

# *Biodiversity Initiatives*

Agriculture and Agri-Food Canada



*Implementing the Canadian Biodiversity Strategy*



Agriculture and  
Agri-Food Canada

Agriculture et  
Agroalimentaire Canada

Canada

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**Biodiversity Initiatives**  
**Agriculture and Agri-Food Canada**

**November 1997**

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# Introduction

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## Background

In 1992, Canada joined some 100 other nations in signing the United Nations Convention on Biological Diversity. The Convention commits its parties to an international effort to conserve biodiversity, including ecosystem, species and genetic diversity, to use biological resources sustainably, and to share the benefits arising from the use of genetic resources.

The *Canadian Biodiversity Strategy* is Canada's response to the Convention. A guiding principle of the Strategy is that all of us—governments, businesses and individual Canadians—should contribute to biodiversity conservation and the use of biological resources in a sustainable manner. Governments are called upon to introduce measures that meet international obligations and ensure environmentally sound decision making.

In support of the *Canadian Biodiversity Strategy*, Agriculture and Agri-Food Canada (AAFC) is active in a broad range of biodiversity related initiatives.

## Purpose and Scope of This Publication

This document describes Agriculture and Agri-Food Canada initiatives that contribute to biodiversity conservation and to the sustainable use of biological resources. Consequently, this compilation reflects only AAFC initiatives affecting ecosystems, wild flora and fauna, and genetic resources. It does not reflect the wide range of activities currently being carried out at the provincial and municipal levels of government.

## How the Inventory Is Organized

The inventory of AAFC biodiversity initiatives is organized to reflect areas of the *Canadian Biodiversity Strategy*, as well as other logical groupings that best illustrate Departmental programs and activities.

## Related Publications

Three other publications are particularly relevant to this inventory:

-  *Canadian Biodiversity Strategy*,
-  *Biodiversity Initiatives—Canadian Agricultural Producers*,
-  *Biodiversity in Agriculture—Agriculture and Agri-Food Canada's Action Plan*.



# A Conservation of Genetic and Biological Resources

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## A.1 Collections of Insects and Arachnids

Since its inception in 1886, the Canadian National Collection of Insects and Arachnids (CNCIA) supported by its library has grown to reflect the research, identification, and information needs of the agriculture sector and other national interests. The Department, along with the Canadian Forest Service, the Canadian Parks Service, Environment Canada, Health Canada, National Defence Canada, and the Canadian Museum of Nature, have all contributed to and benefited from its development. It is Canada's foremost research collection of temperate North American insects and arachnids and contains nearly 15 million curated specimens.

CNCIA provides specimens and associated data to support the Department's research, technology transfer, and information management activities and provides a repository for representative and voucher specimens of national significance. Government, university, and private sector scientists regularly use CNCIA to support their research activities, and donate type and voucher specimens to enhance the capacity of these Collections to support regional and national biodiversity initiatives.

## A.2 Collection of Fungal Cultures and Mycological Herbarium

The Department maintains the Canadian Collection of Fungal Cultures which is the largest living collection of fungal isolates (over 10,000 strains) in Canada. Emphasis is on Canadian sources, culturable plant pathogens, wood decay species, biocontrol agents, food and feed spoilage species, and native saprophytic species. The Canadian National Mycological Herbarium houses and curates the country's largest preserved fungal collection (over 300,000 specimens). The herbarium holds over 95 percent of listed plant pathogens or plant-associated fungi recognized in existing host indices.

## A.3 Plant Genetic Resources Network/Plant Gene Resources of Canada

The Plant Genetic Resources Network preserves over 100,000 samples of plant genetic resources for food and agriculture. The Department maintains the main Seed Genebank, and the Clonal Genebank (trees and small fruits). More specialized nodes have been established under the Green Plan at Winnipeg (cereals), Saskatoon (oilseed Brassicas), Morden (Western ornamentals, special crops), Fredericton (potatoes), and Lethbridge (forages).

The network is mandated to protect, preserve, and enhance the genetic diversity of Canadian crop and wild plants of economic importance. This mandate is achieved by acquiring, evaluating, researching, documenting, and distributing samples of plant genetic resources for food and agriculture. Fundamental genetic building blocks are thereby provided for crop variety development and plant genetic studies both nationally and internationally.



## A.4 Collections of Bacteria and Viruses

The Department holds numerous bacteria and virus collections maintained by individual research scientists and study groups. These include bacterial plant pathogens (Kentville, Harrow, Summerland), food spoilage and food pathogenic bacteria (Kentville, Ottawa), rumen bacteria (Ottawa), bacteria for food production (St-Hyacinthe), pest pathogens (St-Jean, London), and herbicide degrading soil bacteria (Ottawa, Saskatoon). The collections, consisting of approximately 13,500 strains, assist in the breeding of fungal- and pest-resistant crop varieties.

Stocks of *E. coli* bacteria carrying cloning vehicles and cloned genes are maintained as tools for recombinant DNA techniques by most research stations. Many cloned genes from agriculturally important organisms (plants, animals, pathogens, micro-organisms) are available to identify specific organisms and to assay genetic diversity. Cloned genes are used for biotechnological applications, such as breeding and genetic modification of micro-organisms, plants, and animals. They can also be used to assay genetic variation in populations, and for hybridization probing to detect and identify particular organisms carrying specific genes.

## A.5 Farm Animal Conservation

The Department has provided financial and technical support to prepare systems and manuals for Rare Breeds Canada, which practises live animal conservation at the grass-roots level.

## A.6 Native Plant Collection and Propagation

The Department's Shelterbelt Centre in Indian Head, Saskatchewan, is collecting native shrub and fruit seed for wildlife and human food product potential. The Centre is surveying native woody plant populations in the Prairies, collecting germplasm, and maintaining seed banks and germplasm libraries of these populations. Native plains cottonwood in the South Saskatchewan River Valley have been sampled and representative germplasm is preserved.

