

National Agri- Environmental Standards Initiative



Laura Maclean
Environmental Standards Coordinator
Environment Canada

March 15, 2008
Langley, BC



Environment Canada
www.ec.gc.ca

Canada

Outline

- 1 – What is “NAESI”
- 2 – The case for agri-environmental standards
- 3 – Process / methods for developing standards
- 4 – Demonstration of methods for nutrient standards
- 5 – March 2008 deliverables and options for end uses



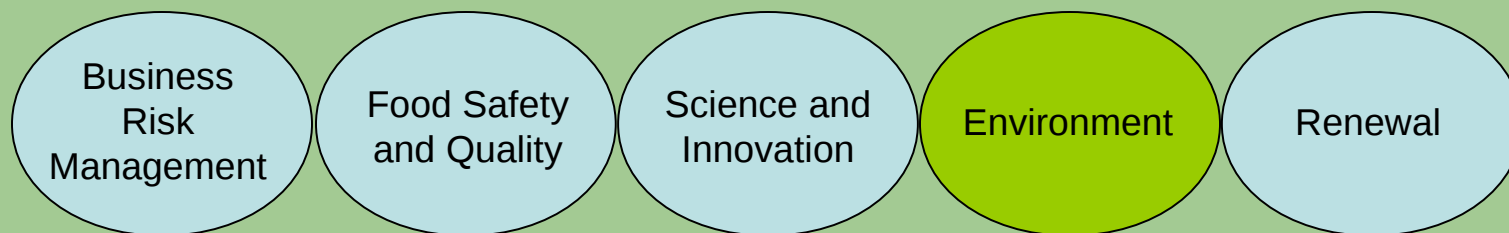
Agricultural Policy Framework (APF)

- Agriculture represents 8.3% of Canadian GDP
- Agriculture provides 1 in 7 jobs across the country
- Canada is the 4th largest exporter of agri-food products in the world
- APF goal is to position Canada as a world leader in food safety, innovation and environmentally responsible agricultural production



Agricultural Policy Framework (APF)

APF (2003-2008) comprises 5 'chapters':



APF Context: Environment Chapter Elements

reduce agricultural risk and
provide environmental benefits to:
**Air, Biodiversity,
Soil and Water**

Delivery Mechanisms

Knowledge &
Information Tools

On-Farm
Action

Performance
Measurement

- National Land and Water Information Service (NLWIS)
- Provincial Scans
- Pesticide Risk Reduction Program (PRRP)

- Watershed Evaluation of BMPs (WEBs)
- Environmental Farm Planning (EFP)
- Greencover Canada
- National Farm Stewardship Program
- National Water Supply Expansion Program
- Farm Certification

- National Agri-Environmental Health Analysis and Reporting Program (NAHARP):
indicators
- **National Agri-Environmental Standards Initiative (NAESI):**
standards



NAESI Framework

- 2003 MOU with Agriculture and Agri-Food Canada (AAFC) provides framework
- Environment Canada agrees to deliver a suite of national environmental standards for agriculture to AAFC by March 2008
- \$25 million budget over four “themes”



What do we mean by “standards”?

Standards are:

- practical and consistent science-based benchmarks to help guide the design of farm practices in achieving desired environmental outcomes
- **not intended as regulatory instruments**
- emphasize potential uses as voluntary targets, especially within landscape management and stewardship programs



