Adaptive Capacity for the South Saskatchewan River Basin[1]

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Dr. Harry P. Diaz, Department of Sociology, University of Regina
Dr. David A. Gauthier, Canadian Plains Research Center, University of Regina

INTRODUCTION

The adoption of adaptation strategies to climate change is particularly critical in regions that are potentially at greatest risk or vulnerability to the impacts of climate change. Dryland areas subject to water shortages, such as the South Saskatchewan River Basin (SSRB) in the Canadian prairies, are an example of such vulnerable regions. As Sauchyn notes in Chapter 6 of this volume, forecasted impacts of climate change on the regional water supply in the dryland areas of the Prairies suggest that adaptations are essential to optimize the benefits of water and reduce economic, environmental and social threats associated with scarce water resources.

This chapter focuses on the role of public institutions as a component of the adaptive capacity of rural communities and rural households for dealing with risks from changing climate conditions and resource scarcities. Formal institutions are expected to serve the needs of civil society and thus it is important for those institutions to develop their capacity to implement activities in an environmentally sustainable manner and be held accountable through reporting on the sustainability of their activities.

The ensuing discussion is intended to contribute to the understanding of the term "adaptive capacity" by discussing conceptual and methodological issues related to institutional adaptation to climate change. Research underway in the SSRB is used for illustrative purposes. The chapter is divided into two sections. The first section sets up a framework for discussing and analysing the adaptive capacity of institutions and presents those components of "institutional adaptive capacity" that are considered fundamental for supporting the adaptive capacity of agricultural producers and rural communities. Based on that analytical framework, the second section discusses the institutional scenario existing in the South Saskatchewan River Basin and its limitations and potential for the development of a regional adaptive capacity.

INSTITUTIONAL ADAPTATION TO CLIMATE CHANGE

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Already a region of water scarcity, the South Saskatchewan River Basin (SSRB) is expected to be seriously impacted by climate change as a result of reduced steam flows and water recharge and increasing evapotranspiration with resultant severe impacts upon crops, livestock, and local ecosystems. CCIAD (2002) has summarized the potential impacts of climate change on water resources for the prairies. These impacts include:

(1) changes in annual streamflow (possible large declines in summer) with implications for the different water users;
(2) increased aridity and likelihood of severe drought with losses in agricultural production and changes in land use; and
(3) increases or decreases in irrigation demand and water availability with uncertain impacts on groundwater, streamflow and water quality.

While some climate change models predict increased rainfall and snowfall in the Prairie provinces as a result of higher temperatures, a much greater loss of water by evaporation is also expected resulting in overall drier conditions. That is, the major impacts of climate change on the Prairie Provinces are expected to be loss of soil moisture and surface water. Furthermore, snow and ice are the principal sources of runoff that supply the prairie lakes, rivers, and streams. Sauchyn in Chapter 6 of this volume reports a predicted decrease in snow accumulation in Canada's mountain ranges due to warmer winters, thereby affecting the availability of water for the Prairies.

In a river basin with a complex variety of physical and social conditions, the specific social impacts of climate change are likely to be heterogeneous. However, a likely common denominator could be potential increases in water-use conflicts between sectors and within sectors regions and users. With increasing aridity, the future demand for water will have to be considered against declining water availability and competition for water between sectors will likely increase. Expected increases in industrial development and the expansion of urban centers, such as Calgary, will place additional pressures on rural area water supplies. In the agricultural sector, farmers and ranchers are already being pressured to increase production in a context where they face increasingly unpredictable supplies, and must increasingly compete with cities and other economic sectors for available water. Conflicts within and among sectors – as is the case of conflicts that emerge around irrigation – are likely to increase.

Within the context of predicted water scarcities, the need to understand regional adaptive capacities to climate change is fundamental. There is no doubt that developments in technology and infrastructure, as well as the availability of economic resources, will be essential to improve water use efficiency. These capacities, however, while necessary, are likely insufficient. As FAO (Food and Agriculture Organization of the United Nations) argues, "institutional changes are going to be as important as, or more important than, technological ones" (2003: 372). The institutional changes that will be required are those involving the development and implementation of comprehensive support mechanisms that improve the capacity of different sectors to adapt to climate change.

