Agriculture and Sustainable Development: Policy Analysis on the Great Plains

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January 1995

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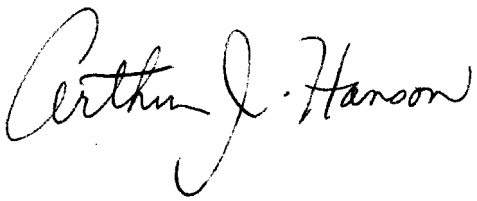
PREFACE

During recent months, as the prolonged and difficult GATT negotiations drew to a conclusion, agriculture has been a prime topic of interest. While the new agreement is expected to result in more orderly trade in agricultural products, other issues continue to haunt the industry, foremost of these being the sustainability of agriculture itself within the Great Plains Region of Canada. The issues affecting sustainability include the use of resources, economic returns and social considerations. These issues can be addressed by appropriate policies.

At IISD we believe that policy design has a major role to play in development of sustainable agriculture within the general context of sustainable development. Ecology and economics are closely linked in the attainment of sustainability for the benefit of present and future generations. In order to expedite the policy design process, a framework consisting of a set of principles and criteria has been developed. The framework has been tested and found robust, both in evaluating existing policies and proposed policies.

Preparation of this report has benefited greatly from the suggestions and guidance of many stakeholders in the field. The workshops held were particularly beneficial, as were the very excellent contributions of personnel at universities and other research institutions.

Under its mandate to promote sustainable development, IISD embarked on the Great Plains Project. This project is complementary to work underway in the United States. The analytical framework presented in this report is therefore expected to have application throughout the entire Great Plains region of the continent and also to other semi-arid regions of the world.



Arthur J. Hanson

President and CEO

International Institute for Sustainable Development

EXECUTIVE SUMMARY

Sustainable agriculture is an issue which excites people in the Great Plains region and particularly those on the Canadian prairies. The dominant use of land on the prairies is for agriculture, the sustainability of which has come under question as a result of developments both within and outside the region.

This study establishes a framework for analysis of current policies from the standpoint of their consistency with sustainable agriculture and sustainable development. The analysis leads to recommendations for change or for specific actions. The analytical framework developed as a result of the study should be applicable throughout the Great Plains region and to other similar semi-arid agriculture regions in the world.

The objectives of the study are to:

1) Identify the issues in agriculture and its sustainability on Canada's Plains.
2) Provide a set of principles, criteria and a framework for the resolution of sustainable agriculture issues on the Prairies.
3) Assist in understanding the effects of selected agriculture and trade policies on sustainable development.
4) Propose specific sustainable action programs for the Plains focusing on agriculture and ecosystems.

While all of these objectives are important, the key objective is to provide a system for policy evaluation. This system would contribute to the understanding of the current policy programs and their effects on sustainable development. The evaluation would also lead to specific action programs to ensure the sustainability of the Canadian Plains.

The existing pattern of agriculture on the prairies has been molded by government policies over time. The development of the area reflects the National Policy adopted following Confederation, with its component parts of railways, tariffs and prairie settlement being designed primarily to further national objectives. The course of development was also influenced by the physical environment. Major initiatives were required to overcome its effects and also those of the export markets to which much of the agricultural output of the region was directed.

There is evident need for agriculture to become more sustainable. Government policies should encourage development of practices which are either consistent with or lead to the sustainability of agriculture. There is increasing interest in developing policy options which will maintain or improve ecological services, particularly in view of the perception that individual existing policies appear inconsistent with these objectives.

The course of the policy development conformed to a sequence of models, namely: the frontier, the conservation, the urban-industrial impact, the diffusion and the induced innovation models. The latter model continues to be applicable to agricultural development on the prairies. The application of technology has affected the economic size of the farm unit and subsequently rural communities. Those communities which survive are taking on some urban characteristics. Community development programs must therefore address both rural and urban concerns to be successful. These concerns include the availability of quality education, health facilities, housing and other essential services. A major challenge arising for rural communities as a result of changes in technology is how the opportunities and challenges for growth can be met without losing the attractions which have led farm people and other rural residents to prefer country life.

At the outset several sustainable agriculture issues were identified. The issues included the measurement of sustainability, land use, degradation of prairie resources, preservation of biodiversity, water use and quality, use of common property, the economic situation, social problems, trade, federal and provincial policies and global change. Discussion of these issues provided a background for developing a conceptual framework for analyzing the impact of government policies upon sustainable agriculture.

Careful attention was given to the development of an analytical methodology for sustainable agriculture. The definition of sustainable agriculture adopted is "one, that over the long term, enhances environmental quality and the resource base on which agriculture depends, provides for basic human food and fibre needs, is economically viable and enhances the quality of life for farmers and society as a whole." Though both parties are interested in achieving sustainability, measurement of sustainability is rendered complex by the differences between the views of economists and ecologists. Nonetheless, appropriate tools for measurement have evolved over time.

The relationship between the costs and returns of agricultural practices is important for sustainability. The prices of resources determined in the market place as well as those which must be derived by other means must be taken into account when determining production costs from the standpoint of sustainability. Techniques for estimating the values of inputs not priced in the market are put forward so that these values could be included when determining total production costs. Given the income derived from grain

in the market place and its attendant cost of production as well as its effect on the land resources and social aspects, grain agriculture on the prairies cannot be considered sustainable at present. A different situation prevails for producers of livestock and some other products.

It was immediately apparent that a simple definition of sustainable agriculture would not be enough to evaluate policies. Therefore, principles of sustainable agriculture were developed. The set of principles are identified below along with the relevant criteria which apply under each of the principles. These principles and associated criteria provide the basis for the analytical framework.

1. Management
   - maintain the integrity of ecosystems
   - enhance the (quantity and quality) flow of services from the resource base for the present and future generations
   - provide for integrated (shared) resource management
2. Conservation
   - efficient use (consumption) of all resources, both renewable and nonrenewable
   - maintain biological diversity
   - provide habitat for wildlife and plants both on land and water
   - optimum use of land for sustainability
3. Rehabilitation
   - restore the productivity of a degraded resource
   - apply waste management principles (reduce, reuse and recover)
   - promote complementary production systems
   - promote closed production systems where appropriate
   - replace degrading processes with others that are beneficial
   - revitalize the resource
4. Market Viability
   - reduce trade barriers
   - economically efficient use of resources
   - assure a sustainable income
   - promote sustainable human economic activity
   - sensitive to supply and demand in the market place
   - unbiased as to commodities & mode of transport
   - enhance value added activity
5. Internalization of Cost
   - promote full environmental costing
   - include all costs associated with economic activity
   - contingent valuation where costs can't be internalized
   - use of natural system economic accounting (inclusion of resources and externalities in system of national accounts)
   - assess beneficiaries of externalities
   - appropriate costs
6. Scientific and Technology Innovations (R&D)
   - enhance air, water and land management
   - ameliorate waste management
   - increase productivity
   - reduce consumption of non-renewable resources
   - promote technology transfer
   - advance biotechnology
   - promote technologies that utilize yet preserve native ecosystems
   - promote technologies to further environmental quality including human health and economic growth
   - develop industries benign to environment
7. Trade Policy
   - maintain or enhance resource base of different trading regions
   - apply true comparative advantage
   - promote international market responsiveness
   - increase value added exports
   - consistent with trade agreements
   - support trade agreements which recognize externalities
8. Societal Considerations
   - promote gender equity
   - enhance human health & education
   - preserve aesthetic values
   - water quality and quantity available for alternative uses
   - alternative options for employment (adjustment programs)
   - maintain and/or enhance food quality, safety and quantity
   - societal neutrality (does not privilege one group over another)

- — protect agriculture from urbanization
- — increase productive capacity of the poor
- — promote fairness and equity in resource allocation for commercial and recreational purposes
- — provide an acceptable quality of life & livelihood
- — sensitive to goals of local people and communities
- — respect human rights

9. Global Responsibility
   - — recognize interdependence among nations
   - — promote intra and intergenerational equity
   - — encourage food health and safety
   - — assist in emergency food aid
   - — promote technology transfer - research and development
   - — promote fairness and equity in income distribution and trade

The merit of the analytical framework was tested by using it to assess the compatibility of four policies with sustainable agriculture. In these case studies, the primary policy instrument adopted was evaluated according to its impact upon sustainable agriculture. The policies analyzed were those instituted under the *Western Grain Transportation Act*, the *Farm Products Marketing Agencies Act*, the *Prairie Farm Rehabilitation Act* and the North American Waterfowl Management Plan, the respective primary instruments being subsidy, supply management, contracts and financial incentives. Each of these policies was described to illustrate the application of the primary instrument utilized.

In application, the framework was found to be robust and able to identify the relevance of the particular instrument and policy under review to sustainable agriculture. Each instrument and policy was assessed assuming all other current programs remained in effect. Subsidy as applied under the *Western Grain Transportation Act* was found to be inconsistent with sustainable agriculture. While the proposed changes to the Act would render the application of this instrument more acceptable, the policy as modified could not be considered consistent with sustainable agriculture. Supply management as exercised under the *Farm Products Marketing Agencies Act* with respect to eggs was found neutral to or consistent with some of the principles of sustainability while being inconsistent with others and on balance was found not supportive of sustainable agriculture. The contract instrument as utilized under the *Prairie Farm Rehabilitation Act* with respect to the Permanent Cover Program was found to be consistent with sustainable agriculture. Two modifications to the program would allow the contract instrument to further advance sustainable agriculture. The financial incentive instrument as used under the North American Waterfowl Management Plan was found consistent with sustainable agriculture, this Plan being an illustration of what can be accomplished by international dedication to a common cause.

Many valuable suggestions were received during the course of the two workshops held in connection with this study. Submissions received from other commentators also added materially to the analysis. These inputs assisted in developing the framework as an effective tool for the evaluation of existing or proposed policies from the standpoint of sustainable agriculture. Adoption of the framework for policy analysis is therefore recommended.

.

AGRICULTURE AND SUSTAINABLE DEVELOPMENT: POLICY ANALYSIS ON THE GREAT PLAINS

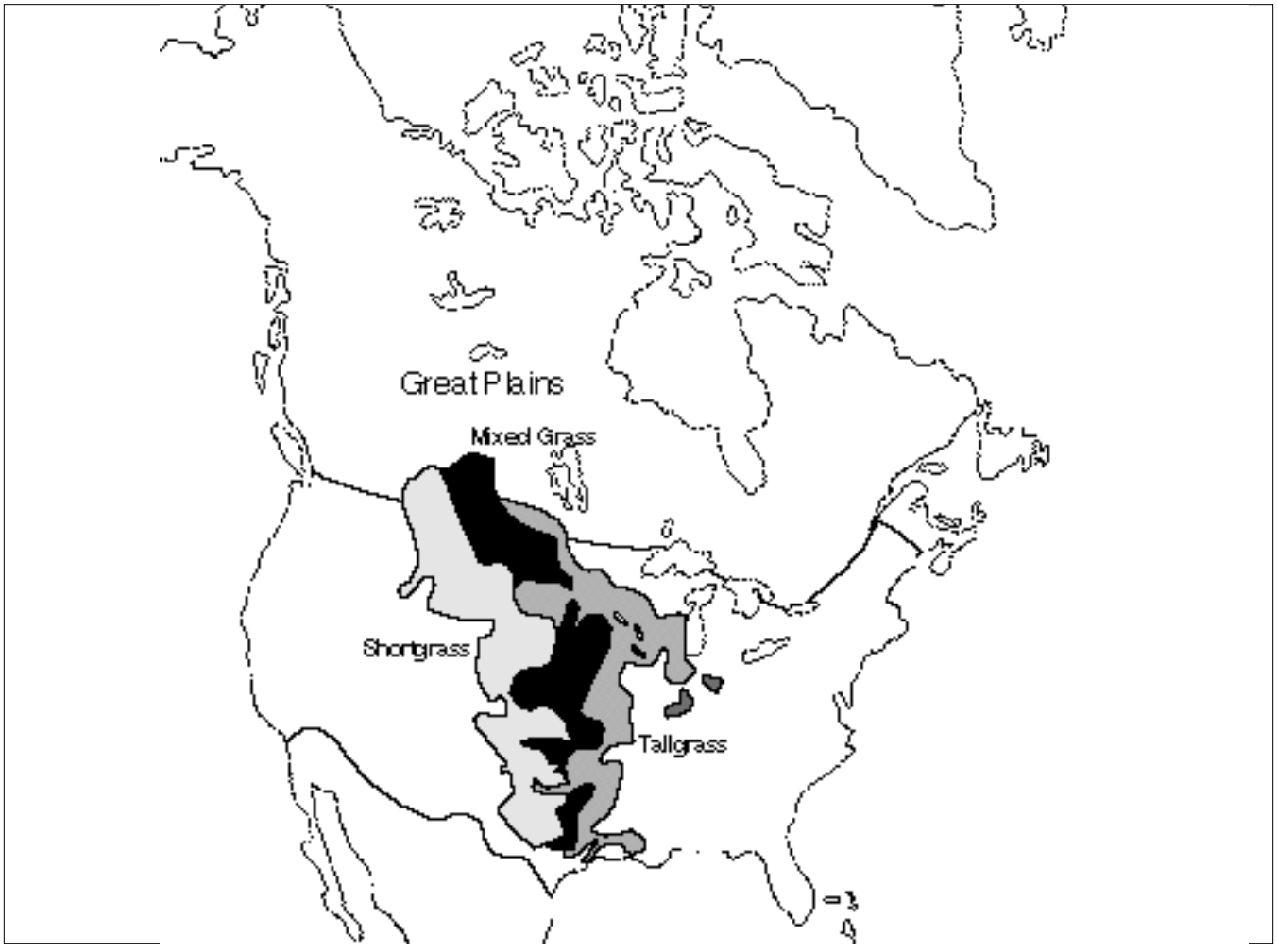
INTRODUCTION

Agriculture is the dominant use of land in the Great Plains Region. Use of land for this purpose can affect the environmental sustainability of the natural resource base which in turn has implications for the economic viability of farming. Together, these considerations raise important questions about the sustainability of agriculture and the implementation of policy prescriptions, including budgetary reforms, for both environmental protection and economic development.

The Great Plains is a vast region extending from the Canadian prairies through the Western United States (Figure l.1). Interest in the sustainability of agriculture and the environment throughout this region is critical for the realization of economic, social and environmental benefits. In the United States, for example, the Western Governors' Association is preparing information and strategies to foster sustainable development within its region. This initiative will require addressing conservation challenges, building partnerships among stakeholders and developing guidelines for sustainability. While this initiative has attracted attention in Canada and led to cooperation with the Association, there is a continuing need to deal with sustainable development issues on the Canadian prairies.

The International Institute for Sustainable Development (IISD), through its Board of Directors and its mandate to be a catalyst for change, launched the study leading to this report. The intent is to establish a framework for analysis of current sustainable development issues that would lead to recommendations for change. This work is complementary to that in the United States, dealing with local issues on the Canadian prairies. The analytical

Figure 1.1 The Great Plains Region



framework developed can be applied throughout the entire Great Plains Region and other semi-arid regions of the world.

BACKGROUND OF THE STUDY

Since the 1987 publication of *Our Common Future* by the World Commission on Environment and Development, there has been an extraordinary effort devoted to the study of sustainable development. The World Commission stated that sustainable development:

> ". . . is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and endorse both the current and future potential to meet human needs and operations." [1]

IISD also recognizes that government activities and policies greatly influence the degree of progress which can be made towards sustainable development, and that much work remains to be done by governments themselves. The Institute believes that development of practical and useful analytical tools is essential so that sustainable development analysis can be conducted at the same level of competence as is the economic analysis of budgets. The present study builds on this theme by reviewing studies of sustainable development at the international, national and provincial level, and by demonstrating the application of an evaluative framework to promote sustainable agriculture and resource use.

The present study also takes into account *Agenda 21*, the 1992 report of the United Nations Conference on Environment and Development (UNCED). Among other considerations, *Agenda 21* states that governments must adjust or reorient their policies to integrate environment and development in decision-making. It also notes the need to make more effective use of economic instruments and market and other incentives in government policy as follows:

> "Environmental law and regulation are important but cannot alone be expected to deal with the problems of environment and development. Prices, markets and governmental fiscal and economic policies also play a complementary role in shaping attitudes and behavior towards the environment." [2]

The promotion of sustainable agriculture and rural development thus requires some major changes. The report also stated, for example, that:

> "Major adjustments are needed in agricultural, environmental and macroeconomic policy, at both national and international levels, in developed as well as developing countries, to create the conditions for sustainable agriculture and rural development. The major objective of sustainable agriculture and rural development is to increase food production in a sustainable way and enhance food security. This will involve education initiatives, utilization of economic incentives and the development of appropriate and new technologies, thus ensuring stable supplies of nutritionally adequate food, access to those supplies by vulnerable groups, and production for markets; employment and income generation to alleviate poverty; and natural resource management and environmental protection." [3]

The UNCED report calls on governments at the appropriate level to review agricultural policy in relation to foreign trade, price policy, agricultural subsidies and taxes, natural resource use and environmental protection. IISD is investigating such considerations through a range of initiatives, these including the development of principles for trade and sustainable development and the promotion of business strategies for sustainable development.

In addition to noting the concerns raised at the international level, the present study reviews the contents of several Canadian reports, including Growing Together, the report of the 1990 Federal-Provincial Agriculture Committee on Environmental Sustainability , and the recent report of Environment Canada entitled An Ecosystem Approach to Decision-Making. [4]

The Federal-Provincial Agriculture Committee defines sustainable agriculture as follows:

> "Agri-food systems that are economically viable, and meet society's need for safe and nutritious food, while conserving or enhancing Canada's natural resources and the quality of the environment for future generations." [5]

The Committee also provides a definition of environmental sustainability:

> "The capacity to maintain indefinitely all the conditions and influences surrounding, and affecting the development of an organism or group of organisms. In the agri-food sector, environmental sustainability is the capacity to maintain indefinitely the environment necessary to sustain agri-food production." [6]

1 World Commission on Environment and Development, *Our Common Future*, Oxford University Press, 1987.
2 United Nations Conference on Environment and Development, *Agenda 21*, 1992.
3 Ibid.
4 Environment Canada, *An Ecosystem Approach to Decision-Making* 1993.
5 Federal Provincial Agriculture Committee on Environmental Sustainability, *Growing Together*, 1990.
6 Ibid.

These views suggest that sustainable development requires a decision-making framework that takes into account the biophysical environment as well as human society and its economy. This is the approach offered by officials at Environment Canada. They make the case that policies made at a sectoral level often fail to appreciate the total impact of a decision on the environment, society and economy. They offer an "ecosystem approach" to decision making as an integrative framework for sustainable development decision making. This approach provides:

> ". . . a framework because it recognizes and allows considerations of the interrelationships and the impacts of human activities (i.e., economy and society) on the physical environment. This allows environmental, economic and social goals to be considered concurrently within an ecosystem framework and thereby encourages sustainable development." [7]

An ecosystem approach is well suited to decisions affecting agriculture on the prairies. As the Manitoba Round Table on Environment and Economy states in its report:

> "Sustainable development is a global philosophy which anchors principles, policies and practices to guide personal and collective behavior in respect of the environment (the life sustaining processes of the earth and its natural resources) and the economy (the provision of jobs, incomes and wealth resulting from economic activity)." [8]

In the present study, the ecosystem approach is made operational through the identification of specific principles for sustainable agriculture. These principles are then related to policy instruments and practices to demonstrate how they may support or impede sustainable agriculture. The implications these effects may have for budget setting at both the national and provincial levels of government as well as producers and agribusinesses are also analyzed.

The Quest for Sustainable Agriculture

The sustainability of agriculture in the prairie region cannot be isolated from the sustainability of development in the region and beyond. The situation is put into perspective by Fox, Adamowicz, Debailleul and Thomassin as follows:

> "While agriculture is one of the important components of sustainable development, other land uses and sectors of the economy have an equally important role to play. The sustainability of agriculture cannot be evaluated in isolation from competing demands for physical and human resources. Three levels of competition for these resources can be identified. First, agriculture is in competition with other land uses within any geographic region. The development of agriculture capacity is often at the expense of forest lands, wildlife habitat or other land uses. Regional differences form the second level of competition. Agriculture in one region is affected by production and resource demands in other regions of the country. There is competition for markets and resource inputs. Examining agricultural sustainability on a national scale requires assessment of human and natural resource endowments in each region. The third level of competition for resources is the global level. International trade has been an important dimension of Canadian agriculture since confederation." [9]

The importance of trade alludes to the history of agricultural development in Canada, which is discussed in greater detail in the next chapter of this report. It is evident, as with other renewable resource sectors, that agriculture is faced with many conflicting economic, social and environmental issues. Environmentally friendly production practices, for example, are often thought to be less remunerative than those traditionally followed with respect to wheat. At the same time, consumers want both a cheap and plentiful supply of food and also production practices that are ecologically sustainable and promote human health. Consequently, an ever present concern regarding economic viability arises. Since prairie production far exceeds local needs, other outlets for this food must be sought in domestic or export markets. Returns from export markets vary greatly over time. This variability is particularly apparent in the case of the dominant crop, wheat, which is dependent on the export market to absorb nearly four-fifths of the volume produced. When problems arise in international trading, revenues from prairie agriculture are greatly impacted.

The objectives of sustainable agriculture have been stated as being:

> "1. To conserve and enhance the natural resources that agriculture uses and shares.
> 2. To be compatible with other environmental resources that are affected by agriculture.
> 3. To be proactive in protecting the agri-food sector from the environmental impacts caused by other sectors and factors external to agriculture." [10]

7 Ibid.
8 Manitoba Round Table on Environment and Economy, *Sustainable Development: Towards Institutional Change in the Manitoba Public Sector,* undated, p. 111.
9 Fox G., V. Adamowicz, G. Debailleul and P. Thomassin. *Agriculture and the Environment: Economic Dimensions of Sustainable Agriculture*. Canadian Agricultural Economics and Farm Management Society, Occasional Paper No. 1, November 1990. p. 7.
10 Federal-Provincial Agriculture Committee on Environmental Sustainability. *Growing Together*. p. 31.

These objectives are reflected in the definition of sustainable agriculture attributed earlier to the Federal-Provincial Committee on Sustainable Development. A number of other related definitions are also in common usage. The American Society of Agronomy, for example, defines sustainable agriculture as:

> ". . . one that, over the long term, enhances environmental quality and the resource base on which agriculture depends, provides for basic human food and fiber needs, is economically viable, and enhances the quality of life for farmers and society as a whole." [11]

Another definition argues that:

> "Sustainable agriculture is both a philosophy and a system of farming. It is rooted in a set of values that reflects an awareness of both ecological and social realities and a commitment to respond appropriately to that awareness. It emphasizes design and management procedures that work with natural processes to conserve all resources and minimize waste and environmental damage, while maintaining and improving farm profitability." [12]

While there are differences in emphasis among the definitions, they are generally concerned with the need for agricultural practices to be economically viable, to meet human needs for food, to be environmentally positive, and to be concerned with quality of life. Since these objectives can be achieved in a number of different ways, sustainable agriculture is not linked to any particular technological practice. Nor is sustainable agriculture the exclusive domain of organic farming. Rather, sustainable agriculture is thought of in terms of its adaptability and flexibility over time to respond to the demands for food and fiber (both high and low), its demands on natural resources for production, and its ability to protect the soil and the resources. This goal requires an efficient use of technology in a manner conducive to sustainability. Finally, because agriculture is affected by changes in market and resource decisions in other sectors and regions, it is important that these changes do not provide a rationale for depleting the agricultural resource base locally.

The Need for Review and Change

Some government programs and policies can encourage practices that are inconsistent with a prairie agriculture which is sustainable. A consistent approach is required to protect the productive capacity of the land for future generations. While there is an increasing degree of interest in discovering policy options that will maintain or improve sustainability, many existing trade and subsidy policies are at odds with this goal.

Producers face many challenges when modifying current production practices. Modification, however, becomes more feasible when there are tangible economic, social and ecological benefits. Since some of the processes currently adopted are considered to be unsustainable, change is essential if the soil resource is to be maintained and local business and the infrastructure supported. Desirable change can also be advanced by national policies, "sustainability" budgets, and by trade agreements consistent with sustainable development on the prairies and throughout the Great Plains region. An understanding of the factors that affect economic viability, agricultural production practices, resource use, and ecological resilience is an essential prerequisite to the design of policies, budgets and agreements for sustainable agriculture and rural development.

Sustainability challenges to the prairie ecosystem represent a combination of ecological, social and economic problems. These problems are not fully taken into account in decision making at any level. The challenges range from the impact of subsidy programs, uncertainty in international markets and future demand, the need for land and water conservation, the protection of habitat and the potential for climatic change in the maintenance of the structure of communities. While Canadian agricultural policies are now being reviewed with respect to their effect on sustainability, some positive changes have already been made. The Prairie Farm Rehabilitation Administration (PFRA), for example, has introduced some innovative programs. So also have other organizations with a particular interest in sustainability, such as Ducks Unlimited, the North American Waterfowl Management Plan, and the Zero Till Association to name a few. Indeed, the major changes in agricultural practices which have occurred have been stimulated by a realization of the potential long term benefits available. Ecologically sound changes, such as minimum tillage and land set-asides, for example, can thus be shown to have significant economic benefits.

The trend across the prairies continues to be toward larger farms and fewer producers. This trend has been driven by technological developments, economic efficiency and government policy. As a result, people move away from the smaller communities, local businesses become uneconomic, and the business operators move elsewhere.

11 American Society of Agronomy, as noted by Uptal Nasavada in "Trade Policy Implications of Sustainable Agriculture", *Canadian Journal of Agricultural Economics*, Vol.39, No. 4, Part 1. p. 595.

12 MacRae, R. J., S. B. Hill, J. Hennings and A. J. Bentley. "Policies, Programs and Regulations to Support the Transition to Sustainable Agriculture in Canada," *American Journal of Alternative Agriculture*, Vol. 5, No. 2, 1990. p. 76.

As communities decline in population, the local infrastructure also declines and producers must travel longer distances to meet their basic needs. It has been argued that the migration of people from the land could be stopped or reversed by programs designed to retain more people in agriculture. Agencies engaged in rural development are seeking opportunities to diversify local economies so that they are not entirely dependent on agricultural activity.

With regard to the policy framework for agriculture, it is clear that some programs and policies, such as those with respect to trade, do not support sustainability. This shortcoming is particularly apparent in the case of wheat. The farm programs existing in both the European Economic Community (EEC) and the United States prejudiced the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) negotiations. At the same time, these programs jeopardize the income otherwise accruing from trade available to other exporters such as Canada, the improvements associated with new GATT agreement notwithstanding. Furthermore, these policies also interfere with sustainable development. Some involve subsidies and/or tax measures which lead to actions that are neither economically nor ecologically sustainable. Few of these policies have been assessed from a sustainable development standpoint. If more sustainable agricultural practices are to prevail, environmental impacts must be factored in when formulating policy.

One of the threats to sustainable agriculture resides in the policies and institutions which affect this sector. In this regard, Fox et al make the following statement:

> "... inflexibility in certain important institutions has reduced the vitality of the climate for innovation and the nature of incentives for resource conservation which are central to the sustainability of the Canadian food and fibre system. Some of these inflexibilities arise as a result of lack of information about certain cause and effect relationships in agricultural ecosystems but many are the result of developments in the legislative, legal and policy environment which have outlived their usefulness. Policy induced resource misallocations and the emergence of politically influential constituent groups with vested interests in the preservation of the current policy regime represent a threat to the ability of the Canadian food system to respond to changing needs and demands."[13]

One of the intents of this report is to shed light on the cause and effect relationships in agricultural ecosystems and thereby act as a catalyst in the formation of policy consistent with sustainable development and sustainable agriculture.

The need for a framework within which to formulate policy has been identified as an important challenge by various stakeholders, particularly those involved in the policy area. Such a framework would contribute to the development of policies that could promote sustainable development in the Plains and other regions.

Terms of Reference

The study is to promote sustainable development in the Great Plains region of Canada and its marginal areas with particular emphasis on agriculture. The specific objectives are:

1. To identify agricultural and sustainability issues on Canada's Prairies.
2. To provide a set of principles, criteria and a framework for the resolution of agricultural sustainability issues on the Prairies.
3. To illustrate the impact of selected agricultural and trade policies and instruments upon sustainable development.
4. To propose specific sustainable development action programs for the Prairies focusing on agriculture and ecosystems.

The study will involve a review of sustainable development issues on the Canadian Prairies. A set of principles and a framework for analysis of policies will be prepared. These will be applied to selected agriculture policies and programs to assess their usefulness in identifying whether the policies and programs are consistent with sustainable agriculture. The framework proposed in this study is an attempt to respond to this challenge. It has two major components: the first is the development of a set of principles and criteria for a sustainability approach to decision making; the second is the application of this approach to selected instruments in four different policy areas. The objective is to evaluate selected agriculture policies and instruments from the standpoint of their compatibility with sustainability. The insights gained provide the background for recommending policies or modifications to existing policies that promote the sustainability of agriculture in the Great Plains Region of Canada, the prairie provinces.

13 Fox et al, Op cit. p. 14.

THE DEVELOPMENT OF AGRICULTURE ON THE PRAIRIES

Any discussion of the sustainability of agriculture on the prairies should be prefaced by an outline of the historical development process. Sustainability in a semi-arid area characterized by highly variable rainfall has been greatly affected not only by the original method of land distribution but also by the development of technology. It is also affected by those fluctuations in net returns that are typical of an agriculture dependent upon the world market for a major share of the output produced.

The initial development of agriculture on the prairies was largely associated with the Hudson's Bay Company. In a charter granted in 1670, the company was given a monopoly on the fur trade in Rupert's Land, and was made responsible for creation of this trade using its own resources and for establishing a colony. Operators of the fur trading posts attempted to grow produce in order to provide a more varied diet than was available from local sources. However, the first real attempt at settlement was by Lord Selkirk in 1812 after he received a major land grant from the Company.

The colony was located at the forks of the Red and Assiniboine rivers. The difficulties faced by settlers in the colony were indicative of those which were to continue to be experienced by agriculturists on the prairies. These difficulties included frost, drought, floods and grasshoppers. The limited output of produce found a ready market at the time among the fur traders. It is said of the period when the country was under the Hudson's Bay Company control that agriculture developed as much as could be expected considering the climatic conditions, the difficulties of transportation and the concentration on the fur trade. This concentration was accentuated by the amalgamation of the Hudson's Bay Company and the North West Company in 1821.

The pace of agricultural development in the west increased greatly after 1870, when the Hudson's Bay Company surrendered to the Crown its charter and Rupert's Land, the Company territory being regarded as that area tributary to Hudson Bay. The remainder of the western territory had never passed out of the control of the Crown. As A.S. Morton states:

> " — the fundamental problems of the country as an agricultural region — transportation and a produce sure enough to support a large settlement and capable of being marketed profitably — were passed over with the land to the hands of Canadians." [14]

At the time, the prospect of the prairies as an area in which a cultivation-based agriculture could profitably be conducted remained in doubt. The prairies were a vast grassland with tree cover limited to river valleys and high elevations, due to the rampant prairie fires. Two expedition teams explored the area during the 1857-60 period. One was led by Capt. John Palliser and the other by S.J. Dawson. Both expeditions independently reached the same conclusion, determining that the interior of the west was composed of an area somewhat triangular in shape with the base running along the 49th parallel from about present day Killarney, Manitoba to Pincher Creek, Alberta with the apex being in the proximity of Saskatoon, Saskatchewan. This area they considered to be an extension of the Great American Desert, with a fertile belt of excellent soil lying to the north. On the other hand, J. Macoun,[15] in 1882, stated that the so-called Palliser triangle was not as arid as previously believed but was "well suited to agriculture." The truth lay somewhere in between. The former view was based on years of low rainfall. The latter focussed on particularly fertile parts of the Souris Valley and the Regina plains during the high rainfall years of the late 1870s, and contained a substantial degree of self-induced optimism.

The National Policy adopted following Confederation encompassed several objectives. It included tariffs to protect eastern industry, a railway or railways to join Canada together and protect the west from being absorbed by the Americans, and settlement to provide traffic for the railways and a market for the products of eastern industry. Settlement was key and settlers were essential to the process. The lands policy adopted was that which prevailed in the Plains region of the United States. The sectional survey, the free homestead system, preemptions, school lands and railway land grants were all based upon previous American experience. Railway and school lands later proved invaluable. They allowed the original "free" homestead to consistently expand as an economic unit under the dry land farming conditions that prevailed on the prairies.

Settlers were attracted to the prairies by the opportunity to own land and also by what was perceived as a chance to improve their economic position. Homesteading was said to be a gamble in which the federal government bet 160 acres with a settler against $10 that he could not stay on the homestead for six months for each of three years without starving to death. Over forty percent of the settlers left, effectively losing the bet. While such an adverse social outcome is deplorable, it must be recognized that

14 Morton, A. S. *History of Prairie Settlement*. MacMillan, 1938. pp. 43-44.
15 Macoun, J. *Manitoba and the Great Northwest*. Guelph, 1882.

most settlers arrived with few finances and had to complement their meager earnings from the land with income from railway construction or other local activity. Relatively few of the original settlers had dry land farming experience.

The settlers who persisted demonstrated their ability to adapt to the local situation. The sustainability of an agriculture based on grain was early placed in doubt. The 1880s were characterized by drought with crops sown on stubble providing little return. While the need to set aside seed and feed in "good" years was recognized it was discovered that allowing land to lie fallow enabled it to absorb enough moisture to provide at least a sustaining crop the following year. This idea was widely publicized by the Experimental Farms established by the federal government. The existing crop varieties, particularly those of wheat, had a growing period which tended to exceed the number of frost free days. Research provided varieties more closely adapted to the local environment and Red Fife was replaced in 1911 by Marquis, the flagship variety for "quality" in Canadian wheat for the following seventy years.

The initial period covering from about 1880 to 1900 can be taken as the first stage in a sustainable development learning curve continuum which persists to this day. Oxen and the walking plow were followed by horses and the gang plow. The scythe and cradle were replaced by the horse drawn binder. The threshing machine was adopted at an early stage along with the steam engine. The latter required a crew of men to operate. The Crow's Nest Pass Agreement of 1897 ensured that rail rates on grain shipments out and agricultural inputs into the prairies would foster development. Meanwhile, the Manitoba Grain Act of 1900 protected the interests of grain producers when marketing their grain.

The initial objective was to develop an agricultural industry which would yield an income sufficient to support the local population and others at a distance while providing the necessities of life. Though the emphasis was on grain for export, mixed farming was practiced since producers learned early in the process the desirability of having livestock to provide sustenance during drought periods. They had the support in this initiative of local governments. The animal culture followed, and in combination with the scale of grain operations obviated any need for concern for sustainability other than to overcome the effects of the climate.

The period 1900 to 1910 was one of great expansion. In response to the lure of cheap land and the advertising by government and railways alike, a great influx of settlers took place on the prairies, totalling 251,594 homestead entries. The methods of farming continued as before while the area in farms increased rapidly. The expansion was facilitated by the extension of the railway network. Much effort was expended by the Department of the Interior, the provincial departments of agriculture and the Canadian Pacific Railway to upgrade the livestock herds and to foster mixed farming practices. The period was one of relative prosperity even though most of the expansion occurred in the semi-arid areas. However, in the expansion, little heed was paid to the quality of land being opened up for settlement, something sure to haunt the prairies in later years.

During the period 1910 to 1930, further expansion of settlement occurred. Essentially, by the end of this period the prairie lands had been occupied. Service industries became established. The war years of 1914-18 were marked by an increasing demand for wheat and attractive prices prevailed.

However, drought years continued to be interspersed with those of more liberal rainfall. Livestock herds continued to expand. Developments in farm machinery, particularly toward the end of the period with the advent of the farm tractor and improved threshing machines, enabled land to be worked with fewer people than was the case when the horse was needed for power. Less land was required for pasture and for the production of feed. Producers were in an expansive frame of mind and average farm size increased. However, during the period, it became evident that some areas being farmed in southern Alberta (outside the irrigation area) and in southwestern Saskatchewan were not suited to the production of grain and should be returned to grass.

The Royal Commission examining the situation in 1921 concluded that a soil survey should be undertaken. The lack of information on soil capability prior to settlement was now being made painfully evident by the distress of producers and the abandonment of farmsteads.[16] The emphasis, nonetheless, continued to be on production with wheat as king.

Disaster struck the prairies in the 1930s. Much of the expansion of the earlier years was debt financed. The collapse in wheat prices brought economic ruin not only to individual producers but also to many of their organizations and suppliers. Indeed, the period 1930-1940 has been spoken of as the "dirty thirties" and "the winter years".[17] The decade was marked by seven years of drought, ending in 1937 when the crop failure in Saskatchewan was almost complete. Accompanying the drought came grasshoppers and army worms which

16 Government of Saskatchewan. *Report of the Royal Commission of Inquiry into Farming Conditions.* King's Printer, Regina, 1921.
17 Gray, J. H. *The Winter Years.* MacMillan, 1966.

destroyed much of what little was produced. Water shortages in the southern areas were common. The detrimental effects of the plow, intensive farming practices made possible by mechanization, and the leaving of large tracts in summer fallow became evident as the high winds of the period gave rise to extensive soil drifting. So dark did the sky become at times from dust that the hens retired to roost in the middle of the day. There began an exodus of 250,000 people from the dry areas in the south to the more favourable areas in the north resulting in deserted farmsteads and broken dreams. The social cost was enormous. The combination of events was not foreseen and influenced those involved for a lifetime. Gray states that while the drought itself could be blamed on nature, the "Dust Bowl" was man made. Millions of acres had been broken by the plow which should never have been broken at all. The land was only suitable for grazing. The dry topsoil began to blow in 1931 and it blew summer and winter until 1938. Producers realized that change was required in their farming practices as the sustainability of agriculture in large areas of the southern prairies came into doubt.

The situation called for drastic action beyond the extension of relief to the stricken areas. Such action was rendered feasible by a reorientation of the work of those researchers who had previously devoted their attention to increasing production. The Dominion Rust Research Laboratory, established in 1925, produced new varieties of grain resistant to disease, such as rust. These new varieties were of great benefit to the prairies.

The Dominion Experimental Farms had developed new methods of farming. Strip farming provided some protection from the wind. The resourcefulness of producers was tested. They recognized the need for trash cover on their fields, which required new types of tillage equipment. The answer was the Noble blade developed in 1934 and other similar trash maintaining cultivators invented by producer ingenuity. Judicious use of the one-way disc also allowed maintenance of trash cover in certain areas.

