An Overview of the Aquatic Component of GAP

USGS National Gap Analysis Meeting
October 6-9, 2003

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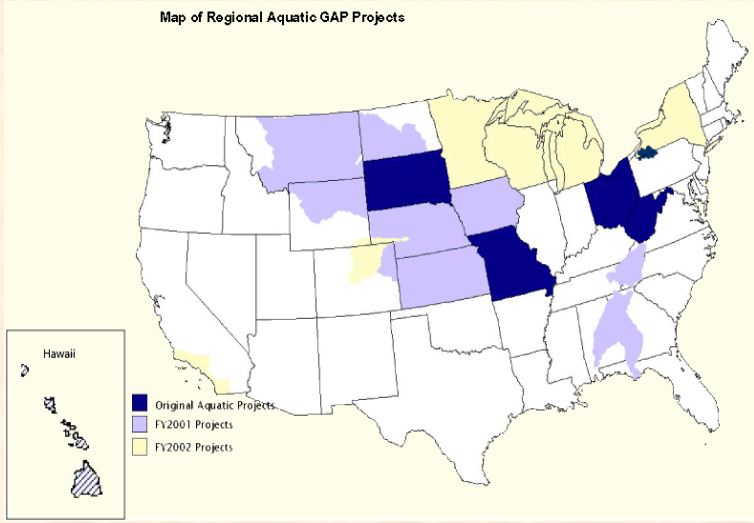
http://www.cerc.usgs.gov/morap/

Purpose of Presentation

- Brief overview of the history and current status of the aquatic component of GAP
- Compare and contrast terrestrial and aquatic components
- Provide context for subsequent topic-specific presentations
  - Why are we doing what we're doing?

History and Current Status of Aquatic GAP

- 1995: First pilot, Upper Allegheny Watershed in NY
- 1997: Statewide pilot, MO
- 1999: Additional state projects, SD, OH, and VA
- 2001: Missouri River Basin project
  - IA, KS, MO, NE, SD
- 2001: Task specific projects
  - AL/GA, species modeling and decision support
  - Upper TN River, assessing threats
  - HI, species modeling, integrating terrestrial, freshwater, and marine
- 2002: Regional and Task specific
  - Great Lakes project 2002
    - OH, MN, MI, NY, WI
  - CO/WY, species modeling
  - CA, incorporating riparian



Comparing Terrestrial and Aquatic Components

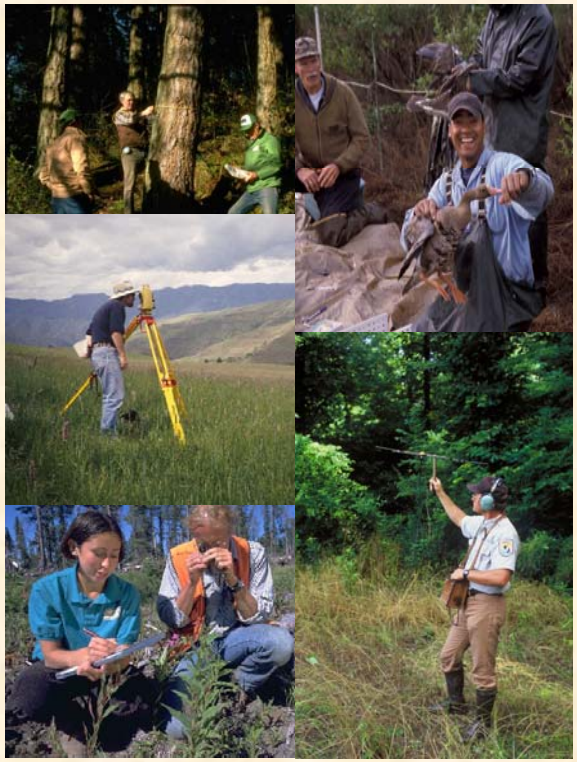
- Same Philosophy/Assumption
  - Protected Areas are critical to the protection of biodiversity
- Same Goal
  - Conserve the **ecological and evolutionary processes that generate and sustain biodiversity**
- Same General Conservation Strategy
  - **Represent** the **spatial patterns** of **surrogate conservation targets** within a **matrix of protected areas** that ensures the long-term **persistence** of these targets by minimizing **threats** from anthropogenic stressors
- Same Specific Objective
  - Assess how well the spatial patterns of surrogate targets are represented in the current matrix of protected areas

Why is There a Need for a Separate Aquatic Component?

- There are several reasons
  - Some are logistical
  - Some are related to fundamental differences in the processes that create and sustain biodiversity
  - Translate into fundamental differences in conservation planning process
  - Some pertain to differences in how geospatial data are developed

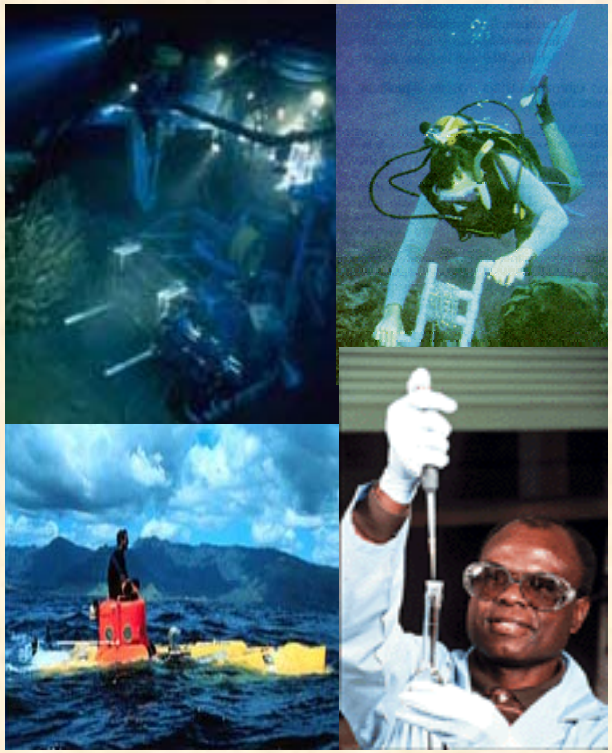
Why is There a Need for a Separate Aquatic Component?

- Distinct sectors of expertise



Terrestrial

Freshwater



Marine

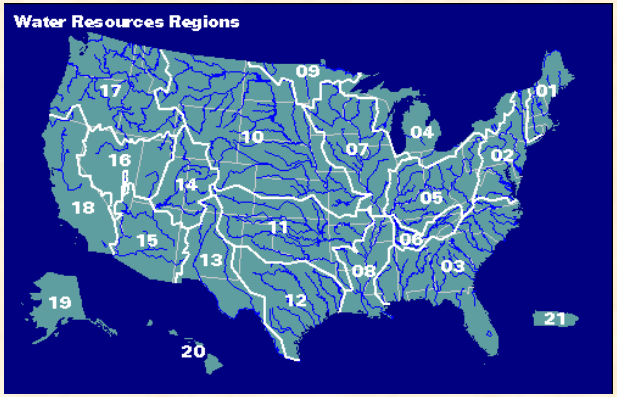
Basic Elements of Conservation Planning

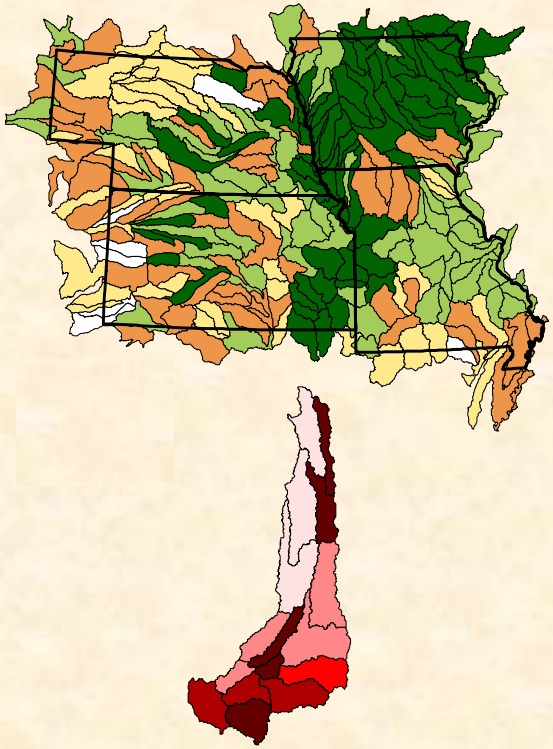
- Select Planning Regions and Assessment Units
- Specify conservation targets (biotic, abiotic, processes)
- Specify conservation goals for the Planning Region
  - Define what constitutes adequate representation
- Review existing protected areas (Gap Analysis)
- Establish conservation priorities to fill gaps
  - Relative comparison of assessment units based on:
    - Significance, condition, threats, costs, and opportunities
- Implement conservation actions
- Monitor key indicators to evaluate success of conservation actions

