Chapter 5: Issues Facing Management of Land Resources

Introduction

There are many issues facing today's farmers. Rising input costs and low commodity prices add to the complexity of the decision-making process. During a 1995 conference into Planning for a Sustainable Future - The Case of the North American Great Plains (Wilhite and Smith 1995), focus groups agreed that farmers faced:

- *heavy debt burdens*
- *lack of access to equity*
- *risk that is personal rather than corporate*
- *high transportation costs*
- *high costs for fertilizer and pesticides*
- *little leverage against big business firms*
- *no control over global commodity prices*
- *seemingly little political clout.*

Not much has changed. In an attempt to compensate for these conditions, there's an increasing tendency to farm more land, to diversify and take other measures. To some, producing more in the face of falling prices is not a solution (Dorosh 1998), and the consequences for the future management of the Prairie soil resource are uncertain.

In 1995, the *National Environment Strategy for Agriculture and Agri-Food* was written for the Canadian federal and provincial ministers of agriculture (AAFC 1995a). The report stated that, "Stresses on the resource base, new technologies and trade agreements, and increased public concern about the environment are just a few of the challenges facing the sector."

It further stated that sustainable development would require finding a balance among social, economic and environmental factors.

Social factors are affected by farm size, population shifts and the infrastructure needed to sustain a good quality of rural life. Economic factors include considerations such as changing markets and increased costs of production. The environmental component reflects changes to the soil and water resource and a heightened public awareness of environmental impact.

The issues affecting sustainability can be divided into four general levels:

- public
- environmental
- community
- on-farm.

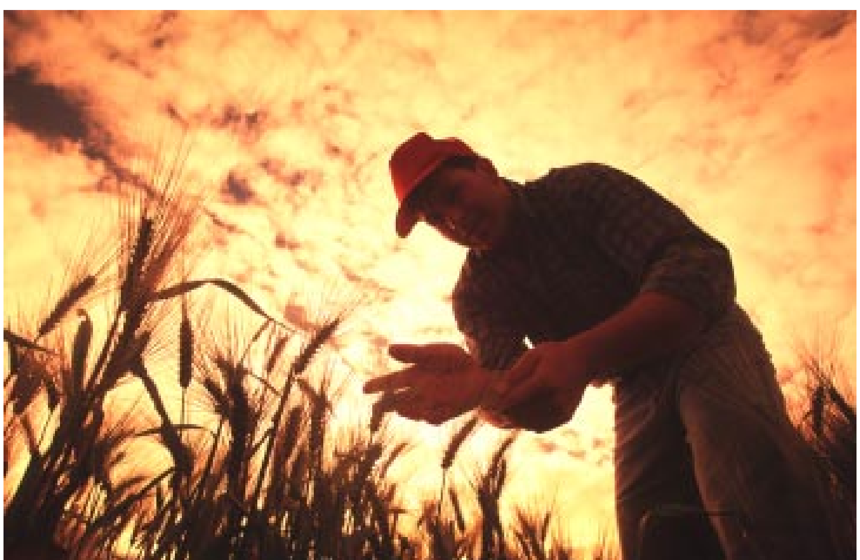

Photo by Dave Reede

There are many issues that affect producers' decisions, some of which allow little or no control, including weather, market conditions and societal attitudes.

Within each of these levels, specific issues and issue drivers (sub-issues) have been identified (see Tables 5.1-5.4). These issues and drivers are likely to affect one or all of three factors:

- market condition
- social/emotional attitudes
- cost of production.

Public Level Issues

Table 5.1 provides an overview of the major public issues that currently affect, or are likely to affect producer decisions. These include issues of policies and legislation as well as issues involving international agreements.

Programs, Policies and Legislation

Government programs can be designed with incentives to encourage the achievement of goals deemed to be in the public good. These incentives can range from the distribution of information to cost-sharing, public recognition and the imposition of laws and regulations.

Policy and legislation can influence trade, markets and stewardship decisions. They can be designed such that market signals and comparative advantage provide incentives to producers and processors to expand. Expansion can put tremendous pressure on natural resources as producers try to provide raw materials for processing and export. At the same time, other policy and legislation may be designed to protect the environ-

CAMC projections require crop yield growth rates of more than double current trends; cattle numbers would increase by 700,000 head (15%), while hog numbers would increase by 5.5 million head (30%). It is unlikely that livestock numbers can be pushed much beyond these levels without Canada becoming a net feed grain importer. In the hog sector, significant growth is occurring in the Prairie region (AAFC 1998). For example, Manitoba's breeding herd expanded by 6.1% in 1999, and output of market hogs in 2000 is expected to grow by 5% to 4.9 million (Manitoba Agriculture and Food 1999).

ment (i.e. sustainability and biodiversity obligations), and encourage sustainable uses of the land so that future generations will enjoy diverse and healthy ecosystems.

An example of a policy driver based on the concept of expanding export targets is the Canadian Agri-Food Marketing Council's (CAMC) growth target of 4% of world agri-food trade. An AAFC paper evaluating the CAMC goal outlines areas where government might support industry in achieving this objective (AAFC 1998). Five priority areas were identified:

- increase the supply of factors of production
- increase productivity
- relax/eliminate regulatory constraints
- increase market access
- ensure environmental sustainability.

Achieving the CAMC goals will involve significant changes in order to increase primary production. Revision of policies related to supply management, grading, licensing and packaging systems, and significant growth in productivity and gains in international markets are essential to meet the export target.

In meeting the CAMC goal, bulk product exports would decrease, but production output would have to increase significantly to supply the growing demands of the processing sector. To achieve this target, it is forecast that one million hectares of new land would have to come into production in Canada, increasing the total cultivated area to 39 million hectares.

The CAMC proposal for a dramatic increase in agri-food exports has clear implications for environmental sustainability. Increasing pressures to produce more from a relatively static land base would result in:

- pressure to bring new lands into annual production. This could result in the conversion of pastures and other marginal lands into cultivated hectares, with impacts on wildlife habitat quality and biodiversity
- increased management intensity on cultivated lands, resulting in greater use of pesticides, fertilizer, genetically modified organisms (GMOs)
- increased manure production and associated nutrient management and waste disposal requirements, and the increasing hazard of non-point water pollution from runoff and leaching of cultivated lands.

International agreements such as the World Trade Organization (WTO) and the North American

The Agenda 21 report identified eight main environmental and natural resource issues that can be applied to Canada's agriculture and agri-food sector:

- ***conservation of soil resources***
- ***surface and groundwater quality***
- ***water quantity management***
- ***sustainable management of wildlife habitat***
- ***air quality and climate change***
- ***energy efficiency***
- ***pollution and waste management***
- ***conservation of genetic resources.***

Free Trade Agreement (NAFTA) may place pressure on Canada to severely restrict mechanisms that are deemed to be subsidizing the cost of production.

On the environmental side, Canada is committed to a number of conventions and obligations, particularly in relation to biodiversity. Depending on the methods used to meet these obligations, their cumulative effect as an issue driver and the resulting impact on land management practices may be far-reaching.

Agenda 21, developed at the United Nations Conference on Environment and Development, Earth Summit, provides an overall blueprint on how to make development socially, economically and environmentally sustainable. It explains that population, consumption and technology are the primary forces behind environmental change. Agenda 21 lays out what needs to be done to reduce wasteful and inefficient consumption patterns in some parts of the world, while encouraging increased but sustainable development in others.

Concern over diminishing genetic resources in animals was more specifically addressed at the Earth Summit. As a result of the meeting, Canada signed the Convention on Biological Diversity (United Nations Environment Programme 1992), and was one of the first countries to ratify it. The Convention is a legally binding international treaty that involves, among other issues, a commitment to develop a Canadian biodiversity strategy, and to carry out plans for the domestic and global conservation of biodiversity. The Canadian Biodiversity Strategy was formally endorsed by federal, provincial and territorial governments in April, 1996.

Agriculture and Agri-Food Canada, as a key responsible federal agency, has developed an action plan to assure the conservation and sustainable use of biological resources. These resources include animal, plant and microbial genetic resources important to the future of Canadian food production. The plan has identified four goals:

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

As part of its strategy, the Government of Canada has established national programs for the conservation of farm, crop and animal genetic resources. Canada's genetic resources are at risk from an increasing specialization of agriculture which uses fewer

When a particular variety of animal or plant has shown superior qualities, farmers will tend to use it in their operations. The concern is that if a disease particular to such a 'super' variety is introduced, it could eliminate production altogether. While clearly no one wants this to happen, the incentive to specialize in the quest for the best possible economic returns is a powerful motivator within the agri-food industry.

breeds of plants and animals. The federal government is working to preserve and enhance the diversity of Canada's genetic resources by acquiring and developing, adapting, monitoring, utilizing and/or releasing plant, animal and other biological genetic resources. The diversity of these resources will provide the basis for enhanced resistance to diseases, insects and other environmental stresses (Government of Canada 1990).