The federal government's response to the situation had far reaching implications. *The Prairie Farm Rehabilitation Act* was passed and an Administration formed (PFRA) in 1935. Technology was applied to solve the problems, even to the distribution of bait for grasshopper control. Drought tolerant grasses and legumes were introduced. The PFRA in cooperation with the Experimental Farms provided 48 experimental substations to teach producers how to control soil drifting. Tree planting was promoted. Almost three million acres in western Saskatchewan and Alberta were restored to grass and community pastures were formed. Dugouts were made to provide on-farm water supplies. Local irrigation schemes were promoted and advice provided on how to store water for livestock. Farmers were relocated from the disaster areas to others with greater potential.[18]

The Canadian Wheat Board, established in 1935, provided a degree of stability to wheat prices. To offset crop disasters, the *Prairie Farm Assistance Act* was passed in 1939 as the forerunner to the crop insurance that became available 20 years later. These imaginative actions of the federal government had their counterparts in the United States, where similar disasters affected agriculture on the western plains during the period.

Regardless of the problems associated with the decade, improvements in farm tractors and combines led to greater mechanization on farms. The tractor proved to be a good replacement for "horse-power" under drought conditions. Combines, developed to be suitable for the average farm, enabled straw to be spread over the surface of the land. Mechanization enabled more to be done by less people, thereby adding to underemployment in agriculture.

A new era in agriculture began in 1938 with the change in the weather cycle. The lessons of the drought years were not to be soon forgotten. Indeed, attention continued to be placed on maintenance of trash cover as the ingenuity of producers gave rise to the disker, which enabled large areas to be covered with a tillage implement that also had the capacity to be utilized for seeding. The self propelled combine came into its own while farm trucks provided the means for transporting grain to the elevator.

These developments allowed larger acreages to be farmed with fewer workers. Even so, farm labourers were in scarce supply during the war years as the young men on the prairies were drawn away to the armed services. In the services, their experience with machinery became invaluable to the air force, army and navy. The taunts of those who classed them as "stubble jumpers" assisted by "beans and old clothes" were quickly cast aside as a result of their performance.

While the early war years, i.e., 1939-42, were notable for the institution of delivery quotas on wheat, they were also marked by the encouragement of an expansion in livestock output, particularly hogs, in support of the war effort. The feed freight subsidy was introduced in 1941 as a "temporary" measure to increase livestock production outside the prairies. Following the termination of hostilities, the need to replenish the food supply in Europe resulted in all out grain production. This situation was short-lived as the war-devastated areas quickly recovered under the stimulus of the Marshall Plan. At the same time,

18 Gray, J. H. *Men Against the Desert.* Western Producer Prairie Books, 1967.

the industrialization of Canada, which was stimulated by the war, persisted, resulting in agriculture's contribution to the economy continuing to fall proportionately.

The 1950s and 1960s were marked by recurrent surpluses in grain production. To reduce the storage costs experienced by grain producers, the Temporary Wheat Reserves Act was introduced in 1954 and was followed by the two-price wheat program in 1967. The "dripping" '50s gave way to the occasional droughts of the '60s. New markets for wheat opened up as China and the Soviet Union became major customers.

Meanwhile, farms became more and more mechanized and human energy was replaced by electric power and more versatile farm equipment. The surplus in grain production became acute by 1970 when operation LIFT, Lower Inventory for Tomorrow, was introduced. The restrictive quotas had earlier been based largely on cultivated acreage giving rise to extensive grain production. With LIFT, an emergency program to reduce output, delivery quotas for wheat were based on acres in summer fallow, a development not in the best interest of sustainable agriculture as some land was summer fallowed two years in succession.

The Task Force on Agriculture Report in 1969[19] drew attention to the problems inherent in agriculture on the prairies. It suggested that the emphasis on wheat should be partially diverted to the production of barley, with more consideration given to the production of forage for livestock. The conclusions of the Task Force were based on perceived market opportunities. However, shortages, real or perceived, in the world output of grains and oilseeds in 1973/74 gave rise to an increase in demand which set off, in combination with rising oil prices, a round of inflation the effects of which remain today in terms of land prices exceeding those which can be supported by net returns.

While a temporary stimulus had been given to hog production on the prairies by the inability to market grain, the increase was quickly dissipated as the returns from grain became more lucrative. At the same time passage of the Western Grain Stabilization Act in 1974 provided a measure of income stability to grain producers in general, thereby improving the economic stability of the prairie region. In addition, the crop insurance which had replaced the Prairie Farm Assistance Act offset much of the impact of yield variability on net returns. Meanwhile, the effects of the below-cost freight rates on grain for export became increasingly obvious, the railways allowing their grain-dependent branch lines and grain movement capability to deteriorate. The federal government and the Canadian Wheat Board intervened to overcome this decline in capability, their actions leading to the passage of the Western Grain Transportation Act in 1983.

What could be considered to be a federal obsession with the prairie grain economy had detrimental effects on the livestock industry. These were exacerbated by the quota policy of the Canadian Wheat Board. Greater livestock production could have offset the tendency to develop a grain monoculture on the prairies. The reduction in risk brought about by the government policies favoured development of larger farms. The emphasis on grain was further accentuated by the 1980 forecast of the Canadian Wheat Board for an increasing world demand for Canadian grain. Meanwhile, technology also favoured a grain monoculture. The multiplication of farm tractor horsepower and the increasing size and sophistication of implements enabled greater acreages to be operated with less labour. Herbicides, pesticides and fertilizers provided the means for increasing yields, the former allowing a reduction in the area devoted to summer fallow. While wheat remained king, oilseeds and special crops, particularly canola, provided a measure of diversity in production.

The family farm, which earlier had been considered a way of life and which federal legislation was designed to promote, had become a business requiring a high degree of management skill. It was highly mechanized, highly efficient and capital intensive. In the process, prairie agriculture took on an urban character as the farm population declined and local institutions were replaced by those at a distance as producers sought the services available in larger centres. [20, 21] As a result, there has been a wrenching adjustment in the social structure of the prairie region.

The transportation infrastructure, particularly that for grain, required adjustment. But this problem, along with that of elevator capacity, was found to be difficult to resolve. Producer attitudes towards such an adjustment tended to change less quickly than the speed with which they responded economically to their own business environment, even though the two continued to be related. The situation contributed to the Growing Together exercise, where an action plan was presented having as principles a more market responsive and self-reliant agri-food industry, while also recognizing regional diversity

19 Federal Task Force on Agriculture. *Canadian Agriculture in the Seventies*. December, 1969.
20 Stabler, J. C., M. R. Olfert and M. Fulton. *The Changing Role of Rural Communities in an Urbanizing World.* Canada's Plains Research Centre, Regina. 1992.
21 Stabler, J. C. and M. R. Olfert . *Restructuring Rural Saskatchewan: The Challenge of the 1990s.* Canada's Plains Research Centre, Regina. 1992.

and providing increased environmental sustainability. [22]

The development of the prairies has raised issues concerning the sustainability of the type of agriculture adopted. The initial development phase was marked by efforts to cultivate the land and provide an income to support an acceptable lifestyle. Little attention was given to the capability of the land being opened for settlement, soil surveys being non-existent during the heady days of expansion. Concern arose over how best to overcome the recurrent droughts, summer fallow being adopted early in the process. The impact of the plow and existing summer fallow practices became very evident in the disastrous 1930s. Research, government action and producer ingenuity enabled the problems of the time to be alleviated. While the effects of periods of drought remain, these have been mitigated by the developments in technology. Farming as a result has changed from a way of life to a sophisticated business with repercussions for the rural community, this whole development fostered by government policy designed to reduce risk for the "family farm". However, government intervention with respect to agriculture can be expected to decline as funds become restricted. Greater self-reliance and increased environmental sustainability are projected to become the cornerstones of the new paradigm.

The course of agricultural development on the prairies followed a sequence of models. These include the frontier, the conservation, the urban-industrial impact, the diffusion and the induced innovation models.[23] During the initial period of development on the prairies the frontier model prevailed. Agricultural production increased by expansion of the area cultivated, and thanks to cheap transportation Western Europe grew as a market. Essentially, this model prevailed until 1930. The drought years of the 1930s resulted in adoption of the conservation model, where a new form of cultivation practice was found essential. While greater attention was given to sustainability, the replacement of tractor power for horsepower rendered some of the attributes of the conservation model inappropriate.

Aspects of the urban-industrial model became apparent in the 1940s as agriculture on the prairies expanded during the second world war. While initially introduced by von Thunen to explain geographical variations in the intensity of farming systems and in the productivity of labour, the rationale of the model later evolved in terms of more effective input and product markets in areas of rapid urban-industrial development. The industrial development of the war years, along with the war itself, stimulated demand for agricultural products. In turn, industrial inputs to enhance agricultural productivity were made available. At the same time a strong off-farm labour market was provided by industry and also by the mobilization of the armed forces, thereby providing a stimulus for higher productivity in agriculture. Regional disparities in productivity and incomes persisted nonetheless.

The diffusion model was in vogue after the end of the war. Agricultural research was making substantial progress in the areas of farm management, varietal development and livestock production. The dissemination of this technical knowledge enhanced productivity on the farm. Producer innovations were refined and tested, improvements in farm equipment being only one example. The applicability of this model effectively ended in the mid-1970s when a major grain and oilseed shortage scare developed which in combination with a rapid increase in oil prices set off a round of inflation.

New cost structures called for cost-saving innovations. The induced innovation model of development was essentially in effect by the 1980s. Technology was developed to facilitate substitution of relatively abundant and cheap inputs of production for those relatively scarce and expensive. This technology was of two types, mechanical, such as tractors and other equipment that allowed the substitution of machines for labour, and biological and chemical, which effectively resulted in "land saving". Machinery enabled each producer to operate a larger area resulting in a decline in labour use per unit of land. Adoption of biological technology facilitated the substitution of labour and other inputs for land. This technology was expressed through new management systems, chemical fertilizers, pesticides and herbicides which when efficiently used resulted in the optimum yield response.

Application of science to agriculture has been demonstrated to yield remarkable increases in output. Advances in biotechnology, now an infant science, are forecast to give rise to a transition in farm practices comparable to the shift from horse power to tractor power. The induced innovation model also contains the elements of induced institutional innovation.

Researchers respond to the changes in the economic environment within which they work. Their rewards lie in the material benefits received for their work and, perhaps even more importantly, in the satisfaction attached to overcoming constraints on output. Technological change in turn gives rise to institutional change. The need for viable institutions capable of supporting more rapid

22 Agriculture Canada. *A Vision for Canada's Food Industry* . Supply and Services, 1989.
23 The various alternative agriculture development models are described by V. Ruttan in his paper "Induced Innovation and Agricultural Development", *Agricultural Sustainability in a Changing World Order*, G. Douglas, ed., Westover, 1982.

agricultural growth and rural development becomes compelling. The implication is that a growing interdependence becomes essential between the natural and social sciences due to the impact of technology on the rural development process. Similar innovation in rural institutions become required if the rural development process is to be fully effective.

The induced innovation model continues to be applicable to agricultural development on the prairies. Technology, however, with its impact on the size of farm, has a major impact on rural communities. Those which survive are taking on more of the characteristics of an urban community. To succeed, community development programs must therefore address both rural and urban concerns. Such concerns include the quality of education, health facilities, housing and other essential services. A major challenge arising for rural communities as a result of induced technology becomes how the opportunities and challenges for growth can be met without losing the attractions which have led farm people and other rural residents to prefer rural life. [24]

Agriculture continues to be faced with many challenges. One is the need to make farming economically viable, to provide the caretakers with the means and the incentives to conserve two of the nation's most important resources, the soil and water. Another is to have institutional and scientific support services, which combine far-sighted wisdom with immediate practical value. Given these, agriculture will continue to provide food for the nation and the world at large. [25]

The history of agricultural development on the plains therefore provides a proper introduction to the historical meaning of sustainable agriculture in the Plains region. The sustainability of agriculture was a very essential objective in the development of the region. Vagaries of the climate, the lack of infrastructure and the need for new technology all had to be overcome. Existing forms of agriculture reflect development in the past as modified by the policies of the present. The current emphasis on sustainability therefore represents only one position along a development course which started in the 1880s. It is nonetheless recognized that the present concept of sustainability in agriculture is much more comprehensive than was originally the case on the Plains.

24 Hayami, Y. and V. Ruttan. *Agricultural Development – An International Perspective.* John Hopkins, 1985. pp. 230-231.
25 Fairbairn, G. L. *Will the Bounty End?* Western Producer Prairie Books, 1984.

ISSUES IN SUSTAINABLE AGRICULTURE

A number of issues concerning sustainable agriculture and resource use on the Great Plains have been identified. They range from the measurement of sustainability to the potential impacts of global change. The issues identified below do not constitute a comprehensive list but do represent those considered to be of major importance. They are also indicative of the diversity of the issues. These issues are not necessarily independent.

MEASUREMENT OF SUSTAINABILITY

While some progress has been made in assessing the sustainability of particular production processes, much remains to be accomplished. Measurement is complicated by the need to establish an appropriate time frame. The tendency is to look at an infinitely long period. This approach is not necessarily appropriate since it is impossible to accurately predict future events. The concern is with the capacity of natural resources in combination with physical and biological systems to provide the desired flow of output in the future. A further complication is that other factors impinge on production. Investments in intellectual and physical capital result in development of new or improved production practices which may involve using other resources to produce the output desired. An example is the substitution of nuclear energy for coal in the production of electrical power.

There are two measures of sustainability to be considered: the economic and the physical. Richard Gray [26] among others has devoted considerable efforts to development of economic measures, while the work of Zentner [27] provides an insight into determination of the physical as related to the soil resource used in agriculture.

> An economic measurement of sustainability is difficult, as there are several viewpoints to consider. Gray stated that two general views prevail concerning sustainability in agriculture, one by consumers and one by producers. Consumers view sustainability in terms of its capacity to provide an abundance of quality food. Producers view sustainability as an income generating activity with economic and social value. The concern they have is with maintaining a net return from the sale of agricultural products. In economic terms, consumers assess sustainability in terms of maintaining a level of consumer surplus in the consumption of food over time. On the other hand, in economic terms, producers regard sustainability as the maintenance of a producer surplus or economic rent (return to factors used in production) over time. This dichotomy of interest provides a basis of conflict and attracts attention to the difficulty experienced when trying to measure sustainability. From the consumer's standpoint, security of the food supply is uppermost particularly among those who have previously experienced shortages or indeed famine. Measurement of the value of food security becomes almost impossible. Time preference becomes a complicating factor as does trying to aggregate the preferences of individuals. Gray contends attempts to measure sustainability in terms of food security should be abandoned.

Gray argues that sustainability may be measured in terms of the flow of income from agricultural production. He also notes that society regards sustainability in terms of all the costs and benefits of production. Particular issues that are raised when measuring sustainability are the discount rate; private versus social costs (negative externalities); non-market benefits (positive externalities); economic flexibility; and income/risk preferences. In addition to maintaining a producer surplus is the need to sustain farm families. Furthermore, sustainability must be measured taking into account uncertainty. Gray suggests that the elasticity of supply (the change in output relative to a change in price) may be a relevant indicator of sustainability. Output in response to price changes is impacted by technologies and available inputs. Consequently, society should support policies which enhance technology through research. Since the tools of government policy impinge on sustainability and policy results from the political process, economic measurement of sustainability becomes a very difficult and hazardous task.

The income flows for farms in the prairie provinces during the five year period 1986 to 1990 are provided in Table 3.1. It is obvious that, given the flows of income from production during the period, agriculture is not sustainable. Receipts from government payments, these not being sustainable, ranged from 52 to 191 percent of farm net income during the period. The range was even greater for individual provinces, Saskatchewan being a prime example where government payments as a proportion of net income ranged from 56 percent to 701 percent. Another illustration of the degree of the economic

26 Gray, R. "Economic Measures of Sustainability", *Canadian Journal of Agricultural Economics,* Vol. 39, No. 4, Part 1, December 1991. pp. 627-635.

27 Zentner, R. *Economics of Soil Conservation in Western Canada.* Research Branch, Agriculture Canada Research Station, Swift Current, 1981.

sustainability of a normally successful commercial grain farm in Saskatchewan is provided in Table 3.2. On a net cash income basis where no allowance is made for depreciation, from 25 to 73 percent of the cash income over the 1988 to 1992 period was received from government payments. The returns from crop sales were greatly depressed over the period due to the export subsidies provided by other grain exporters, the European Economic Community (EEC) and the United States (U.S.) in particular.

Table 3.1
Farm Receipts, Expenses and Income, Prairie Provinces, 1986 to 1990

	Manitoba	Saskatchewan	Alberta	Prairie Provinces
Total Crop Receipts		million dollars		
1986	1,067	2,415	1,317	4,799
1987	806	2,184	1,301	4,291
1988	864	2,292	1,606	4,762
1989	895	2,364	1,824	5,083
1990	1,014	2,454	1,613	5,081
Total Livestock Receipts				
1986	769	772	1,774	3,315
1987	808	851	1,899	3,558
1988	762	936	2,051	3,749
1989	758	899	2,144	3,801
1990	774	884	2,305	3,963
Program Payments				
1986	238	957	661	1,856
1987	478	1,319	806	2,603
1988	432	1,199	748	2,379
1989	450	1,200	560	2,210
1990	169	658	318	1,145
Total Net Income *				
1986	378	1,362	867	2,607
1987	380	720	573	1,673
1988	150	171	927	1,248
1989	471	1,205	806	2,482
1990	472	1,183	540	2,195
Program Payments/Net Income		percent		
1986	63.0	70.3	76.2	71.2
1987	1,25.8	1,83.2	1,40.7	1,55.6
1988	2,88.0	7,01.2	80.7	1,90.6
1989	95.5	99.6	69.5	89.0
1990	35.8	55.6	58.9	52.2

* Net income represents net cash income plus income in kind less depreciation and any changes in the value of inventory.

Source: Adapted from Agriculture Canada, *Farm Income Financial Conditions and Government Expenditures Data Book* , August 1993.

Table 3.2
Saskatchewan Benchmark Grain Farm*, Revenues and Cash Expenses 1988 to 1992

	1988	1989	1990	1991	1992
Cultivated Acres	1,600	1,600	1,600	1,600	1,600
			dollars		
Revenues					
Crop Sales and Final Payments	96,320	92,479	93,331	98,468	87,884
Government Payments	35,820	36,610	20,650	9,107	20,559
Livestock Sales	8,583	8,137	7,990	7,402	8,306
Other Revenues	6,258	5,645	6,774	6,503	6,698
Total	146,982	142,871	128,746	132,145	14,2068
Cash Expenses					
Seed	6,164	5,695	5,399	4,918	4,672
Fertilizer	9,314	9,029	8,388	7,615	8,209
Chemicals	8,418	8,991	8,806	7,905	8,222
Fuel and Power	8,634	9,209	9,871	9,602	10,572
Repairs	9,097	9,702	10,401	9,614	10,018
Interest	16,176	16,101	15,874	13,284	11,863
Other Cash Expenses	38,193	42,953	42,005	50,227	52,238
Total	87,580	92,690	91,939	95,261	97,572
Net Cash Income**	59,403	50,181	36,807	36,884	44,497
			percent		
Government Payments/ Net Cash Income	60.2	73.0	56.1	24.7	46.2

* This farm is not representative of all farms but reflects a normally successful commercial operation (11752 farms in Saskatchewan being 1600 acres or more in size in 1991).

** Net cash income is equal to cash receipts minus cash expenses, no allowance being made for depreciation. It represents the cash available for living expenses, principal repayment and reinvestment in the farm.

Source: Agriculture Canada, *Farm Income Financial Conditions and Government Expenditures Data Book* , August 1993.

While the proportional contribution of agriculture to the Gross Domestic Product (GDP) has declined over time it remains significant in the prairie provinces. Furthermore, the relative degree of provincial support given to agriculture as a proportion of its contribution to the GDP varies by province as indicated in Table 3.3.

Table 3.3
Provincial and Federal Agrifood Expenditures Relative to Agriculture's Contribution to the Gross Domestic Product, Prairie Provinces and Canada, 1986/87 to 1990/91

	1986/87	1987/88	1988/89	1989/90	1990/91
			percent		
Manitoba					
Agri-food/Total Expenditures	3.08	3.07	3.55	3.13	3.44
Agriculture GDP/Total GDP	5.10	4.19	2.97	3.56	4.62
Saskatchewan					
Agri-food/Total Expenditures	9.36	7.23	8.48	7.49	8.14
Agriculture GDP/Total GDP	14.54	9.55	6.11	8.37	10.90
Alberta					
Agri-food/Total Expenditures	6.34	4.95	4.79	5.59	4.82
Agriculture GDP/Total GDP	4.35	3.72	3.55	3.75	4.24
Canada					
Agri-food/Total Expenditures	3.11	4.07	3.67	3.12	2.71
Agriculture GDP/Total GDP	2.46	2.12	1.92	2.03	2.27

Source: Adapted from *Agriculture Canada, Farm Income, Financial Conditions and Government Expenditures* , August 1993.

The above tables provide background for the analysis of policy. They also confirm that severe problems exist in the economic sustainability of agriculture on the prairies. There are indications that the potential exists for increasing aggregate farm income by an expansion of livestock output, an activity which holds forth the prospect of also increasing the sustainability of agriculture in physical terms.

In contrast to the economic measurement of sustainability, a physical measurement is relatively straightforward. It deals with particular processes or uses of resources. Zentner illustrates such measurement with reference to the soil resource. He notes that since the soil resource used in agriculture is largely privately owned, producers can be expected to organize their activities in a manner that maximizes their private benefits. On the other hand, society desires to maximize the social benefits. There is a common interest in conserving the soil since failure to do so increases the marginal costs of production and reduces the future streams of private and social benefits. However, several reasons exist as to why producers adopt a set of soil use strategies which differ from those held desirable. They may lack information on the depletive consequences of particular production practices; they may be faced with constraints irrelevant to society as a whole, including the need to accept lower short run profits as a result of soil conservation practices, institutional restrictions such as quota systems and government policies which create distortions and encourage the use of soil depletive practices; they may have different planning horizons and time preferences; and they may have a short term view on externalities such as saline seeps, soil erosion and contamination of ground water.

Three factors must be considered when estimating the long term consequences of soil degradation. These factors are the value of agricultural production that is permanently lost or not forthcoming as a result of reduced soil productivity; the cost of the additional inputs necessary for agricultural production; and the social costs of the externalities being generated. Accurate measurement of these factors is an exceedingly complex process. Furthermore, estimation of the long term effects on soil productivity is subject to substantial error. In addition, establishment of the economic consequences of soil degradation involves forecasts of future reductions in productivity while recognizing the possibility of development of new technologies. Finally, the economic consequences of soil degradation alone can be determined by estimating the returns otherwise received from the lost production. It should be noted that the additional output

forthcoming from conservation will have a negative impact on price.

Evaluation of sustainability, even in the case of a particular resource used in agriculture, is replete with problems. A number of value judgments are required since some of the variables do not lend themselves to objective measurement. Technologies which tend to conceal the effects of degradation in terms of yield continue to be developed. Consequently, measurement of the sustainability of a resource, such as the soil, is difficult over an extended period of time. On the other hand, exact measures may not necessarily be mandatory when attempting to evaluate sustainability since in many situations the degradation is obvious and, as in the case of the soil, should stimulate action to adopt conservation practices.

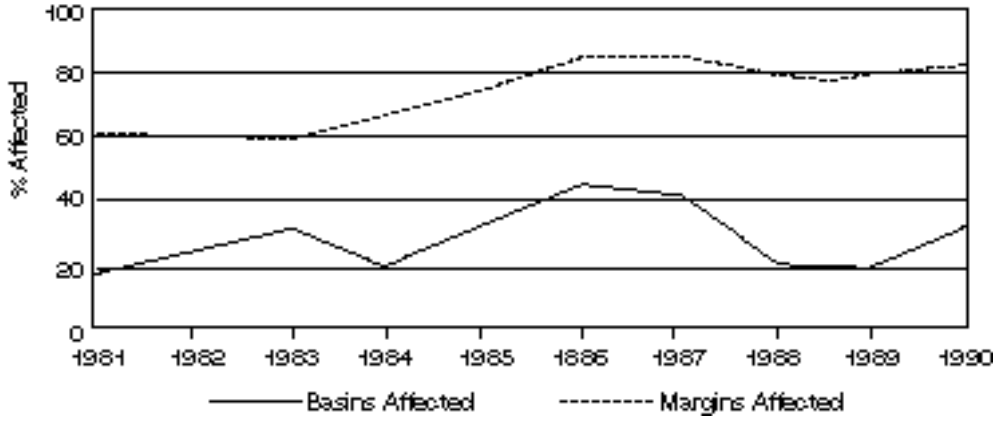
LAND USE

The soils of the prairies developed under grassland vegetation which supported substantial populations of numerous animal species. At the same time, sloughs and small lakes dotted the landscape providing habitat for birds and other wildlife. Trees in river valleys also provided sanctuary. The vegetation of the region varied from short grasses in the drier sections to tall grasses in areas of increased rainfall to reeds and sedges in low lying areas. Numerous species of plants native to the prairies also existed. The prairie landscape prior to 1870 exhibited considerable diversity.

The advent of settlement on the prairies substantially modified the prairie landscape as large areas of the grasslands were put to the plow. In the process, decimation of the previous large herds of animals, particularly the bison, took place along with their dependent predators and scavengers. The pressure to expand the cultivated area gave rise to drainage of wetlands thereby further destroying habitat for wildlife. Over time a grain monoculture developed in much of the prairie area, a farming practice encouraged by prevailing government policies. It therefore becomes apparent that land use on the prairies has evolved over time. Consequently, land use cannot be regarded as being held constant as other forces continue to be exerted on the land base.

Land has multiple uses as was demonstrated during the development phase. Prime uses include animal and plant habitat and agriculture. As the population expands there is greater demand for land for recreational purposes and for housing in urban centres. With the primary use of the land being for grain production, the incipient decline in the grain economy gives rise to the issue of whether the present pattern of land use is appropriate. The relative contribution of agriculture to the economy generally has also declined, further compounding the land use issue. On the other hand, demand for land for purposes other than agriculture is increasing.

Figure 3.1
Percentage of Prairie Ponds with Margins or Basins Affected by Agricultural Practices, 1981-90



Source: Environment Canada. *The State of Canada's Environment,* 1991

Data on land use are provided in Table 3.4. While the trends in land use are similar for each of the prairie provinces, the degree of change differs. The area of land under crops has risen over time. The additional area has been made possible largely as a result of a decline in land devoted to summer fallow and in the case of Saskatchewan and Alberta to an increase in the area of improved land. Over the ten year period, 1981-1991, the area in summer fallow in Manitoba declined by 50 percent, in Saskatchewan by 16 percent, and in Alberta by 20 percent. While data for the area in improved land are not available for 1991, between 1981 and 1985 a decline of 2 percent is indicated for Manitoba while increases of 2 percent and 3 percent were registered for Saskatchewan and Alberta, these increases being stimulated by the agricultural policies in effect. In the process, there has been a reduction in the area of wetlands on the prairies as indicated by Caswell. His data are illustrated in Figure 3.1.[28]

Current land use on the prairies has reduced the quality and quantity of diverse wildlife habitat in Canada. While farmlands and rangelands do provide enhanced habitat for certain species, other species have declined as a result of agricultural expansion and production practices.

Other uses for land are not necessarily competitive with agriculture. While the land is a critical resource for agriculture, it is also a critical resource for the environment and for society. Restoration of some of the land as habitat for wildlife can be complementary to agriculture. At the same time, diversion of some of the land presently used for grain production into the production of livestock can result in agriculture being more sustainable.

Table 3.4
Trends in Land Use, Prairie Provinces, 1981-1991

	1981	1986	1991
		thousand hectares	
Manitoba			
Area in Farms	7,615	7,740	7,725
Under Crops	4,420	4,519	4,761
Improved Pasture	353	275	341
Summer fallow	598	509	297
All Other Land	2,245	2,437	2,326
Saskatche wan			
Area in Farms	25,947	26,599	26,865
Under Crops	11,741	13,326	13,459
Improved Pasture	975	879	1,076
Summer fallow	6,704	5,658	5,713
All Other Land	6,526	6,738	6,618
Alberta			
Area in Farms	19,109	20,655	20,811
Under Crops	8,441	9,163	9,292
Improved Pasture	1,581	1,377	1,742
Summer fallow	2,205	2,127	1,771
All Other Land	6,880	7,989	8,005

Source: Statistics Canada , *Agriculture Profiles, Census of Canada* , 1991.

28 Caswell, F. D. *Prairie Waterfowl Status Report: A Briefing Document.* Environment Canada, 1990.

The purposes for which land is used reflect their relative profitability. The profitability of a particular use in turn continues to reflect existing policies. Notwithstanding this situation, the demands of society are exerting pressure on the current pattern of land use. Eventually these demands will result in the land less suitable for grain production reverting to uses similar to those prevailing before the time of settlement.

Degradation of Prairie Soil Resources

"Despite its widespread severity and global impact, soil degradation remains an emotional rhetoric rather than a precise and quantifiable scientific entity."[29] Soil is degraded as a result of processes that reduce its productivity. [30] Such processes usually arise from poor management of the resource. Soils are degraded primarily by erosion, loss of organic matter, salinization and acidification. The first two processes are interrelated. Acidification is not a major problem except in areas where cultivation has been extended into previously forested areas. Salinization is more prevalent.

Soil Erosion

Soil erosion reduces soil productivity through losses of nutrients, water storage capacity and organic matter. The losses in terms of productive capacity are significant though presently obscured by the application of fertilizer. Annual top soil losses in terms of lost productivity on the prairies are estimated to be in the millions of dollars. The present value of the accumulated annual losses is measured in hundreds of millions of dollars, the actual losses being difficult to quantify.

> Erosion has taken place over the history of cultivation on the prairies. Both wind and water erosion result in the removal of the finer soil particles, thus leading to compaction of the soil and poor soil tilth. Water erosion is a significant problem on long sloping fields, particularly those summer fallowed or left free of cover. The valuable top soil removed is deposited in depressions, road ditches and waterways giving rise to additional costs. Wind erosion is a major problem when there is little cover by crops or residues as in the spring months particularly during dry seasons. Not only are valuable nutrients lost but the soil deposited elsewhere becomes a problem. Indeed, seedling crops may be destroyed.

Dumanski et al [31] have estimated the annual costs of erosion in the prairie provinces to lie in the range of $155-177 million in the case of water and between $213-271 million in the case of wind. Sparrow[32] has expressed annual soil losses in different terms. He estimated the annual soil loss on the prairies by wind to be about 160 million tonnes and that by water to be 117 million tonnes, these losses from erosion greatly exceeding the rate of soil formation. The annual loss in potential grain production arising from soil erosion during the period of cultivation he considered to be 171 million bushels or 4.6 million tonnes of wheat. He argued that 15 percent of the lost production could not be recovered by additions of fertilizer and estimated the value of lost production at $129 million annually, lending credence to the title of his report *Soil at Risk: Canada's Eroding Futur e*.

The physical effects of erosion are painfully evident on the knolls and sloping segments of the prairie landscape. It has led to a gradual evolution of farming practices from an initial use of the plow, through use of blade type cultivation to use of minimum tillage. This progression has enabled increasing amounts of trash cover to be maintained over time, thereby reducing erosion. Moreover, in more recent years the width of fields has increased as a reflecting the size of the equipment used, which resulted from the economies of size in farm operations. In addition, intensive tillage operations to incorporate herbicides and fertilizers were adopted. These latter events work against the soil conservation otherwise achieved through maintenance of trash cover.

Fortunately, a reduction in the cost of suitable chemicals has made the use of chemical fallow more economical, thereby enabling adoption of minimum tillage practices. This change in practice has been driven by the need to minimize production costs, the protection of the land from erosion being a complementary benefit. At the same time, summer fallowing has largely become confined to the brown soil zone as rotations have been extended in the dark brown zone and continuous cropping has become general in the black soil zone. Losses from soil erosion can therefore be expected to be less extensive in the future than in the past.

29 Lal, R. and B. A. Stewart. “Need for Action: Research and Development Priorities”, *Advances in Soil Science.* Vol. 11. Springer-Verlag, 1990. pp. 331-336.
30 Campbell, C. A., R. Zentner, J. Dormaar and R. Voronoy. *Economics of Soil Conservation in Western Canada* ; Campbell, Zentner, Dormaar and Voroney, *Land Quality, Trends and Wheat Production in Western Canada* ; and Campbell, *Soil Conservation in Saskatchewan: A Research Perspective.*
31 Dumanski, J., D. Coote, G. Lucerek and C. Lok. “Soil Conservation in Canada”, *Journal of Soil and Water Conservation* , Vol. 41, 1986. pp. 204-210.
32 Standing Senate Committee on Agriculture, Fisheries and Forestry. *Soils at Risk: Canada’s Eroding Futur e.* Ottawa, 1984. p. 111.

Decline in Organic Matter

The main chemical constituents of soil organic matter are carbon and nitrogen. The former is the energy source for most soil microbes while the latter is one of the most important nutrients for plants. Other necessary components of organic matter are phosphorous and sulfur. Under the ecosystem prevailing previous to cultivation, mineralization and immobilization processes were closely integrated. Plant growth (immobilization) and mineralization of soil organic matter occurred simultaneously. Therefore losses of nutrients were minimized allowing for the accretion of organic matter over time. Carbon transfer through the soil is basic to the functioning of the soil-plant system. Primary productivity determines the amount of carbon entering the system while the amount leaving is controlled by soil micro-organisms. In natural ecosystems, the amount of carbon transferred by means of both processes appears equal.

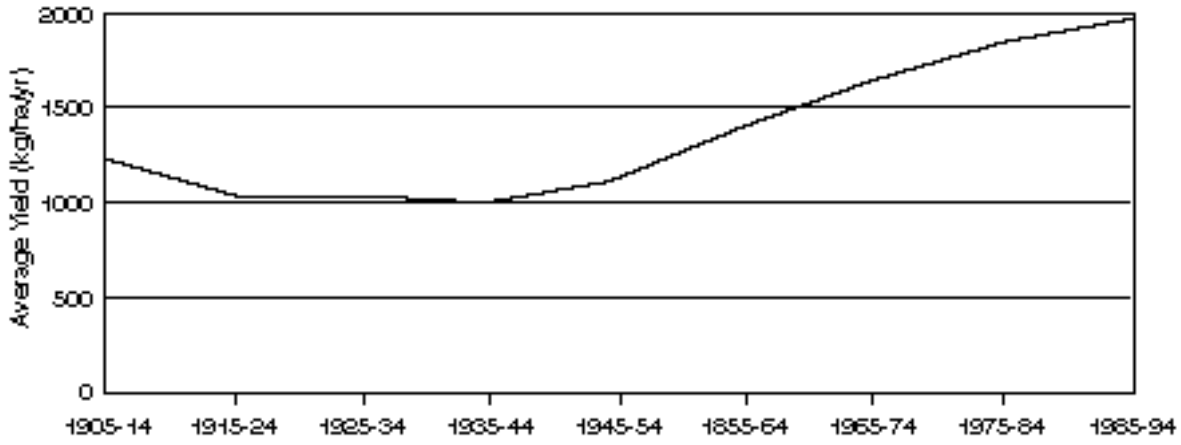
Upon cultivation of the soil for the production of annual crops, productivity and mineralization are uncoupled, particularly when the fields are bare of vegetation. Total inputs of carbon to the soil are altered due to differences both in plant characteristics and to allocation of carbon for above and below ground production.

The practice of summer fallowing has hastened the loss of soil organic matter. Frequent tillage during summer fallowing has increased the rate of decomposition of organic matter while at the same time disrupting soil aggregation and increasing its susceptibility to erosion. There has also been a loss of the more readily available nitrogen.

The magnitude of the losses of organic matter under cereal production has been established as being in the range of 20 to 50 percent in the cultivated layer according to the soil classification. McGill[33] estimated in 1981 that organic matter losses in the topmost layer of soil averaged 41 percent in the brown soil zone, 44 percent in the dark brown soil zone, 49 percent in the black soil zone and 36 percent in the grey soil zone. Research has established that by improved cultural practices, the decline in organic matter can be halted and indeed reversed. Nonetheless, additional nitrogen is now required to maintain yields on many prairie soils.

Regardless of the productivity losses identified, annual wheat yields after an initial decline following settlement have trended upward over the last 50 years. This trend is illustrated in Figure 3.2.

Figure 3.2
Trends in Wheat Yields in the Prairie Provinces, 1905-84



Source: Environment Canada. *The State of Canada's Environment.* Ottawa. and author's estimate.

33 McGill, W., C. A. Campbell, J. Dormaar, E. Paul and D. Anderson. "Soil Organic Losses", *Agriculture Land: Our Disappearing Heritage*. Alberta Agriculture, 1981. pp. 72-133.

The increase in yield identified by Hedlin[34] reflects the impact of adopting higher levels of technology, one of these being the application of fertilizer. The aggregate quantities of nitrogen and phosphorous now being applied is approximately that used by the crops. Data provided by Flaten and Hedlin[35] are reproduced below in Table 3.5.

Uncertainty remains, however, as to how soils will behave under such changed cultural practices as snow trapping, minimum tillage, green manuring and chemical follow. This uncertainty arises because soil changes occur slowly and the effects of agronomic practices take years to become evident.

SOIL SALINITY

Even before cultivation, large areas of the prairies contained saline soils. However, an expansion of these areas has occurred under cultivation. The rate of increase in the salinized area is related in part to the increase in ground water over time. Salinization occurs as water containing soluble salts moves upward through the soil horizon. Evapotranspiration concentrates the salts in the soil solution to reach levels in the root zone that are detrimental to crop growth.