Planning Regions and Assessment Units

Watersheds/Hydrologic Units

Ecologically-Based

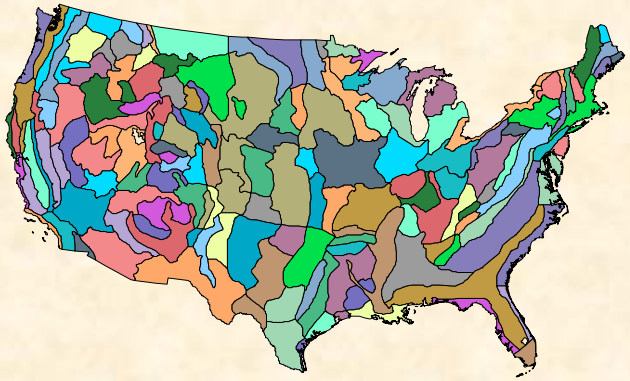


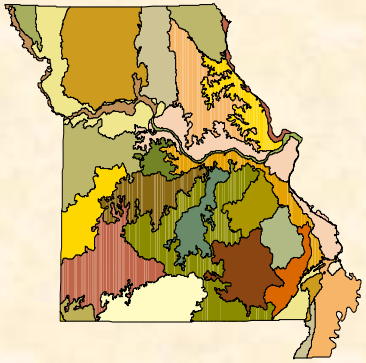


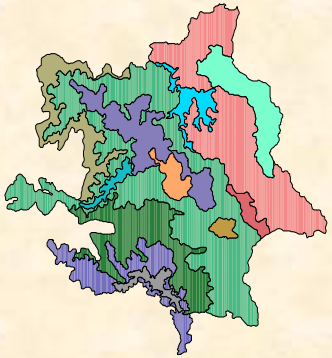
Coarse

Spatial Extent And Grain

Fine

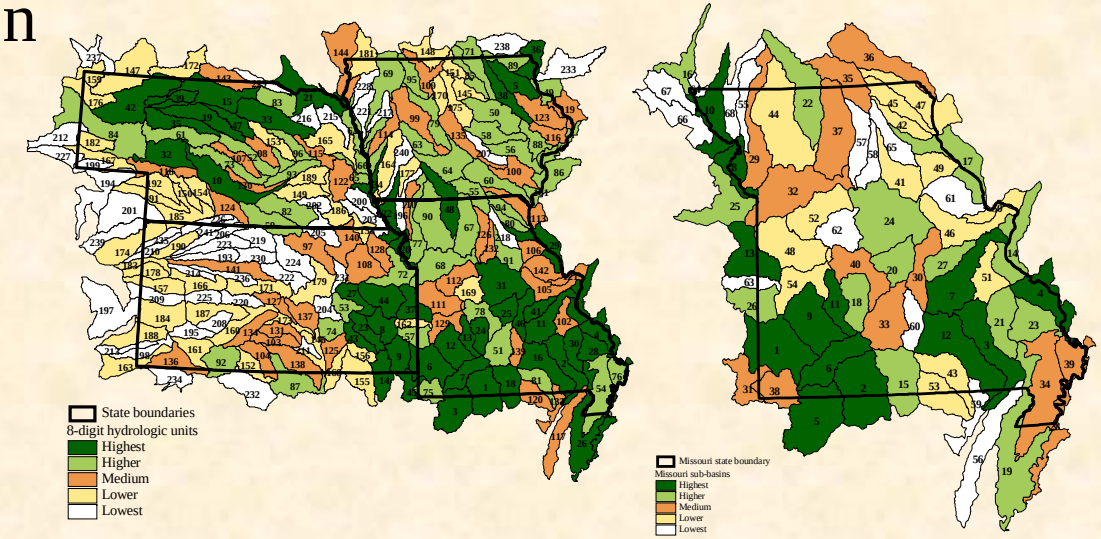






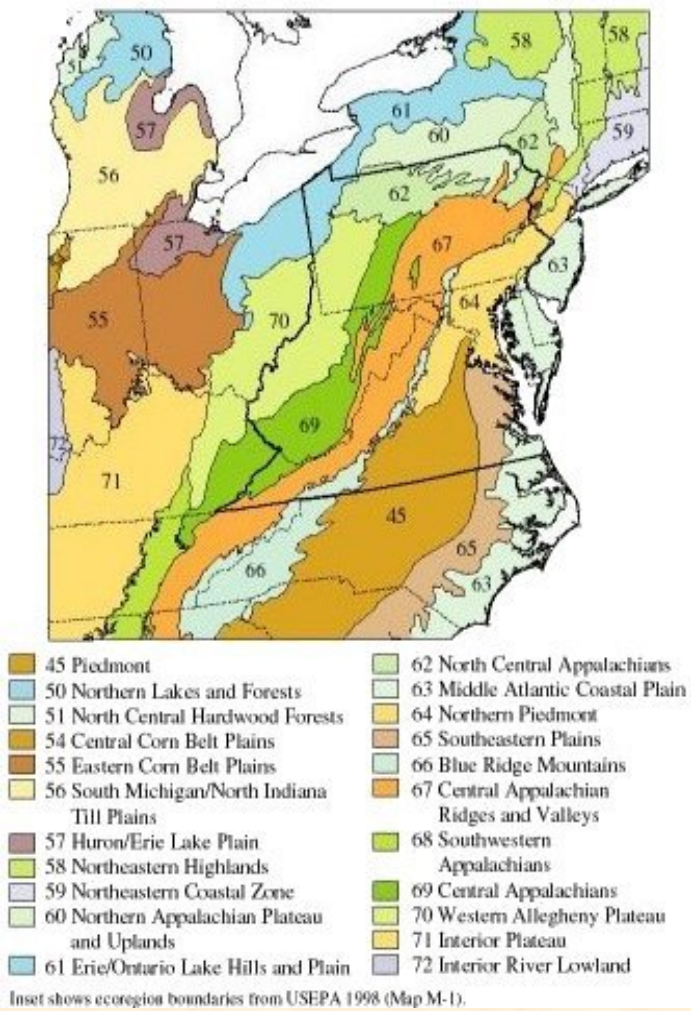
Planning Regions and Assessment Units Must be Carefully Selected

- Comparisons among your assessment units is relative to your planning region

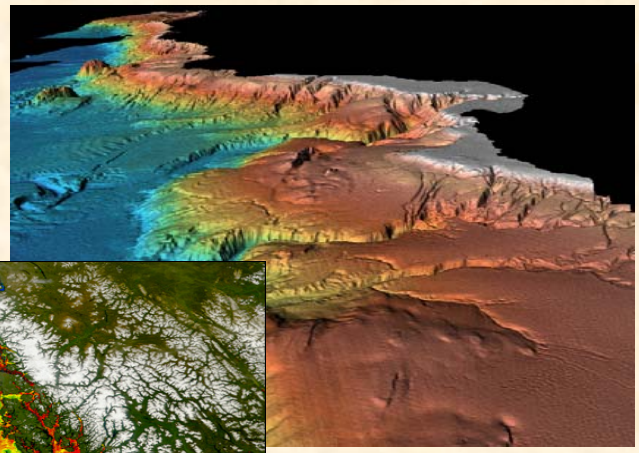


- Should be ecologically-based and hierarchically nested
  - Provide the proper ecological context
  - Meet a variety of conservation objectives
  - Finest level of hierarchy should be at a resolution suited to local planning and management

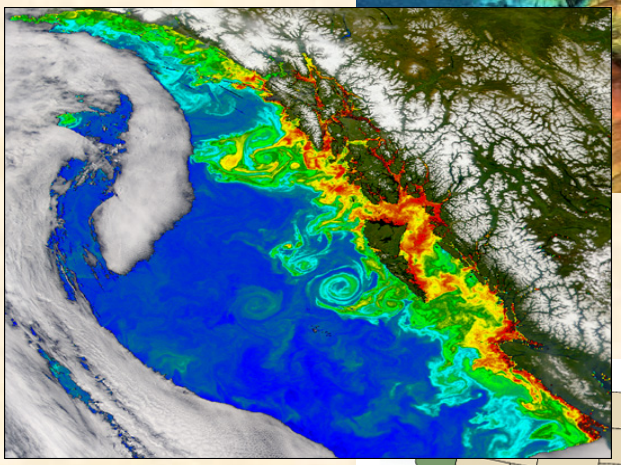
Ecoregions Do Not Account for all Geographic Variation in Marine Ecosystems



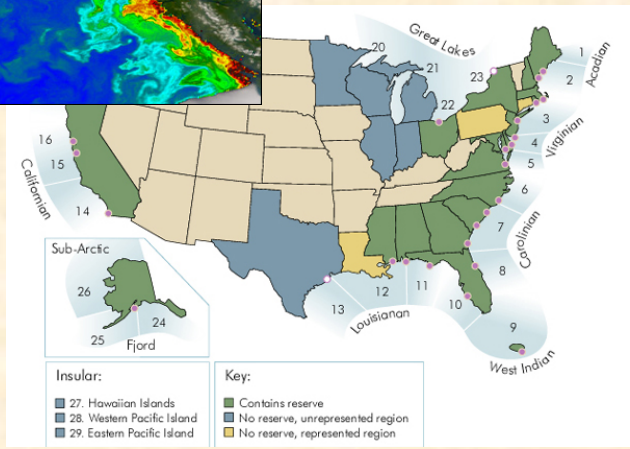
Structure



Function



Composition



Ecoregions Generally Account for Structural and Functional Variation in Freshwater Ecosystems

DO NOT:

- Account for species-level compositional variation
- Define interacting systems

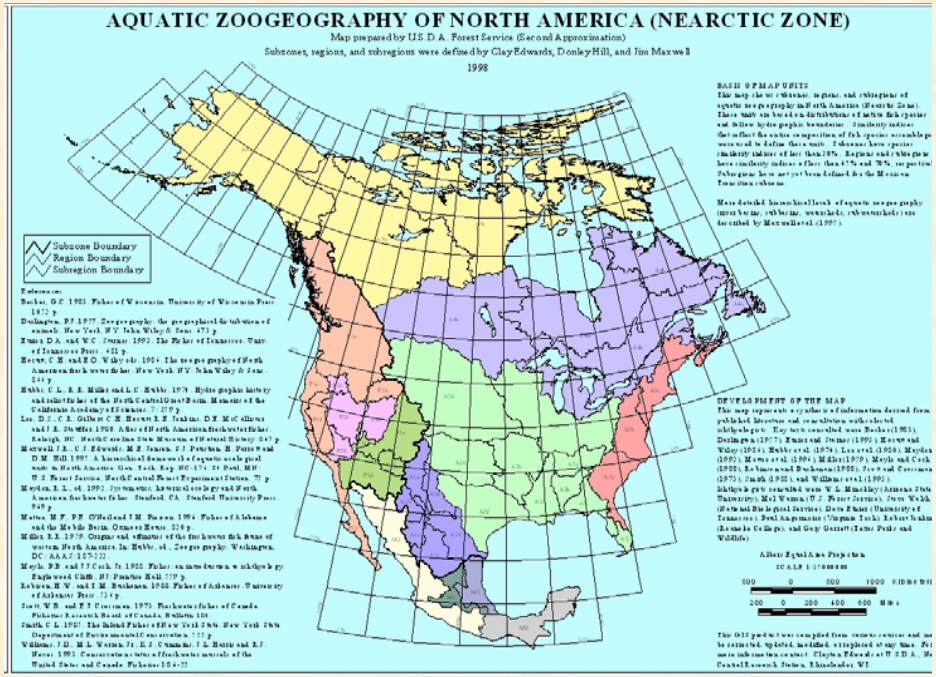
Ecoregional Subsections

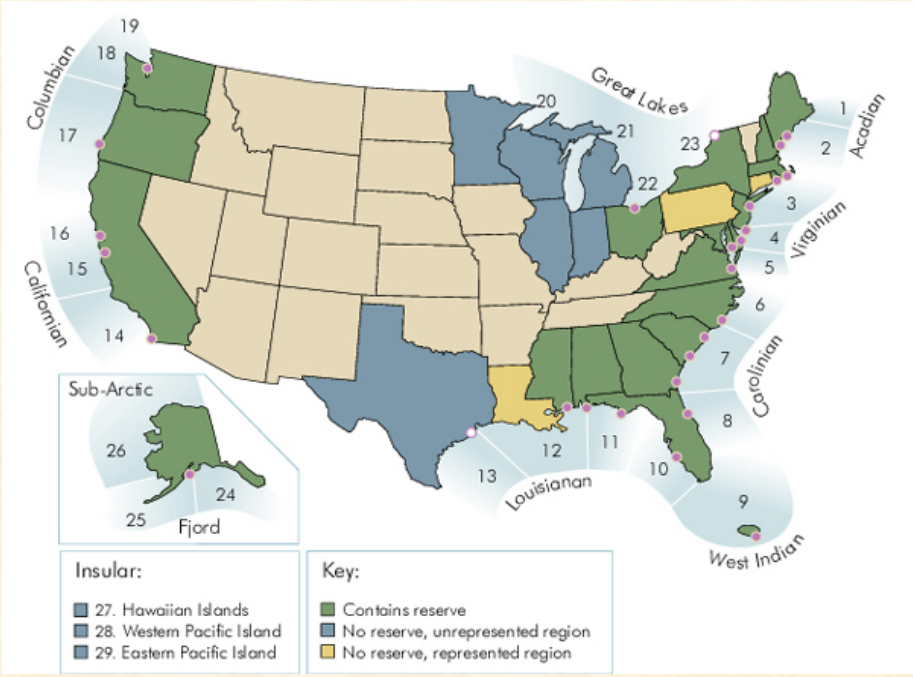
Ozark/Central Plateau

Ecological Drainage Units

Why is There a Need for a Separate Aquatic Component?

- Distinct sectors of expertise
- Different planning regions and assessment units





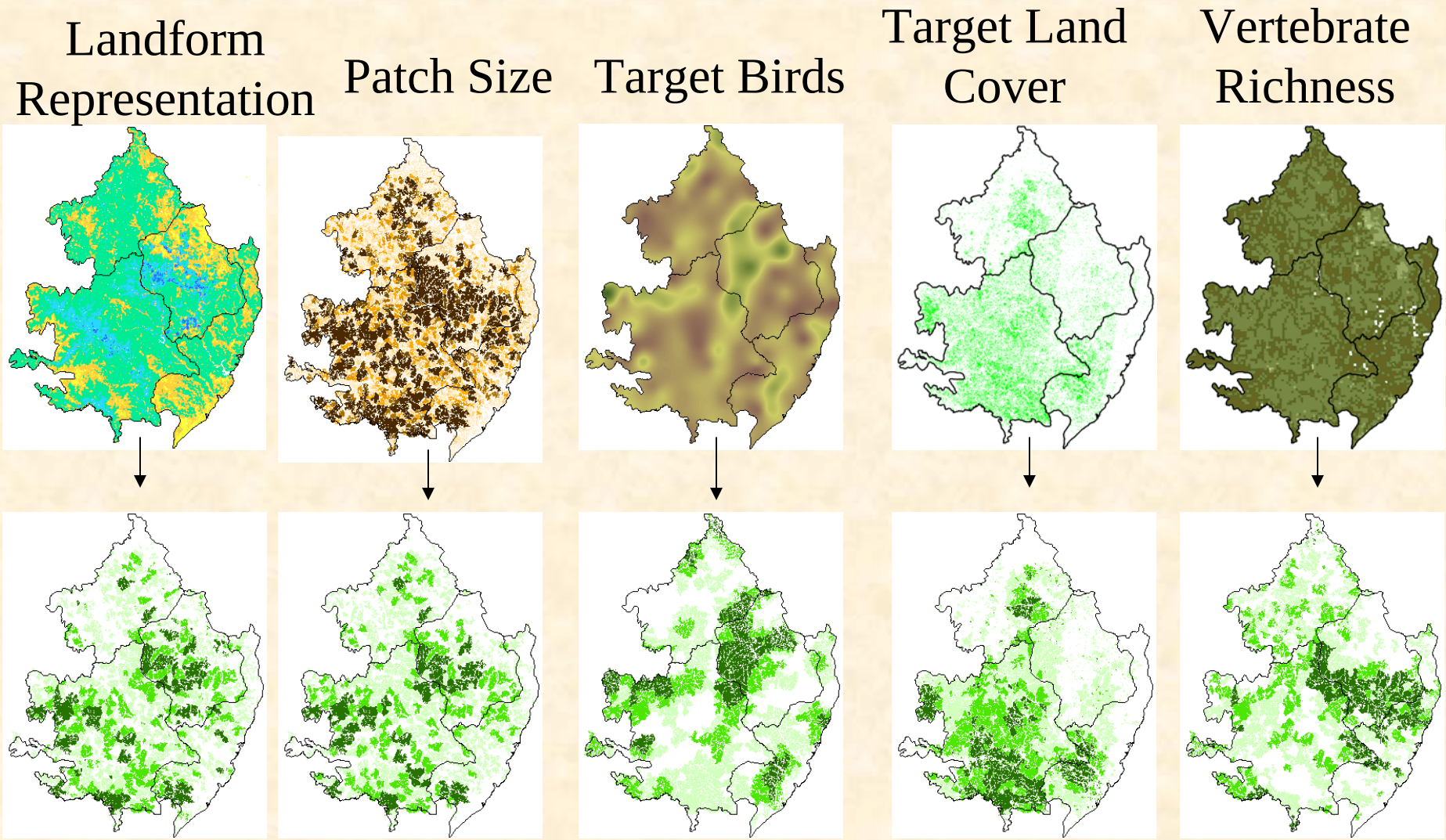
Assessing Gaps and Establishing Priorities by Proxy

Taxon	Identified	Estimated	% Identified
Bacteria	4,000	1,000,000	0.4
Viruses	4,000	400,000	1
Fungi	72,000	1,500,000	5
Nematodes	25,000	400,000	6
Algae	40,000	400,000	10
Arachnids	75,000	750,000	10
Insects	950,000	8,000,000	12
Protozoa	40,000	200,000	20
Crustaceans	40,000	150,000	27
Mollusks	70,000	200,000	**35**
Others	115,000	250,000	**46**
Plants	270,000	320,000	**84**
Vertebrates	45,000	50,000	**90**
Total	1,750,000	13,620,000	**13**

Surrogates for Biodiversity

Type of Surrogate	Cost and Precision	Biodiversity Surrogate	Ability to account for critical processes
Abiotic/Biotic	LOW	Ecosystem types	HIGH
Abiotic/Biotic	↓	Landscape types	⇧
Abiotic	↓	Climate classes	⇧
Abiotic	↓	Landform classes	⇧
Abiotic	↓	Geology, Soil, Substrate classes	⇧
Abiotic/Biotic	↓	Habitat types	⇧
Biotic	↓	"Community" types	⇧
Biotic	↓	Vegetation types	⇧
Biotic	↓	Select Higher Taxa	⇧
Biotic	↓	Select Species/subspecies	⇧
Biotic	HIGH	Select Populations/ Phylogenies	LOW

