



Canadian International
Development Agency

Agence canadienne de
développement international

Desertification: a perspective on Canada

**Canada's First Report on Domestic Activities Relevant to the United Nations
Convention to Combat Desertification**

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Canada 

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Summary

Desertification: a perspective on Canada

Canada is a Party to *the United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and Desertification, Particularly in Africa (UNCCD)*. Canada's primary responsibility under the Convention is as a Donor Party. Canada provides support to developing countries in all regions of the world in their fight against desertification mainly through Official Development Assistance (ODA) programming.

However, because of the existence of drylands in the Canadian prairies, Canada is also considered an Affected Party under this Convention. As an affected developed country, Canada does not have to develop a National Action Plan, but it does have to ensure that desertification issues are integrated into its national sustainable development plans and policies. Another obligation, for all Parties under this Convention, is to report on activities undertaken to address the problem. "*Desertification: A Perspective on Canada*" is Canada's first national report on domestic activities relevant to the UNCCD.

Portions of the three Canadian prairie provinces – Alberta, Manitoba and Saskatchewan – contain land considered vulnerable to desertification. This affected area is comprised of semiarid and dry subhumid lands, which are frequently subject to drought, and under considerable human pressure. The Prairies – Canada's breadbasket – account for over 50% of Canadian farm cash receipts and contains over 80% of the nation's agricultural land. The vulnerability or potential loss of these important fertile lands would result in significant loss in agricultural productivity and have serious economic implications for Canadians. Apart from the economic repercussions, particularly for rural Canadians, there is intrinsic value in maintaining the biodiversity of the Canadian prairies.

The first government initiative to promote sustainable agricultural development on the prairies dates back to 1886 when the Experimental Farm Station Act received royal assent. This led to the establishment of Canada's first five experimental farms, at Indian Head, Saskatchewan and at Brandon, Manitoba. The primary focus on these experimental farms was research and development of soil management practices to improve soil and water conservation. Later, experimental farms were established at Lethbridge, Alberta (1906) and Swift Current, Saskatchewan (1920), with the mandate to "discover suitable cultural methods for the dry areas of the southern prairies and combat the severe problems with drought and wind erosion." Today, the Agriculture and Agri-Food Canada (AAFC) research centres at Lethbridge, Swift Current and Brandon continue to play a leading role in the development of sustainable land management systems for the prairies.

Further measures to combat land degradation were implemented in Canada as early as the 1930s. In 1935, the federal government of Canada created the Prairie Farm Rehabilitation Administration (PFRA) to help farmers overcome severe drought. Now a part of AAFC,

the PFRA continues to implement most land conservation programs in the prairies, working in partnership with other federal government departments – Environment, Natural Resources and Forestry Services; their provincial counterparts, and Canadian civil society.

Action to address land degradation and desertification in Canada is grounded in this partnership approach, and achieving sustainable development demands effective integration of environmental concerns at all levels of policy and decision making. A variety of provincial departments (agriculture, environment, resource management) work collaboratively within their respective provinces, as well as inter-provincially, in their efforts to maintain both the agricultural community and environmental sustainability. Inter-provincial collaboration, for example, has proven effective in the management of water resources, in habitat conservation, and in the involvement of industry and the rural community in programs and initiatives addressing the problems of land degradation. The provincial efforts are in concert with those of PFRA.

Working together, the Canadian public combat desertification through a variety of measures. For example, there are several conservation groups that provide information on conservation farming techniques or help make Canadians aware of the significance of land degradation. Other conservation producer groups, working collaboratively with industry, government, and NGOs, help protect remaining native prairie grasslands and encourage reclamation of marginal lands.

Canadian technology and research capability are fundamental to finding solutions to dryland management. PFRA and AAFC research centres in Saskatchewan and Alberta focus specifically on dryland farming issues and work to better understand issues related to soil organic matter, maintenance of genetic diversity, tillage systems, wind erosion, livestock management, and many other topics. Canada's capabilities in climate research, drought monitoring, remote sensing and geographic information systems (GIS) technologies are also proving important in the fight against land degradation and desertification. Canadian universities are fundamental to this research contribution.



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Canada has developed a wealth of information on land degradation and desertification and has an active role in elaborating and implementing programs both within Canada and in developing countries. For example, Solidarité Canada Sahel, a Quebec non-governmental organization (NGO) plays the role of national focal point encouraging coordination and collaboration amongst NGOs in Canada and in developing countries. Canada's

research network (agricultural research centres, universities) are continually making available to Canadians and developing countries information on new technologies for conservation agriculture, drought monitoring, maintenance of biodiversity and other topics.

Canada's position as both a Donor Party and an Affected Party under the UNCCD is stimulating research, education and awareness, and collaborative efforts that can prove effective in combating land degradation in Canada and abroad.

Introduction

Canada and the convention to combat desertification

Canada has been working to halt the spread of desertification in the developing world for more than three decades. In 1995, as a reflection of this commitment, Canada ratified the *United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (UNCCD)*. Because of its primarily international development purpose, the Canadian government mandated the Canadian International Development Agency (CIDA) and the International Development Research Center (IDRC) to implement the Convention.

Canada's principal obligation under this Convention is, as a developed country, to provide Official Development Assistance (ODA) to affected developing country Parties to assist them in the fight against desertification. Canada is required to report on the level of ODA activities in its annual national reporting to the Convention. Canada's first report - "*Desertification: A Canadian Perspective*" - was submitted to the Third Meeting of the Conference of the Parties of the Convention, in November 1999, in Recife, Brazil. Canada will provide annual updating of this information to ensure Parties and partners are kept apprised of Canadian-supported development activities, which address desertification around the world.

Canada, however, is in a rather unique position as it is also an affected country under the Convention. Portions of the three Canadian Prairie Provinces - Alberta, Saskatchewan and Manitoba - are comprised of semiarid and dry subhumid lands vulnerable to land degradation and desertification. This area - known as the Palliser's Triangle - is mostly agricultural land currently used for crop and livestock production. The Triangle has suffered from land degradation and drought for a long time: many Canadians will remember the Dust Bowl of the 1930s, when thousands of square kilometres of this once fragile land was transformed into dust by severe drought and wind erosion.

The Convention defines desertification as:

"land degradation in arid, semiarid and dry subhumid areas, resulting from various factors, including climatic variations and human activities"

Arid, semiarid, and dry subhumid are "areas, other than polar and sub-polar regions, in which the ratio of annual precipitation to potential evapotranspiration falls within the range of 0.05 to 0.65"

It is estimated that more than 200,000 km² (Palliser's Triangle) is vulnerable or subject to land degradation, thus making it relevant to this Convention. This represents a small portion (3%) of Canada's total area, but it is a significant portion of the prairie ecozone (approximately 42%). Since the disastrous experience of the 1930s, measures have been

put in place to combat degradation, including the 1935 creation of the Prairie Farm Rehabilitation Administration (PFRA), a federal government agency to assist farmers and communities in their fight against desertification. Over the last 65 years, the PFRA has worked with a strong network of partners to identify techniques and implement programs for improving farm practices and land utilization within the area.

Specifically, the PFRA is mandated to *"secure the rehabilitation of the drought and soil drifting areas in the Provinces of Manitoba, Saskatchewan and Alberta, and to develop and promote within those areas, systems of farm practice, tree culture, water supply, land utilization and land settlement that will afford greater economic security"*. Now a part of Agriculture and Agri-Food Canada (AAFC), the PFRA has developed considerable expertise in land rehabilitation, dryland agriculture, erosion control, and sustainable rural development.

The Research Branch of AAFC plays a significant role and is closely involved in production and research issues which contribute to addressing desertification. Major research centres in each of the prairie provinces have regional and national mandates to develop more sustainable crop production systems and protect our soil and water resources. Other federal government departments – Environment, Natural Resources, and Forestry Services – undertake programming of direct relevance to the sustainable development and conservation of Canada's natural resources, including the drylands. Canada's constitution designates the control and sustainable management and use of Canada's land area and natural resources as a shared jurisdiction between federal and provincial authorities. Therefore, each federal department works in close collaboration with its provincial government counterpart.

"Desertification: A Perspective on Canada" is Canada's first National Report to the UNCCD on the status of Canada as an Affected Party. As an affected developed country, Canada is not obligated under the Convention to elaborate a National Action Plan, but is required to ensure that issues related to desertification be integrated into its national sustainable development and environment policies. The development of *"Desertification: A Perspective on Canada"* is Canada's first effort to examine the issue of desertification in Canada within the context of this global Convention. The report examines and elaborates, both for Canadians and the international community, how Canadian policies, programs and projects address land degradation and contribute to combating desertification in Canada.

Canada's response relies upon the continued support, maintenance, and enhancement of infrastructure established to combat desertification. The approach involves federal and provincial governments working closely with individual landowners, farm groups, and NGOs. Some responses are short-term (1 to 5 years), targeted to achieve specific results, or to introduce new technology or management practices such as low-



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disturbance tillage or permanent cover on marginal lands. Other responses are longer term and often aimed at the establishment of infrastructure such as research centres, government agencies, and stakeholder association capacity or the establishment of programs and regulations for soil and water resource management. This report describes the multitude of elements making up Canada's response to desertification.