## A.7 Access to Genetic Resources and Biological Specimens

The Department follows the general principles of Article 15 of the *Convention on Biological Diversity*. Samples of plant genetic resources for food and agriculture are available without restriction for purposes of breeding, research, and education. Animal genetic resources are mainly available by contract. A fee schedule was implemented for access to samples of the Canadian Collection of Fungal Cultures. Biological specimens are freely exchanged on a basis of reciprocal treatment. The Department promotes national and international consensus on access to genetic resources for food and agriculture.

# B Inventories and Information Management

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## B.1 Mycological Data Bases

These data bases describe fungi kept in the National Mycological Herbarium since 1989. To date, 18,612 records have been included. The system was developed to provide cost-effective access to inventory data on systematics (taxonomy and identification), distribution, and basic ecology. A comprehensive host/pest data base of all known fungal, viral, bacterial, and nematode parasites on Canadian plants has also been compiled.

Using a data base management system compatible with that of the U.S. Department of Agriculture, a microbial genetic resources Internet Web site was developed displaying the *Inventory of the Canadian Collection of Fungi Cultures*. Other AAFC microbial collections are also being included on the site.

## B.2 Identification Tools for Fungus, Vascular Plants, and Insects and Mites

The Department produces descriptive information/diagnostic tools such as computer interactive synoptic keys (both stand-alone and on the Internet) and data bases for automated identification systems. Standard dichotomous keys are published in various formats, such as scientific journals or books distributed through library subscriptions or exchanges. Comparative authenticated reference material is also maintained, both living and preserved, to ensure accurate identifications. Expert identification services are offered on fungi, vascular plants, and insects and mites, providing accurate and timely information to clients.

## B.3 Canadian Plant Genetic Resources Information System

Plant Gene Resources of Canada maintains this computerized data base containing information on the origin and characteristics of more than 100,000 seed and clonal crop accessions maintained by the Department's Seed Genebank and Clonal Genebank. Information is currently available to germplasm users outside the Department through query to genebank staff. Interactive services for external clients on the Internet are under development.

## B.4 Data Base of Canadian Beneficial and Invasive or Weedy Plants

The Department is developing a national information system on rare and threatened germplasm and invasive alien pests. The purpose of the system is to incorporate information from the Department's Canadian National Collection of Vascular Plants to meet the needs of the agriculture and agri-food sector in germplasm protection, plant protection, pest management, environmental sustainability, and development of biodiversity indicators.

## B.5 Canadian Insect and Mite Data Base

The Department is developing a national information system on insects and arachnids. It will provide cost-effective access to data on systematics (taxonomy and identification), distribution, basic ecology, and issues of social, economic and environmental importance. The Department is also working with federal and industry partners to design and develop an informatics platform for incorporating information from the Canadian National Collection of Insects and Arachnids and its associated library, as well as other relevant sources.

## B.6 National Data Bases for Livestock and Farm Animal Genetic Resources

In agreement with provincial and industry groups, the Department has developed and, until March 1995, maintained national data bases on performance for beef cattle, dairy cattle, sheep, swine, and dairy goats. The information is used in genetic improvement of livestock and in research. A majority of breeders for each species have participated so that the historical data base is useful in tracking changes in performance characteristics over time for major breeds and to some degree, for minor breeds. Industry groups have now agreed to assume the responsibilities for future genetic evaluations and data base maintenance activities.

The Department has also conducted a survey of the number and location of Canadian farm animal genetic resources. Survey responses were summarized by location for the numbers of each breed and sex. Reports in both hard copy and Web format (<http://inforweb.magi.com/~cfcfagr/homepage.html>) are now available on research animals and on breeds of sheep, goats, and swine. Reports on poultry and cattle are in preparation.

## B.7 Regulatory Data Base Inventories

The Canadian Food Inspection Agency\* maintains a database, accessible through Internet, with information about confined field tests of plants with novel traits, and plants with novel traits authorized for general use.

## B.8 Inventory of Rangeland Resources

Under the Green Plan, the Department is sponsoring a project entitled "Initiation of a Biodiversity Inventory for Agricultural Saskatchewan". The objective of the project is to gather existing wildlife and agricultural survey data for development of a geographically referenced assessment of biodiversity in agricultural Saskatchewan, and to establish suitable biological indicators and benchmarks of biodiversity. The Saskatchewan Conservation Data Centre will serve as the repository and distributor for the study information.

*\* It should be noted that as of April 1, 1997, the regulatory arm of AAFC, the Food Production and Inspection Branch, has been consolidated with regulatory components of Health Canada and Fisheries and Oceans Canada to form the Canadian Food Inspection Agency (CFIA). From this historical perspective, the CFIA will continue to embrace the initiatives of AAFC's Action Plan for biodiversity.*

The Department is carrying out ongoing systematic evaluation of the Community Pastures through intensive biophysical inventories of rangeland resources, and maintains a partial inventory of wild plant and animal resources for the purposes of livestock and vegetation management in the Pastures. This inventory can be integrated with past and future biodiversity inventories held by conservation agencies.

A range condition assessment data base has been completed for 40 of the 87 Pastures. This is the only known data base of its kind in Saskatchewan and Manitoba and is currently being used for range management assessment purposes. The data base is available to other agencies.

## **B.9 Biodiversity Sampling Protocols and Data Bases**

The Department develops and tests sampling protocols for arthropods, and produces relational data bases that are spatially and temporally referenced for use in biodiversity assessments and monitoring programs. In 1995, a workshop was held to discuss and reach consensus on sampling protocols for terrestrial arthropods in grassland ecosystems. The intent of protocol standardization is to reduce sampling error resulting from application differences.

## **B.10 Canadian Soil Information System (CanSIS)**

CanSIS is a computerized data base that records information about soils and their distribution, identifies productive soil types in relation to crop requirements, and provides tools to assess the status of land resources and the sustainability of land management practices. The Department's National Soil Data Base interprets and maps risks and opportunities in sustainable land management. Site-specific information and research results are extrapolated to other regions, and relationships between environmental factors and agricultural productivity are elucidated. The data base is used by other federal departments, as well as other organizations.

