly valuable in the farming community, not just monetarily, but also as a means to secure a livelihood. A trusted relationship must be developed between two farmers if equipment is easily shared or even rented between them. A farmer does not want his equipment to come back in disrepair, whether it was rented or lent. This would mean an extra cost to the farmer for repairs, but could also mean delays in their operation that are often more detrimental. The breakdown of equipment is intrinsic to the art of farming, however. The lending or renting of equipment then is a trusted agreement that the borrower or renter will return the equipment in working order, having fixed any breakdowns that occurred.

This network develops as technology advances and equipment prices rise. Some equipment is not essential to the farming operation, but can be used to better the operation. An example of this is a swathe roller. A swathe roller can be pulled behind a swather and used to compact the swathes to the point that they are less susceptible to being blown away by the wind. They are especially useful for lentils and other pulse crops. They are, however, not essential to the production of these crops, but they do make them easier to harvest and could potentially increase the efficiency of their harvest. Since the use of swathe rollers is not necessary on all crops, there are times when a farmer's swathe roller sits idle. During these times, the farmer could rent this piece of equipment to a trusted neighbour who could not afford to buy his/her own swathe roller. The farmer can then subsidize his/her own purchase of the swathe roller and also help his neighbour.

Another similar network that is at farmers' disposal in the area is an informal network of communication that can be used by farmers to help make decisions. With the abundance of crop diversification options, inputs, farming techniques and market options that exist today, farmers can often be overwhelmed with the decisions they must make. The success of their operations depends on these decisions, and information is a key component to good decision making. The amount of information available can also be overwhelming. Farmers have developed a network of informal communications that are used to share information, gain advice when faced with a difficult decision, and to gain feedback on potential plans. It is in this way that intellectual capital can be developed, as farmers share ideas and critique one another. This network is also reflective of the high levels of trust and regard that exist between neighbours in the area. According to Nahapiet and Ghoshal (1998), networks such as these are vital in facilitating the development and growth of useful intellectual capital. The collective character of

adaptation in the area can also be observed from this. Adaptive strategies are often undertaken by individuals, but learned through the use of these networks.

Although there are strong networks throughout the community, the farmers do not often organize to complete a common goal. Independence is highly valued in the community, and this can limit adaptation in some cases. The norm in the community is to own and operate an independent family farm. Farmers wish to maintain this norm, which can limit adaptive opportunities. An example is the Westside Irrigation Project that is trying to get off the ground in the area. Farmers have come together to have meetings for the development of this project and to rally support for the project, but they have had little success. The farmers wish to find government funding for the venture but this is yet to found. One respondent believes that collectively the farmers could pool their assets and kick start the project, but there is little interest in this because it challenges the previously mentioned norm of operating an independent family farm.

Institutional – External

Several external agencies have contributed to developing the adaptive capacities of local people. As expected, irrigation has been promoted as a solution to the problem of water scarcities. The provincial government played a big role in the development of the irrigation in the area. Irrigation was almost forced on farmers by the provincial government. Farmers not willing to irrigate and whose lands were within the irrigation district were displaced and their lands bought and sold to farmers, some local and some not, that would irrigate. The government also provided funding for young farmers with little equity to develop irrigation on their lands. There was major political will at the time to develop irrigation.

This will has shifted over time. The government has yet to guarantee any funding to develop the Westside Project, a huge irrigation development project on the west side of the South Saskatchewan River that could potentially span as far as Rosetown to the northwest. The government, however, has provided funding for research studies into the viability of the project.

There is a lot more testing and studies that go into any irrigation development than there were in the past. Even when a private farmer decides to develop irrigation on his land he/she must now undergo extensive soil testing. This is regulated by Saskatchewan Agriculture and Food, and developed in light of the soil salination problems that the community has experienced in the past. These tests ensure that irrigation will not cause extensive damage to the soil over time, thus protecting the productivity of the soil.

The provincial government has also facilitated an interesting cooperative within the community. The Rudy Feeder Coop allows farmers to finance their purchase of cattle. The money is borrowed from a bank, but it is guaranteed by the government. Farmers are required to invest 5% to 10% up front, depending on the breed of cattle, and then make subsequent loan payments. If a farmer is incapable of making his payments, then the bank can make up its losses from the investments of the other farmers in the cooperative. If the sum of the investments is not sufficient to meet the sum of the loan payments, then the government will provide the remainder. This cooperative is a strong indicator of the strength

of the networks and the trusting relationships that exist among producers in the community. The government is promoting the utilisation of networks while making them stronger.

