Regional Landscape Conservation Planning for the Long Point Focal Area, the Lake Erie Basin, and the Southern Great Lakes Ecoregion

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Why Do We Need Large-scale Planning?

- More efficient and coordinated than a piecemeal site-by-site approach
- Addresses important landscape-scale phenomena such as movements of wide-ranging animals, beta diversity along environmental gradients, and adaptation to climate change
- Puts forth an inspiring and hopeful vision for the future amidst the doom and gloom of daily losses

Interests and concerns that led to development of large-scale planning

- Interest in theory of island biogeography (MacArthur and Wilson 1963, 1967) – species colonization and extinction
- Increasing interest in large-scale ecological phenomena (e.g., landscape ecology, disturbance ecology)
- Concerns about habitat fragmentation, with increasing evidence of species losses in small isolated habitat fragments
- Evidence of importance of habitat connectivity and corridors to population viability
- Development of metapopulation ecology
- Awareness of limited ability of existing conservation strategies to address these issues
- Development of geographic information systems (GIS)

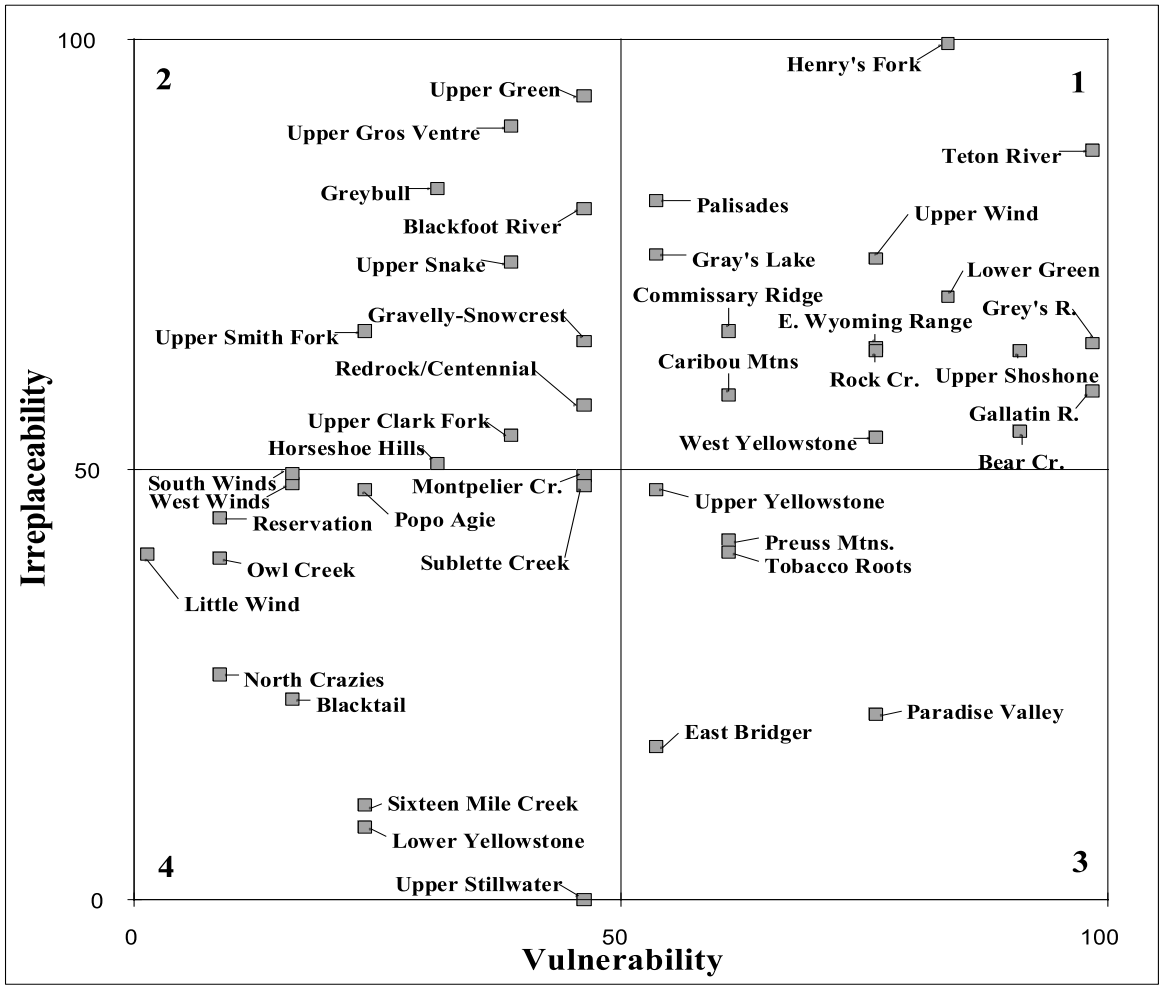
Goals for Comprehensive Regional Conservation Planning

(Noss 1992, Noss and Cooperrider 1994)

- Represent all native landforms, ecosystem types, and successional stages across their natural range of variation in protected and conserved areas
- Protect and restore viable populations of all native species in natural patterns of abundance and distribution
- Maintain natural geological, hydrological, ecological, and evolutionary processes within historic ranges of variability
- Maintain resilient ecosystems and evolutionary lineages in the face of climate disruption and other environmental change

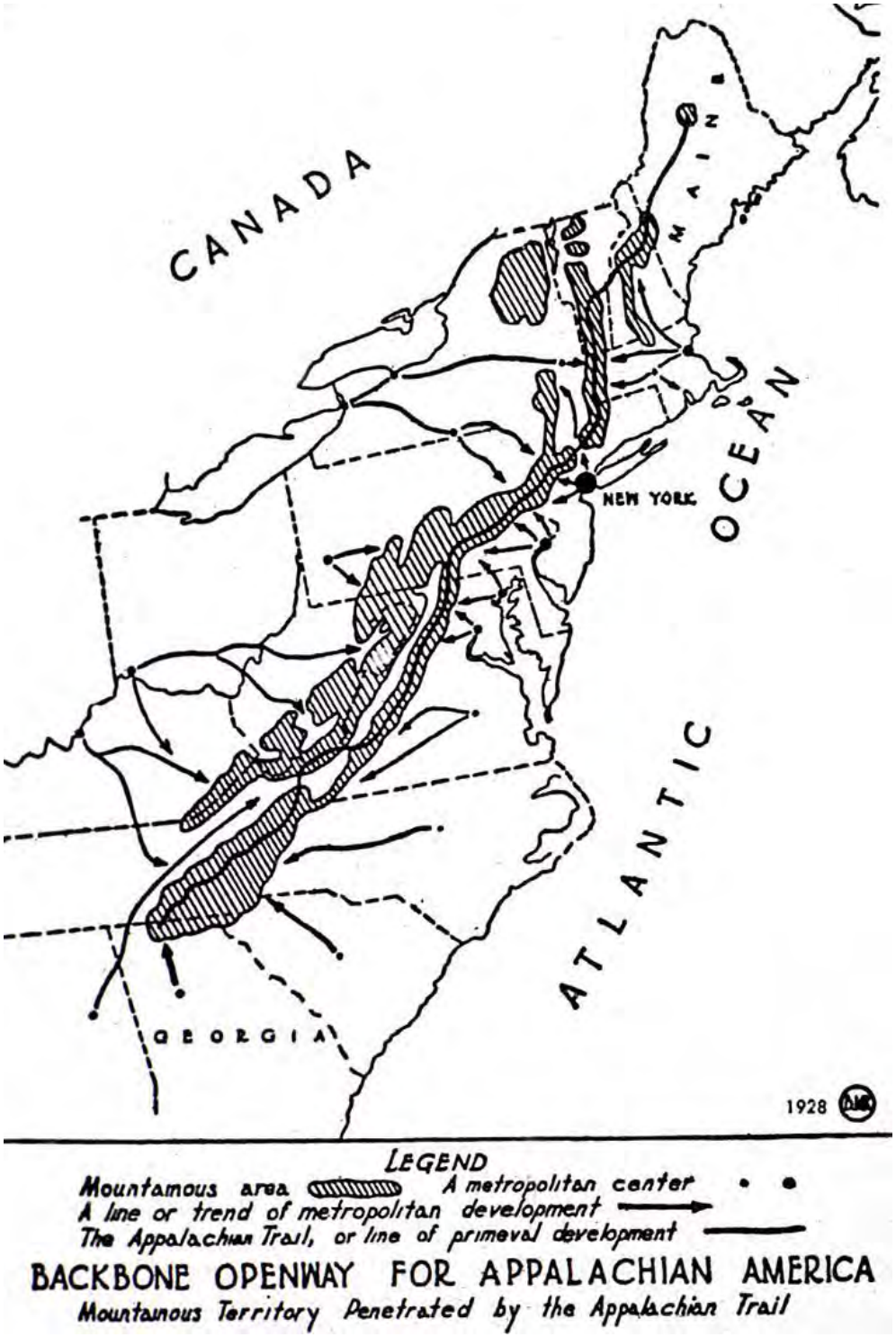
Site Selection and Reserve Network Design: Two Phases of Conservation Planning

For site selection, identify and give priority to sites that are most irreplaceable and most vulnerable



Example of irreplaceability vs. vulnerability graph of "megasites" in the Greater Yellowstone Ecosystem (Noss et al. 2002)

Irreplaceability defined by contribution of a site to conservation goals. vulnerability defined by level of near-term threat



Early Network Design

"An Appalachian Trail: A Project in Regional Planning"

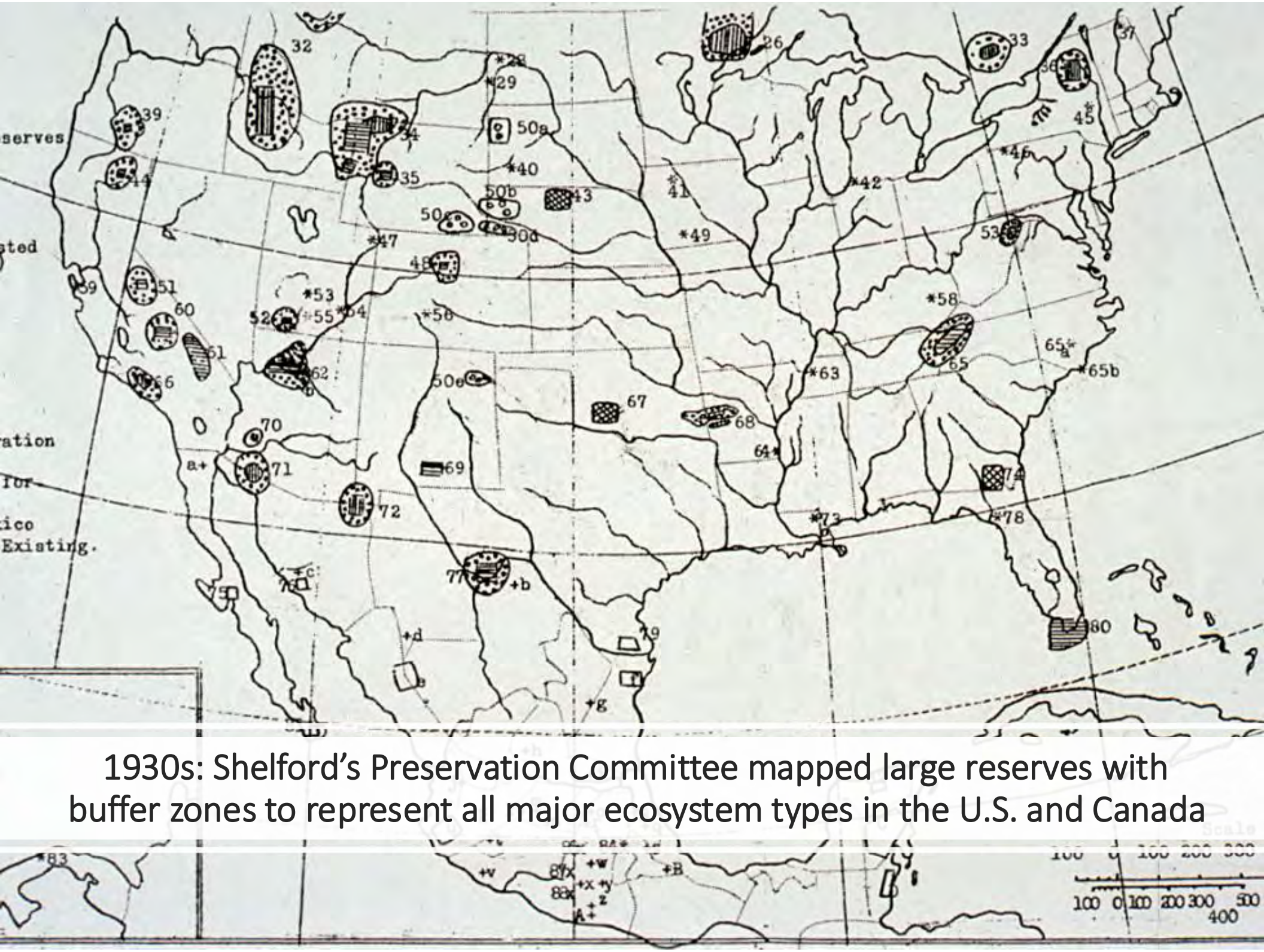
Benton MacKaye (1921, *The Hudson River Valley Review*)

Victor Shelford

First president of Ecological Society of America (1915) and "father" of conservation planning in North America

Naturalist's Guide to the Americas
(1926)

Shelford dressed for the field at Reelfoot Lake, Tennessee, in 1937. Photo courtesy of Eugene Odum.



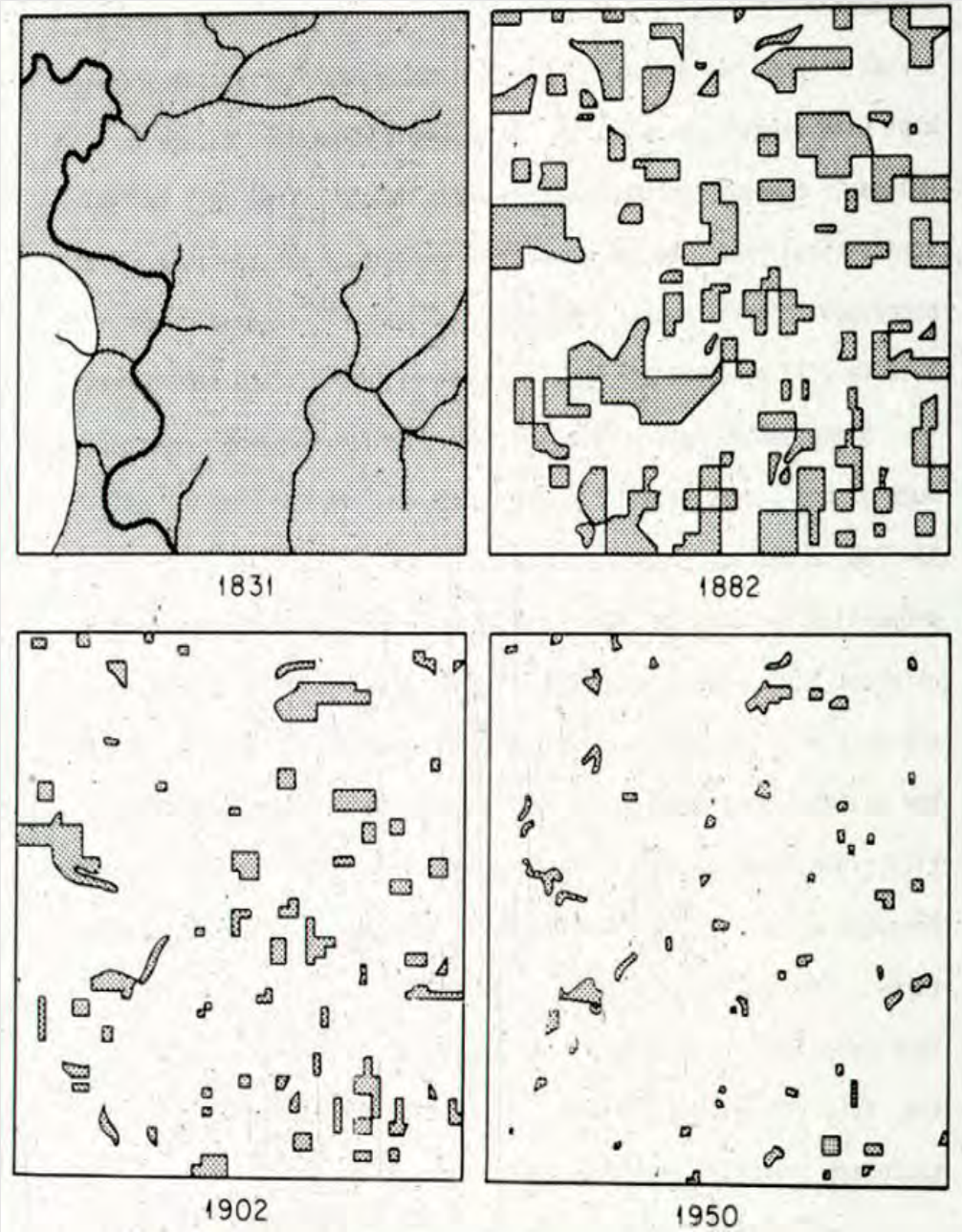
1930s: Shelford's Preservation Committee mapped large reserves with buffer zones to represent all major ecosystem types in the U.S. and Canada

