

**INSTITUTIONAL ADAPTATIONS TO CLIMATE CHANGE
PROJECT**

**Report on the Community Vulnerability Assessment of Cabri and
Stewart Valley, Saskatchewan**

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August 27, 2007

Introduction

This report describes and discusses the results of a community vulnerability assessment done in the localities of Cabri and Stewart Valley. Located in the South Saskatchewan River Basin within the Palliser Triangle, an area characterized by low amounts of precipitation, the communities of Cabri and Stewart Valley are exceptionally vulnerable to water resource issues and other climate conditions. For these communities, as well as for others in similar conditions, climate change constitutes a significant challenge. Forecasted impacts of climate change for southern Alberta and southwest Saskatchewan indicate a prevalence of drier climate in the area, conditions that may significantly increase the vulnerability to climate of these two communities. Thus, the adoption of the adaptation strategies to climate change is particularly critical in this and other dryland regions that are already subject to water shortages in order to maximize the benefits of water and reduce threats associated with scarce water resources.

There is still a limited understanding of the adaptive capacity to climate change of rural communities and regional governance institutions to continue to manage natural resources such as water. This knowledge gap constrains the possibilities of designing and implementing appropriate instruments for communities and institutions to deal with climate change.

The Institutional Adaptation to Climate Change (IACC) Project seeks to fill this gap. The project intends to develop a better understanding of the role that communities and governance institutions play in the development of an adaptive capacity to climate-related problems. The project, supported by SSHRC, is an international comparative study focused on western Canada and northern Chile. It is conducted by an interdisciplinary research team from five Canadian Universities (the University of Guelph, the University of Saskatchewan, the University of Regina, Athabasca University, and the University of British Columbia) and a Chilean university, the Universidad de la Serena, with the participation of several government agencies and institutes in Canada and Chile (more information is available at the website: www.parc.ca/mcri).

The town of Cabri and the village of Stewart Valley were two of the several rural communities selected by the IACC project in western Canada for an assessment of their vulnerabilities. The assessment, carried out in the summer of 2005, involved the systematic collection of information about the communities' current and past exposures and adaptive capacities and their coping strategies. This assessment was complemented by two projects—one focused on the characteristics and impacts of the 2001-2002 drought in the Cabri and Stewart Valley area (Wittrock et al., 2006) and the second on the role that governance institutions play in shaping communities' vulnerability (Diaz et al., 2005). Both of these projects can be accessed on the IACC Project website: www.parc.ca/mcri/comm_vul_assw.php and www.parc.ca/mcri/ass_gov_initw.php.

This report describes and discusses the results from the assessment conducted in the communities of Cabri and Stewart Valley. Firstly, a brief discussion of the nuances of the project are outlined followed by the conceptual approach that will be taken and the

criteria for assessment. Next, an assessment of the various forms of exposures that decrease the two communities adaptive capacity and coping range are outlined (see Table 5) followed by sections that outline the communities current adaptive strategies (see Table 9), future exposures and constraints (see Table 10), future adaptive capacities and opportunities (see Table 11), and conclusions.

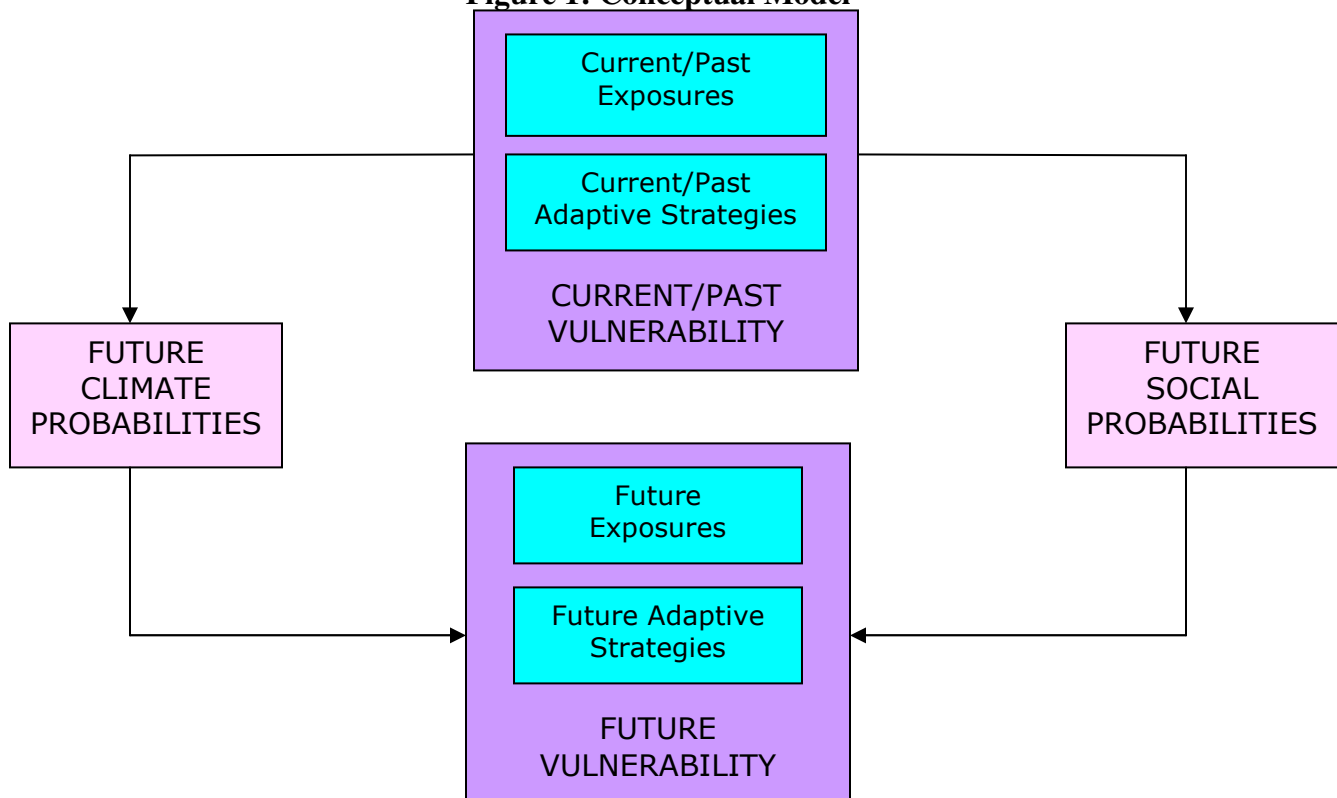
The Project

The goal of the IACC project is 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 basins: the South Saskatchewan River Basin in western Canada, and the Elqui River Basin in north-central Chile.

Three main objectives define the activities of the IACC project. They are: first, to identify the current social and physical vulnerabilities of rural communities related to water resource scarcity in both basins; second, to develop climate change scenarios for the two basins in order to examine the effects of climate change risks on the identified vulnerabilities; and, third, to foster a dialogue for the development of a strategy of adaptation to climate change.

To accomplish these objectives the project adopted a vulnerability assessment model. The model (see Figure 1) emphasizes the need to analyze not only the future vulnerability of systems, but also their vulnerability in the context of current and future climate conditions.

Figure 1: Conceptual Model



The model identifies three sets of interrelated activities: (a) the development of a systematic understanding of current exposure of a system and its adaptive capacity; (b) the assessment of future climate conditions for the area where the system occurs; and (c) the assessment of future vulnerabilities of the system will be affected by future climate conditions. The vulnerability assessment of Cabri and Stewart Valley is one of the studies related to the first set of activities and, as such, it seeks to understand the phenomenon of adaptation in these two communities.

Criteria for the Assessment

The concepts of exposure, adaptive capacity, adaptive strategies and vulnerability were adapted to the Cabri and Stewart Valley communities in concordance with Smit, Wandel, and Young's Vulnerability of Communities to Environmental Change theoretical paper developed for the IACC project. They were adapted as follows:

The exposures of Cabri and Stewart Valley communities are dependant on elements of both climate and the system. Exposure is not solely the existence of internal or external stress; on the contrary, it is the presence of both internal and external forces working in concurrence with one another reflecting the juxtaposition and interaction of both local conditions and physical stimuli (Smit et al., 2006).

Adaptive capacity is understood as a community's ability to adapt to biophysical and social exposures and the environments that these exposures create. The determinants of adaptive capacity reflect both internal and external circumstances such as climate change, technological resources, demographic variables, economic resources, governance institutions, geographic location, kinship networks, political agenda locally and globally, etc.

A community's adaptive strategy is the means by which it manages the environments that the various biophysical and social exposures construct. The determinants of a community's adaptive strategy reflect both internal and external conditions, some of which have been previously outlined.

Adaptation is, to a large extent, a "regionally focused" activity that involves a response to specific climate stimuli. Climate is spatially variable—it changes from region to region. But the impacts of climate upon people and their collectivities are defined not only by the variations of climate elements such as more or less rain, cold, or wind but also by existing social conditions (Bankoff et al., 2004; Wisner et al., 2005). Climate events do not themselves make social systems—for instance communities or households, vulnerable, but rather it is the interaction of disturbances with the inherent social circumstances of the system that define the degree of vulnerability of its members. What makes a community vulnerable are those social patterns such as wealth distribution, social marginalization, differential access to resources, access to health care, and others that make its members susceptible to stress from external forces. The variation of climate and social conditions among communities requires a methodological approach—a community vulnerability assessment able to deal with the complexities of the phenomenon of vulnerability. This

requires paying attention to two aspects: first, to the specific ways in which climate and social conditions interrelate with each other and the impacts of these interactions upon people; and second, how a community's vulnerabilities to climate interrelate with the vulnerabilities of the community to other stimuli, such as economic crises.

