Successful Solutions to Global Biodiversity Data Digitization, Validation, Update, Integration, Access, and Application

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J. Hill and C. Wilson - WDCBE

CODATA 2006; Beijing, China

Considerations for focus of a World Data Center for Biodiversity and Ecology (WDCBE)

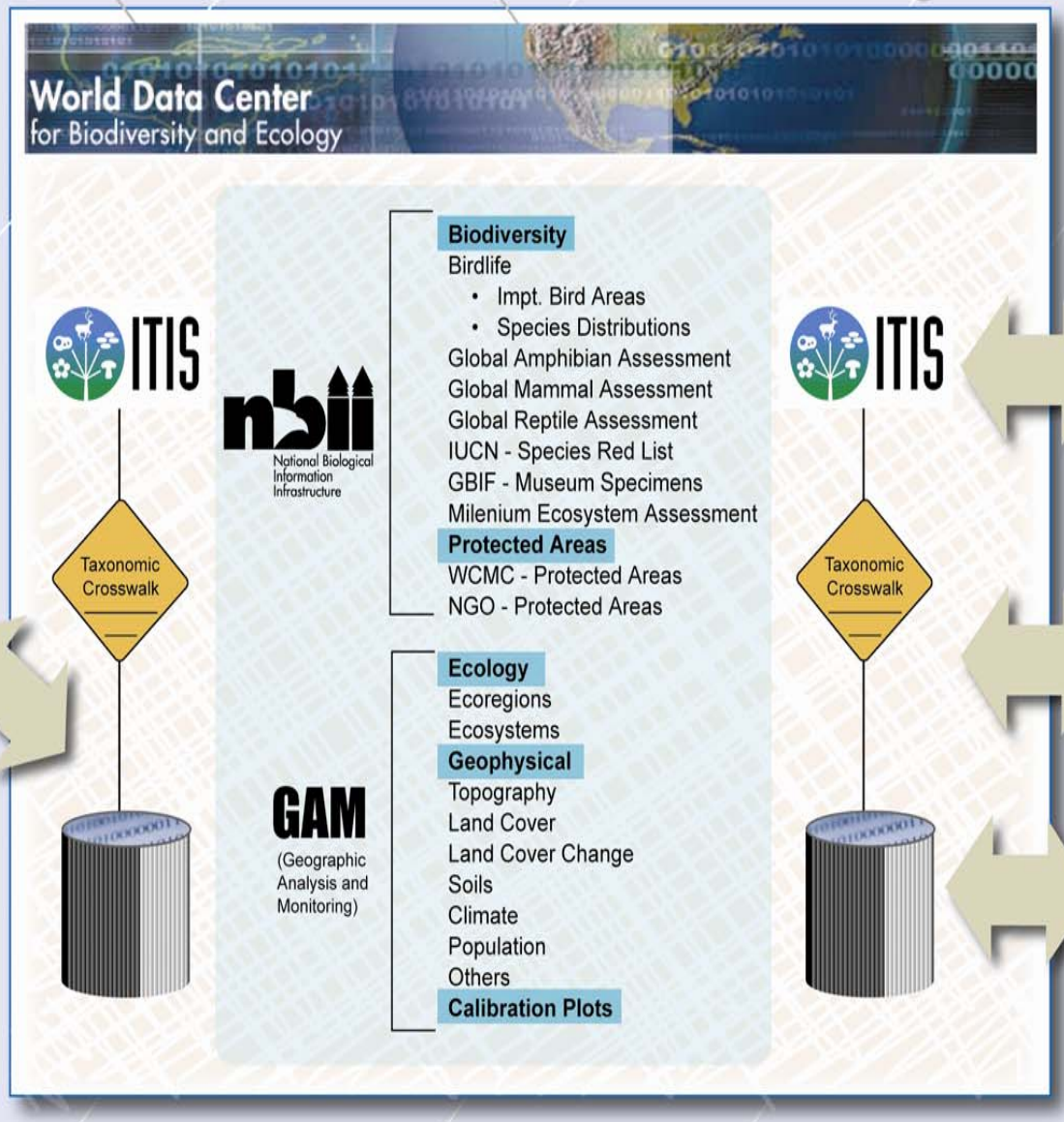
- Global Biodiversity and Ecology Initiatives
- Global Taxonomic and Genetic Initiatives
- International Non-Governmental Organizations
- International Quasi Governmental Organizations
- Global Species (Taxa) Assessments
- Global Biodiversity and Ecological Status and Trends Assessments
- Regional Biodiversity Networks
- National Biological Networks
- Today's Pressing Biodiversity and Ecological Issues
- Data Requirements, Applications, and Access

Data Needs

- Creation of a taxonomic authority for species names
- Acquisition and digitization of priority museum specimens and other biodiversity and ecological data
- Integration with relevant geospatial data
- Properly formatted data for modeling, analysis, and presentation
- Web-enabled data and results

GITAN

Global Integrated Trends Analysis Network



NGO Partners

Global

Regions
IABIN
PBIF

Countries

Analyses

CBD

Global Ecosystem Mapping (Methodology & Data)

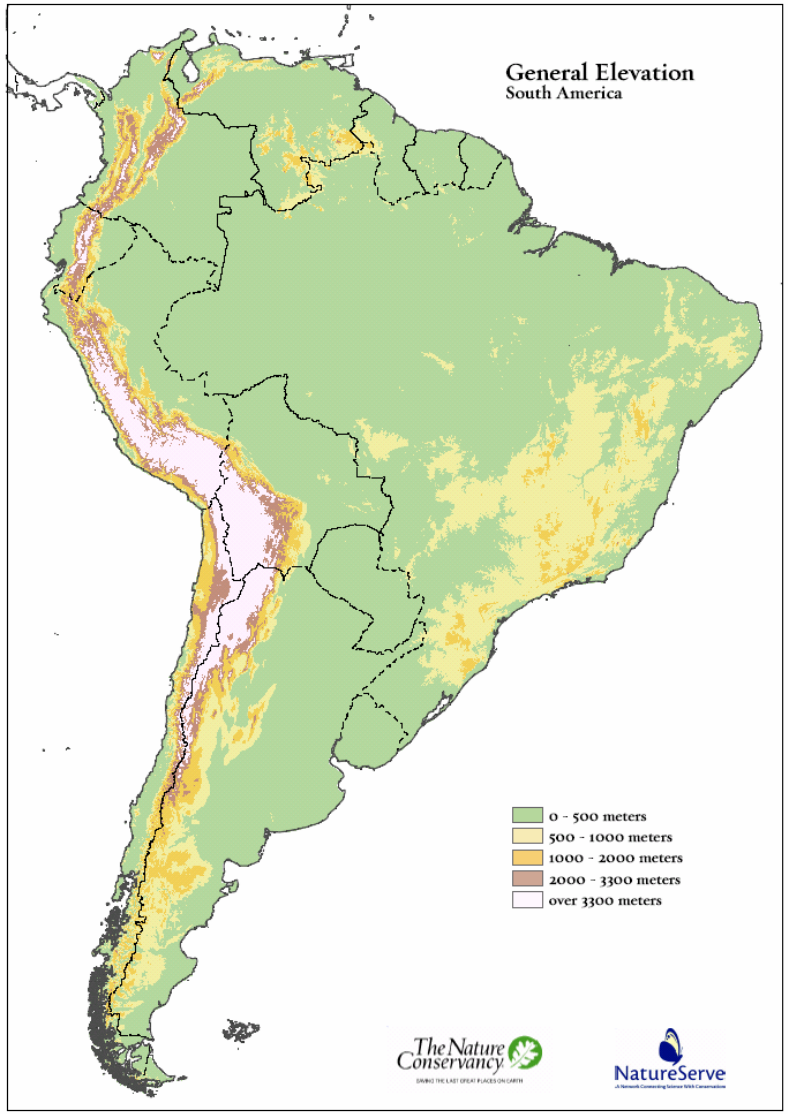
South America, USA, and Others

- *Relief - 90m Shuttle Radar Topographic Mission (SRTM) (cleaned)*

- *Continental mosaic*

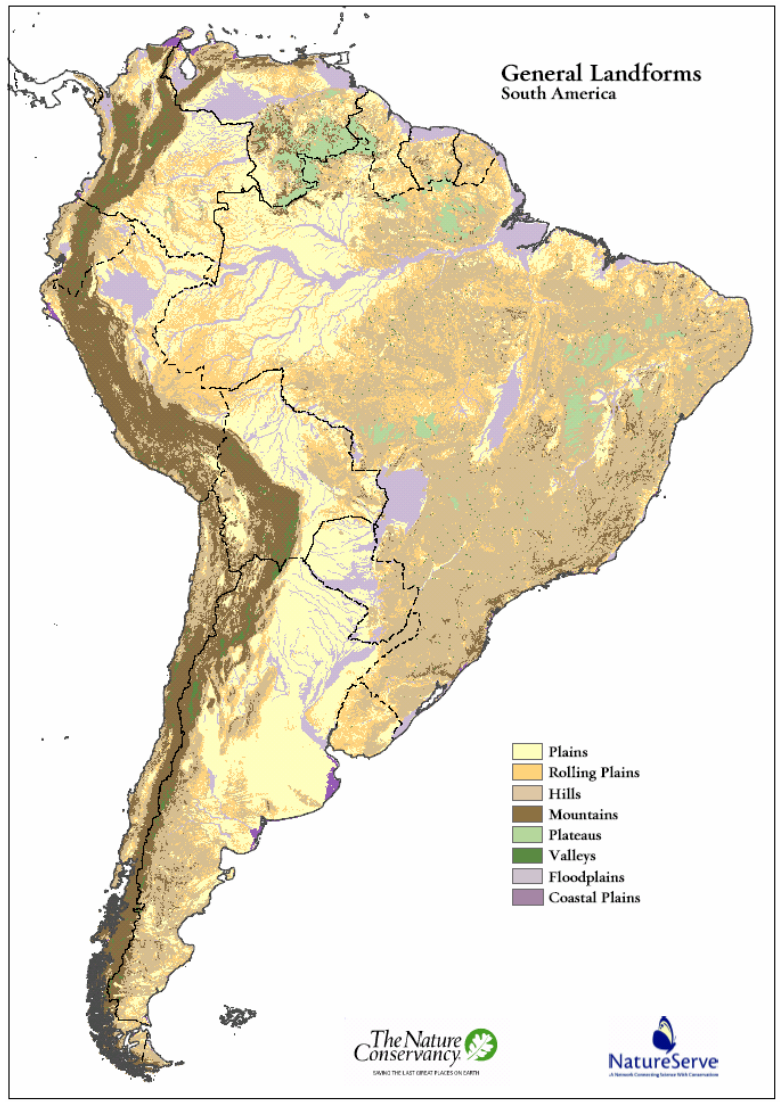
- *Elevation –derived from Digital Elevation Model (DEM)*

- *Ecologically significant*



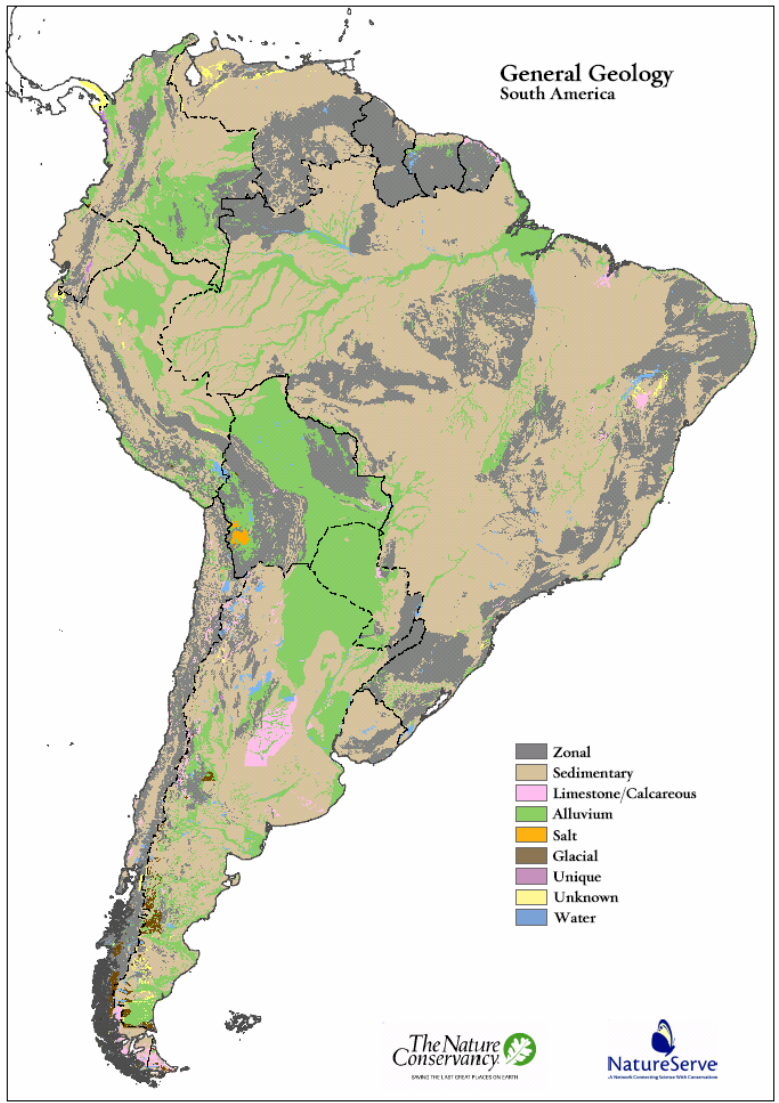
- *Landforms - Digital Elevation Model (DEM) derived classes*

