Highlights and Overview of the 2011 National Wetland Condition Assessment (NWCA) and Upcoming 2016 NWCA

September 15, 2016

1PM EDT

Mary E. Kentula, Ph.D.

US Environmental Protection Agency

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About the Presenters

Mary E. Kentula, Ph.D.

Wetland Ecologist

US Environmental Protection Agency

SWS webinar *Series*

Highlights and Overview of the 2011 National Wetland Condition Assessment (NWCA) and Upcoming 2016 NWCA

Mary E. Kentula

USEPA, ORD, NHEERL-WED, Corvallis, OR

SWS Webinar
September 15, 2016

The 2011 NWCA Collaborators

▶ The USEPA Wetland Division Team and counterparts in the Regions

▶ State and Tribal Environmental Agencies – site evaluation and sampling

▶ The USEPA ORD Analysis Team

▶ Great Lakes Environmental Center - sampling logistics

▶ U.S. Army Corps of Engineers

▶ U.S. Department of Agriculture, Natural Resource Conservation Service

▶ U.S. Department of Agriculture, Forest Service

▶ U.S. Department of Interior, Fish and Wildlife Service

▶ U.S. Department of Interior, National Park Service

▶ U.S. Geological Survey

▶ Cooperating Colleges and Universities

▶ Participating Contractors

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ORD's NWCA Analysis Team and Advisors

Karen Blocksom, WED -- data management & QA,VMMI development

Howard Bruner, CSS-Dynamac Corp. -- Field Operations Manual (FOM)

Sandy Bryce, CSS-Dynamac Corp. – FOM

Siobhan Fennessy, Kenyon College – VMMI development

Alan Herlihy, USEPA OW & OSU – reference, stressors, risk assessment, water chemistry

Brian Hill, MED – soil enzymes

Phil Kaufmann, WED – buffer data analysis and advice

Tom Kincaid, WED – generation of population estimates

Gregg Lomnicky, CSS-Dynamac Corp. – FOM, buffer & hydrology data analysis

Teresa Magee, WED – FOM, VMMI development, plant stressor analysis

Amanda Nahlik WED & Kenyon College – FOM, soils data analysis

Janet Nestlerode, GED – water chemistry

Tony Olsen, WED – survey design and population weights

Steve Paulsen, WED – presentation of population-level results

Dave Peck, WED – advice and help on data management through analysis

John Stoddard, WED – advice on MMI development

John Van Sickle, WED – advice on MMI development and analysis

 Anett Trebitz, MED – water chemistry

Marc Weber, WED – landscape data acquisition & GIS analysis

Presentation Outline

OVERVIEW

- Background

- History

INTRODUCTION TO NWCA

ANALYSIS AND RESULTS

- Definition of Reference

- Biological condition

- Stressor extent

- Estimation of Relative and Attributable Risk

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NWCA is part of USEPA's National Aquatic Resource Surveys (NARS)

➤ Builds from almost 20 years of research and pilot studies done under ORD's Environmental Monitoring and Assessment Program
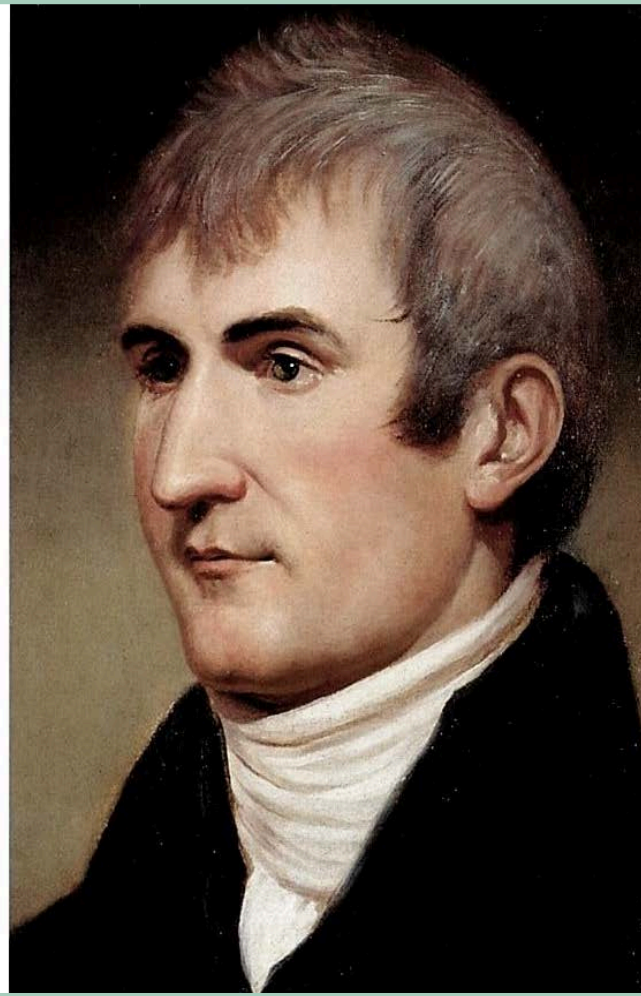

➤ Surveys Rivers and Streams, Lakes and Reservoirs, Coastal, and Wetland systems

➤ Every five years a survey of physical, chemical, and biological aspects of these aquatic systems is completed for the conterminous US
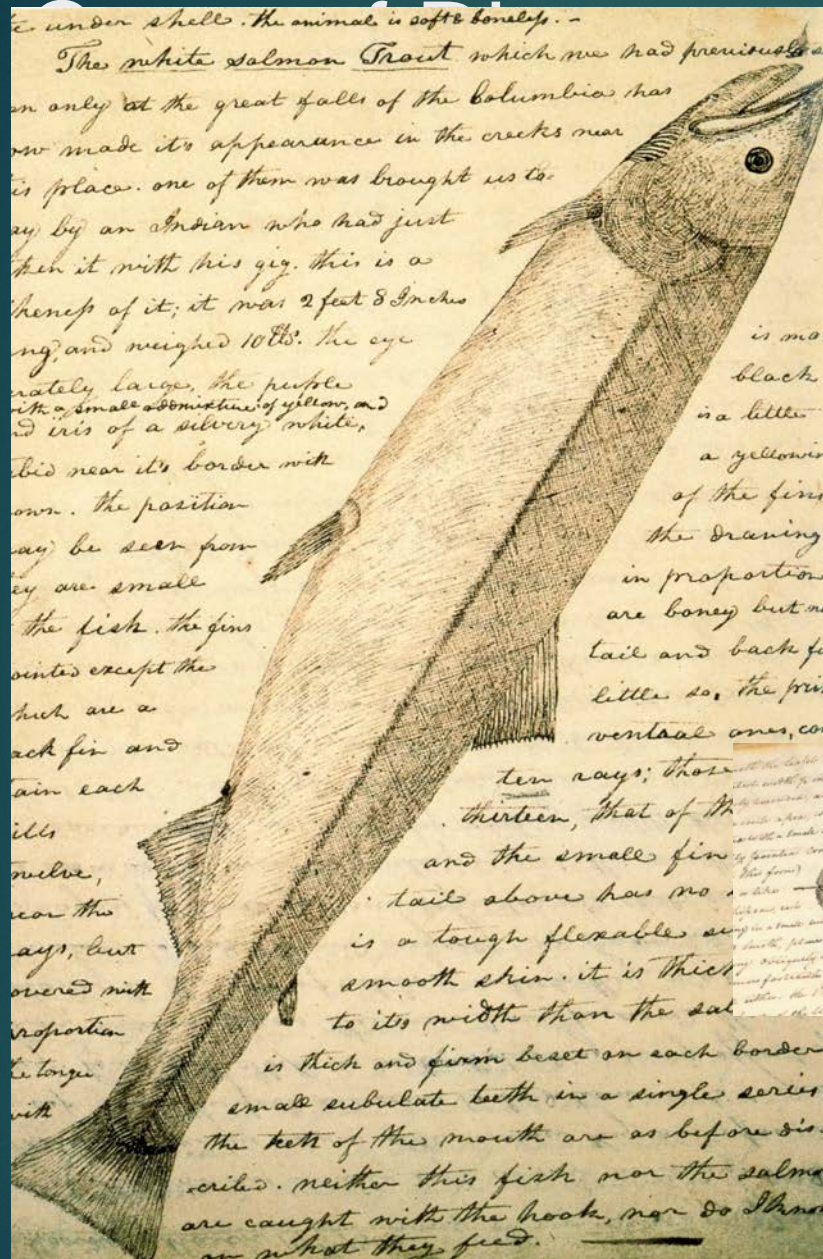
EPA

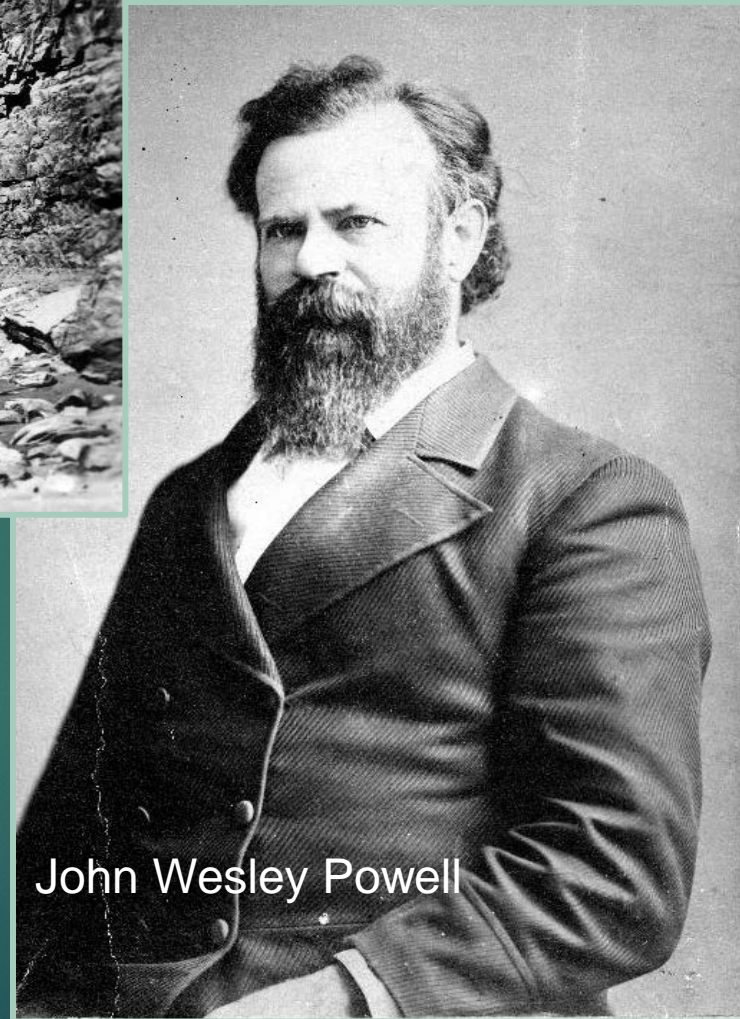# The Corps of Discovery Expedition 1804-06

William Clark

Meriwether Lewis

EPA

The Corps of Discovery Expedition 1804-06

Meriwether Lewis

The Opening of the West -1870s

John Wesley Powell

EPA

Presentation Outline

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- ➤ History

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- ➤ Biological condition

- ➤ Stressor extent

- ➤ Risk Assessment

2016 INNOVATIONS & APPLICATIONS

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NWCA Objectives:

▶ Produce a national report describing the ecological condition of the Nation's wetlands and stressors commonly associated with poor condition;

▶ Collaborate with states and tribes in developing complementary monitoring tools, analytical approaches, and data management technology to aid wetland protection and restoration; and

▶ Advance the science of wetland monitoring and assessment to support management needs.

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What is a Wetland?

"Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: 1) at least periodically, the land supports predominantly hydrophytes; 2) the substrate is predominantly undrained hydric soil; and 3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year." (Cowardin, et al. 1979).
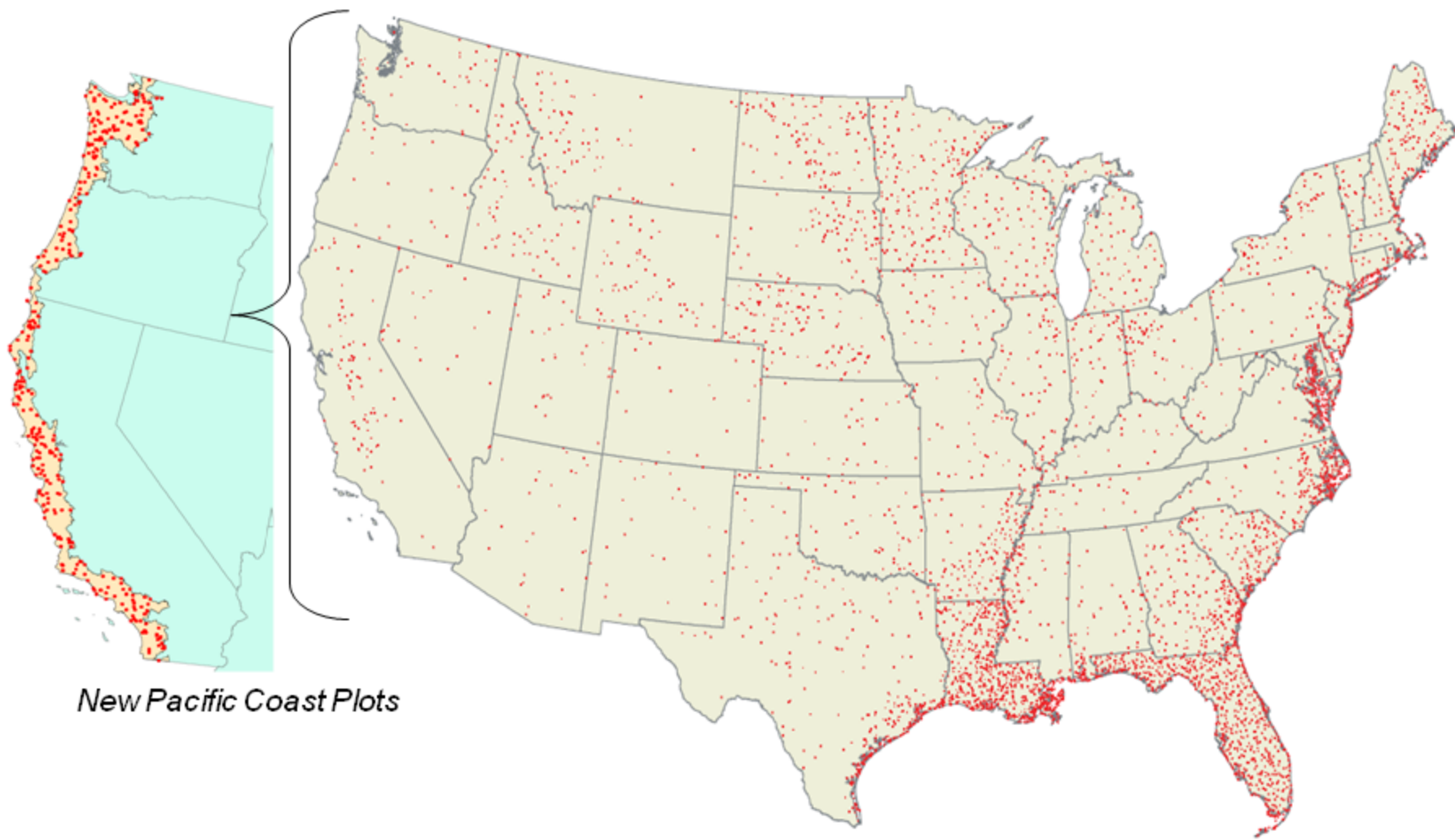
EPA

The NWCA sampled:

Tidal and nontidal wetlands of the conterminous U.S., including farmed wetlands not currently in crop production

The wetlands had rooted wetland vegetation and, when present, open water less than 1 meter deep
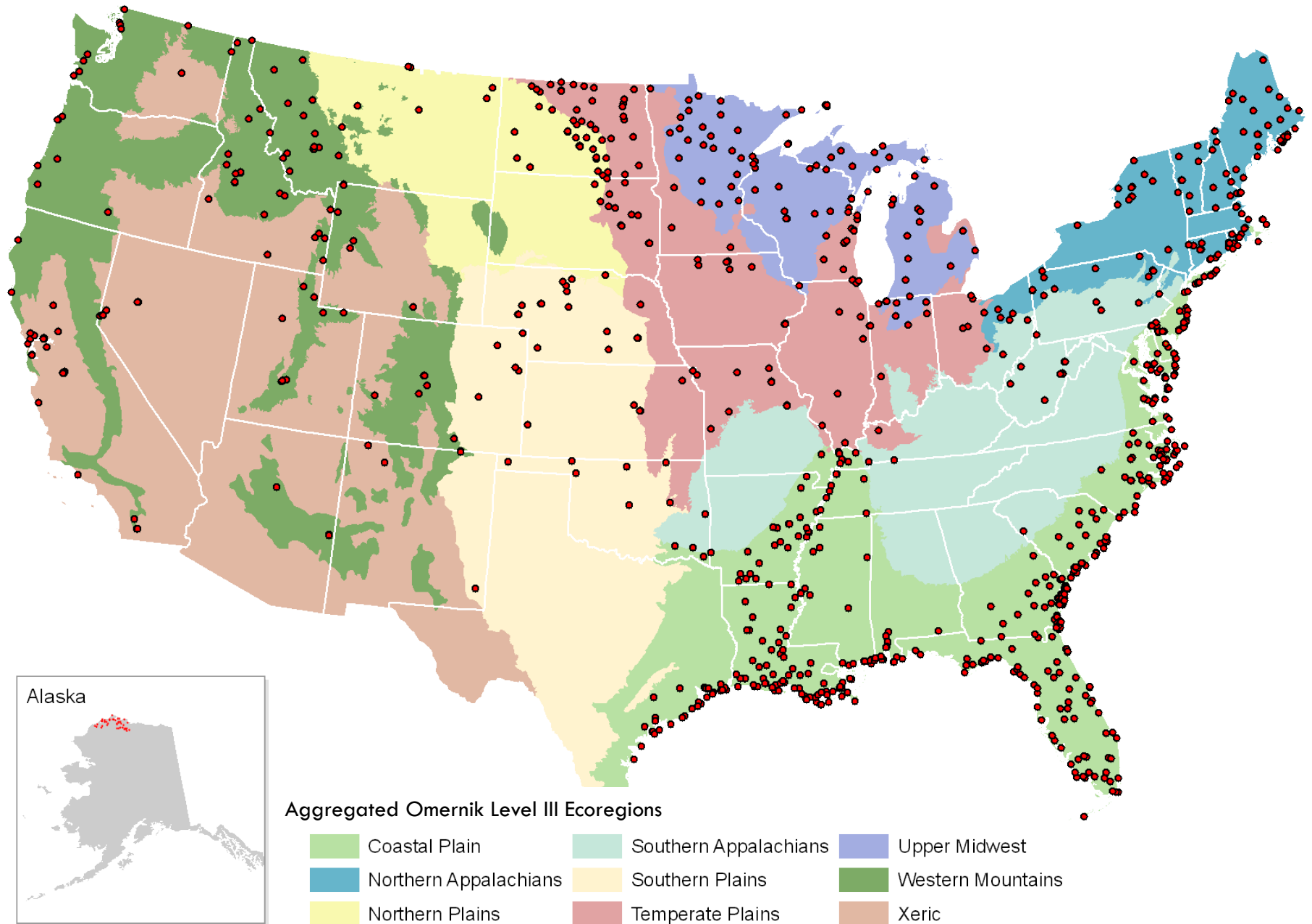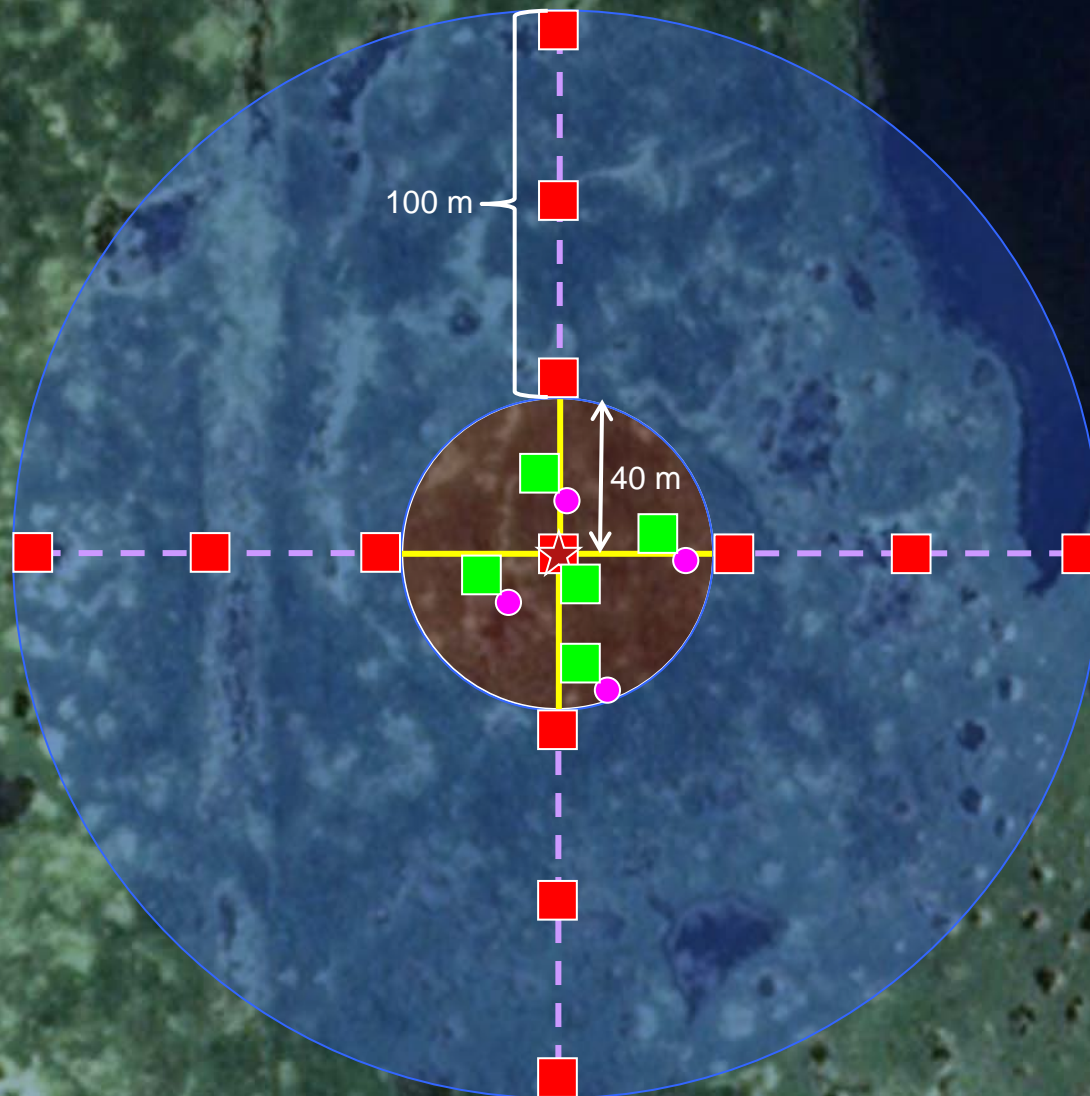
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Status and Trends 2005 Plot Locations

New Pacific Coast Plots

Each red dot is a 4 square mile plot that includes mapped wetlands, deepwater, and uplands.

2011 NWCA - 1138 Sites Sampled

Alaska

Aggregated Omernik Level III Ecoregions

- Coastal Plain
- Southern Appalachians
- Upper Midwest
- Northern Appalachians
- Southern Plains
- Western Mountains
- Northern Plains
- Temperate Plains
- Xeric

NWCA Standard AA and Buffer

Assessment Area

Vegetation Plot

Soil Pit

Buffer Area

Buffer Plot

100 m

40 m

Categories of Data Collected:

▶ Vegetation

▶ Soils

▶ Hydrology

▶ Water Chemistry

▶ Algae

▶ Stressors in AA and Buffer

▶ Buffer Characterization

▶ USA-RAM

NWCA Data Collection and Processing

TYPE	INFORMATION	SAMPLES*
Vegetation	QA / Unknown Identification	10,000
Soils	Chemistry, bulk density, enzyme, and isotope analysis	8,500
Water Chemistry / Chlorophyll-a	Water-quality analysis	2,000
Algae	Taxonomic identification and toxins	2,000
Site Forms (Packets)	Site characterization, vegetation composition and cover, soil profile, hydrology, stressors, buffer, and USA-RAM metrics	70,000+ pgs

* Number of samples taken; not number of sites sampled.

