



GIS for Conservation & Advocacy

A case study of WWF-Canada

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& Tony Iacobelli





Presentation Outline

1. About WWF-Canada
2. GIS and our core business
3. 4 GIS Case Applications
 - Endangered Spaces Campaign
 - Forest Certification Support (FSC)
 - Conservation Reporting (The Nature Audit)
 - Marine Conservation Planning
4. GIS set-up/operations, future directions





WWF's mission

- Conserve biodiversity
- Ensure resource use is sustainable
- Reduce pollution and wasteful consumption

About us

- Global Network - active in 100+ countries
- WWF-Canada (est. 1967)
- 7 Regional Offices, >150,000 supporters
- The way we work





WWF-Canada Priority Ecoregions





GIS and Conservation Programs

GIS – “A tool” among many others

GIS Supports

- Application/dissemination of conservation science
- Awareness - building, assessing the case
- Generating Information/analyses relevant to decision making

Actions that Advance Conservation Outcomes



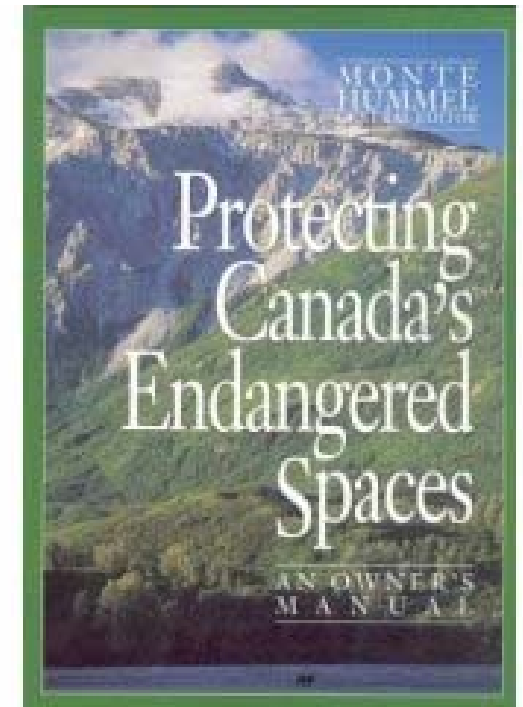


GIS Case #1 – Endangered Spaces Campaign

- 10 year National Campaign 1990-2000
- Protected Areas establishment
- National and International Commitments
 - 12% of land base target

In 10 years

- 38+ million Ha of new protected areas
- 2.9% to 6.8%



A Protected Areas Gap Analysis Methodology

Planning for the Conservation of Biodiversity

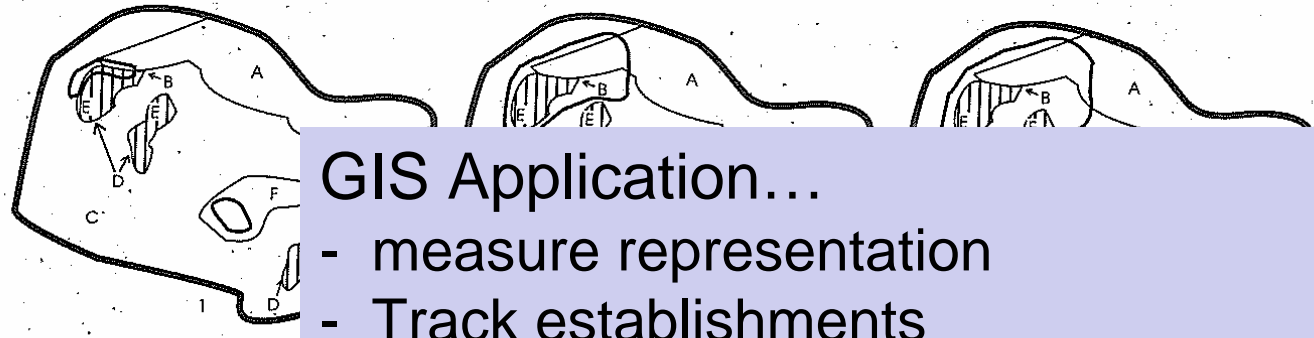
Incorporating the text of a presentation



Endangered Spaces Campaign
World Wildlife Fund Canada
90 Eglinton Avenue East
Toronto, Ontario, Canada M1P 2E3

Figure 19

Schematic of a conceptual natural region with three protected areas system designs and resulting assessments of enduring feature and natural region representation



GIS Application...

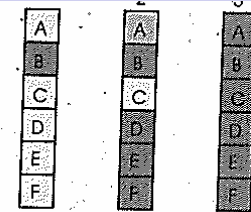
- measure representation
- Track establishments
- Identification of candidates

Legend

- Natural Region Boundary
- Enduring Feature Boundary
- Protected Area Boundary
- ◡ Water

- Not Captured
- ▨ Partially Captured
- ▩ Moderately Captured
- Adequately Captured

- A. Rolling Sandy Fluvioglacial
- B. Sandy Fluvioglacial Shoreline
- C. Undulating Till
- D. Till Shoreline
- E. Water
- F. Organic

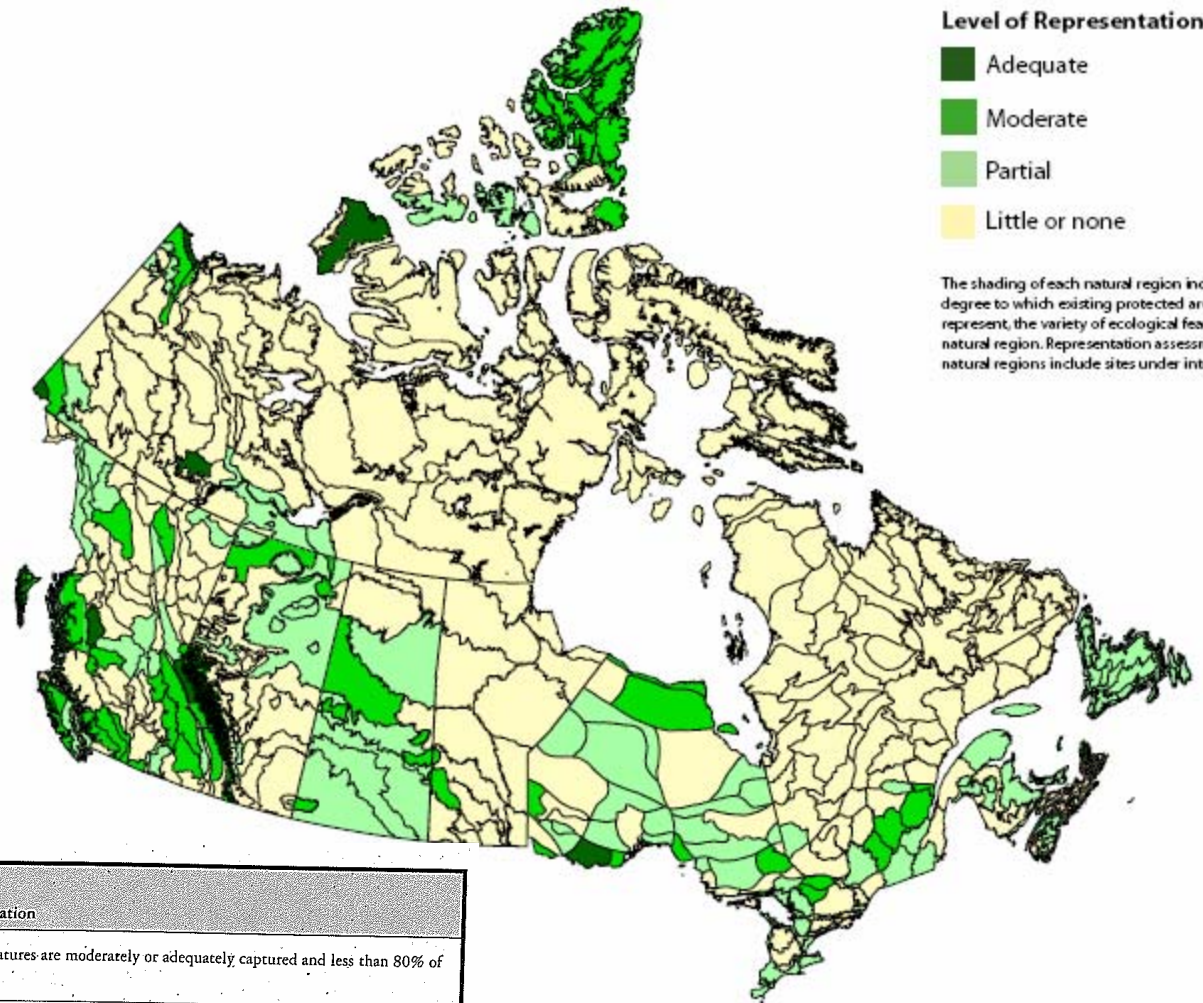


Natural Region Representation Partial Moderate Represented



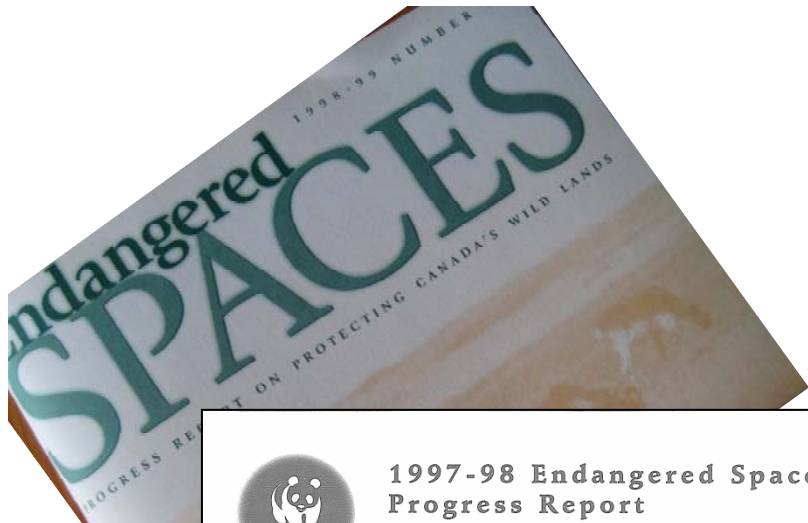
1990

Level of Representation of Canada's Terrestrial Natural Regions at the Beginning of the Endangered Spaces Campaign



World Wildlife Fund Canada / Endangered Spaces

Natural Region Representation	Enduring Feature Representation
Little or No Representation	None of the major enduring features are moderately or adequately captured and less than 80% of features are partially captured.
Partially Represented	(1) Up to 50% of the major enduring features are either moderately or adequately captured, and at least 50% of the remaining features are at least partially captured; or (2) A significant majority (at least 80%) of all features are partially captured.
Moderately Represented	At least 50% of the major enduring features are adequately captured and a majority (at least 80%) of the remaining features are either moderately or partially captured.
Represented	All of the enduring features are judged to be adequately captured in existing protected areas.