- *1st consistent, continent-wide, digital landforms layer for South America*

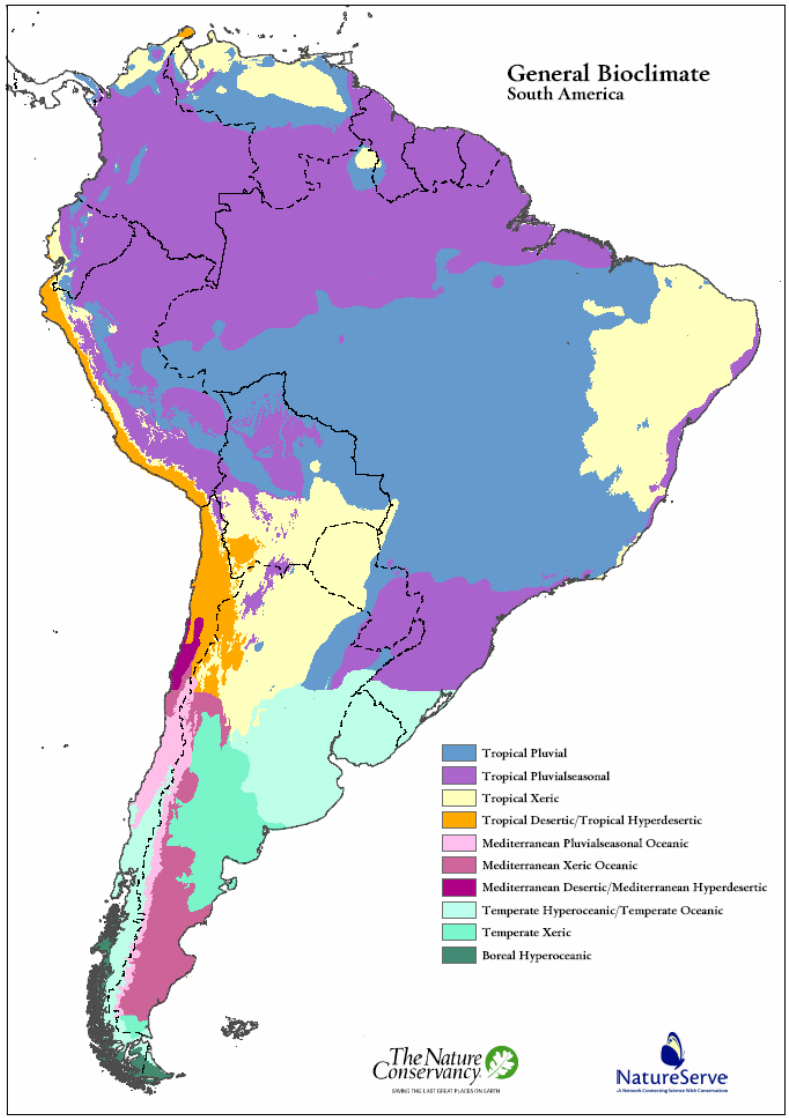


- *Geology (best available data for each country)*

- *Reclassed*



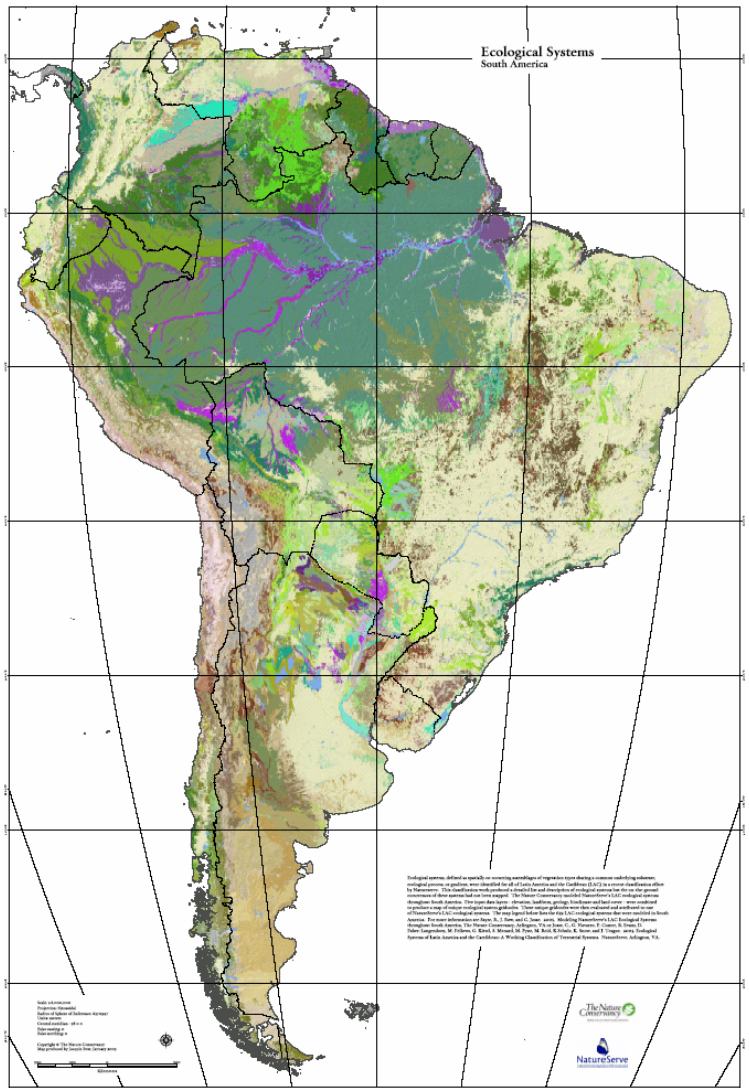
- *Bioclimate - Derived from 1km world climate data*



- *Land Cover (GLC2000; 1 sq km)*

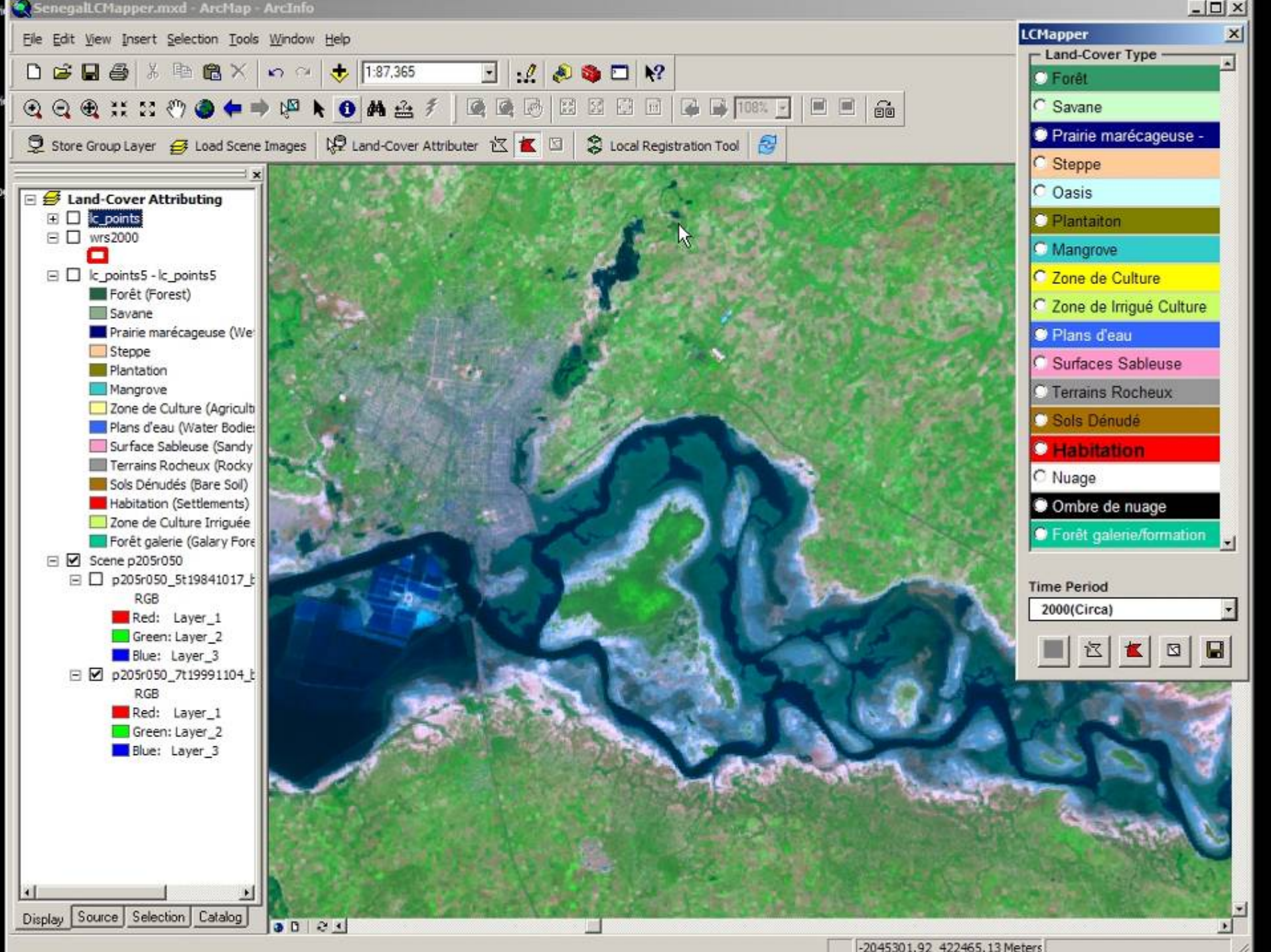
Ecosystem Summary:

- *657 terrestrial ecosystems*
- *450m working resolution*
- *Regional context for national ecosystem maps*
- *Standardized framework for crosswalking other maps*



Rapid Landcover Mapping Tool (RLMT)

