

# Chapter 9

## Institutional Fit and Interplay in a Dryland Agricultural Social–Ecological System in Alberta, Canada

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### 9.1 Introduction

The Special Areas of Alberta are an administrative district of 2.1 million hectares in the dry short grass region of the Canadian Great Plains. The Great Plains have endured recurring dry periods that present a challenge for the social–ecological systems present in the area; however, the human settlement of the region has been influenced by a variety of nonclimatic external factors including the in-migration of European peoples and associated population change, land use policy, and global demand for natural resources and agricultural commodities. The indigenous bison-based system was fundamentally changed by European contact during the latter part of the nineteenth century. Since then, the primarily Euro-Canadian social–ecological system can be divided into three distinct periods of steady progress and adaptation, separated by abrupt system changes prompted by both climate and nonclimatic stimuli. This type of abrupt change in social–ecological systems is frequently associated with political upheaval and prompt institutional and societal reorganization (Folke et al. 2005). Global climate change has the potential to challenge the current period of steady progress and adaptation in the Special Areas of Alberta.

This paper examines three successive phases of agricultural and settlement systems in Alberta's Special Areas in the context of drought and other stresses. Shifts between social–ecological systems are viewed through the conceptual lens of institutional fit and interplay in seeking to explain the transition, from range-based agriculture to intensive crop farming, and finally to a predominantly sedentary,

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grazing-based agricultural system. We contend that the Special Areas have enjoyed a high capacity for adaptation to external perturbation since the last major shift in land use, avoiding a wholesale social–ecological reorganization since the 1940s. This high adaptive capacity, as evidenced by the span of the current agricultural and settlement phase, reflects a high degree of institutional fit and interplay to the conditions of the twentieth and early twenty-first centuries. However, projected climate change, coupled with global-scale nonclimatic forces (e.g., rising oil prices), may lead to decreases in fit and interplay and, consequently, adaptive capacity.

Adaptive capacity is generally used to refer to a system's ability to cope with – or adapt to – external stimuli (Smit and Wandel 2006). Recently, scholarship on the determinants of adaptive capacity has emphasized the importance of including governance, regulations, legislation, and the role of formal and informal institutions as part of the analysis (Keskitalo and Kulyasova 2009; Young 2008). Assessing the role of institutions in the adaptive capacity of a system involves the concepts of “fit” and “interplay.” Fit describes how a single institution matches a resource problem, while interplay addresses how institutions are linked both horizontally and vertically, and the implications of these links for adaptive capacity.

The term fit relates how well the temporal, spatial, and functional scales of an institution match the system it manages (Folke et al. 1998, 2007; Galaz et al. 2008). Spatial fit refers to the congruence between the geographical extent of a biophysical system and an institution's management area. A “problem of fit” here can be indicative of too small or large an institutional jurisdiction, as well as an institutional inability to cope with external drivers of change (Moss 2007; Galaz et al. 2008). For example, Ablan and Garces (2005) illustrate the spatial mismatch between national exclusive economic zones and marine systems in the South China Sea. In this example, overfishing in one country affects resources available in the exclusive economic zone of another, because fish are not bound by jurisdictional delineations. In this situation, the institutional jurisdiction is too small, as national-level institutions have little control regarding the overall population of migratory fish stocks. However, within large national jurisdictions, such as the Philippines, the nationwide implementation of a single fisheries policy based on the distance from the shore does not fit depth-determined variations in the composition of fish communities (Ablan and Garces 2005). In the second case, the institutional jurisdiction is too large, since the “one size fits all” approach to management is inappropriate for a local context (Galaz et al. 2008).

Temporal fit refers to an institution's management horizons relative to biophysical system change. Temporal fit can be either too short or too long. For example, if an institution's approach to resource management is dictated by four-year election cycles, the temporal fit may be too short to adequately manage depleted resources, which can require decades to recover. Conversely, the speed of ecosystem change can be very rapid, so the temporal fit may be considered too long when institutions do not have processes for a sufficiently quick response. For example, Walters and Maguire (1996) note that a slow response in Canadian fisheries policy to early indications of declining North Atlantic cod stocks contributed to the collapse of the cod fishery in 1992.