Surrogate Targets Matter



Biotic Surrogates for Terrestrial Component

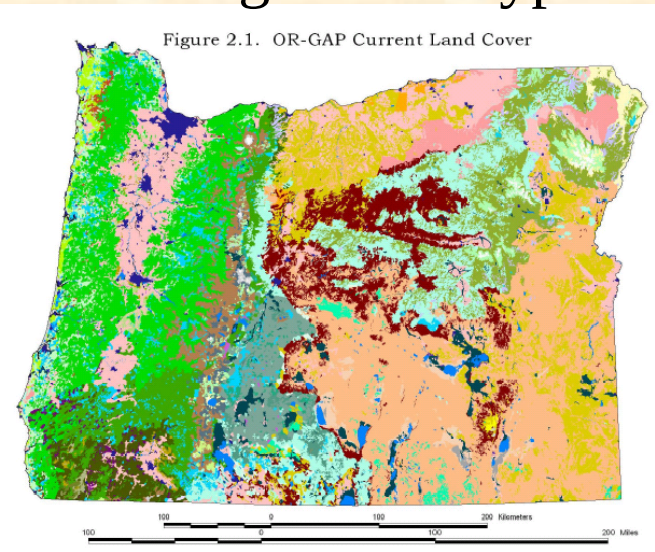
Biotic Surrogates for Aquatic Component

Riverine

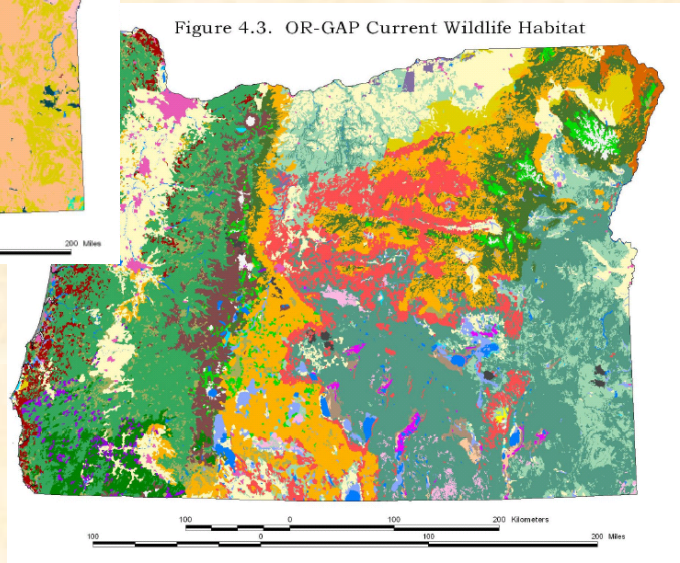
Coastal/Marine

Other Surrogates for Terrestrial Component

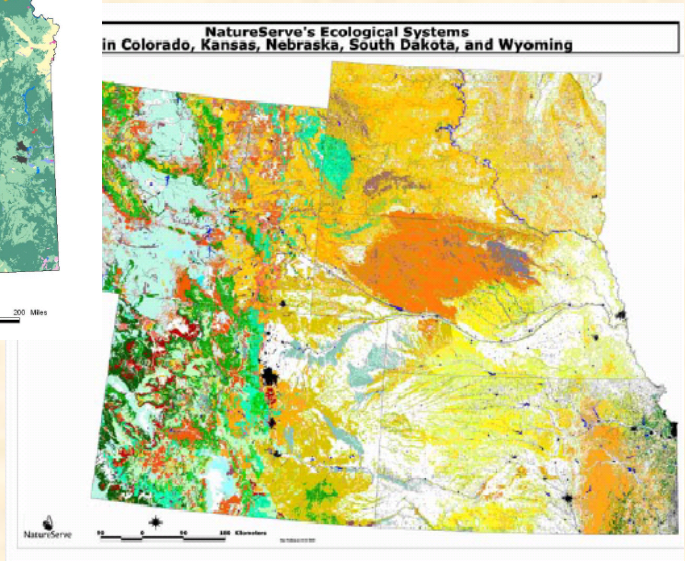
Vegetation Types



Habitat Types

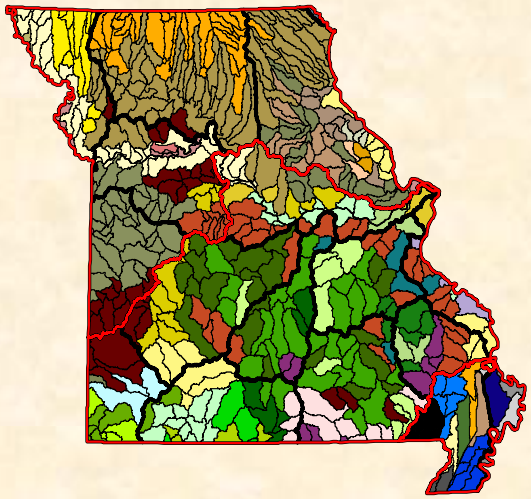


Ecological Systems

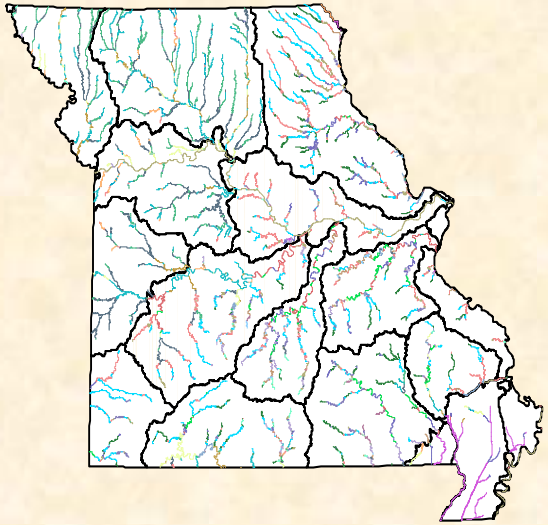


Abiotic/Biotic Surrogates for Aquatic Component

Riverine

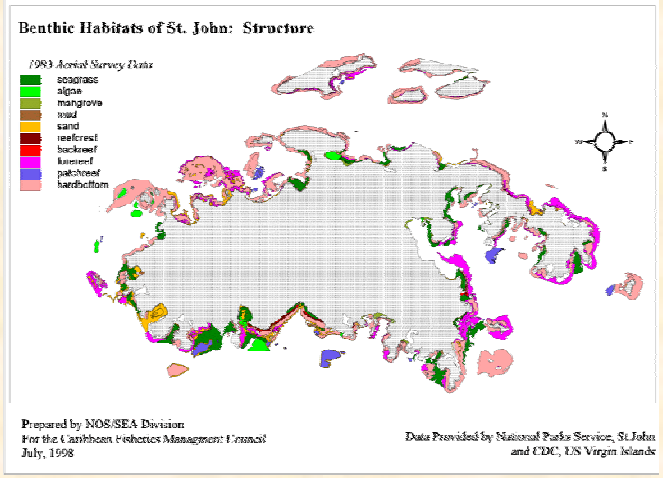


Aquatic Ecological Systems

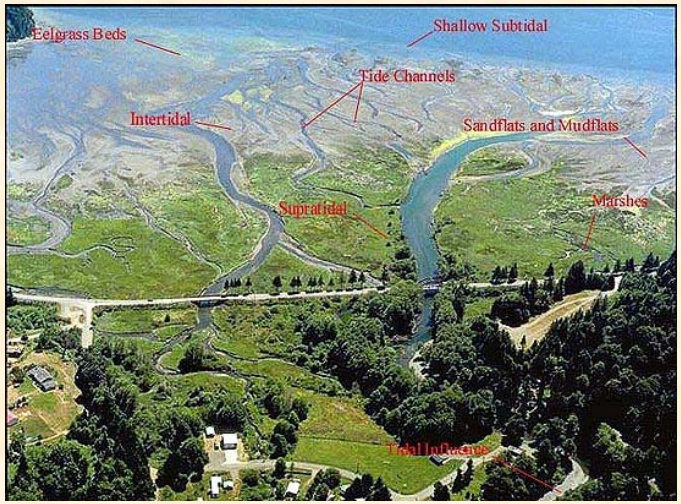


Valley Segment Types

Coastal/Marine



Major Benthic Habitats



Major Habitat Types

Why is There a Need for a Separate Aquatic Component?

- Distinct sectors of expertise
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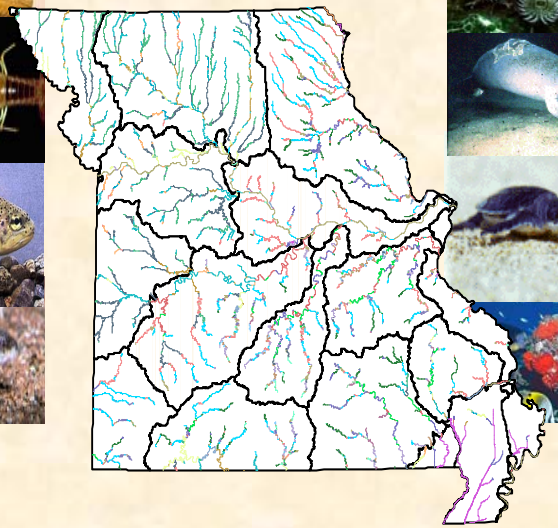
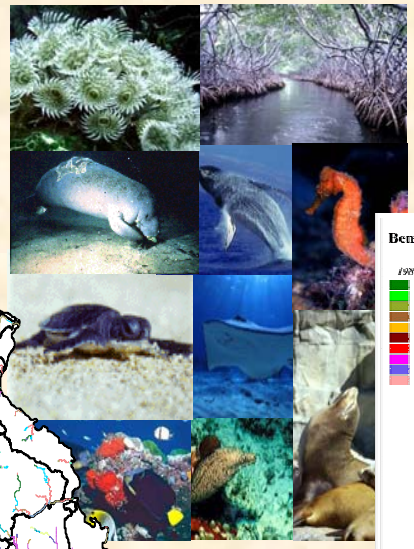
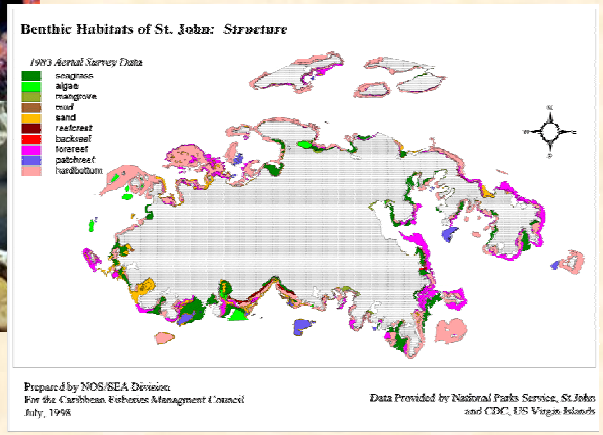
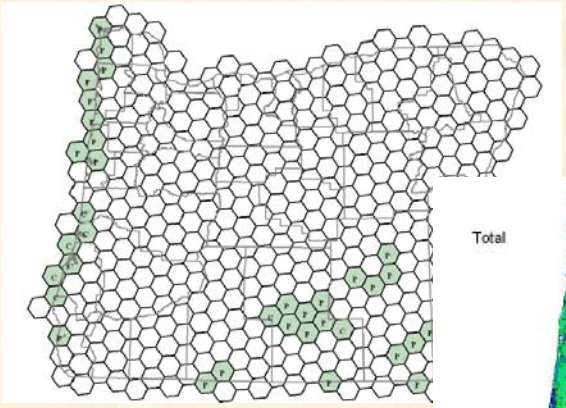
- Different abiotic and biotic surrogate targets







