Community Vulnerability in the South Saskatchewan River Basin: A Case Study of Hanna, Alberta

Prepared for the Institutional Adaptation to Climate Change Project
Prepared by Gwen Young and Johanna Wandel, University of Guelph
Working Paper

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1.0 Introduction

It is well documented that climate change and variability will result in a variety of challenges around the world (IPCC, 2007). In particular, drylands are often challenged by the demands of existing climate variability and it can be expected that climate change will have further impacts on water resource availability (Frederick and Major, 1997; Miller et al., 1997; Arnell and Liu, 2001; Ivey et al., 2004, Sivakumar et al. 2005). The Intergovernmental Panel on Climate Change (IPCC) predicts that there will be a decrease in water availability for populations in dryland areas as water resources are particularly sensitive to climate variations (McCarthy et al. 2001).

The Canadian Prairies are the driest region in Canada (Coote and Gregorich, 2000), with the driest location being within the South Saskatchewan River Basin (SSRB). This area is not only subject to low amounts of precipitation, but often more water is lost by evaporation than by any other use (Coote and Gregorich, 2000). Despite these conditions, the economy is largely driven by agriculture and ranching. Agriculture and ranching are economic activities that are dependent and sensitive to weather, climate and water availability. According to the IPCC (2001), countries, regions, communities and households with a large portion of the economy in agriculture face a larger exposure to climate change.

Due to the sensitivity of drylands and the agriculture and ranching sectors, it is important to understand how these regions are currently at risk to water and climate-related stresses. Furthermore there is a need to document and assess their abilities to cope with these conditions.

As part of the Institutional Adaptation to Climate Change (IACC) project, this case study documents the current vulnerability of Hanna Alberta, located in the heart of the SSRB to water and climate stresses. The paper begins with a description of the study area and research design. This is followed by a discussion of the current stresses, here called exposures, faced by the community and the coping strategies, or adaptations, that have been undertaken by the community and institutions to deal with certain exposures.

2.0 Study Area

Hanna is located in East-Central Alberta (Figure 1). The population of Hanna has remained steady at approximately 3000 residents. Hanna offers several industrial, retail, hospitality and service businesses. The main economic activities include ranching, grain farming, oil and gas development and the ATCO Power generating station. The majority of agricultural producers have mixed operations (ranching and grain farming) to offset changes in the market and climate from year to year.

Hanna is within the jurisdiction of Special Area No. 2. The Special Areas Board administers a unique rural municipal area divided into three Special Areas. The Special Areas were established due to the extreme hardship of the drought years in the 1930s.

The Special Areas Board was set up for land use control during this time and continues to operate in the area. In addition to providing municipal services, water and land management, Special Areas leases public land for the purpose of grazing, cultivation and oil and gas development. The majority of farmers and ranchers lease a large portion of their land from Special Areas. The Board operates five community pastures providing grazing land for patrons on a seasonal basis.

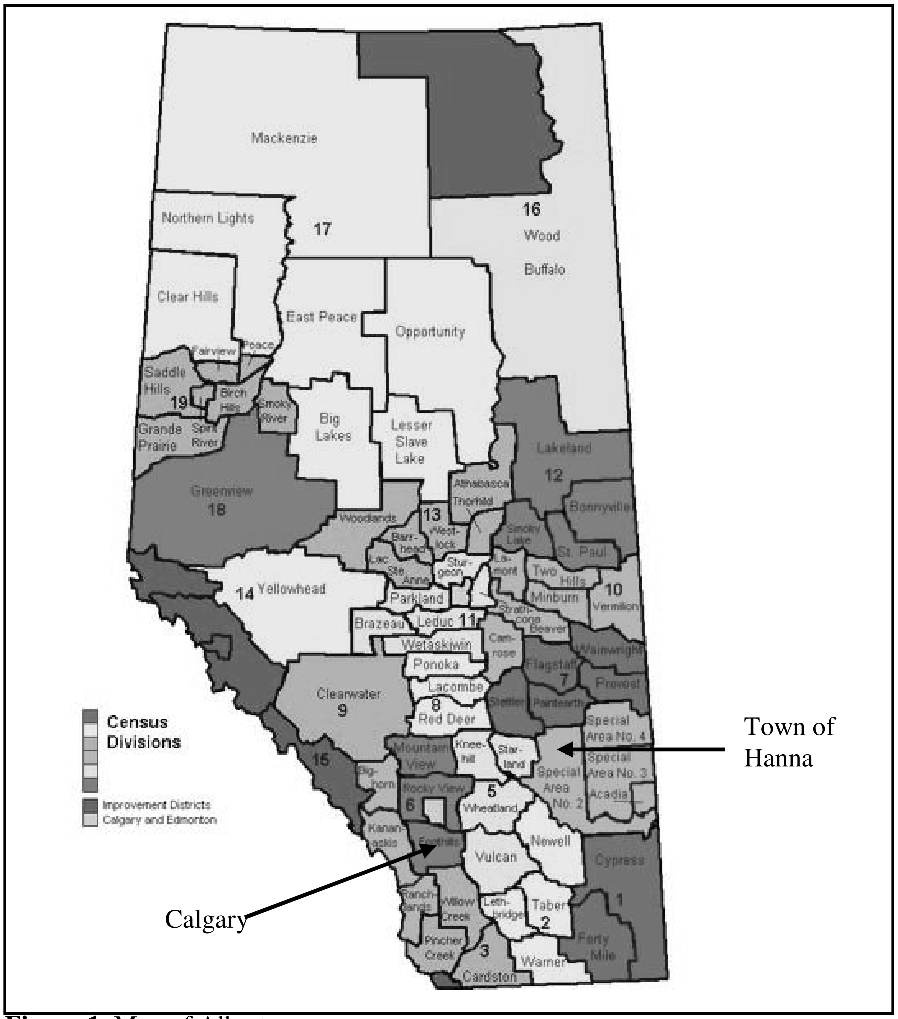

Figure 1. Map of Alberta.