Canada as an affected country

Canada's western interior plains

Canada's western interior plains physiographic region covers 114.9 million hectares, representing about 12% of Canada's land, and comprising two ecozones: the prairies and the boreal plains. The prairie ecozone (46.7 million hectares) has its base on the Canada - United States border, arcing from western Alberta to eastern Manitoba (see accompanying map). This region is the northern extension of what is commonly referred to as the Great Plains of North America.

The prairies were settled during the late 1800s and early 1900s. Since then agricultural activity has significantly modified the prairie landscape.

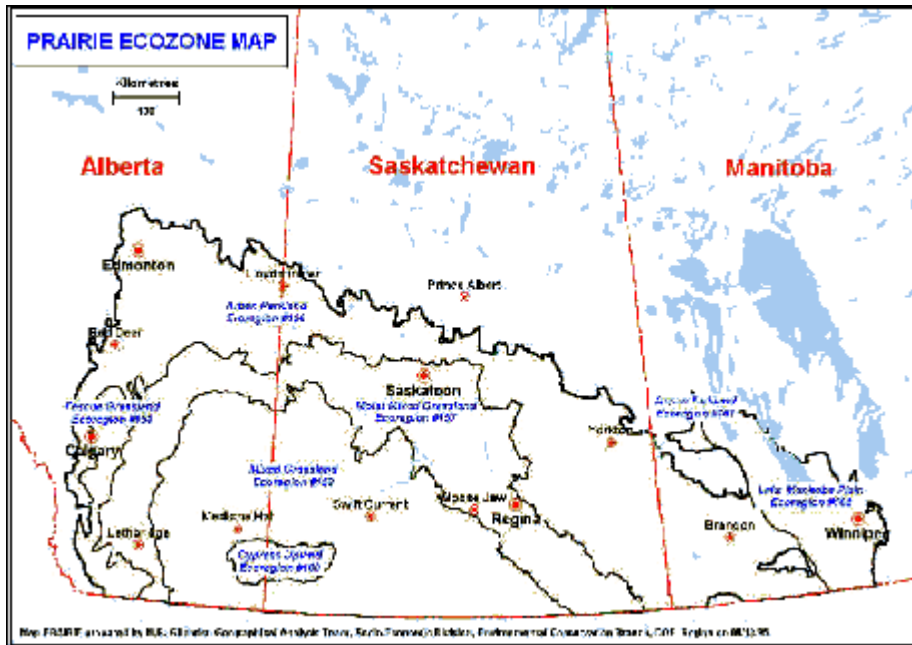
While in general the plains are characterized as a flat, grassland environment, there are areas of significant variation. Three distinct "prairie levels" are defined – the Manitoba Lowlands, the Saskatchewan Plain, and the Alberta Plain or Plateau. Elevations rise from the lowlands of Manitoba through to the foothills of Alberta, with two major escarpments separating the prairie levels. The Manitoba Escarpment separates the lowlands from the Saskatchewan Plain, and the Missouri Coteau represents the boundary between the Saskatchewan Plain and the Alberta Plateau. Several remnant uplands are found along both escarpments. However, many local topographic variations are found within each level, often associated with hummocky moraine uplands or the deeply incised glacial meltwater channels now occupied by streams or rivers (e.g., Saskatchewan River Valley, Qu'Appelle Valley, Frenchman River Valley, Red Deer River Valley).

Climate also varies through the region, typically being more arid in southern Alberta and southwestern Saskatchewan and progressively more semiarid to subhumid moving north and east. With the climatic variations come very noticeable differences in natural vegetation and soil type. The Prairie Ecozone Map illustrates the progressive change from mixed grassland through to moist mixed grassland and eventually an Aspen Parkland ecoregion. There is a boreal transition zone between the parkland and the boreal forest of the north.

Significant topographic variations like the Cypress Hills Upland (southeastern Alberta and southwestern Saskatchewan) are unique in this environment and benefit from significantly greater amounts of moisture due to orographic precipitation. The Cypress Hills Upland contains both fescue grassland and forest (lodgepole pine, white spruce, aspen) communities surrounded by a semiarid, mixed grass prairie environment.

There are, throughout the region, many areas of hummocky moraine where seasonal wetlands provide very significant waterfowl habitat, particularly during the spring and in wet years. As most of the wetland areas depend upon spring snowmelt, their abundance and size can vary greatly from year to year. The moister environments also provide

habitat for more diverse vegetation, with willows and shrub species commonly associated with the wetland complexes.



Short, hot summers, and long, cold winters, with low levels of precipitation and high rates of evaporation, characterize the climate. The mean annual precipitation has extreme variability, ranging from 250 mm in some areas of the arid grassland regions in Southwest Saskatchewan and Southeast Alberta, to more than 500 mm in the Manitoba Lowland. Annual potential evapotranspiration also varies, from highs of more than 600 mm in Southwest Saskatchewan and southeast Alberta, to values below 450 mm in the moister environment of Manitoba. The annual water deficit influences the natural vegetation, as illustrated in the Prairie Ecozone map. Mixed grass prairie was the typical natural vegetation in Southeast Alberta and Southwest Saskatchewan at the time of settlement.

Mid- and tall- grass prairie landscapes were typical of the more northern and eastern portions of the ecozone, with tall grass prairie being common in Manitoba or as a component of the Aspen Parkland ecoregion. However, only small, isolated remnants of natural prairie remain. In comparison to the UNCCD criteria defining desertification, the mixed grassland and much of the moist mixed grassland ecoregion fall into the affected range of 0.05 to 0.65 (ratio of annual precipitation to potential evapotranspiration). Even portions of the Aspen Parkland and boreal forest transition zones are subject to periodic drought (e.g., 1961 was a particularly widespread drought).

Agriculture is the dominant land use in the prairie landscape, with almost 97% of the land classified as agricultural. Over 60% of Canada's cropland and 80% of its rangeland and pasture are located in the prairie ecozone. Other major activities contributing to the economy are mining (coal, potash, mineral, and aggregates), oil and gas production, and, in some areas, tourism. Despite the dominance of agricultural activities on the landscape,

approximately 75% of the population of 3.8 million are found in urban communities. For example, in Saskatchewan, the current population of approximately 1 million is the same as the province's population in the 1930s. The distribution, however, is now much more urban (approximately 64% in Saskatchewan, compared to the Canadian average of 78%).

The relatively high natural fertility and good moisture holding capacity of the area's chernozemic soils made them highly productive when first developed for agriculture. The natural fertility of chernozemic soils is held within the topsoil, which varies considerably in thickness throughout the prairie landscape. Unfortunately, the topography and semiarid climate make these soils extremely vulnerable to wind erosion, water erosion and other forms of degradation. Soils on the crests of knolls or in upper slope positions have thin topsoils and may be severely affected by erosion. Topsoils are thicker and fertility is generally higher in lower slope positions, but unfortunately, these topographic positions are often affected by poor drainage and soil salinity. In the course of the last century, erosion and depletion of the soil's organic matter has reduced soil productivity to the extent that additional fertility inputs (organic and inorganic) are often required to maintain crop production over large portions of the area.



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Past response to soil degradation has resulted in significant areas of cropland being returned to forage production. Within the last 20 years, different cropping systems and the adoption of soil conservation practices such as reduced tillage and zero-till have begun to reverse the decline in soil productivity over perhaps one third of the annually cropped land of the prairies. Nevertheless, the new cropping systems are still quite vulnerable to extended periods of drought. Periodic setbacks are likely and new challenges are constantly emerging. Improper agricultural practices (such as excessive tillage and continued cultivation of marginal land) result in soil degradation through wind and water erosion, salinization, declining soil organic matter levels, soil acidification, degradation of soil structure; and decreased soil fertility. These have a significant impact on the overall health of the ecozone.

The region may also be facing new pressures related to climate change. One climate change scenario, for example, suggests that rising temperatures may result in more frequent drought episodes. Under this scenario, the droughts' effects may be potentially more harmful to the ecosystems in the prairies, with soils increasingly exposed to wind, water and other forms of erosion.

A Canadian Drought Bulletin

The Canadian prairies have been subject to periodic droughts, with intense episodes occurring in the 1930s and the 1980s, and again in some regions during the 1990s.

1930s: This Canadian drought ran from 1929 to 1941, with only slight breaks in the dry conditions in 1935 and 1939. In the period 1936/1937, crops literally burnt in the searing summer heat.

1960s: The prairies were subjected to very severe drought in 1961, which extended over a very large area, including the boreal forest region. Precipitation during the growing season was only 45% of normal values for many areas in the region.

1980s: Canada experienced two major periods of drought in the 1980s that were set up by consistently low moisture conditions in the preceding years, starting as far back as 1977. The first were the back-to-back droughts of 1984 and 1985, and in the second drought in 1988, record high summer temperatures were experienced. From a meteorological perspective, they were of the same magnitude as the drought of the 1930s. The decade was characterized by warm, dry conditions in late winter and spring and the land received little run-off from snowmelt.