Developing Range and Predicted Distribution Maps for Terrestrial Component



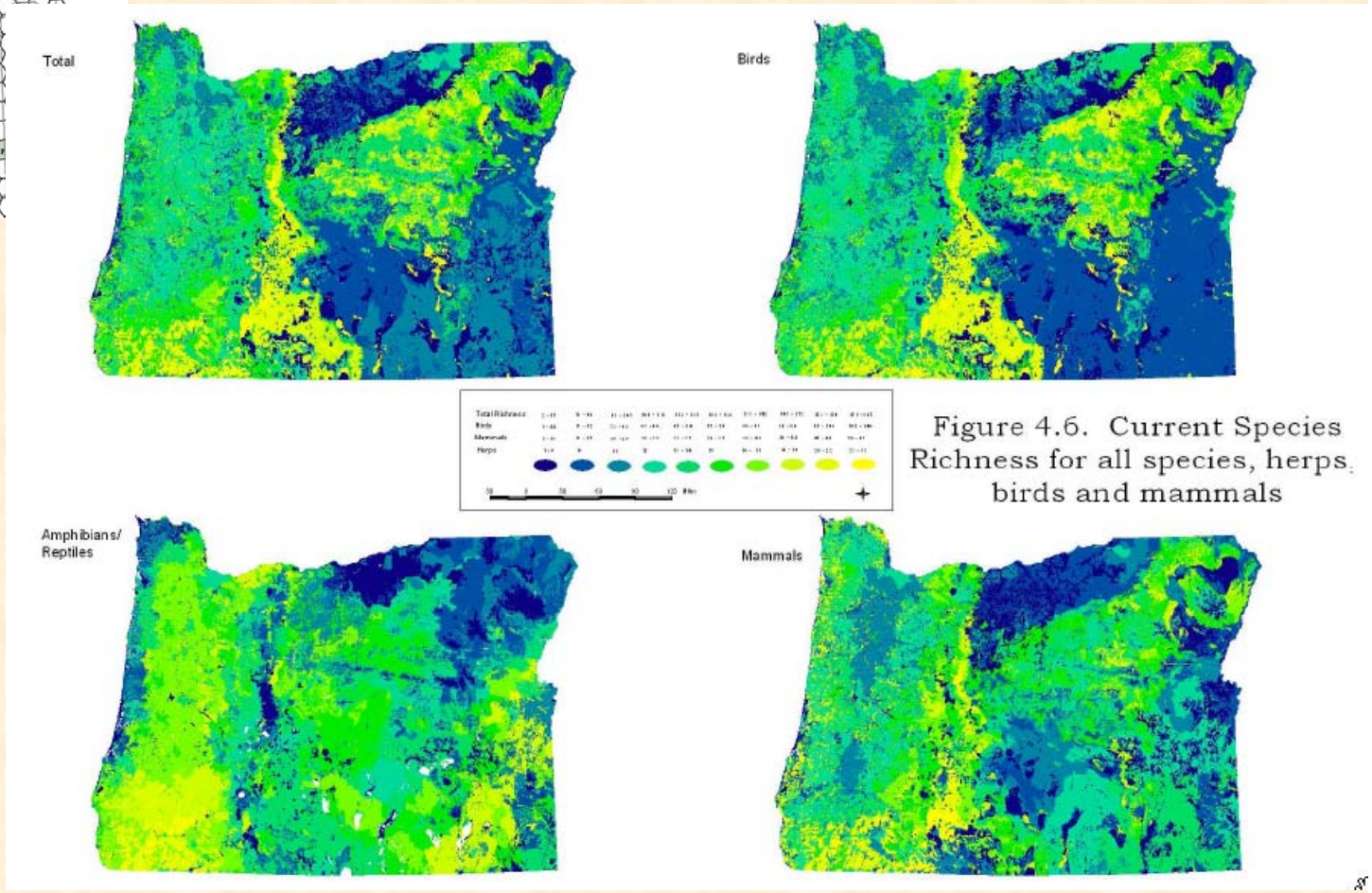
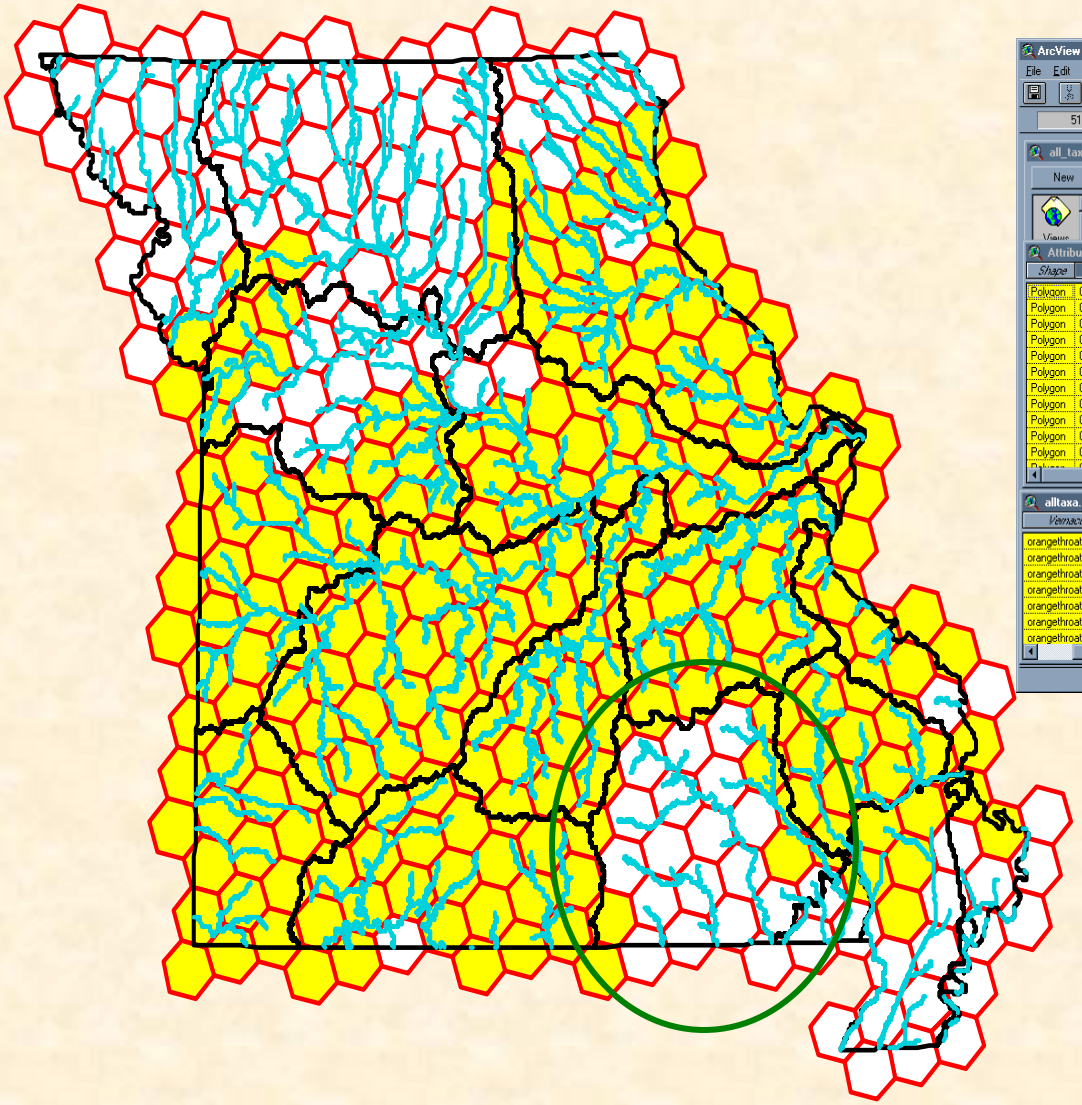
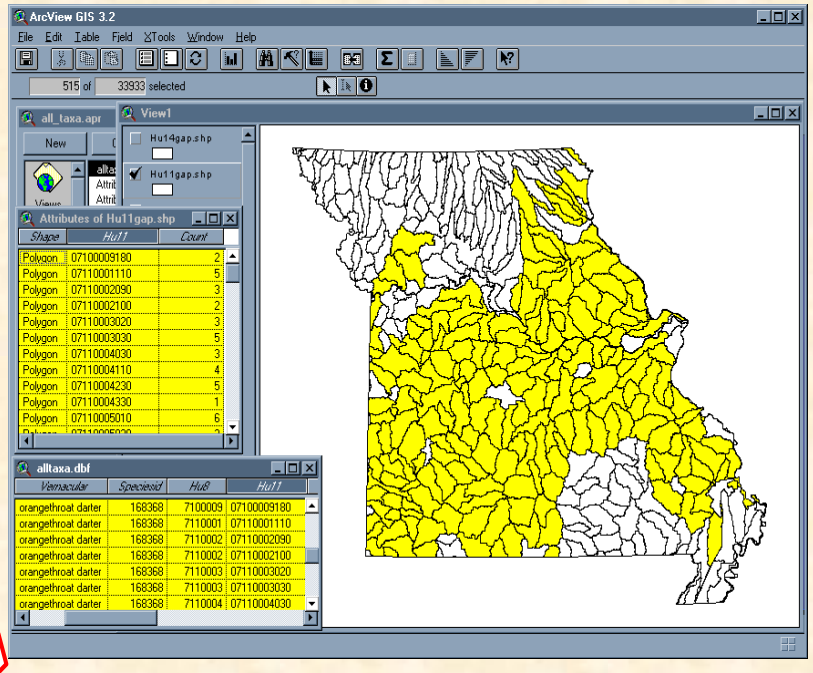