Special Areas makes up the majority of Alberta's portion of the Dry Belt, located in Palliser's Triangle. Palliser's Triangle is characterized as semi-arid and susceptible to prolonged cyclical droughts. The climate of Hanna is generally described as continental, with cold winters, short summers and low precipitation. July tends to be the hottest month, with extreme temperatures reaching above 35ºC, while winters are cold with temperatures reaching below minus 30 ºC at times. Annual precipitation is variable ranging from 0mm-400mm. This area often suffers from a soil moisture deficit. Annual potential evapotranspiration ranges from 800-1000mm (Figure 2) (Coote and Gregorich, 2000; Lac and Colan, 2004).

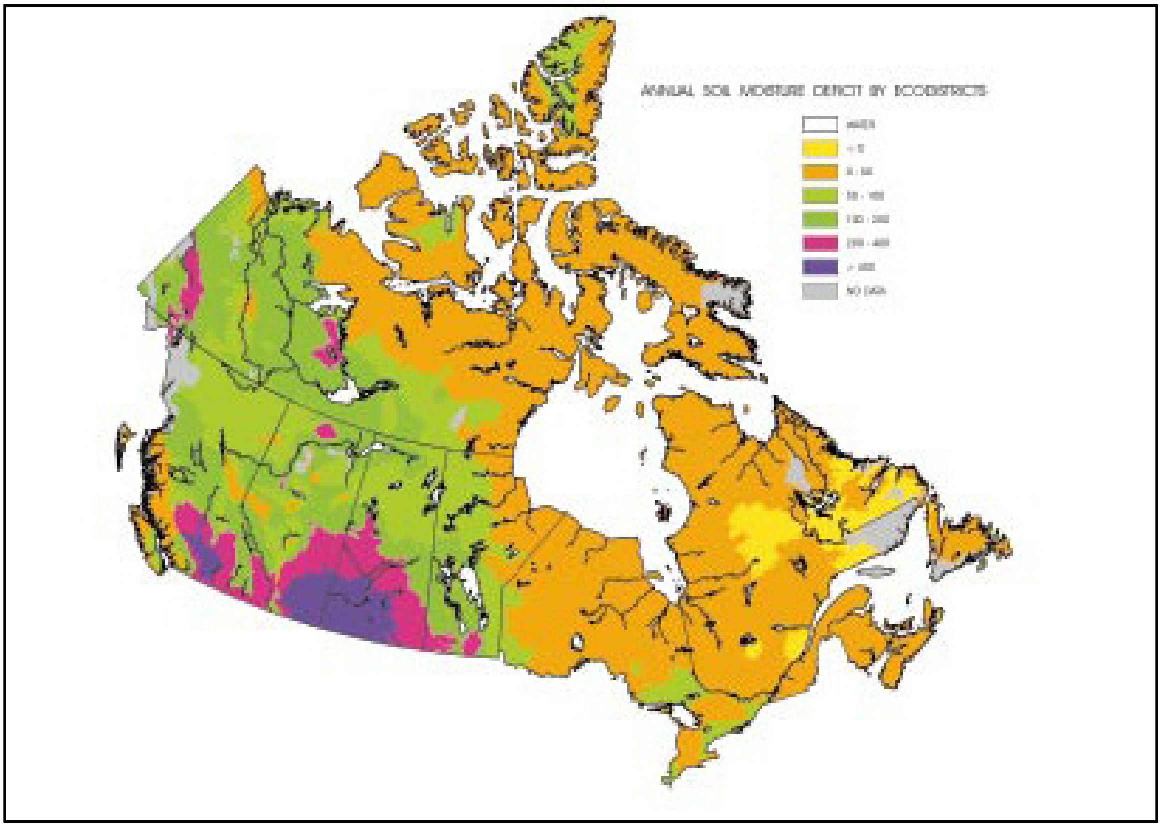

Figure 2. Average annual soil moisture deficit (mm) (Coote and Gregorich, 2000).

Aridity of this area is largely attributed to the evaporative capacity of descending dry air that has crossed the Rocky Mountains. The dry winds from the West, referred to Chinooks, remove moisture from the soil. The warm dry winds of the Chinooks rapidly and drastically raise the temperature. Due to the occurrence of Chinooks, snow tends not to accumulate and there is typically little snow cover during the winter months.

2.1 Water Supply and Uses

Hanna is located within the Red Deer River sub-basin of the South Saskatchewan River Basin. The source of the rivers is snow and ice melt from the Rocky Mountains. Water from the Red Deer River is pumped and pipelined to the Hanna area serving several needs.