Examples of Potential Standards

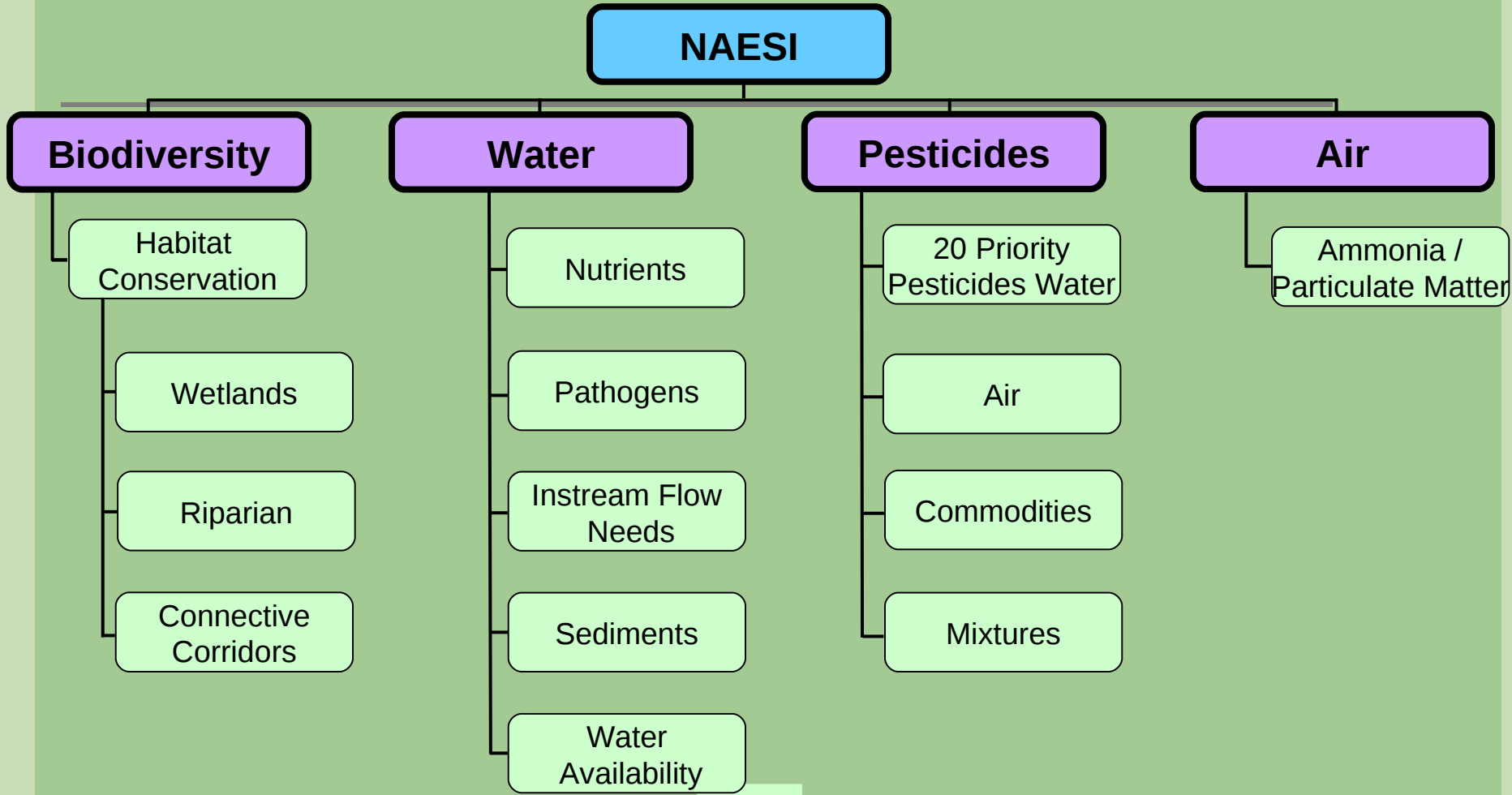
Air - Ranges of percentage reductions in ammonia and resulting impacts on local and regional air quality.

Biodiversity - Represent threshold levels for habitat components relevant in each ecoregion. Seventy-five percent of riparian areas with 30 m vegetated buffer in a specific ecozone.

Pesticides - Maximum pesticide concentration for priority pesticides (e.g., atrazine) to sustain ecosystem health.

Water - Maximum allowable quantity and duration of suspended sediment in order to maintain specified, valued features of stream ecosystem.





Outline

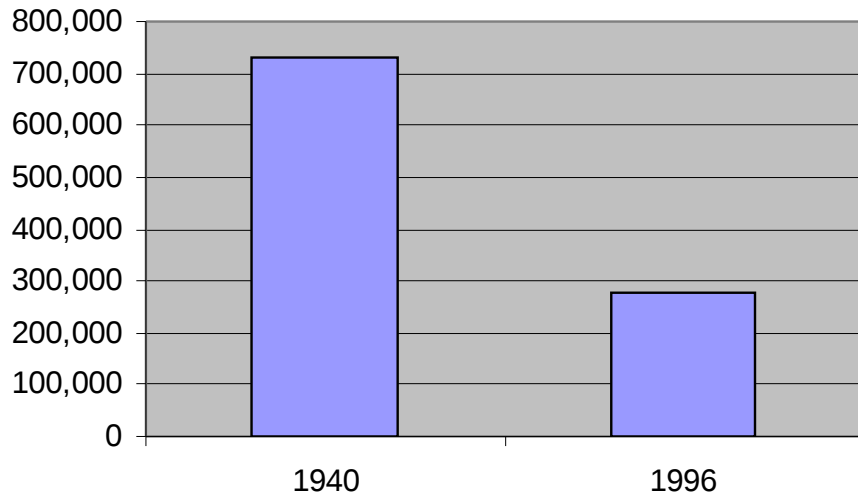
- 1 – What is “NAESI”
- 2 – The case for agri-environmental standards
- 3 – Proposed process for developing habitat-based standards
- 4 – Pilot application of the process to the South Okanagan
- 5 – March 2008 deliverables and next steps



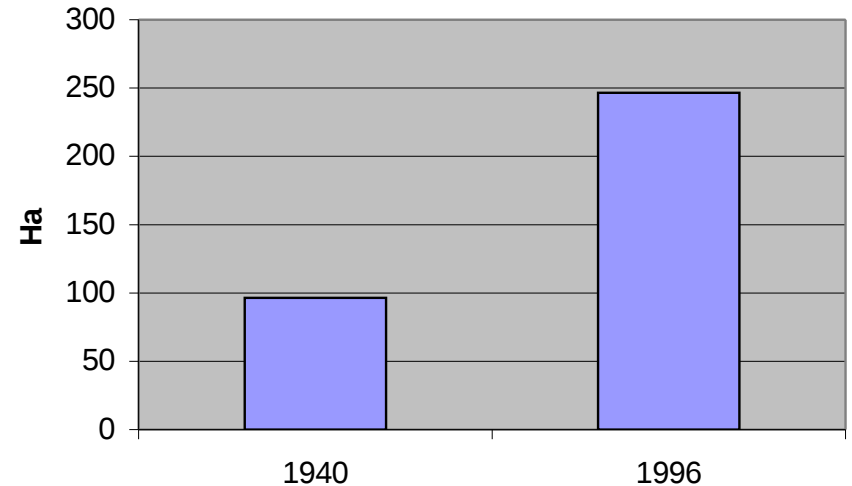
Trends in Canadian Agriculture:

Consolidation of Farm Ownership

Number of Farms in Canada



Average Size of Farm in Canada

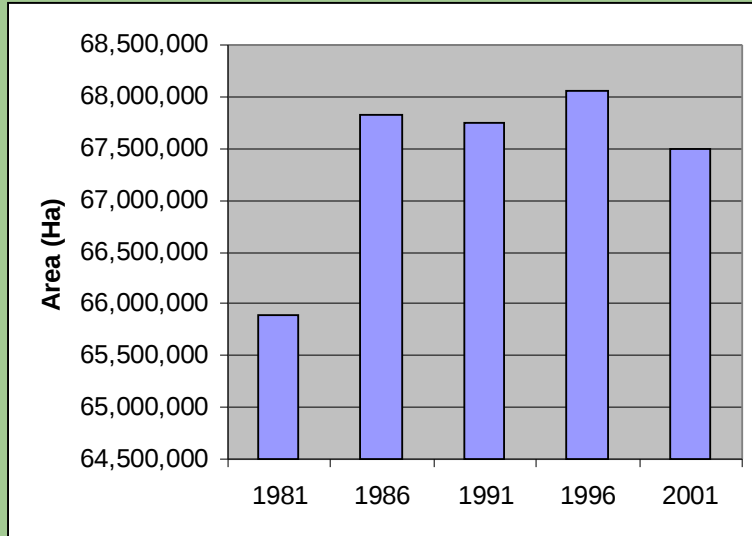


Source: Statistics Canada Census of Agriculture (2001)

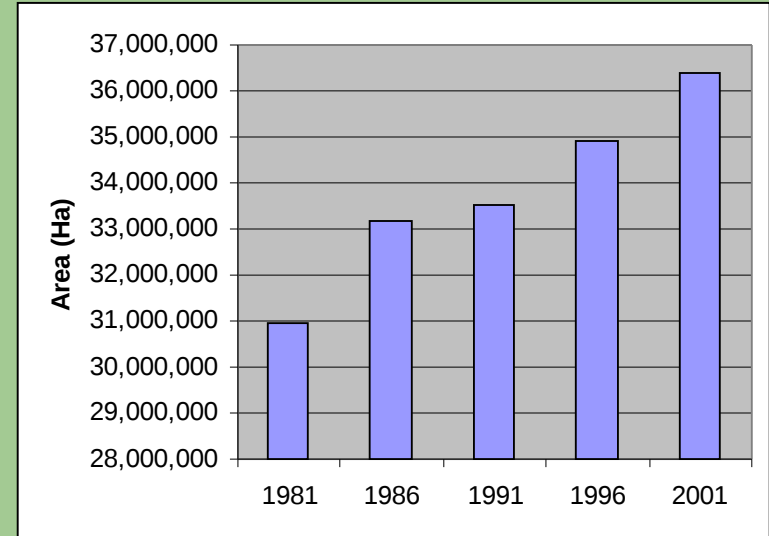


Trends in Canadian Agriculture: Intensification of Production Practices

Total area of farmland in Canada
1981 - 2001



Total area of crops in Canada
1981 - 2001



Source: Statistics Canada Census of Agriculture (2001)



Environmental Quality

- Increased production intensity = more inputs: nutrients (fertilizers, manure), pesticides, irrigation and livestock watering
- More loadings to the environment (nitrates, ammonia, pesticide drift or run-off)
- At the same time, producers are increasingly interested in achieving environmentally sound production practices
- How much is too much?



Wildlife in the Canadian Agricultural Landscape

>600 vertebrate species use farmland

> 200 butterfly species use farmland



Species at Risk (SAR)

