Protected Areas and Connectivity

Current Policy and Landscape Context

CONVENTION
ON BIOLOGICAL DIVERSITY

UNITED NATIONS
1992

Quick guide to the

Aichi Biodiversity Targets

Protected areas increased and improved

By 2020, at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape.

Well-governed and effectively managed protected areas are a proven method for safeguarding both habitats and populations of species and for delivering important ecosystem services. Particular emphasis is needed to protect critical ecosystems such as tropical coral reefs, sea-grass beds, deepwater cold coral reefs, s
ecosystems and coastal wetlands. Additionally, there is a need for
and management effectiveness of protected areas.

NEG ECP
GN-A PMEC

RESOLUTION 40-3

RESOLUTION ON ECOLOGICAL CONNECTIVITY, ADAPTATION TO CLIMATE CHANGE, AND BIODIVERSITY CONSERVATION

WHEREAS, the New England Governors and Eastern Canadian Premiers have shown international leadership through their collective action to address environmental protection and climate change, especially through work to expand use and production of renewable energy and other efforts to reduce greenhouse gas emissions; and

WHEREAS, the region's economy, culture, and identity are closely tied to and dependent upon its forests and water resources; and

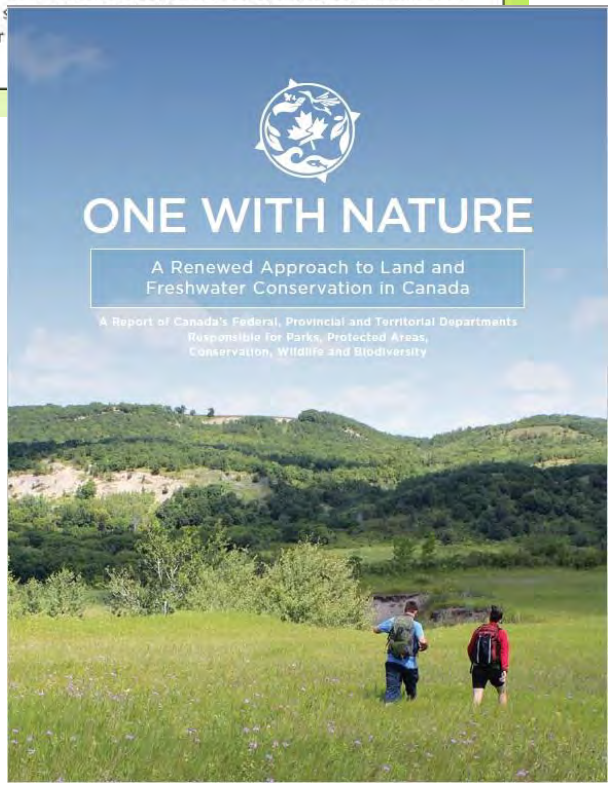
WHEREAS, the region's cities and towns, infrastructure, and natural ecosystems are vulnerable to adverse impacts from climate change. Jurisdictions region-wide are taking steps to adapt to a changing climate, by making communities, infrastructure, and public investments more resilient; and

WHEREAS, the New England Governors and Eastern Canadian Premiers recognize the inherent connection between the region's forested landscape and its forest products economy, and the important role that private forest landowners play in the health and condition of its forests; and

WHEREAS, the Northern Appalachian-Acadian forest is globally significant as the most intact, contiguous temperate broadleaf forest in the world. The Northeastern coastal forest, including the coastal plain, and the Gulf of Saint Lawrence lowland forest provide a vital link for neotropical migrants of global significance. Boreal forests are globally important for millions of resident and migratory birds, including songbirds which depend on boreal forests during different stages of their lifecycles. Together, these forests span portions of all six New England states and five eastern Canadian provinces. Global climate change is a prominent threat to the long-term health of these vital ecosystems. The spread of invasive species and wildlife disease, often exacerbated by global climate change, is another key threat; and

WHEREAS, indigenous people historically have a strong connection to the land, and in the present day continue to recognize the traditional importance of a healthy environment to the social well-being and economic prosperity for future generations; and

WHEREAS, maintaining and restoring ecological connectivity is an important strategy for boosting the resilience of the region's native ecosystems and biodiversity, as well as its economy and human communities. Connected habitats provide the natural pathways necessary for fish, wildlife, and plants to move to meet their life needs and to find suitable habitat as climate conditions change. Intact



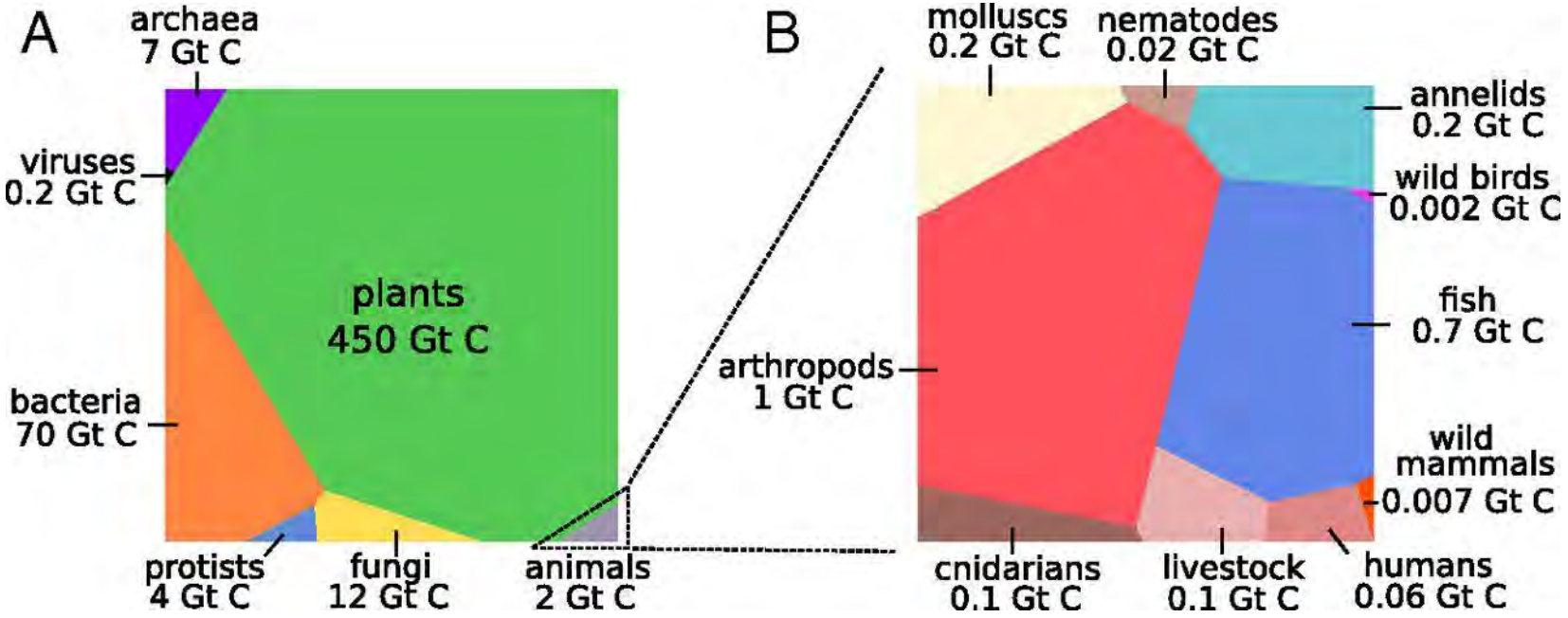
Policy Context (Government Commitments)

- UN Convention on Biological Diversity
- Strategic Plan for Biodiversity 2011-2020
- Aichi Biodiversity Targets (Target 11)
- Canada's 2020 Biodiversity Goals and Targets (Canada Target 1)
    - Pathway to Canada Target 1
    - Canada Nature Fund (Connectivity is one criterion by which land conservation proposals are judged)
    - Connectivity working group
- NEG-ECP Resolution on Connectivity & Climate Change
- Provincial plans & policies

To maximize conservation benefits for biodiversity through our work on the qualitative elements, as responsible federal, provincial and territorial departments, we will seek opportunities to:

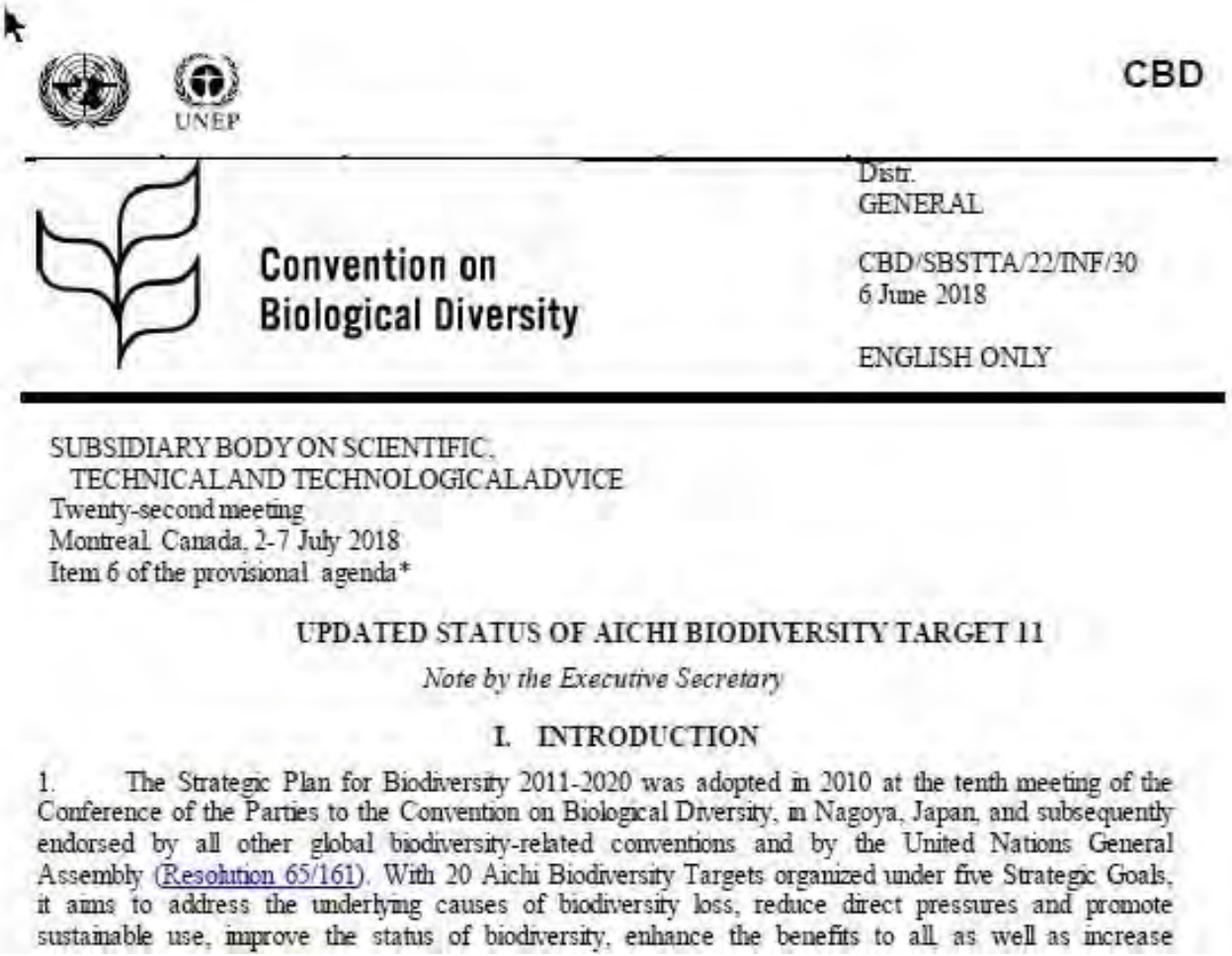
3.1 Work together to design and implement coordinated, connected, representative and effective networks of protected and conserved areas throughout Canada, recognizing that this will be a long-term endeavour and will not be complete by 2020. This priority recognizes the central role these networks play as natural solutions to climate change and biodiversity loss.

Graphical representation of the global biomass distribution by taxa.



Yinon M. Bar-On et al. PNAS 2018;115:25:6506-6511

Progress on Protected Areas Connectivity



UNEP

CBD

Convention on Biological Diversity

Distr.
GENERAL

CBD/SBSTTA/22/INF/30
6 June 2018

ENGLISH ONLY

SUBSIDIARY BODY ON SCIENTIFIC,
TECHNICAL AND TECHNOLOGICAL ADVICE
Twenty-second meeting
Montreal, Canada, 2-7 July 2018
Item 6 of the provisional agenda*

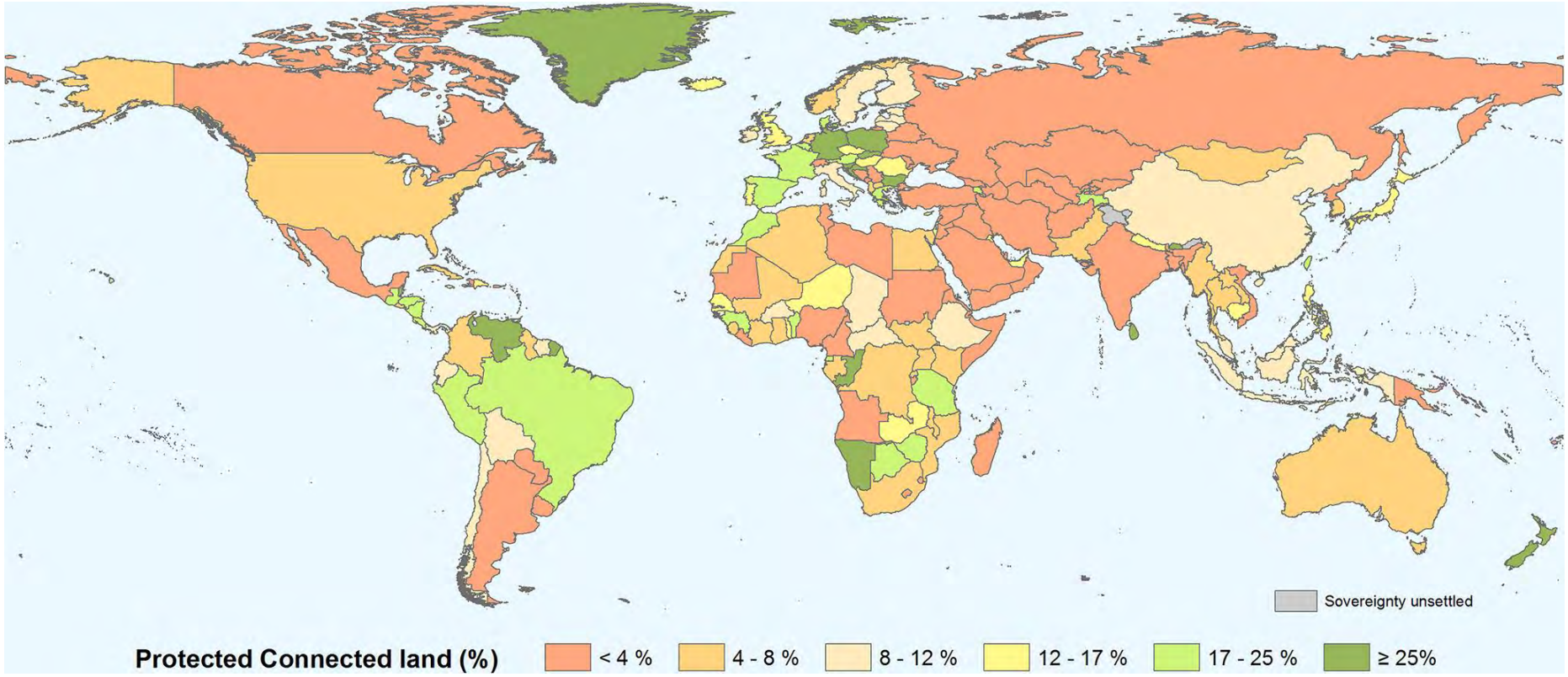
UPDATED STATUS OF AICHI BIODIVERSITY TARGET 11

Note by the Executive Secretary

I. INTRODUCTION

1. The Strategic Plan for Biodiversity 2011-2020 was adopted in 2010 at the tenth meeting of the Conference of the Parties to the Convention on Biological Diversity, in Nagoya, Japan, and subsequently endorsed by all other global biodiversity-related conventions and by the United Nations General Assembly (Resolution 65/161). With 20 Aichi Biodiversity Targets organized under five Strategic Goals, it aims to address the underlying causes of biodiversity loss, reduce direct pressures and promote sustainable use, improve the status of biodiversity, enhance the benefits to all, as well as increase

