



THE 2016 PACIFIC NORTHWEST WETLAND CONDITION ASSESSMENT

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National Aquatic Resource Surveys (NARS)

- ▶ Series of surveys performed on a nationwide basis to determine condition of the Nation's waters
- ▶ Surveys are performed by USEPA in partnership with states and tribes
- ▶ The purpose is to provide data to report to Congress on the efficacy of Clean Water Act Programs
- ▶ Five different aquatic resource types are surveyed on a cyclical basis: rivers, streams, coastal waters, lakes, and wetlands within the conterminous US
- ▶ National Wetland Condition Assessment has been performed 3 times; in 2011, 2016, and 2021

Purposes of the NWCA

- ▶ Produce a national report that
 - ▶ Describes the ecological condition of the Nation's wetlands
 - ▶ Identifies the stressors most likely to influence poor condition in wetlands
- ▶ Collaborate with states, tribes and federal partners in developing
 - ▶ Complimentary wetland monitoring tools;
 - ▶ Appropriate analytical approaches
 - ▶ Data management technologies
- ▶ Advance the science of wetland monitoring and assessment to support wetland policy needs

GOAL: Information on wetland quality that leads to more effective wetland protection and restoration

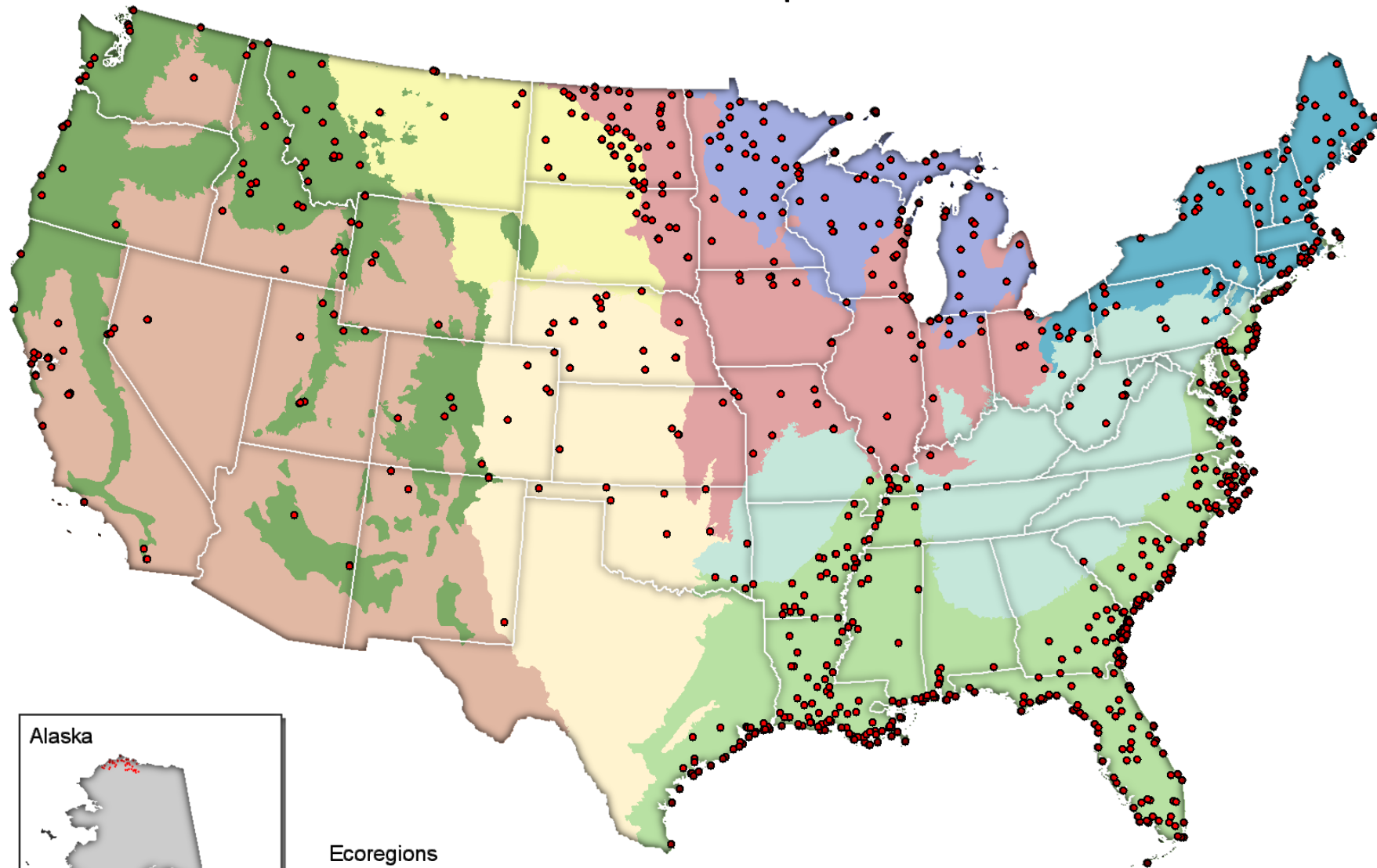
Characteristics of NWCA









- ▶ Uses a probability-based sample design (GRTS) to select sample points which are drawn from a geospatial dataframe
- ▶ Methodology ensures a probability-based, spatially balanced sample
- ▶ Data undergo strict QA at all phases
- ▶ NWCA samples area around a sample point, NOT individual wetlands
- ▶ Results are reported as % of area in good, fair, poor condition
- ▶ Results are also provided for the association of stressors with poor condition
- ▶ Jurisdictional status does not factor into whether an area is assessed