1997-98 Endangered Spaces Progress Report

Executive Summary

Between March 1997 and February 1998, Canadians set aside 1,906,600 hectares of our country's lands and waters in 128 new parks, ecological reserves and other protected areas, raising the total area of our country permanently dedicated to nature protection from 5.7 percent to just short of 6 percent.

Underlying these statistics are very special places to celebrate. The vast, wildlife-rich expanse of core reserves and surrounding special management areas in the Rocky Mountains of northeastern British Columbia was achieved through consensus among local residents, conservation groups, the petroleum industry and First Nations. Far to the east, the Saguenay-St. Lawrence Marine Park was finally secured under combined federal and Quebec legislation, more than twenty years after public concern arose for the endangered beluga whales which struggle to

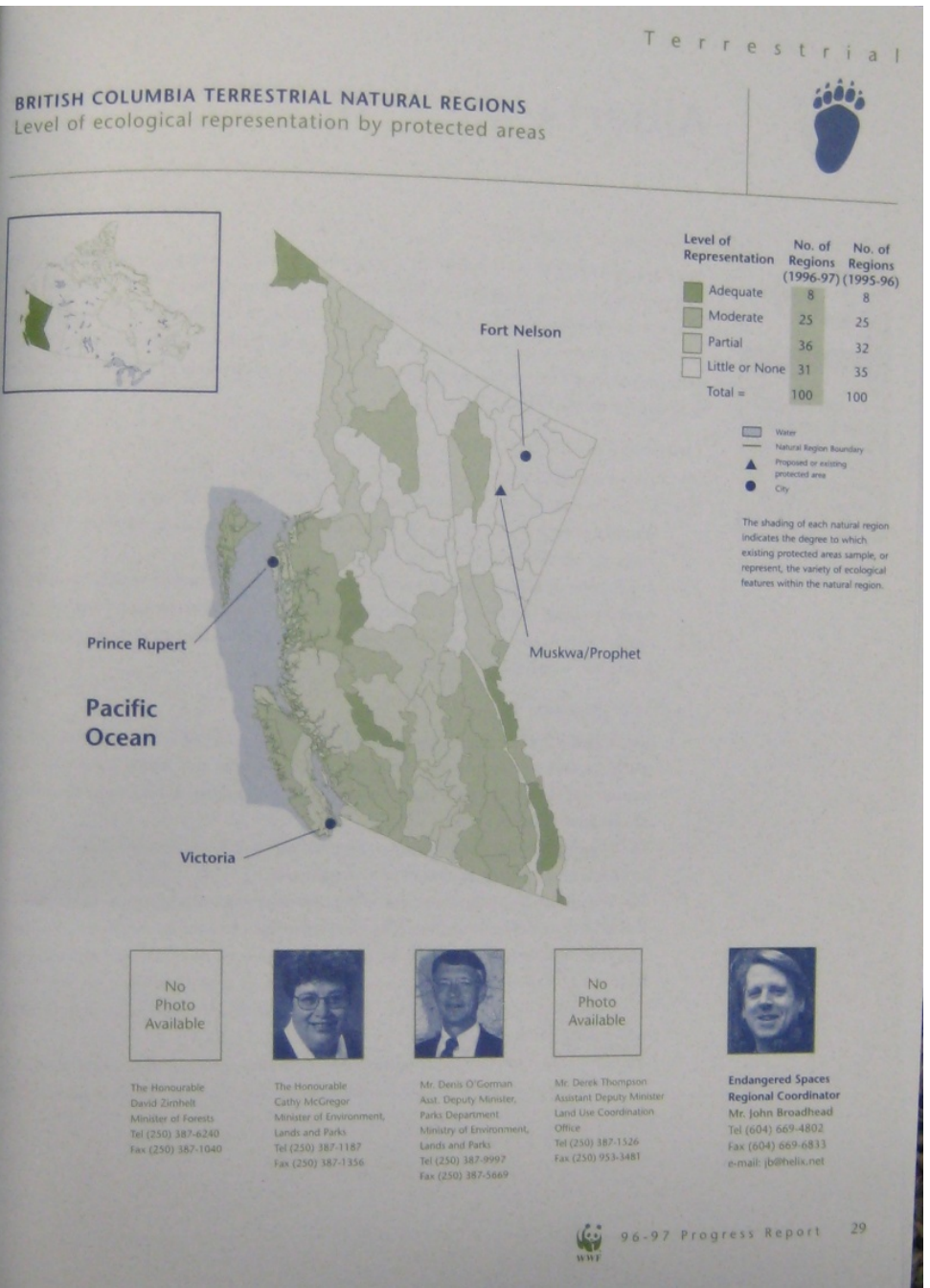
survive in the spectacular but polluted underwater reaches of this historic fjordland.

Stepping back from these and other notable accomplishments, the big picture remains unsatisfactory. The goal of the Endangered Spaces Campaign launched by WWF Canada in 1989, is to adequately represent each of our country's 486 terrestrial natural regions in a nationwide protected areas system by the year 2000, a goal that is officially shared by each province and territory as well as the federal government. By that yardstick, only 11 natural regions advanced significantly during the past year, none achieving adequate representation and

another two moving to moderate. Two hundred and twenty-four regions remain stuck with little or no representation, meaning that we haven't really begun to address their challenges, and are instead simply watch

NATIONAL REPORT CARD on Protected Areas

	Final Grade 1997-98	Last Year's Grade
Marine		
Federal	D+	D
Atlantic Region	D+	D-
Pacific Region	D+	C-
Great Lakes Region	D	D
Arctic Region	D-	D-
Terrestrial		
Prince Edward Island	B	B
Saskatchewan	B-	F
British Columbia	C+	C
Nova Scotia	C+	C-
Yukon	C+	C-
Manitoba	C	B+
Northwest Territories	C	C-
Ontario	D+	C-
Federal	D	A-
New Brunswick	D	F
Newfoundland/Labrador	D	C-
Quebec	F	D-
Alberta	F	D+

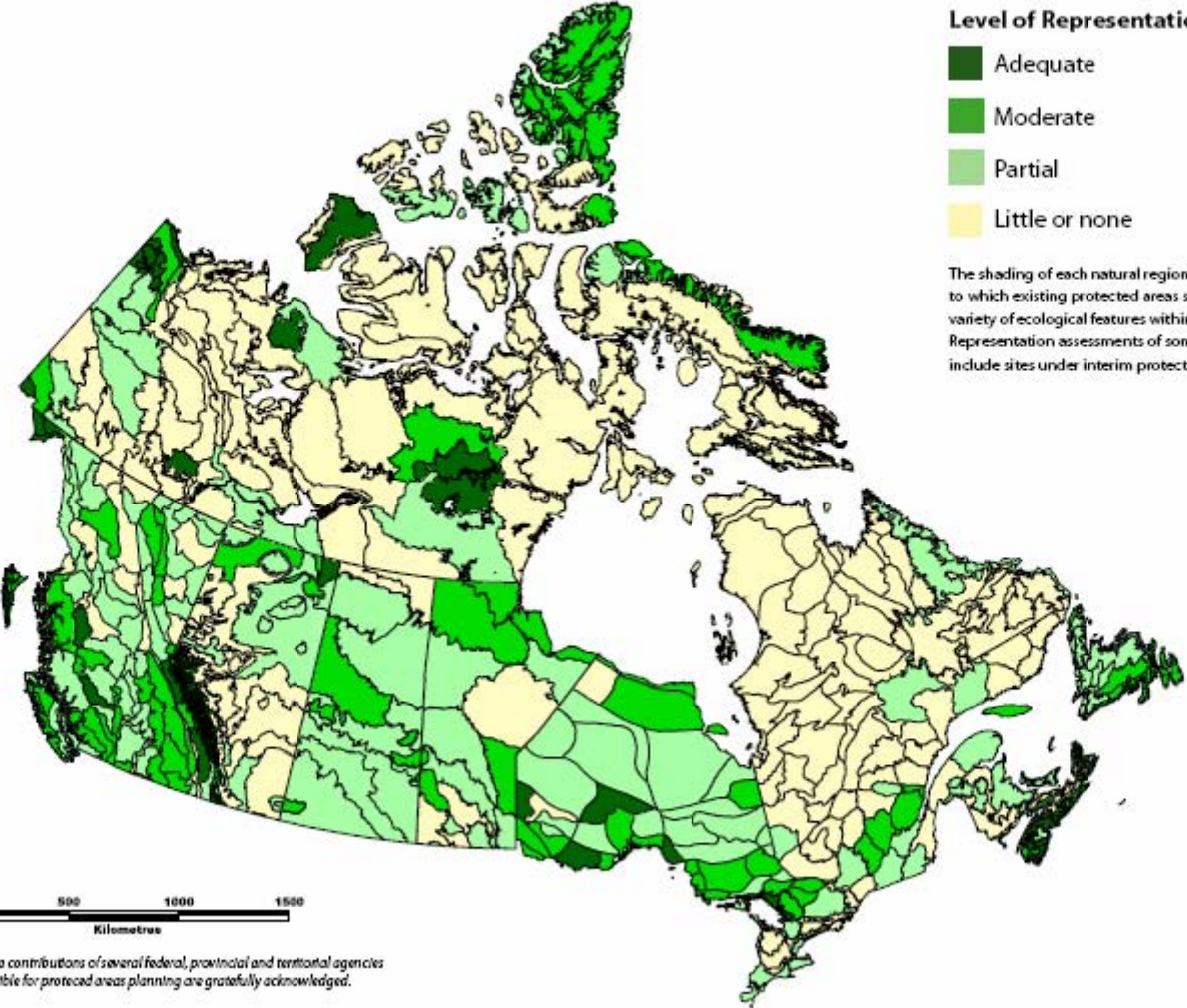


2000

Level of Representation by Protected Areas of Canada's Terrestrial Natural Regions

Statistics

as of July 1, 2000



Level of Representation

- Adequate
- Moderate
- Partial
- Little or none

The shading of each natural region indicates the degree to which existing protected areas sample, or represent, the variety of ecological features within the natural region. Representation assessments of some natural regions include sites under interim protection.

0 500 1000 1500
Kilometres

The data contributions of several federal, provincial and territorial agencies responsible for protected areas planning are gratefully acknowledged.