Canada's Progress in the Global Context – Connected Protected Areas



Source: CBD 2018, Saura et al. 2018

Canada's Progress in the Global Context – By EcoRegion

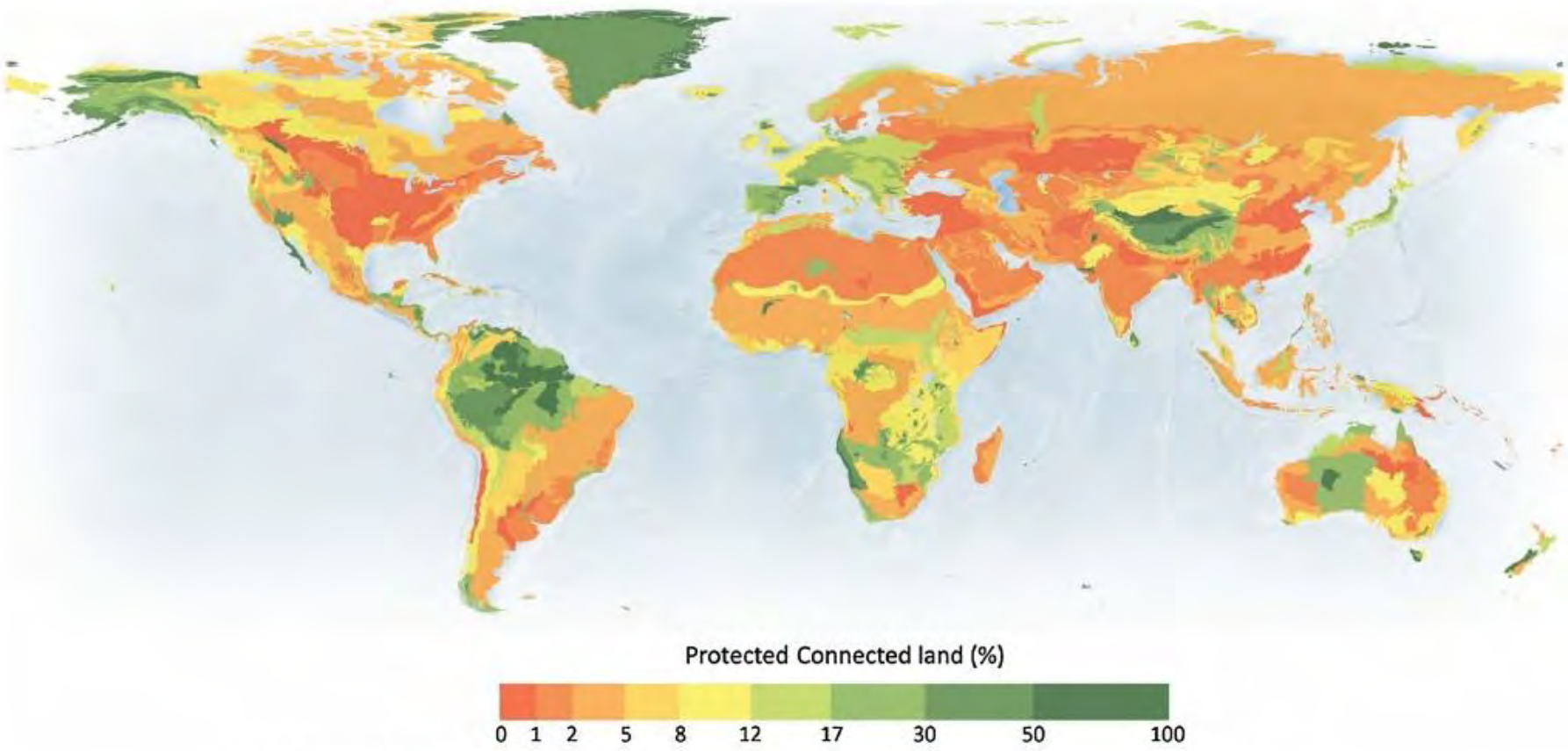
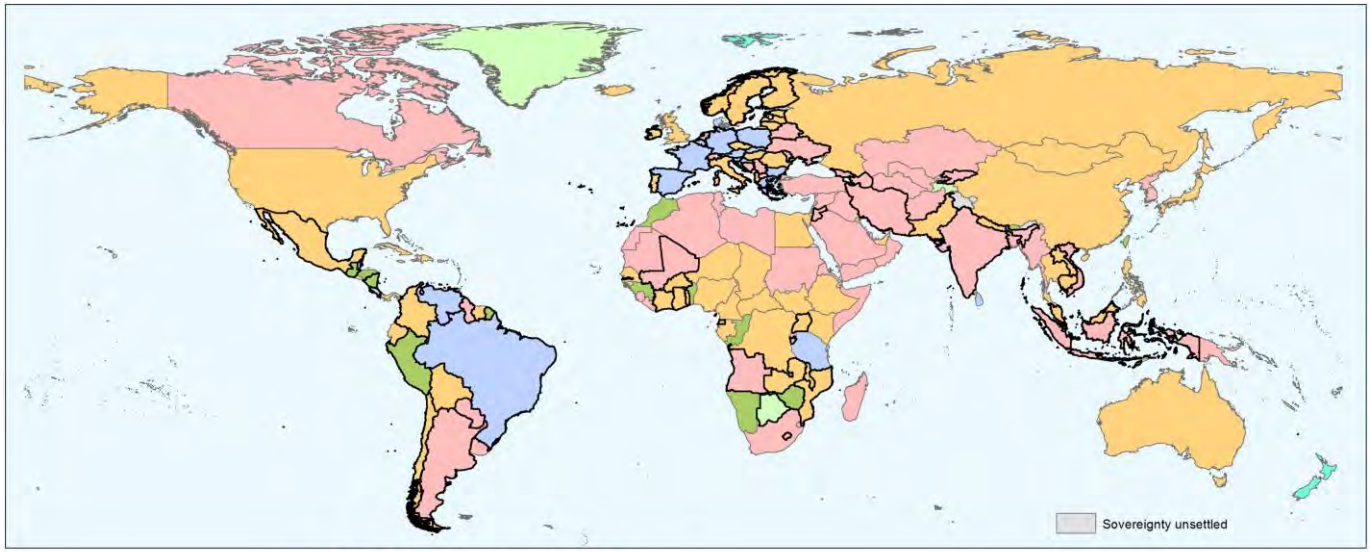


Fig. 3. Protected Connected land (% of ecoregion area) for all the world's terrestrial ecoregions for a reference median dispersal distance of $d = 10$ km.

S. Saura et al. / Ecological Indicators 76 (2017) 144–158

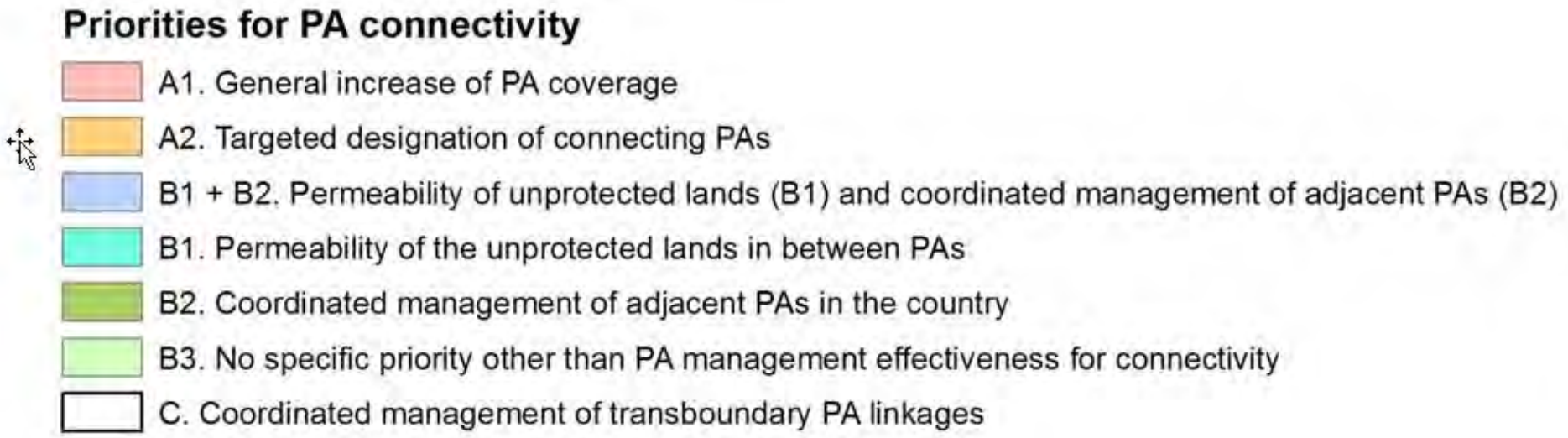
Source: Saura et al. 2017

Global Priorities for PA Connectivity



(CBD 2018, Saura et al. 2018)

Globally Identified Priorities for Increasing PA Connectivity

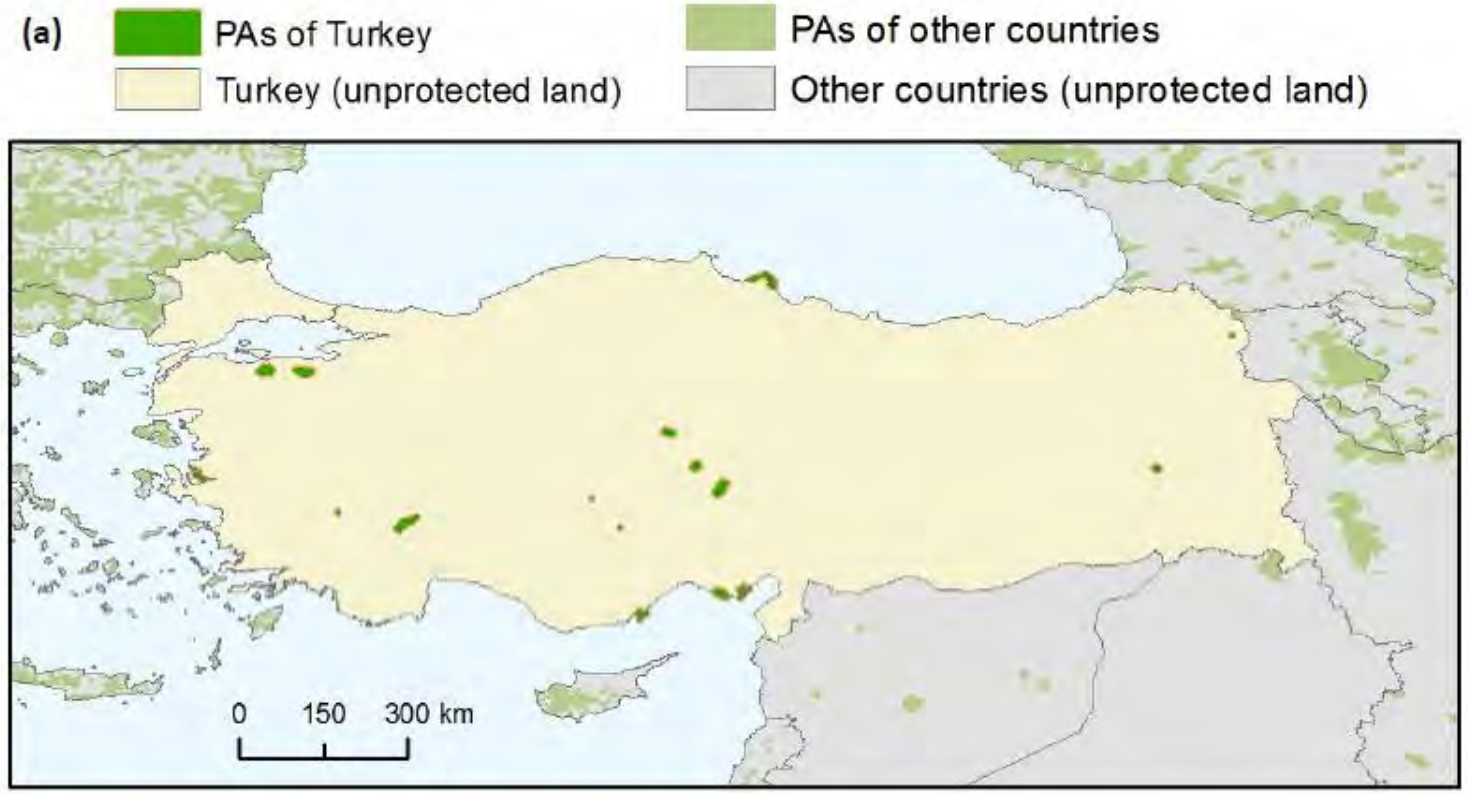


Contributors to PA Connectivity (CBD 2018; Saura et al. 2018)

- Coverage
  - more areas = reduced distances between PAs
  - inclusion of strategic locations
- Size
  - larger areas have more well-connected habitat within them
- Landscape Permeability
  - land use/management
  - corridors
  - barrier mitigation

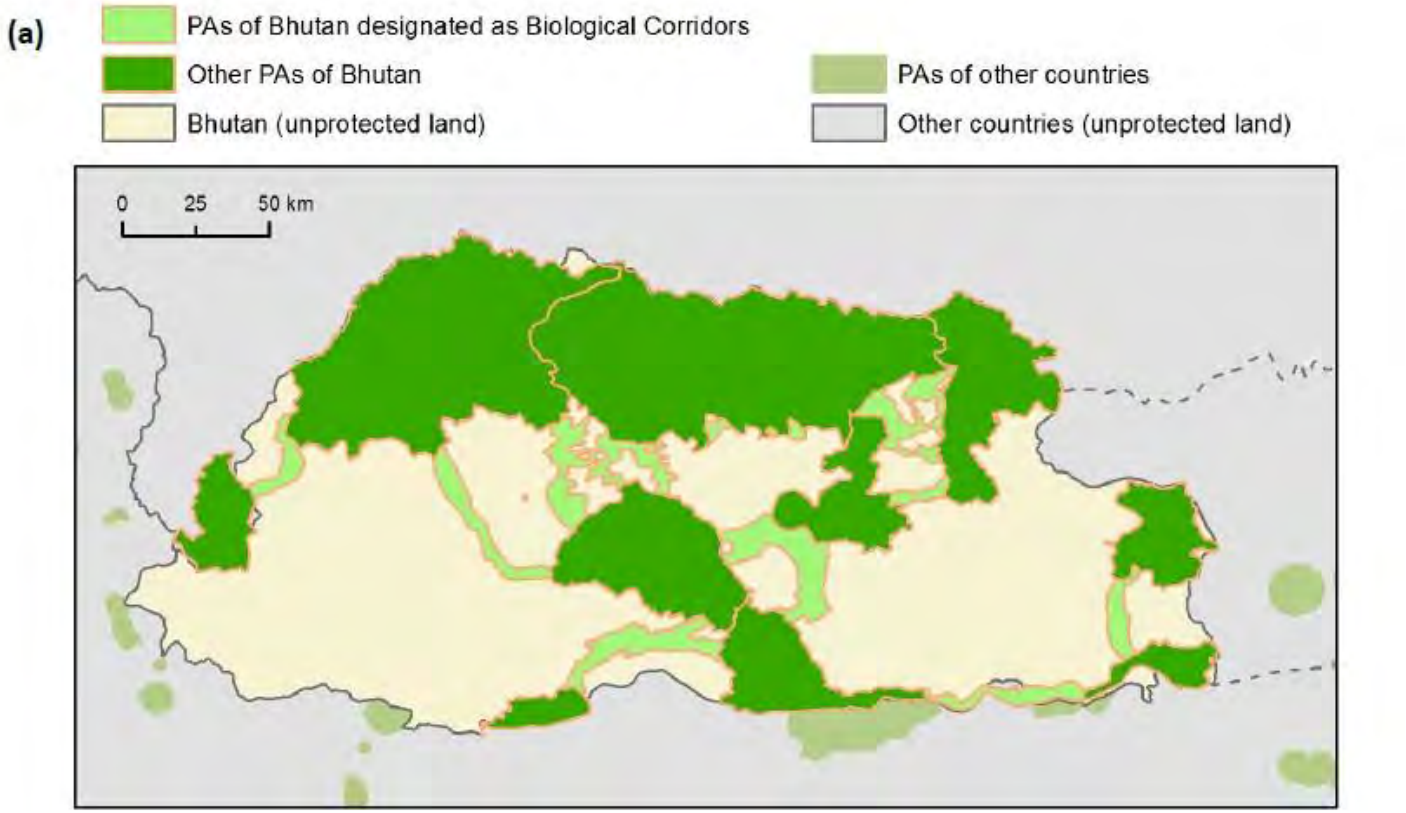
Turkey

Saura et al. 2018. Protected area connectivity: shortfalls in global targets and country-level priorities. Biological Conservation, DOI 10.1016/j.biocon.2017.12.020



Bhutan

Saura et al. 2018. Protected area connectivity: shortfalls in global targets and country-level priorities. Biological Conservation, DOI 10.1016/j.biocon.2017.12.020



PA Coverage and Size in the Maritimes


1969
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus D
USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User
Community


1979
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus D
USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User
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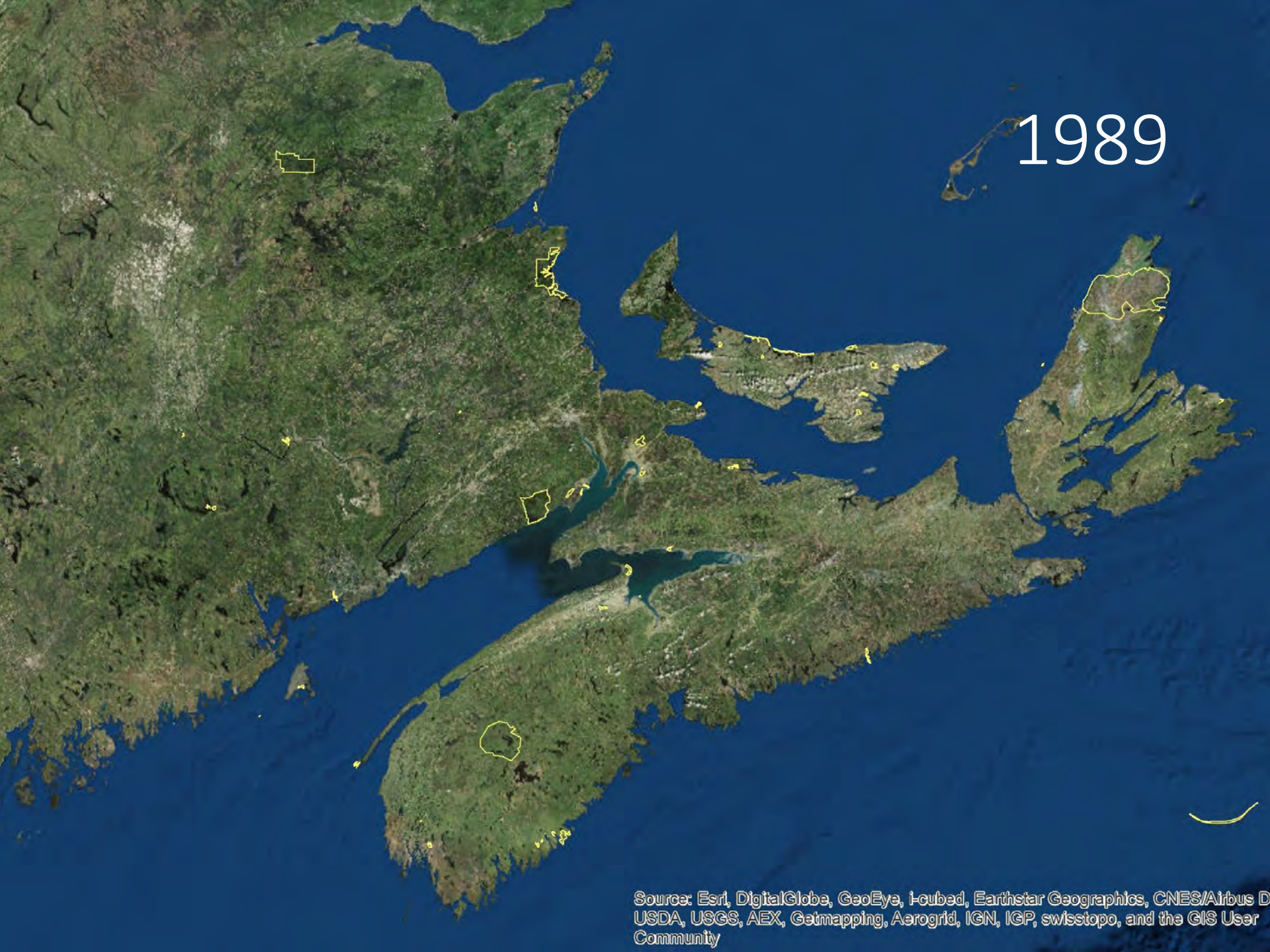
1989
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus D
USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User
Community