Institutional – Internal

The community of Outlook has a wealth of local institutional adaptation initiatives and one of them is social capital. Watershed advisory committees have recently been created to help protect the health of the watershed in the area. There is also the Outlook West Water Association that treats water coming from the river for consumptive purposes.

The local town government has implemented programs to promote efficient water use within the community. One such program involved the distribution of educational flyers throughout the community. Another is the implementation of a policy that places consumptive charges on water. Water can be consumed at a lower rate until an individual reaches a certain amount of water use; after this threshold has been reached, the cost of the water increases. It is to the individual's economical advantage to conserve water.

The town's water system has also been progressively managed. A regular maintenance schedule is observed, and replacement, when necessary, is prompt. This has allowed the community to avoid any major mishaps when it comes to the safety or supply of drinking water.

Rural pipelines have been constructed in the area as well. They were developed through a partnership program between the local municipality and the provincial government. Rural pipelines, when managed correctly, ensure a safe, adequate and convenient supply of drinking water for many people in the area.

The irrigation system in the area is managed by the South Saskatchewan River Irrigation District No. 1. The Irrigation District has worked in the past with provincial governments to improve the irrigation system in the area. The system was converted from flood to pivot with one such project. Farmers were provided with funding in order to make the proper modifications to their existing infrastructure and to purchase any necessary equipment to make the transition. The original canals that caused salination problems in adjacent fields were either lined or replaced with pipelines in a similar project. Both projects improve water use efficiency and protect the soil from degradation.

The Westside Irrigation Project has provided the motivation for an interesting collaboration between local municipal governments. The development of Phase 1 of this project requires an expensive study to identify critical mass of land, assure there is a sustainable supply of water, and make sure economic parameters (cost per acre) are met. Funding for the study required an initial input of 10% of the cost of the study. Instead of allowing this cost to rest on the shoulders of one Rural Municipality, the Rural Municipalities of Fertile Valley, Montrose, Harris, Perdue, and Vanscoy collectively generated the funds and the test was completed. This shows the ability of the neighbouring Rural Municipal governments to cooperate and work towards a common goal.

Water Management

Water management strategies in the area tend to deal with securing an adequate supply of water or increasing the efficiency of water use. In terms of securing an adequate water supply, many farmers have chosen to develop multiple sources of water. By doing this, they know they will have water if one source becomes unusable. Many farmers have access to irrigation canals, private wells, dugouts, and some even have access to the municipal water line for drinking water. In terms of increasing the efficiency of water use, farmers have chosen a number of techniques. Some farmers monitor the soil moisture on their fields with tensiometers, or other devices, so the necessary amount of water is applied by irrigation. Farmers also use irrigation techniques, such as pivot irrigation, that are known to be more efficient. It also appeared that the farmers put a lot of thought into choosing the correct irrigation technique for the application, so that minimal water is used and lost to the surroundings.

Technology

The technology available to improve the efficiency of the irrigation systems in the area has increased significantly over the years. The irrigation system in the Outlook area was originally designed for flood irrigation. The system was then reworked to accommodate the much more efficient pivot system. Pivot systems have since been developed in ways that improve their efficiency and ease of use. Today, farmers have the option to choose between computer controlled pivots, low pressure pivots, and even pivots that allow for pesticide and herbicide application. All these choices allow an irrigation system to be tailored to the operation, thus improving the efficiency of the operation both in terms of water use and means of production.

Future Exposures

This section provides a list of respondents' insights into potential future exposures. For a complete list of these exposures see Table A3 in the Appendix.

Water

Respondents in the area are concerned about reduced flow in the South Saskatchewan River in the future. The community is largely dependent on the river for drinking water and irrigation. If less runoff from snow pack or from glacial melt limits the supply to the South Saskatchewan, the community of Outlook will be significantly impacted. There will be less water available. The community has grown used to having an adequate water supply, and if this is threaten, the current uses and mentalities towards water will have to change significantly.

There is also the threat of more extreme rainfall events. These events can damage crops, erosional damage to land, or even flooding. More extreme rainfall events may also be accompanied by more intense wind or hail events. Both of these have the potential to do serious damage to crops and equipment.