Any technique which removes water from the subsurface such as drainage, use of deep rooted

Table 3.5
Crop Uptake of Nitrogen (N) and Phosphorous (P) in Western Canada and its Relationship to Fertilizer Use Over Time

	Crop Uptake		Fertilizer Used	
Period	N	P	N	P
		thousand tonnes		
1883-1953 avg.	203	36	1	2
1954-1964 avg.	446	75	22	20
1965-1971 avg.	623	110	128	59
1972	637	111	126	64
1973	686	118	262	100
1974	545	93	308	133
1975	668	115	346	146
1976	800	136	363	131
1977	781	134	382	121
1978	831	142	530	156
1979	693	118	591	164
1980	733	125	590	169
1981	898	153	652	175
1982	982	166	682	171
1983	898	151	721	180
1984	696	134	854	204
1985	902	153	914	210
1986	1,133	192	896	202
1987	995	169	825	177

Source: Flaten and Hedlin

34 Hedlin, R. A. “An Additional Perspective”, *Canadian Journal of Agricultural Economics* , Vol. 33. 1986. pp. 30-40.
35 Flaten, D. N. and R. A. Hedlin. “Impact of Technology on Crop Productivity in Western Canada”, *Proceedings of the 34th Annual Meeting of the Canadian Society of Soil Science* Calgary, 1988.

perennials, reducing summer fallow or continuous cropping diminishes the danger of salinization. Once salinization has occurred, the remedy is to leach the salts out of the root zone. The most viable way to accomplish this cleansing is to use all available precipitation to grow crops and thus reduce the accumulation of ground water. This indicates the desirability of reducing the acreage in summer fallow on the prairies. Such a reduction would also lead to a significant decline in the leaching of nitrogen into the subsoil.

Salinization of dryland agricultural soil constitutes a major problem in southern and central regions of Alberta and Saskatchewan and in a few scattered areas of Manitoba. Approximately 2.2 million hectares of improved land are considered to be subject to secondary salinity. The economic impact of this salinity is said to be in the range of $104 - $257 million annually. [36]

Soil Acidification

As indicated previously, acidification is not a major problem in other than a limited part of the prairies. Acidification can be overcome by application of lime. However, heavy applications of nitrogen fertilizers over time have been found to result in soil acidification. Consequently, acidification may become a significant problem in parts of the prairie region under intensive cropping practices which require major inputs of nitrogen fertilizer.

Assessment

While degradation of the soil resource can be reduced or halted by changes in cultural practices, unless these are demonstrated to be economic they are unlikely to be adopted even though desirable from the standpoint of society. Producers are more likely to be interested in maximizing profits in the short-run rather than be concerned with conservation of natural resources and protection of the environment. Any sizable shift in cropping practices by producers will depend on their ability to survive difficult economic times.

Preservation of Biodiversity

Biodiversity is defined as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic systems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems." [37] Biodiversity is considered essential for the resilience of ecosystems. Many ecosystem processes regulate conditions for life. Holling [38] argues that this role provides the rationale for giving priority to rehabilitation, protection of ecosystems and land use management. Resilience enables ecosystems to return to a steady state after being subjected to an unusual event denoted as being a "surprise". The ecosystems may not necessarily return to the same state as before. In other words, ecosystems are subject to discontinuous change. However, there remains the risk that intervention in ecosystems by humans can result in a reduction of their resilient nature rendering them incapable of dealing adequately with unusual events. Holling describes the situation with respect to ecosystems as follows:

> "Ecosystems have a natural rhythm of change, the amplitude and frequency of which is determined by internal processes and structures in response to past external variabilities. These rhythms alternate periods of increasing organization and stasis with periods of reorganization and renewal. They determine the degree of productivity and resilience of ecosystems.
>
> Modern technological man affects these patterns and their causes in two ways. First, traditional resource-management institutions constrain rhythms by restricting them temporally and homogenizing them spatially. Internal biophysical relationships then change, leading to systems of increasing fragility, i.e. to a reduced resilience. Moreover, modern man and his institutions operate with a different historical rhythm which can mask indications of slowly increasing fragility and can inhibit effective adaptive responses, resulting in the increased likelihood of internally generated surprises, i.e. crises. Second, the increasing extent and intensity of modern industrial and agricultural activities have modified and accelerated many global atmospheric processes, thereby changing the external variability experienced by ecosystems. This imposes another set of adaptive pressures on ecosystems when they are already subject to local ones. As a consequence, locally generated surprises can be more frequently affected by global phenomena, and in turn can affect these global phenomena in a web of global ecological dependencies." [39]

Loss of biodiversity has profound implications for development. Biological resources are renewable and output can be increased under appropriate management. Natural habitats which can maintain productivity without significant management have the ability to provide means for human survival. Highly diverse natural ecosystems

36 Dumanski et al, Op cit. 1986.
37 As quoted by R. Sopuck, *Canada's Agricultural and Trade Policies: Implications for Rural Renewal and Biodiversity*, July, 1993. p. 14.
38 Holling, C. S. "The Resilience of Terrestrial Ecosystems: Local Surprise and Global Change", *Sustainable Development of the Biosphere*. W. C. Clark and R. E. Munn, eds. Cambridge: Cambridge University Press, undated.
39 Ibid, p. 313.

also provide important ecological services. These include maintaining hydrological cycles, regulating climate, contributing to the process of soil formation and maturation, storing and cycling essential nutrients, absorbing and breaking down pollutants and providing sites for inspiration, tourism, recreation and research. While nature has some built-in redundancy few data are available on which species are particularly important in the functioning of ecosystems so that the actual value of specific losses of biodiversity is not available. There is need, however, to at least maintain biodiversity by maximizing the number of different species conserved in sufficient quantities to assure survival. [40]

The many values of biodiversity and its importance for development suggest why biodiversity conservation differs from traditional nature conservation. Biodiversity conservation entails a shift from a defensive posture to an offensive effort seeking to meet peoples' needs from biological resources while ensuring the long-term sustainability of earth's biotic wealth. It involves not only the protection of wild species, but also the safeguarding of the genetic diversity of cultivated and domestic species and their wild relatives. This goal applies to modified and intensively managed ecosystems as well as natural ones and is pursued in the human interest and for the human benefit. Conservation of biodiversity seeks to maintain the human life support system provided by nature and the living resources essential for development. [41]

Biological resources support development in virtually all sectors and affect those who live in cities as well as those in the country. Agriculture under good management is an example of the management of a modified ecosystem to yield what is perceived to be optimal productivity. The system is inevitably somewhat impoverished as predators and competitors are eliminated or reduced and the population structure is altered in order to enhance yields. Yet it is ecologically sound and essential to human welfare. Such a system both affects and depends on the more natural ecosystems. [42]

Biodiversity may, therefore, be seen as an indicator of environmental health. Success in maintaining biodiversity must take into account both spatial and temporal factors. It is not, however, possible to ensure a constant level of biodiversity at a particular location over time. Agriculture by its close attachment to the land is in a position to greatly influence biological diversity on the prairies.

Agriculture has substantially changed the prairie landscape. Annual crops have replaced the grasses which previously covered the land. In fact, modern agriculture can be said to have had a greater impact on biodiversity in the Plains region than any other activity.

As agriculture became more intensive, wetlands were drained, trees removed and grasslands cultivated. These actions, while being advantageous for the use of large modern equipment, effectively destroyed the habitat for many plant and animal species. In no area was this development more effective than on the open prairie. These actions were largely induced by public policy which directly or indirectly fostered expansion of the cultivated area. Indeed, more than 80 percent of the prairie landscape has been altered by agriculture. Drainage for use in agriculture has been responsible for 85 percent of the total land drained.

The impact on the bird population, because of following this course, has been significant since the sloughs and small lakes drained provided the habitat for more than 60 percent of the waterfowl on the continent. It should therefore not be surprising that waterfowl populations have declined over time. Continued expansion of the area in agriculture, whether by removal of indigenous prairie trees or extension into the parkland area, serves to reduce the habitat for wildlife. Animals also suffer from the reduction in habitat, often being forced to retreat into more remote areas. In many parts of the prairies native vegetation has become a thing of the past, stimulating organizations to strive to protect any areas remaining.

The extent to which agriculture on the prairies has changed the landscape has been described by Gauthier and Henry. [43] Only one percent of the tall grass prairie, 18 percent of the short-grass prairie, 25 percent of the mixed grass prairie and 25 percent of the aspen parkland remain. Furthermore, conversion of these lands to agriculture continues, as a result largely of agricultural policy. The remaining areas of untouched wildlife habitat have become progressively more fragmented, more isolated, and often too small to sustain viable populations of species that had once been abundant. In no case is this predicament more evident than in that of wetlands, which are said to be disappearing at the rate of 0.5 percent annually in Alberta.

On the prairies, 60 percent of the wetland basins and 80 percent of the habitat surrounding these basins are

40 McNelly, J. A. “The Biodiversity Crisis: Challenges for Research and Management”, *Conservation of Biodiversity for Sustainable Development.* O. T. Sandlund et al, eds., Scandinavian University Press, 1992.
41 World Resources Institue et al. *Global Biodiversity Strategy*. United Nations, 1992.
42 McNelly, J. A. *Economics and Biological Diversity*. International Union for Conservation of Nature and National Resources, Gland, Switzerland, 1988.
43 Gauthier, D. A. and J. D. Henry. “Misunderstanding the Prairies”, Endangered Spaces: The Future for Canada’s Wilderness. M. Hummel, ed., Toronto, 1989. pp. 183-185.

affected by farming each year. This occurrence has a significant impact on waterfowl. Grazing by cattle and other domestic animals reduces plant cover and the supply of food and shelter for meadow and grassland species of mammals, birds and invertebrates. On the other hand, some forms of wildlife thrive under the conditions arising from agriculture. Farm shelterbelts provide cover for numerous species of birds. Other species have benefited from the increased feeding opportunities provided by agricultural crops. These include ducks, geese, sandhill cranes, robins and blackbirds. However, biodiversity remains threatened by agricultural operations, as 12 of the 62 species of plants considered endangered are wetland species. Furthermore, diseases of farm livestock have been known to be transmitted to native animals with devastating results. Conversely, diseases can be transmitted from native animals to those on the farm.

Maintenance of the current level of biodiversity on the prairies, which reflects the impact of agriculture on habitat, cannot be considered particularly difficult. Biodiversity in terms of numbers of different species on the prairies has not been so much affected as have the numbers remaining within given species. The factors contributing to the decline in numbers include agricultural policies, regional development plans, institutional structures, world trade, characteristics unique to the rural economy and the world view prevailing in rural areas. [44]

Water Use and Quality on the Prairies

The great need for water by agriculture is one of the reasons why water is in short supply on the prairies. The lack of water in the southern prairies contributed to the devastating experience of farmers in the drought area of the 1930s. Indeed, during the 1961 - 90 period, the average annual precipitation in Regina was 362 mm while the average evaporation rate was 1016 mm, resulting in a net deficit of 654 mm. [45] This difference illustrates the need to conserve moisture supplies and reduce the evaporation rate through the application of technology. Furthermore, quality water constitutes only part of the supply available. On the other hand, agricultural operations can contribute to loss of quality in water. A further complicating factor is the unequal distribution of water in the prairie region. Consequently, water use and quality have become a major issue on the prairies with regard to the sustainability of agriculture in the region.

The low level of precipitation and its uneven distribution on the prairies in combination with evapotranspiration has made redistribution of the available supply of water of paramount importance. Redistribution may be accomplished by on-farm techniques to retain the precipitation that falls. More generally, water is drained from undesirable locations to others more desirable as well as transferred within basins and also between basins. The latter techniques decrease the impact of the variability of precipitation. Such redistribution activities are not without cost and may have an undesirable effect on the environment.

While ground water is the most abundant and widely distributed water source, the water quality, yield and dependability of the aquifers can vary considerably. Deep aquifers, while more resistant to drought, tend to have high treatment costs in order to make them potable. One of the first activities of PFRA following its inception in 1935 was to embark on construction of on-farm dugouts to capture any runoff for domestic and livestock use. Dugouts have been termed as an inelegant a collection of holes as ever designed by man. They did nothing aesthetically for the landscape. They were utilitarian in the extreme. Yet, if acceptance is a measure of worth, few more valuable projects were ever devised.[46] PFRA projects also included stock watering dams and other on-farm water supply projects. To date, over 200,000 of such on-farm water projects have been completed through joint producer and PFRA action.

Comprehensive planning combined with coordination and sound water management are fundamental requirements for the development and maintenance of secure water supplies. Increased water use combined with occasional droughts have resulted in the failure of many surface sources and shallow water aquifers to provide sufficient water for farms and rural communities. As a result, within the prairies with the cooperation of PFRA virtually every major system has been modified by means of reservoirs so that the flow of water in peak times is made available for use in drought periods. Of the approximately 770 dams in the prairie provinces, 53 percent are in Saskatchewan, 40 percent in Alberta and 7 percent in Manitoba. The most monumental of these river projects is the Gardiner Dam on the Saskatchewan River at Outlook, Saskatchewan, which created Lake Diefenbaker. [47] Even though the irrigation potential remains largely undeveloped, the benefit to cost ratio of this multi-use project generally exceeds one without the uncalculated benefit of the climate modification associated with such a large body of water. [48] Originally proposed by Henry Hind in 1859, the dam was

44 Sopuck, Op cit. p. 16.
45 Agriculture Canada. *PFRA: A Branch Overview*. Regina, December, 1992.
46 Gray, J. H. *Men Against the Desert.* 1967.
47 The background for this project is provided in the *Report of the Royal Commission on the South Saskatchewan River Project,* Queen's Printer, 1952.

completed in 1968. There are an additional 19 major dams on rivers in the prairie region.

Irrigation has been shown to enable a form of sustainable agriculture to develop in an arid region, with a complementary output of products which can provide the basis for development of substantial value added industries. Economic stability is achieved following the development of a successful irrigation area. These benefits serve to offset public investments in the associated water management projects. It should be noted that the development of irrigation in Southern Alberta early in the 1900s enabled the area to escape the disastrous consequences of the "dust bowl" which developed further east on the prairies during the 1930s.

Irrigation accounts for approximately 88 percent of the total water used for agriculture. Irrigation is practised on about one million hectares of land in the brown and dark brown soil zones, the crops produced being primarily cereal grains. Recent droughts have stimulated interest in additional water management projects. Unless the water is wisely used soil salinity problems may be experienced. At the same time inter basin transfers can give rise to introduction of new species and to habitat loss for fish and wildlife.

Redistribution of water tends to be expensive. Use of public funds for this purpose is subject to increasing scrutiny. Questions arise as to whether use of these funds would return greater benefits if spent for other purposes. The net pay-off of most past irrigation projects has been positive. Many projects are multipurpose in nature providing water supplies for power generation, municipal use, recreation, and wildlife habitat as well as for agriculture.

Not only does the sustainability of agriculture have a water quantity requirement but also one of water quality. For human and livestock use, the quality requirements are quite stringent. For crops, levels of tolerance are somewhat higher. Even treated effluent from municipal sewage plants can be used to irrigate crops.

Agriculture itself can become a source of water pollution both on and off location. Local pollution sources include processing plants, and confined livestock operations. The primary pollutants are phosphorous, nitrogen and organic materials. Off-site pollution from agriculture includes phosphorous, nitrogen, pesticides and sedimentation of streams and lakes.

Water has and no doubt will continue to have a major impact on the sustainability of agriculture on the prairies. Snow management can add three centimeters of water for the production of the next crop. [49] The additional water is of great value, particularly in the brown and dark brown soil zones where on average the amount available is inadequate. The additional water from snow management can often provide an alternative to summer fallow as a means to increase soil moisture. Adoption of water efficient cropping systems such as minimum tillage or zero tillage can also alleviate the moisture shortage in crop production. Control of weeds and use of fertilizer improve the efficiency with which the available moisture is used in the production of crops. All these activities point to the desirability of improved water management on the farm. Such management could overcome some of the need to summer fallow in the brown and dark brown soil zones for the purpose of storing water for the next crop.

It must be emphasized that sustainable agriculture on the prairies depends on an adequate supply of water. In the past, there was little outside competition for the available supply. However, competition is expected to increase as municipal demands rise along with the population and as demands from industry expand. In consequence, efficiency in the use of water will become mandatory. In this environment, water from off-farm sources can be expected to be only available at full cost, rendering most proposed additional water storage works for agricultural purposes uneconomical. In addition, greater scrutiny of the pollution of water by agricultural operations can be expected. On the other hand, increasing concern for the maintenance of wetlands for environmental purposes should promote the sustainability of agriculture.

Use of Common Property

In agricultural production a number of so-called "free" goods are used as inputs, primary examples being air and water. In the process, both negative and positive effects may become evident. Misuse or abuse of these goods may arise from the fact they are "free". In terms of environmental impact all goods entail a cost. Indeed, the local landscape provides public goods including amenities such as a satisfying setting, wildlife, air and water. At the same time, private goods such as crops and livestock are also produced. The impact of agriculture on the use of public goods gives rise to tension between agricultural producers and other sectors of society. Producers follow their private economic interests in management of their farms and may in the process reduce, eliminate or impair

48 UMA Engineering Ltd. *Summary Report: Social Evaluation of the South Saskatchewan River Project: Estimation of Economic, Social and Environmental Effects*. Agriculture Canada. 1988.

49 Faculty of Agricultural and Food Sciences, University of Manitoba. *Sustainability of Canada's Agri-Food System – A Prairie Perspective*. IISD. 1994. p. 140.

the public goods desired by others. Unless values are attached to both the public and private goods along with those arising from their impairment or enhancement, the true cost of production will not be taken into account:

> "There has, in other words, to be a trade-off between what are normally understood as 'economic goods', such as food and chargeable rural leisure services, and the sustenance of less measurable environmental goods. The less measurable or definable services have to be properly valued. -- Society must choose on the basis of a full understanding of the choice in question. That means that the economic value of the environmental cost, if one is to be incurred, must be understood." [50]

During the process of production, land may be degraded as a result of a producer's actions which may be encouraged by the instruments of government policy. Habitat may be destroyed in the process. This illustrates the need for soil conservation as degradation affects both the producer and those using the services produced. Often, the producer is unable to capture all the benefits of conservation. Determination of how the benefits may be achieved therefore presents a problem even though the results of conservation are very apparent in purer air, less sedimentation in streams, greater wildlife habitat and other benefits.

The above situation has led to a search for effective means by which the desired end may be achieved. Such means include government regulation, purchase of property rights, financial incentives or fines, cross compliance in government policies, and moral suasion. However, much attention has also been given to valuation of the benefits and the costs to the environment as well as to the returns from production. In this connection Adamowicz makes the following statement:

> "In the analyses of sustainable agriculture we are interested in the provision of environmental services, including the production of food, over the long run. Trade-offs between aspects of these environmental services will undoubtedly have to be made. Non-market evaluation provides one form for evaluating the magnitude of these trade-offs. Also, some insight into the relevant policy approach has also been derived from evidence supported by non-market evaluation. The concern over off-site impacts of agriculture implies an externality control policy may be more relevant than on-site productivity policies." [51]

When the market fails to establish value in terms of price, i.e., market failure, there is the potential to have an unsustainable system. Those who pay the full costs of production sometimes do not receive the benefits and conversely sometimes the amount paid does not cover the full costs of production. In agriculture, producers may not be compensated for soil conservation and therefore may not engage in the practice. As a result, for example, sloughs may be drained which remove habitat for wildlife. Thus many air, soil and water quality problems can be traced to market failure.

Where producers harm the environment by contamination of air or water, regulation appears appropriate since the perpetrators of the problem may not easily be identified, rendering enforcement of the "polluter pays principle" infeasible. Tension between agricultural producers and society in the use of the environment will increase unless the common property issue is resolved.

Common property implies that goods are essentially available for the taking. No property rights are involved. A frequent prescription for overcoming the tendency to abuse public goods is privatization. This principle has application to agriculture with respect to land tenure.

A substantial proportion of the land on the prairies is operated by tenants who hold either cash or share leases. Unless the person operating the land is credited with the value of any improvements made, there is little incentive to invest in long term measures such as soil conservation. When land prices rise the tenant may be unable to resist a change in the ownership of the land, some purchasers merely buying the land for speculative purposes or as a hedge against inflation. These individuals have little interest in conservation. The land also may not be sold on the open market and therefore not purchased for its highest production value. This may or may not be synonymous with environmentally benign land use. Furthermore, the tenant has less collateral to use as the base for borrowing funds, the purpose of which would be improving the productivity of the land.

Private property does not resolve the issue of external effects imposed by one owner on another unless both parties can negotiate the externality. In order to achieve a situation conducive to soil conservation it becomes essential that the responsibilities of the tenant and the landlord be carefully spelled out with the agreement covering an extended period of time. [52]

The present pattern of land tenure on the prairies may therefore have implications for maintenance of the soil resource and ultimately on the sustainability of agriculture. As inferred by Pearce and Warford, absence of operator ownership has degradation.

50 Agri Europe. *Agriculture and the Environment: How Will the EC Resolve the Conflict?* Special Report No. 60. 1991. p. 25.
51 Adamowicz, W. L. “Valuation of Environmental Amenities”, *Canadian Journal of Agricultural Economics* , Vol. 39, No. 4, Part 1, 1991. p. 615.
52 Pearce, D. W. and J. J. Warford. *World Without End*. World Bank, 1993. pp. 248-250.

Table 3.6 indicates that during the 1971 to 1986 period the proportion of the land operated by owners on the prairies declined from 69 to 61 percent. The proportion of the land operated by those renting or holding leases rose from 31 to 39 percent. Over the five year period 1986 to 1991, the respective proportions remained relatively stable. Nonetheless, tenancy remains an issue holding forth the prospect of affecting the sustainability of agriculture on the prairies.

Economic Situation

Economics plays a major role in the sustainability of agriculture. To be sustainable, agriculture must be economically viable. That is not to imply that all producers or all forms of production must be viable in any region at a particular time. Variations in the returns are necessary and indeed desirable. They stimulate change in the mix of products produced, thereby achieving consistency with the demands of the market.

The emphasis on grain production on the prairies combined with the associated dependence on export markets has rendered the prairie region highly susceptible to changes in the world economy. Trade policies of other nations can and do impact severely on the region. In consequence, government has been moved to alleviate the ensuing distress through various programs of assistance.

Farm income received from the marketplace has varied significantly over time, a pattern no more evident in any combination of products than in grains and oilseeds. In recent years, shortfalls of producer income have been partly assuaged by large infusions of government funds. The magnitude of these infusions is very impressive. Total federal government assistance programs for the grains and oilseeds sector reached $3,923 million in 1991/92.[53] As a result, the fluctuations in farm income were much less than they otherwise would have been, thereby reducing the financial stress of many producers. While the money was very acceptable on the part of the recipients, little was accomplished in terms of reorienting of agriculture on the prairies in a more sustainable direction. Land prices were maintained at levels higher than those which could be supported by returns from the market. Desirable change in farm structure was retarded and little change occurred in the mix of products produced.

Data on the relative stability of farm cash receipts on the prairies are presented in Table 3.7. A propensity for receipts from the six major grains to decline is evident during the 1987-91 period, a decline of 12 percent being

Table 3.6
Farm Tenure, Prairie Provinces by Census Years, 1971-1991

	Manitoba	Saskatchewan	Alberta	Prairie Provinces
	percent of total area in farms			
Owned				
1971	74.0	70.9	64.4	68.8
1976	71.4	69.0	64.3	67.6
1981	66.9	67.6	64.9	66.5
1986	62.9	62.1	58.4	60.8
1991	62.9	61.1	59.2	60.7
Rented or Leased				
1971	26.0	29.1	35.9	31.2
1976	28.6	31.0	35.7	32.4
1981	33.1	32.4	35.1	33.5
1986	37.1	37.9	41.6	39.2
1991	37.1	38.9	40.8	39.3

Source: Calculated from Statistics Canada, *Agricultural Profiles*, Census of Canada, 1991.

53 Agriculture Canada. *Part III Expenditure Plan, Estimates.* 1993.

recorded. Meanwhile receipts from other crops increased by 12 percent. Receipts from sales of livestock and livestock products increased by 8 percent. During the same period, program payments declined by 47 percent. The net result was that total receipts declined by 4 percent. The program payments while enhancing income stability on the prairies also can be said to have limited the urgency for needed farm adjustment.

By providing subsidies to producers to reduce food costs, consumers are limited in their ability to choose where they want to spend their money. Consumers are essentially supplying the producers with subsidies for food production. Yet it is possible that consumers are more interested in spending their money on products which provide them with greater satisfaction. The government subsidies force all taxpayers to assist in lowering food costs. When all externalities are accounted for in the price, consumers who would rather spend their money on something else are made worse off, as are those who would spend their money on other products that have lower production costs. Moreover, the viability of those businesses where the consumer's funds would otherwise have been spent comes into question.

Government infusion of funds to agriculture cannot be expected to continue as it has because deficits have accumulated to the extent that any additional debt is difficult to support. Under this situation it becomes necessary to rely on the marketplace for returns, rendering an even more satisfying resolution, at least in part, to the trade issue through the new GATT agreement. A more diverse agriculture on the prairies appears desirable, particularly between farms. Unfortunately, transport policy runs counter to indications from the marketplace that a more livestock oriented farm economy would provide increased returns and absorb greater quantities of the grain produced. Such an economy would enhance the sustainability of agriculture.

While it has been argued that higher prices for products would overcome the economic problems of agriculture, history has shown that this is not necessarily the case. Changes in farm structure occur in high price periods as producers in favourable financial circumstances, or those willing to assume high levels of debt bid up land prices. In low price periods, structural change continues as the farms of those who leave the industry are purchased by those having more capital. Regardless of government assistance policies, structural change continues. On the prairies, this structural change is driven by changing technology in grain production. This technology entails minimum tillage practices that utilize improved cultivation and seeding equipment, materials which are economically feasible only when used on large acreages. While this technology is positive for sustainability, substantial structural change is occurring that is rendering many farm workers surplus.

Table 3.7
Farm Cash Receipts, Prairie Provinces, 1987-91

Income Source	1987	1988	1989	1990	1991*
			million dollars		
Six Major Grains**	4,837.9	4,635.1	4,396.9	4,397.5	4,280.7
Other Crops	461.3	475.6	488.6	541.7	574.2
Livestock and Products	558.4	3,749.2	3,828.5	3,962.8	3,850.3
Program Payments***	2,602.3	2,378.9	2,209.5	964.9	1,373.3
Total (as calculated)	10,459.9	11,238.8	10,896.5	10,046.9	10,078.5
			percent		
Program Payments/Total	24.9	21.2	20.3	9.6	13.6

* Preliminary

** Wheat, Oats, Barley, Rye, Flaxseed, Canola.

*** Crop Insurance, NISA GRIP, WGSA, ASA Price Stabilization, ASA Tripartite Plans, Provincial Stabilization Plans, Dairy Subsidy, Other Payments

Source: Derived from Canada Grains Council, *Statistical Handbook 92*, 1993.

Where farms specialize in grain production, significant underemployment in farm activities occurs during a substantial portion of the year.

Under existing economic conditions, additional income is needed to support the farm and farm family. Off-farm employment is often undertaken, initially as a means to overcome a short term economic crunch. Later, off-farm employment becomes a deliberate choice to diversify and raise the level of family income in order to enjoy the amenities available in urban areas. [54] While technology in agriculture has enabled farm men to enter the off-farm labour force, participation by farm women has been rendered feasible by labour saving devices in the home and a reduction in family size. A substantial proportion of farm women are therefore able to capitalize on their training by obtaining employment at the professional and managerial levels in nearby communities. Improved transportation facilities have rendered feasible greater commuting distances from the farm to the employment site.

Off-farm employment may be said to represent a partial adjustment of labour away from agriculture while continuing farm production. This measure enables the attributes of rural living to continue to be enjoyed. Over time the returns from off-farm employment may outweigh those received from agriculture.

Off-farm employment income has become a substantial proportion of the total income received by farm families. While off-farm income represents a proportionately larger share of total income for families on small farms than on large farms, it represents a significant proportion of the total received even on high-income farms. Off-farm income is expressed in terms of total farm operator income in Table 3.8. Members of farm families have to compete in the same labour markets for the off-farm proportion of their incomes as the rest of the population. In order to compete they must have at least the same level of skill and education.

In rural areas, there is need for wealth-generating activities other than agriculture to utilize fully the labour available, particularly on grain farms, and to provide greater economic stability to these areas. Progress is being made as service and other industries expand in these areas. One such example is the location of production of new-technology farm equipment in rural areas that possess the necessary infrastructure.

The above data indicate that on average about half or more of the income received by farm operators comes from non-farm sources. The proportion declines as income rises. The proportion of operator income received from off-farm sources remains significant, even for those operators having incomes of $250,000 or more where the off-farm income received exceeded $37,500 per operator. The proportion of off-farm income declined as farm-operator income increased, the range for the individual operator income classes being 58.0 to 24.2 percent in 1990 and 59.7 to 38.0 percent in 1991.

Social Problems on the Plains

Rural communities have been under considerable stress in recent years. Many have been in a decline evident for decades. There are numerous reasons for this decline, some at arms length from the price of grain. A primary reason for the decline has been the substitution of capital for labour on the farm. Mechanization has increased productivity per person enabling consolidation of farm units with an attendant out-migration of people formerly on the land. The recent change in grain production technology is the latest example of a long line of similar developments. All have resulted in less people remaining on the land.

Fewer people left on the land reduces the potential customers for businesses in the local towns and hamlets. However, another factor has also been at work. [55] That is the advent of continuous improvement in the road transportation system. Coincident with this improvement has been a change in the shopping patterns of rural dwellers who have developed urban tastes which can only be satisfied at larger centres where a greater variety of goods is available at competitive prices. Rural dwellers are now prepared to go to the larger centres to obtain the services desired and in the process bypass the local centres, eventually leading to the demise of the latter. Thus while these local centres have suffered the major centres have expanded.

Perhaps in no other area is consolidation more evident than in the school system. The demand for provision of improved school services at an acceptable cost has given rise to the busing of students from rural areas to central towns or cities. The role of the school as the centre of many farm communities has now disappeared. As well, many rural post offices have closed.

Provision of infrastructure in rural areas initially absorbed much of the labour surplus to agriculture. Other local

54 Olfert, M. R. *Off-farm Labour Supply With Productivity Increases, Peak Period Production and Farm Structure Impacts.* Dept. of Agricultural Economics, University of Saskatchewan. June, 1993.

55 Stabler, J., M. R. Olfert and M. Fulton. *The Changing Role of Rural Communities in an Urbanizing World,* and Stabler and Olfert, *Restructuring Rural Saskatchewan: The Challenge of the 1990s*. Canadian Plains Research Centre, Regina, 1992.

Table 3.8
Off-Farm Income * as a Proportion of Total Operator Income ** by Income Range, Prairie Provinces and Canada 1990 and 1991

	Income Range					
	$ thousand					
	10-24.9	25.0-49.9	50.9-99.9	100.0-249.9	over 250.0	all ranges
1990	percent					
Canada	99.3	79.0	53.7	30.9	29.1	59.6
Manitoba	99.0	76.7	48.8	27.1	18.3	56.9
Saskatchewan	90.5	68.8	43.5	28.2	24.2	54.6
Alberta	100.3	83.2	61.1	37.5	35.9	66.3
1991						
Canada	98.1	79.3	47.9	25.2	18.8	55.5
Manitoba	94.5	73.1	42.4	21.1	15.2	47.6
Saskatchewan	86.6	65.8	39.6	23.5	19.8	50.0
Alberta	n/a	82.3	55.2	32.3	24.8	63.8

n/a not available

* Includes wages and salaries, net off-farm self employment, investment income, pension income and other off-farm income.

** Includes off-farm income and operating revenues less operating expenses.

Source: Statistics Canada, *Agricultural Financial Statistics* , 21-205.

industries such as farm machinery manufacturing also provided jobs along with other activities. However, over time jobs from these sources tapered off as service industry jobs increased. This did little to stabilize rural communities.

Recently, however, two developments changed the dismal prospects of some local communities. The desire of persons in the city for a more tranquil living environment has resulted in communities adjacent to the cities becoming "bedroom communities". In addition, telecommunications have taken over service tasks in remote areas formerly performed by people. Examples include insurance record keeping and payroll services. Improvements in computer controlled automation have enabled specialized farm production units, such as those for broiler production, to achieve the economies previously only attainable by large "factory in the field" types of operations.

The depopulation of rural areas has major implications on local services for those remaining. The previous local social centres, such as the school, the church and the community hall have been replaced by those more remote. Health services have likewise changed, with doctors and hospitals being located in the larger rural centres. The services remaining tend to be at a distance and entail additional transportation costs.

The decline of the local community has been said to bear a relationship to the sustainability of agriculture. [56] Such a relationship can only be considered indirect as it reflects changes in farm technology and markets which may or may not be conducive to sustainability. The new rural map being drawn as a result of the redistribution of population on the plains reflects changing tastes and social structures. In as much as the redistribution is the result of economic forces, it can be stemmed only by greater employment opportunities in rural areas. While nostalgia may prevail

56 Stabler, J. and M. Olfert. *Farm Structure and Community Viability in the Northern Great Plains.* University of Saskatchewan. April, 1992.

for rural living, government policies should be built on economic opportunities which foster diversification in these areas. [57]

The situation in Saskatchewan provides valuable insights into the impact of greater diversification in agriculture upon service centres. Southern Saskatchewan is marked by either large farms following a grain monoculture or large scale ranches. Both require relatively few individuals to operate with the effect that population declines. A somewhat different situation prevails in northern Saskatchewan. Agriculture there is more diversified, with the population increasing. This growth becomes important both for the well-being of service centres and for the development of manufacturing. However, evidence of any reversal of a decline in trade-centre status as a result of manufacturing is uncommon.[58] The same situation applies to mining operations at a distance from major wholesale/retail centres. Manufacturing or mining centres in relative proximity to the major wholesale/retail centres take on the attributes of bedroom communities without a commercial structure.

Stabler et al,[59] indicate that provincial and federal governments have taken advantage of emerging technologies in an effort to provide services in a cost-effective manner. The same governments selectively attempted to offset the negative effects that inevitably followed by retaining unused or seldom used facilities or distributing infrastructure investment so that expenditures were made in as many communities as possible. In the process, consolidation was accelerated while funds were wasted which could have been used to ensure a complete complement of infrastructure at selected locations. While it would be theoretically possible to create employment opportunities in enough rural communities to slow or prevent further consolidation, this option is not realistic.[60]

Pursuit of cost-minimizing efficiency in infrastructure investment would be less expensive than the course followed previously but would result in further consolidation of rural communities. By coordinating the efforts of governments and private organizations, the preservation of more rural communities without a major sacrifice in efficiency would become possible. Stabler et al are partial to trying the coordination approach in an

Table 3.9
Agricultural Exports and Receipts in Relation to Total Exports, Canada, 1982-91

	Total Exports	Farm Cash Receipts	Agricultural Exports *	Ag Exports/ Total Exports	Ag Exports/ Farm Cash Receipts
		$ million		percent	
1982	81,825	18,871	8,936	10.9	47.4
1983	88,155	18,832	9,206	10.4	48.9
1984	109,437	20,408	9,775	8.9	47.9
1985	116,145	19,690	8,306	7.2	42.2
1986	116,733	20,415	7,892	6.8	38.7
1987	121,462	21,055	8,315	6.8	39.5
1988	134,853	22,020	9,674	7.2	44.0
1989	134,843	22,540	8,237	6.1	36.5
1990	141,720	21,578	9,516	6.7	44.1
1991	138,326	21,415	9,899	7.2	46.2

* Does not include fish, fish products, furs or distilled beverages.

Source: Canada Grains Council, *Statistical Handbook 92*, 1993.

57 Stabler, J., W. Brown and M. Olfert. *Socio-economic Impacts of the Poundmaker Feedlot – Ethanol.* University of Saskatchewan. September, 1993.
58 Stabler, J. and P. Molder. *Rural Manufacturing Industry: Products, Markets, and Location Requirements* . University of Saskatchewan. March, 1992.
59 Stabler, J. et al, Op cit. 1993. pp. 98-99.
60 Stabler, J. and M. Olfert. *Windows of Opportunity*. University of Saskatchewan. March, 1993.

attempt to preserve more rural communities at a minimum cost to society.

IMPACTS OF TRADE ON SUSTAINABILITY

Canada is a major exporting country. Agriculture accounts for a significant share of the total value of exports from the country, Table 3.9. In recent years, the proportion has declined somewhat with agricultural exports remaining relatively stable as the value of total exports from the country increased substantially. The volume of grain exports continues to be impressive as will be observed from Table 3.10.

Given the dependence on the export market for a substantial share of cash farm receipts, as indicated in Table 3.9, there is a national interest in trade policy. This is reflected in the CUSTA, the NAFTA and the GATT negotiations. During the 1982 to 1991 period, the value of agricultural exports represented from 36.5 to 48.9 percent of farm cash receipts. Most of the agricultural exports emanate from the prairie region. Income from exports of grain in particular has suffered in recent years from the export subsidy practices engaged in by the EEC and the U.S. While agriculture has been dealt with in the present (Uruguay) Round of the GATT negotiations, interest remains high among producers. Some of them foresee improvement in their competitive position. Others, primarily those operating under supply management who were concerned that their privileged position might be eroded, have been partially satisfied at least in the short run by the protection of tariffs at levels which others consider "obscene".

Table 3.10
Bulk Exports of Grain, Canada, 1981/82 to 1990/91

thousand tonnes	
1981/82	26048.8
1982/83	28295.4
1983/84	29941.1
1984/85	22025.2
1985/86	23220.9
1986/87	30111.8
1987/88	30351.0
1988/89	17921.3
1989/90	24712.6
1990/91	29252.5

Source: Canada Grains Council, *Statistical Handbook 92*, 1993.

Success of the Uruguay Round of multilateral negotiations hinged on a successful agreement being reached for agriculture. In order to expedite progress, Arthur Dunkel, when Director General of the GATT, took a direct role in the negotiating process. His proposal became the basis for the subsequent negotiations on agriculture. Rude, Massow and Martin [61] have provided an invaluable summary of his proposal and an assessment of its effects if adopted.

The GATT is based on the philosophy that market forces should be the primary factor driving international economic adjustments. The basic objective is the removal of impediments to trade. The GATT is a commercial agreement consisting of 38 articles which spell out the guidelines under which trade is to be conducted. The first part of the agreement is built on two principles, namely, that signatories not discriminate against the products of another member (most favoured nation (MFN) treatment) and that members do not raise import tariffs above agreed levels. Import quotas are condemned in the GATT charter. Attention focuses on eliminating import quotas and other non-tariff barriers and replacing them with tariffs.