1999
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus D
USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User
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2009
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USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User
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2019
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus D
USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User
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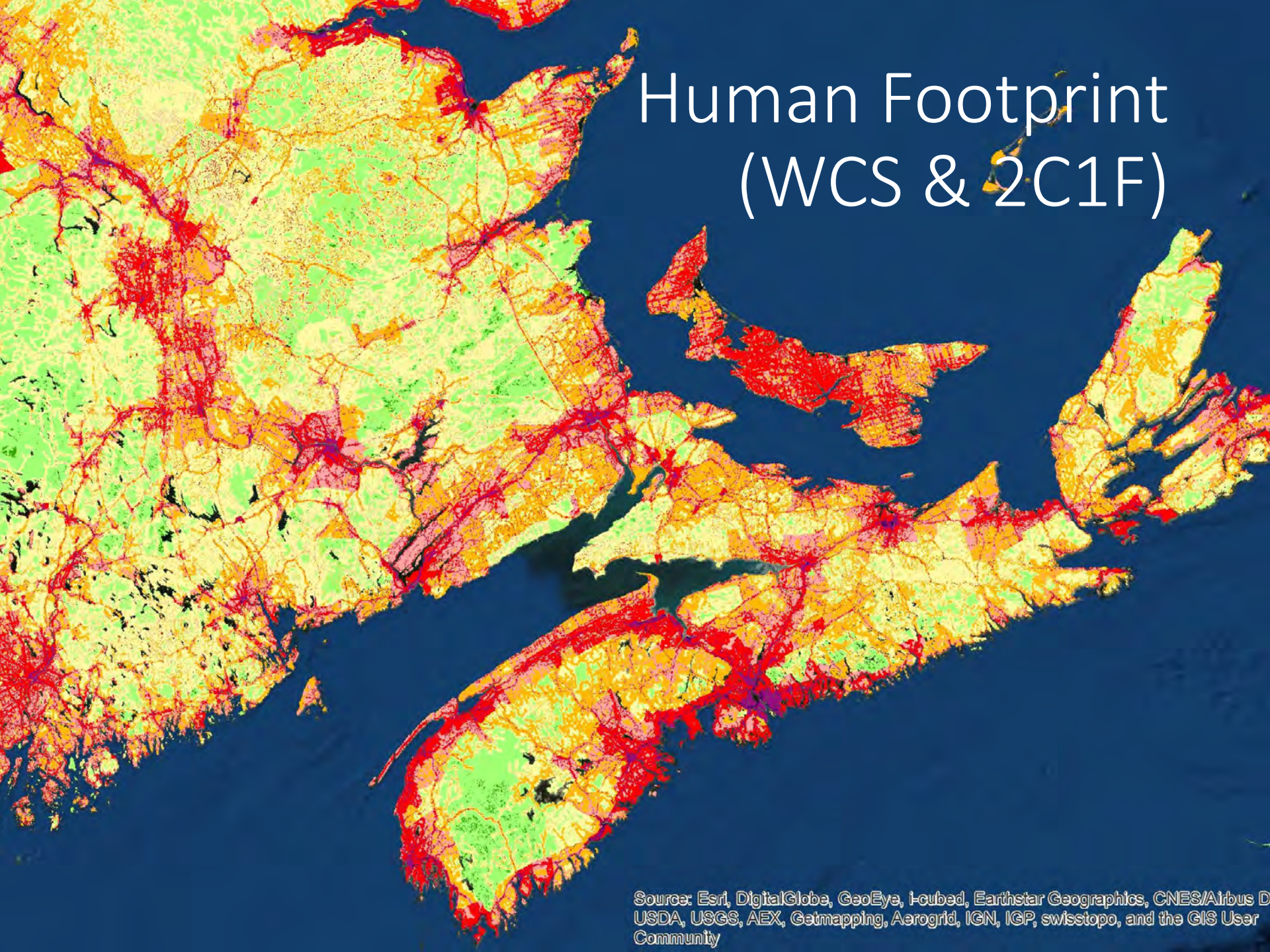
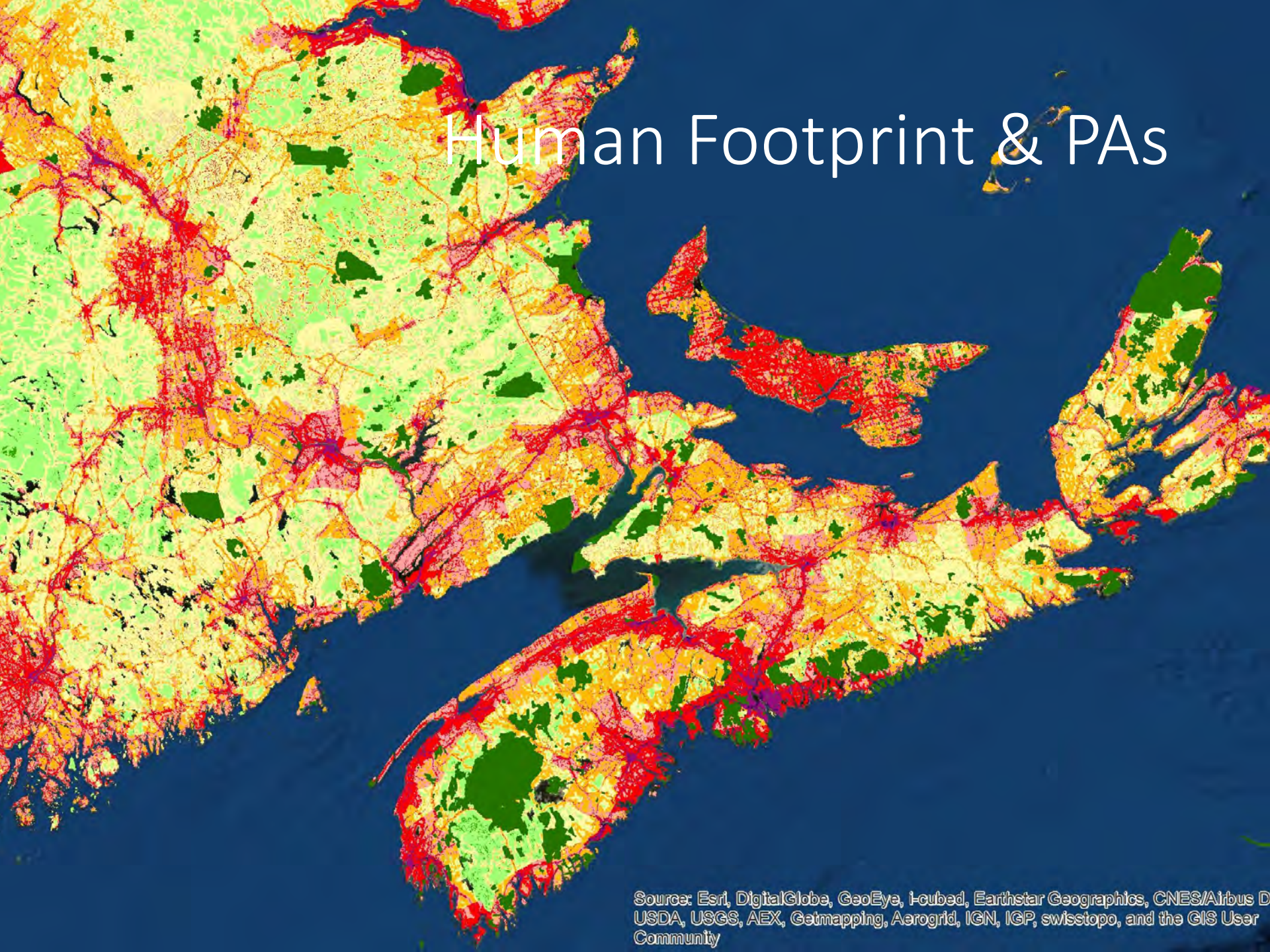
PA Connectivity (& Landscape Permeability) in the Maritimes

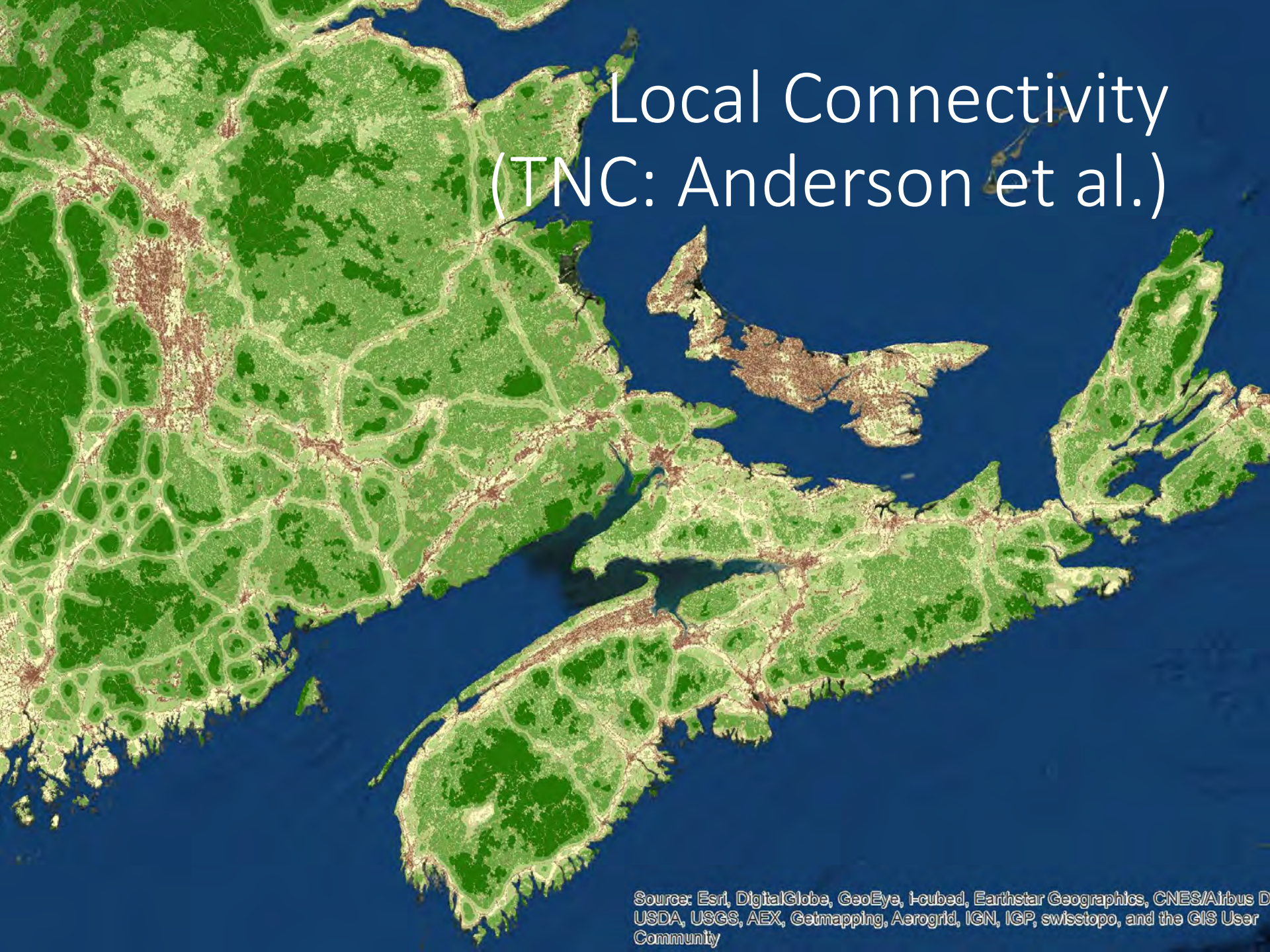
Human Footprint (WCS & 2C1F)



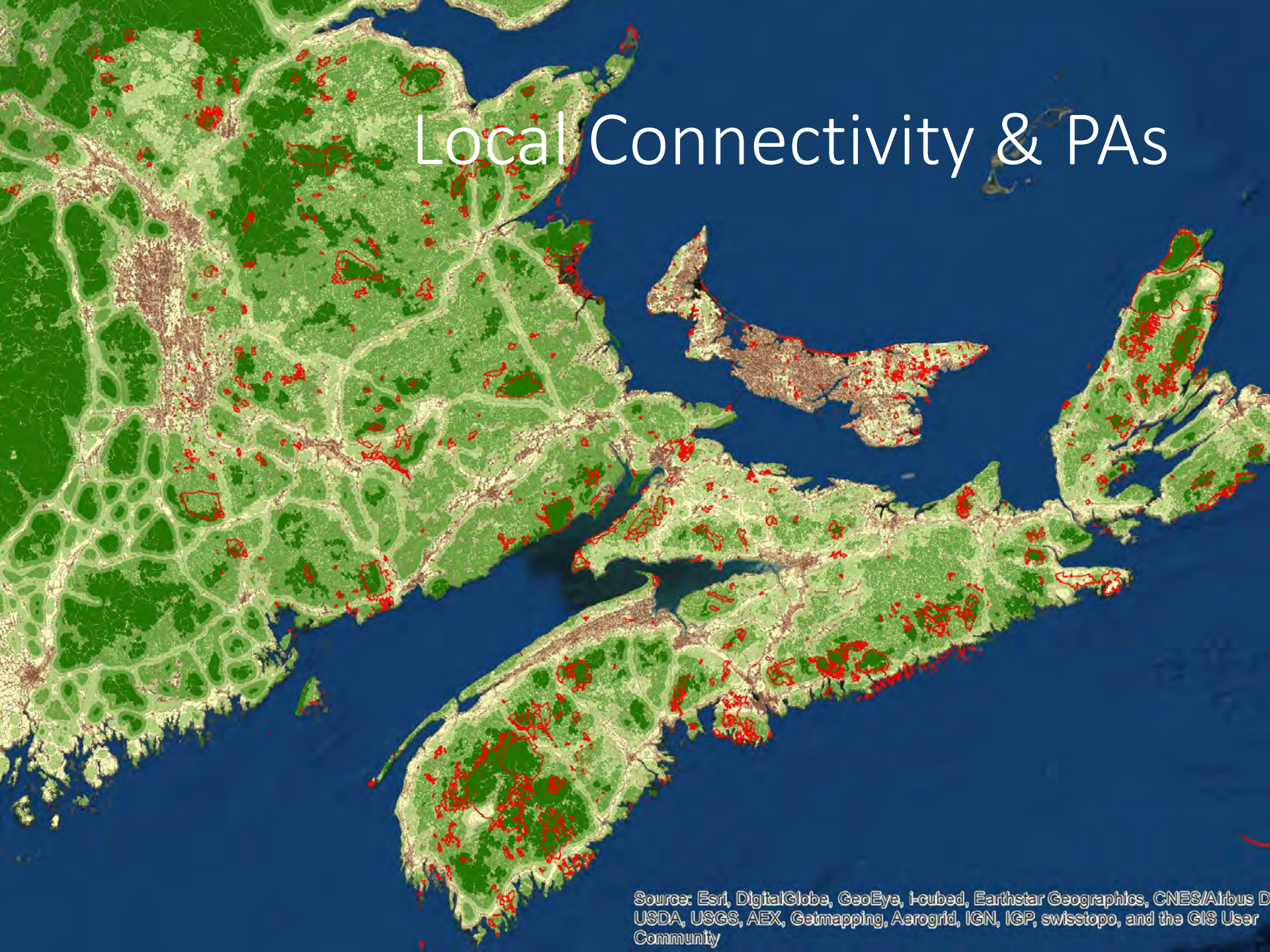
Human Footprint & PAs



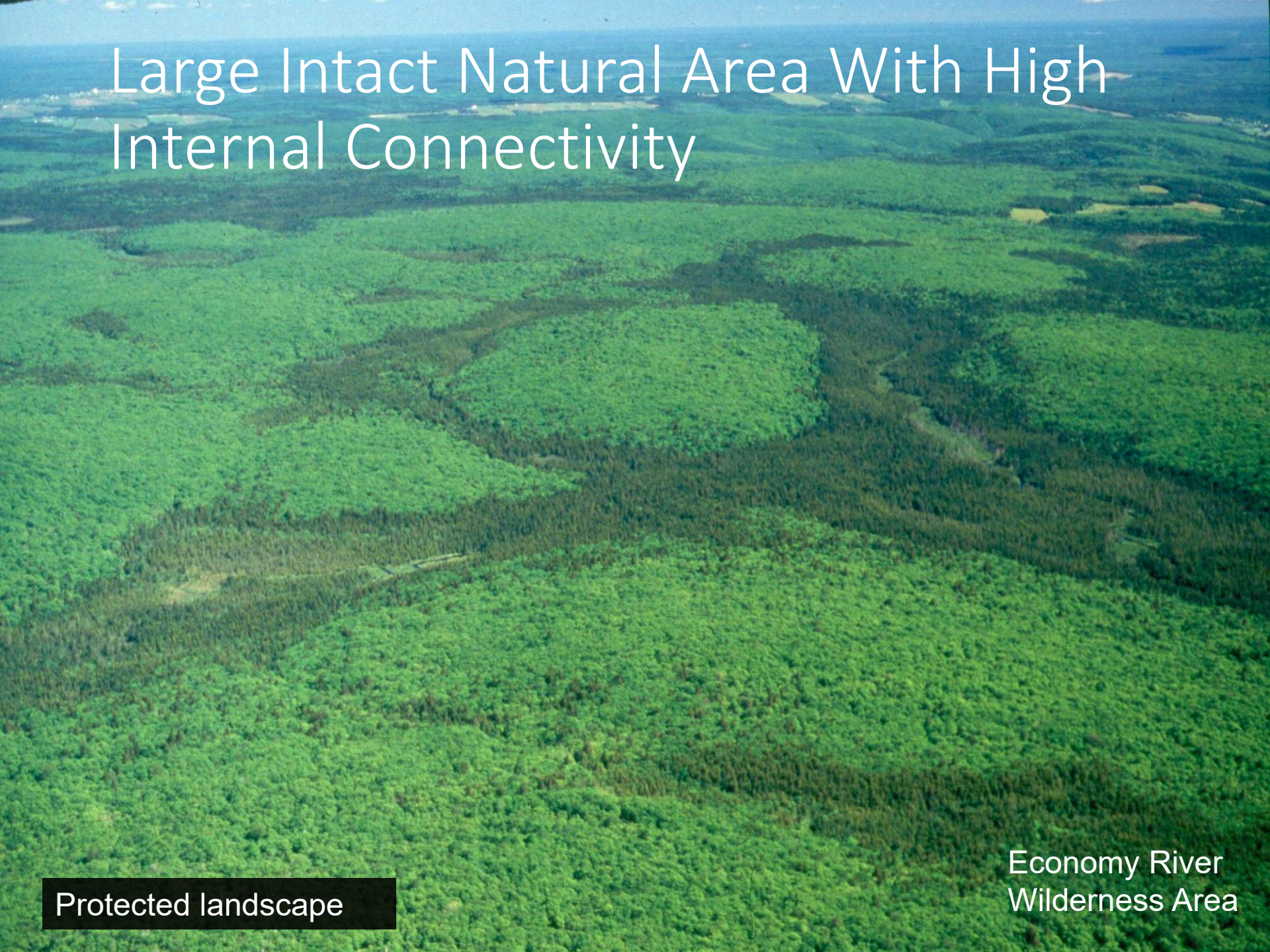
Local Connectivity (TNC: Anderson et al.)