GIS Case #2 – Forest Certification

- Biodiversity conservation in Commercial Forests
- 30 Million Ha under FSC Certification in Canada
- Through active partnerships Industry (FPAC, Others)





Title: FSC Principles and Criteria for Forest Stewardship

FSC reference code: FSC-STD-01-001 (April 2004)

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Contents

Introduction

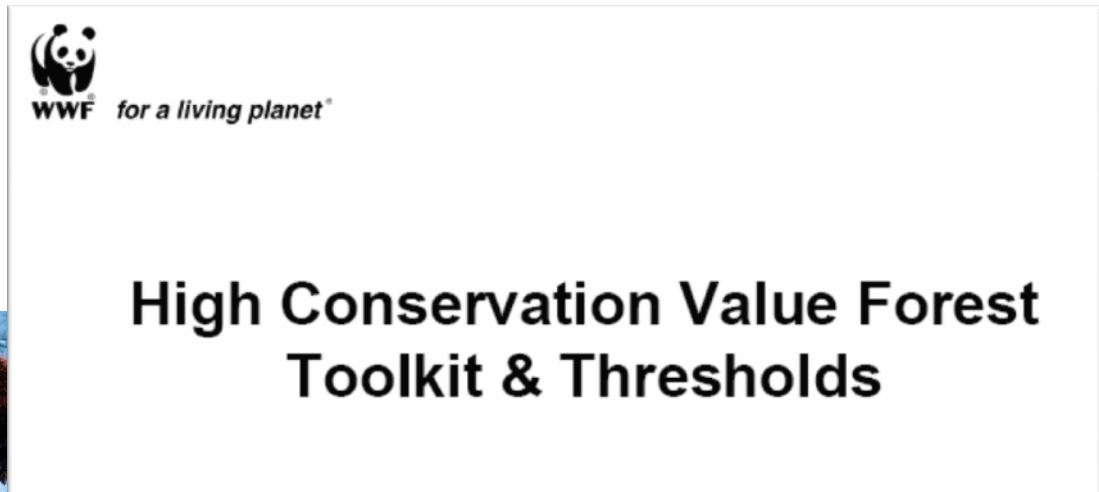
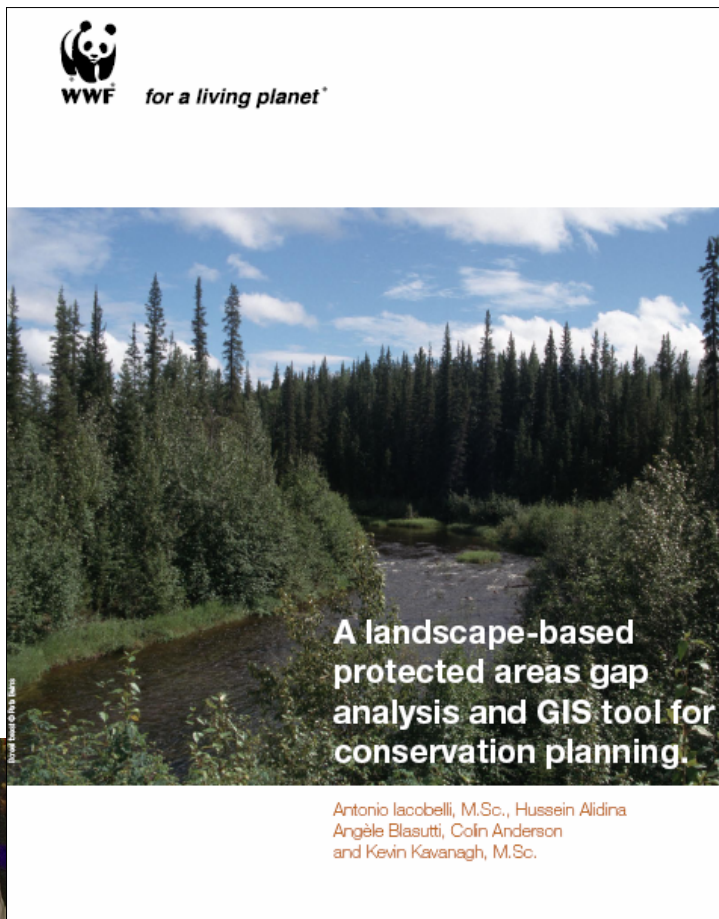
- 1 Principle #1: Compliance with laws and FSC Principles
- 2 Principle #2: Tenure and use rights and responsibilities
- 3 Principle #3: Indigenous peoples' rights
- 4 Principle #4: Community relations and worker's rights
- 5 Principle #5: Benefits from the forest
- 6 Principle #6: Environmental impact
- 7 Principle #7: Management plan

Principal #9: Maintenance of High Conservation Value Forests

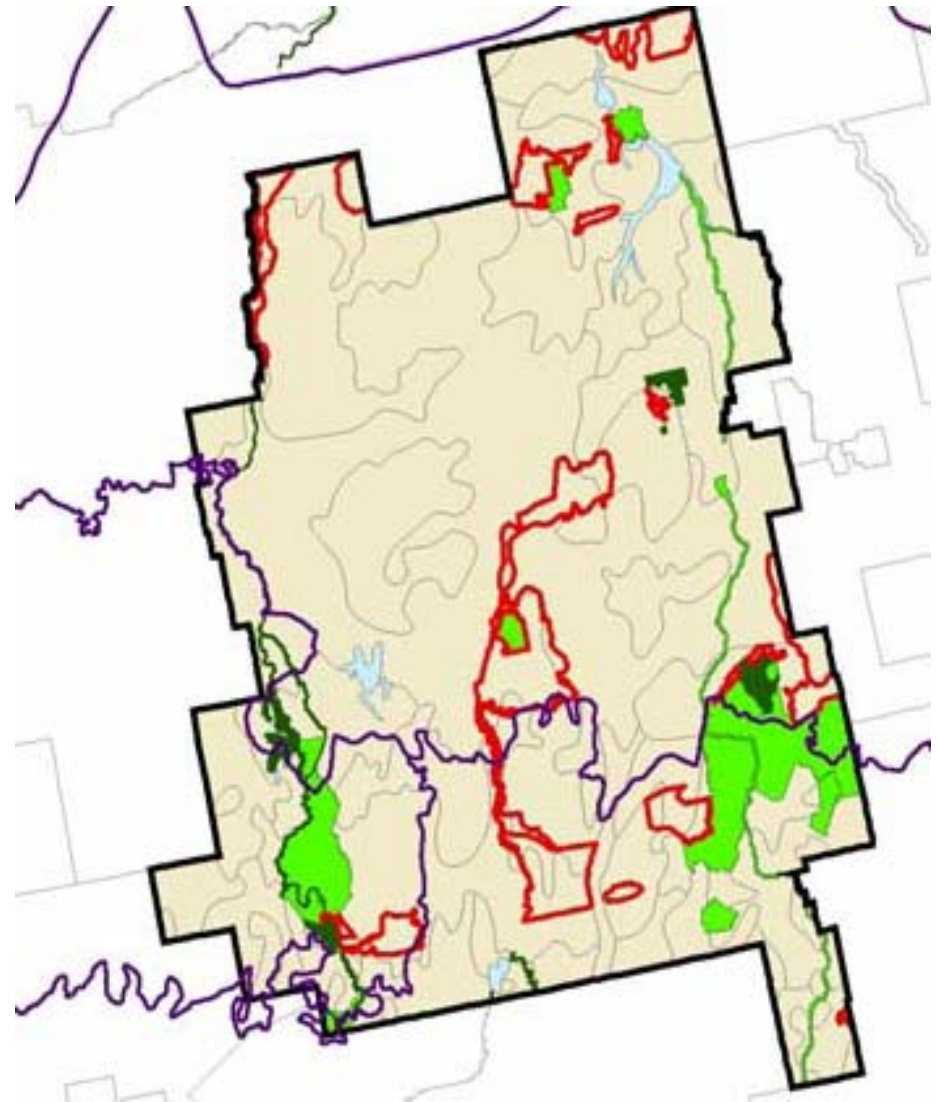
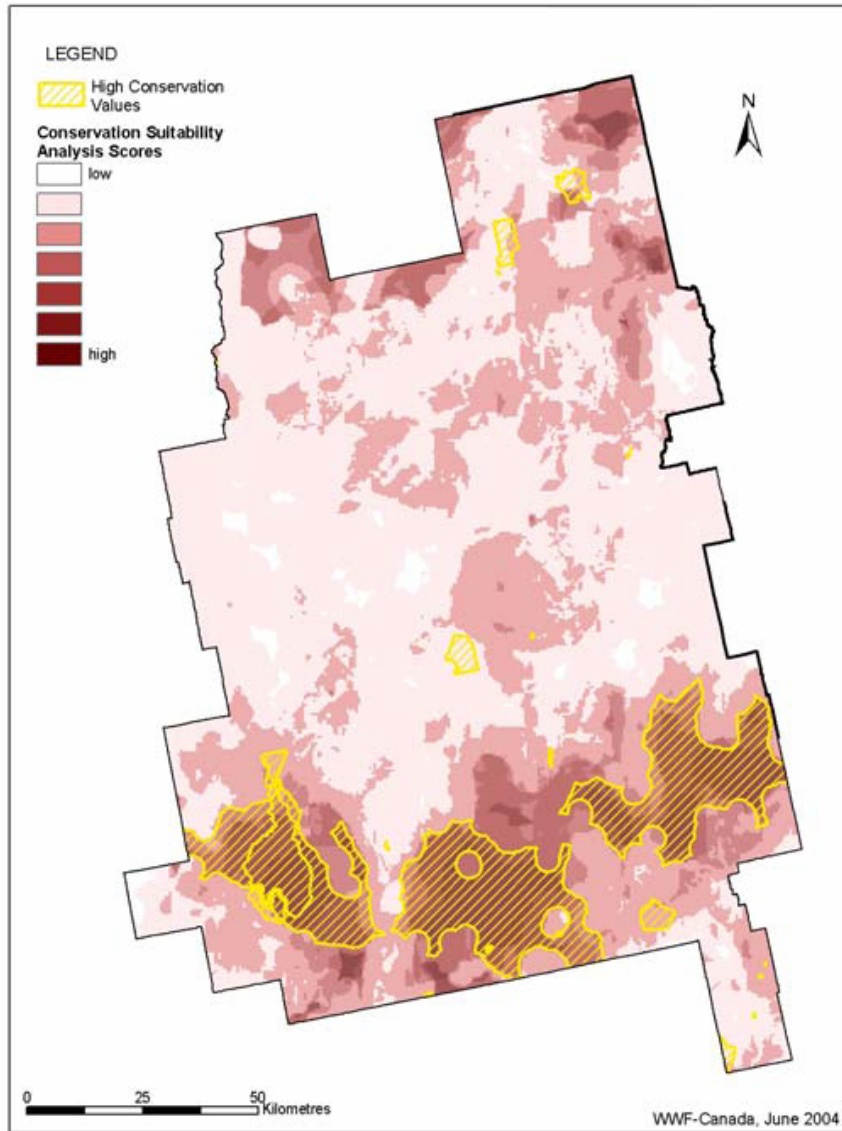