Of paramount importance is the development of adaptive mechanisms in those human settings that are the most vulnerable to climate variability and change, such as in rural communities and rural households. Later in this book, McLeman explores such adaptive

capacity in relation to rural families and communities through his analysis of the dust-bowl migration in southwest U.S. (See Chapter 12.) These adaptive mechanisms will involve capacities such as human and social capital, access to information, and availability and access to resources. Chapter 2 of this volume points out that institutional actions at the level of the state, able to support the strengthening of mechanisms in communities and households, is of prime importance for them to adapt to climate change. Although not so overtly exposed to the most direct effects of climate change, those formal institutions are fundamental to the adaptive capacity of rural communities and agricultural producers. What they do or do not do impinges directly on human communities and ecosystems, which are vulnerable to varied degrees of exposure to stress. Responsive adaptations will involve not only disaster preparedness planning or the introduction of new crops, but also the capacity to identify problems created by climate change, seek solutions to them, and implement those solutions in a fair, efficient and sustainable manner.

The concept of "institution"

The term 'institution', as used in the social sciences, generally refers to all those means that hold society together and is formally defined as: "specific or special clusters of norms and relationships that channel behaviour so as to meet some human, physical, psychological, or social need such as consumption, governance and protection, primordial bonding and human meaning, human faith, and socialization and learning" (Buttel 1997: 40). Similarly, Homer-Dixon (1999: 213) adopts the idea of institutions as "the rules of the game in a society or, more formally, (as) the humanly devised constraints that shape human interaction". Institutions are defined as "stable and predictable arrangements" for the coordination of human interaction (Ferrante, 2003: 5); as "social practices" that involve power and authority (Ishwaran, 1986: 247); or as "sets of norms, values, and beliefs, developed to resolve" recurring social problems (Hagedorn, 1994: 367).

The variety of definitions permits a multiplicity of applications, allowing a wide spectrum of analytical possibilities, ranging from organizations to hegemonic discourses, from highly formalized settings to informal arrangements. Thus, use of the term "institution" has been shaped and explained from a variety of perspectives, each with a different explanation of the logic that motivate institutions, their origins, changes, their relationships to history, level of analysis, and their relationships to individuals. (Jordan and O'Riordan, 1999).

Multiple definitions and perceptions surrounding the term 'institution' create challenges in its use for studies of adaptation to climate change. The World Bank adopts a pragmatic approach to the challenge defining institutions as "the rules, organizations, and social norms that facilitate coordination of human action". The important advantage of this definition is that it includes "organizations" as part of the definition and facilitates operationalizing the term "institution" for research purposes. Organizations link people and major social institutions thereby constituting a more concrete representation of an institution. Newman follows a similar approach defining institutions as "stable sets of statuses, roles, groups, and organizations that provide the foundation for behavior in

certain major areas of life" (Newman, 2004: 302). Thus, an institution is an underlying, durable pattern of rules and behaviours, and an organization is its changeable manifestation. All organizations have a fundamental role in organizing society and its relationships with the environment. Formal public agencies are central to any discussion about "institutional adaptive capacity" since they have a purposeful mandate, a degree of longevity, social acceptance, and a legal basis.

Formal organizations, however, are not the only institutionalized settings that exist in society. Institutions also take the form of less formalized settings where there are no socially recognized organizational structures and specific purposes attached (Haas et al., 1993: 5). Communities and households are good examples of informal settings which have the capacity to define the parameters of the behaviour of their members and the nature of their relationships, in spite of not having the highly formalized nature of bureaucratic organizations. They are not formed just by groups of people living in the same area or under the same roof, but also by symbols, discourses, norms, and all those elements that make organized everyday life possible. However, like many other human settings, they function within institutional systems that link those settings with the larger society. These institutional systems pervade the lives of the community members by imposing a body of regulations, rules, processes, and resources that may either support or conflict with the capacities of those communities and households, impositions that are carried out by organizational structures, such as public agencies (see Alcorn and Toledo, 2000: 218).

Both formal and informal institutional actors exist within a larger societal context that imposes dynamics upon the ways in which households, communities, and public institutions operate. Thus, an assessment of institutional adaptive capacities must consider not only to the capabilities of these formal and informal institutional actors. It must also recognize national institutional dynamics such as the federal system that imposes different functions and responsibilities to the central and provincial governments. Such dynamics influence and shape the organization, operation, and functions of the institutional actors.