# C Indicators and Monitoring Programs

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## C.1 Agri-environmental Indicator Project

In 1993, the Department initiated the Agri-environmental Indicator Project to develop indicators that support the larger policy goal of integrating environmental considerations into decision-making processes at all levels of the agri-food sector. The project aims to develop a core set of regionally-sensitive national indicators that will enhance the information currently available on environmental conditions and trends related to primary agriculture in Canada. Through an interactive consultation process, the following indicators were identified for development: soil degradation risk, risk of water contamination, agri-ecosystem biodiversity change, greenhouse gas balance, farm resource management, and input use efficiency. Each indicator measures several sub-components or attributes and is linked to an issue and corresponding performance objective. The first four indicators correspond to the following agri-environmental issues: land and soil quality, water quality, biodiversity conservation, and climate change. The fifth indicator tracks farm-level management practices; the sixth is linked to efficiency and productivity concerns. Progress reports are released periodically and a comprehensive report will be prepared in 1999.

## C.2 Agro-ecosystem Habitat Availability Indicator

The Department is developing biodiversity change indicators to enhance the information currently available on species and landscape diversity in agro-ecosystems. As part of this initiative, the Department is measuring change in the availability of selected wildlife habitats in agro-ecosystems through the analysis of census and other agriculture data. Potential parameters include the area of improved and unimproved pasture, and the availability of habitat types, such as wetland, grassland, and woodland.

Work is currently underway on enhancing the current information available on grassland, wetland and woodland for the Prairies. A land cover data base with the potential to produce an index or model of habitat fragmentation is currently being developed.

## C.3 Agro-ecosystem Species Abundance Indicator

The Department is currently working on developing a taxonomic richness/species abundance indicator for agro-ecosystems. The indicator is being developed to measure changes in the composition and structure of biotic communities in relation to representative agricultural land use practices and cropping systems. Other approaches will also be considered. This long-term project is evolving conceptually through the collaborative efforts of Departmental scientists, the London Research Centre, the Eastern Cereals and Oilseeds Research Centre (ECORC), and the Saskatoon and Lethbridge Research Stations.

In co-operation with Environment Canada, the Department hosted the SAGE (Sustainable Arid Grassland Ecosystems) Workshop in 1995. The workshop examined approaches and protocols for environmental monitoring and the development of biodiversity indicators. Workshop proceedings contain articles relevant to biodiversity monitoring and reporting for agriculture.

#### **C.4 Risk of Water Contamination Indicator**

The Department is developing an indicator to examine trends in risk of water contamination from agri-chemicals. The indicator will track primary agriculture's success in minimizing water pollution risks and identify areas at higher relative risk. The indicator will consist of several components, including nutrients (N and P) and other contaminants from agriculture. Water quality guidelines and standards established for specific uses will be used to determine acceptable and unacceptable levels of water quality. Principal data sources include the Census of Agriculture, Soil Landscapes of Canada data base, meteorological data, crop and livestock surveys, input use surveys, and federal and provincial water quality monitoring and survey programs.

#### **C.5 Land Cover/Management Component of Farm Resource Management Indicator**

The Department is developing this component to estimate the proportion of cultivated land falling under various classes of soil residue cover (low, medium, high) and the adoption rate of selected soil conservation practices. Measurable parameters include: proportion of farmland under various crops, summerfallow, pasture, conventional tillage, conservation tillage, no-till, and adoption of selected erosion control practices (e.g., strip cropping, grassed waterways, winter cover crops).

A draft methodology has been developed and preliminary analysis completed at the national and provincial scales. Additional work involves extending the national analysis to the ecodistrict scale and validating the methodologies and assumptions used. A technical report on soil cover trends from 1981–1991 was published in 1996.

#### **C.6 Soil Degradation Risk Indicator**

The Department is developing a Soil Degradation Risk Indicator to measure trends in the extent, severity and vulnerability of agricultural lands to soil erosion, salinization, and change in soil organic matter levels. The indicator will identify areas at higher relative risk of degradation and provide a measure of progress in managing agricultural lands sustainably. The indicator has three components: soil erosion (wind, water); soil salinization; and soil organic matter. Performance objectives are to be in the tolerable class of estimated erosion rates, to have low salinity risk related to agricultural activities, and to stabilize/increase soil organic matter levels.

This work builds on the research carried out under the Soil Quality Evaluation Project and related research. Reports on water erosion risk, prairie wind erosion risk, and soil salinity change in the prairie regions for 1981–1991 were prepared in 1996.

## C.7 Input Use Efficiency Indicator

The Department is developing an Input Use Efficiency Indicator. It will have two components: use efficiency for fertilizers, pesticides and energy; and irrigation application system efficiency. One component will report input use efficiency by measuring long-term trends in the amounts of selected environmentally-sensitive inputs used per unit of aggregate production output. Another component will track areas under irrigation by irrigation systems of various efficiencies.

For the input efficiency component, a discussion paper was completed in 1995 and data collection was started. An updated report was completed in 1996.

## C.8 Greenhouse Gas Balance Indicator

The Department is developing a Greenhouse Gas Balance Indicator to track the accumulation and release of the agricultural sector's principal greenhouse gases (carbon dioxide, methane, and nitrous oxide), and to report the net integrated balance. Measurable parameters include fertilizer use, cropping patterns, fossil fuel consumption, animal populations, manure production and storage, and estimated soil carbon flux. The objective is to contribute to the national target of stabilizing GHG emissions at 1990 levels by the year 2000 through the use of management and cropping practices that reduce GHGs.

Development of this indicator supports the national agricultural initiatives component of the Green Plan. Work focusses on validating the models used to develop the indicator (CENTURY model) and improving the accuracy of the existing estimates of the sources and sinks of individual gases. A report on the net carbon dioxide balance for 1986 and 1990 was completed in 1995. Reports on methane and nitrous oxide emissions for the years 1986 and 1990 were completed in 1997.