Collaborative development and application of Protocols and Tools for HCVF



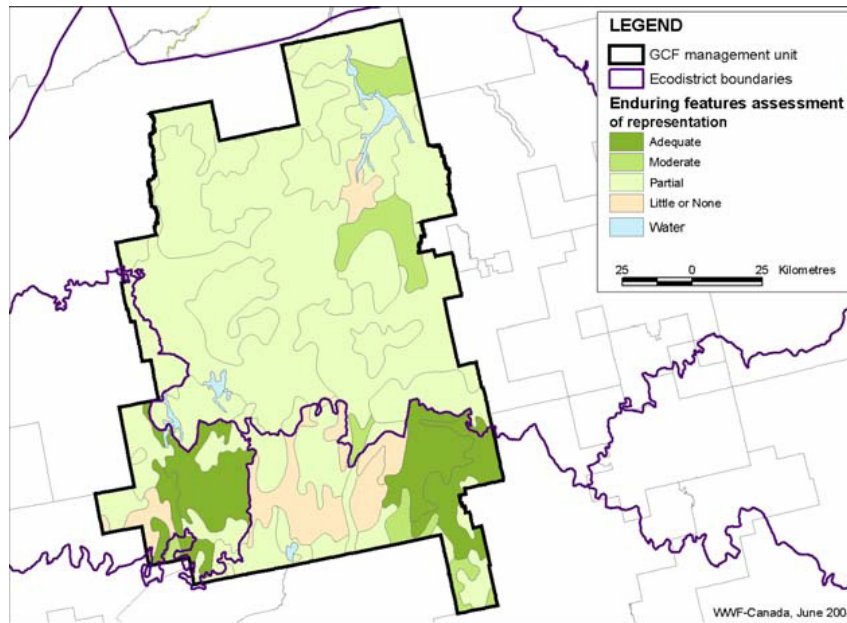
HCVF Areas Gordon Cosens Forest (Tembec | Ontario)



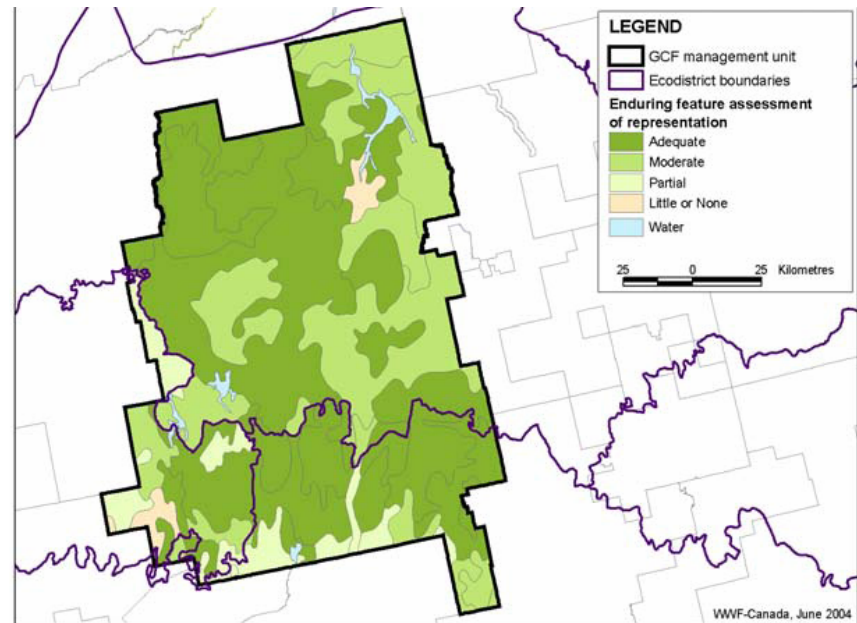


Representation by Protected Areas

Before Certification



After Certification






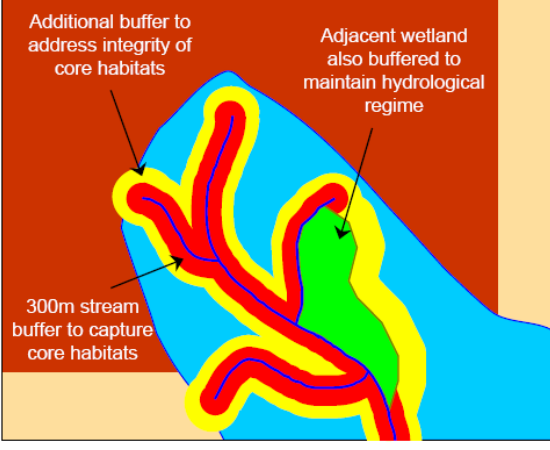
Assessment of Representation Analyst User's Guide

Taken from Appendices 5 & 6 of "A landscape-based protected areas gap analysis and GIS tool for conservation planning."

Antonio Iacobelli, M.Sc., Hussein Aidina
 Angèle Blasutti, Colin Anderson
 and Kevin Kavanagh, M.Sc.



Proposed HCVF Design Guidelines



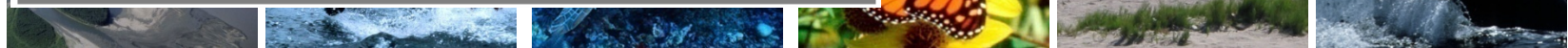
- All streams, wetlands and buffers considered possible HCVFs
- HCVF management options might include:
 - No roads in 300m core buffers; careful consideration of roads in yellow buffers
 - No roads or other activity in wetlands or adjacent areas that could alter hydrological conditions
 - Low intensity seasonal harvesting within red buffers provided forest composition maintained

WWF-Canada HCVF Species Database

Search Filters (19 Records)

96. Abitibi Plains | Species At Risk

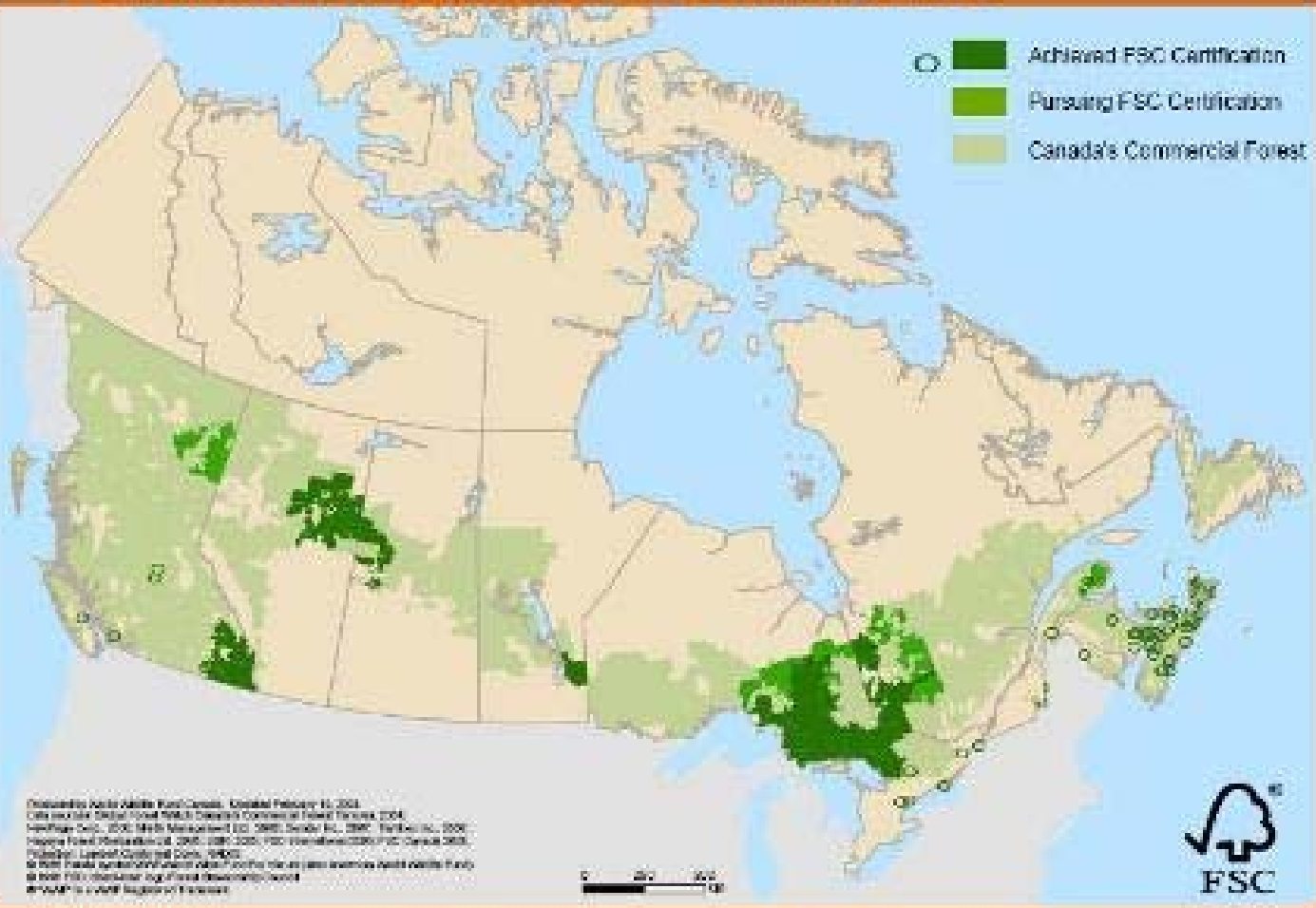
Summary	Species at Risk	Taxonomic Group	Nature Audit
HCV	PEREGRINE FALCON ANATUM SUBSPECIES (FALCO PEREGRINUS)	BIRDS	H
HCV	DEEPWATER SCULPIN (MYXOCOERHALLUS THOMPSONI)	FRESHWATER FISHES	H
HCV	SHORTJAW CISCO (COREGONUS ZENITHICUS)	FRESHWATER FISHES	H
HCV	WOLVERINE (GULO GULO)	MAMMALS	Possible
HCV	WOODLAND CARIBOU (RANGIFER TARANDUS)	MAMMALS	H
HCV	DOG ADDERS-MOUTH (ANALAKIS PALLIDOSA)	VASCULAR PLANTS	HCV
HCV	NORTHERN TWAYBLADE (LISTERA BOREALIS)	VASCULAR PLANTS	HCV
HCV	HOOVER ORCHIS (PLATANHERA HOOKERI)	VASCULAR PLANTS	HCV
Possible	WONARCH (DANIUS FLEXIPPUS)	ARTHROPODS	P
Possible	OLIVE-SIDED FLYCATCHER (CONTOPUS COOPERI)	BIRDS	Possible
Possible	LESSER YELLOWLEGS (TRINGA FLAVIPES)	BIRDS	Possible
Possible	CANADA WARBLER (MILVONIA CANADENSIS)	BIRDS	Possible
Possible	BAY-BREADED WARBLER (DENDROICA CASTANEA)	BIRDS	Possible
Possible	YELLOW RAIL (COOTURHIOPS NOVIBORACENSIS)	BIRDS	P
Possible	KIWI (COREGONUS KIWI)	FRESHWATER FISHES	P
Possible	NORTHERN BROOK LAWREY (ICHTHYOMYZON FOSSOR)	FRESHWATER FISHES	P
Possible	EASTERN WOLF (CANIS LUPUS)	MAMMALS	P
Possible	GREEN-FRANGE ORCHIS (PLATANHERA LACERA)	VASCULAR PLANTS	Possible
Possible	SWAMP-PINK (ARETHUSA BULBOSA)	VASCULAR PLANTS	Possible