Public Institutions and Adaptive Capacity

The adaptive capacity of a public institution should be understood not only as an ability to reduce its own exposure to climate risks but also as the ability to perform functions that facilitate the adaptive capacity of their constituencies. Willems, in his discussion of "institutional capacity" and climate policy, describes the nature of institutional capacity, arguing it is the "ability (of a certain country) to mobilize and/or adapt its institutions to address a policy issue, as climate change" (Willems, 2004: 8).

While adaptive capacity is linked to access to resources, such access by itself is insufficient. Adaptive capacity is also more than a straightforward technical issue. The development and implementation of technological measures by public institutions could be an important contribution to reduce the vulnerability of different social groups. Adger (2003: 30) reminds us, however, that these technological solutions could be problematic for two reasons. First, they tend to have a socially differentiated impact, benefiting some

sectors of society to the expenses of others; a factor that could multiply the negative consequences of climate change, producing "double losers" and "double winners". Second, their contribution to adaptation to climate variability within the existing coping range could be high, but as noted in Chapter 1 of this volume, this range may change in a radical way under new parameters created by climate change.

Climate change could have serious impacts on the availability of resources, the viability of human settings, the livelihood of sectors of the population, and, in the long term, the social processes that characterize the relationships between the civil society and the state. In these terms, climate change affects the paths that promote sustainable development. The adaptive capacity of society is influenced by a multiplicity of factors reflected in the economy, the state, the civil society, and culture. Such factors involve technology, assets, capital resources, human and social capital, scientific knowledge, and institutional capacities such as effective social networks and flexible and innovative organizations. In a sustainable society this multiplicity of factors would be organized in a cohesive and coherent manner that served to increase the adaptive capacities of society. In other words, sustainability requires not a myriad of unrelated adaptive measures but a *structured* adaptive capacity.

Public institutions require flexibility to deal with the unanticipated conditions that may result from the impacts of climate change. Their role includes implementing an enabling environment that strengthens civil society to deal successfully with the challenges of climate change. Impacts on the city of New Orleans during the 2005 hurricane Katrina serve as an example of how important public institutions are for ensuring residents can deal with major weather events. As Smit and Pilifosova (2003: 22) argue "…adaptation is less about identifying and implementing specific climate change adaptation measures and more about strengthening an ongoing process where resources are available to identify vulnerabilities and employ adaptive strategies." Adaptive capacity, to be successful, must allow for the identification and resolution of people's problems and the satisfaction of their needs in a fair, efficient and sustainable manner. In this context, the adaptive capacity of public institutions is related to their ability to anticipate problems and to manage risk and challenges in a way that balance social, economic, and natural interests.

Dealing with the complexities of the impacts of climate change requires a policy and management approach based on institutional arrangements that are necessarily different from those fashioned around traditional policy problems. Climate change impacts are not just limited to specific sectors, such as the economy or the environment. Thus, approaches and arrangements to address climate change impacts should act across traditional sectors, issues and political boundaries and address complexity and uncertainty.

There are at least five key principles that should inform the public institutional approach and its arrangements to address climate change impacts. They are:

(1) *Persistency*, where political efforts are maintained over time enabling the accumulation of learning experience;

(2) *Purposefulness*, where political efforts are supported by stated principles and goals;
(3) *Information-richness and sensitivity*, where the best information is sought and made widely available to sustain the political efforts;
(4) *Inclusiveness*, where the full range of stakeholders are involved in policy formulation and in management; and
(5) *Flexibility*, where there is a preparedness to experiment, preventing persistence and purposefulness from becoming rigidity (Alfaro, 2004).

Institutional arrangements that support these principles are systemically related to input, processing, and out put factors. Thus there needs to be openness of the political system to identify problems and issues in the civil society combined with an ability to seek solutions to those problems and a capacity to implement solution. Several authors describe the capacities that institutions require to deal with challenges such as resource scarcities (Homer-Dixon, 1999) and the challenges of sustainable development (World Bank, 2003, Goodin, 1996; and UNEP, 2002). They identify many of the components that should define the adaptive capacities of public institutions.