Climate

Many farmers in the community see potential benefits to farming due to climate change. Increased heat units would allow for different, more highly priced crops to be grown in the area under irrigation. Longer growing seasons would also allow for more diversification options.

There are more opportunities for irrigation farming than dry land farming from the anticipated increase in heat units and length of growing season. The increase in heat units means that there will also be more evapotranspiration. Without an increase in precipitation, this means that the area could become even drier at times. Irrigation, as long as the flow of the South Saskatchewan River is maintained, allows farmers in the area to provide their crops with adequate moisture and take advantage of the extra heat.

Degradation of the Land

There are worries in the community that the land upon which the agricultural industry finds its foundations will be further degraded. The productivity of the land is essential to the agricultural economy. Poor farming practices can cause the soil to become infertile or destroy the natural water storage systems within the soil. Farmers in the area foresee potential perturbations due to further degradation of the land, thus having negative implications for their farming operations.

Discussion of Future Adaptive Strategies

This section provides a list of respondents' insights into potential future adaptive strategies. They were obtained from the interview data. For a complete list of these adaptive strategies see Table A4 in the Appendix.

Water Management

There is a high consensus among respondents that the area will need more dams, reservoirs and irrigation development in the future. Lake Diefenbaker and the South Saskatchewan River are seen as huge, virtually untapped resources. The people in the area would like to see more dams and reservoirs to hold the water, and more irrigation projects implemented to use the water.

Some respondents even believe that water will become an exportable commodity from the area. The details into how this system would be developed were not discussed in great detail. Possible pipelines into the United States were one means mentioned.

Institutional

Farmers would like to have more financial security in the future, and some believe that this can be accomplished through adjustments made by governance institutions. The most important changes they wished to see involve subsidies, insurance and markets. Farmers would like to see subsidies available to help them cover their basics requirements. They would also like to see crop and hail insurance programs evolve and respond to changes that farmers experience. They wish that a more adaptive management approach was taken to these programs to ensure that they are adequately covered in

times of stress. They would also like to have easier access to foreign markets, which could potentially allow them to market their commodities for higher prices.

A significant number of respondents brought up the necessity for institutional action against the threat of climate change. Some farmers would like to see the initiation of crop breeding programs that give consideration to climate change. The development of crop varieties that are resilient to new climatic conditions will be vital to sustaining agriculture under these conditions. Wetland protection was also mentioned as a possible means of preserving the water supply in the area. Policies designed to mitigate carbon emissions were also proposed. It was mentioned that there could potentially be the necessity to make participation in climate change programs and adhering to climate change policy mandatory in order to guarantee the success of such ventures.

Financial Management

The typical financial structure of the prairie farming operation of today will be completely redesigned in the future. There is the potential for corporate farms to move into the prairies and drastically change the ways in which farms are managed. Foreign investments, whether to start corporate farms or simply to buy land, could also become more common in the future.

Commodity pricing could also be designed in a different manor. One respondent called for the need to limit the up-side when times are good in order to reduce the down-side when times are bad. This would bring an end to such drastic differences between incomes from year to year and would allow farmers to more accurately plan financially for the future.

Economic diversification away from agriculture and towards tourism is another strategy that is prevalent in the area. Outlook sees the potential in recreation that there is in the South Saskatchewan River and they wish to take advantage of this. The wealth and overcrowding of Alberta and the proximity to Saskatoon are seen as advantageous to the community. The plans are being put in place to start development in this direction.

There is definite potential in the area to grow some higher priced crops with an increase in growing season. Peppers are a perfect example of this. Producers receive a better price for red peppers than green peppers. Green peppers can currently be grown in the area but red peppers cannot. Red peppers are simply green peppers that are allowed to further ripen on the vine. Currently, the growing season is too short to allow for peppers to mature to their red state. With a longer growing season, red peppers could potentially be grown in the area, allowing farmers to make more money off basically the same crop.

Social

A significant number of respondents believe that migration will play a huge role in shaping the future society of the Canadian prairies. Many respondents believe that the depopulation of the rural landscape will continue as people get more and more fed up with the state of agriculture there. They see people

migrating towards bigger centres and towards water. The use of migrant seasonal workers was seen as a possible means of combating potential future work force deficits.

Many respondents also believe that farmers must unite and be better organized in the future if their voice is to be heard. This will mean that farmers will need to sacrifice some of their independence and self reliance. An organized front of farmers is viewed as having huge potentials when it comes to securing adequate financial capital for future development on the prairies.