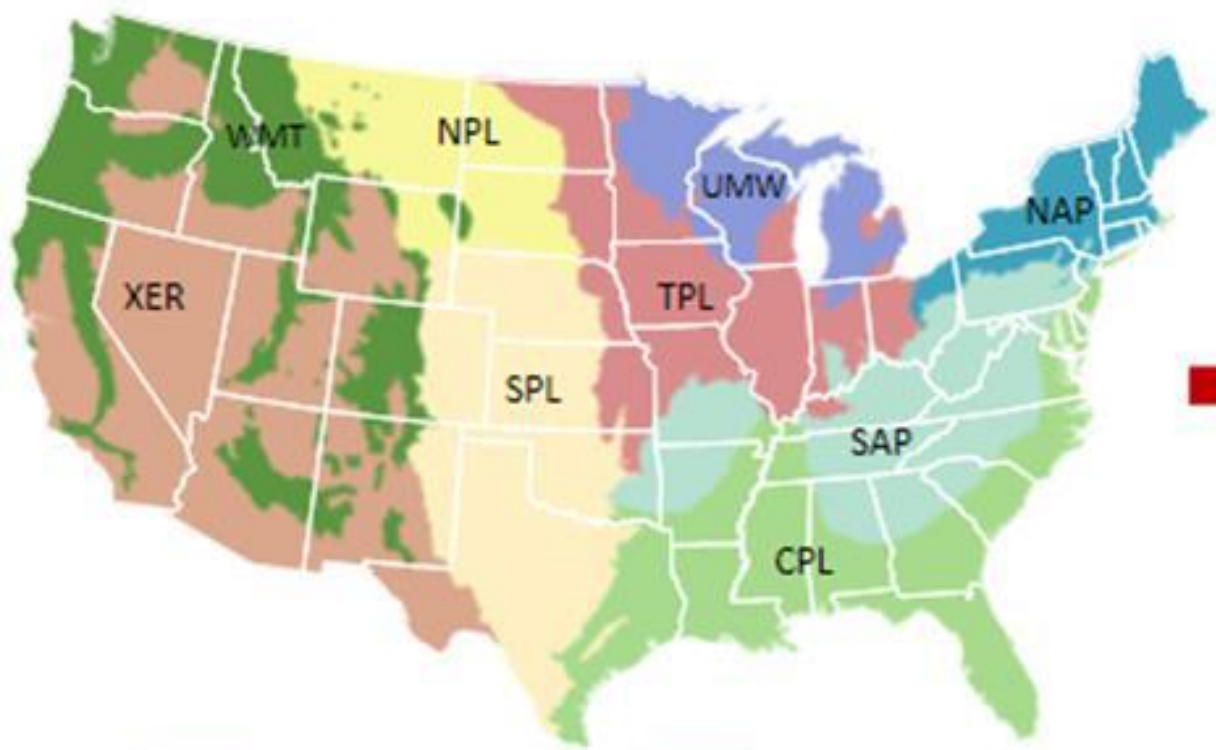
Thank you to all of our partners in the PNWCA!

- ▶ USEPA Office of Water, USEPA Office of Research and Development, USEPA R10 Wetlands Unit and Regional Science Council
- ▶ USFWS
- ▶ NRCS
- ▶ ID Department of Environmental Quality
- ▶ ID NRCS
- ▶ PG Environmental
- ▶ The Quinault Tribe
- ▶ The Umatilla Tribe
- ▶ WA Department of Ecology
- ▶ WA NRCS