Vulnerability is understood as the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Ability to cope refers to the social and economic capacities of the system to deal with the risks associated with climate conditions. Accordingly, the most vulnerable systems are those which are most likely to be exposed to perturbation and possess limited capacity for adaptation. Thus, vulnerability is characterized as a function of the **exposure** of a system (a household, a community, an ecosystem, and so on) to climate change and its **capacity to adapt**. Generally, a system that is more exposed to a climate stimulus will be more vulnerable, a system that has more ability to cope with the exposure will tend to be less vulnerable.

The community vulnerability assessment projects, including that for Cabri and Stewart Valley, were oriented to understand the role played by exposure and coping capacity in shaping the vulnerability of the community and its households. In these terms, the objective of the vulnerability assessment was thus achieved via a detailed analysis of the components of vulnerability.

A General Description of the Communities

Located in southwestern Saskatchewan, within the RMs of Riverside and Saskatchewan Landing, the prairie communities of Cabri (approximately 70 km northwest of Swift Current) and Stewart Valley (approximately 50 km north of Swift Current) lie approximately 46 km apart. Both are small communities, with Cabri occupying 1.33 square km and Stewart Valley 0.86 square km (Statistics Canada, 06/02/2007, 2007). Also, in accordance with Statistics Canada, the population of Cabri in 2006 was 439, with an approximate decrease of 9.1% from the 2001 population of 483, and an approximate 17 percent decrease from the 1996 population of 529. The population of Stewart Valley, on the other hand, has remained virtually static. In 2006 the population of Stewart Valley was 100, approximately 1% lower than the 2001 and 1996 populations of 101.

The town of Cabri is situated approximately 10 km south of the South Saskatchewan River, which is, incidentally, used by the town as the main water source. The water is pumped from a reservoir just outside of town to the water treatment plant, where it is treated for consumption. The village of Stewart Valley is a part of the Swift Current Creek drainage basin. This basin drains into the South Saskatchewan River at Lake Diefenbaker. The village gets its water from three wells near the water treatment plant, where the water is treated by continuous chlorination.

Further, the two communities are located in the Palliser Triangle, a semi-arid region in the southwestern portion of the province. The Palliser Triangle is the driest region of the Canadian Prairies and is thus characterized by rainfall deficiency, which makes recurrent

droughts a serious risk. The community of Cabri sees only 367 mm of precipitation per year while Stewart Valley receives on average 94 mm more. Thus, Cabri and Stewart Valley are predominantly agricultural communities in an area where recurrent droughts are a large source of risk, uncertainty, and adversity to the local economies. In these terms, these communities tend to be more exposed to uncertainties of climate than many of their fellow Saskatchewan communities.

These communities face other challenges. Rural demographic trends place Cabri and Stewart Valley in an increasingly vulnerable position. According to the government of Saskatchewan Community Profile Report, there is a rural out-migration trend that has resulted in an average population decrease of 0.5 percent per year with a projected decrease of 1.6 percent in 2010, 1.5 percent in 2015, and another 1.6 percent in 2029 (Statistical Profile: Saskatchewan Community Profiles, 06/09/2007, 2001) It should be noted that these statistics are applicable to RMs that include small and medium towns/villages (population under 1,500). Most of the people migrating out of the area are younger, which results not only in diminishing numbers but also in an aging of the local population. These population trends threaten rural economies and render communities such as Cabri and Stewart Valley increasingly vulnerable by significantly increasing their exposure to a variety of external processes and reducing their adaptive capacity. The economic uncertainties of rural communities such as Cabri and Stewart Valley also contribute to this out-migration trend. A lack of proper employment for youth geared towards a more professional source of revenue causes youth to relocate to larger centers. This, again, contributes to a decrease in the youth demographics, resulting in an increase in exposure to a variety of social processes and a decrease in communal adaptive capacity.

Figure 1: Cabri and Stewart Valley Location in the SSRB



The following tables from Statistics Canada provide a detailed profile of both Cabri and Stewart Valley in terms of population, employment and education level. It should be noted that Statistics Canada displays no count less than 10 and individual counts have been randomly rounded, excluding total population counts, in order to protect the confidentiality of Canadians (figures adapted from Statistics Canada: www.statcan.ca).

Cabri and Stewart Valley are similar in many ways. Table 1, however, which depicts the population and dwelling counts and labour force indicators for Cabri and Stewart Valley compared to Saskatchewan, uncovers one notable difference between the two communities, the population change over the last decade. Cabri underwent an 8.7% decrease between the 1996 and 2001 census years followed by a 9.1% decrease between the 2001 and 2006 censuses (a substantial 17.8% decrease in population over the last decade). In contrast, Stewart Valley underwent no change at all between 1996 and 2001 and a mere 1% decrease between 2001 and 2006 (losing only 1 individual). Also, the employment rate in Stewart Valley is 13.3% lower than that of Cabri's.

Table 1: Cabri and Stewart Valley Characteristics Compared to Saskatchewan

Characteristics	Cabri	Stewart Valley	Saskatchewan
Population and Dwelling Counts			
Population 2006	439	100	968,157
Population 2001	483	101	978,933
Population 1996	529	101	990,237
2006 to 2001 population change (%)	-9.1	-1.0	-1.1
1996 to 2001 population change (%)	-8.7	0.0	-1.1
Total Private Dwellings	252	44	438,621
Population density per square Km.	328.9	116.1	1.6
Land Area (square km)	1.33	0.86	588,276.09
Labour Force Indicators in 2000			
Participation rate (%)	58.7	64.7	61.6
Employment rate (%)	57.3	70.6	63.5
Unemployment rate (%)	0.0	0.0	5.7
Source: Statistics Canada 2001 and 2006			

According to Table 2, which displays the employment industry trends of Cabri and Stewart Valley, the residents of Cabri do not have a single dominant industry in which they are employed; they are represented in a diversity of industries. The leading four employment industries are agricultural and other resource-based industries (20.9%), wholesale retail and trade (20.9%), health and education (25.6%), and other (25.6%). Residents of Stewart Valley on the other hand have more concentrated source of revenue as the overwhelming majority of respondents are represented in agricultural and other resource-based industries (45.5%).

Table 2: Cabri and Stewart Valley by Employment Industry

Industry Group	Cabri			
	Male	Female	Total	Percent
Total – Experienced labour force	115	100	215	100.0
Agricultural and other resource-based industries	40	10	45	20.9
Manufacturing and construction industries	0	0	0	0.0
Wholesale and retail trade	30	15	45	20.9
Finance and real estate	10	10	10	4.7
Health and education	10	45	55	25.6
Business services	10	10	15	7.0
Other services	35	20	55	25.6
Industry Group	Stewart Valley			
	Male	Female	Total	Percent
Total – Experienced labour force	45	15	55	100.00
Agricultural and other resource based industries	15	10	25	45.5
Manufacturing and construction industries	0	0	0	0.0
Wholesale and retail trade	10	0	0	0.0
Finance and real estate	10	0	0	0.0
Health and education	10	10	10	18.2
Business services	0	0	0	0.0
Other services	10	0	0	0.0

Source: Statistics Canada 2001 Census (numbers may not add up due to rounding)

According to Table 3, which describes Cabri and Stewart Valley by age and gender, both communities are very similar in terms of the age trends of the residents. In both Cabri and Stewart Valley the majority age representation is concentrated in the 25 to 54 years of age category. Cabri had a representation percentage of 34.2% in 1996 and 36.5% in 2001. Similarly, Stewart Valley's was 45% in 1996 and 38.1% in 2001. In both communities the lowest representation was in the 0 to 4 years of age category. In 1996 Cabri's representation was 3.8% and in 2001 it was 3.1%. Again, like Cabri, Stewart Valley's representation was lowest in this category as well with a 10% representation in 1996 and a 4.8% representation in 2001. Also, in both communities, females, had a slightly higher representation than males. Cabri's representation in 1996 was 52.4% and in 2001 it was 52.0%. Stewart Valley's was 50% in 1996 and 52.3 in 2001. Like Table 1, one notable difference is the overall population difference of the communities between 1996 and 2001. Cabri's population decreased significantly while Stewart Valley's stayed virtually static.

Table 3: Cabri and Stewart Valley by Age and Gender

Population By Age and Gender	1996 Male	1996 Female	1996 Total	2001 Male	2001 Female	2001 Total
Cabri						
Age 0 - 4	10	10	20	5	5	15
Age 5 – 14	45	35	80	30	30	60
Age 15 – 19	10	10	20	20	20	40
Age 20 – 24	10	5	15	5	0	10
Age 25 – 54	90	90	180	80	95	175
Age 55 – 64	25	25	45	20	15	35
Age 65 - 74	30	50	75	25	40	60
Age 75 and over	35	50	85	45	50	85
Total – All Persons	255	275	525	230	250	480
Stewart Valley						
Age 0 - 4	5	5	10	10	0	5
Age 5 – 14	10	10	15	10	10	10
Age 15 – 19	5	5	5	10	5	10
Age 20 – 24	0	5	5	5	0	10
Age 25 – 54	25	20	45	25	20	40
Age 55 – 64	5	5	5	0	0	5
Age 65 - 74	5	5	15	5	10	15
Age 75 – and over	5	5	10	0	5	10
Total – All Persons	50	50	100	50	55	105
Source: Statistics Canada 1996 & 2001 Census (numbers may not add up due to rounding)						

Table 4 displays the level of education of residents of Cabri and Stewart Valley for the population over 20 years of age in 2001. Based on this table, a few notable differences between the communities can be distinguished. First, residents of Stewart Valley (23.1%) are more likely to obtain a university certificate, diploma, or degree than those of Cabri (7.3%). Second, residents of Cabri (24.4%) are far more likely to obtain a college certificate or diploma than those of Stewart Valley (0.0%). Third, Cabri (24.4%) has significantly more residents than Stewart Valley (0.0%) whose highest completed level of education is high school.