Inherently linked to the issue of biodiversity is the sub-issue of wildlife and habitat conservation. Biodiversity may be defined as the diversity of life, and may be considered at the genetic, species and ecosystem levels. Canada's public, and in particular the environmental community, are strongly interested in the conservation of wild species and natural ecosystems. Agriculturalists rely on the conservation of domesticated species and genetic resources for the improvement of crops and animals.

Public and environmental issues concerning conservation of wildlife and habitat arise because agriculture impacts natural landscapes and modifies habitat, often at the expense of some wildlife species or populations. Today, few policy instruments remain which negatively impact habitat. However, increased management intensity, increased pesticide use, and pressures to bring new lands into agricultural production may negatively affect wildlife habitat and populations.

It should also be noted, however, that agriculture interacts positively with wildlife. Across the Prairies, there are a number of wildlife habitat success stories. Some of these include the Agricultural Rehabilitation Development Act (ARDA), the North American Waterfowl Management Plan (NAWMP), and recent initiatives to restore riparian health such as the *Cows and Fish* project in Alberta. Increasingly, producers are being asked to farm with wildlife and habitat in mind. At present, however, there are few economic incentives to encourage this. To continue to preserve Canada's diversity of wildlife, it may be necessary to:

- support land and water stewardship with fiscal incentives (so that farmers can capture value from maintaining wildlife habitat)
- encourage more use of conservation easements with tax incentives
- encourage adoption of best management practices
- provide compensation for wildlife damage and expanded prevention measures
- assist landowners and rural communities to take economic advantage of natural landscapes whenever possible
- support the acquisition (public and private) of new habitat sites.

In order to protect wildlife species and their habitats, federal *Species at Risk* legislation is under consideration for both private and Crown lands in Canada. The Species at Risk strategy would allow for quicker action to protect a species, rather than waiting until it is endangered or faces extinction as a consequence of human activity. Agricultural concerns with such legislation relate to potential restrictions on land use and lack of compensation for foregone economic opportunities.

The proposed Species at Risk conservation strategy also includes explicit reference to stewardship initiatives, promoting an approach that works both for farmers and wildlife recovery. In partnership with both government and conservation agencies, informed farmers may well be able to manage their lands for efficient agricultural production while minimizing impacts to species at risk.

A number of options might be used to influence land and biodiversity management. For example

- some sensitive areas may be legislatively prohibited from production
- whole-farm planning may facilitate maintenance or improvement of endangered habitat through awareness
- revenue generation may be linked to conserving species at risk, such that wildlife is considered an asset and not a liability when managing the land
- tax incentives may be offered for conservation activity.

International Agreements

The federal government represents the public in the issue area of international agreements involving other trading partners, and often the rest of the international community. Examples of drivers within this issue category include the Kyoto Protocol, the Convention on Biological Diversity, NAWMP, and NAFTA and WTO agreements.

Agricultural concerns with Species at Risk legislation relate to potential restrictions on land use and lack of compensation for foregone economic opportunities.

Photo courtesy of Ducks Unlimited Canada

Kyoto Protocol: In December 1997, representatives from Canada and 160 other countries met in Kyoto, Japan and agreed on new, legally binding limits for greenhouse gas emissions in the world's industrialized nations (United Nations 1998).

Under the agreement which has yet to be ratified, developed countries are to reduce emissions of six greenhouse gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride. A certain amount of flexibility was built into the agreement to allow developed countries to meet part of their commitments through emissions trading.

Canada committed to reducing greenhouse gas emissions to 6% below 1990 levels by the year 2012 (United Nations 1998). In 1995, at least 80% of Canada's total greenhouse gas emissions resulted from the use of coal, oil and natural gas to generate electricity and to power factories, homes and cars. At present, agriculture accounts for about 10% of Canada's greenhouse gas emissions (Jacques et al. 1997). Greenhouse gas emissions and related climate change issues may affect the agricultural industry in the areas of soil management, increased production of forage crops, reduced fossil fuel usage and cropping practices.

Agriculture and Agri-Food Canada, Environment Canada and non-government organizations such as Ducks Unlimited, have emphasized the development and adoption of best management practices in agriculture to reduce greenhouse gas emissions.

The Agriculture and Agri-Food Table on Climate Change has recognized that there are major opportunities to sequester carbon from best management practices. These include reducing summerfallow, no-till and reduced tillage, use of perennial forages/legumes, more efficient application of fertilizers and organic amendments. Estimates indicate that sequestering between 11 and 26 Mt of carbon dioxide per year is possible, depending upon adoption rates and incentives used (AAFC 2000).

Although progress has been made towards altering agricultural practices to make them more environmentally sustainable, agriculture's mode of operation will almost always be economically driven. If a practice is not financially viable, it will likely not exist, regardless of responsible stewardship or the environmental benefit.

NAFTA: The North American Free Trade Agreement (NAFTA) began January 1, 1994. The objectives of this understanding between Canada, Mexico and the United States are to facilitate the cross-border movement of goods and services between the territories of the parties.

The agricultural provisions of the U.S.-Canada Free Trade Agreement, which have been in effect since 1989, were incorporated into the NAFTA. Under these provisions, all tariffs affecting agricultural trade between the United States and Canada (with a few exceptions for items covered by tariff-rate quotas), were to be removed by January 1, 1998.

Mexico and Canada reached a separate bilateral NAFTA agreement on market access for agricultural products. The Mexican-Canadian agreement eliminated most tariffs either immediately, or over 5-15 year periods. Tariffs between the two countries affecting trade in dairy, poultry, eggs and sugar are maintained.

Since the implementation of NAFTA:

- ***Canadian agricultural exports to the U.S. have increased by 35%. Canada's exports to the U.S. surpassed $10 billion in 1996, increasing 19% from 1995 (AAFC 1998)***
- ***Canadian agricultural export growth to Mexico was 7.6% in 1996, representing an export value of Cdn $388 million from Cdn $361 million in 1995***
- ***U.S. exports to Canada and Mexico have increased by 20% and 12% respectively.***

WTO: The World Trade Organization (WTO), contains the Agreement on Technical Barriers to Trade, which commits signatories to work towards compatibility of standardization measures (WTO 1998). Another WTO agreement deals with sanitary and phytosanitary measures, including standards used to protect human, animal or plant life and health.

The WTO agreement sets down rules for the international trade of agricultural products and calls for substantial reductions in trade distorting subsidies. Under the WTO Agreement on Agriculture, members are to reduce tariffs on agricultural goods by 36% over six years, with a minimum reduction of 15% for each tariff line. A reduction of 20% has been achieved already. However, the successful interpretation and application of WTO rules is increasingly coming under question. The agreement is supposed to provide for better trade rules for agriculture and more secure access for Canadian agricultural products. The Organization of Economic Co-operation and Development has predicted that this agreement will contribute $8 billion to the Canadian economy by the year 2002.

In 1989, the European Union (EU) imposed a ban on imports of Canadian beef produced with growth-promoting hormones.

- ***Health protection measure - the EU argued that the ban on Canadian imports was a health protection measure. However, internationally accepted studies have consistently found that the growth hormones in question present no danger to beef consumers.***
- ***Dispute settlement - Canada requested a WTO dispute-settlement panel in 1996, after direct consultations with the EU failed to resolve the dispute. In August 1997, the WTO panel ruled that the EU's ban on imports of Canadian beef had to be lifted.***
- ***Non-compliance - Europe indicated it will not comply with the ruling. Subsequently, the WTO approved Canadian retaliatory trade action, but the European market for Canadian beef remains closed for the foreseeable future.***

The WTO goal is to eliminate trade barriers. However, sanitary and phytosanitary health protection standards are becoming a trade barrier issue. They could be used to protect domestic markets by setting standards and making food safety claims.

The reduction of barriers to trade may allow the export of commodities and products in which Canadian agriculture and agri-food producers have a comparative economic advantage. This will cause producers to examine a wider range of land use options, and may result in new cropping and land management strategies.

Environmental Issues

Issues at the environmental level include public perception of what agriculture may be doing to the land and environment in general, and public expectations of a plentiful supply of safe water, air and food (AAFC 1997). Issues include the effects of natural variability on the environment, and the way that farmers must compensate for natural variability. Issues and drivers are listed in Table 5.2, along with a brief discussion of a few of the conditions and possible changes to land management that may apply.

Public Perception

The way the public views agriculture's role in the environment has implications for land management change. Western Canadian farmers are largely seen as good stewards of the land, and Canada is viewed as a world leader in producing nutritious, safe food products (The Advisory Group 1994). Yet this trust is certainly not based on extensive public knowledge of the agricultural sector with less than 3% of North Americans directly involved in farming.

Recent surveys indicate that consumers and producers share common concerns regarding the impact of agriculture on the environment (The Advisory Group 1997). Yet the two groups often use different language to describe these concerns. Producers might express concern over proper disposal or management of wastes, loss of soil fertility and soil erosion. Consumers, on the other hand, often talk in terms of water pollution, loss of wildlife habitat and shortage of water supply.