1990s: Droughts occurred in some localities in the 1990s particularly in the northwest part of the region and extending beyond the prairie ecozone into the Peace River country of northwestern Alberta and northeastern British Columbia. Drought conditions that started in 1988 extended into 1991 in the more northern regions and recurred in the northwest in 1998 and 1999. Impacts were primarily on water supply and loss of economic production.

2000: Fall (1999) root zone soil moisture was less than 60% of normal in much of the western prairies and in places less than 40%. Snowfall over the winter was much below normal, resulting in minimal recharge of soil moisture or water supplies. However, during the 2000 growing season, much of Saskatchewan and Manitoba received average to above average precipitation, whereas southern Alberta experienced well below average to extremely dry conditions (<40% of normal). Fall 2000 conditions indicate potential problems for next year. Pasture conditions are fair to poor and dugouts vary from dry to half full. Southern Alberta has been particularly affected this year by extremely dry conditions and many dugouts are empty.

The prairies are not just home to humans, they are also the habitat of a wealth of plants and animals. Wetlands, for example, provide major breeding, staging, and nesting habitat for migratory waterfowl using the North American Flyway. Wetlands provide critical habitat for more than half of North America's waterfowl, but the transformation of the prairies ecozone by agricultural activities and related degradation has resulted in dramatic reduction in habitat for many species. This ecozone, compared to others in Canada, has significantly higher numbers of extirpated, threatened and endangered wildlife species relative to its area and population.



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Grasslands National Park and Climate Change

Grasslands National Park, part of Canada's National Park system, was established in the 1970s and is located within the heart of the mixed grassland ecoregion of southern Saskatchewan. As a national park, Grasslands has been set aside for a variety of reasons – one of which is that it contains some of Canada's only remaining natural grassland ecosystems. It is also home to several rare and endangered plant and animal species. Retaining and protecting this tract of native prairie is, without doubt, an important component in the battle to preserve grassland biodiversity. It also provides a means of monitoring environmental change on natural ecosystems and, through rehabilitation of disturbed portions of the park, allows scientists to monitor restoration of degraded land. However, this park, like the rest of the prairie ecozone, is subject to global climate change.

A recent study ([Climate Change and Canada's National Park System, 2000](#)) began looking at the potential changes this park would experience with global climate change. Several climate models were used in this initial assessment. Potential changes include a possible increase in drought frequency as a result of increasing evapotranspiration rates, increased summer temperatures, and decreased precipitation. This will increase the potential for wildfires on the native prairie. It will also mean an expansion in the saline soil areas.

Wetland areas will also be affected. This can be significant as wetlands within the semiarid environment are already subject to significant seasonal and annual variation.

Species diversity and population sizes may also change. For example, it is thought that the grasshopper population might increase with warmer conditions.

Further research is required to fully understand the implications of global climate change on the grasslands environment. Preserving a portion of this ecosystem within Grasslands National Park provides opportunities to better understand and monitor these changes.

Sustainable development in affected regions

Sustainable development in Canada

Environmental conservation and protection and the responsible use of our natural resources are an integral part of sustainable development. Canada's social and economic development relies on stewardship of the natural capital represented by our nation's freshwater, forests, wildlife, soils, minerals, and energy resources. We also depend on our environment for non-market benefits such as health, recreation, and leisure. Canadians recognize that environment must be fully incorporated into the economic and social decision-making process as forethought, not afterthought.

The Government of Canada has responded to growing environmental concerns in many ways, such as the establishment of a Commissioner of the Environment and Sustainable Development, and setting a legal requirement for federal government departments to pursue sustainable development strategies that include reports to Parliament.

Environmental Impact Assessment – A Tool for Sustainable Development

Since 1974, the Canadian Government has used the Environmental Assessment (EA) procedure to predict the likely environmental effects of development initiatives requiring federal involvement. The Canadian Environmental Assessment Act (CEAA) seeks to encourage actions that promote sustainable development, and to ensure that projects to be carried out in Canada or on federal lands or using federal funds do not cause significant adverse environmental effects. This law, which is currently being revisited under the supervision of the Canadian Environmental Assessment Agency, provides for public participation in the process, so that concerns are taken into account at the planning stages.

Strategic Environmental Assessment (SEA) is a systematic, ongoing process for evaluating, at an early stage, the environmental effects and consequences of policy, plan or program proposals. It is recognized as a key to establishing, achieving and assessing sustainable development. As the process is predictive, it allows for policy developers to anticipate and develop responses to initiatives before they are implemented. While this process is new in Canada, it has recently proven effective in a variety of other countries (e.g., United States, United Kingdom, Sweden, the Netherlands, South Africa).

Canada participates actively at the international level in the discussions and promotion of integrated economic, environmental and social considerations into broader decision-making in several key organizations such as the Commission on Sustainable Development (CSD), the United Nations Environment Programme (UNEP), the Organization for Economic Cooperation and Development (OECD), and the World Trade Organization.

For example, the CSD was established after the Rio Earth Summit in 1992 to review the progress of implementation of Agenda 21, elaborate policy guidance and options to

achieve sustainable development, and to promote dialogue and build partnerships for sustainable development. One of the issues in Agenda 21 is "combating desertification and drought". The CSD holds high-level meetings annually to discuss and promote a wide variety of both sectoral and cross-sectoral issues identified in Agenda 21 within the international, regional and national contexts. In 2002, the CSD will be reviewing the progress of implementation of Agenda 21, which would provide the backdrop to a summit-level conference 10 years after the Rio Earth Summit. Negotiations are under way at the United Nations General Assembly on the holding of this conference.

Sustainable development has also been identified as a strategic priority for the OECD. At the Ministerial Council Meeting in 1998, Ministers asked the OECD to undertake a three-year project on key aspects of sustainable development. The project culminates in a major analytical report and policy recommendations for the consideration of Council Ministers in 2001. Sectoral policy issues, with an emphasis on energy, transport and agriculture, have been examined and key challenges related to climate change and the management of natural resources will be addressed within the context of social equity and the environment-economy interface. These efforts are expected to elaborate an economic framework for sustainable development and to generate policy advice regarding the institutional basis for sustainable development, measurement of progress, the direction of technology, and the question of balancing public policy interventions with market-based solutions.

Canada has historically been a supporter of UNEP, which is recognized as the leading global environmental authority promoting the coherent implementation of the environmental dimensions of sustainable development within the UN system. It also serves as a recognized advocate for the global environment. Canada is supportive of UNEP reform efforts, and maintains that UNEP should be strengthened and supported.

Canada is also an active participant in the Committee on Trade and Environment (CTE) in the World Trade Organization (WTO). The CTE was created to identify the relationships between trade and environmental measures in order to promote sustainable development, and to make recommendations on whether any modifications to the provisions of the multilateral trading system are required. One area where Canada has been particularly active is in seeking clarification of the relationship between WTO rules and trade measures in multilateral environmental agreements (MEAs). As well, Canada supports efforts to strengthen cooperation between the WTO and UNEP, other international environmental-related organizations and the Secretariats of MEAs. Another issue of importance to Canada is whether WTO rules should be clarified to cover voluntary standards based on life-cycle considerations, such as ecolabelling programmes. Domestically, policy integration is sought through the strategic environmental assessment of trade agreements. Work on developing robust methodologies for this assessment is underway.

Reports to the Commission on Sustainable Development

There has been considerable improvement in the integration of economic, environmental and social considerations into broader decision making since the 1992 Rio Earth Summit. Canada is responding to the international emphasis on sustainable development through its annual participation at, and reporting to, the Commission on Sustainable Development (CSD) charged with the follow-up to Rio. In May 2000, Canada presented to the Commission a report entitled "[Cultivating a Secure Future: Rural Development and Sustainable Agriculture in Canada](#)".

Five other submissions were made by Canada at this time, including the monograph "Learning from Nature: Canada - The Ecosystem Approach and Integrated Resource Management." The series of six monographs submitted by Canada to this Commission describe the nation's experience with issues associated with the sustainable development of land resources and the challenges that remain in the integration of sustainable development.

Canada is a signatory of a spectrum of multilateral environmental agreements such as the UNCCD, the United Nations Framework Convention on Climate Change (UNFCCC) as well as the biodiversity-related Conventions on: Biological Diversity (CBD), International Trade in Endangered Species (CITES), Migratory Species (CMS), and the Ramsar Convention on Wetlands. The inherent relationships between these agreements are of particular value. For example, sustainable development in drylands and the conservation and protection of land resources in the prairies region contribute not only to Canadian response under the UNCCD, but also relate to Ramsar and CMS obligations on the maintenance and restoration of wildlife habitat. These also address both dimensions of Canadian adaptation and carbon sequestration potential within the context of the climate change convention. The goals of the CBD are particularly relevant as the maintenance of diversity (species, genetic, ecosystem, and landscape) is fundamental to all environmental concerns and, therefore, environmental sustainability in the face of economic development.

Canada also participates actively in the Global Environmental Facility (GEF), which is the financial mechanism for the UNFCCC and the CBD. Initiatives that cut across GEF's four focal areas (particularly biodiversity and climate change as well as international waters) to address land degradation are pursued in cooperation with the CCD.