Table 4: Cabri and Stewart Valley Level of Schooling for Population Over 20 Years

Cabri		
Highest Level of Schooling for Population 20yrs and Older	2001	%
Total population	205	100.0
Individuals with less than a high school certificate	35	17.1
Individuals with a high school certificate and/or some post secondary	50	24.4
Individuals with a trades certificate or diploma	55	26.8
Individuals with a college certificate or diploma	50	24.4
Individuals with a university certificate, diploma or degree	15	7.3
Stewart Valley		
Total population	65	100.0
Individuals with less than a high school certificate	10	15.4
Individuals with a high school certificate and/or some post secondary	0	0.0
Individuals with a trades certificate or diploma	15	23.1
Individuals with a college certificate or diploma	0	0.0
Individuals with a university certificate, diploma or degree	15	23.1
Source: Statistics Canada 2001 Census (numbers may not add up due to rounding)		

The Assessment of the Communities

In consultation with partners and stakeholder organizations, the researchers of the IACC Project pre-selected 17 communities in the SSRB. Twelve in Alberta and five in Saskatchewan. Six communities were then selected for the study from this initial list—Cabri, Stewart Valley, and Outlook in Saskatchewan and Taber, Hanna and the Blood Tribe reservation in Alberta. In 2005, Canadian researchers assessed the vulnerability of three communities in the SSRB: Cabri, Stewart Valley and the Blood Tribe reservation.

The vulnerability assessment of Cabri and Stewart Valley followed a strict protocol established by the IACC researchers. The protocol for community research includes meeting with town council members, engaging with the community, talking with key informants, and ensuring that all interview responses remain confidential and anonymous. With regard to this last point, the researchers involved sought and obtained the approval of research procedures by the Ethic-Research Board of the University of Regina.

The community vulnerability assessment of the localities of Cabri and Stewart Valley in southwestern Saskatchewan was carried out between June and August of 2005. The assessment involved three main activities.

- **Archival Research** was carried out in both the Saskatchewan Archives and the local library to compile information about the history of the communities and historical information about water and climate related issues.
- In addition, a number of semi-structured **interviews** were conducted with residents in and around the rural communities of Cabri and Stewart Valley. Respondents included business people, local authorities, and senior citizens, as well as farmers and ranchers living

in the vicinity of these two localities. Both male and female residents were interviewed. The researchers interviewed a total of 30 people in Cabri and 11 in Stewart Valley. Reflecting the community demographics, many respondents were farmers or senior citizens.

- As a follow-up to the interviews, two **focus groups** (with participants from both communities) were conducted in Cabri in November 2005. One of them was focused on the relationships between the communities and governance organizations and the other was the droughts of 2001 and 2002.

The last two research activities (interviewing and focus groups) were directed to assess the vulnerabilities of the two communities in regard to water and climate-related events. This assessment involves the identification of: (i) the conditions that have affected or are affecting the communities and household; (ii) the adaptive capacities that the community is using or has used in dealing with those conditions; (iii) the different evaluations that community members make of the role played by external institutions in reducing the community's vulnerability; and (iv) the community members' assessment of the ability of existing adaptive mechanisms to deal with future climate conditions. We were interested in obtaining a comprehensive understanding of the communities' vulnerabilities that went beyond problems related to climate and water. Rather, we wanted to understand how a diversity of vulnerabilities to a multiplicity of phenomena—climate, changes in government policies, global markets, and others—affected each other and the viability of the community. All of the interviews and focus groups were recorded and transcribed verbatim and then coded and deduced using the NVivo software package. Qualitative data analysis was then conducted and findings were interpreted.

Our approach was based on the notion that a crucial aspect of vulnerability assessment is to gather and understand the members of the communities' own information on their exposure-sensitivities and adaptive capacity. The active and unbiased engagement of community representatives and other stakeholders is an important part of this approach. As such, the in-community assessment has been conducted using participatory methodologies, which requires researchers to live in communities and experience and observe daily life. By living in the community, researchers can develop trust, gain a deeper understanding of social interactions, and witness risks, exposures and adaptive strategies.¹

The vulnerability community assessment was completed by two additional studies. The first was focused on the impacts of the droughts of 2001 and 2002 upon the areas where the two communities are found (Wittrock et al., 2006; for access to this article see www.parc.ca/mcri/vul_comm_ass.php). The second study based on the interviews carried out during the assessment focused on the value system that supports the adaptive

¹ A graduate student of the University of Regina, Stephanie Jeanes, lived in Cabri from June to August of 2005. During this period of time, and with the support of another graduate student, Erin Knuttila, she contacted and interviewed people in the two communities and participated in their activities. Without their support, hard work, and dedication this report would not have been possible.

strategies found in the communities (Morito, 2006:,for access to this article see [www.parc.ca/mcri/pdfs/fromdocs/Morito\[1\]\[1\].ValuesAnalysisandInstitutionalAdaption.pdf](http://www.parc.ca/mcri/pdfs/fromdocs/Morito[1][1].ValuesAnalysisandInstitutionalAdaption.pdf)).

The following pages discuss the results of the interviews and focus groups. The discussion has been organized into different sections, each related to one of the main components of the evaluation guide. The first section deals with the various exposures experienced by the members of the two communities. The second section focuses on the adaptive responses of the communities to the external stressor. The last section covers what the respondents consider to be the future exposures and adaptive capabilities of the communities.

Current Exposures

The economic and social exposures that affect the Cabri and Stewart Valley communities mirror those experienced throughout much of rural Saskatchewan. Lack of employment opportunities and a diversified economy able to provide income alternatives have forced young people to move into other areas. This out-migration has resulted in the short term in an increasing age of the population remaining in the communities and, in the long term, in a significant challenge for the sustainability of these communities.

Table 5: List of Exposures

Economic
➤ Lack of employment opportunities
➤ Lack of demographic resources to sustain economy
➤ Lack of economic activity
➤ High input costs
➤ Lack of access to capital
Social
➤ Lack of demographic resources and economic activity to support infrastructure
➤ Lack of sports and recreational programs
➤ Fading social support network
Environmental
➤ Climate
○ Warming winters
○ Extreme unpredictable variability
➤ Droughts (1988, 2001, 2002)
➤ Water quality
➤ Erosion
➤ Floods
Institutional
➤ Inadequate coverage and returns from crop and hail insurance
➤ High insurance premiums
➤ Strict water regulations
➤ Poor inter/intra-institutional communication
➤ Poor communal needs assessment from institutions

The absence of proper employment that allows for economic fulfillment and sustainability are one of the main challenges in the communities of Cabri and Stewart Valley. This issue was brought up by the majority of respondents as the predominant social challenge that the communities experience. With both communities characterized by a predominance of agricultural activities, it is difficult to keep youth in the communities. This prevalence of a single economic industry, as most all respondents made very clear, is problematic since farming is no longer as sustainable as it once was; to engage in agriculture nowadays is often not feasible.

As expected, environmental exposures to climate events such as droughts or floods create harsher conditions for farmers in the current agricultural context. As some respondents noted, in some cases when there is a poor crop, often times the cost of harvesting would be substantially more than what the return would be. In this situation, many farmers become “double losers”, being affected by both climate and economic conditions (Olmos, 2001).

It should be noted that the economic and social stresses of agricultural producers are not simply a result of contemporary circumstances, they are attributed to continuously altering conditions over an extensive period of time.

Most farmers have witnessed and experienced considerable changes in nearly all avenues of farming ranging from farm practices to technological developments. Economic changes in the farm economy and local, provincial, and world markets have been identified as some of the fundamental processes that contribute to the increase in the vulnerability of rural households.

Southwestern Saskatchewan was long renowned for generating large, high quality quantities of durum wheat that is sold in the world market. This, however, is no longer the case. A majority of farmers in both communities highlighted that although the same quantity of durum wheat is being produced for the world market, much more land must be harvested in order to obtain this quantity. It was also noted that this is due in part to the weak Canadian dollar as of recent. Durum wheat is traded using the U.S. dollar, which makes it very difficult for Canadians to remain competitive. This situation however has since changed as the value of the Canadian dollar has increased substantially.

One respondent stated that grains were at an all-time low. He noted that when he started farming in 1974 the return on durum wheat was roughly \$6 a bushel and, at the moment of the interview, in 2005, it was reduced to approximately \$4 a bushel. The majority of respondents claimed the same trends were affecting their livelihood in the same manner.

Most farmers have nevertheless adapted to this situation by diversifying their production. Newer and more economically viable crops such as peas, lentils, or dry beans are sold in the free market whereas traditional, now less valuable crops such as durum wheat are sold via the Canadian Wheat Board. This coping capacity, however, is limited given the

“cost-price squeeze” that affects most farmers, as it is in the case of inputs. In addition, the rising cost of machinery and other technology required to run an efficient farm results in higher input costs and, in effect, less net income. One of the respondents noted that when he started farming the cost of a combine was between \$18,000 and \$20,000. Now a new combine costs nearly \$200,000.

Fertilizers and chemicals such as pesticides and insecticides were also found to be a major contributor to increased input costs. In the recent past, dry years have become a more common occurrence and insects such as grasshoppers and flea beetles have become problems that have accompanied the climate shift. Consequently, more acres must be farmed to get the same end result, input costs are significantly higher, and the return is the same if not less. Farmers make less per acre now than they did when they began farming. Many believe that this lack of access to capital prevents community members, especially youth, from continuing on with an agricultural means of employment as it is simply too expensive and not a secure enough source of revenue.