Interests between consumers and producers can diverge when it comes to food safety and the use of chemicals, additives, or

GMOs. Many in the public would like to see a decrease or cessation in the use of agricultural chemicals. Yet producers are faced with a wide range of plant and animal pests, and generally rely on management schemes that use chemicals. Such differing views, and the distinctly different vocabularies of each group, highlight the critical need for improved communication between producers and the public (Finn and Vincent 1997).

The public is becoming more influential in agriculture and policy development, and wants to be increasingly consulted and informed about farm impacts (Prairie Research Associates 1998). Clashes might be minimized through an improved knowledge of each group's viewpoint and rationale. If communication does not improve, an uninformed public could increasingly conclude that agriculture is a threat to the environment and that food supplies are unsafe, and demand greater regulatory control.

Agriculture is widely viewed as responsible for managing soil and water resources wisely, and as being publicly accountable for doing so (Wayland 1990). As such, land stewardship is a driver of the public perception issue and society wants assurances that land and water resources left to future generations will be productive and healthy. Although most farmers view themselves as managing their land sustainably for future generations, some common practices might well reduce soil quality in the long run (AAFC 1995b).

Increasingly, agriculture will be expected to maintain soil and water resources as close to their natural, unspoiled state as possible. Where cultivation is practiced, it may increasingly be viewed as bad for the land, with erosion and degradation as consequences. Many believe that agricultural chemicals are an unnecessary input that is polluting the land.

Pressure will increase to manage agricultural lands within their natural state, specifically to:

- maintain grasslands as such, and return more lands to pasture
- reduce tillage (including less fallow) and increase crop residue cover in fields as a part of a holistic management approach

As intensive livestock operations (ILOs) locate closer to rural communities, or consumers seek to better understand the risks and benefits of different management practices, an effective communications strategy will be a key component in public consultations towards assuring flexibility in land management options. Such a strategy must be:

- ***informative – include effective dissemination of information on agricultural chemical application and use (including benefits and risks)***
- ***sensitive – reflect the overall effect of farm activities on the local economy, and the potential impact of land management change on the environment***
- ***open – provide information so the public may be comfortable with planned developments***
- ***clear – e.g. where biotechnology is viewed by many with suspicion, an effective communication plan and further research could allay concerns and clarify problem areas.***

Out of a commitment to good stewardship, or at least wanting to be perceived as good stewards, rising numbers of farmers may adjust land management practices accordingly. On the other hand, landowners may change their agri-chemical use and tillage practices to access or respond to a wide range of environmental and economic instruments designed to foster sustainable development (Harker 1997).

- lower chemical and fertilizer inputs.

Overall, expectations may favor a movement towards a low-input sustainable agriculture philosophy. That is, the use of cultivation, nutrients, manure, pesticides and other inputs at lower rates on an as-needed basis.

The public expects agriculture to have a minimal negative effect on the ecosystem. It requires reassurance that current practices are sustainable, and that the environment is not being harmed. This need for reassurance is complicated by the fact that existing sustainable relationships within agriculture are often not readily apparent.

Pressures to conserve wildlife habitat will increase, as will as efforts to sustain, and in some cases, restore lost biodiversity. This will include an increasing reliance on aquatic-use guidelines as the standard for environmental water quality, due in part to the sensitive nature of aquatic life, and a public distrust of the higher threshold levels of drinking water guidelines (Harker et al. 1998).

Ideally, agriculture must be seen as conserving, restoring and even enhancing natural ecosystems, while reducing dependence on large-scale monoculture practices (Wilhite and Smith 1995). This suggests producers should:

- reduce nutrient, pesticide and situation losses from agricultural lands in order to meet aquatic standards
- apply voluntary restraint to meet socially accepted environmental objectives, and to reduce the likelihood of the application of outside, and sometimes arbitrary, policies and regulations.

Abundant Safe Water, Air, and Food

Having plenty of safe water, air and food for human consumption is a chief public concern. Water supplies must be sufficient to meet domestic, industrial and recreational requirements. Water and air must be clean and free of objectionable colour, odour and taste. Yet, agricultural practices are often perceived as adversely affecting our supplies of water, air and food (AAFC 1995a).

The public expects food production to be efficient, socially responsible and adequate to feed a hungry world. At the same time, producers must be economically viable and protect themselves against the risk of low yields and crop losses. Some public concerns represent market opportunities. Consumers concerned with animal rights may wish to purchase products which have been raised in a free range environment. This will provide new opportunities for some farmers to fill niche markets.

Land management practices to address supply concerns might utilize an ethical approach that would:

- reduce inputs while contributing to enhanced water conservation
- use cleaner agricultural practices which could include BMPs that focus on reduced application and loss of farm chemicals
- consider emerging issues such as bio-ethical and animal rights concerns, the use of growth hormones, and GMOs.

On the other hand, the drive to maximize food supply will create incentives to bring more land under cultivation and into more intensive production. Split applications of fertilizer, as well as the over-application of fertilizer, pesticides and other inputs, could be used to assure that high production levels are achieved.

Agricultural practices are often seen as affecting food safety. Many consumers believe that organically grown food is natural and therefore better for you, that perfect food ought to be without blemishes or insect damage, and that food should be available at a low cost.

Concerns about the safe use of agricultural chemicals and biotechnology are involved as well. Water, air and food are expected to be free of pesticides, bacteria, excessive nutrients, heavy metals, growth hormones and dust. Organic food sales may grow if more problems are linked to agricultural chemicals. They should retain their own niche market regardless of these concerns. Increasing numbers of farmers will change their production practices to meet societal expectations of producing safe food. Others will adjust farming practices in an attempt to lower chemical inputs while maximizing overall profit.

Natural Variability

Natural variability in the ecosystem is an obvious issue related to the potential for land management change. This includes drivers such as severe weather conditions, climate change and incidence of pests and disease.

Agriculture must be prepared to address extremes in weather. Drought may be isolated or wide-spread. Flooding occurs periodically in susceptible areas. Risk from frost is an increasing hazard as diversification moves specialty crops further into the fringes of growing season extremes. Failure to compensate for such extremes can put sustainable agriculture and soil and water resources at risk.

Farmers may adjust cultivation practices to hedge against extremes in weather conditions. For example, a farmer might change a cropping and cultivation strategy to capitalize on a short-term market for replacement crops created by adverse weather conditions. Some producers will adopt soil conservation practices. Others will maintain a regime like crop/fallow because it allows them to cautiously hedge against the possibility of drought and crop loss.

There has been increasing movement away from a *seed-and-pray* attitude, to one of longer-range field planning as reflected in:

- flex cropping according to spring subsoil moisture conditions versus pre-set decisions as a basis for crops planted

The agriculture and agri-food sector in Western Canada is poised for significant growth which will be influenced by a variety of factors. Global population is expected to be 6 billion by 2000, and 8.1 billion by 2025. Population growth in Canada will increase modestly at 0.9% annually, while world growth will be at 1.5% annually, suggesting that much of the demand for Western Canadian products will grow through exports. Economic growth in Asia is forecasted at between 6-12% annually over the long-term. The growth rate, coupled with a huge population base, opens up food and fibre opportunities in this region.

Assuring safety in water, air and food production may well require the adoption of land management practices that reduce or restrict inputs through methods such as:

- ***integrated pest management (IPM) – relying more heavily on techniques that reduce pesticide requirements***
- ***manure application – e.g. reducing seasonal application on frozen soils, in keeping with legislation and guidelines***
- ***cattle access – restricting direct access to water, through fencing away from ponds and streams, or limiting time and location of access by grazing animals***
- ***growth hormone and GMO use – may be voluntarily restricted.***

- increased efforts to maintain adequate crop cover to hedge against wind and water erosion
- choosing cropping strategies that avoid extremes in seeding and harvest dates
- using larger equipment to shorten required seeding and harvest windows.

Addressing specific and generalized threats from pests and disease can dramatically affect cropping ability. Increased risk of crop failure occurs in conjunction with certain crop and pest relationships such as fusarium wilt in wheat. Some farmers will alter overall land management to reduce the likelihood that their lands are a source of pests and disease. They may use increased tillage and crop rotation strategies to address problems, while at the same time reducing the total cost of agro-chemical use.

Agriculture must be prepared to address extremes in weather such as drought, flooding, and the risk of frost.

Farmers may adopt voluntary quarantines and cropping rotations to combat encroaching disease and weed problems. In other cases, non-native invader plant and animal species may warrant a chemical approach. Support will be given to research and development into pest resistant crops, including, to some extent, those relying on GMOs.

Community Level Issues

Community level issues that can influence on-farm management include demographic change, competing land use, rural infrastructure, and requirements for transportation and off-farm employment (Table 5.3).

Demographic Change

Drivers of demographic change include incidence of fewer farmers, older farmers, an increasingly educated labor pool and fewer small communities.

Census data points to a continuous decline in Prairie farm population. As farm sizes increase, there will be fewer farmers living on the land. The age of Prairie farmers is also on the rise, with the number of younger farmers declining (MacArthur 1998). Part of this increase may be due to the general aging of the population.