The second part of the agreement impacted heavily on agriculture since it dealt with prohibition of quantitative import restrictions, customs regulation, state trading, anti-dumping and countervailing duties, dispute settlement and escape provisions. Two articles of this agreement were of particular importance to Canadian agriculture: Article XI which prohibited import quotas except where domestic output of agriculture and fishery products was restricted; and Article XVI which prohibited export subsidies except in the case of agricultural products. Protection for Canada's supply management programs was provided under Article XI(c)(1), this being initially introduced to allow the U.S. to protect its farm programs under Section 22 of the U.S. Agricultural Adjustment Act. The EEC was allowed to use variable import levies, these not being specifically excluded under the GATT. Furthermore, the GATT defined no limits on domestic assistance to agriculture.

These exemptions allowed developed nations to provide high levels of support to agriculture. The result was that surplus grain stocks accumulated, international prices were depressed, trade disputes developed, and trade patterns were created which were inconsistent with market forces. It came as no surprise that agricultural negotiations

61 Rude, J., M. von Massow and L. Martin. *Implications of the Dunkel Proposal for an Agreement in GATT on the Canadian Agriculture and Food Sector.* George Morris Centre, Guelph. August, 1992.

centred around the elimination or modification of the exemptions. Furthermore, new areas were negotiated, these including services, intellectual property and textiles. The negotiations therefore became very complicated. Some countries vowed that if progress was not made on agricultural trade they would not sign the document.

Dunkel attempted to overcome the impasse which developed in negotiations by putting forth his proposal. Its provisions extended to four broad categories: market access, domestic support, export competition, and sanitary and phytosanitary regulations.

1. Market Access

There were four components to market access:

1. Conversion of all non-tariff border measures to tariffs (tariffication) equivalent to the level of import protection during the 1986 to 1988 period.
2. Average tariff reductions of 36 percent across all agricultural products during the 1993-1999 period with the minimum reduction of an individual tariff of 15 percent.
3. Minimum market access to imports using a tariff rate quota mechanism allowing a certain proportion of a country's domestic consumption being available to imports at a preferential tariff rate; equal to 3 percent of domestic consumption initially rising to 5 percent by 1999.
4. A safeguard mechanism to temporarily limit import surges or to take into account price declines.

2. Domestic Support Provisions

Domestic programs were classified as "green" or "amber". "Green" programs were permissible and not subject to mandatory reduction. "Amber" programs were inconsistent with GATT principles and expenditures on them would have to be reduced. "Green" programs were those which were generally available to all forms of agricultural production. "Amber" programs were lumped together and their financial cost measured in terms of an aggregate measure of support (AMS). "Green" programs provide price support to producers other than those in such areas as research and extension, disease control, food aid and direct payments to producers not related to either price or output.

"Green" programs are considered non-countervailable. Measurement of the support of "amber" programs was defined in terms of price support, direct payments and other payments such as input subsidies and measures to reduce marketing costs. Expenditures on "amber" programs must be reduced by 20 percent from 1993 to 1999, a maximum limit of assistance being established.

3. Export Subsidies

Export subsidies must be reduced on agricultural products. This reduction will bring agriculture under a discipline similar to that for other products. A prime example of such a subsidy is that provided under the *Western Grain Transportation Act.*

During the six year period, 1993 to 1999, expenditures on export subsidies are to be reduced by 36 percent from the 1986 to 1990 period, and the volume of product on which export subsidies are paid must be reduced by 20 percent.

4. Sanitary and Phytosanitary Provisions

Under Dunkel's proposal, an attempt was made to limit use of health and sanitary regulations as non-tariff barriers. The thrust is toward working toward international harmonization of standards and practices.

The proposal also contained a dispute-settlement mechanism, *The Understanding on Rules and Procedures Governing the Settlement of Disputes,* which would be of major benefit to agriculture. Furthermore, adoption of the Dunkel proposal would shift agricultural trade policy away from a protectionist course.

Rude et al state:

> "The implications of these recommendations by Mr. Dunkel go far toward putting agriculture under the disciplines of the GATT. The new rules would give agricultural products equal status with industrial products. Import quotas would be forbidden for agricultural products just as they currently are for industrial products. These reforms would reduce export subsidies materially. GATT reform would convert the U.S. waiver from its GATT responsibilities, and the European community variable input levies, into equivalent tariffs. The proposed agreement would put discipline into the use of public monies to encourage agriculture, while at the same time defining more clearly what types of public expenditure are subject to countervailing duties." [62]

They continue:

> "The pre-1990 status quo is simply a figment of history. Canada needs to develop long-term policies for agriculture in the future. Those policies need to be consistent with international rules. They need to be developed with assurance that Canadian agriculture will not continue to be victimized by U.S. Trade Law. Most importantly, it is time the

62 Ibid, pp. 38-39.

> uncertainty ended so that Canadians can get down to the business of demonstrating their ability to compete." [63]

Agreement on Dunkel's proposal would have required existing national agricultural policies to be compromised, including those of Canada. The EEC and the U.S. could not agree on adopting Dunkel's proposal as written. They did agree to overcome some of their differences in the agricultural component of the Uruguay Round and to reach a settlement on their oilseed dispute. The agreement was termed the Blair House Accord (BHA). In the process, changes in the final draft of Dunkel's proposal were agreed upon. These changes related to domestic and export subsidies.

1. Domestic Subsidies

The modifications agreed to were as follows:

1. All domestic supports, commodity specific, and non-commodity specific, became included in the calculation of the base period 1986-88 sector-wide aggregate measure of support (AMS) for all of agriculture.
2. Under the BHA, countries would undertake to reduce the sector-wide support by 20 percent in equal parts during the implementation period. This declining ceiling would define the maximum permissible total subsidy expenditure for all of agriculture during the six year implementation period.
3. Under the BHA, "green" programs would be exempt from all trade action including countervailing duties (CVD) only to the end of the implementation period.
4. In addition to the two categories of domestic subsidies, "green" and "amber", the BHA created a new category of domestic subsidy, "production limiting", which may be referred to as the "blue" category. This category of support would not be subject to reduction commitments and would be exempt from trade action other than countervailing duties so long as the expenditure level on a commodity basis did not exceed the 1992 level.
5. A crop-based program would have to meet the "production limiting" provision (e.g. set asides etc.) and one of two additional criteria in order to qualify as "blue", these being that payments are based on fixed area and yields or payments are made on 85 percent or less of the base level of production.
6. Programs existing in 1986-88 and which would be classified as "non-amber" at that time, would be counted in the base AMS. If these programs had been changed after 1988 such that they met the "blue" or "green" criteria they would not be counted in the calculation of future AMS's.

2. Export Subsidies

Under the BHA, countries would have to reduce export subsidies by 36 percent in terms of expenditure and 21 percent in terms of volume. A modest degree of flexibility is provided in the implementation of the reductions in export subsidies.

While disagreement continued to prevail during the Uruguay Round negotiations with respect to agriculture, indications were that Dunkel's proposal as modified by the BHA would be adopted regardless of the positions being taken by some of the countries involved in the negotiations. The EEC and U.S. farm support systems were essentially converging regardless of the negotiations. The opposition of France was felt to be without substance.

As stated by Agri-Europe:

> "...although the developed world undoubtedly needs a Uruguay Round agreement for broad world trade and macro-economic reasons, the agriculture chapter of the Round is becoming almost daily more irrelevant. In fact, current development of individual domestic policies - the 1990 U.S. Farm Bill and the MacSharry reforms being outstanding examples - and future production trends themselves have an automatic liberalizing effect. If nothing else, the French proposals will have the important effect of concentrating minds on the new realities of the world agricultural situation". [64]

The New GATT Agreement

Following protracted negotiations, a new GATT agreement was reached on December 15, 1993. The agreement is both comprehensive and complex. The preamble to the agreement concerning agriculture spells out the objective desired with respect to trade and the general attitude of those countries participating in the negotiations. The preamble is quoted below:

> "Members,
>
> Having decided to establish a basis for initiating a process of reform of trade in agriculture in line with the objectives of the negotiations as set out in the Punta del Este Declaration;
>
> Recalling that the long-term objective as agreed at the Mid-Term Review "is to establish a fair and market-oriented agricultural trading system and that a reform process should be initiated through the negotiations of commitments on support and protection and through the establishment of

63 Rude et al, Op cit. p. 40.
64 Agri-Europe. Brussels. September 3, 1993. p.2.

strengthened and more operationally effective GATT rules and disciplines";

Recalling that "the above-mentioned long-term objective is to provide for substantial progressive reductions in agricultural support and protection sustained over an agreed period of time, resulting in correcting and preventing restrictions and distortions in world agricultural markets";

Committed to achieving binding commitments in each of the following areas: market access; domestic support; export competition; and to reaching an agreement on sanitary and phytosanitary issues;

Having agreed that in implementing their commitments on market access, developed country members would take fully into account the particular needs and conditions of developing country Members by providing for a greater improvement of opportunities and terms of access for agricultural products of particular interest to these Members, including the fullest liberalization of trade in tropical agricultural products as agreed to at the Mid-Term Review, and products of particular importance to the diversification of production from the growing of illicit narcotic crops;

Noting that commitments under the reform program should be made in an equitable way among all Members, having regard to non-trade concerns, including food security and the need to protect the environment; having regard to the agreement that special and differential treatment to developing countries is an integral part of the negotiations, and taking into account the possible negative effects of the implementation of the reform program on least-developed and net food-importing developing countries;

Hereby agree,...." [65]

The Articles which follow outline the terms of the Agreement as to market access, safeguards, domestic support commitments, export subsidy commitments, sanitary and phytosanitary measures, implementation of the commitments and dispute settlement. Further detail will be forthcoming prior to the final signing of the Agreement by the participating countries. Since a degree of compromise was required to reach agreement the proposals of Dunkel were not fully adopted.

The new agreement augurs well for Canada. Grain and oilseed producers may be slightly better off since subsidy wars are not entirely suppressed. At the same time, the benefits to red meat producers will be positive though limited. Losses to dairy and poultry producers will also be limited. As Rude et al [66] infer, completion of the Uruguay round will provide a more predictable agri-food business environment and allow Canadians to demonstrate their ability to compete. The replacement of tariffs by import quotas for supply-managed commodities can be expected to shield producers from competition in the short run to the disadvantage of processors and other users of these commodities. Major adjustments are now necessary in some agriculture policies. An improved dispute settlement mechanism is provided which could be beneficial to Canadian agriculture. The encouragement given to trade by the general reduction in tariffs and non-tariff barriers is of major advantage to a trading nation such as Canada while also providing an impetus for economic growth.

The objectives of the GATT negotiations were comprehensive. The belief that trade may be environmentally beneficial since it increases incomes was enunciated. Restrictions on trade were held to be a less efficient means of protecting the environment than are international agreements on common goals and standards. Unfortunately, attainment of these objectives proved to be very difficult if not impossible. Difficulties in the international sphere stimulated discussions leading to regional trade arrangements. Foremost amongst these have been those between countries in the EEC, the Canada-United States Trade Agreement (CUSTA) between Canada and the United States, and the North American Free Trade Agreement (NAFTA) amongst Canada, the United States and Mexico. Trade agreements have stimulated countries to rely more on market forces than on market intervention in establishing prices. Associated policies have been the privatization of state industries and reductions in government expenditures and regulation.

TRADE AND THE ENVIRONMENT

Concern over trade policies and their impact on the environment led to the following statement by the United Nations Conference on Environment and Development (UNCED):

> "Environment and trade policies should be mutually supportive. An open, multilateral trading system makes possible a more efficient allocation and use of resources and thereby contributes to an increase in production and incomes and to lessening demands on the environment. It thus provides the additional resources needed for economic growth and development and improved environmental protection. A sound environment, on the other hand, provides the ecological and other resources needed to sustain growth and underpin a continuing expansion of trade. An open, multilateral trading system, supported by the adoption of sound

65 General Agreement on Tariffs and Trade, *Agreement on Agriculture*. MTN/FA II-A1A-3. December 15, 1993. p. 1.
66 Rude et al, Op cit. p. 40.

> environmental policies, would have a positive impact on the environment and contribute to sustainable development." [67]

Notwithstanding the choice of words by the Commission, one of the most contentious issues remains, that of dealing with externalities and internalization of costs. It is argued that trade negotiations should now be directed toward encouraging internalization of these externalities either through regulation or other economic instruments. Some forms of environmentally sound practices are not allowed under the GATT rules. Furthermore, countries or firms which attempt to raise prices to cover the environmental costs of production are likely to be priced out-of-the-market by others not so disposed. In no case was this concern more obvious than during the NAFTA discussions where environmental and labour practices in Mexico led the U.S. to attempt to extend its jurisdiction to the other countries involved, Canada and Mexico, through extraterritorial action. Unfortunately, much of this action can only be seen as a covert means of restricting trade.

Pearce and Warford [68] state that given the large gains to be obtained from free trade, policies that restrict trade for environmental purposes must be approached with caution. All other approaches to reducing environmental damage should be exhausted before trade policy measures are contemplated. They state that there are four results of free trade which have implications for the environment. These include: an increase in economic activity which tends to drag more materials and energy through the economic system; a potential industrial and agricultural reorganization to capture the economies of scale made possible by larger markets; neglect to take into account environmental losses in the same fashion as does production for the domestic markets; and removal of subsidy systems which in turn lead to a reduction in output. While trade liberalization may produce negative environmental externalities, there are also environmental gains. The implications do not mean that free trade should be resisted but rather that the most cost effective policies should be adopted to deal with any externalities. Restricting trade is unlikely to be the most efficient way of addressing such externalities.

The relationship between trade and sustainability comes to the fore with respect to trade in grains and oilseeds. Trade and pricing practices by the EEC encourage potentially unsustainable production practices. Similarly, grain trade policy in the U.S. encourages exports, with minimal attention given to the relationship between production and the sustainability of agriculture. Canada is not immune in this respect since it has essentially fostered exports of grain, particularly wheat, so as to retain a share of the world market regardless of the costs in terms of potential pollution and the deterioration of the soil resource. If the costs of all externalities were incorporated into total production costs, the volume and the value of trade could dramatically change. Furthermore, this change in trade (and attendant increase in world prices) could be beneficial to agriculture in many developing countries now serving as sinks for the grain exports of the developed countries.

Gray and Furtan [69] in their research establish that under current income support and export programs for grain (wheat), the net gains from the present volumes of trade have been negative even without accounting for any adverse effects on sustainability. Their research indicates that Canadian gains from trade would be improved by a unilateral reduction in wheat acreage. Even under multilateral free trade the net gain from wheat exports remains modest.

Any form of trade-liberalizing agreement trades off some domestic sovereignty for some domestic economic benefits, the protests of former Canadian prime minister Brian Mulroney that no sovereignty will be sacrificed notwithstanding. [70] The cost of losing local control over services is difficult to quantify. The cost of losing control over foreign investment may be high. Under free trade such costs can be expected to impact on agriculture and its sustainability. Nonetheless, there is something to be gained by a country such as Canada in development of a sustainable agriculture. The standards established will ultimately have to be adopted by competing exporters and the technologies developed utilized by others. Canada will therefore continue to benefit from the improvements fostered in technology both from its application at home and its subsequent adoption abroad.

FEDERAL AND PROVINCIAL POLICIES

The vision of the future of agriculture presently shared by both the federal and provincial governments is one that is more responsive to the market; which exhibits greater self-reliance; which recognizes regional diversity; and which provides increased environmental sustainability (the four pillars of reform). [71] This vision has proven to be difficult to put into practice. Changes in policy subsequently

67 UNCED, Op cit. *Agenda 21*. 1992.
68 Pearce, D. W. and J. J. Warford. *World Without End*. World Bank. 1991. pp. 299-300.
69 Gray, R. and H. Furtan. "Improving Gains from Trade in Wheat for the Canadian Economy", *Improving Agricultural Trade Performance Under the GATT*. Becker, Gray and Schmitz, eds. 1992.
70 Cosbey, A. and D. Runnalls. *Trade and Sustainable development: A Survey of Issues and a New Research Agenda*. IISD. 1992.
71 Agriculture Canada. *Growing Together*. 1989.

introduced are not necessarily consistent with the vision of environmental sustainability as related to agriculture. Federal and provincial legislation does not necessarily have a common thrust. While federal legislation continues to have the greatest impact on agriculture, provincial legislation also exerts an influence.

Much of the federal legislation is designed to address real or perceived problems arising in the grains industry. By inference, other legislation which would encourage development of a more sustainable agriculture, such as an expanded livestock industry, is given a lower priority. This shortcoming reflects the relative importance attributed to grain, particularly in the prairie region. At the same time, the legislation tends to support an agriculture based on the production of grain largely for export. Some federal legislation, however, is of a general nature, such as farm rehabilitation and farm credit. Other legislation, for example the *Farm Income Protection Act,* has broad application. Additional legislation has bestowed the right for imposition of import controls for producers of specific products for the purpose of regulating the supply available to the market. However, this legislation must be amended to be consistent with the new GATT agreement.

Government policies by commodity tend to have a regional thrust exhibiting a predilection to support the dairy industry in Eastern Canada and the grains industry in Western Canada. This is reflected in the aggregate level of support given to these two industries. The presumed need for these expenditures suggests that these industries require structural adjustment. Maintenance of the status quo through price support gives rise to questions of the impact of these programs upon equity amongst producers. [72] Prairie livestock producers with minimal program support are able to compete in the international market. A transfer of resources on the prairies into the livestock industry therefore appears desirable. It presents the possibility of making agriculture on the prairies more sustainable while reducing financial vulnerability to the international grain market.

Perhaps no other legislation has greater impact on prairie agriculture than that regarding export grain transportation assistance. A major transportation subsidy is paid to the railways for movement of "export grain and grain products". Data as to the extent of this subsidy are provided in Table 3.11. The effect is to enhance local prices for grain on the prairies and thereby adversely affecting the livestock feeding industry, much of whose output must compete in the international market. Other transportation assistance programs such as branch line rehabilitation, the system improvement reserve and the financing and leasing of hopper cars are also directed toward assisting the movement of grain. While the "method of payment" of the transportation subsidy remains a contentious issue, the direction of change which would arise if the subsidy were paid to producers is not in doubt. Cattle production would increase on the prairies enabling an expansion of the feeding industry while hog production also would increase. These activities would diversify agriculture and ostensibly make it more sustainable. It should be noted also that the present "method of payment" is considered inconsistent with the new GATT agreement and will therefore have to be modified.

Under the Constitution, responsibility for agriculture is shared between the federal and provincial governments. The former provides programs national in scope while the latter provides provincial programs, although both cooperate in fields of joint jurisdiction. There is no guarantee that either federal or provincial programs will not be counterproductive to sustainable agriculture. On the other hand, provincial programs can be expected to relate particularly to the concerns of local constituents.

One illustration of an area where the federal and provincial governments have separate policies is that of farm credit. This duplication has been replete with problems. While the thrust of these policies has been to lower the borrowing costs of producers when purchasing assets, particularly for land, the result has been to increase the price of land and thereby raise the costs of production. At the same time, other lenders giving greater recognition to the cash flow of the farm business are discouraged from full participation in the farm credit field.

Provincial legislative programs with respect to agriculture fall into specific categories. These include farm assessments and property tax exemptions; provision of tax credits and exemption from sales taxes; credit; commodity price stabilization; land improvement and development; and training programs. Most of these programs were introduced before any concern was expressed as to their impact on sustainable agriculture. One program impacting on sustainability adopted by all provinces is the rebate or non-applicability of taxes on fuel used for agricultural production. While the thrust of the program is to enhance farm income, it also fosters additional use of a non-renewable resource, fossil fuel. Some of the gains from the provincial programs are capitalized into land values thereby increasing production costs and consequently are not conducive to sustainability. Other programs are of a

72 Wilson, A. G. and L. Hope. *Agricultural Support and Regulatory Programs Which Impinge on the Livestock Industry: A Summary and Critique*. Transport Institute, University of Manitoba. March, 1992.

Table 3.11
Federal Expenditures Under the Western Grain Transportation Act
1987-88 to 1992-93

Year	Expenditures
	$ thousand
1987 - 88	941,234
1988 - 89	777,339
1989 - 90	568,755
1990 - 91	644,937
1991 - 92*	779,320
1992 - 93*	724,500

* Forecast

Source: Agriculture Canada, *Farm Income, Financial Conditions and Government Expenditures Data Book*, August 1993.

"beggar my neighbouring province" type designed to enhance local production. Some programs interfere with comparative advantage in production between provinces.

Even where price stabilization plans have been introduced in cooperation with the federal government, "topping up" of such programs on a provincial basis distorts natural comparative advantage. Each province has a land development program. However, not all the projects are consistent with desirable land use from the point of view of sustainability. All provinces have programs fostering agricultural education in recognition of the fact that the well being of agriculture depends upon the management capabilities of those engaged in the profession.

While much publicity has been given to adoption by governments of programs which foster sustainability, progress in this respect remains slow. Internal reviews of programs with respect to their impact on sustainability continue. The relative lack of progress thus far towards development of policies and programs consistent with sustainability reflects the political process in a democratic society.

GLOBAL CHANGE

Considerable concern has been expressed over the potential for global warming arising from the accumulation of radiatively active gases in the atmosphere. Carbon dioxide and nitrous oxide have been identified as contributors to global climate warming through the greenhouse gas effect in the upper atmosphere. The concentration ratios of these two gases in the atmosphere before the industrial revolution have been estimated as having increased by 26 and 8 percent, respectively.[73] Uncertainty remains as to what climate changes would eventually arise as the concentration of these gases increases. As the content of carbon dioxide in the atmosphere increases, plants respond with increased rates of photosynthesis and reduced rates of evapo-transpiration.

Three strategies for dealing with prospective climate change are possible: do nothing and accept whatever change arises; adopt policies which facilitate adaptive responses; or adopt policies designed to reduce greenhouse gas emissions.[74] The degree to which greenhouse warming is occurring remains a matter of debate. Natural capacities to adapt to the change will reduce the impact of any climatic change. Agriculture is expected to be more affected by climate change than many other sectors of the economy.

Regardless of the strategy adopted for dealing with potential climate change, increased attention is being given to the effects of the individual gases, their source, and how to reduce their emissions. The development of prairie agriculture has contributed to the concentration of both carbon dioxide and nitrous oxide over time.

Following the commencement of cultivation of the prairies, large reductions in the level of organic carbon in the soil occurred. While the proportion of the organic carbon lost was substantial, it accounts for only a few percent of the carbon dioxide generated worldwide by land clearing activities. However, the rate of loss of carbon as the cultivation period lengthens declines quickly and soon approaches a steady state, becoming neutral with respect to carbon dioxide emissions. Farming practices with the greatest potential for retention of carbon in the soil include reduction in summer fallow and use of minimum tillage.

Indeed, proper management practices have been shown to increase the amount of carbon in the soil, removing carbon dioxide from the atmosphere in the process.[75] The extent to which such management practices can abate the greenhouse effect can only be estimated at present. The effects associated with these practices, (change in fossil fuel consumption in tillage and in the manufacture of inputs) have to be considered in relation to the amount of

73 Curtin, D. *Role of Agriculture as a Source and Sink of the Greenhouse Gases Carbon Dioxide and Nitrous Oxide*. Agriculture Canada Research Station, Swift Current. March, 1993.
74 Rosenberg, N. and P. Crosson. *Processes for Identifying Regional Influences of and Responses to Increasing Atmospheric CO_2 and Climatic Change — the MINK Project: An Overview*. U.S. Dept. of Energy, Pub. DOE/RL/01830T-H5. 1991.
75 Janzen, H. H. *Preserving Organic Matter Reduces CO_2 Emission.* Agriculture Canada Research Station, Lethbridge. January, 1992.

carbon dioxide absorbed. It is worthy to note that these management practices also contribute to the sustainability of agriculture.

Less information is available on nitrous oxide emissions from prairie soils. Denitrification losses from prairie soils have arisen under cultivation but the extent to which these have taken place is unknown. In order to understand the role of agriculture with respect to nitrous oxide emissions, it will be necessary to determine the effects of different tillage practices. Nitrous oxide from application of fertilizer can contribute to the total level of emissions. On the other hand, the net impact of agriculture on the accumulation of radiatively active gases in the atmosphere can be expected to be minimal. Most of the accumulation arises from the combustion of fossil fuels.

Canada has made a commitment to stabilize emissions of carbon dioxide and other greenhouse gases at 1990 levels by 2000. If this commitment and similar ones made by other nations are met, dangerous human impact on the climate would be avoided. The greenhouse effect is real, being based on scientific principles. Greenhouse gases keep the earth warm enough to be habitable but the continuing increase of greenhouse gases of human origin, such as those arising from the burning of fossil fuels, holds the potential to raise the global annual-mean surface air temperature to unacceptable levels. It is, however, uncertain as to the rate at which any warming will occur. Existing forecasting models are not consistent in their projections. Indeed, accurate predictions of future greenhouse gas concentrations are limited by an incomplete understanding of the biospheric processes that control the sources and sinks and of the way they may change in the future.[76] It is therefore prudent to limit increases of greenhouse gases of human origin.

The potential impact of any foreseen increase in global warming upon agriculture on the prairies appears limited.[77] The effects of warming on the prairies would be of three types: the direct physiological effect of increased carbon dioxide and other greenhouse gases on crops and weeds; the effects caused by changes in climate; and indirect effects of changes in world agricultural markets induced by the global pattern of climate change.[78] Warming would result in the extension of agriculture northward, but the land there is not suitable for grain production. Extreme droughts could be expected on occasion while the carrying capacity of rangelands would decrease. While yield losses could be expected in some crops, on the whole, losses could be offset by development of drought tolerant and disease resistant crops. Global change elsewhere would decrease cereal production in current high cereal production areas leading to greater demand for cereals of Canadian origin.

The global issue cannot be restricted to the potential impacts of climate change. There is an international development aspect. Development elsewhere can be expected to have a major impact on the sustainability of agriculture as presently understood in the prairie region. Such development has five sustainability dimensions, namely, environmental, economic, political, social and cultural. [79] Environmental sustainability is closely linked with population. Existing resources must be allocated wisely. Achievement of development and environmental sustainability in the developing countries can be expected to be aided by increased agricultural production. Such will reduce the need for imports of food, particularly grain, from a country such as Canada. This reduction may well make mandatory a reorientation of agriculture on the prairies, since a substantial proportion of the grain exported goes to these countries. Sustainability must be considered in the global context. The following quotation appears highly relevant:

> "The pursuit of sustainability is also linked across nations. The globalization of the world economy has eroded the ability of all countries to pursue independent economic policies. The global nature of major environmental threats led to unprecedented international cooperation to address common problems, such as depletion of the ozone layer. As a result of modern communications, political change on one continent can influence change on another. The same communications technology has allowed the dominant cultures to project their values and lifestyles well beyond their national boundaries. The growing interdependence of the community of nations implies that sustainable development must in time become a global goal." [80]

The list of sustainable agriculture issues identified above should not be construed as complete. The abbreviated comments on each will be seen merely to introduce the issue. Each has a degree of complexity which should be recognized. Furthermore, many of these issues are not independent of each other. Agricultural sustainability must be considered within the general context of environmental sustainability within Canada. It cannot be divorced, however, from that in the world at large.

76 Canadian Climate Program Board. *Climate Change and Canadian Impacts:The Scientific Perspective* . CCD91-01, Environment Canada. 1991.
77 Adams, R. M. “Climate, Agriculture and the Environment”, *Sustainable Agricultural Development: The Role of International Cooperation.* IAAE, University of Oxford. 1992. pp. 450-458.
78 Jackson, C. I. *Global Warming: Implications for Canadian Policy* , CCD92-01. Environment Canada. 1992.
79 CIDA. *Sustainable Development: Discussion Paper*. July 15, 1991. p. 6.
80 Ibid. p. 20.

ANALYTICAL METHODOLOGY

The meaning of sustainability remains a subject for debate, particularly in the field of agriculture. Its many dimensions include economic, social and environmental matters. An integrated approach is therefore required if true sustainability is to be achieved. Definition of sustainability becomes difficult since philosophical and value judgments are involved.

The value accruing to society from sustainable development is difficult to measure, particularly for social issues such as the quality of life, equity and poverty alleviation. Indeed, these issues involve value judgments which tend to be influenced by theological views. [81] The question becomes whether the correct end and the means for achieving that end can be determined by using the traditional tools for measurement. Traditional analytical tools nonetheless continue to have their place in measurement of the many other aspects of sustainability. Even in the social realm these tools have much to contribute.

Measurement of sustainability in agriculture is rendered more difficult by the dichotomy of views held by ecologists and economists. [82] Going in one direction are those who analyze sustainable agriculture within the framework of ecology. Going in another direction are those who analyze sustainability within the framework of traditional economics. There may be said to be five major differences between these two disciplines: the time frame normally considered; the degree to which nature as well as humans enter into the analysis; the attitude towards natural and human created capital (ecologists viewing human created and natural capital as complementary with economists viewing these largely as substitutes); the degree to which non-market goods and services are incorporated into the analysis; and the degree of emphasis placed on environmental quality. [83] These differences in views are not insurmountable since both of these disciplines are interested in increasing sustainability. There is therefore value in using available tools for the measurement of sustainability. Pearce and Warford have used these to good advantage in their analyses. [84]

There is a substantial body of knowledge with respect to measurement of the various attributes of sustainability including welfare, public choice, market failure, externalities, private and public goods, and intergenerational equity. Contributions have been made by a large number of researchers to the measurement of sustainability. A distillation of the individual contributions is therefore presented below. These contributions extend to most aspects of sustainability.

CONTRIBUTIONS TO MEASUREMENT OF SUSTAINABILITY

Welfare is an essential aspect of sustainability. It is of prime importance that the welfare of the community as a whole be maximized. Welfare is linked to development. Increased output gives rise to a greater availability of goods to all members of society thereby increasing aggregate wealth. Increased output may in turn impact on the environment. Furthermore, the distribution of goods and services among persons gives rise to questions of equity. Development therefore becomes highly relevant to sustainability. Many contributions have been made to the measurement of welfare, only a few of which will be mentioned here. [85]

Reder [86] gives substance to the meaning of welfare in his indicator that welfare increases (decreases) whenever one or more individuals become more (less) satisfied without any other individuals becoming less (more) satisfied. He also introduces the concept of compensation being paid to the individual being adversely affected by the change, this compensation being made available by an equivalent tax on the individual benefiting — total welfare increasing if the net benefit of the change exceeds zero. Arrow [87] argues that welfare increases even in the case where compensation is possible but remains unpaid. Little further expands Reder's concept and states:

81 Daly, H. E. and J. B. Cobb. *For the Common Good.* Beacon Press, Boston. 1989.
82 Batie, S. S. "Sustainable Development: Concepts and Strategies", *Sustainable Agricultural Development: The Role of International Cooperation*. IAAE, University of Oxford. 1992. pp. 391-402.
83 These differences are outlined in Costanza, R., H. Daly and J. Bartholomew. "Goals, Agenda and Policy Recommendations for Ecological Economics", *Environmental Accounting for Sustainable Development.* Amada, Serafy and Lutz, eds. World Bank. 1989.
84 Pearce, D. W. and J. J. Warford. *World Without End*. World Bank. 1993.
85 Pareto, V. *Cours d'Economie Politique*. Lausanne. 1987.
Pigou, A. C. *The Economics of Welfare*. 4th ed., MacMillan. 1932.
Reder, M. *Studies in the Theory of Welfare Economics*. Columbia. 1947.
Arrow, K. *Social Choice and Individual Values*. Wiley. 1951.
Scitovsky, T. *Welfare and Competition.* Irwin. 1951.
Little, I. M. D. *A Critique of Welfare Economics.* 2nd ed., Clarendon Press. 1958.
Nath, S. K. A *Reappraisal of Welfare Economics*. Kelly. 1969.
Rowley, C. and A. Peacock. *Welfare Economics.* Robertson. 1975.
86 Ibid. pp. 14-17.
87 Arrow, Op cit. p. 38.

> "A change is economically desirable if it results in a good distribution of welfare, and if a policy of distributing money by lump sum transfers could not make everyone as well off as they would be if the change were made." [88]

Reder, Arrow and Little introduce taxes and subsidies as instruments which could be used to increase welfare. Little nonetheless cautions:

> " ... welfare is a subject in which rigour and refinement are probably worse than useless. Rough theory or good common sense, is, in practice, what we require. It is satisfying, and impressive, that a rigorous and logical system, with some apparent reality, should have been set up in the field of the social sciences: but we must not let ourselves be so impressed that we forget its reality is obviously limited; and that the degree of reality is a matter of judgment and opinion". [89]

Scitovsky [90] expands on the work of others by drawing attention to the impact of one person's consumption on another's welfare, whether favourable or unfavourable. An analogous situation arises with respect to production. When production or consumption activities give rise to side effects which may be of benefit to others or inflict costs upon them, these effects are called externalities. Their distinguishing feature is that they are economic creations which do not or cannot go through the market. As a result, some persons receive benefits at no cost to themselves while others incur costs or endure discomforts without compensation.

From an economic point of view, the issue raised relates to efficiency. Decisions should be made after assessing all the costs against all the benefits, regardless of whether these costs are determined by the market. The costs and benefits of externalities are seldom if at all determined in the market place. To achieve true efficiency such costs and benefits (externalities) must be taken into account (internalized). Activities which produce beneficial or positive externalities, in order to ensure an adequate supply of the service is available, are often provided by public intervention. The situation is much different for activities which give rise to negative externalities. Internalization of such externalities implies either taxing the gainers or compensating the losers. These externalities may be of the nuisance category such as noise or even a dust storm caused by improper farm practices; of a capacity category where use of a resource by one person may adversely affect use of the resource by others, as in land used for agriculture versus wildlife habitat; or of a supply category where only a finite resource is available, thereby affecting use by future generations, as in the case of mining. The impact of the latter on future generations may be mitigated by advances in technology which effectively increase the supply of the resource or provide substitutes.

Scitovsky considers negative externalities in terms of the impact of production practices on the environment. He draws attention to issues which have come to be better recognized in the present day. These are the social costs, wastes and pollution associated with production yet not internalized. He introduces the concept of pollutants reaching a critical level beyond which the regenerative powers of nature are unable to cope, a concept so eloquently described by Holling.[91] Environmental externalities are said to be the most difficult to internalize with the state often having to intervene on behalf of the public since the individual responsible for the pollution or other externality may not be readily identified.

Nath[92] devotes considerable attention to the social objectives of society while recognizing the existence of externalities. These objectives vary over time. Achievement of these objectives is attained through policy instruments including taxes, subsidies, direct public investment, the pricing policies of public enterprises and, to a degree, through the actions of private organizations. An individual policy instrument may affect more than one objective, and an objective may be affected by more than one instrument. He expresses economic efficiency in relation to what he describes as social welfare functions. He contends that attaining technological efficiency and being continually innovative are desirable goals, as they would help obviate many resource allocation problems. Though it isn't expressly stated in his work, Nath is a strong supporter of research and development.

Rowley and Peacock [93] devote considerable attention to market failure, the failure of the market to take into account all costs including those associated with externalities. They categorize goods as being of three kinds: private goods where consumption by an individual deprives others of that use, these goods being characterized by production cost as well as consumption cost; public goods which are enjoyed by all, an individual's consumption having no effect on that of others with no

88 Little, Op cit. p. 12.
89 Little, Op cit. p. 279.
90 Scitovsky, Op cit. pp. 268-284.
91 Holling, C. H. "The Resilience of Terrestrial Ecosystems: Local Surprise and Global Change", *Sustainable Development of the Biosphere*. W. C. Clark and R. F. Munn eds. Cambridge University, undated.
92 Nath, Op cit. pp. 146-153.
93 Rowley and Peacock, Op cit. pp. 25-45.

cost attached (even though there may be a related production cost); and mixed goods which possess the characteristics of both public and private goods. Externalities are associated with mixed goods and these give rise to market failure. The two authors introduce public choice as a decision-making tool when dealing with externalities. They devote considerable attention to the problem of pollution and propose a tax rather than a regulatory scheme to maintain water quality (assuming the polluters can be identified). The procedure offering the greatest promise is the establishment of a value for each unit of pollution production, with the water quality entity issuing a share equal to this value. These shares would be offered at public auction, the total number of shares issued reflecting an agreed upon acceptable level of pollution. Polluters would be required to hold shares equal to their level of pollution, the cost of these shares providing an incentive to adopt available technology to eliminate such pollution.

Turner [94] expands upon some of the earlier ideas and divides capital into two parts, environmental and human created. Both provide a stream of goods and services. The natural environment provides among other things:

1. A source of raw materials for production processes.
2. A sink for the waste products of production processes.
3. Life supporting services.
4. Aesthetic goods.

Environmental capital may or may not be substituted by human created capital. It may be depreciated, augmented or liquidated and be used directly or as an input to production processes. [95]

Some think natural resources tend to be finite. Technological improvements, discovery of substitutes and development of new reserves stimulated by rising prices of conventional sources have often resulted in an increase in the abundance of resources, the replacement of coal by natural gas being but one example. These events lead others to believe that the resources available become limitless albeit at increases in cost. Others argue that finiteness has already been reached. Logic would suggest that the true situation lies somewhere between these two rather extreme positions.

Measurement of the level of natural or environmental capital is required if the true costs of production processes are to be determined. Attempts to determine this level have led to pressure to expand National Income Accounting to include valuation of environmental goods and services. Such a valuation is difficult since these are non-market goods and therefore do not have explicit prices. Several approaches have been taken to achieve an evaluation, including: replacement value; property value; contingent valuation; and total economic value. Non-pricing of environmental goods leads to their overuse. But the difficulty of costing environmental goods and the politics of making any price effective frustrates efforts to incorporate their cost into a production process.

The inability to value environmental goods with any pre-determined degree of accuracy renders a true economic benefit cost analysis difficult to achieve. Cosbey comments in this regard:

> "By whatever method, the proper pricing of natural capital is a step toward sustainable development. If it were possible to completely internalize externalities, there would be no need for other types of institutional facilitation, since decisions at all levels would be made on the basis of prices containing all relevant information. The technical difficulties of actually costing natural capital — the political difficulties of implementation, and the problem of determining local shares of global externalities — make this an incomplete solution." [96]

The issue becomes one of determining the safe minimum standard for use of the environment in order to take into account sustainability. This idea was introduced by Ciriacy-Wantrup into benefit/cost analysis. [97]

The following statement by Magrath therefore appears appropriate:

> "Like it or not, we need to focus on marginal improvements in the environment. Economics is pretty good at working at the margins. We already have some perfectly serviceable analytical tools, and with some minor revisions and extensions, such as expanding national accounts to include natural resources correctly (something which should not seem unusual) mainstream economics can go a long way toward understanding and alleviating environmental problems." [98]

94 Turner, R. K. "Sustainability, Resource Conservation and Pollution Control: An Overview", *Sustainable Environmental Management: Principles and Practice* . Beethoven Press, London. 1988.
95 Cosbey, A. J. *Coal Burning for the Generation of Electricity in Nova Scotia. Is It Sustainable Development?* Unpublished thesis, Dalhousie University. 1992.
96 Ibid. p. 40.
97 Ciriacy-Wantrup, S. V. *Resource Conservation*. University of California Press. 1952.
98 Magrath, W. B. "Comment on Regional Sustainable Development by Nijkamp", *Proceedings World Bank Annual Conference on Development Economics*. World Bank. 1991. p. 96.