CANADA: WORLD LEADER IN FSC CERTIFICATION

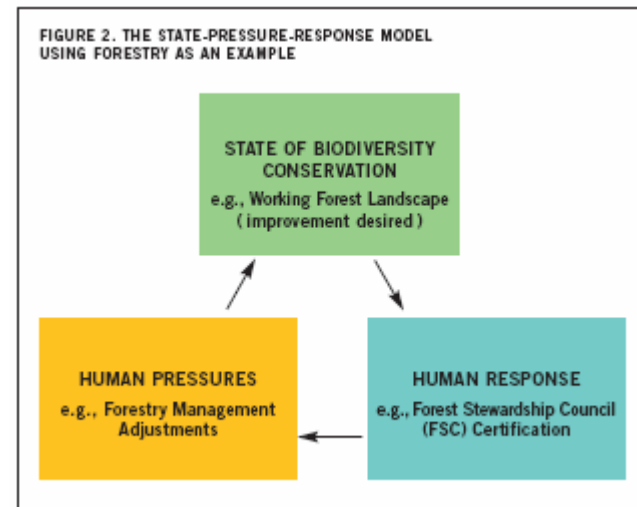
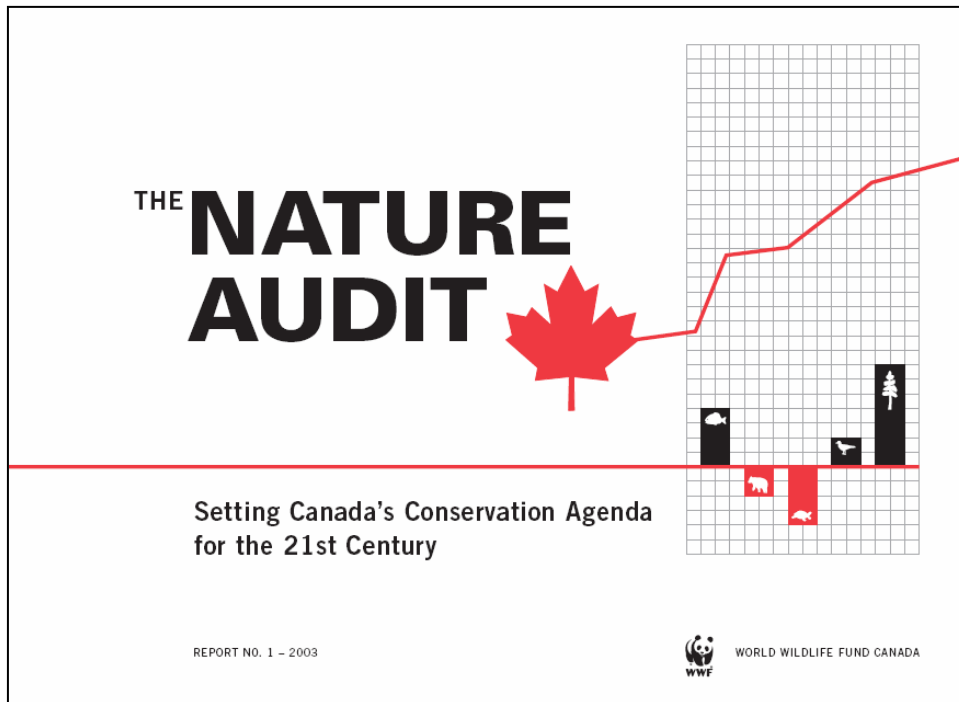
26 Million Hectares as of February 2008





GIS Case #3 – The Nature Audit

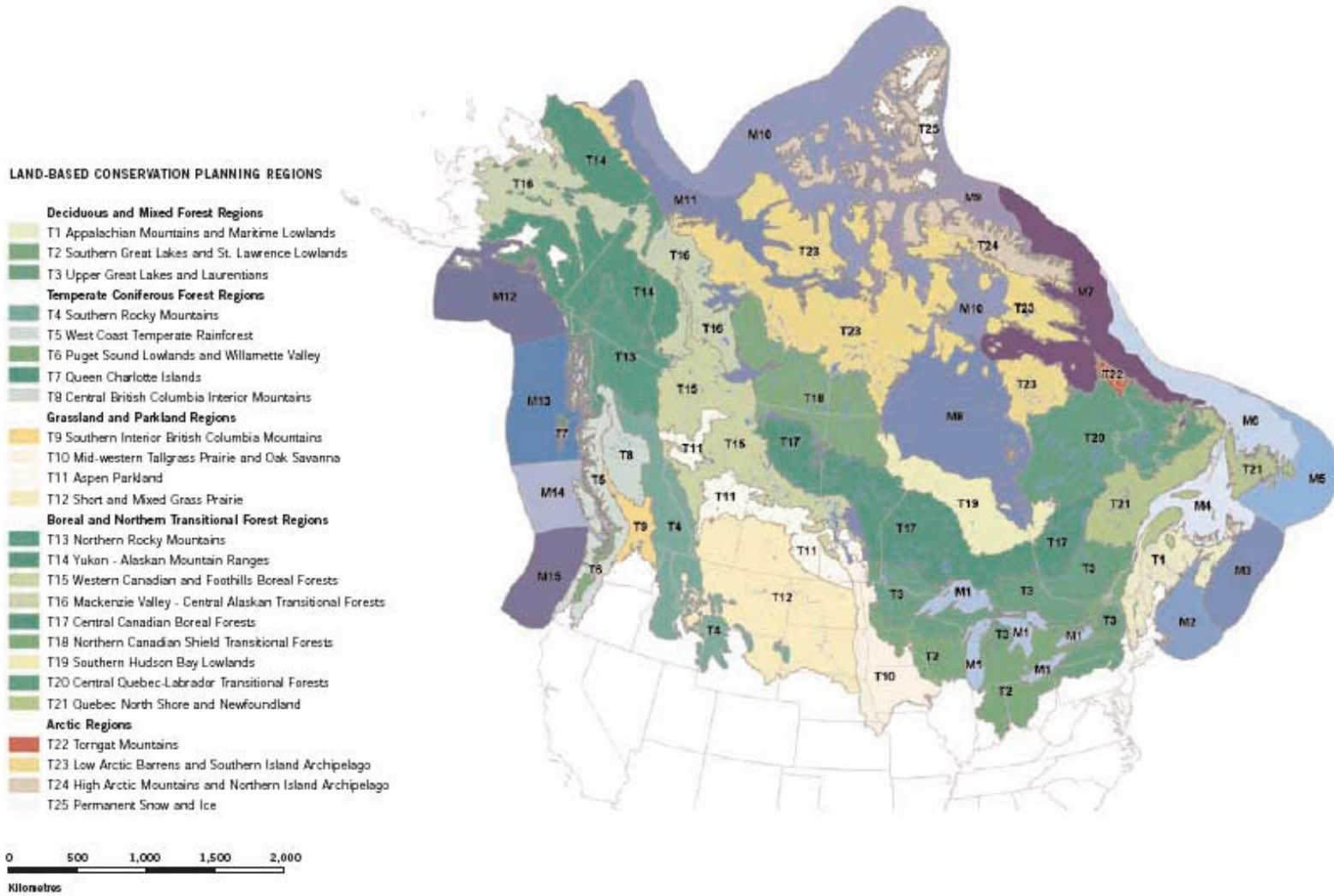
- National Assessment (2003)
- State–Pressure–Response



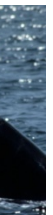


Framework - Conservation Planning Regions

FIGURE 3. CONSERVATION PLANNING REGIONS



NEARLY ONE-HALF: AMOUNT OF CANADA COVERED BY FOREST





FIGURES 10A AND 10B. CHANGE IN RANGE AND ABUNDANCE FROM BASELINE (C. 1600) TO PRESENT: AMPHIBIANS (10A) AND REPTILES (10B)

LEVEL OF CHANGE BASED ON REGIONAL DISRUPTION SCORES

- Negligible to Very Low
- Low
- Moderate
- High
- No Species Assessed (Terrestrial)
- No Species Assessed (Marine)

0 500 1,000 1,500 2,000
Kilometres

TABLE 9. CHANGES IN REPTILE AND AMPHIBIAN CAPITAL

Number of native reptile and amphibian species examined: **91**

Number of species losses from Conservation Planning Regions: **3**

OVERALL REGIONAL CHANGES, PRE-EUROPEAN SETTLEMENT TO PRESENT DAY

	Reptiles		Amphibians	
	Regional Abundance Trends (%)	Regional Range Trends (%)	Regional Abundance Trends (%)	Regional Range Trends (%)
Contracted > 50%	17.0	5.2	3.9	3.5
Contracted > 20%	50.5	22.7	30.6	15.5
No Change (+/- 20%)	31.0	71.1	61.6	77.2
Expanded > 20%	0.5	0.0	1.3	1.3
Expanded > 50%	1.0	1.0	2.6	2.6

Reptiles are thought to have undergone major reductions in abundance since European settlement. Range and abundance declines for amphibians are somewhat lower, but still of concern. All the range and abundance expansions are due to the introduction of species into other parts of Canada, where they are not considered native, such as the introduction of the bullfrog from eastern Canada into BC.

FIGURE 10A.

