AGRI-ENVIRONMENTAL INDICATOR PROJECT

Agriculture and Agri-Food Canada

REPORT NO. 19

SUMMARY OF ACTIVITIES IN FISCAL-YEAR 1996-1997

Prepared by:

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On behalf of the Environmental Indicator Working Group
of Agriculture and Agri-Food Canada

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SUMMARY

- Baseline calculations were completed and reports were distributed on the following indicators:
  - Inputs Management component (national level) of Farm Resource Management;
  - Soil Cover and Land Management component of Farm Resource Management;
  - Soil Salinity component of Risk of Soil Degradation;
  - Nitrogen component (for Ontario) of Risk of Water Contamination.

- Calculations progressed on the following indicators:
  - national and regional soil erosion by wind and water;
  - national risk of water contamination by nitrogen;
  - 1990 baseline estimate for the agroecosystem greenhouse gas balance indicator;
  - "Bare soil days" indexes for the soil cover and land management component of the Farm Resource Management indicator;
  - Regional analysis of the farm inputs management component of the Farm Resource Management indicator;
  - Data analysis and compilation for the Irrigation Application Efficiency indicator component.
  - Compilation of census of agriculture data for the habitat component of the Agroecosystem Biodiversity indicator.

- Studies were initiated to:
  - advance the conceptual basis and analytical framework for both the habitat and species components of the Agroecosystem Biodiversity indicator.
  - investigate approaches for including soil organic matter and soil compaction into the Indicator of Risk of Soil Degradation.
  - validate selected Census of Agriculture variables.
  - validate the economic approach for quantifying fertilizer and pesticide input use efficiency;
  - analyse and update selected climatic variables in agricultural areas of Canada to support the Indicator of Risk of Water Contamination and other indicators.
  - review the literature and potential approaches for developing a phosphorus component for the Indicator of Risk of Water Contamination.

- Meetings were held in June 1996 & March 1997 with the Advisory Committee on AEIs.

- Project coordination and management activities included:
  - meetings of the departmental Inter-Branch Environmental Indicator Working Group;
  - a departmental workshop of indicator analysts and researchers (June 1996);
  - updating the AEI Project Work Plan.
  - meetings of the technical teams working on the Indicator of Risk of Soil Degradation (March 1997) and Indicator of Risk of Water Contamination (August 1996).

- External liaison activities pursued included:
  - input to the OECD initiative on agri-environmental indicators;
  - domestic and international distribution of AAFC material on agri-environmental indicators;
  - participation and presentation by researchers and analysts of material and results related to AEIs in various domestic and international fora.

- AAFC devoted about $342,400 and 5.88 person-years to the AEI Project in the 1996-1997 fiscal-year.

1.0 The Agri-environmental Indicator Project— A Brief Overview.

The Agri-Environmental Indicator (AEI) Project was initiated in 1993 by Agriculture and Agri-Food Canada (AAFC) in response to recommendations made by several groups, including the Federal/Provincial Agriculture Committee on Environmental Sustainability, the Canadian Agri-Food Research Council and the Auditor General of Canada . All of these recognized a fundamental need to further develop the information base available to decision-makers on environmental conditions and trends in Canadian agriculture.

Through the AEI Project, six indicators and their associated components are being developed: risk of soil degradation; risk of water contamination; agroecosystem greenhouse gas balance; agroecosystem biodiversity ; input use efficiency; and farm resources management. Each indicator is described in Appendix 1. The indicators are being developed to assess the degree to which key agri-environmental issues are being addressed and objectives met, to help identify areas and resources at risk, to support the design and targeting of strategies and actions, and to facilitate communication among stakeholders, and between stakeholders and policy-makers.

Implementation of the project is coordinated by an InterBranch Environmental Indicator Working Group (EIWG) which reports to the Departmental Management Committee through the Policy Branch. Environment Canada, Statistics Canada, and the National Agriculture Environment Committee also participate in this working group. An Advisory Committee of key stakeholders provides independent advice to AAFC on the design and implementation of the AEI Project.

The project is currently in a methods development and baseline calculation phase. Outputs are released periodically in the form of progress reports and technical papers. A comprehensive report to be released in 1998-1999 will update and report the indicators using data from the 1996 Census of Agriculture and other sources.