Presentation Outline

OVERVIEW

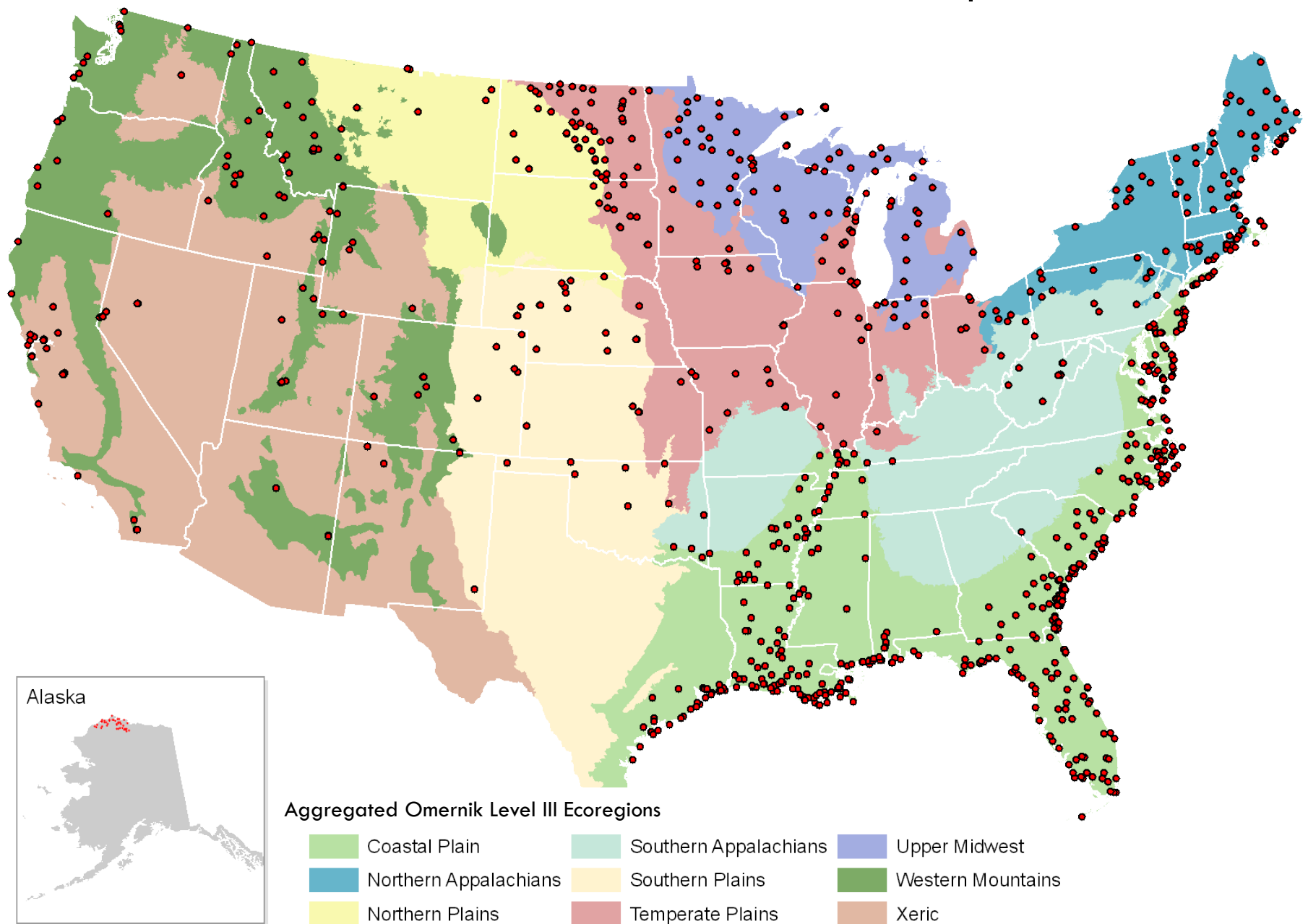- ➢ Background

- ➢ History

INTRODUCTION TO NWCA

ANALYSIS AND RESULTS

- ➢ Definition of Reference

- ➢ Biological condition

- ➢ Stressor extent

- ➢ Estimation of Relative and Attributable Risk

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2011 NWCA - 1138 Sites Sampled

Alaska

Aggregated Omernik Level III Ecoregions

- Coastal Plain
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Aggregation of Ecoregions for Reporting

9 Aggregated Omernik Level III Ecoregions

Coastal Plains
Northern Appalachians
Northern Plains
Southern Appalachians
Southern Plains
Temperate Plains
Upper Midwest
Western Mountains
Xeric

4 Aggregated NWCA Ecoregions

Coastal Plains
Eastern Mtn and Upper Midwest
Interior Plains
West

NWCA Reporting Groups

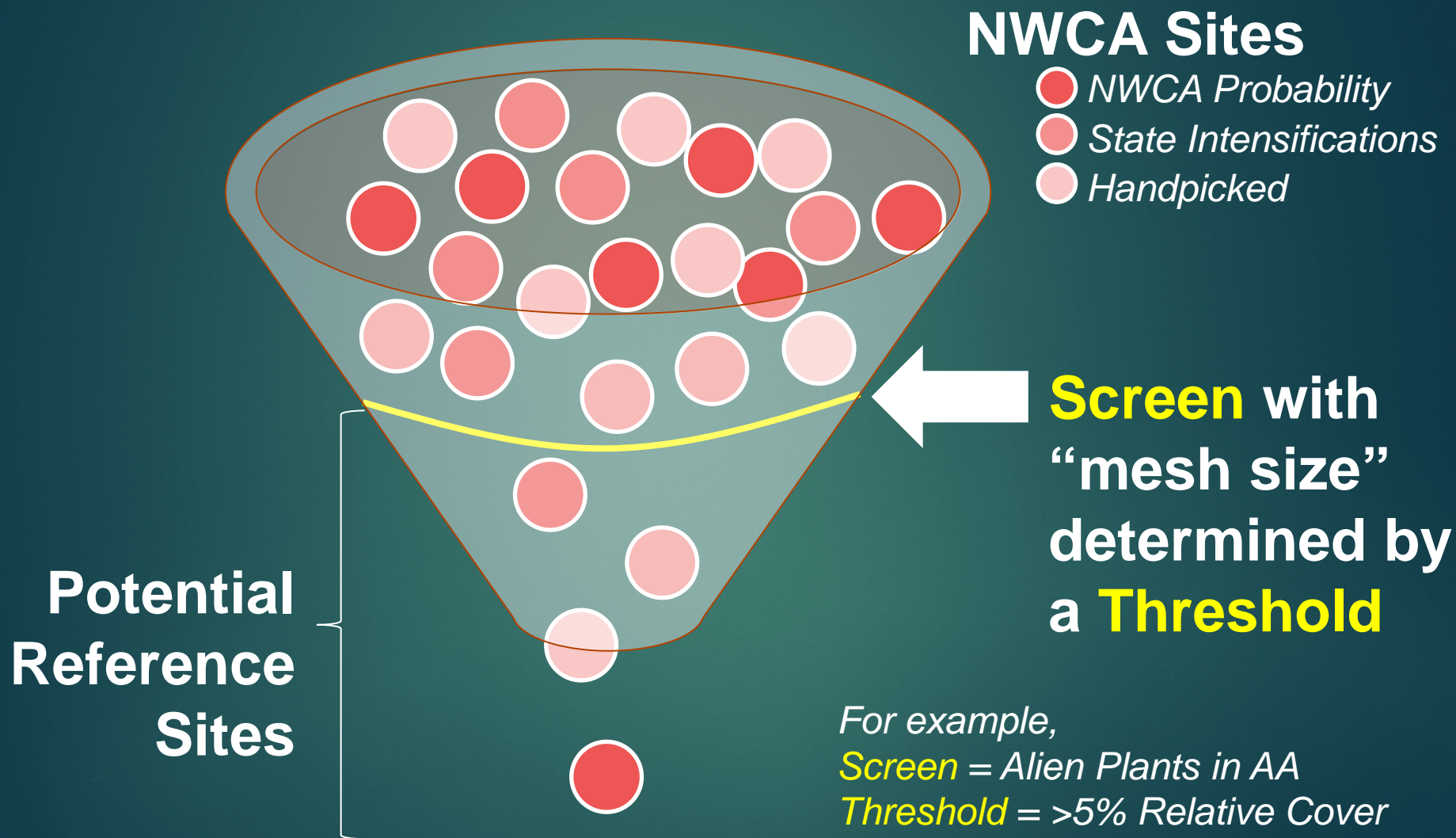| NWCA Aggregated Ecoregions / NWCA Aggregated Wetland Types	Palustrine, Riverine, and Lacustrine Herbaceous (PRLH) *Aggregates PEM, PF, PUBPAB*	Palustrine, Riverine, and Lacustrine Woody (PRLW) *Aggregates PFO, PSS*	Estuarine Herbaceous (EH) *Includes E2EM*	Estuarine Woody (EW) *Includes E2SS*
Coastal Plains (CPL) *Same as Coastal Plains (CPL) in Nine Aggregated Ecoregions; includes Eastern and Gulf Coastal Plains*	1. Coastal Plains Herbaceous (CPL-PRLH) *72 Sites Sampled*	2. Coastal Plains Woody (CPL-PRLW) *189 Sites Sampled*	9. Estuarine Herbaceous (ALL-EH) *272 Sites Sampled*	10. Estuarine Woody (ALL-EW) *73 Sites Sampled*
Eastern Mountains & Upper Midwest (EMU) *Aggregates Northern Appalachains (NAP), Southern Appalachains and Piedmont (SAP), and Upper Midwest (UMV)*	3. Eastern Mountains & Upper Midwest Herbaceous (EMU-PRLH) *73 Sites Sampled*	4. Eastern Mountains & Upper Midwest Woody (EMU-PRLW) *127 Sites Sampled*	*Note: The Estuarine reporting group encompasses estuarine wetlands in all ecoregions (hence, the prefix "ALL"). However, estuarine wetlands only occur in CPL, EMU, and W ecoregions. There are no estuarine wetlands in IPL.*	
Interior Plains (IPL) *Aggregates Temperate Plains (TPL), Northern Plains (NPL), and Southern Plains (SPL)*	5. Interior Plains Herbaceous (IPL-PRLH) *138 Sites Sampled*	6. Interior Plains Woody (IPL-PRLW) *52 Sites Sampled*		
West (W) *Aggregates Western Mountains (WMT), and Xeric (XER)*	7. West Herbaceous (W-PRLH) *67 Sites Sampled*	8. West Woody (W-PRLW) *75 Sites Sampled*		
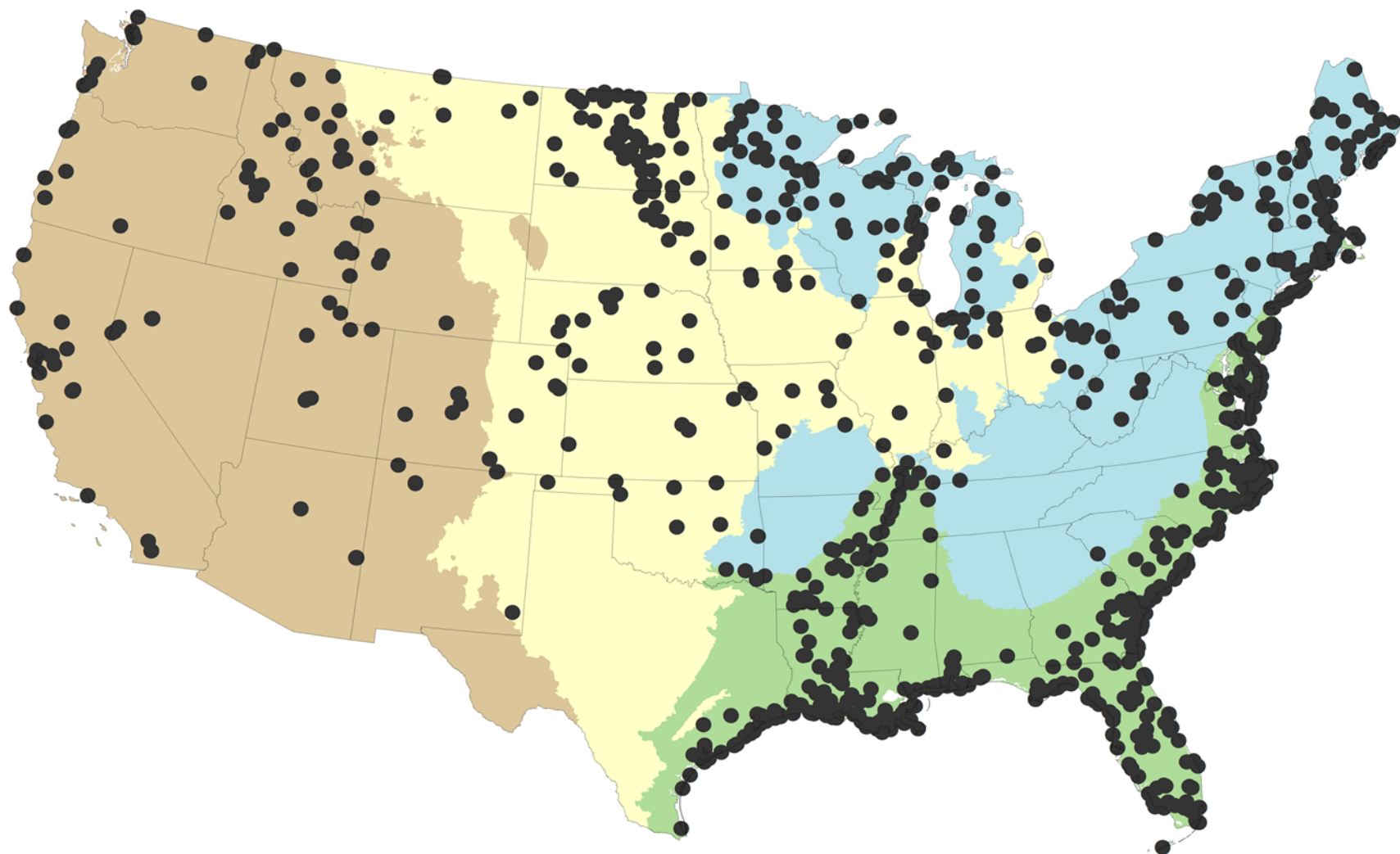
NWCA 2011 Sites Sampled