Habitat Fragmentation

- Loss of habitat area
- Apportionment of remaining area into smaller and more isolated pieces

Cadiz Township, WI

John Curtis (1956)



Empirical support for “Bigger is Better”

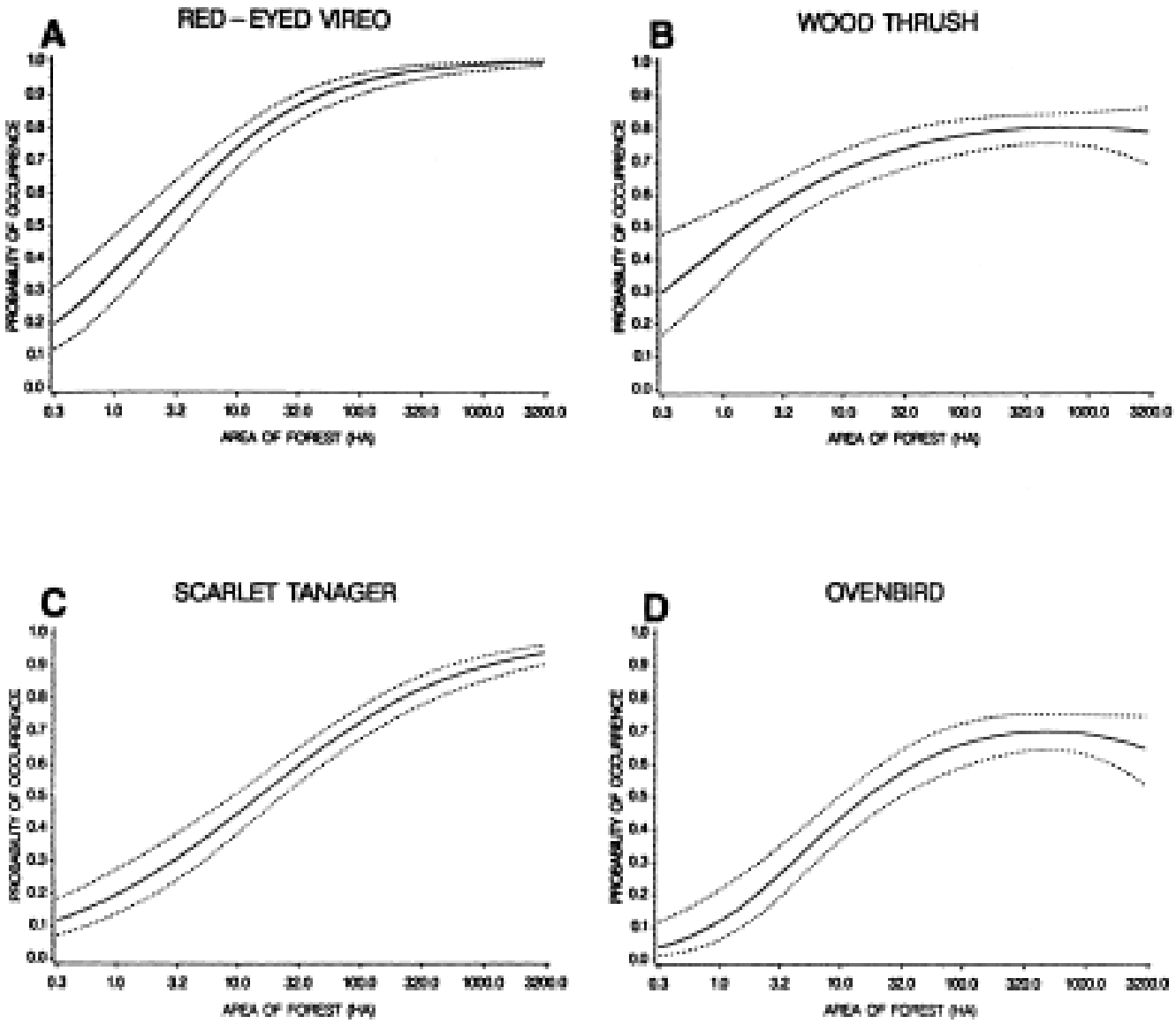
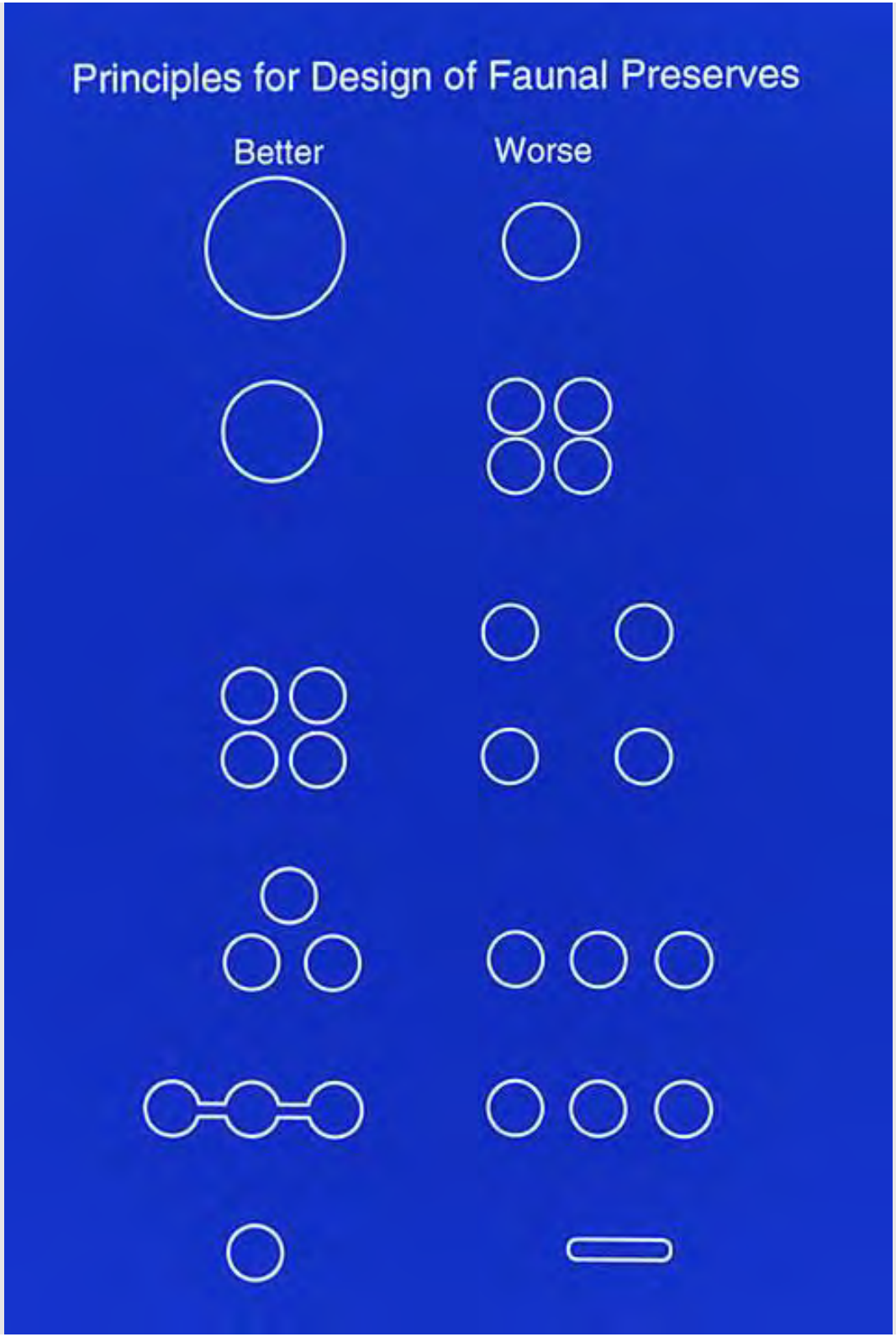


Fig. 2. Probability of detecting 4 species of common, forest-interior, neotropical migrants from a random point in forests of various sizes. Dotted lines indicate 95% confidence intervals for the predicted probabilities.

Area-dependent neotropical migrant songbird species show increasing probability of occurrence as forest patch size increases

From: Robbins et al., 1989, *Wildlife Monographs*

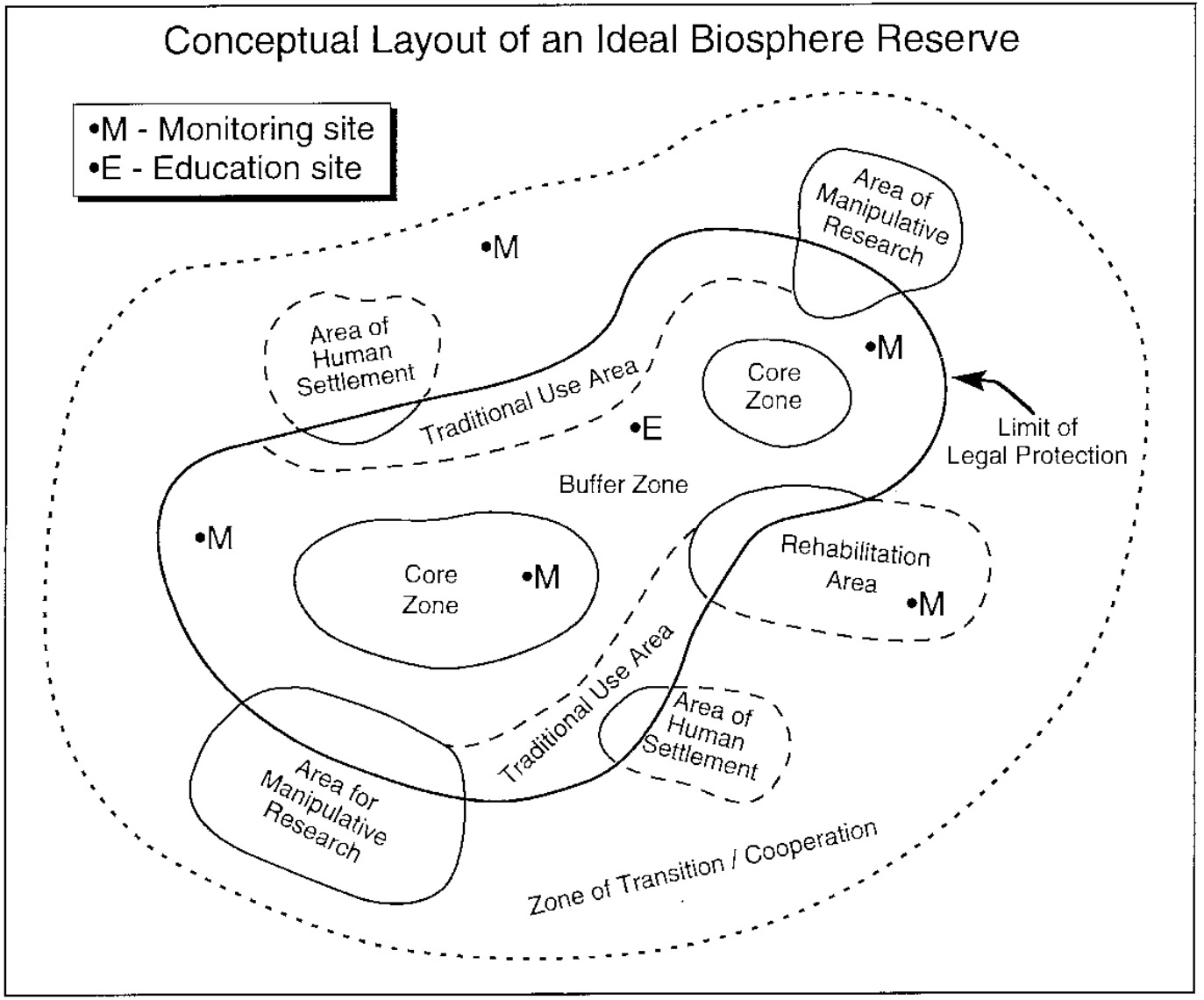


Reserve design "principles" were developed in the 1970s by Diamond, Terborgh, Wilson, Willis, and others. These principles were drawn from island biogeographic theory and observational data, especially for vertebrates.

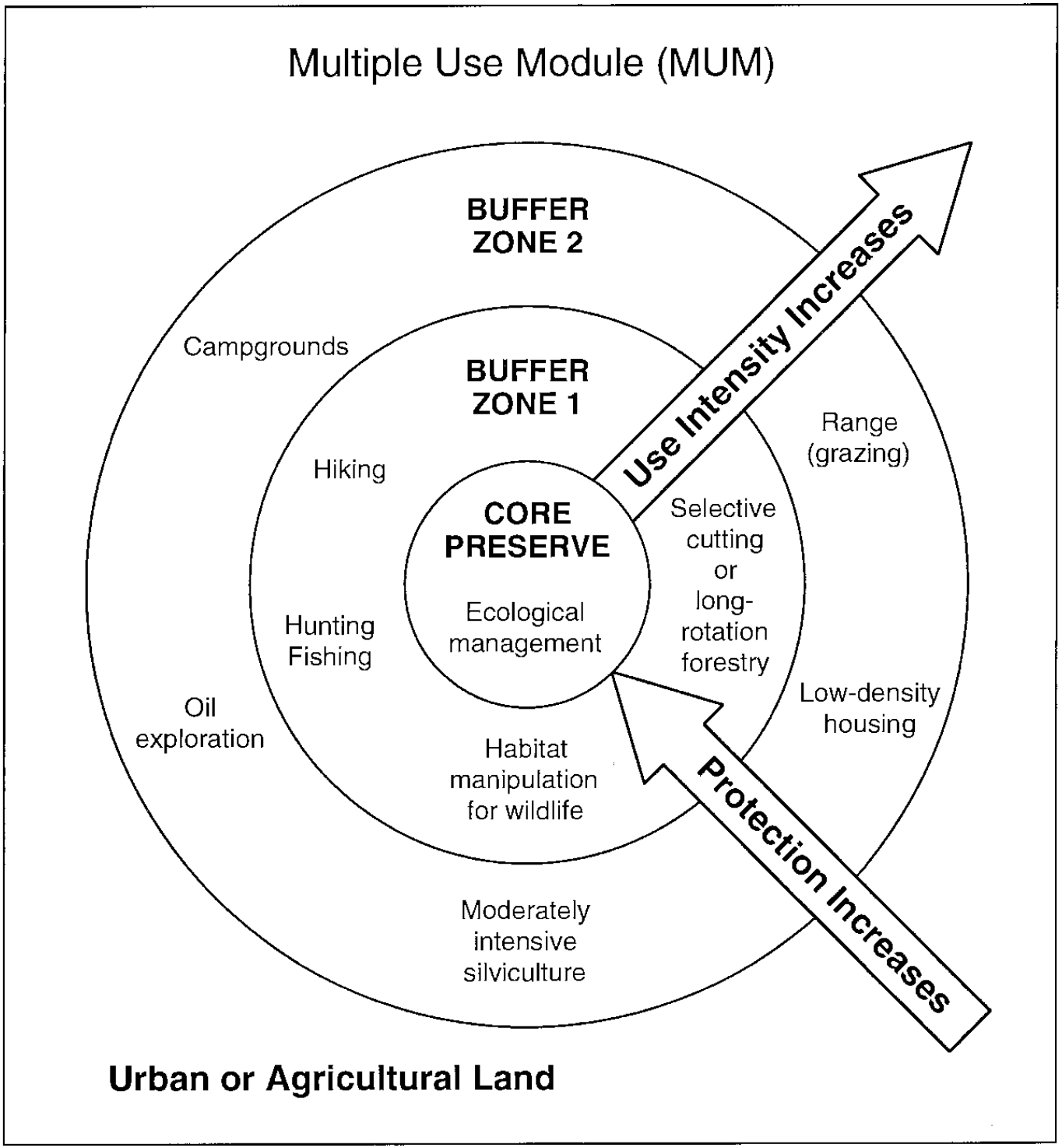
They proved controversial… (e.g., Simberloff and Abele 1976)

From Diamond (1975)

Buffer Zones: UNESCO Man and the Biosphere Program, Early 1970s



Adapted from Hough (1988)