Local Connectivity & PAs



Large Intact Natural Area With High Internal Connectivity



Agricultural landscape

Urban landscape

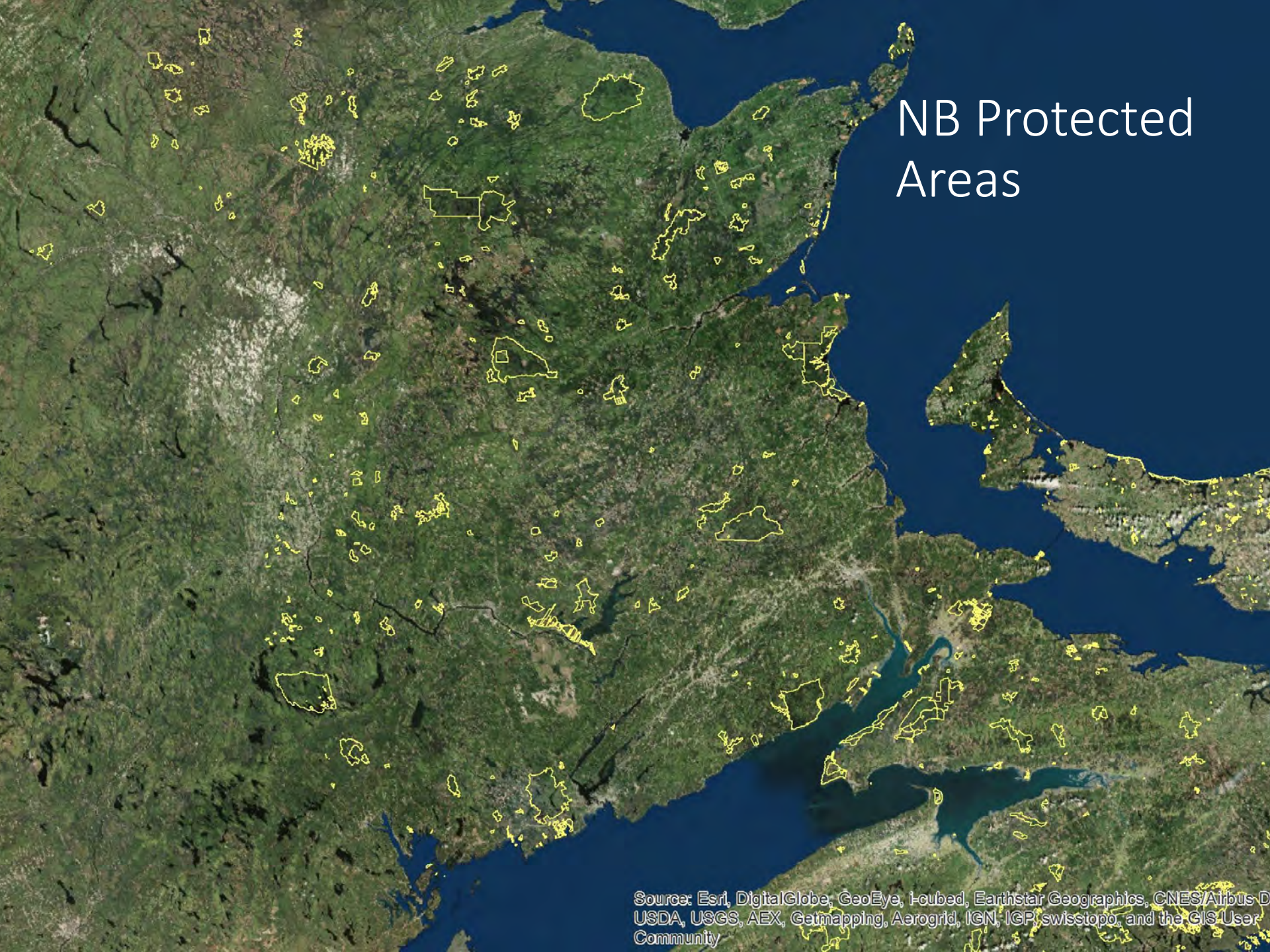
Suburban landscape

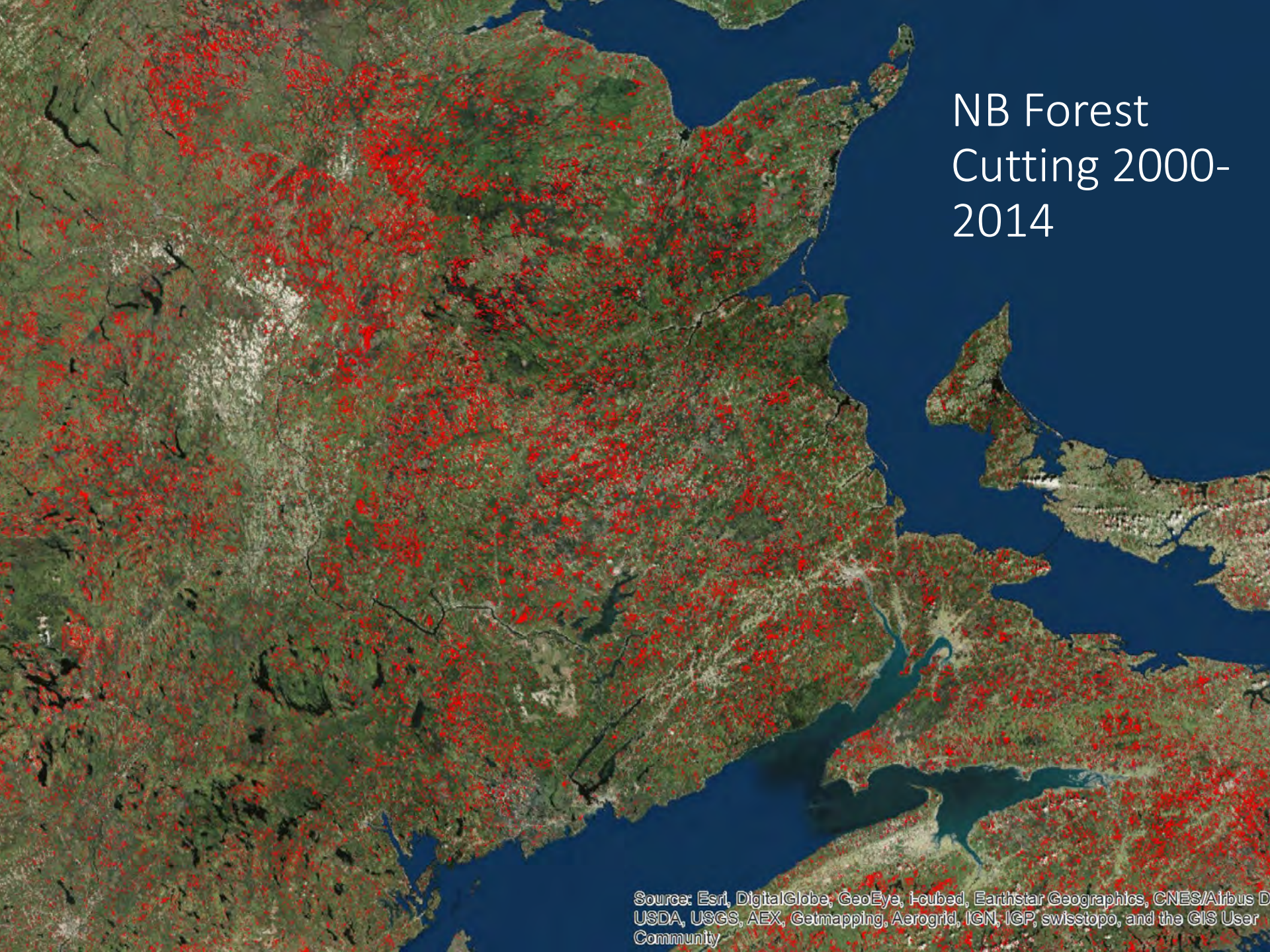
Highway in agricultural landscape

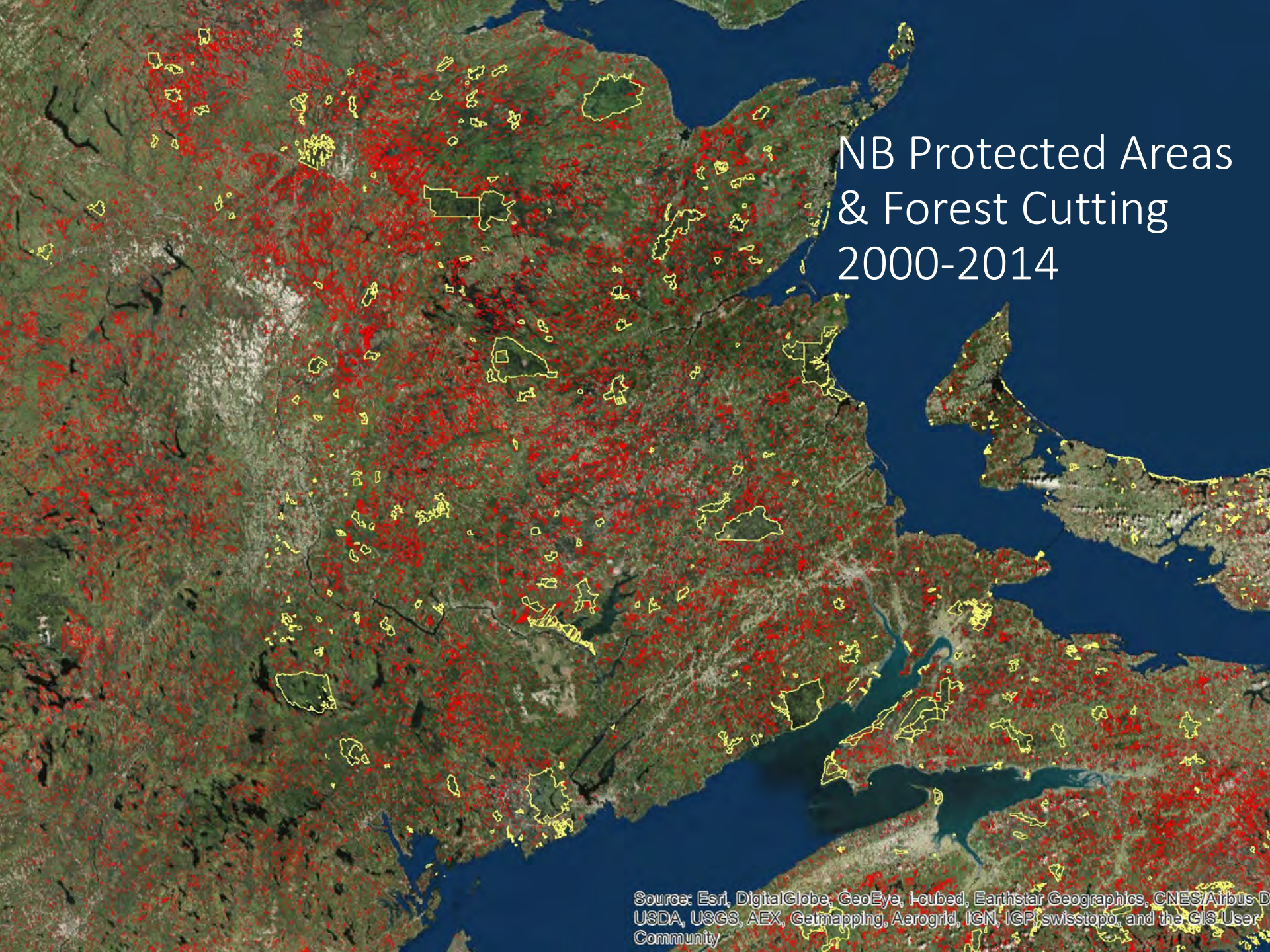

Highway & Utility Infrastructure (‘corridors’)


Forestry-dominated landscape

NB Protected Areas




NB Forest Cutting 2000-2014
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus D
USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


NB Protected Areas
& Forest Cutting
2000-2014
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus D
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NS Mainland
Protected Areas
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus D
USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User
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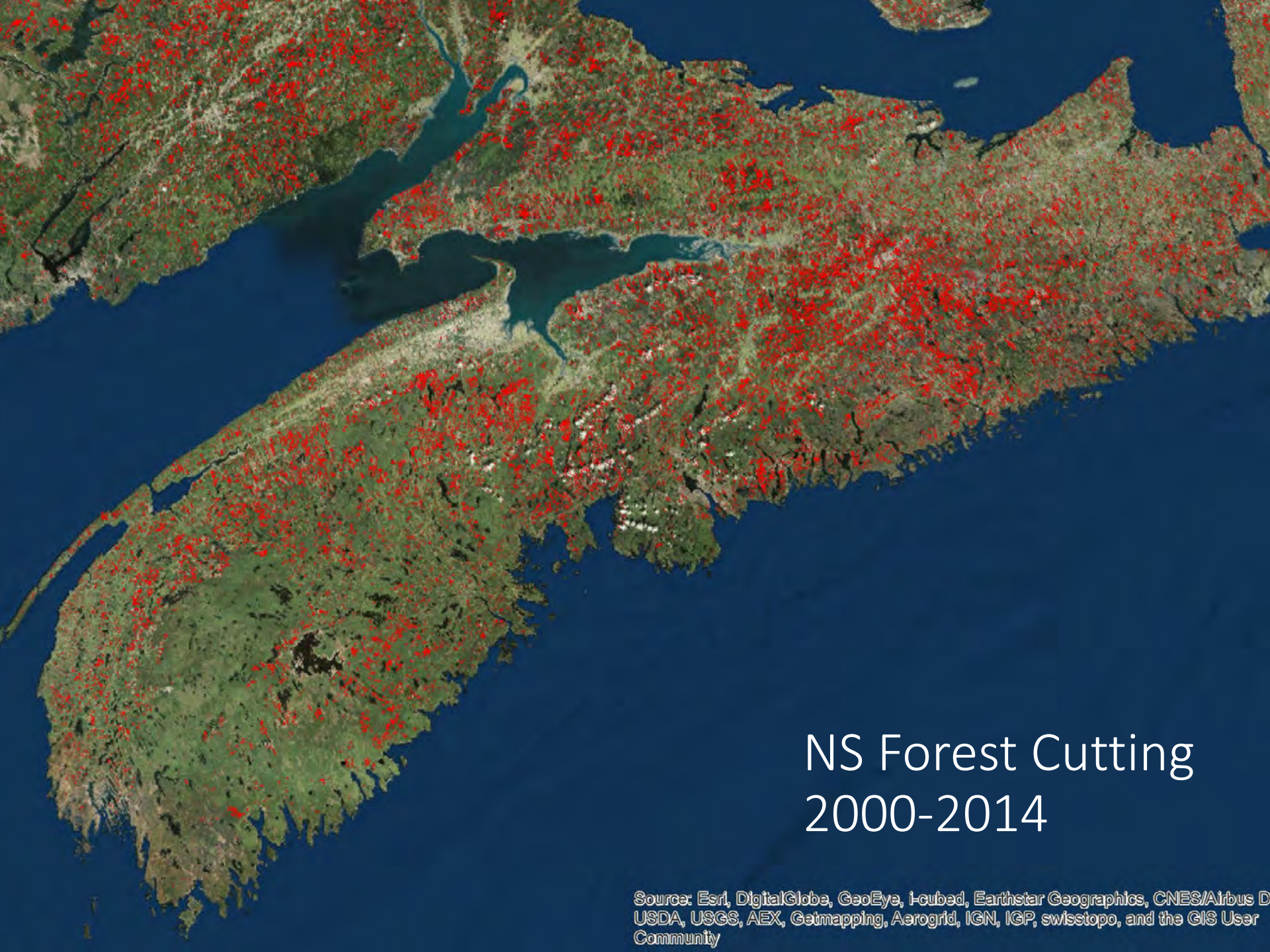
NS Forest Cutting
2000-2014
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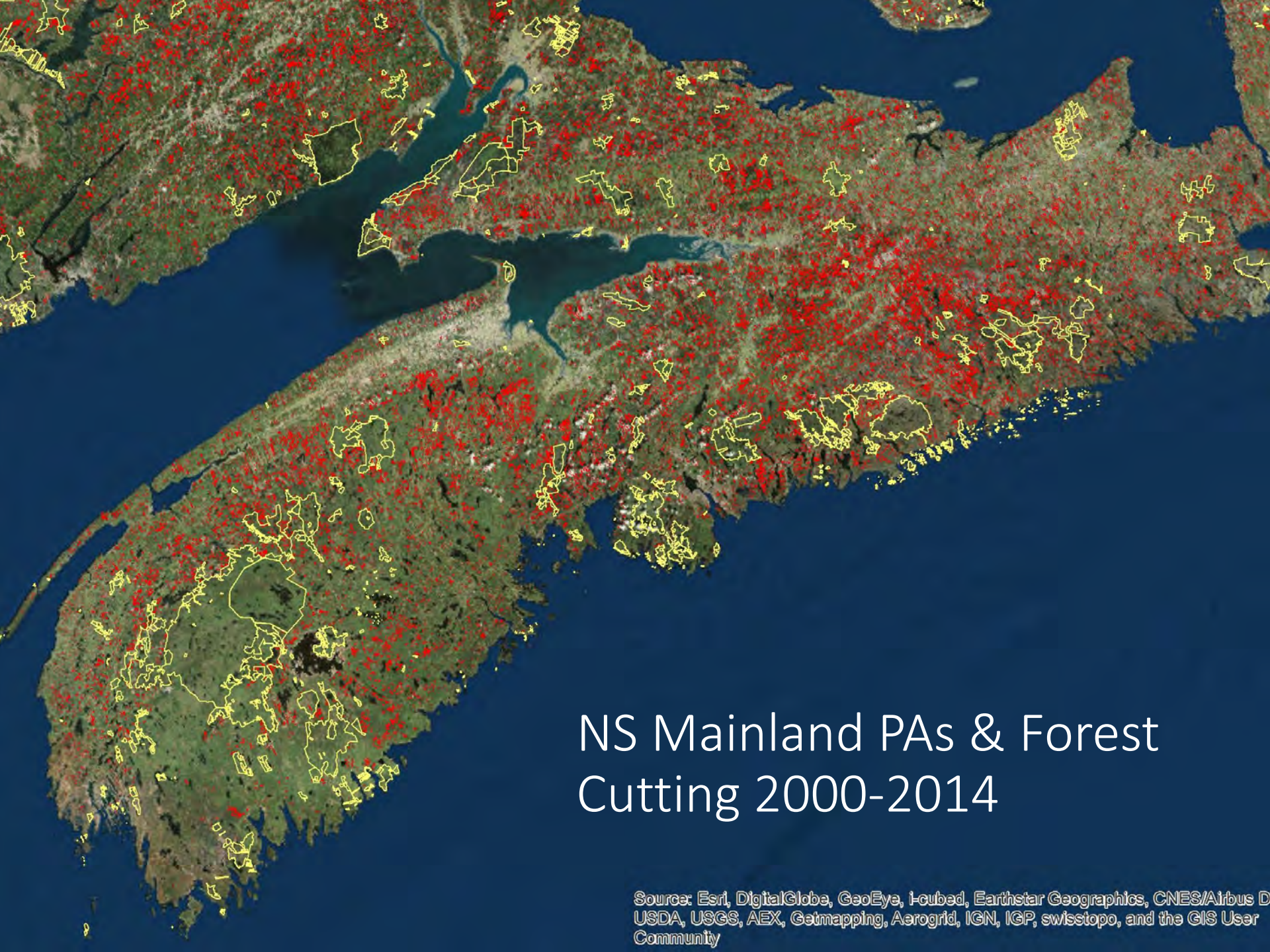
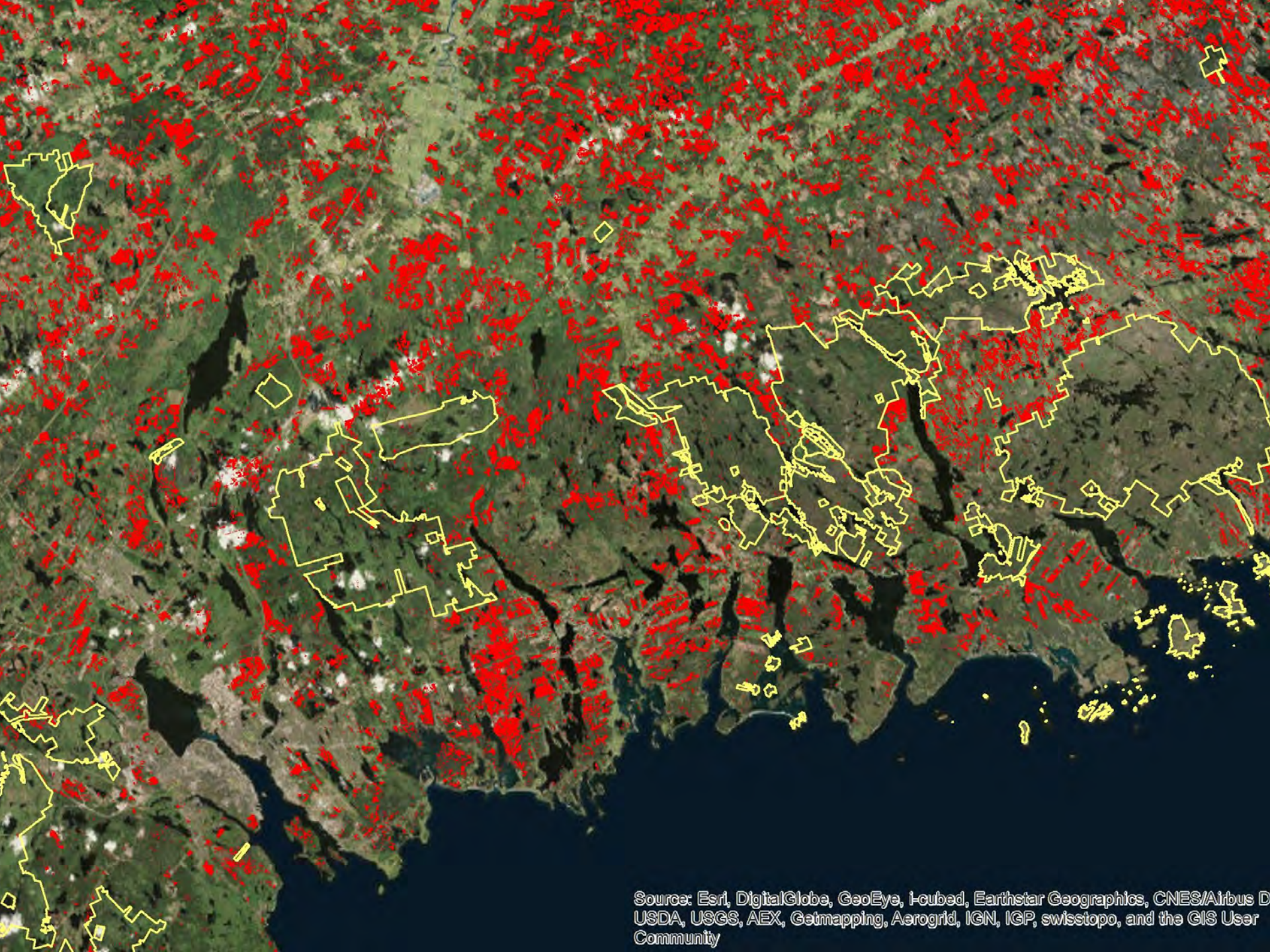