2011 NWCA - Sampled Sites

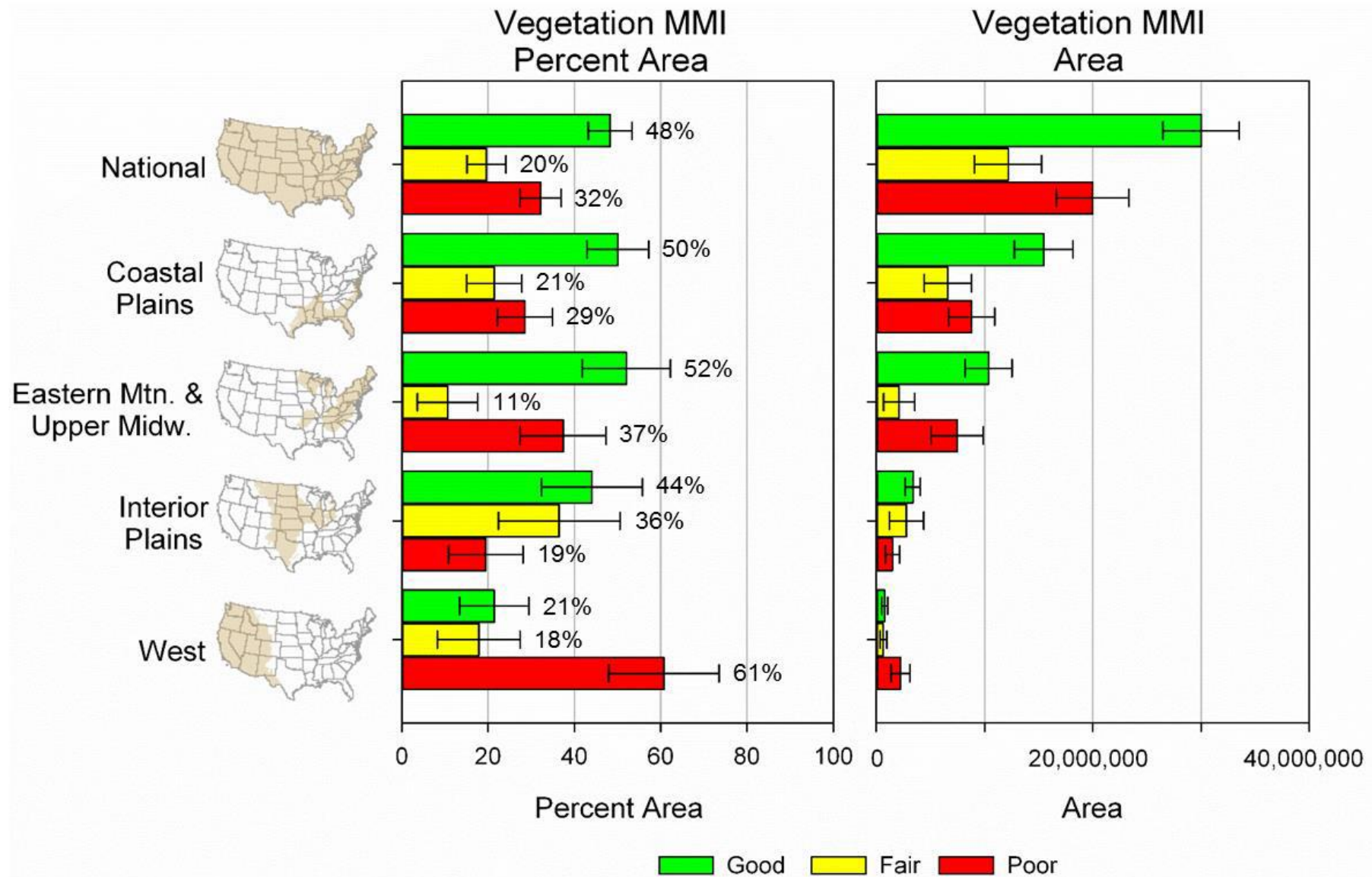


- Ecoregions
- | | | |
|---|---|---|
|  Coastal Plain |  Southern Appalachians |  Upper Midwest |
|  Northern Appalachians |  Southern Plains |  Western Mountains |
|  Northern Plains |  Temperate Plains |  Xeric |

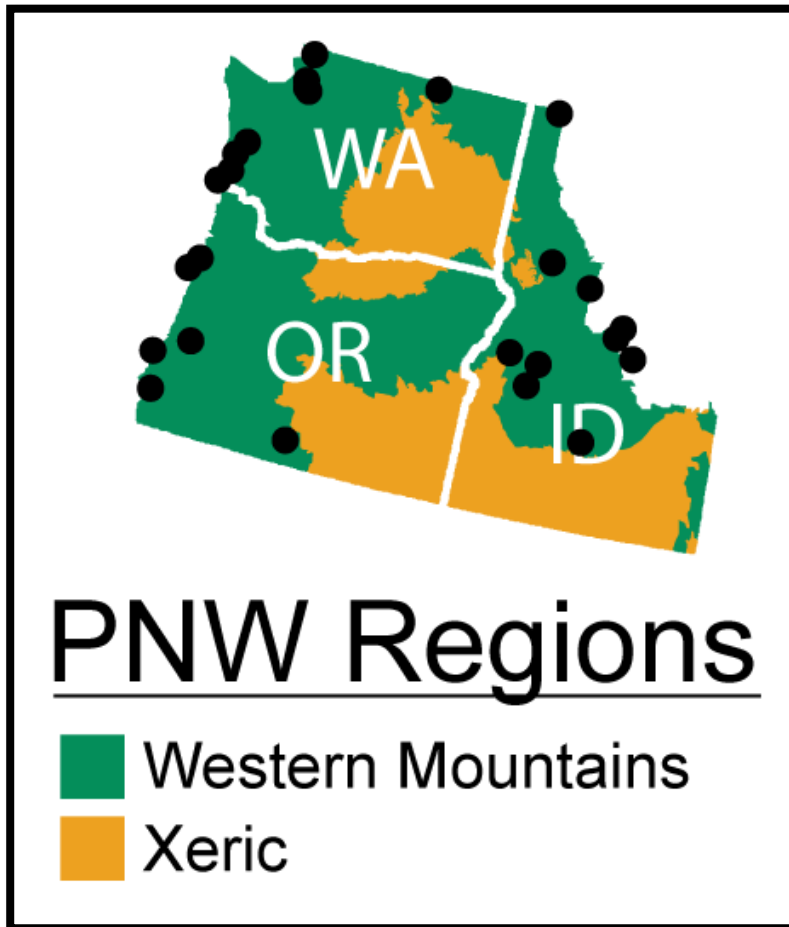


- | | |
|----------------------------------|------------------------------|
| CPL Coastal Plains | TPL Temperate Plains |
| NAP Northern Appalachians | UMW Upper Midwest |
| NPL Northern Plains | WMT Western Mountains |
| SAP Southern Appalachians | XER Xeric |
| SPL Southern Plains | |

- | |
|--|
| CPL Coastal Plains |
| EMU Eastern Mtn and Upper Midwest |
| IPL Interior Plains |
| W West |