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Biodiversity and Agriculture

The Canadian Biodiversity Strategy was prepared in 1995 as Canada's response to the United Nations Convention on Biological Diversity. Subsequent to that report, Agriculture and Agri-Food Canada, in 1997, prepared *Biodiversity in Agriculture: Agriculture and Agri-Food Canada's Action Plan*.

The action plan identified the key biodiversity issues facing agriculture in Canada and identified the main challenges being faced by AAFC. These include habitat conservation and fragmentation, agricultural practices, wild species at risk, diversity of domesticated species, exotic species, living modified organisms, and atmospheric changes.

AAFC has long recognized the need to conserve biodiversity and has initiated and worked with other federal departments, provinces and producers on a number of programs which contribute to the conservation and protection of biodiversity. AAFC sees the challenges ahead and are actively responding in their efforts to meet them. Their efforts (programs, research activities, cooperative efforts) are being guided by four main goals:

- To promote sustainability in agro-ecosystems while respecting natural ecosystems.
- To increase awareness and understanding of biodiversity in agriculture.
- To conserve and facilitate access to genetic resources that are important to agriculture, and share knowledge, expertise, and technologies in a fair and equitable way.
- To integrate biodiversity conservation policies, programs, strategies, regulations, and operations.

Partnerships and consultative processes

Canadian communities, researchers, governments and industry work in concert in their efforts to resolve dryland management issues. It is through this collaborative effort that the combat against land degradation and desertification will be most successful.

Federal-provincial collaboration

Under the Canadian Constitution, the responsibility for agriculture and natural resources is shared between the provincial and federal governments. Provinces have a responsibility for resources within their boundaries. Provincial interests in managing ecosystems – land, water, and wildlife – are implemented through regulatory and licensing responsibilities within their boundaries. The federal government has responsibility for areas that have inter-provincial and international implications.

Information and Skills across Boundaries

As a federal agency working across the prairie region, the Prairie Farm Rehabilitation Administration (PFRA) helps transfer information and skills across provincial and federal boundaries. Some examples where the PFRA is active include:

- The Prairie Provinces Water Board (PPWB): Canada, Saskatchewan, Manitoba, and Alberta signed the PPWB agreement in 1948. This agreement established a board to recommend the best use of inter-provincial water and to recommend allocations between the provinces. The purpose was to resolve conflicts between upstream users and downstream needs.
- PFRA is also involved in the Prairie Habitat Joint Venture (PHJV), the Inter-provincial Working Group on Agricultural Sustainability, the International Institute for Sustainable Development (IISD), and the Centre for Studies in Agriculture, Law and the Environment (CSALE)
- Alberta Agriculture, Food and Rural Development, Alberta Environment, and the PFRA are participating in Alberta's Drought Plan Development Team (DPDT). This group has the mandate to create a drought risk management plan for agriculture in Alberta. The plan defines drought monitoring requirements and a rational process for designating different levels of drought. It also describes a commitment to long-term mitigation of drought risk in agricultural areas. Further, it includes a proposal for upgrading the province's weather and hydrology monitoring capabilities.

- The Canada Saskatchewan Irrigation Diversification Centre (CSIDC) is an irrigation research and demonstration station that encourages diversification to higher crop values and more intensive production on a sustainable basis. The partners at CSIDC are from both government (AAFC, Sask Water) and industry (Saskatchewan Irrigation Projects Association, Irrigation Crop Diversification Corporation).

Achieving sustainable development demands effective integration of environmental concerns in all aspects of policy, and at all levels of decision making. Consequently, in Canada, policy integration and sustainable natural resource planning is often achieved through federal-provincial collaboration. Such cooperation often involves extensive consultation, financial assistance, and the establishment of formal agreements (accords, memoranda of understanding, councils and committees) that provide a framework for partnership-based resource management. This process encourages sharing of experience, expertise and technology, and for results in harmonized policy directions at a national level.

Inter-provincial natural resource management

Similarly, provincial governments in the prairies are working amongst themselves to harmonize and integrate provincial policies, including how they relate to shared water and natural resources. For example, since 1988 each prairie province has had a Prairie Conservation Action Plan (PCAP) to coordinate natural resource management and conservation activities. These activities are harmonized at the inter-provincial level by provincial coordinators. In 1998 the governments of Alberta, Saskatchewan and Manitoba renewed their commitment to this plan in conjunction with numerous stakeholders such as the Saskatchewan Stock Growers Association and the World Wildlife Fund.

Prairie Conservation Action Plan

The Prairie Conservation Action Plan (PCAP) was first developed in 1989 through an initiative of the World Wildlife Fund and the governments of Alberta, Saskatchewan, and Manitoba. During a five-year period, more than \$1 million was spent on projects within the prairies. Since that time, all three provinces have committed to new plans. Each province has developed an action plan focusing on a variety of goals and objectives of importance to their particular situation. For example:

- Manitoba's PCAP (1996-2001) is based upon an integrated landscape- or ecosystem-based approach. Their main focus for this period is on identifying and implementing economic activities that go hand-in-hand with the restoration and maintenance of healthy prairie ecosystems. The program is sponsored by Manitoba Natural Resources, Environment Canada, World Wildlife Fund Canada, and the Critical Wildlife Habitat Program.
- Saskatchewan's PCAP also emphasizes the need for an ecosystem perspective. It addresses issues such as land tenure, and agricultural development and fragmentation of native prairies. It encourages the involvement of private landowners, lessees, rural and urban municipalities, the provincial and federal governments, First Nations, and special interest groups. Funding partners include AAFC Research Branch and PFRA, Canadian Adaptation and Rural Development Fund Saskatchewan (CARDS), Canadian Wildlife Service, Ducks Unlimited Canada, Saskatchewan Agriculture and Food, Saskatchewan Stock Growers Association, Saskatchewan Environment and Resource Management, and the Saskatchewan Wetland Conservation Corporation.
- The Alberta PCAP focuses on conserving the biological diversity of native prairie ecosystems and recognizes the role of ranching in preserving them. The program encourages the incorporation of conservation ethics as part of all activities and management decisions on the prairie, particularly with community initiatives. The PCAP is implemented through the Prairie Conservation Forum, which is a multi-stakeholder group with about 40 members. This diverse group includes conservation organizations, provincial and federal government departments and agencies, oil and gas producers, and a variety of agricultural organizations.

Dialogue with rural communities

Of course, the federal and provincial governments in Canada work directly in partnership with Canadians living in affected rural and remote areas across Canada, including Canada's affected drylands. Together they seek to foster strong, dynamic communities and to ensure ownership of the sustainable development process. Activities are designed so that local populations, whose livelihoods depend on maintaining a healthy environment, have access to federal services and information, and so that they can actively participate in the identification of priorities in their regions.

The Canadian Rural Partnership

The Canadian Rural Partnership (CRP) is an initiative designed to support rural community development by adopting new approaches and practices. The CRP seeks to ensure that federal programs, policies and activities provide a coordinated network of support to rural communities. Designed and framed by an interdepartmental working group of representatives from 28 federal departments and agencies, and rural teams in each province, it provides one-stop access to information of particular interest to rural Canadians. Coordination and leadership is provided through institutions such as the Rural Secretariat, located in Agriculture and Agri-Food Canada, to facilitate dialogue and partnerships around issues and priorities.

Community involvement is further enhanced with programs promoting local initiatives. Community-based groups that wish to undertake projects that will result in positive, measurable impacts on the environment can access information, technical assistance, and financial resources. Land and wildlife conservation projects, for example, or research initiatives, can benefit from federal and provincial assistance, thereby allowing citizens of affected regions to identify local issues and to implement small-scale solutions.

Government Working with Communities

- Environment Canada's EcoAction 2000, previously known as Action21, supports projects that aim to reduce the threats of climate change, enhance water quality, and protect wild animals, plants, and their habitats. This program has funded projects such as the Land Stewardship Resource Centre, a conservation information service in Alberta. The Manitoba Zero Tillage Association has also benefited from support from this program. It operates a 256 ha farm that seeks to enable no-till agricultural producers to remain competitive while providing protection to the environment. The Handbook for Partners in Land Conservation, an initiative of the NGO Alberta Naturalists, aims to improve land owners' access to conservation information and projects that seek to control erosion through the establishment of shelterbelts, such as the Grey Soil Management Project in Manitoba.
- The Canadian Adaptation and Rural Development Fund (CARD) provides the agricultural community with funding for a variety of projects. The funds, provided by Agriculture and Agri-Food Canada, are delivered in each province by an Adaptation Council whose membership is drawn from rural, agriculture and agrifood stakeholders. In Saskatchewan, for example, the Saskatchewan Council for Community Development (SCCD) provides the administrative structure to support the Saskatchewan Adaptation and Rural Development Council (SARDC). Several types of projects are eligible. For example, projects eligible under the Environmental Stewardship program include education, training and public awareness initiatives, technology transfer, and agricultural resource monitoring.

The SCCD is a non-profit organization formed to promote community-based development.