On the input side, relative to the rural agricultural areas of the SSRB, it is essential for institutions to have knowledge of the current physical and social vulnerabilities existing in the agricultural sector and the early identification of the impacts of climate change upon natural and social resources. An institution must be "sensitive to early signs of problems" (World Bank, 2003: 185-186) related to the impacts of climate change. The existence of appropriate information systems that allow for the gathering and evaluation of information able to support decision-making processes (referred to by Homer Dixon as "instrumental rationality") is a central factor in fostering such sensitivity. The issue is not only the capacity to collect information but also "the quality" of the collected data in terms of identifying local problems and issues, the needs of different social groups, as well as the ability of the institutions to "return" this data to different constituencies.

On the processing side, the identification of vulnerabilities imposes a fundamental task upon public institutions: to resolve the identified problems in ways that balance the interests of the diversity of stakeholders. The capacity to resolve problems requires arrangements that are "internal" to institutional actors, such as the existence of proper resources in the institutions and their ability to link to other institutions in order to coordinate the solution of problems. Some of these arrangements include:

- Avoiding policy measures or programs that may favour specific stakeholders to the detriment of others and the consideration of the diversity of interests during the process of reducing identified vulnerabilities. For example, the World Bank (2003; 187) emphasizes two elements in this process of balancing interests: getting everybody represented in the decision making process and facilitating the negotiation process.
- Institutional features such as transparency, performance reporting, and accountability (e.g. OAG, 2004; Stratos, 2003) that promote fairness and provide the opportunity for self-evaluation (World Bank, 2003: 187).

- Forums and networks of negotiations during the process of finding the best solution to the vulnerabilities identified in the input side (World Bank, 2003).
- Availability of resources, human capital and fiscal resources within the institutions (Homer-Dixon, 1999).
- Coordination among different public institutions and their capacity to agree and act on shared bases, objectives, and methods.
- Institutional barriers, such as management practices that affect the decision-making processes, e.g. the existence of highly centralized structures of power within institutions.
- Recognition of climate change adaptation options as a viable strategy in the mandates and decision-making process of the institutions.

On the output side, the adaptive capacity of the institutions reflects their ability to implement solutions. This feature will vary according to how well they can communicate their decisions and the implementation procedures to those they serve. Also important for public institutions is their success in promoting capacity building and problem solving within the civil society. Examples include fostering of social capital and networks for mutual support within the rural communities. In addition, public institutions display more adaptive capacity if they can monitor how the solutions have been worked through and evaluate their degree of success.

In these terms, the role of public institutions in the development of an adaptive capacity to climate change –or institutional adaptive capacity—is most clearly reflected in governance. Governance focuses on relationships between civil society and the state, a relationship where public institutions play a fundamental role in reducing the vulnerability of stakeholders (Hall, 2005). In the context of climate change, governance involves the allocation and distribution of resources, not only of natural resources but also of those economic, social and political resources that are fundamental for coping with new climatic conditions.

The process of developing successful adaptive capacity in which governance plays a fundamental role, entails the organization of material and human resources in order to resolve questions of sustainability: what should be sustained, how to do it, and for what purposes. In these terms, it is a political process oriented to organizing the distribution of society's resources in different ways, i.e. ranging from a neo-liberal, free market society, to a highly centralized society. The specific form of governance depends a great deal upon a variety of discourses --value-frameworks, paradigms and models—that are articulated by the many and various constituents making up the social and political spectrum of society. These discourses are important because they not only define the nature of the problem but also frame the possible solutions. Thus, public institutions' role in the development of an adaptive capacity reflects different core values, political and cultural paradigms upon which they are explicitly or implicitly founded.

ADAPTIVE CAPACITY IN THE SOUTH SASKATCHEWAN RIVER BASIN

The SSRB stretches from the Rocky Mountains across southern Alberta and Saskatchewan, covering an area of 420,000 square kilometres with an estimated population of 1.5 million. The basin is divided into five major watersheds: Bow, Oldman, Red Deer, South Saskatchewan (Alberta) and South Saskatchewan (Saskatchewan). Approximately 65% of the basin population lives in major urban centres, mainly Calgary, Lethbridge, Medicine Hat, Swift Current, and Saskatoon, while the rural population is spread among approximately 225 towns and villages and their surrounding areas (Sobool and Kulshreshtha, 2003). The study area depends economically on agriculture and beef production, as well as on the food processing industry, petrochemical industry, hydropower generation, and mining, mainly potash and oil and gas) (Lac, 2004).