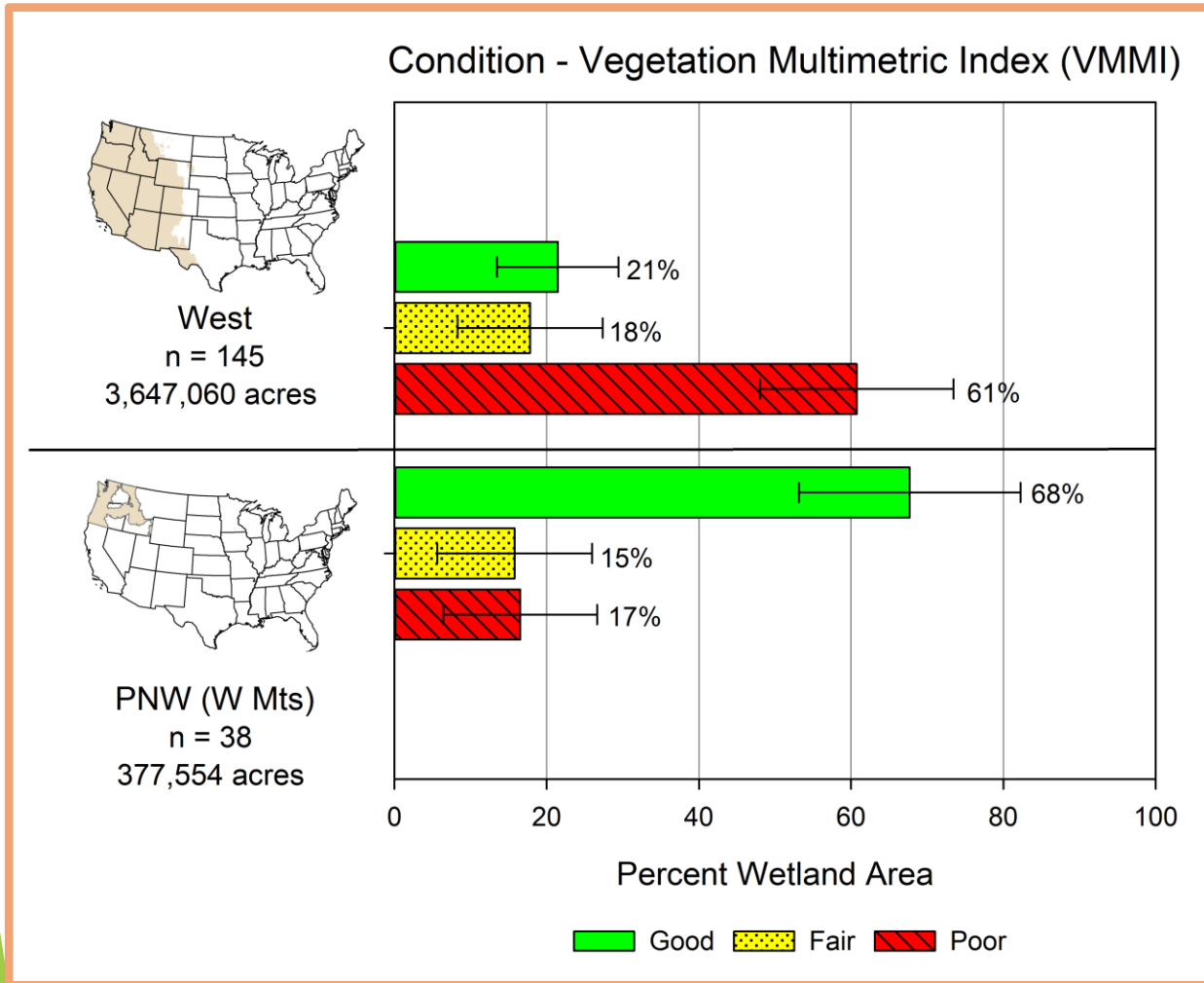


Further Analysis-Regional Results: Pacific Northwest



- ▶ In the Western Mountain region of the PNW, 38 probability sites were sampled
 - ▶ Represents an estimated 377,554 acres
- ▶ Used these sites to make condition extent estimates for PNW Western Mountains
- ▶ ****Disclaimer****
 - ▶ Sample size is small, so confidence intervals may be large

Regional Condition Extent Estimates



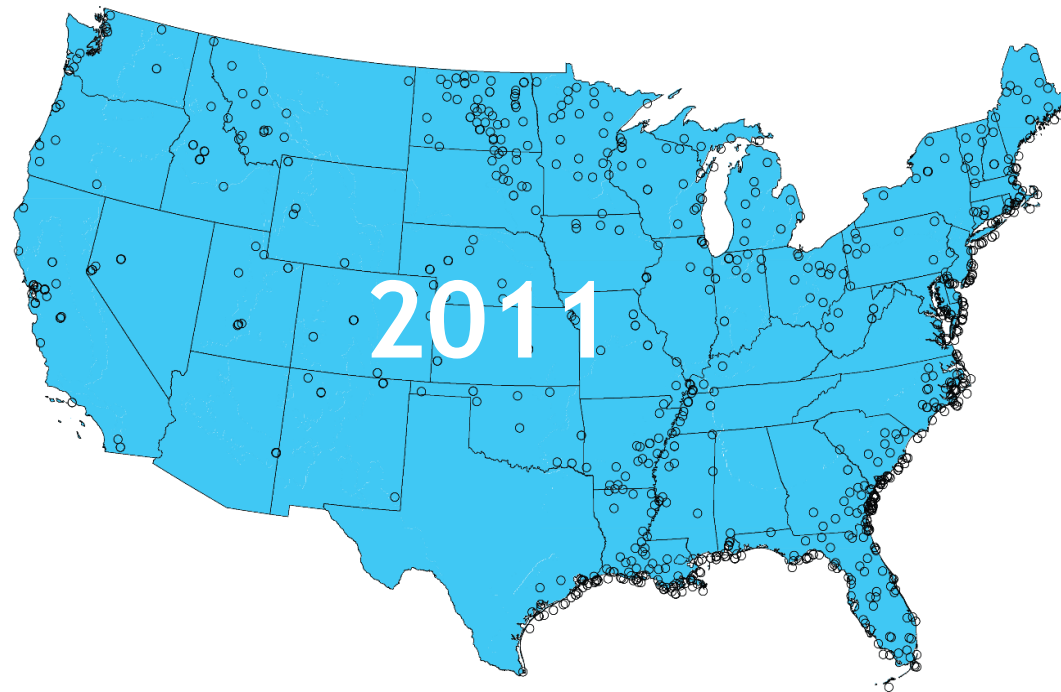
- ▶ All NWCA Wetland Types
- ▶ Across West :
 - ▶ 61% in **poor** condition
 - ▶ 21% wetland area in **good** condition
- ▶ PNW (W Mtns):
 - ▶ 68% wetland area in **good** condition
 - ▶ 17% in **poor** condition