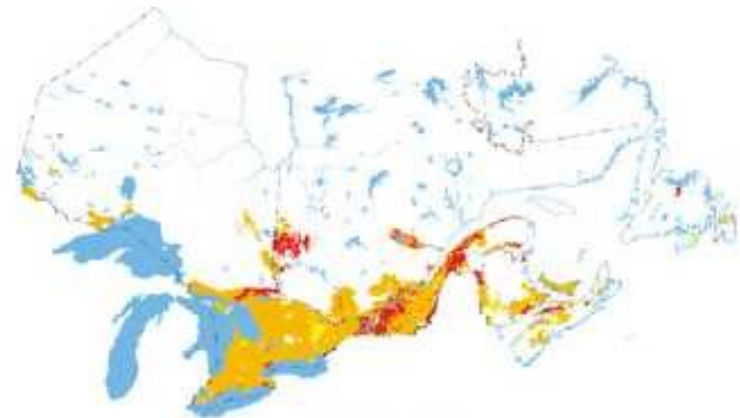
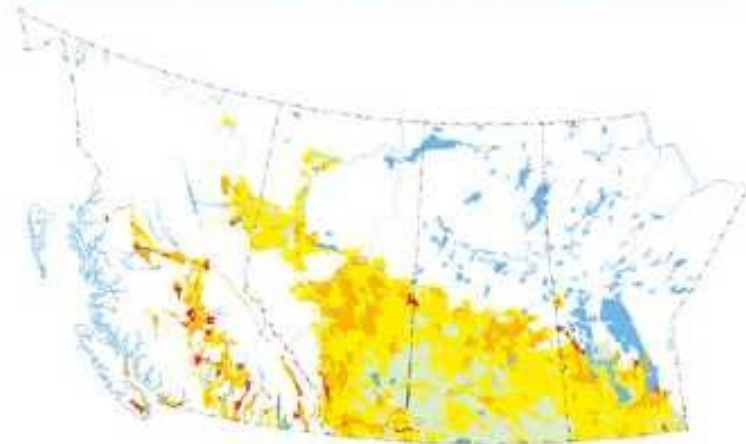
- 41% of vertebrate SAR occupying agricultural land use woodlands
- 63% of SAR occupying agricultural lands use wetlands
- 39% of SAR occupying agricultural land use grasslands



NAHARP Biodiversity Indicators

- 1 - Wildlife Habitat on Farmland
- 2 - Wildlife Damage to Crops and Livestock
- 3 - Invasive Alien Species
- 4 - Soil Biodiversity

Figure 24-1: Change in wildlife habitat capacity on Canadian farmland between 1981 and 2001



Classes of Habitat Capacity Change



NAESI Goals

- Define the 'goalposts' through a series of science-based performance measures
- Support a consistent national approach to achievement of common environmental outcomes in agriculture over the long term
- Support the move to environmental farm planning and provide direction to the selection of BMPs
- Enhance environmental performance of the agricultural sector and promote environmental stewardship



Outline

- 1 – What is “NAESI”
- 2 – The case for agri-environmental standards
- 3 – Process / methods for developing standards
- 4 – Pilot application of the process to the South Okanagan
- 5 – March 2008 deliverables and next steps



NAESI Approach

- Develop standards based on scientifically valid relationships between habitat quantity and quality and biological endpoints
- Focus on standards for endpoints affected primarily by agriculture
- Be consistent with key environmental legislation, Canadian Biodiversity Strategy, and AAFC Biodiversity Action Plan
- Derive standards at ecologically appropriate scales but ensure they can translate to targets at the farm scale
- Address linkages with other NAESI themes
- Link standards to the AAFC NAHARP indicators program



AIR Theme

Standards will focus on:



- Ammonia (NH_3) emissions as a precursor to particulate matter formation
- Methods include a combination of ammonia monitoring to determine sensitivity of PM levels to reductions in agricultural ammonia



WATER Theme

Standards will be developed for five sub-themes:

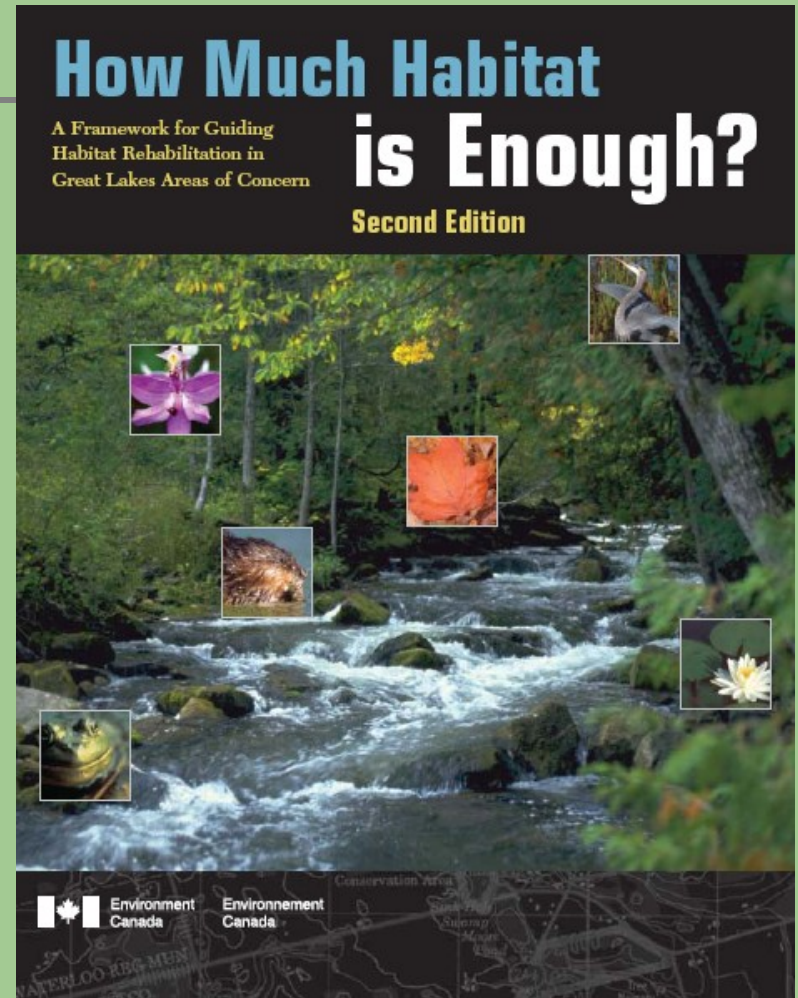
- *Pathogens*
- *Nutrients*
- *Sediments*
- *Water availability*
- *Instream flow needs*



BIODIVERSITY Theme

Focus on habitat-based standards for woodlands, wetlands, riparian areas and grasslands.