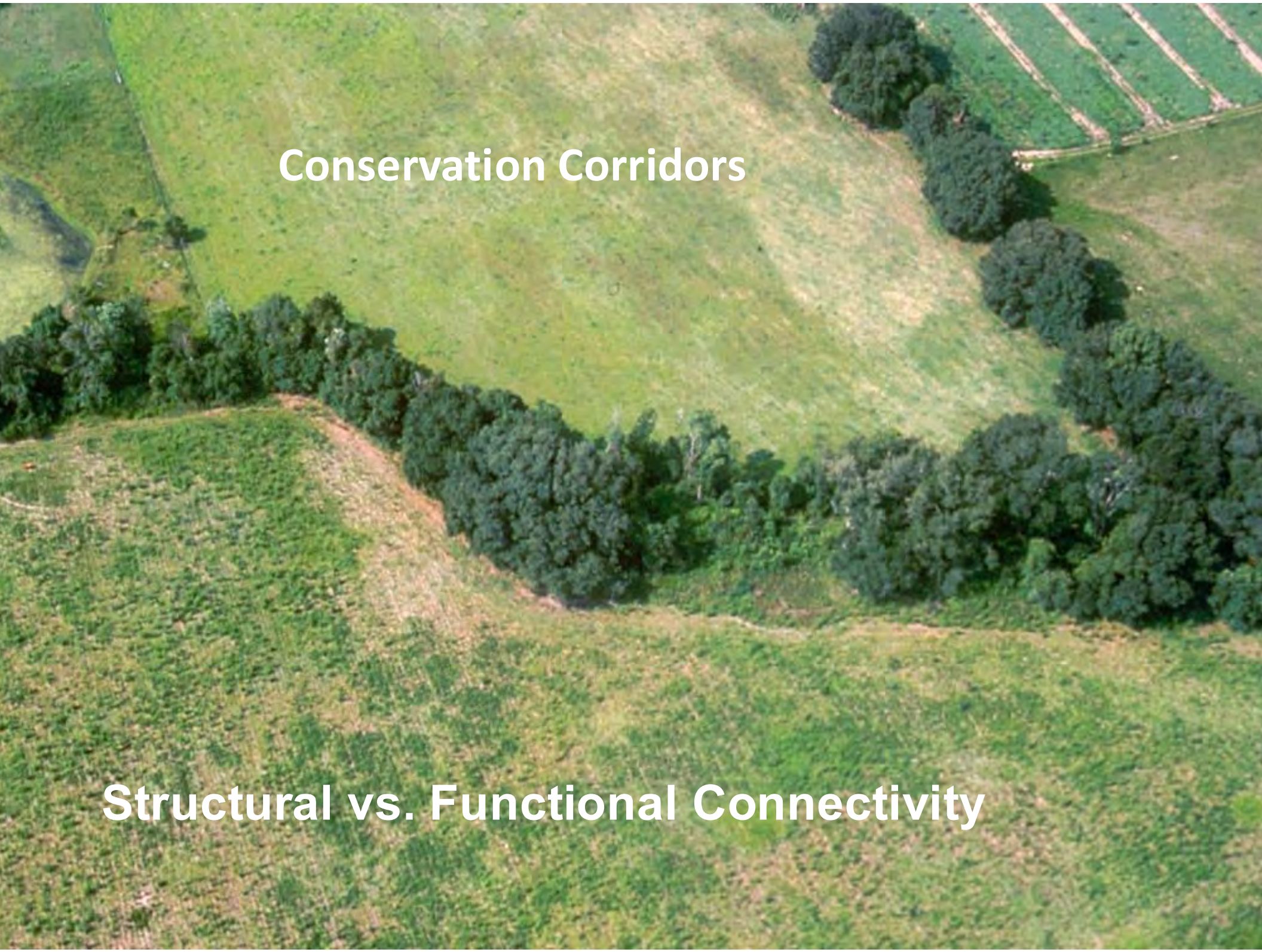
MUMs extend the Biosphere Reserve zoning model to multiple spatial scales and many different landscape types

From Noss (1987)
After Harris (1984)

Holistic Connectivity Principle

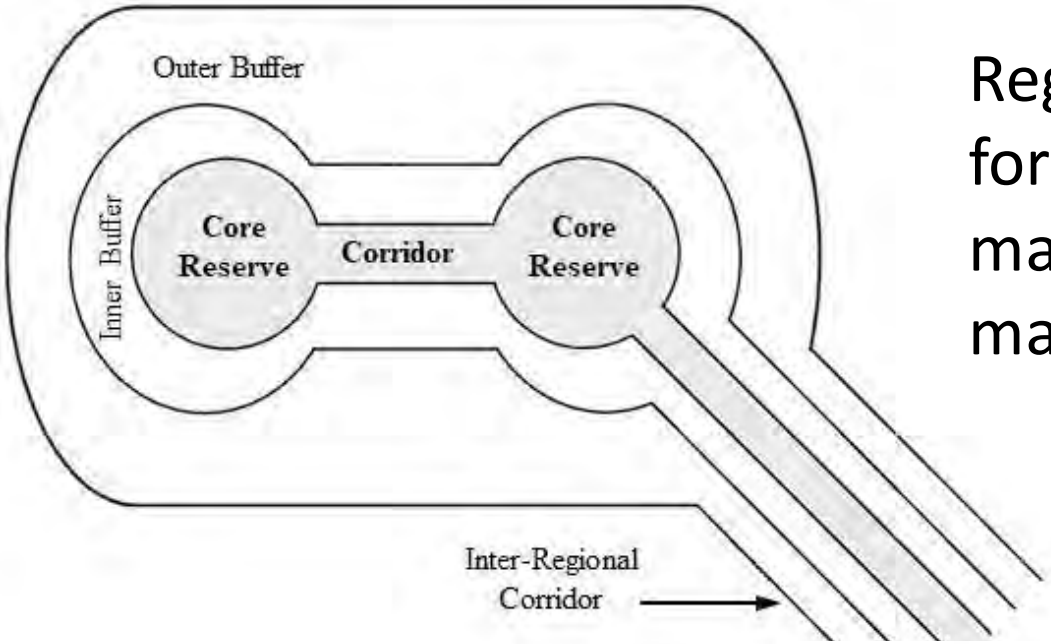
A connected system of reserves can be a whole greater than the sum of its parts.

Although no single reserve might maintain viable populations of focal species, a well-connected network of reserves might maintain viable populations or metapopulations.

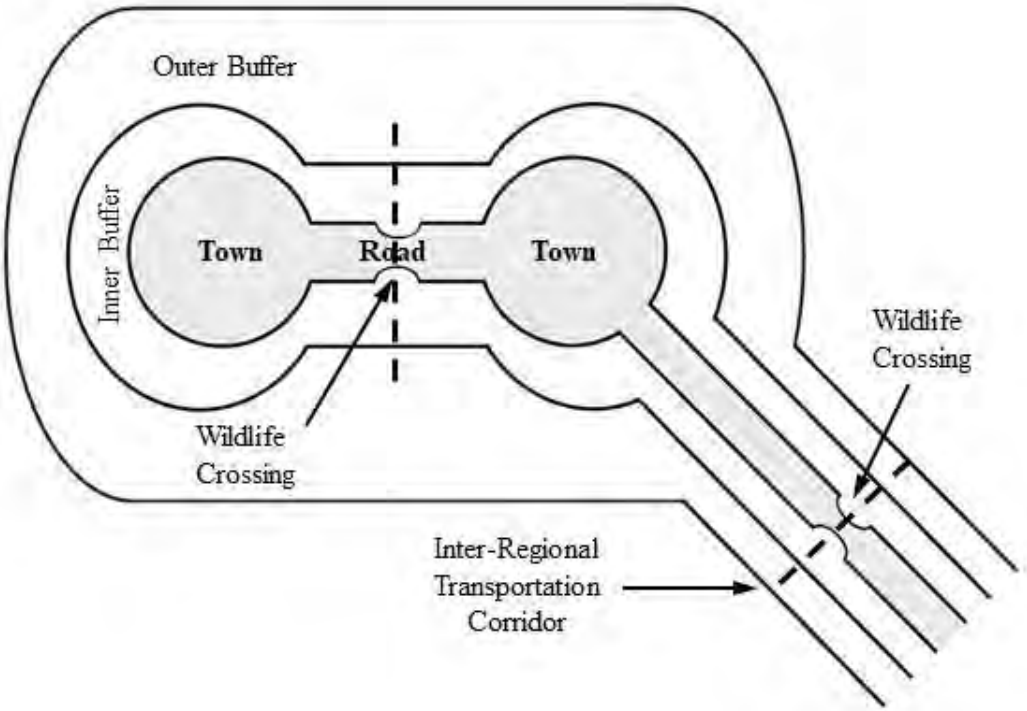

Conservation Corridors
Structural vs. Functional Connectivity

Functional Connectivity

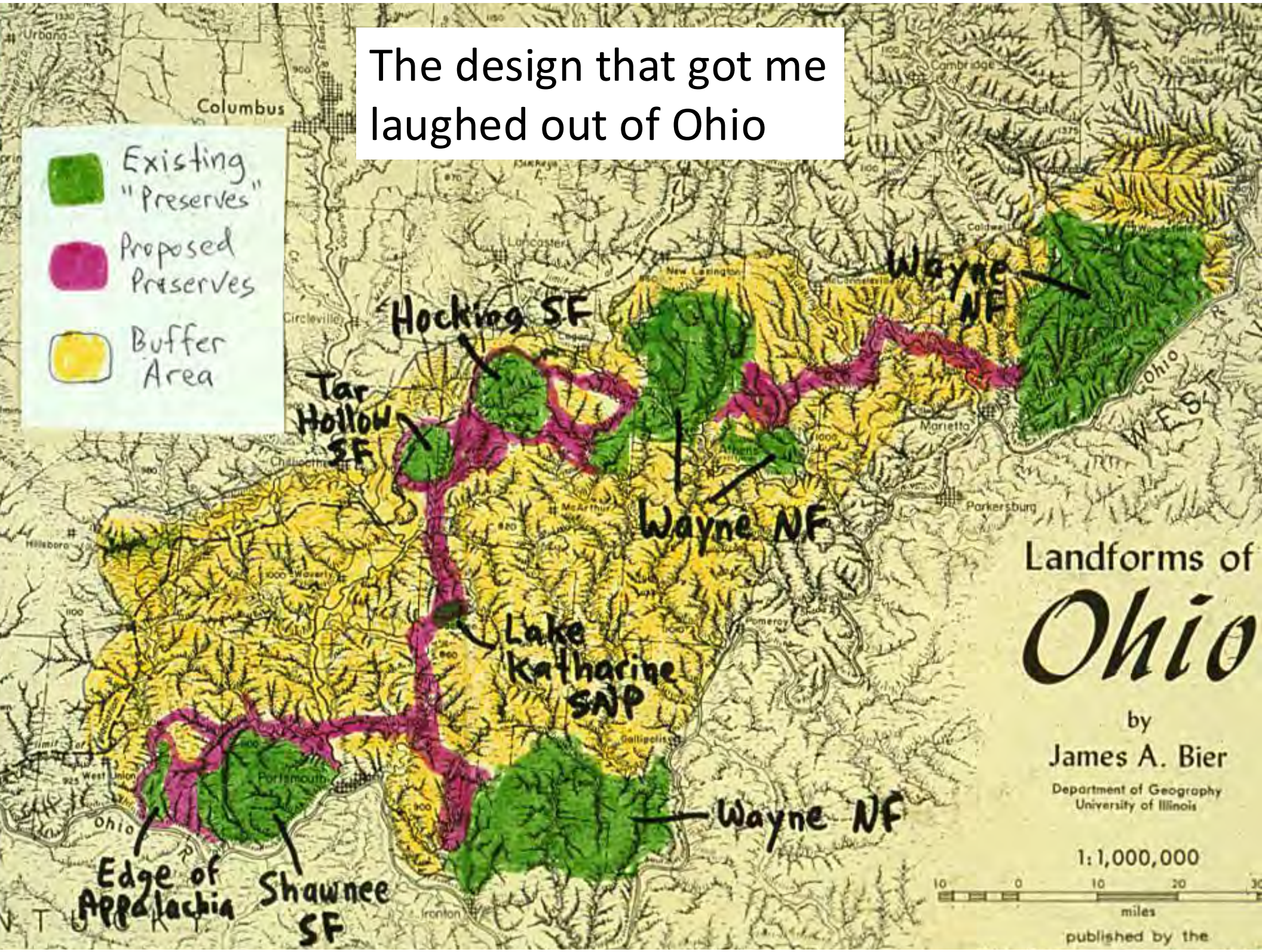
Measured according to the potential for movement, dispersal, and interchange among populations of particular focal species (especially those most sensitive to fragmentation)



Regional reserve network designs for (top) human-dominated matrix and (bottom) wildland matrix regions

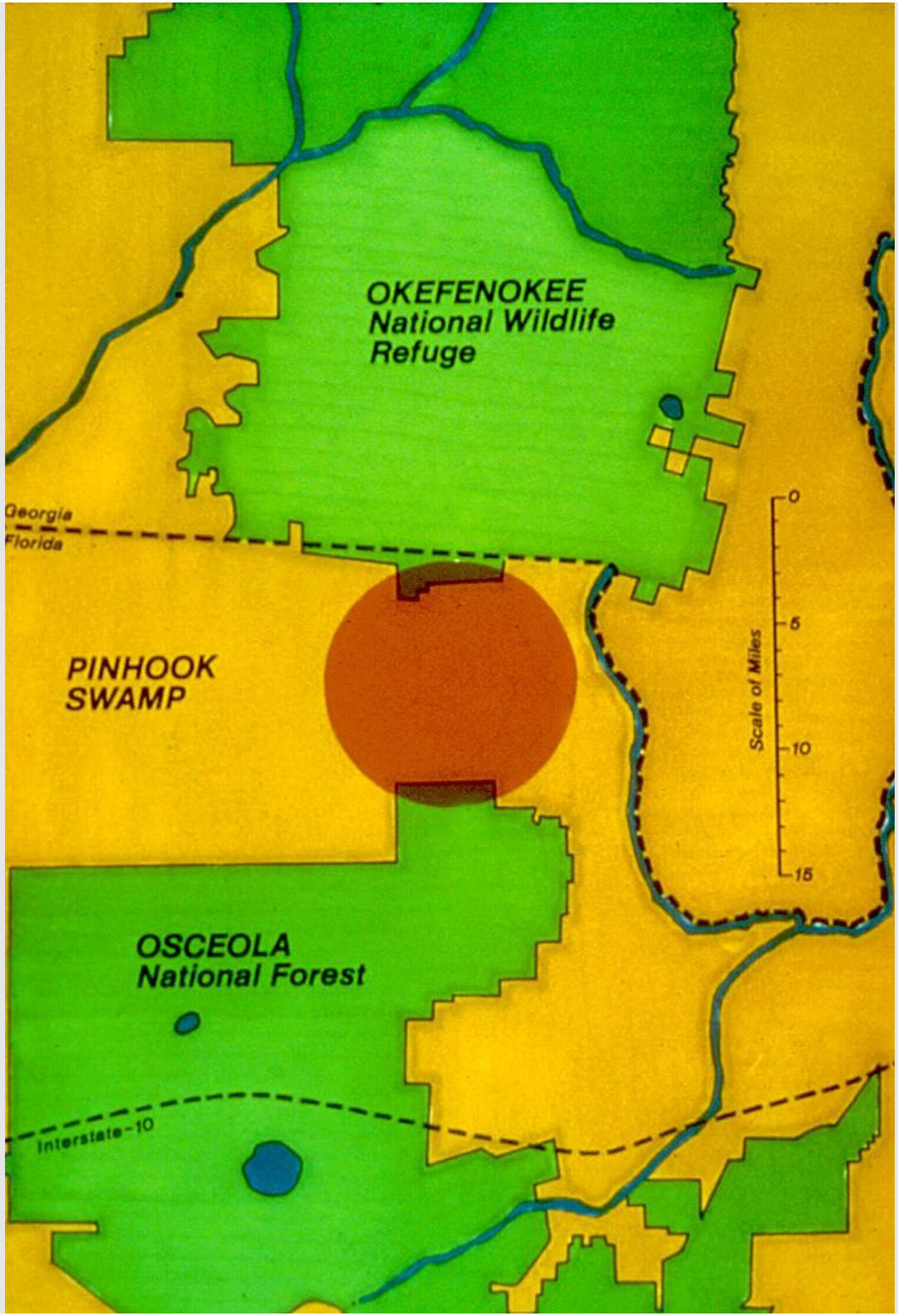


From: Noss (1992)


The design that got me laughed out of Ohio
Existing "Preserves"
Proposed Preserves
Buffer Area
Hocking SF
Tar Hollow SF
Wayne NF
Wayne NF
Wayne NF
Lake Katharine SNP
Edge of Appalachia
Shawnee SF
Landforms of
Ohio
by
James A. Bier
Department of Geography
University of Illinois
1:1,000,000
miles
published by the