The further transition from the small family farm to the large corporate farms is another adaptive strategy apparent from the interview data. This goes hand in hand with a further increase in the average size of a farm, as more family farms are divided and purchased by other farmers.

Other

There is a significant drive within the community towards crop diversification. The community is split between whether this means genetic modifications or breeding programs. Farmers in the area would like to see varieties developed that are suited for the Saskatchewan climate and that are suited to the future climate. Crop breeding and genetic modification are seen as tools to use against the risk of climate change.

The idea of diversifying farming operations is also popular in the area. One strategy for this was to return the prairies back to grass and raise cattle and buffalo. According to the Canadian Land Inventory, almost all the land surrounding Outlook is capable of sustaining ungulates (see Figure 7). More cattle and buffalo production could be a viable adaptation to cope with stresses. The future prairie landscape could look much like that of the past, as the patchwork quilt of today is replaced by the original sea of grass.

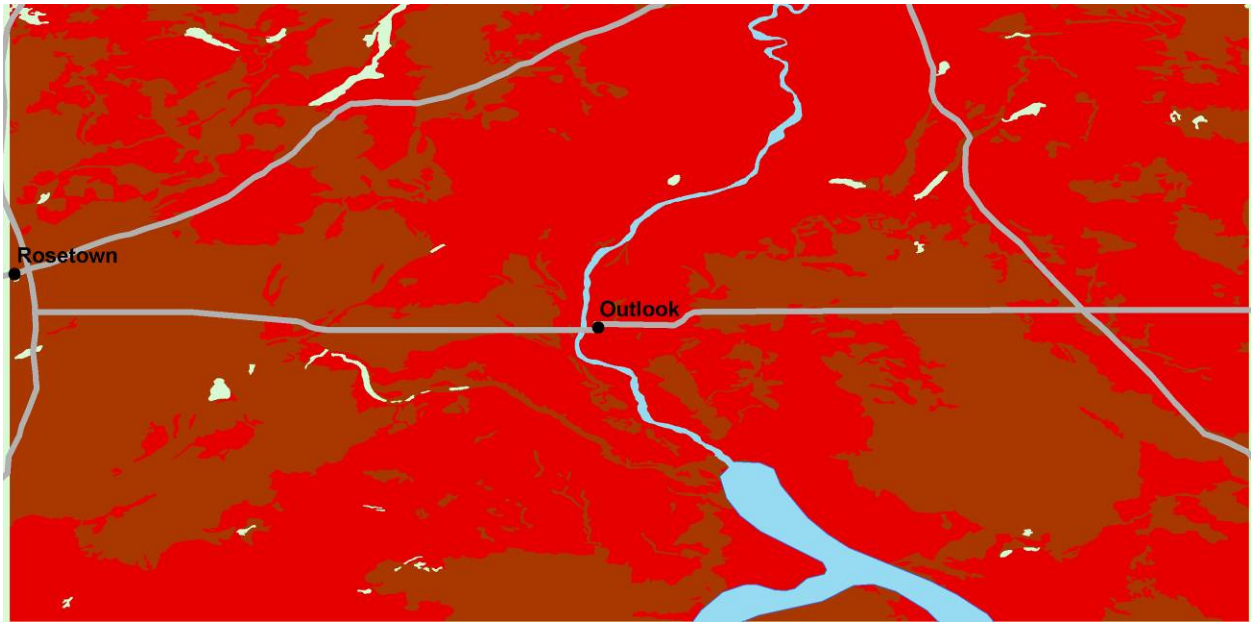

Figure 7. Land around Outlook that is suitable for ungulates – Red = moderate to no limitations; Brown = severe limitations; Blue = South Saskatchewan River and Lake Diefenbaker (Canada Land Inventory, 1999).

There is also much interest in the area into alternative sources of energy. Developing wind, solar, geothermal, and nuclear energy production within the province were all mentioned during the course of the interviews.

Conclusions

Outlook is exposed to a number of socio-economic and environmental forces, most significantly low returns on agriculture, crop damage due to weather, and the loss of its younger work force. These forces are currently threatening the sustainability of the system in its current state. The community is, however, definitely not without hope. There is access to a wealth of adaptive capitals at the disposal of the community and the community seems willing and prepared to use them.

The current economic state of agriculture on the prairies makes it difficult to stay afloat in the industry. Input costs are high and returns are low. Farming is often a gamble, with players struggling to decide which combination of crop, labour and inputs will give them the best hand. Often the dealer (i.e. world markets, weather, etc.) is counting cards and the farm is on the table.