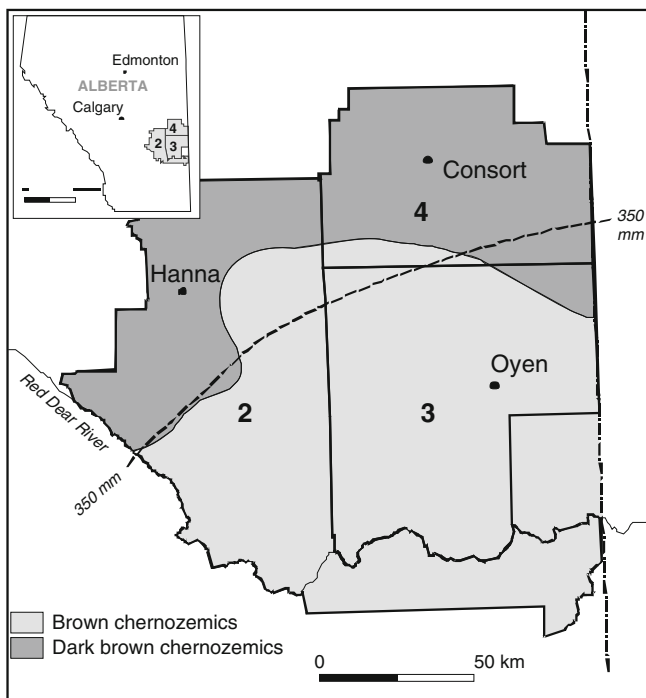
Functional fit defines how well an institution’s mandate is matched to the system of interest. For example, Bauer (2004) reviews the impacts of Chile’s 1981 Water Code, which established water as a commodity. The Water Code, as an institution, has been criticized for failing to promote equity among water users; however, this can also be seen as a case of poor functional fit between an institution designed to manage water quantity allocation and a system in which insecure land tenure and lack of access to securing rights in water markets precluded equitable participation.

The concept of institutional interplay is used to describe how institutions interact with each other (Lebel 2005; Gehring and Oberthür 2007). Interplay can be used to highlight conflicting mandates or other potential sources of conflict, both horizontally and vertically. Horizontally, interplay expresses the relationship between organizations and the various rules they implement (Lebel 2005). Vertical interplay is concerned with cross-scale linkages, for example among regional, provincial, and federal institutions (Lebel 2005).

## 9.2 The Special Areas of Alberta, Canada

The North American Great Plains have been occupied for the past 11,000 years. Throughout the history of the region, livelihoods have been tied to harvesting and managing natural resources. Prior to European contact, the First Nations peoples primarily survived by hunting bison. Early European settlers established extensive grazing methods, followed by crop-based agriculture. Currently, this region includes a range of agricultural systems, ranging from intensive, irrigated crop agriculture to large grazing operations. This coupling of the native prairie ecosystem and the various social systems –including their associated settlement systems and governance structures – can be viewed as a social–ecological system, as outlined in Berkes and Folke (1998). Analyzed at the regional scale, this social–ecological system is known as the Special Areas administrative unit (commonly and hereafter referred to simply as the “Special Areas”).

The Special Areas constitutes a large part of what climatologist Vilmow (1956) originally described as Canada’s Dry Belt (Marchildon et al. 2009). The Special Areas covers 2.1 million hectares of sparsely populated land in the Canadian province of Alberta, north of the Red Deer River between 50.6° and 53.3° north and 110° and 112.5° west (see Fig. 9.1). Most of the Special Areas receives less than 350 mm of precipitation each year, making it one of the driest environments in the Canadian Great Plains (Jones 2002). Evaporation generally exceeds precipitation throughout this area, so its contemporary agricultural systems rely on storing winter moisture, groundwater, and the surface water that originates in the Eastern Slopes of the Canadian Rocky Mountains. The area primarily consists of fertile brown and dark brown chernozem soils, with frequent instances of solonchic soils, which are a product of low precipitation coupled with high evaporation, and are characterized by subsoil that is hard when dry, swollen and compact when wet, and consequently difficult to cultivate (Wandel et al. 2009). The area is part of the dry



**Fig. 9.1** Alberta's special areas, 1941

Source: Wandel et al. 2009

shortgrass prairie ecozone, which is marked by treeless prairie with few trees or shrubs except in particularly wet areas.

Southeastern Alberta was first settled by Europeans beginning in 1881, and was opened for homesteading in 1909. Like much of the Great Plains, the region was subjected to the “dust bowl” years of the 1920s and 1930s (Khandekar 2004), which were accompanied by high rates of out-migration and the attendant collapse of the rural settlement system. The Special Areas administrative unit originated with an institutional reorganization that transferred local government authority to the provincial government as a temporary solution to the crisis of the 1920s and 1930s (Gorman 1988; Marchildon 2007). This administration survives today in the portion of the region illustrated in Fig. 9.1.

Bison (estimated to number between 30 and 60 million) were the staple resource for the First Nations inhabitants of the North American Great Plains for approximately 11,000 years prior to European contact. By AD 100, the bow and arrow had begun to supplement the spear and throwing stick for hunting bison. Pedestrian hunters also herded bison into jumps (cliffs and other natural drops) and pounds (constructed corrals). Bison grazed on the short grass prairie, vegetation that the First Nations peoples altered only when they burned it in order to drive bison herds to organized kill locations (Daschuk 2009).

