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Understanding Adaptive Policy Mechanisms through Farm-level Studies of Adaptation to Weather Events in Alberta, Canada

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Executive Summary

Governments must operate in an ever-changing and uncertain world. We know for example that the climate is changing, but not precisely how or what the specific impacts will be–introducing yet more complexity to fields such as agriculture and water resources management. We know that energy prices are highly unpredictable and that international trade rules are in a state of flux–creating further challenges for development policy. The impact of our economic activity and our cultural connectedness today evoke types of responses in society and our ecosystems for which we have no prior experience.

Crafting policies in this setting to address acute issues, be they economic, social or environmental, is inherently complex and dynamic–this is the reality facing today's policymaker. The climate change issue is a case in point and has provided motivation for this research on adaptive policies. Higher variability in hydrology is projected by the Intergovernmental Panel on Climate Change in their most recent report, evoking great concern in such areas as world food supply, power generation and irrigation, just to name a few.

Experience demonstrates that policies crafted to operate within a certain range of conditions are often confronted by challenges outside of that range. The result is that many policies don't accomplish their goals and have unintended or perverse impacts. Therefore, to help policies help people, policymakers need ways to craft policies that can adapt to a range of anticipated and unanticipated conditions.

The multi-year Adaptive Policies research project endeavours to identify mechanism that help public policies adapt to anticipated and unanticipated conditions. This report studies farm-level coping and adaptation measures for weather shocks (for example, flooding) and stresses (for example, drought), identifies policies which have aided these measures and studies these policies for their adaptive mechanisms. It is the premise of this research project that policies which have either aided or impeded a farmer's ability to cope with change, are also likely to contain mechanisms which have helped the policy itself adapt to changing circumstances.

Coping and Adaption Measures used by Farmers

Case study locations were identified by examining the historic exposure to climate stress–as represented by precipitation variability, and adaptive capacity–as represented by a suite of socio-economic and environmental indicators obtained from the Canada Census of Agriculture and reflect the determinants of adaptive capacity. Two locations were selected having similar levels of historic

climate stress, but with potentially varying levels of adaptive capacity. The study areas were near Coaldale and Foremost.

Three major weather extremes were common to both areas: drought conditions in 2001; heavy rainfall and flooding that took place in June of 2002; and, the extreme heat and dryness reported in 2007 (especially in July).

For drought, crop insurance was commonly used by farmers in both regions to cope over the short term, while minimal and reduced tillage techniques, crop diversification, crop rotation and the selection of crops that were better suited to drought conditions were some of the common long-term strategies. Unique to Coaldale were irrigation related strategies and the ability to divert water, purchase more water rights and the use of efficient irrigation technology. In the Foremost region, farmers could do little about obtaining more water. Over the short term, they made efforts to reduce their input costs and become more financially sound. Long-term strategies included participation in market research groups, the use of technology that minimized soil disturbance and moisture loss, shelterbelts, community water pipelines and the dissemination of local knowledge between farmers.

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

In coping with extreme heat, there were many similarities in the strategies used by the two regions in their response to drought events. Over the short term, farmers in both regions employed crop insurance and waited out the extreme temperatures. Many felt that there was simply nothing they could do in the immediate sense. Over the long term, adaptation strategies included the implementation of crop rotation techniques, alteration of seeding and harvesting times to take advantage of early season moisture and the selection of crops specifically suited to the given conditions. Coaldale farmers were able to increase and shift their irrigation operations, employ organic farming techniques and made use of government programs to help them cope with the heat. Foremost farmers tended to use long- term practices that adapt to extreme heat. Continuous field covers of organic material, either through chemical fallow or leaving trash from harvest are effective

in retaining as much moisture in the soil as possible. The use of improved technology that reduced the disturbance of the soil and minimized moisture loss were also key strategies for Foremost farmers. Over the long term, preparation of shelterbelts and community water pipelines offered further assistance in coping with extreme heat.

Policies Facilitating Coping and Adaptation Measures

Alberta's Irrigation District (ID) program, and more specifically, the St. Mary River Irrigation District (SMRID) has played a key role in helping farmers in the Coaldale region adapt to weather extremes. A prime example is the water-sharing agreement brokered in 2001 to deal with the drought conditions. The SMRID was an influential player in negotiating, communicating and implementing the mitigation plan, which was an unprecedented sharing of water resources for the common good. The SMRID has also been integral to helping farmers cope with heavy rains. Directly after the rainfall in 2002, the SMRID assisted the county in cutting roads, helped farmers pump water and worked with Alberta hail and crop insurance providers to recognize flood areas. From a long-term perspective, they have worked with the counties to make "sure that our channels and waterways are now set up better; we supervise them a little bit better to make sure we don't run into the same problem." The Town of Coaldale has now built storage ponds inside the town to handle sewer backup (and reduce the risk of overflowing sewage lagoons). For these reasons, the ID program and the SMRID were studied further with respect to adaptive policy mechanisms which may have been helping this program perform so well over the years.

Participants in both regions cited the Canadian Agriculture Income Stabilization (CAIS) program in relation to coping and adaptation strategies. However, the majority of participants thought it was difficult to use and trigger, complex and always seemed to be changing. In several instances, the predecessor program to CAIS, the National Income Stabilization Account (NISA) was viewed more favourably. Participants also noted that a new suite of income stabilization programs will be rolled out in the coming year under the updated federal Agriculture Policy Framework (APF). This evolution of income stabilization programs over time was seen as a unique opportunity for studying adaptive policy mechanisms.

Examples of Adaptive Policy Mechanisms

The CAIS and ID related programs were studied for examples of adaptive policy mechanisms. A policy that has the ability to adapt to "anticipated conditions" is built upon insights into cause-and-effect relationships. The mechanisms include:

- **Automatic Adjustment** – Some of the inherent variability in socio-economic and ecologic conditions can be anticipated, and monitoring can help trigger pre-determined policy

adjustments to keep the policy functioning well.

- **Integrated Assessment** to Inform Policy Parameters – Through an integrated assessment of causal factors, key impacts and scenario outlooks, policies can be crafted to perform under a range of anticipated conditions, and possibly function even under the worst cases.
- **Multi-perspective Deliberation** – Deliberative processes strengthen policy design by building recognition of common values, shared commitment and emerging issues and by providing a more comprehensive understanding of cause-and effect relationships.

The ability of a policy to adapt to "unanticipated conditions" is a newer notion, based on a holistic appreciation of system complexity, capacity, performance and dynamics. The mechanisms include:

- **Formal Review and Continuous Learning** – policy review undertaken on a regular basis, even when the policy is functioning well, can help policies deal with "emerging" issues, and trigger policy adjustments.
- **Encouraging Self-organization and Networking** – by encouraging interaction, policies can foster the emergence of innovative responses to unexpected events.
- **Subsidiarity** – by recognizing that action will occur at different levels of jurisdiction, depending on the nature of the issue, policies can be crafted to assign authority to the lowest jurisdictional level of jurisdiction consistent with effectiveness.
  Promoting Variation – small-scale interventions for the same problem offer greater hope of finding effective solutions. Diversity facilitates the ability to persist in the face of change.

A summary of the adaptive policy mechanisms observed in the three generations of income stabilization programs in Alberta and also in the ID related programs is provided below. Examples were observed across all seven adaptive policy mechanisms. The majority of examples came from the ID program and in the context of dealing with unanticipated conditions.

One example of automatic adjustment was observed in the ID's Irrigation Rehabilitation Program (IRP) and involved the inter-district funding formula. Fifty per cent of the funds are allocated on the basis of the number of irrigation acres in each district, and 50 per cent of the funds are allocated on the basis of the replacement cost of specified infrastructure in each district. Each of these two values will shift within and between irrigation districts (IDs) from year to year, and thus the policy is able to adjust for changing needs annually.

For acquiring multiple perspectives from an analytical basis, an example of integrated assessment was seen in ID's Water Sharing Agreement (WSA) in which water supply forecasts and water rationing strategies for irrigation and non-irrigation users were formulated. There were four examples of obtaining multiple perspectives through deliberative processes. The first was from the

next generation of income stabilization programs under APF II in which stakeholder consultations were held to understand sector requirements in the new suite of risk management programs. The other three examples were from ID-related programs. For example, in developing water transfers, ID's are required to hold a public meeting discussing the potential transfer and must hold a plebiscite to gain the approval of at least 50 per cent of the irrigators in the district before a transfer application will go forward to Alberta Environment. Also, in relation to the 2001 WSA, ID's brought together a diverse group of stakeholders (IDs, cities and towns, recreational water users, industrial water users) who were able to reach consensus regarding how to equitably share the available water during a drought year.

Examples of formal review and improvement processes were observed in the ID-related programs. The WSA developed mechanisms to monitor and equitably distribute whatever amount of water that would become available. A Conservation Holdback provision was developed in which a transfer application process triggers an environmental review by the Regional Director, giving him/her discretion to hold back up to 10 per cent of the water allocation being transferred to meet the government's conservation objectives and protect aquatic environments. Also, the Water Management Planning Process for the South Saskatchewan River Basin (SSRB) committed to reviewing the regulation in 2000 because of "limitations of the databases and estimates of current and future water uses."

It was evident that one of the ID program's greatest strengths from the perspective of adaptive policies was its ability to promote self-organization and social networks. In response to the 2001 drought, the IDs organized themselves to create a water-sharing arrangement to allow all license holders to receive an equitable portion of whatever water would become available. The program in the SMRID was instrumental in developing networks in the region to work together to construct emergency preparedness plans. Self-organization was also facilitated through the introduction of formal and informal water markets within the IDs. By allowing water rights to be tradable, the province of Alberta has transformed "historical licenses into marketable commodities," ultimately providing flexibility in what had become an intractable water allocation situation.

The mechanism of subsidiarity was observed in both the policies studied. Alberta withdrew from NISA in 1995 based on concerns that government funding was going every year to every farmer regardless of need. To address this, in 2001 the province of Alberta created the Farm Income Disaster Program (FIDP) to provide income support to farmers in the province experiencing, for reasons beyond their control, an extreme reduction in farm income. This illustrates how bringing the governance closer to the ground (for example, from federal to provincial level) was necessary to create a program that responded to the needs of farmers. From the Irrigation District Act (IDA), fees for administration, maintenance and rehabilitation of the irrigation infrastructure are determined yearly by the ID board. Each district operates independently and how each functions can vary due to

size and physical characteristics, providing needed flexibility for responding to surprises and emerging issues.

Finally, with respect to the adaptive policy mechanism for promoting variation, under Canada's new agricultural income stabilization program, a suite of programs are being developed to complement one another and manage risk:

- **AgriInvest** – provides coverage for small drops in income and allows for investments that help mitigate risks or improve market income; and
- **AgriStability** – provides support when a farmer experiences larger farm income losses; AgriRecovery – provides a coordinated process for federal, provincial and territorial governments to respond rapidly when disasters strike, filling gaps not covered by existing programs; and **AgriInsurance** – an existing program which includes insurance against production losses for specified perils (weather, pests, disease) and is being expanded to include more commodities [**Agriculture and Agri-Food Canada (AAFC, 2007**]. This need for variation was illustrated during the years of the CAIS program in Alberta – the Alberta Farm Recovery Plan (AFRP) was created in 2007 to address the economic strain that Alberta farmers were facing attributed to Canada's rising dollar, the drop in livestock prices and high feed prices spurred on by demand for biofuels in the U.S.

1.0 Introduction

This report documents the third of three community-level case studies undertaken in Canada as part of the Adaptive Policies Project – a joint multi-year research project of the International Institute for Sustainable Development (IISD). The Energy and Resources Institute (TERI), and the International Development Research Centre (IDRC).

The Adaptive Policies Project attempts to address two main questions:

1. Do public policies that build the capacity of communities to cope with surprise and long-term change have adaptive features?
2. What are the adaptive features that enable policies to remain effective despite changes in external conditions?

Experience demonstrates that policies crafted to operate within a certain range of conditions are often confronted by challenges outside of that range. The result is that many policies don't accomplish their goals and have unintended or perverse impacts. Therefore, to ensure policies help people, policymakers need ways to craft guidelines that can adapt to a range of anticipated and unanticipated conditions.

This multi-year Adaptive Policies (AP) research project endeavours to identify mechanisms that help public policies adapt to anticipated and unanticipated conditions. This report studies farm-level coping and adaptation measures for weather shocks (for example, flooding) and stresses (for example, drought), identifies policies which have aided these measures and studies these policies for their adaptive mechanisms. It is the premise of this research project that policies which have either aided or impeded a farmer's ability to cope with change, are also likely to either contain mechanisms which have helped the policy itself adapt to changing circumstances.

Included in this case study is a summary report on the results of 30 farm-level surveys for two locations in the southern region of Alberta. The surveys were conducted by Jennifer Medlock and Andrew McCoy of Times Two Consulting and are discussed in Sections 3 and 4. This field research was funded and supervised through the (AP) project and also through The Prairie Climate Resilience Project (PCRP), funded by Climate Change Impacts and Adaptation Directorate, Natural Resources Canada.

Two particular public policies were analysed further in this case study for their adaptive policy features. These included the Canadian Agricultural Income Stabilization (CAIS) program, and Alberta's ID program. The adaptive policy analyses for these two programs were undertaken by

Christa Rust of IISD (see Section 5) and Jennifer Medlock of Times Two Consulting (see Section 6), respectively.

2.0 Research Methods

The research methodology used for this community case study is similar to the methodology of the first two community-level case studies undertaken in Manitoba and Saskatchewan. The methodology is based on four logical elements:

- selection of study sites which have been subject to high climatic variability;
- identification of adaptive measure by farmers at those sites;
- establishment of convincing linkages between those measures and government policies that influenced them; and
- analysis of the policies themselves for adaptive features.

Previous IISD and TERI research has mapped areas of high climatic variability and vulnerability in the Canadian Prairies and in India. The research teams, both in Canada and India, are using this previous research to select case study areas that have been exposed to significant climatic variability/extreme events. The assumption is that community members who remain actively involved in agriculture have had to adapt in order to remain so. Therefore, these high-variability sites will be prime locations for seeking evidence of adaptive measures.

Through local surveys, interviews and other methods, the field researchers identified successful coping and adaptation measures by farmers. The measures that are identified in the field include individual, household and collective behaviours at the community level. Using a variety of methods and informants, the field researchers studied the linkages between successful or popular adaptation measures to enabling factors that have facilitated these measures. These enabling factors include agricultural and water management policies, as well as other socio-economic and ecologic factors.

Policy linkages may be first-order (direct) or second-order, acting through intermediate enabling factors. For example, local respondents may report that an important adaptation measure has been the diversification of their agricultural production, among various crops with differentiated markets. This behaviour may have been fostered by an intermediate organization (for example, cooperative) that supports marketing of different crops and provides market information and advice to farmer-members for a variety of crops. The co-operative itself is not a policy, but there may be national policies that played a strong role in the establishment of co-operatives (for example, financing, purchase agreements and transportation support). Crop diversification is the behaviour, co-operative organization is the key enabling factor, but credit guarantees for farmer co-ops may be an important second-order policy supporting the diversification of agricultural production. This research may also choose to identify policies that appear to have hampered or constrained local adaptive measures.

Having identified a set of policies that can be linked to the observed and reported coping and adaptation measures, researchers will analyze these for their adaptive mechanisms. This work should help to confirm whether policies that aid local communities to adapt successfully are themselves intrinsically "adaptive."

2.1 Site Selection

Case study site locations were identified using a combination of historical climate data to describe climate exposure (E), and socio-economic data which described adaptive capacity (A). This methodology is founded in the vulnerability approach where system vulnerability (V), is conceptualized as function of a system's exposure to E and A to deal with those effects. The more exposed a system is to a particular climate stimulus, the greater the system vulnerability, and conversely, the greater the adaptive capacity of the system to a given climate event, the lower its vulnerability. Smit and Pilifosova (2003) express this relationship formally as:

$$V_{it\,s} = f(E_{it\,s}, A_{it\,s})$$

Where

$V_{it\,s}$ = vulnerability of system i to climate stimulus s in time t

$E_{it\,s}$ = exposure of i to s in t

$A_{it\,s}$ = adaptive capacity of i to deal with s in t

For the Alberta case studies, two locations were selected that exhibited similar levels of exposure based on precipitation variability, but exhibited different levels of adaptive capacity based on available socio-economic and environmental data.