NS Mainland PAs & Forest Cutting 2000-2014
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus D
USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community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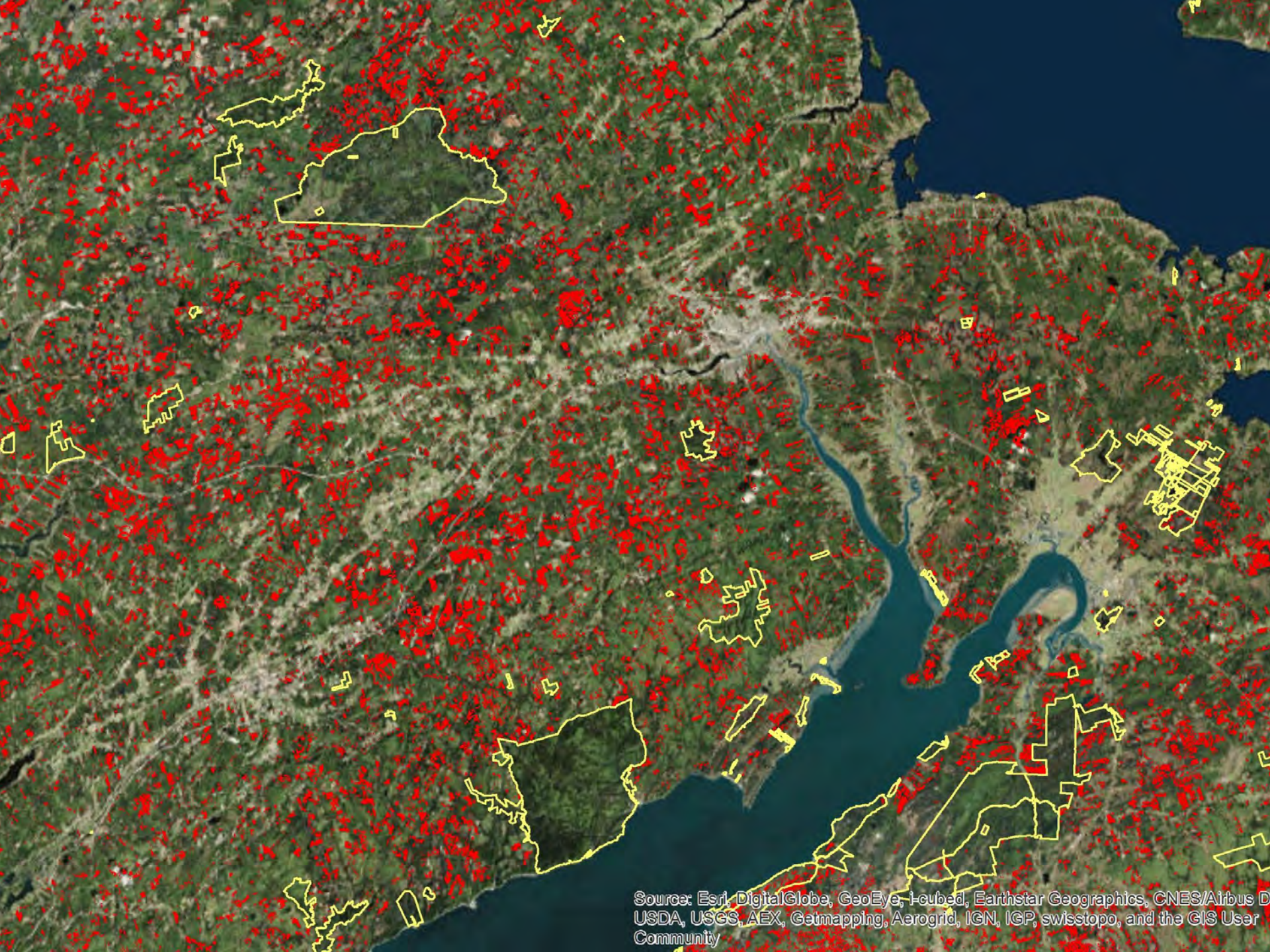
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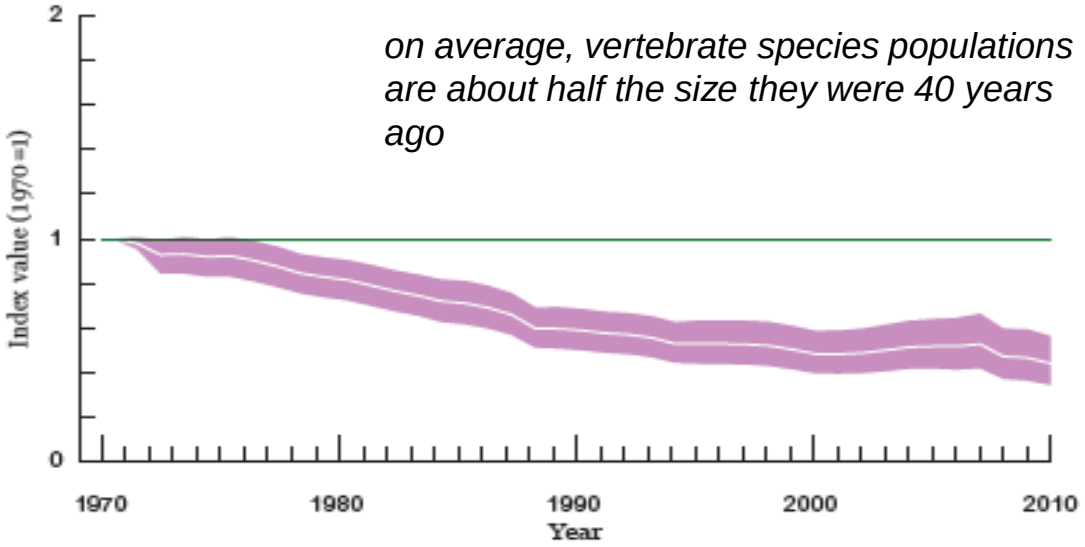
Global Living Planet Index – *(WWF, ZSL, 2014).*

trends in 3,811 populations of 1,638 species

on average, vertebrate species populations are about half the size they were 40 years ago



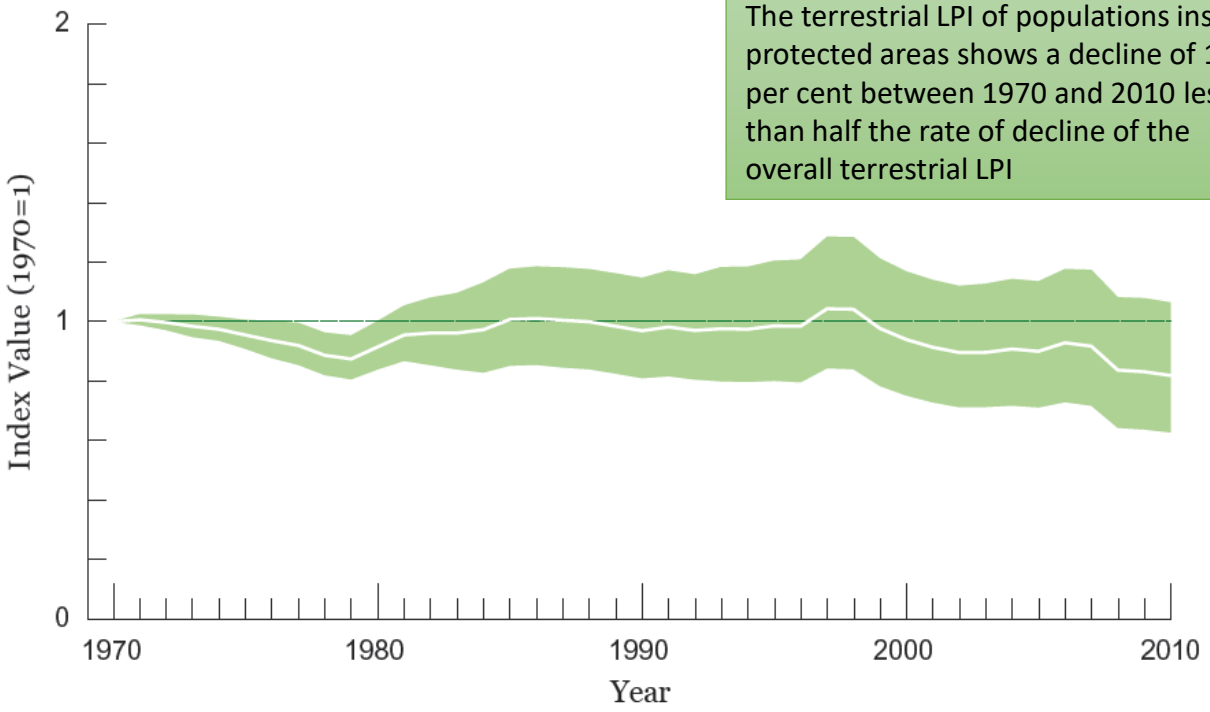
The global LPI shows a decline of 52 per cent between 1970 and 2010

The tropical LPI shows a decline of 56 per cent between 1970 and 2010.

Slide courtesy of Stephen Woodley, IUCN WWF/ZSL, 2012

LPI for Protected Areas

The terrestrial LPI of populations inside protected areas shows a decline of 18 per cent between 1970 and 2010 less than half the rate of decline of the overall terrestrial LPI

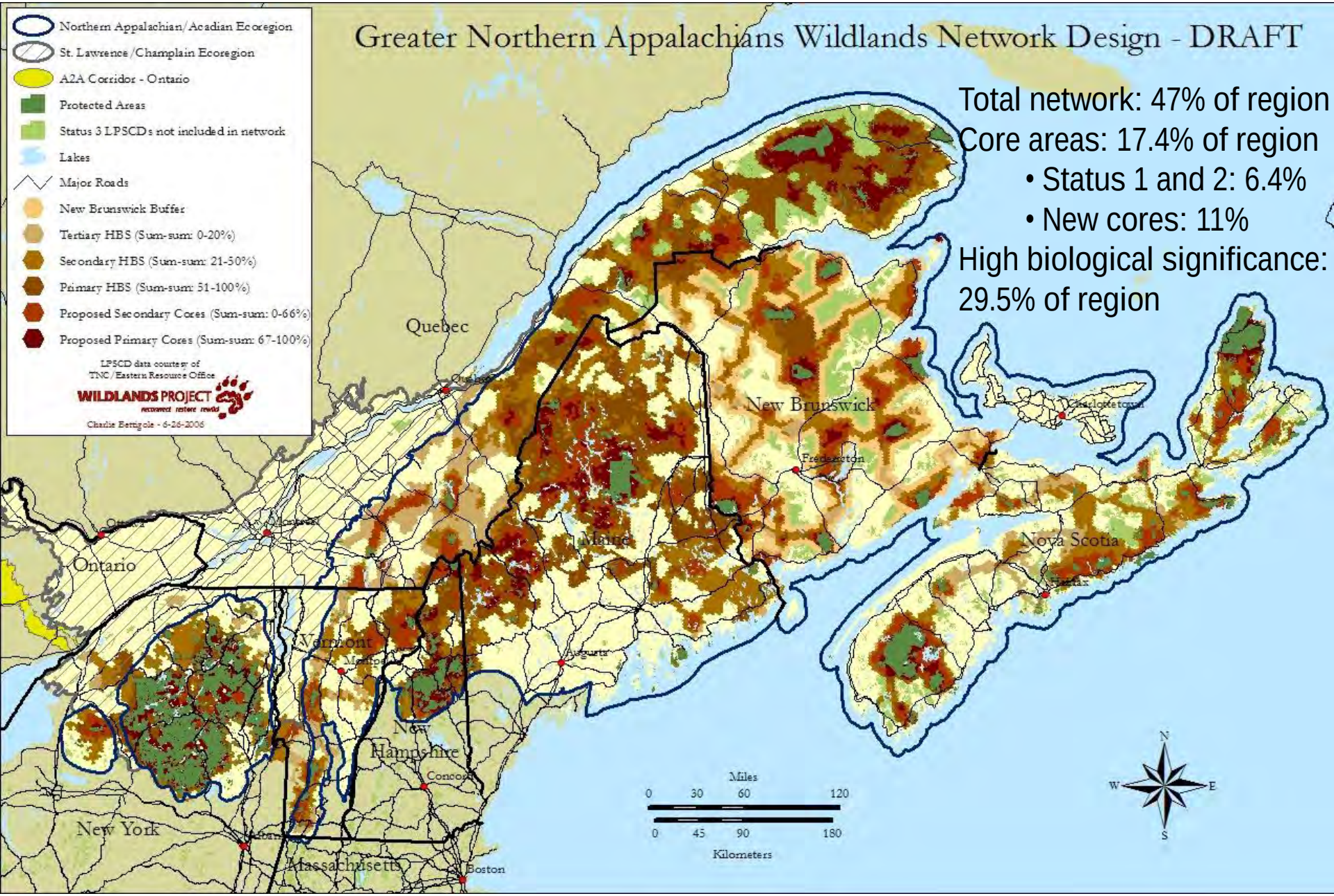


Source: WWF, ZSL 2014

Slide courtesy of Stephen Woodley, IUCN

Barrier Mitigation


quency of Selection
1 - 10%
11 - 20%
21 - 30%
31 - 40%
41 - 50%
51 - 60%
61 - 70%
71 - 80%
81 - 90%
91 - 100%
Summed Summed Runs
Quebec
Hexagons Locked into MARXAN
St. Lawrence/Champlain Valley - Limited Data Avialability (Focal Species Only)
Northern Appalachian/Acadian Ecoregion
New Brunswick
Prince Edward Island
Nova Scotia
Maine
Ontario
Nova Scotia
Vermont
New Hampshire
New York
Massachusetts
0 50 100 200 300 400
Kilometers
WILDLANDS PROJECT
reconnect restore rewild
Charlie Bettigole - 6-29-


Greater Northern Appalachians Wildlands Network Design - DRAFT
Northern Appalachian/Acadian Ecoregion
St. Lawrence/Champlain Ecoregion
A2A Corridor - Ontario
Protected Areas
Status 3 LPSCDs not included in network
Lakes
Major Roads
New Brunswick Buffer
Tertiary HBS (Sum-sum: 0-20%)
Secondary HBS (Sum-sum: 21-50%)
Primary HBS (Sum-sum: 51-100%)
Proposed Secondary Cores (Sum-sum: 0-66%)
Proposed Primary Cores (Sum-sum: 67-100%)
LPSCD data courtesy of
TNC/Eastern Resource Office
WILDLANDS PROJECT
reconnect restore rewild
Charlie Bettigole - 6-26-2006
Total network: 47% of region
Core areas: 17.4% of region
• Status 1 and 2: 6.4%
• New cores: 11%
High biological significance: 29.5% of region
Quebec
New Brunswick
Maine
Nova Scotia
Ontario
Vermont
New Hampshire
New York
Massachusetts
Boston
Fredericton
Charlottetown
Halifax
Miles
0 30 60 120
0 45 90 180
Kilometers
N
W
E
S

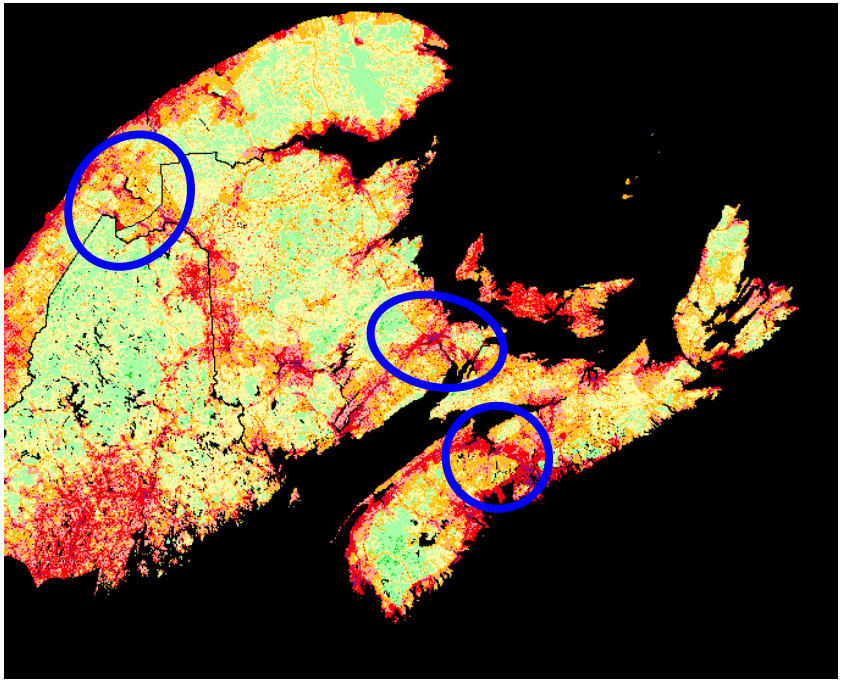
Importance (irreplaceability) values:
Site selection optimization program (MARXAN) output