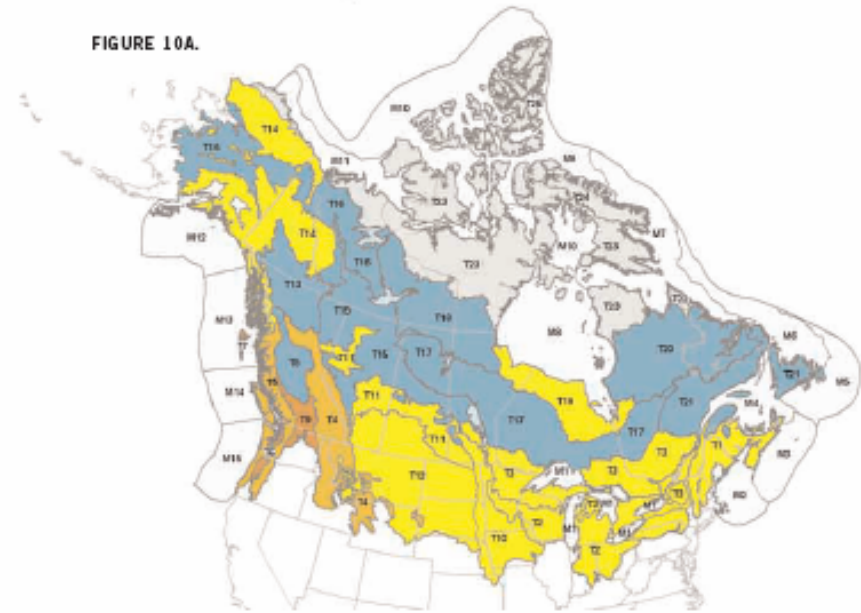
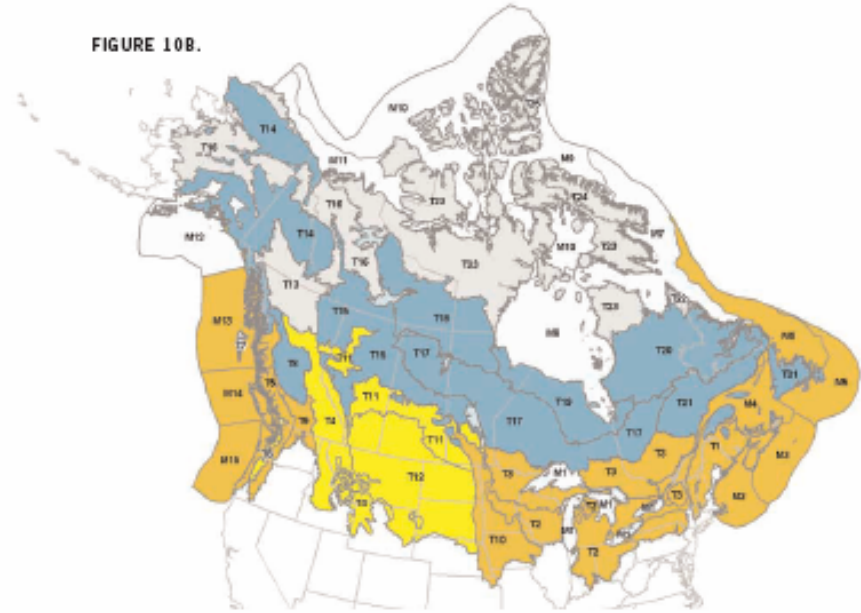


FIGURE 10B.



10,000+. THE NUMBER OF RED-SIDED GARTER SNAKES KILLED EACH YEAR ALONG A SINGLE 3.2-KILOMETRE SECTION OF HIGHWAY 17 IN MANITOBA

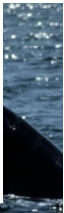
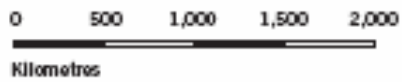
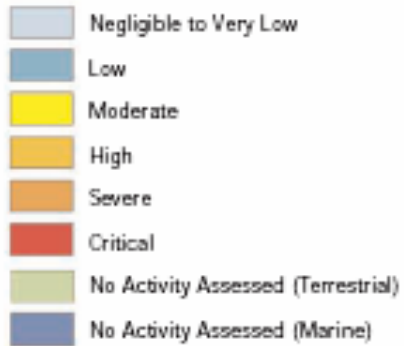


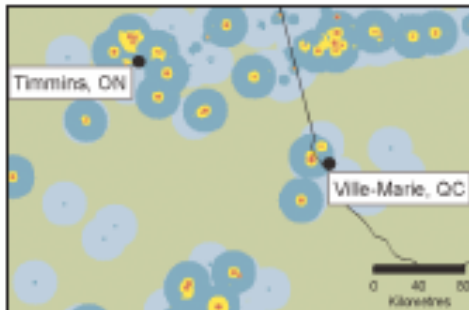


FIGURE 30. INDUSTRY FOOTPRINT SCORE: MINING

LEVEL OF DISRUPTION



Enlarged view of part of CPR T17 straddling the Ontario/Quebec border, showing detailed mining footprint pattern.





Nature Audit: Cumulative Footprint

FIGURE 39. INDUSTRY FOOTPRINT SCORE: CUMULATIVE

LEVEL OF DISRUPTION

- Negligible to Very Low
- Low
- Moderate
- High
- Severe
- Critical
- No Activity Assessed (Terrestrial)
- No Activity Assessed (Marine)

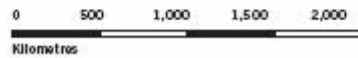
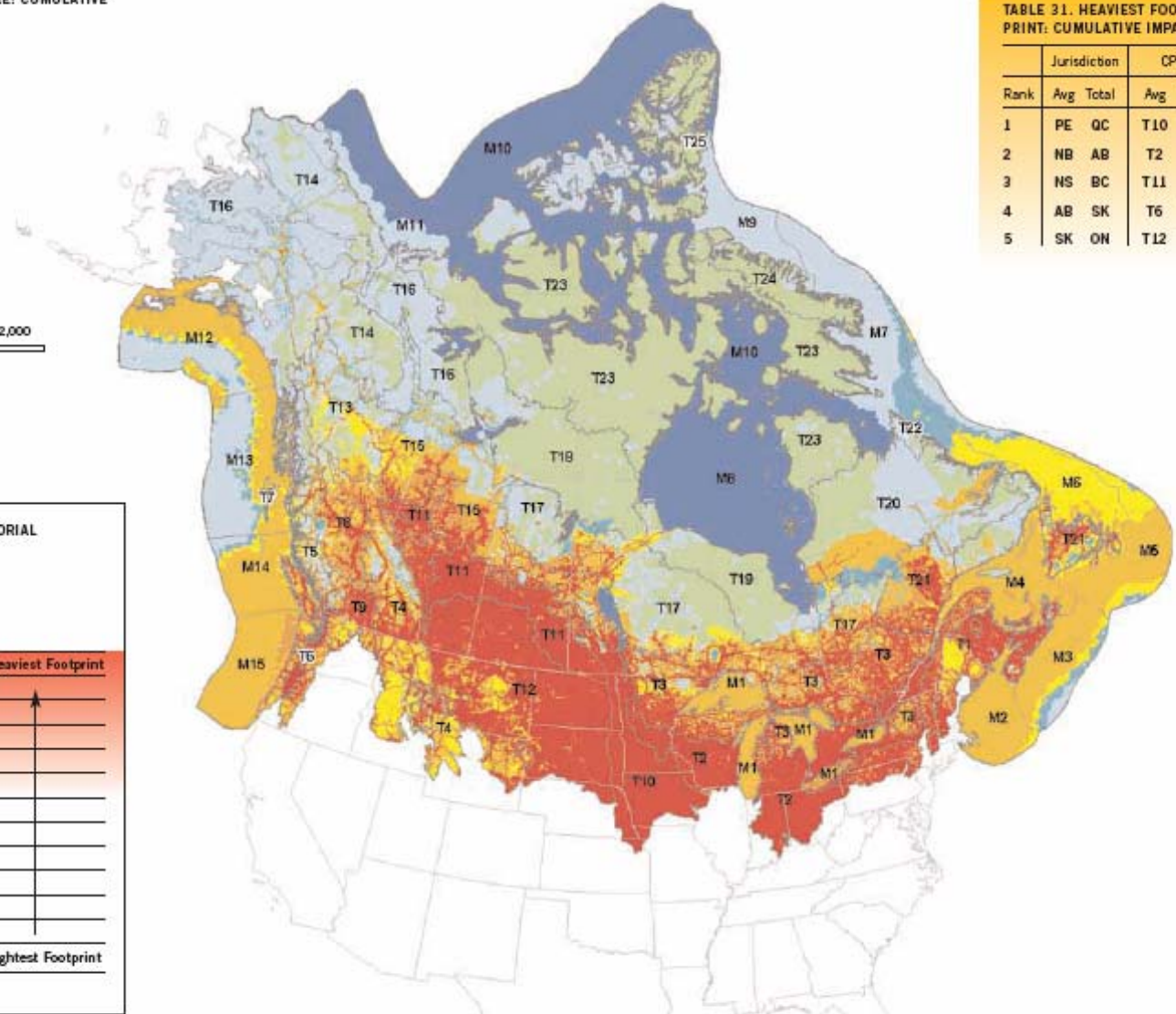


TABLE 30. PROVINCIAL AND TERRITORIAL FOOTPRINT LEVEL RANKINGS

Rank	Based on average footprint per square kilometre	Based on total footprint contribution for the area of province or territory		
1	PE QC	QC	Heaviest Footprint	
2	NB AB	AB	↑	
3	NS BC	BC		
4	AB SK	SK		
5	SK ON	ON		
6	BC MB	MB		
7	ON NF	NF		
8	MB NB	NB		
9	QC NT	NT		
10	NF NS	NS		
11	YT YT	YT		
12	NT NU	NU		
13	NU PE	PE		Lightest Footprint

TABLE 31. HEAVIEST FOOT-PRINT: CUMULATIVE IMPACT

Rank	Jurisdiction		CPR	
	Avg	Total	Avg	Total
1	PE	QC	T10	T12
2	NB	AB	T2	T2
3	NS	BC	T11	T3
4	AB	SK	T6	T15
5	SK	ON	T12	T11



IF EVERYONE ON EARTH LIVED LIKE THE AVERAGE CANADIAN, WE WOULD NEED AT LEAST FOUR EARTHS TO SUSTAIN OUR LIFESTYLE



Recommended Actions

TABLE 32. PRIORITY STRATEGIC APPROACH REQUIRED TO MEET THE REGIONAL CONSERVATION NEED.