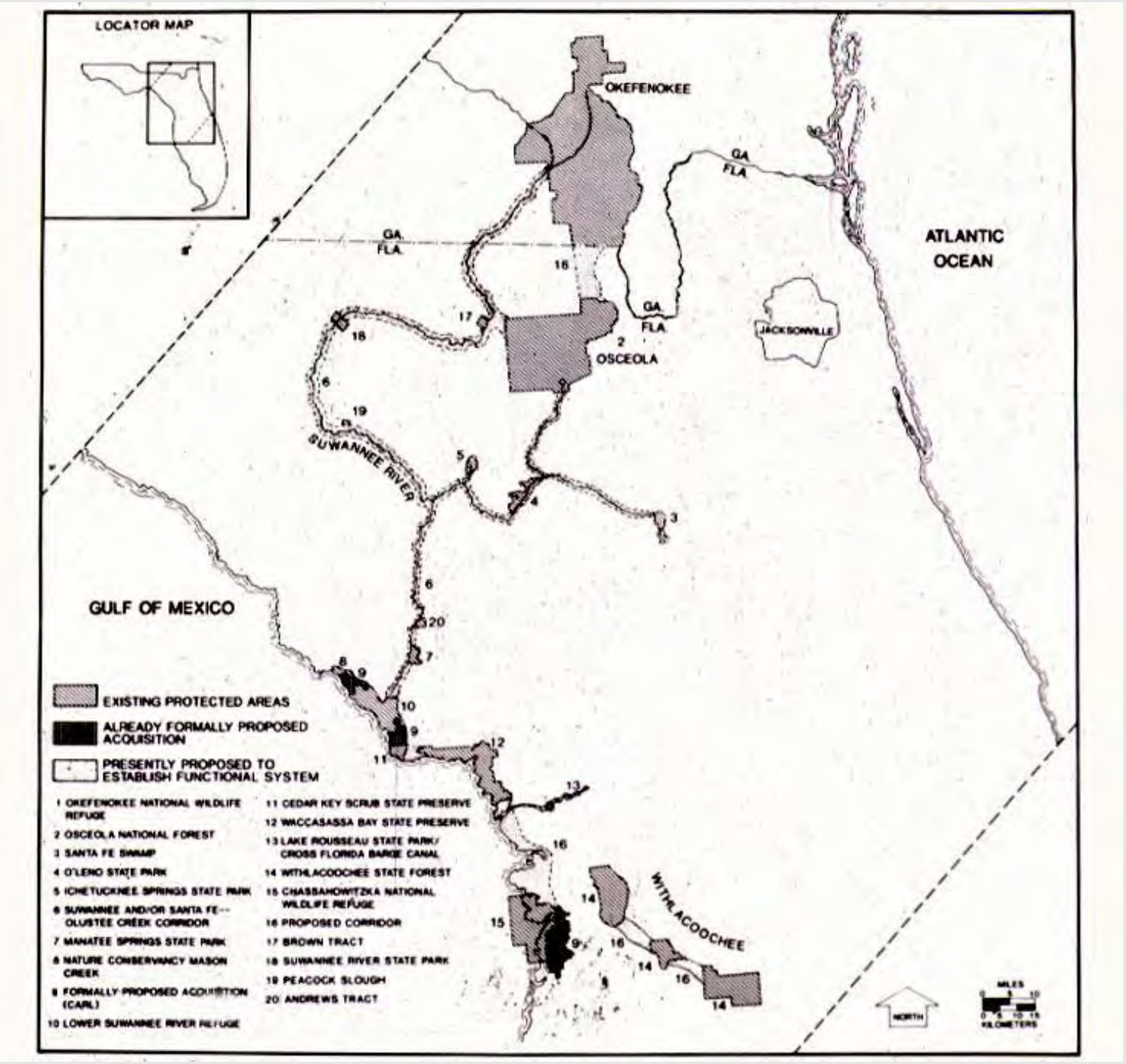
Evolution of the Florida Wildlife Corridor

- Goal was what we now call "**rewilding**"
- Emphasis on the "3 Cs": Cores, Corridors, and Carnivores (Soulé and Noss 1998, *Wild Earth*)
- Main focal species were **Florida panther** and **Florida black bear**, with the goal of recovering their populations across Florida and beyond



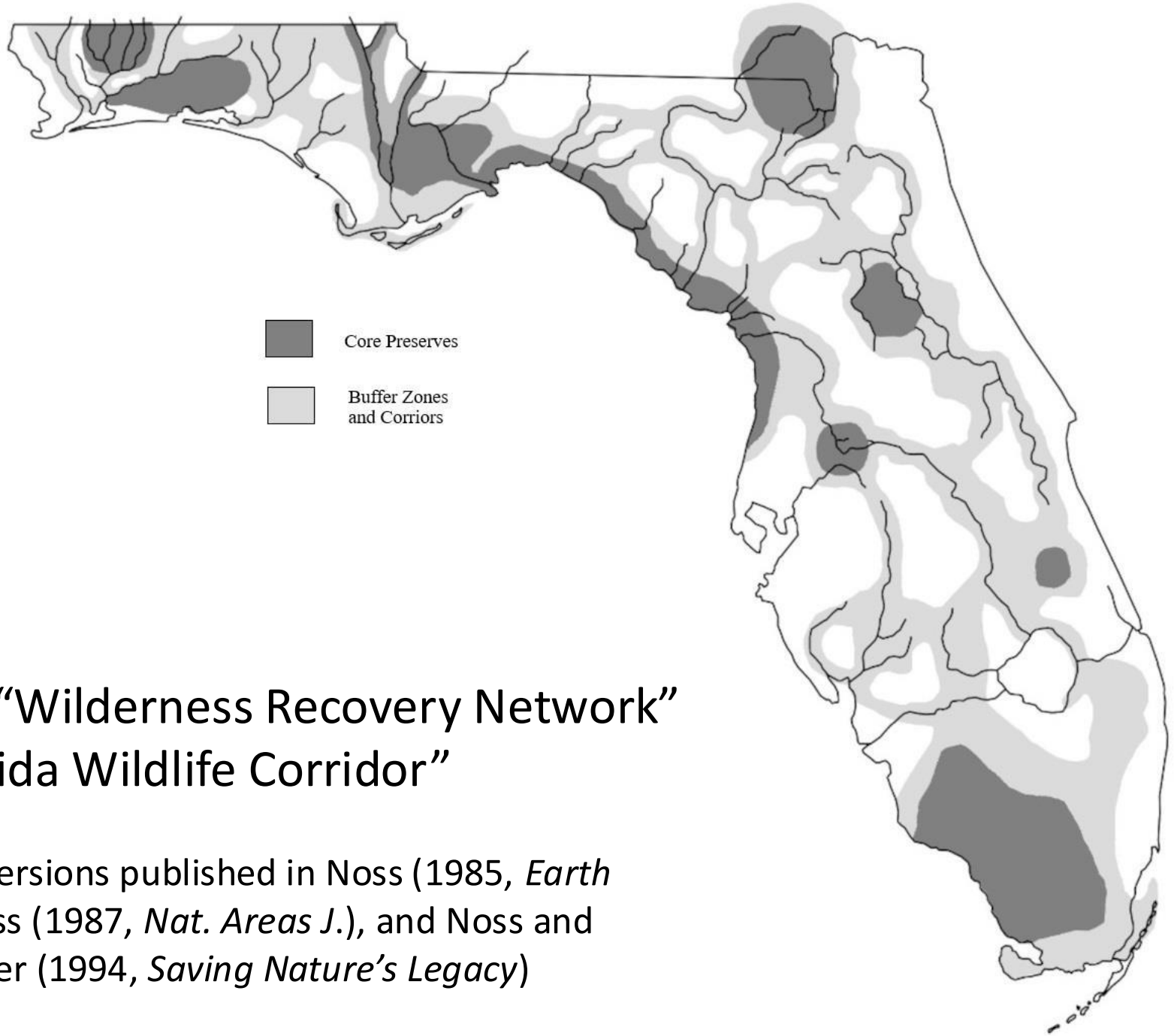
One of Larry Harris's proposed linkages in Florida, early 1980s

The Pinhook Swamp linkage is now mostly protected



Suwannee Network (from Noss and Harris 1986)

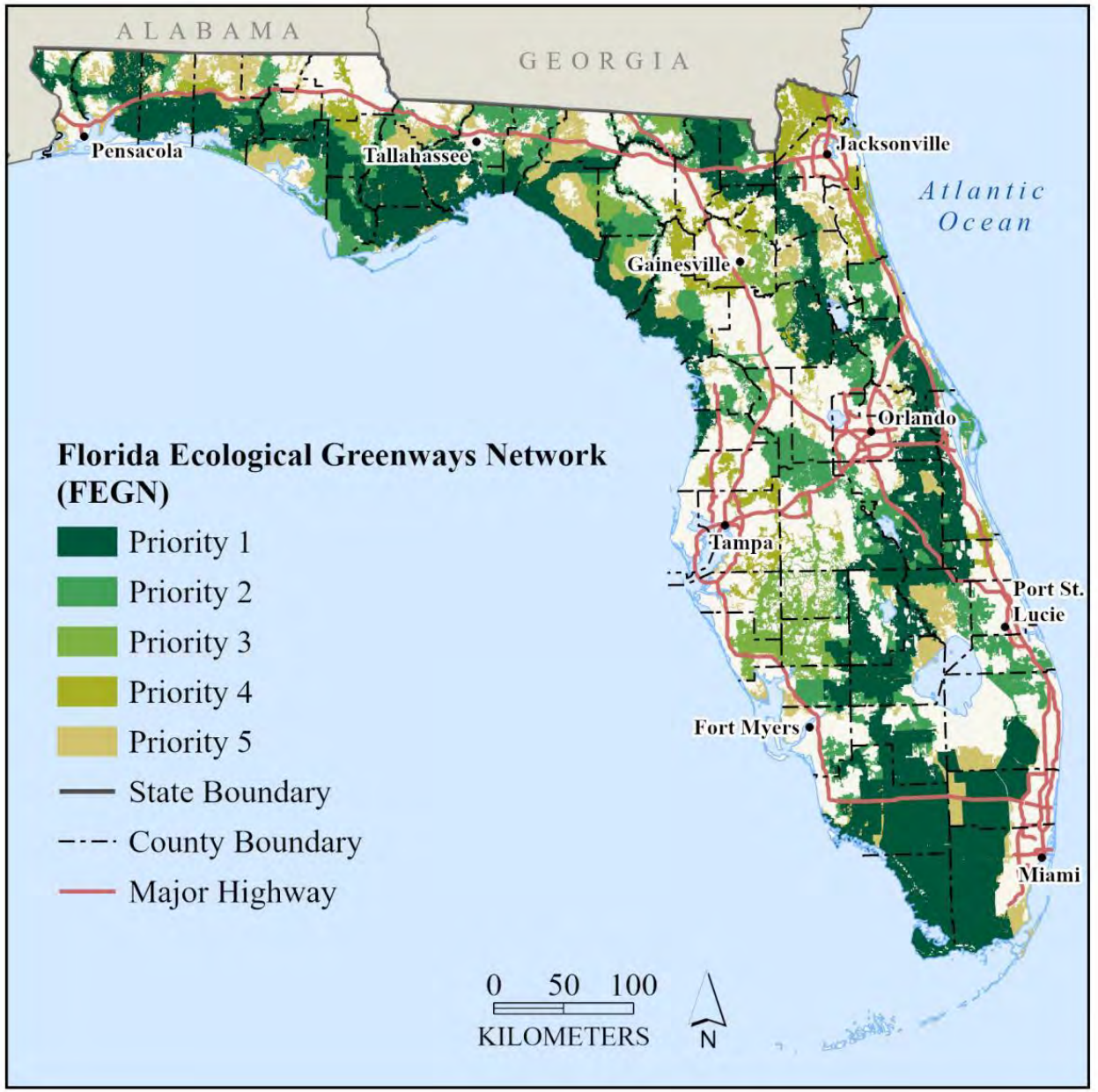
Used the Suwannee River and its tributaries to connect the Okefenokee/Pinhook/ Osceola complex to conservation areas along the Gulf Coast



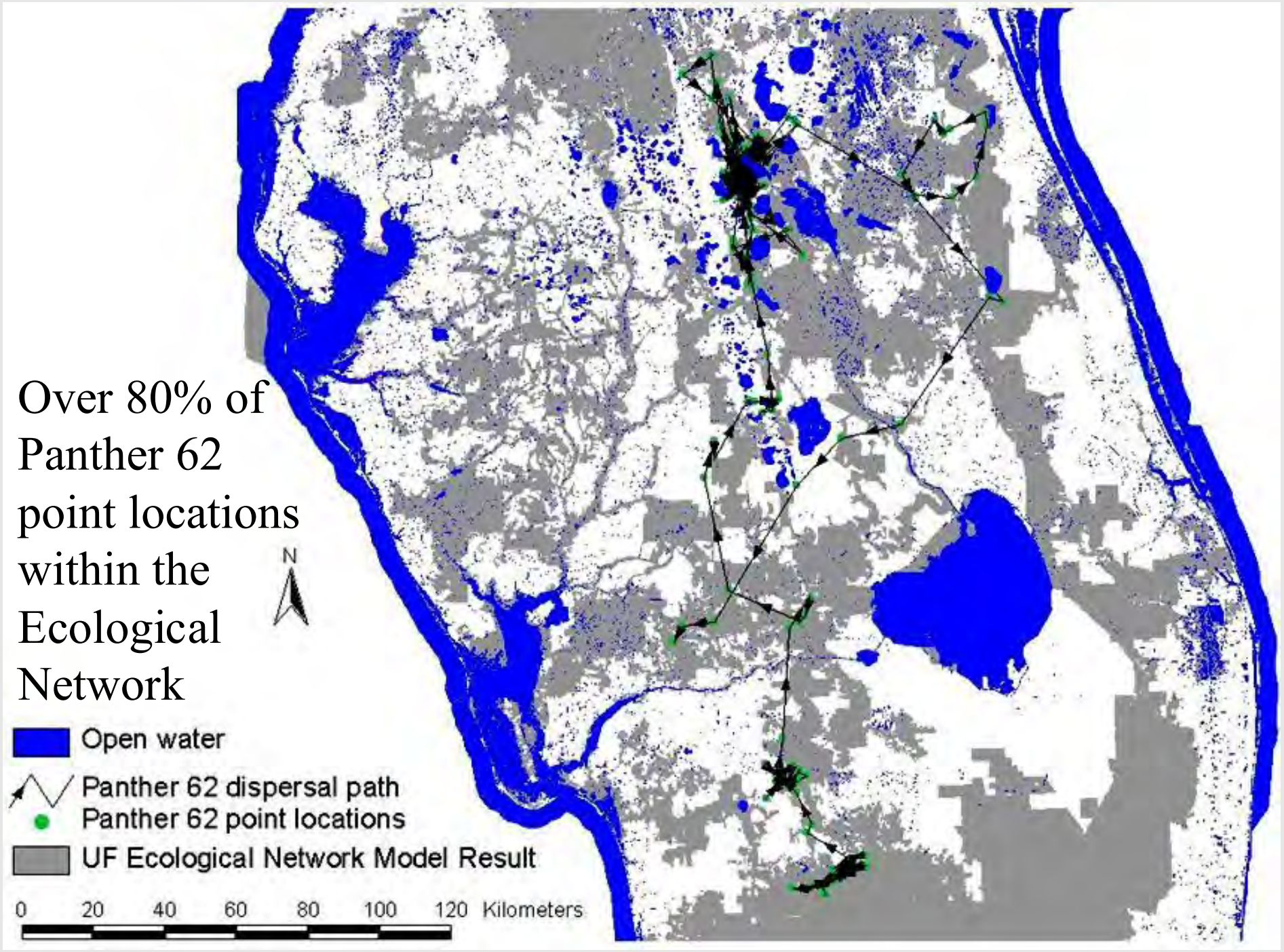
Florida “Wilderness Recovery Network” or “Florida Wildlife Corridor”

Previous versions published in Noss (1985, *Earth First!*), Noss (1987, *Nat. Areas J.*), and Noss and Cooperrider (1994, *Saving Nature’s Legacy*)

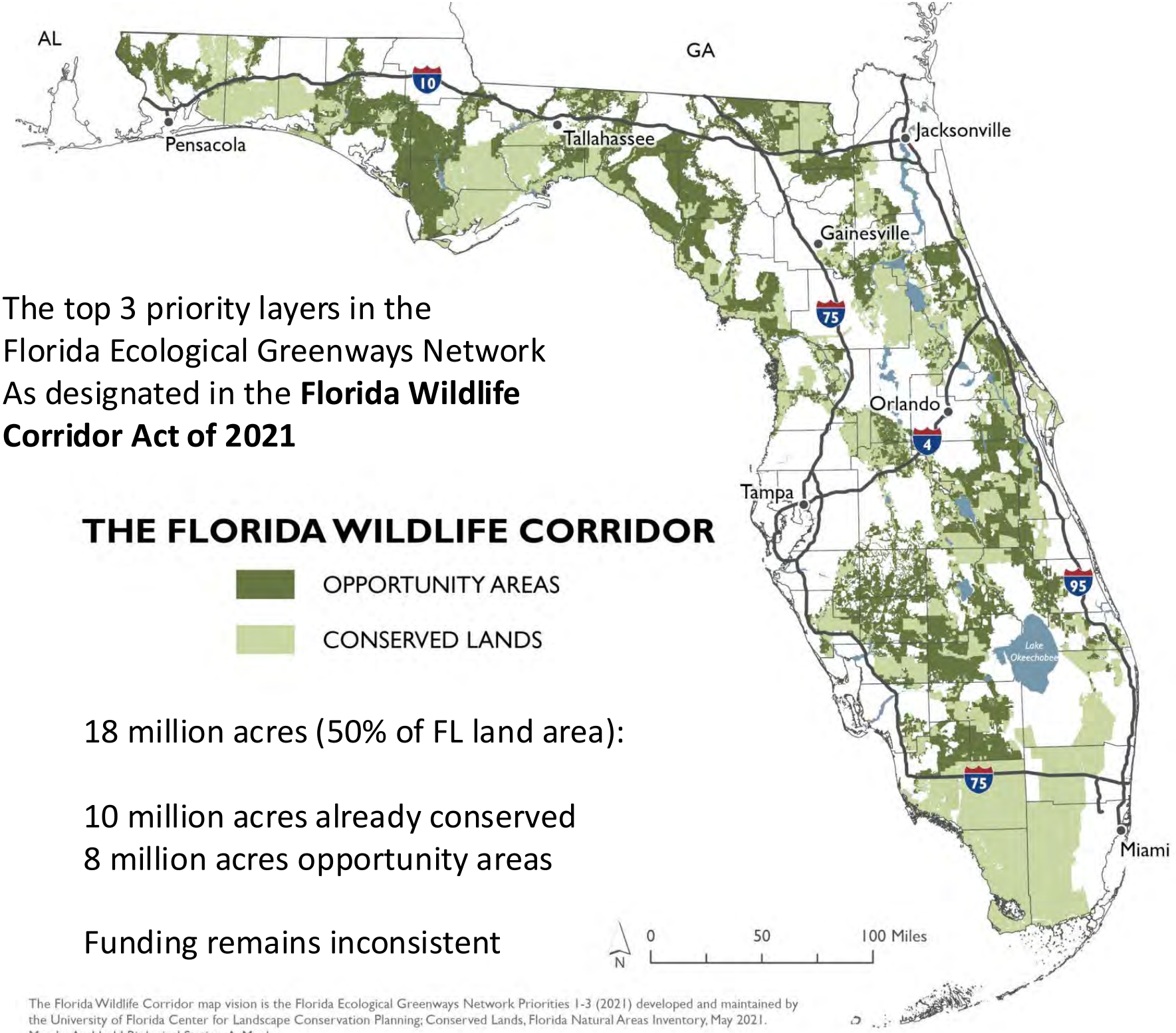
The vision of a connected statewide network of conservation areas and corridors was forgotten for a decade until Tom Hoctor and colleagues developed the Florida Ecological Greenways Network in the late 1990s.