Total of 1138 sites

NWCA Aggregated Ecoregions

Coastal Plains (CPL)

Eastern Mountains and Upper Midwest (EMU)

Interior Plains (IPL)

West (W)
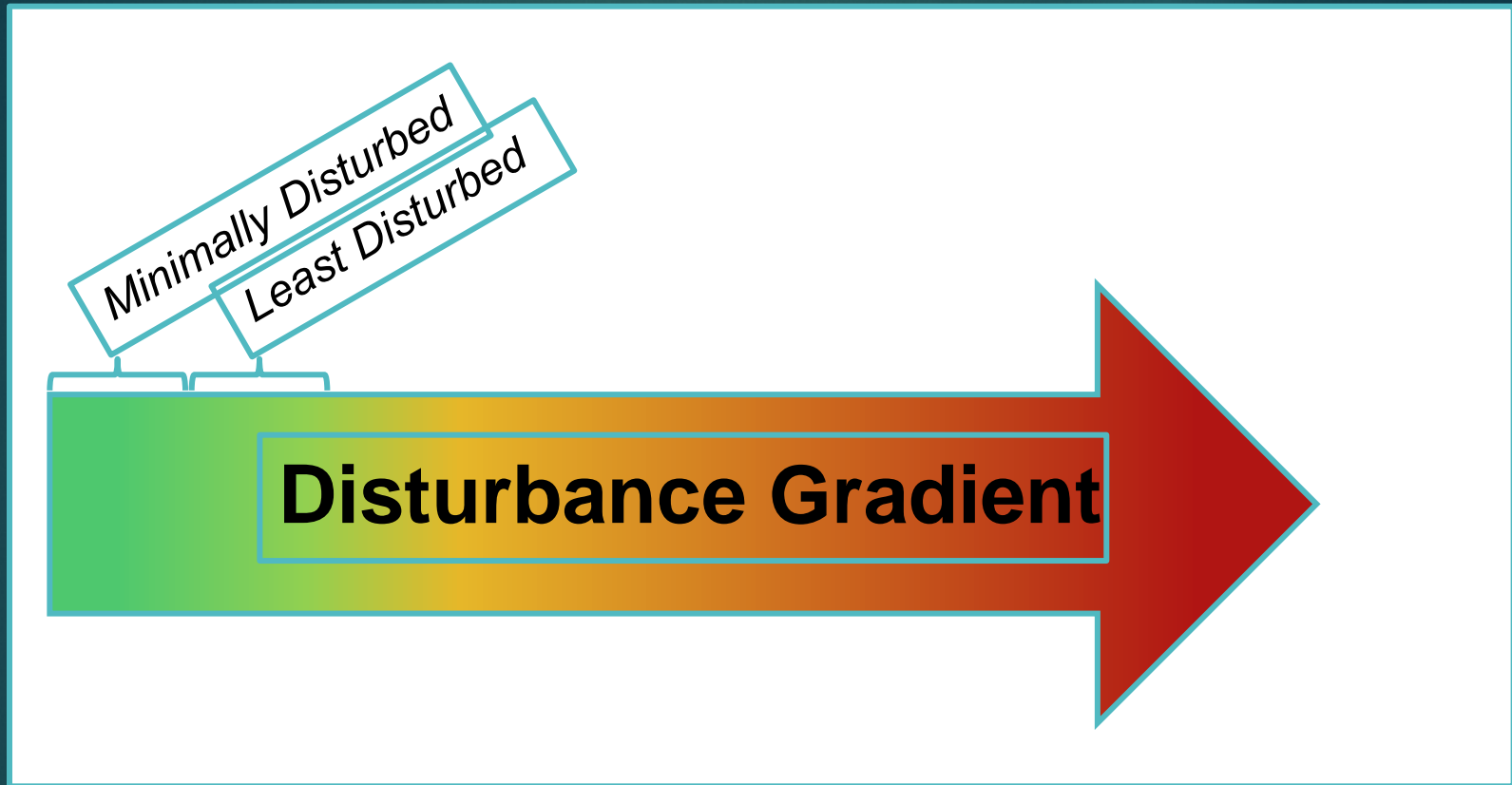
> Following Stoddard et al. (2006) definitions of reference:

  ▷ *Least Disturbed* sites represent the best available conditions given the current state of the landscape

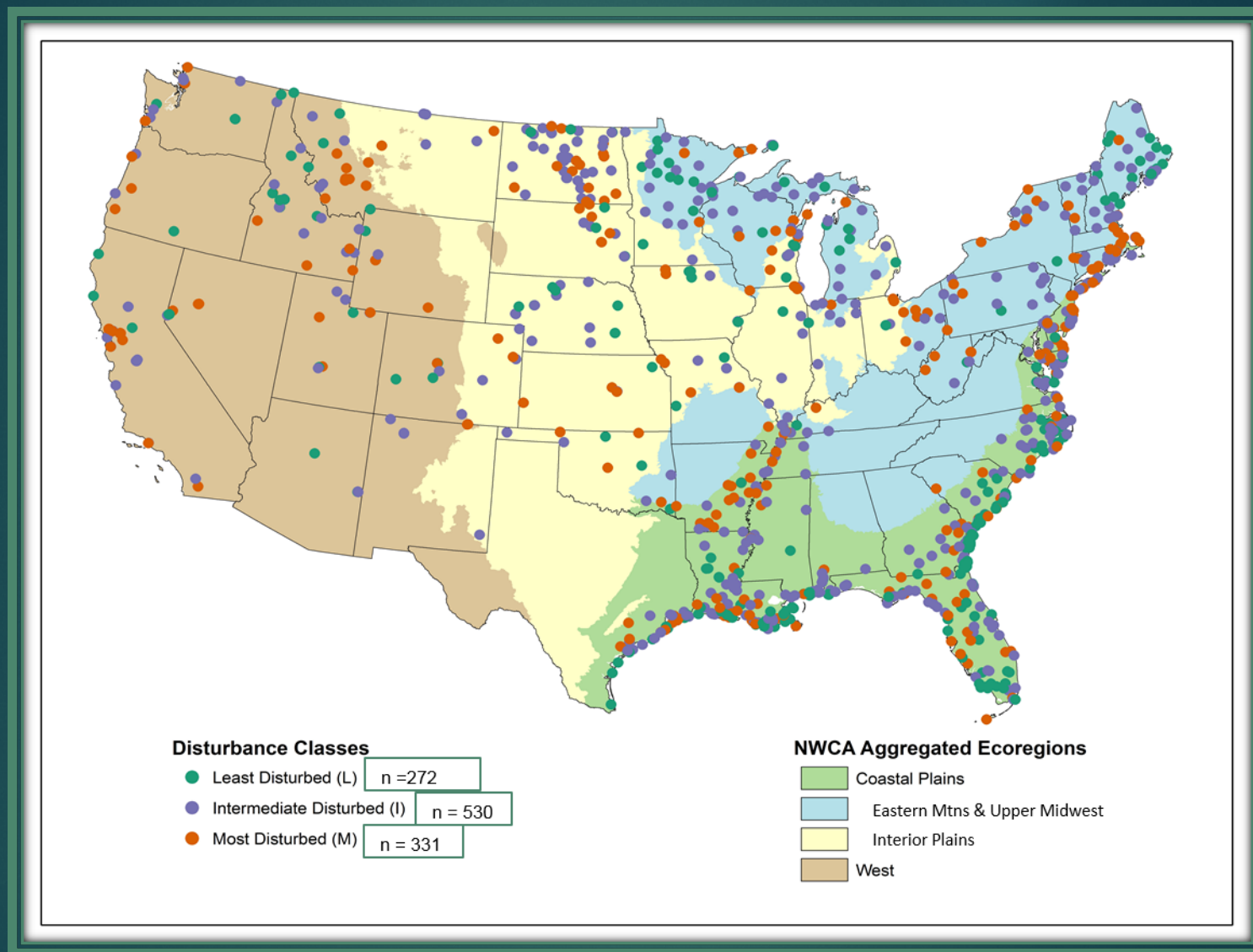 ▷ *Minimally Disturbed* sites have no evidence of significant human disturbance

The Screening Approach

NWCA Sites
- *NWCA Probability*
- *State Intensifications*
- *Handpicked*

Screen with "mesh size" determined by a **Threshold**

Potential Reference Sites

For example,
Screen = Alien Plants in AA
Threshold = >5% Relative Cover

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Quantitatively defining reference

▶ Definition of reference customized by NWCA aggregated ecoregion
  ▷ *The initial thresholds for identifying reference sites were strict*
  ▷ *Relaxed thresholds, as needed, based on least disturbed condition in a region*

▶ Thresholds were determined by
  ▷ *Observed presence of indicator in buffer and hydrology data*
  ▷ *Combination of published background concentrations and natural breaks in the data for soil chemistry*
  ▷ *BPJ for Relative Cover of Alien Plant Species*

▶ Reference sites must pass all thresholds

▶ Definition of reference is not intended to change with time

▶ New least disturbed sites will be identified with each assessment, thus adding to the pool of reference sites

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Distribution of Sites by Disturbance Class

Disturbance Classes
- Least Disturbed (L)   n = 272
- Intermediate Disturbed (I)   n = 530
- Most Disturbed (M)   n = 331

NWCA Aggregated Ecoregions
- Coastal Plains
- Eastern Mtns & Upper Midwest
- Interior Plains
- West

Most Disturbed

Cape Cod, Massachusetts

High Density Residential Development

Golf Course

Bear Pond

nwca11-1748

SITE_ID = NWCA11-1748
STATE = MA
ECO_X_ST = EMU-PH
REF_NWCA = M

DISTURBANCE INDEX SCORES
B1H_ALL = 1.4
H_DIS = 3
HEAVYmetal_INDEX = 3
%ALIEN = 65

Imagery Date: 8/24/2013   42°25'23.87" N   70°55'44.76" W   elev   1 ft   eye alt   1806 ft

© 2014 Google

Google earth

Least Disturbed

SITE_ID = NWCA11-1743
STATE = MA
ECO_X_ST = EMU-PH
REF_NWCA = L
DISTRUBANCE INDEX SCORES
B1H_ALL = 0.12
B1H_RESURB = 0.23
%ALIEN = 1.3

nwca11-1743

Residential Development

© 2014 Google

Google earth

Imagery Date: 8/24/2013   42°40'30.56" N   71°03'18.23" W   elev 130 ft   eye alt 1846 ft