Between 1991 and 1996, younger farmers (under 35 years of age) decreased by 22% across the Prairies, while the number of farmers over the age of 35 continued to rise. Meanwhile, the number of farmers older than 54 increased by 6% in Alberta, but decreased by 6.7% and 8.6% in Saskatchewan and Manitoba.

The distribution of farm size is similar between age groups (Statistics Canada 1997), yet there may be little or no incentive for older farmers to move toward the larger land base that might be required for future farming. In fact, there may be a number of reasons for older farmers to avoid this type of expansion.

An increasingly educated labor pool, which is required for high-tech agricultural machinery, will demand higher salaries and better working conditions. Farming practices will have to adapt to these greater labor costs by taking steps that include:

- adopting high-tech trends (e.g. precision farming) particularly as the application of such technologies becomes more economically viable
- increasing farming intensity to help make such technology more affordable
- targeting inputs to control cost efficiencies.

Due to economic and social factors, it will continue to be difficult for small Prairie communities to survive. The most vulnerable will be those without local industry, and perhaps those affected by rail abandonment. Small communities that survive will have to find a niche in local industry or tourism. Other stable or growing *key communities* (Stabler 1992) will become stronger in the future. An example of this is the Winkler-Morden area of Manitoba, where the rural population continues to increase (Statistics Canada 1997) in response to local vision and cultural factors that encourage younger people to remain in the community.

If trading centre consolidation continues as predicted (Stabler 1992), then travelling distances between some farms and rural service centers will increase, resulting in higher transportation and shipping costs. Use of larger vehicles may be necessary to create efficiencies, requiring a greater investment in equip-

The climate is changing, but it is difficult to sort out anthropogenic from natural causes. International commitments for reducing greenhouse gases have been agreed to under the Kyoto Accords. In Canada, agriculture contributes about 10% of the greenhouse gases that may be affecting climate change (Jacques et al. 1997). The agricultural industry must be ready to adapt to climate changes by adjusting management strategies to reduce greenhouse gas emissions and possibly capturing benefits by sequestering carbon. As such, farmers may adjust tillage practices to capitalize on a potential market in carbon credits. But changing tillage techniques can be costly, and farmers may be hesitant to lock themselves into a cropping system based on the long-term storage of carbon, or on land and fertilizer practices to reduce greenhouse gas emissions if there is no clear economic benefit for them to do so.

ment and road infrastructure. Other effects may include a move to higher return specialized crops or livestock, and a decreased reliance on high-cost inputs to counter the increased cost of transporting commodities to service centers.

Competing Land Use

As a community level issue, competing land use is driven by factors such as rural residential development and local zoning requirements. Rural population will continue to grow in areas where the farming population is slowly replaced by non-farm residents. This is especially true of urban fringe areas and is mainly due to rural residential development and growth in the rural value-added industry, as well as recreational and tourism activities.

Land prices will continue to rise in areas affected by rural residential development and competing land uses. This, in turn, may lead to greater subdivision of land in affected areas, adding to:

- higher farm land prices, making it difficult to sustain inter-generational transfer of farms in the urban fringe area
- consumer participation in crop production through increased involvement in harvest and processing activities (e.g. strawberry picking)
- conflicting issues where non-farming interests may require livestock operations to relocate further away from residential and urban fringe areas
- increased fragmentation of wildlife habitat as parcels of land are subdivided.

Rural Infrastructure

Improvements to existing rural infrastructure and additional developments are needed to support the changing agricultural industry. Within the next ten years, additional infrastructure must be in place to ensure that the agricultural sector is not hindered by a lack of water, roads and other services. A key obstacle is the on-going lack of sufficient funding in rural areas to implement and maintain infrastructure requirements.

Local zoning requirements are used to regulate and restrict the location and use of buildings and land. A common land use restriction relates to the infringement of intensive livestock operations (ILOs) on nearby residential properties. Concerns are often raised by the spreading of manure on land near residential developments, or are related to soil and water quality implications from runoff and leaching.

Effective public consultation is crucial to ensuring that local concerns are addressed. Acceptable modifications to management practices can usually be found through such a process. Where agricultural management may be restricted by zoning requirements, limitations might be offset to some extent by:

- ***securing an increasingly dispersed land base to compensate for nutrient build-up and leaching hazard on manured lands***
- ***using composting, timely application, etc., where farming odours infringe on residential development, or runoff and bacterial contamination pose surface water hazards.***

Drivers of rural infrastructure include the need for improved communication systems and changes in the value-added industry. Diversification of farm production will rely on enhanced communications systems to help producers make timely decisions, apply best management practices and facilitate the sharing of experience. This includes having access to timely information such as weather and pest forecasting.

As Western Canada's largest manufacturing industry, food processing is likely to continue to increase to the extent that supporting infrastructure permits (Canada West Foundation 1997). The net effect will be reduced shipping of unprocessed raw materials and a move towards the CAMC value-added processing targets. Expansion and improvements to existing infrastructure need to be made in three key areas: production capabilities, processing facilities and post processing capabilities (including waste handling).

Water, waste-water, natural gas, and transportation infrastructure are key constraints on value-added processing (Kettler 1998). Historically, the federal government has made significant commitments to infrastructure development and there are expectations at the local level that senior governments will continue to do so. Decisions on where this development takes place will determine:

- the location on the landscape where certain crops and livestock will be produced (e.g. given irrigation supply, labor pools, high-voltage power, natural gas pipelines, etc.)
- useful by-products from local food processing operations that might be applied to the land as fertilizer and soil amendments.

Improvements to existing rural infrastructure and additional developments are needed to support the changing agricultural industry.

Transportation Change, Off-farm Employment

Changes in transportation infrastructure and policy, and opportunities for off-farm employment will continue to affect land management strategies. With the loss of the freight rate subsidy, farm costs for moving crops to export markets have increased. Longer transportation distances are a reality, as shipping point consolidation results in a system of inland terminals. This, along with removal of railroad lines, is causing increased road traffic and maintenance. There is, however, a possibility that future impacts on the transportation infrastructure will be less severe, given an anticipated increase in the application of low-pressure tire technology (Stabler 1999). Municipal governments are affected, as they are responsible for the maintenance of a significant amount of rural roads. They, in turn, may increase land taxes to compensate for higher maintenance costs. Farmers will tend to offset higher transportation costs and taxes by:

- diversifying into livestock and specialized crops with higher returns
- feeding grain locally rather than shipping at low or negative returns
- investing in larger trucking equipment or hiring semi-trailer units to ship grain or other farm products.

Opportunities for off-farm employment are critical considerations for most farmers. According to Statistics Canada (1997), farmers derive about 29% of total income from on-farm sources, with 50% of income coming from off-farm employment. The remainder is derived from interest, dividends, transfers, child tax credits, etc. Under these conditions, the long-term survival of farms depends heavily upon access to off-farm income. But off-farm employment opportunities, which were already on the decline before termination of the transportation subsidies, have been further reduced by the loss of the subsidies (Olfert and Stabler 1999). This is particularly relevant in rural communities of about 1,000 people, where up to 50% of the labor force may be local farmers.

The stability of off-farm employment revenue allows many farmers to structure farming operations around this income source, and to specialize in low-intensity cereal grain production, or cater to local market gardening requirements. The more a farm depends upon off-farm employment, the less diversified (in both crops and livestock) the operation is apt to be. However, access to either selling or working in small urban markets continues to decline and the magnitude of compensatory future adjustments to farming operations is expected to be substantial (Olfert and Stabler 1999).

On-Farm Issues

Many issues and drivers are external to the farm gate, yet affect on-farm management. There are a number of issues over which the farmer has direct control, or which are particularly evident at the on-farm level. For example, the price of chemical fertilizer is determined by factors external to the farm gate. However, the farmer has control over the amount of fertilizer used, the method of application and the frequency of fertilizer use.

Issues within the on-farm level can be sub-divided into: the ability to take risk, considerations related to managing inputs and outputs, land tenure and adapting to technological advances (Table 5.4).

Ability to Take Risk

A farmer's land management decisions are unlikely to be determined solely by scientific or economic theory. Farmer values, traditions, the influence of peers and net returns all play a role in determining how each parcel of land is managed.

In many cases, farmers continue with a particular practice simply because they are familiar with it, and know that it will produce income at relatively low risk. They often gain confidence in a new technique from observing a neighbor's success, then applying the technique to their own operations. Statements such as: "My father farmed this way for years, why should I change" or "I can't afford to risk this crop on something new" are often expressed. These perspectives exemplify two key areas

Farmer values, traditions, the influence of peers and net returns all play a role in determining how each parcel of land is managed.

Photo by Dave Reede

that might be viewed as negative drivers to land use change. Limited experience with crop-soil-weather variability, as well as limited availability of capital are likely to promote the status quo.