MEASUREMENT OF SUSTAINABILITY ISSUES

Economy is an ingredient of sustainability along with environment and the well being of people. Four factors present themselves in this regard:

1. Environmental damage is of importance not only because of its economic effects but because it lowers productivity, soil degradation being one example.
2. A greater priority must be given to the environment if economic policies are to be sustainable, such as in agricultural policy.
3. Attention is required to ensure that economic growth is also sustainable growth, such as in the emphasis placed on the production of wheat on the prairies.
4. While raising income continues to be a major goal of policy, the need remains to be aware of the potential trade-offs between increases in income and environmental deterioration, with poverty understood to be a major cause of environmental destruction.

Costs are of paramount importance in production. The relationship of costs to output is reflected in the volume of output which will be made available at alternative prices. Costs may be expressed in terms of the values of the items foregone as a result of using particular inputs in production of a given product. Costs may also be expressed in terms of the funds required to produce the desired product. These costs include those which involve an actual financial outlay and those which do not. The latter costs may be considered in terms of their return if used elsewhere. Time is also a factor in production as it allows plant size to be optimally adjusted in terms of costs and output.

Sustainability requires that all costs be recognized in production. Such costs include the impact on the environment, the effect of present use upon future availability, use of common property, unpriced inputs and even non-use values. Unfortunately, accurate determination of many of these costs is very difficult if not impossible. It is nonetheless essential that these externalities be costed in order to determine the true cost of production of any commodity.

For agriculture to be sustainable all the costs associated with production must be identified and determined whether in the form of direct outlays or of externalities. Establishment of these costs will enable a direct assessment to be made of the economic viability of a particular form of production given the return available. As Gray [99] observed, sustainability may be defined in terms of the flow of income from production. Issues to be considered when measuring sustainability include the discount rate; private versus social costs (detrimental effects or negative externalities); non-market benefits (positive externalities); economic flexibility and income/risk preferences. At the same time a producer surplus is required to sustain farm families. Means to assess each of these relative to agricultural production are discussed below.

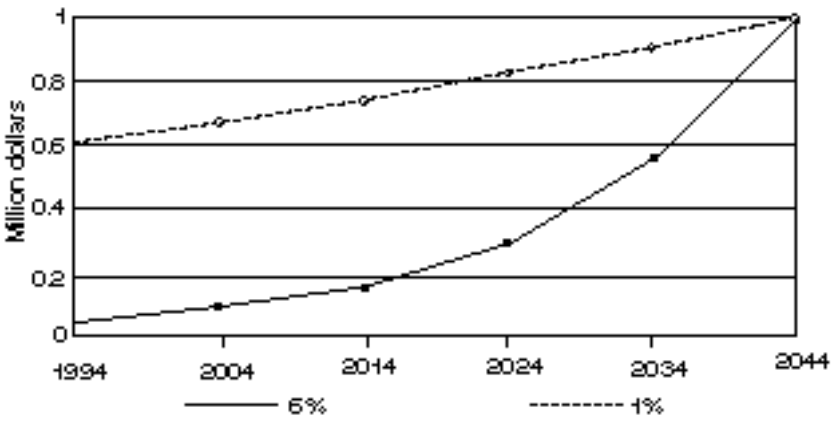
1. Discount Rate

The Brundtland definition of sustainability includes the requirement that equity prevail between generations. In other words, equivalent opportunities should be available to future generations as experienced by the present generation. As applied to agriculture, this requirement infers that equivalent resources be available for use in the future. Equity may be considered to prevail where the prices of inputs used at present are equivalent to those which would be experienced in the future, given a particular discount rate. The price of the input in the future cannot be accurately foretold, since technology may effectively increase the supply available. On the other hand, a particular resource may be capable of being finite, for example wetland contiguous to agriculture which is expected to increase in value over time. Establishing an appropriate discount rate is of significant importance. An input in limited supply is considered to have a high future value. Therefore, in order to encourage restricted use in the present, a low discount rate should be imposed, resulting in higher prices in the market place. The use of energy in agricultural production offers an ideal example. Rather than subsidizing the cost of agricultural fuel, it would appear more appropriate if the fuel was costed in terms of its perceived future value in order to minimize present use and encourage the development of new sources of energy.

An illustration of the impact of alternative rates of interest upon the discounted value of a resource is provided in Figure 4.1. If the resource is valued at one million dollars 50 years hence, its present value, assuming a six percent interest rate in the interim, is $54,290. If it is assumed that a one percent interest rate prevails in the interim, the present value is $608,040. The importance of the discount rate used, once the future value of the resource is established for its valuation at present and intervening years, becomes very apparent.

99 Gray, Op cit. pp. 627-635.

Figure 4.1
Discounted Value at Interest Rates of 1 and 6 Percent of $1 Million in 2044 at Ten Year Intervals, 1994-2044



Source: Standard Discount Calculation.

2. Costing Detrimental Effects Arising from Production (Negative Externalities)

Effects considered detrimental associated with agricultural production include:

1. Herbicide, pesticide and fertilizer residues
2. Degradation of the soil resource, loss in organic matter
3. Destruction of habitat, particularly that of wetlands
4. Excess use of water
5. Contamination of air and water
6. Output of greenhouse gases associated with use of fossil fuels
7. Interference with the natural ecosystem

Methods of costing where no market exists (market failure) are discussed below.

Producers use herbicides, pesticides and fertilizers as aids to production. While the costs of these items are established in the market place, the detrimental effects arising from their use are not costed. Judicious use will minimize any detrimental effects. Furthermore, many of these items are benign to the environment. As an option for those which do have detrimental effects, their true cost could be established by ascertaining the crop losses which would arise from non-use and deducting the original cost of the chemical. This sum could be offered to the farmer in exchange for not using the chemical.

The cost of production in terms of degradation of the soil resource is difficult to establish but easy to identify. One of the proxies for soil degradation is the loss of organic matter. While inept farm practices in the past have given rise to soil degradation, means are at hand for ensuring the present level of organic matter in the soil is maintained or enhanced through cultural practices which provide continuous trash cover. The decline in soil productivity under cultivation has been overcome by the use of technology. Presently, the replacement cost of the soil nutrients as fertilizer may be considered representative of the impact of production on the soil, with this cost included in farm budgets.

Agriculture has a major impact on the habitat of birds and animals. As a result, some species thrive while others decline. In recent years, government policies in combination with the "development of the 40-foot cultivator" have had the effect of encouraging the draining of sloughs and potholes on the prairies and thereby affecting waterfowl habitat. Earlier maintenance of this habitat by the farmer was a positive externality enjoyed by the public. The cost of maintaining this habitat is represented by the amount of money which would have to be paid to the farmer to maintain the wetland and for any crop damage associated with the greater bird population.

Agriculture is by far the greatest user of water on the prairies. Approximately 88 percent of this water is used for irrigation. Unless this water is wisely used, it can contribute to soil salinity. The low prices charged for water encourage excessive use. While most water development projects on the prairies have benefit/cost ratios in excess of unity, there is a tendency not to charge market clearing prices for water in order to encourage irrigation development. However, as pressure increases on the

available water supply there is a need to price this resource according to what the farmer is willing to pay for the water as reflected in the net benefits received from irrigation development.

Confined livestock operations can result in contamination of the air and the water supply. Most of these operations are now required to be benign to the environment through regulation. In these cases, the costs of conforming to the regulations are included in the total costs of production. On the other hand, the effluent and manure produced if properly handled can be a valuable joint product of the operation by increasing soil tilth and fertility. In addition, the technology is available to capture the methane produced for use as fuel and in power generation. The value of these joint products may exceed the costs of any environmental regulation required to make these operations neutral in terms of air and water contamination.

Contrary to the perceptions of many on the prairies, agricultural production uses only about 4 percent of Canada's total energy consumption.[100] Direct energy use includes gasoline, diesel fuel, electricity and heating fuel. Indirect energy inputs are those used in the production of fertilizers, seed, pesticides, herbicides and the energy component of machinery. There is a major potential for reducing the energy used by adopting less intensive tillage systems. In theory, agriculture has the potential to produce more energy than it utilizes. While the cost of energy is significant in agricultural production, the issue of whether the price in the market place relates to real cost remains. Price can be used to encourage conservation and also to lead to an increase in supply. Energy taxes, by increasing price, have this effect. On the other hand, eliminating taxes or even providing subsidies on farm use of fuel have been shown to have the opposite effect. The actual cost of energy is incorporated into the cost of agricultural production. Whether the true cost is thereby reflected remains a moot point.

3. Non-Market Benefits (Positive Externalities) from Agriculture

The positive externalities with respect to agriculture remain largely unpriced. These include such things as value to others of the rural landscape, including the presence of wildlife, and an attractive lifestyle. Most of these benefits involve interpersonal evaluations and cannot be said to reduce agricultural production costs. It is possible to utilize a surrogate market technique to establish the net value of country living. Where housing of the same quality is available both in a city and a rural setting, the net additional costs associated with country living — increased travel, a different tax base, local recreational and other services, and less free time — become a measure of the value of a rural lifestyle.

4. Risk and Uncertainty

These add to farm costs and where commercial risk-taking or insurance firms establish premiums, the premium becomes an input cost. Not all risks and uncertainties can be offset by insurance. Agricultural production is subject to the vagaries of nature. Receipts from the market place vary greatly over time. The result has been agricultural policies which attempt to stabilize returns and to offset losses arising from natural causes. None of the policies developed thus far have been entirely successful. However, the reduction in risk exposure has encouraged an increase in the size of agricultural production units. These units tend to have lower costs of production when appropriate adjustments are made in their land, labour and machinery components.

5. Income

While the discussion thus far has dealt with the cost of agricultural inputs in a sustainable environment, it is essential that the returns from production exceed the costs in order to sustain the human family on the land. Producers receive little if any income from the positive externalities they provide to society. Consequently, they have to depend upon the prices available in the market place. Since grain producers on the prairies are so dependent on the export market for their grains, the predatory pricing tactics of competing exporters have reduced their net incomes below that necessary for a livelihood (in the absence of government subsidies). When assessed in this respect, grain production is presently unsustainable. This condition cannot continue because when the very basic necessities of life are placed in competition with the environment, the environment will always lose. [101] The situation may be alleviated somewhat by the new GATT agreement and also by a restructuring of grain agriculture on the prairies. The situation is different for producers of livestock and several other farm commodities where the net returns from production are sustainable.

For sustainability, both the costs of inputs established in the market place and also those for which no market exists should be included when costing production of agricultural products. The market cost of inputs is easily determined. The same is not true for inputs for which no market exists. Various devices have been illustrated as a means to estimate these prices. In some cases, no explicit value can be expressed since such a value depends on the viewpoint of the individual. The income obtained from sale of products must, however, exceed their production

100 University of Manitoba, Op cit. p. 97.
101 McGuire, R. T. “Food, Energy and Environmental Quality: The Necessity for Balance”, *Choices*. Second Quarter. 1991. p. 4.

cost by a significant margin in order to provide the farm family with an acceptable income. Otherwise, as the economic situation of the family deteriorates the environment is placed at risk.

Principles for Sustainable Agriculture on the Prairies

Sustainable agriculture is a subset of sustainable development. Therefore it is appropriate to revisit the definition of sustainable development to help define the scope of this study. Sustainable development has been defined in the Brundtland report as:

> "... a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and endorse both the current and future potential to meet human needs and operations." [102]

This definition has come to be accepted in many areas of sustainable development research. It provides an idea of the scope of sustainable development, but does little to explain how sustainable development can be operationalized. Sustainable development can best be described as a concept rather than being strictly defined as a practice. This concept must be implemented at all levels and areas for sustainable development to be realized. The various contributors to development, such as agriculture, manufacturing, service industries, and even lifestyle, have different viewpoints on sustainable development and how it can be attained. For this reason, several definitions of sustainable development exist.

While the main focus of this study is agricultural policy instruments and their effects on sustainable agriculture in the Canadian prairies, it does not imply that the other activities on the prairies are unimportant. It must be recognized that agriculture depends on many of these activities, and that some of these activities are dependent on agriculture. Although the study is not restricted to agriculture, a definition of sustainable agriculture assists in narrowing the broad definition of sustainable development to confine this project to a manageable task.

Sustainable agriculture was defined earlier in this report as:

> "... one that, over the long term, enhances environmental quality and the resource base on which agriculture depends, provides for basic human food and fibre needs, is economically viable, and enhances the quality of life for farmers and society as a whole." [103]

While this definition focuses on agriculture, it should be recognized that environmental quality and the resource base are being shared by other activities as well. The above definition does acknowledge that future generations and society are affected by the concept of sustainable agriculture. It is also important that the agricultural activities be economically viable. Due to the outside support required to keep them functioning, they could not otherwise be considered sustainable. As with sustainable development, several other definitions for sustainable agriculture exist because of the many viewpoints on the subject.

It is very difficult to evaluate policy instruments based on the definitions for sustainable development or sustainable agriculture. The definitions provide the concept of sustainable agriculture but lack a description of its components. A more detailed outline of the major aspects of sustainable development is required. To better define what is meant by sustainable development in agriculture, a set of principles have been developed. The principles enunciated cultivate a better understanding of the issues pertaining to sustainable agriculture, while bringing the concept closer to a measurable state.

These principles must encompass the concerns of sustainable development, and not just those of agriculture. While agriculture is a major contributor to the economy of the Canadian prairies, it is not the only one. To review sustainable agriculture on the Canadian prairies, the principles must include provisions for other activities. The primary issues of sustainability were discussed earlier in order to provide an indication of the scope of sustainable development. The three main areas outlined were environmental concerns, economic concerns and social concerns.

The following set of principles is put forward as including those which are essential to the sustainability of agriculture in the prairie region. They have been classified into categories of stewardship, economic viability and social concerns. These principles were vetted by peer review at a workshop. While the description of each is general, it will become apparent that their application is specific.

Stewardship

Management

Our sojourn here is limited. During this period, there exists both an individual and a collective responsibility to sustain the environment for both our own and future generations. Economic and social activities should be undertaken in such a fashion as to maintain and preferably

102 World Commission on Environment and Development. *Our Common Future.* 1987.
103 American Society of Agronomy, as noted by Uptal Nasavada in "Trade Policy Implications of Sustainable Agriculture", *Canadian Journal of Agriculture Economics,* Vol. 39, No. 4, Part 1. 1991. p. 595.

enhance the capacity of the resources used, for the benefit of future generations as well as our own.

Conservation

The need to maintain biological diversity should be further explored while strengthening essential ecological processes. Non-renewable resources must be used wisely. A balance must be maintained between the use of resources and the economic and social effects on society. The major renewable resource in agriculture, the soil, must be protected so that its inherent productivity is maintained.

Rehabilitation

Where renewable resources such as the soil have been damaged, as feasible effort must be expended for their rehabilitation. The original productivity is thereby restored or preferably increased, noting that improvement may be possible only over a long term. It is recognized that the lack of adequate care has contributed to soil degradation on the prairies. The destruction of habitat which has occurred must be mitigated. Where the quality of water has been impaired by inappropriate practices, the causes should be removed so that the original quality may be restored.

ECONOMIC VIABILITY

Market Viability

Production cannot be sustained unless it is economically viable. Such viability requires that the net returns from marketing are positive. Unless such returns are adequate within a region, the prairies for example, producers cannot be expected to continue to utilize their available resources for this purpose. The net returns from production should enable an adequate standard of living to be maintained, while at the same time being sufficient to continue to attract replacement operators.

Internalization of Costs

In our society, certain production inputs and outputs are not priced in terms of their real value. Examples include the air we breathe and the carbon dioxide absorbed by plants. Furthermore, the by-products of production in terms of their environmental damage or enhancement are not necessarily subject to a monetary penalty or premium. What is required is that the real costs of both presently considered "free goods" or "undervalued goods" be incorporated into the total costs when determining the net returns of production. Such costing, for example, will include the value of any net loss or gain in soil nutrients as a result of crop production.

Scientific and Technological Innovation

Research to enhance the development of technologies which contribute to the maintenance of environmental quality and economic growth must be supported. Such support should extend to provision of educational services which will further the research program while at the same time maintain social and cultural values. Maintenance of human health should coincide with this provision. Improving the efficiency of production is now an objective of research, but the development of research institutions and markets in order to capture the externalities associated with production is required. Means to ensure that the results of the research are effectively communicated to farmers are necessary.

Trade Policy

Barriers to trade can create impediments to the achievement of sustainability. Consequently, trade liberalization is an important component of progress toward sustainable development. In addition, such liberalization leads to greater international efficiency in production. As a result, true comparative advantage should be an objective of trade policy. This objective implies recognizing the real costs of production and therefore the maintenance of environmental integrity. For example, exports of wheat should be made only where the real costs of production are less than the prices available in the world market. On the other hand, unsubsidized imports of sugar from developing countries should not be reduced as a result of internal price support schemes. An open approach to trade is necessary. Such a stance requires a degree of international cooperation not yet experienced. Nonetheless, trade policy should support and augment the degree of cooperation achievable through international trade agreements.

SOCIAL CONCERNS

Societal Consideration

Economic activity should minimize social costs while maximizing social benefits. At the same time it should not detract from human health and cultural resources or the quality of land and water. Cultural and social diversity should be respected. In agriculture, a balance must be struck between the size of production units consistent with technology and a social structure acceptable to all stakeholders, including those providing the infrastructure.

Global Responsibility

Ecological interdependence exists among nations as there is no boundary to our environment. Stakeholders in the maintenance of the environment are therefore not necessarily local. How the local environment is treated ultimately impacts on other parts of the world and can be expected to haunt those guilty of its mistreatment. For example, excess use of fossil fuels with the attendant production of carbon dioxide and other contaminants, unless accompanied by appropriate means for their absorption, will impact unfavorably on the environments of other nations. There is a responsibility on the part of all

nations to "think globally when acting locally". In agriculture, for example, cropping practices should be adopted which minimize the contaminants produced while providing sinks for those which are produced. There is a continuing need to merge environmental considerations with those of economics in decision making at the local and international levels in order to provide equitable solutions to problems. For agriculture, this need implies provision of technology, where appropriate, to assist other nations in overcoming their problems. At the same time, social and cultural differences must be respected while attempting to improve the human condition. There remains a moral responsibility to ensure that developing nations have an adequate supply of food. That doesn't necessarily mean they should be given food but rather that, if possible, they be enabled to produce their own supply.

EVALUATIVE FRAMEWORK FOR THE PRINCIPLES

The Principles outlined in the previous section indicate the type of issues policy-makers should be concerned about when designing agricultural policies. They do not indicate how they can be used to ensure appropriate policy design. This section develops an evaluative framework to assist policy makers in ensuring their programs or policies promote sustainable development on the Canadian prairies. The evaluative framework provides information about policy performance with respect to the principles important to sustainable development and resource use.

Although other policies and programs have an effect on sustainable development and resource use on the prairies, the focus of this study is on agricultural policies. Analysis of agricultural policies with respect to their impact on sustainable development will provide insight into sustainable practices across the prairies, but will not indicate the effects of all policies in use throughout the region. Therefore, the framework must be able to be applied to other policies affecting the prairie region of Canada.

Policies and programs are usually made up of several policy instruments. Each policy is designed to reach a particular goal or objective. Problems arise when the policy instrument does more than just meet its objectives. Because of the broad consequences of some policy instruments, the sustainability of the prairies is affected. The same policy instrument has the potential to promote or to hinder sustainable development, depending on how it is operationalized. For the purpose of this study, the instruments of the policy will be analyzed, and the results of the policy instruments considered collectively to determine the effect of the policy as a whole on sustainable development across the prairies. The purpose is to demonstrate how one policy instrument, used in different ways, can lead to dramatic differences in sustainable agriculture and resource use.

The analysis of policy instruments requires a framework that will guide researchers on a systematic approach capable of singling out individual effects. The framework should be able to suggest where and what conflicts are occurring within the concept of sustainability. By knowing where and what the conflicts are, policy-makers will be better equipped to design more sustainable policies and programs. Therefore, it is important that the principles and the framework enable a review of the policy instruments from the viewpoint of sustainable development and not just sustainable agriculture. Such a perspective will ensure a broader overview of the issues pertaining to sustainable development.

The purpose of this framework is to take advantage of the information available and provide a quick and easy assessment of the policy. The evaluative framework entails a descriptive rather than empirical analysis of the policy. The descriptive analysis can provide information using less resources than the other technique. As well, many of the indicators used in this evaluative framework are difficult to measure empirically. The descriptive approach also has the advantage of flexibility. The majority of the agriculture policies vary exceedingly in their design and type and in the number of policy instruments used. A flexible evaluative framework is required in order to analyze all of the policies.

To evaluate the policy or program as to its effects on sustainable development and resource use, it is necessary to review the objectives of the program. Figure 4.2 outlines the evaluative framework in the form of a flowchart. After reviewing the objectives, the policy instruments adopted within a policy are identified. The major policy instruments are then individually described in terms of their usage, thus ensuring the reviewer will understand the implications of the individual policy instruments. Each policy instrument is analyzed separately to determine its effects on sustainable agriculture and resource use.

The policy instrument is assessed in terms of its compatibility with each principle to ensure that all aspects of sustainable development are included in the analysis. The analysis ascertains whether the policy instrument is promoting sustainable agriculture and if not, why not. For the policy instrument to be consistent with a particular principle, it must meet all the criteria of that principle. The criteria for each principle are outlined in the next section. The assessments with respect to each principle are then combined within the evaluative framework. It then becomes possible to determine whether the policy or program is promoting sustainable development. Chapter 5 provides examples of how existing policies and programs are reviewed within the evaluative framework.

While policies and programs may or may not promote

sustainable agriculture, the evaluative framework provides the information necessary to suggest desirable modifications which will render the policies and programs more in line with sustainable development. With some programs or policies, changing them to achieve sustainability may be very difficult due to their objectives. The objectives of the program or policy are therefore scrutinized with respect to sustainability. It should be recognized that the objectives of the policy or program are important matters. It is possible that the objectives of the policy or the program may not be sustainable and should be reconsidered.

The Criteria for Sustainable Agriculture and Resource Use

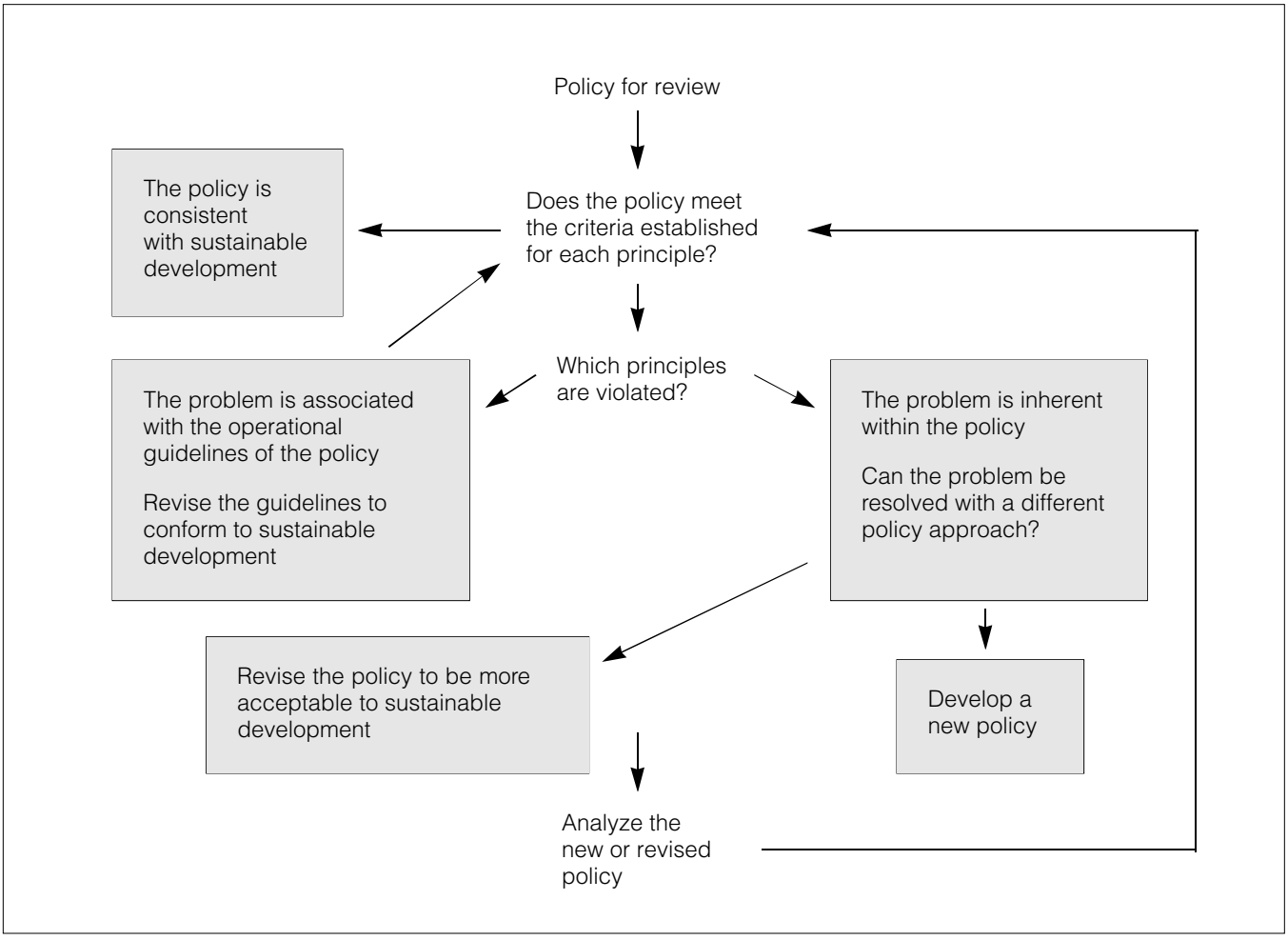
The principles enunciated above can be used as benchmarks for the evaluation of agricultural policies. Their usefulness can be greatly enhanced by development of the criteria for sustainable agriculture inherent within each of the principles. A particular policy can be appraised by comparing its consistency with these criteria. However, any particular program or policy can be expected to conform to only a limited number of these criteria, even while being consistent with the majority of the principles.

Criteria are required for each principle to provide some form of measurement. While the criteria do not provide an empirical measure that is absolute, they do provide more detail than the principles alone. The criteria will assist policymakers and researchers when making policy reviews by enabling a more complete understanding of sustainable development in an agricultural context. The criteria for each principle are provided below.

1. Management

- maintain the integrity of ecosystems
- enhance the (quantity and quality) flow of services from the resource base for the present and future generations
- provide for integrated (shared) resource management

Figure 4.2
Evaluative Framework



2. Conservation

- efficient use (consumption) of all resources, both renewable and nonrenewable
- maintain biological diversity
- provide habitat for wildlife and plants both on land and water
- optimum use of land for sustainability

3. Rehabilitation

- restore the productivity of a degraded resource
- apply waste management principles (reduce, reuse and recover)
- promote complementary production systems
- promote closed production systems where appropriate
- replace degrading processes with others that are beneficial
- revitalize the resources

4. Market Viability

- reduce trade barriers
- economically efficient use of resources
- assure a sustainable income
- promote sustainable human economic activity
- sensitive to supply and demand in the market place
- unbiased as to commodities & mode of transport
- enhance value added activity

5. Internalization of Cost

- promote full environmental costing
- include all costs associated with economic activity
- contingent valuation where costs can't be internalized
- use of natural system economic accounting (inclusion of resources and externalities in system of national accounts)
- assess beneficiaries of externalities appropriate costs

6. Scientific and Technology Innovations (R&D)

- enhance air, water and land management
- ameliorate waste management
- increase productivity
- reduce consumption of non-renewable resources
- promote technology transfer
- advance biotechnology
- promote technologies that utilize, yet preserve, native ecosystems
- promote technologies to further environmental quality including human health and economic growth
- develop industries benign to environment

7. Trade Policy

- maintain or enhance resource base of different trading regions
- apply true comparative advantage
- promote international market responsiveness
- increase value added exports
- consistent with trade agreements
- support trade agreements which recognize externalities

8. Societal Considerations

- promote gender equity
- enhance human health and education
- preserve aesthetic values
- water quality and quantity available for alternative uses
- alternative options for employment (adjustment programs)
- maintain and/or enhance food quality, safety and quantity
- societal neutrality (does not privilege one group over another)
- protect agriculture from urbanization
- increase productive capacity of the poor
- promote fairness and equity in resource allocation for commercial and recreational purposes
- provide an acceptable quality of life and livelihood
- sensitive to goals of local people and communities
- respect human rights

9. Global Responsibility

- recognize interdependence among nations
- promote intra and intergenerational equity
- encourage food health and safety
- assist in emergency food aid
- technology transfer — research and development
- promote fairness and equity in income distribution and trade

GUIDELINES FOR POLICY DEVELOPMENT

Currently much of the discussion has revolved around a review of existing policies and programs. The evaluative framework has the potential to assist in the development of new policies or programs and ensure that they promote sustainable development. This section outlines how policy is formulated and where the evaluative framework can be of assistance.

Ideally, policies or programs are designed to overcome a problem that only government intervention can resolve. Several models exist that describe efficient processes for policymaking. In real-world applications, the policymaker does not always have the option to use these convenient models because of the very large and complex problems involved and the presence of outside forces such as lobby groups. It is, however, useful to describe the basic procedure for policymaking to enable an understanding of why an evaluative framework is required.

One of the most basic models for policymaking is the Comprehensive Rationality model. Adie and Thomas [104] describe the Comprehensive Rationality model as a neat, logical process for policy or program design. The model is composed of six steps, namely:

1. Recognition of a problem that a new policy or modified policy can amend;
2. Determine the nature of the problem and clarify the goals or objectives in relation to the problem and then rank these goals in terms of their importance;
3. List all the possible policies that could achieve these goals;
4. Determine all the possible consequences that could conceivably follow from each of the alternative policies;
5. Compare each alternative and its consequences with all other alternatives;
6. Choose the policy alternative that maximizes the attainment of the goals or objectives with minimum adverse consequences.

While this is just one of many models that may be used for policy development, it does outline many of the critical steps required to accomplish this end. At some point, all the policy models must evaluate the consequences of the alternatives. It is important to recognize the weakness of this model. Actual policy making is complicated because not all problems are easy to recognize and interference to the process can occur in many forms, such as inappropriate lobbying. Aucoin,[105] and also Adie and Thomas [106] indicate that some models, such as the incrementalist model, do not review all of the consequences as some are considered irrelevant because they are uncontrollable and difficult to determine. To improve the efficiency of policy development, a system is required that can assist policy-makers in evaluating some of these ignored consequences.

The proposed evaluative framework is designed to analyze the consequences of alternative policies on sustainable development. This framework may not enable the policy-maker to analyze completely all the consequences for each alternative policy. It will nonetheless improve the efficiency of the process. Each of the policy alternatives should be analyzed using the evaluative framework to determine their different consequences. This analysis will provide the policy-maker with information about the effects of the policy on sustainable development as well as the sustainability of the policy. If a policy promotes non-sustainable practices or provides subsidies to one group of people at the expense of others, the policy is not sustainable.

The evaluative framework and principles can be used as a preventative measure as well as a corrective one. It is possible to evaluate the objectives of the new policy using the framework. By evaluating the objectives of the new policy with respect to sustainable development before the instruments are determined, it is possible to avoid implementation of non-sustainable policies. The evaluative framework also provides an indication of the effects of policy instruments on sustainable development. This information can be particularly useful when choosing these instruments.

104 Adie, R. F. and Paul Thomas. *Canadian Public Administration.* Prentice-Hall. 1982.
105 Aucoin, Peter. "Theory and Research in the Study of Policy-Making", *The Structures of Policy-Making in Canada*, edited by G. Bruce Doern and Peter Aucoin. MacMillan. 1971.
106 Adie et al, Op cit. pp. 92-102.

SELECTED AGRICULTURE POLICIES AND SUSTAINABILITY

SELECTION OF POLICY INSTRUMENTS

While regulation is often adopted as a policy instrument, many other instruments are available to government to achieve social and economic goals with the same or even superior results. These instruments are market oriented in thrust, effectively providing an incentive to modify action consistent with the objective desired. Incentives have been shown to yield the desired results at less cost than the heavy hand of direct government regulation even though many organizations prefer to operate under the latter. Indeed, the economic advantage of other economic instruments has been amply demonstrated by research.

Certain instruments are more effective than others in achieving the desired end. Therefore, it is important to choose the most appropriate instrument or instruments. In addition, care must be exercised in application in order to ensure success. Several factors should be taken into account when determining the instrument most suitable in a particular situation and also when designing the instrument. In no case is this concern more important than with respect to the instruments to use when furthering policy regarding the sustainability of agriculture and that of other resource sectors.

The factors which should be considered include: environmental effectiveness; realization of economic benefits; international competitiveness; distribution impacts; transition and adjustment costs; administration and compliance costs; jurisdiction; consistency with other government policies; and industry and public acceptability. Each of these factors has direct application when designing agricultural policy which is expressed through instruments. A discussion of each follows.

The effectiveness of the instrument in achieving its objective is critical. Instruments vary in their capacity to achieve the objective in different situations. For example, if complete control over the marketing of wheat is essential, then quotas may be appropriate. In cases where it is desired to encourage producers to follow a particular practice, an incentive may be appropriate.

Economic benefits should follow from use of the instrument and be achieved at minimum cost. In addition, whether the instrument encourages innovative strategies consistent with sustainability in agriculture must be confirmed. Furthermore, the instrument must accommodate the entry of new producers. It must also allow for the development of the industry, such as in the further processing of raw products.

The instrument selected should be compatible with or indeed promote international competitiveness. This choice is crucial to the sustainability of prairie agriculture, which relies so greatly on export markets to absorb a substantial proportion of the total output of its major products. Incentives should be provided, where appropriate, to encourage actions favourable to greater competitiveness.

Any instrument affecting change will have distributional impacts. The cost of taking action can be expected to be shared quite differently according to the instrument chosen and how it is designed. Consequently, before introducing an instrument it is essential that its distributional aspects be carefully assessed before being adopted. For example, if the instrument considered for adoption is believed to be positive for sustainable agriculture, what will be the impact on other industries? If equity would be destroyed, then the instrument should be rejected. Even within agriculture the instrument could destroy equity even as it proves beneficial to the industry in aggregate. The impact of the considered instrument on regional equity is also of concern. In addition, examination of the potential impacts on consumers and taxpayers in general should be part of the assessment process.

The costs of the adjustment brought about by a particular instrument should be ascertained before its adoption. While change is endemic to agriculture, the costs of the additional change which would be associated with the instrument are of major concern. Furthermore, the change arising may be of benefit to producers in the long run through improvement of the sustainability of agriculture, yet detrimental to the economic viability of individual producers in the short run. The associated transition and adjustment costs can be reduced by advance notice of the introduction of the instrument. However, the instrument should not reward those who have neglected to adopt the technology that is already available for rendering agriculture more sustainable.

The administrative costs attached to any particular instrument are of major concern with respect to monitoring and compliance. It is highly desirable that such costs be minimized in achieving the objective desired. For example, a particular instrument may be able to utilize an existing administrative structure. In other cases, the instrument may be designed to minimize the administrative costs and at the same time reduce any potential for "moral hazard".[107] Since the sustainability of agriculture is in the interest of both producers and the

107 Exploitation of the operation of the policy for private gain.

public at large, the administrative costs of an instrument designed to further this objective need not be excessive.

In Canada, the federal and provincial governments share joint responsibility for legislation with respect to agriculture under the Constitution Act. The division of powers has been based on the ability to pay for the necessary programs. Lately, the individual provinces have been assuming a more important role in agriculture. This shift has arisen due to the funds available and also from legal cases which defined specific federal and provincial jurisdictions. In particular cases, provinces delegate their responsibility to the federal government, as with marketing boards exercising supply control.

The jurisdictional aspects of any instrument are therefore of concern, raising the question of which level of government has the authority to introduce the instrument even though the most appropriate level may be obvious. The matter is further complicated with respect to sustainable agriculture by the distribution of taxing powers, if indeed the instrument does incorporate imposition of a tax. Use of land, water and air within a province is its responsibility and only a direct tax may be applied in this connection, whereas the federal government can apply both direct and indirect taxes. The instrument utilized should therefore be one having the support of both levels of government, particularly where sustainability has an interprovincial aspect.

In no case is an examination of the impact of a potential instrument more appropriate than where other instruments being applied may be affected. The instruments currently utilized for agricultural policy are not necessarily consistent with achievement of sustainability in agriculture and some actually have negative effects. Of major concern is the impact of the instrument on government expenditures. If possible, the instrument should not contribute to an expansion of government deficits. Furthermore, some instruments are inconsistent with international trade rules and these should be avoided, particularly by a country so dependent on international trade as Canada.

Instruments vary with respect to their degree of approval by the public in general and by the agricultural industry in particular. Factors affecting desirability are the simplicity, visibility, achievability and acceptability of the instrument. In addition, if it is to be approved (thereby encouraging compliance and minimizing administrative costs), the instrument must be seen as consistent with other instruments already applied. If adopted, the instrument should be made subject to a periodic review of performance. Approval will be more easily achieved if government, industry and other interested parties are involved in the instrument selection process. Particularly important in this respect are instruments affecting the sustainability of agriculture. Even within government organizations, differences of opinion prevail with respect to whether existing instruments are consistent with the sustainability objective. These differences are not conducive to their acceptability by the public at large.[108]

POLICY INSTRUMENTS USED IN AGRICULTURE

Policies are composed of individual instruments. The instruments are chosen to enable the objectives of the policy to be attained. Regulation is frequently selected as the instrument capable of creating a desired result. It is also used in a complementary fashion with other instruments such as in transportation policy. Quotas are used as an instrument where control of the flow to market is desired, as in grain-marketing policy, or indeed to control the total quantity marketed, as in the operation of the supply-management marketing boards. Subsidies are frequently used when the intent is to encourage a particular response such as by the provision of trees for farm planting or to support income as in grain transportation legislation. Contracts may be used to ensure a particular action is taken. Land retirement has been used very effectively to encourage more sustainable use of marginal lands. Pooling, as practiced, is used to average returns from sale over time and also to average marketing charges, pooling being widely adopted by marketing boards. Under cross compliance, certain actions are required to be taken elsewhere in order to participate in a particular program. This instrument is frequently used in American agricultural policy, but has received less attention from Canadian policy-makers.