Genesis of PNWCA

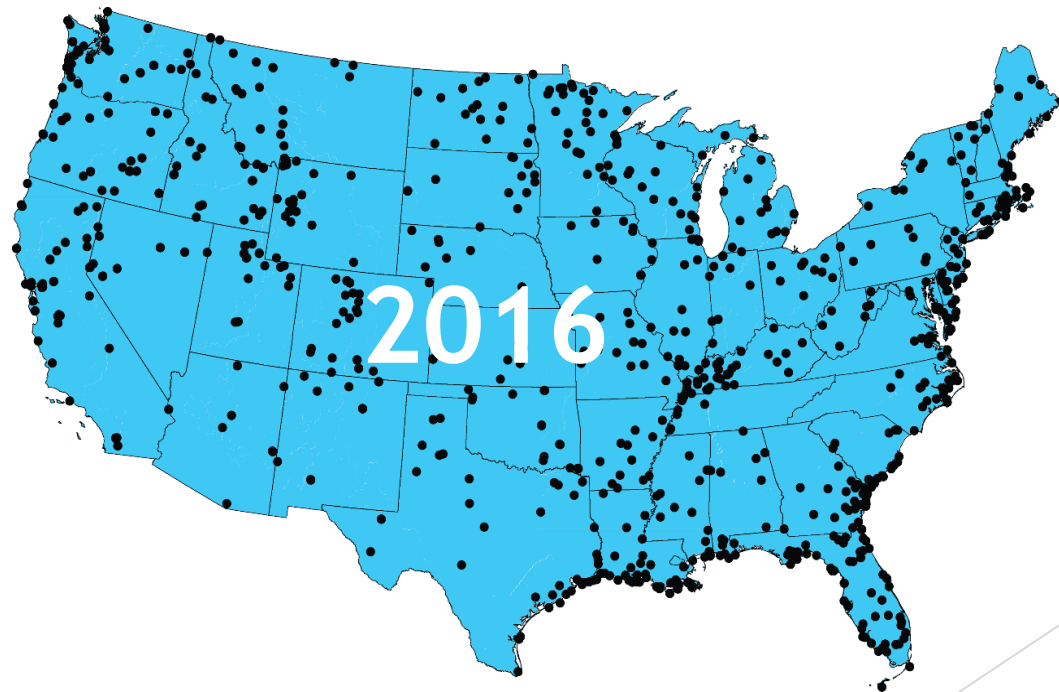
- ▶ Questions raised by results of 2011 NWCA:
 - ▶ Were the results real, or could they have been skewed by aggregating such a large area, or by other factors affecting the distribution of sample points?
 - ▶ Concerns were raised by a large number of western states that the sampleframe (S&T plots) did not adequately capture the population of wetlands in the West
 - ▶ Analysis of PNW data seems to suggest that wetlands in the PNW may be in better condition than the rest of the West. Is this true?
 - ▶ Are there differences in condition based on ecoregion? Wetland type?
 - ▶ Are the stressors most likely to be associated with poor condition the same in the PNW as the rest of the country? As the rest of the West?

Genesis of the PNWCA

- ▶ As a result of the questions raised, and with the cooperation of participating states and tribes, R10 was able to obtain intra-agency funding to pay for the analysis and sampling of enough additional sites in the PNW to address these questions.
- ▶ The Office of Water also provided additional contractor support to sample additional sites (reference sites) that increased the total of sites.
- ▶ Thanks to the completion of the National Wetlands Inventory, the NWCA team in Corvallis was able to combine those sites with the Status and Trends plots to provide a much more robust sample frame from which to draw points.



**Distribution of
NWCA sample points
In 2011 vs. 2016**



Methodology

- ▶ NWCA Team selects sites using a probability-based design
- ▶ Sample teams undergo several day training course to learn sampling protocols and QA protocols. EPA provides each state/tribe with a kit of equipment to use in sampling.
- ▶ Field methodology is designed to sample one site per day.
- ▶ Vegetation, soils and hydrology are sampled, as well as characterizing the 100 m buffer around the plot.
- ▶ Field data are uploaded to EPA lab in Corvallis
- ▶ Labs analyze samples in accordance with established QA practices
- ▶ Data are posted online in the NWCA site for use by states, tribes and public

What's in the Report

- ▶ Overview of the NWCA
- ▶ Questions raised in 2011 leading to PNWCA
- ▶ Measures used and structure of the results
- ▶ Subpopulations that were able to be evaluated
- ▶ Areal estimates of wetland condition categories for each group of subpopulations
- ▶ Physical Indicators of stress for each group of subpopulations
- ▶ Chemical Indicators of stress for each group of subpopulations
- ▶ Associations between stressors and biological condition for each group of subpopulations
- ▶ Major findings of the PNWCA
- ▶ Appendix with tables of all of the results