Basic process is to consolidate all available published landscape metric thresholds and combine these with habitat requirements a list of surrogate species (including but not limited to SAR) to establish 'generic' habitat standards by ecozone.



PESTICIDES Theme

Standards will developed for:

- *20 single pesticides using a modified CCME Guidelines derivation approach*
- *Two commodities*
- *Pesticide mixtures*



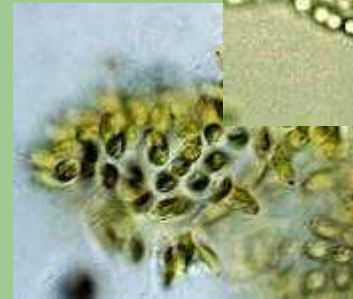
Outline

- 1 – What is “NAESI”
- 2 – The case for agri-environmental standards
- 3 – Process / methods for developing standards
- 4 – Demonstration of methods for nutrient standards
- 5 – March 2008 deliverables and next steps



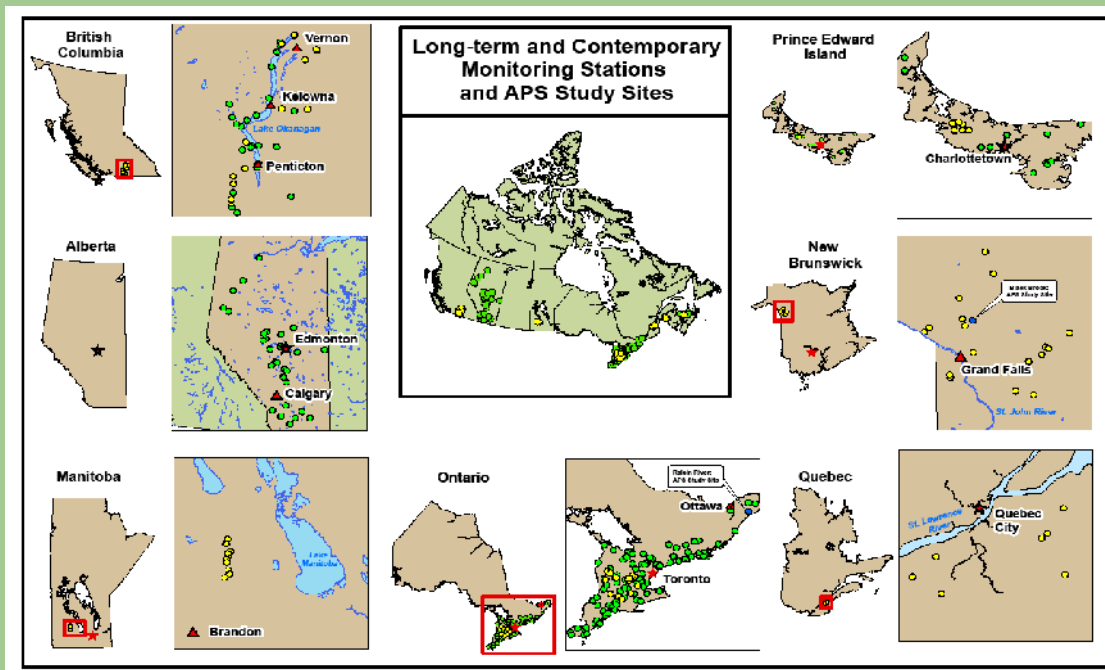
Nutrients Subtheme

- N and P cause eutrophication of inland and coastal waters
- Forms of N (nitrate, nitrite, ammonia) are toxic
- Challenge was to develop biological and chemical standards to protect biota from impairments caused by:
 - eutrophication (streams, rivers, coastal waters)
 - nitrate toxicity (freshwater and marine)



Standards to prevent eutrophication of streams

- Long-term monitoring data - N and P from > 200 water quality stations for up to 12 years for BC, AB, ON and PEI.

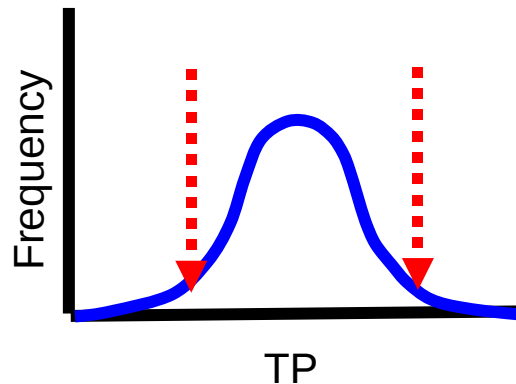


- Contemporary data – N, P and biological data from ~70 sites in BC, MB, ON, QC, NB and PEI