Weather is also a major concern for farmers in the area. Despite their access to irrigation, farmers still find themselves struggling against numerous weather and climate related phenomenon. Every year there is the potential to harvest bumper crops or nothing at all, as the difference between success and devastation can simply be one prairie hail storm.

There is a continued trend towards the out-migration of people aged 20 to 40 years within the community. The community invests in its youth, in terms of primary and secondary education and

healthy community life but sees little returns on these investments as the youth are drawn away from the community in search of careers the community cannot provide. This deficit in human capital could cause major problems in the future, when the current experienced personnel retire and can no longer bear the brunt of sustaining the community.

There are many innovative and interesting ways that the community is coping or is planning to cope with the various exposures identified through this study. The community possesses the natural and technological capital that provides them with many diversification options in terms of crops or economic base. Irrigation broadens the range of crop diversification options. Also, the development of a more ungulate based economy was mentioned and would allow the community to exploit the vast tracts of land suitable for ungulate production. The recreation and tourist industry may also be feasible for the area, given the availability of land suitable for these uses and the services to support it.

The existence of strong networks increases the ability of the community to cope. There are exhibitions of trust and reliance between neighbours and fellow farmers that will facilitate the sharing of information and goods. The area appears rich in social capital and will be able to exploit this for adaptive purposes.

The community looks to the future, aware of the possible hardships it may face, and remains positive. It is ready to take advantage of opportunities that may arise and has a history of dealing with adverse conditions in a proactive and innovative manner. They recognize there will be changes in the future, as there has been in the past. They trust in their creativity in problem solving and stand strong and confident that they will be able to overcome and remain resilient in the face of future challenges. This is their outlook.

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Appendix: Exposures and Adaptive Strategies – Past, Present and Future

Table A1. Complete list of Current and past exposures.

Temperature
• Early frost (August) can be problematic to vegetable producers and dry land farmers, while frosts in early September can be devastating to irrigation farmers (irrigation crops usually develop slower than dry land crops)
• Lack or abundance of heat during different stages of crop development can limit yields or decrease the quality of the crop
• Extreme temperatures impede farming practices
• No ice road across the river at Riverhurst in the winter of 2005-2006
Water
• Droughts (1930s, 1961, 1980, 1988, 2001) – droughts are good for irrigation farmers, but could ruin dry land farmers
• Excess rain at the wrong stages of growth or when field operations need to be completed
Environmental
• Hail (devastating in July for a vegetable grower and throughout the season for a cereal farmer)
• Insects
• Disease and fungal infections
• Wildlife
• Foot and mouth disease and the BSE
• Storm damage to irrigation equipment (lightening, wind)
• Salinity on irrigated land
• Shifting sand bars in the river can deter irrigation
Institutional
• Lake Diefenbaker is kept at a lower level due to SaskPower's use of the lake to generate electricity. This leaves the lake at a level too low to allow water to flow out by gravity, when it otherwise would. Irrigation then requires pumping, which adds on cost.
• Crop insurance
○ Available coverages do not adequately cover the costs of vegetable crops, forcing vegetable growers to use multiple companies for crop insurance
○ Small acreages of vegetables are not eligible for coverage
○ Crop insurance pay outs are calculated based on yields from an entire farm, not individual parcels of land. Some section may then be hailed out (or destroyed) without adequate compensation if there is crop on other parts of the farm
○ Farmers are not allowed to grow the same crops on dry land and irrigation, to avoid the farmers tampering with their reported yields – this causes an interruption of continuous cropping practices and increases the amount of work for the farmer
○ Doesn't cover costs of production
○ Coverage has been dropping but premiums have been increasing
• No baseline commodity pricing – farmers have reduced insight into the returns that they can