The main pipeline from the Red Deer River serves the ATCO Power generating station, in addition to irrigation and stock water needs. From the power station's cooling pond, water is released down the Blowdown Canal and flows to the Carolside Reservoir. From the Carolside Reservoir, water is released down Berry Creek where further downstream converges with Dead Fish Creek, before returning to the Red Deer River. Dead Fish Creek originates from the Dead Fish pumping station (also from the Red Deer River) and flows into the Dead Fish Reservoir, before meeting with Berry Creek. Along the system producers pump water to fill dugouts for stock water and for irrigation. To receive water, producers must be holders of a water agreement with Carolside South

Irrigation Committee (Special Areas) via Alberta Environment. Producers contact the Carolside Irrigation Commission's Ditch Rider (an employee of Special Areas in charge of regulating flow in the canal) to release water. Depending how far the farm/ranch is located away from the reservoirs, it can take up to a week for water to reach the producer. Additionally, some producers have tap-offs on the ATCO pipeline between the river and the power station used for stock water.

A secondary pipeline off the ATCO pipeline provides water to the Henry Krueger Water Treatment Plant. Water is purified and distributed to households in the town of Hanna and surrounding towns. Water is gravity fed via a pipeline to the east as far as Delia and to the town of Oyen to the west. However, this water is not accessible to many of the rural households. Households without access to the Henry Krueger pipeline either depend on personal wells or haul water for household needs.

3.0 Research Design

3.1 Conceptual and Methodological Framework

Following the conceptual framework of the IACC project, this study interprets vulnerability as a function of exposure and adaptive capacity (Ford and Smit, 2004; Smit and Wandel, 2006). In the climate change field, the IPCC Third Assessment Report defines vulnerability 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” (McCarthy et al., 2001: 89). A system[1] may be a household, community, industry, an ecosystem, activity, a nation and so on. Generally, a system that is more exposed to a particular climate stimulus will be more vulnerable, and a system that has more adaptive capacity will tend to be less vulnerable due to the ability to cope with the exposure.

Exposure is reflective of both the characteristics of the system and the climate conditions (Downing, 2003; Smit and Pilifosova, 2003; Smit and Wandel, 2006). Exposure is a property of the system (not a hazardous event) relative to climatic conditions. Exposure represents the combination of local conditions (sometimes referred to as sensitivity or occupancy characteristics) and external physical stimuli. Local conditions (e.g., settlement location, livelihoods, land-uses, etc.) reflect the broader social, economic, cultural, political and environmental conditions. Therefore exposure is not limited to the presence of an external stress. A system’s exposure to a physical stimulus only has meaning relative to the sensitivity of the system.

Adaptive capacity describes a system’s potential or ability to adapt to exposure (Wheaton and McIver 1999; Bryant et al. 2000; Yohe and Tol 2002; Smit and Wandel, 2006). Adaptive capacity is context specific and it varies from country to country from community to community, among social groups and individuals and over time. The scales of adaptive capacity are not independent. For example, the capacity of a household to

[1]For the purposes of this case study, the system of interest is the community of Hanna and surrounding area.

cope with climate risks will depend to some degree on the adaptive capacity of the broader community and is further reflected by the adaptive capacity of the region (Smit and Wandel, 2006).

Adaptation, or adjustments in a system to better cope with external stress, has the ability to reduce or modify the severity of climate change impacts (Tol et al. 1998). There are many forms of adaptation. Based on their timing, adaptations can be anticipatory or reactive. Depending on their degree of spontaneity they can be autonomous or planned. With respect to spatial scope, they can be local to widespread, and based on their form, they can be technological, behavioural, financial, institutional and/or informational (Smithers and Smit, 1997; Smit et al.1999; 2000; Smit and Pilofosova, 2003).

The research approach used to guide this study mirrors the above conceptualization of vulnerability. The vulnerability approach has been used in a number of studies around the world in order to characterize the nature of vulnerability of a system to relevant climate-related stresses with respect to the system's ability to deal with those stresses (Adger, 1999; Vasquez-Leon et al. 2003; Ford and Smit, 2004; Sutherland et al. 2005; Belliveau et al. 2006; Crabbe and Robin, 2006). An important feature of the vulnerability approach is the involvement of the population and stakeholders of the system in identifying stresses and adaptive strategies. The analysis begins with the community (or sector, industry, region) as the starting point. The assessment of current vulnerability involves identifying and documenting the nature of past and current exposure-sensitivities faced by the community, the adaptive strategies they have employed, and how this reflects their capacity to adapt. It requires involvement of actors or stakeholders at various levels and/or sectors of society in order to identify the multiple forces and factors to which the community is sensitive, and to document their adaptive strategies.

3.2 Methods

Identifying community-relevant exposures and adaptive strategies requires compiling data on the experiences of people living in the community. This involves several data collection techniques. The following section describes the methods and techniques of fieldwork used in the vulnerability assessment of Hanna, Alberta.

The vulnerability assessment took place during the month of November 2006. November was purposefully selected as this time of year is typically slower for the farming and ranching industries, and local producers are more likely to be available for interviews. The fieldwork occurred with strong collaboration with IACC's institutional partner, Prairie Farm Rehabilitation Administration (PFRA). The collaboration with the local PFRA office enabled for the assessment to take place in an efficient and effective manner. PFRA has a positive influence and reputation in the area, and local producers were willing to be involved and assist with the fieldwork of the IACC project.