Minimally Disturbed

Northern Lakes & Forests Ecoregion

SITE_ID = NWCA11-R110
STATE = MN
ECO_X_ST = EMU-PH
REF_NWCA = L

NO SCORES FOR ANY OF THE DISTURBANCE INDICES

Structure of NARS Reporting

I. Status of biological condition

II. Extent of stressors

III. Relationship between stressors and biological condition

2011 NWCA Target Population
Estimated Wetland Area = 94,913,706 acres
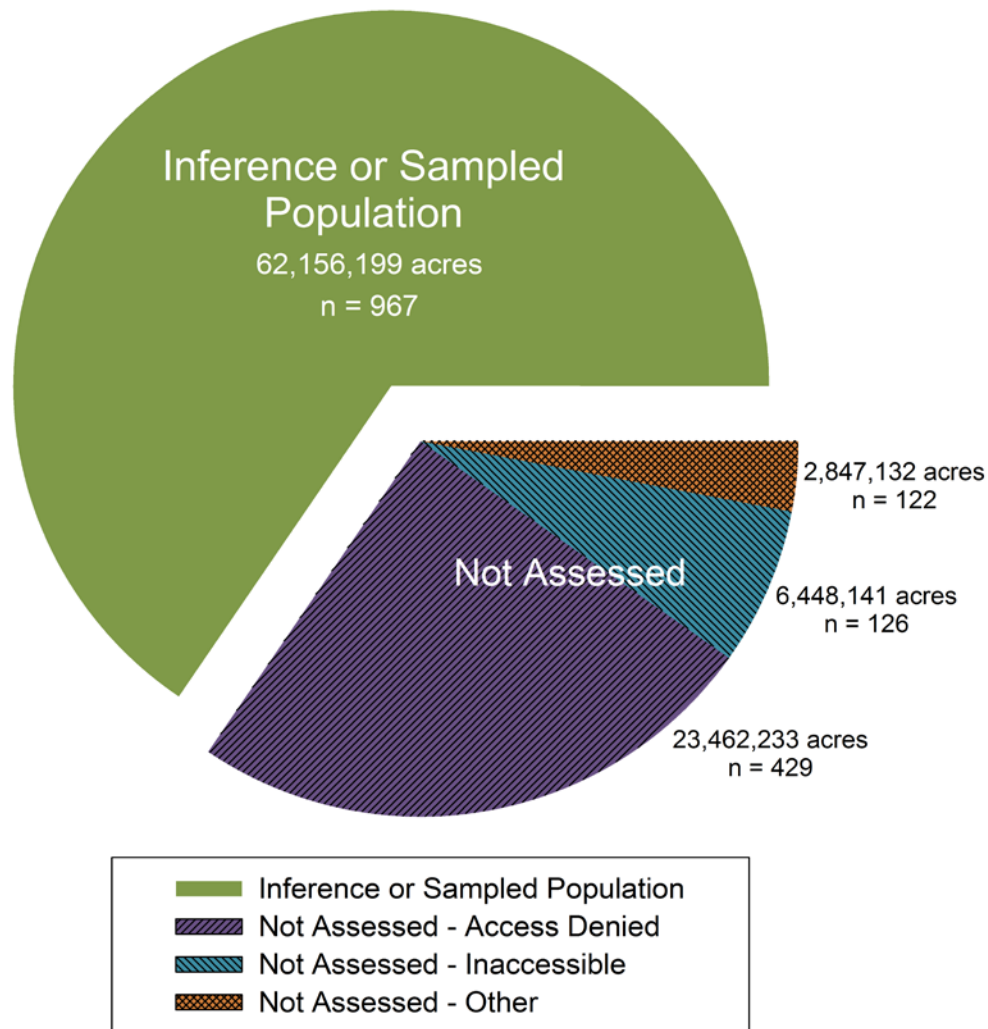
Condition Class Thresholds by Reporting Group

Least Disturbed (Reference) Site Distribution
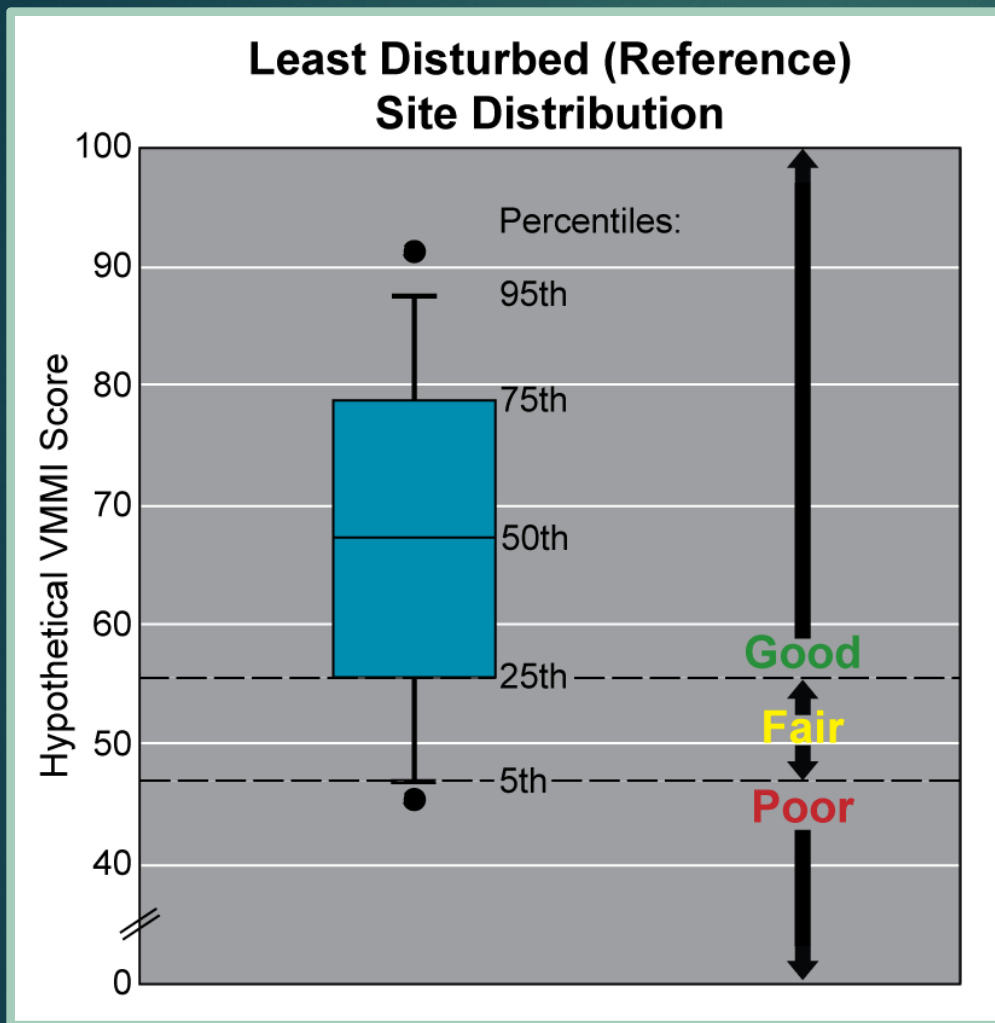
Based on distribution of VMMI values in least disturbed sites:

▶ Good = VMMI > 25th percentile

▶ Fair = VMMI between 5th and 25th percentile

▶ Poor = VMMI < 5th percentile

(Paulsen et al. 2008)

WETLAND BIOLOGICAL CONDITION
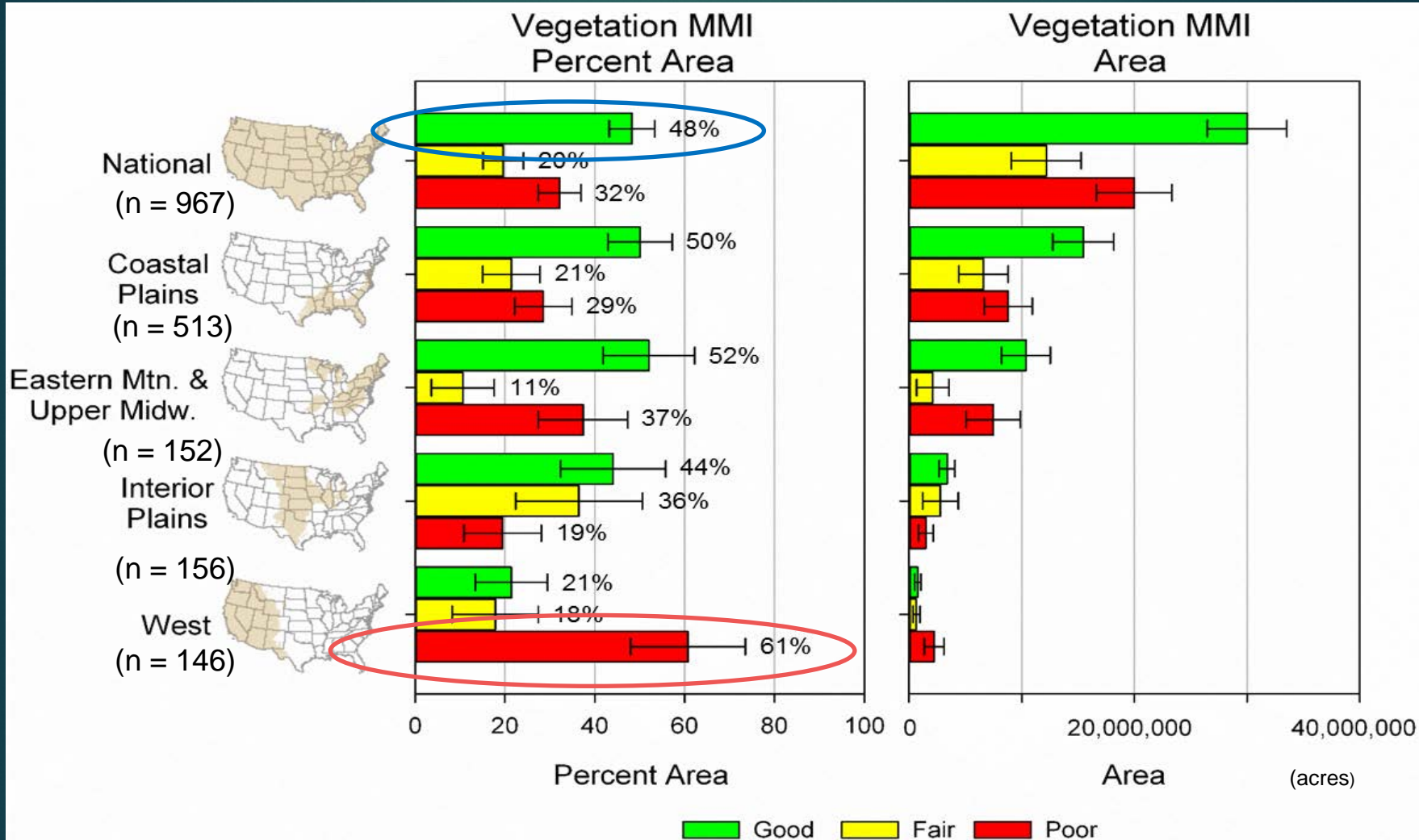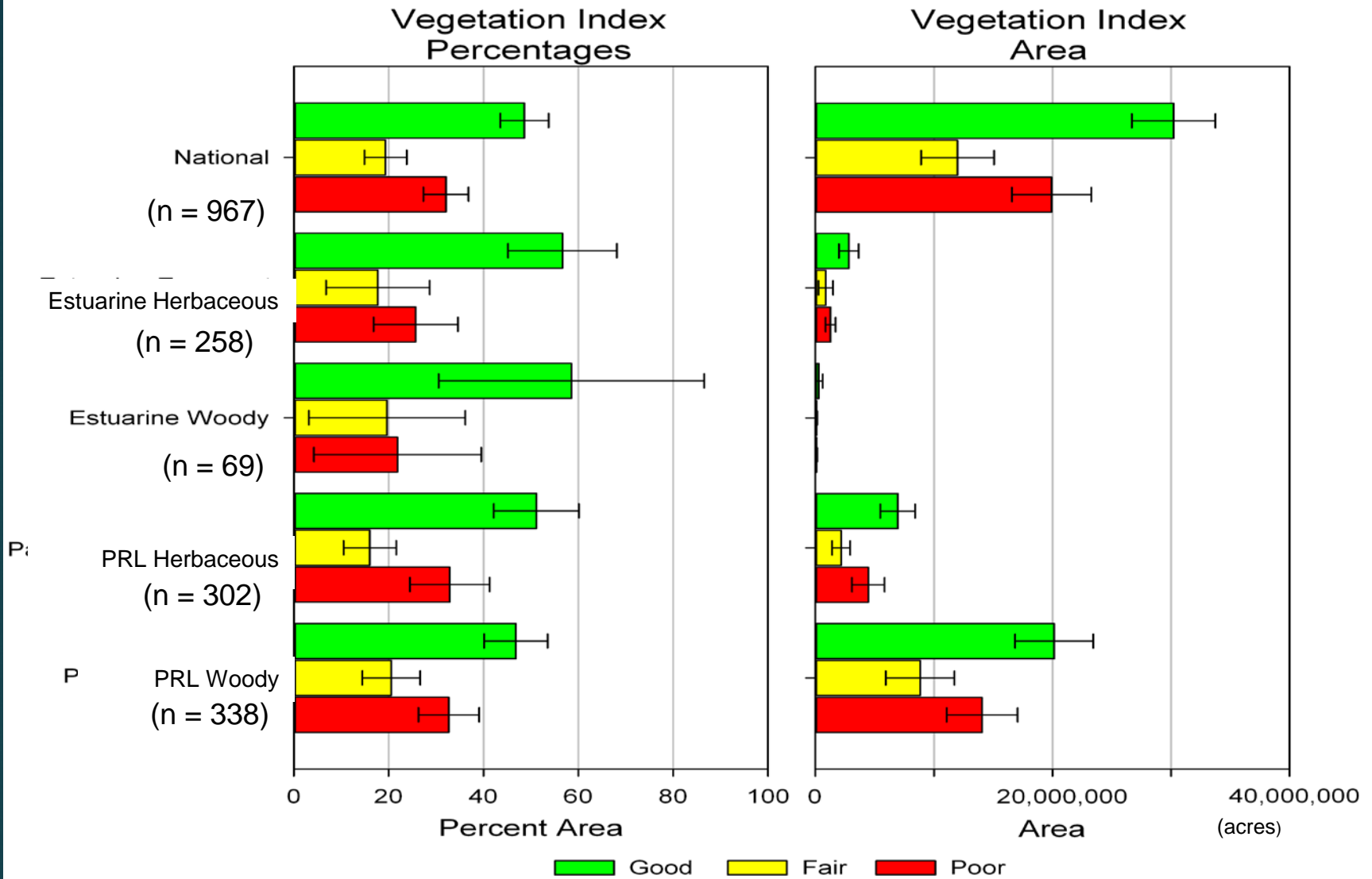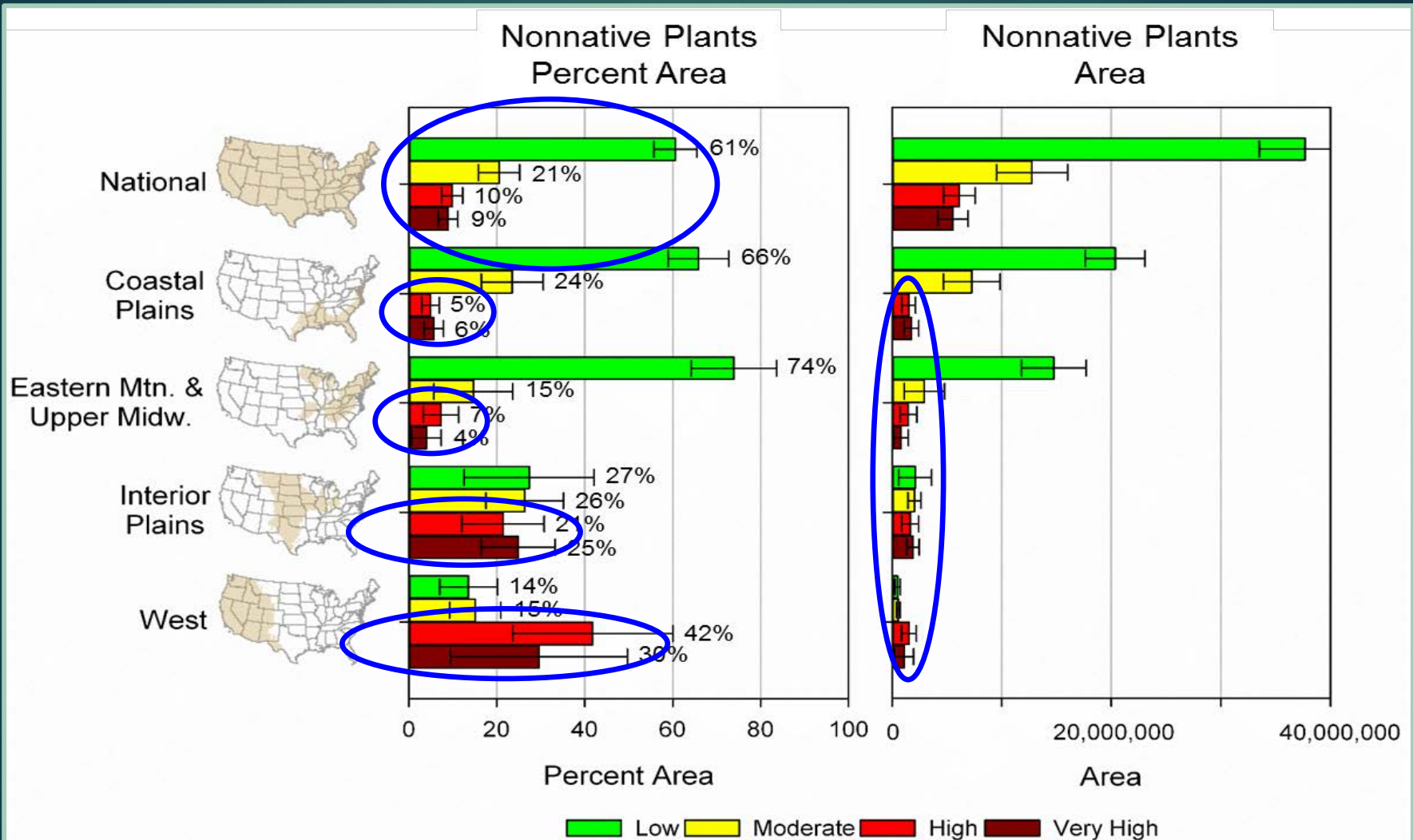
Relationship Between Stressors and Biological Condition