This report summarizes the key activities, outputs and expenditures within the AEI Project in the period from April 1, 1996 to March 31, 1997.

2.0 Project Management Activities within Agriculture and Agri-Food Canada.

- The EIWG met in June 1996 and March 1997. Major agenda items include:
  - Coordinating indicator development and Project implementation.
  - Initial design of the comprehensive Project report.
  - Coordinating AAFC's input into the Organisation for Economic Co-operation and Development (OECD) initiative to develop a core set of agri-environmental indicators, and other international activities related to agri-environmental indicators.

- A departmental workshop of principal indicator investigators and other analysts was held in June 1996 to assess progress, refine work plans and discuss issues common across indicators.

- In October 1996, the AEI Project Work Plan for 1996-1997 (Appendix 2, Report 15), was

released. This work plan represents updates to the original project work plan completed in October 1995.

- The publication series for documents generated through the AEI Project was systematically ordered and the reports were numbered (see Appendix 2).

3.0 External Liaison and Consultation Activities.

- The AEI Project Advisory Committee met in June 1996 and March 1997. During these meetings the Committee reviewed the progress on various indicators and various aspects of project implementation.

- AAFC responded to numerous domestic and international information requests by providing documentation on indicator development.

- An AEI Project brochure was prepared and distributed.

4.0 International Activities.

- AAFC contributed to international work on AEI's by:
  - contributing to the work of the OECD Joint Working Party on Agriculture and the Environment, which is overseeing the OECD's AEI Program.
  - validating the data and calculations for the OECD nutrient balance indicator.
  - distributing progress reports on the Risk of Water Contamination, Risk of Soil Degradation (salinity component) and Farm Resource Management (land and farm inputs components) indicators as a contribution to the OECD initiative.
  - presenting the overall approach and preliminary results of AAFC's AEI Project to the Ecology '96 Symposium in Denmark.

5.0 Progress on the Development of Individual Indicators.

5.1 Risk of Soil Degradation

- Activities:
  - Work continued to prepare a national water and wind erosion risk analysis for Canada as a follow up to information presented in the report, **The health of our soils— toward sustainable agriculture in Canada,** which focused on the prairies and southern Ontario. The national analysis covers all of agricultural Canada for 1981 and 1991 and will include discussion of regional trends in soil erosion risk. Wind erosion analyses will focus on the prairie region.
  - Analysis of change in soil salinity risk was extended to the full prairie region.
  - A sub-committee was established to examine approaches to estimating tillage erosion based on soil and landscape data available in the Soil Landscapes of Canada database.
  - A pilot study was initiated using the Century model to estimate organic matter change in the soil landscape polygons of the Mixed Wood Plain of southern Ontario.
  - Work was contracted to test the development of a soil compaction indicator. The analyses were conducted on soils from southwestern Ontario and the Maritimes.
  - Approaches and progress on this indicator were presented to the AEI Advisory Committee at its June 1996 meeting.
  - The Soil Degradation Study Team met in March 1997 to review progress on the indicator and plan further work.

- Outputs:
  - A report documenting the methods and results of calculations of soil salinization risk entitled **Soil Degradation Risk Indicator: Soil Salinity Risk Component** (Appendix 2, Report 16) was prepared and distributed in November 1996. Calculations for the indicator have been completed for 1981 and 1991. There has been little increase in the risk or extent of soil salinization between the two periods.

<u>Lead Investigators:</u>

Soil Erosion (Wind & Water), Soil Organic Matter, Soil Compaction
G. Wall, Harrow Research Station
Soil Salinization
R.G. Eilers, Brandon Research Station

<u>Contributors:</u>

H. Rees (Fredericton), J.M. Cossette (St. Foy), G. Padbury (Swift Current), J. Tajek (Lethbridge), L. Van Vliet (Summerland).