## C.9 Fungal Organisms as Bio-indicators

The Department has conducted surveys across Canada of plant pathogenic fungi, mycorrhizae, mushrooms, and wood decaying fungi. In agricultural settings, AM fungi, mycorrhizal with many crops, and native plants have been surveyed for comparison in undisturbed sites, cultivated sites, and sites adjacent to human use.



# D Research

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## D.1 Biosystematics Research

The Department's Biosystematics Program conducts biosystematic research on insects and arachnids, economic fungi, and crop and wild plants to address the needs of the agriculture and agri-food sector in crop development, plant protection, pest management, environmental sustainability, and development of biodiversity indicators. It is the largest program of its kind in the country and is critical to national and international networks that provide the taxonomic framework for understanding, conserving and using biodiversity.

In collaboration with Environment Canada, Natural Resources Canada, and the Canadian Museum of Nature the Department provides comprehensive biosystematics research and technology transfer support for federal programs, provincial government agencies, universities, and industry.

## D.2 Shelterbelt Centre Research

The Department's Shelterbelt Centre is studying genetic diversity in native woody plant populations. Adaptability of these plants in prairie ecosystems is leading to the development of *Ecovars*—ecological varieties to be used for restoration of prairie and parkland wildlife habitats and shelterbelt plantings. Studies to determine methods of tree and shrub planting that minimize impacts on the ecosystem and biodiversity are currently underway. As well, alternative pest and weed control methods that will lessen the use of pesticides in tree planting are being studied. Alternative shelterbelt designs that are more structurally diverse than single row, single species belts are also being studied in order to enhance agricultural production and, at the same time, promote agro-ecosystem biodiversity and sustainability.

## D.3 Evaluation of the Sustainability of Farming Systems in Saskatchewan

The Department is participating in research in Saskatchewan to evaluate the social, economic, and environmental components of sustainable land management in an integrated and comprehensive manner. Research involves identifying and evaluating sustainability indicators that prevail on 30 farms, using information obtained directly from farmers through field surveys of wild plants and insect populations and other forms of biodiversity, through soil mapping, and from independent sources. Long-term simulations will indicate the capability of farming systems to provide environmental protection and economic viability. The analysis of current and proposed alternative systems will be augmented for other indicators using an international framework for the evaluation of sustainable land management.

## **D.4 Assessment of Species Diversity in the Mixedwood Plains Ecozone**

The Department is working on a project on species composition and biogeography of selected taxa belonging to some of the major phylogenetic groups inhabiting the Mixedwood Plains. The assessment includes diverse taxa representing a wide range of structural and functional roles in the biotic communities of the ecozone. The project is intended to provide a framework for analyzing the status and dynamics of species level biodiversity in the plains.

## **D.5 Crop Breeding**

The Department's crop research is directed toward developing and evaluating new crop varieties that will enable producers to access new markets, diversify production, improve the quality of their products, and enhance resistance to pests and pathogens. Increased crop diversity will enable farmers to use new crops in rotation, aiding pest management strategies and ensuring more balanced soil nutrient distribution both spatially and temporally.

Canada's crop breeding program emphasizes crops that represent large acreage nationally or regionally, strong production potential in northern latitudes, or have the capability to act as effective components of a system for diversification or sustainable cropping practices.

## **D.6 Research in Support of Crop Diversification**

Many Departmental research centres are studying new crops and varieties for rotation, intercropping, replacement, niche markets, and market opportunity. A wider diversity of alternative crop options supports the use of effective crop rotation as pest and resource management tools. Departmental programs that support crop diversification are carried out in conjunction with provincial initiatives and in co-operation with the private sector.

## **D.7 Research on the Conservation and Use of Farm Animal Genetic Resources**

The Department is conducting research on the conservation and use of farm animal genetic resources. This activity encompasses cryopreservation; embryo technologies (collection, maturation and transfer); cloning, development of technology to culture and modify embryonic stem cells; and characterization of the chicken genome, in particular, identifying endogenous viral genes and gene markers in co-operation with the U.S. Department of Agriculture.

## D.8 Research on Using Micro-organisms to Improve Agricultural Production

Micro-organisms such as *Rhizobia* are useful for symbiotic nitrogen fixation. Research objectives are to identify most performing strains for specific crops, and to characterize bacteria and beneficial fungi better adapted to soil and climate conditions.

## D.9 Research on Ozone to Reduce Greenhouse Gases and Atmospheric Acidity

This important research, supported by the federal Green Plan initiative, is aimed at minimizing harmful effects on all life forms. Increased radiation as a result of stratospheric ozone reduction, global warming from greenhouse gas emissions, and acidification of rain and water supplies have adverse effects on plants, animals, and micro-organisms. If the effects become severe, the distribution of some species could be significantly altered.

# E Species and Ecosystem Management

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## E.1 Agri-environmental Programs

Between 1991 and 1997 the Sustainable Agriculture Component of the Green Plan provided \$138 million to help the agri-food sector adopt more environmentally sustainable practices. The aim of the program was to ensure long-term environmental sustainability of the resources on which agriculture depends by addressing a broad range of environmental issues.

Of the \$138 million, \$34 million has been used to address national areas of concern, including air and climate, energy, and genetic resources. Activities include expanding genetic resource preservation capabilities; establishing a system to co-ordinate and increase farm animal genetic resources conservation; developing soil and water conservation technology, including the impact of soil conservation on the accumulation of mycotoxin in crops; assessing the risks related to crop plants with novel traits; investigating the role of agriculture on the production of greenhouse gas emissions; promoting alternative pest management practices; improving safety assessment of non-traditional fertilizer products; evaluating feedstock for ethanol production; and examining possibilities for waste reduction in the food industry.

The remaining \$104 million has been matched by equal funding from provinces under joint agreements to address regional concerns related to soil, water, wildlife, and pollution. Activities included: promoting sound manure and waste management practices; demonstrating conservation tillage methods; promoting alternative pest management practices; training in safe pesticide handling and container disposal; and preserving, conserving, and creating wildlife habitat.

The Department continues to support sectoral efforts to conserve species and ecosystems in agriculture through the Canadian Adaptation and Rural Development Fund and the National Soil and Water Conservation Program.