While the northern Great Plains have always been relatively dry, the area has been subject to major climatic perturbation in the past. The warming of the Neo-Atlantic Climatic Episode between AD 850 and 1200 allowed for the establishment of Aboriginal maize-based farming in the southern parts of the Great Plains. The following Little Ice Age from the thirteenth to the early nineteenth centuries prompted Aboriginal in-migration to the northern Great Plains after the collapse of maize farming increased the appeal of the regularity and reliability of bison herd movements in this region.

European contact further changed the Aboriginal social–ecological systems. The introduction of horses and guns facilitated bison hunting, and the European-based fur trade created a demand for industrial-scale production of pemmican (dried and pounded bison meat and fat) by both Aboriginal groups living on the Plains, and Métis (people of mixed European and Aboriginal descent) hunters who moved into the western Great Plains as they began to deplete their traditional bison hunting areas in the Red River Valley.

An increasing demand for bison hides and preserved bison tongues, coupled with advances in hunting technology in the form of fast-loading and accurate rifles, led to the near extinction of the bison in the late nineteenth century (Arthur 1984). The collapse of the bison hunt, and its associated economic and food insecurity prompted the settlement of Treaty 6 (1876) and Treaty 7 (1877) with the Plains Cree and other First Nations. The treaty process re-settled Aboriginal groups spread throughout the Canadian Plains to smaller plots of land known as reserves. Shortly after this re-settlement, the predominantly European settlement systems and attendant formal institutional structures were established in the present-day region of the Special Areas.

### ***9.2.1 Phase I: Open-Range Ranching, 1880–1906***

The first European social–ecological system to be established in southeastern Alberta was open-range cattle ranching. Aboriginal re-settlement onto reserves left the present-day Special Areas vacant, and ranchers began to establish large range-based operations. The establishment of large-scale ranching was facilitated by a number of economic and institutional developments. A large market for live cattle existed in Britain, and major cattle businesses began to emerge in the United States to meet this demand (Breen 1983). The Canadian federal government, eager to stimulate similar export-oriented businesses in Canada, passed an order-in-council to permit 21-year leases of land of up to 100,000 acres (40,468 ha) at the rate of one cent per acre per year. These leases were “closed”, meaning that they explicitly prohibited homestead settlement and thus resulted in a very low population density. Furthermore, in order to encourage cattle ranching in the Canadian Great Plains, the Canadian federal government permitted ranchers to bring cattle duty-free from the United States for 2 years. It is estimated that approximately one-third of all the land in southwestern Alberta was soon being used for grazing in this manner (Jameson 1986).

Open-range ranching reached its zenith by the late 1890s, but institutional changes coupled with a climatic stimulus in the early twentieth century precipitated a crisis causing the collapse of open range ranching in the Special Areas (Evans 1983). There were a number of factors that caused this crisis. First, there was a major change in the market for live cattle after 1900. With improvements in chilling methods, British imports of chilled beef from Argentina began to supplant live cattle imports from Canada. Second, in 1904, the federal government abolished large leases, and shifted toward policies that heavily favored homestead settlement over ranching. Finally, the particularly cold “Killer Winter” of 1906–1907 decimated the cattle herds of the Canadian West. The portion of the Great Plains most affected by this was the short grass prairie of the Dry Belt. Evans (1983) estimates that between 60 and 65% of cattle stock in short grass ranching operations perished.

Large ranch operations were in a poor position to adapt to the Killer Winter, largely because of the shift in institutional attitude to favor smaller, crop-based homesteading operations. Smaller, more marginal ranchers were in a better position to survive stock losses and less secure land tenure arrangements (Elofson 2000). Adaptation strategies included the introduction of grain cultivation alongside now smaller cattle operations, or even a wholesale shift to grain farming (Evans 1983).

The open-range social–ecological systems described above illustrates a shift from relatively high institutional fit and interplay to an institutional reorientation, which in conjunction with a climatic stimulus, was a poor fit for open range cattle ranching. The original 21-year, 100,000 acre grazing leases were a good spatial and temporal fit for open-range ranching. Functionally, the federal government of the 1880s sought to facilitate extensive cattle ranching with the removal of import duties on cattle in the first 2 years. Domestically, however, the area was under federal jurisdiction, and thus there was a lack of interplay, with (largely nonexistent) local and regional institutions. Local-level institutions were unlikely to emerge with the relatively low population density, as the area had a total settler population of 75 in 1901 (Wandel et al. 2009). Furthermore, there were no long-range international trade negotiation and thus no replacement market when Britain shifted its trade focus to Argentina. In the late nineteenth century, the federal government and its institutions were a poor spatial fit for the local social–ecological system. Federal administration was poorly connected to local realities due to a lack of local institutions (and thus no vertical interplay), that left ranching vulnerable to the cyclical droughts of the Dry Belt. Indeed, the abolishment of the large leases and the shift toward homesteading were a poor functional fit for ranching.