Panther 62 Movements and the Ecological Network



The top 3 priority layers in the
Florida Ecological Greenways Network
As designated in the **Florida Wildlife Corridor Act of 2021**

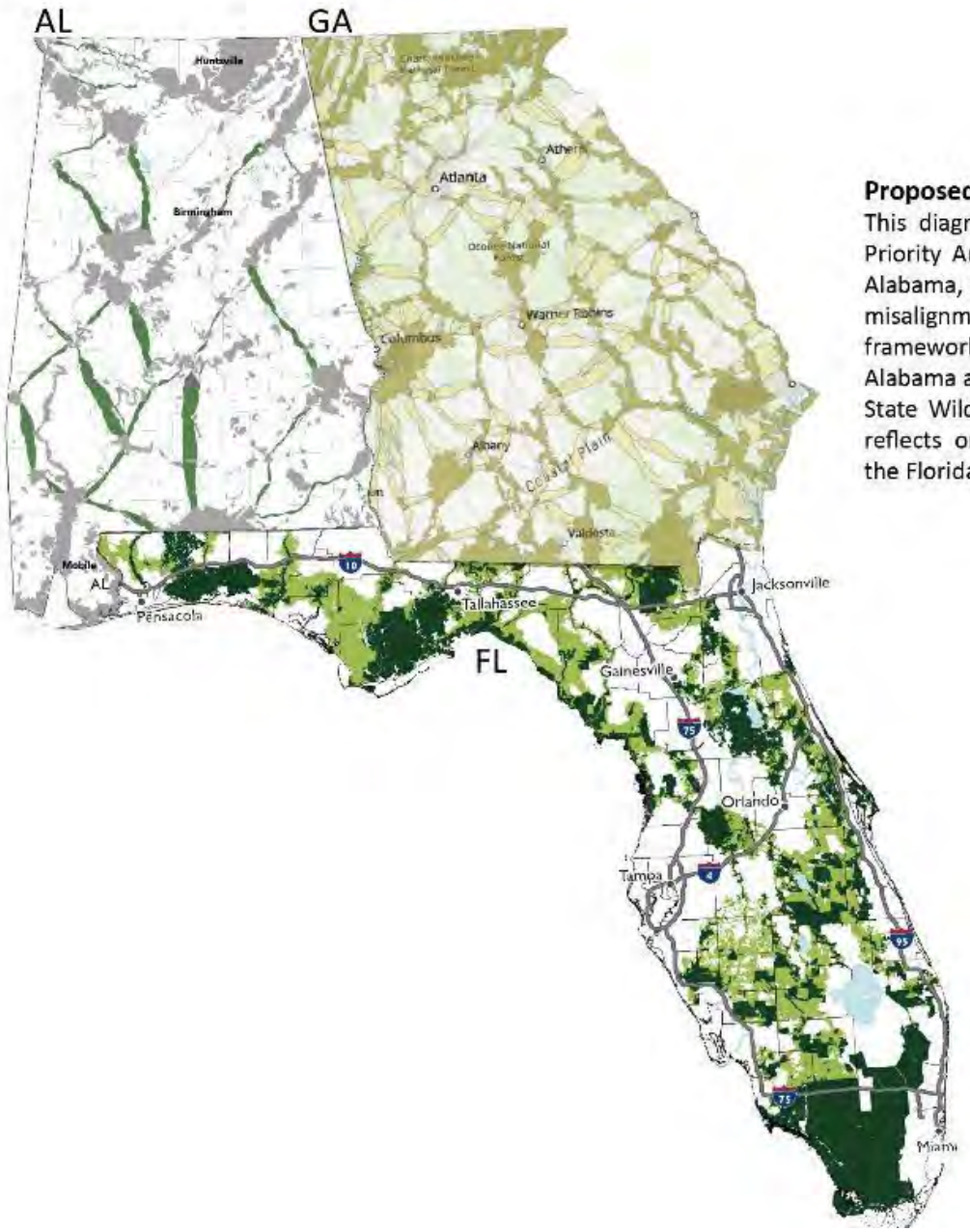


18 million acres (50% of FL land area):

10 million acres already conserved
8 million acres opportunity areas

Funding remains inconsistent

Improving connectivity across political borders…



Proposed Tri-State Project Area

This diagram illustrates the current Conservation Priority Areas (CPAs) and wildlife corridors across Alabama, Florida, and Georgia, highlighting areas of misalignment between state-level conservation frameworks. The CPAs and corridor data for Alabama and Georgia were derived from their 2025 State Wildlife Action Plan revisions. Florida's data reflects ongoing planning efforts associated with the Florida Wildlife Corridor.

Yellowstone to Yukon (Y2Y)

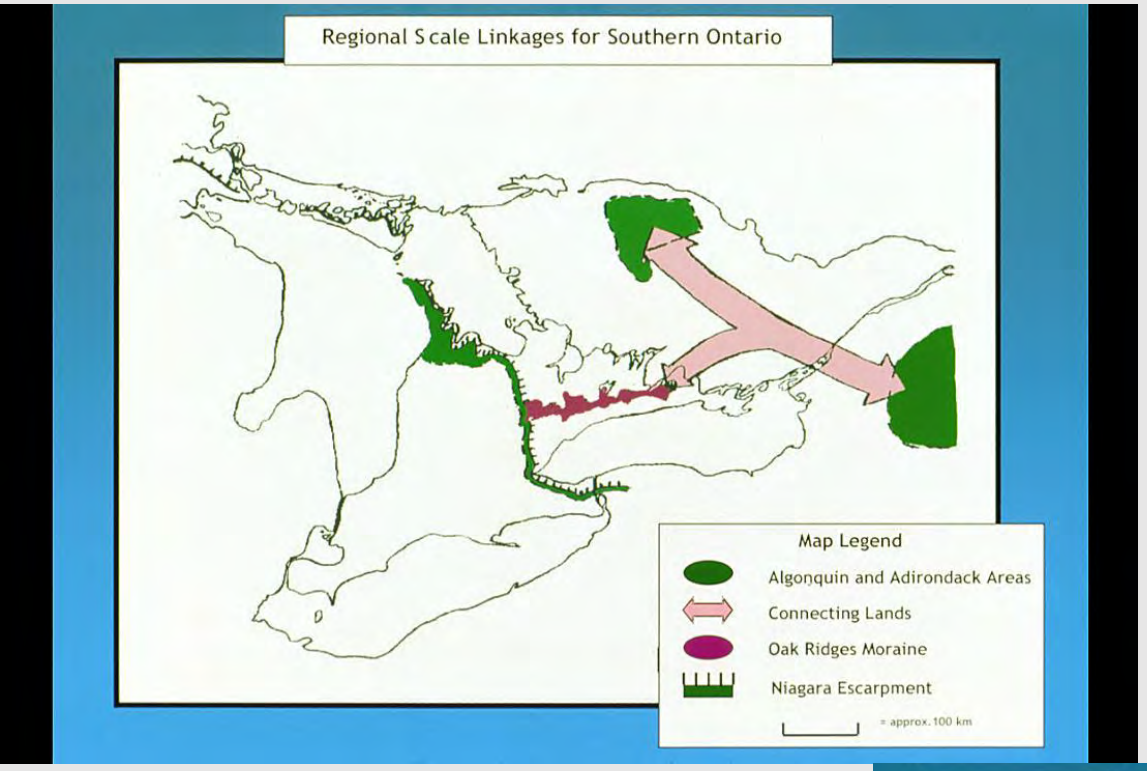
California Essential Habitat Connectivity Project

(Spencer et al. 2010)

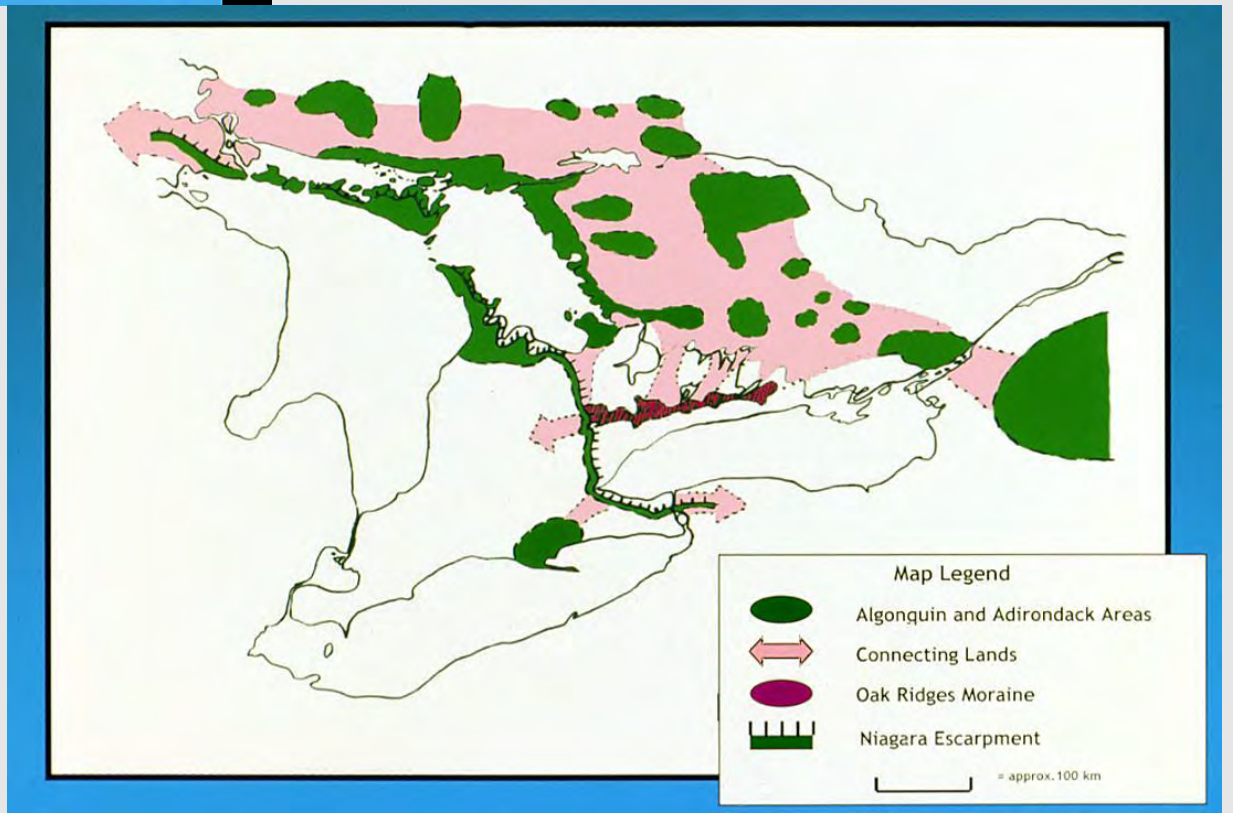
California Dept. of Transportation

California Dept. of Fish and Game

Federal Highways Administration

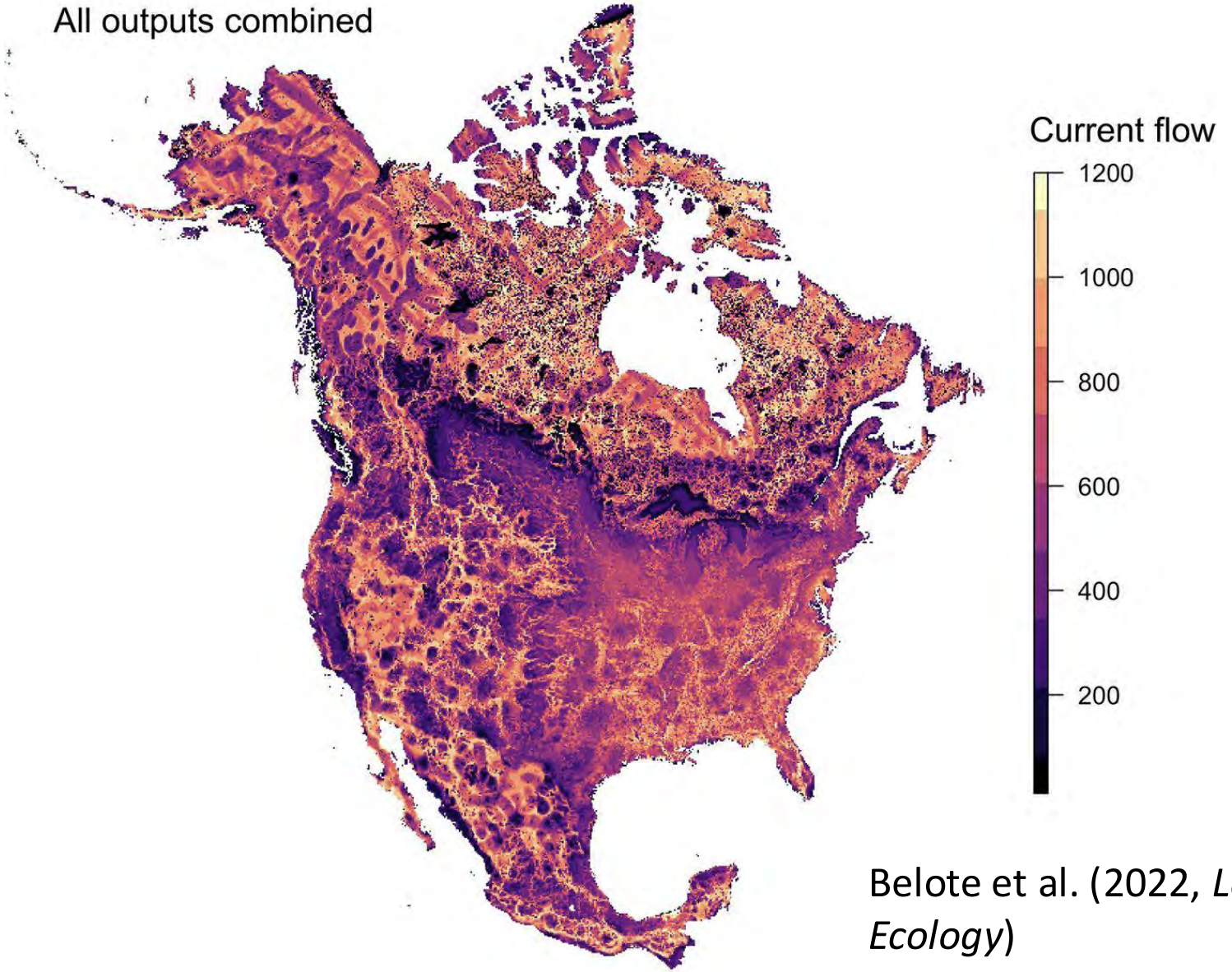


Ontario and New York: Algonquin to Adirondacks (A2A)



In October 2024, New England Governors and Eastern Canadian Premiers (NEG-ECP) adopted a new resolution reaffirming their commitment to collaborate across borders on ecological connectivity, adaptation to climate change, and biodiversity conservation – the Staying Connected Initiative (SCI), a transboundary, public-private partnership with TNC New York the lead convener.

”Species agnostic” connectivity across North America based on landscape resistance modeled at several spatial scales. Animals are assumed to avoid areas with high human modification.