During the field season the researchers lived in Hanna. Living in the community was important to build rapport and familiarity with the area. It provided opportunities to experience and observe both common and uncommon events and practices, and to ground-truth statements given by respondents. This experience helped put specific exposures, sensitivities and adaptations in a more comprehensive context.

Forty-seven semi-structured interviews were conducted in Hanna and the surrounding area. Semi-structured interviews allow for respondents to discuss, unprompted, the problematic conditions faced by the community and/or personally through their experience, and how they coped with the situations. This is the primary source of data on current exposure, sensitivities and adaptive strategies. An interview guide was used to structure the interviews rather than a questionnaire. The guide was designed to allow respondents to identify items relevant to them, minimize researcher influence, encourage elaboration of experiences and insights, while probing for information in key areas. Purposive sampling of community members was used to in order to gain insights from a cross-section of the community with respect to livelihood, water use, experiences and knowledge related to the study. Additionally, several local institutions were included in the sample as it has been documented that the adaptive capacity of a system will be greater when institutions and arrangements governing the allocation access to resources assure equitable distribution (Adger, 1998; Adger, 2003; IHDP, 2005; Naess et al. 2005). Thus institutions can play a significant role in improving (or hindering) a system's ability to cope or adapt to changing conditions. As a result, a range of livelihoods, industry and institutions were captured in the sample (Table 1). It should also be noted that most respondents possessed overlapping characteristics. For example the representative from the Hanna Learning Center is also a resident of the Town of Hanna.

Producers	**26**
Grain Farmers	1
Ranchers	13
Mixed Farmers	12
Industry	**3**
ATCO Power Generation Station	1
Fluid Experts	1
Oil and gas Environmental Consultant	1
Community Residents	**5**
Institutions	**13**
Carolside South Irrigation Committee	2
Special Areas	2
Bullpound Community Pasture	1
Town of Hanna	1
PFRA	2
Henry Kroeger Water Treatment Plant	2
Ducks Unlimited	1
AFSC-Crop Insurance	1

Table 1. Community vulnerability assessment interview sample.

All interviews were transcribed and coded using NVivo. Transcripts were coded following the protocol established in the Data Analysis Guide for Communities-based Assessment of Vulnerabilities from the IACC project. Information from interviews and observation was complimented by data from census records, publications, historical documents, newspapers, government reports, climate and hydrological records.

4.0 Current Vulnerability

The following section characterizes the current vulnerability of Hanna. First, the current exposures are described followed by the adaptive strategies and capacity.

4.1 Current Exposures

For the purpose of consistency and comparison with other IACC community case studies, exposures are divided into the following categories: temperature, wind, precipitation, water resources, water management and socio-economic.

4.1.1 Temperature

Respondents indicated seasonal sensitivity to temperature. In particular, summer heat waves, typically occurring in July are problematic. When summer temperatures reach above approximately 30ºC, conditions become stressful for producers. For farmers, especially dryland farmers, high temperatures increase evaporation decreasing soil moisture and stressing, sometimes burning, crops and grasses. Even farmers with irrigation find it difficult to prevent crop loss due to heat.

"Well I guess the problem I've had with canola is the hot July. And if you don't get any moisture in July and it turns real hot it really cuts your yield and this area is subject to that once in a while," local farmer

Ranchers indicated that the hot (often compounded by dryness) conditions can decrease weaning weights, affecting the prices for calves. The heat causes stress to the cows and in turn the cows will not eat enough to meet their nutritional requirements and will not produce sufficient milk. The heat also can decrease conception rates as bulls become lethargic and heat stresses the cows causing a decrease in pregnancy rates.

Cold temperatures in the winter are important for farmers. The cold kills insects and crop pests. However colder temperatures in the winter mean higher feed costs for ranchers- the colder the temperature, the higher the feed demand. When temperatures are below -20 ºC ranchers typically increase their feed by one third to one half. This can become very costly. Ranchers are also sensitive to the extreme cold during calving season (March-May) as such temperatures can affect the health of the cow and her calf.

In addition to extreme heat and cold, producers identified temperature fluctuations as problematic. Crops can be set back significantly in the spring when temperatures drop and frost occurs. Freeze-thaw conditions in the winter, often caused by Chinooks, dry the soil and melt snow cover, reducing soil moisture and available run-off in the spring affecting crop and grass growth in the spring. Large variations in temperature often cause respiratory sickness in cattle.

4.1.2 Wind

Chinooks are the cause of plenty of lost moisture. Temperature fluctuations are often caused by Chinooks. The drastic and rapid increase (and decrease) in temperature create freeze-thaw conditions. During the winter, Chinooks rapidly increase the temperature and melt snow cover, limiting snow accumulation. Minimal snow accumulation decreases potential soil and subsoil moisture, resulting in poor grass and/or crop growth. Often Chinook winds are not warm enough to thaw the soil, therefore snowmelt will not be retained in the soil as the ground is still frozen. Low snow accumulation in the winter months also results in minimal spring runoff. Ranchers then have difficulty filling dugouts to meet their stock watering needs. Additionally, the dry air of the Chinooks causes evaporation in the winter.