### ***9.2.2 Phase II: Monoculture Wheat-Crop Cultivation, 1908–1920s***

As noted above, federal policy shifted to emphasize homesteading in the northern Canadian Great Plains in the early nineteenth century. In 1906, two years after the abolishment of the large leases, the area had a population of 800. In 1909,

the present-day Special Areas became the last extensive region of the Canadian Great Plains that opened to homestead settlement under the Dominion Lands Act. Settlement was guided by the Dominion Land Survey, which mapped out six mile by six mile by six mile (9.65 by 9.65 km) townships, which were further subdivided into 36 sections of 640 acres (259 ha). Settlers were granted 160 acres (65 ha) on the condition that 25% of the land was cultivated and a permanent homestead established within 3 years. Furthermore, two sections per township were reserved for schools, with the proceeds of land sales expected to fund the school buildings. School districts were formally established by 1911, and municipalities and local improvement districts had formed by 1914. This reorganized the social ecology of the region, now focused on small, intensely cultivated family-run homesteads governed by numerous rural and urban municipalities. This shift to a high density wheat-farming system was reinforced by external climate and macro-economic stimuli during 1915 and 1916. The First World War was accompanied by inflated wheat prices by a rapid inflation in wheat prices – the world price would more than double between 1914 and 1918 – and above average rainfall produced bumper crops in 1915 and 1916 (Jones 2002; Marchildon 2007; Marchildon and Anderson 2006). In-migration continued during this time, and the 1921 Census lists an all-time high of 26,000 settlers in the Special Areas.

Climatic stimuli, however, ultimately triggered the decline of the wheat-farming phase. In 1917, farmers experienced the first in a series of successive droughts. With the exception of one wet year in 1927, droughts persisted every year in the Special Areas until 1939 (Marchildon et al. 2008). Federal response focused on immediate, short-term aid in the form of a total \$300,000 of loans for seed grain, fodder, and relief for Alberta (Jones 1985). However, most drought response strategies were left to the provincial governments. This placed tremendous strain on the provincial government of Alberta, which had spent \$7 million in relief loans by 1924 (Jones 1985). In 1921, the United Farmers of Alberta were elected to the provincial legislature, promising to address the catastrophic drought situation in the Dry Belt. The new government passed the Drought Relief Act in 1922 and the Debt Adjustment Act in 1923, which instituted debt moratoria and consequently contributed to the high loan default rate (Jones 1985). However, the 1922 Tax Recovery Act forced homesteaders to pay tax arrears or forfeit their land (Jones 1985). As the droughts continued, the provincial government helped fund farmers to move their families, equipment, and supplies into irrigated areas further west and north of Calgary.

The climatic stimulus of prolonged and severe drought meant that municipalities went bankrupt, roads were abandoned, and schools were closed due to the collapse in local property revenues. As noted above, the establishment of the wheat-farming social–ecological system was primarily the result of an institutional re-orientation to homesteading. The system was characterized by unprecedented human population density in the region and a reliance on monoculture cultivation, with an attendant emergence of local institutions. The institutions and policy instruments which guided the emergence of this system, especially the Dominion Lands Act and Dominion Land Survey, were designed to fit a relatively small farm size of 65 ha

(160 acres), and only had provisions to increase farm size to 130 ha (320 acres). Furthermore, the conditions of obtaining secure land tenure prescribed cultivation. Consequently, these instruments had a high degree of spatial and functional fit only if climatic and commodity price conditions were such that small scale crop farming was profitable. Due to higher-than-average rainfall before 1917 and high wheat prices before and during the First World War, small scale farming was financially attractive to farmers in the Special Areas in this period.