Trade agreements have been used to achieve easier entry into markets in other countries such as under the GATT and CUSTA. A complementary effect is the encouragement of greater competitiveness in local industry, this process often being accompanied by restructuring. Monetary controls such as those exercised by the Bank of Canada are used to manipulate the money supply and control interest rates. These can have differential impacts on export and import industries. Taxation is often used as an instrument to reduce perceived inequities in income distribution, as well as to provide funds for the support of government services. Research becomes an effective instrument in the pursuit of greater economies in production and in the introduction of new techniques, as made apparent by the work accomplished through the Agriculture Canada Research Stations.

108 This review draws heavily from the Government of Canada Green Plan Discussion Paper, *Economic Instruments for Environmental Protection*, 1992, and applies its thrust to the selection of instruments consistent with sustainability in agriculture.

The various instruments indicated above have been used to enable the objectives of agricultural policies to be achieved. Some have been more effective than others, hence the selection process becomes very important. The instruments cited do not constitute a complete listing of those available. Furthermore, the application of the instruments varies widely. What is required is selection of an instrument or combination of instruments which will accomplish the objectives of the policy with minimum delay and with acceptable cost.

In this report, selected instruments of government policies are analyzed for compatibility with the principles of sustainable agriculture. The primary instrument adopted in each case, to achieve the desired objectives, is spelled out. Its application and operation within the program or policy is analyzed to determine its compatibility with sustainable agriculture in the prairie region. The respective primary instrument used by each of four individual policies will be analyzed with regard to its compatibility with sustainable agriculture. These policies include those made effective by the Western Grain Transportation Act, the Farm Products Marketing Agencies Act, the Prairie Farm Rehabilitation Act and the North American Waterfowl Management Plan, respectively. A point worthy of emphasis is that each of these policies is examined taking into account other policies which are in place.

Assessment of the Western Grain Transportation Act

Objective

The stated purpose of the Act is to facilitate the transportation, shipping and handling of western grain. The transportation policy inherent in the Act originated in the rail rates, which were devised to encourage development. The rail rates were established on export grain and agricultural inputs under the Crow's Nest Pass Act of 1897 (their application being modified later to become the statutory rates on "export grain" in legislation passed in the 1920s). They were found to be no longer compensatory to the railways by the 1960s. By the late 1970s, the federal government was required to subsidize effectively the movement of "export grain" with the railways experiencing the balance of the losses on grain movement. To reduce their losses, the railways allowed their grain-movement capacity to decline. While the statutory rates were of historic importance to prairie development, change became mandatory.

The transportation policy established by the Act grew out of a review commissioned by the federal government and was conducted under J. C. Gilson.[109] Seven principles were specified as guidelines for the review. These were enunciated as follows:

1. A statutory framework should be created by Parliament to give effect to the new arrangements, and specifically to provide a basis on which adequate compensation to the railways for moving grain could be established at the earliest possible date.
2. In accordance with proposals made to it by the major producer organizations in Western Canada, the Government of Canada is prepared:
   (a) To commit itself by statute to the payment, on an annual basis, of an amount equivalent to the 1981-82 shortfall in railway compensation; and
   (b) To enter into discussions with the producer organizations and the railways concerning ways of meeting cost increases in the fiscal years beyond 1981-82.
3. While the Government is prepared to bear a substantial part of the cost of grain transportation in future years, its resources are limited. An increased contribution by grain producers will be required.
4. In return for being compensated, the railways will be required to take action on several fronts, including:
   (a) Performance and service guarantees related to grain transportation;
   (b) Commitments regarding additional investment programs that would be undertaken;
   (c) Adjustments to other rates in order to promote diversification and processing in Western Canada; and
   (d) Presentation of data concerning their revenues, costs and investment plans.
5. The economic distortion within the agricultural sector, stemming from the statutory rate, should be reduced, without recourse to new transportation subsidies for crops not covered by the present statutory rate, or for goods such as livestock and processed agricultural products.
6. The new framework to be developed should promote increased efficiency and economy in the operating of the grain transportation system, and the western railway system as a whole.
7. Nothing in the new arrangements shall affect the existing government's financial commitment for branch line rehabilitation. In addition, the Government will take prompt action to procure an additional 1280 hopper cars in 1982.

109 Gilson, J. C. *Western Grain Transportation: Report on Consultations and Recommendations*. Supply and Services, Ottawa. 1982. pp. 2-3.

Following his review, Gilson made recommendations whereby each of the principles could be addressed. Most of the recommendations were made effective in the *Western Grain Transportation Act*. There was one major exception. Gilson proposed that the gross railway revenue shortfall to be paid by the Government be gradually shifted from payment of the entire amount directly to the railways in 1982-83 to payment of 81 percent to the producers by 1989-90, the gross sum later determined to be $658.6 million. This recommendation was rejected for political reasons.

Features of the Legislation

The Act passed in 1983 has several primary provisions.

1. The appointment of a grain transportation agency administrator whose responsibilities are to:
   (a) carry out studies relating to the transportation, handling and shipping of grain.
   (b) make recommendations to the Minister of Transport and others to increase the capacity, reliability and efficiency of the grain handling and transportation system.
   (c) advise and cooperate with system participants on measures to improve capacity and efficiency.
   (d) promote reciprocal and other arrangements between the railway companies to facilitate the efficient and reliable movement of grain for the purpose of maximizing the returns to producers.
   (e) provide a tonnage forecast for the movement of grain for the ensuing crop year by February 28, such forecast to be revised by April 15 of that year.
   (f) monitor the performance of system participants and develop a national scheme of penalties applicable to system participants.
2. The establishment of a senior grain transportation committee whose responsibilities are to advise and make recommendations on:
   (a) performance objectives for system participants and related sanctions and awards.
   (b) measures to improve the capacity and efficiency of the grain transportation system.
   (c) the allocation of railway cars for the movement of grain.
3. The requirement that the railways submit annually to various parties statements regarding investments in equipment for the movement of grain.
4. The opportunity for the Minister of Transport to take such action as required to ensure an adequate supply of cars, the control of cars being delegated by the Minister to the Grain Transportation Agency.
5. The provision of a Crow Benefit of $658.6 million annually, to be augmented by the Government's cumulative share of the cost of moving grain, the total to be deducted from the cost of moving grain when calculating the rates to be paid by shippers.
6. The definition of a procedure for calculating railway costs, eligible costs including the volume related variable costs for grain dependent branch lines plus a contribution to constant costs equal to 20 percent of variable costs.
7. The establishment of an annual rate scale determined by dividing the estimated eligible costs less the CN adjustment by the base year revenues, the freight rates from individual delivery points being established by multiplying the former statutory rates by the rate scale with provision for rate adjustment at contiguous points.
8. The determination of an adjustment in revenue to CN, this adjustment representing the additional cost experienced in moving grain from Edmonton to Prince Rupert as compared to from Edmonton to Vancouver (to provide port parity) plus the cost of operating the line from Thompson Junction to Churchill.
9. The specification of a formula for determining the share of the freight rate to be borne in any crop year by the Government of Canada, this share being the quotient as expressed in percentage of dividing the estimated government commitment less the CN adjustment (plus or minus any changes in the tally) by the estimated costs less the CN adjustment for that year, the remaining share to be assumed by the shipper.
10. The exclusion, when calculating eligible costs, of the cost of capital and depreciation arising from the funds provided under the branch line rehabilitation program and also for those railway cars for grain provided by organizations other than the railways.
11. The provision for a limitation on the share of the total rate assessed the shipper.
12. The opportunity for the railways to introduce variable rates at particular delivery points under certain conditions.
13. The requirement that the operation of the Act be reviewed at four year intervals along with its effects upon the handling, shipment and transportation of grain.
14. The payment of the government commitment directly to the railways, this practice being commonly referred to as the method of payment.

As indicated above, the legislation is quite complex even though the objective is clear. Proposals for change should become more meaningful with this summary of the content of the legislation as background.

ECONOMIC INSTRUMENTS INCORPORATED INTO THE POLICY

The primary instrument used in this transportation policy is subsidy. The distribution of the subsidy is the critical issue affecting sustainable agriculture. A secondary instrument is regulation to ensure the various aspects of the legislation are made effective.

Subsidy as a Policy Instrument

The movement of "export grain" by rail is subsidized from locations on the prairies to "export position", i.e. Vancouver, Prince Rupert, Churchill and Thunder Bay, the producer paying the lesser of the freight rate from his delivery point to the Pacific Coast or Thunder Bay. "Export grain" refers to a wide range of grains and products. The effect of the subsidy is to encourage the movement of these grain products out of the prairie region rather than other products such as livestock.

Few policies have been subject to the degree of analysis as that arising from the *Western Grain Transportation Act.* [110] The studies undertaken have been devoted to analysis, in varying degrees of depth, of the impact of directing the subsidy in different proportions to producers rather than to the railways. In the interest of economic efficiency, it has been proposed by the majority of these studies that the subsidy be paid directly to producers. Analysis indicates the impacts of directing the subsidy to producers would be as follows:

1. Prices for crops in those categories now eligible for the reduced rates would decline on the prairies but not necessarily by the entire increase in the cost of movement since greater local use of crops in the production of livestock or in processing could have a positive effect on the average price received, any such effect being considered limited.
2. Since the increase in the cost of movement of all grains would be similar on a tonnage basis, production of the higher valued crops would increase while that of the lower valued crops would decline.
3. Income from grain would decline on the prairies and be accompanied by a decline in land values even where the government commitment was paid to producers other than on a shipments basis.
4. There would be no noticeable impact on grain producers in Eastern Canada.
5. Under full cost transportation rates, producers would seek the most economical method of shipping grain with the result that rationalization of the grain handling and transportation system would occur at a more rapid pace than at present and be accompanied by a reduction in aggregate costs.
6. Expanded use of trucks could be expected with the range of economic trucking distances relative to those of the railways increasing, there being said to be an indeterminant but unsubstantiated increase in road maintenance costs.
7. Land rendered marginal for grain production by the increase in transportation costs would be converted to other more sustainable uses such as grassland for livestock.
8. Livestock production would increase significantly on the prairies as grain prices fell and comparative advantage allowed to prevail, the increase in livestock numbers varying between regions as agriculture became more livestock oriented.
9. Any need for "Crow Offsets" by individual provinces would be eliminated and a more level "playing field" would be achieved among livestock producers in the various provinces.
10. Cattle feeding operations would increase as a result of lower feed grain prices, such operations being located in areas where liberal forage and grain supplies are available.
11. Hog production would increase with location of the additional output reflecting the relative decline in the price of grain as a result of full transportation rates being paid by the shipper.
12. Livestock prices would not be significantly affected by the additional output as a result of the increase in grain transportation costs since these prices are established in a North American context where the Canadian supply is only a small fraction of the total available. While the economics of production would shift toward the prairies, little effect on prices in Eastern Canada is foreseen except in the case of feeder cattle purchased from the prairies.
13. With the advent of lower input prices as a result of the higher freight rates on grain, there would be additional opportunities for the processing of oil seeds and other grain "eligible" crops. Non-grain "eligible" crops such as alfalfa for processing would be discouraged though this impact could be mitigated by greater demand locally for livestock feed and by increasing demand from the United States. At the same time, more remunerative crops would be sought out including those which could be further processed locally.

110 Summaries of the research conducted are provided by Kerr, W. A., G. Fox, J. Hobbs and K. Klein, *A Review ofWestern Grain Transportation Policies*, Agriculture Canada, Working Paper 6/91 and by Wilson, A. *Review of Recent Studies of the Impact of a Change in the Method of Payment as Related to Production and Processing: Implications for CN Rail*, Transportation Institute, 1993.

14. Livestock slaughter would become more economic on the prairies as increasing volumes enable the capture of economies of scale in meat packing.

Notwithstanding the benefits which would accrue in aggregate from a redirection of the subsidy to producers, a limited number of farm organizations remain opposed. They argue that increasing the rate of rationalization of the handling and transportation system would render adjustment difficult and give rise to significant losses in fixed plant. In addition, depending on how the subsidy was paid to producers, it could result in the benefit now enjoyed by "grain" producers being dissipated among all producers giving rise to the "dilution" effect. Furthermore, it is contended that road maintenance costs would increase thereby shifting some of the existing federal cost responsibilities to the provinces.

Action to Modify the Thrust of the Subsidy

Support for the subsidy as presently applied has not been unanimous on the prairies. Livestock producers in particular have recognized its detrimental effects on their industry. As a result of their agitation and the need for more efficient use of government funds, the Minister of Agriculture initiated a review with the objectives of removing the biases in the *Western Grain Transportation Act* and introducing efficiency measures. Such measures include:

> "Lifting prohibition orders on abandonment of high cost, low-volume grain dependent branch lines. National Transportation Agency approval will still be required before lines are abandoned. Lines, which were only protected until 1999, will now be eligible for alternative service funding until 2001 or 2003. The freight-rate provisions will be changed to remove biases and encourage port neutrality. Other freight rate changes will also help Canadian railways and ports compete with other grain carriers.
>
> Maximum freight rates will continue to be regulated by the National Transportation Agency but railways will be allowed greater flexibility to offer incentive rates to producers, which will improve efficiencies and reduce costs". [111]

The producer panel established is to make recommendations for a modified program under the *Farm Income Protection Act.* Under the program, payments would be made to producers of grain and other agricultural products produced in the designated (Canadian Wheat Board) area who would be affected by the proposed amendments to the *Western Grain Transportation Act* and the *Canadian Wheat Board Act.*

When developing the program the Panel is to take into account the following principles:

"1. The program should be compatible with Canada's international obligations.

2. The program should encourage long-term environmental and economic sustainability.

3. The program should not unduly influence the decisions of producers of agricultural products with respect to production or marketing.

4. The program should encourage adjustments with respect to production or marketing so as to improve the effectiveness of the responses of producers to market opportunities.

5. The program should provide for the allocation of funds in a manner that takes into account the effect of the higher freight rates resulting from transferring funds from the railways to producers, within an up-dated pooling regime on producers of grain and other agricultural products.

6. If program funds transferred from the *Western Grain Transportation Act* are distributed in a broader fashion than just to prairie grain producers for higher freight rates, the program should become part of the national safety net programming for agriculture, treating producers across the country in a similar manner". [112]

During the first four years, the payments are to be limited to grain producers based on an as yet undetermined formula. The panel is to submit its final report by April, 1994.

The proposed amendments to the *Western Grain Transportation Act* include those which:

1. Will provide a more expedient process to remove low-density, high-cost grain-dependent branch lines through the use of incentives and savings from the existing program funds to temporarily finance the provision of alternate services.

2. Will provide port neutrality through the removal of biases inherent in the rate scale and in the payment method, both of which favour some routes or ports or both. The freight rate structure would retain the principle of generally distance-related rates.

3. Eliminate restrictions on the offering of incentive rates which are available when grain traffic is handled more efficiently, as in the use of larger blocks of cars.

4. Phase down payments to railway companies over a four-year period and replace those payments by payments to producers under a program to be established under the Farm Income Protection Act.

111 Government of Canada. *WGTA Producer Panel Established,* News Release. June, 1993.
112 Ibid. p. 2.

Grain shippers would concurrently assume an increasing share of the freight rate.

At the same time, the *National Transportation Act*, the *Canadian Wheat Board Act* and the *Farm Income Protection Act* would be amended to be consistent with the proposed amendments to the *Western Grain Transportation Act.*

Revision of the legislation (program) is to be guided by the following principles:

1. The program should be compatible with Canada's international obligations.
2. The program should ensure long term environmental and economic sustainability.
3. The program should provide for the allocation of funds in a manner that takes into account the effect of the amendments proposed to be made to the *Western Grain Transportation Act*, the *National Transportation Act* and the *Canadian Wheat Board Act* on producers of grain and other agricultural products.
4. If program funds transferred from the *Western Grain Transportation Act* are paid more broadly than to prairie grain producers for higher freight rates, the program should become part of the national safety net programming for agriculture, treating producers across the country in a similar manner.

The proposed legislation makes provision for increased efficiency in the movement of grain. Many of the proposed amendments have been suggested by producers and researchers alike. On the other hand, the method of distribution of the subsidy monies among producers is not spelled out but is to be recommended by the review panel. Some observations may be made nonetheless. Producers have been opposed to inclusion of the subsidy under any existing "safety-net" program, believing the funds would subsequently disappear as a separate entity. They can be expected to be highly suspicious of the government's statement that there will be a statutory commitment to pay the subsidy, particularly in view of the fact that the proposed commitment already represents a 10 percent reduction from that formerly established by statute. They tend to regard the subsidy as part of the pay-off for agreeing to the elimination of the previous statutory rates on "export grain". The phase-in of the payments to producers from payment to the railways, if put into effect, will reduce in the short run the incentive for producers to make desirable adjustments in their production patterns. On the other hand, it should render easier the adjustments required in the handling and transportation system. If the subsidy is to be compatible with foreign trade obligations, it must be distributed independently of shipment patterns. In addition, if it is to be neutral with "long-term environmental and economic sustainability" on the prairies then the subsidy should be applied to all lands used for production, taking into account their productivity, implying that "dilution" will be mandatory. In order to ensure positive action with respect to sustainability, payment of the subsidy to a producer should be made only if the producer engages in pre-determined land management practices. In other words, cross compliance would become necessary in order to receive the funds.

Comparison of the Present and the Proposed Western Grain Transportation Act

In order to place in perspective the relative impact of the proposed changes in the transportation legislation and that which prevails under the present Act upon sustainable agriculture, assessments of the use of the subsidy instrument are presented in parallel below. These assessments illustrate how the evaluative framework can be used to appraise a policy instrument as applied under a current policy and as proposed under a modified policy according to its impact on sustainable agriculture.

IMPACT OF PRESENT TRANSPORTATION SUBSIDY UNDER THE ACT

While the method of payment of the grain transportation subsidy inherent in the Act has been subjected to intensive economic analysis, its impact on sustainable agriculture has not received the same degree of attention. The subsidy is therefore evaluated below in terms of its consistency with the principles of sustainability, namely management, conservation, rehabilitation, market viability, internalization of cost, scientific and technical innovation, trade policy, societal considerations and global responsibility.

1. Management

The subsidy encourages the production of "grain" for export, which involves cultivation of the soil resource. Use of land otherwise marginal for grain production is assisted, which unless carefully managed will become degraded. Good stewardship of large areas of such land implies a return of the land to grass. This conversion would give rise to an increase in the livestock population with the benefit of returning additional nutrients to the soil. A grain monoculture is effectively promoted, suggesting that the policy has a negative effect upon resource management. The grain monoculture can be expected to be detrimental to maintenance of the diversity of plants and animals living on the land. It should be noted that while land use in some areas such as the Regina plains is unlikely to be affected by the subsidy, the subsidy does have income effects which are identified later.

IMPACT OF PROPOSED CHANGES IN THE LEGISLATION

The ultimate package of the changes which are made will be based on political as well as economic and other considerations. It is nonetheless assumed for purpose of analysis that all the changes necessary to conform to the principles established will be made, including: payment of the subsidy on the basis of cultivated acreage taking into account productivity; introduction of cross compliance in the interest of "long-term environmental and economic sustainability"; and a phase-in of the new method of payment of the subsidy. It should be recognized that the politics of the issue may give rise to a method of payment of the subsidy significantly different from that assumed, as was the case with respect to the recommendation made in this regard by Dr. Gilson ten years previously. Given the above assumptions, the impact of the subsidy on sustainable agriculture will be briefly reviewed below.

1. Management

Management of the resources used in agriculture can be expected to improve particularly with the introduction of cross compliance. It can be expected that there will be greater integration in the use of resources. For example, lands now marginal for grain production can be expected to be converted to livestock production, given the improvement in the economics of livestock production versus that of grain production. Retirement of land to grass in the marginal areas will contribute to the maintenance and indeed the enhancement of the resource base for future generations.

2. Conservation

The subsidy does not encourage optimum use of land since the economics of production are distorted. The encouragement of an extensive agriculture which is associated with the subsidy cannot be said to be positive for conservation. In the process, the subsidy can be considered detrimental to the maintenance of habitat for wildlife, the economics of which are adversely affected. Similarly, the influence of the subsidy on both water quality and quantity cannot be considered to be positive. Since lack of moisture is one of the causes of land being marginal, cropping in moisture-deficient areas is associated with summer fallow which can be detrimental to the land depending on the tillage program adopted. Summer fallow also can contribute to secondary salinity and to erosion by wind and water in the absence of careful management. There is nothing in the subsidy which can be considered positive for such management.

3. Rehabilitation

The subsidy as applied does not promote rehabilitation of the land. Since a grain monoculture is encouraged, livestock production which could assist in rehabilitation is effectively discouraged. Degrading practices are not replaced by those more beneficial as a result of the subsidy nor is there any encouragement given to revitalizing a degraded resource such as the soil.

In summary, from the standpoint of stewardship of the environment, the subsidy can be considered to have a negative influence. It is found wanting in terms of the management, conservation and rehabilitation criteria. At the same time, it should be recognized that conservation of the soil resource is possible notwithstanding a grain monoculture, as the Agriculture Canada Research Station at Swift Current has so effectively demonstrated. [113] Zentner cites five major causes for producer strategies that vary from what society would prefer: lack of knowledge of the depletive consequences of certain practices; personal constraints irrelevant to society as a whole such as tenure, taxation, risk and tradition; lower farm profits; different time preferences and discount rates; and the lack of concern for externalities. The subsidy cannot be said to encourage individual producers to adopt conservation practices consistent with good stewardship of resources for future generations.

2. Conservation

Use of land more closely approximating the optimum is to be anticipated as a result of the assumed change in the method of payment. With lands now marginal with respect to grain being sown to grass and with the associated encouragement for greater livestock output, the potential for preservation of soil and water quality is greatly increased. At the same time, the additional acres in grass can be expected to improve wildlife habitat, particularly if action is taken to provide an adequate supply of water for livestock. There is no inherent encouragement from the subsidy for maintenance of the genetic stock or biodiversity other than that associated with increased acreages in grass.

3. Rehabilitation

It is to be expected that increased livestock production on the prairies will lead to enhancement of existing soil quality. There is no assurance that the assumed method of payment of the subsidy will have any impact on whether proper management is adopted in dealing with the increased output of animal waste. Grain and livestock production on the prairies have been complementary from the time of settlement and the initial degree of complementarity may be restored. Thus any soil degradation associated with a grain monoculture will be somewhat mitigated.

113 See for example, Zentner, R. P. *Economics of Soil Conservation in Western Canada* . Agriculture Canada Research Station, Swift Current. 1981.

4. Market Viability

The subsidy as applied essentially reduces the economic deterrent to interprovincial trade associated with the cost of movement of grain eastward as far as Thunder Bay. It does not contribute to an economically efficient use of resources since the economics of production are tilted toward "export grain". In addition, excess use of the transportation system is encouraged, this being made particularly evident by the degree of cross-hauling of grain taking place as a result of the less than full cost rail transportation rates in effect. On the other hand, the subsidy can be said to enhance the incomes of those shipping grain for export since they do not pay the full cost of shipment. As with all subsidies, such enhancement cannot be considered sustainable.

The subsidy distorts market signals as it applies to a particular set of products and not to others. Production of "export grains" is encouraged relative to livestock and other products not falling within this classification. The subsidy is of course not transportation neutral with respect to all commodities. At the same time, an increase in value added activity is discouraged for those processed products not qualified to move at "export grain" rates.

5. Internalization of Cost

No provision is made under application of the subsidy to internalize any costs. Significant externalities arising as the result of the continuation of grain production in otherwise marginal areas can be expected. Such externalities can be expected to include land degradation and loss of habitat for wildlife. Other externalities which could arise include an increase in the incidence of salinity, and erosion by wind and water.

4. Market Viability

The long term viability of any industry cannot depend on continued provision of subsidies no matter how judiciously applied. The assumed method of payment will, however, encourage a more efficient use of resources even though the full impact is to be delayed for five years. Responsiveness to the market will be restored as the subsidy becomes one of income rather than export support. In addition, the former bias between transportation modes will be greatly reduced, as will the bias between the movement of the different products produced on prairie farms. At the same time, the bias against value added activity is removed. There will be no impact on existing barriers to interprovincial trade.

5. Internalization of Cost

There is nothing in the method of payment which will lead to internalization of cost. The externalities associated with increased livestock production may merely offset the forecast reduction in the externalities associated with grain production. Depending on an individual's point of view, contented livestock herds may add greater value to the landscape than fields of grain on marginal land.

6. Scientific and Technological Innovation

The subsidy can be considered neutral with respect to this criterion. While much research has been conducted on the use of marginal land and much innovation has taken place in equipment to use on such land, these initiatives have not been motivated by the subsidy. [114] Indeed, the effect of the subsidy has discouraged the application of some research findings. The subsidy therefore has not been conducive to needed research into alternative forms of production. Use of otherwise marginal areas for grain production gives rise to a greater handling and transportation requirement.

7. Trade Policy

The transport subsidy as applied is essentially an export subsidy on "grain". While some "grain" used domestically moves at the reduced rates arising from the subsidy, the volume is minimal in relation to that moving for export. The subsidy is therefore not "green" (being an export subsidy) in terms of the GATT and its application will have to be changed. It is of course inconsistent with comparative advantage between countries and indeed among regions within Canada. In the process, international market signals are distorted since the prices at the farm are increased as a result of the subsidy.

The subsidy has the effect of deterring increased value-added activity on the prairies as it only applies to a limited number of products. The economics of production are biased toward grain rather than livestock, the latter having the potential to add significantly to the export of value-added products. In fact, even with the deleterious effects of the subsidy, exports of livestock and livestock products are significant. In total, the subsidy must be considered negative with respect to trade policy.

With respect to economic viability in aggregate, the subsidy must be considered inconsistent with this concept. The subsidy does provide additional funds to those who ship "grain" for export and the total impact on sustainable agriculture on the prairies must be considered detrimental.

6. Scientific and Technical Innovation

The more diverse nature of agriculture encouraged by the assumed method of payment of the subsidy may not necessarily encourage greater innovation. However, researchers in the field of sustainable agriculture on the prairies will be encouraged to see greater adoption of the practices so long proposed, but discouraged, by the current method of payment. As a result they can be expected to redouble their efforts in this regard. Consequently, there will tend to be greater transfer of technology from the research bench to the farm. This is not to suggest that research in the field of biotechnology will increase, since the link between this research and the method of payment is tenuous.

7. Trade Policy

The assumed method of payment of the subsidy qualifies for "green" status under the GATT agreement. While the funds distributed effectively become additional income to producers on the prairies there will be a modest, if any, impact on true comparative advantage in trade. Market prices at the farm level will directly reflect those attainable in the world market for those products exported. Consequently, greater responsiveness on the part of producers to the world market can be expected. The increased livestock output arising from the assumed method of payment will lead to an increase in the volume of value-added exports.

114 The research conducted by personnel at the prairie Agriculture Canada research stations and the Alberta, Saskatchewan and Manitoba universities has been extensive in this regard. See for example, Campbell, C. A. *Soil Conservation in Saskatchewan*. Agriculture Canada Research Station, Swift Current. undated.

8. Societal Considerations

The subsidy has some social impacts. The funds represent a transfer of resources from general taxpayers to those shipping "grain" for "export". Such a transfer gives rise to questions regarding both fairness and equity in income distribution. The subsidy appears to be based more on political considerations rather than on equity. Non-recipients of the subsidy can legitimately argue that the subsidy detracts from equity since it privileges by legislation one group in society over another and indeed one group in agriculture over another. At the same time, since grain production is encouraged, potential opportunities for employment in the production and processing of livestock are foregone, with implications for the sustainability of local communities. The extensive form of agriculture encouraged by the subsidy can be expected to affect the prairie landscape. Other issues of interest to society such as the health and safety of the food supply will not be directly impacted. However, there will be a relatively greater availability of grain than livestock products as a result of the subsidy. In the process of farming the marginal areas encouraged by the subsidy, less habitat for wildlife, is maintained, which detracts from the range of opportunities available. The subsidy adversely affects employment opportunities on the prairies, value-added activities being effectively discouraged. This consequence has a detrimental influence on rural development.

8. Societal Considerations

Greater value-added activity implies that opportunities for employment will increase to the benefit of local communities. Nonetheless, the subsidy is not neutral between members of society as it applies only to prairie agricultural producers. There will be little effect on the incidence of poverty, as the payment is related to the productivity of land and not to particularly needy individuals. It should be recognized, however, that diversion of the subsidy away from a reduction in the rates charged to moving grain to a general payment not directly related to grain movement will have a major impact on land values. The associated reduction in the returns from grain can be expected to bring about a fall in land values. This loss will be borne by the owners of land. Since this is the case, the subsidy should be paid to land owners, the inference being that land rents will fall accordingly. [115] Payment of the subsidy from society's point of view assumes those in agriculture have particular needs. As a result, questions as to the impact on the fairness and equity of income distribution as affected by payments of tax dollars continue to arise. No impact on food, health, or safety can be expected, though the balance between the supply of livestock products and that of grain will be affected.

115 Wilson, A. et al. *Compensation Requirements and Impacts for Manitoba Producers of a Total Transportation Rate Regime for Grain*. Transport Institute. 1993.

9. Global Responsibility

Since the subsidy encourages greater production of grain than would otherwise be the case, the increased volume has to be marketed. Consequently, grain producers in other parts of the world are affected. Any reduction in price (ignoring of course the distortions caused in the international market arising from the export subsidy activities of others such as the European Economic Community and the United States) arising from the greater supply on the world market can be expected to be disadvantageous to producers in other parts of the world. Furthermore, grain is often used as a component of Canada's food aid. While gifts of food in the form of grain can be useful to help off-set famine, other gifts of grain can be detrimental to producers in the recipient countries. Consequently, the subsidy has implications for fairness and equity in trade and indeed indirectly for income distribution on the world scene. On the other hand, the transfer of Canadian grain technology to other parts of the world can be said to be independent of the subsidy.

Overall Assessment

The subsidy as applied is generally inconsistent with the principles for agricultural sustainability on the prairies. The detrimental effects far outweigh any beneficial attributes. This imbalance is attributable to the manner in which the subsidy is applied and is a reflection of the political process. Therefore, there is need for the subsidy, if deemed essential, to be applied in a manner consistent with sustainable agriculture.

9. Global Responsibility

In a global sense, the assumed method of payment will have a negligible if any effect on income distribution nor will there be any contribution to food, health and safety or intergenerational equity. To the extent that the supply of grain may be reduced, there will be less pressure to sponsor aid shipments where these would be detrimental to producers in the recipient countries. [116] A degree of fairness in world trade in grain would be restored, the extent of which is predicated on the actions of other exporters. The method of payment has no impact on the transfer of grain technology to other countries.

Overall Assessment

The changes in the method of payment of the subsidy inherent in the proposed changes in legislation would render the subsidy more consistent with the principles for sustainable agriculture. However, payment of a subsidy has negative connotations for sustainability.

116 Klein, K., G. Fox, S. Kulshrestha and B. Stennes suggest as a result of their research described in *Regional Implications of Compensatory Freight Rates for Prairie Grains and Oilseeds* , Agriculture Canada, Working Paper 3/91, that the impact of a change in the method of payment would have a limited impact on the output of grain. 1991.

The Subsidy and Sustainable Agriculture

The subsidy as presently directed under the *Western Grain Transportation Act*, i.e., where paid to the railways, has been shown to have deleterious effects on sustainable agriculture. Its application is inconsistent with the principles for sustainability. There are major externalities associated with the present method of payment such as the negative impact on livestock production and the overuse of the rail transportation system. Such externalities have stimulated a search for a method of payment which will support sustainability. The review underway is expected to result in legislative action which will render the method of payment of the subsidy more benign in this regard and more supportive of sustainability.

Any industry which requires a long-term subsidy cannot be considered sustainable. Therefore, the question of why a subsidy is required arises. The subsidy has its roots in the political process being designed to support development. The subsidy has been continued largely as a quid pro quo for other policies and also due to a political commitment, largely unexpressed, to prairie grain producers. Gradual withdrawal of the commitment began with the passage of the *Western Grain Transportation Act,* which provided for an increased contribution by producers to the cost of rail transportation of grain from the prairies. The current review process represents a continuance of this trend while promoting sustainability.

The returns from grain production on the prairies are being adversely affected by the agricultural and trade policies of other exporters. While a new GATT agreement has been reached there is no guarantee that true comparative advantage in the world market will prevail in the short run. In the long run an end to the so called "grain subsidy war" may occur for sustainable agriculture reasons.[117] Use of fertilizers and pesticides to maintain grain production in western Europe is creating major environmental problems leading to controls on use which can only result in a decline in exports. Nonetheless, a re-orientation of prairie agriculture appears desirable for sustainability. This reorientation can be assisted by the proposed change in the method of payment as indicated by the analysis referred to above.

Continuance of the subsidy over time has connotations for sustainability. While the method of payment issue is expected to be settled in a manner consistent with sustainability, continuance has been shown to depend on politics. Payment on an annual basis will result in substantial administration costs. The question arises as to why the government's acknowledged obligation (or so-called Crow Benefit) would not be discharged by a lump sum payment, such as represented by a bond, in which the value of the subsidy is capitalized. [118] If the obligation is for real, then it appears reasonable that it be paid out as a lump sum so to avoid future administration costs. The argument that the deficit would be increased by such a course appears specious since the bonds could have alternate maturity dates. Payment in such a fashion would greatly encourage adjustment in prairie agriculture. It would make the industry more sustainable while at the same time providing the means for producers to accomplish this end.

The subsidy now appears to have taken on a life of its own apart from the stated objectives of the Act. If the real intent of the legislation is to provide additional income to agricultural producers, a much more efficient and equitable means should be sought, one that would have minimal impact on other sectors of the community. This situation calls for an income policy.

ASSESSMENT OF THE FARM PRODUCTS MARKETING AGENCIES ACT

Objective

The stated objective of the *Act* is to establish the National Farm Products Council and to authorize the establishment of agencies for farm products.

The historical purpose of this legislation is to correct the perceived imbalance in bargaining power between producers and others engaged in the marketing of farm products.

The above goal has no relevance to sustainable agriculture. The content of the legislation may, however, have implications for sustainability and for the agencies formed under the *Act*. Consequently, both the content of the *Act* is reviewed and also the operation of the marketing organizations formed under the *Act*, the Canadian Egg Marketing Agency being used as a prototype.

Primary Features of the Legislation

1. The *Act* provides for the establishment of the National Farm Products Marketing Council consisting of not less than three but not more than nine members appointed by the federal cabinet, at least 50 percent of the members to be primary producers.
2. The duties of the Council include:
   (a) Advising the Minister on all matters relative to the establishment and operation of agencies under the Act with a view to

117 See for example the recent article in *Feedstuffs,* "An Animal Agriculture Can Help Espry's Plans" and the article in USDA's *Agriculture Outlook* for July 1993, "Solutions for Ag-Related Pollution: The EC Approach".
118 For a more complete discussion of this issue see Wilson et al, 1993. pp. 91-107.

maintaining and promoting an efficient and competitive agriculture industry.

(b) Reviewing the operation of agencies to ensure that they carry on their operations in accordance with the objectives established.

(c) Cooperation with the agencies to promote more effective marketing of farm products in interprovincial and export trade.

(d) Consultation with provincial governments which have their own marketing councils exercising similar powers to the National Council within their own borders.

(e) Establishing marketing agencies for a farm product or products to conduct marketing plans. A significant number (majority) of persons engaged in the production of the product or products are required, or in the case of a promotion-research agency where the majority of the aggregate of producers and importers of the product or products are in support in those provinces to which the agency applies. All requests are subject to the approval of the Minister.

(f) Reviewing any amendment to a marketing plan submitted by the agency charged with implementation of the marketing plan.

(g) Reviewing the operation of the marketing agencies formed, including all proposed orders and regulations and authorizing them to implement the marketing plan.

(h) Dealing with complaints received regarding the operation of any particular agency.

(i) Registering persons engaged in production or marketing of the regulated product in interprovincial or export trade and requiring the marketing agency to provide such information when requested.

(j) Providing for public hearings on the operation of any agency or when an expansion of the existing powers of an agency has been requested.

(k) Working with agencies in promoting more effective marketing of farm products in interprovincial and export trade, and in the case of a promotion-research agency in the promotion of such marketing in import trade, and in connection with promotion activities relating to farm products.

(l) Conducting studies on its own volition or upon request by the Minister into any matter relating to the marketing or promotion of a farm product in interprovincial or export trade.

Where the federal cabinet is satisfied a majority of the producers of a product are in favour, it may establish farm products marketing agencies. These agencies would address the marketing of those farm products in interprovincial or export trade which are not regulated under the *Canadian Wheat Board Act* or the *Canadian Dairy Commission Act*. To determine if such a majority exists, the Council may hold a plebiscite of the producers. The cabinet proclamation shall include designation of the product or products involved, the marketing agency formed, the powers vested in the agency and the exercise of such powers in interprovincial trade. The proclamation also shall indicate that except in the case of tobacco, eggs or poultry, the agency is not enabled to fix and determine the quantity in which any regulated product may be marketed in interprovincial or export trade. Members of the Board of an agency formed are in office at the pleasure of the Minister.

The objects of an agency are:

1. To promote a strong, efficient and competitive production and marketing industry for the regulated product or products in relation to which it may exercise its powers.
2. To conduct and promote research activities relating to the regulated product having due regard to the interest of producers and consumers and where applicable the importers of the regulated product.