During the spring and summer months the dry wind is problematic. Even with a moist spring a week of windy conditions can dry the soil. Wind can be devastating to grassland or a crop that is a little moisture short and still trying to grow. The constant, dry, strong wind not only dries out the soil but also causes erosion, posing problems for machinery and grass and crop growth.

4.1.3 Precipitation

Insufficient, or a complete lack of precipitation was identified by respondents as the most stressful condition. The timing of precipitation is of equal importance as the quantity that falls.

Open-winters (low snow fall and/or accumulation) were identified as a concern by ranchers and farmers. For ranchers, snow melt is the biggest source of stock water, making ranchers dependent on snow accumulation. Open-winters result in little run-off in the spring to fill dugouts for stock water. For both ranchers and farmers, open-winters often result in insufficient soil moisture affecting crop and grass production.

"Probably our snowmelt is one of the biggest things for stock. If you don't get some snowmelt in lots of cases you don't have water..." local rancher.

With respect to timing of snowfall, producers indicated that snowfall from November to February is not nearly as important as snowfall in March and April. Snow that falls at the beginning of the winter often melts and evaporates due to the occurrence of Chinooks. Meanwhile, snow that falls in the latter part of the winter is more likely to soak into the soil and provide run-off for the dugouts.

Rainfall is most important to farmers and ranchers during the growing season, from May to August. Low amounts of precipitation through the growing season results in low yields and poor grass growth. The only time precipitation (rainfall or snowfall) was identified as being problematic was during the harvesting season (September-October). Both ranchers and farmers indicated that early spring moisture is essential for crop and grass growth. Lack of moisture at this time of year results in poor germination and early growth is stunted. July was noted as a crucial month to receive some rain to compete with the evaporative effects of the hot, dry conditions. A dry July can reduce crop production by nearly half.

Repeated dry years have historically been problematic for producers. Respondents agreed that the third consecutive year is the most difficult. Continuous dry years can decrease well water levels, substantially decrease soil and sub-soil moisture, decrease waterfowl habitat and populations and dry-up dugouts. These extremely dry conditions are compounded by a drastic rise in grasshopper populations which devastate remaining crops and pastures. During repeated dry years grasshopper numbers increase exponentially and can completely destroy pastures and cropland. During the last dry period (2000-2002) the lack of rainfall, combined with the infestation of grasshoppers resulted in many farmers unable to harvest their crops. Additionally, the dry conditions compounded by the summer heat creates ideal conditions for prairie fires resulting in loss of grass and cropland

Another form of precipitation that was identified as being problematic was hail. Farmers have lost crops to hail in addition to damage to their homes.

4.1.4 Water Resources

Drinking water comes from several sources. Some respondents are connected to the Henry Krueger Water Treatment pipeline. Those unable to connect to the Henry Krueger pipeline rely on personal well water or they haul water to their property for household water. Well water was identified as being poor quality with high sodium and iron concentrations, often undrinkable. During prolonged dry periods, well water levels decrease, forcing homeowners to haul water from another source, for example the Henry Krueger Water Treatment Plant. This is both time consuming and costly. Respondents were also concerned about potential groundwater contamination by the oil and gas industry, in particular coal-bed methane developments.

Water for irrigation is pumped from the Red Deer River. High turbidity in the Red Deer River is a strain on the pumps and has caused the pumping stations to shut down. The pumps cannot function properly with high amounts of sediment in the water. The pumps have been shut down for weeks at a time resulting in insufficient water to meet irrigation demands.

4.1.5 Water Management

With respect to the potable water system, it was noted that the treatment plant is only able to supply water for up to 12 hours after the plant is required to shut down (maintenance, power failure). This situation could potentially be problematic, leaving the area without potable water.

Issues were also identified regarding the irrigation water system. To receive water, irrigators must contact the Carolside South Irrigation Committee's 'Ditch Rider' to open the gate from the reservoir and allow water to flow down the canal for irrigators to receive water. Irrigators then pump the water out of the canal. However, irrigators at the end of the system often do not receive the water they have requested. This is because irrigators further up the system have been known to take water they have not 'ordered' leaving others with insufficient water or none at all. This situation is particularly problematic during dry years. As a result, farmers at the end of the system have experienced crop failure.

From the management perspective, it was noted that due to the extensive length of the system it is difficult for one person (the Ditch Rider) to regulate and monitor the activities of the users. In addition, the current Ditch Rider is the only person trained for the job. Much of his knowledge of the system is experience-based. This is problematic when he goes on vacation or is ill, in addition to when he retires.

Water users were generally unsatisfied with the level of communication from the Carolside South Irrigation Committee. They felt there was often little to no notice regarding how much water would be available for irrigation making it difficult to plan their crops.

4.1.6 Socio-Economic

In addition to the various environmental exposures there were several compounding socio-economic stresses. Farmers identified the removal of the crow rate (transportation subsidy offered to the Canadian Pacific Railway by the Canadian government) and the disappearance of local grain elevators as particularly problematic. Farmers now have to haul their grain approximately 100km to the nearest grain elevator and pay a significantly higher price for rail transportation. This problem is amplified by both the costs to transport the grain to the elevator and the low prices received for their product. Additionally, farmers are being faced with a multitude of rising costs of production. For example, rising electricity costs are increasing the cost of pumping water for stock water and irrigation systems; often limiting how much irrigation is possible, higher input costs for no/minimum till operation requiring farmers to nearly double their yields to break-even, crop insurance is expensive with high penalties, and increasing size and equipment costs make it extremely difficult for farmers, forcing many to decrease their farming area or to quit farming all together and ranch.