USGS/EROS


SenegalLCMapper.mxd - ArcMap - ArcInfo
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Plans d'eau
Surfaces Sableuse
Terrains Rocheux
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Habitation
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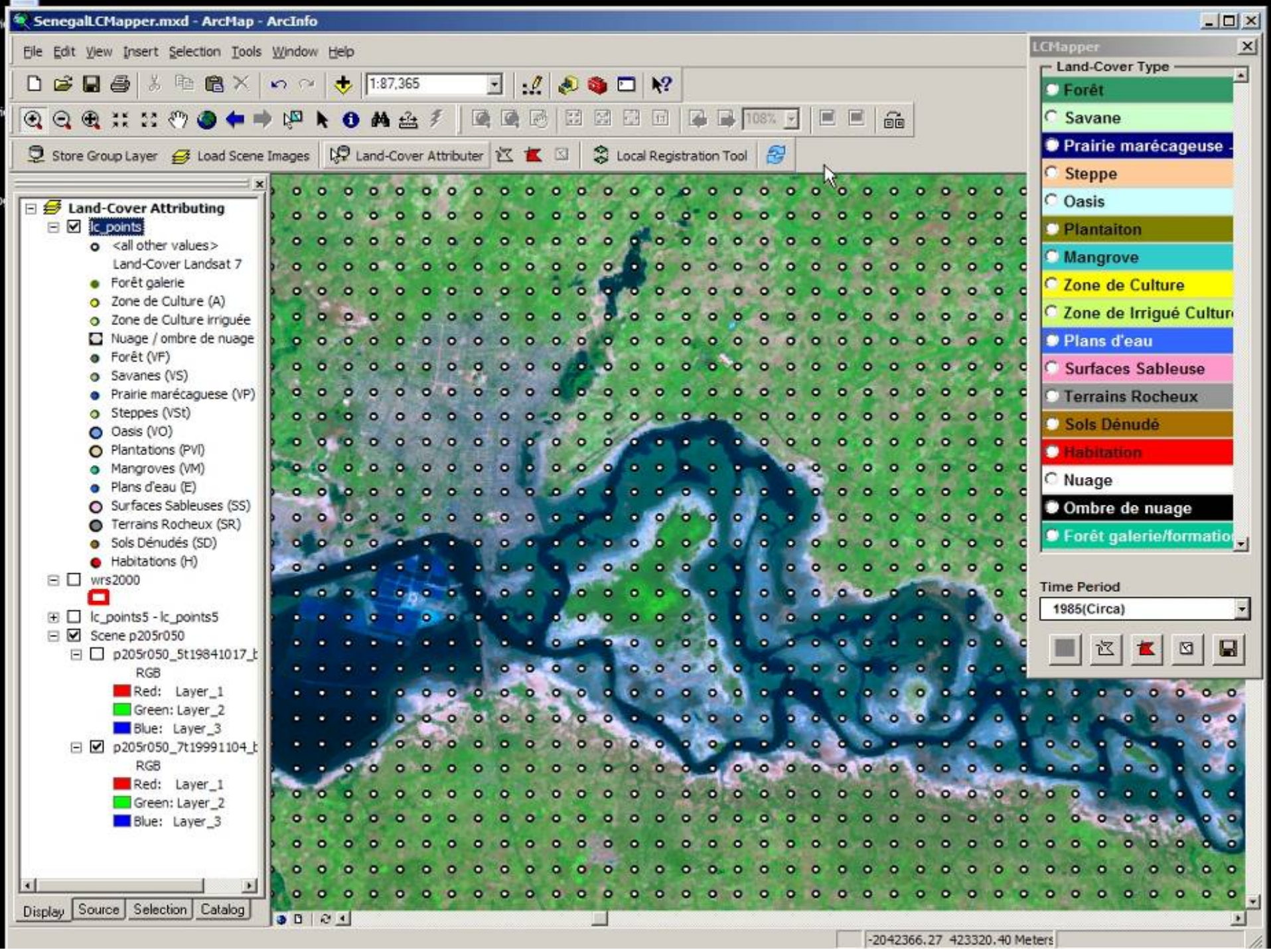
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Land-Cover Landsat 7
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Zone de Culture (A)
Zone de Culture irriguée
Nuage / ombre de nuage
Forêt (VF)
Savanes (VS)
Prairie marécaguese (VP)
Steppes (VSt)
Oasis (VO)
Plantations (PVI)
Mangroves (VM)
Plans d'eau (E)
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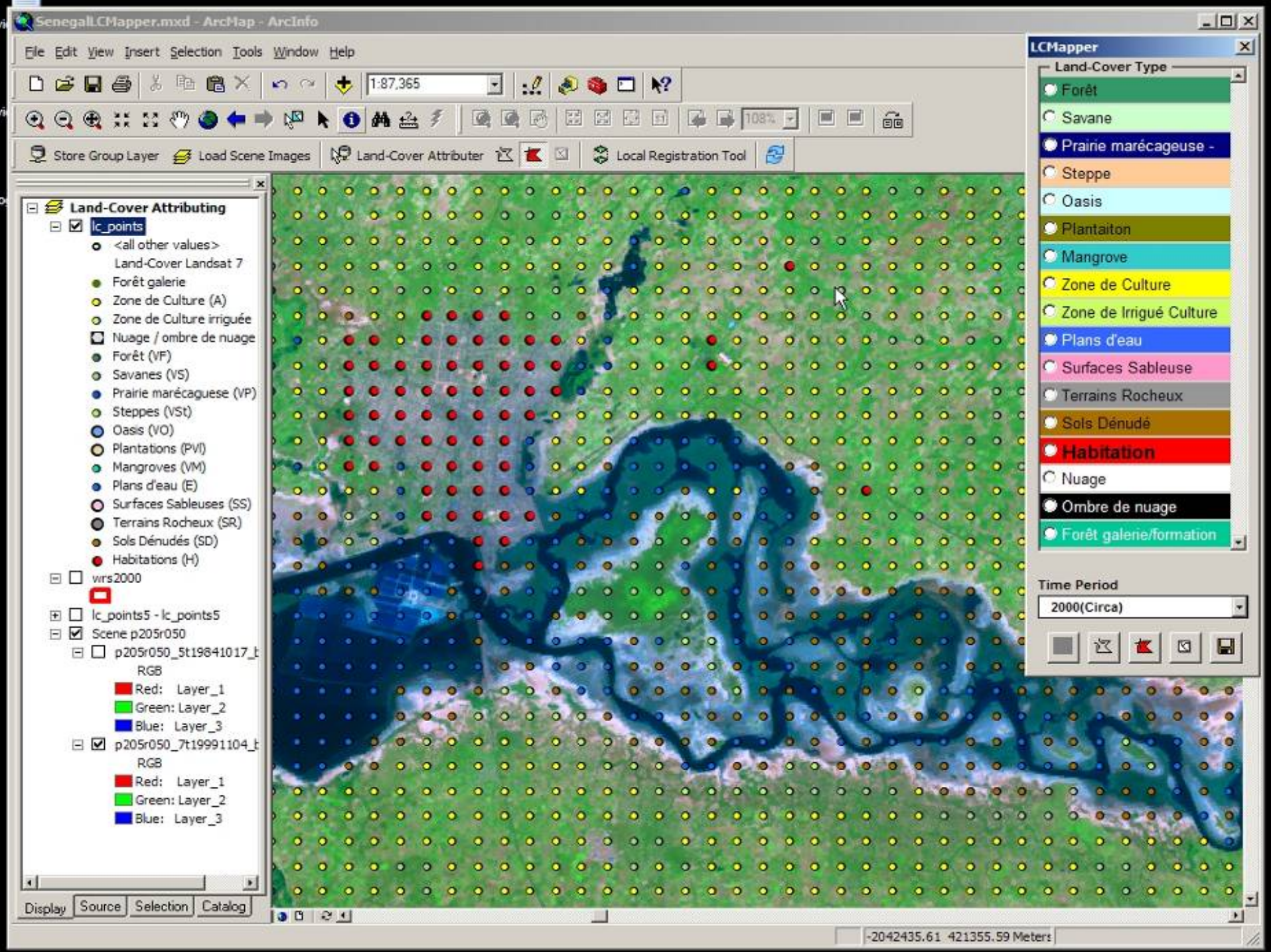
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Plantaiton
Mangrove
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Zone de Irrigué Culture
Plans d'eau
Surfaces Sableuse
Terrains Rocheux
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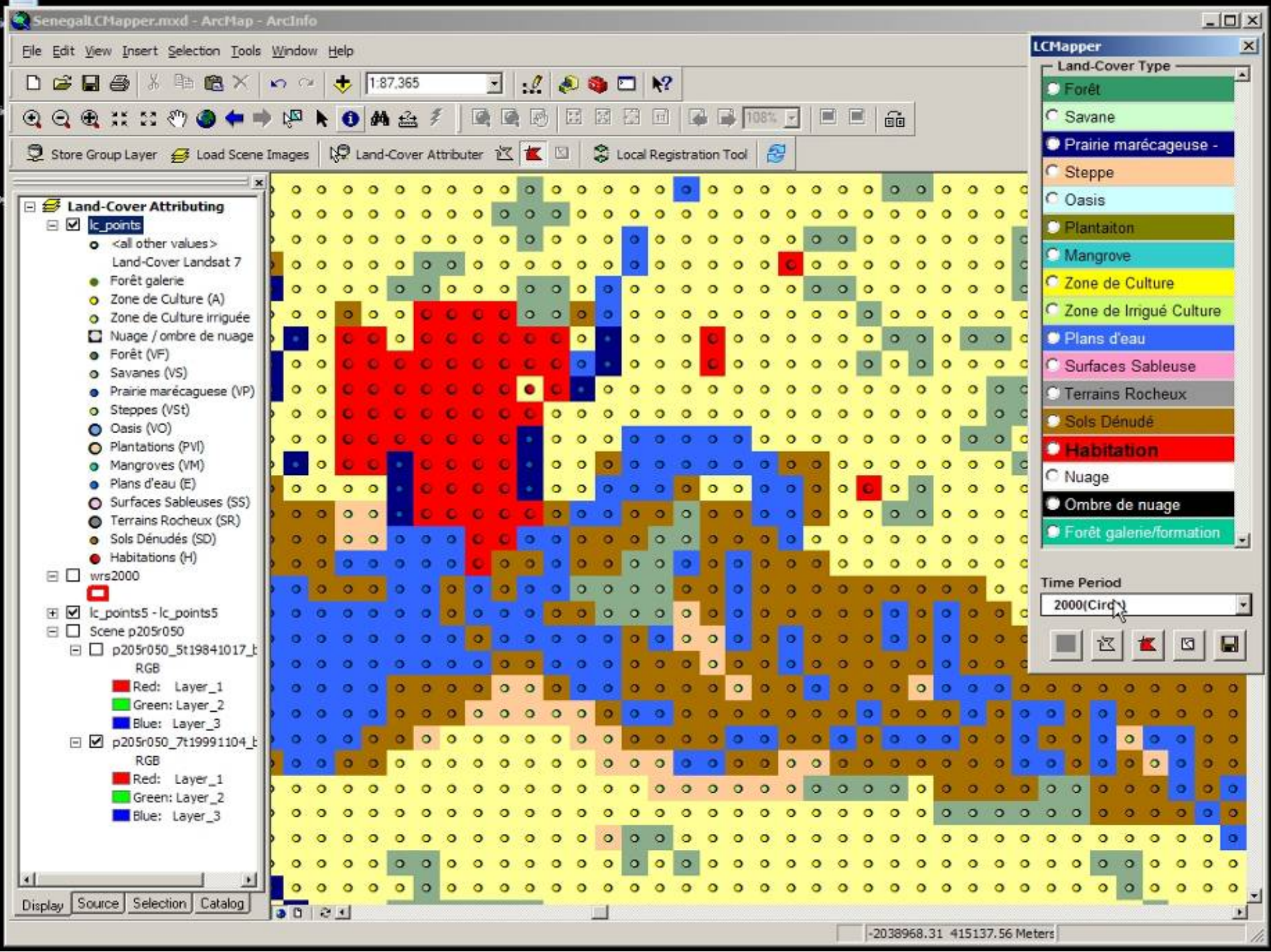
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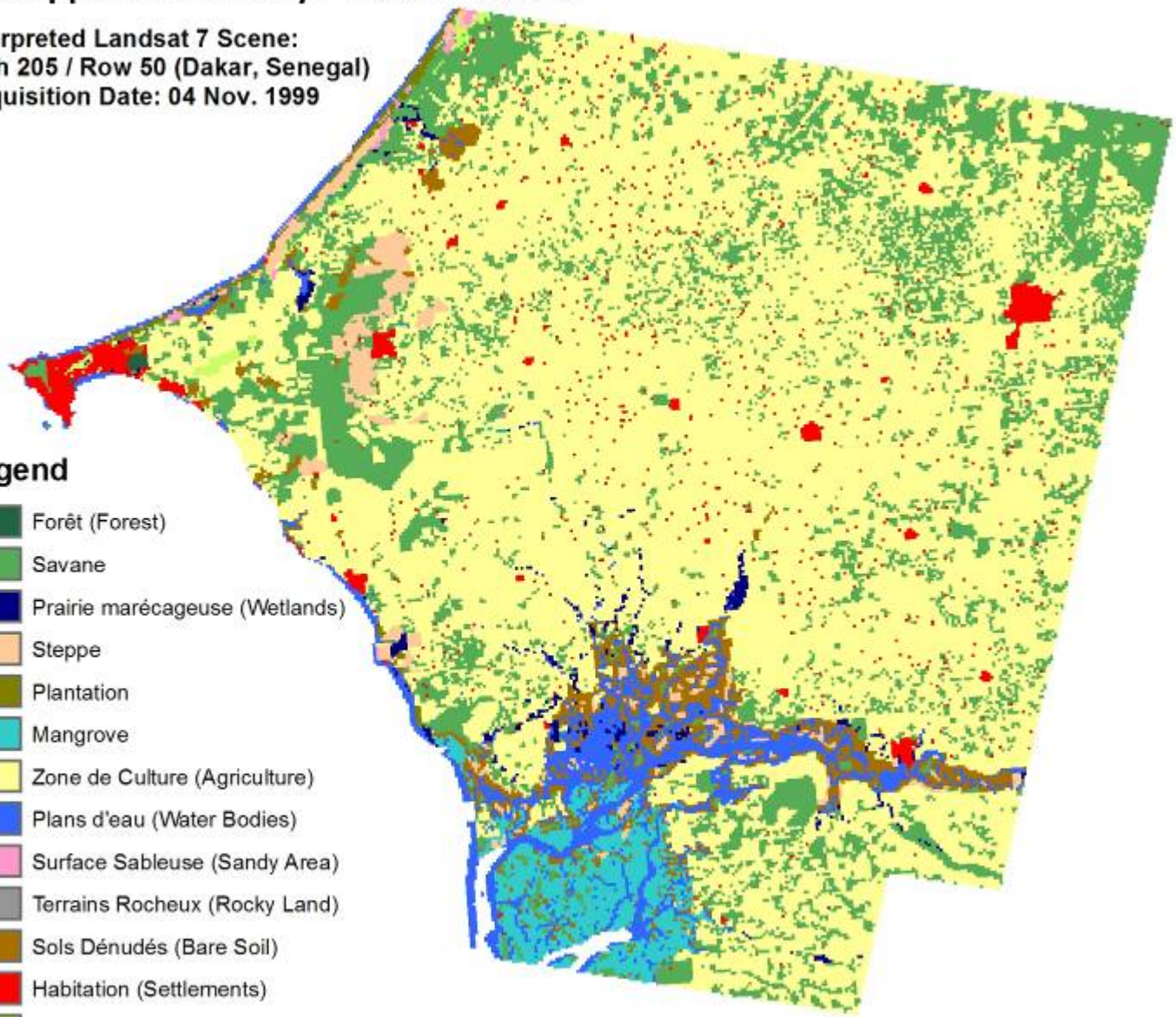
Habitation
Nuage
Ombre de nuage
Forêt galerie/formation
Time Period
2000(Circa)
-2038968.31 415137.56 Meters