## E.2 Community Pastures Program

The Department manages 87 Community Pastures covering approximately 930,000 hectares of land across the Prairies. About 770,000 hectares are native vegetation supporting biodiversity in the remaining native prairie and parkland ecosystems. The Pastures are among the largest remaining blocks of grassland in the country and are believed to function as sustainable ecosystems. Biodiversity is being conserved through modern range management practices (range condition assessments, grazing management plans, etc.) and managing wild and domesticated biological resources. Permanent cover is maintained to protect these lands from erosion, and rangeland resources are managed to ensure a healthy relationship among soil, water, and biota.

Community Pastures also provide habitat for numerous Ducks Unlimited wetland projects. These wetland projects range from 4 to 1,214 hectares in size and provide water for livestock and suitable habitat for nesting waterfowl and other wildlife species.

### **E.3 Shelterbelt Centre Program**

The Shelterbelt Centre Program works with local and regional wildlife groups on habitat improvement, and provides technical assistance in planning such improvement for a variety of species. Work involves producing and distributing tree seedlings for farmstead, field, wildlife, and agro-forestry plantings throughout the Prairie provinces. About 10 percent of the seedlings are provided for projects related to land reclamation and for organizations such as 4-H clubs.

Shelterbelts are reducing soil erosion and introducing biological, compositional, structural, and functional diversity in the agro-ecosystem. Over 1300 kilometres of field shelterbelts are planted annually in the Prairies. Demonstration forest belt plantings have been established at eight sites. The Program also promotes and aids in the sustainable use of biological resources on agricultural lands.

### **E.4 Reservoir Management**

The Department manages 23 reservoirs in southwest Saskatchewan that provide water sources for irrigation, recreation, and municipal water supply. Select reservoirs also provide the control necessary for international apportionment of stream flows between Canada and the U.S. Several reservoirs also provide flood protection to downstream communities and infrastructure. The reservoirs provide aquatic habitat that would not otherwise exist in this water deficient semi-arid ecosystem. Management strategies are oriented toward conserving both fish and wildlife habitat.

### **E.5 Revegetation Projects**

In cases where development is disturbing native prairie on community pastures, the Department is working with field staff and industry (oil and gas companies, gravel excavators, etc.) to undertake revegetation projects using native species.

In partnership with Ducks Unlimited Canada, the Department is studying methods of re-establishing woody plants and native grasses in prairie ecosystems. The objective is to restore upland and wetland habitat that has been impacted by agriculture production.

## **E.6 Grazing Strategies for Riparian Sites**

The Department is delivering projects on grazing strategies for riparian sites. Projects include vegetation monitoring and co-operating with the North American Waterfowl Management Plan and Ducks Unlimited in delivery of grazing plans in Monet and Mount Hope pastures. Project objectives are congruent with maximizing plant species diversity and enhancing wildlife habitat.

## **E.7 Sustainable Development of the Great Sandhills**

Under the Partnership Agreement on Rural Development, the Department provides funding to the Great Sandhills Planning Commission to study sustainable development of the Great Sandhills in Saskatchewan. The study will determine if development can occur with minimal impact on the Great Sandhills environment and its biodiversity.

## **E.8 Endangered/Threatened Species Projects**

Recognizing that some Canadian species are threatened or endangered as a consequence of Prairie (and other ecozone) habitat loss to agriculture, the Department is committed to managing for biodiversity conservation of the 930,000 hectares of rangeland it administers. The Department played a role in co-operative rangeland management and supplying the land base (habitat) for the early phase of the Swift Fox release program in Saskatchewan. In co-operation with Saskatchewan the Department is managing a Black Tailed Prairie Dog Colony in order to avoid surrounding landowner conflict and to develop innovative techniques to sustain the colony and grazing capacity.

The Shelterbelt Centre is actively involved in the restoration of habitat for threatened and endangered species. Creation of nesting sites for ferruginous hawks in Community Pastures is underway. The project includes monitoring to evaluate the success of nest site restoration. Multiple row tree plantings have been established to provide habitat for the threatened loggerhead shrike.

In co-operation with the Manitoba Department of Natural Resources, selected Manitoba pastures are being made available as collection sites for Tall Grass Prairie restoration programs.

## E.9 Permanent Cover Program

The Permanent Cover Program was developed in 1988 and delivered in Alberta and Saskatchewan under the National Soil Conservation Program. Under the Program, landowners were encouraged to grow perennial forages or trees on designated erodible or marginal lands. The purpose of the Program is to convert these lands to alternative land use, provide soil conservation and wildlife habitat benefits, and offer an alternative source of income to producers. The Program was extended in 1991 to cover Manitoba, Alberta, Saskatchewan, and the Peace River Region of British Columbia.

Applicants were required to enter into a contract with the federal government to keep the land in permanent cover for either 10 or 21 years, and become ineligible for federally funded annual crop insurance and farm financial privileges for the duration of the contract. Land area had to be between 16 and 259 hectares.

About 15,000 farmers enrolled in the Program, retiring an area of approximately 500,000 hectares from annual cropping. The Program, which expired in 1993, provided \$70 million in direct cash payments to producers, and continues to be administered by the Department.

## E.10 Waterfowl Crop Damage Compensation Program

Since 1990, compensation for waterfowl crop damage has been provided under crop insurance programs on a spot-loss basis for the Prairie provinces and Quebec. The Program covers crop damage caused by migratory waterfowl. Under cost-shared federal/provincial agreements, waterfowl crop damage compensation may be paid when crops are damaged by waterfowl and where approved prevention programs are in place to reduce losses caused by waterfowl.



# F Introduction of Non-indigenous Organisms

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## F.1 Regulatory and Quarantine Programs

Under the authority of the *Seeds, Feeds, Fertilizer, Health of Animals*, and *Plant Protection Acts*, the Canadian Food Inspection Agency regulates animals, plants, and other products that may influence both wildlife and domesticated biodiversity through competitive displacement, genetic dilution, and disease transmission. Regulated plants, animals, and products are subject to safety reviews or certification requirements, which include an environmental assessment.