The agency is to submit to the Council a marketing plan or amendments to an existing plan to accomplish its objects. The agency is vested by the Council with the powers deemed necessary to carry out its objects. It may perform on behalf of a province any function relating to intraprovincial trade in the regulated product or products. Furthermore, with the approval of the cabinet, the agency may grant authority to another body to perform any function on behalf of the agency relating to any aspect of interprovincial or export trade with respect to the regulated product or products. It should be noted that a particular marketing plan shall allocate that quota on the basis of production from that area in relation to the total production of Canada during a period of five years immediately preceding the effective date of the marketing plan. Furthermore, when allocating additional quotas to accommodate anticipated growth in market demand, the marketing agency should consider the principle of comparative advantage in production.

An agency is authorized by proclamation to exercise its powers in relation to one or more farm products in import trade. The majority of the members of the agency shall be comprised of two groups, primary producers of the given farm products and the importers of these farm products. Representatives shall be in proportion to the share of each such group in the aggregate of the total intraprovincial,

interprovincial and import trade in all of those products. The agency is also authorized, by proclamation, to exercise its powers in relation to one or more of the given farm products in export trade.

Marketing agencies are not agents of the Crown and are required to be self-sustaining after initial establishment. To ensure the directives of the agency are fulfilled, the Minister on the recommendation of the agency will appoint an inspector who is given wide powers to force individuals to perform according to these directives. Furthermore, enforcement may be achieved by recourse through the courts. In the case where a promotion and research plan provides for levies or charges to be payable by persons engaged in the production or importation of the regulated product or its marketing, any outstanding payment may be collected through the courts.

Two legal aspects of the legislation are of profound importance to the operation of marketing agencies in Canada: when intraprovincial trade is the responsibility of a province; and when interprovincial and export trade are the responsibility of the federal government. A description of each follows:

1. The Minister with the approval of the cabinet may on behalf of the federal government enter into an agreement with any province relating to intraprovincial trade in a regulated product or products in relation to which the agency may exercise its powers and for such other related matters as may be agreed upon by the Minister and that province.
2. Nothing in the Competition Act applies to any contract, agreement or other arrangement between an agency and any person or persons engaged in the production or marketing of a regulated product where: the agency has authority under this or any other Act; under a proclamation issued under this Act; or under an agreement entered into pursuant to this Act.

This latter aspect, in particular, renders the legislation unique and bestows upon marketing agencies immunity from actions which would otherwise be prohibited and subject to penalty through the courts.

Regulation is the principal instrument used by the Council and also by the marketing agencies formed under the Council. The same applies to the over one hundred marketing agencies or boards operating under provincial legislation. In most of these cases, the thrust is to achieve their stated purposes through cooperation among the producers and by using various bargaining devices with purchasers of the particular product being marketed. While some agencies bargain with processors regarding price, others such as Manitoba Pork provide a particular means of price establishment. Few such agencies attempt to influence the volume marketed. The regulations in such cases are used to support or enforce the directives of the marketing agency.

The discussion above draws attention to the fact that none of the agencies formed under the purview of the National Marketing Council, with the exception of those established with respect to tobacco, eggs and poultry, have any power to regulate the quantity of the product marketed in interprovincial and export trade. The national agencies established for eggs, chickens, broilers and hatching eggs have therefore been given the power under federal-provincial agreements to control the volume to be marketed. In other words, these agencies exercise supply management of the product marketed. In order for these agencies to exercise this power, imports have been controlled under the Export and Import Permits Act, this previously allowed under Article XI of the GATT. Control was extended over both the raw product and many of its processed forms. As a result of the conclusion of the Uruguay Round of the GATT, import controls will give way to tariffs, the proposed levels of which, in the short run, will be as effective as import control as a trade restriction device. Tariffs have been in effect on some imports, particularly those of highly-processed products, but these are being gradually eroded under the CUSTA.

Supply management has been accompanied by externalities. The item used to restrict supply such as land or quota has risen in value due to the capitalization of the benefits received as a result of supply management. This rise in value increases the net worth of the original participants but adds to the costs incurred by any new entrants. While the different national agencies have been successful in reducing risk, increasing stability and providing market security, they have charged higher domestic prices to consumers than those available in the export market. They have thereby reduced consumption. It has also been argued that the agencies exercising supply control have been complacent in responding to opportunities in the export market and for value-added activity. As a result, considerable industry and government attention has been directed toward making the agencies more accountable and flexible, including in the manner in which the quota is established and allocated. In addition, the allocation of quota between provinces has become an issue. There has been little recognition of the directive that quota be allocated in relation to comparative advantage in production, the argument being that provincial quotas should reflect local consumption.

The National Poultry Task Force, established during the Growing Together exercise, undertook a review of the operation of the supply control marketing agencies for poultry. Their work was prophetic. The Task Force was guided by six principles: recognition of the relevance of supply management systems; favouring responsibility-

sharing and cooperation by industry; satisfying market needs; improving the transparency of the system; ensuring system responsiveness; and increasing system efficiency. [119]

The Task Force concluded that supply management systems can be viable and effective and are widely supported while recognizing changes must be made to improve them. In addition, the risks and benefits of supply management decisions should be shared among the key players in the food chain. Decision-making responsibility should similarly be shared under established and responsive controls by obtaining credible input from key participants and adhering to meaningful demand requirements, thereby mitigating risks for all. Decision-making should be reasonably transparent and decision-makers accountable. Where disputes occur between key players, they must have access to an efficient and effective dispute resolution mechanism which can impartially resolve the issue and bind the parties. Furthermore, supply management systems have an obligation to satisfy the market with product, when and where the product is required and in the quality desired.

These systems must signal to the market and various supply and demand constituents that growth is available, achievable and can be satisfied. In furthering this end, supply management systems should provide primary and secondary processors with secure and predictable procurement conditions at reasonably competitive prices. The policies in which supply management and import quota management are operated should be transparent and harmonized to provide for the fair treatment of all stakeholders. They must comply with GATT requirements. Operations of the supply management system, especially production allocation processes, should be flexible enough to respond to changing market configurations and conditions. To obtain this desired flexibility requires amending the unanimity requirement in the Federal/Provincial agreements.

In order to promote efficiency, pricing systems related to supply management should be transparent and provide an incentive for improved efficiency, productivity and quality at all levels of the food chain. Over time, efficient producers, like other participants in the food chain, have the right to expect recovery of real costs, including quota values, plus a reasonable return on investment. Special pricing systems should be designed to supply domestic and international markets where products are traded without restrictions.

Notwithstanding the conclusions of the Task Force, there has been minimal modification of the supply management system. The *Farm Products Marketing Agencies Act* as modified in 1993 (as described above) provides for introduction of promotion and research plans and also for more representation from stakeholders other than producers. In the future, the supply management system can be expected to be modified substantially as a result of the new GATT agreement.

The *Farm Products Marketing Agencies Act* merely provides the framework within which national agencies operate. Consequently, in order to provide an assessment of the ultimate impact of the legislation upon sustainable agriculture, it is necessary to assess the operation of agencies under the Act. The agency chosen to be assessed as a prototype is the Canadian Egg Marketing Agency. This agency engages in supply management of eggs. Background on the operation of the Agency will therefore be provided so that an assessment of its operation is meaningful.

Canadian Egg Marketing Agency

Each province has jurisdiction over the marketing of its agriculture products to the point of first sale outside the province under the Constitution Act. Consequently, when a national marketing agency is formed it is necessary for a province to delegate its power over the marketing of the product to the federal government. This transfer is accomplished through a federal-provincial agreement. The initial *Federal-Provincial Agreement* was signed in 1972 when the formation of a Canadian Egg Marketing agency was contemplated.

The Canadian Egg Marketing Agency was subsequently established by federal order-in-council on December 15, 1972 at the request of producers. The Agency has twelve members, one from the egg commodity board in each province and two members appointed by the federal cabinet. The agreement was revised in 1976 as the *Federal-Provincial Agreement in Respect of the Revision and Consolidation of the Comprehensive Egg Marketing Program for the Purpose of Regulating the Marketing of Eggs in Canada.* The Agreement has six parts: covenants by the Ministers of Agriculture; covenants by the supervising agencies; covenants by the provincial commodity boards; covenants by the agency itself; covenants by all parties; and interpretive matters.

The national supply management system for eggs, established under the agreement, is an arrangement which is implemented through a series of regulatory federal and provincial actions. Such actions are required due to the divided constitutional jurisdiction over the marketing of farm products. The integrated scheme has several key components. These include:

119 National Poultry Task Force. *Towards the Development of a Second Generation of Poultry Supply Management Systems* March 15, 1991.

1. A system for determining the demand for shell eggs (excluding hatching eggs) and for allocating complementary federal and provincial egg marketing quotas to producers.
2. Application of liquidated damages to provincial commodity boards when provincial hen flock sizes are exceeded.
3. Action to ensure that the interprovincial movement of eggs is not impeded.
4. A licensing scheme applicable to the marketing of eggs in intraprovincial, interprovincial and export trade.
5. Cost of production pricing through a central system administered by the Agency in consultation with the provincial commodity boards.
6. A program for the removal of within-quota eggs which are surplus to table market requirements, this called the National Surplus Removal Program.
7. A system of levies to cover the administrative and marketing expenses of the Agency, including those arising from the National Surplus Removal Program.

Under the agreement, federal and provincial egg marketing regulators divide up the anticipated markets for Canadian eggs on a provincial basis and impose limits upon Canadian production of eggs. Producers benefit from these actions since provincial rivalries are kept in check and egg prices are stabilized at a level which provides a fair return. The limit on production arises from the complementary federal and provincial egg quota system which is imposed on producers.

There are two distinct markets for eggs in Canada, the "table" market and the "industrial" market. The former is the traditionally higher priced market provided by wholesalers, dealers, retailers, hotels, restaurants and institutions which serve consumers. The latter absorbs those eggs which are not purchased by the table market, and they are processed further. The volume of eggs directed into this market varies during the year as the demand in the table market fluctuates. Producers sell their eggs to the egg grading stations which perform washing grading, packaging and other marketing functions. A price is set that the grading stations are required to pay producers for their eggs, the "producer price". This price is established periodically using a formula established by the Agency. The formula utilized covers the producer's cost of production plus a reasonable return on investment in plant and equipment as described below. The egg grading stations in turn add their washing, grading, packaging and handling charges to the price paid to the producer and offer the eggs to the table market.

To ensure the egg grading stations buy all the within-quota eggs at the producer price, the Agency guarantees that they will not be required to sell their eggs into the industrial market at a loss. The Agency acquires the eggs going to the industrial market under the National Surplus Removal Program, absorbing any loss. The loss is covered by a levy imposed on producers, this levy being deducted from the amount which would otherwise be paid to the producer for each dozen eggs. Consequently, each producer actually receives for the eggs delivered a net amount per dozen which is a blend of the price available in the table market and the price available in the industrial market. (Losses experienced in sales to the industrial market are incorporated into the cost of production formula).

With this discussion as background, further detail on the essential components of the egg marketing system existing under the federal-provincial agreement is provided below. This detail will provide for a meaningful assessment of any impact of the system on sustainable agriculture.

1. Quota

A national quota is a basic feature of the marketing system for eggs. This quota was initially established on a national basis and allocated among the provinces based on their average production during the five years previous to the establishment of the Agency. A mechanism is provided under the federal-provincial agreement whereby the aggregate of the provincial egg marketing quotas may be adjusted as required by the market. A federal egg marketing quota is assigned to each producer so that the total of all such quotas plus the total of all provincial quotas allotted by the provincial egg commodity board equals the provincial allocation established for the province in that particular year. Each provincial egg commodity board assigns a provincial quota to each producer in the province so that when taken together with the total of all federal quotas assigned to producers of the province by the Agency, they do not exceed the provincial allocation. In practice, the quota is imposed on the number of laying hens held by the producer, the producer being given a quota of a particular number of laying hens rather than one based on the number of eggs marketed. The historical quotas established do not reflect egg consumption by province with the result that provinces with high aggregate consumption continue to agitate for higher quotas. On the other hand, little attention has been given to the requirement under the Act that additional quotas be allocated according to comparative advantage in production. The allocation of quota is therefore controversial among provinces.

2. Liquidated Damages

Under the federal-provincial agreement, provision is made for a liquidated damages system. Each province is allocated a maximum laying-hen flock size. If the province's laying-flock size is exceeded, the provincial commodity board is required to pay the Agency liquidated damages as determined by the Agency. Enforcement is by means of a bond posted with the Agency.

3. Import Restrictions

Restrictions on the imports of eggs and egg products into Canada are an essential component of the national supply management system for eggs. The federal cabinet has placed eggs and certain egg products on the import control list under the Export and Import Permits Act so that the domestic controls on import will ensure a fair return to producers. Such import restrictions are required to insure supply and demand remain in balance to the benefit of egg producers. Import restrictions in such a case are permitted under Article XI of the GATT and also under Article 706 of the CUSTA. However, import controls are to be replaced with tariffs on January 1, 1995 under the new GATT agreement. The proposed level of the tariff on eggs will essentially be as effective as import control until 2001. The proposed level of the tariff is being challenged by the Americans under the terms of the CUSTA and is yet to be approved by other nations acceding to the new GATT agreement.

4. Interprovincial Movement

The federal-provincial agreement essentially requires that movements of eggs among provinces not be artificially restricted.

5. Licensing

Complementary federal and provincial licensing schemes are imposed on all those engaged in the marketing of eggs. The ostensible purpose of such licensing is to provide an accurate record of egg movements to enable the planning required to maintain the national supply management system for eggs.

6. Cost of Production Pricing

Cost of production pricing is a major component of the national supply management system for eggs. Prices payable to producers for the various grades of eggs are established weekly through consultation between the Agency and the provincial commodity boards based on a cost of production formula. This formula is approved by the National Farm Products Council and the operation of the formula is monitored on a continuing basis. The formula takes into account depreciation, pullet costs, feed, labour, overhead, return to debt and equity and also provincial commodity board levies. The actual prices are decided upon to provide a central pricing system which takes into account transportation and marketing differentials and which has sufficient flexibility to be responsive to market conditions. The over-riding concern is that the producer price be set at a level which covers the costs of production plus a reasonable profit.

7. National Surplus Removal Program

This program is essential to the national supply management system. Since demand for table eggs varies seasonally, while hens tend to lay on a regular basis, the eggs produced within quota in excess of those absorbed by the table market at the established price must be diverted into the industrial market. A further complicating factor is that consumers desire specific grades of eggs in volumes which may not be consistent with those produced at a given point in time. The Agency purchases the eggs in excess of table market requirements from the egg grading stations on a weekly basis. The volume is approximately 17 percent of production. The price paid to the grading stations is equal to the price paid to the producer plus an amount sufficient to offset washing, grading, packaging and handling costs (recently about 10 cents per dozen). The eggs purchased by the Agency are sold to Canadian processors under contractual arrangements at prices similar to those paid by U.S. processors or those available in the export market. Since losses under the surplus removal program are substantial (about 50 percent of the value of each dozen), the losses are offset by the imposition of levies, the producer receiving a blended price of that portion sold in the table market and that sold in the industrial market. The operation of this program has been quite controversial, particularly with regard to the levies which are imposed. These levies are described below.

8. Levy System

Three principles guide the operation of the levy system: recovery of expenses, uniformity of levies and equalization of returns. The supply management system for eggs is designed to be self-financing. Under the Act, levies are to be imposed by the Agency that covers the administrative, marketing and other costs incurred on an annual basis. Such costs include the creation of reserves, any losses on the sale and disposal of eggs, equalization or adjustment payments among egg producers based on monies realized from the sale of eggs within particular time periods, and any other costs necessary for the operation of the Agency. Under the federal-provincial agreement, the levies are collected by the provincial commodity boards. The levies are to be uniform on all eggs sold by producers, or in other words, the

> same levy applies across Canada. Equalization of returns from sales to the table and industrial markets occurs on a national basis with national market sharing and cost of production pricing being agreed to in the federal-provincial agreement. The burden of losses on sales to the industrial market is therefore assumed by producers in relation to their deliveries. The levies imposed are allotted to three funds. The administration fund covers the administrative costs of the Agency and it is incorporated into the cost of production formula. The cost of production equalization fund covers the losses incurred under the National Surplus Removal Program on sales to Canadian processors. The fund is also incorporated into the cost of production formula. The producer fund covers the losses on export sales of eggs acquired under the National Surplus Removal program, these losses not being incorporated into the cost of production formula. [120]

The activities of the Canadian Egg Marketing Agency are typical of those agencies exercising supply control under the *Farm Products Marketing Agencies Act.* Consequently, the same assessment of the effects of these activities upon sustainable agriculture would apply to other marketing agencies exercising supply management. The over-riding policy instrument used is regulation. However, regulation is applied only for the purpose of ensuring that the intent of the marketing legislation is accomplished. Several marketing instruments are essential to the supply management instrument. These include quota, liquidated damages, import restrictions, levies, "surplus" removal and licensing. Brief reference also should be made to cost of production pricing. To incorporate all these instruments into the analysis, the impact on sustainable agriculture of the inclusive instrument, supply management, will be assessed.

Assessment of Supply Management

Before proceeding to an assessment of supply management as an instrument affecting sustainable agriculture, some general comments on the effect of supply management and its associated instruments are appropriate. Given that the opportunity to exercise supply management under legislation is unique to "agriculture", the system has been understandably subject to intensive scrutiny. Initially, marketing board legislation was the prerogative of the provinces, designed to redress the perceived imbalance in bargaining power between producers and subsequent operators in the marketing chain. Since the legislation did not allow producers in a province to extend control to the national market, they agitated for the control made available under the *Farm Products Marketing Agencies Act.* In theory, the desire was to support the operators of "family farms". However, the reduction in the risk associated with production, arising as a result of the legislation in combination with the economies associated with size, has resulted in a decline in the number of participating producers. This decline is confirmed by statistics.

Several authors have commented on the operation of agencies exercising supply management. Typical of their comments are those published by Forbes *et al* [121] and those published by the Growing Together exercise.[122] The regulation applied is said to render production of the supply managed commodity a profitable venture whereas, previously, returns were either inadequate or depressed. In addition, returns have been rendered more stable.

While the decline in the number of producers has been slowed, and though production and marketing systems remain firmly in the control of producers, the decline does continue. Vertical integration has been thwarted while production remains primarily a "family farm" enterprise.

Notwithstanding what may be viewed as positive developments as a result of regulation, reform is necessary and should be guided by certain principles. These principles include: that price should provide normal profits to producers having a rising standard of efficiency; protection should be given from distress selling by foreign sources; bargaining power between producers and other industry participants should be equalized; the integrity of the Canadian common market should be protected; mechanisms should be provided to correct regulatory abuse; and existing producers should leave to their successors a more competitive industry than they experienced. To accomplish these ends, revision of the cost of the production formula should be undertaken to reflect more closely real costs, thereby reducing the value of quota. True movement of quota on the basis of regional comparative advantage should prevail. There should be more individuals representing the public interest on the boards of the agencies. As indicated above, not all of these recommendations have as yet been adopted.

Warley[123] has expressed concern over the implications for international trade arising from the regulations with respect to supply management. He argues that the

120 The authors are indebted to Penny Kelly of the Manitoba Egg Producers Marketing Board for the information supplied respecting the operation of the Canadian Egg Marketing Agency. The interpretation of the information is the authors'responsibility.
121 Forbes, J. D., R. D. Hughes and T. K. Warley. *Economic Intervention and Regulation in Canadian Agriculture*. Supply and Services, Ottawa. 1982.
122 Growing Together, *Proceedings of a National Agri-Food Policy Conference on Supply Management.* Agriculture Canada. 1989.
123 Ibid. pp. 14-18.

regulatory process should be made more accountable through transparent decision-making and by provision of written policy directives to regulatory agencies. These should make the local industry more competitive. He also suggests that quotas be transferable by auction, that individual production quotas be increased to capture economies of scale, and that dual quotas be established to permit efficient producers to produce at lower or unregulated prices for competitive markets.

Particular attention has been focused in the past on how the cost of production formula is derived. The existing process is said to require upgrading to approximate more closely the real costs of efficient producers. Quota values are considered to reflect profitability. Consequently, the existing formula appears to indicate costs in excess of those actually incurred. Furthermore, higher than justified prices reduce consumption, deterring achievement of economies of scale. All improvements in productivity should be recognized and at least some of the benefits allowed to accrue to society at large.

Veeman [124] has outlined consumer concerns with respect to supply management. She presented data to support the premise that the prices established exceed the operating costs of efficient producers. In addition, consumer subsidy equivalents as a result of supply management are very substantial. Since the supply managed commodities are not luxuries but basic foods, the artificial price increases arising from supply management represent a regressive tax on consumers, those in the lower income groups being relatively more adversely affected than those in the higher income groups. She also expressed concern over both the production quota levels and the import quota levels. Furthermore, rigidities in the pricing procedures adopted are not in the interest of consumers. Rigidities in the adjustment of quota allocation among provinces balkanize provincial production and limit interprovincial trade. She argues that supply management systems should emphasize management rather than restriction.

The various critiques provided concerning supply management emphasize the desirability of enhancement of productivity and of allocation of quotas consistent with the principle of comparative advantage among provinces. Some provincial commodity boards are much more forward looking in this regard than others. The Manitoba Egg Producers Marketing Board, for example, has fostered development of a highly competitive processing industry and supports reallocation of quota in relation to comparative advantage (local producers being very productive).

The above discussion provides background which should be of assistance when assessing supply management as an instrument affecting sustainable agriculture. Some of the procedures adopted to support this concept appear inconsistent with the principles for sustainability. These are identified in the assessment provided below.

1. Management

   Supply management has little if any influence on maintenance of the resource base for future generations or indeed the maintenance of genetic diversity. Any impact on land, water or air quality must be considered minimal. Any large scale units which develop under supply management can have a negative impact on soil, air and water quality, yet without these effects being directly related to this instrument. On the other hand, the restraint on output may provide a greater impetus for minimizing use of inputs in order to maximize net returns. The supply managed commodities in Canada are those which require limited use of land since they are normally produced in a closed environment. Poultry production has largely become a housed enterprise, whether for broilers, turkeys or eggs. Such commodities lend themselves to integration directly or by contract. Consequently, efficiency in use of resources is to be expected.

2. Conservation

   Any influence of supply management on conservation arises largely from the limitation on output. As compared to the situation where production of the same commodities occurred under the "free" market, less of the commodity produced is liable to be wasted. Since production of these commodities occurs within a restricted area using limited land resources, preservation of air quality in the microclimate becomes difficult. The manure produced when spread can be said to preserve the soil. However, these activities do not necessarily arise from supply management. Likewise, land is used sparingly. But this practice is more a function of the production process than that of supply management. Any impact on maintenance of the genetic stock and biodiversity will be minimal. This instrument can be said to be neutral with respect to provision of habitat for wildlife.

3. Rehabilitation

   Supply management as an instrument has little to offer in terms of rehabilitation. On the other hand, the methods of production followed for the current supply managed commodities have some connotations which are relevant to the principle of rehabilitation. It could be construed that supply management is remotely involved. Integration in some poultry production plants is effectively

124 *Growing Together*, Op cit. pp. 38-40.

complete. About the only inputs from the outside, other than labour, is a portion of the feed supply. Some operations have become so integrated that all the products produced, such as broilers, are processed so that all items other than the dressed bird sold are recycled for use in production of subsequent generations. The concentrated nature of production requires use of good waste management, if only for the control of disease. Other aspects of the rehabilitation principle are not impacted, including such factors as restoration of degraded resources and revitalization of resources. The need to apply technology to the production processes utilized ensures that any degrading processes previously adopted are replaced with those more beneficial.

4. Market Viability

   Several aspects of supply management are incompatible with this principle. While the stated intent of the Act is to allow free movement of the products regulated across provincial borders, this movement has not occurred. The difficulty arises due to the failure, such as in eggs, to allocate provincial quotas in relation to comparative advantage rather than with respect to consumption in the provincial markets. Consequently, interprovincial movements have been restrained. Quota allocation has even been a matter of court action among provinces.

   Supply management has given rise to a lack of responsiveness to market needs. One of the criticisms of supply control expressed during the Growing Together exercise was that the agencies exercising power failed to take advantage of new market opportunities. In addition, quality of product was said to suffer due to lack of outside competition. Some agencies have tended to emphasize supply control rather than supply management.

   While theoretically supply management could be universally adopted, in practice it has only been selectively allowed. The Act restricts supply control to tobacco and poultry. Consequently, supply management, as exercised, is not commodity neutral and therefore can be considered biased.

   The pricing arrangements of agencies engaged in supply management account for transportation costs between markets. These differentials apply among the provinces which are in deficit and those which are in surplus. Therefore pricing, at least in theory, is neutral with respect to transportation.

   As indicated previously, efficient use of resources is encouraged due to supply management. The objective being sought is maximization of net returns. Waste generation should also be expected to be kept to a minimum.

   One of the objectives of supply management has been provision of an acceptable level of income to the producer. This objective has been attained for a limited number of producers. Since it is artificially obtained (rather than through the free market) the sustainability of such income can be questioned. Supporting legislation can be changed. On the other hand, stability of income has been enhanced under supply management.

   Production of the products now under supply management would be sustainable regardless of whether this instrument is in effect. Those products benefiting from supply management appear more sustainable under its control. However, much more could be done to render production more competitive in the world market.

   Supply management is not conducive to value-added activity since producers obtain their returns essentially from the raw product. Significant advances have nonetheless been accomplished in processing the raw product through co-operation between an agency and a processor. A good example is the processing of shell eggs by a processor with the cooperation of the Manitoba Egg Producers Marketing Board.

5. Internalization of Cost

   Supply management does not of itself encourage internalization of cost. The pricing formula merely incorporates the costs actually experienced by the producer and does not account for any externalization costs. As a result of supply management, there are additional costs imposed on those who do not have a quota to produce, as well as on consumers, the latter aspect being discussed in terms of another principle.

6. Scientific and Technological Innovation

   Improvements in air, water and land management occur in supply managed production because these improvements require adoption of new techniques, as in disease control and feed preparation. The same applies to advances in waste management. In poultry production one of the main forms of waste is the dead birds which must be disposed of with minimal impact on the environment.

   The factor of production on which the quota is based to control output can have a major impact on animal (bird) productivity. Eggs provide an excellent example. The quota for eggs is based on the number of hens. Consequently, above average output per hen effectively increases the quota for the producer.

   The need for improved waste management can impact on biotechnology as new means of disposal are sought. The same applies to air and waste management. These developments, however, have only a tenuous relationship to supply management.

The concentrated production units in the poultry industry under supply management have an incentive to increase labour productivity since labour, in addition to feed, is a prime source of expense. As a result, production units are highly mechanized with new applications of automation continuing to be developed. There is nothing in supply management, however, to encourage technology transfer to other areas, though producers of the same product emulate the innovators and early adopters.

7. Trade Policy

   Supply management may be judged inconsistent with the principle of trade policy. It is in this area that much of the criticism of supply management has been generated. Regardless of the terms of the Act, which call for the application of true comparative advantage in trade, support for this concept is neither uniform nor general among the agencies. Some provincial agencies actually endeavour to thwart, through legal action, achievement of comparative advantage. Agencies which have comparative advantage are therefore not in a position to capitalize on their position. Increasing pressure is being applied to give greater recognition to comparative advantage when allocating provincial quotas. Further progress along this line is therefore anticipated. With regard to international trade, the exercise of true comparative advantage is thwarted by the high domestic prices arising from supply management.

   One of the major criticisms of supply management is that it has fostered inward looking industries. In no case has this criticism been more real than during the Growing Together exercise. Under supply management, the export market is used only as a safety valve to absorb excess supply at the world price. The prices at which the product is sold in the export market have to be competitive, therefore sales into the export market have to be subsidized. Amendments to the *Farm Products Marketing Agencies Act* support promotion of the products in the export market and encourage local production to be more competitive. It is said that the quality of product desired in the export market has not been forthcoming due to complacency brought on by favourable returns from the limited domestic market.

   Supply management has not lent itself to the export of valued added products. One of the reasons is that agencies have not as a rule engaged in processing. Processors have long contended that if they are to compete in the export market they must have access to the raw material at the same price as their competitors. Only reluctantly have some agencies responded to this request while others have been supportive.

   An exception was made under the previous GATT agreement for the use of import restrictions for a product subject to within country supply management. Much attention was given to Article XI of the agreement during the Uruguay Round, with Dunkel proposing to have it replaced by tariffication which will occur in 1995. Provision also is made for application of supply management under the CUSTA, though the gradual removal of duties on processed products ensures weakening of supply management as presently exercised.

8. Societal Considerations

   Due to the predisposition of agencies adopting supply management to be inward looking, many opportunities for expansion of trade are overlooked and in the process potential additional employment lost. The restriction on the quantity available to the market directly affects consumers, even though food, health and safety are not influenced. Under the Act, producers of supply managed commodities are given immunity from legal action under the Competition Act, a privilege not extended to any other group in society. The additional farm income generated, notwithstanding that it is capitalized into the value of the quota, provides the means whereby producers of the product can bid for land on a competitive basis with others in society, thereby providing some degree of control over urban encroachment.

   The elevated prices in the domestic market serve to increase poverty levels among the poor who utilize these basic products in their diets. At the same time, the incomes of producers are increased, raising questions concerning equity in the distribution of income.

9. Global Responsibility

   Supply management cannot be construed to be consistent with global responsibility. Intragenerational equity is affected due to the need for quota to produce, the cost of which is increasing. Capitalization of the benefits into the value of quota increases the costs of production of new entrants. For the supply managed products, little surplus is available to provide international food aid. This instrument also has detrimental effects on world income distribution since trade is largely thwarted at present. Developing countries who could export similar products are largely unable to compete in countries where supply management prevails and their attempts in this regard are thwarted. Supply management is therefore found wanting in the global context.

Overall Assessment

In summary, supply management has a limited impact on stewardship, including management, conservation and rehabilitation. The effect on market viability is mixed,

being positive to producers and negative to consumers raising the question of whether supply management is sustainable. There is little or no influence on internalization. Certain features of supply management do provide an impetus for technological innovation. With respect to trade policy, supply management must be considered detrimental. Benefits are provided to a limited number of producers whereas the costs are spread over society, inflicting an added burden on the poor. With respect to global responsibility, supply management has a negative influence. On the whole, supply management is found wanting from the point of view of sustainable agriculture.

This assessment points to the dilemma faced by policy-makers with respect to supply management. There are benefits to the few, drawn from the revenues provided by the many. Some less interventionist means should be developed to accomplish the stability of returns provided by supply management. To accomplish fairness and equity, an income policy is suggested that should be sustainable.

Assessment of the Prairie Farm Rehabilitation Act

Objective

The stated objective of the *Act* is, "to provide for the rehabilitation of drought and soil drifting areas in the Provinces of Manitoba, Saskatchewan and Alberta."

The Act provides for the establishment of advisory committees whose duties are to advise the Minister on the best methods to use in rehabilitation of the drought and soil drifting areas in the three prairie provinces. The duties also include developing and promoting of farm practice, tree culture, water supply, land utilization and land settlement which will afford greater economic security. From funds appropriated by Parliament, the Minister is authorized to undertake development, construction, promotion, operation and maintenance of any project. In this connection, the Minister is provided power to enter into agreements with any province, municipality or person.

The simplicity of this Act reflects the urgency of the problem which it was designed to address. The Act was passed in 1935 at a time of great distress in agriculture on the prairies. Continuing drought had rendered livestock feed unavailable in much of the prairies and distress selling of livestock was common. Grain prices were exceedingly depressed. A major problem of the period was the prevailing high winds which gave rise to massive dust storms and crop failure in much of the southern prairies. The "better" farmers of the time plowed deeply, burying the stubble in the fall without regard for the necessity to husband what soil moisture remained from the limited amounts of precipitation received. This depressing situation has been described as follows:

> "The drought of the 1930s was by far the worst. The drastic decline in farm prices and the length of the drought reduced many farmers and ranchers on the prairies to destitution. Thousands of farms on sub marginal lands were abandoned to weeds and soil drifting, unfit for crop production or grazing. Conditions were especially severe in the short grass plains of southwestern Saskatchewan where massive outlays for relief were needed for many years. Declining incomes for individuals and governments at all levels made it clear that not only were suitable steps required to alleviate the causes of the drought, but that long term projects for the entire region were in need of study." [125]

When originally passed, the Act was expected to have a life of five years or less, but the progression of the drought led to amendment of the original *Act* in 1937 to include measures for land utilization and resettlement of farmers. By 1939 the usefulness of the PFRA organization created became so apparent that the time restriction on the Act was removed.

At the outset, the PFRA dealt primarily with alleviating the serious water shortage on farms by building structures to catch and store runoff for stock watering, irrigation and domestic purposes. The work of the PFRA was complementary to that done by the Dominion Experimental Farms with respect to soil drifting and other farm problems. The PFRA's programs are designed to:

1. Secure the adoption by farmers of tillage and cropping practices which will enable them to farm under wide and changing physical and economic hazards.
2. Divert marginal land from annual crop production and return such lands to permanent grass for use as grazing.
3. Husband the limited water resources of the prairies for the benefit of agriculture.

Anyone experiencing conditions in the drought area cannot help but have a favourable view of the work of the PFRA. The work accomplished is physically apparent. Furthermore, the PFRA has worked with producers as they attempt to solve their own problems, which encouraged their support.

While attention has been given to the possibility of enlarging the responsibilities of the PFRA under the *Act* to include preservation of the quality of the environment and rural development, the Act has not been amended.

125 Prairie Farm Rehabilitation Administration. PFRA. A Branch Overview. Agriculture Canada. December, 1992.

Expansion of the activities under the existing Act has been accomplished by federal-provincial agreements and by agreements with other groups. A prominent example of the expansion in responsibilities is the National Soil Conservation Program within the prairie region. One element of this program, the Permanent Cover Program (PCP), will be assessed in terms of the contract instrument used to accomplish the objective. This program is considered typical of those engaged in by the PFRA. These programs range from administration of community pastures, provision of trees for farm shelter belts, irrigation in the three prairie provinces to rural development. The PFRA is expected to be a major force in the application of the Green Plan which may add to its responsibilities, preservation and enhancement of plant and animal genetic resources in Canada and also research into integrated pest management.

The PFRA contends that a long-term effort is required to provide continuity in policy so that producers are able to make rational on-farm decisions. Actions that integrate grain production, on-farm and regional diversification, marketing and environmental sustainability are held to be the keys to ensuring the sustainability of agriculture on the prairies.

Permanent Cover Program (PCP)

The purpose of the PCP is to reduce soil deterioration on high risk lands presently in annual cultivation. These lands are not suited for the growing of annual crops and should be permanently converted to forage and/or tree cover. The program is directed toward lands where annual cultivation is causing long term soil damage and where special farming practices cannot reduce the ongoing deterioration. By maintaining these lands in permanent cover, the soil resource will be conserved while providing feed for livestock and habitat for wildlife.

The PCP was initially introduced under the National Soil Conservation Program and was applied through separate federal-provincial agreements to Saskatchewan and Alberta. It was designed as a three year program commencing in 1989 but proved so popular that it was fully subscribed within one year. The initial commitment of $16 million was subsequently increased in 1991 by an appropriation of $50 million under the Third Line of Defense Initiative, FSAMII, the extended program being called PCPII. Since the terms of PCP and PCPII were slightly different, these differences are outlined below.

Under the PCP, soils falling into Canada Land Inventory Classes 5 and 6 were eligible for inclusion. Two options were provided to landowners in Alberta but only one in Saskatchewan. Under the first option land could be converted to permanent cover with no long term obligation, though the intent was to retain these lands under forage production. To offset the cost of establishing the forage crop, a payment of $20 per acre was available, a 40-acre minimum being established per applicant. While this option was available to land owners, it could be extended to tenants where permission by the land owner was given. The maximum cultivated acreage to be enrolled by a landowner was 640 acres.

The second option, which was only available in Alberta, provided that the land be retired to permanent cover under a long term contract. It was available to land owners only, since a caveat was applied to the land for a period of either 10 or 21 years. The $20 per acre payment still applied to the establishment of the permanent cover crop. The amount of the additional payment for either the 10-year or 21-year period was determined by a bidding process, owners having the option to offer their land for contract at alternative prices. Offers equal to or less than 35 percent of market value for 21-year periods or 17 percent for 10-year periods were successful. In practice, one time payments for successful bidders were equal to a maximum of 35 percent of the market value of the land for 21-year agreements and 17 percent for 10-year agreements. An upper limit of $64,000 was established for an individual land owner. Land enrolled under the PCP program is ineligible for crop insurance.

Under PCPII, the program was extended to include the three prairie provinces and the Peace River Block of British Columbia. Under the new regulations, the eligible lands were identified in more detail as falling into Canada Land Inventory Classes 4, 5 and 6. The eligible lands had one or more of the following characteristics:

1. Light textured soils.
2. Droughtly soils with poor water holding capacity.
3. Eroded soils, where the erosion extended to the subsoil.
4. Soils with poor drainage.
5. Saline soils.

Only land owners were eligible, with the minimum acreage being 40 acres and the maximum payment to an individual being $64,000. A $20 per acre payment was provided for establishing a forage crop or trees. Under the 10-year contract an additional payment of $20 per acre applied in Manitoba and Saskatchewan, while in Alberta/B.C. the payment was $30 per acre. For the 21 year contract the payment was $50 per acre in Manitoba and Saskatchewan and $65 per acre in Alberta/B.C.. Land enrolled in the program could be placed in waterfowl plans as well, thereby providing the producer with an additional return from the land.

Approximately 1.2 million acres were enrolled in the two programs. All the available funds were committed well

before the program expiry dates. It is obvious the contract instrument was highly effective in encouraging improved land use.

Both programs also had other net benefits. Perlich outlined how the discounted value of the benefits were less than the discounted value of the costs resulting from the PCP. [126] Benefits to producers include program payments and future yield increases; those to government include the reduction in agricultural subsidies; while certain other benefits accrue to the environment. The costs to the producer are the change in the rental value of the land, while the government absorbs the payments made under the PCP and associated administrative costs.

Perlich's in-depth analysis estimated the effects of the program on producers, taxpayers and the environment. Three soil associations in southern Saskatchewan, Chaplin, Haverhill and Ardill were examined as to the effect of the PCP on yield and soil deterioration. In the analysis, the long term impacts were projected assuming existing conditions would continue to prevail. To accommodate the features of the PCP, the costs and benefits were calculated under the 10-year and 21-year retirement packages at discount rates of 0, 5 and 10 percent.