2.1.1 Exposure Mapping

First, an exposure map was generated based on a coefficients of variability calculated from average precipitation data (1960-2002). The data were compiled by the Prairie Farm Rehabilitation Administration (PFRA) for IISD's Prairie Climate Resilience Project. The coefficient of variability is presented on Figure 2-2.

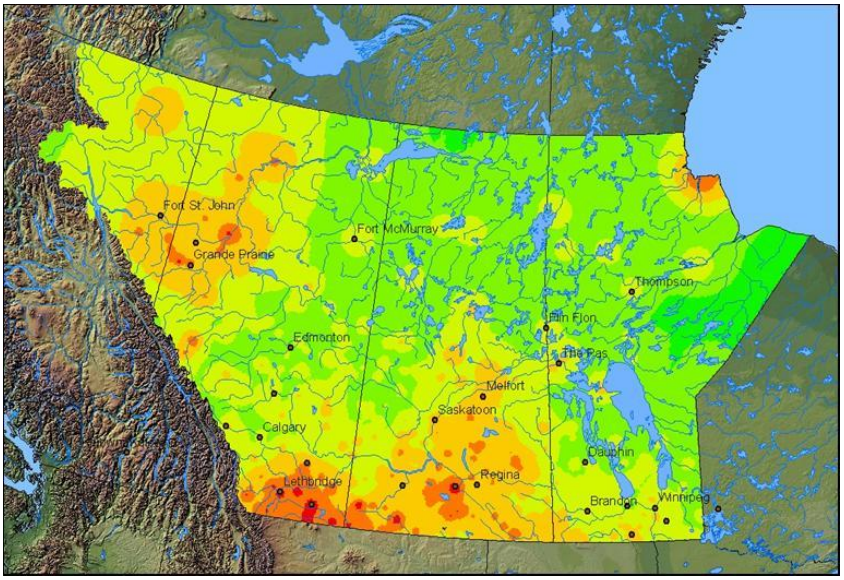

Figure 2-2: Precipitation variability map–Coefficients of variability calculated from average precipitation data, (1960-2002).

2.1.2 *Adaptive Capacity Mapping*

Second, as part of the PCRP, socio-economic and environmental data were compiled to map the adaptive capacity across 53 census divisions in the prairie agriculture region (Swanson *et al.*, 2007). In our analysis, it was possible to extract data for 20 indicators from the 2001 Census of Agriculture and Census of Population relating to six determinants of adaptive capacity–Economic resources; Technology; Infrastructure; Information, skills and management; Institutions and networks, and Equity (based on Smit *et al.*, 2001). We developed an index of adaptive capacity for each of the 53 census divisions in the prairie agriculture region and then mapped these indices on a relative basis for each census division (i.e., census divisions ranked according to index value).

The results of the adaptive capacity mapping are presented in Figure 2-3. Census divisions exhibiting the highest adaptive capacity were clustered near urban centres in three main corridors (in Manitoba around Winnipeg extending south along and to the east of the Red River; in Saskatchewan from the Saskatoon area to Regina; and in Alberta extending southeast of Calgary to the United States border). Census divisions exhibiting the lowest adaptive capacity were typically along the northern boundaries of the Prairie agricultural region.

Contributing to the higher adaptive capacity in census divisions near urban centres were aspects such as:

- off-farm earnings;
- diversity of employment opportunities;
- computer technology;

- use of computers in farm management;
- transportation networks;
- email and Internet use to keep abreast of current climate trends and innovative farming practices; and
- opportunities to access agricultural education institutions.

Census divisions along the northern extent of agriculture were disadvantaged with regard to these aspects of adaptive capacity.

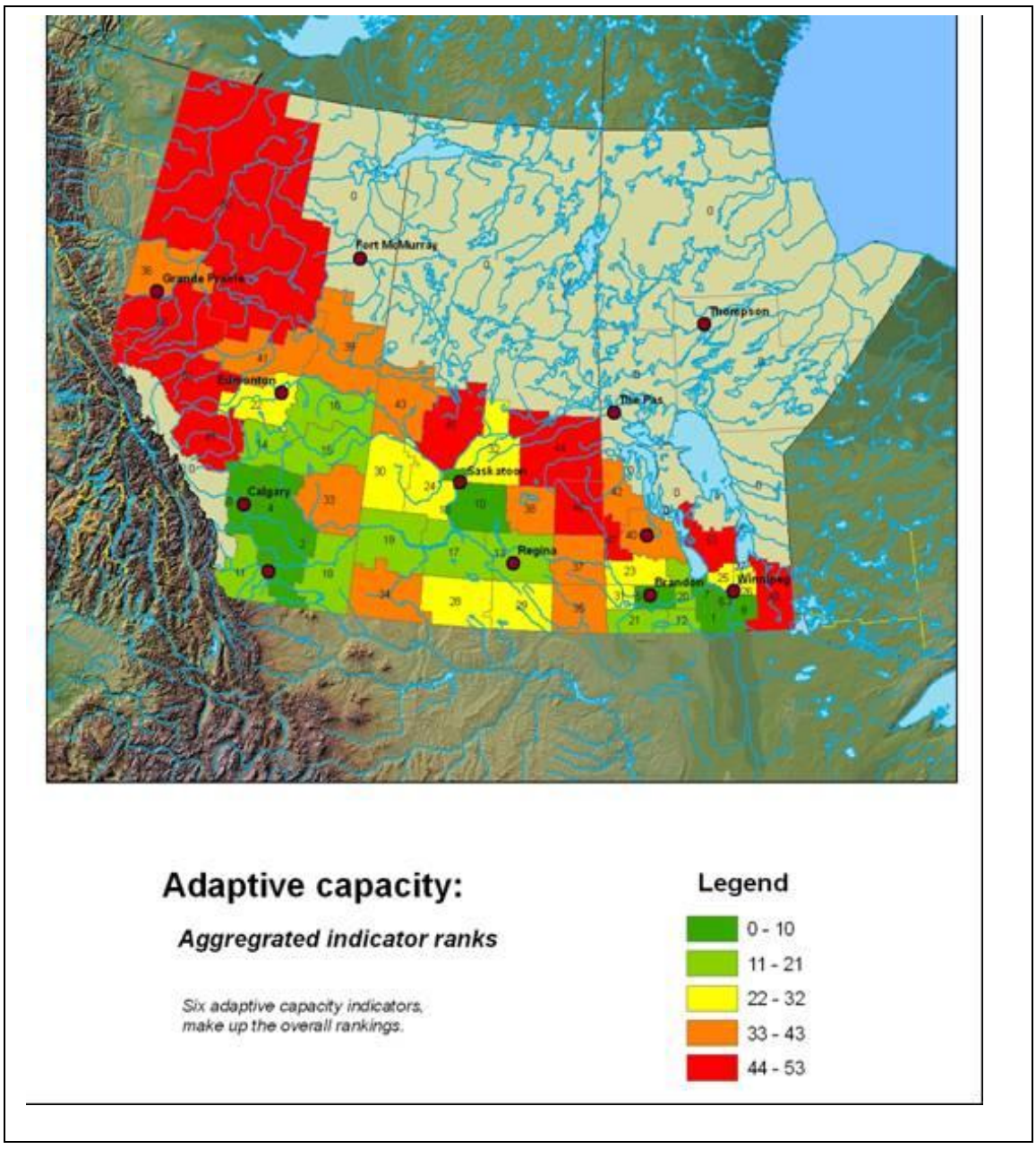

Figure 2-3: Adaptive capacity indices for census divisions in the prairie agriculture region–relative rankings (1 being the highest and 53 the lowest rank).

2.1.3. *Combining Exposure and Adaptive Capacity Mapping*

Field case study locations were identified by overlaying the exposure map (precipitation variability map) with the adaptive capacity map (Figures 2-4 and 2-5). This we refer to as a vulnerability space map. The intention here was to identify two study locations that had similar levels of exposure, but which differed with respect to adaptive capacity.

Based on these criteria, two case study locations were selected: one in the vicinity of Coaldale, the other in the vicinity of Foremost, Alberta. Coaldale is located 12 km east of the city of Lethbridge in Southern Alberta. Foremost, is located 130 km southeast of Lethbridge and 100 km southwest of Medicine Hat.

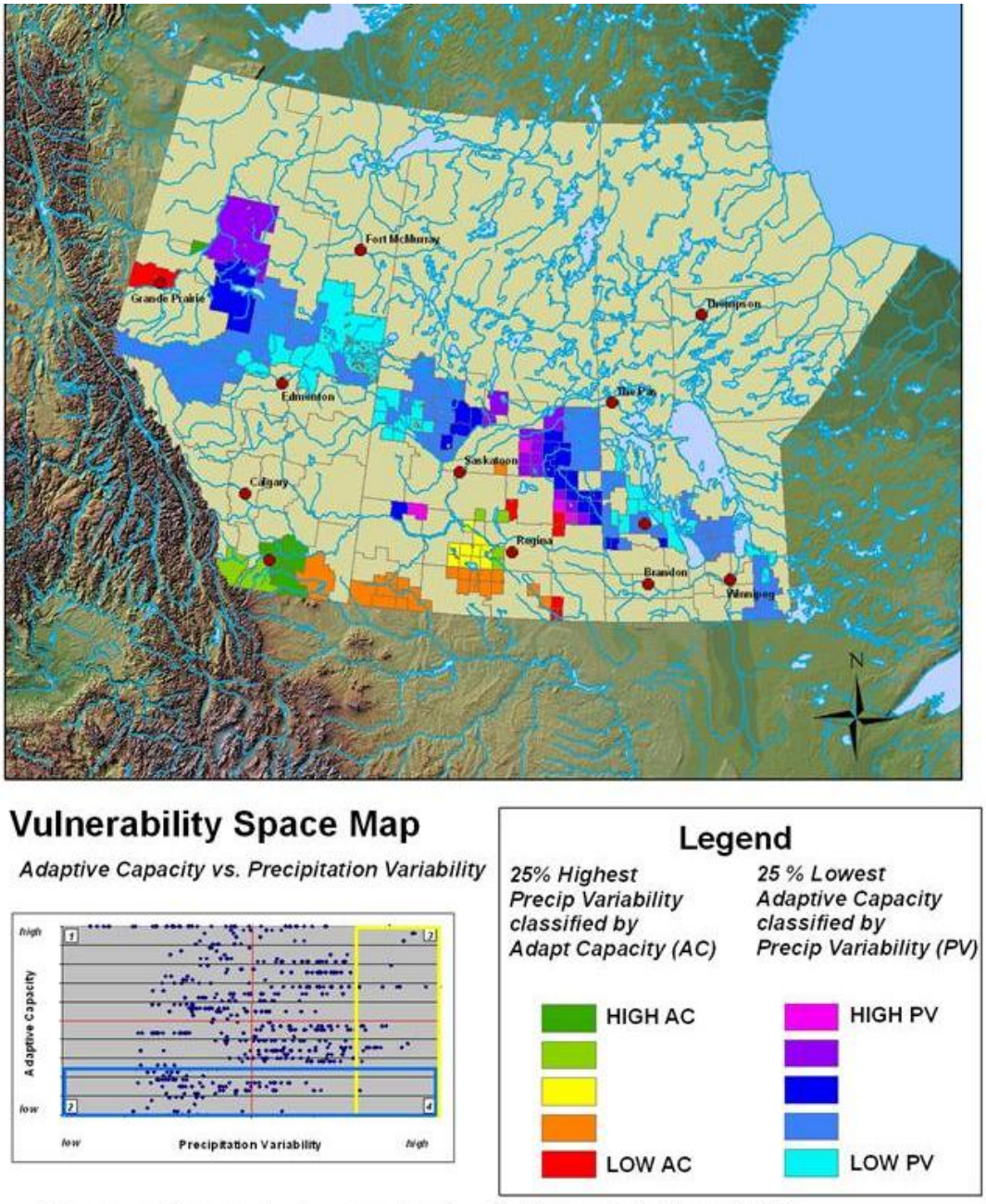

Figure 2-4: Vulnerability space map for the prairie agriculture region.

Figure 2-5: Alberta field study locations.

2.2 Identifying Community-level Coping and Adaptation Measures

To identify farm-level coping and adaptation measures, field research was conducted by Times Two Consulting in Calgary, Alberta. Jennifer Medlock and Andrew McCoy carried out research, which involved initial contacts in two case study areas and subsequent interviews with farmers and organizations. The methods described below are excerpts from the field technical report (Medlock and McCoy, 2008).

2.2.1 *Farm-level Interviews*

Forty semi-structured interviews were conducted between November 15, 2007 and February 15, 2008 (15 with farmers and five with agricultural organization representatives in each region).

Interviews were carried out in person or over the telephone and ranged in length from 12 minutes to 1.5 hours, with an average of 50 minutes. Most of the interviews were digitally recorded. The interviews loosely followed a questionnaire (see Box 2-1), though this was used as a starting point and further questions/probes were added depending on the responses.

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

Potential interviewees were contacted by telephone and further information on the project, along with the questionnaire and consent form, was sent by email or fax in advance of a scheduled interview.

2.3 Policy Identification and Analysis

A set of criteria helped guide the selection of policies for further analysis of adaptive policy mechanisms. These criteria included:

- The policy is related to agriculture and water resources management.
- The policy is mentioned by more than one interviewee.
- The policy has been implemented in different locations, or over long time span with some common basis of design.
- Information is available and the persons involved with the policy are accessible.
- It is not too outdated.
- The policy has been helpful or neutral over time, but not a constraint on adaptation.

Table 2-1: Indicators Identified for the Aspects of Adaptive Capacity

Determinant	Aspect	Indicator
Economic Resources	Income generation relative to capital investment	Ratio of gross farm receipts to total capital investment. Higher is better.
	Income generation relative to summary expenses	Ratio of income to expenses. Higher is better.
	Off-farm earnings	Off-farm earnings as a percent of total family income where families have at least one farm operator. Higher is better.
	Diversity of employment opportunities	Ratio of off-farm contribution of time to on-farm contribution of time. Not available with current dataset. Alternative was the ratio of employment in agriculture to employment in other industries within CD. Lower is better.
Technology	Water access technology	Ratio of value of irrigation equipment to value of all other farm equipment. Higher is better.
	Computer technology	Ratio of farms reporting use of computer to all other farms. Higher is better.
	Technological flexibility	Ratio of value in tractors under 100 hp to total value of all other tractors. Lower is better.
	Technological exposure	Ratio of technologically-demanding to less demanding farm types. Higher is better.
Information, skills and management	Enterprise information management	Ratio of farms reporting computer livestock and crop record keeping to all other farms. Higher is better.
	Sustainable soil resource management practices	Ratio of area of no-till or zero till seeding to tilled area. Higher is better.
	Sustainable environmental management practices	Ratio of farms reporting windbreaks and shelter belts to all other farms. Higher is better.
	Human resources management	Ratio of total farms reporting paid agriculture labour to all other farms. Higher is better.
Infrastructure	Soil Resources	Proportion of area in dependable agricultural land. Higher is better.
	Surface Water Resources	Ratio of surface water area to total land area. Higher is better.
	Groundwater Resources	No. and/or yield of wells. Higher is better.
	Transportation Network	Ratio of high-capacity—to-low-capacity roads. Higher is better.
Institutions and Networks	Informal operating arrangements	Ratio of total farms reporting formal agreements to total number of farms reporting sole proprietorships and partnerships without written agreement minus miscellaneous category. Lower is better.
	Email use	Ratio of total farms reporting Email use to all other farms. Higher is better.
	Internet access	Ratio of farms reporting Internet use to all other farms. Higher is better.
	Opportunity to access agricultural education institutions	Distance between centroids of each Census Division and the nearest regionally significant agriculture institution. Lower is better.
Equity	Employment opportunities	Unemployment rate from Statistic Canada's 2001 Census of Population 20% Sample Data for population of 15 years and over. Lower is better.
	Opportunity to access health and social services	Ratio of labour force in health and social service occupations to all other occupations. Statistics Canada 2001 Census of Population 20% Sample data for population. Higher is better.
	Distribution of income - general population	Rating by Alessandro's work as published in Catalogue no. 21-006-X1E (Rural/urban divide is not changing: income disparities persist)
	Distribution of income - agricultural producers	Ratio of farms reporting sales in excess of 250k to all other farms. Lower is better.