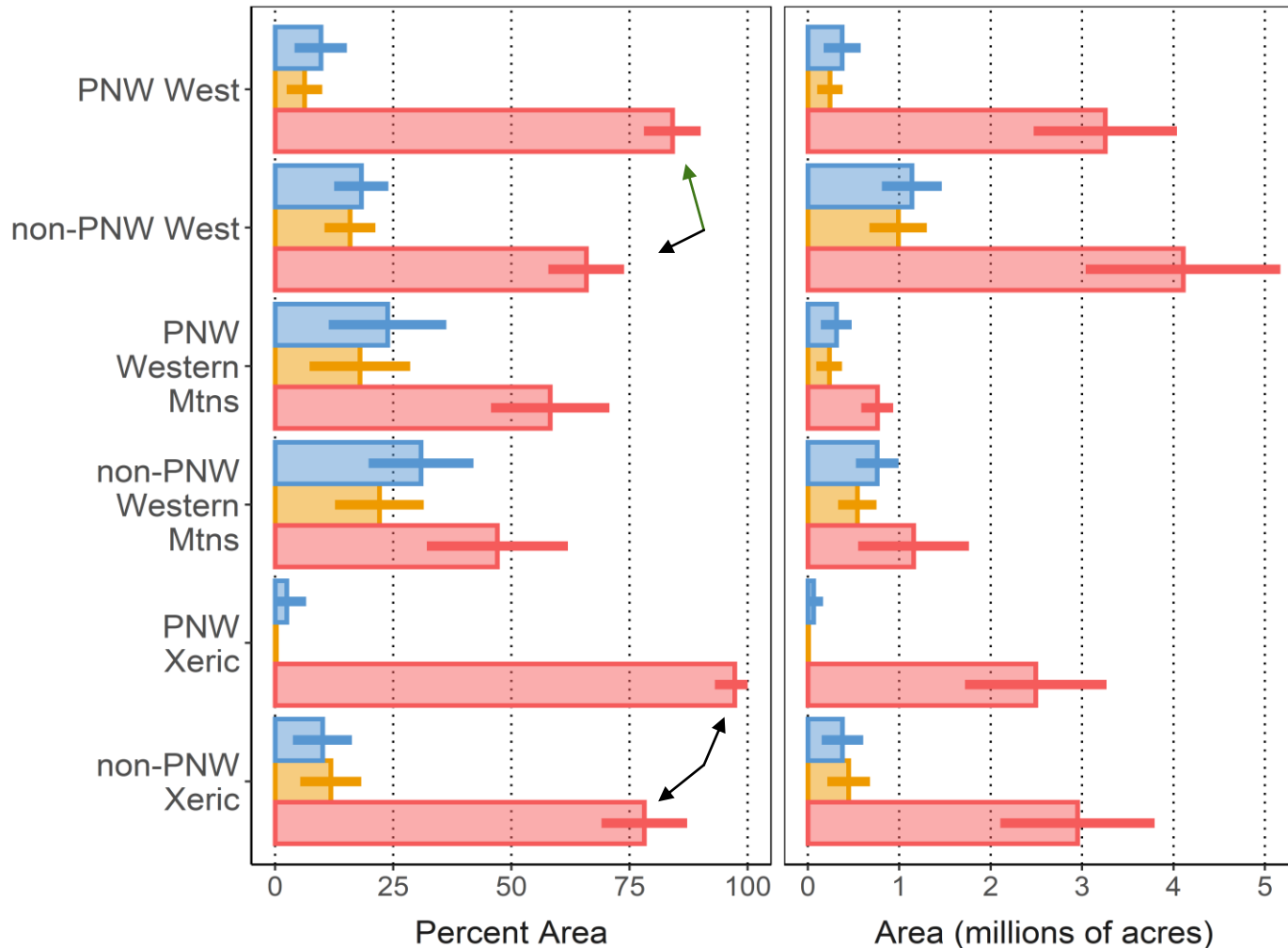
Subpopulations that were evaluated in the 2016 PNWCA

- ▶ The Western Mountains (WMT) and Xeric (XER) ecoregions within the PNW
- ▶ The PNW compared to the WEST ecoregion minus the PNW
- ▶ The WMT and XER ecoregion subpopulations of the PNW compared to the WMT and XER subpopulations of the Non-PNW West
- ▶ The inland woody and inland herbaceous Wetland group subpopulations of the PNW
- ▶ The Washington, Oregon, and Idaho state subpopulations
- ▶ Two Multi-metric descriptors of condition are used to report on condition: the Vegetative Multi-Metric Index (VMMI) and the Non-Native Plant Index (NNPI)
- ▶ The effects on condition based upon the presence of 6 physical stressors, and based on chemical (heavy metals) stressors in the soil

Results: Condition in the PNW by Ecoregion vs. Rest of the West (non PNW West)

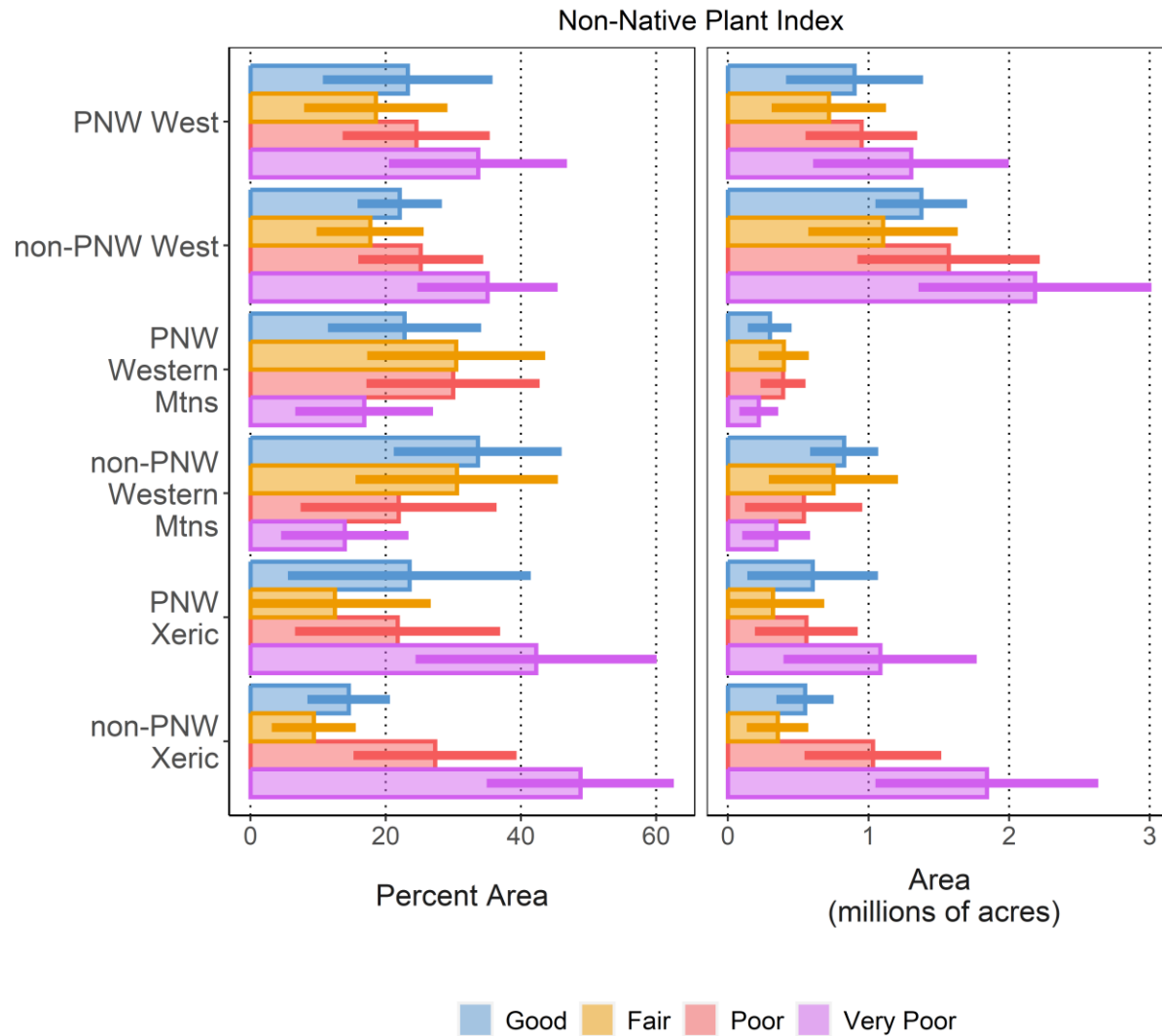
- ▶ Wetland condition in the PNW is largely **POOR**, with 58% of the WMT ecoregion and 97% of the XER ecoregion in poor condition. 24% of the wetland area in the WMT was in good condition and 16% was in fair condition
- ▶ The XER ecoregion has about 2.6 million acres of wetland area, as compared to the WMT ecoregion, which has about 1.3 million acres of wetland area. Thus, the condition of wetland area in the XER ecoregion has a greater effect on wetland condition within the PNW as a whole.
- ▶ The PNW has more wetland area in poor condition than the rest of the west.
- ▶ The XER ecoregion in the PNW has more wetland area in poor condition than does the rest of the West; the differences in condition in the WMT ecoregions for these two groups are not as clear cut.