Ability to learn from first-hand experience is restricted by the relatively short time during which any operator actually farms the land. Farmers might control a land parcel for only 30 to 40 years. Within this period, specific combinations of crop-soil-weather conditions may only repeat themselves a few times. Hence, the opportunity to use experiences gained under a particular set of circumstances might not arise again for several years, limiting a farmer's confidence in adopting new practices as a standard management tool. As a result, many farmers rely upon the wisdom of past generations in making management decisions.

As well, gaining solid experience about the effectiveness of new management practices (e.g. a particular seeding decision) requires time for convincing evidence to accumulate. A decision made in the spring of one year may not have full repercussions for nearly 14 months, when the crop is finally sold. During that time, a farmer must make additional management decisions without knowing the outcome of the previous year's choices. As a result, an operator may not be in a position to effectively consider the merits of a land use change for at least two years.

Everyday agronomic considerations have a major effect on land use decisions. These may be of a short-term nature, such as what, where and how to seed, tillage choice and what herbicide to use. Such decisions are often restricted by the sequence within a cropping rotation, past herbicide choices and current soil moisture conditions. These decisions may be overshadowed by concerns for the cost of inputs and the immediate potential to market the crop at a profit. Given limited experience with variability, and in view of current input and commodity prices, many farmers may be unwilling to risk a significant shift in management.

The availability of capital has a direct impact on land management. It determines what type of farming system is used and usually affects the type of machinery and infrastructure held by the farmer.

Lack of capital often forces a farmer to use the resources at hand such as older equipment and less efficient farming techniques which could result in lower yield and lower income. Ready capital might allow a farmer to increase machinery size and thereby manage a larger land base. It may allow new technology into the farming system such as direct seeding, conservation tillage and variable rate fertilization and seeding. On the other hand, financial risk can be reduced through using less capital, as cash flow may not always be sufficient to repay high debt loads.

In some situations, existing farming practices are only tolerated because lack of capital does not allow change. Extending crop rotations or diversifying farm production requires the capital to access the necessary land, machinery, and other inputs.

Managing Inputs & Outputs

The effective management of on-farm inputs is an obvious, ongoing priority. Less clear has been the requirement to effectively manage non-production outputs such as runoff and erosion, or the pesticides and nutrients that can be a part of runoff and leaching waters. In the past, the management of non-production output has often resulted from other management decisions. For example, direct seeding may have been adopted because it is a more profitable seeding system, with benefits to soil conservation being the secondary consideration.

It is critical to balance inputs in order to produce output at a profit. However, not all inputs can be managed. The weather, which provides moisture and heat is a prime example. Nevertheless, how inputs are managed can have a significant impact on the land. Input costs must be balanced with anticipated returns, while taking into account the risk that a specific input may prove ineffective. Related drivers include the management of agro-chemicals, manure, tillage practices, cropping choices and water and energy use.

Concerns abound about the potential health risks of prolonged pesticide use, as well as the immediate effects of spray drift on adjacent crops and shelterbelts. Farmers are increasingly wary of a build-up of herbicide tolerance in certain weed species that, together with other management techniques, can lead to a shift in the weed spectrum. Cost is a significant concern.

Photo by Dave Reede

Effective management of on-farm inputs is a priority. How inputs are managed can have a significant impact on land and on the profitability of a farming operation.

A classic example of nitrogen management in Western Canada has been the use of summerfallow in crop rotations over the past 20 years. The decision the farmer is faced with is basically one of both nitrogen (N) and herbicide application vs. summerfallow (where moisture is not limiting). The practice of summerfallow can reduce the N requirement of the crop, due to native soil N being mineralized during the fallow period. As fossil fuel and associated N prices continue to increase, more farmers may opt to fallow, further depleting levels of baseline N in the soil.

Producers will seek to reduce weed control costs and chemical inputs, in conjunction with a better understanding of reasonable weed control thresholds. More emphasis will be placed on farm health and safety requirements, resulting in an increase in spraying regulations and a narrowing of the range of chemicals for specific uses. An increase in specialized crops will require specialized pest control.

There will be a greater emphasis on:

- integrated pest management to reduce overall chemical use and cost
- environmental record keeping including the use of pesticide audits
- improved application using low volume nozzles, shrouds and wicks to counter drift and cost concerns
- herbicide rotation to address herbicide resistance
- pesticide specificity for bio-engineered (herbicide specific) crops
- biological controls to cut down on overall pesticide use
- reduced pre-emergent herbicides through conservation tillage, diversified cropping options
- controlling new weed/pest sources on areas of non-cropped lands (ditches, riparian).

Fertilizers make up a large portion of the expense of many farming operations, with 72% of producers using commercial fertilizers. Yet many farmers question the value of soil test results, even though others routinely assess soil fertility through soil tests and other consultations (AAFC 1995b). The gross cost of chemical fertilizer influences the rate at which it will be applied. For each crop, land, climate and farmer combination, a particular cost exists for applying the product for maximum return. Such decisions might have a similar impact on land management, to that of changing crop rotation or reducing crop/residue output.

In the past, fertility management has often focussed on supplying enough nutrient in a single pass to supply season-long cropping needs. This can lead to excessive in-field nutrient supply, which may result in crop damage and/or leaching losses. To reduce financial risk, there will be increased interest in split nutrient applications (e.g. applying supplemental N to winter wheat in the spring, after moisture availability has been verified). There may be a movement towards the precision application of fertilizer for both economic and environmental benefits, although crop yield benefits from this practice are uncertain. This uncertainty is especially true where yield may be limited by moisture availability rather than fertilizer placement. However, increased costs of fuel and farm labour could limit this as a viable option for the majority of crops grown (i.e wheat).

Emphasis on efficiency of chemical fertilizer use will include:

- split applications where increased costs are practical
- precision farming advances that result in higher yields for the same fertilizer cost. (custom applicators and larger farms may adopt this first)
- build-up of organic matter and associated fertility (e.g. through expanded use of legumes)
- some increased fertilizer use particularly on specialty crops
- micro-nutrient management and nutrient balancing for speciality crops grown on highly variable soil.

As a driver of input/output issues, manure management once largely revolved around N content, with secondary issues being manure volume disposal and associated odours. Increasing numbers, size and concentration of ILOs have highlighted a number of management problems. These include runoff, saturation and leaching issues associated with phosphorus and nitrogen, and the growing need for better odour control near ILOs.

Custom manure applicators, however, do not routinely have the capability to apply manure on a soil test or nutrient basis. This is because commonly used equipment has no mechanism to effectively control flow rates (Haag, 1999).

Emphasis on proper handling of manure from a nutrient, environmental and waste management perspective will increasingly dictate on which lands manure can be applied, and the amounts that can be used. This is especially true in view of escalating concerns about contamination of soil and water quality. Future trends in manure management will feature:

- a greater role for perennial forages as a nutrient management sink
- the contribution of custom applications as a strong, practical option for routine disposal
- composting to decrease volume, resulting in less bulk to haul away
- the use of new, cost-effective technologies (e.g. constructed wetlands) for nutrient management
- a greater use of organic (manure) fertilizer, due to increased availability near expanding ILOs.

Interest in irrigation is expanding as farmers seek to grow more speciality crops, particularly in Alberta and Manitoba. Demand for local water supplies is further exacerbated by greater local processing requirements for higher value crops such as potatoes. Energy costs also continue to rise, despite falling commodity prices.

Custom manure applicators do not routinely have the capability to apply manure on a soil test or nutrient basis. This is because commonly used equipment has no mechanism to effectively control flow rates (Haag, 1999).

The market value of an ever-decreasing supply of water will continue to rise, costing more to access and use. Specialization into certain crops will demand high water volumes, emphasizing the need to maximize moisture use efficiency by:

- improving water capturing technologies such as stubble management, shelterbelts and snow fencing
- using high stubble and other techniques will be used to assure adequate groundwater supplies are recharged from snowmelt and other sources
- growing crops such as alfalfa that are more deep-rooted and have a higher nutrient-extracting ability
- improving irrigation efficiency as water and energy pricing increase application costs.

Farmers will seek lower energy input systems to decrease the cost of production. Alternatives will include moving to less energy-intensive organic farming, as well as increased adoption of energy efficient equipment and innovative products such as solar grain dryers and solar pumps.

Land Tenure

Relationships in land tenure are changing on the Prairies (Statistics Canada 1997). These changes include a shift in the ratio of farmland ownership versus rental operation, the type of rental agreements being used, and approaches to ownership management (e.g. sole proprietorship versus partnership arrangements), and Treaty Land Entitlements.

Since the 1960s, there has been a steady increase in the percentage of rented Prairie farmland (refer back to Figure 4.2). The 1966 Census of Agriculture showed that approximately 27% of Prairie farmland was leased or rented, while the 1996 census showed 39% rented.

The type of rental agreement has also changed over the years (Figure 5.1). Some 40 years ago (1956), cash rent, as opposed to crop-share, accounted for 15% of the rental cost to farm operators on the Prairies. By 1996, 54% of rental costs were attributed to cash rent.