Figure 4.6. Current Species Richness for all species, herps, birds and mammals

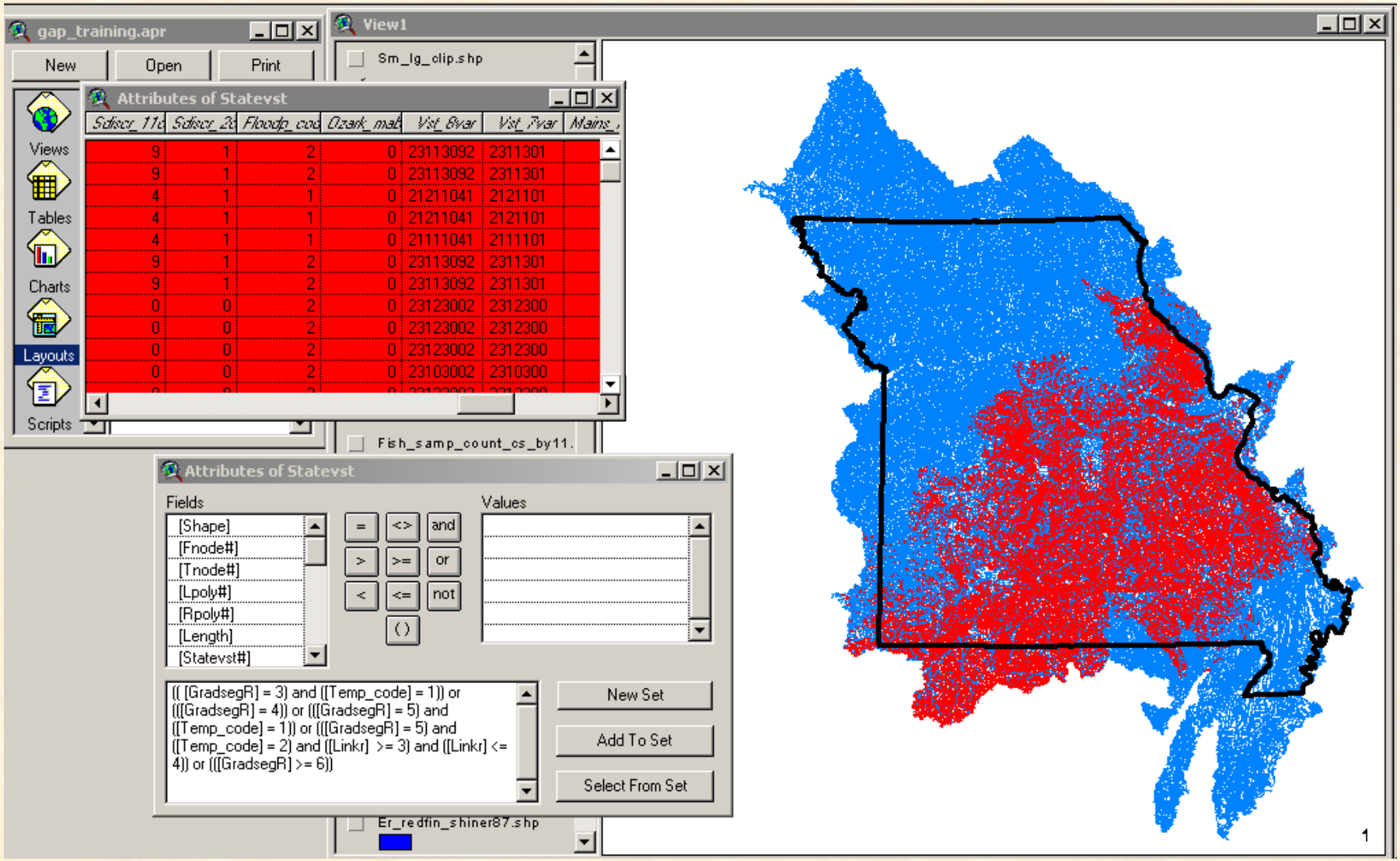
Grid-based Range Mapping is Inappropriate for Obligate Aquatic Freshwater Species



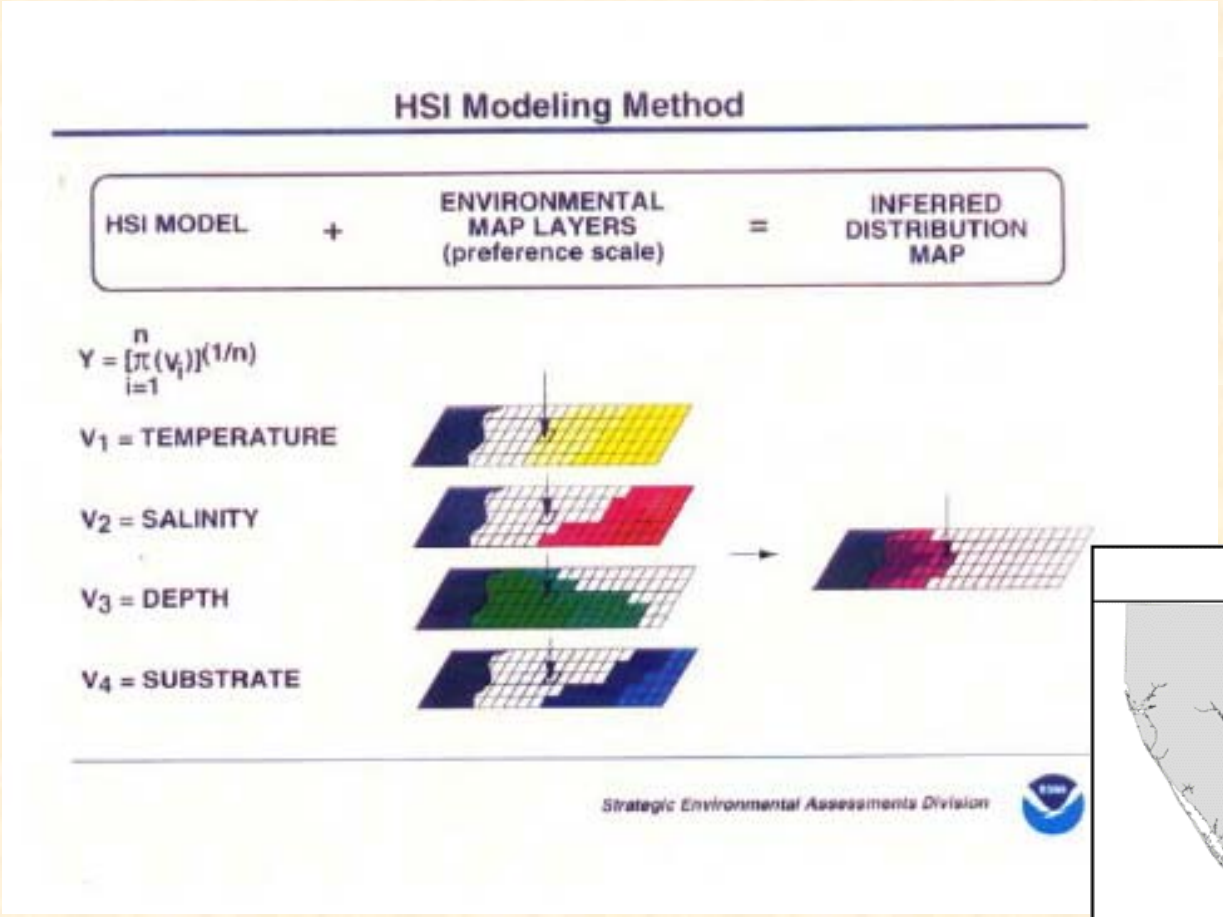


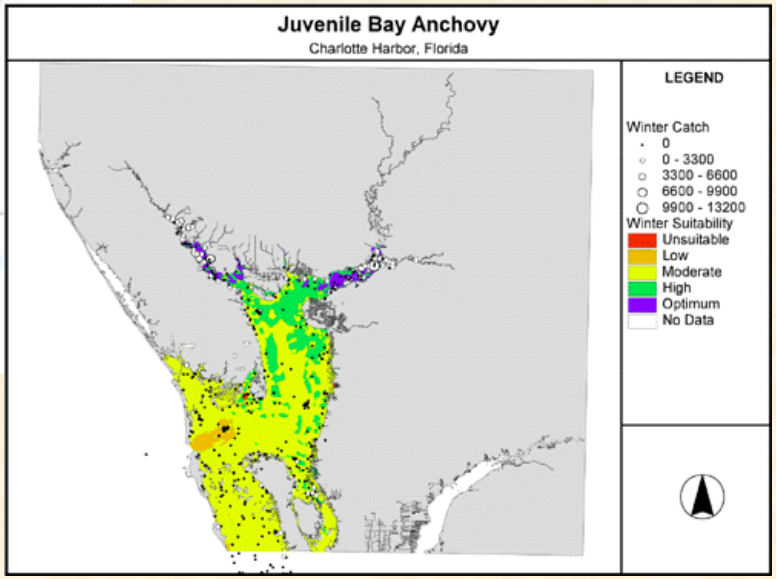
Statewide Range of the Orangethroat darter