Once an appropriate policy has been identified using the above criteria, it is analyzed for its adaptive mechanisms. These mechanisms and their supporting principles are summarized in Table 2-1.

A policy that has the ability to adapt to "anticipated conditions" is built upon insights into cause-and-effect relationships. Mechanisms include:

- Automatic Adjustment – some of the inherent variability in socio-economic and ecologic conditions can be anticipated, and monitoring can help trigger pre-determined policy adjustments to keep the policy functioning well.
- Integrated Assessment to Inform Policy Parameters – through an integrated assessment of causal factors, key impacts and scenario outlooks, policies can be crafted to perform under a range of anticipated conditions, and possibly function even under worst cases.
- Multi-perspective Deliberation – deliberative processes strengthen policy design by building recognition of common values, shared commitment and emerging issues, and by providing a more comprehensive understanding of cause-and effect relationships.

The ability of a policy to adapt to "unanticipated conditions" is a newer notion, based on a holistic appreciation of system complexity, capacity, performance and dynamics. Mechanisms include:

- Formal Review and Continuous Learning – policy review undertaken on a regular basis, even when the policy is functioning well, can help policies deal with "emerging" issues and trigger policy adjustments.
- Encouraging Self-organization and Networking – by encouraging interaction, policies can foster the emergence of innovative responses to unexpected events.
- Subsidiarity – by recognizing that action will occur at different levels of jurisdiction, depending on the nature of the issue, policies can be crafted to assign authority to the lowest jurisdictional level of jurisdiction consistent with effectiveness.
  Promoting Variation – small-scale interventions for the same problem offer greater hope of finding effective solutions. Diversity facilitates the ability to persist in the face of change.

An analysis of the complete policy chain is necessary to identify important mechanisms which help policies adapt to shocks and stresses. The policy chain is a depiction of the stages of policy design and implementation as they pertain to the roles and responsibilities of the different actors involved. Figure 2-7 presents an idealized process of policy design and implementation. Policies are designed with varying degrees of consultation with relevant stakeholders and it is typically the case that an institution or organization different from the one which designed the policy is responsible for implementing the policy.

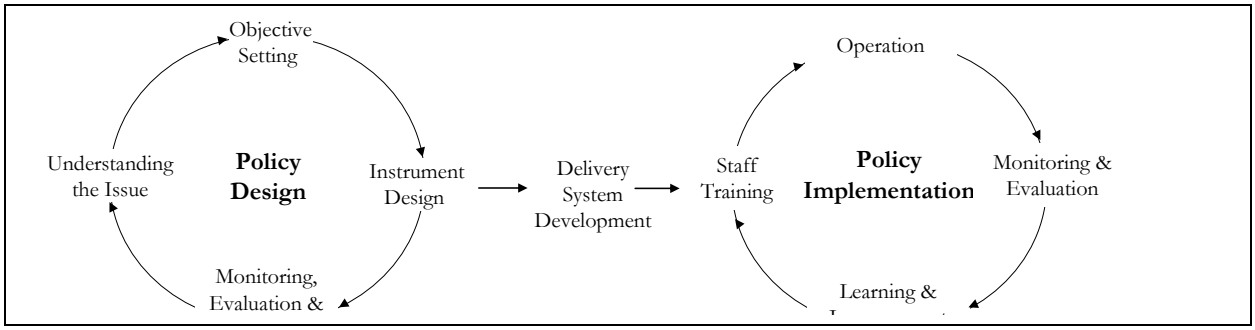

Figure 2-7: Idealized illustration of policy design and implementation.

Objectives	Adapting to Anticipated Conditions			Adapting to Unanticipated Conditions			
Analytical Basis	**Analysis of cause/effect and outcomes**			**Holistic appreciation of system complexity, capacity, performance and dynamics**			
Adaptive policy principles	• Fine-tune the process.[4] • Incorporate monitoring and remedial mechanisms.[8] • Understand carefully the attribution of credit.[9]	• Respect history[14] • Understand local conditions, strengths and assets.[4] • Place effort on determining significant connections rather than measuring every thing.[9] • Look for linkages in unusual places.[9]	• Gather multiple perspectives from range of stakeholders.[8] • Use deliberative practice to build trust and consensus.[10] • Use epistemic communities to inform policy design and implementation.[1]	• Conduct selection by evaluating performance of potential solutions, and selecting the best candidates for further support.[4] • Policies should test clearly formulated hypotheses.[5] • Evoke disturbance.[6]	• Create opportunity for self-organization and build networks of reciprocal interaction.[4, 6] • Promote effecti adaptive cooperation.[9] • Facilitate copying of successes.[9] • Ensure that social capital remains intact.[12]	• Match scales of governance and ecosystems • Clearly identify the appropriate spatial and temporal scale to enable integrated management.[13]	• Promote variation, diversity[4, 6] and redundancy.[6]
Adaptive policy mechanisms	**Automatic adjustment**	**Integrated assessment**	**Multi-perspective deliberation**	**Formal review and continuous learning**	**Encouraging self-organization and networks**	**Subsidiarity**	**Promoting variation**

Table 2-2 Framework for Adaptive Policies

	Some of the inherent variability in socio-economic and ecological conditions can be anticipated, and monitoring can help trigger important policy adjustments to kee the policy functioning well.	Through an integrated assessment of causal factors, key impacts and scenario outlooks, policies can be crafted to perform under a range of anticipated conditions, and possibly function even under worst cases.	Deliberative processes strengthen policy design by building recognition of common values, shared commitment and emerging issues, and by providing a comprehensive understanding of causal relationships.	Policy review undertaken on a regular basis even when the policy is functioning well, will help policies deal with "emerging" issues, and can trigger policy adjustments to conditions that could not have been anticipated.	Encourage interaction and initiative to foster emergence of innovative responses to unanticipated events. Provide space for flexible responses and reduce barriers to collaboration and learning.	Subsidiarity recognizes that action will occur at different levels of jurisdiction, depending on the nature of the issue. It assigns priority to the lowest jurisdictional level of action consistent with effectiveness.	Small-scale interventions for the same problem offers greater hope of finding effective solutions.[4] Diversity facilitates the ability to persist in the face of change, and spreading risks is part of managing complex systems.[6]

Table Notes:

1 Senge, P., 1993. The Fifth Discipline: the art and practice of the learning organization. New York. Currency Doubleday.

2 Dewey, J., 1927. The Public and its Problems. New York. Holt and Company. In Busenburg G J., 2001. Learning in organizations and public policy. Journal of Public Policy 21(2), 173-189.

3 Walker, W. E., Rahman S. A., and Cave J., 2001. Adaptive policies, policy analysis, and policy-making. European Journal of Operational Research 128, 282-289.

4 Glouberman, S., Campsie P., Gemar M., and Miller G., 2003. A Toolbox for Improving Health in Cities. Ottawa, Canada. Caledon Institute for Social Policy.

5 Lee, K., 1993. Compass and Gyroscope: integrating science and politics for the environment. Washington, DC. Island Press.

6 Berkes, F., Colding J., and Folke C., 2003. Navigating Social-Ecological Systems: building resilience for complexity and change. UK Cambridge University Press [based on Panarchy].

7 IISD (International Institute of Sustainable Development), 1994. Principles of Trade and Sustainable Development. Winnipeg, Manitoba, Canada.

8 Holling, C. S., 1978. Adaptive Environmental Assessment and Management. Chichester. John Wiley, 377.

9 Axelrod, R. and Cohen M. D., 2000. Harnessing Complexity: organizational implications of a scientific frontier. New York. Basic Books.

10 Forester, J., 1999. The Deliberative Practitioner: encouraging participatory planning processes. Cambridge. MIT Press.

11 Haas, P M., 1992. Epistemic communities and international policy coordination. International Organization 46(1), 1-35.

12 Ruitenbeek, J. and Cartier C., 2001. The Invisible Wand: adaptive co-management as an emergent strategy in complex bio-economic systems. Indonesia: Centre for International Forestry Research., 13 IUCN 2000. The Ecosystem Approach. The World Conservation Union.

3.0 Observed Community-level Coping and Adaptation Measures

3.1 Socio-Economic and Ecological Context

Coaldale, a town of 6,200 people, is located 12 kilometres east of the city of Lethbridge in Southern Alberta. A defining characteristic of agriculture in the area is the irrigated water system. The broader Southern Alberta region contains 1.5 million acres of irrigated land, comprising two-thirds of the total number of irrigated acres in Canada. Farmland in the Coaldale region, therefore, is dominated by irrigated land, though some farmers also work small numbers of dryland acres as part of their operations. Typical crops grown in the region are sugar beets, potatoes, beans, corn, wheat, canola and barley. As well, irrigation has supported the development of dairy, hog and cattle operations. Coaldale is located within the SMRID, one of a network of 13 irrigation districts within the province.

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

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

Both of the case study locations lie within the famed Palliser Triangle. From 1857 to 1860 Captain John Palliser led a group of scientists into what was then the virtually unknown (to Europeans) territory lying west of what is now Manitoba. Palliser's group, known as the British North American Exploring Expedition, was charged by the government of the day with exploring, studying, and mapping the plains between the North Saskatchewan River and the American border (see Figure 3-1). They identified a triangular region roughly bounded by the lines adjoining Cartwright, Manitoba;

Lloydminster, Saskatchewan; and Calgary, Alberta. This area became known as the Palliser Triangle, an arid region unsuitable for settled cultivation. Palliser warned that disaster would befall those who tried to settle the region.

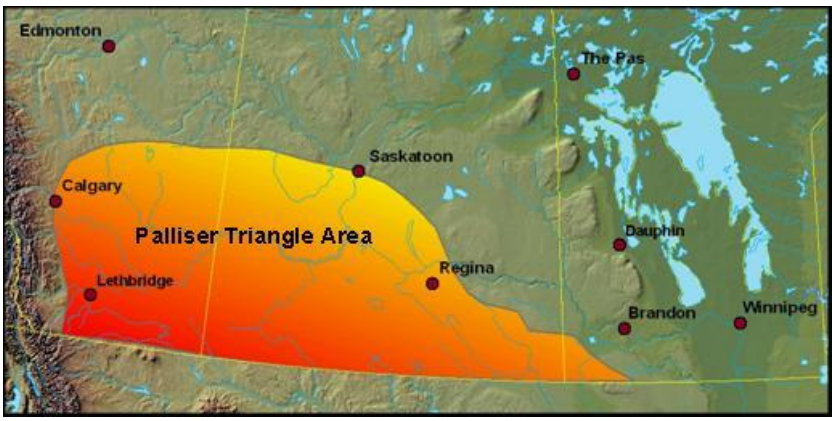

Figure 3-1: The Palliser Triangle within the prairie agricultural region (from Spry, 1968; in Lemmen *et al*., 1997).

3.2 Weather-related Shocks and Stresses

Table 3-2 provides a comparison of extreme weather events in Coaldale and Foremost as reported by interview participants. The extremes that were identified by a large number of participants are in italicized text.

Table 3-2: Comparing Extreme Weather Events in Coaldale and Foremost

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

2007	*Extreme heat and drought (C4, C7, C8, C9, C10, C14, C15, C16, C19, C20)* Hail (August) (C4, C9)	*Extreme heat and drought (F1, F2, F4, F8, F11, F16, F14, F17)*

Note: C1… Cn and F1… Fn are respondent identifiers.

From Table 3-2, it can be seen that three major weather extremes are common to both areas–the drought conditions in 2001, the heavy rainfall and flooding in June 2002 and the extreme heat and dryness reported in 2007 (especially in July). Furthermore, the drought conditions of 2000 that were described by a majority of Foremost interviewees were also mentioned by two of the interviewees in Coaldale. The single extreme weather event that seems to be distinct to Coaldale is the heavy rains that took place in June and September of 2005. This was not mentioned by any Foremost respondents.

3.3 Coping and Adaptation Measures

3.3.1 Coping with Drought

Crop insurance was commonly used by farmers in both regions to cope with drought over the short term, while minimal and reduced tillage techniques, crop diversification, crop rotation and the selection of crops that were better suited to drought conditions were some of the common long-term strategies (Table 3-3). Unique to Coaldale were irrigation related strategies and the ability to divert water, purchase more water rights and the use of efficient irrigation technology. In the Foremost region, farmers could do little about obtaining more water, so over the short term, they made efforts to reduce their input costs and become more financially sound. Long-term strategies included participation in market research groups, the use of technology that minimized soil disturbance and moisture loss, shelterbelts, community water pipelines and the dissemination of local knowledge between farmers.

Table 3-3: Coping and Adaptation Measures for Drought

Short-term Coping Measures	Long-term Adaptation Measures
Coping with Drought – Coaldale	
• Diverting water to high-value crops. • Purchasing water rights. • Crop insurance.	• No-till practices • Organic farming • Crop diversification and rotation • Crop choices specifically targeted for drought • Changing seeding and harvest schedules • Use of government programs • More efficient irrigation technologies
Coping with Drought – Foremost	
• Crop insurance helped in some cases. • Reduced level of inputs–lowered costs of operation. • Financially stable–in relatively good condition beforehand.	• Minimal/no till methods. • Chemical fallowing reduced soil disturbance. • Participation in market research groups. • Changing types of crops to those that are better suited to the heat. • Use of technology (for example, air drills that minimizes soil disturbance). • Shelterbelts. • Local knowledge systems–networking between farmers. • Community water pipelines. • Crop rotation and continually having organic matter on fields.

3.3.2 Heavy Rains and Flooding

In coping with heavy rains and flooding, farmers in both regions made use of crop insurance to cope over the short term and incorporated long-term adaptation strategies such as crop rotation and shifted seeding and harvest times (Tables 3-4). In Coaldale, farmers pumped water off the land, dug ditch and drainage systems, bought more silage for their cattle, re-ploughed their fields and put sawdust in between the rows of crops in U- pick operations. Longer term adaptations unique to this region included building more permanent drainage systems and the use of water pumps, reduced tillage practices and the selection of crops better suited to wet conditions. In Foremost, some farmers felt that they couldn't do anything to respond to wet conditions over the short term, and simply reduced their movement and disturbance of the land. Long-term adaptations such as rotation to less expensive crops through wet areas and changing seeding times were similar to techniques employed in Coaldale.

Table 3-4: Coping with Heavy Rains and Flooding.

Short-term Coping Measures	Long-term Adaptation Measures
Coping with Heavy Rains and Flooding – Coaldale	
• Pumping water off the land. • Digging ditches. • Changed harvest practices to get more susceptible. • Moved cattle out of pens. • Bought more silage to feed cattle. • Put sawdust between rows of crops (for U-Pick). • Use more fertilizer. • Re-spray fields. • Crop insurance.	• No-till practices. • Organic farming. • Crop diversification and rotation. • Crop choices specifically targeted for extreme moisture. • Changing seeding and harvest schedules. • Use of government programs (for example,, IRP). • Building drainage systems. • Purchasing water pumps.
Coping with Heavy Rains and Flooding – Foremost	
• Lack of response–not a lot that can be done. • Avoidance of fields–reduces damage and input costs. • Reduced movement on the land. • Presence of crop insurance.	• Crop rotation–planting of less expensive crops in low-lying and areas prone to flooding. • Earlier seeding times to take advantage of early moisture–enables crops to make it through remainder of season even if it was dry later in season.

3.3.3 Extreme Heat

In coping with extreme heat, there were many similarities in the strategies used by the two regions in their response to drought events (Table 3-5). Over the short term, farmers in both regions employed crop insurance and waited out the extreme temperatures. Many felt that there was simply nothing they could do in the immediate sense. Over the longer term, adaptation strategies included the implementation of crop rotation techniques, alteration of seeding and harvesting times to take advantage of early season moisture and the selection of crops specifically suited to the given conditions. Coaldale farmers were able to increase and shift their irrigation operations, employ organic farming techniques and made use of government programs to help them cope with the heat. Foremost farmers tended more towards adapting over the long term to the extreme heat. Continuous covers of organic material, either through chemical fallow or leaving trash from the harvest in the fields are effective in retaining as much moisture in the soil as possible. The use of improved technology that reduced the disturbance of the soil and minimized moisture loss were also key strategies for Foremost farmers. Over the longer term, preparation of shelterbelts and community water pipelines offered further assistance in coping with extreme heat.