There has also been a decrease in the percentage of land managed under sole proprietorship in the past 25 years (Figure 5.2). In 1971, almost 92% of the farms on the Prairies were managed by sole proprietors, while partnerships accounted for 6%. Other categories (family-owned corporations, and non-family corporations, miscellaneous management) accounted for the rest.

The 1996 census shows that only 65% of Prairie farms were sole proprietorships, while partnerships have risen to 25%, and family owned corporations to 7.5%. Group management approaches provide for a larger asset base and help to spread risk. Non-family corporations and other management categories account for less than 2% of holdings. There are no data available on how much total land is controlled by each management category.

The increase in rented land may not impact the stewardship of the land. However, if a renter is in a short-term lease and has no plans to renew, there will be little incentive to take proper care of the land.

Increasing numbers of cash rent landlords may not be living near their land. This is in contrast to landlords who still have crop-share agreements, with possibly more interest in land management decisions.

Current trends related to tenant farmers seem increasingly destined to detract from optimum soil management because

- a tenant farmer may opt to reduce inputs (e.g. fertilizer), due to low prices and tight margins, doing so first on rented land
- absentee landlords and the trend to cash rent may decrease incentives for good land management when the risk of farming rests largely with the operator
- traditionalist landlords may require tenants to keep a certain portion of lands in black fallow.

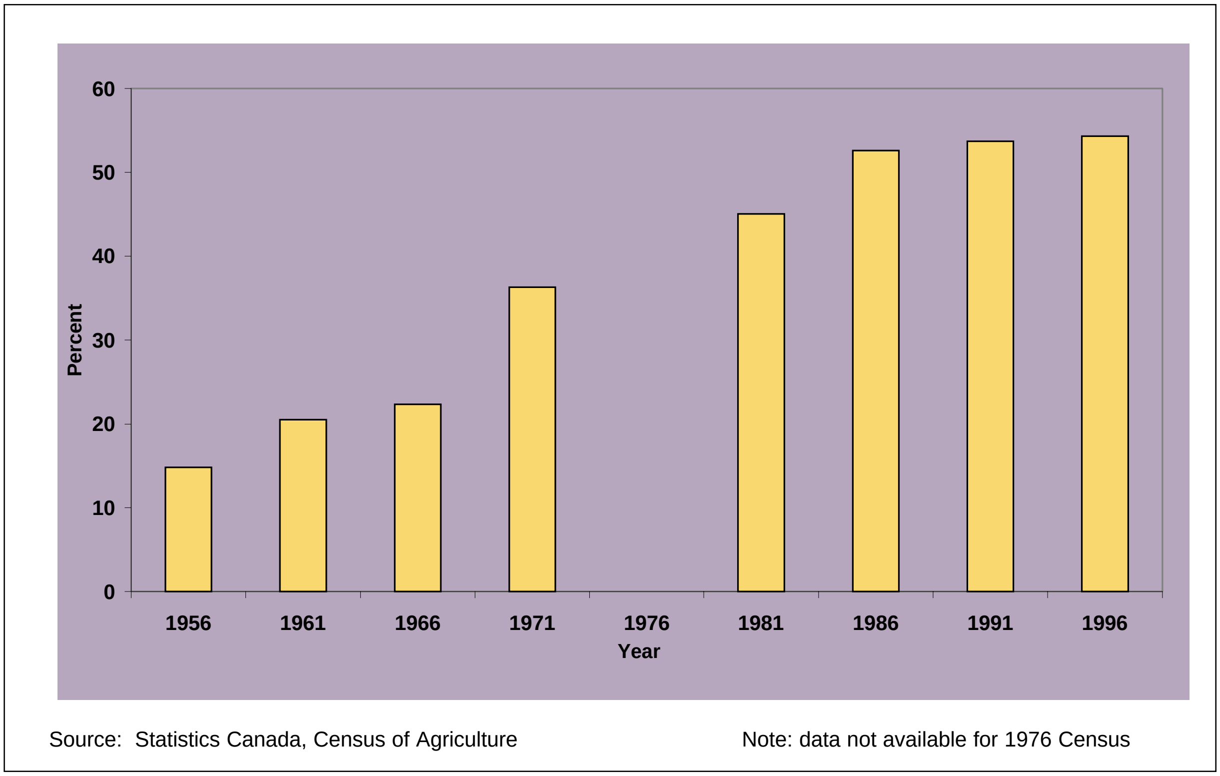

Figure 5.1 Cash rent as percent of total rent costs for Prairie farms (1956-1996).

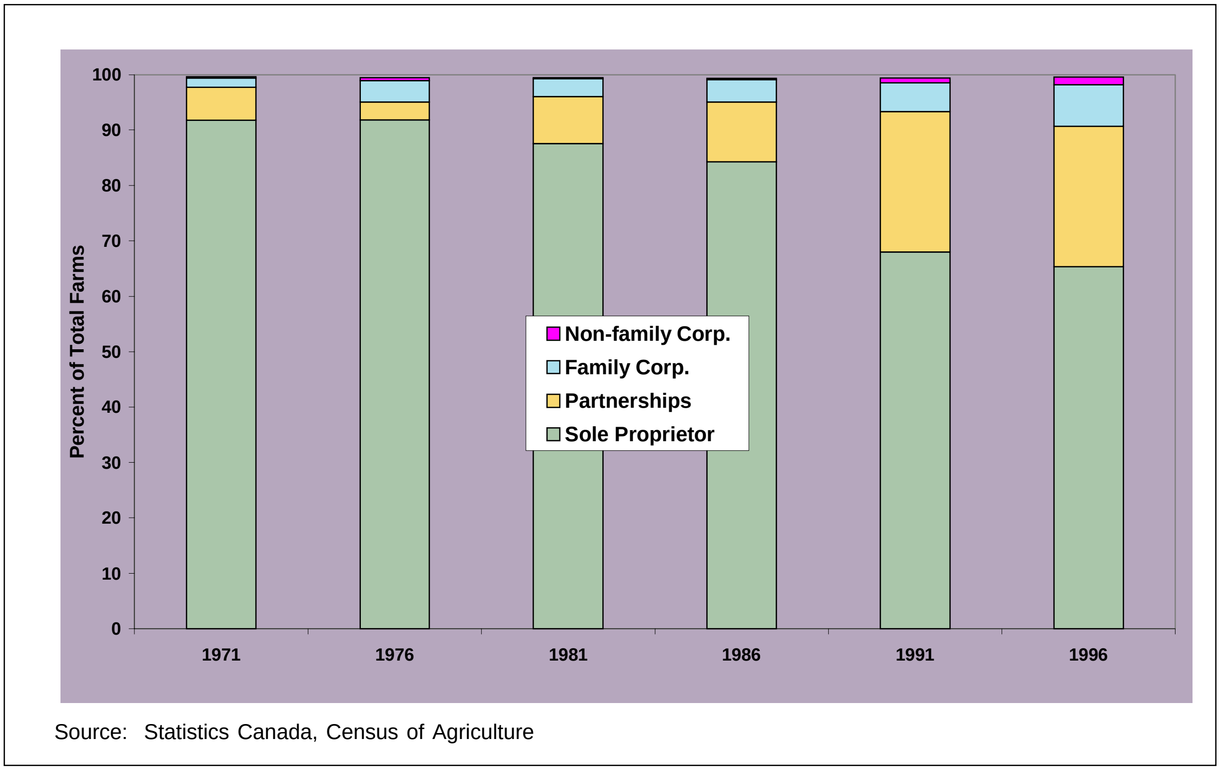

Figure 5.2 Prairie farm management (1971-1996).

Technological advances

The repercussions of technological advances overlap greatly with many of the issues and effects previously mentioned. For example, the most significant change in technology in the past 60 years has been the increasing mechanization on the farm. Changes in biotechnology, the science of herbicides, advances in crop nutrient management and the introduction of precision farming will allow continued increases in production.

Coupling improved crop varieties with better equipment has allowed cropping on land previously considered marginal for agricultural production. When such lands are cultivated or altered to enhance production strategies, there may be a decrease in quantity or quality of natural vegetation and available wildlife habitat. This can result in decreases to biodiversity, reductions in water quality and increases in soil erosion.

Bio-engineering holds great promise as a means of increasing agricultural production (e.g. improved frost tolerance). Yet concerns regarding the use of bio-engineered crops reflect a wide-spread uncertainty as to the development and role of this expanding technology. Discomfort with the use of bio-engineered organisms revolves around the issue of transferring genes into unnatural hosts, and possible repercussions as to future weed or pest control strategies and food safety by the consuming public.

Questions about the suitability of biotechnology can have a significant effect on the market development of a crop, and influence the uptake of technology. Canadian producers are currently growing a few bio-engineered crops such as canola, and some contracts are being let to develop pharmaceuticals from genetically altered crops. There remain huge potential global markets for bio-engineered products in areas of the world where sufficiency of food supply is an issue and imports are essential for basic survival.