5.2 Risk of Water Contamination (IROWC)

- Activities:

  IROWC-N:

  - Work continued to prepare and validate a Canada-wide IROWC-N assessment for 1981-1991. Regional members of the IROWC technical team either provided estimates for their regions of nitrogen recommendations for the crops of relevance or have prepared actual nitrogen budgets. These estimates were used with the current methodology to prepare maps of nitrogen remaining after harvest and, for regions of the country where there is a net moisture excess, an average nitrogen concentration or IROWC-N.
  - Climatic analyses were carried out in the semi-arid plains for 26 long-term weather stations to provide modeled estimates for the water balance for a range of soil textures and three standard crop rotations.
  - Climatic analysis was initiated for climate stations in Ontario and Quebec to provide modeled estimates of actual evapotranspiration and excess moisture as determined by precipitation minus potential evapotranspiration using 30 year climatic normals.
  - The treatment of the residual nitrogen from manure was incorporated into the IROWC-N calculation to capture changes in distribution and intensity in the livestock industry.
  - A methodology was presented to the AEI Advisory Committee meeting in June 1996 to relate cropping patterns and soil conditions to the IROWC-N. This methodology was demonstrated for the agricultural region of southern Ontario.
  - The IROWC Technical Team met in Ottawa in August 1996 to review progress and plan further development of the indicator.
  - The spatial basis for the nitrogen component of the indicator of risk of water contamination (IROWC-N) was adjusted to include a variety of bases with primary representation at the farmland level.

  IROWC-P:

  - A literature review and an analysis of work on agricultural phosphorus was prepared to support development of a methodology for the phosphorus component of the indicator of risk of water contamination (IROWC-P).

- Outputs:

  - A progress report entitled **Indicator of Risk of Water Contamination: Nitrogen Component** (see Appendix 2) was prepared and distributed in December 1996.

<u>Lead Investigators:</u>

B. MacDonald, Harrow Research Station
R. Simard, St. Foy Research Station

<u>Contributors:</u>

B. Bowman, London Research Station
C. Chang, Lethbridge Research Station
P. Milburn, Fredericton Research Station
B. Zebarth, Summerland Research Station

5.3 AGROECOSYSTEM GREENHOUSE GAS BALANCE

- Activities:
  - Data were gathered and methane (CH_4) emissions from Canadian agriculture (livestock and farm animal manures) for 1986 and 1991 were calculated.
  - Data were gathered and net emissions of nitrous oxide (N_2O) from Canadian agriculture for 1986 and 1991 were calculated using an OECD/IPCC methodology.
  - Progress on this indicator, including initial calculations of a net GHG balance baseline for 1990, were presented to the AEI Advisory Committee in March 1997.
  - Progress and preliminary results on this indicator were presented to the Workshop on Greenhouse Gas Research in Agriculture in Quebec City, March 1997.

- Outputs:
  - There were no specific report outputs during this fiscal-year.

LEAD INVESTIGATOR:

R. Desjardins, ECORC

Contributors:

H. Janzen, Lethbridge Research Station
E. Pattey, ECORC
P. Rochette, Ste-Foy Research Station

5.4 AGROECOSYSTEM BIODIVERSITY CHANGE

5.4.1 SPECIES COMPONENT

- Activities:
  - A presentation documenting the initial conceptual basis of the indicator was made to the AEI Advisory Committee in June 1996.
  - A consultant was hired to further develop the conceptual basis of the indicator. Work progressed on a literature review and draft report that will outline the concepts and methods of developing this indicator.
  - A follow-up presentation to the AEI Advisory Committee was delivered in March 1997.
  - Lead investigators participated in the Environmental Monitoring & Assessment Network (EMAN) National Meeting in Saskatoon, January 1997.

- Outputs:
  - There were no specific report outputs during this fiscal-year.

LEAD INVESTIGATORS:

I. Smith, ECORC
A. Tomlin, London Research Station

Contributors:

V. Behan-Pelletier, ECORC
K. Fox, London Research Station

5.4.2 HABITAT COMPONENT

- Activities:
  - A draft approach to developing this indicator using Census of Agriculture data was presented to the Advisory Committee in June 1996.
  - Consultants were hired early in 1997 to complete a literature review and further develop the conceptual basis for proceeding with this indicator.
  - A follow-up presentation to the AEI Advisory Committee was delivered in March 1997.
  - A presentation on the indicator component was made at the EMAN National Meeting in Saskatoon, January 1997.

- Outputs:
  - There were no specific report outputs during this fiscal-year.