Table 3-5: Coping with Extreme Heat.

Short-term Coping Measures	Long-term Adaptation Measures
Coping with Extreme Heat – Coaldale	
• Wait it out. • Increase irrigation. • Crop insurance.	• No-till practices. • Organic farming. • Crop diversification and rotation. • Crop choices specifically targeted for extreme heat. • Changing seeding and harvest schedules. • Use of government programs.
Coping with Extreme Heat – Foremost	
• Lack of response–not really a lot that can be done . • Avoidance of fields–reduces damage and input costs. • Reduced movement on the land. • Presence of crop insurance. • Sound financial strategies–saved own money over time.	• Selection of crops that are better suited to the heat. • Earlier seeding times to take advantage of early moisture–enables crops to make it through remainder of season even if it was dry later in season. • Crop rotation and higher organic matter levels on fields leads to more organic soil and better moisture retention. • Leaving trash on fields retains snow which increases soil moisture content. • Changing types of crops to those that are better suited to the heat. • Use of technology (for example, air drills that minimizes soil disturbance). • Planting of shelterbelts. • Community water pipelines–aids in day-to-day living.

4.0 Policies Facilitating Coping and Adaptation Measures

Unique to the Coaldale region is the access to irrigation resources and infrastructure. Respondents in this region highlighted many aspects related to irrigation management such as the water rationing agreement, calculation of water rations during the 2001 drought year, implementing more efficient irrigation technologies and receiving help with drainage during the flood.

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

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

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

For the most part, many of the other programs and policies referenced and discussed by participants were common to both regions (Table 3-6). Even though NISA is no longer operating, participants in both regions commented on the fact that it was preferred to CAIS, which replaced

it.

Table 3-6: Comparison of Programs in Coaldale and Foremost

Program	Coaldale	Foremost
Canadian Agriculture Income Stabilization program (CAIS)	• One interviewee thought it was good. • Remainder thought the program was difficult and complicated to use.	• Two participants thought it helped and was a good program. • Majority thought it was difficult to use and trigger; complex and always seemed to be changing.
National Environmental Farm Plan Initiative (NEFPI)	• Widely used in region, perceived as useful to farmers. • Farmers already aware of many of the environmental issues that it highlights.	• Positive program for farmers. • Downside is that it takes time to get money from the program and doesn't really tell participants anything they didn't already know.
Net Income Stabilization Account (NISA)	• Viewed more favourably by some participants; seen as more predictable and straightforward.	• Used by some farmers and many thought it was the best program going. • Aided farmers by setting aside money that could be used to deal with tough times..
Crop Insurance	• Roughly half of the participants have crop insurance every year. • One participant stated that it has allowed him to keep farming. • Other participants find it too controlling of their operations to be eligible to make claims.	• Mixed reviews–some farmers always have it and feel it is the only useful program. • Others felt it is a mess and not set up to really help farmers address loss of crops. • Complicated and difficult to get adequate returns from the program.
Ducks Unlimited Programs	• Some involvement in program–awareness was high, participation limited.	• Assisted in some grass seeding and environmental enhancement.
Canada-Alberta Water Supply Expansion Program (CAWSEP)	• Some participants made use of program to expand water retention and delivery infrastructure.	• Limited participation in program in region–some expansion of community pipelines.
Water Cooperatives	• So comments.	• Drought situations led to the development of SE Alberta Water Co-op. •
Shelterbelt Program	• Used by five participants to develop shelterbelts on operations and plants trees in farmyards.	• Limited participation by farmers in region; has been used extensively by some farmers to greatly increase shelterbelts.
Canada Alberta Farm Stewardship Program	• Used by more than half of the participants to improve infrastructure on farm and to improve technology–double-walled fuel storage tanks, GPS systems and chemical storage buildings.	• Limited use; has helped with the purchase and use of some new technology (for example, GPS for machinery).

St. Mary River Irrigation District (SMRID) Program	• Irrigation Rehabilitation Program (IRP) • SMRID's emergency management plan	

In many ways, the attitude and participation in each of the programs was similar for both Coaldale and Foremost. The only real variance between the regions occurred in the number of farmers participating in the programs. CAIS, crop insurance and the NEFPI were the most widely used and commented upon programs for both regions. Participants made use of CAIS, but the general attitude was that it was an overly complicated and difficult program to use. Participant comments point to the fact that it was poorly designed, that there were high costs associated with submitting claims through the program and it always seemed to be changing. In the words of one farmer, it is understandable that it was so complex because how can a program be designed to suit the needs of over 100,000 farmers nationwide.

Crop insurance was widely used by farmers in both regions and the common feeling was that even though it might not provide sufficient returns for losses incurred it does offer some protection. One farmer in Coaldale stated it has allowed him to continue farming. The feeling in Foremost about the program was more negative. Many farmers felt that crop insurance did not allow them to make claims on the unique conditions and occurrences on their operations and it was difficult to get adequate returns for their losses. The National Environmental Farm Planning Initiative was used widely by participants in both regions and for the most part it was an effective and well-received program. There were limited criticisms in both regions regarding the fact that it identified environmental issues that many farmers were already aware of and it could take time to receive financial support through the program.

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

5.0 The Canadian Agriculture Income Stabilization Program: An Adaptive Policy Analysis

The Canadian Agricultural Income Stabilization (CAIS) program was created under the 2003 APF. CAIS combines income stabilization assistance and disaster assistance into one comprehensive program to help farmers protect their farming operations from both small and large drops in income.

This policy was selected for study because it was frequently cited this program, and its predecessor, NISA, was also mentioned by farmers in Alberta and across the prairies in relation to coping and adapting to weather-related stresses. Additionally, this policy has recently undergone a major redesign in response to negative feedback from farmers and other experts. With the CAIS program as the focal point, this section analyzes three generations of income stabilization programs to detect if any adaptive policy mechanisms were inherent in the evolution of the policy over time.

5.1 Policy Intent

CAIS is built on the philosophy that governments and farmers share in the cost of replacing lost income. Farmers share the cost by paying an annual participation fee and by absorbing a portion of their lost income themselves. For smaller losses, governments and farmers shoulder the loss equally. As losses deepen, the percentage of government's share increases to four times the farmer's share.

A loss must occur in order for a farmer to receive government payments under CAIS. Loss is measured by comparing the production margin with the reference margin. A production margin is the farmer's allowable income minus allowable expenses in a given year. A reference margin is the farmer's average production margin for three of the past five years (in the CAIS calculation, years with the lowest and the highest production margins are dropped). Once the production margin is determined, adjustments are made for changes in receivables, payables and inventory in the current year. These adjustments help to estimate the potential income/loss for the year. When a farmer's program year income falls below his/her historic income, benefits are triggered based on the magnitude of the margin decline and the farmer's selected coverage level.

5.2 Policy Changes, Drivers and Impacts

In Canada, there is a long history of agriculture safety net policies and programs designed to increase income stability and reduce market risks. During the post-war period many of the safety net programs focused on traditional commodity price stabilization–*Agricultural Prices Support Act*, *Agricultural Stabilization Act*, *Western Grain Stabilization Act*, *Crop Insurance Act*, *Western Grain*

Transportation Act, Feed Freight Assistance and the National Tripartite Stabilization Program. It was not until the late 80s the direction of Canadian agricultural policy shifted toward whole farm income stabilization.

In 1991, the umbrella statute and first generation of safety net programming for agriculture was enacted. The *Farm Income Protection Act* (FIPA) provided the framework for the integration of safety net programs for virtually all commodities–the whole farm approach. Five safety net programs were developed under this legislation to cover the direct needs of different products.

- Net Income Stabilization Account;
- crop insurance;
- provincial companion programs;
- cash advance programs; and
- Agriculture Income Disaster Assistance /Canadian Farm Income Program (Zafiriou and Smith, 2002).

The characteristics of FIPA programs were voluntary; involved cost sharing between farmer and government, market orientated, based on performance triggers and were actuarially sound. The intention of the Act was to encourage a more "market-oriented" and "self-reliant" philosophy that was at the same time intended to be trade- and production- neutral, equitable across provinces and environmentally sustainable with minimum overlap or duplication of purpose.

NISA was developed jointly between farmers, the Government of Canada and participating provinces under the new Act with the intention of addressing the level and stabilization of farm income. Income stabilization encouraged farmers to set aside money in individual accounts in high income years for use in bad years. Farmers could deposit money annually into their NISA account based on eligible net sales and receive matching government contributions (federal 2 per cent: provincial 1 per cent). The maximum amount of annual eligible net sales per individual was $250,000. In lower income years, farmers could make withdrawals from the funds they had set aside. Withdrawals were triggered when gross margins fell below a three-year average (gross margin trigger) or when family income fell below a minimum family income level (minimum income trigger). The program was designed to help farmers achieve long-term farm income stability on an individual basis instead of a common insurance type account.

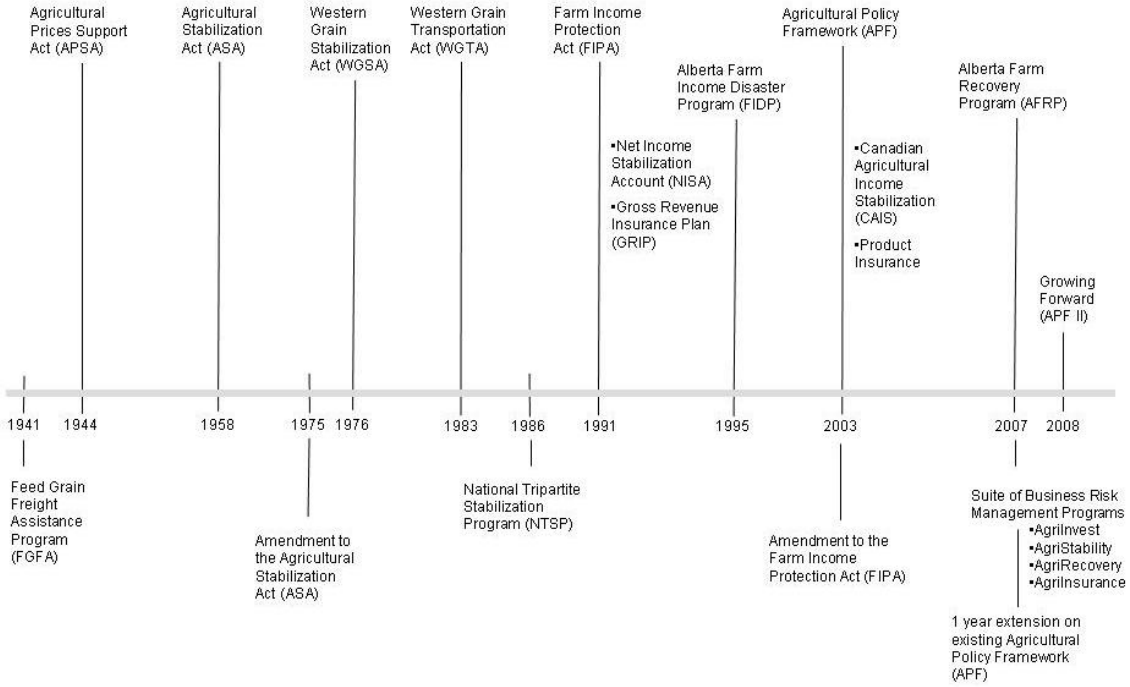

Figure 5-1: History of Canadian Agriculture Income Stabilization.

Using this first suite of safety net programming as a learning tool, FIPA was amended in 2003. The amendment called for a strengthening of the principles and objectives for safety net programming. The strengthening led to the APF, a five-year federal-provincial-territorial agreement on agriculture. The goal of the framework was to help create a national approach to agriculture, one that provides a solid foundation for success based on five integrated pillars of programming– Business Risk Management, Food Safety and Quality, Science and Innovation, Environment and Renewal (AAFC, 2008).

CAIS was introduced under the APF in 2003 effectively replacing the FIDP, Canadian Farm Income Program and Net Income Stabilization Account. With the introduction of CAIS, the government tried to address some of the issues identified with NISA. Under CAIS, for a farmer to receive government payments, a loss must occur. Under NISA, in the previous set of programs, government payments (matching contributions) were triggered by farmer contributions rather than actual losses and so payments occurred regardless of loss. Therefore, the timing of payments and losses are better matched under CAIS than under the prior programs, which will naturally lend itself to improved stability. Smaller farms had less eligibility to contribute to NISA, meaning less eligibility for government payments, and so fewer payments were received by farmers in periods

when losses occurred. Under CAIS, participation is based on the same measure as the trigger (production margin) rather than on sales. Therefore, low sales limiting eligibility for payment should not be a problem. Conversely, large farms were limited in terms of the stabilization they could receive by the contribution cap of $250,000 in eligible net sales under NISA. Since deposits are proportional to production margin under CAIS, and there are no limits on deposits, this is far less likely to occur under CAIS.

The CAIS program had three components that differed from previous income stabilization programs:

- The measure of farm income cushioned under the program is production margin. It serves as a trigger for both support payments and farmer contributions.
- Farmers make contributions to the program to share financing of triggered payments.
- Since support under CAIS is layered, the farmer's share of triggered payments decreases as realized production margin decreases.

Payment is received when current year farm income is less than average farm income from previous years. The amount of support received is based on the level of protection the farmer chooses. Unlike NISA, farms with sales of supply-managed commodities are eligible for CAIS, although under an altered design. This eligibility is based on a farm's percentage of supply-managed sales relative to total farm sales. In the stabilization layers, triggered CAIS payments are prorated according to the percentage of farm sales from non–supply managed commodities.

Starting March 31, 2008, a new vision for agriculture income stabilization policy will be fully transitioned with the end of the five-year Agricultural Policy Framework and the birth of the Agricultural Policy Framework II – Growing Forward. In 2007, agriculture ministers agreed to seek the authorities from their governments to continue existing programs under the current APF for up to one additional year while Growing Forward programs are being developed and implemented. Growing Forward programs were developed based on consultations with over 3,000 participants from across the country. The programs are guided by a vision for a profitable and innovative agriculture, agri-food and agri-based products industry that seizes opportunities in responding to growing market demands and contributes to the health and well being of Canadians (AAFC, 2008). The new suite of programming combines a contributory style savings account, a disaster relief framework, an improved margin-based program, expanded production insurance and a cost of production component. Taken together, these programs represent the federal government's proposal to replace the safety net approach with a more adaptive risk management approach. Growing Forward is essentially about improving income from the farm through proactive steps to avert future income declines and grow and adapt the business.

The new suite of programs replaces CAIS, Product Insurance and other safety net policies with a suite of programs that are designed to be more responsive, predictable and bankable for farmers. The new approach advances agricultural stabilization policy into the proactive realm of risk management by improving income from the farm through proactive steps to avert future income declines and grow and adapt the business. The four programs that form the business risk management approach are:

- **AgriInvest** – a savings account for farmers, supported by governments, which provides coverage for small drops in income and allows for investments that help mitigate risks or improve market income.
- **AgriStability** – provides support when a farmer experiences larger farm income losses. The program covers declines of more than 15 per cent in a farmer's average income from previous years.
- **AgriRecovery** – a disaster relief framework which provides a coordinated process for federal, provincial and territorial governments to respond rapidly when disasters strike, filling gaps not covered by existing programs.
- **AgriInsurance** – an existing program which includes insurance against production losses for specified perils (weather, pests and disease), and is being expanded to include more commodities (AAFC, 2007).

The section that follows will provide a brief look at all four of the new suite of business risk management programs. Not all the programs are fully developed and that is reflected in the amount of detail available on the program. AgriStability and AgriInvest were the first to be launched in 2007. Together these two programs replace the coverage previously provided under CAIS. AgriRecovery and AgriInsurance will be phased in during the transition period allowed by the one-year extension of the 2003 APF.