Changes in biotechnology could result in:

- various practices (rotations, pesticide use, nutrient application) being dictated by contract

Canada is utilizing Treaty Land Entitlement (TLE) with First Nations peoples as a way of allowing them to purchase new lands, in order to compensate for land shortfalls in settling previous treaties. Once purchased, it appears likely that many TLE lands will then be rented out. As well, current First Nation land tenure and assignment arrangements tend not to be long-term.

There may be little incentive for tenants to make improvements or investments to land where long-term tenure is not assured. Short-term approaches to land-use management will be favoured and may lead to possible degradation of land and water resources.

Marginal lands within TLE may not be contiguous, making livestock operations on them unlikely. Such lands require a high level of management to be successfully operated under cultivation.

Multinational corporations will increasingly gain control over on-farm inputs like seed and agricultural chemicals. This could result in a potential loss of flexibility for on-farm management decisions. Adoption of particular crops into farm rotations can require producers to use associated herbicide regimes to effectively control weeds in advance of subsequent crops (i.e. canola and wheat). On the other hand, biotechnology promises access to new product markets, increased cash flow and greater economic diversification.

- fewer pesticide options due to demands of biotech crops
- an increasing lobby from public or special interest groups against genetically engineered products
- product labeling requirements to differentiate transgenic products on a farm-by-farm, or a field-by-field basis.

Recent technologies are paving the way towards the precision application of seeds, nutrients and pesticides. These are aimed at assuring the optimum application of inputs, while improving profitability and reducing environmental impact. There are many unanswered agronomic questions related to precision farming. For instance, where will the precision application of fertilizer on a landscape pay the greatest dividend? The answer can change from year-to-year, depending on factors like growing season precipitation which may be more limiting to crop production than the precision application of inputs.

Precision farming technology is in the early stages of development and has yet to have widespread practical application. Its application is currently questionable for small grain operations due to the large capital cost involved and the skills needed to operate and understand the equipment. Nevertheless once applications are refined, precision farming may facilitate efficient application of farm chemicals, providing more uniform yields with overall higher production, improved land management and possibly greater net returns, especially for high-input, intensively managed crops.

As this technology becomes more user-friendly, and capital costs are reduced, uptake will improve. Initial clients are likely to be in high valued crops where a net income gain can be realized. Larger-scale field research will be fostered by the promise of increased production at reduced cost. This research will result in a better understanding of the effects of soil and climatic variability on crop yield from an on-farm, research and policy perspective.

Conclusions

The issues likely to affect changes in land management on the Prairies can be divided into four main levels of influence. These include public, environmental, community and on-farm considerations. Within these levels, individual issues will be affected by a specific set of drivers, the overall impact of which will almost certainly result in a change in land management practices.

Public level issues include policies and legislation and international agreements. Pressure will be placed on the soil and water resource base to meet CAMC-style export targets, while seeking to conserve natural biodiversity and wildlife habitat within farming systems. International trade will increase amidst an ever-tightening array of controls.

In seeking to maximize returns, some farmers will bring existing and new lands into more intensive production, whereas others will actually reduce inputs while expanding their land area. A few may reduce inputs to directly address environmental concerns. A widening range of crop markets will invariably subject some lands to radically different production techniques.

Environmental issues include those of public perception; the need for safe water, air and food; and the ability to cope with natural variability. There is an on-going need for agriculture to clarify its actions and become more accountable in the public mind, while sustaining sensitive lands and reducing negative effects on the environment. The public expects an ample supply of safe water, air and food, produced and protected in a socially responsible manner. This must be balanced against the economic necessity that farmers face in continually hedging their activities against the hazard of significant crop loss. Some farmers will increasingly employ conservation tillage practices, while others choose to dissipate risk by maintaining or increasing crop/fallow practices.

Agriculture must be increasingly proactive to avoid restrictive, perhaps unwarranted regulation. Reduced tillage and chemical inputs on some lands will coincide with increased efforts to maintain and enhance wildlife habitat. At the same time, competing market forces to feed a hungry world may result in ever-intensive production techniques on new lands. Some farmers will incorporate a longer-term view of crop planning, involving a wider use of reduced tillage, cover crops and straw mulching for soil stabilization and nutrient recycling. Still other farmers may be reluctant to lock themselves into any plan that is dependent on fixed, long-term practices.

Community level issues are those relating to demographic change, competing land use, rural infrastructure, transportation change and off-farm employment. There is little incentive for aging Prairie farmers to expand their land base. An increasingly educated rural labor pool will demand higher salaries. Rural communities will continue to decrease in size and number. Land prices will rise adjacent to urban areas, with urban/rural conflicts necessitating increased efforts at public resolution of concerns. Successful farm diversification will rely on availability of timely information for field management and marketing considerations. Rail line abandonment will result in the deterioration of existing roads, at least in the short term, with a compensating need by rural municipalities to increase tax revenues. Off-farm employment will continue to be the major source of farm revenue for many farmers.

Older farmers will be reluctant to invest in significant land management changes. They may compensate for their decisions by cutting back on inputs. Specialized farming techniques will help to offset escalating land prices. ILO operators will require access to a greater land base to facilitate manure management and adjust application techniques to comply with odour and runoff concerns. Farmers might compensate for higher taxes and transportation costs by producing higher value crops, feeding locally-produced grains to livestock, supporting other value-added ventures and contracting or purchasing larger trucking capacity. Access to the local job market will govern the degree to which farming operations are specialized.

On-farm issues involve considerations related to the ability to take risk, manage inputs and outputs, land tenure and technological advances. The inability to take risk tends to favour the status quo rather than promoting a significant change in land-use management. On the other hand, producers who can, will seek to reduce input costs as they acquire a better understanding of weed control thresholds, and place more emphasis on health and safety and environmental factors. Farmers will try to balance the cost-benefit of N derived from chemical fertilizer versus that from crop/fallow practices and a fallow year without a crop. ILO concentrations are bound to highlight issues of runoff and odour control.

Farmland rental is on the increase, while sole proprietorship continues to decline. Landlords are increasingly less connected to the land. Where treaty lands are rented out, agreements will likely be on a short-term basis. Short-term cash rent agreements will tend to discourage a stewardship approach to land management. Renters may tend to withhold inputs and degrade the soil to a greater extent than if they owned the land.

Photo by Dave Reede

Many farmers will continue to rely on the collective wisdom of past generations, and most farmers will tend to be conservative in their overall approach to change. Restricted cash flow, high input costs and low commodity prices will mean some farmers are unwilling (or unable) to risk significant change. Where change occurs, there will be greater emphasis on improved pesticide management, split nutrient applications and proper manure handling to reduce costs, increase efficiency and address environmental concerns. Efficiencies will continue to increase in water conservation, water application and energy use.

Biotechnology may cause multinational corporations to gain greater influence or control over on-farm inputs, resulting in a loss of flexibility in on-farm management decisions.

Farmer up-take of this technology may be slowed due to public concern over transgenic products and the need to market such crops separately. Precision farming applications will increase as associated costs decrease and agronomic relationships are clarified. In the short term, precision farming technology will largely be confined to large scale operations and custom applicators.

The agricultural region of Western Canada is a landscape full of opportunities. Government and producers need to work together to make Prairie landscapes more productive today, and into the future.

Table 5.1 **Potential Effect of Issue-Drivers (selected examples) on Land Management Practices (Influence of drivers on market/social/cost considerations and anticipated land-use change).**

PUBLIC LEVEL ISSUES	**Issue-Drivers** → { **Market Condition** (MC) / **Social/Emotional** (S/E) / **Cost of Production** (CP) } → **Land Management Change** → **Acceptable Net Return** (e.g., MC = organic premium, price paid; S/E = social pressure, altruistic concepts; CP = inputs, lost revenue)	
***Issues** & drivers* (Pressure for change)	***Market Condition, Social/Emotional, Cost of Production*** *(Reasons why change is likely to occur)*	***POSSIBLE LAND MANAGEMENT CHANGE*** (Anticipated practices and probable effects)
Policies & legislation • Export targets	• MC - anticipated demand for more raw products	• Pressure to bring new land into production, conversion of pastures and wetlands, increased farming intensity, use of more pesticides and chemical fertilizer, and more manure to spread.
• Marketing boards	• MC - mask market signals CP - cost changes as NAFTA removes protective tariffs	• Restricted markets can encourage inefficient production of commodities, due to status quo production methods.
• Sustainability and biodiversity	• S/E - public pressure to change production practices CP - regulations may force land out of production	• A small amount of land may be legislatively removed from production. Improve or maintain wildlife habitat; compensate by increasing intensity on other lands, resulting in more pesticides and fertilizer use.
International Agreements • Kyoto Protocol	• MC - tarriffs against countries not meeting Kyoto standards S/E - desire to be more environmentally friendly. CP - increases, as carbon costs of inputs and costs of new technology are passed on to producers, sale of carbon credits may offset these costs	• High carbon costs of inputs could change intensity of production, including chemical use, to decrease in the short term. More land brought into production as margins decrease on current hectares (low yields). As technology advances, production will increase.
• NAFTA, WTO	• MC - new markets, pressure on internal markets from US CP - decrease in some costs	• It is uncertain what will happen to production intensity. It may increase as a reaction to declining margins, or there may be pressure to compensate by bringing more pastures, grassland and wetlands into production.