For importations, the standards for environmental release and safety reviews are compatible with principles of Organization for Economic Co-operation and Development (OECD) member countries. Plant and non-traditional animal importations are subject to environmental reviews before import permits are issued. Non-traditional farm animal importations are subject to assessment under the *Canadian Environmental Assessment Act (CEAA)*. Destruction of live animals that carry or may carry foreign animal diseases and sanitary disposal of carcasses is undertaken by Departmental staff under the *Health of Animals Act*.

## F.2 Diagnostics of Insects, Mites, and Fungi

The Department identifies insects, arachnids, and fungi to differentiate indigenous from non-indigenous species when they are intercepted at Canadian borders. Such assessment reduces the risk of economic losses and ecological degradation resulting from the introduction of non-indigenous pest species, especially in the agriculture and forestry sectors.

# G Management of Inputs and Pests

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## G.1 Biocontrol

Over the years, biological pest control has been and will continue to be a cornerstone of AAFC's pest management strategies for the control of rangeland weeds and invasive agricultural pests. AAFC, in collaboration with the International Institute of Biological Control, contributes to the safe introduction into Canada of biological control organisms as alternative methods to control important pests, in particular the Apple Ermine Moth, the European sawfly, the Alfalfa Plant Bug, the Bertha Armyworm and the Canada Thistle.

Patron cattle from select Community Pastures are used to graze areas of Last Mountain Lake National Wildlife Area in an effort to control smooth brome grass, an invasive introduced grass to the native mixed grass prairie.

## G.2 New Crop Varieties with Pest Resistance

The production of new crop varieties with pest resistance is a key component of crop breeding programs. Major pest threats to crop production have been documented and potential new threats are monitored so that all significant pests are considered in breeding programs. Breeding programs include pest resistance screening as a routine feature, and may use biotechnological tools to introduce genetic resistance into new varieties.

## G.3 New Crop Varieties to Better Manage Inputs

Better management of inputs is an important aspect of all Departmental crop diversification initiatives and is key to the mandate of the Semiarid Prairie Agricultural Research Centre in Swift Current. The thrust is to reduce inputs through the use of new crop varieties, improved management practices, and better timing and selection of inputs.

## G.4 Pest and Input Management Through Soil and Water Conservation Practices

AAFC carries out research to improve soil management practices based on the reduction of tillage, which optimizes the use of fertilizers and water. Such systems feature more crop rotation, in order to reduce the need for pesticides, and thus reduce the risk of water contamination.

## G.5 Using Inputs to Benefit Agricultural Production and Soil Micro-organisms

Inputs of fertilizer, pesticides, and energy are used to optimize yields and minimize the risk of crop failure due to diseases and pest attacks. However, there are environmental risks associated with excessive or otherwise inappropriate use, including build-up in the soil and possible escape into the natural environment. Pesticides can also be lost through evaporation and leaching. The Department carries out research on application rates and time of application of inputs, to result in less pressure on soil organisms though greater efficiency. Outputs are in terms of best management practices and integrated pest management. More selective and less persistent pesticides benefit soil organisms and other biodiversity.

## G.6 Pest Management

Departmental staff meet annually to review proposed insect, weed and pest management practices for the Shelterbelt Centre, Community Pastures system, and irrigation projects. Through this effort, threatened and endangered species and their habitats are protected from pesticide application. Vegetation management proposals such as shrub control are routinely presented to provincial wildlife agencies for recommendations. Mechanical scraping is being evaluated as an alternative management tool for invasion of shrubs in pastures.

## G.7 Reduction of Harmful Substance Release

The Department continues to incorporate in its programs and policies the principles embedded in the Canadian Toxic Substances Management Policy. The policy provides a framework for making science-based decisions on the effective management of toxic substances. The policy has two key management objectives: virtual elimination from the environment of toxic substances of concern that result predominantly from human activity and that are persistent and bioaccumulative; and management throughout their entire life cycle of other toxic substances of concern in order to prevent or minimize their release into the environment.

To implement our commitments to reducing ozone depletion, the federal government passed regulations in 1994 under the *Canadian Environmental Protection Act* to freeze the production and consumption of Methyl Bromide (a fumigant used primarily in agriculture) to 1991 levels by 1995, with a further reduction of 25 percent by 1998.

Joint industry-government efforts are underway to find alternatives to methyl bromide as Canada moves towards phasing out its use (with allowable exemptions under the Montreal protocol) by 2001.

## G.8 Farm Inputs Management Survey Initiative

The Farm Inputs Management Survey is a joint initiative with Statistics Canada to address a gap in national data concerning the management of commercial fertilizers, commercial pesticides, and manure. The survey has collected data on:

- ❖ Manure management—storage and timing of application.
- ❖ Fertilizer management—how to decide the type and amount of fertilizer to apply, timing of application, frequency of soil testing, reduction of nitrogen by amount of legume plough down, and reduction of nutrients by amount of manure application.
- ❖ Pesticide management—sprayer calibration, timing of pesticide applications, how to decide on the timing of pesticide applications, and use of alternative pest control methods.

The survey was conducted in 1995 to support the development of an Inputs Management Component of a Farm Resource Management Indicator. A comprehensive analysis of the results was published in 1996. As well, a new question has been included in the 1996 Census of Agriculture data relating to the method of manure application.

# H Living Modified Organisms (LMOs)

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## H.1 Risk Assessments of Importations

Under the *Plant Protection Act* and the *Health of Animals Act*, living modified organisms are regulated in the same way as their traditional counterparts, to prevent the importation and spread of pests or diseases that are injurious to plants or animals. While living modified organisms may differ by just a few genes from traditionally derived crop plants, livestock animals, microbial products, or biological control organisms, they are assessed on the basis of their novel traits. Side effects that the actual genetic modifications may have imparted on the organisms are also considered.

## H.2 Safety Assessments for Plants

Under the *Seeds Act* and *Seeds Regulations*, the potential risks associated with the use and release into the environment of plants with novel traits are assessed. Guidelines have been developed for field testing these plants, and determining their environmental safety for general use.