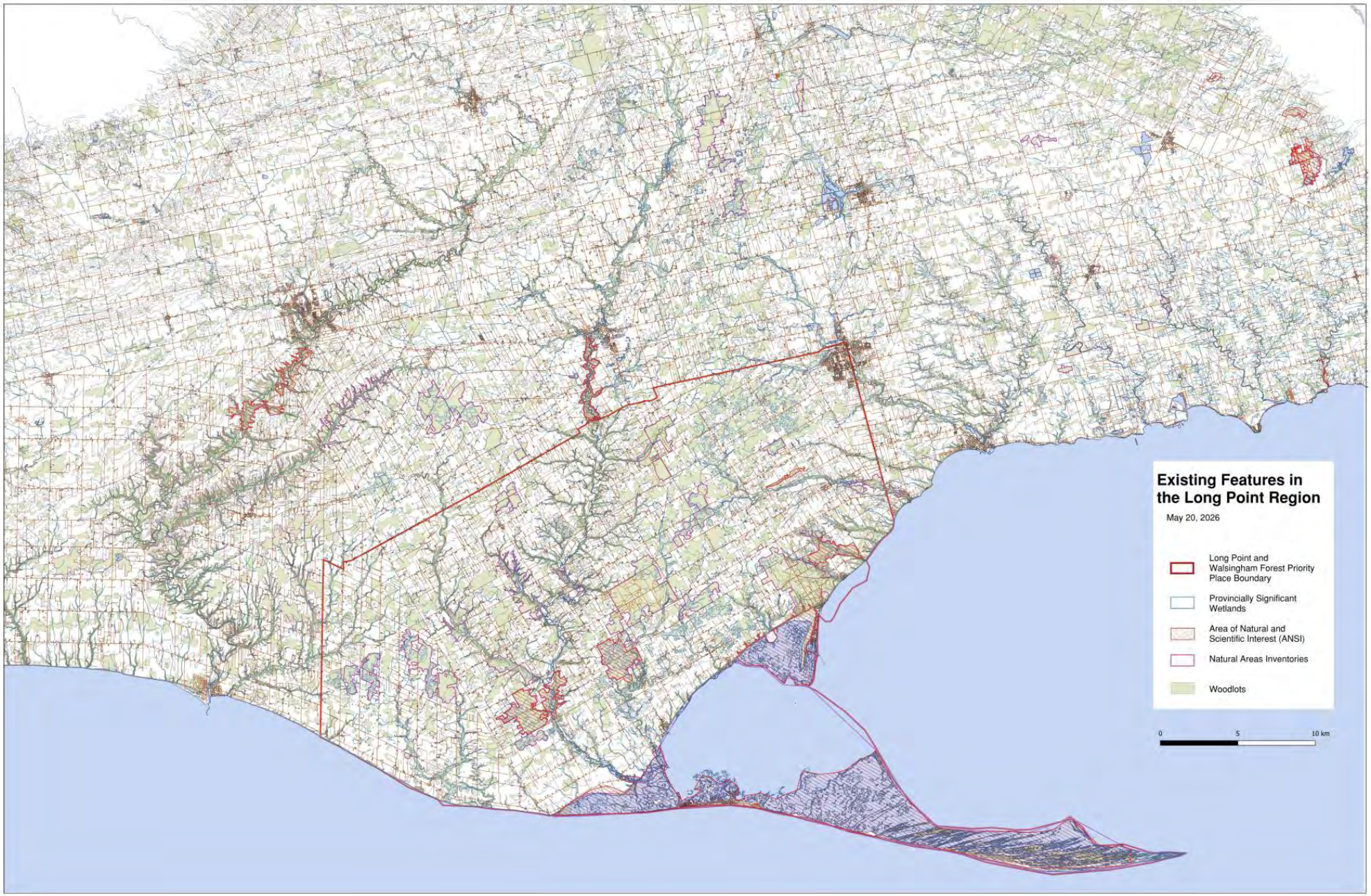
Belote et al. (2022, *Landscape Ecology*)

Four Nested Study Regions for Landscape Conservation Planning

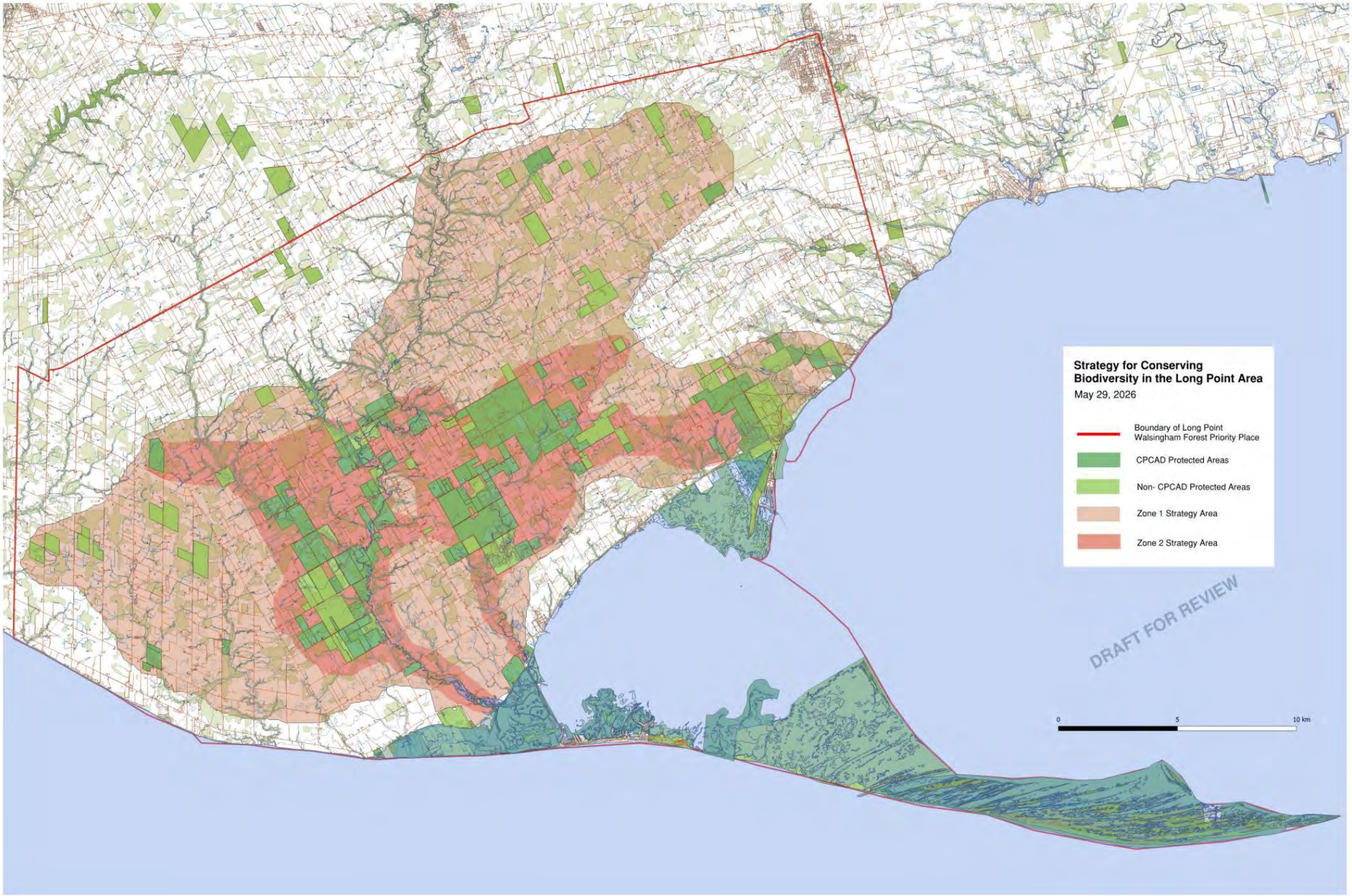
- Long Point Focal Area
- Lake Erie Basin
- Southern Great Lakes (Forest) Ecoregion
- Great Lakes Basin

Different planning objectives and questions often require different spatial scales and planning regions.

Fine Scale: Long Point Focal Area

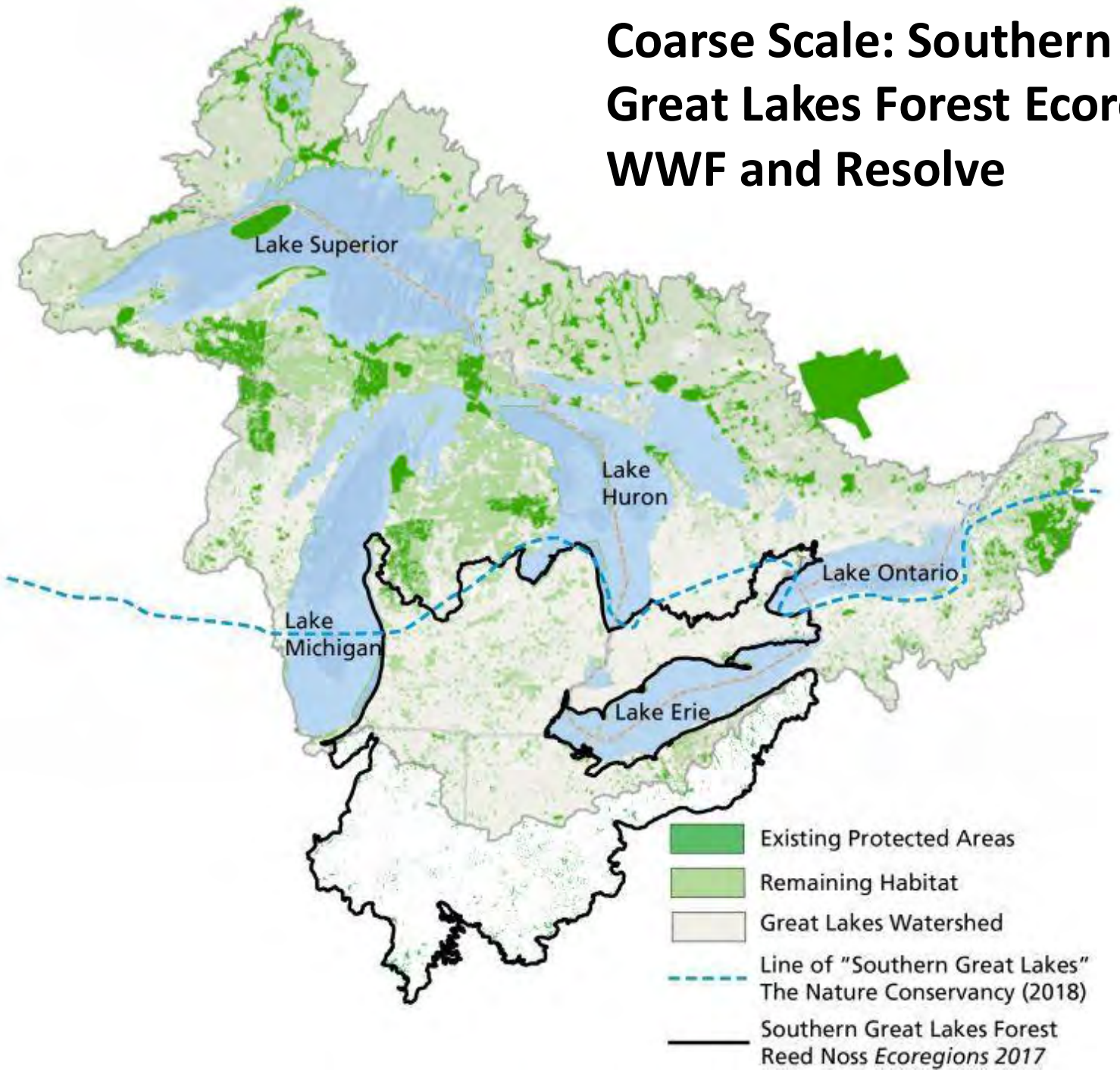


Fine Scale: Long Point Focal Area

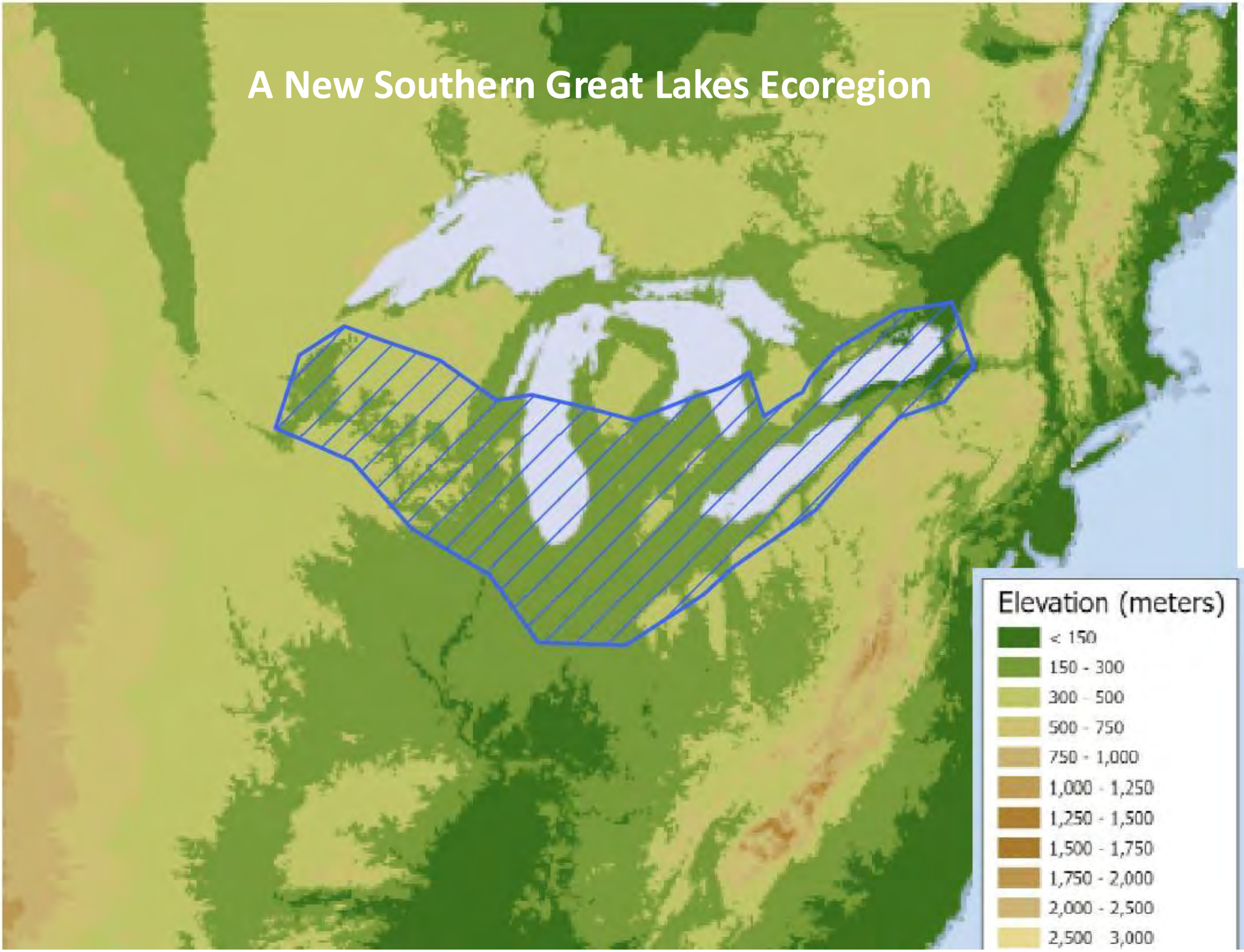


Intermediate Scale: Lake Erie Basin (Watershed)