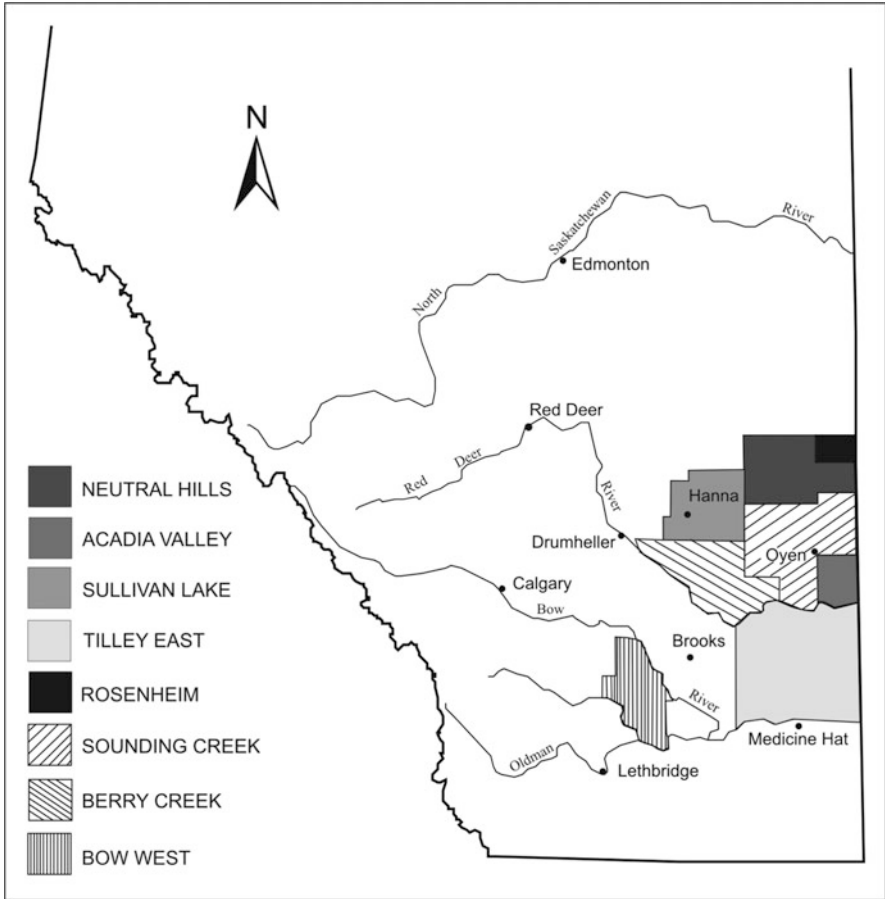
Although local-level institutions such as municipal governments and school districts had been facilitated by the federal government policy – although the province of Alberta was created in 1905, it did not gain control over public lands and resources until 1930 – there was little vertical interplay. Generally, local level institutions relied on local revenues, while federal drought response was limited to providing minimal relief (i.e., basic foodstuffs and seed) to farm families in only the most extreme circumstances. Provincially, there was insufficient interplay between local institutions and provincial aid strategies to prevent the collapse of local institutions, and provincial strategies exacerbated this by facilitating out-migration. Generally, the institutions of the early wheat-farming phase were designed to fit a federally designed and desired outcome for the Canadian Plains as a whole, but they did not fit the long-term climatic and macro-economic reality of the Dry Belt of southeastern Alberta.

### ***9.2.3 Phase III: The Special Areas and Mixed Ranching, 1930s to Present***

The prolonged droughts and associated dramatic failure of the wheat-based crop farming social–ecological system of southeastern Alberta prompted experimentation with strategies beyond short-term relief at the provincial government level. The first of these experiments was in the Tilley East Area immediately north of the city of Medicine Hat (see Fig. 9.2). In 1927, the provincial government passed a law, placing the area under the stewardship of a single board that would facilitate taking over land from bankrupt farmers and publicly manage access to both land and water in order to allow the more sustainable, larger ranches and ranch-farms to expand. The major impediment to the scheme was the fact that, as in the case of the two other prairie provinces of Saskatchewan and Manitoba, the federal government – not the province of Alberta – owned public (Crown) lands as their resources. Only after the 1930 federal transfer of public lands and resources to the three provinces, could the government of Alberta execute its first Special Areas scheme (Marchildon 2007).

The experiment proved successful enough that the Alberta government extended the administrative control of the existing board to the Berry Creek Area directly north of Tilley East in 1932. In 1935, under the Special Municipal Areas Act, Sounding Creek, Neutral Hills, and Sullivan Lake Special Areas were added to Tilley East and Berry Creek. Two years later, the Bow West Special Area was also added. Finally, in 1938, the provincial government amalgamated all of the





**Fig. 9.2** Alberta’s present-day special areas  
 Source: Marchildon 2007

municipalities and improvement districts into a single Special Areas administration headquartered in Hanna. With local government eliminated, the new administrative entity was mandated to manage all public resources, including land and water resources, as well as roads and schools throughout the Special Areas. Appointed by the provincial government in Edmonton, the Special Areas Board was conferred all the legal and administrative tools required to manage the area in the manner it deemed most efficient for the remaining residents (Gorman 1988; Marchildon 2007).

The main objective of the Special Areas Board and its predecessors was to reduce the population of the region while transforming small wheat farms into larger ranches and ranch-farms. The government administrators took over bankrupt farm lands and then leased these lands at inexpensive rates; in 1938, for example, grazing lands were leased for 2.5 cents per acre, while crop lands could be rented for a one-sixth share of the annual crop. The boards also created community

pastures out of Crown lands, offering everyone within a particular district inexpensive access to grazing lands. By 1941, the population in the Special Areas was 15,000, roughly one-half of what it had been 10 years before, while the average farm was double the provincial average in size, and would be 3.6 times larger than the provincial average by the mid-1950s (Marchildon 2007).