## H.3 Safety Assessments of Livestock Feeds

Under the federal *Feeds Act and Regulations*, all novel feeds derived from living modified organisms, including plants with novel traits and viable microbes, must undergo an assessment for their safety and efficacy. The review comprises an evaluation of safety to humans, livestock, and the environment. Specific guidelines delineating required data requirements have been developed for both types of novel feeds.

## H.4 Safety Assessments of Microbial Products Intended for Field Application

The potential risks associated with the use and release of microbial products intended for field application or registration under the *Fertilizers Act* are evaluated, including microbial agents that are products of biotechnology. Guidelines have been developed for assessment of micro-organisms for environmental and human health effects, and have requirements for exposure assessment, monitoring, mitigating, and terminating confined trials.

## H.5 Regulation of Veterinary Biologics

Under the *Health of Animals Act* and *Health of Animals Regulations*, veterinary biologics are assessed for purity, potency, safety and efficacy before licensing. Guidelines for their regulation have been developed.

## H.6 Biotechnology Research

The Department conducts research in support of regulations concerning products derived by biotechnology. New biotechnologies are developed in the areas of resources (soil, water, climate, biological resources); crops (protection and varieties); animals (reproduction, welfare, genetics and nutrition); and food (safety, nutrition, and quality including non-food uses of agri-food products).

Projects in support of regulation include: biosystematics research into crop plants and related species that may be weedy; stability, safety and effectiveness of virus transgenes in birds and animals; genetic recombination between distantly related and unrelated viruses in plants with novel traits; and persistence of marked recombinant *Baculovirus* or *Rhizobium* in the environment. Scientific research in support of regulation allows the Department to take steps to minimize harmful effects on the environment by products derived from biotechnology techniques. Traditional and non-traditional biotechnology is used to produce new crop and animal varieties with nature-friendly traits.

## H.7 Identifying and Anticipating Introduction of Potentially Harmful LMOs

- ❖ The Canadian Food Inspection Agency has established a data base of Canadian submissions including authorized releases of plants with novel traits which have been approved in Canada. This information has also been included in “Biotrack”, the international data base operated by the Organization for Economic Co-operation and Development (OECD). Biotrack provides worldwide information on trials being conducted, the LMOs, organizations conducting the trials, and the traits incorporated into the living modified organisms with novel traits.
- ❖ Canadian data base on veterinary biologics: the Canadian food Inspection Agency maintains an internal-use data base on products licensed for use in Canada. Information includes the trade name, manufacturer and importer of each product, including the current license status.
- ❖ The Plant Health Risk Assessment (PHRA) Unit within the Science Advisory and Management Division (APHD) and the Centre for Plant Quarantine Pests (CPQP) are developing data bases to collect their information on plant pests and risk assessments. In addition, the North American Plant Protection Organization (NAPPO) keeps track of plant pests and genetically modified plant environmental releases. This information is used to augment plant protection programs under the *Plant Protection Act*.

# Policy and Assessment Initiatives

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## I.1 Environmental Assessments of Projects

The Department conducts environmental assessments of projects under the *Canadian Environmental Assessment Act (CEAA)*. CEAA applies to projects for which the Department is a proponent, provides financial assistance, grants an interest in federal land, or exercises regulatory authority.

Policies, procedures and approaches have been developed to guide project managers and other Departmental staff in the application of CEAA. A Departmental manual provides detailed information on CEAA's requirements and procedures relating specifically to agricultural projects. Staff training sessions assist in enhancing the expertise of all Departmental staff involved.

The following guides and training sessions have been prepared to deal with specific project areas:

- ❖ For environmental assessments of importations of non-traditional animals into Canada, the Department has produced the *Agriculture and Agri-Food Guide for Environmental Assessments of Animal Importations*, and carried out training sessions across the country.
- ❖ For environmental assessments of projects undertaken by the Prairie Farm Rehabilitation Administration (PFRA), the Department has produced an *Environmental Assessment Users' Guide*.
- ❖ For environmental assessments of projects undertaken by the Department's Facilities Management and Security Services, a *User's Guide to the Canadian Environmental Assessment Act* provides guidance to Departmental project managers, regional engineers, and administrative officers responsible for physical activities and projects.

## I.2 Environmental Assessments of Policy Proposals

The Department is applying a non-legislated environmental assessment process to Departmental policy and program proposals. The assessments identify the anticipated environmental impacts, including those on biodiversity, of policy and program proposals to Cabinet.

## I.3 Environmental Assessments of Agricultural Safety Net Programs

In 1991, the Department incorporated a provision under the *Farm Income Protection Act* to require periodic environmental assessment of the three major agricultural subsidy programs: Crop Insurance, the Net Income Stabilization Account, and the Gross Revenue Insurance Program. The first assessments, completed in 1993 and 1994, described the impact of the programs on biological and natural resources, and identified opportunities for improvement. The Department will conduct assessments every five years.



## **I.4 Integrated Modelling System**

The Department is developing a modelling system that integrates economic and environmental variables based on the Canadian Regional Agriculture Model (CRAM) and the Erosion Productivity Impact Calculator (EPIC). This predictive capability will assist in assessing the direct and indirect environmental impacts from policy initiatives. The model currently has the capacity to assess the effects of policy changes on soil erosion in the Prairie region, and to link wind and water soil erosion rates in the Prairies to farm management practices. The overall objective of the initiative is to develop a predictive capability for all key agri-environmental issues, including biodiversity.

## **I.5 Analysis of Economic/Environmental Policy Instruments**

The Department is assessing a wide range of policy instruments for their ability to simultaneously accomplish economic and environmental objectives in an equitable and cost-effective manner. In 1995, six papers on potential applications of economic instruments to selected agri-environmental issues were commissioned from university researchers in Canada and the United States. The papers examined nutrient use, pesticide application, soil erosion, water pollution, climate change, and wildlife habitat. Two studies commissioned in 1995 examined the feasibility of using cross-compliances as a means of achieving sectoral environmental objectives.