IPS for Streams: Approaches

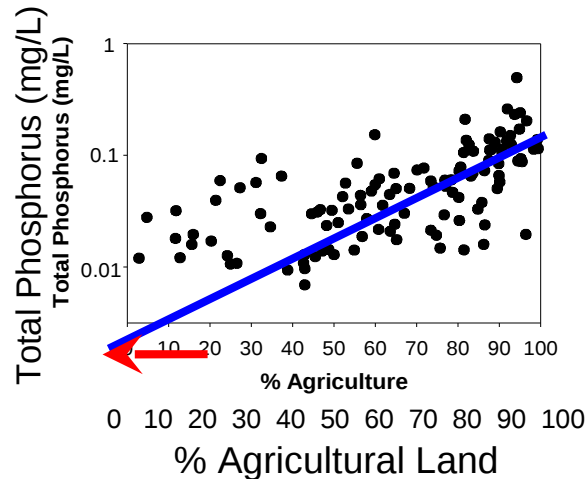
Percentile Approach

1. 25th percentile of all data (US EPA)
2. 80th percentile of data from reference sites during sensitive seasons (Aus & NZ)
3. lesser of reference plus 50%, or the upper trigger range that encompasses the reference conc. (CCME)



Y-intercept Approach

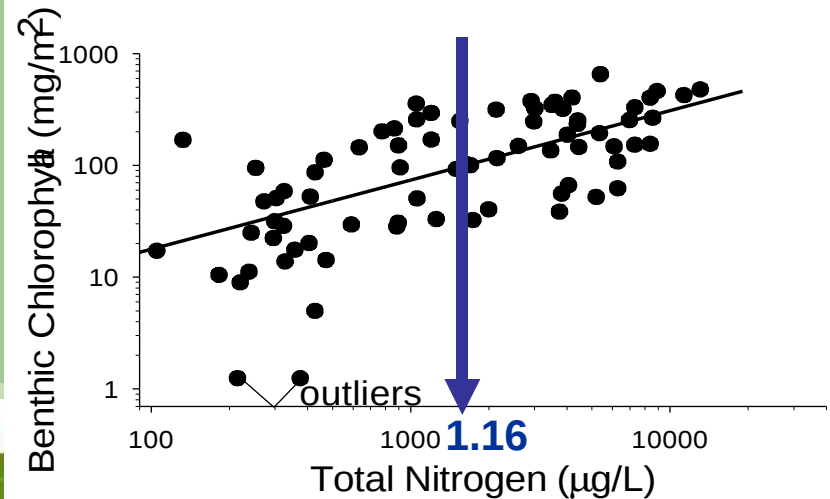
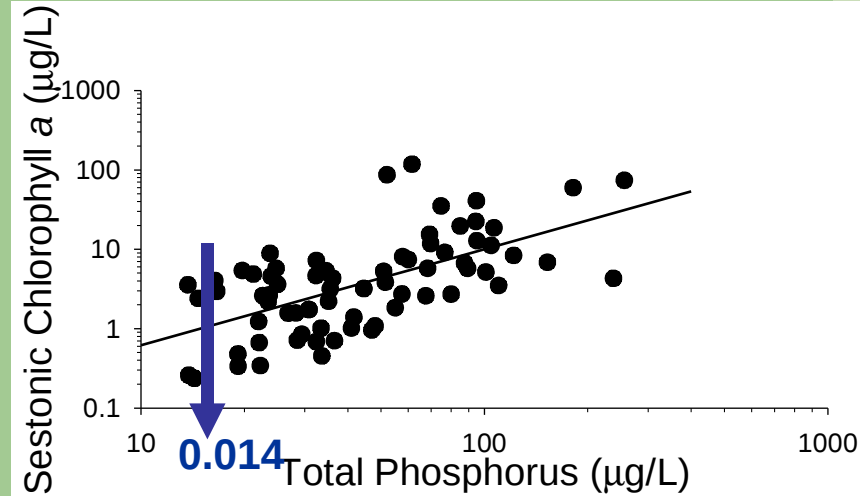
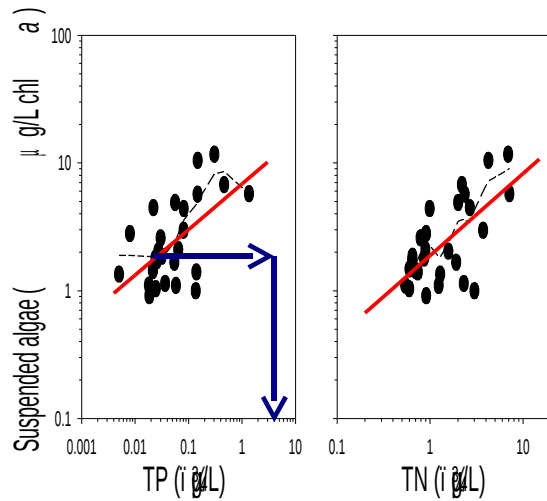
1. Y-intercept for the mean station TP or TN regressed against percentage agricultural land in the catchment.