The land use is primarily large and medium scale agriculture. The area includes the highest wheat percentage area in crop in Canada (i.e. highest number of farms with 51 to 80% of their area cultivated with wheat) (Natural Resources Canada, 2004) and is cropped mostly with only 15 field crops (grain, oilseeds and pulses) and a few forage crops (Canadian Council of Ecological Areas, 2004). Livestock production is also a main agricultural activity with large areas left for pasture. There are numerous dams, reservoirs, diversions and irrigation projects. In southern Alberta, 13 irrigation districts divert about 2.3 billion cubic metres (1.8 million acre-feet) of water to irrigate about 500,000 hectares (1.2 million acres) of land. Approximately 120,000 ha (300,000 acres) of land are irrigated by 25 irrigation districts throughout southern Saskatchewan. In addition to supplying water for irrigation, the basin is used for recreation, hydro-electricity and is the principal source of household water for 45% of Saskatchewan's population, including cities such as Regina, that are outside the geographical area covered by the basin.

A fundamental problem for the agricultural sector in the basin is the availability of water, a serious problem in the context of the expected climate change impacts for the area related to increasing evapotranspiration and aridity. The current availability of water is already fragile in areas of the basin. The allocation of irrigation licenses has reached its limit in southern Alberta, although irrigation farming could still be improved through better management and technologies. These improvements, however, are problematic since there is less water return to rivers and the quality of the water could be seriously affected (Lalonde and Corbett, 2004). The demand for water in the basin is expected to increase significantly as the result of the expansion of the economy in southern Alberta. By 2046, the demand for non-irrigation consumptive use is expected to be between 63 and 132 percent higher than today, mainly as the result of the expansion of industry and cities such as Calgary (Lalonde and Corbett, 2004). This increasing demand is problematic in the context of the expected impacts of climate change upon the water resources of the basin. It was within this context that the Alberta Environment Minister expressed concerns about the capacity of cities such as Calgary to meet their demand for water in 30 years (Globe and Mail, April 22, 204).

There are a number of federal governmental institutions that have specific roles related to water management issues in the basin. These institutions, among others, include Environment Canada, Agriculture and Agri-Food Canada, Health Canada, Parks Canada, Natural Resources Canada, and the National Water Resource Institute. The direct

management of the SSRB water resources, however, involves integrated planning from the three provinces: Alberta, Saskatchewan, and Manitoba. In 1969, these three provinces created a sharing system articulated in the Master Agreement on Apportionment which continues to guide board activities to this day. Under this agreement, Alberta and Saskatchewan are each not to exceed the use of 50% (net depletion) of the natural flow within their respective boundaries. Furthermore, they should not exceed the use of 50% (net depletion) of the flow entering the respective province (Lac, 2004; Environment Canada, 2004) Environment Canada, 2004).

The provincial governments are responsible for the management of their water resources to meet their commitment to the Master Agreement on Apportionment and to ensure water availability and water quality to all non-irrigation consumptive users. The provincial governments of Alberta and Saskatchewan are also responsible for monitoring water level and streamflow. Two main provincial agencies are in charge of these tasks: Alberta Environment and Saskatchewan Watershed Authority. These two agencies have developed water management strategy frameworks (i.e. Water for Life in Alberta, and the Saskatchewan Water Framework). Alberta is also developing a multiphase water management plan for the water use in the SSRB that involves input from four multi-sector stakeholder Basin Advisory Committees and the general public. The provinces establish and update drinking water quality objectives, but most municipalities control their own water systems. Municipal governments operate water and waste water utilities, having primary responsibilities for providing safe drinking water to households. In addition, federal agencies such as the Prairie Farm Rehabilitation Administration (PFRA) --a branch of AAFC—also play central roles in supporting agricultural producers' management of natural resources. The PFRA offers programs and services, technical assistance (and sometimes financial assistance) in many areas related to agriculture including water supply development, waster water treatment, irrigation, soil and water conservation

The above description of the public institutional system in the South Saskatchewan River Basin indicates the existence of many institutions that work at a variety of levels implementing a wide variety of programs. There is a vibrant number of civil society organizations that also embrace a broad mandate of sustainability issues relevant to the SSRB. The Canada West Foundation, for example, is a charitable organization that conducts and communicates non-partisan economic and public policy research of importance to the four western provinces. Its 'natural capital' project is intended to highlight the importance of natural capital, including water resources, in sustainability policy discussions.