Different Methods for Predicting Species Distributions in Riverine Ecosystems



Methods for Mapping Predicted Distributions in Marine are Similar to Terrestrial





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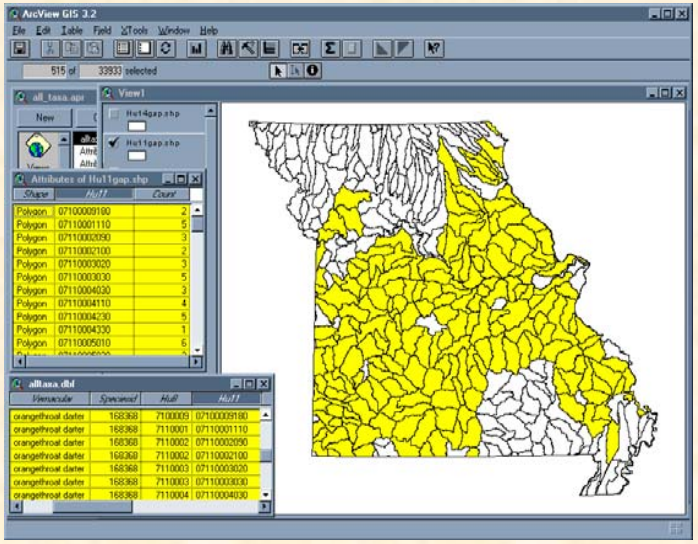
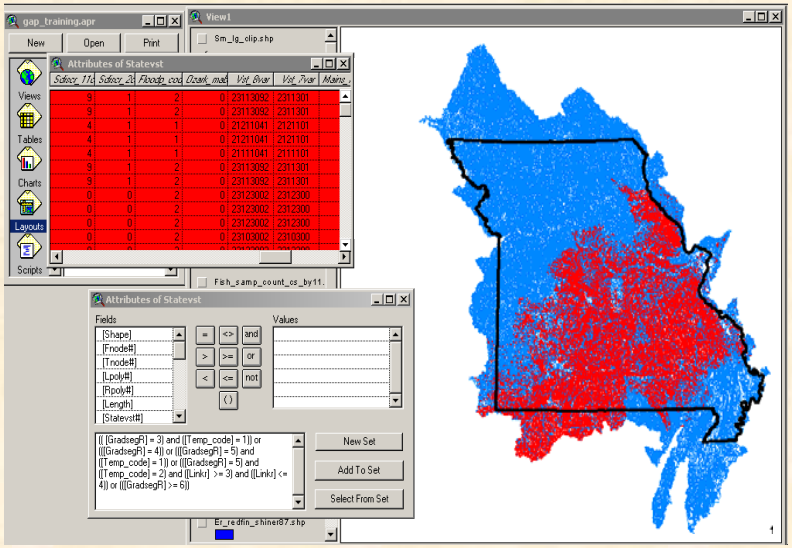
- Different planning regions and assessment units
- Different abiotic and biotic surrogate targets
- Different methods of mapping biotic surrogates





Identifying Conservation Gaps

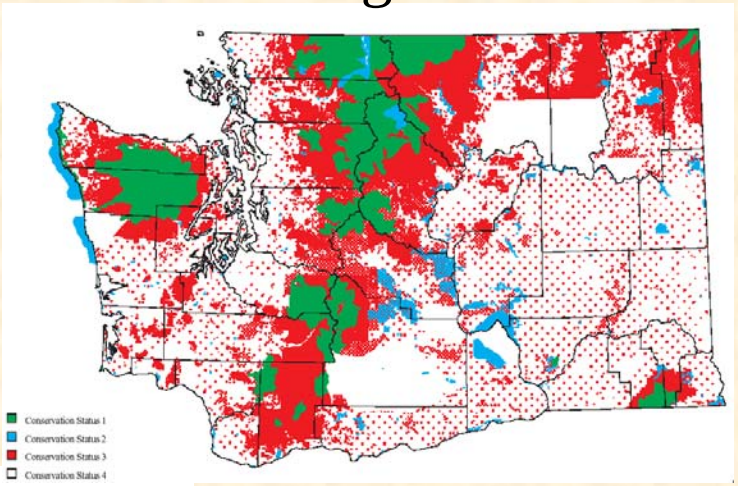
Table 14: Conservation Status of steppe zones (percent).

Steppe zone	Status 1	Status 2	Status 3	Status 4
Blue Mountains Steppe	0.00	5.91	14.30	79.79
Palouse	0.00	0.09	2.74	97.17
Three-tip Sage	0.00	1.27	12.10	86.64
Klickitat Meadow Steppe	0.00	0.38	6.49	93.13
Bitterbrush	0.00	0.00	6.93	93.07
Central Arid Steppe	0.00	5.91	9.16	84.93
Wheatgrass/Fescue	0.34	0.42	6.01	93.23
Canyon Grassland	0.00	0.59	5.19	94.22
Big Sage/Fescue	0.00	0.06	3.98	95.96
All steppe zones	0.05	3.38	8.45	88.12

Table 15: Conservation Status of steppe zones (hectares).

Steppe zone	Status 1	Status 2	Status 3	Status 4	Total
Blue Mountains Steppe	0	3,833	9,283	51,780	64,896
Palouse	0	416	12,792	454,263	467,471
Three-tip Sage	0	13,761	131,510	941,735	1,087,006
Klickitat Meadow Steppe	0	239	4,089	58,680	63,008
Bitterbrush	0	0	1,696	22,767	24,463
Central Arid Steppe	0	182,423	282,836	2,622,834	3,088,093
Wheatgrass/Fescue	2,987	3,632	52,264	811,384	870,267
Canyon Grassland	0	1,238	10,845	196,999	209,082
Big Sage/Fescue	0	119	8,197	197,407	205,723
All steppe zones	2,987	205,661	513,512	5,357,849	6,080,009