Ranchers are also dealing with relatively low prices for their product. Ranchers indicated low cow/calf prices in the wake of the BSE outbreak. Ranchers took a significant hit on prices, however prices have begun to rebound. Ranchers have also had to deal with high feed prices, often occurring during prolonged dry periods and infestation of grasshoppers when the demand for feed increases.

Respondents identified the biggest limiting factor for growth in the area was access to water. A larger, more secure source of potable and irrigation/stock water would provide the opportunity for economic diversification. At this time there is a moratorium on the Carolside Irrigation project and the Red Deer River is nearly fully allocated, making it very difficult to access water. The lack of access to water translates into lack of industry, lack of income and young people leaving. Locals find it difficult to find and keep employees, especially for help on farms and ranches. Young people from the area are drawn to the higher wages of the booming oil and gas industry.

Residents of Hanna and the surrounding area are concerned that rural areas are not being supported or valued by the government. They feel that rural concerns are not being heard at higher levels of government.

Producers identified the diminishing presence and expertise of PFRA in the area as a concern. PFRA is no longer as involved at the local level as they used to be. The local PFRA office is unable to participate in many of the local organizations due to limited human resources and fewer people on the ground to deliver programs. As a result, fewer resources, information and assistance are readily available.

4.2 Adaptations

"farming practices have changed a lot since the 30s and moisture, rainfall is probably the same, it's probably the farming practices that are a lot better" local producer

The following section describes the adaptations undertaken by industry, producers, townspeople and various institutions (Special Areas, PFRA, Town of Hanna) in order to cope with the identified exposures. Again, for the purpose of consistency and comparison with the other IACC case studies, adaptations have been divided into the following categories: water management, financial management, technological adaptation, land management and institutional adaptation.

4.2.1 Water Management

Water shortages have always been a concern for producers in this area. They have suffered through many dry years, most recently the drought of 2001. Many water management adaptation strategies have been in response to these experiences.

To cope with dry conditions and low run-off, ranchers have constructed more, and/or improved dugouts for stock watering. Dugouts have been constructed in strategic locations to capture more run-off, and deeper to reduce evaporation. PFRA played a significant role in promoting dugouts. A dug-out typically has the capacity to carry a reserve of water that will last approximately 1-2 years. During prolonged dry periods, ranchers will recharge dugouts from wells, canals and/or hauled water via pumps and shallow pipelines. Since the 2001 drought, many ranchers have installed shallow pipeline to move water around the land to avoid over-grazing. The pipelines have been effective in transferring water and little is lost to evaporation.

The majority of households interviewed that were not connected to the Henry Krueger treated water pipeline did have personal wells. However, the water is often of poor quality. Most had installed personal water purification systems including water softeners, reverse osmosis, and carbon and/or ultraviolet filters. Meanwhile other respondents choose to haul treated water from the Henry Krueger Water Treatment Plant for household use, while others use the poor quality well water for washing and cleaning but buy bottled water for drinking. When personal wells begin to run dry during prolonged dry periods, such as the 2001 drought, respondents hauled water for household uses and/or stock watering. Some respondents have had to haul water daily. This is not only time consuming but also costly.

To keep up with the demand for treated water and to have sufficient treated water for potential expansion of the pipeline system, the Henry Krueger Water Treatment Plant is in the process of increasing the capacity of their clear well at the plant.

To secure access to water, some producers have made arrangements with industry to share a water supply. For example, when the ATCO pipeline was being built, a group of producers organized and requested 'tap-offs' to be built in the pipeline, allowing the producers to have access to the water when it is being pumped from the river. This arrangement was made because the pipeline was being buried beneath the producers' land. Other producers have also made deals with oil and gas companies to make use of some of the water the companies are pumping in for their projects.

When irrigation became available to farmers via the Carolside and Dead Fish Irrigation Project (approximately 1988), many farmers began to irrigate as a way to cope with the dry conditions. Recently two pumps were added at the Dead Fish pumping station after the irrigation system had run dry several times. Since the addition of the pumps irrigators rarely fall short on water.

During prolonged dry periods, it is common for some irrigators to not adhere to the rules and regulations with respect to water usage. Some irrigators will pump water from the canals as it passes by, even if they have not requested it from the 'ditch rider'. Irrigators have also been known to pump more than their requested amount. These situations leave irrigators downstream, who requested water, with little to no water.

4.2.2 Financial Management

"changes are being driven mostly by people who are trying to cut their costs" local producer

For many producers, the rising costs associated with farming have forced most farmers to diversity their operations. There are very few remaining producers that strictly farm. Most have reduced their cultivated area and shifted to ranching. The majority of producers also have off-farm employment. Farmers and ranchers agreed that in order to farm/ranch you almost have to work off the farm. Producers also indicated that in order to survive as a farmer and/or rancher, the size of the operation must increase. As inputs and equipment become more expensive, a producer must produce more in order to off-set the costs of production.