Land Use/Land Cover of Western Senegal

LCMapper Preliminary Product Results

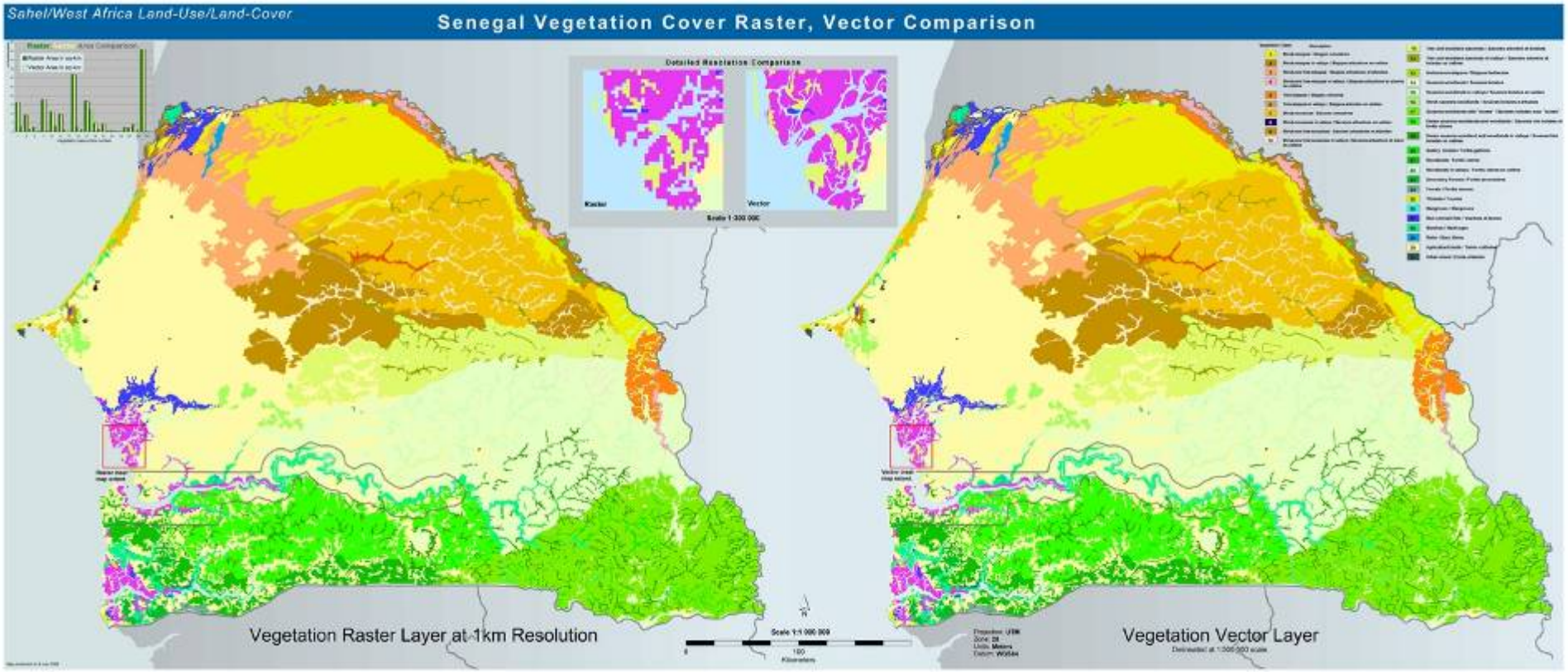
Interpreted Landsat 7 Scene:
Path 205 / Row 50 (Dakar, Senegal)
Acquisition Date: 04 Nov. 1999



Legend

- Forêt (Forest)
- Savane
- Prairie marécageuse (Wetlands)
- Steppe
- Plantation
- Mangrove
- Zone de Culture (Agriculture)
- Plans d'eau (Water Bodies)
- Surface Sableuse (Sandy Area)
- Terrains Rocheux (Rocky Land)
- Sols Dénudés (Bare Soil)
- Habitation (Settlements)
- Zone de Culture Irriguée (Irrigated Agriculture)
- Forêt galerie (Galary Forest)

Map Produced: 08 July 2005

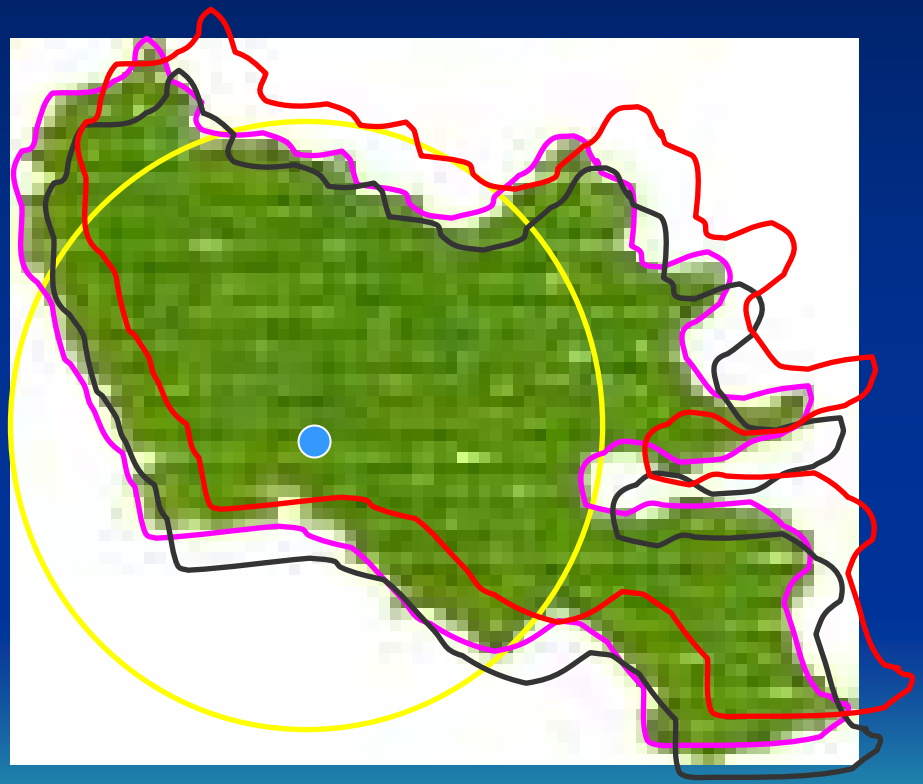

Sahel/West Africa Land-Use/Land-Cover
Senegal Vegetation Cover Raster, Vector Comparison
Detailed Resolution Comparison
Raster
Vector
Vegetation Raster Layer at 1km Resolution
Vegetation Vector Layer

Protected Areas Focus

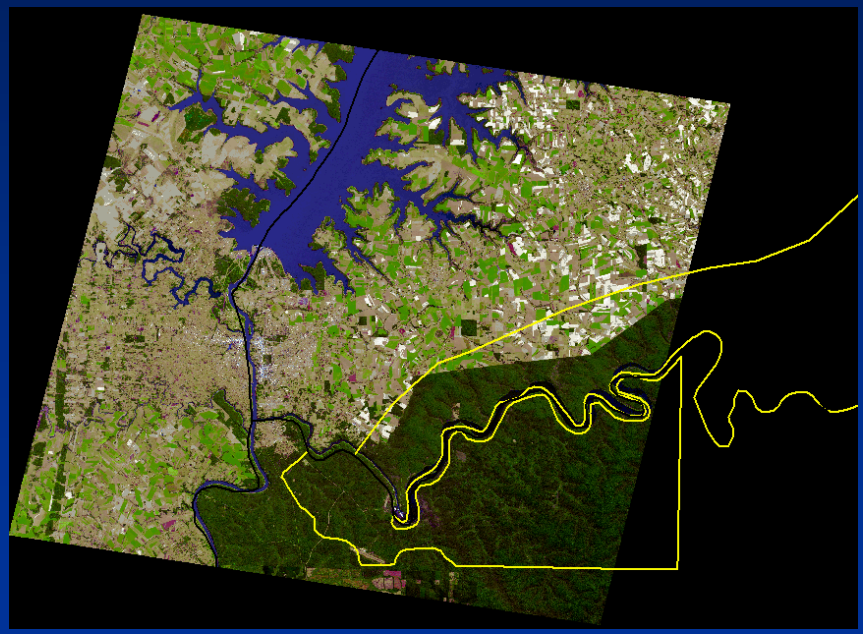
- Convention on Biodiversity targets (conservation effectiveness)
- Global initiatives (e.g., Global Earth Observation System of Systems-GEOSS)
- Regional initiatives (e.g., Inter-American Biodiversity Information Network- IABIN)
- National initiatives
- Local initiatives

Comparison of the Protected Area Database (PAD; US - national) vs. World Database on Protected Areas (WDPA; UNEP/WCMC global)

- Points vs. polygons
- Varying boundaries for same protected area
- Polygons vs. imagery
- Management effectiveness issues

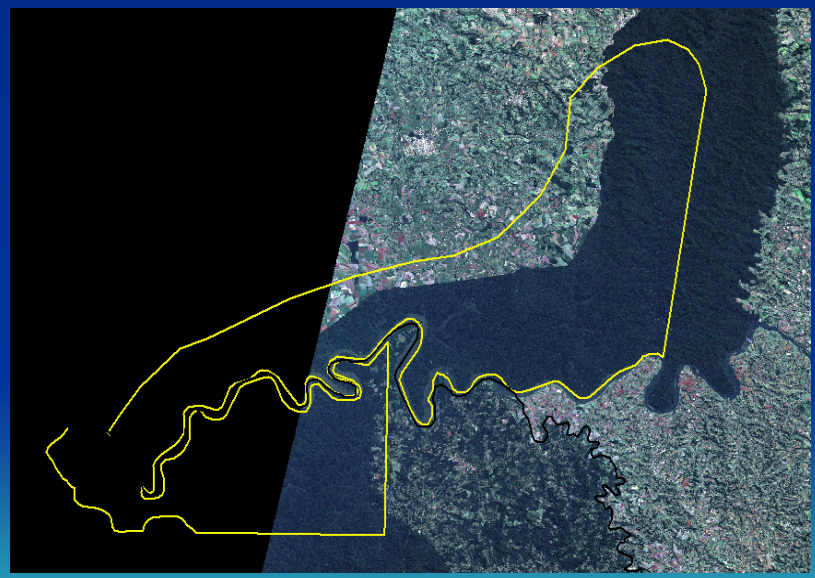


Protected Area Polygon Issues



Encroachment or inaccurate boundary

Open polygons



Varying Protected Area Data

PAD-National

WDPA-Global

Protected Area Data - Scales and Resolutions

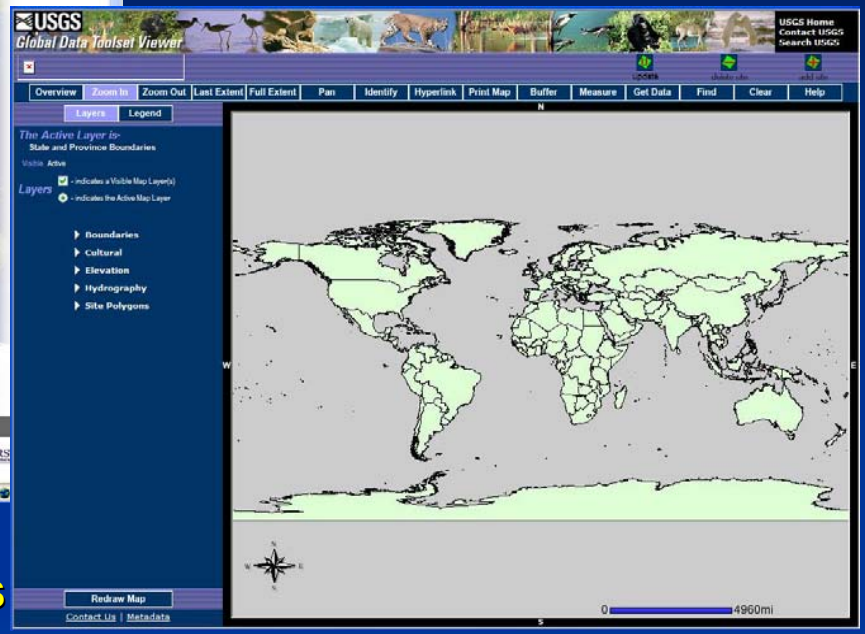
PAD

WDPA

Effects:

- Levels of analysis
- Types of conservation management

Global Data Toolkit



- **Input, validate, update polygons**
- **Engage/enable user community**
- **Easy web access**
- **Improve overall global biodiversity and protected area data**

Integrated Taxonomic Information System (ITIS)

- Authoritative source of species scientific names and their hierarchical classification
- Largest taxonomic thesaurus and data base of its kind
- Working with Catalog of Life (and Species 2000)
- Baseline taxonomic crosswalk between various biodiversity data bases

Application of Integrated Biodiversity Data: Assessing Zoonotic Disease Risk

- Knowledge of wild animal distributions and movements can help predict the spread of diseases to humans and domestic animals.
- The ecology and geography of species' distributions is predictable if sufficient data are available.
- Goal is to standardize, integrate, and web-enable massive amounts of existing biological data.

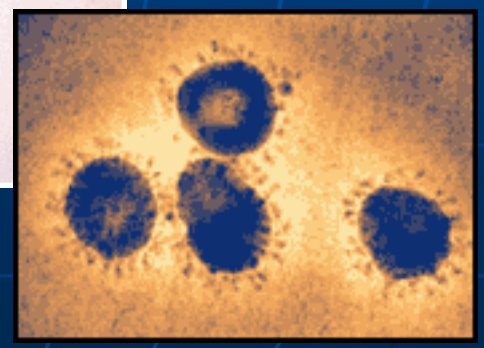
Zoonotic Diseases

75% of emerging infectious diseases are zoonotic (human/wildlife), including:

- Ebola
- Hantavirus
- SARS
- Avian Flu

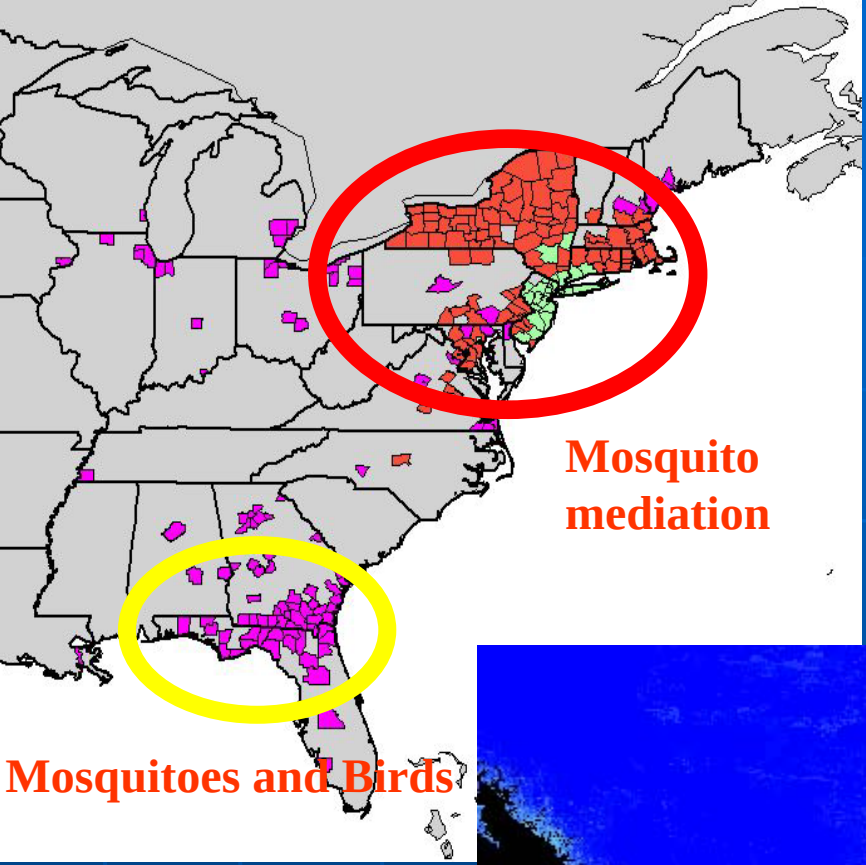
Left: Electron micrograph of Ebola virus.