Washington State



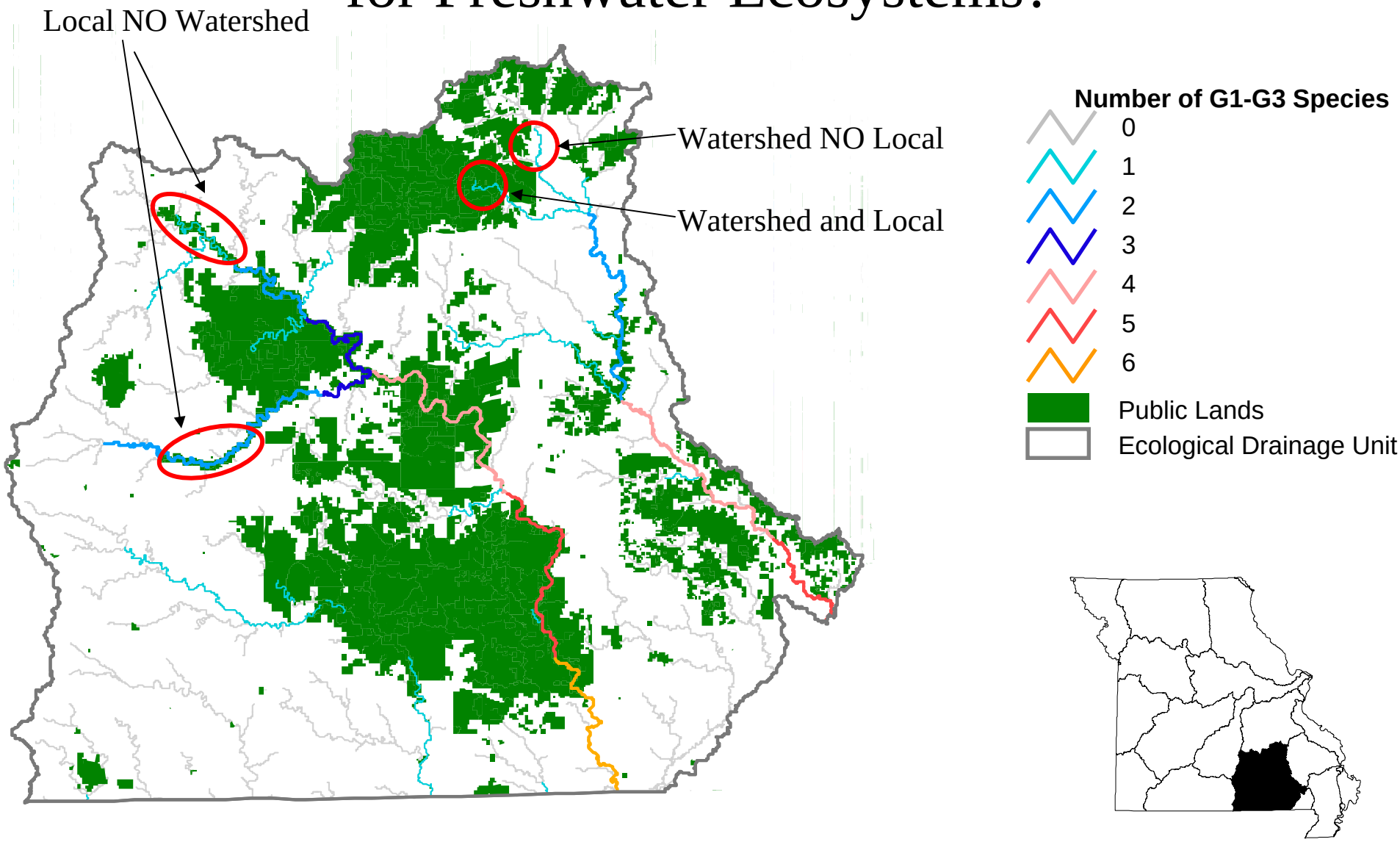
Status 1

Status 2

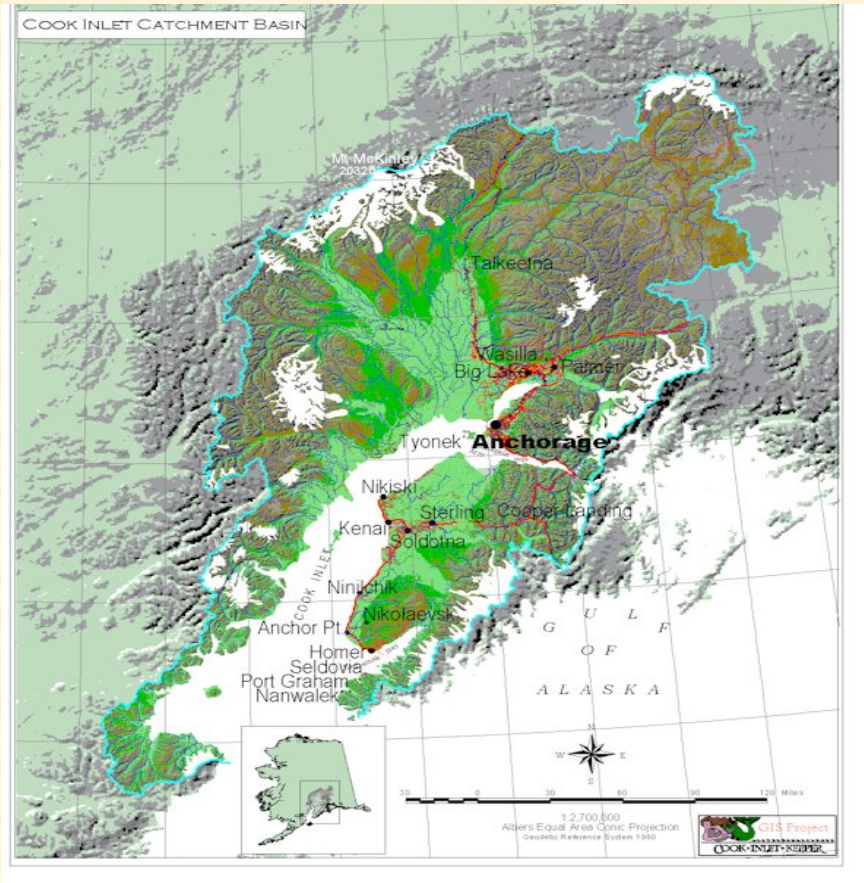
Status 3

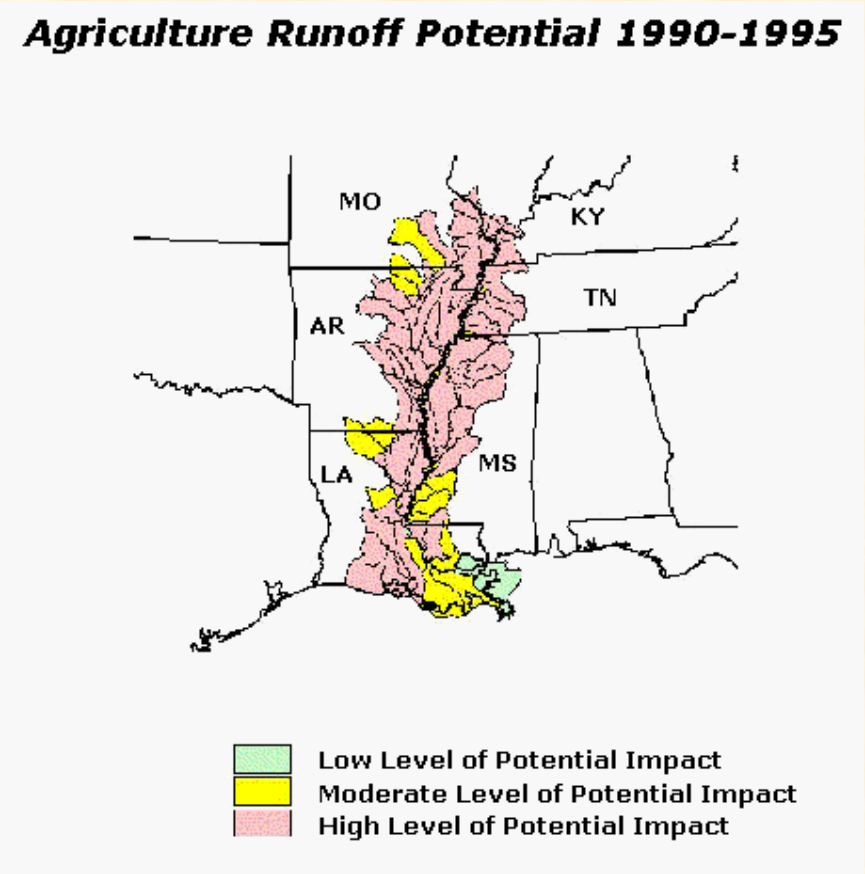
Status 4

Identifying Conservation Gaps for Freshwater Ecosystems?



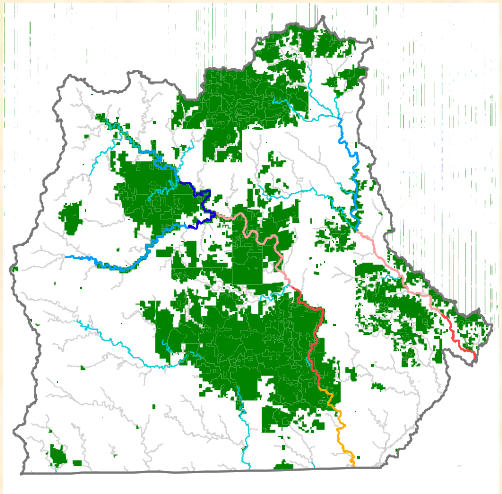
Identifying Conservation Gaps for Coastal/Marine Ecosystems?

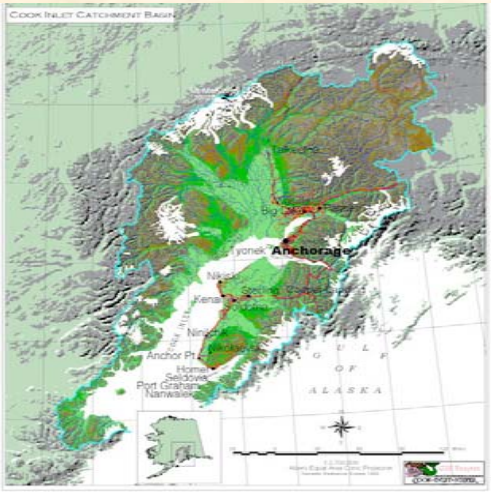




Why is There a Need for a Separate Aquatic Component?

- Distinct sectors of expertise
- Different planning regions and assessment units
- Different abiotic and biotic surrogate targets
- Different methods of mapping biotic surrogates
- Different definitions of what constitutes a gap





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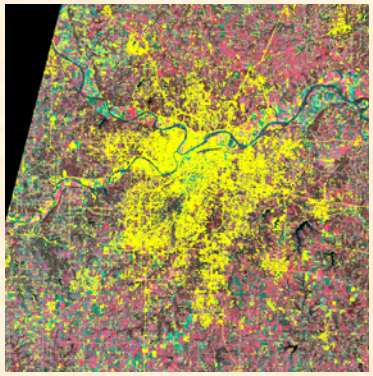
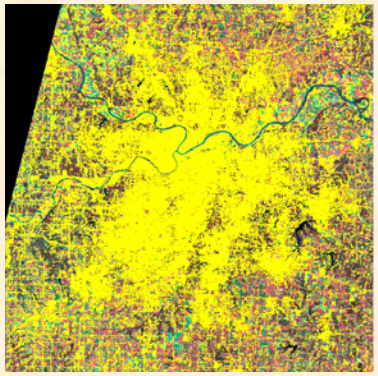
- Different methods of mapping biotic surrogates
- Different definitions of what constitutes a gap
- Different factors to consider when establishing priorities to fill conservation gaps

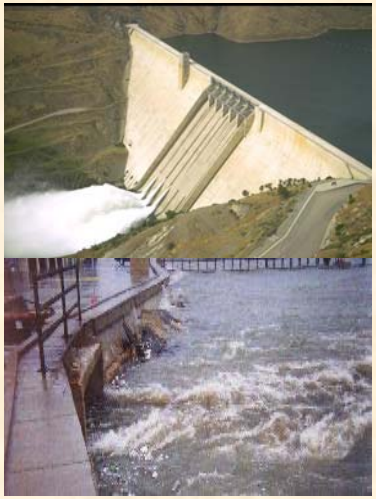
Differences in Establishing Priorities

- Significance (richness, endemism, distinctiveness)
- Costs (acquisition, maintain, economic losses)

- Condition and Threats







- Opportunities
  - Different laws, regulations, management programs

Summary

- Terrestrial and Aquatic Components have the same philosophy/assumption, goal, general strategy, objective
- Fundamental and methodological differences dictate the need for separate components
- Aquatic component has grown rapidly in the last 3 years
- Significant progress has been made towards developing the data and assessment methods needed to identify conservation gaps in riverine ecosystems
- Need to expand efforts into other major aquatic ecosystems
- Possibly expand focus to devising innovative tools/analyses for establishing priorities to fill gaps
  - Decision Support Systems
  - Systematic conservation planning algorithms/software
  - Will require additional geospatial datasets needed by planners and managers (socioeconomic data, law/regulations, conditon/threats)