- The Canadian Agricultural Rural Communities Initiative (CARCI) was established to enhance the sustainability of agricultural rural communities, particularly those affected by changes in the agricultural sector. The initiative is allocated money from CARD and responds to their rural development priority.
- PFRA delivers the Rural Water Development Program - Community and Group Projects. This program is designed to contribute to the stability and development of prairie rural areas and to ease the impact of drought in Manitoba, Saskatchewan, and Alberta. It encourages projects that enhance income-generating opportunities and/or the implementation of environmentally sustainable agricultural practices related to the use of water resources. Farmers, Indian bands, communities, and rural municipalities are able to qualify for technical and financial assistance. Development of wells, dugouts, dams, pipelines and springs, as well as projects to improve water quality are eligible.

Community involvement also encourages the use and protection of local and traditional knowledge. In the Canadian prairies, however, much of this knowledge has been gained over a relatively short time period, as agriculture in the region is a recent phenomenon. Canada's First Nations for the most part did not actively engage in agricultural activities within the prairie environment until after European settlement in the late 1800s. However, respect for the environment by First Nations has always been an important component of their culture. The First Nations are using this respect for the land, in concert with the knowledge they have gained from the agricultural community. They, like other rural residents, are learning to adapt to the needs of dryland farm management.

Canadian Aboriginal Communities and Dryland Management

Canadian aboriginal communities in affected areas in the prairies are engaged in dialogue with government on sustainable dryland agriculture. Adaptation of traditional knowledge to emerging needs and new technologies, specifically in terms of farm management and irrigation, is a priority for them. These communities want to ensure that their particular concerns are taken into account, and that all can benefit from progress made in the direction of sustainable development.

- In Alberta, members of the Blood Tribe from the Blackfoot Nation, in collaboration with federal and provincial governments, are implementing the Blood Tribe Agricultural Project, a 12-year irrigation project, allowing for greater economic development through diversified sustainable agricultural development. This project includes a training and information component, a construction component, as well as the development of farming and agribusiness activities.

- Practising the Law of Circular Interaction: First Nations Environment and Conservation Principles is a multimedia educational resource kit developed by the Saskatchewan Indian Cultural Centre with assistance from Saskatchewan Environment and Resource Management.

Cooperation with industry

Successful implementation of measures to combat land degradation and desertification relies upon participation and cooperation of industry. Working with all levels of government, industry members participate in the development of conservation policies, as well as in the implementation of research projects. They can also provide a significant role in education and awareness with stakeholders. Cooperation with industry ensures that farmers and agricultural businesses remain competitive, while promoting the sustainable use of land resources throughout the country.

Industry-led initiatives include the dissemination of conservation information and demonstrations of innovative sustainable technology, as well as assisting producers in finding cost-effective means to combat land degradation.

Industry-led Initiatives

There are many industry-led initiatives at work in the prairies, such as:

- Industry-led adaptation councils have been established across Canada in every province and territory under the [Canadian Adaptation and Rural Development \(CARD\) Fund](#). The councils work in partnership with government and industry to promote adaptation and diversification in the agriculture and agrifood sector. Councils identify and select projects that reflect local priorities, and administer their funds. Agriculture and AgriFood Canada provides the financial backing and decision making authority. Information sharing between councils is encouraged to help identify common interests and priorities, and foster greater inter-provincial cooperation.
- The [Canadian Federation of Agriculture \(CFA\)](#) promotes the conservation of soil and water resources. It provides information on and encourages the use of sustainable agricultural practices. For example, it supports conservation tillage, residue management, and extended crop rotation through forage and erosion control.

- The CFA is an umbrella organization representing both provincial general farm organizations and specific commodity groups. These groups in turn have among their members other provincial commodity groups as well as individual farm families. The Federation was formed in 1935 and through its members represents more than 200,000 farm families in Canada. The CFA is financed by contributions from member organizations including, among several others, the Keystone Agricultural Producers (Manitoba), Saskatchewan Wheat Pool, and the Wild Rose Agricultural Producers (Alberta).
- In Saskatchewan, the federal and provincial governments and industry have supported a producer-driven information program on soil conservation through the Saskatchewan Soil Conservation Association. This organization is managed by producers and conducts an extension program that includes a newsletter, field demonstrations and events, and an annual conference. Its mission is to "promote conservation production systems that improve the land for future generations."
- The Alberta Reduced Tillage Initiative (ARTI) is a partnership of agricultural organizations, industry and government that share a common philosophy about reduced tillage and the resulting conservation and economic benefits. ARTI has full-time agronomists located throughout Alberta who can provide information to producers on the benefits of reducing the amount and intensity of tillage. Their role is to coordinate and present programs and activities that disseminate quality, practical production information that will lead to the adoption of reduced tillage technology by Alberta farmers.

Raising awareness: voices of civil society

Combating land degradation and desertification means first of all informing stakeholders and decision-makers about the dangers of unsustainable land management practices. While most government programs include an awareness-raising component, effective information and advocacy depends to a large extent on the involvement of civil society.

Conservation and Non-Profit Organizations

- The Land Stewardship Resource Centre is an electronic clearinghouse and free educational referral service developed in Alberta. It provides a variety of information about land conservation practices, programs, and agencies, as well as referrals to other information sources including videos and books. The Resource Centre is part of the Land Stewardship Centre of Canada (LSCC), an independent, not-for-profit charitable organization based in Alberta. Funding comes from a variety of sponsors including the general public, Environment Canada (Eco Action 2000), Alberta Agriculture, Food and Rural Development, Ducks Unlimited Canada, Alberta Ecotrust, Wildlife Habitat Canada, Alberta Pacific Forest Industries Inc., Alberta Conservation Tillage Society, and many others.
- "The Canadian Centre of Sustainable Agriculture Inc. is dedicated to the furthering of food systems that are in all stages economically viable, socially supportive, ecologically sound, and that meet the needs of today without compromising the needs of future generations." The Centre is organizing a conference entitled "Exploring Sustainable Alternatives", scheduled for Humboldt, Saskatchewan on December 8-10, 2000. Topics to be addressed include: What is sustainable agriculture; Pasture improvement options; Crop rotations for better weed control and soil fertility; and Beef production on intensively managed pastures. The conference brings together producers and researchers from across western Canada and portions of the northern United States.
- [Nature Saskatchewan](#), a conservation organization, is one of several groups in Saskatchewan promoting conservation easements. Conservation easements are voluntary legal agreements between a landowner and a qualified conservation agency. Under this agreement, the landowner continues to own and manage the land with benefits to both the landowner and the environment. The advantages to the landowner include tax benefits from Revenue Canada as an easement is considered a charitable gift; however, the landowner still retains ownership and is able to transfer the easement if the land is sold or transferred intergenerationally.
- Ducks Unlimited Canada is the Canadian member of an international, privately funded, non-profit organization whose goal is to preserve migratory waterfowl by protecting and improving the quality of nesting, brood rearing, and staging

habitat. Their Prairie Care program involves the Conservation of Agriculture Resources and the Environment within the three prairie provinces and is part of the North American Waterfowl Management Plan (NAWMP). Private landowners become involved through projects developed on their lands and through the practice of conservation farming. Prairie CARE focuses on land management and works closely with producers to promote soil and water conservation and the modification of their land management practices. The program helps establish and manage forage crops on cultivated lands, and provides funds to lease or purchase key habitat areas.

NGOs in Canada play an active role in the elaboration and implementation of programs to combat land degradation, both at home and in developing countries. Organizations such as Solidarité Canada Sahel, which represents the North American focal point for NGOs under the UNCCD, and its partner, USC Canada, have built national-scale networks that ensure coordination and collaboration between non-governmental actors in Canada in developing countries.

International NGOs in Canada

- June 17, 1999 was World Day to Combat Desertification. On that day members of USC Alberta visited schools and organized games to demonstrate pressures felt by people in developing countries, and helped students to plant drought-resistant bushes in their school yard. The classes were shown USC's films about desertification in Mali. They developed an understanding of its causes and explored some of its solutions.
- USC's regional office in Alberta is very active in schools. They have a twinning program linking a grade four class in Lethbridge with the Gono School in Mali. The Canadian students gather school supplies to help equip their colleagues in Mali and learn how desertification affects many people there. They have planted trees in solidarity with students in Mali and in June 1999, grade four and five students spoke on video about what they had learned about desertification. USC has also recently developed a teaching kit about desertification, including two short films, "Challenges in Arid Lands" and "Food for the Future".
- Similarly, Solidarité Canada Sahel has been active in raising awareness of local elected officials and municipalities to issues related to desertification. To date, almost one hundred cities have signed the Mayors' Declaration on Desertification, and various Canadian cities have been successfully paired with cities in developing countries, as a gesture of solidarity, to share experience in development projects.
- Solidarité Canada Sahel organizes a yearly "Bike Tour" around St-Jean Lake, involving young people, to raise awareness on water and desertification issues.

Public information campaigns have included posting of desertification posters in public transport buses. In 2000, Solidarité Canada Sahel involved young volunteers and elected officials in an event focused around the burdens of women in drought-affected developing countries.

Measures relevant to the convention

Land degradation and desertification is a complex issue caused by a combination of physical and human interactions, and Canada has developed a broad spectrum of measures and approaches to address its dryland problems. The following provides an overview of relevant socio-economic and conservation-oriented programs that help form Canada's response to the problem.

Measures to improve the economic environment

Sustainable use of land resources is at the heart of sustainable economic development and food security of people in affected regions. The Government of Canada and provincial governments work with stakeholders to improve their economic environment and provide information and advice for the implementation of environmentally sustainable projects that will contribute to economic security.