AgriInvest replaces the coverage for margin declines of less than 15 per cent previously covered by CAIS. AgriInvest accounts help farmers protect their farm income from small declines or provide funds for investment to reduce risks or improve profitability.

The AgriInvest program is delivered by the federal government in all provinces except Quebec. Under this program, farmers (individuals, partners in a partnership, co-operatives, corporations, estates, trusts, limited partnerships and landlords in a joint venture) who make a deposit to their AgriInvest account will receive a matching government contribution based on a percentage of Allowable Net Sales (ANS) of eligible commodities. Each year, farmers can deposit up to 1.5 per cent of their ANS into an AgriInvest account and receive a matching contribution from federal and provincial governments. Farmers will have the flexibility to use the funds to cover small margin declines or for risk mitigation and other investments. Eligible participants are limited to ANS of

$1,500,000 per year. Based on this limit, the largest matching government contribution would be $22,500. For the 2007 program transition year, there is no account balance limit. A $600 million federal commitment during the transition year will kick-off the program providing farmers with account contributions without requiring a contribution from the farmer. For 2008, ANS limits will be based on 25 per cent of the average of 2007 and 2008 data. After 2008, accounts will be limited to 25 per cent of a farmer's ANS for the program year and the two preceding program years. If ANS was not calculated for one or more of these years, the limit will be calculated based on the average of years available. Farmers are able to take up to two withdrawals from their account during the 2007 program transition year. Governments are reviewing whether withdrawal triggers should be in place for 2008 and subsequent program years.

The AgriStability program was developed to help ease economic constraints caused by cost pressures and rapidly emerging global trends. AgriStability is a federal-provincial program that builds on past margin-based programming with the addition of a more responsive inventory valuation, enhanced negative margin coverage, and the new Targeted Advance Payment (TAP). TAP was created to provide assistance in times of serious income declines. It utilizes the industry/sector income decline to determine the extent of loss. Based on the industry/sector income decline and the farmer's reference margins, TAP will help bridge the gap between the time of revenue loss and the time when the final advanced payment is made under AgriStability.

AgriStability payments are received when farmers' current year program margin falls below 85 per cent of their reference margin providing they have:

- six months of farming in their program year;
- completed a production cycle in the program year;
- the industry/sector income decline lower than their reference margin; and
- a significant portion of their farm sales coming from the industry/sector experiencing the decline (50 per cent or more).

When natural disaster strikes, existing programs do not always address the extent of farmer losses. In the past, governments have responded to these natural disasters on a case-by-case basis. This action created uncertainty for farmers while they waited for governments to determine if support was possible and at what level. At their November 17, 2007 meeting, federal, provincial and territorial Ministers of Agriculture agreed on the details of AgriRecovery, a disaster-relief framework which ensures rapid and coordinated assistance for farmers hit by smaller natural disasters. AgriRecovery will address gaps not covered by the other programs within the Business Risk Management (BRM) suite. Past programs made no accounts for negative margins.

Governments are putting the necessary authorities in place to implement AgriRecovery and other

programs under the new MRM suite. Disasters covered by AgriRecovery would be regional in scope, have a relatively moderate impact on the Canadian industry as a whole, be easily contained, have few trade implications. Larger natural disasters are defined as national in scope, resulting in relatively large costs to governments, significantly affecting the competitiveness of the Canadian agricultural sector, resulting in potential health risks to Canadians and resulting in significant trade implications. Federal, provincial and territorial ministers have committed that their governments will work together when a large disaster strikes to ensure the needs of farmers are met. Assistance to address these types of disaster would be cost shared on a 60/40 federal-provincial/territorial basis. Governments will determine how these larger disasters will be addressed on a case-by-case basis. This program is intended to provide assistance to farmers in the event of serious income disasters that go beyond the capacity of coverage for ongoing income stabilization programs.

The AgriInsurance program builds on existing crop insurance and production insurance, and provides coverage for production and asset losses caused by natural perils. Coverage is expanding to include other products such as livestock and additional horticultural crops. Under the program, farmers pay premiums to protect their commodities. Farmers get a payment when they experience a production loss during the year. AgriInsurance is managed by the Agriculture Financial Services Corporation in Alberta.

5.3 Details of Policy Design and Implementation

Farm safety net programs are the joint responsibility of the federal-provincial/territorial governments. Safety net programs in Alberta, such as NISA, disaster programming and crop insurance, operated under an agreement that expired on March 31, 2003. Knowing that safety net programs would need to be renewed, the federal and provincial/territorial governments conducted a review of NISA and other safety net programs. The findings of the review identified several shortcomings in the set of programs being offered.

To address the shortcomings of the existing agreement, CAIS and Production Insurance, two national cost-shared programs were introduced in the 2003 APF. The APF and its programs are the second generation of agricultural income stabilization.

5.3.1 Canadian Agricultural Income Stabilization Program

The CAIS program was conceived as a margin-based program with government payments matched according to a schedule of farmer deposits. The CAIS program was built on the philosophy that governments and farmers should share in the cost of replacing lost income. The program is administered by AAFC for all of Canada except Alberta, Ontario, Quebec and PEI, where the provincial governments administer the program. In Alberta, the Agriculture Financial Services Corporation (AFSC), a provincial crown corporation, administers the program.

CAIS integrates whole farm income stabilization and disaster coverage to provide protection against both small and large drops in farming income. Program benefits are triggered when the production margin in the program year falls below the reference margin. Farmers participate by making contributions that are used to finance claims. Farmers make deposits into individual accounts proportional to their reference margins. The minimum deposit that a farmer must make is that required to finance the farmer's portion of payments to restore 70 per cent of the reference production margin from a complete loss.

5.3.2 Production Insurance

The Production Insurance program, predecessor of Crop Insurance, was re-branded under the 2003 APF. The program was developed to addresses specific needs by covering additional commodities and products. The program is a federal-provincial-farmer cost-shared program that aims to stabilize a farmer's income by minimizing the economic effects of production losses caused by natural hazards. The program objective is to ensure that farmers in the agriculture and agri-food industry across Canada have access to affordable insurance ultimately stabilizing farmers' income by minimizing economic effects of production losses caused by natural hazards.

These two programs were designed to address the shortcoming of past programs by providing:

- permanent disaster coverage for farmers;
- equitable treatment to farmers, across all commodities and provinces;
- better direction of government dollars to where there is need;
- affordable coverage for beginning farmers;
- programming that more effectively assists farmers in back-to-back disasters; and
- a streamlined set of programs that work well together.

In addition to these programs, there are also two notable programs, one developed prior to the APF and one developed after the APF, which serve to help stabilize farmer income and compliment the 2003 APF programming.

5.3.3 Advance Payments Program

The Advance Payments Program (APP) has been available for several years under the Prairie Grain Advance Payments Act, which covered wheat and barley in the designated areas of the Canadian Wheat Board (CWB) and the *Advance Payments for Crops Act* which covered all other crops produced across the country.

The program provides eligible farmers with cash advances–at harvest of up to $250,000 with the first $50,000 interest free, to store eligible product (field crops, maple syrup, honey and ranch-raised fur) after harvest. A cash advance allows the farmer to store the crop and sell it throughout

the year to achieve higher returns and avoid flooding the market with surplus goods. The program is accessible through the CWB and approximately 50 other farmer organizations, which administrate the program through an agreement with the Federal Government.

Farmers apply for the cash advance through a farmer organization (not directly from AAFC). The APP guarantees repayment of cash advances issued to farmers by the farmer organization. These guarantees help the farmer organization borrow money from financial institutions at lower interest rates and issue farmers a cash advance on the anticipated value of their farm product that is being produced and/or that is in storage. The cash advance rate must not exceed 50 per cent of the average market price that the Minister estimates will be payable to farmers of the agricultural product in that area. The farmer has until the end of the production period (maximum of 18 months) to repay the cash advance. Farmers have to repay their cash advances as their agricultural product is sold or when they are entitled to a payment under a BRM program (CAIS or Product Insurance).

5.3.4 *Alberta Farm Recovery Plan*

In 2007, the Alberta Government announced transitional assistance for Alberta farmers faced with the economic strains attributed to Canada's rising dollar, the drop in livestock prices and high feed prices–spurred on by the demand for biofuels in the US. The AFRP was designed to provide an immediate injection of funds to help the livestock sector adjust to the new market realities of increased cost pressure and emerging global trends.

The AFRP was modeled on an existing Alberta framework that had a proven track record of delivering timely payments to farmers–FIDP. The AFRP provides transitional funding which "targets" payments to farmers that demonstrate need. This method eliminates the risk of compensating farmers for their loss more than once through different programming.

The AFRP builds on the CAIS program by providing an immediate injection of funds to farmers faced with economic strain. Eligibility for payments under AFRP are determined using 2006 CAIS calculations. Farmers already participating in the CAIS program at that time automatically saw their AFRP entitlements calculated. Farmers who were not existing CAIS participants were required to submit a 2006 CAIS application prior to December 31, 2007 in order to apply for AFRP funds. Application acceptance for the AFRP funds did not necessarily grant acceptance into the 2006 CAIS program. The 2006 CAIS program year was selected because it represents the most recent year with complete information and allowed for quicker processing with no application submission requirements.

5.4 Identification and Analysis of Adaptive Policy Mechanisms

In this section, we examine the specific design features of income stabilization programming to

identify the adaptive policy mechanisms. The analysis is based on the framework for APs described in Section 2.3. The examination will identify adaptive policy mechanisms that have helped the policy effectively respond to both anticipated and unanticipated conditions under which the policy must operate.

5.4.1 Adaptive Mechanism of the Net Income Stabilization Account

NISA is the predecessor income stabilization program to CAIS. NISA was viewed more favourably across the prairies relative to the current CAIS program. It was believed to be more predictable and straightforward. In fact, many thought it was the best program going–it aided farmers by setting aside money that could be used to deal with tough times. Through an analysis of the program, it has been determined that it has two adaptive features.

Subsidiarity

In 1995, Alberta withdrew from federal NISA program based on concerns that:

a. government funding was distributed every year to every farmer regardless of need;
b. the continuing aversion of the cattle industries to support stabilization; and
c. because accounts were not being drawn down in response to low farm returns (Hedley, 2004).

In 1994, Alberta began extensive consultations with farmers across Alberta. The consultations lead to the creation of the FIDP and the withdrawal from NISA in 1995. FIDP provided income support to Alberta farmers experiencing, for reasons beyond their control, an extreme reduction in farm income. The program responded to the continuing decline in hog prices and the hog industry's position that commodity-specific programming was unacceptable because of trade implications. The program designed to supplement the net income of farmers, regardless of the commodity, when the current year net income fell below 70 per cent of the average for the proceeding five years.

Formal Review and Continuous Learning

While not a mechanisms specific to the NISA policy instrument, the Office of the Auditor General of Canada audits federal government operations and provides Parliament with independent information, advice and assurance regarding the federal government's stewardship of public funds. NISA was a federal-provincial cost shared program and it was audited annually.

Automatic Adjustment

In lower income years, farmers could make withdrawals from the funds they have set aside. Withdrawals were triggered when gross margins fell below a three-year average (gross margin trigger) or when family income fell below a minimum family income level (minimum income trigger).

5.4.2 *Adaptive Mechanism of the Canadian Income Stabilization Account*

CAIS is a program that arose out of the second generation of income stabilization policy. Most respondents thought that this program was difficult and complicated to use and always seemed to be changing. Promoting variation is the main adaptive mechanism observed in this agriculture policy.

Promoting Variation

The Alberta government felt it necessary to provide a greater variety of income stabilization in the province given that agriculture farmers were exposed to a range of shocks and stresses in the province. The AFRP was launched in 2007 to address the economic strain that Alberta farmers were facing attributed to Canada's rising dollar, the drop in livestock prices and high feed prices spurred on by demand for biofuels in the U.S. The AFRP builds on the CAIS program by providing an immediate injection of funds to farmers faced with economic strain utilizing 2006 CAIS information and illustrates the importance of variation in policy response.

5.4.3 *Adaptive Mechanism of the New Business Risk Management Suite*

A third generation of income stabilization policy is now being implemented in Canada.. Under this new policy a suite of business risk management programs are being developed and rolled out. Through an analysis of the available information on these programs, it appears that two adaptive mechanisms are being leveraged in the design and implementation of the programs: multi-perspective deliberation and promoting variation.

Multi-perspective Deliberation

National stakeholder consultations were held with over 3,000 farmers and processors to understand what the sector requires to effectively manage risk. Additional consultations will continue to make sure the new suite of programs will:

- encourage innovation–from basic research to practical implementation;
- generate benefits for the sector and all Canadians by contributing to priorities such as food safety, environmental sustainability, and health and wellness;
- be flexible so that provinces and territories can adapt programs to regional needs;
- modernize and put in place innovative regulations and standards, while meeting the needs of society and helping the sector be competitive; and,
- ensure simple, transparent and efficient service delivery for all programs.

Promoting Variation

Under the new income stabilization program that is currently under development, a suite of programs are being developed to complement one another and manage risk:

- **AgriInvest** – provides coverage for small income declines and allows for investments that help mitigate risks or improve market income;
- *AgriStability* – provides support when a farmer experiences larger farm income losses; *AgriRecovery* – provides a coordinated process for federal, provincial and territorial governments to respond rapidly when disasters strike, filling gaps not covered by existing programs; and
- **AgriInsurance** – an existing program which includes insurance against production losses for specified perils (weather, pests and disease) and is being expanded to include more commodities (AAFC, 2007).

6.0 The Alberta Irrigation District Program: An Adaptive Policy Analysis

Irrigation plays a major role in water management and allocation in Alberta. More than 1.6 million acres are irrigated in Alberta, representing two-thirds of all irrigation development in Canada (Alberta Irrigation Information, 2007). Irrigation accounts for 71 per cent of surface water use in the province, compared with 15 per cent for commercial and industrial use, and 5 per cent for municipal use (Nichol, 2005). Delivery and use of irrigation water in Alberta is controlled by 13 IDs, all of which are located within the (SSRB). Each district is run by a board of directors that is elected by farmers owning irrigated land within the district, a structure legislated by the IDA of 2000.

A prime component of the water allocation system in Alberta is that the right to divert and use water is prioritized under a "first-in-time, first-in-right" principle. In other words, the rights of "senior" license holders (for example, holders of licenses granted earlier in time) trump those of more "junior" license holders. The IDs hold the majority of the senior licenses in the province, giving them priority access to available water. As well, the IDs hold licenses accounting for approximately 75 per cent of the total volume of water allocated in the SSRB (Bjornlund *et al.*, 2006). The tremendous volume of water under their control, combined with the seniority of their licenses, make the IDs dominant players, both economically and politically, in Alberta's water rights regime (Bankes and Kwasniuk, 2005).

This section will describe and analyze the evolution of irrigation district policy in Alberta using its largest ID (the SMRID) as the main case study.

Box 6-1: What is an Irrigation District?

According to the IDA (2000), an "Irrigation District" is a corporation that operates in a similar manner to a municipality, with a board of directors responsible for managing the affairs of the district. The main responsibilities of the IDs are to deliver water to irrigation farmers and maintain the irrigation infrastructure. Irrigators within the district have their irrigable acres listed on the district's assessment roll. They pay a flat fee per acre for administration, maintenance and rehabilitation of the irrigation infrastructure, but do not pay for the water itself (Nichol, 2005). The license, granting water allocation rights, is owned by the ID, not the individual irrigators.

The IDs operate independently and the manner in which they carry out their functions varies due to their differing sizes and physical characteristics (Bjornlund *et al.*, 2006). For example, larger IDs are mandated to have a larger number of board members. As well, IDs tend to implement different irrigation technologies and may have different sources of revenue.

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6.1 Policy Intent

The general purpose of the *IDA* is "to provide for the formation, dissolution and governance of IDs in order that the management and delivery of water in the districts occur in an efficient manner that provides for the needs of the users" (Section 2). The text of the *IDA* cites a four-fold role for IDs:

- to convey and deliver water through the irrigation works of the district in accordance with this Act;
- to divert and use quantities of water in accordance with the terms and conditions of its license under the *Water Act*;
- to construct, operate and maintain the irrigation works of the district; and,
- to maintain and promote the economic viability of the district (Section 6).