Perlich found that the net benefit to producers ranged from a loss of $20 million to a gain of $50 million (the cost of the program to government in Saskatchewan was established at $19 million). However, only where all the land in these soil associations is considered marginal does the net benefit to producers not exceed zero, compensation from the program and the value of future yield increases being greater than the reduction in rent. Net benefits to government were substantially more than $39 million. The total net benefit varied by soil association, and was greatest on the Chaplin soil (poorest), intermediate on the Haverhill soil and least on the Ardill soil (best). The 21 year PCP program yielded a greater net benefit than did the 10 year program. Even where the net benefit to the producer was negative (where all the land was considered marginal), the net benefit to society ranged from $20 million to $40 million. The total net benefit ranged from $20 million on the Ardill soil to $90 million on the Chaplin soil.

Government expenditures on the PCP lands were only one third of those which would have been experienced on other programs, resulting in a 3:1 benefit/cost ratio, i.e., for every one dollar spent on the PCP, three dollars were saved on other programs. The benefit/cost ratios for all soil associations were above 1. This confirmed that the PCP was very cost effective.

Perlich concludes:

> "The program (PCP) is necessary to offset other government interventions as well as environmental externalities. Subsides, regulations, and institutions encourage the use of land in grain production where it may not be optimal. Externalities such as debt, disinterest or disregard for intergenerational resource distributions, and insufficient information as to the best cultural practices, entice growers to grow their crops in a less than optimum manner. The PCP makes the production of forage more economically sound. This facilitates a reduction in annual cropping, thought to be a major cause of soil erosion and environmental deterioration in rural Saskatchewan. Thus, the PCP can alleviate some of the pressure on our natural resource base through reductions in marginal acres cropped." [127]

The PFRA confirmed the large, net savings to government arising from the PCP, in an addendum to their draft report of July 1992. [128] They established that the savings arising from the 1.2 million acres enrolled in the PCP were $11.8 million annually. In addition, payments on these lands under the various *ad hoc* grain support programs would be avoided. In reality, the total savings to taxpayers would be even greater as provincial government expenditures on some of these programs are not taken into consideration. Given the $11.8 million annual savings, the long term payoff of the PCP is very impressive. Since the total budget for the PCP for land retired for either 10 or 21 years was $66 million, the program would be paid for in less than six years. In other words, the average benefit/cost ratio would exceed 2:1.

The above analysis draws attention to the savings to the federal government which would arise from diversion of the least productive lands for grain into forage production. Producers allocate their resources according to the profitability of enterprises whether crops, forage or trees. Adjustment out of grain production can be expected to be delayed, however, as long as sufficient monetary support is provided to make this enterprise viable. The observed limited response to a change in relative prices between enterprises reflects the relatively stable wheat economy (whether returns are achieved in the market place or by way of subsidy).

126 Perlich, K. A. *The Economic and Environmental Benefits and Costs of the Permanent Cover Program*, unpublished thesis. University of Saskatchewan. 1992.
127 Ibid. p. ii.
128 PFRA. *Potential Impact of Permanent Cover Programs on Federal Government Expenditures: Draft Report.* Policy and Analysis Services. July, 1992.

However, lower grain prices and lack of profitability in export sales may trigger an interest by producers in searching for alternative enterprises. Conversion of poor land to forage, in combination with production of grain on the good land, could be the basis for the support of a strong livestock industry. According to Perlich's analysis, even in the case of the Ardill soil association, the best examined, the shortfall in farm income caused by placing the land in the PCP was small in relation to the savings to government. An additional payment could therefore be made for the retirement of this land to forage, to offset this shortfall while substantially reducing government expenditures. The current delay in providing additional funds for expansion of the PCP may therefore be questioned.

The above discussion provides background for an objective assessment of the contract instrument as applied within the PCP. By contract, the right to use the enrolled properties was restricted to a particular purpose for either 10 or 21 years, producers having the opportunity to "buy-out" the right transferred during the intervening years. Use of this instrument has had limited application heretofore in Canada, but has been used extensively in the United States under the conservation reserve program. An assessment of the instrument in terms of its consistency with the principles for sustainable agriculture appears below.

1. Management

   The instrument promotes enhancement of the resource base for intervening years. The time horizon is however limited to either 10 or 21 years. There is no provision for an extension of these time periods at present, although retirement to forage or trees for either of these periods may be expected to result in a permanent change in production practices. The instrument as used in the program can be expected to contribute to genetic diversity and preservation of the land and water resource, particularly in combination with other programs such as those of Prairie CARE (Conservation of Agriculture, Resources and Environment) under the North America Waterfowl Management Plan (NAWMP) and Ducks Unlimited. To this extent, there is provision for shared resource management.

2. Conservation

   The intent of the program is to preserve the soil resource for the future. In combination with other PFRA programs, water quality as well as quantity will be conserved. The impact on air quality will be positive since the potential for dust storms is reduced as a result of the associated retirement of land to forage. As indicated above, the additional forage area will increase habitat for wildlife, with this increase accentuated by complementary programs. Genetic and biodiversity can therefore be expected to be maintained. The program assists in the restoration of the land through diversion into grass and trees, which appears to be the optimum use of the land at the present time.

3. Rehabilitation

   The retirement of the degraded lands to grass or indeed to trees as enabled by the instrument should over time restore at least part of their original productivity. Perlich evaluated the PCP in terms of the increased potential yields which would occur if the land was later returned to grain production. However, much of the land retired should remain in forage and/or trees. While retained in forage, the land will be revitalized as the organic material produced, directly or indirectly, is returned to the soil. The program in conjunction with other programs helps restore the wildlife population while rendering the prairie landscape more appealing.

4. Market Viability

   Restricting use of the enrolled lands by contract for even a limited number of years has been shown to result in a more economically efficient use of resources. Furthermore, it is obvious that participating land owners believe that entering into a contract will be positive with respect to their net returns from the land. While the high benefit/cost ratios are predicated upon payment of other subsidies, there is reason to believe that even in the absence of these subsides there still would be a net benefit from the contracts on the land enrolled in the PCP, indicating that a sustainable income could be expected. In addition, the artificial encouragement of grain production on these lands arising from subsidies would be removed. To the extent that forage replaces grain on the land, there will be less pressure on the grain handling and transportation system. The contracts on these lands which give rise to additional forage production can be expected to enhance value added activity as a result of the associated greater livestock production. Effectively, the current bias toward grain production is removed. The program, on the other hand, is neutral with respect to reduction in interprovincial trade barriers.

5. Internalization of Cost

   The contract instrument as applied in the PCP has no direct impact on the internalization of costs. There is an indirect benefit since the costs in terms of soil degradation, attached to grain production on the lands involved, will be removed. There also will be some unmeasured benefits through improvement in the prairie landscape.

6. Scientific and Technology Innovation

   This instrument has little, if any, direct impact on technological innovation. The resulting change in land use may stimulate a degree of research into

the development of more suitable classes of forage for the land. While research into the various aspects of livestock production is already underway, some additional pressure for research may arise from the increased population of animals. In addition, since those who previously produced grain on these lands will have to reorient themselves to production of forage and animals, significant innovation can be expected to occur in farm equipment. Existing technology can also be expected to be more fully utilized. There is no direct link between the restriction on land use arising from the contracts as applied in the PCP and the development of biotechnology.

7. Trade Policy

   The change in land use arising from use of the instrument has implications for trade policy. The increase in forage and the associated expansion in livestock output enhances the resource base. The increase in livestock production is also consistent with demand in the world market, as there is relatively greater demand for livestock products than for grain at unsubsidized prices. This is the case on the prairies where a ready market exists for beef in the western United States. At the same time, there is increased value added since a large proportion of the beef moves as cuts rather than on the hoof. Since livestock production, cattle in particular, is largely unsubsidized, it can be construed that the effect of the instrument as applied is to move toward true comparative advantage in trade.

8. Societal Considerations

   The change in land use associated with this instrument has a positive effect on the rural landscape, resulting in a degraded environment being replaced by one characterized by grassland and contented cows. Some of the land may even be available for recreational purposes. The more natural environment can be expected to attract wildlife. At the same time, there is the potential for increased employment opportunities in livestock management and in processing. A more stable form of agriculture arises. An increased area in grassland can be expected to reduce the siltation of water courses while provision of retention ponds for livestock will provide additional habitat for wildlife. The instrument as used has no impact on food, health and safety. While grain production declines, livestock production increases. The application of subsidies moves toward neutrality. As indicated earlier, the drain on the public purse is reduced, thereby diminishing any unfairness in income distribution.

9. Global Responsibility

   Intergenerational equity may be said to be increased as a result of application of the instrument. The soil resource will be preserved or enhanced over a 10 or 21 year period. However, there is no guarantee that this improvement will continue over the longer term. Furthermore, as presently applied, the areas restored to forage are only blocks limited in size whereas larger area blocks may be necessary to address the problem of soil degradation. There is a positive effect on the distribution of income amongst producers though not appreciable for the world at large. Any effect on food, health and safety in a global context is minimal, as is any effect on the distribution of technology on a global basis. Since livestock production is relatively unsubsidized, there is movement toward greater fairness in income distribution and trade. On the other hand, those who have "mined the land" appear to benefit while those who adopted land preserving practices must rely on the market place and such other largesse as may be provided by government.

Overall Assessment

The contract instrument as applied in the PCP appears consistent with sustainable agriculture. There are certain shortcomings which should be addressed. The length of time for which the instrument applies must be considered too short since there is no guarantee the land may not again be used for annual cultivated crops. It has been suggested that some longer term benefit could be ensured by planting trees on the land. Restrictions on the amount of land which can be retired on one farm (as reflected by the ceiling on the amount of money which can be paid to an individual land owner) augurs against retirement of contiguous units. Restoration of the land is more effectively accomplished in large blocks. The amount of funds devoted to this instrument is far too limited given the large areas of Class 4, 5 and 6 soils which have been degraded by cultivation. The degree to which the funds have been restricted is surprising as there is such a large benefit/cost ratio for the government. Action to overcome these shortcomings will render use of the instrument in the PCP even more supportive of sustainable agriculture.

ASSESSMENT OF THE NORTH AMERICAN WATERFOWL MANAGEMENT PLAN

Objective

The overall objective of the North American Waterfowl Management Plan (NAWMP) is to enhance and protect high quality wetland habitat in North America that supports a variety of wetland-dependent wildlife and recreational uses. More specific objectives for accomplishment by the year 2000 are to:

1. Protect a minimum of 6 million acres of quality waterfowl habitat with about 3.7 million acres occurring in Canada and 2.0 million acres in the United States.

2. Achieve a continental breeding duck population of 62 million birds resulting in a fall flight of 100 million ducks.
3. Maintain a continental wintering goose population of 6 million birds.
4. Maintain a continental swan population of 152 thousand birds.

The Plan emerged in 1986 after a two-year gestation period during which a number of public and private agencies designed in detail a comprehensive land use and waterfowl habitat program. The program arose in response to the decline in waterfowl numbers and the degradation of wetland habitat. The plan was signed in May 1986 by the Secretary of the Interior for the United States and the Minister of the Environment for Canada. The plan was extended to Mexico under a tripartite agreement among the three countries signed in 1988.

Under the agreements, the three countries recognized the continuing loss of habitat and the declining waterfowl populations. They jointly agreed that a unified continental effort would be required if the waterfowl population was to be restored to the level of the 1970s.

The Plan is a broad policy framework that describes its scope and goals, identifies problems facing the waterfowl population, sets general guidelines for addressing problems, and establishes population and habitat goals for waterfowl in North America. The Plan is a partnership effort involving private, state/provincial and federal interests. The Plan focuses on many ongoing and planned waterfowl management efforts continent wide and also stimulates new efforts. One of the 14 joint ventures established under the Plan is the Prairie Habitat Joint Venture which covers parts of the three prairie provinces.

Canadian partners in this joint venture include the PFRA, Ducks Unlimited Canada, Environment Canada (Canadian Wildlife Service), Wildlife Habitat Canada and provincial organizations. Under the Plan, the objective is to have 75 percent of the funds provided by the United States, divided equally between federal and non-federal sources, and 25 percent provided by Canada, the federal government contribution being 10 percent, the contribution of the three prairie provinces being 10 percent with the remaining 5 percent coming from private sources. In practice, these shares have varied somewhat. Approximately two thirds of all Plan expenditures are spent in Canada and these are delivered through the Prairie Habitat Joint Venture.

The Plan coordinates the management and planning of the waterfowl conservation efforts of the three countries. Desirable goals are identified, recommendations are made for the development of government and non-government programs for the protection of waterfowl and habitat, and the efforts of private and public organizations in waterfowl conservation are coordinated, these culminating in maintenance of an adequate database.

The principles of the plan are enunciated as follows:

"1. Protection of waterfowl and their habitats requires long-term planning and the close cooperation and coordination of management activities by Canada, Mexico and the United States, within the framework of the 1916 and 1936 Migratory Bird Conventions.
2. In waterfowl management decisions and actions, first priority should be to perpetuate waterfowl populations and their supporting habitats. Management actions should be at intensities required to prevent the individual waterfowl populations from decreasing to low levels and to encourage optimum use of the available habitat.
3. The maintenance of abundant waterfowl populations is dependent on the protection, restoration and management of habitat. The persistent loss of important waterfowl habitat should be reversed.
4. Waterfowl populations should be managed by identifiable sub-populations where these can be biologically justified and for which management regimes are feasible.
5. Joint ventures of private and governmental organizations should be considered as an approach to financing high-priority research and management projects of international concern that only can be addressed through a pooling of resources.
6. The managed subsistence and recreational harvests of the renewable waterfowl resource are desirable and consistent with its conservation.
7. Recreational hunting will continue to be managed under existing regulatory processes in Canada and the United States. These processes will be subject to continuous review to ensure they are compatible and consistent with waterfowl population needs on a continental basis, and to evaluate their environmental impacts and to ensure public participation.
8. The concept of stabilizing hunting regulations — with review at five year intervals and provisions for predetermined responses to substantive waterfowl population functions — is desirable to encourage long-term waterfowl management efforts." [129]

129 Environment Canada, 1986, as quoted by R. Gray et al. *The Economic and Sociological Evaluation of Land Use Options, Saskatchewan Implementation Plan of the North American Waterfowl Management Plan*. Saskatchewan Wetland Conservation Corporation and Wildlife Habitat Canada. October, 1992. pp. 4-5.

Activities conducted under the Plan are coordinated through a three stage structure, this structure made necessary by the large number of organizations involved. Under the Plan, a committee of 12 persons with equal representation from Canada and the United States is made responsible for overall direction of the program and for overseeing the 14 joint ventures in the various regions, one of which is the Prairie Habitat Joint Venture (PHJV) which includes parts of the prairie provinces. This body is responsible for implementation of the programs within this area. An advisory board of members of Canadian implementing agencies approves programs, arranges financing and makes any necessary adjustments to programs after their evaluation. This board makes periodic progress reports to the Plan committee. Overseeing the various programs within the individual provinces is the responsibility of the provincial implementation groups, which are composed of within province implementing agencies. Approximately $1 billion is expected to be spent under the PHJV by the year 2000, when the Plan is scheduled to terminate.

Coordination of the activities under the PHJV is not an easy task. Consequently, principles have been established to guide programs and delivery mechanisms. These are repeated below since they reflect the thrust of the activities of PHJV.

"1. Objectives for habitat initiatives will be targeted to attain incremental waterfowl population objectives across prairie Canada.

2. Implementation of the habitat joint venture will focus on maintaining a healthy and diverse landscape through integrated land use management to provide continuing waterfowl and agricultural benefits.

3. In the long term, changes in land use practices that improve duck recruitment rates over a vast area are preferable to radical shifts in land use on small areas.

4. Complexes of small wetlands and associated upland nesting cover will be the target of direct habitat enhancement ventures on 3.6 million acres of high waterfowl capability and low agricultural capability.

5. Indirect conservation initiatives building on soil, water and wetland conservation programs will focus on enhancing waterfowl populations throughout the prairies through improved land use practices over large areas.

6. Minimizing the impact of crop damage by waterfowl will continue to be a fundamental component of implementing the PHJV by Canadian wildlife and agricultural agencies.

7. Evaluation will be an integral component of the program. Monitoring and evaluation, supported by directed research, will be the basis for adjusting the program to attain habitat protection, waterfowl recruitment and agricultural land use objectives.

8. The major coordinating role of the Canadian component of the agreement will be vested with the Canadian Wildlife Service. Provincial government agencies will be responsible for coordinating the program implementation and delivery.

9. The funding required to achieve habitat objectives in the PHJV is in addition to current funding levels of waterfowl habitat conservation programs undertaken by participating agencies.

10. All agencies/sectors having major interests in waterfowl, soil and water resources will be encouraged to participate in planning, implementing and evaluating the venture to:

    a) promote the integration of public and private soil, water and habitat conservation programs having common objectives;

    b) discourage conflicting inter-agency objectives; and

    c) promote policy changes that will contribute to achieving habitat protection and enhancement objectives.

11. Where feasible, habitat initiatives under the NAWMP should utilize existing delivery systems.

12. Habitat endorsement on private land will be a fundamental component of the Plan implementation. Participation by landowners in habitat protection initiatives will be on a voluntary basis using free market incentives.

13. Title or responsibility for management of habitat secured under the Plan will reside with Canadian interests.

14. Public lands of major importance to waterfowl will be targeted for protection and habitat enhancement.

15. Agricultural extension programs to demonstrate, promote and implement conservation farming techniques beneficial to waterfowl will be a major component of the Plan's habitat ventures.

16. Public education will be an integral component of all phases of the habitat enhancement and agricultural extension program to increase public awareness and to demonstrate benefits to agriculture and wildlife." [130]

The provincial organizations formed to be responsible for putting these principles into practice vary by province. The organization in Manitoba, the Manitoba Habitat Heritage

130 Prairie Habitat Joint Venture. Prairie Habitat: A Prospectus. 1993. pp. 30-31.

Corporation (MHHC), may be taken as representative. Each of the major components under the purview of the MHHC are discussed briefly below.

1. Manitoba Prairie CARE (Conservation of Agriculture Resources and Environment)

   This organization offers a broad range of land and water conservation options including: incentives to advance farming practices that improve wildlife habitat; land lease or purchase for waterfowl habitat development; and support for grassroots conservation farming techniques. These programs are delivered by Ducks Unlimited with support from the MHHC.

2. Prairie Farming Program

   Under this program, agricultural practices that assure soil sustainability and waterfowl production are evaluated, demonstrated and promoted. Small wetlands and upland nesting habitat are secured by annual lease payments to landowners under the Adopt a Pothole program. This Prairie Farming Program is delivered by the North American Wildlife Foundation.

3. Green Acres Program

   This program offers landowners several habitat improvement options. These include: land lease or acquisition for wildlife habitat; wetland restoration; nest structures; salinity control plantings; small dam construction; and conservation demonstration projects. Many of the projects are undertaken in partnership with local conservation organizations. The program is implemented by the MHHC with support from Manitoba Natural Resources, Environment Canada, Wildlife Habitat Canada as well as by other partners.

4. Heritage Marsh Program

   This program represents a cooperative effort by several organizations, the intent being to conserve, manage and develop the province's most significant marshes for the benefit of wetland wildlife and all Manitobans. Partners in the program include Manitoba Natural Resources, Ducks Unlimited Canada, Wildlife Habitat Canada, the Manitoba Wildlife Federation and the Manitoba Naturalists Society.

5. Waterfowl Damage Prevention and Compensation Programs

   These programs are important as anyone having a field of cereal grain in proximity to duck or goose habitat will attest. Under these programs the risks experienced by farmers and the liability for crop damage are reduced. The federal and provincial governments cost share these programs.

6. NAWMP Evaluation Programs

   These programs are undertaken by the various Plan partners to ensure they are effective in reaching the objectives established.

7. NAWMP Partnerships

   This program is directed towards providing additional ways to conserve the social, water and rural landscape and help ensure the Plan responds to the needs of Manitoba. Support from individuals and organizations is solicited.

Producers approve the measures undertaken to improve wildlife habitat since they are voluntary, the financial incentives acceptable, and the benefits demonstrated. [131] The number of organizations involved in the delivery process, however, results in confusion relative to their responsibilities. [132] The benefit/cost ratios of the MHHC initiatives approach 6:1 while all those under the PHJV approach 5:1. [133] A detailed assessment of the financial incentive instrument, as applied to attain the Plan's objectives and relative to consistency with the principles established for sustainable agriculture, follows. It should be recognized that achievement of the Plan's objectives also is accomplished through moral suasion and demonstration. The financial incentive instrument is used to lease or purchase land for waterfowl habitat. It is worthy of note that the cost of application of the instrument is impacted by the municipal taxes imposed on the land used for habitat.

1. Management

   The purpose of the financial incentive instrument, as applied under the Plan, is to preserve and expand habitat for wildlife, particularly for waterfowl. While some land is purchased and therefore habitat will be maintained over the long term, other land is leased. The expectation is that the change in land use, resulting from the leases, will persist after the leases expire. It therefore can be said that at least some of the additional habitat arising from the instrument will be maintained for future generations. While this habitat is useful for the production of the waterfowl resource, it is also conducive to maintenance of other birds and animals, thereby contributing to diversity. The changes arising from use of the instrument are also supported by a wide range of other activities associated with the Plan as conducted by numerous entities. In reality, there is a sharing of responsibility for the maintenance of waterfowl habitat.

131 Gray et al, Op cit. *An Economic Evaluation of Land Use Changes in Southwest Manitoba* Manitoba Habitat Heritage Corporation. November, 1992.

132 Gray et al, Op cit. Western Opinion Research Inc. *Wildlife Habitat Conservation Study*. Manitoba Habitat Heritage Corporation. November, 1992.

133 Gray, R. *An Analysis of the Prairie Habitat Joint Venture Initiatives on Prairie Agricultural Subsidy Requirements*. North American Waterfowl Management Plan. October, 1993.

2. Conservation

   Application of the principle encourages optimum use of the land from an economic standpoint while promoting preservation of the soil and other attributes of the environment. Producers have the option of whether to participate. Those who participate, either through selling or leasing their land, effectively indicate that participating is to their economic advantage. Habitat for waterfowl is preserved along with the soil and water resources. The additional habitat provided serves to enable the maintenance of existing species, particularly birds and animals preferring a water environment. These are desirable externalities to a program of action which promotes conservation of waterfowl for the purpose of sport. The instrument is used as a tool to conserve a rural landscape which is productive for both agriculture and wildlife.

3. Rehabilitation

   The thrust of the entire Plan is to rehabilitate the waterfowl population which has declined primarily because of the destruction of habitat resulting from current farming practices. Such practices reflect technology and the farm policies in effect. These practices also give rise to degradation of the soil resource. The instrument is used to convert some of the most degraded lands into waterfowl habitat, which will result in at least a degree of rehabilitation. The lands most affected are those which formerly provided nesting cover and contained numerous small wetlands or sloughs. Use of the financial incentive instrument is accompanied by a host of other supporting activities, these arising from other organizations. In other words, rehabilitation is a joint effort. The rehabilitation of the waterfowl resource remains far from complete but substantial progress has been made.

   The financial incentive instrument has enabled a large number of organizations and individuals to assume a stewardship role in the maintenance and enhancement of the waterfowl resource. The associated benefits indicate the instrument is being used in a manner consistent with sustainable agriculture.

4. Market Viability

   The financial incentive is applied in a manner to encourage producers to participate in the Plan on the basis of net returns. Consequently, it can be said the resources diverted under the Program are being utilized in an economically efficient manner. Producers appreciate the income provided, as made evident in their willingness to see the land diverted and in opinion research. This income can be considered more sustainable than that previously received from grain, as enhancement and protection are being encouraged rather than the degradation of the environment which previously occurred. Furthermore, the financial incentive instrument engenders responsiveness to the market, a greater return on the land being offered than that which is otherwise available. Any bias attached to use of the instrument relates to its purpose, which is to provide more waterfowl for hunting purposes, other desirable effects being the result of externalities. At the same time, value added activity will be increased, as land retained for waterfowl purposes may ultimately expand tourism. Certain market viability attributes such as transportation nonetheless remain unaffected by the instrument. Trade barriers are not affected. However, the Plan is a tripartite and involves national governments which recognize that migratory birds are not influenced by national boundaries.

5. Internalization of Cost

   In general, all the costs incurred can be expected to be included when applying the instrument. The instrument can be used to offset one significant cost, the externality of increased crop destruction. The instrument reduces the externalities associated with grain production and replaces them with externalities more consistent with sustainable agriculture.

6. Scientific and Technology Innovations

   Several technological innovations have arisen as a result of use of the instrument. Research has been directed toward determining the most appropriate forage crops to use as nesting cover, the type of artificial nests which are most effective, and the control of predators. Water and land management techniques also have been subject to scrutiny. The thrust is toward increasing the productivity of waterfowl in the prairie region. Farming practices which are not detrimental to the environment desired for maximum waterfowl output have also been investigated. Management of the waterfowl resource stimulates a whole range of scientific analyses, encouraging the transfer of technology from other areas and also the modification of some of this technology to be compatible with local conditions. Any impact on development of biotechnology is minimal.

7. Trade Policy

   Use of the financial incentive instrument ultimately results in increased north-south "trade" in birds to be hunted. The Canadian prairies have the potential to become one of the most productive waterfowl areas on the continent and to hold a comparative (and even absolute) advantage in this capacity. The fact that hunters in the United States are willing to support production in Canada reflects a demand, and the Plan as applied in Canada acknowledges this demand. Waterfowl

production can be said to be a value added enterprise particularly evidenced when land otherwise not utilized is purchased or leased for waterfowl production.

8. Societal Considerations

   Application of this instrument can be considered positive with respect to sustainable agriculture. An enhanced prairie landscape adds to personal enjoyment. Limited opportunities arise for additional employment as a result of the associated resource conserving activity. It could be argued that one group in society, waterfowl hunters, become privileged.

   This group has, however, indicated its willingness to pay for the privilege of increased availability of recreational land. There can be said to be little impact on regional poverty, any impact being related to the increase in returns from directing land formerly used in grain production into waterfowl habitat, one of its original uses. At the same time, there is little, if any, real impact on fairness and equity in income distribution. Other concerns of society such as food, health and safety or indeed waste management are not directly influenced by the application of the instrument.

9. Global Responsibility

   The Plan, including its primary instrument, represents an interesting example of international cooperation in the management of a resource having value for recreational purposes. The resource is primarily located in Canada while the demand for the resource largely occurs in the United States with the result that private and public sources of funds in the latter country provide about two thirds of the funds spent on the resource in Canada. Expansion of the waterfowl resource can be expected to enhance intergenerational equity. Although the leases cover only a limited period of time, the instrument encourages improved land management. Therefore, intergenerational equity in use of the resource will be improved. The instrument has no impact on food health and safety. Income can be said to be transferred from well-to-do hunters to grain producers who may be in less favourable financial circumstances. Since only three countries are involved, other parts of the world will be largely unaffected, other than to the extent that the technology developed under the Plan can be applied elsewhere. No emergency food aid can be expected to be provided by the Plan.

Overall Assessment

The above assessment of the financial incentive instrument under the Plan indicates that it is compatible with and also promotes sustainable agriculture. Enhanced stewardship of both the land and waterfowl resources arises. Beneficial externalities replace negative externalities such as land degradation. The international nature of the Plan, combined with the large number of participating organizations, necessitates a complex organizational structure to accomplish the objective of an enhanced waterfowl population, particularly in view of the need to manage the substantial sums of money involved. On the other hand, the degree of cooperation made apparent by the success achieved in enhancing a particular resource provides an illustration of what can be accomplished through dedication to a common cause.

CONCLUSIONS

The present pattern of agriculture on the prairies has been molded by the government policies adopted over time. The development of the prairies reflects the National Policy instituted following Confederation with its component parts of railway construction, tariffs and immigration. These were designed to further national objectives, not the least of which was to forestall American expansion northward beyond the 49th parallel. The course of development was also influenced by the environment, the effects of which required major initiatives to overcome, and by the distance to the export markets within which much of the agriculture product of the region found an outlet. The region is well acquainted with adversity, due to both the natural environment and world economic conditions.

Agriculture on the prairies has progressed through a series of stages, beginning with the initial breaking of the land and followed by a conservation stage made necessary by the type of cultivation being practiced and existing climatic conditions. During the 1940s, industrial development largely outside the region and the armed forces drained the surplus labour from the farms necessitating replacement by mechanization. Following this stage of development, there was a period during which information on the products of research was distributed, many of these products being utilized directly in farm operations. Next came the induced innovation stage. Problems which must be solved give rise to induced innovation. This stage of development remains underway.

Technology continues to have a major impact on the economic size of the farm unit and in turn on rural communities. Those communities which survive are taking on some urban characteristics. Residents on the land are willing to travel considerable distances to obtain the selection and mix of commodities desired. Community development programs must therefore address both rural and urban concerns if they are to be successful. These concern the quality of education, health services, housing and other social services. A major challenge arising for rural communities becomes how to meet the opportunities and challenges for growth without losing the attractions which have led farm people and other local residents to prefer rural life.

Issues in Agriculture and its Sustainability on the Plains

Several issues regarding sustainable agriculture on the prairies were identified. These issues include measurement of sustainability, land use, degradation of prairie resources, preservation of biodiversity, water use and quality, use of common property, the economic situation, social problems, trade, federal and provincial policies, and global change. An in-depth review of these issues provided insights into desirable changes to be made. At the same time, it provided a background for the development of a conceptual framework for use in analyzing the impacts of government policies upon sustainable agriculture.

The Principles and Framework

The definition for sustainable agriculture adopted is "one that over the long run, enhances environmental quality and the resource base on which agriculture depends, provides for basic human food and fibre needs, is economically viable, and enhances the quality of life for farmers and society as a whole." In order for agriculture to be sustainable, adequate returns must be able to be obtained from production without any need for subsidy.

An analytical methodology was developed to assess sustainable agriculture. Measurement of sustainability is a complex exercise but an appropriate kit of tools has been developed. The relationship between costs and returns is critical to sustainable agriculture. For sustainability, production costs must include those established in the market place and those which are not. Techniques are presented for estimating the costs of these non-market inputs. The income derived from grain in the market place, relative to its production costs, indicated that grain agriculture on the prairies recently has not been sustainable. Livestock agriculture has been sustainable.

The principles essential for sustainable agriculture include management, conservation, rehabilitation, market viability, internalization of costs, scientific and technical innovation, trade policy, societal consideration and global responsibility. Each of these principles is described in the report where their relevant criteria are also presented. The principles and their criteria are incorporated into a framework for assessing, within individual agricultural policies, the consistency of particular policy instruments with sustainable development.

Assessment of Particular Instruments and Policies from a Sustainable Agriculture Perspective

The merit of the framework developed was verified by using it to assess the primary instruments used to further the objectives of particular policies. These policy case studies included the *Western Grain Transportation Act*, the *Farm Products Marketing Agencies Act*, the *Prairie Farm Rehabilitation Act*, and the North American Waterfowl Management Plan. The critical features of each of the policies were described to provide the background necessary for assessing objectively the principal policy instrument adopted in each case. This assessment indicated whether the instrument and the policy were compatible with sustainable agriculture. The particular

policy case studies along with their primary instruments covered a broad range lending credibility to the assessment process. The degree to which the instruments and policies were consistent with sustainable agriculture also varied widely. The success arising from this broad application of the framework indicated that this technique was particularly robust.

The subsidy instrument as applied under the *Western Grain Transportation Act* was found to be inconsistent with sustainable agriculture. The proposed changes to the method of payment of the subsidy would render this instrument more acceptable. However, any subsidy is considered to be inconsistent with sustainable development.

The supply management instrument utilized for eggs under the *Farm Products Marketing Agencies Act* was found to be either neutral to, or consistent with, some of the principles. Other principles were violated, these including trade policy, societal consideration and global responsibility. As a result, the instrument was deemed inconsistent with sustainable agriculture.

The program selected under the *Prairie Farm Rehabilitation Act* was the Permanent Cover Program. Contracting is the instrument used in this program. This instrument was assessed for consistency with the principles established. While the instrument and the program were found consistent with sustainable agriculture, the objectives were not fully attained. Two weaknesses were revealed, the limitations on retirement of land in contiguous blocks and the niggardly amount of funds made available to a program having such a high benefit/cost ratio.

The primary instrument used to accomplish the objectives of the North American Waterfowl Management Plan is financial incentive. This program is unique among the four case studies because the funds for the instrument are provided on a coordinated basis by government and private entities in both Canada and the United States, with Canada being the principal financial beneficiary. The benefit of the increased bird population extends to the United States and beyond as bird migration takes place. Use of the analytical framework revealed that the financial incentive instrument adopted under the Plan is compatible with the principles established and promotes sustainability in agriculture. Beneficial externalities replace those which are detrimental. The degree of cooperation among the funding sources to achieve a common end illustrates what can be accomplished toward making agriculture on the prairies more sustainable.

Sustainable Agriculture Action Programs for the Prairies

The discussion of the issues with respect to sustainable agriculture revealed the need for the alignment of agricultural policies to support sustainable agriculture. A large volume of information is available on how to make agriculture on the prairies sustainable. Furthermore, a large cadre of research talent is available including personnel at Agriculture Canada Research stations, prairie universities, industry firms and prairie organizations interested in sustainable agriculture. Their efforts can be made more effective by ensuring that all policies are consistent with this concept.

RECOMMENDATIONS

Information gathered in the course of the study, the testing of the framework developed and the reviews conducted by the participants of the workshops, as well as others in the field, provide the background for the following recommendations.

1. The framework, given its robustness, should be used to assess existing agricultural policies for consistency with sustainable agriculture and to guide development of alternative or new policies to accomplish this end.
2. Others have suggested that the framework, while providing a valuable normative assessment of policies for consistency with sustainable agriculture, could be enhanced by the development of a sustainability index. It is therefore recommended that attention be directed toward development of such an index where the individual principles and associated criteria are placed in a hierarchy indicating their relative importance with respect to sustainable agriculture.
3. In keeping with the terms of reference for the Great Plains Project, it is recommended that a study be undertaken comparing the impacts of U.S. and Canadian policies upon sustainable agriculture. In order to be manageable, the differential policy effects on two contiguous areas in the respective countries could be determined, i.e., the Red River Valley and the Southwestern Saskatchewan/Montana areas. Contacts have already been made with U.S. universities.
4. Participants in the review process have a common interest in ensuring attainment of sustainable agriculture on the prairies. Since this goal can be achieved by following various courses of action, it is recommended that a prairie success guide for sustainable agriculture be developed which will incorporate among other things the demonstrations of research by its application on prairie farms.

This report represents the output of the first stage of the Great Plains project. The analytical framework developed proved to be useful when evaluating policy instruments and policies for consistency with sustainable agriculture. There is the potential for the framework, which is now normative in application, to move toward empirical measurement. The framework has much to contribute as a means for assessing current policies for their compatibility with sustainable agriculture and for guiding the development of alternative policies to achieve sustainable development.

GLOSSARY

ECOSYSTEM

An assemblage of biological communities, including people, in a shared biophysical environment.

Ecosystem Approach to Decision Making

A framework that allows consideration of the interrelationships and the impacts of human activities, both economic and social, on the biophysical environment.

ENVIRONMENTAL SUSTAINABILITY

The capacity to maintain indefinitely all the conditions and influences surrounding and affecting the development of an organism or group of organisms. In the agri-food sector, environmental sustainability is the capacity to maintain indefinitely the environment necessary to sustain agri-food production.

EXTERNALITIES

The actions of an individual or a group that affect the capacity of another individual or group to act are termed externalities. Externalities can be either beneficial or detrimental, with most attention being devoted to the latter.

INSTITUTIONS

An institution is a collective mechanism for action. Institutions include such things as markets, property rights, environmental protection, laws and customs as well as families and other kinship relationships. Institutions are important because they define the opportunity set of alternative choices that are available for individuals.

INSTRUMENTS

A policy instrument is a means by which the objectives of a policy may be furthered or attained. Instruments include regulation, quotas, subsidies, pooling, cross compliance, contracts, trade agreements, monetary actions, taxation, supply control and moral persuasion.

MARKET FAILURE

Market failure is the failure to establish, in the market place, the real value of a resource which may be used in the production process. Such resources are usually publicly owned and ubiquitous. Common examples include water and air. While use of certain resources such as the soil may result in degradation the cost attached is not taken into account when calculating the total cost of production.

POLICY

Policy is a definite course or method of action selected from the alternatives available to guide and determine present and future decisions. By inference policy is expected to be consistent over time, although ad hoc decision-making tends to be considered part of overall policy in its ability to achieve short run objectives.

PROPERTY RIGHTS

Property rights have three aspects:

1. clearly defined in terms of the identity of the owner and the specific attributes of the assets involved.
2. legally definable, others can be denied use of the attributes without consent of the owner.
3. ownership can be transferred by voluntary transactions, usually for a stated payment.

It is generally accepted that ownership of property provides an incentive for resource conservation as compared to public ownership. On the other hand, property rights may render difficult application of policies considered desirable in the national interest.

RESILIENCE

Resilience of an ecosystem is the ability to maintain its structure and patterns of behaviour in the face of disturbance. Essentially it refers to a system's ability to return to its original state after a disturbance.

RESOURCE ACCOUNTING

Resource accounting places values upon the stocks and flows of natural resources. Resource accounting provides several measures, including: the value of the detrimental effects of production as well as the value of the output, the former offsetting in part the latter; the addition to welfare of environmental protection measures as well as the products of the measures themselves; the deprivation of the natural environment as well as that of productive assets; the value of natural resources; and the cost of resource depletion and environmental degradation.

SUSTAINABLE AGRICULTURE

"Sustainable agri-food systems are those that are economically viable, and meet society's need for safe and nutritious food, while conserving or enhancing Canada's natural resources and the quality of the environment for future generations." [134]

134 Federal-Provincial Agriculture Committee on Environmental Sustainability. *Report to Ministers of Agriculture.* 1990. p. 11.

Sustainable Development

The World Commission on the Environment and Development defined sustainable development as ensuring that development "meets the needs of the present without compromising the ability of future generations to meet their own needs". The Commission continued the definition with "a process in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and endorse both the current and future potential to meet human needs and operations".

System of National Accounts

National accounts, as presently constructed, record the values of the products of economic activity but not those of externalities. Externalities not measured include the negative effects of pollutants; environmental protection measures which add to the product but not necessarily to welfare; depreciation of the natural environment; and the value of natural resources. The accounts provide no measure of economic sustainability in the face of resource depletion and environmental degradation. From the standpoint of resource accounting the present system of national accounts is therefore incomplete.

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APPENDIX A

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