Through most of the postwar era, rural society in the Special Areas, including the leases, community pastures, roads, and schools upon which ranchers and farmers are dependent, have been administered by the Special Areas Board. In effect, the Special Areas Board takes the place of local, democratically elected, government. Despite the fact that residents have not faced droughts on the scale suffered before the Second World War, and despite commissions that have offered the possibility of the restoration of local self-government, the majority of the people in the region have consistently supported this unique institutional arrangement, and it has persisted to the present day in the former Neutral Hills, Sullivan Lake, Sounding Creek, and Berry Creek Special Areas. It is noteworthy that the portions of the Special Areas that benefited from irrigation (Acadia Valley, Bow West) or military base development (Tilley East) after the 1930s are no longer part of this institutional arrangement.

Currently, the land tenure system in the Special Areas is comprised of 60% public land, 91% of which is administered through grazing and cultivation leases. Lease land within the Special Areas has been assessed for both suitability for cultivation and carrying capacity for grazing, and only a few parcels in particularly moist areas in river valleys can be cultivated under the terms of the lease. The bulk of the land is under 20-year renewable grazing leases, in which the terms of the lease specify a maximum carrying capacity, and lease land is inspected twice annually for signs of overgrazing (Slemp 2006). Consequently, the current institutions explicitly specify a particular land use, ranching, on a large portion of the land base of the region. Furthermore, the provincial government of Alberta directly subsidizes ranching through the maintenance of five community pastures on grazing reserves within the Special Areas. The community pastures are designed to help farmers build herds through access to both land and bulls for breeding (Hyland 2006). Priority is given to ranchers with fewer resources for cattle raising, thus facilitating new entrants into ranching operation. There is no similar support system for dryland farming in the region, and thus the current institutional structure implicitly promotes a conversion to an extensive land use which does not involve cultivation. These institutional strategies for promoting ranching are managed to fit within the Special Areas Board's mandate to "drought-proof" the area, in this case, to retain or return as much of the land as possible to permanent grass cover and to maintain healthy grassland systems on both leased and grazing reserve land.

The land tenure system in the Special Areas illustrates particularly good fit in spatial, temporal and functional terms. Spatially, the large land base allows for low density stocking rates on very large tracts of land including several farm operations over 100,000 hectares. Temporally, the renewable 20-year grazing leases allow for investment in good grass cover, with many ranchers re-seeding native grass species. In terms of ecological resilience to drought, ranching preserves the moisture in

short grass prairie better than commercial crop farming. Furthermore, the Special Areas Board and its attendant administration is not subject to recurring election cycles, and administrators remain in their position for many years. Functionally, the Special Areas Board can emphasize drought-proofing in light of persistent dry periods and carry out its mandate without catering to election cycles.

In the present-day Special Areas, both horizontal and vertical interplay are well developed and match the current social–ecological system. Horizontally, the organization tasked with implementing the land tenure system, the Special Areas administration, closely matches its mandate. Vertically, the Special Areas administration is under the direct supervision of the Alberta government’s Department of Municipal Affairs. Furthermore, the Special Areas administration maintains a small irrigation project in the southern portion of the region and has managed to enhance security of irrigation water in collaboration with the provincial government’s Department of the Environment by installing pumps on the Red Deer River to recharge one reservoir. In doing this, the Special Areas administration works in collaboration with a private utility company, ATCO Power, to pump water from the river to another multi-purpose reservoir which serves as a cooling pond for a thermal generating station, local recreational area, and irrigation canal recharge for the residents in the region.

Vertical interplay is also evident in terms of the government of Alberta’s collaboration with the government of Canada. Through a federal-provincial agreement known as the Master Agreement on Apportionment administered by the Prairie Provinces Water Board, a minimum of 50% of the natural flow of rivers in the Canadian plains must be passed on to the next downstream province. The southern portion of the Province of Alberta is increasingly water stressed, and portions of the South Saskatchewan River Basin (SSRB) are over-allocated for use. In Alberta, water diversions are subject to volume-based water licenses, and license priority is determined by its date of issue. Most of the Special Areas is part of the Red Deer sub-basin of the SSRB, and while the Red Deer River is not currently over-allocated, the more southern sub-basins of the St. Mary’s, Oldman and Bow Rivers are over-allocated. As a consequence, the flow of the Red Deer River is frequently used to meet Alberta’s apportionment to Saskatchewan as per the federal policy. In turn, this federal policy places limits on the volume of water which can be used – and licensed – by Alberta Environment, and consequently influences whether or not the large-scale diversions are approved.