In response to meeting common needs across a large geographic area, organizations have formed larger associations to represent their collective interests. For example, the Partners for the Saskatchewan River Basin (PFSRB), based in Saskatoon, promotes stewardship and education across the entire basin of more than 3 million people depending upon the North Saskatchewan, Red Deer, Oldman, Bow, Highwood, South Saskatchewan, Battle, Saskatchewan, St. Mary, and Carrot Rivers. In order to accomplish this mission, the PFSRB develops public awareness and education tools, facilitates

partnerships and networks of organizations that cross political and sectoral boundaries, and designs and implements stewardship action projects. Other associations focus on promoting networks throughout a province, such as the Saskatchewan Network of Watershed Stewards (SNOWS), a partnership involving provincial, federal and non-government organizations, and designed to co-ordinate and support watershed stewardship programs in Saskatchewan.

Some associations focus on particular geographic areas within the larger water basin. For example, the Bow River Basin Council, originally established as a water quality association, operates as an arms-length, advisory council to the Government of Alberta with 120 members representing commercial / industrial, individuals, irrigation licensees, non-profit, academic, municipal and administrative / regulator and First Nations interests in the basin. The Council was very involved in developing the Alberta water strategy, state of the river reports, and the SSRB water management plan. There are several other groups in Alberta similar to the Bow River Basin Council, including the Chestermere Watershed Committee, the Nose Creek Watershed Partnership, the Iron Creek Watershed Improvement Society, and the Oldman Water Quality Initiative.

Some associations focus on smaller watershed areas such as the Swift Current Creek Watershed Stewards or the Turtle Lake Watershed Partnership in Saskatchewan, while others have an even broader focus on sustainability issues across a regional scale. For example, Alberta's Prairie Conservation Forum is a partnership among government and non-government organizations that allows members to discuss a wide array of sustainability topics related to the prairies, including climate change and water conservation. The Saskatchewan Prairie Conservation Action Plan (PCAP) partnership brings together over 25 industry, agricultural, government, non-government and academic representatives to focus on native prairie conservation and includes education programs in rural areas such as the 'Cows, Fish, Cattle Dogs and Kids Game Show' which fosters an awareness of the interrelationship among all ecosystem elements. In another collaborative initiative, provincial and federal government agencies are collaborating on a southern Alberta sustainability strategy that aims to assess the socio-economic vitality of southern Alberta without significantly impacting the environment. Other associations are focused on particular aspects of water management, such as the Alberta Irrigation Projects Association and the Saskatchewan Irrigation Projects Association, which provide irrigators with the opportunity to meet and work together. Other initiatives are established for specific periods of time such as the Wonder of Water program. Initiated in 2003 for a two-year period, that program promotes the establishment of longer-term partnerships focused on water conservation.

Research networks have been developed to facilitate collaborative work among scholars and others. The Water Institute for Semiarid Ecosystems (WISE), based at the University of Lethbridge, is a consortium of scientists, and people from industry, environment, agriculture and the irrigation districts. The Prairie Adaptation Research Collaborative (PARC) based in Regina fosters a wide range of research related to adaptation issues on the prairies.

The above examples of programs and initiatives in the SSRB reflect the critical importance of water as a resource to meet a multitude of needs throughout the basin. The increasing recognition of impacts from climate change in an area which has a long history of adapting to water shortages has contributed to the development of government partnership programs focused directly on climate change. For example, Alberta Environment has a project to assess awareness of adaptation issues within its own organization and is developing a climate adaptation strategy. At the same time it participates in an interdepartmental climate change working group. This willingness for institutional partnership has also spread among other public and civil society institutions that participate in the management of water resources.

The existence of this network of government and civil society organizations in the SSRB and the willingness of these organizations to establish partnerships provide a significant potential for the development of an institutional adaptive capacity to climate change. The existence of the network and the predisposition to partner with other organizations could facilitate the production and dissemination of knowledge of the current physical and social vulnerabilities existing in the basin and the early identification of the impacts of climate change upon natural and social resources, as well as to provide forums for facilitating negotiation processes oriented to a more rational and fair use of the water resources. Moreover, the network could also facilitate the coordination among different public institutions and between public and civil society organizations, as well as their capacity to agree and act on shared bases, objectives, and methods in order to face the challenge of climate change.