Examining Opportunities for Economic Growth

The PFRA conducts a number of initiatives in various sectors that aim to improve economic security. Analysis of issues and opportunities for economic growth is undertaken in partnership with stakeholders at the local and regional level and government contribution allows for effective transfer of information, technical assistance or financial resources.

The PFRA's [Prairie Agricultural Landscape \(PAL\)](#) project is one example of such an approach. In its first phase, it undertook an analysis of economic, social and environmental issues in affected areas, as well as an assessment of the impact of agriculture on natural resources. This in turn led to identification of growth opportunities and strategies, taking into account the effect of possible environmental degradation, such as soil erosion, on the economic well-being of people in the Prairies.

Provincial governments also seek to improve the economic well-being of their rural communities, through the provision of services such as technical assistance, land conservation information, training and education. They undertake research and promote new enterprises that have been analysed and will result in better utilization of resources while generating additional revenue. Provincial programs also allow for rural agricultural communities to access financial support for environmentally sustainable and innovative agricultural initiatives.

Natural resources conservation measures

In Canada, programming is being undertaken at all levels in order to promote natural resource conservation. Innovative programs integrate the conservation of land, water and biological resources using an ecosystem approach, and they are conducted with active stakeholder participation. Programs that aim to limit the effects of erosion, promote sustainable agricultural practices, and enhance knowledge of land and climate issues ensure that the use of Canada's natural resources is sustainable and not detrimental to the environment.

Maintaining or restoring the vegetative cover is an effective means of fighting land degradation and soil erosion. Programs at the federal level aim to promote conversion of land from cultivation to permanent cover, or by the maintenance of shelterbelts. Long-term agreements between landowners and government agencies enable management of converted land to be undertaken in a harmonized way, to achieve conservation of the resource and cost-effective grazing.

Pastures, Shelterbelts and Recover Programs

Community pastures and shelterbelts have been important programs in Canada since the Dust Bowl of the 1930s. These methods, combined with recover programs sponsored by the provinces continue to provide methods for effectively maintaining or restoring vegetative cover.

- The [PFRA](#) manages 87 community pastures across the prairies, covering more than 900,000 ha. Most of these pastures were developed in the 1930s in response to drought. Cultivated marginal lands severely eroded, or at risk of erosion, under annual crop production, are protected by establishing permanent cover.
- In Saskatchewan, 55 provincial community [pastures](#) occupy 324,000 ha and an additional 243,000 ha are operated by producer cooperatives.
- Beginning in the spring of 2001, the Saskatchewan provincial government will fund a Conservation Cover Program to encourage the conversion of certain farmlands from annual cropping to perennial cover for livestock forage and other uses. The new program is still in its planning stages but will be structured to advance a number of environmental and economic objectives, including soil conservation, protection of rural water quality, enhancement of fish and wildlife habitat, reduction of greenhouse gas emissions, carbon sequestration in agricultural soils, and increased forage and pasture supplies for the province's expanding livestock sector.

- The PFRA's Shelterbelt Centre provides trees and shrub seedlings to prairie landowners for farm, field, wildlife and agro-forestry plantings. Technical assistance is provided to show how tree plantings can support sustainable agriculture by improving soil moisture and reducing soil erosion and energy requirements.
- Provincial agriculture departments also provide free information to farmers regarding shelterbelts and re-cover methods. [Alberta Agriculture, Food and Rural Development](#), for example, provide farmers with very specific information on species, planting methods, and the requirements for a successful shelterbelt program. Information on this topic, as well as many others, is regularly discussed in a newsletter produced by the Department entitled "Alberta Conservation Connection".



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PFRA/AAFC

Soil conservation is also enhanced by activities promoting sustainable land management practices, such as fertilization techniques and pesticide management, or cropping techniques and water management. Reduced tillage, saline seep control, and manure management are among the many techniques promoted by such initiatives, by both federal and provincial governments. In some instances, as in Alberta and Saskatchewan, landowners can have a legal responsibility to avoid

land degradation and to restore degraded land (e.g., Saskatchewan's *Soil Drifting and Control Act*).

Healthy Soil

- The National Soil and Water Conservation Program (NSWCP), a \$10 million initiative aims to advance environmental sustainability through the promotion of resource stewardship, and enhancing technology, research and development.
- In Alberta, the Straw Management/Utilization Program supports initiatives for alternate uses of straw, reducing the need to burn straw on fields, thereby enhancing soil conservation. A similar initiative occurs in Saskatchewan, the Stubble Burning Pilot Project, which aims to encourage non-burning options for crop residue management to maintain soil quality.

- In Saskatchewan, provincial funding is allocated through the Agriculture Development Fund. This fund provides ongoing funding for strategic research in integrated soil management at the University of Saskatchewan. It also has a project-based component that provides funds for numerous soil-related initiatives.
- A recent federal/provincial program, the AgriFood Innovation Fund (AFIF), allocated \$4 million for projects and programs in sustainable agriculture. This included several soil conservation initiatives. One of their funded projects is the Grazing and Pasture Technology Program. This program is delivered jointly by the Saskatchewan Stockgrowers Association and Saskatchewan Agriculture and Food. Rangeland and forage specialists provide technical advice and training to producers involved in range/livestock production and encourages multiple use of rangeland and environmental sustainability.

Canada has a strong land management system already in place and a variety of federal and provincial departments, industry partners and NGOs have helped develop and disseminate technology and information concerning land management and natural resource conservation. Canada uses this information and technology to help meet the obligations of the UNCCD. Our involvement at the international level helps bring science, knowledge and technology to bear, while integrating them with the traditional knowledge and social realities of the particular developing country. Participation by local communities and the people most affected are vital to creating long-term, sustainable solutions.

Sharing Canadian Capability in Natural Resources Conservation

The PFRA, in cooperation with CIDA, is involved in several international projects where Canadian capabilities are being shared with other nations. For example, in China (Inner Mongolia Autonomous Region) PFRA is helping with three major initiatives: a zero tillage project, a grazing management project, and a study on the revegetation of active sand dunes. These projects are designed to accomplish a variety of goals, including the development of range condition guidelines and the demonstration of rotational and deferred range management practices. There is an education and training component operating with each project.

More than 20 Research Branch scientists and other university and provincial government specialists have been actively involved in the 10-year (\$10M) CIDA-sponsored Hebei Drylands Project in China. This project has focused on capacity building and technology transfer in the areas of soil and water conservation, irrigation efficiency, integrated pest management and development of drought-tolerant crop varieties. To date, this project has included the training of more than 50 Chinese scientists, some to the Ph.D. level.

In Ethiopia, PFRA is providing assistance to the Tigray Region in the creation of a new water development and management agency with the long-term goal of making the region self-sufficient in food. Canadian input will be provided in short-term intervals with the emphasis on institutional strengthening, based on the establishment of good professional practices. Senior specialists in various disciplines related to water resources (including basin rehabilitation) and irrigation development act as mentors to Ethiopian staff.

Water conservation and sustainable irrigation practices are fundamental in the fight against land degradation and desertification. In a semiarid landscape like the southern prairies, water is a commodity that is often scarce and always subject to seasonal and annual fluctuations. Conservation of surface water bodies, groundwater resources, riparian environments, and natural drainage channels are important. Likewise, irrigation practices must consider the water supply and be able to respond to the fluctuating water resource conditions.

In many parts of the affected region, agricultural activity related to low annual precipitation has often influenced the incorporation of summer fallow rotations. The use of irrigation to increase and stabilize production can have the added benefit of reducing the use of summer fallow. In Western Canada, a number of irrigation development projects have been established to improve the economic viability of prairie farmers. Irrigation has permitted producers to reduce the risk of drought, increase productivity, diversify into higher-value crop production and develop a stable supply of crops that can support value-added processing.

Irrigation Development

- The PFRA provides technical assistance for water development projects for and irrigation to ensure sustainable diversification, and to lessen the adverse effects of drought in affected regions. Major activities include development of water supplies and infrastructure to alleviate water-related constraints to economic growth, promoting best management practices, and investigation of innovative water treatment technologies.
- In Alberta, the first phase of irrigation development occurred in the 1880s when commercial irrigation was developed by the railway companies to attract settlers. For over 20 years Alberta's provincial government has provided irrigation development support. Currently, the province is organized into 13 irrigation districts located within the South Saskatchewan River basin. The water users cooperatively own irrigation districts. The majority of irrigated land in Alberta (84%) occurs within these districts. Recent estimates indicate about 16% of agriculture output is produced on irrigated lands, which make up approximately 4% of the farmed area of Alberta.

- In Saskatchewan, the stimulus for irrigation development came with the extreme drought in the 1930s. In an attempt to save and improve agriculture, the federal and provincial governments began work to develop irrigation systems in drought-prone areas of the province. Saskatchewan is currently divided into 4 development areas, containing organized irrigation districts as well as privately irrigated land. However, in Saskatchewan, it is estimated that approximately 71% of irrigation occurs outside of the irrigation district.
- Due to the moister climate regime in Manitoba, irrigation development has not been as extensive. The drought of the 1980s created the stimulus for irrigation development. Since the 1980s, an expanding potato industry and the need for stability and quality control in production has increased irrigation development in the province. Funding for irrigation infrastructure in Manitoba has largely been a private effort resulting in market-driven development of high-value irrigation crops.