Vegetation MMI



Good Fair Poor

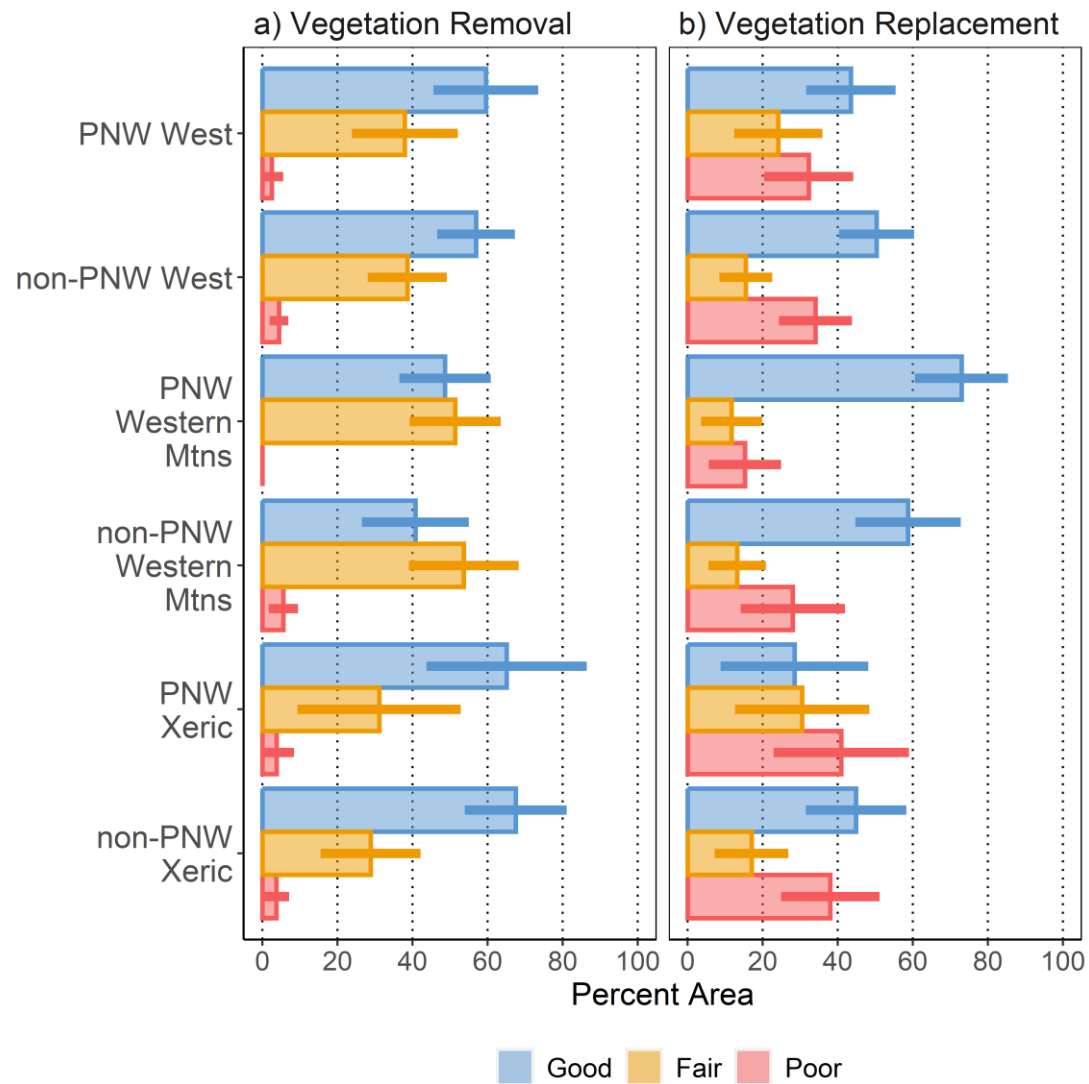
Wetland condition in 2016 as measured by the Vegetation Multimetric Index (VMMI) and presented by the ecoregion subpopulations (Western Mountains (WMT), Xeric (XER)) and the Pacific Northwest (PNW) vs. non-Pacific Northwest West (non-PNW). The 95% confidence intervals are shown for each estimate. PNW n=119, PNW-WMT n=75, PNW-XER n=44; non-PNW West n=195, non-PNW WMT n=105, non-PNW XER n=90.