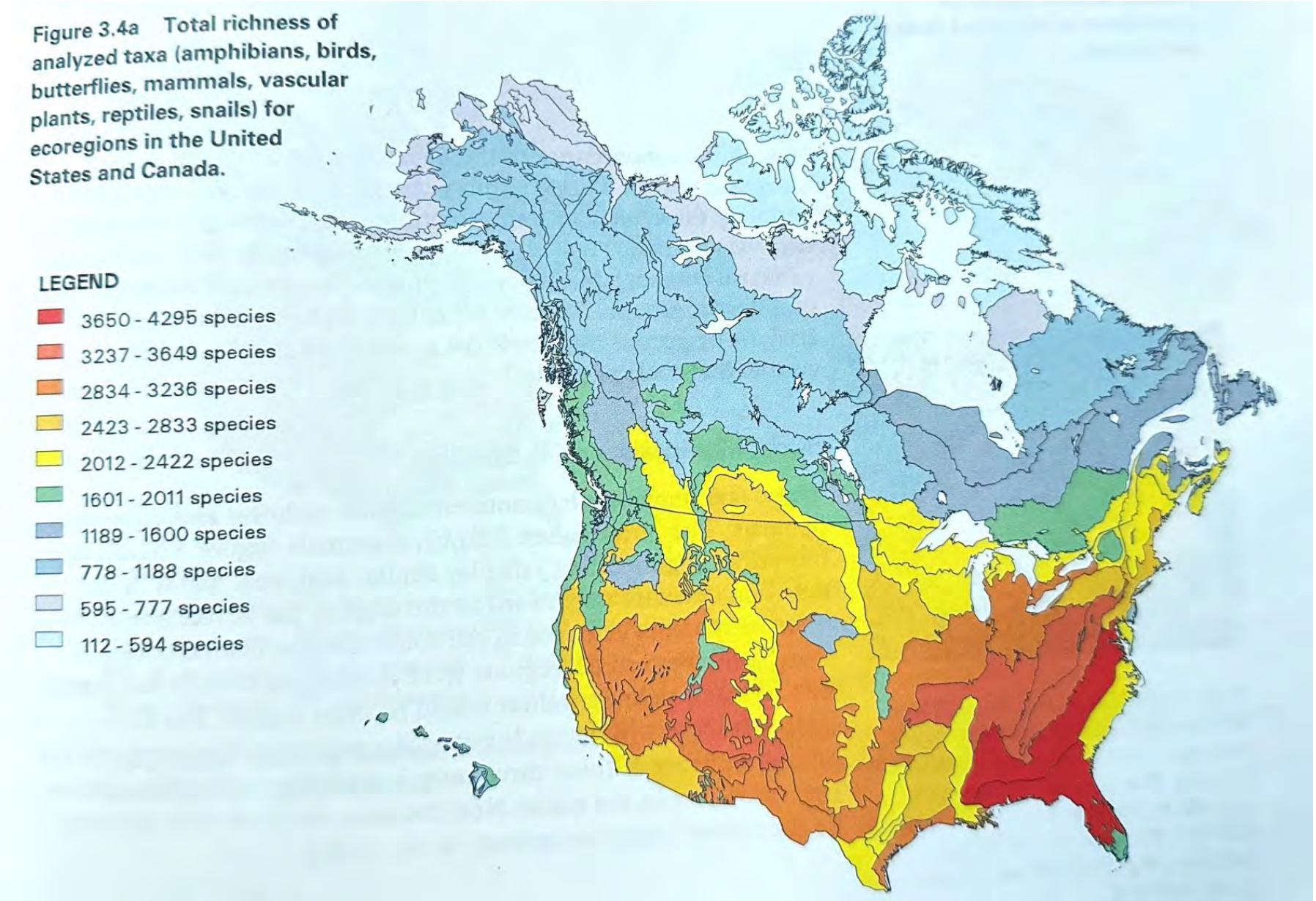
Coarse Scale: Southern Great Lakes Forest Ecoregion WWF and Resolve



A New Southern Great Lakes Ecoregion



The Southern Great Lakes (Forest) Ecoregion Has Relatively High Species Richness and the Highest in Canada



From: Ricketts et al. (1999, *Terrestrial Ecoregions of North America*)

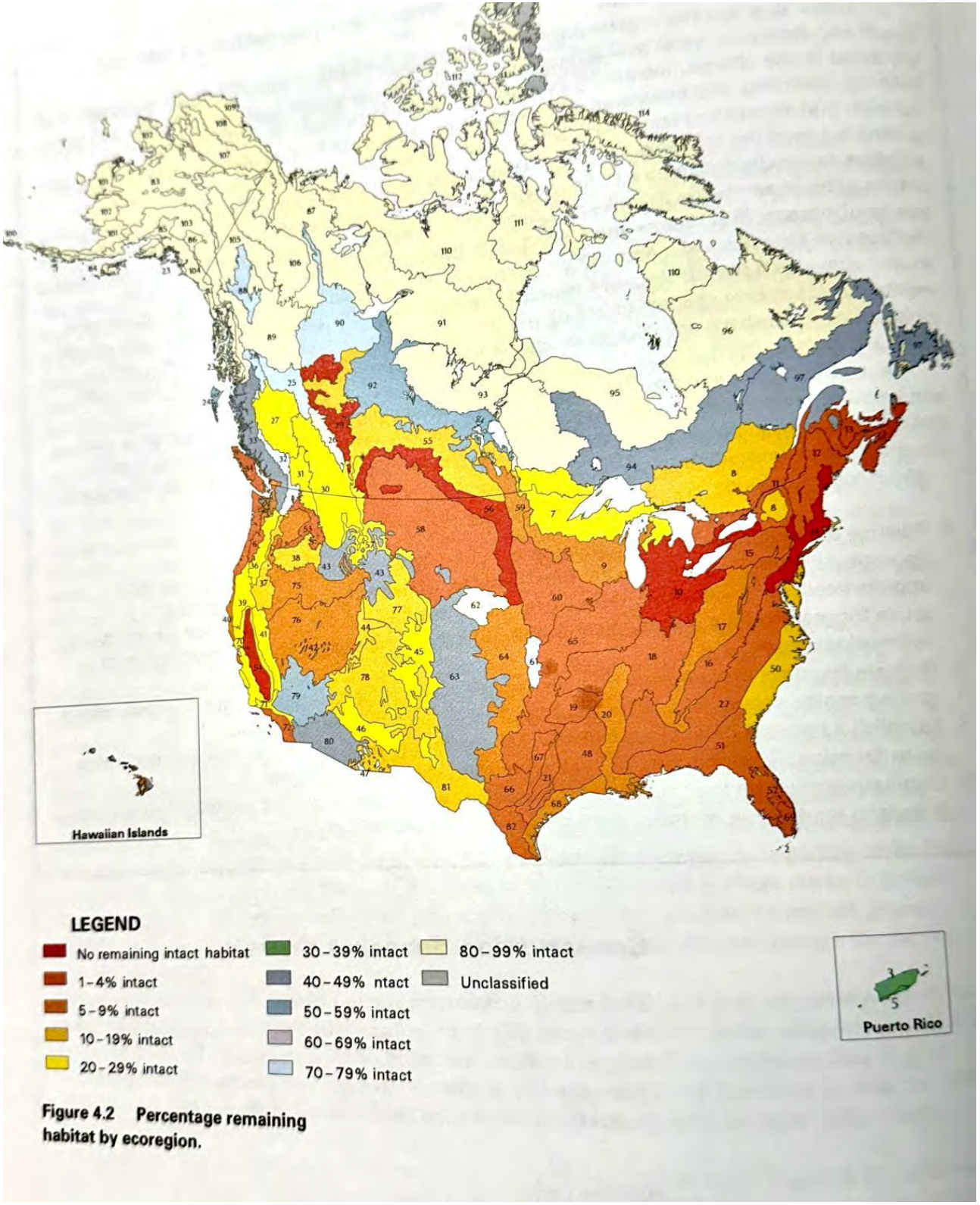


Figure 4.2 Percentage remaining habitat by ecoregion.

The Southern Great Lakes is in the highest category of habitat loss (**Critical**) among all North American ecoregions… "no remaining intact habitat"

Ricketts et al. (1999)

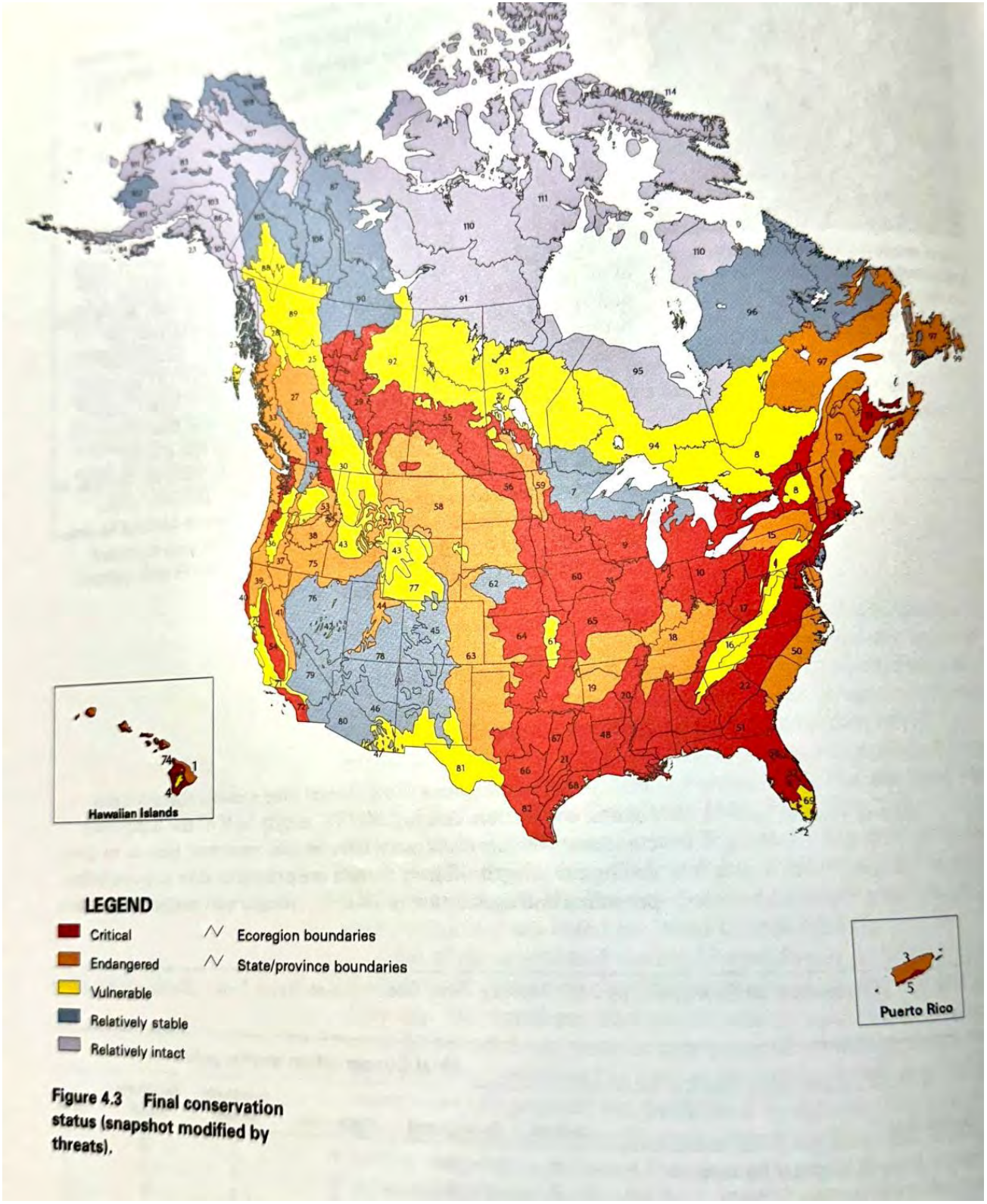


Figure 4.3 Final conservation status (snapshot modified by threats).

The Southern Great Lakes is in the most urgent conservation status category – **Critical** – considering current condition plus near-term threats

Ricketts et al. (1999)

The Southern Great Lakes Ecoregion is one of the least intact and most highly converted ecoregions in North America

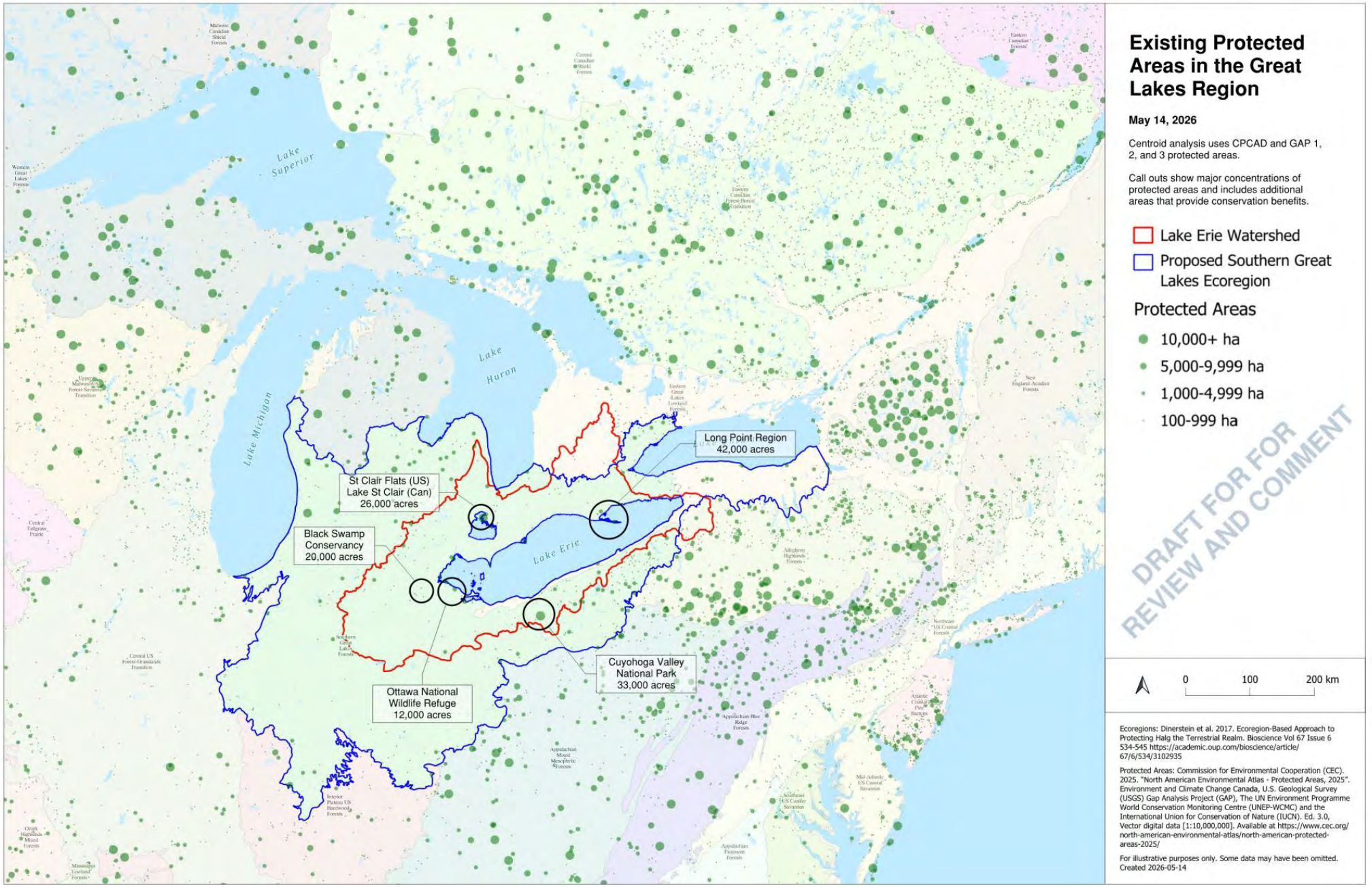
- < 10% original habitat remaining
- Only 1-2% protected/conserved (more on U.S. side)
- Ignored in most conservation planning efforts (spans 2 countries)
- **Yet has outstanding ecological values:**

  - Lake Erie is the shallowest and by far the most productive of the Great Lakes

  - Southern Ontario has the highest concentration of biodiversity in Canada

  - At least 230 terrestrial and freshwater species have their centers of distribution in this region, with many restricted to the Southern Great Lakes

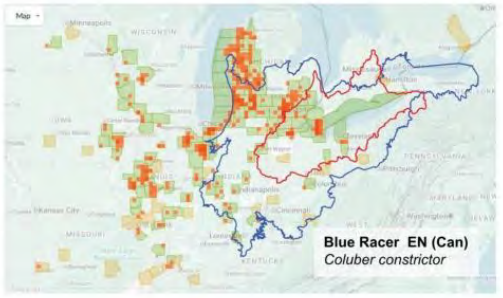
Deficiency of conservation areas in Southern Great Lakes

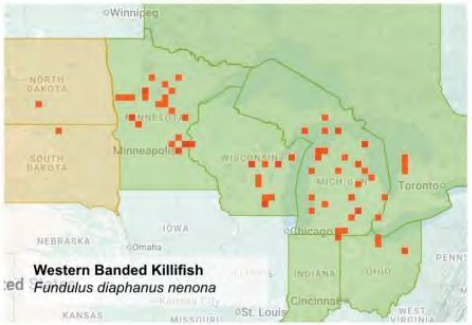


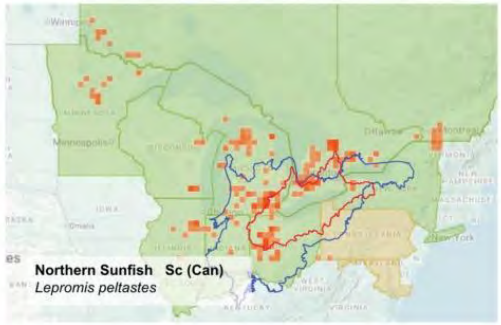
Many rare small-range species are not adequately protected:

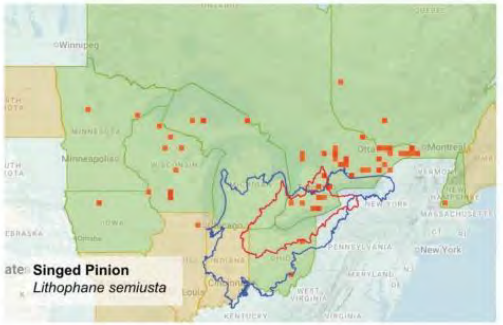
- American Badger (ssp *jacksoni*)
- Henslow's Sparrow,
  Loggerhead Shrike (ssp *migrans*)
- Eastern Foxsnake, Blue Racer,
  Blanding's Turtle
- Eastern Sand Darter, Northern Sunfish, Northern Brook Lamprey, Western Banded Killifish
- Eastern Pondmussel, Elktoe, Banded Globe
- Karner Blue Butterfly, Hoosier Locust, Hine's Emerald, Davis' Shield-bearer
- Big Water Crayfish
- White Lady's Slipper, Yellow Gentian, Soapwort Gentian, Blue Ash, Murray Birch, Hairy Puccoon, Rayed Bean, Prairie Tick-trefoil, Pitcher's Thistle, Hoosier Locust, Kalm's St. John's-wort, Lakeside Daisy
- Etc.