It is difficult to predict the types of discourses that might prevail in the process of developing this institutional adaptive capacity. One of the few empirical studies in this area is a relatively recent study of the perceptions and attitudes of members of the natural resource policy community in the Prairie provinces, a community integrated by members of any institution that have influence over the formulation of policies. The study shows that droughts, water supply, and climate change are among the most important policy concerns, ranking at the top of a list of fifteen current natural resource issues. The study classified the values, or core beliefs, of the most important members of the policy community –the representatives of industry, government, universities, and environmental organizations-- into two domains: the economic domain (with an emphasis on support for private property rights and free market economic expansion) and an environmental domain (with an emphasis on nature and limits to growth). The results show that industry and government members of the policy community are more inclined to support industry interests than ecological concerns, in opposition to university and environmental movement representatives that are more predisposed to ecological values (Wellstead, Davidson, and Stedman, 2002). This value system could have the potential of influencing the development of an adaptive capacity oriented to ensure the economic sustainability over a more balanced sustainable development.

This institutional setting has already demonstrated its capability to foster the development of an adaptive capacity to current climate related vulnerabilities. The establishment of PFRA is an example of an institutional response to set of climate-related conditions. It

was founded in response to the drought of the 1930's, as a federal government initiative to assist agricultural communities on the prairies develop agricultural processes and techniques that would lessen the vulnerability of the farming and ranching communities to climate-related stresses. Over its many years of service it has operated a variety of soil and water assistance programs including extension services, infrastructure grant programs, and many others, becoming an important source of support for both agricultural producers and rural communities. PFRA, for example, played a central role in ensuring the sustainability of Cabri, a rural community in one of driest areas in southern Saskatchewan. In the early days water was a precious resource in the area of Cabri, being hauled for miles for irrigation and consumption. In the early 1950s PFRA was asked to provide a solution to secure a stable source of drinking water for the town population. The result was the building of a water reservoir by PFRA, a reservoir that is still used by the locals.

Another example of proper adaptation to water scarcities is the water conservation program of the City of Regina. In Saskatchewan, the South Saskatchewan river is dammed to form Lake Diefenbaker, a significant resource for hydroelectric power generation, irrigation, and recreation. A portion of the flow from Lake Diefenbaker is diverted into the Qu'Appelle River system where it is again impounded to create a smaller reservoir at Buffalo Pound Lake. Buffalo Pound Reservoir supplies 99% of Regina's water. The drought of 1987-1988, characterized by above-average annual temperatures and below normal annual precipitation (Wittrock et al., 2001), forced the City of Regina to examine several alternatives to reduce the impacts of the drought. One of the most important decisions was to implement a water conservation strategy that is still in effect.

The program has different components. During the summer the demand for water can be as much as double the normal daily average. The program delivers a public awareness campaign and promotes outdoor watering guidelines. These guidelines, followed on a voluntary basis, encourage costumers to restrict watering to one day a week. The City also promotes xeriscape, or low water use, landscapes as an alternative to turf landscapes. In addition, the City also provides water conservation tips to save water and encourages the installation of water saving showerheads, the use of ultra low flow toilets, the use of drip irrigation for trees and shrubs, and other measures. The City has also established measures to reduce the demand for water, such as a new rate structure where customers pay for all water they use as opposed to getting the first amount for a fixed cost. Finally, it has also adopted a variety of measures to rationalize the watering of public and green spaces in its jurisdiction, such as watering at night to reduce evapotranspiration and the installation of automated systems for turning on and off water systems in some of the parks. The result of all these measures has been a steady decline in both per capita use and peak demand. A focus of concern, however, is the capacity of this current strategy to deal with more severe forms of droughts that are expected as a result of an increasing rate of climate change (Social Dimensions of Climate Change Working Group, 2005).

Similar water conservation programs have also been implemented in other localities in the SSRB. In the case of Cabri, for example, the local government, recognizing potential

water supply problems, has established its own form of water conservation, such as restrictions for lawn watering, i.e. three hours in the morning or the evening during three days a week. During the 2001/2002 drought, one of the most serious recent droughts in the basin, lawn watering was prohibited, the local car wash was closed and water was rationed.

There are also examples of a lack of adaptation to water scarcities. A large portion of the older homes in the city of Calgary, the largest urban center in the SSRB, do not have meters, which allows residents to use as much water as they want for a flat charge (Globe and Mail, April 22, 204).