Due to higher input costs necessary for no-till farming, increased cost of machinery, poor grain prices and higher freight rates for grain, farmers are either decreasing cropland or quitting farming completely and increasing grassland for ranching. More and more farmers are seeding land back to grass and increasing their herd as a way to cope with the multiple economic stresses of farming.

During years when grain production and/or prices are low, farmers will often use the crop as feed for their cattle. Most ranchers try to grow their own feed to reduce costs. To avoid buying feed, ranchers try to carryover feed supplies (1-3 years) in preparation for a potential subsequent dry year. In dry years ranchers typically decrease their herd size or lease additional land to run their herd. During the 2001 drought, selling cattle worked out in the favour of many ranchers as BSE hit shortly after. As a result, when BSE did hit, ranchers had sold off many of the older cows and were able to keep the younger ones.

In many cases, without the oil and gas industry, farming and ranching would not be viable for most operations. Landowners receive compensation from the industry to lease land and to drill and maintain oil and gas wells. In many ways, oil and gas development subsidizes local producers either through off-farm employment or direct revenue for development on a landowner's property. Of the respondents, approximately 15-25% of household income comes from oil and gas revenue.

It was common for producers to carry crop and/or pasture insurance. Although many respondents noted that while carrying insurance is expensive, pay-outs are not always granted and penalties are high, it gives people peace of mind and in general has been beneficial.

Lastly, to cope with the labour shortage, producers have sought out foreign workers. Several residents have hired employees from Mexico and Brazil.

4.2.3 Technological Adaptations

Ranchers have started to use solar systems and nose pumps to reduce energy costs and increase water efficiency for stock watering. Solar panels are being used to create energy to pump water from dugouts to troughs. The system is expensive, however it saves on power, especially in the winter when water needs to be heated or in motion. Nose pumps are pumps that are activated by the cows. It is an on-demand watering system which uses water more efficiently.

With respect to irrigation, some farmers have changed to drop nozzles on their irrigation pivots to reduce loss from evaporation and wind drift.

4.2.4 Land Management

Producers in Special Area 2 are growing crops and grass on very marginal land. However, producers have developed land management strategies to keep the land as viable as possible under the poor conditions. For example, ranchers will often let fields rest for a year or so. One respondent referred to this practice as ‘banking grass.’ Ranchers will also rotate pastures to avoid overgrazing. In general, ranchers are cautious and tend to only stock their pasture at the capacity of a drought year. Ranchers are also seeding more drought tolerant grass varieties, such as native grasses. A few ranchers have leased land elsewhere, such as Saskatchewan, or in other municipalities to lessen the impact on their land.

"I stock at a low density and I carry way more grass than I need to and I'll graze until, if the snow stays away, probably February...I do that because of 2003 and because you never know what you are going to get here," local rancher

Most farmers have shifted to minimal or no-till farming. No-till farming allows a farmer to plant the crop and control weeds without turning the soil. No-till helps to prevent soil erosion, build organic matter in the soil and minimize soil disturbance. Farmers are also changing their crops to more drought tolerant varieties.

To retain soil moisture, producers have employed several strategies. Farmers will leave stubble on their fields and ranchers will avoid grazing all the grass as a way to capture snow on their fields to increase soil moisture.

4.2.5 Institutional Adaptations

The following section describes adaptation strategies that institutions have made available to residents to cope with the identified exposures.

Probably the most significant institutional adaptation for the area was construction of the ATCO pipeline. The arrival of ATCO to the area brought not only hundreds of employment opportunities but also access to water resources. The agreement between ATCO and Alberta Environment provided sufficient water for the power plant and provided access to irrigation and stock water via the Carolside-Deadfish Irrigation Project that was enabled due to this agreement. Additionally, an agreement was made with the Henry Krueger Water Commission to tap water off the ATCO pipeline to supply water to the treatment plant and to provide potable water to Hanna and surrounding areas. Due to these agreements the area has benefited from employment opportunities and a more secure supply of potable and irrigation/stock water.

With regards to land management, Special Areas created community pastures in the 1940s after the Depression that are still actively used today. There are five community pastures in the Special Areas. Patrons must reside in the Special Areas to use the pasture. The community pasture is a grazing reserve to help ranchers increase their herd base and take pressure off their land. Patrons request how many head they would like to bring into the pasture and for what period of time. Unfortunately in 2002, the community pasture had to send cows home to avoid overgrazing. The drought and the grasshoppers destroyed the pasture, forcing Special Areas to return the cattle to the patrons.

Special Areas rents equipment to producers making projects more cost-effective for residents. Equipment rental include pumps, pipeline, spraying equipment, ploughs etc. Often producers make use of the equipment to improve water management, for example renting pipeline to move water to a different location on their property and/or by burying pipeline to divert water. Special Areas also provides an incentive program to make improvements to land and/or water management practices for residents who are leasing land from Special Areas. Residents who make improvements on leased land are eligible for tax credits. To ensure that lease land is being taken care of, Special Areas has inspectors to visually inspect if ranchers are over grazing and/or stocking higher than the carrying capacity.

In an attempt to secure a greater quantity of water for irrigation and stock water, Special Areas has been promoting a project, the Special Areas Water System project, for the last several years. This irrigation project was first proposed nearly 40 years ago. If successful, water would be diverted from the Red Deer River in order to provide access to water for residents north of Hanna.