LEAD INVESTIGATOR:

T. Weins, PFRA

5.5 Input Use Efficiency

5.5.1 Irrigation by Application System Efficiency (IBASE) component

- Activities:
  - Data on irrigation system efficiencies, system distribution (area) and environmental sensitivity/risk were obtained and analyzed.
  - Progress on this indicator was presented to the AEI Advisory Committee meeting in June 1996.
  - Issues raised by the AEI Advisory Committee concerning the applicability of the indicator and the use of groundwater to identify whether irrigation affects water supply shortages were examined.

- Outputs:
  - There were no specific report outputs during this fiscal-year.

Lead Investigator:
-Mr. T. O'Brien, PFRA

5.5.2 Fertilizers/Pesticides/Energy component

- Activities:
  - A study was completed to validate the economic approach used to quantify the fertilizer and pesticide use components of the indicator.
  - The results of the validation study were presented to the AEI Advisory Committee in March 1997.

- Outputs:
  - An informal report was prepared documenting the results of the validation study.

Lead Investigator:
S. Narayanan, Policy Branch

5.6 Farm Resource Management

5.6.1 Soil Cover/Land Management component

- Activities:
  - Work continued during the 1996 growing season to collect field data to validate selected Census of Agriculture variables.
  - Surveys using Landsat imagery and ground-truthing of residue levels in both eastern and western Canada were completed and data analysis was initiated.
  - A database containing the area of all significant crops for 1981 and 1991 was prepared at the ecodistrict level for all provinces.
  - Data were compiled and analysed on agricultural land use and soil cover at national and provincial levels for 1901 to 1991.
  - Tables calculating the number of "bare soil days" under each of conventional tillage, conservation tillage and no-till were prepared for all significant crops in all ecoregions for 1981 and 1991.

- Outputs:
  - A revised version of the summary technical report for this indicator entitled **Farm Resource Management Indicator: Soil Cover and Land Management Component** (Appendix 2, Report 18) was prepared and distributed in December 1996. This report summarizes trends in soil cover due to cropping (land use) and tillage practices.

Lead Investigator:

E.C. Huffman, ECORC

5.6.2 Inputs Management component

- Activities:
  - An AAFC-Statistics Canada working group completed a national analysis of the farm inputs management survey (FIMS) and also pursued regional analyses of FIMS data.
  - A sampling of regional results of the FIMS were presented to the Advisory Committee in March 1997.

- Output:
  - Statistics Canada and AAFC jointly prepared and distributed, in July 1996, a comprehensive report documenting the results of the farm inputs management survey at the national level, entitled **Farm Inputs Management Survey, 1995**.

Lead Investigators:

D. Culver, Policy Branch
N. Hillary, Statistics Canada
Robert Koroluk, Policy Branch

6.0 EXPENDITURES.

The following resources were expended by AAFC on the AEI Project in 1996-1997. These estimates only include costs directly incurred on AEI development. The ongoing costs of maintaining databases that are being used to develop AEIs (and which also support other programs and activities) are not included.

ACTIVITY/INDICATOR	INDICATOR COMPONENT	DOLLARS (,000)	PERSON YEARS
Project Coordination, Consultation, and Reporting		43.3	1.08
Analysis of regional water data and water balance calculations.		30	0.15
Risk of Soil Degradation	Wind and Water Erosion	20	1.4
	Salinity	10	0.3
	Organic Matter	12	0.1
	Compaction	13	0.1
Risk of Water Contamination	Nitrogen	58	0.25
	Phosphorus	7.5	0.2
Greenhouse Gas Balance	CO_2, N_2O & CH_4	50	0.3
Agroecosystem Biodiversity Change	Species level	30	0.4
	Habitat level	17.6	0.2
Input Use Efficiency	Irrigation by Application System Efficiency	1	0.04
	Fertilizer, Energy, Pesticide Use Efficiency	8	0.06
Farm Resource Management	Soil Cover and Land Management	22	0.5
	Farm Inputs Management	0 [1]	0.8
Total		342.4	5.88

[1] Costs for preparing and distributing the national-level report of the Farm Inputs Management Survey were borne by Statistics Canada.