➢ Relative Extent of Stressors

➢ Relative Risk

➢ Attributable Risk

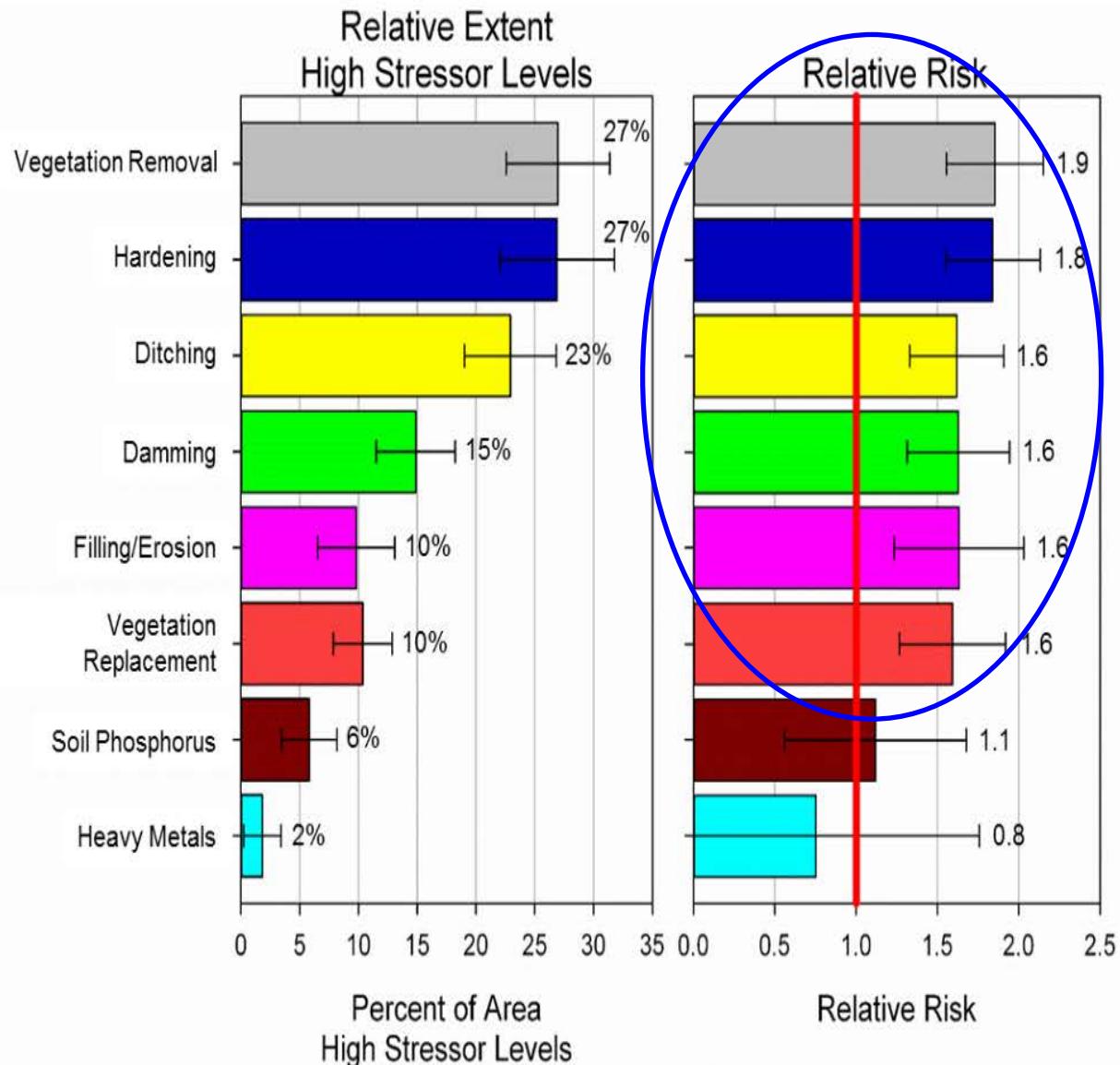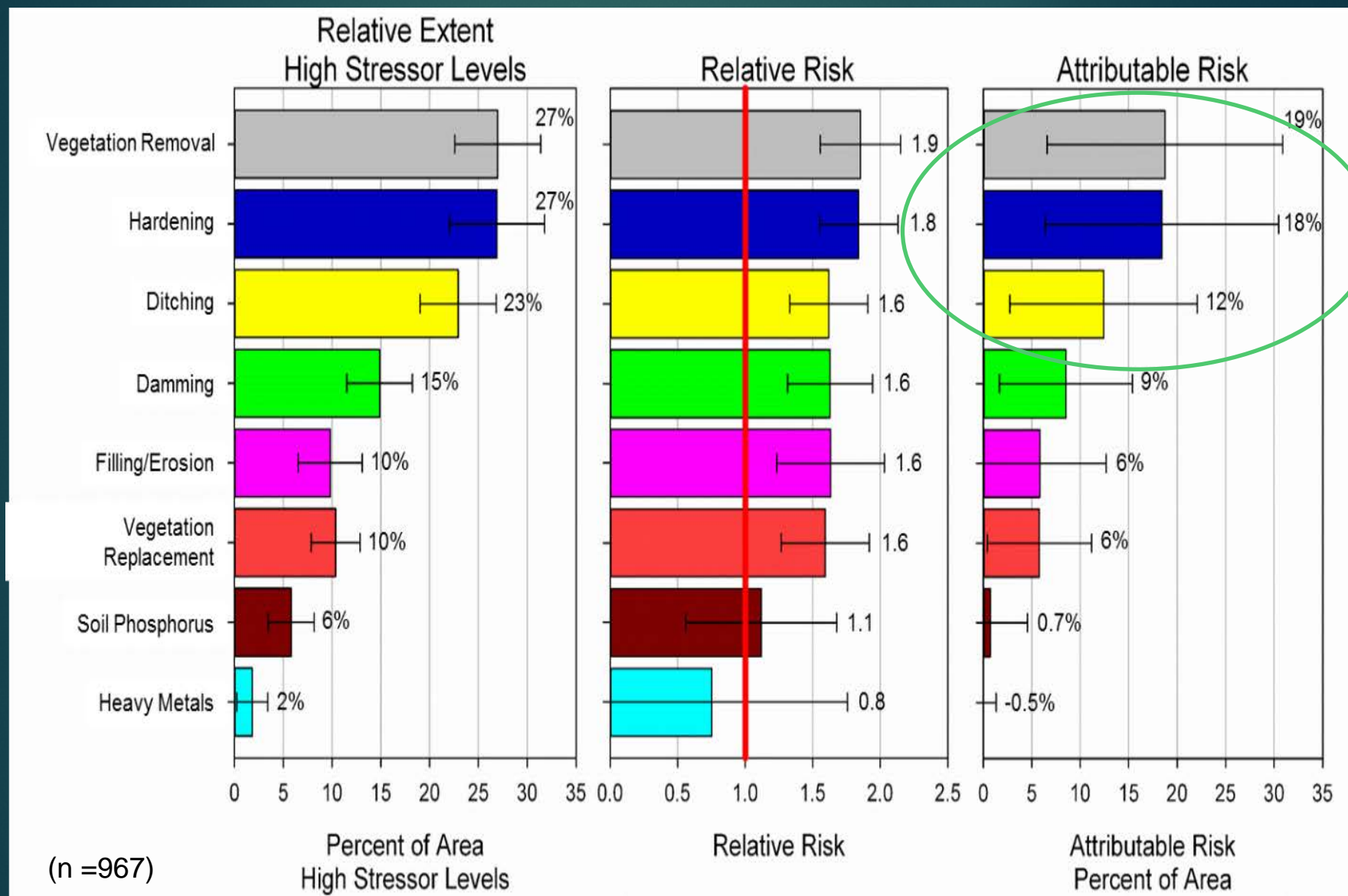(Van Sickle and Paulsen 2008)

