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The Convention on Biological Diversity: Opportunities and Constraints for Agricultural Systems in Canada

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The Issue

Biological diversity, or biodiversity, refers to the diversity of life at all levels and the linkages between these different levels (Wilson, 1992). Biodiversity is commonly interpreted at three levels: 1) genetic diversity – the genetic variation provided by species; 2) species diversity – the variety of species within a given area; and 3) ecosystem diversity – the variety of biotic communities and habitats and the diversity within ecosystems at the landscape or regional level. An extensive body of research has shown that biodiversity has intrinsic, ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic value, and that it is essential for the adaptation and evolution of systems and species and for maintaining the life-sustaining systems of the biosphere (Holling et al., 1995). Concerns over biodiversity loss stimulated the initiation of a formal global response, namely the Convention on Biological Diversity (CBD), in 1992. In December of that year, Canada became the first industrialized country to ratify the CBD, which entered into force on December 29th, 1993. It should be noted that while, to date, 187 countries are parties to the CBD, the United States has not ratified and is not a party to the convention.



Subsequent to ratifying the CBD, Canada has developed, and continues to develop, a policy framework to help it meet its goals within the CBD. This article evaluates the potential for opportunity and/or constraints for Canadian agricultural systems as parties to the CBD develop programs and policies to meet their biodiversity objectives. The article begins by introducing those parts of the CBD that are relevant for agricultural systems and discusses, in general terms, the Canadian response to the CBD. The article then presents the specific biodiversity initiatives that have been developed by the Canadian government and discusses the potential impact of these initiatives on Canadian agriculture.

Implications and Conclusions

The analysis of the CBD and Canada's policy response since ratification provides some insights into the potential opportunities or constraints for the agricultural system in Canada. The CBD itself seems to have limited application to biodiversity issues that are primarily national in scope. Further, even where biodiversity loss due to agriculture may be considered international in scope, the CBD's dispute settlement mechanism appears to be ineffective and non-binding.

The impact of the CBD on Canadian agriculture will be through the policies that are developed by the Canadian government in response to its ratification. Canada has developed a number of plans that provide some direction as to how the country will meet its biodiversity objectives. These plans focus broadly on biodiversity conservation through *ex situ* and *in situ* approaches. It is difficult to determine, at this stage, the full range of costs and benefits and the distribution of these costs and benefits between farmers and society in general; however, it seems that *ex situ* approaches to biodiversity conservation will not impose significant costs or constraints on Canadian agriculture. In fact, the conservation of as much of the existing genetic capital as possible for future breeding programs may be critical for the long-term sustainability of agricultural systems. In contrast, *in situ* conservation may impose significant costs on Canadian agriculture. The asymmetric distribution of costs and benefits between farmers and the rest of society associated with *in situ* conservation implies that, in the absence of financial support for conservation activities, either the conservation objectives will not be met, imposing welfare costs on society, or farmers will need to be forced to invest in conservation, imposing costs on farmers.

The Convention on Biological Diversity

The three primary objectives of the CBD, as stated in article 1, are "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources." The CBD establishes an ambitious set of general obligations that address the full range of human activities that affect biodiversity. While emphasizing national action to conserve and sustainably use biodiversity within national jurisdictions, the CBD creates an international

structure to support national implementation and to promote continued international cooperation (Downes, 1999). The relationship between developed and developing countries and the role that this relationship plays in the conservation of biodiversity are important components of the CBD. Swanson (1999) indicates that diversity and development appear to be inversely correlated and that biodiversity conservation will be most cost effective by targeting less-developed countries since they have the most diversity and the least resources to conserve it; however, this issue is generally beyond the scope of the present article.