IPS for streams: biological data

Regression Analysis

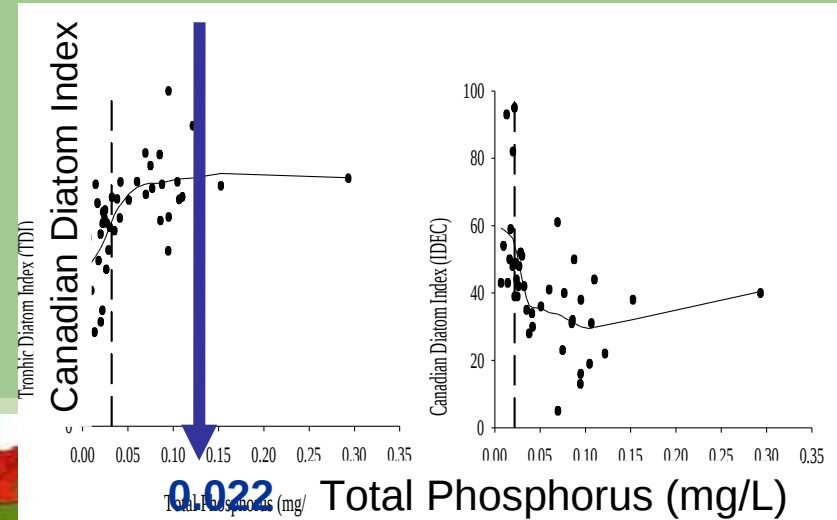
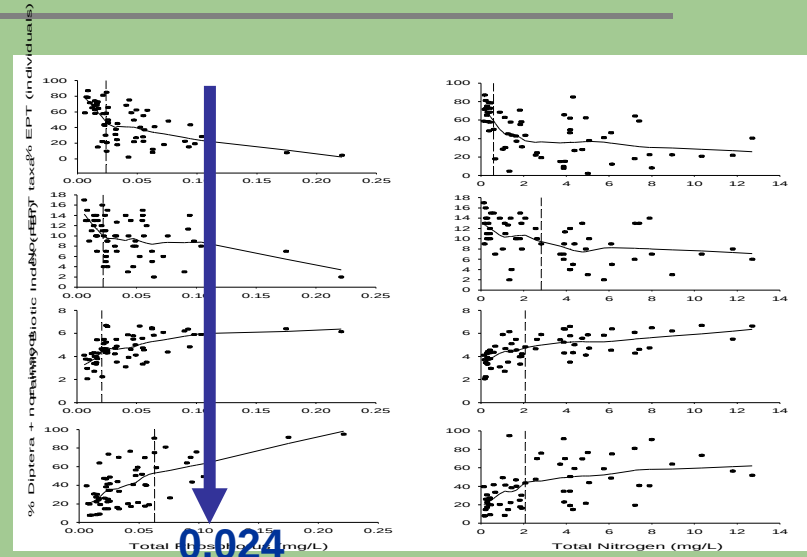
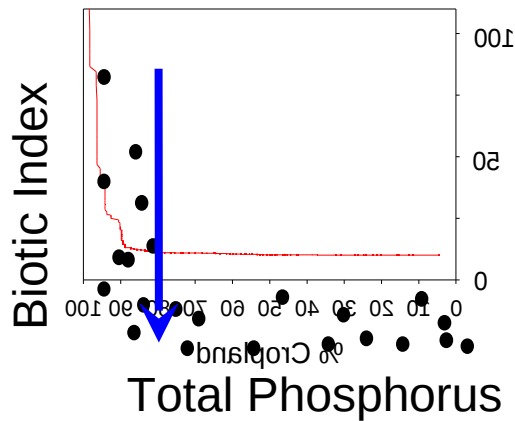
- identifies the TP or TN associated with proposed limits to algal abundance



IPS for streams: biological data

Regression Tree Analysis

- identifies a change point in the response of a dependent variable (biotic metric) to an independent variable (i.e., TP or TN metric)



IPS for streams: recommendations

	Recommended IPS		Resulting Biological Condition			
	TP (mg/L)	TN (mg/L)	Sestonic Chla $\leq 5 \mu\text{g/L}$	Benthic Cha $\leq 100 \text{ mg/m}^2$	Benthic Diatom	EPT
BC	X	x	?	?	?	?
AB	x	X	?	?	?	?
MB	x	x	?	?	?	?
PEI	0.032	0.86	N	Y	Y	Close



IPS to prevent eutrophication of medium and large rivers

- Based on 25th percentile of ~200 medium and large rivers from agricultural regions across Canada

Ecozone	Medium Rivers		Large Rivers	
	TP (mg/L)	TN (mg/L)	TP (mg/L)	TN (mg/L)
Atlantic Maritime	0.007	0.21	0.005	0.17
Mixedwood Plains	0.024	1.02	0.019	0.63
Boreal Shield	0.004	0.13	0.005	0.15
Prairies	-	-	0.066	0.90

- Medium = $10^2 - 10^3$ km² for humid regions; $5 \times 10^2 - 5 \times 10^3$ km² for arid regions
- Large = $10^3 - 10^4$ km² for humid regions; $5 \times 10^3 - 10^4$ km² for arid regions



Gaps and Limitations of Proposed Standards to Prevent Eutrophication

- Knowledge Limitations

- *insufficient knowledge as to the effects of nutrient additions*

- Data Limitations

- *insufficient data of ambient nutrient concentrations and biological responses to nutrients (along with relevant confounding physical factors)*