Bankes and Kwasniuk (2005), argue that the values underlying the *IDA* are at odds with those of the *Water Act*, the other major piece of legislation regulating irrigation water allocation and use. They claim that the *IDA* reads more like a public utility statute concerned with fiscal stability, while the *Water Act* articulates the public interest in water conservation and broader environmental and ecological values.

Two main legislative tools govern the role and operations of IDs in Alberta: the *Water Act* (1999) and the *IDA* (2000). Both emerged from a major water law review in the 1990s. At a broad level, the *Water Act* defines the licensing requirements and allocations for all water users in the province, whether they be individuals or large organizations such as IDs. More specifically, this report focuses on policy emerging from the *IDA*, which defines the water management responsibilities and structure of the districts (given the distributed authority provided to them through the *Water Act*) (Alberta Agriculture, Food and Rural Development, 2004).

6.2 Policy Changes, Drivers and Impacts

Irrigation legislation in Alberta dates back to the *Northwest Irrigation Act* (*NIA*) in 1894. Railway companies had initiated the construction of irrigation projects in Southern Alberta in the 1880s, hoping to lure settlers to the area (Nichol, 2005). However, when settlers arrived, they brought with them the doctrine of riparian rights to settle disputes over water allocation. Under this system, water rights are restricted to those whose property abuts bodies of water (Nichol, 2005) and thus, large-scale irrigation or development of land away from a water source were not allowed (Percy, 2005). In response to this, "a substantial political movement began to support the development of a law of water allocation that was conducive to irrigation" (Percy, 2005: 2092).

6.2.1 The Early Years: Pre-1920

William Pearce, a Department of the Interior federal government official in the late 1800s, had a strong influence on resource development policies in Western Canada during this time, and was instrumental in the development of the *NIA* of 1894. He was an enthusiastic supporter of irrigation development and felt that irrigated agriculture was key to stimulating settlement of the area. The Act was thus designed to encourage agricultural settlement by providing secure water rights (Percy, 2005).

The Act established a clear and rigid system of rules based on legislation that was previously developed for gold fields in California (*AIA*, 2005). It placed control of water rights in the hands of the crown, restricted riparian rights and regulated the appropriation of water for all uses (Nichol, 2005). Water could only be acquired according to a licensing system, which stipulated the quantity of water a licensee could divert and use. Precedence for licenses were determined by the date the application was filed (Nichol, 2005 citing Percy, 1977), thus beginning an allocation system based on the "first-in-time, first-in-right" principle.

Nichol (2005) describes the *NIA* as the "cornerstone" of Alberta's water resource allocation system and contends that it remains the basis of water legislation in Alberta today. Four fundamental principles underlying Alberta water law have been carried forward from the original *NIA* through the entire 20th century (Percy, 2005):

- **Government ownership** – this means that the government can prohibit anyone from using or diverting water without first obtaining a license.
- **Allocation of water by license** – early licenses granted by the federal government typically established the right to divert large quantities of water for irrigation purposes. Many of the licenses held by the IDs date back to the late 1800s. These licenses were usually granted without a fixed term and were treated as permanent in nature. They could only be cancelled if the licensee committed an offense as specified in the Act.
- **Prior allocation principle** – the senior licensee is entitled to receive the entire allotment of water stipulated in the license before a junior licensee is entitled to receive any water. Priority of license depends on date of application.
- **Nontransferability** – water allocations were nontransferable, except if the land was sold (the license ownership transferred with the land). In 1894 Act, this rule was implicit as every license was required to incorporate a particular source of supply and point of diversion. Alberta made this rule explicit in the *Water Resources Act* (*WRA*) of 1930, stating that the licenses were inseparable from the land.

What Percy (2005) calls a "fatal flaw" of the 1894 Act was recognized early on in Southern Alberta.

The policy of handing out secure long-term water licenses combined with the prohibition of their transfer meant that water supplies would quickly become fully allocated. In 1920, a House of Commons debate highlighted the fact that granting large licences for irrigation might pre-empt water supplies required for new and expanding municipalities (Percy, 2005).

Government policy during this time consisted of conducting land and water surveys to determine feasibility of potential irrigation developments (IWMSC, 2002). Actual development of irrigation infrastructures was left to private companies that held the expectation that the projects would increase productivity and land values enough to recoup the construction and operation costs and provide a return on investment.

These expectations were too high, however, and returns were quite discouraging. Funds collected from irrigation users were not enough to cover the costs. Land sales were slow, and the administration of irrigation projects was a burden due to the high number of individual contractors and difficulty in collecting water rates (IWMSC, 2002). In response to this, the province passed the *IDA* in 1914. The legislation eased the burden to water suppliers by simplifying administration, and also provided a mechanism to allow farmers to organize themselves into local districts, which could then issue guaranteed bonds for the development of irrigation projects (Nichol, 2005). The districts were also given authority to levy taxes for the operation and maintenance of the irrigation projects and to deal with the day-to-day administration of the system [Alberta Agriculture Food and Rural Development (AAFRD), 2000]. The first farmer-owned, financed and operated ID established under this Act was the Taber Irrigation District in 1917.

6.2.2 *The Adjustment Years (1920 to 1950)*

Even with the creation of IDs reducing some of the administrative burden, the economics of irrigation farming remained problematic during the 1920s (Nichol, 2005). Many farmers could not afford to pay the assessed rates, and some projects continued to operate only by cash infusions from the founding companies or the federal or provincial governments (IWMSC, 2002). The province established several commissions to address the issues being faced by the irrigation sector. Reform measures from the commissions included:

- relieving irrigation water users from capital works debt by having corporate entities and governments shoulder large portions of capital costs;
- greater government financial responsibility, recognizing that benefits of irrigation go beyond the farm gate;
- encouraging higher value crops; and
- creating payment schedules more in keeping with the farmer's ability to pay (IWMSC, 2002).

In 1930, control of natural resources (including water resources) was transferred from the federal government to the provinces under the Natural Resources Transfer Agreement (Percy, 2005). The following year, the Alberta government passed the *WRA* (1931), which re-enacted the same model of water allocation law outlined in the original *NIA*. The legislation made explicit that water transfers were prohibited–water licenses were attached to the land and ownership would only be transferred through the sale of the land (Percy, 2005).

By 1950, the shift from corporate irrigation enterprises to farmer-run IDs was complete. Eleven of the 13 current IDs had been formed, and farmer-run organizations were seen as the most durable and effective administrative bodies for irrigation projects (IWMSC, 2002). The Alberta Irrigation Projects Association was established in 1946, creating a single voice for the IDs in dealing with government and other stakeholders.

6.2.3 Rehabilitation and Expansion of the Delivery Systems (1950 to 1970)

During this stage of irrigation development, there was direct involvement of federal and provincial governments in large irrigation infrastructure projects (IWMSC, 2002). The creation of the Prairie Farm Rehabilitation Administration (PFRA)–an arm of Agriculture Canada–in 1935 set in motion federal government involvement in rehabilitation by funding critical irrigation infrastructure projects By the 1950s, the PFRA had become a major player in both rehabilitation and expansion projects (Nichol, 2005). The goal of these investments was to stabilize and expand irrigated agriculture in Southern Alberta. Further incentive for major funding came from the need to resettle drought-stricken farmers and returning war veterans (IWMSC, 2002).

In 1968, the *Irrigation Act* was introduced. This act granted water licenses to IDs and provided uniform rules and administrative authorities for them. Each district was to be run by a board of directors (a structure still in place today) that would regulate the supply and distribution of water to users within the district. In 1969, the provincial government initiated a cost-sharing rehabilitation program, with the province providing 86 per cent and the districts 14 per cent of the funds. The program was extended in 1975 and several more times after 1980, and is still in place today as the IRP. The funding ratio is now 75 per cent from the province and 25 per cent from the districts.

By 1970, the federal and provincial governments had been involved in rehabilitation and expansion projects in almost all of the 13 IDs (IWMSC, 2002). The extensive support of the two levels of government between 1950 and 1970 helped give irrigation farmers confidence that their water supplies would not be suddenly cut off due to infrastructure failures or bankruptcy of the operating agency, events many had experienced in the past (IWMSC, 2002).

6.2.4 *Provincial and Irrigation District Control (1970 to 1990)*

IDs- experienced tremendous growth during the 1970s, with the area on the assessment rolls increasing by 50 per cent (from 280,000 to 420,000). This was due in large part to the increased use of sprinkler irrigation (especially centre-pivot sprinklers) which reduced irrigation manpower requirements and increased the area that could be supplied with water from the distribution network. Also during this time, the province took more control of the irrigation infrastructure. In 1973, the federal government signed an agreement with the province to withdraw from hands-on management of irrigation projects in the St. Mary River and Bow River developments. In 1975, the provincial government announced that Alberta Environment would assume responsibility for rehabilitation, operation and maintenance of the major irrigation headworks (the infrastructure required to divert water from its sources and convey it to districts). The objective of moving to provincial ownership was to maintain a secure and continuous supply of water for the districts and all other uses, and to operate the projects for multi-purpose use (IWMSC, 2002). Since that time, the Alberta government has been primarily responsible for planning, managing and constructing irrigation infrastructure, although the costs of many projects continue to be shared between the provincial government and the IDs (Johnston *et al.*, 2001).

Revisions to the *WRA* in 1975 gave irrigation water use priority over industrial, power or recreational use, third in water allocation behind domestic and municipal use (Nichol, 2005).

During the 1970s and 1980s, critics voiced concerns about the inflexibility of the province's water allocation policies (Nichol, 2005). Percy, 1977 argued that the appropriation system would maximize benefits of water use only by "sheer coincidence" (p. 163) and that it "fails to permit the transfer of a water rights where a new, more highly valued use must be carried on at a different location on the stream" (p. 164) (quoted in Nichol, 2005). Further, Percy (1977) claimed that the Act did not provide an adequate framework to deal with changing patterns of water use or with the competition for water among many different uses that were likely to occur in the future. Veeman, 1985 advocated transferable water rights to add flexibility to the system and encourage economic growth. In 1991, the government initiated a broad review of its water management policies, culminating in the passage of the *Water Act* (1999) and the *IDA* (2000) (discussed below).

The rapid expansion of irrigation during the 1970s coincided with increasing public and stakeholder concerns about environmental issues (IWMSC, 2002). At the same time, irrigation water supply shortages in the SSRB became more frequent. As a response, Alberta Environment initiated a review process in 1984 to examine water management issues in the SSRB. The Alberta Water Resources Commission held public hearings and produced a report of recommendations (1986). The SSRB Water Management Policy was announced in 1990 and provided guidelines related to irrigation expansions, multi-purpose use of water, priority uses and minimum and preferred in-stream flows, water conservation and public consultation.

Specifically, the policy called for the establishment of the maximum amounts of water that could be allocated for irrigation expansion, resulting in the *South Saskatchewan Basin Water Allocation Regulation*, passed in 1991. Under this regulation, the IDs could expand beyond their area limits if improvements in efficiencies and reduced return flows allow expansion within their respective licensed volumes (IWMSC, 2002). The SMRID has not held a plebiscite with its irrigators to expand the number of acres irrigated (personal communication with AAFRD representative). The government committed to reviewing the Regulation in the year 2000, resulting in Alberta Environment issuing an "Approved Water Management Plan for the South Saskatchewan River Basin" in August 2006. This plan supersedes the 1991 regulation and recommends it be repealed. The plan says that the *IDA* (2000) governs potential acreage expansions within the IDs within their existing allocations.

6.2.5 Major Water Law Reforms (1990-present)

By the early 1990s, increasing concerns over water shortages, more focus on environmental implications of water use, and frustration with the inflexibility of licence transfers highlighted the need to reform the 1931 *WRA*. Bankes, 1995 writes that "the *WRA* and its predecessor statutes were designed to meet the needs of a frontier community, not the needs of a post-industrial conserver society" (p. 2). In other words, the basic model of water law was not designed to deal with water scarcity:

"Legislation had essentially granted secure water licenses of indefinite duration that were free of charge, once a modest initial application fee had been paid, and not readily transferable, except with the land or undertaking to which they were attached. The system created no incentives for the efficient use of water and could allow water use to adapt in the face of changing societal needs only in the most cumbersome manner" (Percy, 2005).

In response, provincial policymakers started to shift their emphasis from managing water *supply* (for example, building dams and finding more water sources to tap) to managing water demands (for example, adjusting land use practices and water conservation techniques) in the context of potential water shortages (Johnston *et al.*, 2001). A major reform of water law during the 1990s resulted in the passages of the *Water Act (1999)* and the *IDA (2000)*, which together replaced the 1931 *WRA*. *The IDA* will be discussed in the next section, the focus here is on the *Water Act*.

The new *Water Act* has a much broader mandate than the previous *WRA* (Nichol, 2005). The purpose of the Act is "to support and promote the conservation and management of water" while recognizing the need for environmental sustainability and economic growth (Section 2). Reforms appearing in the new *Water Act* that have bearing for IDs include the following:

- **Enabling water licence transfers** – previously, licenses were attached to the land and could not be transferred separately from the land. The *Water Act* (Sections 81 and 82) allows licenses to be transferred to different parcels of land for existing or alternative uses (Rush *et al.*, 2004). Transferable water allocations were controversial during the reform consultation process with the result that a political safeguard was built into the Act. Any transfer must be authorized in an approved water management plan (for the SMRID, this is the SSRB Water Management Plan) or by an Order-in-Council. As water management plans are also approved by Cabinet, the Act ensures strong political oversight will guide any transfer decisions (Percy, 2005). The intent of the policy is that applications for transfers be adjudicated in the same way as new licenses (for example, they should bring no harm, no impairment to other users and not exceed the amount of water allocated in the original license). Percy (2005) says, in addition, transfers must not cause adverse effect on aquatic environment. Percy (2005) contends that the transfer provision adds an element of flexibility in water allocation:
- "It creates a practical and workable method for accommodating new users, and it provides an incentive for all water users to reduce wasteful use by allowing the marginal value of their water to be recognized. The Act also encourages the many changes in water use that can occur without raising serious issues of water policy." (p. 2102).
- ***Appointment of regional directors*** **–** regional directors, appointed by Alberta Environment, perform a variety of duties, including issuance, amendment, suspension and cancellation of registrations, approvals and licenses (Sections 38, 42, 51, 55) (Rush *et al.*, 2004). The directors have discretionary power to issue water management orders, prioritize water use in areas where there is a dispute and to issue licence transfers.
- ***Water conservation holdback*** **–** the Act allows regional directors to hold back up to 10 per cent of a license transfer to protect aquatic environments and facilitate implementation of water conservation objectives (Section 83) (Rush *et al.*, 2004).
- ***Integration of environmental concerns into licensing decisions*** – older legislation was broad enough to permit environmental factors to be considered in allocation decisions, but in practice, administrators focused more on the impact of a licence application on other water users than on the broader environmental implications (Percy, 2005). The new Act specifically integrates evaluations of licence applications with provincial environmental protection and assessment regimes. Transfer applicants are required to provide public notice of an application and any person who feels "directly affected" by the application can submit a statement of concern to the regional director, and ultimately bring an appeal to the Environmental Appeal Board if the director decides to issue the licence (Percy, 2005).

Bankes and Kwasniuk (2005), argue that the *Water Act* strengthens the IDs' control of water resources. First of all, the Act maintains the "first-in-time, first-in-right" principle of allocation. An

Alberta Institute of Agrologists report (2005) contends that politicians gave clear direction to drafting committee that first-in-time rights were to be respected and were not up for debate (AIA, 2005). Secondly, the Act accords an "extraordinary degree of protection upon those water rights that predate the new Act" (Bankes and Kwasniuk, 2005: 7). The Act recognizes licences issued under predecessor Acts and protects their original priorities, terms and conditions (IWMSC, 2002). For example, licences issued under the *Water Act* have expiry dates, while licenses that predate the Act (such as those held by IDs) were typically issued in perpetuity. As well, directors may suspend licenses that have an adverse effect on the aquatic environment only if the licenses were issued after the Act came into effect (older licenses are exempt).