The Department sponsored a literature search titled, "Integration of Agriculture and Biodiversity: Inventory of Agencies". Included were agencies involved in the integration of wildlife and agriculture for use in a decision-making protocol for the Green Plan in Saskatchewan.

# J Communication Initiatives

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## J.1 Electronic Information

- ❖ **AAFC Electronic Information Service (Internet: <http://www.agr.ca>)** : The Department's electronic information service provides easy access to information about news, trade, policies, commodity prices, regulations, federal agri-food programs; agri-science and technology; officials; research; and expertise.
- ❖ **Research World Wide Web Site (<http://res.agr.ca>)** : The Research Branch Web Site allows quick and easy access to Departmental information relevant to biodiversity. Much of this information has educational value and is accessible by a broad range of users, from primary school level to national and international scientists. The site also allows easy access to specialized information in the areas of entomology, mycology and botany, and in some aspects of plant, microbial and animal genetic resources. The same Internet server hosts the Canadian Soil Information System (CanSIS), and link to sites of other research centres.
- ❖ **International Biodiversity Information Management Initiatives** : The Department is participating in international initiatives, such as *Species 2000—Indexing the World's Known Species* ; the *Biodiversity Information Network (BIN21)* ; *U.S. Interagency Taxonomic Information System (ITIS)* , a global data base on insects and related arthropods; the *BioNet*; and other large-scale initiatives. To develop a North American module, the Department is working with the USDA and other international partners in the Major Entomological Facilities Networks and the Association of Systematic Collections.
- ❖ **Ananet Hyphomycetes Internet Linkage** : The Economic Fungi team of the Biosystematics Program has developed an international forum on the Internet, *Ananet* , to disseminate knowledge and facilitate identification of Hyphomycetes. The first interactive key for identifications of the genus, *Fusarium* , was developed and tested through international and national co-operation. Data sharing on hosts and pests has been arranged with the USDA Systematic Botany and Mycology Laboratory.

## J.2 National and International Workshops and Courses

In collaboration with other countries, federal departments, provincial agencies, universities, and farm organizations, the Department organizes workshops, courses and special events on issues relating to agro-biodiversity.

- ❖ In collaboration with the Central Bureau voor Schimmelcultures, the Netherlands, the Department offers a North American version of a course on food and airborne fungi. The Department's Economic Fungi team has also provided expertise at major mycological meetings across North America, provided expert identification, and conducted nature tours.

- ❖ In partnership with other federal departments and universities, the Department organizes workshops and training sessions for scientists, technicians and resource managers wishing to acquire the basic knowledge and skills required to identify insects and arachnids. These courses are presented by Departmental scientists and technicians using the resources of the Canadian National Collection of Insects and Arachnids and the Entomology Library.
- ❖ The Department has held several workshops on farm animal genetic resources conservation and use in order to raise awareness in industry, governments and educational establishments. Lecture notes and slides were prepared for use by university animal science and veterinary medicine departments. Workshops were organized on animal germplasm conservation, the animal-related part of the national germplasm conservation network, and animal genome research.
- ❖ The Department provided financial support and shared planning for two major international conferences held in Canada in 1994: the Third Global Conference on the Conservation of Domestic Animal Genetic Resources; and the Fifth International Congress on Genetics Applied to Livestock Production.

### J.3 Expert/Advisory Committees

- ❖ Expert Committee on Plant and Microbial Genetic Resources: This committee provides advice and makes recommendations to the agri-food sector on the conservation and use of plant and microbial genetic resources for food and agriculture. Its membership is drawn from federal and provincial governments, industry, non-governmental organizations and scientific societies.
- ❖ Seeds, Feeds, Fertilizers, Veterinary Biologics, and Biotechnology Advisory Committees: These committees provide advice on appropriate policies and guidelines affecting different commodity areas. They include representatives from the scientific community, federal and provincial governments, producer groups and industry, and meet on an “as needed” basis to address issues associated with new products and to discuss new regulatory or licensing requirements.
- ❖ Committees on Farm Animal Genetic Resources: The Department has established two advisory and steering committees to develop a farm animal genetic resources conservation program for Canada: the Canadian Steering Committee for Animal Germplasm (CANSTAG); and the Canadian Animal Germplasm Technical Experts Board (CAGTEB). CANSTAG develops strategies and programs while CAGTEB provides the technical background necessary for sound farm animal genetic resources conservation. CANSTAG comprises senior officials in government, industry and universities. CAGTEB comprises technical experts from governments, universities and the private sector. These committees have recommended the establishment of a “Canadian Foundation for the Conservation of Farm Animal Genetic Resources”, to serve as the national focus. The foundation was incorporated in January 1996.

## J.4 International Fora

-  **International Support:** The Department acts as the federal lead for Canada's relations with the U.N. Food and Agriculture Organization (FAO) and the Inter-American Institute for Co-operation in Agriculture (IICA). Canada's positions are developed through consultation and consensus with appropriate responsibility centres in the federal and provincial governments. The advice of other stakeholders is also sought. When considering programs and budgets in these organizations and their subsidiary groups, support is provided for activities and policies that enhance the development of methods for conservation and sustainable use of biological resources; deliver access to and transfer of technology related to sustainable use of resources; and encourage private sector concurrence and involvement.
  
-  **Intergovernmental Fora addressing Genetic Resources for Food and Agriculture:** Two key fora are the U.N. FAO Commission on Genetic Resources for Food and Agriculture and the Conference of the Parties to the Convention on Biological Diversity.
  
-  **Participation in International Plant Genetic Resources Networks:** Canada is responsible for preserving principal world base collections of barley and oats, and world duplicate collections of oilseed Brassicas and pearl millet. The Department maintains large genetic resources collections (over 35,000 samples) for oats and barley in an attempt to represent world genetic diversity in these genepools. Departmental scientists participate in international crop co-ordinating committees. There are also case-by-case collaborations with other programs, particularly the U.S. National Plant Genetic Resources Program.