APPENDIX 1

DESCRIPTION OF AGRI-ENVIRONMENTAL INDICATORS[1]

1. SOIL DEGRADATION RISK

- DESCRIPTION:
  - Indicator reports trends in the extent, severity, and vulnerability of agricultural lands to soil erosion, salinization and change in soil organic matter levels. Development of a soil compaction component is also being investigated. The indicator will identify areas of higher relative risk of degradation and measure progress in managing agricultural lands sustainability.
  - The soil erosion (water, wind) component of this indicator will be measured in tonnes/ha./yr expressed in 5 classes of risk (tolerable, low, moderate, high, severe). Soil salinization will be expressed in a dimensionless multiplicative index (1 to 40) divided into 3 classes of salinity risk (low, moderate, high). Units of expression for the soil organic matter component have not been determined.
- MEASURABLE PARAMETERS:
  - Estimated erosion, % change in erosion rate; Universal Soil Loss Equation "C" factor, erosion reduction by crop residue. Soil salinization measures electrical conductivity, land area, topography, net aridity (climate), and ratio of permanent cover to summerfallow. The parameters for soil organic matter are to be determined.
- COVERAGE:
  - SPATIAL: Wind erosion addresses cultivated land in the prairies at the Soil Landscapes of Canada (SLC) polygon scale; water erosion addresses cultivated land in Canada at the SLC scale. Salinization covers agricultural areas of the prairies. The spatial coverage for soil organic matter is to be determined.
  - TEMPORAL: Soil erosion and salinization are both assessed from 1981-1991, with updates every 5 years after 1991.

2. RISK OF WATER CONTAMINATION

- DESCRIPTION:
  - This indicator identifies trends in the risk of water contamination from nutrients (nitrogen and phosphorus). The indicator will track primary agriculture's success in minimizing water pollution risks and will identify areas at higher relative risk. The components of this indicator are nitrogen and phosphorus contamination risk.
  - The indicator will be expressed as a ratio of the potential contaminant concentration (mg/L) to the maximum allowable concentration (mg/L). Indicator may be reported in risk classes.
- MEASURABLE PARAMETERS:
  - Precipitation, evapotranspiration, nitrogen inputs/outputs, phosphorus inputs/outputs, crop yields, livestock densities, soil characteristics, land management practices, water quality data.
- COVERAGE:
  - SPATIAL: National coverage calculated at the cropland and/or farmland level and expressed on an SLC or ecodistrict basis.
  - TEMPORAL: Baseline year for national indicator will be 1981 with updates from 1991 on a 5-year cycle to coincide with the Census of Agriculture.

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[1] A more complete (but slightly dated) description of each AEI is available from the Environmental Indicator Working Group (1995), **Description of Indicators and Project Activities and Outputs to 1998** (Appendix 2, Report 10).

3. Agroecosystem Greenhouse Gas (GHG) Balance

- DESCRIPTION:
  - This indicator tracks the accumulation and release of the principal greenhouse gases from the agricultural sector and reports the net integrated balance.
  - This indicator is measured in net emissions and/or uptake of each greenhouse gas and will be expressed in tonnes per year. The integrated GHG balance will be expressed in tonnes of CO_2- equivalent units.
- MEASURABLE PARAMETERS:
  - Fertilizer use, cropping patterns, fossil fuel consumption, animal populations, manure production and storage, estimated soil carbon flux and other related factors.
- COVERAGE:
  - SPATIAL: Initially at a national level and eventually also at the provincial level. It may be possible to also report components of the indicator at more detailed levels.
  - TEMPORAL: 1986 baseline year with periodic updates.

4. Agroecosystem Biodiversity Change

This indicator is still being developed and defined conceptually.

- DESCRIPTION:
  - The species abundance/diversity component measures change in diversity & abundance of species groups in relation to major agricultural cropping systems. The habitat availability component will report on changes in the availability of broad habitat types such as wetlands and woodlands.
- MEASURABLE PARAMETERS:
  - Species abundance/diversity: species abundance and taxonomic richness of groups of non-domesticated biota inhabiting agroecosystems, and adjacent areas. Habitat availability: possibly the area of "unimproved" land for pasture, grazing or hay and the area of grasslands, wetlands, and woodlands, in relation to species habitat requirements.
- COVERAGE:
  - SPATIAL: Not yet determined for the species abundance/diversity component. The habitat component will first report on habitat on agricultural land in the three prairie provinces, then the rest of the agricultural areas in Canada.
  - TEMPORAL: Not yet been determined for the species abundance/diversity component. The habitat component will use 1991 as a baseline year. If possible it will be compared with 1981 or 1986 and also with 1996 when Census data become available in 1997.