The CBD is somewhat distinguishable from other multilateral environmental agreements (MEAs) in that most MEAs deal with resources where decisions made by a state may affect resources used in common with others (e.g., joint waters, common airspace, common climate). In contrast, the subjects of the CBD are primarily terrestrial life forms that, unlike the ozone layer and the climate system, lie firmly and clearly within the boundaries of individual countries. The primary connections between countries regarding these terrestrial resources lie in their potential usefulness in the future and in the interests that some countries are taking in other countries' development choices. Swanson (1999) argues that the exceedingly vague and undefined interests of the CBD could be used to justify intervention in almost any and every facet of national decision making; however, it seems the extent of the potential for disputes and dispute settlement among parties to the CBD is unknown. In fact, while biodiversity is defined by the CBD, damage to biodiversity is not defined. The CBD places few precise binding obligations upon parties, but rather provides goals and guidelines, which are further elaborated by decisions of the Conference of the Parties (COPs). Most of the commitments of parties under the CBD are qualified and their implementation will depend upon the particular national circumstances, priorities and resources available to the individual parties (UNEP, 2001a). Article 27 indicates that the solution of disputes between contracting parties will be through negotiation or mediation by a third party and if this is unsuccessful the CBD provides details of the arbitration and conciliation process in annex II. However, a majority of cases of damage to biodiversity occur in a purely national context and as such may be beyond the scope of the CBD. In fact, the United Nations Environment Program (2001b) has stressed that national law is of crucial importance to achieve the objectives of the CBD. This calls into question the role of and need for the CBD, an issue that will be discussed briefly in the conclusion of the article.

Biodiversity and Agriculture

The parties to the CBD have identified the important dimensions of agricultural biodiversity to include 1) the genetic resources for food and agriculture, including cultivated species, domesticated species and managed wild plants and animals, as well as wild relatives of cultivated and domestic species; and 2) the components of agricultural biodiversity that provide ecological services, including a diverse range of organisms in

agricultural production systems (UNEP, 2002). Biodiversity goods and services provided to Canadian society include genetic material for plant and animal breeding programs, nutrient recycling and soil fertility maintenance by soil organisms, maintenance of hydrological services including water quality and quantity management by wetland systems, pollination and pest control and greenhouse gas management (AAFC, 1997a; Thrupp, 2000).

Despite the goods and services provided by biodiversity in agricultural systems, the stock of biodiversity is decreasing due to the necessity of converting land from natural vegetation to more intensively managed commodity production systems. In general, the modern problem of terrestrial extinction has been characterized as a problem of conversion of the range of life forms on earth to a smaller range of species. Although the recently increased rates of extinction have not significantly reduced global biomass stocks (net primary productivity has decreased by only 4 percent) its constituency has been altered dramatically (Swanson, 1995). This homogenisation of ecosystems, particularly due to agricultural development, is due to a change in the relative investment rates, from individuals to governments, regarding the various species. The public-good nature of many of the goods and services provided by biodiversity ensures that its value is not apparent to decision makers, causing an under-investment in biodiversity. The intent of the CBD, and subsequent domestic initiatives of the parties to the CBD, is to develop policies and programs to address this market failure.

Canadian Action from the CBD

Within Canada, the federal, provincial and territorial governments developed the Canadian Biodiversity Strategy (CBS) (Environment Canada, 1995) in accordance with article 6a of the CBD. The CBS was developed to guide the implementation of the CBD and to enhance the co-ordination of national conservation efforts. While many of the CBS strategies directly or indirectly address biodiversity issues in agriculture, the specifically agriculture-related directives to federal and provincial governments, are to 1) maintain the agricultural resource base through research, policy and program reform, and economic incentives; 2) conserve biological resources through *ex situ* facilities (e.g., seed and field gene banks); 3) develop *in situ* conservation mechanisms for wild relatives of crops, domesticated animals and microbial organisms; and 4) promote sustainable farm practices that are compatible with wildlife (AAFC, 1997).

In response to the CBS, Agriculture and Agri-Food Canada (AAFC) developed an action plan (1997a) that set a framework to guide AAFC's implementation of the CBS and to transform its strategic directions into practical actions. The 1997 biodiversity action plan set out four general goals for conserving biodiversity: 1) promote sustainability in agro-ecosystems while respecting natural ecosystems; 2) increase awareness and understanding of biodiversity in agriculture; 3) conserve and facilitate access to genetic resources that are important to agriculture, and share knowledge, expertise and

technologies in a fair and equitable way; and 4) integrate biodiversity conservation and sustainable-use objectives in departmental policies, programs, strategies, regulations and operations. Each of these goals is supported by a series of more specific objectives that provide somewhat more direction for policy and program development.

In 1997 AAFC also published its first strategy for environmentally sustainable agriculture (AAFC, 1997b), which included a number of commitments that addressed biodiversity conservation as a component of sustainable agriculture. Based on a recommendation of the Auditor General in May 1998, AAFC's second strategy for environmentally sustainable agriculture (AAFC, 2001) specifically incorporated AAFC's biodiversity strategy and serves as the department's updated Biodiversity in Agriculture Action Plan. These plans provide the foundation for the development of Canada's policy approach for addressing its "commitments" under the CBD, and as such serve as important documents in an analysis of the potential impacts of the CBD on Canadian agriculture.