At a less formal institutional level, there are also examples of adaptive capacity within rural communities. A recent study of the adaptive measures to climate change of Alberta producers shows a significant number of past and current adaptive strategies used by farmers to adapt to climate variability. Measures have included changing the location of their operation, the use of shelterbelts and bushes to conserve moisture, crop insurance, changing crop types and varieties, reduced or zero tillage, and others. In terms of future strategies, farmers mention the adoption of organic farming, enhancing crop insurance, and -- especially relevant to the development of an institutional adaptive capacity-- the need for governments to increase their role in the development of adaptive capacities among farmers, particularly in the area of education and dissemination of information (Stroh Consulting, 2005). At a collective level, Adger (2003) has emphasized the role of social capital as an adaptive capacity, arguing that form of capital is an important element for coping with climate variability and hazard. This form of capital is also prevalent within the multitude of rural communities that exist in the SSRB, being an important mechanism used by people to cope with drastic changes, such as the structural transformation of agriculture, and the problems of everyday life (Diaz and Nelson, 2005).

The existing institutional setting also has its limitations, as was demonstrated in the case of the drought of 2001 and 2002. That drought, which could be interpreted as a harbinger of a typical natural hazard under future climate scenarios, had repercussions that went far beyond agricultural production, affecting recreation, tourism, health, the supply of electric power, transportation and forestry. A recent study of the impacts of the drought indicates that in spite of the government response and the safety net programs, “the wide arrange of adaptation measures, including government programs, could not cope with the immensity of the losses”, especially in the west (Wheaton et al., 2005:23).

These limitations seem to be related to a lack of preparation to deal with climate related problems and the existence of a very limited coordination among institutions. The study of Wittrock, Wheaton, and Bealieu on the adaptability of prairie cities shows that public institutions lack the necessary awareness and preparation to deal with many climate related problems. There is the need, the authors argue, for more information about climate impacts and adaptation, and increased research to facilitate the decision-making process around issues that are affected by climate (Wittrock, 2001). The study about water resources and climate change in the city of Regina shows the same limitation (Social Dimensions of Climate Change Working Group, 2005). The different institutions

that participated in the study were aware of climate change and its potential impacts upon water resources. This awareness, however, has not translated into a significant integration of climate changes issues into the institutional agenda and organization. In the best of the cases, it has limited to the assignment of resources to promote and monitor the reduction of greenhouse gas emissions.

Not surprisingly, the existence of a wide array of institutions in the SSRB engaged in numerous activities across a variety of temporal and spatial scales with varying degrees of focus on water management and conservation and climate change issues is characterized by problems of coordination among all of those institutions or activities. In the study on climate change and water resources in the City of Regina, the issue of institutional coordination in regard to water quality was raised by participants in a focus group. Participants were very critical of the capacity of public institutions to gather standard information about water quality. This information, it was argued, is collected by different institutions and for different purposes as the result of the lack of coordination among the different government levels and institutional squabbles about who is in charge of particular issues. This concern has been echoed in several informal interviews with representatives of public institutions, claiming that it is one of the most fundamental problems of government organizations. This example indicates that institutions tend to focus on areas relevant to their mandates which are mostly defined by a perceived set of problems, the clients they serve and sources of funding provided for their services. Also, institutions operate at specific levels or scales of influence, whether they are local municipal governments, national non-government associations or local business associations.

We have argued that the social impacts of climate change are likely to be heterogeneous given the variable impact of climate change among different socio-economic sectors. Formal and informal institutions should be structured in a manner that facilitates the development and implementation of comprehensive support mechanisms that improve the capacity of different sectors to adapt to climate change. Such an institutional structure would be characterized by transparency in decision-making, performance reporting, and accountability that promote fairness and provide the opportunity for self-evaluation. A fundamental focus, particularly of public institutions should be the *anticipation* of problems such that risks and challenges can be managed in a way that balances social, economic, and natural interests. The ability to anticipate requires knowledge of the current physical and social vulnerabilities. Thus institutions should include a focus on optimizing the resources available to identify vulnerabilities and employ adaptive strategies. Our study of the SSRB reflects the critical importance of the adaptive capacity of institutions in addressing the management of water as a resource to meet a multitude of needs throughout the basin.

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