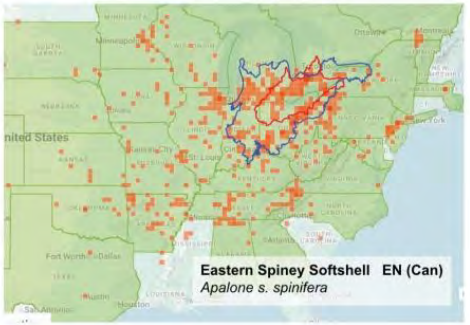
Many restricted-range species have high proportions of their ranges within the Southern Great Lakes Region

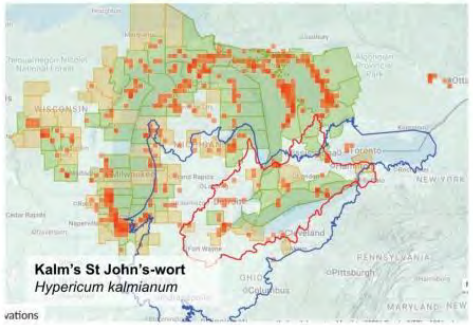


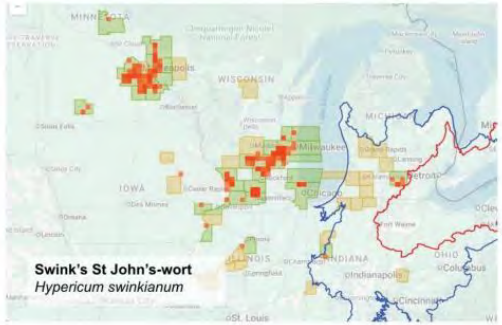


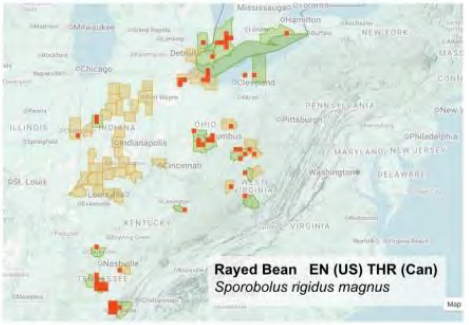


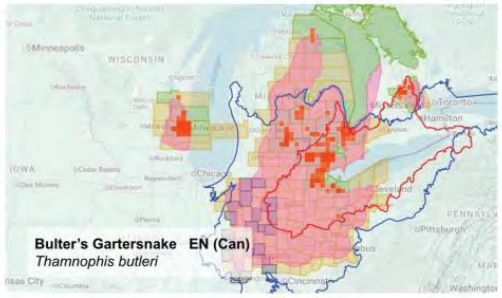


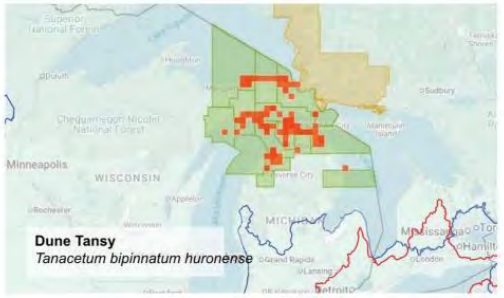












Selected Restricted Range Species in the Southern Great Lakes Region

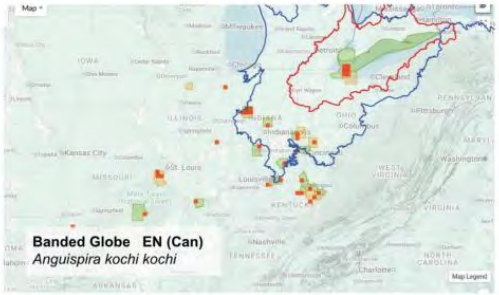
Southern Great Lakes Ecoregion (Revised)

Lake Erie Watershed

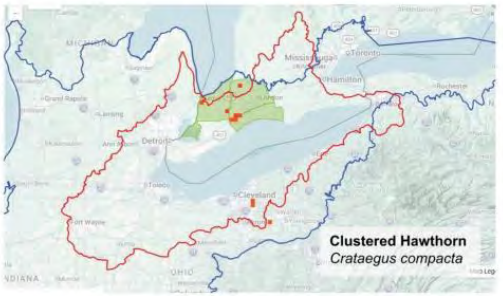
Maps adapted from iNaturalist

June 1, 2026

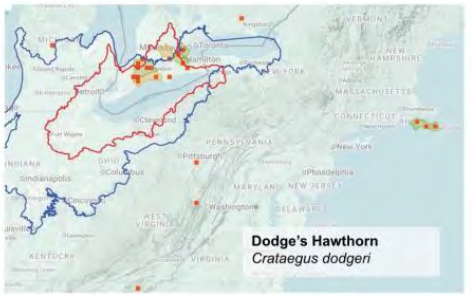
Moth sp.
Agonopterix pteleae



Banded Globe EN (Can)
Anguispira kochi kochi



Clustered Hawthorn
Crataegus compacta



Dodge's Hawthorn
Crataegus dodgeri

Jesup's Hawthorn
Crataegus jesupii

American Badger EN (Can)
Taidea taus jacksoni

Pennsylvania Hawthorn
Crataegus pennsylvanica

Rough Hawthorn
Crataegus scabrida

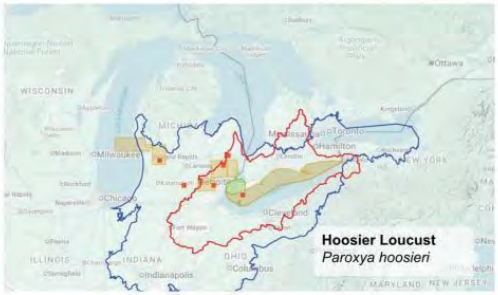
Caughnawaga Hawthorn
Crataegus suborbiculata

Fleshy Hawthorn
Crataegus succulenta

Persius Duskywing EN (Can)
Erynnis persius persius

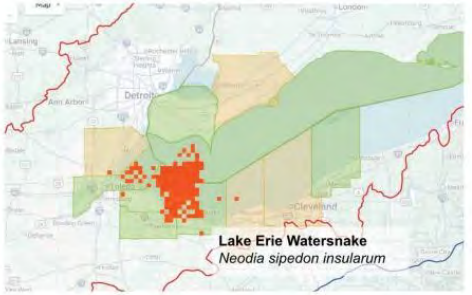
Murray's Birch
Betula X murrayana

Juniper Sedge
Carex juniperorum



Hoosier Loucust
Paroxya hoosieri

Kirtland's Snake
Chlonophis kirtlandii

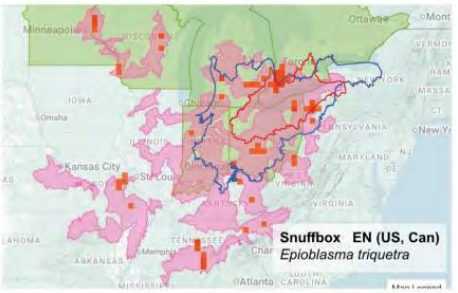


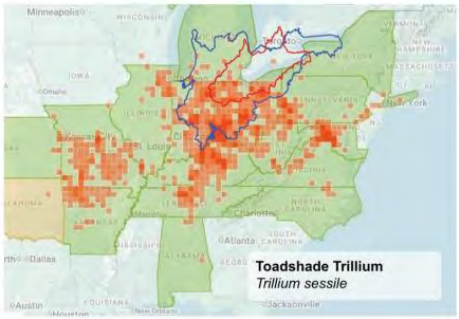
Lake Erie Watersnake
Neodia sipedon insularum

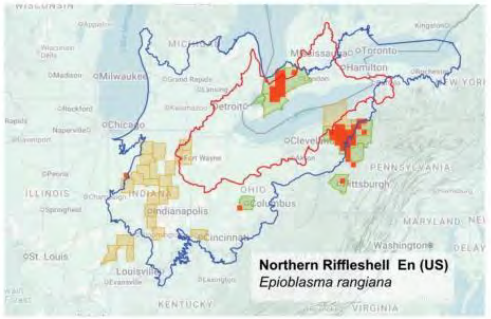

Northern Appressed Clubmoss
Lycopodiella margueritae

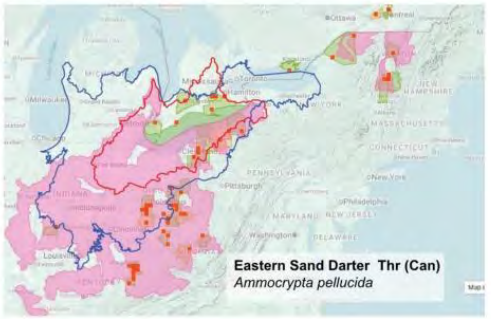

Ornamented Pea Clam
Pisidum cruciatum

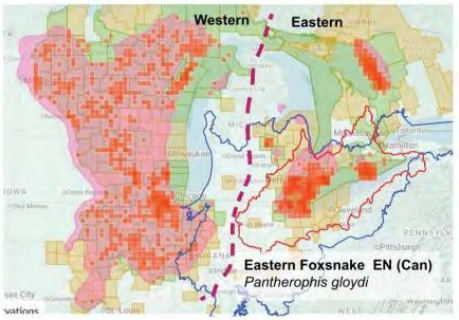

Rayed Bean EN (US)
Paetulunio villosa fabalis


Snuffbox EN (US, Can)
Epioblasma triquetra


Toadshade Trillium
Trillium sessile


Northern Rifflesheil En (US)
Epioblasma rangiana

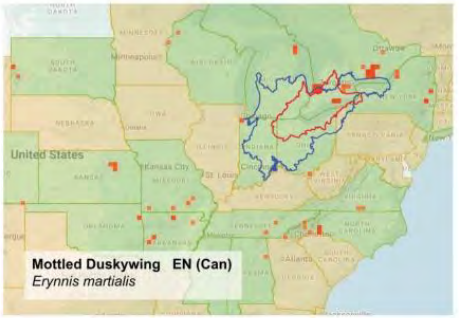

Eastern Sand Darter Thr (Can)
Ammocrypta pellucida


Western
Eastern
Eastern Foxsnake EN (Can)
Pantherophis gloydi


Hairy Valerian
Valeriana edulis var. ciliata

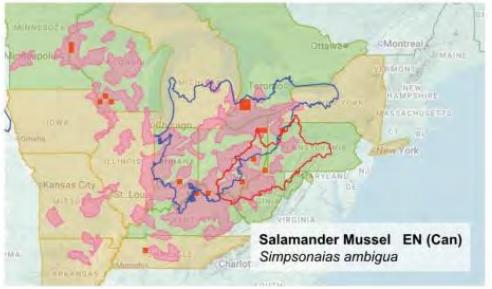

Indian Wild Rice
Zizania aquatica var. aquatica


Newmon's Brocade
Meropleon ambifusca


Mottled Duskywing EN (Can)
Erynnis martialis


Blazing Star Borer
Papaipema beeriana


Golden Borer
Papaipema cerina


Salamander Mussel EN (Can)
Simpsonaias ambigua


Great Lake Sandreed
Sporobolus rigidus magnus

Great Lakes Basin

Ecological Restoration and Rewilding

With such vast loss of native vegetation and wildlife, regaining ecological integrity in the Southern Great Lakes will require extensive ecological restoration and rewilding (including species reintroductions) over large areas

American Badger (*Taxidea taxus jacksoni*)

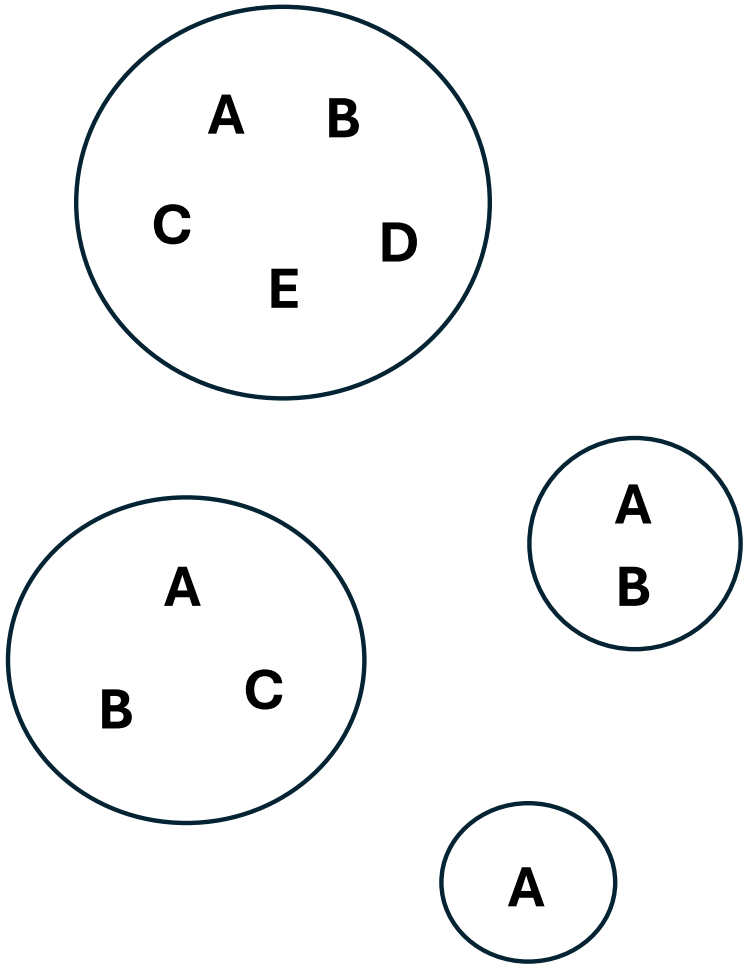
Fisher (*Pekania pennanti*)

Eastern Foxsnake (*Pantherophis vulpinus*)

But Big, Connected Reserves Are Not Enough!

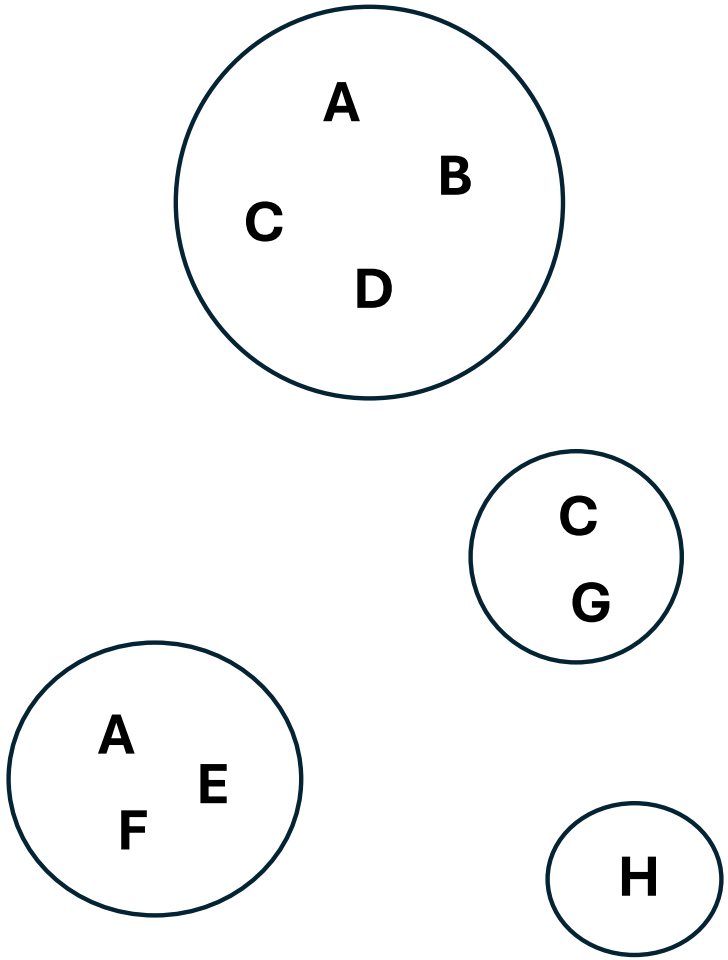
Beta Diversity Patterns: Nestedness vs. Turnover

Nestedness: typical for vertebrates



Small reserves hold subsets of species found in larger reserves

Turnover: typical for plants



Small reserves hold species not found in larger reserves

Top-Down and Bottom-Up