Relationship Between Stressors and Condition

Relative Extent
High Stressor Levels

- Vegetation Removal — 27%
- Hardening — 27%
- Ditching — 23%
- Damming — 15%
- Filling/Erosion — 10%
- Vegetation Replacement — 10%
- Soil Phosphorus — 6%
- Heavy Metals — 2%

Percent of Area
High Stressor Levels

n = 967

Vegetation Removal

Hardening

Ditching

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Relationship Between Stressors and Condition

Relationship Between Stressors and Condition

(n =967)

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  ➤ Definition of Reference

  ➤ Biological condition

  ➤ Stressor extent

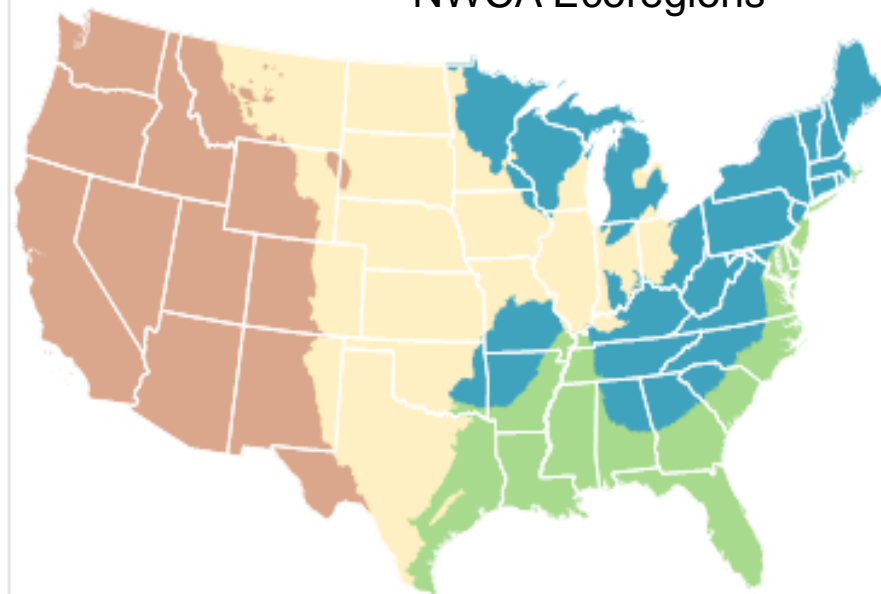 ➤ Estimation of Relative and Attributable Risk

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Aggregation of Ecoregions for Reporting

Regional Condition Extent Estimates

Condition - Vegetation Multimetric Index (VMMI)

West
n = 145
3,647,060 acres

21%
18%
61%

PNW (W Mts)
n = 38
377,554 acres

68%
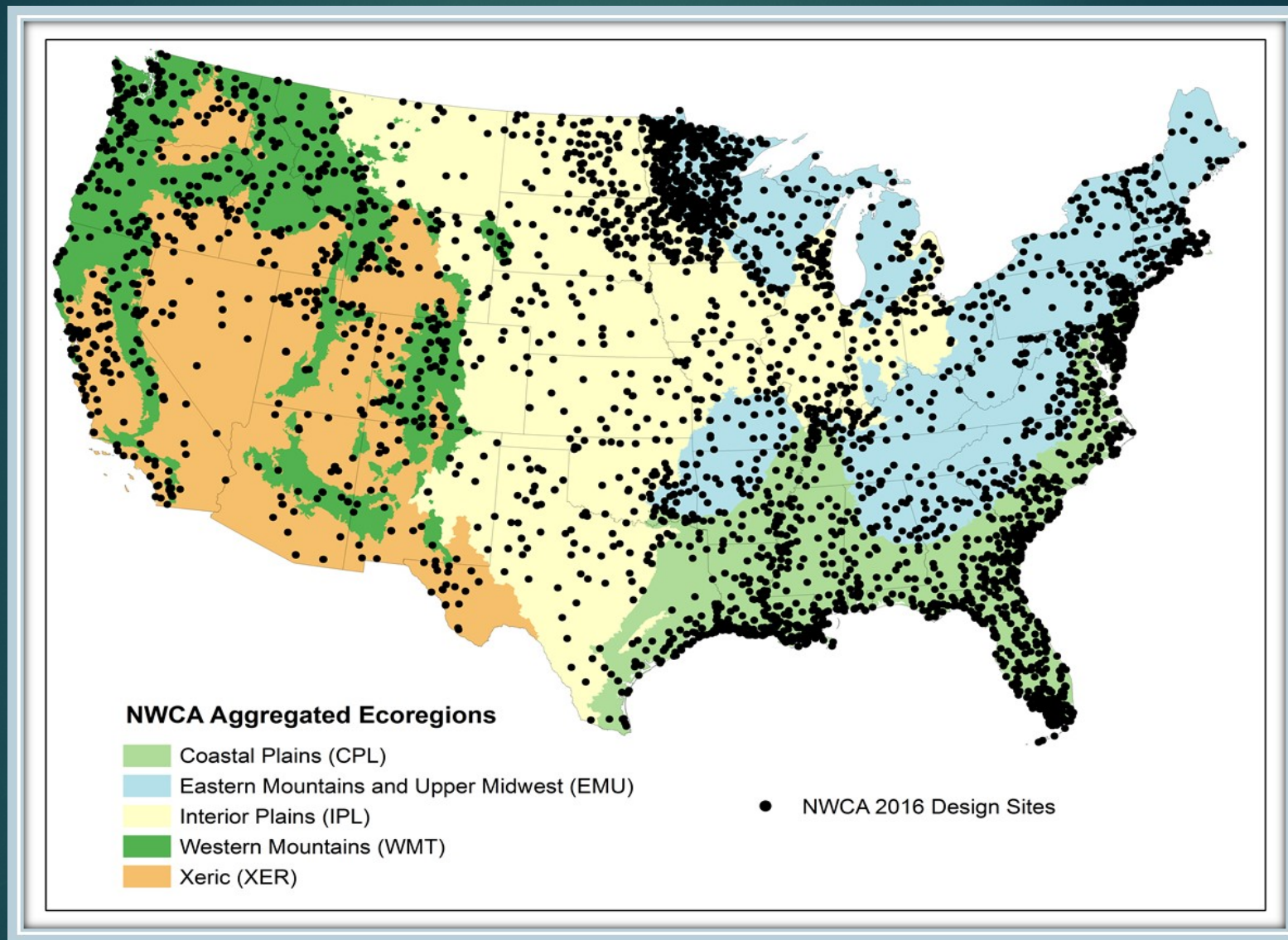15%
17%

Percent Wetland Area

Good   Fair   Poor
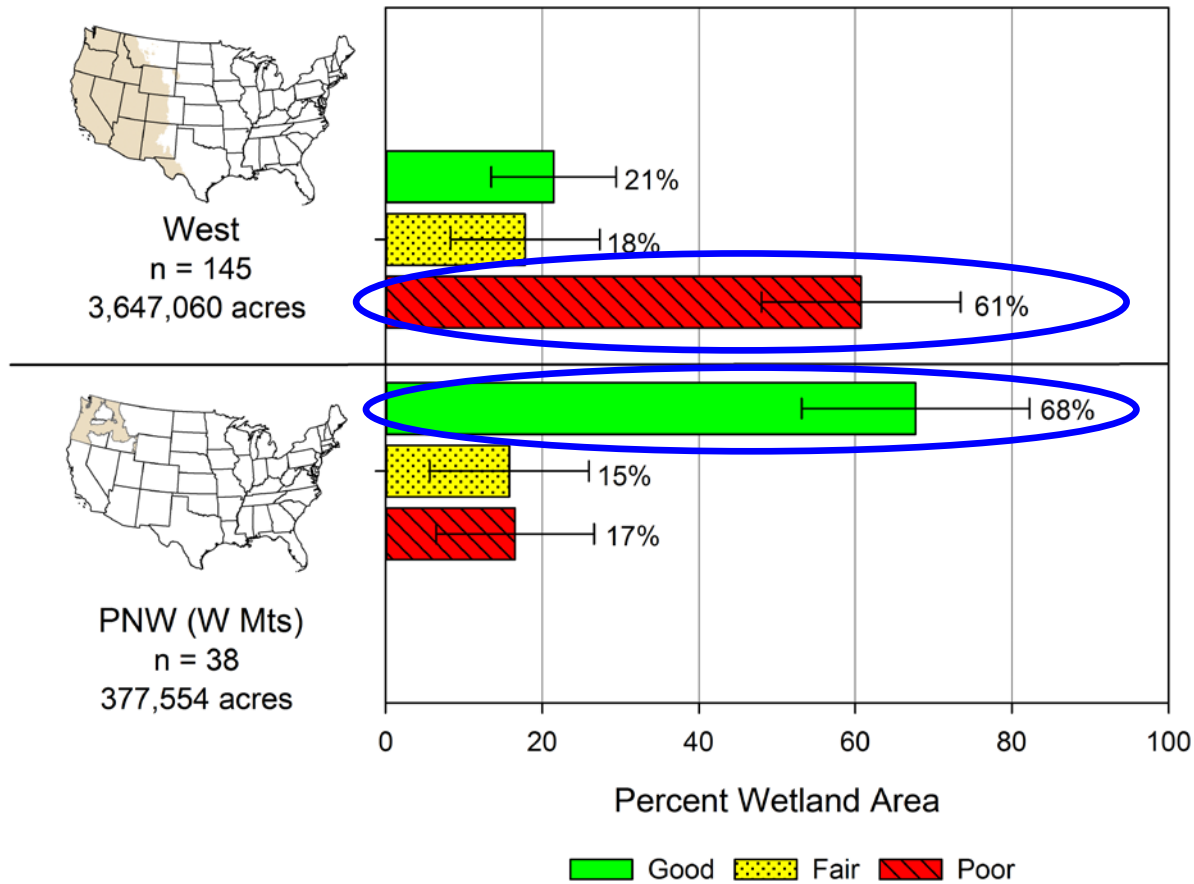
► **All NWCA Wetland Types**

► **Across West :**
  ▷ *61% in poor condition*
  ▷ *21% wetland area in good condition*

► **PNW (W Mtns):**
  ▷ *68% wetland area in good condition*
  ▷ *17% in poor condition*