	NEWFOUNDLAND AND LABRADOR	NOVA SCOTIA	PRINCE EDWARD ISLAND	NEW BRUNSWICK	QUEBEC
Conservation First: Outstanding opportunities remain to protect intact habitats and species groups: Opportunities remain throughout the Conservation Planning Region to apply the Conservation First Principle to protect ecosystems and species in advance of widespread industrial development.	Terrestrial: Northern tip of Labrador, although widespread protection already in place (T22)				Marine: Davis Strait and Ungava Bay (M7); Terrestrial: only in extreme northern parts of province (T22, T23)
Time-limited conservation opportunities remain to protect intact habitats and species groups: Opportunities remain throughout the Conservation Planning Region to apply the Conservation First Principle to protect ecosystems and species in advance of widespread industrial development, but human pressures are increasing and some species groups are showing increasing disruption from baseline conditions or have yet to recover from historical declines.	Marine: Northern and central coasts of Labrador (M7); Terrestrial: Most parts of Labrador (T13)				Marine: Davis Strait and Ungava Bay (M7); Hudson and James Bay (MB); Terrestrial: Northern and central parts of province (T20)
Priority conservation actions need to focus on the protection of remaining large habitat blocks and the implementation of regional wildlife management strategies. Widespread adoption of industry best practices is needed outside of protected areas to stem some regional species declines and to prevent further habitat degradation. Some species groups may require monitoring and active recovery intervention.	Marine: Southern Labrador coast and northeastern coast of Newfoundland (M6) Terrestrial: Most of the commercial boreal forest zone (T21)	Terrestrial: Highland areas in Cape Breton (T21)		Terrestrial: Highland areas around Christmas Mountains (T21)	Terrestrial: Most of the commercial boreal forest zone (T17, T21)
Priority conservation actions need to focus on the protection of remaining natural areas with urgent conservation attention directed at the highest quality sites. Comprehensive management and intervention is required to protect some wildlife populations. Widespread adoption of industry best practices along with some restoration efforts are required outside of protected areas to address species declines and habitat degradation. Active recovery efforts will be required for some species groups.	Marine: Grand Banks (M5)	Marine: Scotian Shelf (M3)			
A comprehensive set of conservation actions are required, including protection of remaining natural areas, adoption of best management practices for natural resource-based industries, and significant efforts to restore habitat and recover species. Conservation efforts need to place a high priority on conservation of any significant natural areas remaining. Widespread adoption of industry best practices is needed in conjunction with effective monitoring and enforcement in order to help stem habitat degradation. Significant habitat restoration and species recovery efforts need to be undertaken, preferably in conjunction with one another.	Marine: Gulf of St. Lawrence (M4)	Marine: Gulf of St. Lawrence (M4)	Marine: Gulf of St. Lawrence (M4)	Marine: Gulf of St. Lawrence (M4)	Marine: Gulf of St. Lawrence (M4); Terrestrial: The mixed forest region in the Laurentians (T3)
Significant habitat restoration and species recovery efforts are required but must occur in tandem with the protection of remaining natural areas. Urban growth and/or industry practices must be managed to reduce the human footprint in these regions. Comprehensive and intense local efforts are needed to rehabilitate habitats and species populations in these regions. These efforts will need to be sustained over the long term to ensure their success.		Marine: Bay of Fundy/Gulf of Maine (M2); Terrestrial: All of the province outside of Cape Breton Highlands (T1)	Terrestrial: All of Prince Edward Island (T1)	Marine: Bay of Fundy/Gulf of Maine (M2); Terrestrial: All of the province outside of Christmas Mountains (T1)	Terrestrial: Appalachian Mountains (T1) and St. Lawrence Valley (T2)



GIS Case #4 – Marine Conservation Planning

- Marine conservation lags far behind....
- Building the case
 - Science/tools for marine conservation planning and MPA Networks
 - Atlantic focused case study application/ proof of concept





Gulf of Maine & Scotian Shelf Study



Framework based on...

International Guidance
Experience (From
elsewhere, Australia,
California)

Knowledge (Science and
Local Experts)





Gulf of Maine & Scotian Shelf Study

Conservation features

Representative areas

Bio-geographic regions
Benthic seascapes
Pelagic seascapes

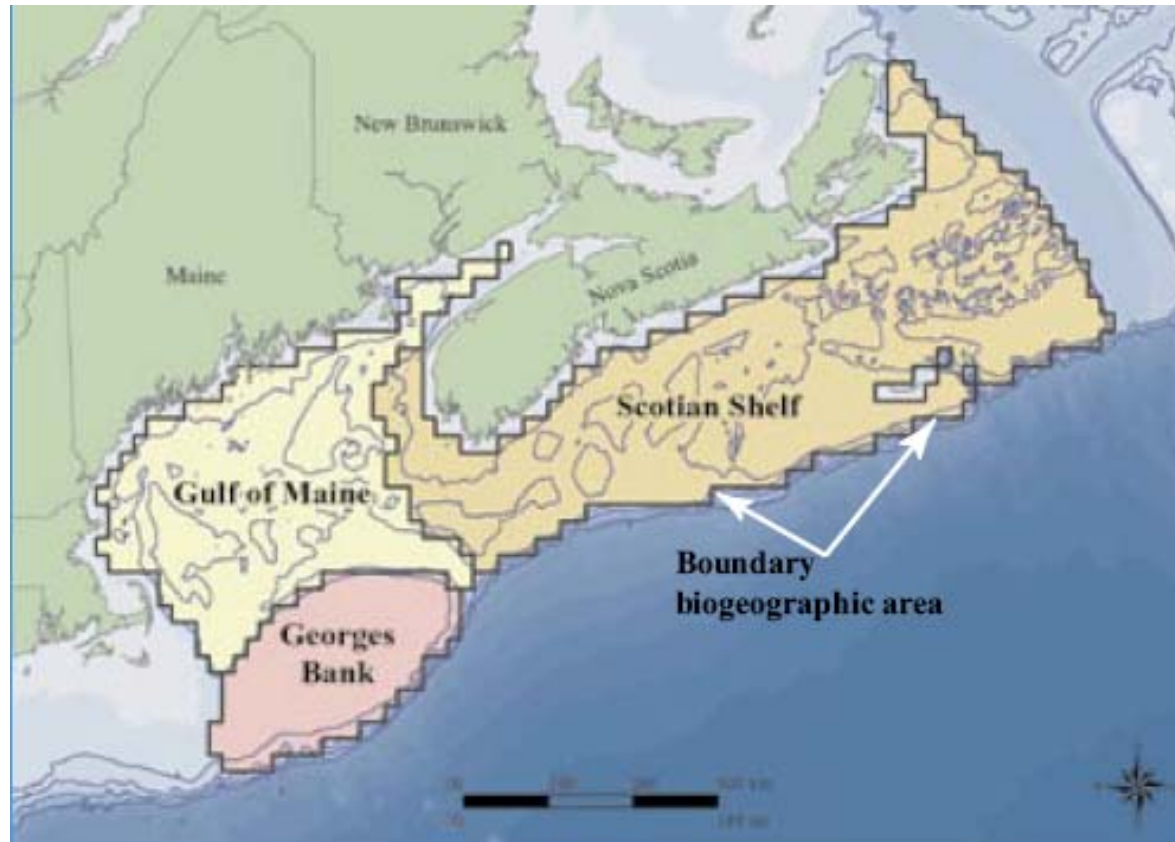
Distinctive areas

High primary productivity
Demersal fish
– abundance
 Adult/Juvenile
– diversity
Cetacean abundance





Biogeographic Regions





Pelagic Habitats

Benthic Habitats

Figure 8-8. Distribution of benthic seascapes defined by depth, substrate, and benthic temperature-salinity zones.

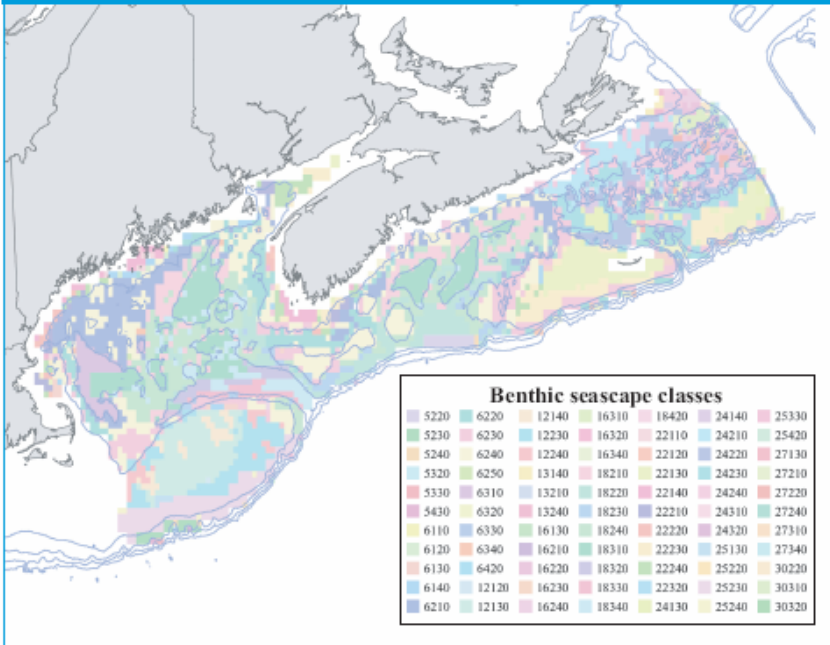
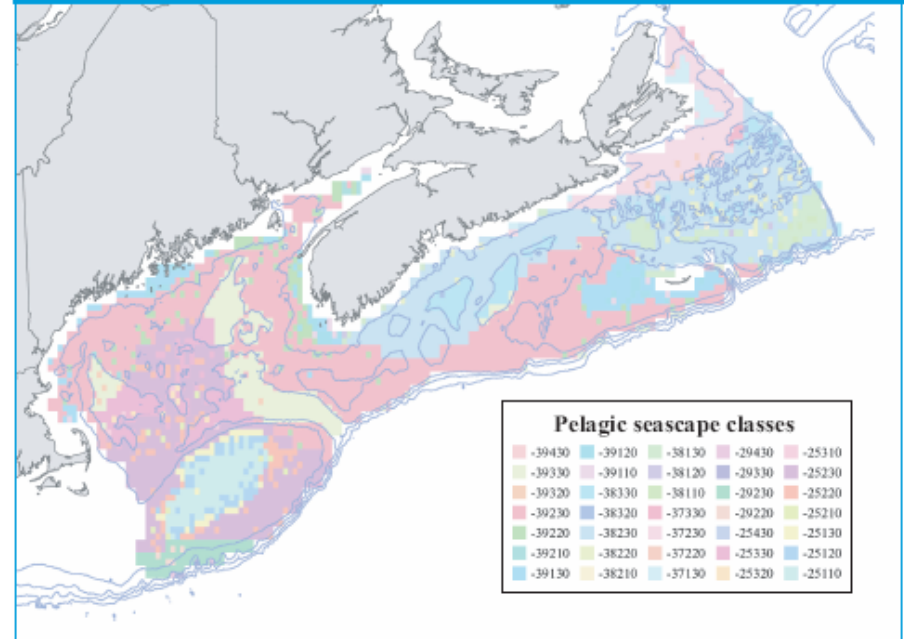