This situation—where vulnerability to climate multiplies already existing economic vulnerabilities—is even more detrimental as a result of conditions imposed by the institutional framework in which farmers operate. The norms and rules imposed by the insurance industry are an exemplary case cited by the respondents. Farmers, in order to be eligible to collect insurance, must harvest even the crops that are damaged and not worth harvesting; eligibility requires that everything must be harvested. With the rise of fuel prices, the time it takes to harvest, the decreasing coverage of insurance, and higher premiums, the return that the farmers receive from insurance is nearly as poor as what they would receive from sales returns, if any of the damaged crops were accepted at all.

Those community members who do not directly depend on agriculture for their subsistence are indirectly affected by economic activity that occurs in the agricultural realm as well. Many of them provide a variety of services to local farmers so that their income is highly tied to the economic upheavals of agriculture. Several respondents in Cabri and Stewart Valley noted that the income of farmers is one of the predominant facets that affect their livelihood. If the agricultural producers are not collecting income then they are not spending money at the stores, restaurants and gas stations.

Economic upheavals are accompanied by exposure to social processes that affect the sustainability of communities and households. Currently, there is indeed a declining representation of youth in the communities due in part to the out-migration trend of youth in search of secure employment and economic sustainability. Many children leave the community after high school and very few of them return.

One respondent stated that, in light of the aforesaid, his livelihood is dependant on agriculture as well and is therefore, indirectly related to the climate shift. In drawing parallels, if there is no youth to uphold the agricultural lifestyle of the communities, as predicted by many respondents, then the local economies are in dire jeopardy as they are all intertwined and densely-bound by both internal and external forces in a seemingly very organic nature.

The increasing scarcity of youth affects both the economic viability of local business, as well as the availability of services. Several respondents expressed concern that the local school may be amalgamating with other school boards and perhaps moving to a larger center in the near future. They noted that the trend seems to display that most things are in fact migrating to larger centers (Swift Current). This is a cause for alarm to the local community members, especially those in Stewart Valley.

This concentration of services in larger settings also has implications for the community's social capital. As one respondent noted, the school is the glue that holds the community together; it symbolizes tradition and social solidarity. As businesses have died out or relocated, many other things follow suit, perhaps most notably the fading sports teams and recreational activities. At one point, like many other rural Saskatchewan communities, Stewart Valley was very prosperous in this measurement. That time is now past as there are no longer enough people or finances to sustain the necessary amenities to amass hockey, figure skating, baseball or curling teams and events. They were a source of communal identity that has faded; their loss has made these communities more loosely knit and almost transparent. It is feared that the loss of the school would reduce what social solidarity remains.

In terms of environmental exposures, temperature and water are the two principal events brought up by the vast majority of respondents as the major causes of challenges forcing these two semi-arid communities in the South Saskatchewan River Basin. The overwhelming majority of the interviewees noted that the recent winters in the two communities have not been nearly as harsh and with much less snow, as previous years. Many respondents noted that snowfall in the past was much higher and regularly drifted as high as the tops of the fences in their yards; one respondent even recalls snow as high as the tips of telephone poles in some extreme cases. This lack of snow accumulation results in a decrease in surface runoff, which, in turn, results in lower lake levels and water scarcities. This will be elaborated upon in the sections following. With respect to temperatures, however, the single greatest exposure that resulted in household vulnerabilities noted by respondents was the extreme unpredictable variability of temperatures.

According to respondents this extreme variability of temperature and its timing has myriads of possible consequences. A cool spring with late frosts for instance, can delay seeding, which may result in lower crop yields. This was the case in the 2005-growing season as one respondent recalls that July was the only month in the entire year that there was not frost. Early frost, on the other hand, is also devastating to crops. This decreases the quality of crops, which, in effect, results in lower yields as well.

Hot temperatures, like cold temperatures, can result in damaged crops when they are unseasonable. Hot temperatures dry out the land, burn crops and allow an environment for various crop-threatening insects such as flea beetles, saw flies, and grasshoppers to flourish. With respect to pests, white tail and mule deer have been noted to claim high protein pulse crops as sustenance.

Moreover, the increasing fluctuation of temperatures and weather patterns ranging from one extreme to the other is said to cause increased sickness in cattle. Respondents noted that the Chinooks that come out of Alberta can cause a fluctuation of up to 30 degrees Celsius in a matter of days or even hours. As Chinooks recede and the temperature decreases, bugs die off, when it advances and temperatures increase, bugs resurface. This causes a decrease in the adaptive capacity of cattle and often times their immune system is the victim. As a result cattle become ill with pneumonia and frequently die.

Ultimately, the effects of climate variability and extreme conditions are a loss of capital (see Table 6). As discussed in the previous section, climate events may increase economic vulnerability to the extent that they affect farm crops and animals, as well as resources such as water and soil. This affects the adaptive capacity of the community and household, making them increasingly vulnerable by threatening future sustainable activities.

Cabri and Stewart Valley have long been victims of severe drought; most notable were the droughts of 1988, 2001, 2002 and 2003. The drought of 1988 was referred to as the worst of those mentioned. One farmer stated that 1988 was a disaster; he came out with only 400 bushels of wheat on the entire farm. This is significantly low seeing as the average yield that respondents noted was approximately 40 bushels per acre (depending on crop type).

The droughts spanning from 2001 to 2003, although not identified to be quite as devastating as the drought of 1988, still had significant economic impacts on agricultural producers, as displayed in Tables 6, 7, and 8. The crops in this time frame were regarded as crop insurance level crops—the worst quality crops an individual can produce and not collect crop insurance. Everything grown must still be marketed.

The major problem with drought mentioned by most respondents is lower yields (see Tables 7 and 8) that lead to lower income, which effectively increases the economic vulnerability of farmers. The economic damage associated with the 2001 and 2002 droughts in Canada has been estimated in the billions: spring wheat, canola, barley, and oat yields ranged from 8% to 22% below average (Sauchyn, 2005). According to Wittrock et al., in the rural municipalities of Riverside and Saskatchewan Landing alone there was a loss of \$14.3 million in 2001, and \$7.3 million in 2002. In 2003 net returns improved slightly but still resulted in a loss of \$4 million. The total damage in the two RMs from 2001 to 2003 was estimated at \$25.8 million (see Table 6) (Wittrock et al., 2006). (For access to this article consult the IACC website: www.parc.ca/mcri/vul_comm_ass.php)

Table 6: Economic Impact of Drought on Crop Production for the RM's of Saskatchewan Landing and Riverside

Particulars	Total Net Revenues from Crop Production (\$000) during				
	98-00 AVG	2001	2002	2003	2004
RM of Saskatchewan Landing No. 167, 93% Representation	\$2,328.84	(\$3,219.83)	(\$359.57)	\$1,419.51	\$1,154.96
RM of Riverside No. 168, 87% Representation	\$3,120.49	(\$5,637.54)	(\$1,476.96)	(\$175.18)	\$6,923.64
Total RM Crop Impacts	\$5,449.33	(\$8,857.37)	(\$1,836.53)	\$1,244.33	\$8,078.00
Economic impact of the drought		(\$14,306.70)	(\$7,285.86)	(\$4,205.00)	

Source: Adapted from Wittrock et al

Table 7: Crop Yields, RM of Riverside No. 168, 1998 - 2004

Crop	1998	1999	2000	2001	2002	2003	2004
Spring Wheat (bu/ac)	29	35.6	31.9	24.9	17.2	12.7	32.8
Durum (bu/ac)	32.5	37.3	35.3	21.7	19.1	23.1	38.4
Oats (bu/ac)	45.1	45.8	58.3	39	34.6	23.5	56.5
Barley (bu/ac)	48.6	52.1	45.8	38	26.4	24.7	54.1
Fall Rye (bu/ac)	23	29.4	27.5	N/A	20	19.1	38.3
Flax (bu/ac)	16.5	25	25	10	10	9.2	N/A
Canola (bu/ac)	12.2	34.3	35	14.6	15.8	10.8	31.8
Mustard Seed (lbs/ac)	817.4	1244.9	1027.2	570	716	570	698
Lentils (lbs/ac)	925.8	1695.8	1409.3	439	977	672	1425
Peas (lbs/ac)	1817.7	2879.1	2479.2	533	1484	1138	2461
Canary Seed (lbs/ac)	1062	1201.6	1213	899	1007	713	1102

Source: Saskatchewan Agriculture and Food

Table 8: Crop Yields, RM of Saskatchewan Landing No. 167, 1998 - 2004

Crop	1998	1999	2000	2001	2002	2003	2004
Spring Wheat (bu/ac)	28.9	37.7	39.4	17.8	20.3	18.7	32.2
Durum (bu/ac)	32.9	43.8	40.4	17.7	22.6	23	31.7
Oats (bu/ac)	43.9	51.6	73.8	N/A	35.9	N/A	48.8
Barley (bu/ac)	30.2	48.9	59.8	24.5	29.8	36.6	49
Fall Rye (bu/ac)	25.5	38.7	N/A	N/A	N/A	N/A	N/A
Flax (bu/ac)	20.3	25.3	N/A	13	N/A	10.5	19.9
Canola (bu/ac)	26.6	32	26.1	23.5	23	16.3	32.5
Mustard Seed (lbs/ac)	N/A	1197	1262.5	N/A	550	889	1380
Lentils (lbs/ac)	935.9	1714.4	1707.3	559	785	737	1614
Peas (lbs/ac)	1683.6	2457.5	2531.6	531	1081	1196	2056
Canary Seed (lbs/ac)	495	N/A	1100	N/A	N/A	829	939

Source: Saskatchewan Agriculture and Food

Residents of Cabri reported water shortage as the predominant water-related exposure. This is largely due to the to the community's main source of potable water, which is the South Saskatchewan River.

The majority of respondents have noticed a decreasing amount of precipitation in the winter months, which affects the snow pack in Alberta's Rocky Mountains. This is detrimental to Cabri's water supply as the rapid depletion of snow pack over a reasonably impermeable soil generates much surface runoff for a period of a few weeks. The primary source of water for prairie rivers is the Rocky Mountains. In these mountains the moist air masses from the ocean drop a very large quantity of orographic precipitation (Hayashi and Kamp, 2005). A lack of orographic precipitation results in an epiphenomena in which prairie rivers are left low, which impacts upon Cabri's potable water supply.