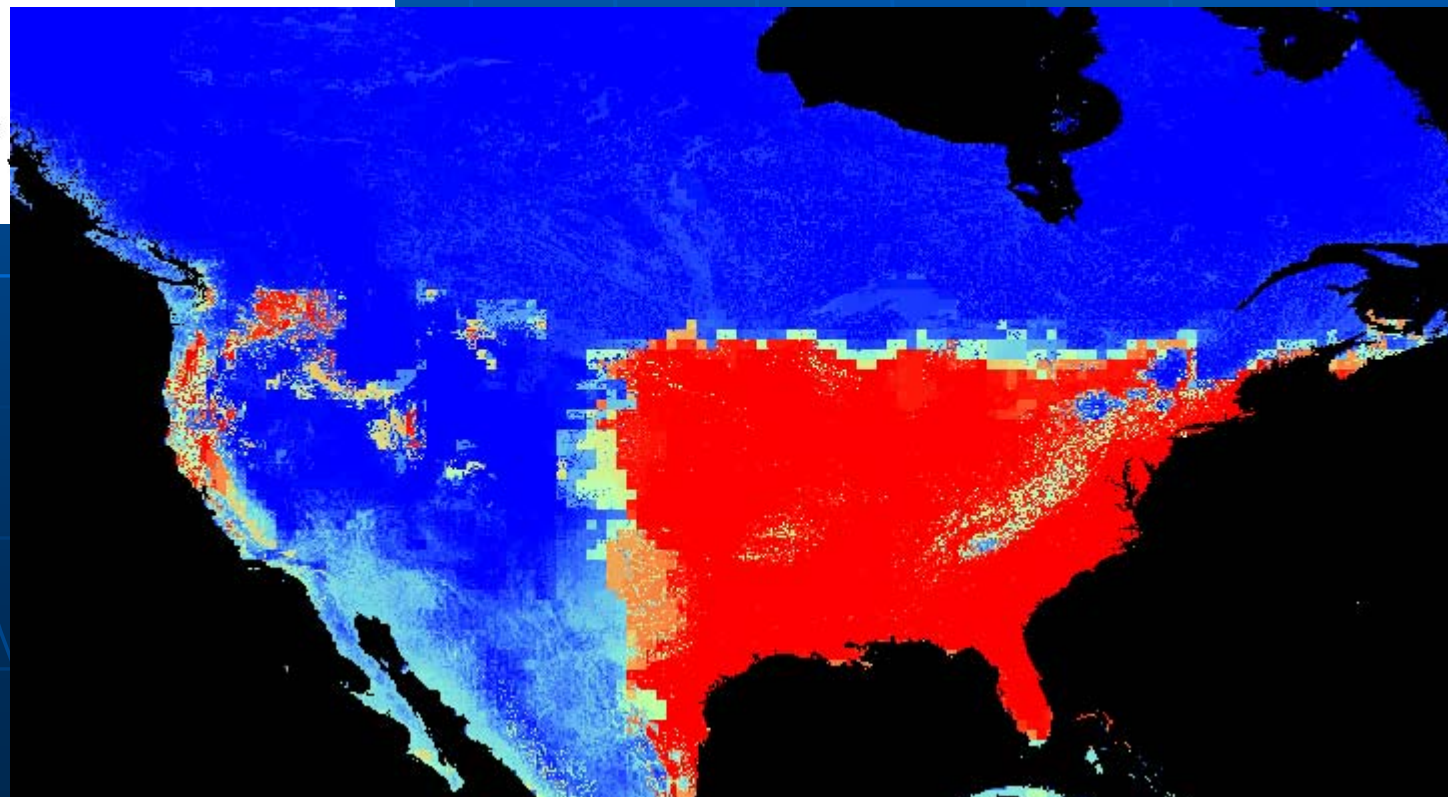
Below: Image of the SARS coronavirus



Images courtesy of CDC

West Nile Virus Forecasting (2001-2002)





Avian Flu (H5N1)

Now found in East Asia, India, Africa, the Middle East, Eastern Europe, and Western Europe

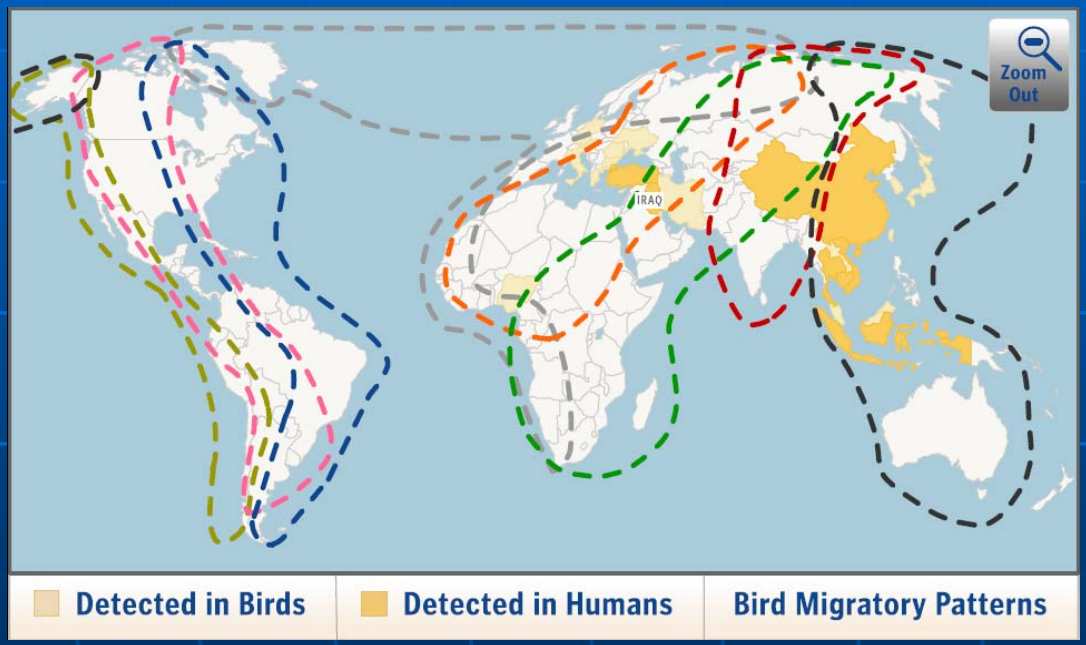


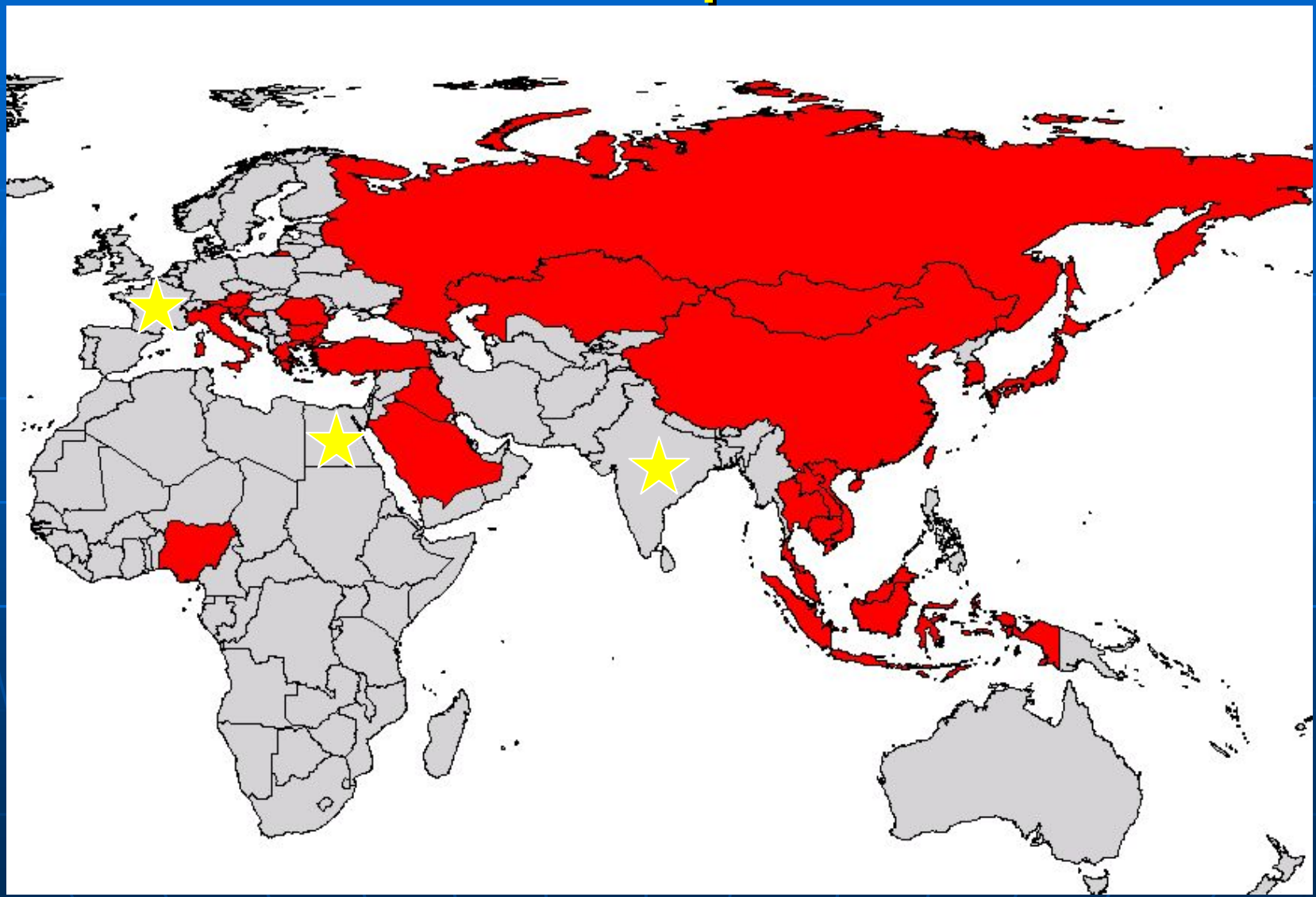
Image courtesy of the Washington Post

Fewer than 200 human cases … but mortality rate exceeds 50%

Economic impact …billions of dollars nationally.

Where and when might it appear in North America?

H5N1 Spread



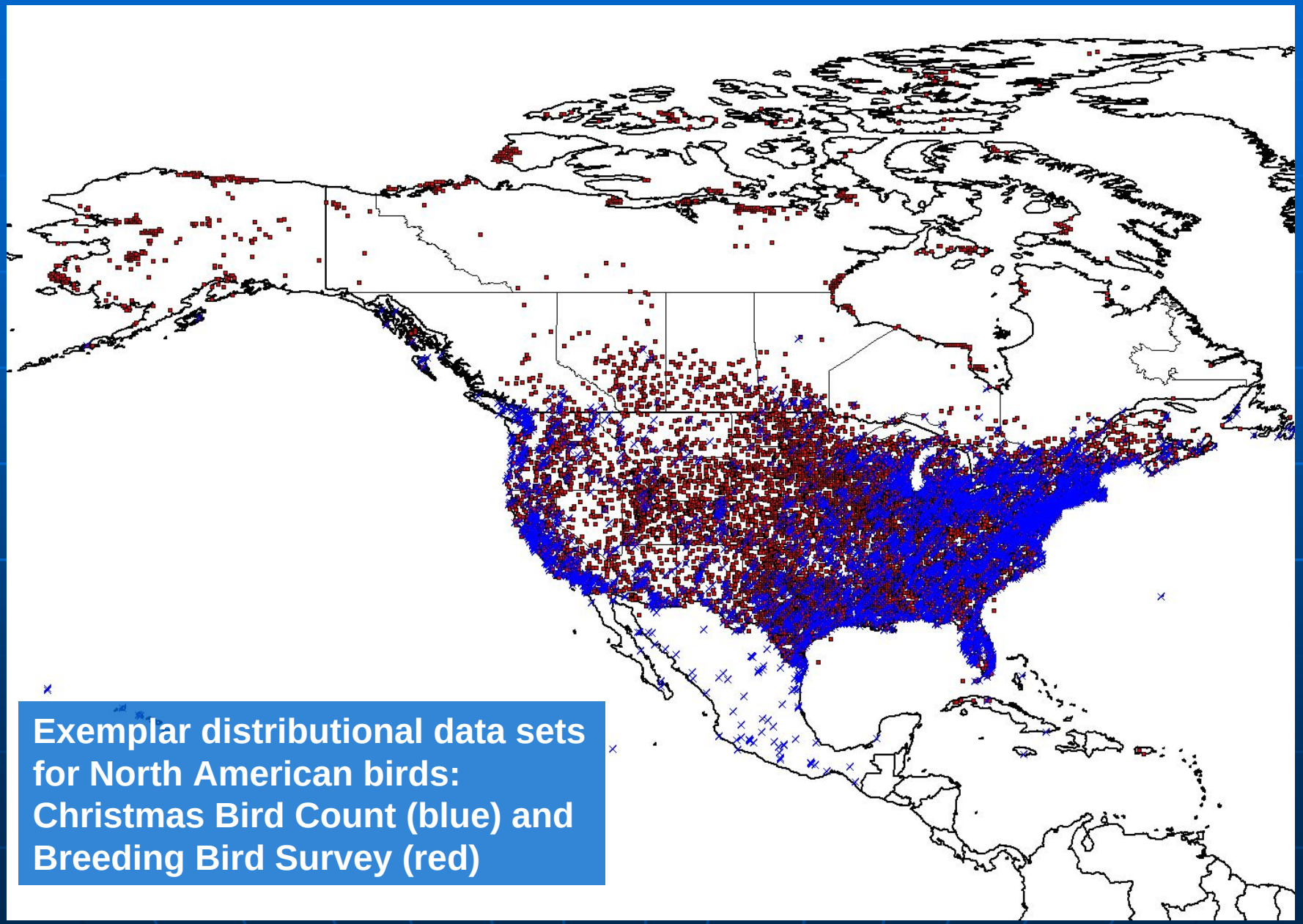
H5N1 Lessons

- Extremely rapid and efficient spread, mediated by bird migration.
- Spreading very broadly across Europe and Asia today.
- Likely to reach North America!