Two Countries One Forest
Deux Pays Une Forêt

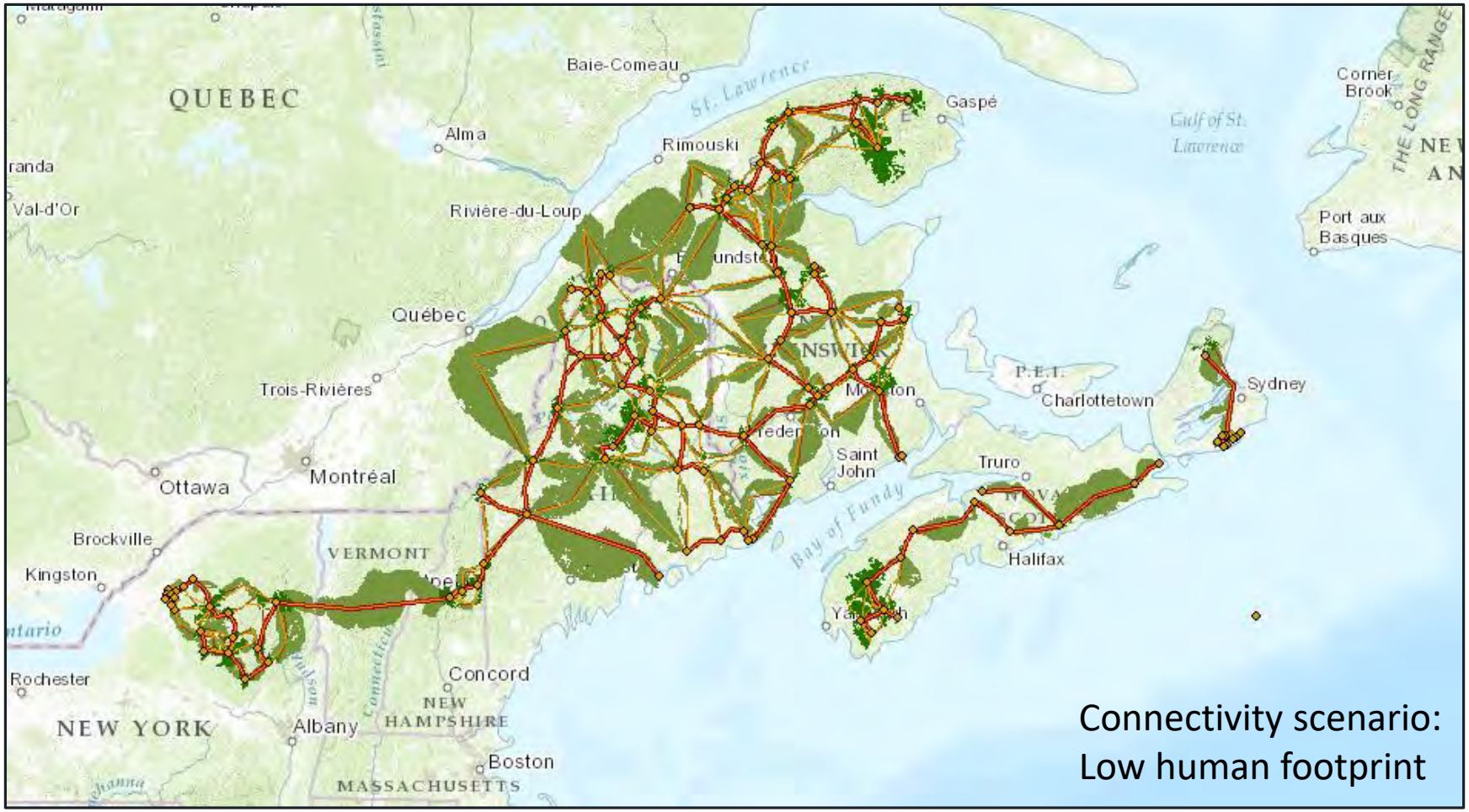
Critical linkage areas

Biodiversity importance

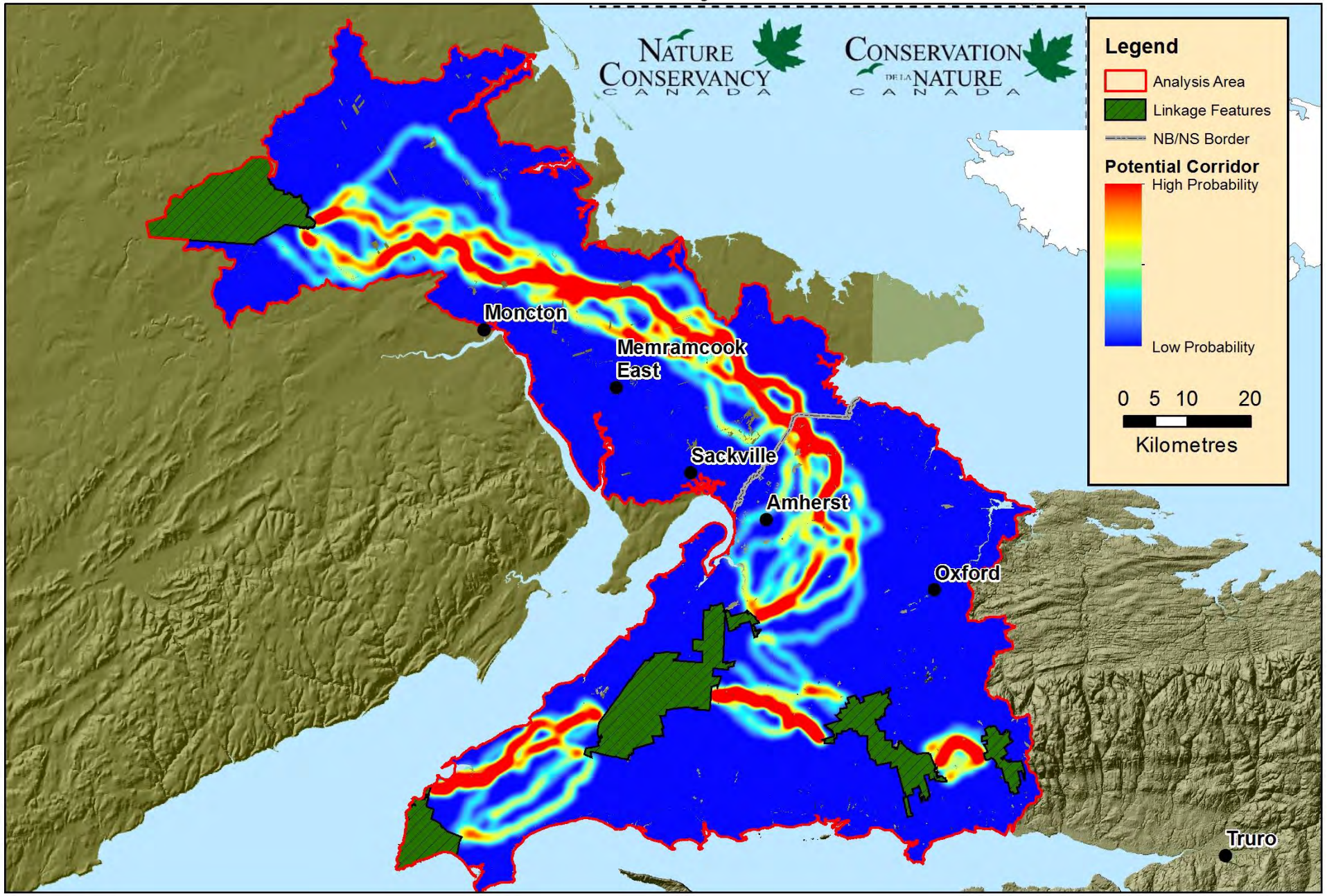
Human footprint



Ecological connectivity models



(Perkl and Baldwin 2013; 2C1Forest: Data Basin)

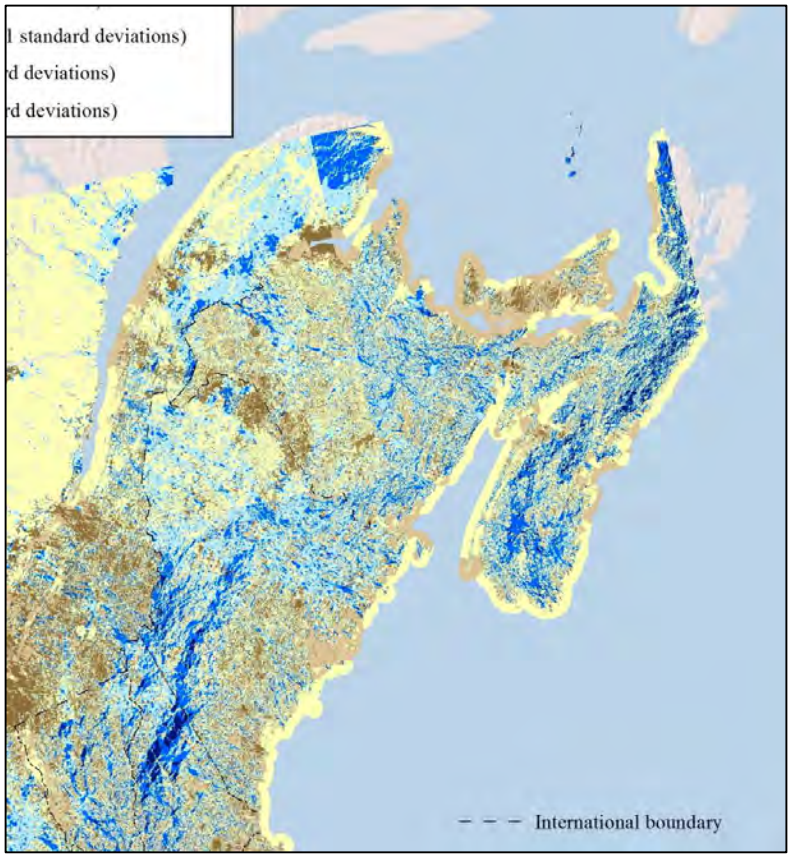


Wildlife Connectivity Analysis for the Chignecto Isthmus Region

(Nussy 2016)

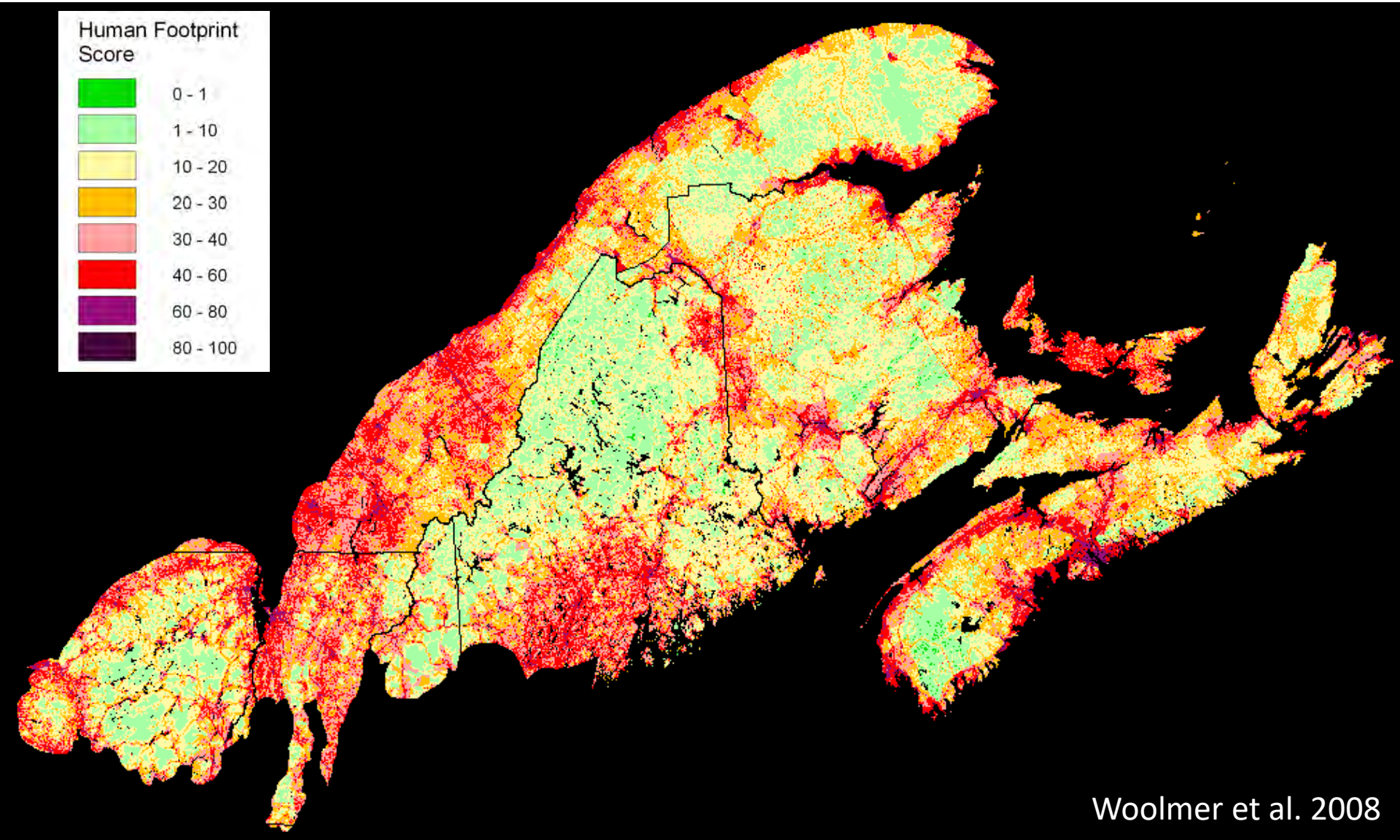
Prioritized resilient & connected sites

Regional flows
Anderson et al. 2012



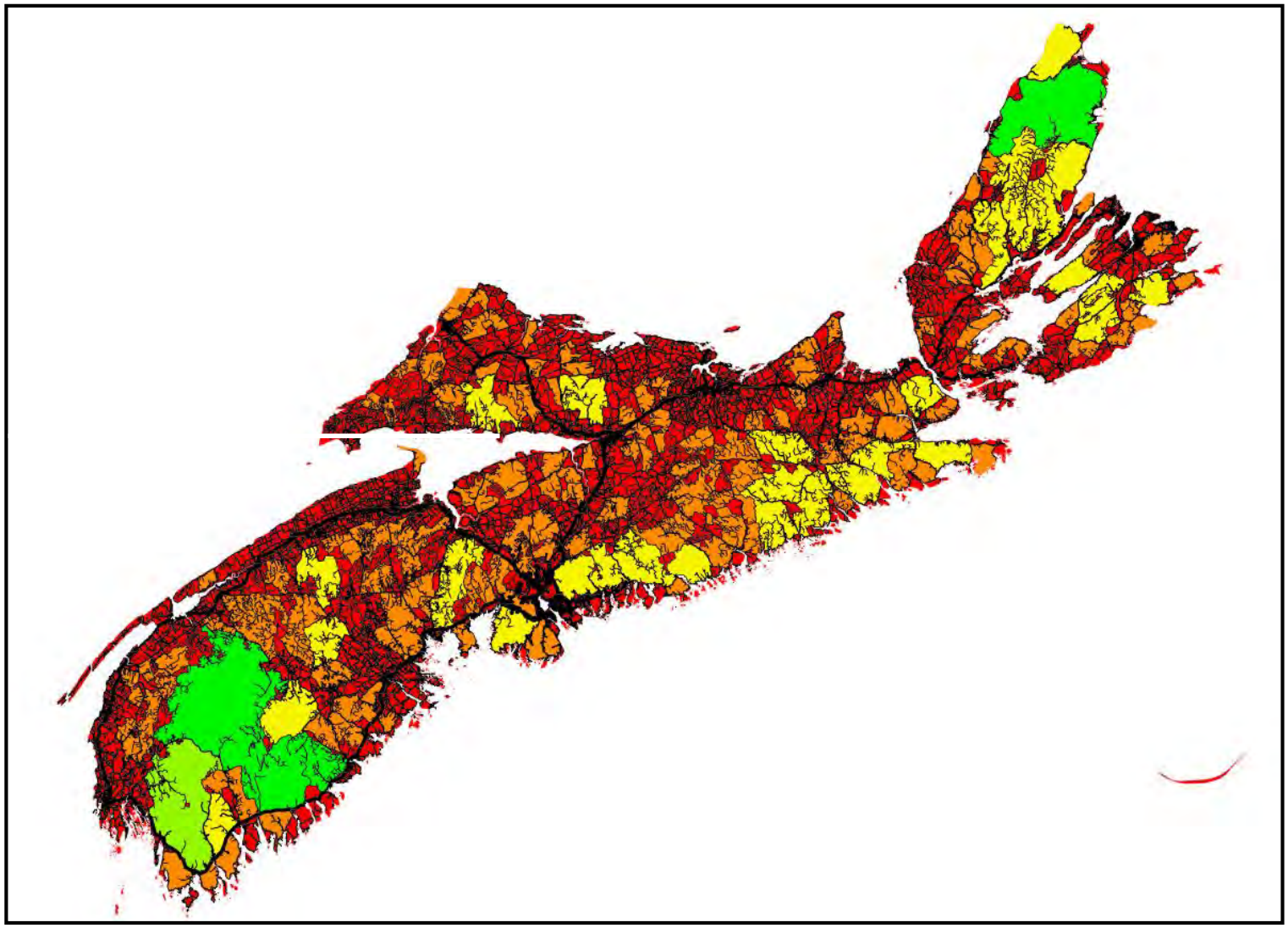
Resilient for diversity and permeability, and linkages between sites that have high flow
Anderson et al. 2016

Last of the wild: Human footprint (2000)