A final document related to irrigation policy development is the provincial government's Water for Life Strategy (published in 2003), which outlines the basic foundation for a water management plan for the next decade. The Strategy is based on attaining three key goals: a safe, secure drinking water supply; healthy aquatic ecosystems; and reliable, quality water supplies for a sustainable economy. As with all previous water policies, the Strategy reiterates the "first-in-time, first-in-right" allocation principle (AIA, 2005). It also calls for adopting a watershed approach to management and decision-making. Local Watershed Planning and Advisory Councils were to be created to aid in setting priorities for water management. The councils are intended to act as a liaison between provincial-level committees and local governments in the watershed. However, they do not have any regulatory power (Rush *et al.*, 2004). Other highlights of the strategy include:

- increasing efficiency and productivity of water by 30 per cent by 2015;
- establishing a multi-stakeholder advisory council to guide implementation of the strategy;
- implementing broad-based water conservation activities; and
- monitoring water allocation transfers within each river basin.

6.3 Details of Policy Design and Implementation

The Alberta government's reform of water law in the 1990s included a review of irrigation legislation. The review was conducted in response to issues raised by IDs, irrigation farmers and other stakeholders. A key issue raised was the need for greater autonomy for IDs so that they could manage their affairs in an "effective manner" (Bankes and Kwasniuk, 2005). The new IDA maintained the governance structure from previous Acts, but also introduced changes to water transfer provisions that have strengthened ID control of water resources and increased the rights of derivative users (irrigators within the IDs).

6.3.1 Governance Structure

Part two of the *IDA* outlines the governance structure for the IDs. The Act is administered by AAFRD, as compared with the Water Act, that is administered by Alberta Environment.

The Act establishes each of the 13 IDs as corporations. It further mandates that each ID must be run by a board of directors. The Minister appoints the first board. The number of members on the board is determined by the size of the ID. For example, because the SMRID has greater than 200,000 assessment acres, its board must have seven members. A person is eligible to serve on the board if he/she is an irrigator within the ID (except in rare circumstances). Each ID must also appoint a manager. In the SMRID, the organizational structure is such that a general manager oversees staff in the areas of administration, engineering, and operations and maintenance.

The *IDA* also maintains an Irrigation Council from previous legislation. The council is made up of not more than seven members, each appointed by the Minister. The role of the council is to monitor the operation and financial performance of the district. The government has signed agreements with each district to cost-share rehabilitation projects within the districts (the IRP). The Council must grant approval before a district makes an expenditure under the IRP. An irrigation secretariat assists the council in fulfilling its functions.

The ID is also mandated to pass rate bylaws each year, encompassing fees for administration, maintenance and some rehabilitation of the irrigation infrastructure. Irrigators that have their irrigable acres on the assessment roll constitute the ID's ratepayers. The assessment roll includes a list of all parcels of land that contain irrigation acres and for each parcel lists the legal description of the land, the name of the owner, the number of irrigation acres. The fees are charged on a per acre basis. The ID may pass other bylaws (for example, governing the maximum amount of water that may be delivered by the district to each acre or governing how the water is delivered and distributed to users).

6.3.2 *Changes under the New IDA*

Bankes and Kwasniuk (2005) argue that the most recent law reforms give more control of water allocation to the IDs and also more rights to derivative users (users that do not hold licenses themselves, but have rights to obtain water from a licensee). Irrigation farmers within IDs are considered derivative users. Major changes under the new Act include the following (see Bankes and Kwasniuk, 2005 for a detailed interpretation of the changes):

- **Permanent license transfers** – formal licence transfers are governed by the *Water Act* (as described above) with further stipulations outlined in the *IDA*. For example, the ID must hold a public meeting announcing the transfer and must hold a plebiscite to gain approval of irrigators in the district. If more than 50 per cent of irrigators vote in favour of the transfer, the application will go forward to Alberta Environment.
- **Temporary license transfers** – irrigators have always been able to transfer water allocations among their own parcels of land (Nichol, 2005). However, Bankes and Kwasniuk (2005) note that under the *IDA* (Section 25), the transfer requires only the

approval of the ID, whereas under the *Water Act* and predecessor legislation, it would require a formal licence transfer process.

  - Under Section 26, an irrigator may transfer water entitlements to another parcel of land not owned by the irrigator (as long as the land is eligible to be served by the ID). Such a transfer was not possible under the *WRA* and is only possible within the *Water Act* as part of a formal transfer. Importantly, under the *Water Act*, this transfer would be subject to the 10 per cent conservation holdback provision and an assessment of the effects on the aquatic environment. Under the *IDA*, these rules do not apply, making the process much simpler to complete.

- **Rural use agreements** – a 2002 amendment to the *IDA* (Section 19) allows an ID to enter into a rural use agreement that allows district water to be used for purposes other than irrigation. Before, the water user would have needed to obtain a license under the *Water Act* (or *WRA*) to use water for non-irrigation purposes. With the moratorium on granting new licenses in the SSRB, it is unlikely that the user would be successful in obtaining a license under the *Water Act*, so this is a significant amendment.
- Bankes and Kwasniuk (2005) conclude that the *IDA* and related amendments increase the authority of the IDs to allocate and reallocate water within the districts. With the option of obtaining a license under the *Water Act* or using the provisions of the *IDA*, it is expected that IDs will choose the latter route. It avoids the 10 per cent conservation holdback, avoids triggering a review by the regional director (and potentially the Environmental Appeal Board), and minimizes transaction costs. There is further economic incentive in that by amending licenses under the *IDA* and not transferring them under the *Water Act*, the ID maintains control over the entire licensed amount and will earn income from the annual water fees.

6.4 Identification and Analysis of Adaptive Policy Mechanisms

Mechanisms of adaptive policies observed in the ID program are summarized below. The analytical framework used in this section follows that outlined in Section 2.3.

6.4.1 Automatic Adjustment

There are a number of policies and programs emerging from the *IDA* that demonstrate an automatic adjustment mechanism by anticipating a range of socio-economic and environmental conditions.

IRP

The IRP began in 1969 and is a cost-shared program between the AAFRD and the 13 IDs, renewed through annual agreements between the province and each district. The aim of the program is to rehabilitate water conveyance and storage infrastructures. Currently, the cost-share ratio has 75 per cent of the funds coming from the province and 25 per cent from the ID. Funding

levels have ranged from $600,000 to $32M over the life of the program. The SMRID received $5.9M in grants from the provincial government in 2006.

The automatic adjustment mechanism in the policy is in the inter-district funding formula. Half of the money is allocated on the basis of the number of irrigation acres in each district, and the other half is distributed on the basis of the infrastructure replacement cost of specified infrastructure in each district. Each of these two values will shift within and between IDs from year to year, and thus the policy is able to adjust for changing needs annually.

6.4.2 *Integrated Assessment*

2001 Water Sharing Agreement

The SMRID played a leadership role in establishing the WSA between IDs, municipalities and industrial water users during the drought year of 2001. The WSA will be discussed in detail under the section on Self-Organization and Networking, but one component of building the agreement provides an example of an integrated assessment policy mechanism.

Representatives from Alberta Environment and AAFRD formed a technical advisory committee to the IDs and other groups negotiating the sharing agreement. Though not voting members, they attended all meetings to provide information about how priority might be implemented under a variety of water supply scenarios and about laws and policies (Rush *et al.*, 2004). Through monthly planning sessions, water supply forecasts and water rationing strategies for irrigation and non-irrigation users were formulated. The Irrigation Branch of AAFRD then worked with the IDs and Alberta Environment, to calculate estimates of the volume of water that would be available, and were also able to calculate values for each farmer using individual on-farm irrigation system data (personal communication with AAFRD representative).

6.4.3 *Multi-perspective Deliberation*

SSRB Water Management Policy

Predictions of water shortages led the provincial government to develop a policy establishing guidelines for irrigation expansion within the IDs (IWMSC, 2002). The SSRB Water Management Policy was released in 1990, and is an example of a multi-perspective deliberation policy mechanism. The guidelines were created through a multi-stakeholder process that considered the following inputs:

- the Alberta Water Resources Commission recommendations on the location and magnitude of irrigation expansion (which itself was the result of extensive public consultation);
- consultations with the Irrigation Council, representatives of IDs, and existing and potential

irrigation farmers; and
- discussions with Members of the Legislative Assembly.

Ultimately, the guidelines appear in the South Saskatchewan Basin Water Allocation Regulation (1991) and established the maximum amounts of water that can be allocated for irrigation.

Water Transfer
As described in the previous section, permanent water license transfers are governed by the *Water Act*, with further rules given in the *IDA* if the transfer involves an ID. The ID is required to hold a public meeting discussing the potential transfer and must hold a plebiscite to gain the approval of at least 50 per cent of the irrigators in the district before the transfer application will go forward to Alberta Environment.

2001 Water Sharing Agreement
The WSA is a good example of multi-perspective deliberation. It brought together a diverse group of stakeholders (ID members, residents from cities and towns, recreational water users and industrial water users) who were able to reach consensus regarding how to equitably share the available water during a drought year. As well, the use of experts from Alberta Environment and AAFRD as a technical advisory committee added another perspective and another level of deliberation.

6.4.4 Self-organization and Social Networking

2001 Water Sharing Agreement
A prime example of social networking and self-organization in policy building occurred in 2001. Southern Alberta was hit by unprecedented drought conditions in 2000 and 2001, presenting a major challenge to all farmers in the region. The winter of 1999-2000 saw below normal snowpack in the Rocky Mountains (the source of fresh water for irrigation). This was followed by below-normal precipitation in 2000, leading to low reservoir storage levels in the fall of 2000. Anticipating more water shortages for 2001, ID officials from the "Southern Tribs" (districts supplied by water from the three main tributaries that supply the Oldman River from the south–the Waterton, Belly and St. Mary Rivers) convened a multi-agency coordinating committee to construct and implement a mitigation and preparedness plan in case the conditions did not improve by the start of the 2001 irrigation season.

Originally, the group was the SMRID Main Canal Advisory Committee made up of managers from the St. Mary River, Taber and Raymond IDs. This committee was already in existence, meeting regularly to discuss the operation of their common irrigation canal (the "main canal" in the committee title) (Milk River Watershed News, 2002). These three districts represent approximately 80 per cent of the irrigation area in the Southern Tribs.

In November 2000, other stakeholders were invited to the table. The committee was first expanded to add the four other IDs in the area (Magrath, United, Aetna and Leavitt districts), and then in the spring of 2001, other affected water users were invited to join the water-sharing group. These included municipal water users (towns and villages such as Coaldale, Grassy Lake, Bow Island, Cardston, Magrath, Raymon, Taber, Barnwell, Burdett, Foremost, Hillspring, Stirling and Warner), commercial and industrial water users (for example, Rogers Sugar, Old Dutch Potato Chips, Lamb-Weston, Husky Oil and Shell), and recreation users (such as golf courses). Owners of private water licenses joined together to form the Southern Water Users Association, and also became part of the discussions.

The IDs proposed a water-sharing arrangement to allow all licence holders to receive an equitable portion of whatever water would become available. The water sharing agreement put aside the "first-in-time, first-in-right" doctrine that underpins the Alberta irrigation regulation and instead implemented an equal sharing of water regardless of the dates on the licenses. This prevented senior licence holders from diverting their full rations of water and leaving none for junior holders.

However, power differentials between the IDs and other members of the water-sharing group are significant. Because the province has maintained the "first-in-time, first-in-right" approach to water rights, owners of higher-priority licenses are still able to take priority rather than their share. The IDs thus hold ultimate decision-making power, making them critical players in any future water-sharing agreements (Rush *et al*, 2004).

Emergency Preparedness

The SMRID has been instrumental in developing networks in the region to work together to construct emergency preparedness plans. In conjunction with other IDs, affected towns and villages, water coops and others, the SMRID began developing a disaster communication plan after an extreme rainfall event in 1995. The dry season of 2001 extended the plan to include responses to both drought and flooding, and more extreme rains in 2002 and 2005 began to test the various components of the plan. An SMRID board member believes that "we now have a much better idea what can happen, and we're much more prepared for it" (personal communication). For example, in preparation for an extreme rainfall event, SMRID staff is prohibited from taking holidays between June 1 and June 15. All staff members are available in case of an emergency. The plan also calls for the SMRID to hire vehicles, backhoes, pumps, trucks and whatever else might be needed to help drain flooded areas. Similarly, a long-term emergency plan is in place for drought, and "if we get to a situation where it looks like we're going to need to ration, [the SMRID is] prepared to put the plan into action" (SMRID board member, personal communication). The SMRID plan is also co-ordinated with similar emergency response plans in the Town of Coaldale, the City of Lethbridge, and the County of Lethbridge. This plan has now been established as SMRID policy.

Water Markets

Changes to the *Water Act* (1999) and the *IDA* (2000) have allowed temporary and permanent transfer of water rights in Alberta. By allowing water rights to be tradable, the province has transformed "historical licenses into marketable commodities" (Horbulyk and Lo, 1998: 245) in Nichol (2005), ultimately providing flexibility in what had become an intractable water allocation situation. Firstly, the province had instituted moratoriums in the major river basins, meaning there was no further water to allocate to new users. At the same time, the province continued to perpetuate the "first-in-time, first-in-right" principle of water rights, meaning that the IDs maintained control of the vast majority of water resources through senior licenses (without an expiry date). Finally, because stakeholders in the province were resistant to the implementation of water metering, a water-pricing regime was not a possible policy solution.

The transfer provisions in the *Water Act* and the *IDA* have created an economic instrument–water markets–that display the characteristics of self-organization in both the informal and formal markets that have emerged.

Informal Markets.

In the SMRID, water rationing in 2001 precipitated the creation of an informal market for trading water allocations. Section 26 of the *IDA* allows irrigators to temporarily transfer water allocations to other irrigators in the district. Following the Act, the SMRID defined rules for the transfer process (Nichol, 2005). For example, owners of the parcels of land were required to sign a 2001 Water Allocation Transfer form (at the SMRID offices). Transfers were temporary, not subject to any fees and could take place at any time during the irrigation season. Under special circumstances, transfers could take place between users in the SMRID, the Raymond Irrigation District (RID), and the Taber Irrigation District (TID). At the time, the SMRID, RID and TID were involved in the development of a communal water- sharing agreement to deal with the water shortage.

The SMRID experienced more market activity than other IDs in 2001, with 222 water transactions registered during the irrigation season. Nichol (2005) found there were 151 unique buyers and 114 unique sellers (representing about 12 per cent of irrigators in the district). Approximately 1,500 farmers in the SMRID did not participate in market activity.

Nichol (2005) found that the majority of buyers and sellers found each other through word of mouth, though some buyers found sellers hard to locate. The SMRID now maintains a list of potential buyers and sellers on its website. As the summer wore on and the drought intensified, the rate of transactions increased. Transfers tended to shift water use to higher-value crops such as potatoes and sugar beets. An advantage of temporary, short-term water leases is that buyers purchase water on an as-needed basis, avoiding unnecessary costs when precipitation levels are

high. Nichol (2005) found that prices did not decline with increasing volumes of water purchased, indicating that those users requiring large amounts of water paid a premium. The largest volumes purchased were for potato and specialty crop production and averaged $89 per acre-foot. Smaller volumes purchased for lower-valued crops, like cereals and oilseeds, averaged $69 per acre-foot.

Formal Markets

Sections 81 and 82 of the *Water Act* define the legal process for permanent transfers of water licences. Very limited activity has taken place in the formal market of trading permanent water rights. Horbulyk (2007) reports that less than 10 permanent transfers had been authorized by early 2006. License purchases are limited to those who already have a license, keeping many who would buy rights for non-consumptive uses (for example, maintaining in-stream flows) out of the market, though one can become eligible by buying land with an attached license. Nichol (2005) explored six case studies of permanent transfers, finding that participants incurred considerable expense to set up new systems and protocols for those that might follow.

Alberta's water markets do not yet feature prominent "water banks," "trading exchanges" or other marketplace infrastructure. However, anecdotal evidence suggests that a number of individuals within the irrigation industry are willing to act as market intermediaries–one private sector electronic trading exchange is ready to commence once there is a viable market. Rush *et al.* (2004) suggest that IDs are not interested in permanent transfers that would leave the district, but might accept long-term leases to certain industries.