Initial Data Requirements for Avian Influenza Predictions

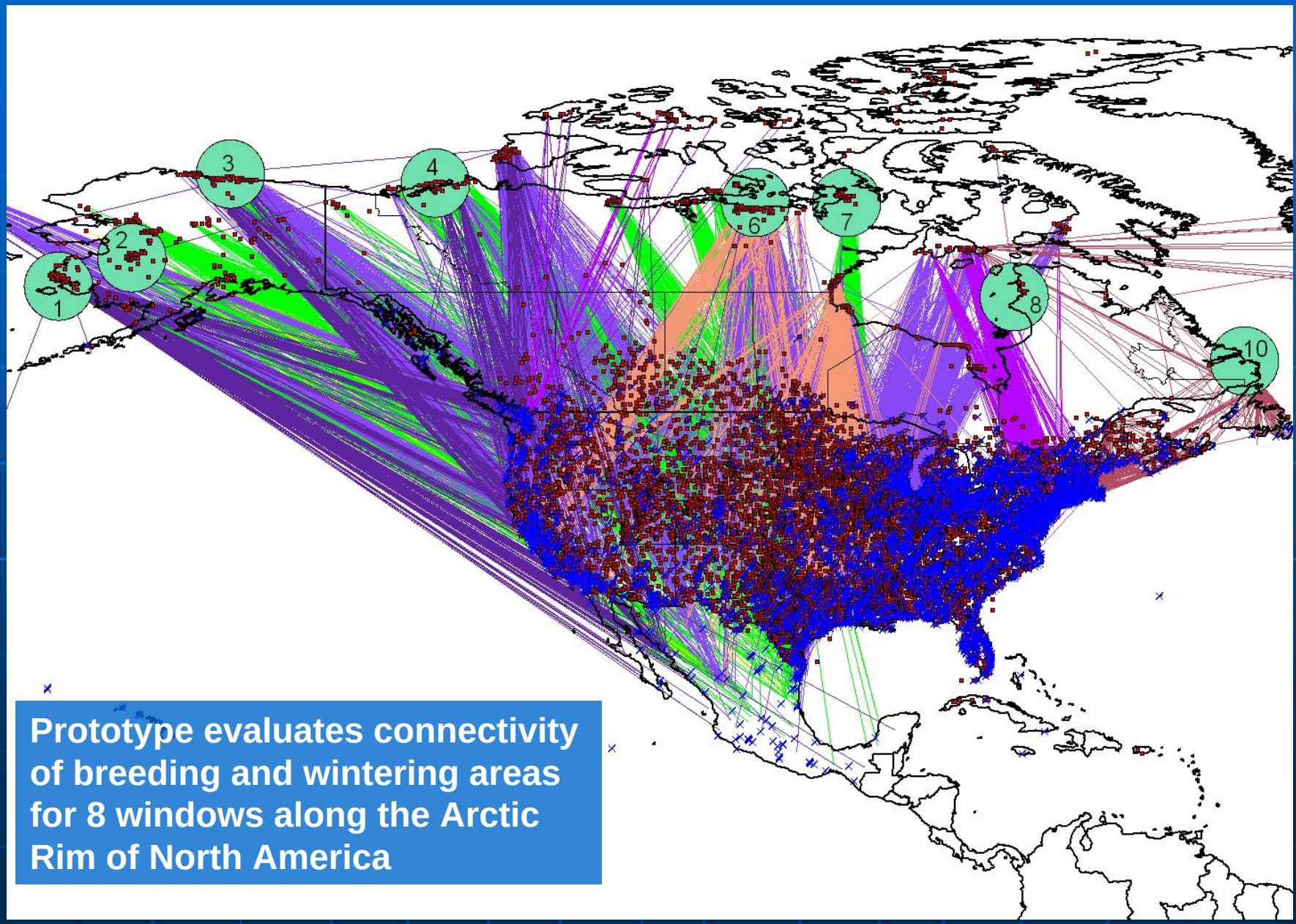
- **Animal distributions**
  - Museum specimens (>200 years)
  - U.S. species surveys
    - Christmas Bird Count (50 years)
    - Breeding Bird Survey (30 years)
- **Migratory routes**
  - Bird banding data (> 80 years)
- **Ecological data**
  - Ecosystems, wetland inventories, land cover, land use

Occurrence Data



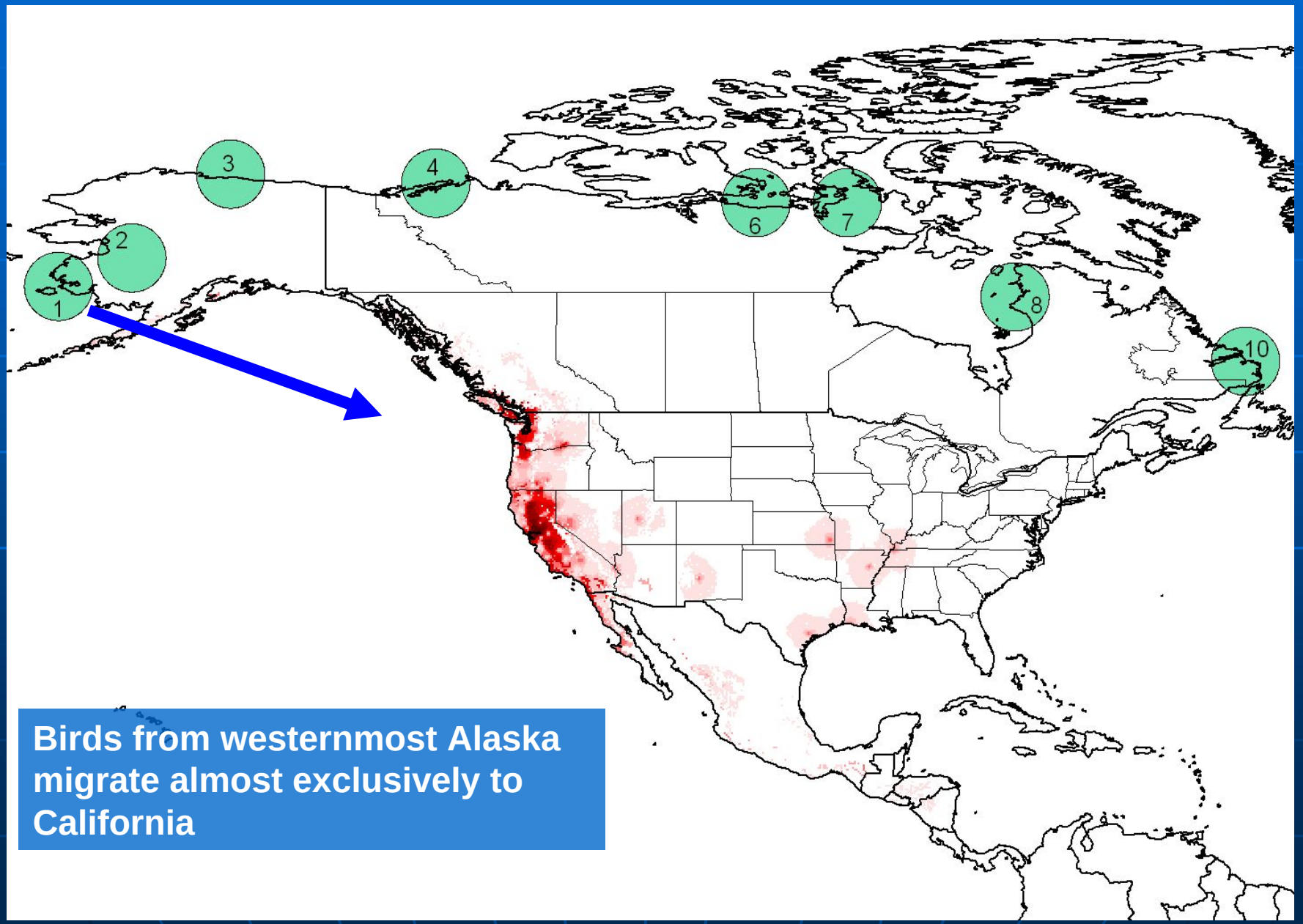
Exemplar distributional data sets for North American birds: Christmas Bird Count (blue) and Breeding Bird Survey (red)

Paths and Windows



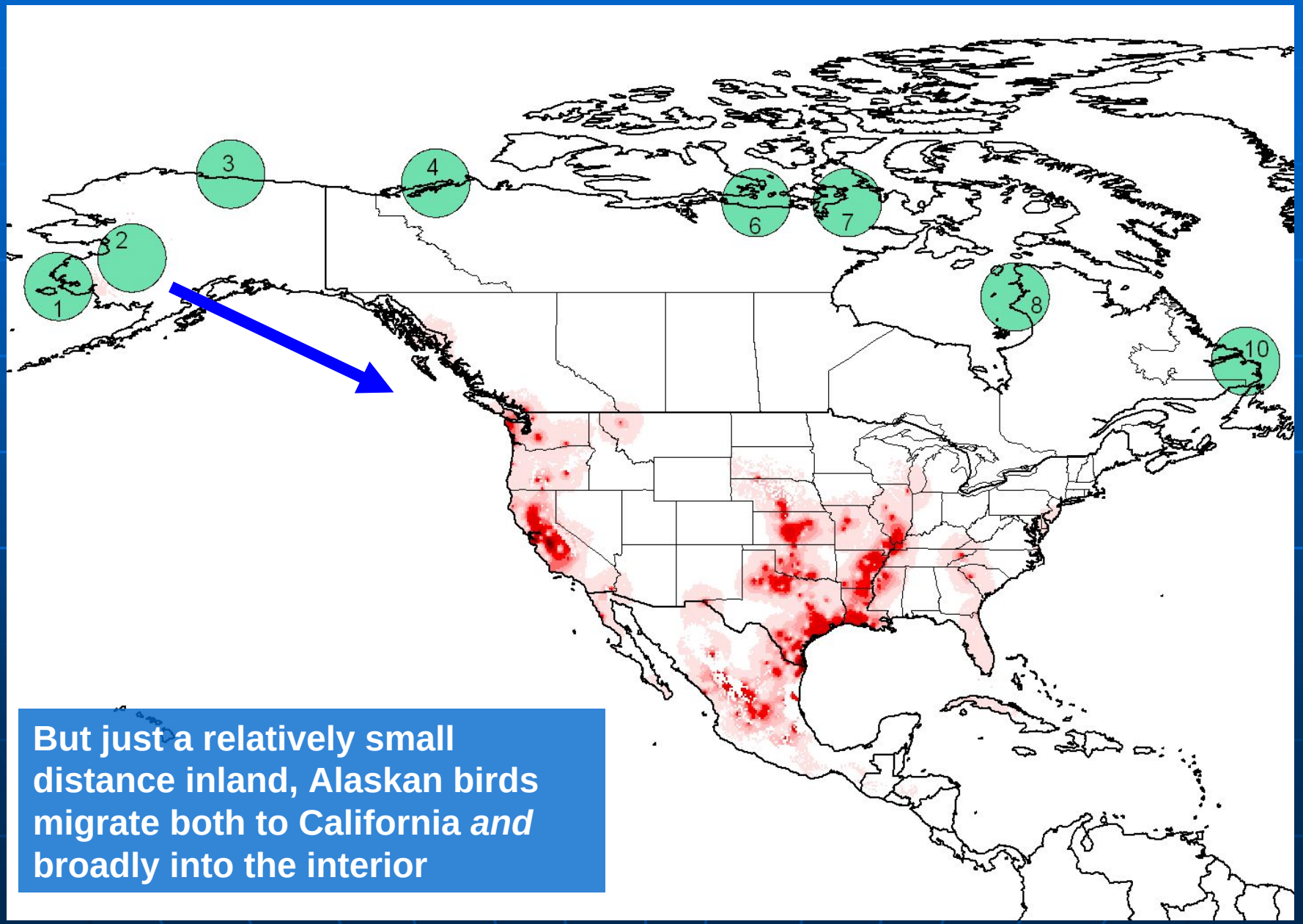
Prototype evaluates connectivity of breeding and wintering areas for 8 windows along the Arctic Rim of North America