Currently there is a moratorium on additional irrigation water agreements (new users and irrigation expansion) along the Carolside and Dead Fish Irrigation systems. The moratorium began nearly 5 years ago.

During times of water shortage, such as the 2001 drought, the Carolside Irrigation committee met with the water users. At that time it was agreed that all irrigators must decrease their use by one third. This was to ensure that all users receive some water to maintain their basic crops and stock water needs.

‘In the past, PFRA had a larger impact on farming and ranching practices in the Special Areas than it does today. PFRA was established in response to the drought of the 1930s. PFRA has been helping farmers and ranchers cope with the challenging conditions of the Prairies, and many producers in the Hanna area have depended on PFRA as a resource. As previously mentioned, PFRA played a key role in promoting dugouts to capture runoff for stock watering. PFRA assisted producers in the planning and development of shallow pipeline systems to transport water around the land. Producers also take advantage of the information, expertise and resources the PFRA office has to offer. Unfortunately PFRA is doing significantly less extension work and their human resources are decreasing.

In the 1990s the federal government, through PFRA, was promoting the Green Cover Program (Permanent Cover Program). The program gave producers a monetary incentive to seed marginal land back to grass for soil conservation reasons. Many producers took advantage of this incentive as farming was becoming more expensive and less lucrative. Some producers have also taken advantage of the Environmental Farm Plan (EFP) program delivered by Alberta Environment to improve the environmental health and sustainability of their operations. The program is free and many of the improvements made by producers can qualify for up to $50,000 in cost-shared assistance through the federal Canada-Alberta Farm Stewardship Program.

As mentioned, most producers carry some form of insurance. Many producers were also taking part in the Canadian Agricultural Income Stabilization program (CAIS). The program is designed to integrate income stabilization and disaster protection, helping producers protect their operations from drops (large and small) in income. However, most respondents found they were not benefiting from the program and it was costing more than they were benefiting.

The final incentive program that producers discussed was the BSE recovery program. The program provided $225 for the sale of a mature animal as a way to reduce the number of older animals on ranches and force ranchers and feed lots to sell in a depressed market.

Ducks Unlimited projects have also helped producers cope with the climatic conditions. Ducks Unlimited have collaborated with producers in the development of small dams. These dams have captured run-off water to help conserve wildfowl habitats. The captured water is also accessible to the land owners for stock watering and some irrigation. The small reservoirs serve the purpose of waterfowl habitat and in turn producers have access to use that water to fill dugouts, if necessary.

With regards to potable water, the Henry Krueger Water Commission has taken several steps to cope with stresses. For example, they will be increasing the capacity of the clear well to accommodate growth and they began a training program for students to earn their level one operating license at the treatment plant. As there are currently only two trained operators, the program is geared to have more highly trained personnel in case of sickness or emergencies. The Commission has also approached Special Areas to take over the treatment plant to gain more support and trained personnel.

5.0 Conclusion

This case study aimed to describe the current nature of vulnerability in the town of Hanna, in Special Area 2, Alberta. This was achieved using the vulnerability approach which seeks to identify current exposures faced by the community and how the community has managed or adapted to such conditions. Over forty interviews were conducted with residents of the community providing a cross-section of perspectives and experiences of livelihoods and water use and dependency.

For the most part, respondents identified water and climate related exposures as being particularly problematic, often compounded by socio-economic conditions. With respect to water, access to water resources (both potable and non-potable) was often identified as a concern and limitation in the area to further development, both at the farm level and the community level. Regarding precipitation, it was not only the quantity of precipitation that respondents are sensitive to, but the timing of precipitation as well. Climate-related exposures that were identified by respondents primarily involved diminishing soil moisture and crop and cattle health. Chinook winds, for example, reduce snow cover and run off, cause evaporation and dry the soil. Extreme and fluctuating temperatures are difficult on crops and cattle, and contribute to evaporation and diminishing soil moisture. Meanwhile, compounding socio-economic conditions included rising production and energy costs, labour shortages and the perceived lack of provincial and federal support (illustrated by the diminishing presence of PFRA).

To cope with the various exposures, individuals and institutions have implemented several adaptive and management strategies. Individual coping mechanisms involved water and land management, financial and technological strategies. As producers in an agricultural area in the dry belt of the Canadian Prairies, farmers and ranchers have developed many management strategies over the decades to cope with the difficult conditions and marginal lands. Many producers were shifting away from farming and increasing pluriactivity by shifting to more ranching and working off-farm (often in the oil patch or at the ATCO power station). Revenue from oil and gas development in many cases is indirectly subsidizing producers. Farmers and ranchers are also using more water and energy efficient stock watering and irrigation technologies to decrease energy and water use. Institutions have played a significant role in helping residents of the Special Areas cope with the dry and difficult conditions, past and present. Special Areas has a robust history of institutional adaptations, especially in managing prolonged dry periods.

Residents of Hanna and the surrounding area are faced with a variety of climate, water and socio-economic exposures, however the type of reliance on water and dependency on particular climatic and moisture conditions determines the sensitivity to the exposures. Individual adaptations involved several types of adaptations, however in this particular case, institutional strategies have tremendous capacity to mediate exposures, particularly water shortages.

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