Irrigation in Canada is being practised within an environmentally sustainable framework. The use of this valuable technology must consider factors such as surface water and groundwater quantity and quality as well as local conditions that might lead to increased soil salinization. It is important to be aware of the environmental characteristics of the area where irrigation is being, or is proposed to be, practised.

Research measures: including the research and application of best practices and lessons learned

Integration of research conducted by universities, federal and provincial government departments, non-governmental organizations, and industry-based associations is fundamental to better understanding issues and developing solutions to land degradation and desertification problems. Research is conducted on all aspects of agricultural land use, including cereal and other crop resistance to drought and pests, livestock management, conservation, irrigation, and climate and meteorological forecasting. Programs ensure that farmers and landowners have access to knowledge and technology and best management practices, and technical assistance enables them to make informed sustainable land use choices. Distribution of this research knowledge and technology to farmers is made possible through provincial networks (government specialists and extension agronomists), via numerous provincial publications, and, in recent years, through the use of information technologies such as the Internet.

Lessons Learned, Best Management Practices, and Benefit from Technical Assistance

- The Canada-Saskatchewan Irrigation Diversification Centre (CSIDC) has the goal of identifying and developing crop diversification and intensification opportunities. The partners at SCIDC are from both government (AAFC, Sask Water) and industry (Saskatchewan Irrigation Projects Association, Irrigation Crop Diversification Corporation).
- The Manitoba Crop Diversification Centre (MCDC), a partnership involving PFRA, Manitoba Agriculture, and an industry group, seeks to identify, evaluate and demonstrate new crops and value-added opportunities for sustainable agriculture.
- Alberta's Environmentally Sustainable Agriculture Program (AESAP) is guided by a 29-member board that includes a broad agricultural-based industry membership, provincial and federal agriculture departments, and the University of Alberta. It supports applied research to develop better management practices and technologies for cropping, livestock and processing sectors. The program's objective is to facilitate the continued development and adoption of management practices and technologies that make the agricultural production and processing industry more environmentally sustainable.

GIS technology applied to decision-making

The use of Geographic Information System (GIS) technology has become an effective tool with which to make economic, environmental, and socially sustainable decisions in the prairie agricultural sector. GIS is being used at various levels of decision making – from regional studies for agricultural policy and programs, to community-level decisions regarding economic development, to farm-level decisions on production planning. The ability to use spatial information in decision making is becoming widespread on the Canadian prairies, and has been made possible by government, NGOs and private industry cooperation to develop the information and databases and make them available for all levels of decision-makers.

GIS Technology and Prairie Agriculture

- The PFRA, with input from AAFC Research Branch and other stakeholders, has recently completed a review of the state of the land resources and how they are being used in the "Prairie Agricultural Landscapes" report. In this study, farming practices were related to land resources using a GIS analysis to determine whether the current agricultural practices are consistent with the capability of the land to

support the activities. This analysis will become the basis for continued GIS analysis of the impact of economic growth or climate change on the distribution of agricultural production in the Canadian prairies.

- The Rural Municipality of La Brouquerie in southeastern Manitoba has been using GIS as a tool to assess the effectiveness of local by-laws related to siting of intensive livestock operations. The R.M. councillors can now analyse and visualize the impact of certain land management restrictions on the ability of livestock operations to coexist with other community interests.
- Individual farmers are using Geographic Positioning Systems (GPS) and GIS to more precisely apply herbicides and fertilizers. This precision farming approach is more effective in controlling pests and in obtaining maximum economic benefit from inputs. It is generally more environmentally friendly as pesticides are applied only to specific target areas.

Farming systems, land use and genetic resources

At the federal level, Agriculture and Agri-Food Canada's Research Branch manages country-level research programs and maintains decentralized research centres, each concentrating their activities in issues relevant to their regions. For example, Prairie research centres focus their research on crops and examine variety breeding, crop rotations and management, and use of alternative crops for soil conservation purposes. Other areas, like livestock management (including grazing and manure management) or land use techniques (such as tillage, irrigation, fertilizer and pesticide use) are also being investigated in order to find and adapt best management practices to local realities and ecosystems.

Canada's Prairie Region Research Network

- The [Semiarid Prairie Agricultural Research Centre \(SPARC\)](#) located in Swift Current, Saskatchewan, is one of the major centres in the network of AAFC research centres. This centre has a national mandate for developing dryland farming systems and concentrates its research on dryland farming systems within the drier areas of the brown and dark brown soil zone of southwestern Saskatchewan and southeastern Alberta. Focus areas include: determining the economic performance and risks of various management practices and production technologies, cereal breeding, crop rotations, alternative crops, legume green manuring, tillage methods, fertilizer application, pest control, and methods of forage production and utilization. Research is also conducted on the environmental sustainability of the soil and water resources. Research conducted at the Centre involves linkages with other AAFC Research Centres and universities throughout western Canada.

Two major nodes of SPARC located outside of the headquarters area are:

1. The Indian Head Research Farm (Indian Head, Saskatchewan), which maintains the Seed Increase Unit to provide breeder seed from stock developed by AAFC plant breeders, and winter nurseries in New Zealand and California. It is the location of the Arid Prairie Wheat Breeding Program and carries out applied conservation tillage research studies in cooperation with local and provincial conservation groups.

2. The Western Land Resource Group with nodes across Western Canada develops and maintains up-to-date resource databases, provides interpretations of land use suitability and conducts research on and documents the state of the regional land resource base affecting it.

- The [Centre for Precision Farming](#), located at Indian Head, Saskatchewan, is studying ways to help farmers boost production, cut input costs, and decrease pollution. Using information gathering from remote technologies (satellite imagery, aerial photographs, and ground-based spectral radiometers), researchers are attempting to determine more effective and economical ways of assigning management units to a field.

Internationally, Canadians are active in the Consultative Group on International Agricultural Research (CGIAR), a consortium of 37 industrialized and developing countries plus 15 foundations and international organizations. Members assist developing countries by funding a global network of 16 International Agricultural Research Centres (IARCs) located around the globe. The Centres carry out research and related training and promote institutional strengthening. Their programmes in crop and livestock agriculture, aquaculture, forestry and agroforestry address technical and policy problems and transcend national boundaries. Research results and benefits are broadly shared by the both the developing world and Canadian farmers.

Funding of Canadian public-sector agricultural research has been declining and our private sector research is relatively small compared to other agricultural exporters. Although Canada has an enormous potential research capacity to share, significant cost savings can be realized through partnership. Therefore, Canadian involvement in international agricultural research organizations like CGIAR makes competitive sense. Also, close research ties with CGIAR provide direct and immediate benefits to Canada in the form of research access to genetic material from the large CGIAR collections of crop and related germplasm. Virtually all Canadian crops are developed from germplasm not indigenous to Canada. There is a continuing need for varietal development and improvement in Canadian crops to deal with changing pest and disease conditions, new production technologies and quality and price competition from producers in other countries. These factors make Canada particularly dependent on germplasm collections from other countries and regions and the open system of germplasm exchange that exists among public-sector research establishments around the world.

Sharing Canadian Capability in Agricultural Research

Canada has an important research niche from which to make a sizeable contribution. There is a role for Canadian researchers to work in concert with the global agricultural research community. For example, the Canada-CGIAR Network Initiative (CCNI) is a national support organization which seeks to build a consortium of Canadian organizations and individuals that share a concern for poverty and food insecurity. The purpose is to foster Canadian action on international agricultural research.

Within the CGIAR international partnership, Canada is channelling its human resources and scientific expertise. The CIDA-sponsored CGIAR-Canada Linkage Fund (CCLF) was initiated in 1995 to provide funding to strengthen collaboration between Canada's science community and the IARCs of the CGIAR. It was launched because Canada recognized the need to: (a) increase Canada's involvement in addressing food insecurity and related problems in developing countries; (b) increase the CGIAR's utilization of Canada's strong scientific base; and (c) expand each group's knowledge of the other's strengths, activities and accomplishments. Two examples of such collaboration which relate directly to dryland management are:

- The University of Guelph and the International Centre for Agricultural Research in Dryland Areas (ICARDA) are exploring women's role in dryland agriculture. For example, their role is changing in the dry areas of West Asia and North Africa as a result of male out-migration. Women are now assuming a bigger role in household livelihood and farm resource management.
- The University of Saskatchewan and ICRISAT are working with farmers in East Africa to help them improve incomes through increased chickpea yields. Facilities at the University of Saskatchewan are being used to develop molecular markers for drought- and wilt-resistant traits. This will assist in the selection of genetic material with greater production potential.

Measures to improve knowledge, assessment, and monitoring of climate, drought and desertification

Climate Research and Drought Monitoring

In the Canadian Prairies, it is speculated that global warming could have a dramatic impact on agricultural practices. In particular, there is concern about an increase in aridity of the region, which adversely affects agriculture and its supporting sector. The Research Branch of AAFC is developing crop varieties that will be better adapted to drought and potential insect and disease pests associated with climate change. Research is being conducted, using new technologies such as remote sensing and geographic information

systems, to assess risks, evaluate the state of ecosystems, and to devise new and improved land use practices to respond to a changing climate.