The water is pumped through a seasonal pipeline in the summer and held in a reservoir just beyond the town. The water is then pumped to the town water treatment plant. In the recent past many Cabri residents noted that the reservoir has been extremely low which has in turn created a water scarcity in the town. In order get water to the town treatment plant the river must be high enough for the intake pumps to reach it and transfer the water to the town reservoir. Since the intake pumps for Cabri's reservoir are located at the top (or inlet) end of the lake, they are the last pumps to receive water due to the high levels they require. With the lack of surface runoff from the Rocky Mountains the river was not high enough for the intake pumps to retrieve water. This situation has caused problems with the water supply of the community in the recent past. Another explanation was provided by one respondent who believed that the problem was due to poor management, that is, letting the town reservoir run far too low.

In the past, according to respondents, the water treatment plant and its processing potential also caused water quantity problems. Farmers that spray crops used to come and get water for their sprayer, sometimes filling up large containers. The amount of water that the treatment plant can draw in and treat could not keep up with the quantity of water demanded by the farmers for spraying their fields, thus causing water shortages. A few respondents noted that the town had to go as far as shutting down the town car wash to conserve water. Accordingly, farmers are no longer allowed to spray crops with town water. They now have to draw directly from the South Saskatchewan River or surrounding creeks. This policy has created problems for farmers in that the high concentration of silt in the water has caused corrosion of pipes and clogged filters resulting in frequent replacement.

The residents of Stewart Valley, on the other hand, have reported no issues concerning a shortage of water. Again, this is largely due to their source of water. The village of Stewart Valley utilizes three wells located near the water treatment plant. Raw water is pumped directly from the wells to a 10,000 gallon cistern in the water treatment plant, where it is treated by continuous chlorination. The fact that the community has a consistent source of water not dependant on surface runoff is the contributing factor that

makes the community less vulnerable to drought than the neighboring community of Cabri.

The only time respondents noted any shortage of water is during power outages. During such outages the power to the pump turns off, this leaving residents without power and water. This however is not considered to be a significant problem for any of the respondents. Regardless, community members still practice water conservation as a preventative measure.

Respondents from both communities maintained that low water levels also have an effect on recreational activity. One respondent explained that environmentalist groups have lobbied and succeeded in keeping water levels low because of piping plovers that nest on the shoreline. As a result, water levels are intentionally kept low until the end of July. This affects recreational activity since boat launches cannot be utilized; thus, most recreation that centers itself around Lake Diefenbaker is left static until water levels are brought up. This also affects the local tourism industry as it makes it difficult for tourism to flourish if the chief tourist attraction is non-accessible.

Floods and strong rains, while somewhat uncommon in this particular region of the province, have proved to be an issue in recent years. Several respondents reported that with the increase of precipitation in the last couple of years their basements have become flooded following a heavy rain. Also, for farms with low-lying fields, heavy rains mean flooded crops and poor yields; this was the case with many respondents in 2005. A few respondents reported having so much moisture that their crops were turning yellow due to root rot. Farmers with higher crops or better drainage, on the other hand, may have flourishing crops with higher yields following a heavy rain.

For the vast majority of respondents, water quality in terms of everyday consumption did not prove to be a major issue in either community. Many residents do, nonetheless, make use of a water cooler for household consumption. This is simply a preference issue in terms of taste. Respondents noted that the town water supply is always kept within government regulations and is therefore always good in terms of quality.

The only problem encountered with water quality in terms of everyday consumption occurred in 2003 in Cabri. A valve was left open in the water treatment plant that caused the basement to flood, and there was a backlog from the filtering engine to the clean water supply. It was not known if any substance such as oil had seeped into the system. Consequently Public Health was contacted and a “boil water” advisory was issued as a precautionary measure. This did not prove to be much of an inconvenience or issue to the respondents.

Although water quality did not prove to be a major cause of concern, nearly every respondent noted that the town water supply in both communities had a very high concentration of magnesium. This is said to be caused from ground water getting into the reservoir. Due to this residents cannot make use of bleach with town water as its reaction with magnesium causes water to turn brown. For many residents this has proved to be a

slight problem in cases of washing clothing or any light surface that requires bleach as a disinfectant.

A few respondents from both communities identified the smell of water from the town reservoirs to be an issue. As respondents explained, there is much organic growth under the ice and at times this causes water to come out with a rotten smell. An aeration system has to be run year round to help ventilation problems and decrease odor.

Another environmental exposure mentioned by some respondents was wind. In dry years in fields that were summer fallowed, topsoil has been blown off and carried into ditches, leaving the summer fallowed land virtually useless for agricultural purposes. As well, surrounding trees have been blown right down to the roots, killing them, rendering shelterbelts ineffective and leaving fields more vulnerable to wind exposure. Most farmers have, however, adapted to wind erosion by means of continuous cropping, so that wind cannot blow topsoil around and wear down fertile fields as plants protect the soil at all times.

Other forms of extreme climate events such as hail, rain, and wind storms are recognized as becoming more severe. Hail storms specifically have been singled out as causing the worst damage. Although the respondents noted no specific instances, hail storms were said to flatten crops, reduce yields significantly and to be one of the dominant forces that increase household and community vulnerability.

Although implied and elaborated upon above in the economic, social and environmental exposures sections, it is important to reiterate the predominant institutional exposures that respondents highlighted. The most commonly addressed institutional exposure was the inadequacy of crop and hail insurance returns and coverage. As mentioned before, most respondents noted that in years when conditions are harsh and crop insurance is relied upon, the insurance provided by institutions such as Saskatchewan Crop Insurance Corporation (SCIC), is just enough to keep a farm operational. Respondents argued that the returns provided by institutions are unjust. While droughts, harsh conditions and unpredictable weather become increasingly common, reducing crop and hail insurance coverage are decreasing; thus leaving agricultural producers in a very vulnerable state.

Furthermore, many respondents who rely on agricultural production for their subsistence reported that not only do crop and hail insurance coverage put them into a vulnerable position, but so does the cost of insurance. Many participants reported opting out of purchasing crop and hail insurance due to the extremely high premiums that providers enforce. Of those who reported not purchasing insurance, a few noted that adding crop insurance on top of already high input costs is not viable. The gamble of not purchasing insurance and having poor yields makes these respondents less vulnerable than the gamble having insurance and not needing to make use of it.

Unfortunately, with increased harsh conditions that damage crops, not purchasing insurance is becoming more common. If individuals are forced to use crop insurance due to lost yields, the following year premiums are higher. With more common harsh

conditions farmers rely on crop and hail insurance more, which drives their premiums up, making insurance virtually unaffordable. Therefore, institutional conditions that were created to reduce farmers' vulnerability to climate events have an opposite result due to their costs, leaving those farmers in most need in a detrimental situation.

Water regulations were also seen as problematic by some of the respondents. They argued that institutions that enforce water regulations, such as Saskatchewan Environment and Saskatchewan Water, are becoming stricter with communities in regards to quality of water standards. This institutional enforcement is bittersweet for respondents. Although it is a positive characteristic in that it promotes high-quality safe water for consumption, it also holds negative connotations in that many communities cannot meet standards. If communities cannot meet water standards then Saskatchewan Water takes control of community water supplies; the amount they charge for water is substantially more than if it were managed through the communities themselves.

Many respondents in both Cabri and Stewart Valley reported that this is a very likely scenario for their communities since they do not have the appropriate technological or demographic resources to meet the enforced standards. According to respondents this possibility is already occurring as water inspectors have been out on various occasions due to poor water samples with extremely high amounts of magnesium and complaints from residents regarding this. Not only will water fees be substantially higher in this scenario but taxes will also increase, due to the new equipment and qualified employees that will be required.

In addition, participants of the focus group centralized around institutional issues recognized inter- and intra-organizational communication of public agencies as one of the chief impediments in dealing with institutions. They maintained that it is very difficult to deal with governmental organizations in particular, noting that the answers they receive from these organizations are dependant on the governmental representative providing the response. This makes it difficult for communities to plan accordingly as they have no concrete guidance; answers are always changing depending on who is being dealt with. Respondents accredit this to having too many organizations and departments. Having an abundance of departments makes it difficult for people to communicate with one another; there are so many different avenues of communication that it is very easy to mix messages.

In regards to poor communication, respondents have identified the Saskatchewan Watershed Authority (SWA) as not communicating with the communities concerning communal needs. Respondents from Cabri noted that they are constantly at odds with SWA to keep water levels high so that the community can fill its reservoir and not experience water shortages. The SWA, however, does not assess the needs of the community and proceeds with regulating water levels as it sees fit. Not only does this affect the community of Cabri, it affects other communities and farmers further down the river that rely on Miry Creek irrigators for irrigation purposes. Like Cabri, the water levels are too low for Miry Creek's intake pumps to reach the water.

Discussion of Current Adaptive Strategies

As displayed, the community of Cabri has witnessed scarcities of water in the recent past. Accordingly, various adaptive strategies have been taken in this and other communities, such as Stewart Valley, to acclimatize themselves and become less vulnerable to drought (see Table 9: water management strategies).