- Consequently

- *IPS for regions with only a few stations sampled over only a few years are draft and must be validated*
- *Biological conditions associated with all IPS must be verified*



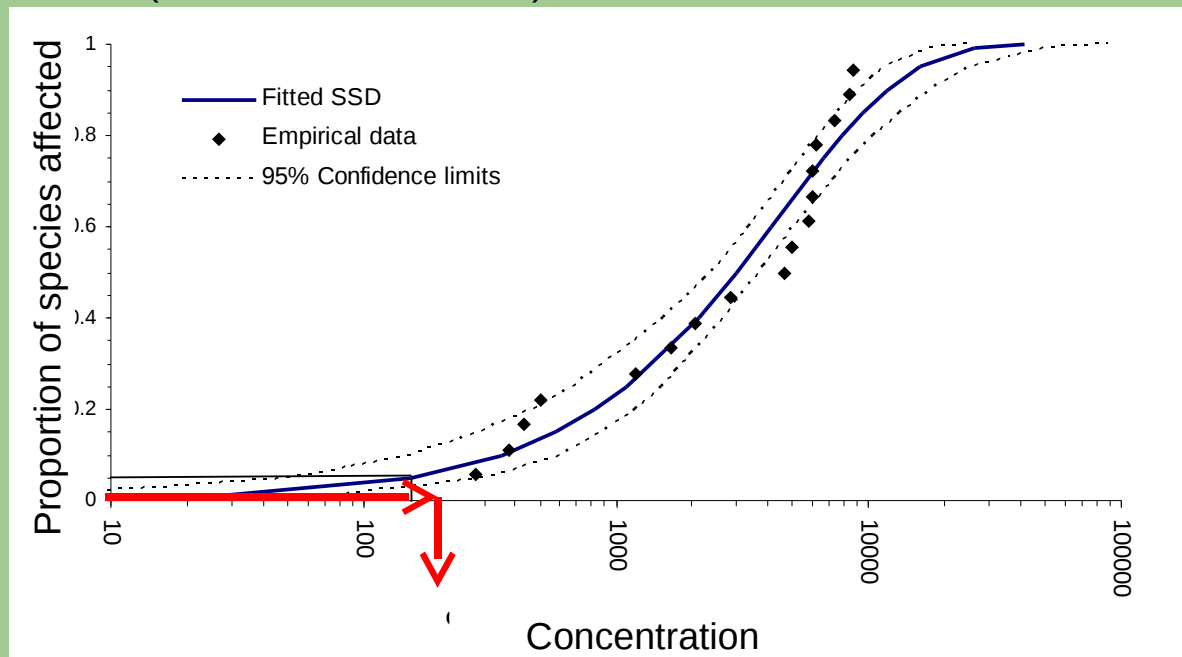
IPS for Nitrate to Prevent Toxicity

- In 2003, interim Canadian Water Quality Guidelines (CWQG) were published
- Guidelines were 'interim' because of limited data for Canadian organisms
- New data were collected for rainbow trout, freshwater amphipod, Pacific purple sea urchin and topsmelt, and used to supplement existing data to calculate nitrate IPS



Freshwater NO_3^- Species Sensitivity Distributions

- a) Long-term (based on no-effect concentrations for growth, reproductions or behaviour)
- b) Short-term (based on LC50 values)



The criterion value is chosen as the 5th percentile of species affected. Therefore, the nitrate IPS will be protective of $\geq 95\%$ of aquatic biota.

IPS for Nitrate to Prevent Toxicity: DRAFT Only

	Freshwater		Marine	
	(mg/L NO ₃)	(mg/L N)	(mg/L NO ₃)	(mg/L N)
Short-term	154	35	2124	480
Long-term	38	8.54	251	57

- Short term IPS is supposed to simulate a short, large pulse of a toxicant like a spill.
- Long-term IPS is more akin to chronic exposure.



Outline

- 1 – What is “NAESI”
- 2 – The case for agri-environmental standards for biodiversity
- 3 – Proposed process for developing habitat-based standards
- 4 – Pilot application of the process to the South Okanagan
- 5 – March 2008 deliverables and options for end uses



Deliverables

- 89 agri-environmental standards for air, water, biodiversity and pesticides
- Technical Series reports
- Synthesis Reports by theme
- Peer review
- Stakeholder consultation



Future Priorities

- Validate and refine the standards in real-life scenarios
- Continue research to further develop the priority standards from NAESI I
- Test national applicability of the priority standards from NAESI I
- Develop standards for other agri-environmental priorities
- Strengthen integration across NAESI themes
- Partner with AAFC? provinces? on standards implementation



Potential End Uses for Agri- Environmental Standards

- scientific benchmarks to assess environmental quality – e.g. CCME Guidelines
- goalposts for indicators and monitoring efforts – e.g. NAHARP
- provide guidance to direct future work on Beneficial Management Practices (BMPs)
- use to evaluate the environmental outcomes of programs like Environmental Farm Planning
- measurement of EG&S?
- environmental certification / branding ... ?
- others??





Thank you!

http://www.agr.gc.ca/env/naesi_e.php



Environment
Canada

Environnement
Canada



Environment Canada
www.ec.gc.ca

Canada⁴⁰