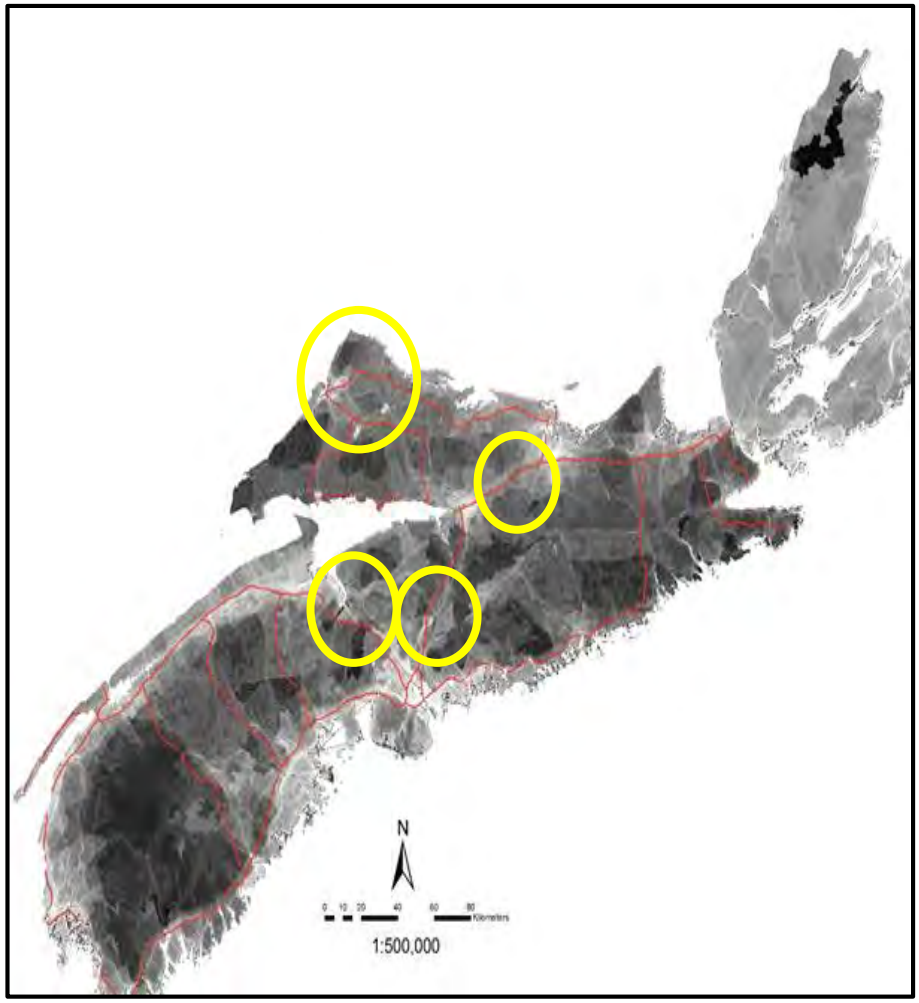


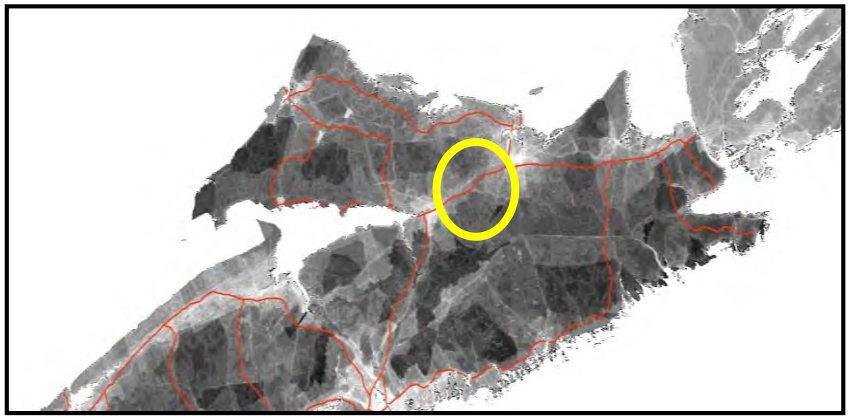
Woolmer et al. 2008

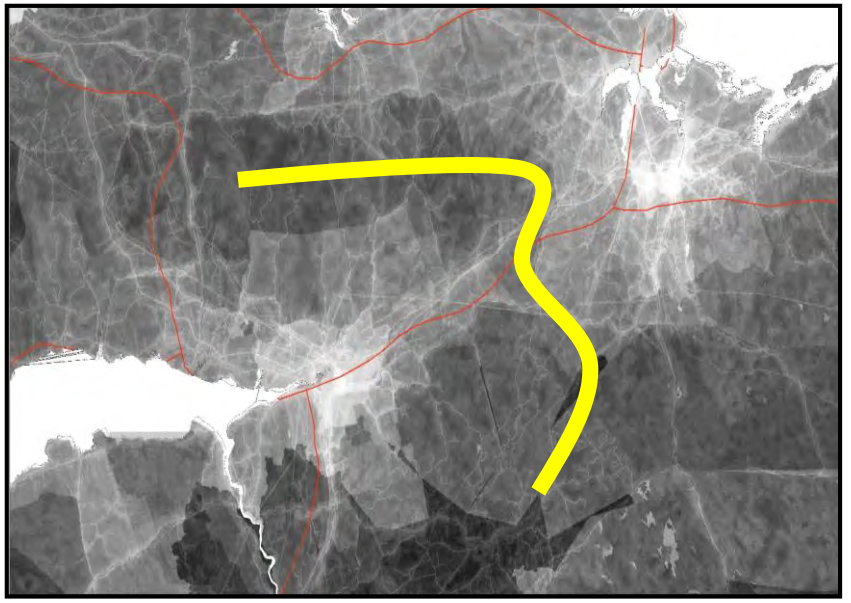
Rad effect zones and human footprint



Key areas for maintaining & restoring connectivity across highways

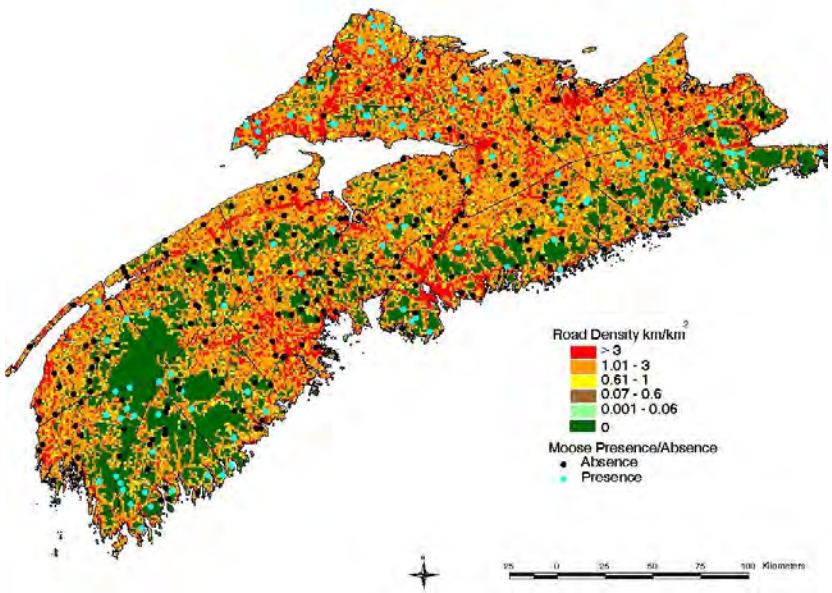




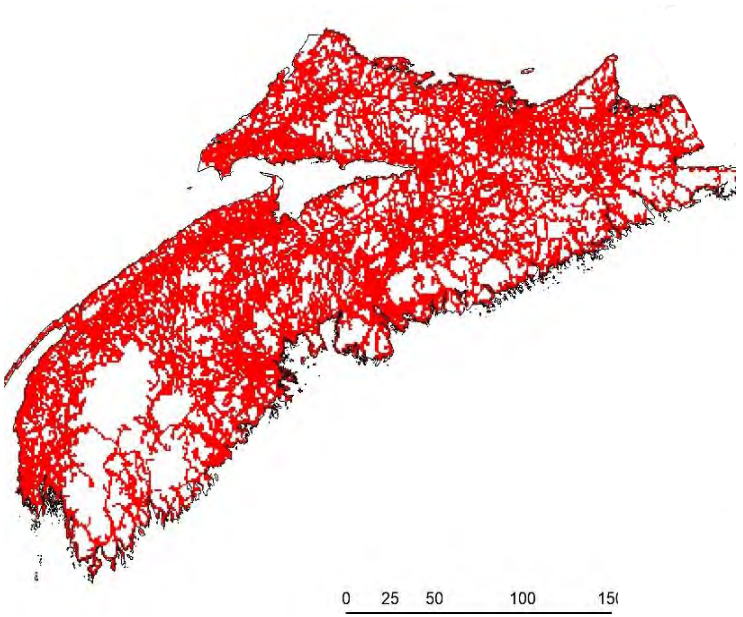


Road density

2000

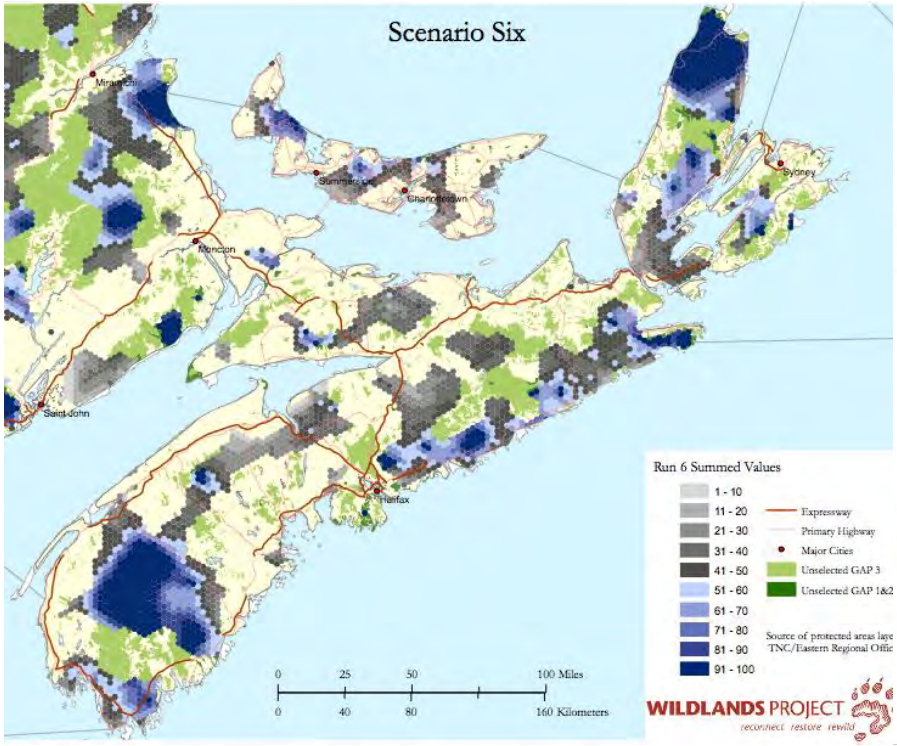


2018

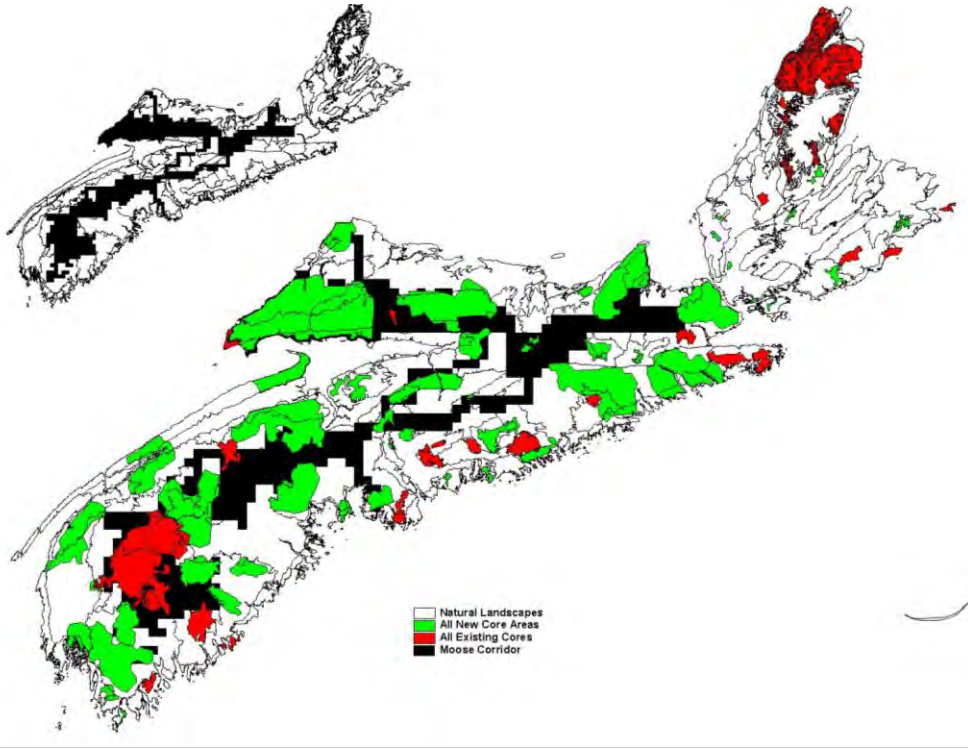


Core areas and connectivity

Reining et al. 2006



Beazley et al. 2005



Core areas and connectivity

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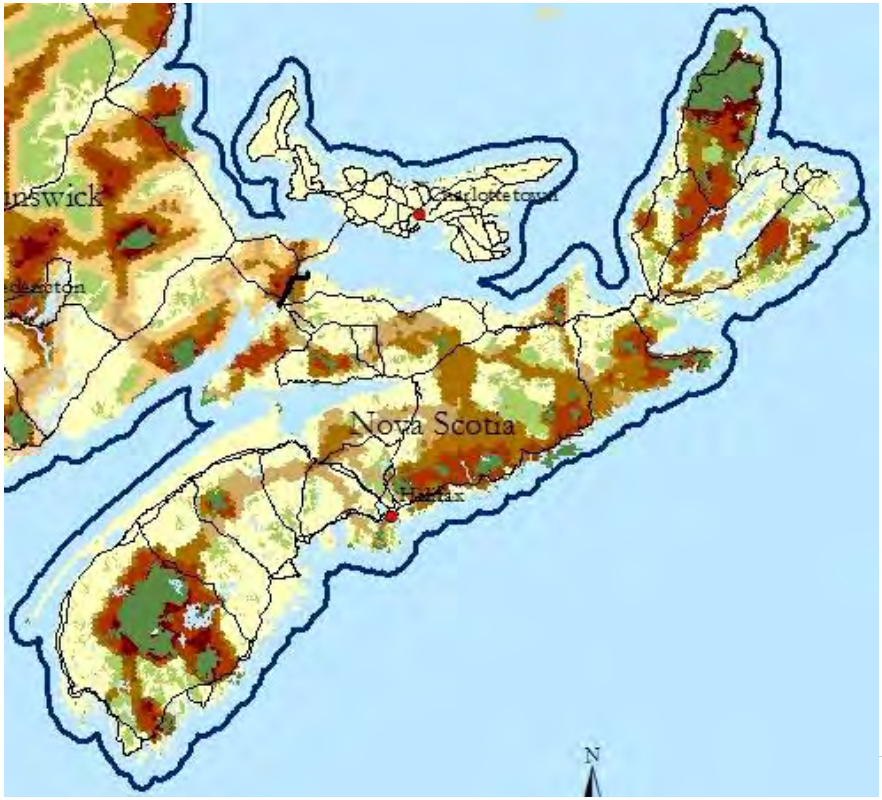
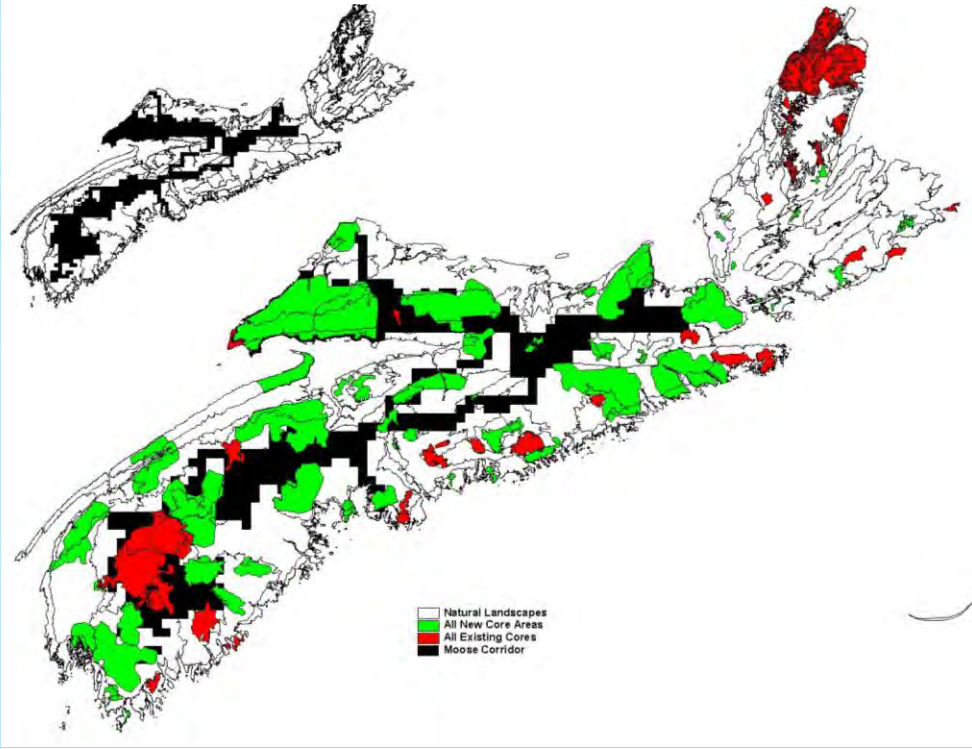
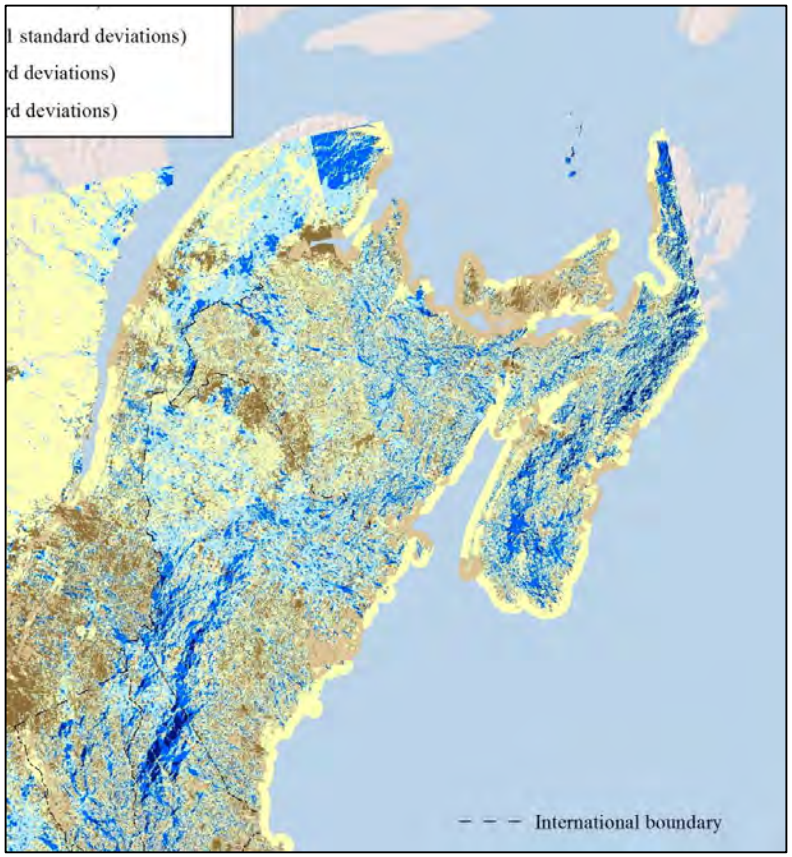