Table 9: Current Adaptive Strategies

Water Management
➤ Water scheduling policy
➤ Haul water from wells in the RM
➤ Fill dugouts and spray tanks from the creeks, rivers, and lakes
➤ Low-level pumping system project
➤ Buy bottled water, recycle previously used water
➤ Water quality testing
Financial
➤ Crop and hail insurance
➤ Move to larger centers to find secondary income
➤ Find employment in the oil and gas industry for the winter months
➤ Substitute low-value high-yield crops for high-value low-yield crops
Technology
➤ Practice continuous cropping over summer fallowing
➤ Practice air seeding over tillage for seeding purposes
➤ Spray crops rather than till for weeds
Social
➤ Communal crop spraying
➤ Community social support networks
➤ Communal pressure for policy enforcement
External Institutions
➤ Canadian Wheat Board – provide a stable source of revenue through developing, arranging and selling to markets
➤ Saskatchewan Agriculture – supply water line and intake pumps in drought years
➤ Prairie Farm Rehabilitation Administration – construct reservoirs for farmers and develop a dugout building program; free engineering consultation for water quantity and quality management in the South Saskatchewan River Basin
➤ Saskatchewan Environment, Saskatchewan Water and Public Health – determine water quality regulations and conduct water quality testing
Internal Institutions
➤ Public Works – water rationing policies and water quality testing
➤ Water Committee – addresses any local problems or questions regarding water
➤ Recreational Institutions – golf course, hunting, fishing etc.

During the droughts of 2001 and 2002, when water scarcity was an issue, both communities implemented restrictions to minimize water use. In both communities a water scheduling policy was put into place. In Cabri, for instance, the town was divided

alphabetically. Surnames that begin with a letter that falls between and including A and M can water on Monday, Wednesday and Friday and the those between N and Z can do so on Tuesday, Thursday and Saturday, both between the hours of 6am to 9am and 6pm to 9pm. Sundays are off limits to all residents. Stewart Valley, however, organizes its water scheduling policy according to streets; every street has a different day in which it can water. It should be noted that these community water conservation policies are currently still in effect for water scarcity preventative measures in both Cabri and Stewart Valley.

Residents in both communities who required a more substantial supply of water hauled it from wells located in the Rural Municipality or bought it from larger centers such as Swift Current. Those residing outside the communities, mostly farmers, often filled their cisterns from their dugouts or nearby creeks. In Cabri farmers still have restrictions on using town water for spraying their crops; they must make use of various creeks, rivers, dugouts and wells to obtain water for spraying. These water conservation measures not only control water demand but they also ensure an adequate supply of water in case of a fire emergency.

Currently in Cabri there is a project in place for a new low-level pumping system to prevent water scarcities, that is to say, a system that allows water to be pumped from the South Saskatchewan River in instances when water levels are low due to lack of surface run off or precipitation. It is a work in progress and must be done in steps for economic reasons. However, a temporary system has been arranged with extended hoses reaching out in to the middle of the river and a floating intake pump. This will allow water to be pumped to the reservoir regardless of river height.

On the whole, the overwhelming majority of respondents in both communities are extremely conscious of water use and abide by the policies implemented by community governance bodies. For pre-emptive measures some respondents still practice water conservation as if in a drought context. For instance, many respondents noted that they still make use of the rinse wash from their laundry by recycling it for the garden or toilet, some brush their drive way rather than rinse it, and others collect rain water for their gardens.

In light of the water issues that Cabri has undergone, the town council, the town foreman, and a group of local water experts have created a water committee. The rationale behind the committee is to address any water related issues that the community encounters. When such an occasion arises ,the committee meets and attempts to deal with the issue in the most appropriate manner.

To ensure high-quality safe water, Public Works in both communities sends weekly water samples from the water treatment plant and public wells to the Health Department's provincial water lab to test for manganese, magnesium, potassium, chlorine, and bacteria levels. Individual cisterns of homeowners are sampled as well, although only once a year. One respondent noted that although he probably should sample his cistern every

year, he is on a five-year testing cycle. He claims that the water quality is the excellent and that there have been no changes over the last five years.

As noted previously, farming is becoming less and less sustainable and is often no longer a feasible means of livelihood. As a result community members appear to have taken a range of measures to ensure financial stability (see Table 9: financial adaptive strategies). Crop and hail insurance was a common theme noted by respondents as a very common coping mechanism to ensure a degree of financial stability. With droughts and extreme weather occurring more often, hail and crop insurance is imperative to ensure a marginal source of revenue in years where conditions are harsh. This coping mechanism is, however, limited to those who could afford the premiums.

In years when conditions are unforgiving, crop and hail insurance is often insufficient to keep a farm afloat and maintain a satisfactory standard of living. Many respondents alleged that they have had to find a secondary source of income to subsidize the poor returns they received from crops and/or crop insurance. Accordingly, as Cabri's location is close to rich deposits of sodium sulfate and an established medium crude oil and medium natural gas industry, many farmers subsidize lost income by taking various jobs in these industries in the winter months. Other respondents take trades or try to obtain employment in larger centers such as Swift Current.

Finding proper employment for females was reported to be much more difficult as there is a lack of jobs in the area. One of the respondents who did find local employment reported working part-time at the Cabri hotel and part-time at the Credit Union, while at the same time studying to get a youth care worker certificate to hopefully obtain employment at the school—all to subsidize lost income on the farm.

In regard to poor economic conditions that affect the viability of many farms, a common coping mechanism has been crop substitution. With returns diminishing on traditional crops that flourish in the southwestern Saskatchewan environment, such as durum wheat, many farmers raise crops that do not grow as well but are of higher value. Some respondents noted growing canola and other pulses for this reason. Farmers are eliminating lower value crops that grow well for higher value crops that grow poorly to stay in business.

The adoption of new farming practices is also a common coping capacity (see Table 9: technological adaptive strategies).

Summer fallow or 50/50 cropping has seemingly becoming a thing of the past, as most respondents noted that continuous cropping is becoming a more prominent practice. If fields are continuously cropped wind cannot blow topsoil around and wear down fertile fields, since plants protect the soil at all times. This protects investments and in effect allows for a more stable source of income.

Summer fallowing crops was done under the rationale that it was conserving moisture. However, when soil is tilled for weeds it exposes preserved moisture to the atmosphere.

This causes evaporation, which dries out the soil. Under this new rationale diskers have taken a back seat to air or direct seeding. Diskers essentially turn the ground over to both seed and weed whereas air seeders shoot seeds directly into the stubble. Unlike diskers, this leaves the soil undisturbed, which preserves the protective cover that holds in moisture, thus causing increased yields and revenue.

Following this new form of seeding, weeding must be tended to in a different manner. Diskers weed and seed at the same time as the soil is turned over. Air seeding, on the other hand, leaves weeds in the soil. Therefore, spraying for weeds accompanies this form of seeding. Spraying on the whole has become more popular as insecticides, pesticides, herbicides and pre-emergent herbicides have prove to be effective. There are, however, alternatives to this practice. One respondent believed rotating crops also eliminates bugs and disease. If crops are rotated, then bugs that are predominant in specific crops do not have the opportunity to grow in numbers and spread disease. He believed that crop rotation breaks down the reproductive cycle of insects and pests

Spraying, however, is not simply a technological adaptive strategy; on the contrary, it holds social connotations as well. Respondents reported that spraying is a community effort. If only one individual were to spray it would prove to be useless as insects, pests, and weeds on neighboring farms that were not sprayed would, over time, carry onto the next field and the one after that in a domino effect. For this reason all farms work together and spray to decrease community and household vulnerability and increase their coping range and adaptive capacity (see Table 9: social adaptive strategies).

In both Cabri and Stewart Valley cooperation with other community members—what is called ‘social capital’ in the social sciences literature (Adger, 2003)—is instrumental sustaining households and communities. Respondents maintained that rural Saskatchewan individuals are a tough bunch who stick together. If the community has needs it will address those needs itself, without government and without funding.

These two communities use social capital in many ways to decrease vulnerabilities and increase their adaptive capacity and coping range. For instance, a few respondents reported that they could recall cases when there was a storm and crops and buildings would be damaged. In such cases the community assembled crews to help plow crops, shingle and rebuild buildings. Other respondents noted that in times of water shortages neighbors or other community members watered lawns or gardens of those around the community who do not have a water truck to haul water.

Social capital is also an effective tool in dealing with water related problems. Respondents reported that during water shortages there is community pressure to preserve water. There is a serious social stigma attached to those individuals who do not abide by water scheduling policy because in doing so the entire community is distressed. Communities are more than simply a place of residence for the residents of Cabri and Stewart Valley—they are a social support network. Respondents noted that communities or friends are like families and there is not much difference between the two.

Respondents were also asked about the role that external organizations—those associated to governance—play in defining the conditions of vulnerability of the community (see Table 9: external institutional adaptive strategies). According to majority of respondents, several external organizations have played a large role in aiding communities in their pursuit of sustainability and adaptation to exposures; perhaps most commonly noted was the role of the Canadian Wheat Board. Although many respondents consider the returns that the Wheat Board provides to be unjust, they recognize the stability that it presents. For many farmers, while they may be able to find better returns elsewhere, doing this is a gamble that most are not willing and cannot afford to take whereas the Wheat Board provides a reliable source of revenue. One respondent noted that the Wheat Board develops, arranges and sells to markets that he would otherwise not have. It is definite revenue that can be relied upon.

As well, crop and hail insurance was commonly cited as an institutional adaptive strategy for promoting sustainability. Like the Wheat Board, while respondents claim that crop and hail insurance has decreasing coverage and higher premiums, they recognize that at the very least it will cover the cost of production and provide enough for farms to continue to operate the following year. Crop insurance guarantees a certain level of production. If that level is not met then farmers are paid for the difference to bring the level of production up to what they are insured for.

Saskatchewan Agriculture was also cited as an institution that increased the coping range of communities. In recent drought years Saskatchewan Agriculture has supplied farms with irrigation line and pumps to transfer water from sloughs to dugouts to allow farmers to water cattle in the winter months.