Currently, the Prairie Association of Water Managers (PAWM), a Special Areas-based organization working in conjunction with Special Areas personnel, has proposed a large-scale diversion from the Red Deer River involving a 4.5 km long pipeline, 80 km of canals and existing reservoirs in northern Special Areas. The proposed mean diversion of 53,000 cubic meters allow for almost 40,000 hectares of supplementary irrigation as well as stock watering (to meet the drinking needs of livestock) during particularly dry years, and thus increase the resilience of the Special Areas to extreme dry conditions (Special Areas Board 2005). The license application was submitted in 2003; to date, PAWM has yet to receive an allocation from Alberta Environment. Furthermore, their project proposal has led to

conflict with environmental non-governmental organizations and the upstream City of Red Deer. It is expected that, as Alberta's population continues to grow and water needs increase, conflict will also increase and vertical interplay will continue to weaken.

### 9.3 Discussion and Conclusion

The Special Areas of Alberta have undergone three dominant social–ecological system phases since the European settlement was established in the late nineteenth century. Institutional and societal reorganization is both triggered, and then reshaped, by a combination of environmental, economic and political factors creating, in effect, a new social–ecological system in each phase. The establishment of the open ranching phase began with the slaughter of the vast bison herds driven by the external demand for bison products and the containment and enclosure of Aboriginal peoples. This first phase came to a close as a result of the loss of institutional support for extensive ranching coupled with the extreme climatic event of the winter of 1906–1907. The second monoculture wheat-farming phase was triggered by government support of family farm settlement, furthered by favorable climatic conditions and rising wheat prices. This social–ecological system collapsed as a result of the climatic stimulus of prolonged drought combined with the inability of local, regional and national institutions to respond to the disaster. The third and current phase of Special Areas administration based on mixed ranching has lasted longer than any other phase of Euro-Canadian settlement on the Canadian Prairies. The administrative structure which was established during the most recent institutional and societal reorganization, although intended as a temporary measure, has persisted to the present day.

During the wheat monoculture phase, the fit between the ecosystem and local and regional institutions was poor relative to the first and third phases. Homesteaders were expected to subsist on 160 acres of cultivated land. The homesteading system relied on the associated high population density for the maintenance of local government and associated services such as schooling. Institutional reorganization radically changed the desired outcome from small scale crop-based farming to extensive, ranching based livelihoods. In this case, the current institutions shaping land use are comprised of a system of land tenure which retains at least half of the region's area in public ownership and administered under restricted use leases, a shift in agricultural norms from cash cropping to grazing, and the Special Areas Board's "drought-proofing" mandate. In effect, the Board is facilitating the conservation of moisture-stressed short grass prairie, the key economic element in the ecosystem.

Since their establishment, the Special Areas have remained relatively resilient to repeated short-term droughts. The average farm size in the Special Areas became much larger than the average farm size in the rest of Alberta due to provincial policy. By the census of 1941, the average farm in the Special Areas was a little more than two times the size of the average provincial size. By 1956, this average

Special Areas farm was almost four times the size of the average farm in the province (Marchildon 2007). This was accompanied by a further significant decrease in population from just over 15,000 in 1941 to 11,000 by the mid-1970s (Wandel et al. 2009). Since that time, the population of the Special Areas has remained relatively constant, indicating a relatively stable system.

The stability of the current socio–ecological system was illustrated during the most recent drought disturbance in the Special Areas. Southeastern Alberta was faced with a severe drought from 2001 to early 2003, to the point where some of the large irrigation districts in the southern part of the SSRB ran short of water. The Special Areas were subject to poor grass growth, crop failures among dryland farmers, and a concurrent grasshopper outbreak which decimated what vegetative growth there had been. The drought event did not, however, lead to widespread bankruptcy, in part due to the already high resource accumulation which allowed individual farmers to draw on costly adaptation strategies such as hauling stock water and importing feed for livestock. Furthermore, several dryland farmers converted their operation to mixed ranching or abandoned cropping in favor of extensive grazing operations altogether (Wandel et al. 2009). Furthermore, the current social–ecological system of the Special Areas seems resilient to more than climatic stimuli. Despite changing commodity prices, including the crash of beef prices following the confirmed report of *bovine spongiform encephalopathy* (BSE) in Alberta in 2003, and recurring dry periods, the area has continued to support a viable agricultural economy.