The remainder of this article will be organized around the two biodiversity objectives in AAFC's most recent action plan: 1) improve agricultural biodiversity (objective 1.4, which focuses on the genetic and species scale agricultural biodiversity in primarily domestic varieties of plants and animals); and 2) improve the conservation of natural biodiversity (objective 1.5, which focuses on genetic, species and ecosystem scale natural biodiversity) (AAFC, 2001). These biodiversity objectives will now be discussed in terms of their potential consequences for Canadian agriculture.

Conservation of Agricultural Biodiversity

The CBD defines agricultural biodiversity very broadly to include "all components of biological diversity of relevance to food and agriculture, and all components of biological diversity that constitute the agro-ecosystem" (UNEP, 2002). However, AAFC seems to consider agricultural biodiversity, as addressed in objective 1.4 of their second action plan (AAFC, 2001), more narrowly as the genetic material for food and agriculture, including cultivated domestic and wild plant and animal species and wild relatives of these species. It has been shown that selective breeding of plants and animals to increase productivity and uniformity has narrowed the genetic base of agricultural varieties. For example, 90 percent of the world's food comes from only 30 crop species (Barrett, Barbier and Reardon, 2000). In addition, land conversion and habitat loss has narrowed the genetic base of wild relatives of the agricultural varieties in Canada and throughout the world. Therefore, the intent of this AAFC objective is to address the need for a broad genetic base for agricultural species to facilitate the development of new varieties of crops, animals and micro-organisms in order to maintain the sustainability of agriculture in the face of economic and environmental shocks.

The primary mechanisms identified to "improve agricultural biodiversity" are to invest in research and knowledge building and in improving *ex situ* conservation facilities

in accordance with article 9 of the CBD. An important example of *ex situ* conservation investment in Canada is the establishment of the Plant Gene Resources of Canada facility in Saskatoon, Saskatchewan. This facility was established for the conservation and study of seed crop genetic resources; it contains a gene bank that houses more than 110,000 samples of seed from Canada and around the world and is acquiring germplasm from Canadian native plant species. This facility forms part of a network of *ex situ* conservation facilities that maintain, for example, heritage fruit varieties, potatoes, bacteria, fungi, moulds, insects, domestic animals and woody plants (AAFC, 2001). In addition, the Canadian government has said it will support bilateral and multilateral initiatives aimed at the conservation of, and access to, global genetic material¹ (AAFC, 1997).

The improvement of agricultural biodiversity by way of *ex situ* conservation of genetic resources and genetic material² will have primarily positive consequences for Canadian agriculture. As discussed, the ability of agricultural production systems to respond to, economic, disease or climate shocks is determined by the genetic capital available for plant and animal breeding programs. It is important to note that economic, disease or climate shocks may change and/or become more prevalent and severe in an era of climate change. Considering that the loss of genetic resources through extinction is an irreversible change and that there is uncertainty over what genes will be valuable for future breeding programs, the conservation of as large a stock of genetic resources as possible is important. Swanson (1995) showed that in the context of biodiversity, option value, which represents the value of retaining a larger choice set until the next period's information arrives, is clearly positive.

It should be noted that the CBD states clearly that *ex situ* conservation should serve to complement, not substitute for, *in situ* conservation (article 9) and as such, *ex situ* conservation will not weaken requirements for *in situ* conservation. The implications of *in situ* biodiversity conservation for Canadian agriculture will be discussed in the next section.

Conservation of Natural Biodiversity

The interpretation of *natural biodiversity* used by AAFC seems to be consistent with the second dimension of agricultural biodiversity provided by the CBD: "...the components of agricultural biodiversity that provide ecological services, including a diverse range of organisms in agricultural production systems that contribute at various scales" (UNEP, 2002). This definition captures a broad range of biodiversity components including wildlife and wildlife habitat, soil biodiversity, insect pollinators and wetland systems. The primary conservation mechanism identified is *in situ* conservation, defined by the CBD as the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings (article 2).