In terms of water quantity aid, The Prairie Farm Rehabilitation Administration has contributed to the communities by promoting sustainable irrigation practices. PFRA has constructed a reservoir outside the community of Cabri for farmers and has also implemented a program for building dugouts. The institution is also in the process of tackling water quality and quantity issues in the South Saskatchewan River Basin. PFRA, in cooperation with the community of Cabri, is conducting a study to obtain a manageable group of ideas to enable safe reliable water for irrigation, livestock watering and domestic and potable use. Specifically, the study is focusing on watershed management to protect both surface and groundwater sources to prevent water quality and scarcity issues during drought years.

Among other external institutions identified by respondents were Saskatchewan Environment, Public Health and Saskatchewan Water, all of which were reported to play a role in water quality conservation. Weekly water samples are sent to the Public Health water lab to test for various things such as potassium, manganese, magnesium, chlorine and bacteria to ensure quality safe drinking water. If necessary they will issue a “boil water” advisory until the problem is corrected. This has occurred in Cabri on at least one occasion as noted by various respondents (see Environmental Exposures). Saskatchewan Water ensures that the strict regulations and standard health parameters set by Saskatchewan Environment are followed for water supply that is for human consumption.

Respondents noted that they tell the towns what to do and how to deal with issues in an efficient and safe manner.

Public Works, a faction of the local government, was the chief local institutional support recognized by respondents to aid in the pursuit of adapting to exposures (for a complete list see Table 9: internal institutional adaptive strategies). Public Works was primarily identified to aid in the role of water conservation. For example, a water scheduling initiative was put into place for watering gardens and lawns to help ration water. Also, an economic initiative was spearheaded by Public Works. Residents in Stewart Valley were given a minimum set fee that included 8000 gallons of water per two months. If a household was to go over the 8000-gallon landmark, then a fee was installed to be paid for every gallon above and beyond. Further, Public Works is also responsible for water quality in terms of sending weekly samples to Public Health to ensure high-quality safe water.

Water governance organizations have also contributed to local development. Due to Lake Diefenbaker forming in 1967—a product of a decision taken by the government—as a result of the construction of Gardiner Dam, a number of recreational organizations have emerged which use the lake. The Cabri Golf Course, for example, is one of many that can operate due to the irrigation that the lake provides. Various other fishing, hunting, and other recreational organizations have also been centered around the lake. One respondent noted that the lake may have not helped farming as much as anticipated, but the institutions that encompass it relieve the stress of farming with the recreation and enjoyment they offer.

Future Exposures – Constraints

According to some scholars, the severity of recent droughts is comparable to the dust bowl years of the 1920s and 1930s, an argument that suggests a return to the drought cycle in the prairies (Khandekar, 2006; Sauchyn, 2005). Further, Kharin and Zwiers (2000) argue, severe drought is forecast to occur with an increasing rate of recurrence under global warming. In the same vein, Sauchyn (2002) argues that the Canadian GCM forecasts “an increase in temperature and therefore an approximately 50% increase in the area of subhumid climate and a significant area of semiarid climate by the 2050s.” Accordingly, the increasing aridity projected by the GCM scenarios represents a higher frequency of dry years over a larger area. This, along with the historical lack of precipitation in the Palliser Triangle where Cabri and Stewart Valley are located suggests that the occurrence of droughts in the future is almost certain. This trend is clearly in line with the preoccupations of many respondents regarding future exposures (see Table 10 for a list of future exposures).

Table 10: Future Exposures—Constraints

➤ Increase in water scarcities
➤ More frequent droughts
➤ Increased risk in fire hazards
➤ Lack of demographic resources
➤ Lack of economic activity
➤ Tourism industry
➤ Institutional interference
➤ Out-migration trends

Almost all respondents fear that water scarcities will continue in the future. The fear is that there will be epiphenomena that will result in a decrease in economic activity, which will drive youth out of the community. With an agriculturally dominant socio-economic base, the future of the community would be put in jeopardy since there would be no future candidates to sustain agricultural activity.

Also, many respondents reported that an increase in extreme weather conditions poses a concern in the future. If extreme weather conditions persist then the agricultural sector of the communities will see devastating effects. As noted earlier, extreme weather conditions can significantly effect the vulnerability of households and communities by reducing crop yields and reducing the health of livestock.

One of the specific concerns mentioned by the respondents is that this increase in frequency of extreme droughts would make the communities become more vulnerable to fire hazards. Although at the moment there appear to be no problems with fire hazards, it is apparent that the increased risk of fire is on the minds of residents. It was noted that when local residents with water trucks leave, they leave their trucks filled with water behind and sign them over to somebody else during their absence in case of a fire. Further, the fact that during times of drought and extreme temperatures residents water the lawns and trees of other residents who do not have water trucks may be due in part to an awareness of increased fire risk.

Institutions also play a role in future challenges for communities. As outlined in the institutional exposures section (see Table 5), stricter water regulations may increase community and household vulnerability. Stricter regulations make it difficult for communities to meet standards due to a lack of technological and demographic resources. If communities cannot meet water standards, then Saskatchewan Water takes control of communal water treatment operations. Respondents reported that this process is currently in effect, as water inspectors have been out on various occasions due to poor water samples with extremely high amounts of magnesium and complaints from residents regarding these magnesium issues. This will cause an increase in water rates and taxes since new equipment and trained employees will be required to bring water quality up to standards, thus increasing future household economic vulnerability.

According to respondents, as outlined previously, the likelihood of a loss of youth demographics threatens these rural communities' futures as well. With agricultural

production often no longer a feasible source of revenue, youth are migrating elsewhere to find sustainable employment. This threatens the future of the local school, which threatens sports and recreational organizations and events, which ultimately threatens the social solidarity, tradition and identity of the community. For this reason, the loss of the school is a major concern for the communities' future sustainability and adaptive capacity.

Future Adaptive Capacities – Opportunities

Although the current and future challenges that the communities of Cabri and Stewart Valley pose as threats, both communities are adapting to their exposures and creating opportunities out of them. (See Table 11 for a list of future adaptive capacities and opportunities).

Table 11: Future Adaptive Capacities – Opportunities

➤ Cooperative farming
➤ Farming as a corporate business venture
➤ Diversification of crops
➤ Diversification of markets
➤ Tourism industry

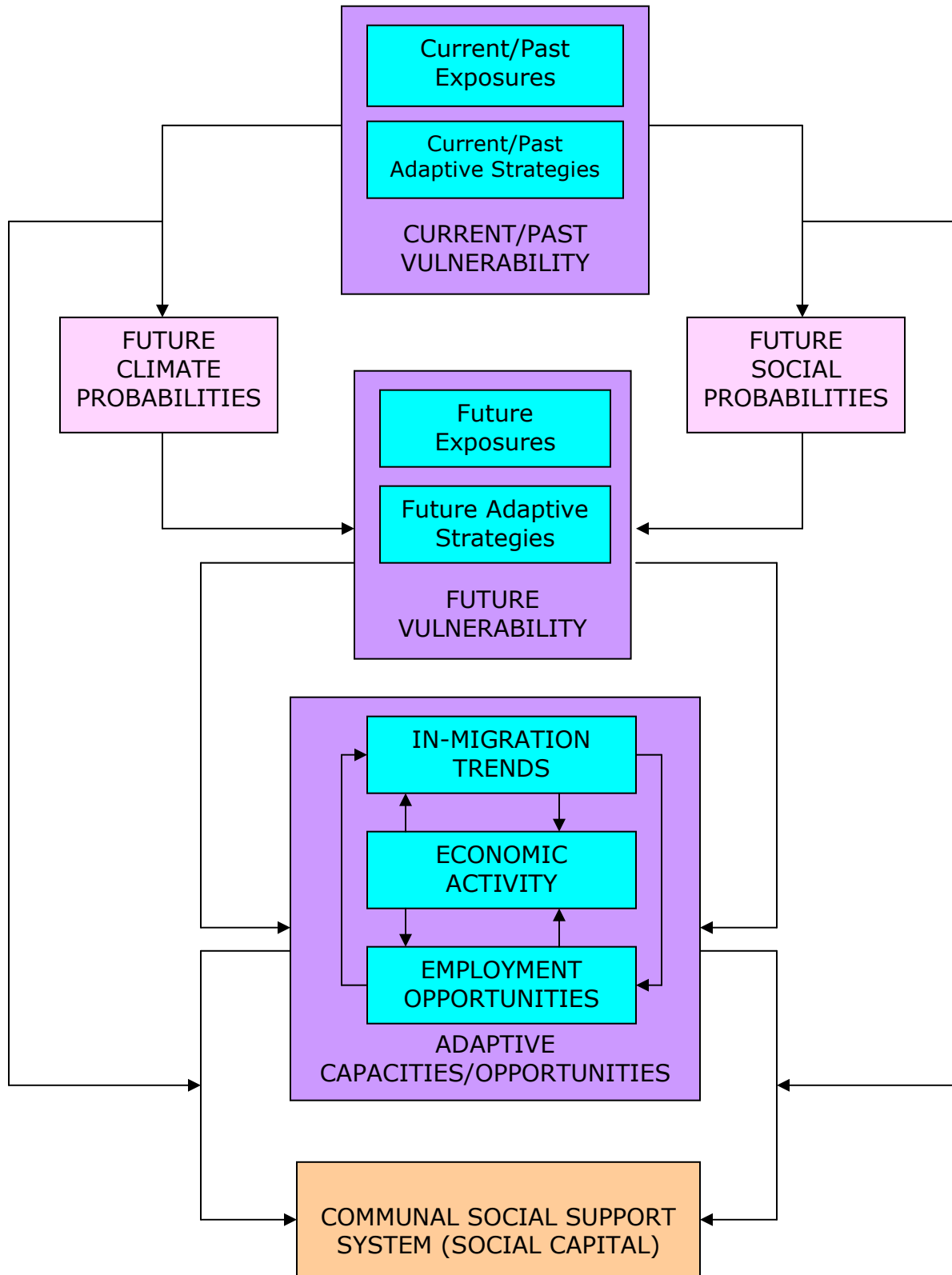
Many respondents believed that in order to increase their adaptive capacity and opportunities they must return to the days of old. Cooperative farming is one initiative that respondents reported as a viable way to continue an agricultural lifestyle and have a sufficient source of revenue in the future. In co-op farming, farmers pool grain, machinery, and labor. Therefore, regardless of crop failure, depending on how many individuals are involved in the co-op farm, every individual receives an equal percentage of the returns. Co-op farming is not only a social means of crop insurance but a means of promoting communal social solidarity as well. It is an opportunity to strengthen social ties and increase the social support network of the community.