NWCA Aggregated Ecoregions 2011 vs 2016
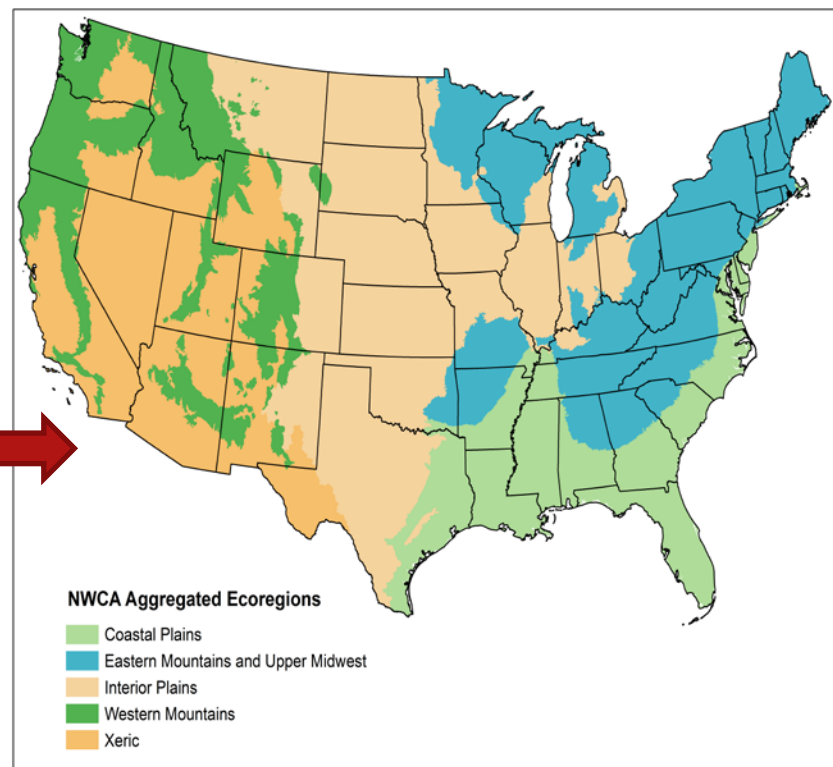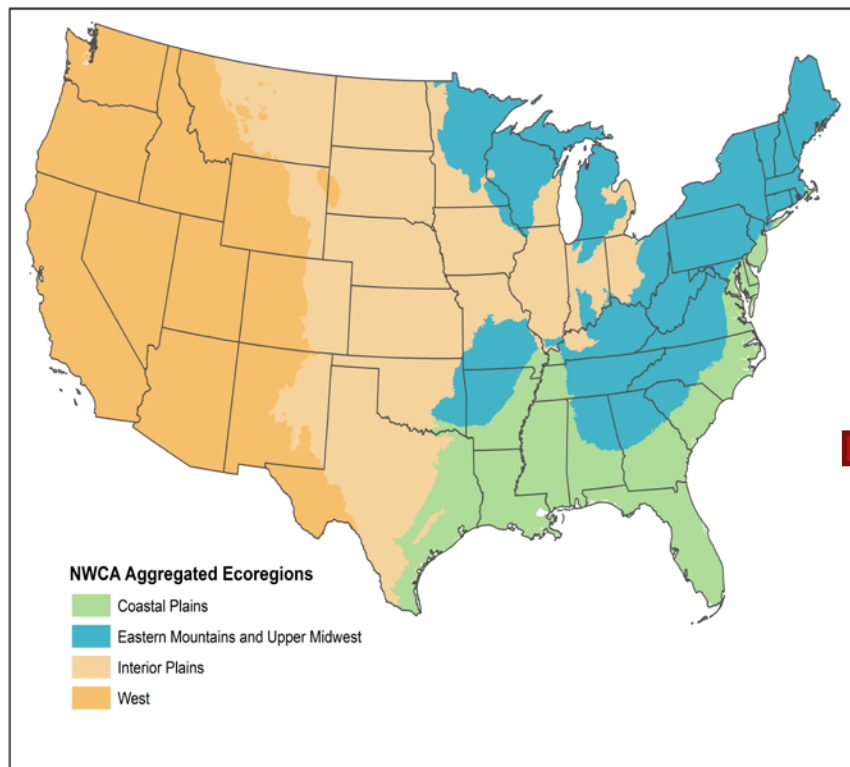
2016 Points – S&T and NWI Sample Combined Frame

NWCA Aggregated Ecoregions

- Coastal Plains (CPL)
- Eastern Mountains and Upper Midwest (EMU)
- Interior Plains (IPL)
- Western Mountains (WMT)
- Xeric (XER)

• NWCA 2016 Design Sites

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2011 NWCA results can be used in scientific research for :

➢ National and ecoregional benchmarks for tracking changes in the resource over time

➢ Quantitative descriptions of the characteristics of least disturbed wetlands and/or wetlands in good condition

➢ Focusing research on likely causes of poor wetland condition based on stressor extent, relative risk, and attributable risk

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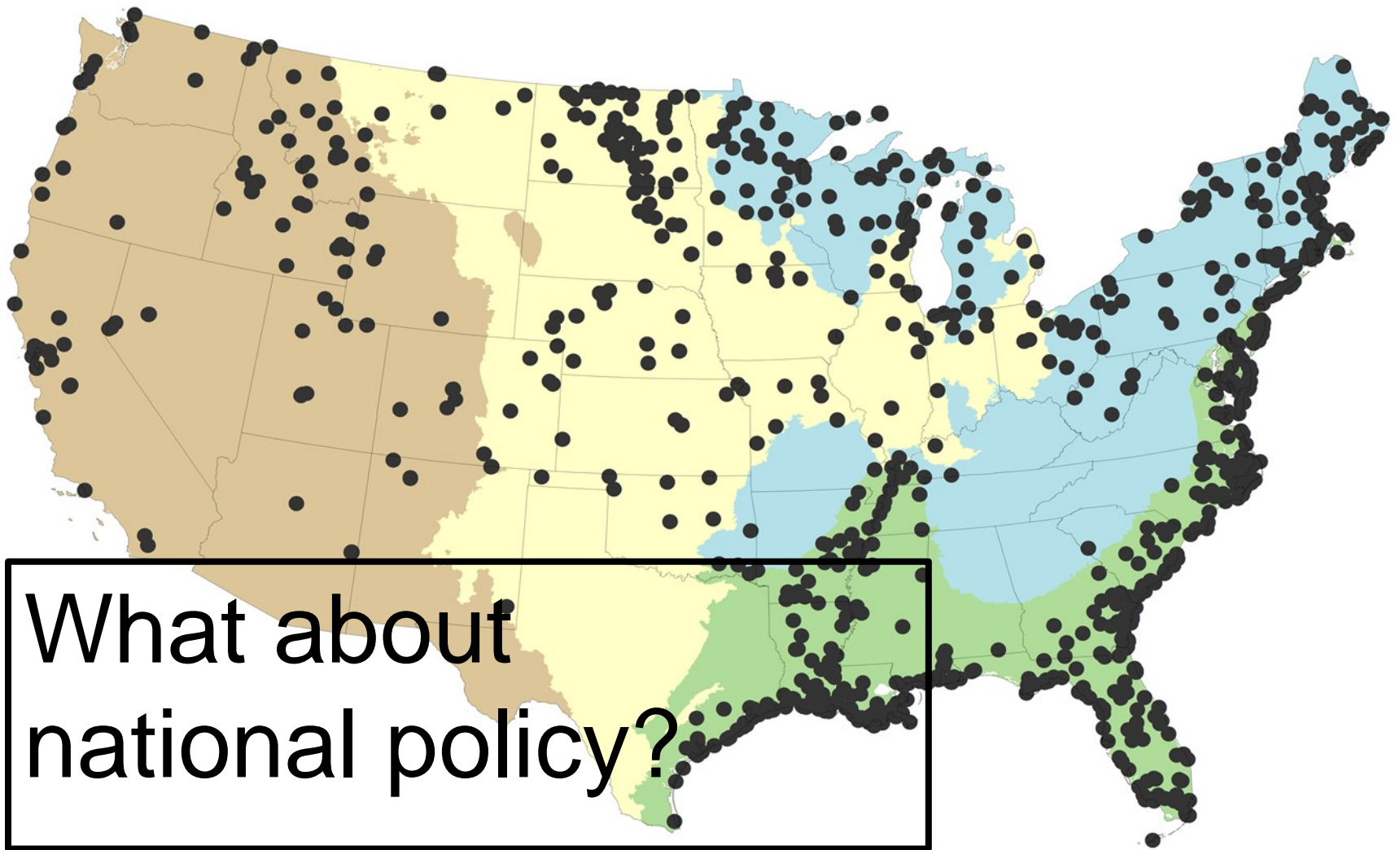
What about national policy?

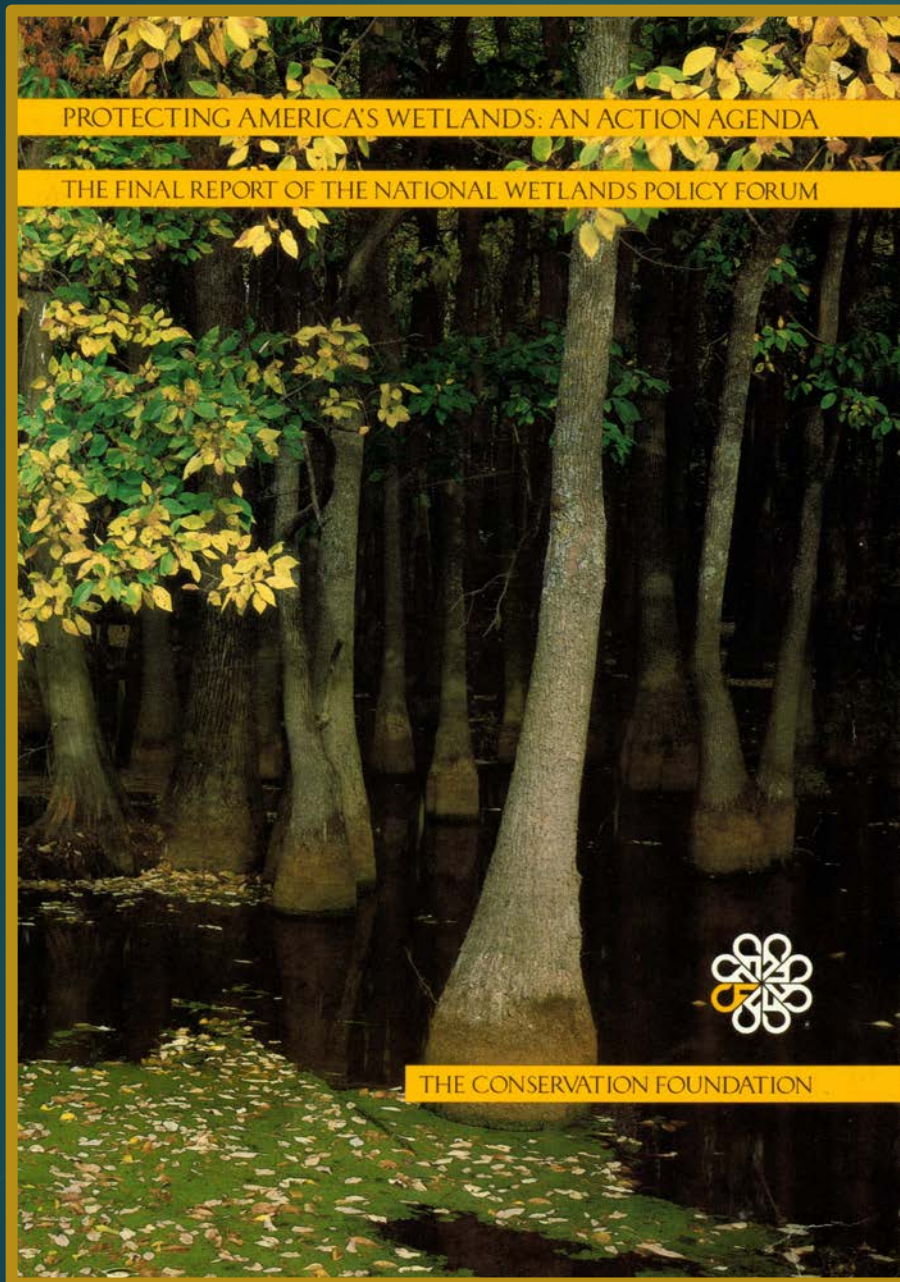- • NWCA 2011 Sites Sampled

NWCA Aggregated Ecoregions
- Coastal Plains (CPL)
- Eastern Mountains and Upper Midwest (EMU)
- Interior Plains (IPL)
- West (W)

The No Net Loss Policy recommended by the National Wetlands Policy Forum was adopted by President G.H. Bush in 1989 and by every president since that time.

PROTECTING AMERICA'S WETLANDS: AN ACTION AGENDA

THE FINAL REPORT OF THE NATIONAL WETLANDS POLICY FORUM

THE CONSERVATION FOUNDATION

The Final Report of the National Wetland Policy Forum, 1988 recommended:

➢ A short-term goal of no net loss in wetland quantity and quality

➢ A long-term goal of net gain in quantity and quality

Policy Implications of 2011 NWCA Results

➢ 2011 NWCA sets a benchmark for tracking future trends in wetland quality and, ultimately, for tracking progress toward the goals of the No Net Loss Policy in terms of wetland quantity and quality

➢ The NWCA results raise the question: "Is the current status of wetland quality what we want as a target?"

  ➢ only ~50% of wetland area nationally is in good biological condition, while

  ➢ ~30% of wetland area nationally is in poor biological condition

➢ Identification of critical stressors to wetlands can shape a targeted approach to improving wetland quality

🌱EPA

For the 2011 NWCA Final and Technical Reports and Analysis Datasets see
http://water.epa.gov/type/wetlands/assessment/survey/index.cfm

2011 NWCA Campus Research Challenge
https://www.epa.gov/national-aquatic-resource-surveys/national-wetland-condition-assessment-campus-research-challenge

Upcoming − Environmental Monitoring and Assessment Topical Collection on the technical aspects of the NWCA

Questions

Our Next Webinar

October 27, 2016

Sea Level Rise and Coastal Wetlands in LA

Julia Cherry, Ph.D.   *Loretta Battaglia, Ph.D.*
Associate Professor   *Associate Professor*
University of Alabama   *Southern Illinois University*

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