The mechanisms put forward by AAFC to conserve natural biodiversity focus on both the department itself and the Canadian agricultural sector. For example, both the 1997 and

2001 action plans identify, as priorities, the funding of research and information transfer to increase the knowledge and awareness of natural biodiversity within AAFC and the agricultural sector. It is anticipated that these mechanisms will engender stewardship of the land and thereby internalize the external costs associated with declining natural biodiversity. It is unlikely that research and education will externally impose additional costs or constraints on agricultural producers; however, there may be welfare effects associated with changes in AAFC spending priorities as biodiversity research and education receive a greater proportion of the department's budget. Further research would be required to determine whether there would be a net welfare gain or loss.

Departmental target 1.5.4 of the 2001 action plan states that AAFC will contribute to biodiversity conservation and enhancement on lands it administers. This target primarily addresses the management of AAFC community pastures. The impact that this target has on farmers may be positive, at least in the long run, as it has been shown that in many cases rangeland that is managed for biodiversity conservation (good to excellent range conditions) also provides good livestock productivity (Feather, Hellerstein and Hansen, 1999). PFRA (2003) reports that 50 to 75 percent of the federally managed pastures are in good to excellent condition, meaning that management on 25 to 50 percent of the pastures will need to change; such a change would include decreasing the animal stocking rates if biodiversity objectives are to be met. Farmers who depend on government pastures may be negatively affected, at least in the short run.

An important component of *in situ* conservation proposed in the CBD is the establishment and management of protected areas, including environmentally sound and sustainable development in areas adjacent to protected areas and rehabilitation and restoration of degraded ecosystems. The 1997 AAFC action plan's approach to *in situ* conservation is quite general. For example, the plan recommends encouragement of the conservation of natural lands, adoption of conservation range management, establishment of multi-row shelter-belts and riparian buffers, and adoption of integrated pest management. At the policy development level the 1997 action plan supports environmental management tools such as environmental farm plans and best management practices; integration of biodiversity conservation into agricultural policies in the early development phase; adoption of programs that do not favour a particular commodity and do not encourage intensive monoculture; and consideration of biodiversity, including vulnerable, threatened and endangered species and rare, unique or fragile ecosystems, in the environmental assessment of projects, policies and programs. The 2001 AAFC biodiversity action plan is much more specific in identifying the following as a goal: "by 2006, there will be a neutral or positive trend in habitat availability on agricultural lands across Canada" (AAFC, 2001, target 1.5.6).

It is worthwhile to note that at this time policies have already been developed and are being put in place to help Canada meet its biodiversity objectives through *in situ* conservation. For example, the Species at Risk Act (Environment Canada, 2003) and the

Ecological Gifts Program (Environment Canada, 2000) legislate or facilitate the conservation of biodiversity. Further, the environment pillar of the Agricultural Policy Framework (APF) explicitly highlights the goal of biodiversity conservation on agricultural lands, the completion of agri-environmental farm plans and the adoption of improved stewardship through environmentally beneficial practices (AAFC, 2003).³

These initiatives aimed at *in situ* biodiversity conservation may pose a significant constraint to future development of Canadian agricultural systems. Programs aimed at maintaining or increasing biodiversity on privately managed land will likely preclude certain management alternatives and thereby decrease the range of management options available to the farm. For example, with respect to private costs, shifting land from the production of commodities to biodiversity conservation means giving up income from the commodities that could have been produced on that land. Acquiring information about the conservation rules and management alternatives will impose additional costs on farmers. With respect to benefits, increased adoption of conservation management will provide a range of ecological goods and services, some of which can be captured by the farmer; however, many of the benefits provided by *in situ* conservation are public goods and are enjoyed off-farm. Therefore, markets will not provide farmers with adequate economic incentives for the socially optimal provision of biodiversity through markets. As a result, it could be argued that biodiversity conservation will need to be enforced by the government or encouraged by means of financial incentives.

The importance of financial conservation incentives is recognized within the CBD (e.g., article 8m); however, AAFC's biodiversity action plans provide very little guidance on the use of financial incentives to encourage conservation. In fact, the only mention of financial incentives is in goal 4.1.3 of the 1997 action plan, which recommends the examination of a variety of instruments, including "... non-trade-distorting economic instruments such as green marketing ..." to serve as incentives for biodiversity conservation (AAFC, 1997). In terms of subsequent policies and programs, the Species at Risk Act does contain provisions for compensation that apply only in very specific land use prohibitions (Environment Canada, 2003). The environmental pillar of the APF recommends that biodiversity conservation be achieved on a voluntary basis (clause 24.3) or through cost-shared programs between parties to provide incentives to address environmental risks and enhance environmental benefits from agriculture (clause 26.8) (AAFC, 2003). Further, the APF states that these financial incentives will be guided by agri-environmental farm plans. It seems that without a more clearly specified incentive process the *in situ* conservation objectives of the CBD, and more specifically the AAFC target (1.5.6) of neutral or positive trend in habitat availability, will be difficult to attain and/or will impose welfare costs on the Canadian agriculture sector.