Note: The above table / flow chart gives examples of how certain **Issue-Drivers** might influence one of three main decision factors: **Market Condition**, **Social/Emotional** considerations, and **Cost of Production** which in turn may result in **Land Management Change** in order to assure **Acceptable Net Return** (not shown in the table). Some view the **Social/Emotional** factor as a sub-set of **Cost of Production**. Nevertheless, the category attempts to identify social and altruistic reasons for changing land management. The column **Possible Land Management Change**, briefly describes a range of anticipated changes.

Table 5.2 Potential Effect of Issue-Drivers (selected examples) on Land Management Practices (Influence of drivers on market/social/cost considerations and anticipated land-use change).

ENVIRONMENTAL ISSUES	Issue-Drivers → { **Market Condition** (MC) / **Social/Emotional** (S/E) / **Cost of Production** (CP) } → **Land Management Change** → **Acceptable Net Return** (e.g., MC = organic premium, price paid; S/E = social pressure, altruistic concepts; CP = inputs, lost revenue)	
***Issues** & drivers* (Pressure for change)	***Market Condition, Social/Emotional, Cost of Production*** *(Reasons why change is likely to occur)*	***POSSIBLE LAND MANAGEMENT CHANGE*** (Anticipated practices and probable effects)
Public perception		
• Land stewardship	• S/E - wants to be perceived as taking good care of the land CP - costs increase if taxes imposed for erosion control	• Increase forage hectares, reduce tillage & fallow, lower chem inputs. Reduced erosion potential. Lower production.
• Ecosystem impact	• MC - increasing market for green products S/E - belief in desirability of habitat/biodiversity CP - access environmental incentives, avoid green taxes	• Reduce agri-chemical use and losses; preserve, restore/enhance natural ecosystems; balanced nutrient use, seek voluntary compliance versus control.
Human use water/air/food		
• Supply	• MC - price/demand for specific crops S/E - conviction of the need to feed a hungry world CP - hedge against the risk of low yields and crop loss	• Adjust management practices to suit crops in demand; maximize producing area; tendency to over apply fertilizer and pesticides to maximize production.
• Safety	• MC - perceived need for safe food and water S/E - fulfill societal expectation of safe food, water, & air CP - lower chemical input costs; integrated pest management (IPM)/fencing costs	• Lower chemical use and losses; apply IPM strategies; restrict cattle/water access, manure management; conform to regulations. Better chemical balance. Extra management.
Natural variability		
• Severe weather	• MC - market for replacement crops S/E - fear of being perceived as a poor manager CP - hedge against possibility of lost crops	• Extended rotations, flex-cropping, less fallow, less drainage, more trash cover. More stable soil conditions. Less flexibility in cropping choices.
• Climate change	• MC - possible market for carbon credits S/E - perception contributing to warming CP - reduce tillage costs	• Reduce tillage and store carbon where practical.

Note: The above table / flow chart gives examples of how certain **Issue-Drivers** might influence one of three main decision factors: **Market Condition**, **Social/Emotional** considerations, and **Cost of Production** which in turn may result in **Land Management Change** in order to assure **Acceptable Net Return** (not shown in the table). Some view the **Social/Emotional** factor as a sub-set of **Cost of Production**. Nevertheless, the category attempts to identify social and altruistic reasons for changing land management. The column **Possible Land Management Change**, briefly describes a range of anticipated changes.

Table 5.3 **Potential Effect of Issue-Drivers (selected examples) on Land Management Practices (Influence of drivers on market/social/cost considerations and anticipated land-use change).**

COMMUNITY LEVEL ISSUES	**Issue-Drivers** → { **Market Condition** (MC) / **Social/Emotional** (S/E) / **Cost of Production** (CP) } → **Land Management Change** → **Acceptable Net Return** (e.g., MC = organic premium, price paid; S/E = social pressure, altruistic concepts; CP = inputs, lost revenue)	
***Issues** & drivers* (Pressure for change)	***Market Condition, Social/Emotional, Cost of Production*** *(Reasons why change is likely to occur)*	***POSSIBLE LAND MANAGEMENT CHANGE*** (Anticipated practices and probable effects)
Demographic change		
• Fewer and older farmers	• MC - little attempt by older farmers to seek new markets CP - larger farms, bigger equipment, smaller margins	• Increased use of large machinery; fewer tillage passes, less intimate knowledge of the land; cumulative long-term effect due to the continued clearing of farmsteads and marginal lands.
• Fewer small communities	• MC - fewer markets, niche markets required S/E - isolation, loss of way of life CP - longer hauls, increased shipping costs	• Move to more specialized products and industry. Use of inputs may decrease, as overall costs rise with distance to servicing and costs of transportation.
Competing land use		
• Rural residential	• MC - opportunities for niche markets to be developed CP - increasing production costs for niche crops, and pressures on subdivision and land costs	• Greater specialization of cropping to increase net returns; implement odour control requirements; respond to recreational, habitat pressures. Move livestock operations.
Rural infrastructure		
• Communication systems	• MC - better access to weather, market, disease/pest information CP - timely information reduces pest control costs	• Greater flexibility in cropping, greater targeting as part of crop management (e.g. specific chemical inputs).
• Value-added industry	• MC - expanded opportunities to sell value-added product CP - lower transportation costs to processing markets	• Expanding hog and cattle industry, intensification of land use, manure and waste management issues.
• Transportation change	• MC - greater distance to market CP - increased road taxes; increased costs of shipping	• Increased diversification includes specialized crops with higher returns, and grain fed locally (e.g., hog and livestock production) to circumvent raw-product shipping costs.

Note: The above table / flow chart gives examples of how certain **Issue-Drivers** might influence one of three main decision factors: **Market Condition**, **Social/Emotional** considerations, and **Cost of Production** which in turn may result in **Land Management Change** in order to assure **Acceptable Net Return** (not shown in the table). Some view the **Social/Emotional** factor as a sub-set of **Cost of Production**. Nevertheless, the category attempts to identify social and altruistic reasons for changing land management. The column **Possible Land Management Change**, briefly describes a range of anticipated changes.

Table 5.4 Potential Effect of Issue-Drivers (selected examples) on Land Management Practices (Influence of drivers on market/social/cost considerations and anticipated land-use change).

ON-FARM ISSUES	**Issue-Drivers** → { **Market Condition** (MC), **Social/Emotional** (S/E), **Cost of Production** (CP) } → **Land Management Change** → **Acceptable Net Return** (e.g., MC = organic premium, price paid; S/E = social pressure, altruistic concepts; CP = inputs, lost revenue)	
***Issues** & drivers* (Pressure for change)	***Market Condition, Social/Emotional, Cost of Production*** *(Reasons why change is likely to occur)*	***POSSIBLE LAND MANAGEMENT CHANGE*** (Anticipated practices and probable effects)
Ability to Take Risk • Availability of capital	• MC - Intensive livestock operations involving multiple owners, outside money S/E - pressure to conform, adopt new ways CP - increasing interest rates, expense of technology	• Decisions from outside ILO owners, not operators. Larger equipment, larger farms, farming marginal lands. Risk of erosion, environmental pressures.
Managing inputs/outputs • Pesticides Nutrients/manure Water & energy	• MC - demand for niche markets, specialty products S/E - concerns over spray drift, health risks, water pollution, odour CP - concerns with over application, cost versus benefit, herbicide resistance, cost of fossil fuels and nitrogen	• Crop diversification, increased use of specialized chemicals, greater intensification, learning curve for new crops; move to organic farming, custom application, increased IPM; increased use of legumes in rotations, custom application, precision applications, irrigation.
Land Tenure • Ownership versus rental	• MC - increased land prices leads to more rented land S/E - need to be good land stewards CP - minimize investment, or maximize return on investment, due to increasing rental cost	• Tendency to less sustainable land use versus the desire to adopt best management practices; cropping practices which provide highest yield for lowest cost. Decreased quality of soil/water resources.
Technological Advances • Biotechnology	• MC - demand for uniformity of quality and supply CP - technology may lower or increase cost of production simplified pest control	• Intensive land use practices, alternative agronomic practices. Greater risk of resource depletion. More control by multinationals means less control for farmers.
• Precision farming	• CP - reduce cost of over application of chemicals	• Increasing precision management of crop varieties. Higher yield, perhaps higher profit.

Note: The above table / flow chart gives examples of how certain **Issue-Drivers** might influence one of three main decision factors: **Market Condition**, **Social/Emotional** considerations, and **Cost of Production** which in turn may result in **Land Management Change** in order to assure **Acceptable Net Return** (not shown in the table). Some view the **Social/Emotional** factor as a sub-set of **Cost of Production**. Nevertheless, the category attempts to identify social and altruistic reasons for changing land management. The column **Possible Land Management Change**, briefly describes a range of anticipated changes.