With a resource as expansive and dynamic as agriculture, imagery acquired from repeated satellite overpasses becomes a valuable source of data for mapping the state and changing condition of crop and soils. As an added advantage, radar is considered an "all-weather" sensor as imagery can be acquired through cloud cover. Consequently, for applications requiring a timely and dependable information source, acquisition of imagery with radar satellites is assured.

RADARSAT: Canada's Contribution to Remote Sensing Technology

The Canada Centre of Remote Sensing (CCRS) has been extensively involved in remote sensing research and is considered a leader in radar and hyper-spectral applications development. CCRS has conducted numerous agricultural research initiatives, including many in the prairies. Research at CCRS, using Canada's RADARSAT-1, has proven that Synthetic Aperture Radar (SAR) sensors are very sensitive to the amount of soil moisture in the top layer of the soil. This imagery is used in the production of maps of surface soil, and the information is useful in hydrological modelling, and in determining water availability for crops.

Canada's RADARSAT-1 is currently the most sophisticated civilian radar satellite in orbit. Canada will soon launch RADARSAT-2, which promises to provide considerably more information on agricultural resources. Its cross-polarized channel will be particularly important for soil conservation mapping and for providing information on crop conditions.

Research at CCRS has also demonstrated that radar imagery can detect soil roughness and could thus be used to monitor tillage. Information related to the type and timing of soil tillage is critical in establishing soil erosion risks. The type and amount of residue cover left on the soil as a protective cover can also be mapped with radar and optical sensor imagery. This information could be used in establishing erosion rates and thus could help to target conservation programs and prescribe conservation approaches. As well, imagery acquired over several years can be used as a benchmark to evaluate the effectiveness of conservation incentive programs.

Agrometeorology is another promising field of research and public and private Canadian institutions have developed expertise and technology to assist land users and policy makers in planning ahead. This involves identification of climate trends and their possible effects on crop yields, and includes developing strategies for monitoring drought.

Federal and provincial government departments are also working together to develop responses to climate change and land degradation. Indeed, Canada's response to climate change in the prairies also entails adaptation of agricultural practices to changing conditions. Although not directly aimed at preventing or reversing land degradation,

initiatives in this field have an impact on land use and practices. Stakeholder, as well as private sector participation in research initiatives and technology development, is stimulated by the creation of networks that allow for effective distribution and use of information.

Prairie Agroclimate

Agriculture and Agri-Food Canada's PFRA has established a Prairie Agroclimate Unit to develop a strategy for the Branch to work in partnership with the Research branch and other federal and provincial departments, universities, and the private sector, to provide timely information about climate trends, variability and the impacts on agriculture and water supply on the Prairies; and to promote ideas and activities for groups / individuals to reduce our vulnerability to drought and other climatic extremes. Research, development, evaluation and application of drought, yield and water supply indices is being undertaken. The science and potential application of seasonal climate predictions from Environment Canada is being evaluated.

A [Drought Watch](#) web site is providing current information on the state of farm water supplies, pastures, and accumulated rainfall. This site links to many sources of vital information from agencies with similar interests.

Governments and other centres on the Prairies are currently evaluating needs and working to establish new climate data networks for providing real time information about climate related production risks, and drought response plans are being updated. In Manitoba, for example, the Agrometeorological Centre of Excellence (ACE), a provincial initiative, is establishing an agrometeorological network for the purpose of providing real-time climate data and other products to the agriculture sector.

The Prairie Adaptation Research Cooperative (PARC) is a federally funded research network established in March 2000 for the purpose of understanding the potential impacts of climate change on the Canadian Prairie Provinces, and conducting research necessary to develop appropriate adaptation strategies. Established under the Climate Change Action Fund (CCAF), PARC provides funding for targeted applied research to study adaptation to changes in climate on the prairies and to better understand the impacts of climate change. Adaptation in this context refers to a change in a system (environmental, human or socio-economic) that maintains or improves the viability of that system under variable or changing conditions - in this case, variable and changing climate. It involves taking steps to minimize negative impacts of climate change and to maximize the benefits. PARC promotes and coordinates collaborative research among sectors and disciplines on climate change impacts and adaptation, and acts as a focal point for development of highly qualified personnel in this emerging field.

Benchmarks and indicators

Agriculture is intimately linked with the natural environment, as soil and water resources are vital to agricultural productivity. Soil- and water-based benchmarks and indicators provide a framework with which to measure the environmental performance of various agricultural practices or the effectiveness of conservation measures on the natural environment. These criteria are also useful for monitoring the evolution of land use practices in response to increased agricultural demand and to provide the basis for strategic decision making in the area of land resource utilization into the future. The Research Branch of AAFC, in cooperation with universities and other government agencies, are fortunate to have a network of long-term crop rotations and soil benchmark sites in different agro-ecosystems. These sites are used to determine the effect of various land management systems on important physical and chemical properties of soil, including carbon sequestration.

The Organization of Economic Cooperation and Development (OECD) is coordinating an effort among its member countries to develop agri-environmental indicators. In recognition of the need for indicators, AAFC has initiated the [Agri-Environmental Indicator Project](#). The indicators are measures of key national environmental conditions and risks resulting from agriculture, and of management practices used by farmers. Fourteen indicators were developed within 6 categories: environmental farm management, soil quality, water quality, greenhouse gas emissions, agroecosystem biodiversity, and production intensity. A report entitled [Environmental Sustainability of Canadian Agriculture](#) has been prepared by AAFC, providing a description of these indicators.

Data collected on an ongoing basis, such as in the Census of Agriculture, also provides information used in analysis of agricultural impacts on natural resources. The Census provides information on crops, land uses, land management and livestock. Results for three census years (1981, 1991 and 1996) were used in the Agri-Environmental Indicator Project.

In addition, technology such as radar and remote sensing also provides information about land uses, such as tillage practices, soil moisture and roughness. Research at the CCRS, in close collaboration with federal and provincial governments, and universities, seeks to develop methodologies to extract crop condition indicators (leaf area, plant moisture content, chlorophyll and nitrogen, for example) from optical imagery. This information will be useful in precision farming, allowing producers to take corrective action when provided with real-time information.

Prairie Agricultural Landscapes: A Land Resource Review

Resource conservation and economic viability are paramount to the long-term prosperity of the agriculture industry. Future growth in primary production is expected to come from the prairies, and will pose challenges for the sustainable management of the resource base. The land base required to meet this growth is forecast to come from improved crop management, reduction of summer fallow, and increased pressure to cultivate environmentally sensitive lands.

The [Prairie Agricultural Landscapes \(PAL\)](#) study was initiated by the PFRA to report on the current state of land resource management in the prairie region of Canada. The recently published (2000) report provides the basis for strategic decision making in the areas of land resource utilization into the future.

"The PFRA vision for the future goes beyond prevention of resource degradation; the vision is to improve land resources. Prairie agricultural landscapes can provide a healthy and productive land and water resource base through continued cooperation between government agencies and private landowners. The PFRA role is to work with prairie people to support a sound rural economy, a healthy environment, and a high quality of life."

The PAL report highlights the state of current prairie land resources and emphasizes the importance of proper land management in reducing the risks of environmental degradation associated with some agricultural practices. In many ways, it provides a benchmark for four key resource groups – cultivated land, rangeland and forage land, water quality and riparian areas.

Conclusion

Canada has a long history of addressing land degradation and desertification within a national context – dating back to the Dust Bowl era of the 1930s. Many systems initiated at that time are still in place, including shelterbelts and community pastures. Historical experiences with community pasture systems have been supplemented with other new approaches such as conservation tillage and permanent cover programs. Of significance has been the development of an integrated, collaborative system to deliver conservation programs and extension activities through provincial and federal agriculture departments. Current efforts continue to be directed at maintaining those systems, adjusting them to meet ever-changing pressures (economic, social, environmental, and from globalization), and adapting and adopting new technology as it becomes available.

Canada is a global player in land degradation and desertification issues but we are not alone in dealing with problems related to economic development and environmental sustainability. We share with developing countries concerns about managing fragile and important dryland ecosystems upon which our rural economy, and indeed national food security and economic export interests, are based. The commitment made by Canada, and the support and collaborative response from the provinces, non-governmental organizations, and civil society is demonstrated in the many programs and initiatives identified in this report.



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Our status as Party to this Convention is in our national interest because this Convention (and related issues like biodiversity), and the global thinking which is emanating from it, will benefit our own vision and approach of how we address our own, and the world's drylands. The Convention provides a lens that is useful to the Canadian stakeholders (federal and provincial departments, researchers, NGOs, communities, etc.) through which to view our actions at the national level.

This report has demonstrated the multitude of responses implemented in Canada in the continuing effort to combat desertification. The cooperation of federal and provincial governments, private landowners, industry, and NGOs is fundamental to this objective. This effort is important not only to the Canadian prairies, but is also vital as Canada shares its knowledge as a both an Affected and Donor Party to the UNCCD.