The CBD *in situ* conservation mechanism of protected area systems and the regulation of activities surrounding these protected areas (article 8) may also affect Canadian agriculture; however, AAFC uses much weaker language than the CBD to address this

objective. Goal 1.2.3 of the 1997 Biodiversity Action Plan is to “encourage the conservation of natural lands within agro-ecosystems.” Therefore, while it is difficult to be certain, it seems that protected areas may not be an important component of AAFC’s biodiversity conservation plan. It is worthwhile to note, however, that the establishment of protected areas and surrounding buffer zones may increase land values, whether through decreased local land supply or through increased demand for recreational land adjacent to these protected areas. Once again, while the biodiversity conservation benefits of these protected areas are gained by society, and indeed there may be gains in aggregate social welfare, the costs are disproportionately borne by local farmers.

Conclusion

Since Canada ratified the CBD it has developed a number of plans that provide some direction as to how the country will meet its biodiversity objectives. As agricultural development depends on the conversion of natural areas to lands that produce marketable commodities, the Canadian agricultural industry has been an important focus of biodiversity plans.

The mechanisms identified in Canada’s biodiversity plans can be separated into *ex situ* and *in situ* conservation approaches. In general, it seems that *ex situ* approaches to biodiversity conservation will not impose significant costs or constraints on Canadian agriculture. In fact, the conservation of as much of the existing genetic capital as possible for future breeding programs may be critical for the long-term sustainability of agricultural systems.

In contrast to *ex situ* conservation, it seems that *in situ* conservation may impose significant costs on Canadian agriculture. Whether the *in situ* conservation takes the form of increased biodiversity within privately managed agricultural lands or establishment of protected areas and buffer zones, in many cases there is an asymmetric distribution of costs and benefits between farmers and the rest of society. The CBD explicitly supports the provision of financial support for *in situ* conservation. The AAFC action plans focus more on engendering stewardship through research and education initiatives and tend to avoid the question of providing financial support for conservation activities. The AAFC’s subsequent APF recommended that biodiversity conservation be achieved on a voluntary basis or through cost-shared programs to provide incentives guided by agri-environmental farm plans. While stewardship initiatives will contribute to conservation of biodiversity, it seems that in order to meet the objective of non-decreasing habitat availability on agricultural lands, financial incentives will need to be provided; otherwise, significant costs will be imposed on farmers.

A question that emerges from this discussion is, What is the role of the CBD? As discussed, the CBD does not seem to have an effective dispute settlement mechanism, and biodiversity issues primarily occur within national contexts and may be beyond the scope of the CBD. In fact, the importance of national law in achieving CBD objectives has been

acknowledged by the parties to the CBD. The role of the CBD may simply be to encourage nations, through moral suasion, to take action to conserve national biodiversity. By ratifying the CBD, governments demonstrate to citizens in their own country and in other countries that they are willing to address the problem of biodiversity loss. Swanson (1999) states that the CBD came into existence because there exists a common interest in the coordinated management of domestic resources, not on account of a joint interest in a common resource, and the recognition of this more complicated form of commonality is an achievement in itself. However, in the context of this article, it is uncertain whether the development of Canadian policies aimed at biodiversity conservation would have occurred if Canada had not ratified the CBD.

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Endnotes

¹ In AAFC's 1997 Biodiversity in Agriculture Action Plan, objective 1.7 of goal 3 states: "Implement activities as appropriate for Canada from the *Global Plan of Action for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture* endorsed at Leipzig, June 1996."

² The CBD defines *genetic material* as any material of plant, animal or other origin containing functional units of heredity; *genetic resources* are defined as genetic material of actual or potential value.

³ For example, goal 24.1.4 of the APF states that the parties agree, in collaboration with the agricultural sector and other stakeholders, to ensure compatibility between biodiversity and agriculture, with key priority areas being habitat availability, species at risk and economic damage to agriculture from wildlife. Goal 24.2.3.5 aims to increase the use of management practices that promote compatibility between agriculture and biodiversity, and to minimize economic damage from wildlife to agriculture.