expect in any given year
• Ministered exemption required when importing raw potatoes in Saskatchewan – deters processing plants from establishing here
• Organization of the grain transportation system produces a narrow window for delivery of grain to the grain handling terminals, putting further stress on individual farming operations and forcing the farmer to store more grain for longer
• Fruit growers association provides advertising
• Saskatchewan Government assistance aids in times of drought
• Weak municipalities because there are too many of them
• Too many organisations and a lack of cooperation between them
• Government policy and bureaucracy keep corporate investors from investing in the West Side project
• Subsidies in foreign countries allow them to more sell their commodities for less and edge Canadian farmers out of the market
Economic
• Irrigation ensures that some crop is always available in the area, which attracts buyers
• Difficult to access foreign markets
• High input costs and low returns
• Lack of infrastructure and the farmers can't afford to develop the infrastructure on their own, leaving them dependant on outside sources
• Custom farm work is not always done at the ideal times -- causing the farming operation to suffer
• Custom work and grain hauling provide jobs for the area
• Lack of resources available to hire adequate help and lack of economic returns on labour
• Low commodity prices
• Huge debts are incurred when setting up an irrigation operation
• Fuel prices are high
• Some crops require new and expensive machinery, which means that the farmer may have to incur more debt if he wishes to grow them
Employment
• As the younger generation leaves the farm and the area there is more pressure put on the older generation to maintain the farm work
• Farming is extremely labour intensive and often long shifts are required
• Farming and working off the farm often conflict and usually the farming operation suffers
• Not enough labour force available
• Loyal help is common in the community
Social
• Lack of organization amongst farmers
• Farmers are extremely independent
• Attachment to the land
• Children, while they are living at home, are not as involved in the farming operation as they once were
• Increase in the aging and retired population and a lack of young people in the community means a smaller work force
• Lack of educational opportunities beyond formal education, for example there are no lectures or

art openings
Other
• Some crops are harder on machinery than others, which can limit diversification options
• Flood irrigation limits a farmer to growing either cereals or forage crops
• Learning irrigation farming techniques is an intensive undertaking
• The physical strain involved with irrigation (especially flood irrigation) produces extreme wear and tear on the body, which compounds over time.
• Poor economic state of farming can cause the farmers to become depressed

Table A2. Complete list of Current and past adaptive strategies.

Financial management
• Custom farming
• Off the farm jobs -- allow for more flexibility when selling grain, but can have negative effects due to missing the timing of farming operations
• Maintaining enough saving to be 'self insured' for a one or two years
• Selling more cows than usual when the crop yields are low
• Selling anything that is not absolutely necessary to the operation, as well as only spending money on necessities
• Leaving the farm and searching for different careers
• Not renting land when margins are low
• Forward contracting (selling grain before the crop is harvested) to make sure that the basics are covered
• Developing tourism and recreation industry
• Seeking employment during the winter months
• Diversifying crops or converting to forage/pasture lands
• Larger farms
• Dropping insurance (crop, hail, vehicle, etc)
• Growing higher priced crops (vegetables, potatoes, mint, timothy, etc)
Social
• Reliance on neighbours and family for sharing or renting of equipment and for assistance in tough times
• Dual income households
• Parents are encouraging their children to seek careers off the farm
• Intermarriage of ethnicities produced a more homogenous population
• Informal communication amongst farmers aids in decision making about different economic strategies
Institutional – external
• Farmers not interested in irrigation were displaced from their farms and their lands were bought by the government and sold to farmers that were interested in developing irrigation.
• Farm start programs (for young people with little equity) during the period following construction of the dam allowed young people to more easily get into irrigation farming in the area
• Spot loss hail program abolished – reduces liability of the government

• Increased crop and hail insurance rates
• Rationalisation of the grain transportation system – got rid of the Crow rate, closed elevators on rail lines, closed secondary rail lines, opened inland terminals – this shifted grain transportation to the highways. No programs were put in place to compensate for the trucks on the highways.
• The Canadian Wheat Board was created in the 1930's to help farmers market their grain
• PFRA experimental farm helped to teach farmers in the area about irrigation
• Canada-Saskatchewan Irrigation Diversification Centre conducts research into future opportunities with irrigation farming
• Increased size of school divisions and health divisions
• Water quality regulations changed to ensure safety of drinking water supply
• Rudy Feeder Coop -- a cooperative that finances cattle for farmers. It is backed by a government guarantee. The bank lends the money but the government guarantees it. The farmers in the cooperative put up 5 or 10% depending on what the type of animal they are raising. If the farmer doesn't pay his loan when it's due every other farmer can lose his 5 or 10% before the bank loses any money, so the chances the bank loses any money is next to zero.
• Provincial and federal drought payment
• Canada Sask Water Supply Expansion program, gave about $380,000 worth of funding to do phase 1 study of the west side project and also another $340,000 to complete a topography study
• Dropped school tax for all property owners
• Sask Ag and Food requires extensive soil testing before farmers can put in new irrigation
• CanSask infrastructure grant allowed the town to build a new lagoon
Institutional – internal
• Creation of water shed advisory committees
• Rural water pipelines constructed (partnership program with governments)
• The town water system has been managed in a progressive manner with regards to replacement and maintenance of equipment
• The town has tried to educate people on efficient water use with flyers
• Consumption charge put on water – People are allowed to use water at a lower rate up to a certain amount. If their consumption surpasses this amount, then they are charged a higher rate.
• Replaced canals with pipelines or lined canals
• West Side Irrigation project committee is trying to develop a major irrigation project on the west side of the South Saskatchewan River
• 5 RM's – Fertile Valley, Montrose, Harris, Perdue, and Vanscoy put up the 10% for the 40,000 dollars and UMA did the study to identify critical mass of land, assure there is a sustainable supply of water, and make sure economic parameters are met (cost per acre) for phase 1 of the west side project.
• The Irrigation District and the government provided funding for converting flood land to pivot
• Outlook West Water Association treats water coming from the river
Water management
• More efficient water use
• Multiple sources available (canals, wells, municipal)
• Monitoring soil moisture on the fields
• Recycle water