Other community members spoke of farming in the future as having to become more of a corporate business venture in order to adapt to challenges. As farming is becoming a less viable means of livelihood, individuals may start purchasing land for investment and then hiring out work instead of working it themselves. This would create opportunities for diversification of the current economic base and effectively make communities more stable. There would also be an increase in employment opportunities, which may keep youth in the communities, which would, again, make communities more stable.

There are also opportunities to diversify crops. With the change in climate and growing season, there may be an opportunity to grow non-traditional high value crops such as corn. This may improve the economic situation of farmers, as it would diversify markets as well.

With the creation of Lake Diefenbaker in 1967, and the change in climate, there has been a significant increase in recreational institutions that surround the lake. Residents noted

Figure 2: Web of Significance



that the tourism industry has flourished and will continue to do so if climate change persists in the same manner. This increases employment opportunities and makes communities more stable as it broadens their economic foundation. In this event, there would be the opportunity for a new communal superstructure to be built, which would considerably increase the coping range of the communities.

Figure 2 displays the possible trends and predicted outcomes of future adaptive capacities and opportunities noted by respondents. These future adaptive capacities and opportunities are products of past, current, and future vulnerabilities. Respondents believe that there is light at the end of the tunnel and that exposures can also provide opportunities. On one hand, exposures create unfortunate conditions that put communities in disappearing, while on the other, they open new avenues and shed light on new capacities and opportunities that may allow communities to thrive and reestablish their roots. The focal opportunities that respondents noted to come out of vulnerabilities are cooperative farming, undertaking farming as a corporate business venture, diversifying crops, diversifying markets, and utilizing different industries that can be made out of the new environment. Respondents believed that by utilizing their current situation and engaging in the aforementioned activities, in-migration trends, economic activity, and employment opportunities will follow. They believe that these three outcomes are interconnected with and will effectively prosper off of the other, and result in the rebuilding and rediscovery of the notion of community. A new superstructure will be built and a new communal social support structure and increased social capital will be exposed.

Conclusion

Following an extensive period of literature review, collecting information on the communities of Cabri and Stewart Valley, and hours of interviews and conversations with community members, the results of the analysis are not overly surprising given the communities' geographic location. Water scarcities, lack of proper employment, lack of economic activity, and diminishing demographics are the focal challenges reported by the majority of respondents.

For the vast majority of residents, particularly in Cabri, droughts have proven to make water their most valuable resource. During drought years there have been significant impacts on both communities. Water conservation practices have been undertaken and continue as a preventative measure in case of water scarcities. Further, both communities saw a major decrease in crop yields resulting in poor returns and revenue and resulting in increased household and community vulnerability. Not surprisingly, the local economy was significantly impacted as well. Residents did not spend money at local businesses because they could not afford to.

Too much precipitation has also had a major impact on Cabri and Stewart Valley, more so in recent years. During these years massive rainfall has led to root rot in crops resulting in crop loss. Additionally, heavy precipitation has created issues with flooding

of house basements. Poor drainage plans around homes cause surface water to flood basements and in effect damage houses.

Regardless, there is indeed evidence of an adaptive capacity in both Cabri and Stewart Valley as farmers and community members continue to survive and are currently sustainable. However, due to the nature of the economic foundation of Cabri and Stewart Valley, climate change issues, the exposures they create, and the challenges they pose are still a large concern for the vast majority of individuals interviewed. Community residents felt that they and their communities are exceptionally vulnerable to climate change and that their current adaptive capacity is not enough to sustain them for much longer. If climate change persists in the same manner, they fear their communities will wither away as their economic and social livelihood is at the mercy of the environment and the environment is consistently presenting them with new challenges.

Residents' prediction of the future of their communities seems to hold true when looking at demographic trends. There is an out-migration trend of youth in search of proper employment that is whittling away at the already vulnerable youth demographic. More and more farmers are straying from their agricultural roots in search of a more stable source of income, forcing them out of the communities to areas that provide sustainable employment. Those residents who do reside in the community and continue with a traditional agricultural lifestyle are suffering financially as nature is taking away rather than giving back. The limits and restraints of the adaptive capacity and coping range of Cabri and Stewart Valley seemingly far outweighs their future adaptive capacities and opportunities.

Although residents feel that continuous global exploitation and disregard for the environment is resulting in a slow depletion of their adaptive capacity and reduction of their coping range, they try to maintain optimistic. Residents are preparing themselves for the future and try not to dwell on how things were, but on how things can be and the possibilities that lie ahead of them.

Reference List:

“A Resource Guide for Community Vulnerability Assessment.” 2002. Guide prepared for the Institutional Adaptation to Climate Change Project. University of Regina.

Adger, W. 2003. “Social Aspects of Adaptive Capacity,” in J. Smith, R. Klein, and S. Huq, eds., Climate Change, Adaptive Capacity and Development, Imperial College Press: London, pp. 29-49.

Agriculture and Agri-Food Canada. Drought Watch Website. 06/08/2007.
<http://www.agr.gc.ca>

Corkal, D., Inch, B., and Adkins, E. P. 2007. “The Case of Canada—Institutions and Water in The South Saskatchewan River Basin,” Institutional Adaptation to Climate Change Project. University of Regina.

Diaz, P., and A. Rojas. 2006. “Methodological Framework for the Assessment of Governance Institutions,” Institutional Adaptation to Climate Change Project. University of Regina.

Diaz, H. and Gauthier, D. 2006. “Adaptive Capacity for the South Saskatchewan River Basin,” Institutional Adaptation to Climate Change Project. University of Regina.

Diaz, H. and Rojas, A., 2006. “Methodological Framework for the Assessment of Governance Institutions.” Institutional Adaptation to Climate Change Project Working Paper No. 33. University of Regina.

Hayashi, Masaki and Kemp, Garth van der. 2005. “Snowmelt Contribution to Groundwater Recharge,” in Sauchyn et. al. (eds.), 2005, The Science, Impacts and Monitoring of Drought in Western Canada: Proceedings of the 2004 Prairie Drought Workshop, Canadian Plains Research Center: University of Regina, pp. 21-26.

Jeanes, Stephanie. 2006. “Ethnographic Research in Cabri and Stewart Valley, Saskatchewan: Report to the Communities.” Institutional Adaptation to Climate Change Project. University of Regina.

Kharin, V.V. and Zwiers, F.W. 2000. “Changes in the Extremes in an Ensemble of Transient Climate Simulations with a Coupled Atmosphere-Ocean GCM,” *Journal of Climate* 13, pp. 3760-3788.

Khandekar, L. Madhav. 2004. “Prairie Drought in the Context of Global Warming: A Synthesis,” in Sauchyn et. al. (eds.), 2005, The Science, Impacts and Monitoring of Drought in Western Canada: Proceedings of the 2004 Prairie Drought Workshop, Canadian Plains Research Center: University of Regina pp. 21-26.

Massie, Merle. 2004. "Community Characterization Project: Cabri Saskatchewan." Document prepared for the Institutional Adaptation to Climate Change Project. University of Regina.

Massie, Merle. 2004. "Community Characterization Project: Stewart Valley, Saskatchewan." Document prepared for the Institutional Adaptation to Climate Change Project.

Natural Resources Canada. Palliser Triangle Global Change Project. 05/31/2007. <http://www.gsc.nrcan.gc.ca>

Olmos, S. 2001. "Vulnerability and Adaptation to Climate Change: Concepts, Issues, Assessment Methods," *Foundation Paper*, Climate Change Knowledge Network. Available at www.cckn.net

Saskatchewan Regional Economic and Co-operative Development. Statistical Profile: Saskatchewan Community Profiles. 06/12/2007. <http://www.rd.gov.sk.ca>

Sauchyn, Dave. 2005. "A 250-Year Climate and Human History of Prairie Drought." in Sauchyn et. al. (eds.), 2005, The Science, Impacts and Monitoring of Drought in Western Canada: Proceedings of the 2004 Prairie Drought Workshop, Canadian Plains Research Center: University of Regina, pp. 27-30.

Sauchyn, Dave. 2002. "Aridity on the Canadian Plains: Past Records and Future Forecasts," *Geographie physique et Quaternaire*, 56(2-3).

Sauchyn, Dave. 2005. "The Potential for Land Degradation Under Climate Change in the Vicinity of Six Rural Communities in Saskatchewan," *Prairie Forum*. 30(2), pp. 173-186.

Smit, B., Wandel, J., and Young, G. 2005. "Vulnerability of Communities to Environmental Change." Institutional Adaptation to Climate Change Project Working Paper No. 21. University of Regina.

Saskatchewan Agriculture and Food. Statistics: Saskatchewan Crop Yields by Rural Municipality. 06/06/2007. <http://www.agr.gov.sk.ca>

Statistics Canada. Community Profiles. 05/24/2007. <http://www.statcan.ca>

Wittrock, V., Dery, D., Kulshreshtha, S. and Wheaton, E. 2006. "Vulnerability of Prairie Communities' Water Supply During the 2001 & 2002 Droughts: A Case Study of Cabri and Stewart Valley, Saskatchewan." Saskatchewan Research Council Publication No. 11899-2E06.