However, southeastern Alberta has not been faced with prolonged and severe drought on the scale of the 1920s and 1930s. Both farmers and regional institutional representatives note that they tend to plan for drought events lasting a maximum of 3 years (Wandel et al. 2009). Climate records show that there have been no severe multi-year droughts since the mid twentieth century. Furthermore, the last 60 years have exhibited one of the most favorable moisture regimes in the past 400 years (Sauchyn 2007). Climate scenarios, however, project warmer, drier summers and decreased flow levels in the South Saskatchewan River’s tributaries throughout the twenty-first century (Lapp et al. 2009). Given the expected climate change coupled with the insights from the 400-year moisture record presented in Sauchyn (2007), it is likely that the region will be subject to longer, more severe droughts than it has experienced over the past 70 years. A social–ecological system and its attendant institutions designed to match drought events lasting three years or less may face unprecedented challenges in the coming decades.

Another major challenge for the current social–ecological system is Alberta’s oil and gas industry. Currently, many farm and ranch operations in the area lease small parcels of land to oil and gas companies for wells and pumps. To date, the revenues from these leases has increased capital accumulation on farm operations and provided off-farm employment to those wishing to supplement their incomes. However, the oil and gas industry places high demands on Alberta’s water resources, and this introduces potential conflict. Since 2005 alone, surface water use in Alberta’s petroleum industry has increased by 3.67% (CAPP 2009). Furthermore, as oil and gas revenues take on increasing importance in the regional

economy, the institutional fit may decrease. Schindler and Donahue (2006) note that, to date, the cumulative effects of drought and human use of Alberta's water resources have seldom been considered in institutional arrangements. The Special Areas administration and its associated land tenure system were designed for the specific purpose of managing an agricultural resource in light of the recurring drought. Increasing resource use conflicts have already become evident in the case of concerns over coal bed methane contaminating the groundwater resource (Bester 2007) and maintaining water reserves for upstream growth in the City of Red Deer (Williams 2006). As the conflict among the various institutional and noninstitutional actors increases, the currently successful institutional interplay will be challenged.

There are a number of broad public policy lessons or implications that can be drawn from this case study of the Special Areas of Alberta. The first is that even in countries with well-developed civil society institutions such as Canada, the state plays a major, if not determinative, role in shaping the social-ecological system through the policies, laws, regulation, subsidies and other instruments at its disposal to support or reshape institutions. Although civil society also engages in institution-building, governments have certain advantages in that they can pass and enforce laws, impose and collect tax revenues, use the funds so collected to subsidize or encourage activities, as well as actively manage land, water and other resources in which the state has some ownership or regulatory control. Moreover, because governments have a mandate to act for all of its citizens or residents unlike civil society organization whose mandate is limited to its membership, the state (whether defined as local, regional or national government, or some combination of all) has an obligation to act in the public interest in the event of social-ecological crisis.

The second lesson is that state involvement and intervention can be critical in determining the nature and quality of the institutional fit. If the state intervenes to encourage a mode of socio-economic habitation that conflicts with, or destroys, the long-term ecological sustainability of land and water resources, for example, then this will produce social and ecological dislocation. Based upon a management horizon that was too short-term, the federal government recklessly encouraged farm settlement and monoculture wheat cropping in the Dry Belt of the Palliser Triangle. Despite evidence that this region was subject to cyclical bouts of prolonged drought, the federal government treated this high-risk part of the Palliser Triangle the same as other, lower-risk areas, of the Canadian Plains for the purposes of settlement policy (Marchildon 2009). It must also be recognized, however, that the crisis produced by such poor spatial and temporal fit may elicit a more desirable set of public policies from the state, thereby facilitating a better institutional fit. For example, the government of Alberta's response to the crisis of drought in the 1920s and 1930s produced an innovative response through the creation of the Special Areas and the rapid transition from monoculture agriculture to mixed farm-ranch agriculture that fitted much better with the soil, water and long-term climate features of the region.

The third lesson is that the state is not monolithic. The state is made up of various levels of government, each with its own roles, responsibilities and capacities. Therefore, it is important to determine the level of government that is most

appropriate, given such roles, responsibilities and capacities as well as the size and peculiarities of the region and population that most requires state intervention in order to avoid or mitigate a social–ecological catastrophe. Of course, the appropriate or effective level of government to ensure effective spatial fit depends on numerous factors including constitutional authority, effective responsibility, fiscal capacity, governance competency, and proximity to the population most affected by the lack of the institutional fit. The government of Alberta was prevented from instituting the Special Areas until it gained constitutional authority over land and resources from the federal government in 1930. At the same time, the convergence of a fiscally limited local government with a federal government that was too distant from the population in this unique region within the Palliser Triangle meant that the provincial government was the most logical choice for intervention. At the same time, given the fact that rivers cross provincial boundaries, the federal government must play a role in avoiding beggar-thy-neighbor policies in order to protect the national interest. This has been achieved through intergovernmental collaboration through federal-provincial agreements such as the Master Agreement on Apportionment or inter-provincial institutions such as the PAWM.

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