Full Prototype - 7 Arctic Waterfowl Species



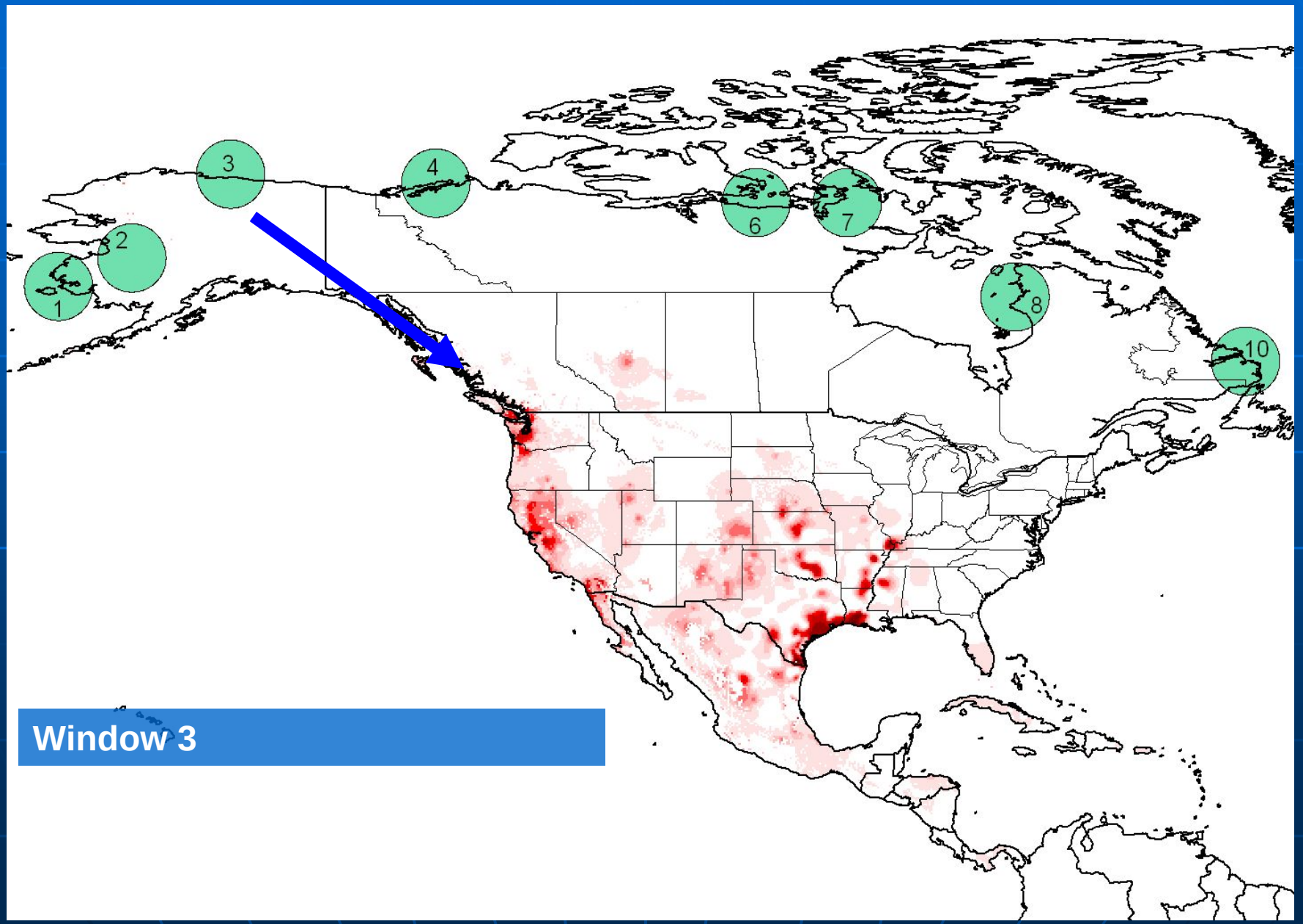
Birds from westernmost Alaska migrate almost exclusively to California

Full Prototype - 7 Arctic Waterfowl Species

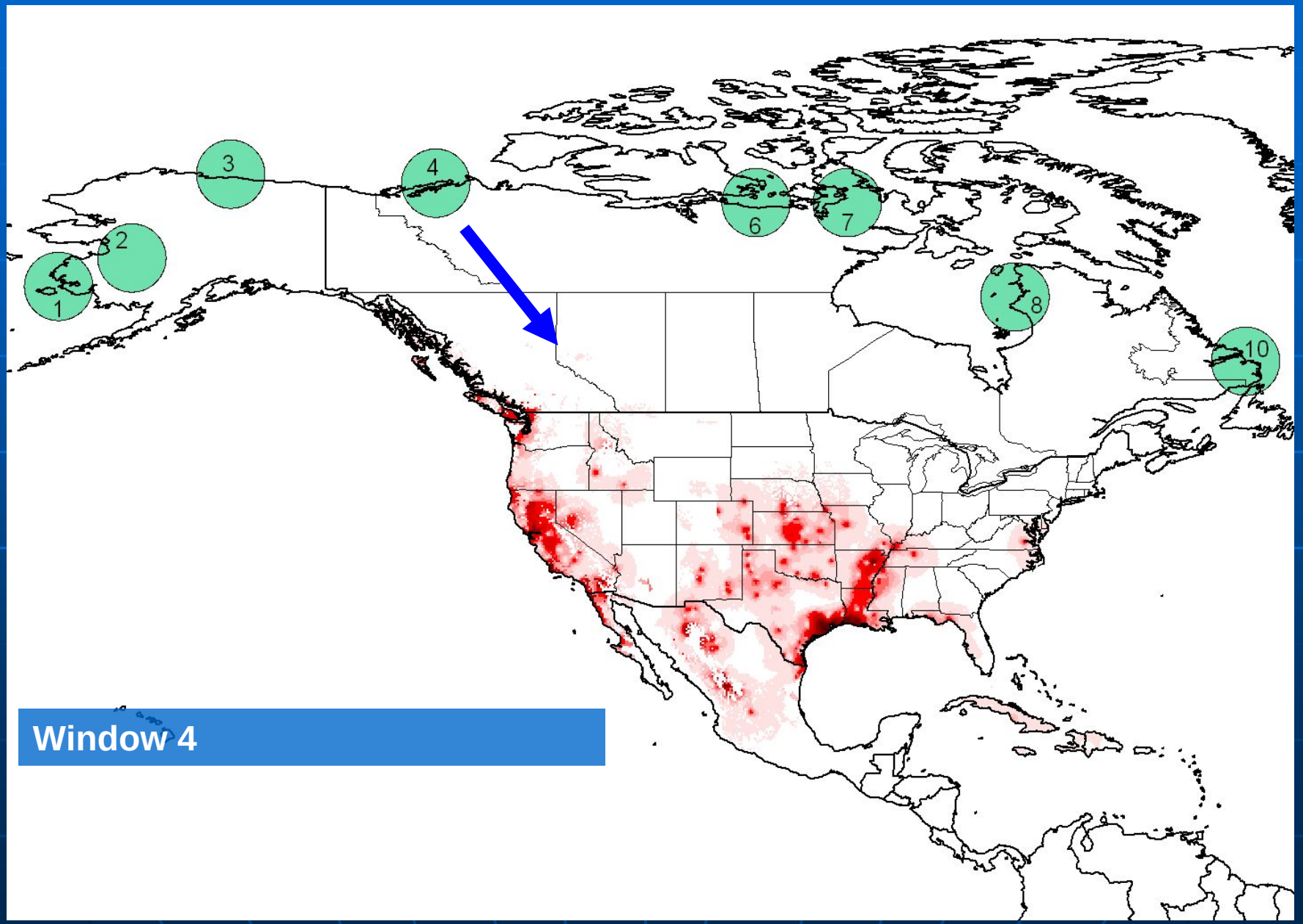


But just a relatively small distance inland, Alaskan birds migrate both to California *and* broadly into the interior

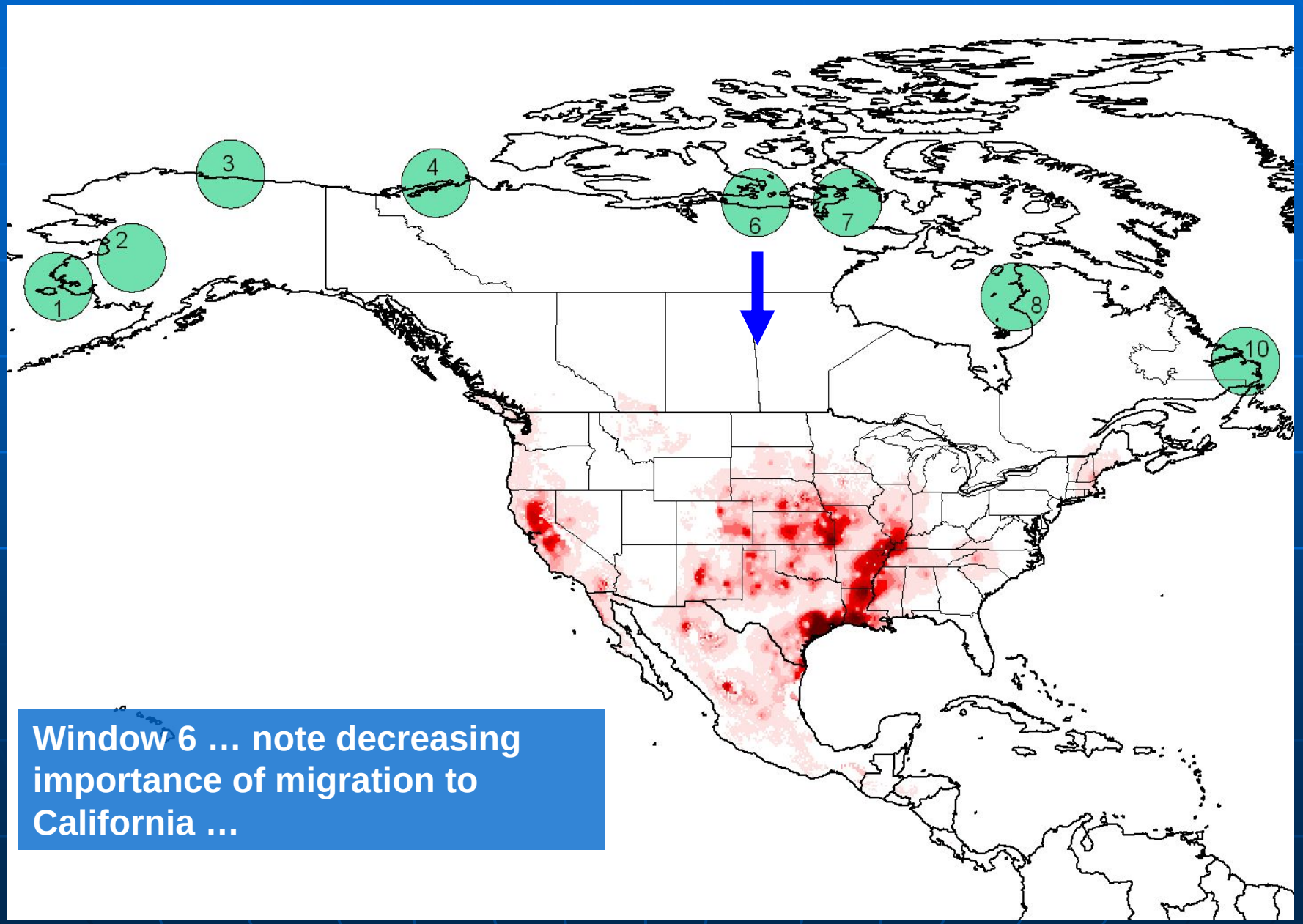
Full Prototype - 7 Arctic Waterfowl Species