6.4.5 Formal Review and Continuous Learning

SSRB Water Management Planning

In creating the South Saskatchewan Basin Water Allocation Regulation (1991), the provincial government demonstrated the use of a formal review policy mechanism. The regulation set the maximum amount of water that can be allocated for irrigation in each ID (the limit for the SMRID was 150,000 hectares). However, the maximum allocations were recognized as approximations based on partial scientific knowledge. The government, therefore, committed to reviewing the regulation in 2000 because of the "limitations of the databases and estimates of current and future water uses" (IWMSC, 2002: 21). As a result, Alberta Environment issued an "Approved Water Management Plan for the South Saskatchewan River Basin" in August 2006.

2001 Water Sharing Agreement

During the 2001 drought year, mechanisms were developed to monitor and equitably distribute whatever amount of water would become available. Early predictions suggested six inches per irrigated acre, but this increased to eight inches in May and finally to 10 inches in early June. The Irrigation Branch of the Alberta government (within AAFRD) along with the ID, calculated for each farmer how many days of irrigation he/she was entitled to, taking into account factors such as

the total area irrigated and the method of irrigation used. The IDs have been commended for their work in creating an equitable water management strategy by the International Irrigation Association, the provincial and federal governments, the U.S. government and the World Committee on Irrigation and Drainage.

Conservation Holdback

The *Water Act* has integrated a formal review mechanism within the licence-transfer process through the introduction of a conservation holdback provision. The transfer application process triggers an environmental review by the regional director, giving him/her discretion to hold back up to 10 per cent of the water allocation being transferred to meet the government's conservation objectives and protect aquatic environments. However, the holdback provision is modest and unlikely to restore large quantities of water to a river system (Percy, 2005)–Alberta Environment has admitted that this holdback provision, in addition to any license cancellations, will not produce significant environmental benefits (Nichol, 2005).

6.4.6 Subsidiarity

Irrigation Districts Act

The *IDA* stipulates that each ID is its own private corporation. Because of this, each district operates independently and how it carries out its functions can vary due to differing sizes and physical characteristics (Bjornlund *et al.*, 2006). At the discretion of the board, each district charges a flat fee per acre to cover administration and maintenance of the irrigation system. For example, the fee varied from $8.25 in the United Irrigation District to $18.50 in the SMRID (the Eastern Irrigation District chose to waive the irrigation rate in recognition of the economic impacts of the BSE crisis) (Alberta Agriculture and Food, 2007). The large variance in rates is the result of differing irrigation technologies (piped versus pressurized water supply) and whether the districts have alternate sources of funding (Bjornlund *et al.*, 2006).

Water transfer provisions in the *IDA* and *Water Act* also promote variation in solutions for water allocation issues. Transfers may be temporary leases or permanent licence transfers.

The *Water Act* allows for regional differences to be accounted for in calling for the creation of regional water management plans (for example, the SSRB Water Management Plan). Local and regional public consultation are a key component of developing these plans, providing another opportunity to incorporate unique, local solutions to water management issues (*Alberta Water Act* Fact Sheets).

Water for Life Strategy

Rush *et al.* (2004) describe the watershed as an optimal unit for water management and planning because it's a complete hydrologic unit and therefore an appropriate scale for looking at sustainability. The Alberta Water for Life Strategy called for the establishment of Local Watershed

Planning and Advisory Councils to act as a liaison between the province and local governments within the watershed. The SMRID is located in the Oldman Watershed and is a member of the Oldman Watershed Planning and Advisory Council. This committee was active in providing recommendations to the South Saskatchewan River Basin Water Management Plan, published in 2006 and is still currently an active group. Its mission is "To maintain and improve the Oldman River Watershed through partnerships, knowledge and the implementation and integration of sustainable watershed management and land use practices" (for more details, visit the Oldman Watershed Council website at: http://www.oldmanbasin.org/what_council.html).

Water Act

Under the *Water Act*, directors are appointed by Alberta Environment at a regional level to issue, amend, suspend or cancel water licenses.

7.0 Conclusions

The Alberta case study focused on two coping and adaptation measures to respond to climatic stresses on the prairies–income stabilization and irrigation planning and management. In this section, we address two high-level questions relevant to this research project:

1. Do public policies that build the capacity of communities to cope with surprise and change have adaptive features?
2. What adaptive features enable policies to remain effective?

7.1 Do Public Policies that Build the Capacity of Communities to Cope with Surprise and Change have Adaptive Features?

This case study analyzed a series of policies linked with income stabilization in the CAIS program, and irrigation planning and management through the Alberta Irrigation District (AID) program.

For the AID, the presence of a provincial program implemented at a district level to provide irrigation infrastructure and operational and management capacity for this infrastructure (and the water resource it distributes), serves as a short-term coping and long-term adaptation measure for farmers in southern Alberta. An analysis of the *IDA* and the AID program revealed several examples across the range of adaptive policy mechanisms. From these observations, it would appear that in this case, public policies that build the capacity of communities to cope with surprise and change do have adaptive features.

But does this program help reduce the vulnerability and increase the resilience of the farmers in this region? In seeing vulnerability as a function of exposure to stress and the ability to adapt to stress, the answer to this question is not clear cut. While it is certainly the case that adaptive capacity is increased through irrigation and irrigation management, the practice of irrigation in general serves to maintain exposure to a region that is prone to drought and insufficient average precipitation necessary for profitable agriculture production. Relative to an area that produces similar crops in the same climatic region, the area with irrigation can be said to be less vulnerable. And assuming that the exposure in the region to the climate stress (for example, drought) does not increase in the future, irrigation can reduce overall vulnerability. But if the exposure does increase in the future, as might be the case with climate change, vulnerability might remain either the same or increase as a result.

From the perspective of long-term resilience of the agro-ecosystem the AID program displays many of the features which Berkes *et al.*, 2001 cite as helping to build community resilience. These

features are summarized in Table 7-1 and include learning to live with change and uncertainty, nurturing diversity, combining different kinds of knowledge and creating opportunity for self-organization. From the list of resilience factors in the table, we can see that the AID program exhibits many factors in each of the categories. From the creation of emergency preparedness plans, water sharing agreements and water-conservation practices, the AID program has demonstrated that farmers are learning to live with uncertainty and change, and this has certainly created opportunity for self-organization. In times of climatic stresses, some IDs have opted not to expand their irrigated land to conserve their water resource to help them deal with future climate stress. The only factor that might be in question is does irrigation, however well managed, nurture ecological memory? The practice of irrigation, by its inherent function, is masking the ecological feedback from the climate system. Taking the thought experiment to the extreme–drought of such length that the water resource is depleted–if the AID program has been successful in promoting self-organization and building the rapid feedback capacity to respond to environmental change, the program could evolve into some other useful purpose aside from managing water for irrigation.

Table 7-1. Clusters of Factors for Building Resilience from the Local Perspective in Lagoon Social-ecological Systems (from Berkes and Seixas (2005) – categories based on Folke *et al*. (2003).

Resilience Clusters	Resilience Factors
Learning to live with change and uncertainty.	• Learning from crises. • Building rapid feedback capacity to respond to environmental change. • Managing disturbance. • Building a portfolio of livelihood activities. • Developing coping strategies.
Nurturing diversity for re-organization and renewal.	• Nurturing ecological memory. • Nurturing a diversity of institutions to respond to change. • Creating political space for experimentation. • Building user trust . • Using social memory as source of innovation and novelty.
Combining different kinds of knowledge.	• Building capacity to monitor the environment. • Building capacity for participatory management. • Building institutions that frame learning, memory and creativity. • Creating cross-scale mechanisms to share knowledge. • Combining local and scientific knowledge.
Creating opportunity for self-organization.	• Building capacity for user self-organization. • Building conflict management mechanisms. • Building self-organization for equity in resource access and allocation. • Building self-organization in response to external drivers. • Creating matching scales of ecosystem and governance. • Creating multi-level governance.

For the CAIS program, we also found evidence it was a short-term coping measure used by farmers in the regions studied. There were significantly fewer adaptive policy features evident from the analysis of this policy, relative to the AID program. This observation is consistent with the

predominantly negative feedback of the policy from respondents interviewed across the Prairie Provinces. Nonetheless, four examples of adaptive policy mechanisms were identified, further supporting the hypothesis that policies which help communities cope with stress will have adaptive policy features.

But we must also ask the question, is vulnerability reduced and resilience increased or maintained through the use of this income stabilization policy? With respect to vulnerability, adaptive capacity is certainly increased via policies which help farmers to stabilize their economic resources. If exposure to the climate stress remains the same over time, vulnerability could be said to be reduced via the policy. If, however, climate change results in an increase in the exposure to climate shocks and stresses, then vulnerability may not be reduced, and could possibly increase.

With respect to resilience, the CAIS program does not appear to have as many positive attributes as compared to the AID program. Most notably, since the payout is not linked with any change in behaviour, with regard to coping or adapting to the stress that was experienced, the income stabilization payout does not appear to help farmers learn to live with change and uncertainty.

7.2 What Adaptive Features Enable Policies to Remain Effective?

A summary of the adaptive policy mechanisms observed in the three generations of income stabilization programs in Alberta and also in the ID related programs is provided in Table 7-2. Examples were observed across all seven adaptive policy mechanisms. Most examples came from the AID program and share the context of dealing with unanticipated conditions.

One example of automatic adjustment was observed in the ID's IRP and involved the inter-district funding formula. Half of the funds are allocated based on the number of irrigation acres in each district, and half are allocated based on the infrastructure replacement cost of specified infrastructure in each district. Each of these two values will shift within and between IDs from year to year, and thus the policy is able to adjust for changing needs annually.

For acquiring multiple perspectives from an analytical basis, an example of integrated assessment was seen in the ID's WSA in which water supply forecasts and water rationing strategies for irrigation and non-irrigation users were formulated. There were four examples for obtaining multiple perspectives through deliberative processes. The first was from the next generation of income stabilization programs under APF II in which stakeholder consultations were held to understand sector requirements in the new suite of risk-management programs. The other three examples were from ID-related programs. For example, in developing water transfers, ID's are required to hold a public meeting to discuss the potential transfer and must hold a plebiscite to gain the approval of at least 50 per cent of the irrigators in the district before a transfer application will go forward to Alberta Environment. Also, in relation to the 2001 WSA, ID's brought together

a diverse group of stakeholders (IDs, people from cities and towns, recreational water users and industrial water users) who were able to reach consensus regarding how to equitably share the available water during a drought year.

Examples of formal review and improvement processes were observed in the ID-related programs. The WSA developed mechanisms to monitor and equitably distribute whatever amount of water that would become available. A conservation holdback provision was developed in which a transfer application process triggers an environmental review by the regional director, giving him/her discretion to hold back up to 10 per cent of the water allocation being transferred to meet the government's conservation objectives and protect aquatic environments. Also, the Water Management Planning Process for the SSRB committed to reviewing the regulation in 2000 because of "limitations of the databases and estimates of current and future water uses."

It was evident that one of the ID programs' greatest strengths (from the perspective of adaptive policies) was its ability to promote self-organization and social networks. In response to the 2001 drought, the IDs organized themselves to create a water-sharing arrangement to allow all licence holders to receive an equitable portion of whatever water would become available. The SMRID was instrumental in developing networks in the region to work together to construct emergency preparedness plans. Self-organization was also facilitated through the introduction of formal and informal water markets within the IDs. By allowing water rights to be tradable, the province of Alberta has transformed "historical licenses into marketable commodities," ultimately providing flexibility in what had become an intractable water allocation situation.

The mechanism of subsidiarity was observed in both policies studied. Alberta withdrew from NISA in 1995 based on concerns that government funding was going every year to every farmer regardless of need. To address, in 2001 the province of Alberta created the FIDP to provide income support to farmers in the province experiencing, for reasons beyond their control, an extreme reduction in farm income. This illustrates how bringing the governance closer to the ground (for example, from the federal to provincial level) was necessary to create a program that responded to the needs of farmers. The *IDA* is used by the board of the irrigation district to determine fees for administration, maintenance and rehabilitation of the irrigation infrastructure . The districts operate independently and how they carry out their functions can vary due to their differing sizes and physical characteristics, providing needed flexibility for responding to surprises and emerging issues.

Finally, with respect to the adaptive policy mechanism for promoting variation, under Canada's new income stabilization program, a suite of programs are being developed to complement one another and manage risk:

- **AgriInvest** – provides coverage for small drops in income and allows for investments that help mitigate risks or improve market income;
- **AgriStability** – provides support when a farmer experiences larger farm income losses;
- **AgriRecovery** – provides a coordinated process for federal, provincial and territorial governments to respond rapidly when disasters strike, filling gaps not covered by existing programs; and
- **AgriInsurance** – an existing program which includes insurance against production losses for specified perils (weather, pests and disease) and is being expanded to include more commodities (AAFC, 2007).

This need for variation was illustrated during the years of the CAIS program in Alberta–the AFRP was created in 2007 to address the economic strain that Alberta farmers were facing attributed to Canada's rising dollar, the drop in livestock prices and high feed prices spurred by demand for biofuels in the U.S.

Table 7.2 Summary of Adaptive Policy mechanisms for the CAIS and Alberta Irrigation District Programs

Adapting to Anticipated Conditions			**Adapting to Unanticipated Conditions**			
Automatic adjustment	**Integrated assessment**	**Multi-perspective deliberation**	**Formal review and continuous learning**	**Encouraging self-organization and networks**	**Subsidiarity**	**Promoting variation**
ID: IRP–the inter-district funding formula.	ID: 2001 Water Sharing Agreement–water supply forecasts and water rationing strategies for irrigation and non-irrigation users were formulated	APF II-national stakeholder consultations held to understand what the sector requires in the new suite of programs for farmers to manage risk.	NISA-report of the Auditor General of Canada–Farm Income Protection.	ID: 2001 Water Sharing Agreement–the IDs proposed a water-sharing arrangement to allow all licence holders to receive an equitable portion of whatever water would become available.	NISA-Alberta withdrew from NISA in 1995 based on concerns that government funding was going every year to every farmer regardless of need. In 2001, Alberta created the FIDP to provide income support to Alberta farmers experiencing, for reasons beyond their control, an extreme reduction in farm income.	CAIS-AFRP was created in 2007 to address the economic strain that Alberta farmers were facing attributed to Canada's rising dollar, the drop in livestock prices and high feed prices spurred on by demand for biofuels in the U.S.
		ID: SSRB Water Management Policy–Multi-stakeholder process incorporating input from the Alberta Water Resources Commission, Irrigation Council, and discussions with Members of the Legislative Assembly.	ID: SSRB Water Management Planning–committed to reviewing the regulation in 2000 because of the "limitations of the databases and estimates of current and future water uses"	ID: Emergency preparedness–The SMRID has been instrumental in developing networks in the region to work together to construct emergency preparedness plans.	*IDA*–fees for administration, maintenance and rehabilitation of the irrigation infrastructure are determined yearly by the board of the ID. Each district operates independently and how they carry out their functions can vary due to their differing sizes and physical characteristics	APF II–The new suite of programs were developed to complement one another so that they can be responsive, predictable and bankable

		ID: Water transfers–irrigation district required to hold a public meeting discussing the potential transfer and must hold a plebiscite to gain the approval of at least 50 per cent of the irrigators in the district before the transfer application will go forward to Alberta Environment.	ID: 2001 WSA–during the 2001 drought year, mechanisms were developed to monitor and equitably distribute whatever amount of water would become available.	ID: Water markets–by allowing water rights to be tradable, the province has transformed "historical licenses into marketable commodities," ultimately providing flexibility in what had become an intractable water allocation situation.		
		2001 WSA–brought together a diverse group of stakeholders (IDs, people from cities and towns, recreational water users and industrial water users) who were able to reach consensus regarding how to equitably share the available water during a drought year.	ID: Conservation holdback–the transfer application process triggers an environmental review by the regional director, giving him/her discretion to hold back up to 10 per cent of the water allocation being transferred to meet the government's conservation objectives and protect aquatic environments.			

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