5. INPUT USE EFFICIENCY

- DESCRIPTION:
  - This indicator consists of two components: irrigation by application system efficiency and use efficiency for fertilizer/pesticide/energy. The irrigation by application system efficiency component tracks the efficiencies of various application systems and the land area upon which water is applied by each of these systems. The fertilizers/pesticides/energy use efficiency component reports input use efficiency (productivity) by measuring long-term trends in the amounts of each input used per unit of aggregate production output.
  - Fertilizers/pesticides/energy use efficiency is calculated using an economic approach and expressed as a ratio of inputs over outputs through an index with the base year set at 100. Irrigation by application system efficiency is expressed as the percentage of the water that passes through the applicator that is used by the crop.
- MEASURABLE PARAMETERS:
  - Fertilizers/pesticides/energy use efficiency measures aggregate fertilizer, pesticide, and energy inputs (implicit quantity in constant dollars) and aggregate primary output of crops (grains, oilseeds, forages, fruits, vegetables, etc.) and livestock (cattle, hogs, dairy, poultry). Irrigation application system efficiency uses information available from research and field trials on the efficiency of the application systems, tracks the land area being irrigated and the application systems in use.
- COVERAGE:
  - SPATIAL: Fertilizers/pesticides/energy use efficiency is covered nationally, and is disaggregated by prairie and non-prairie regions of Canada. Irrigation application system efficiency covers Western Canada.
  - TEMPORAL: For fertilizers/pesticides/energy use efficiency base year is 1980 with annual updates. The irrigation application system efficiency indicator will be measured from 1981, however the area included will vary depending on the data records

6. FARM RESOURCE MANAGEMENT

- DESCRIPTION:
  - The soil cover & management component estimates 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. Farm inputs management tracks the extent of adoption by farmers of selected best management practices for inputs (fertilizer, manure, and pesticides).
  - Soil cover & management is expressed as a percent adoption of soil conservation practices, and trends in areas of cultivated land with high, medium and low soil residue cover. Farm inputs management will be expressed as the distribution and frequency of use of the identified inputs management practices.
- MEASURABLE PARAMETERS:
  - The soil cover/management component determines the proportion of farmland under various crops, summerfallow, pasture, conventional tillage, conservation tillage, no-till; and adoption of selected erosion control practices.
  - The farm inputs management component includes factors such as: how liquid manure is stored; how commercial (chemical) fertilizer was applied; and whether any pest control methods other than chemical pesticides are used .
- COVERAGE:
  - SPATIAL: Soil cover & management: national coverage disaggregated by province and ecodistrict. Farm inputs management: national, provincial and ecozone.
  - TEMPORAL: Soil cover & management component: 1981 is baseline year and will be updated on a 5 year cycle to coincide with the Census of Agriculture. Farm inputs management has a baseline year which is 1995. Frequency of updates has not been determined.

APPENDIX 2

PUBLICATIONS AVAILABLE AS OF APRIL 1997

Environmental Indicator Working Group. 1993. **Developing Environmental Indicators for Agriculture: Discussion Paper**. Report No. 1. Environment Bureau, Policy Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario.

McRae, T., and N. Lombardi. 1994. **Consultation Workshop on Environmental Indicators for Canadian Agriculture: Final Report**. Report No. 2. Environment Bureau, Policy Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario.

Environmental Indicator Working Group. 1994. **Developing Agri-environmental Indicators for Canada: General Proposal**. Report No. 3. Environment Bureau, Policy, Agriculture and Agri-Food Canada, Ottawa, Ontario.

McRae, T. 1995. **Report of the Second National Consultation Workshop on Agri-environmental Indicators for Canadian Agriculture**. Report No. 4. Environment Bureau, Policy Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario.