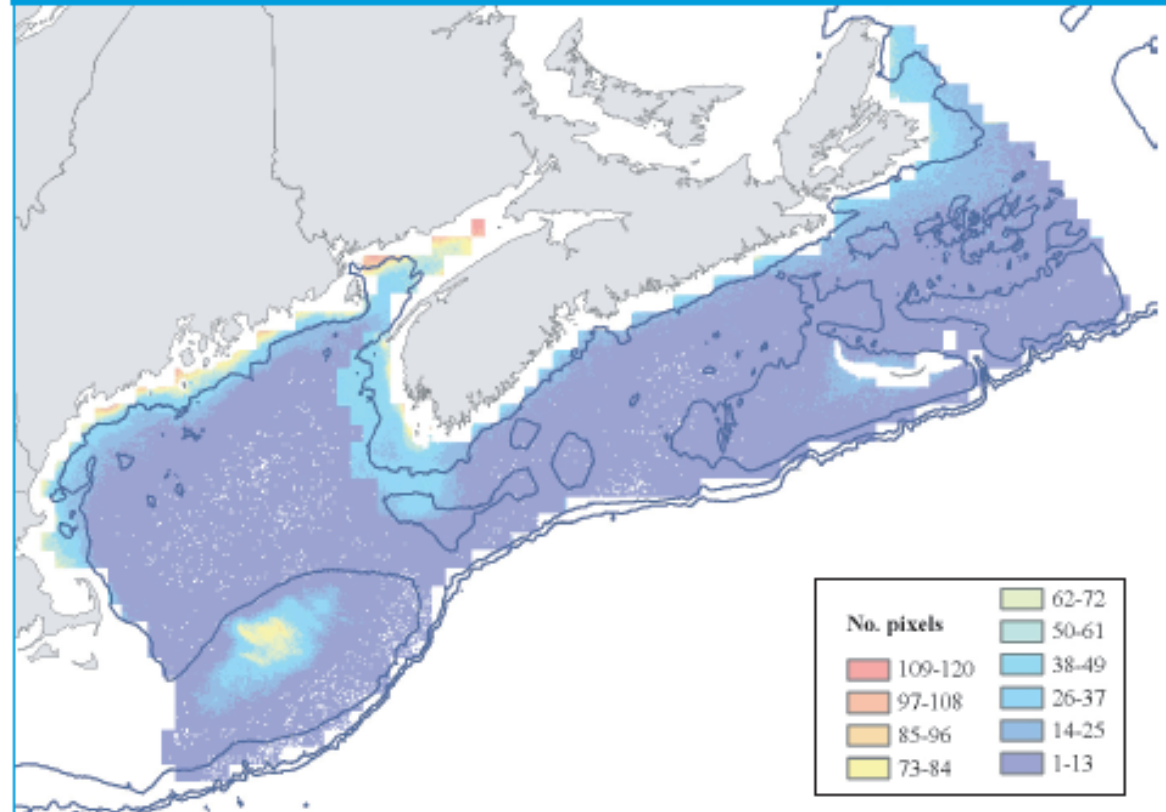
Figure 8-9. Distribution of pelagic seascapes defined by stratification, depth, and pelagic temperature-salinity zones.





Processes – Primary Productivity

Figure 5-3. Distribution of pixels that exhibited persistently high chlorophyll concentrations: number of 2-week periods each pixel was in the top 10%. Includes only those pixels that were in the top 10% for at least 3 years (i.e., during at least one 2-week period for each of 3 years or more).





Biology – Species Distributions

Figure 7-4. Distribution of sightings of dolphins and porpoises (odontocetes) in the Gulf of Maine and Georges Bank biogeographic areas: average annual SPUE values.

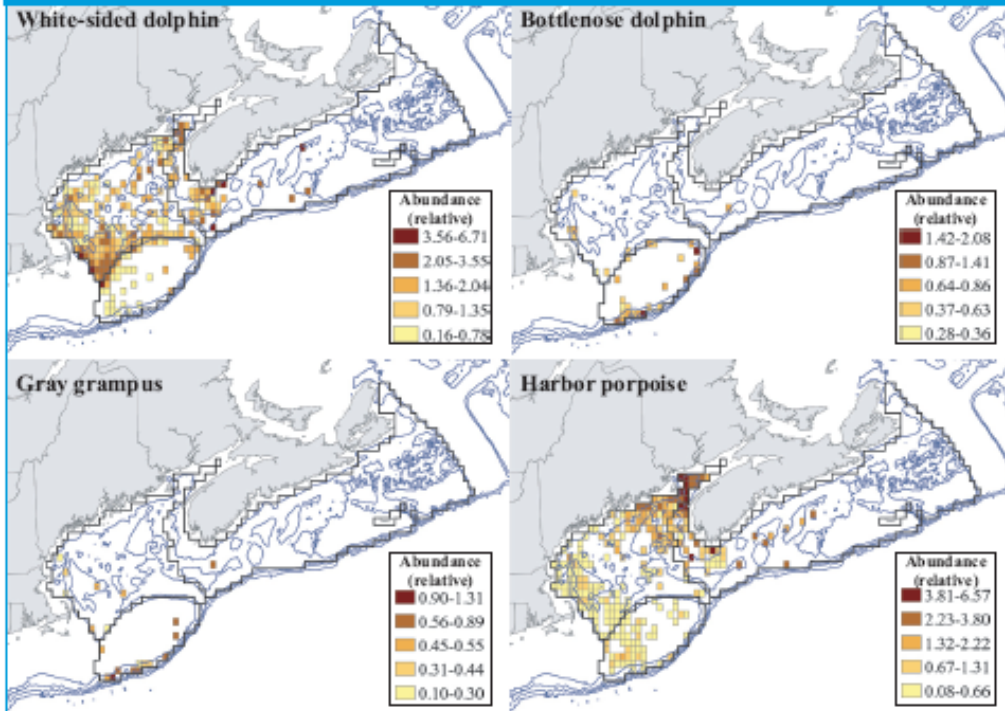
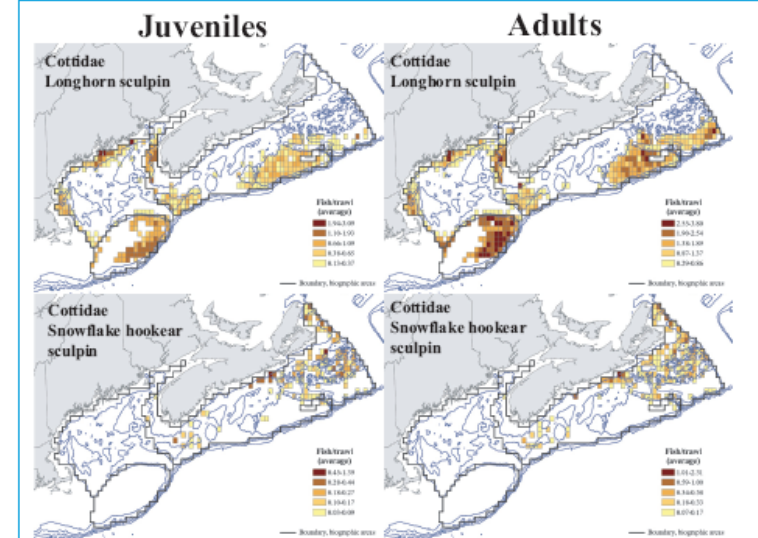


Figure 6-8. Examples of abundance patterns for selected species of resident demersal fishes.



“what set of selected areas meets **conservation objectives** for a **minimum cost** in a **spatially coherent** manner?”

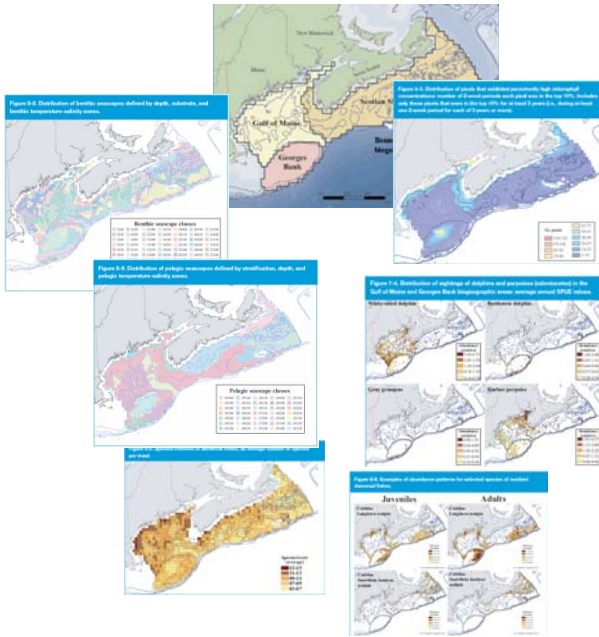
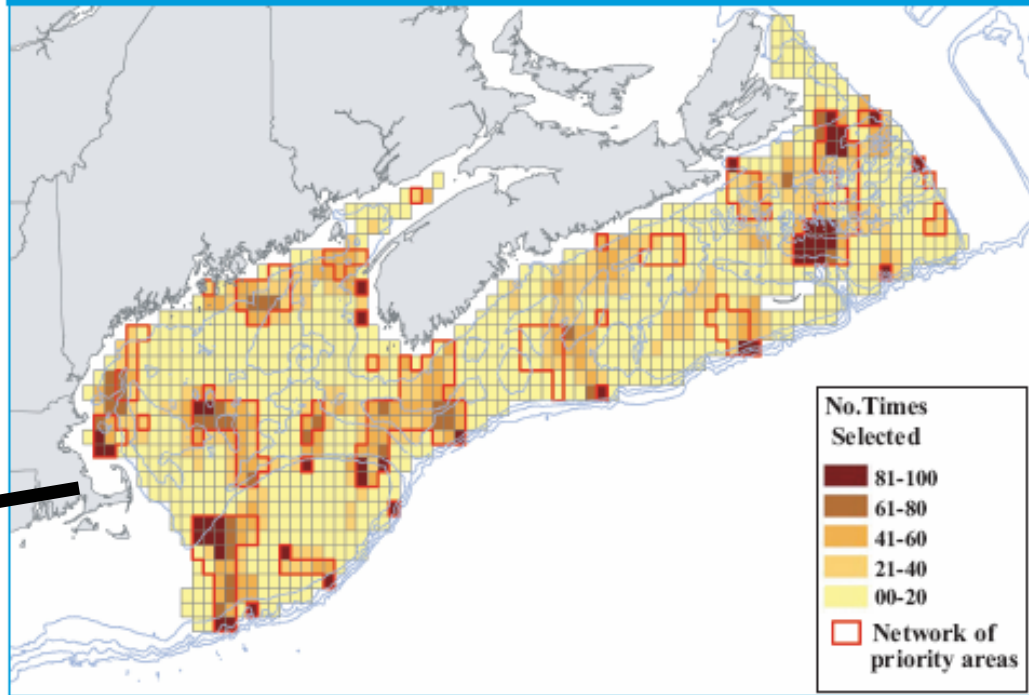


Figure 9-4. Frequency with which individual planning units were selected over 100 MARXAN runs (i.e., summed solution).



Input to Multi Stakeholder Management Planning Processes

ESSIM





WWF-Canada GIS Operations

- Decentralised Model
- Conservation Program Staff (4) & GIS Users (2)
 - \$\$
 - License/Data agreements (ESRI Grants and reduced fees)
 - Hardware
- Depend on Public Data Infrastructure
 - Conservation Commons
- Emerging Applications (Freshwater, Climate Adaptation)





Thank you

Hussein Alidina

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www.wwf.ca