• Timers on lawn sprinklers are common
• Keeping crops wet under irrigation
Technology
• Conversion of flood irrigation to pivot
• New bridge allows for less restrictions on traffic
• Trickle vs. Overhead sprinklers – when the application fits
• Automatic sprinkler systems
• Low pressure pivots
• Computer controlled pivots
• Pesticide and herbicide application through the irrigation system
Other
• Working irrigated fields down after harvest to limit snow pack and avoid wet conditions in the spring
• Growing many different types of vegetables
• Farmers do their own maintenance on farm and irrigation machinery
• Farming on the prairies has evolved from a system of tilling and maintaining summer fallow to a system of continuous cropping and minimum till agriculture

Table A3. Complete list of future exposures.

Water
• Less runoff from snow or glaciers – less flow in the South Saskatchewan River
• More extreme weather events
• Erosional damage and flooding from extreme rainfall events
• More droughts – droughts are good for irrigation farmers, but could ruin dry land farmers
• More sustained periods of wet or dry conditions
Climate
• Longer growing season
• Higher temperatures (+30C to +35C) during July will have negative effects
• More heat unit may also produce benefits with irrigation, such as more crop diversification options
• Longer, drier summers and milder winters
Other
• The younger generation is leaving and there are fewer people to take over the family farm
• The younger people that do take over will have troubles making ends meet and finding markets
• Depopulation of the prairies
• Public perceptions on GMO's and non-organic food production could limit farmers' choices for diversification
• West side project for 370,000 acres of new irrigated land could potentially create 3000 to 4000 new jobs (construction, tourism, recreation, secondary industry, services)
• Aging population on the prairies
• No economic base to build necessary infrastructure
• Higher food costs
Environmental

• Further degradation of the land

Table A4. Complete list of future adaptive strategies.

Water management
• More dams and reservoirs
• More irrigation
• More development to use the available water
• Exporting water as a commodity
Institutional
• More use of Lake Diefenbaker's potential
• More funding for infrastructure
• More subsidies and programs that help farmers to cover their basics
• Evolution of crop insurance to better suit the situation
• Crop breeding programs to better suit climate change
• More wetland protection
• Forced climate change policies
• More political will to leave a legacy in Saskatchewan and tackle a huge problem
• Possible addition of water restrictions on the use of water to water lawns
• Policies to reduce CO2 emissions
• Easier access to foreign markets
Financial Management
• More irrigation would attract more secondary industry
• Sell land to foreigners
• Corporate farming
• Long term increase in pricing will create new standards for pricing
• Need to limit upside in good times to help decrease the downside in bad times
• Less economic dependence on agriculture
• Tourism and recreation become more important
• Ethanol production
• Possible abolishment of the Canadian Wheat Board
Social
• More organization amongst the farmers
• Corporate farms overtaking family farms, or one farmer taking over many family farms – this is perceived as negative
• Migration towards water
• Death of the small town and an increase in larger centres
• Migrant seasonal labour
Other
• Return the prairies to grazing lands (much like when the buffalo roamed)
• Diversify crops and possible genetic modifications
• Alternative energy (geothermal, wind, solar)
• Nuclear energy and uranium production
• Even bigger and more efficient equipment