MacDonald, K.B., and H. Spaling. 1995. **Indicator of Risk of Water Contamination: Concepts and Principles**. Report No. 5. Ontario Land Resource Unit, Centre for Land and Biological Resources Research, Research Branch, Agriculture and Agri-Food Canada, Guelph, Ontario.

MacDonald, K.B., and H. Spaling. 1995. **Indicator of Risk of Water Contamination: Methodological Development**. Report No. 6. Ontario Land Resource Unit, Centre for Land and Biological Resources Research, Research Branch, Agriculture and Agri-Food Canada, Guelph, Ontario.

McRae, T., N. Hillary, R.J. MacGregor, and C.A.S. Smith. 1995. **Role and Nature of Environmental Indicators in Canadian Agricultural Policy Development**. Report No. 7. Paper presented to the June 1995 Symposium of Environmental Indicators of the Resource Policy Consortium, Washington, D.C.

Hillary, N., M. Spearin, and D. Culver. 1995. **Farm Resource Management Indicator: Inputs Management Component: Discussion paper on a survey of inputs management practices**. Report No. 8. Policy Branch, Agriculture and Agri-Food Canada, Ottawa.

McRae, T., N. Hillary, R.J. MacGregor, and C.A.S. Smith. 1995. **Design and Development of Environmental Indicators With Reference to Canadian Agriculture**. Report No. 9. Paper presented to the North American Workshop on Monitoring for Ecological Assessment of Terrestrial and Aquatic Ecosystems, Mexico City, September 1995.

Environmental Indicator Working Group. 1995. **Description of Indicators and Project Activities and Outputs to 1998**. Report No. 10. Environment Bureau, Policy Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario.

Narayanan, S. 1995. **Input Use Efficiency Indicator: Use Efficiency for Fertilizers, Pesticides, and Energy**. Report No. 11. Farm Economics Division, Policy Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario.

Smith, C.A.S. 1995. **Research and Development Needs in Monitoring Agro-Ecosystems in Canada**. Report No. 12. Paper presented to the North American Workshop on Monitoring for Ecological Assessment of Terrestrial and Aquatic Ecosystems, Mexico City, September 1995.

Smith, W.N., P. Rochette, C. Monreal, R.L. Desjardins, E. Pattey, and A. Jacques. 1995. **Agroecosystem Greenhouse Gas Balance Indicator: Carbon Dioxide Component**. Report No. 13. Centre for Land and Biological Resources Research, Research Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario.

Banerjee, R. 1996. **Summary of Activities in Fiscal-Year 1995-1996**. Report No. 14. Environment Bureau, Policy Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario.

Environmental Indicator Working Group. 1996. **Project Work Plan for 1996-1997**. Report No. 15. Environment Bureau, Policy Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario.

Eilers, R.G., W.D. Eilers, and M.M. Fitzgerald. 1996. **Soil Degradation Risk Indicator: Soil Salinity Risk Component**. Report No. 16. Manitoba Land Resource Unit, Research Branch, Agriculture and Agri-Food Canada, Winnipeg, Manitoba.

MacDonald, K.B. and D.B. Gleig. 1996. **Indicator of Risk of Water Contamination: Nitrogen Component**. Report No. 17. Research Branch, Agriculture and Agri-Food Canada, Guelph, Ontario.

Curran, P., T. Huffman, and M. McGovern. 1996. **Farm Resource Management Indicator: Soil Cover and Land Management**. Report No. 18. Research Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario.

Banerjee, R. 1997. **Summary of Activities in Fiscal-Year 1996-1997**. Report No. 19. Environment Bureau, Policy Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario.

Statistics Canada. 1996. **Farm Inputs Management Survey, 1995: A survey of manure, commercial fertilizer and commercial pesticide management practices on Canadian farms**. Catalogue No. 21F0009XPE. Ottawa, Ontario.

APPENDIX 3

MEMBERS OF THE AGRI-ENVIRONMENTAL INDICATOR PROJECT ADVISORY COMMITTEE

Mr. Ron Bertrand
B.C. Ministry of Agriculture
Fisheries & Food

Ms. Marie Boehm (past-Chair)
University of Saskatchewan

Mr. Denis Chartrand
Statistics Canada

Mr. Doug Chekay
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APPENDIX 4

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