Full Prototype - 7 Arctic Waterfowl Species

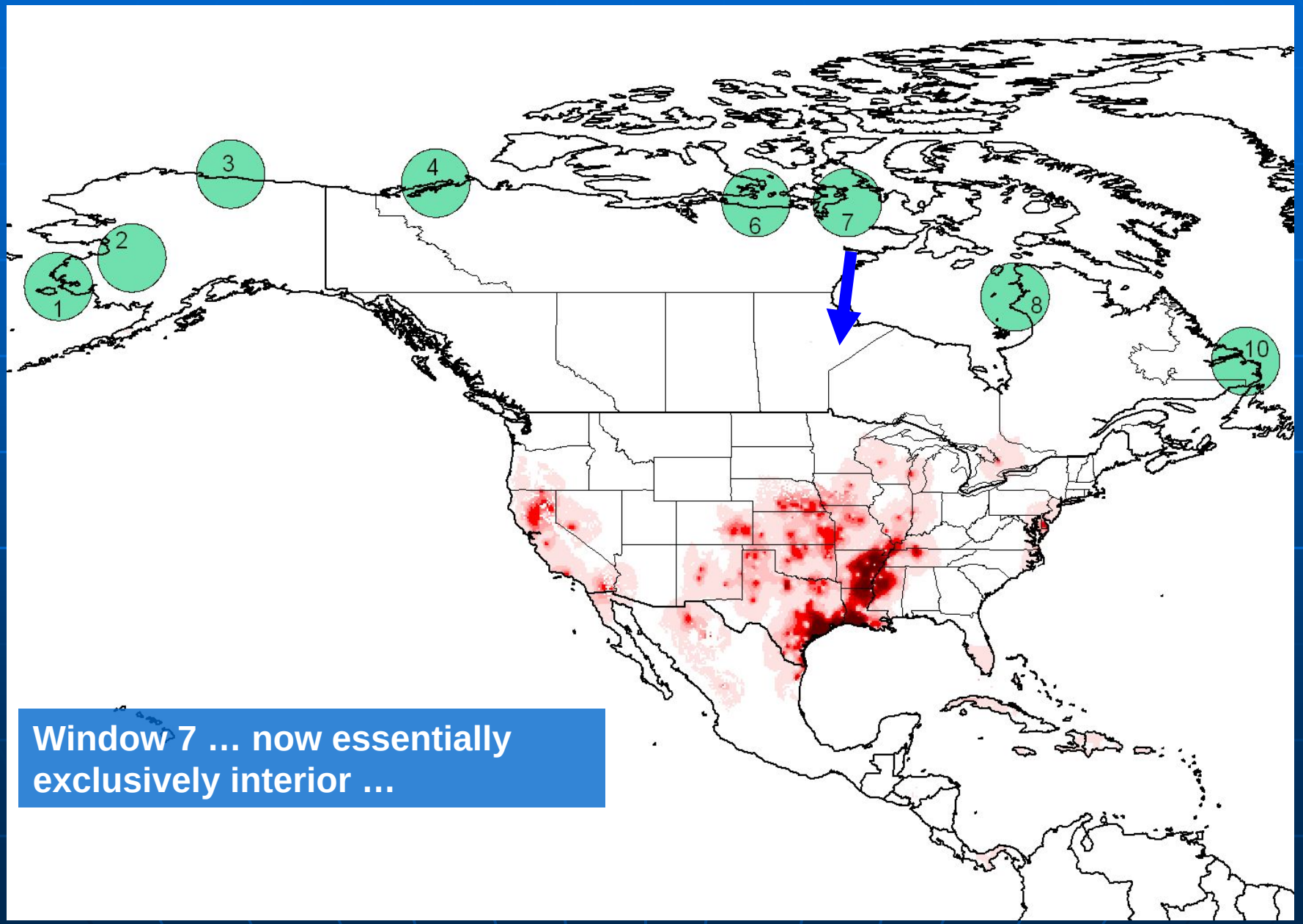


Full Prototype - 7 Arctic Waterfowl Species



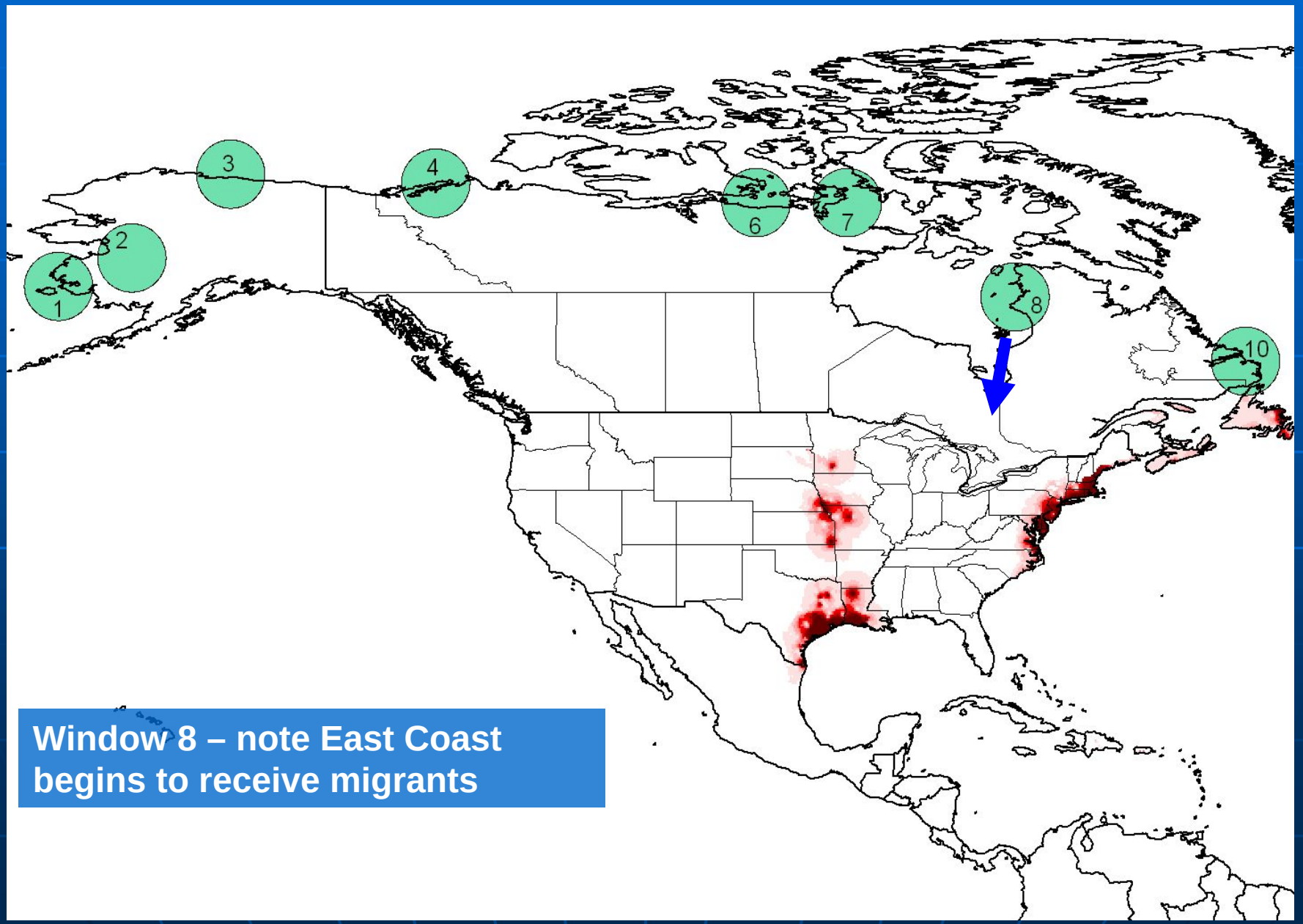
Window 6 … note decreasing importance of migration to California …

Full Prototype - 7 Arctic Waterfowl Species



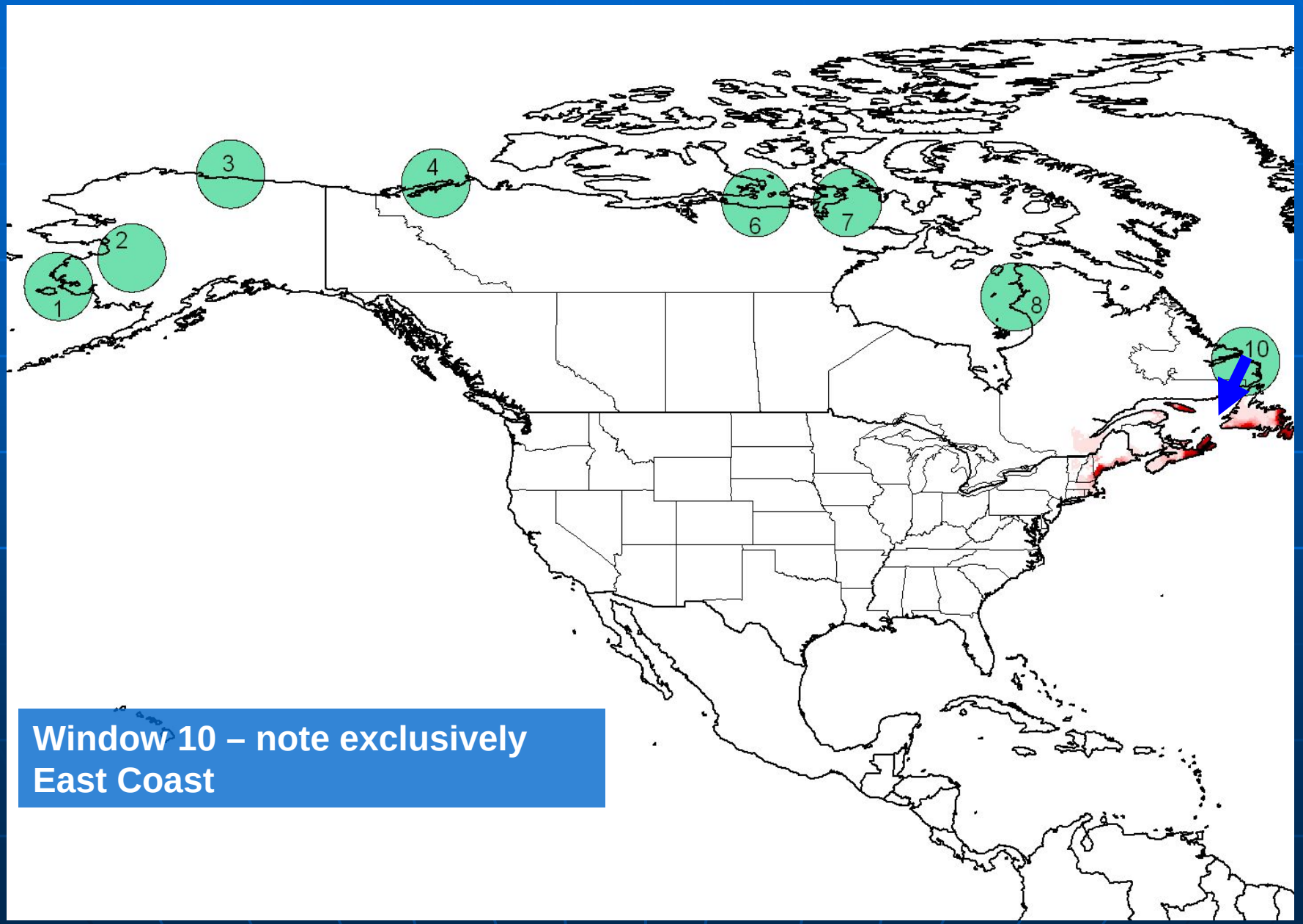
Window 7 … now essentially exclusively interior …

Full Prototype - 7 Arctic Waterfowl Species



Window 8 – note East Coast begins to receive migrants

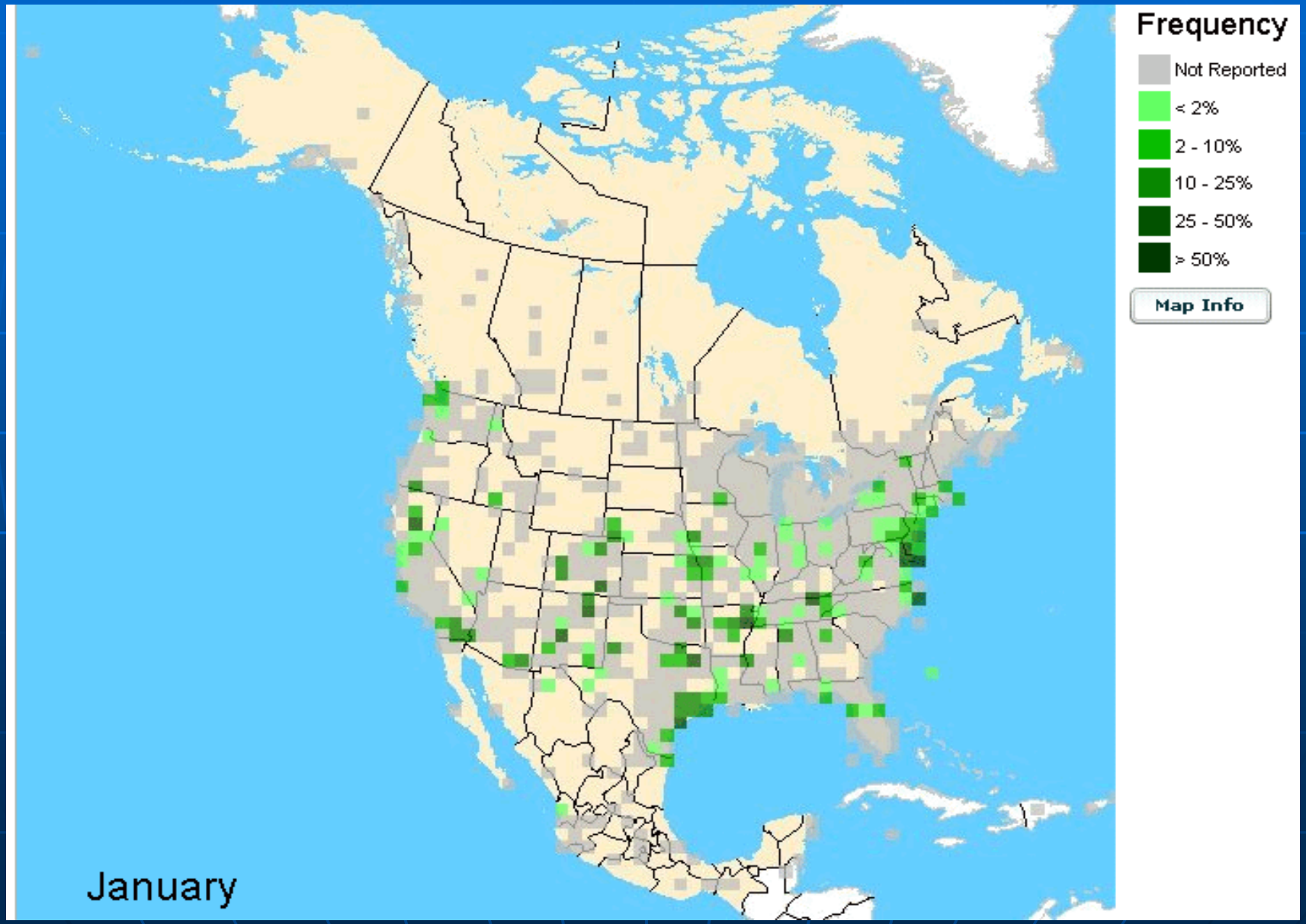
Full Prototype - 7 Arctic Waterfowl Species



Window 10 – note exclusively East Coast

Snow Goose Movements

Need to add dynamics of movement between distributional areas



Thank You