Beazley et al. 2005



Prioritized resilient & connected sites

Regional flows
Anderson et al. 2012

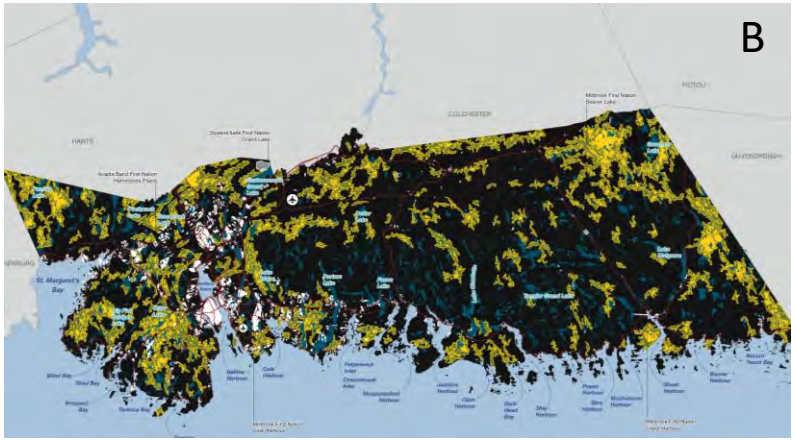


Resilient for diversity and permeability, and linkages between sites that have high flow
Anderson et al. 2016

Generalized connectivity & pinch points to wildlife movement

A. Generalized connectivity

B. Pinch points to wildlife movement



Road-wildlife interactions in the Chignecto Isthmus region of Nova Scotia and New Brunswick

Amelia Barnes, MES Candidate

Dalhousie University

Supervisor: Dr. Karen Beazley

DALHOUSIE UNIVERSITY

Symptoms of loss of habitat connectivity due to roads

- Roadkill
  - Major visible symptom
- Road avoidance behaviours
  - Less visible
  - Wildlife may not be able to reach important habitat resources
  - Or are restricted to shrinking habitat patches

Main objective

- Identify & reduce barriers to wildlife movement
    - Positive implications for population viability

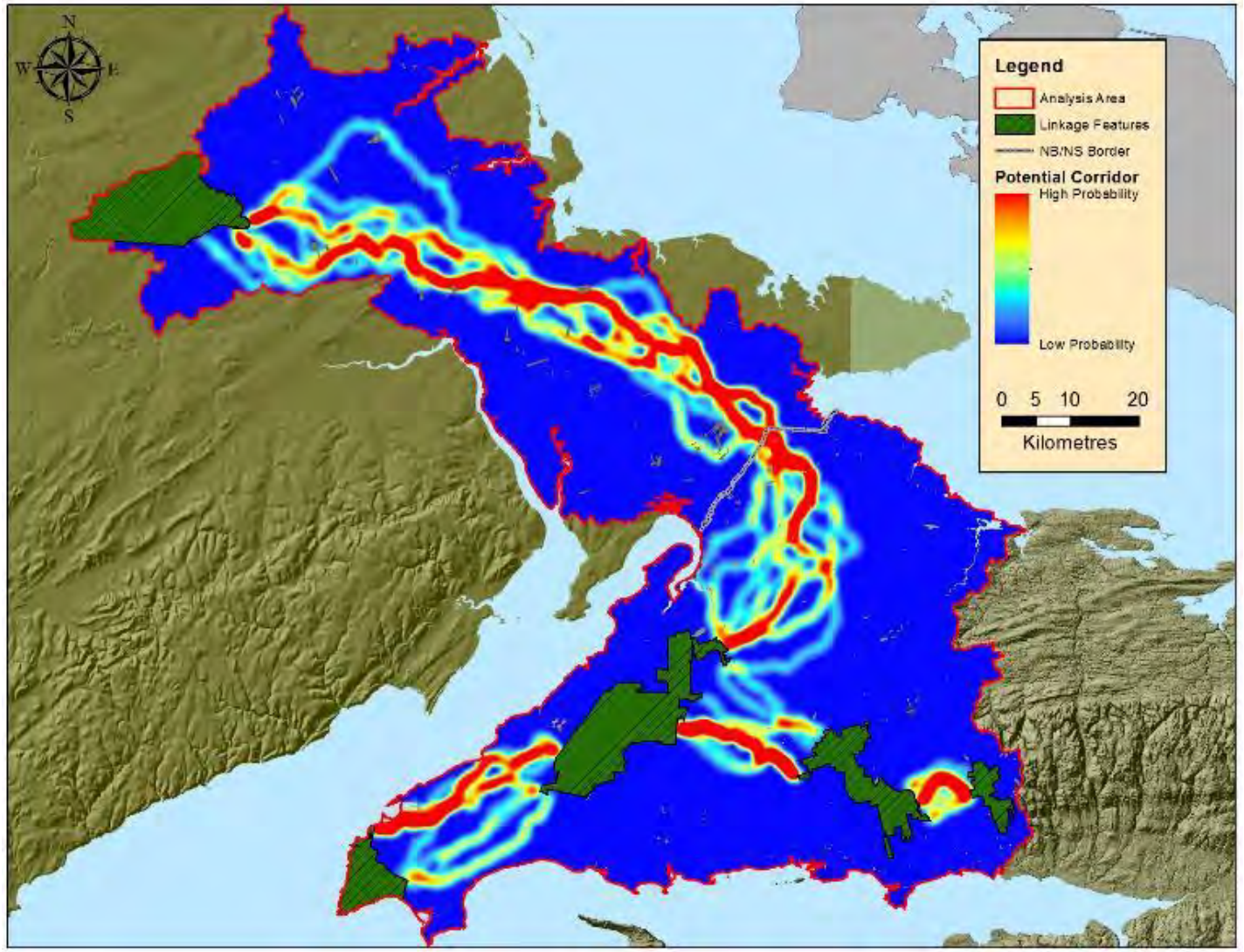
Through:

- Verifying a modeled wildlife corridor
- Comparing wildlife-vehicle mortality by road class and traffic volume

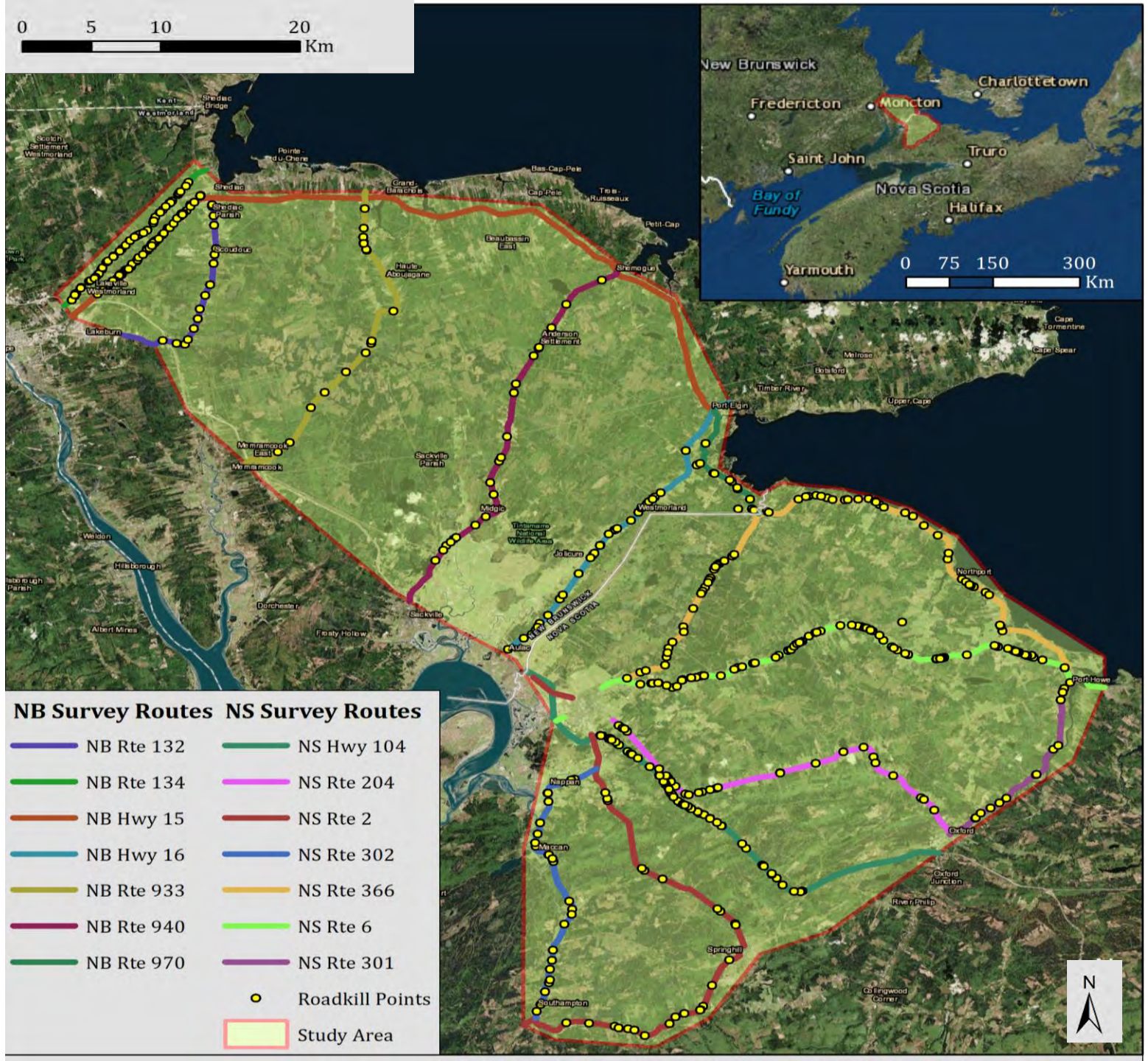
Fieldwork – Summer 2018

- Dr. Bill Friedman Conservation Intern with the Nature Conservancy Canada
- Early morning roadkill surveys on 14 roads in the Chignecto Isthmus
- Photos, GPS waypoints, roadside removal

Study area

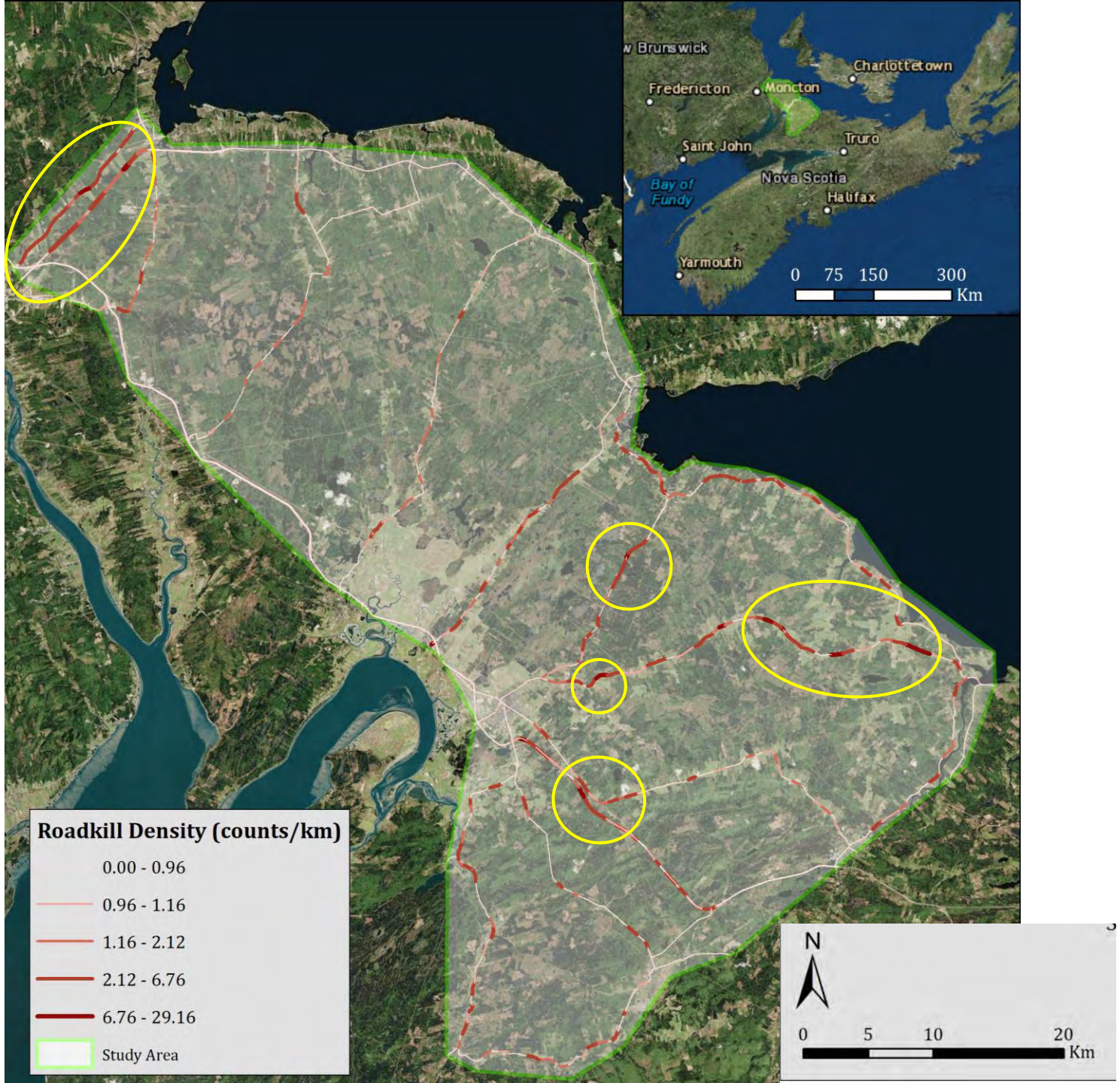


Kernel Density model of potential corridors across the study area
Source: Wildlife Connectivity Analysis for the Chignecto Isthmus Region, 2016


0 5 10 20
Km
New Brunswick
Charlottetown
Fredericton
Moncton
Saint John
Truro
Nova Scotia
Bay of Fundy
Halifax
Yarmouth
0 75 150 300
Km
NB Survey Routes
NB Rte 132
NB Rte 134
NB Hwy 15
NB Hwy 16
NB Rte 933
NB Rte 940
NB Rte 970
NS Survey Routes
NS Hwy 104
NS Rte 204
NS Rte 2
NS Rte 302
NS Rte 366
NS Rte 6
NS Rte 301
Roadkill Points
Study Area
N

569 observations of wildlife roadkill recorded

Wildlife-vehicle collision hotspots

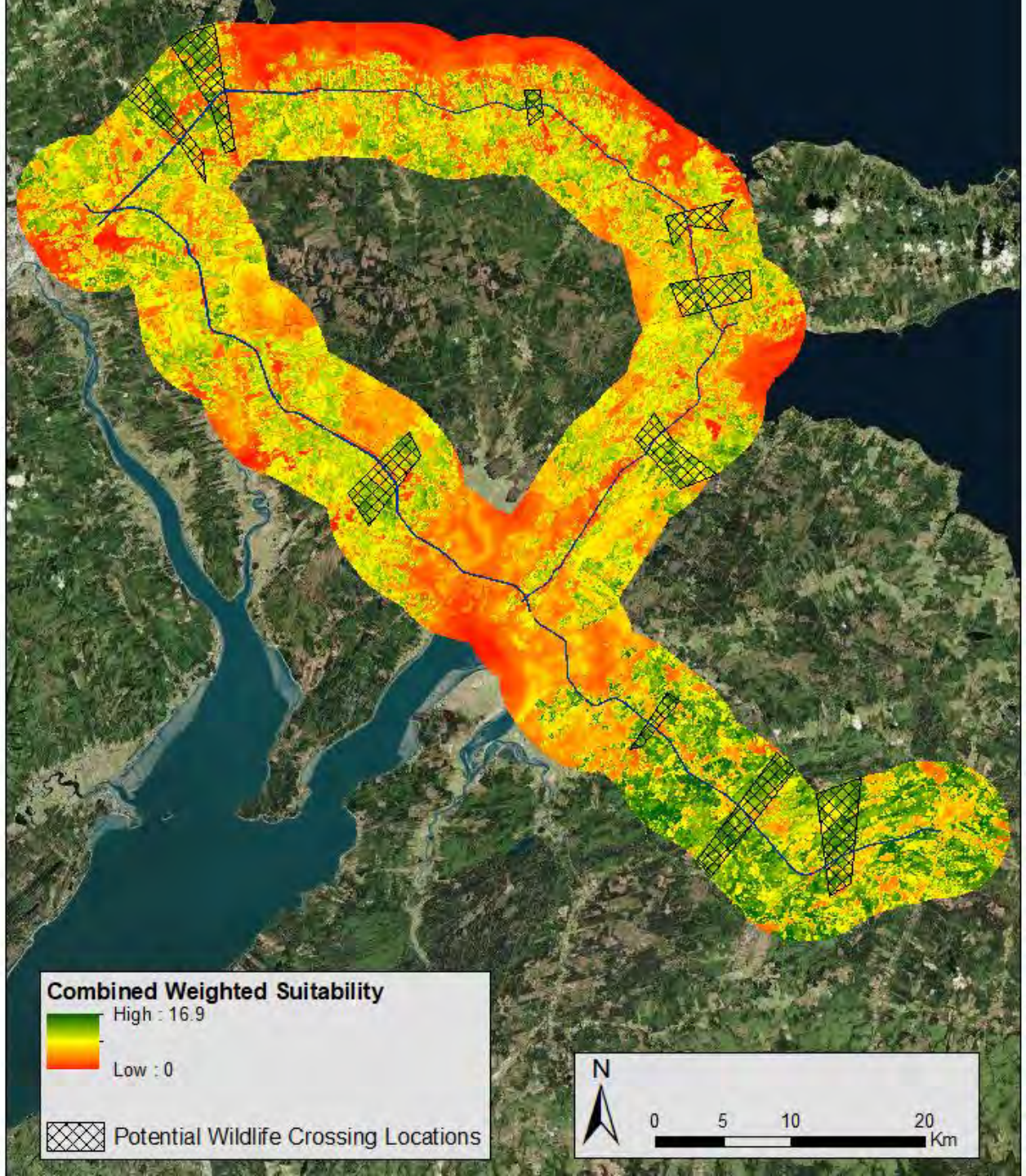


Recommendations

- Goal: safe wildlife crossings in the Chignecto Isthmus
- Mitigation actions to reduce mortality & increase habitat connectivity might include:
  - Wildlife fencing
  - Culverts, tunnels, pipes
  - Overpasses
  - Targeted signage
- Important that mitigation is targeted to areas where there is suitable habitat on both sides & where animals are likely to attempt to cross.

Locations for potential crossing structures along major roads

- Roadside habitat suitability analysis
  - 3 wide-ranging mammals – moose, bobcat, bear
- Analysis looked for highly suitable habitat on both sides of 4 major roads



Opportunities & challenges related to wildlife crossing structures

Opportunities

- Perforation of road barriers to maintain natural ecological flow
- When implemented well, reduction in wildlife-vehicle collisions
  - Reduced impact of mortality on populations
  - Promotion of motorist safety

Challenges

- Can be expensive to retroactively integrate into existing road infrastructure
- No “one size fits all” crossing structure
- Fencing needed to promote use of crossing structures
  - Only feasible on controlled-access highways

Next Steps

- Integrate roadkill survey data with large animal collision data from NS & NB
- Compare roadside habitat analysis with modeled wildlife corridor & collision hotspots

Acknowledgements

Thank you to:

- Dr. Karen Beazley, Dalhousie
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- NB Dept. Energy & Resource Development