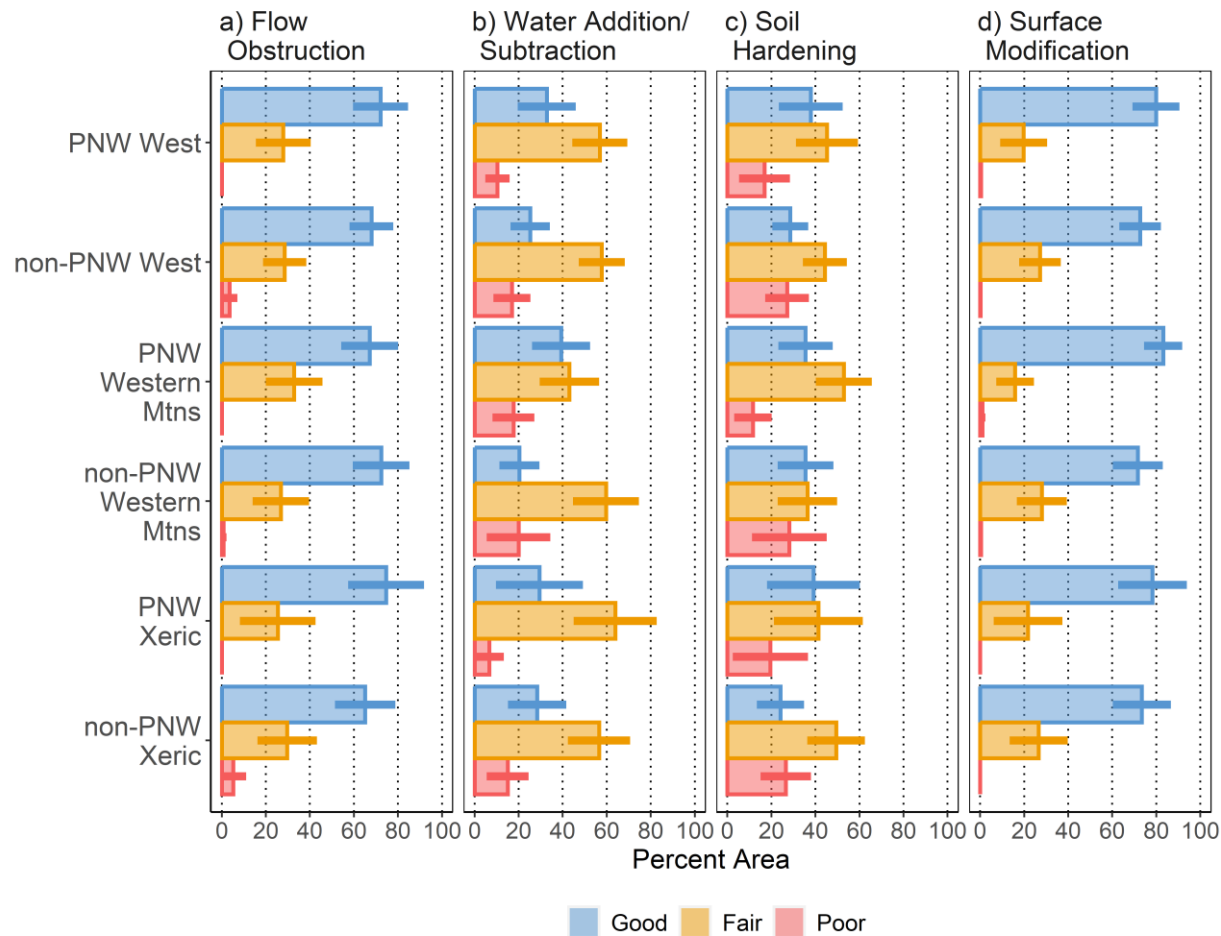
Condition in 2016 based on stress from nonnative plants, as measured by the Nonnative Plant Indicator (NNPI) for the Pacific Northwest (PNW) ecoregion subpopulations, i.e., Western Mountains (WMT) and Xeric (XER), non-PNW West, and non-PNW ecoregion subpopulations. The 95% confidence intervals are shown for each estimate. PNW n=119, PNW-WMT n=75, PNW-XER n=44; non-PNW West n=195, non-PNW WMT n=105, non-PNW XER n=90.

Physical Indicators of Stress

- ▶ Six physical indicators of stress (human-mediated physical alterations) were developed from the data collected on the field forms
- ▶ Stressors reflect human impacts to the three components which identify wetlands: Vegetation, Hydrology and Soils
- ▶ Vegetation Removal
- ▶ Vegetation Replacement
- ▶ Water Addition/Subtraction
- ▶ Flow Obstruction
- ▶ Soil Hardening
- ▶ Surface Modification



Condition estimates based on the extent of Vegetation Removal (3.4.a.) and Vegetation Replacement (3.4.b.) in the Pacific Northwest (PNW) and the Western Mountain (WMT) and Xeric (XER) ecoregion subpopulations in the PNW, as well as the non-PNW West, the non-PNW WMT and the non-PNW XER regions. Condition categories are Good, Fair, or Poor for all subpopulations. Good condition is when there is a low incidence of the stressor present; Fair condition is when there is a moderate incidence of the stressor present; Poor condition is when there is a high incidence of the stressor present. The 95% confidence intervals are shown for each estimate. PNW n=119, PNW-WMT n=75, PNW-XER n=44; non-PNW West n=195, non-PNW WMT n=105, non-PNW XER n=90.

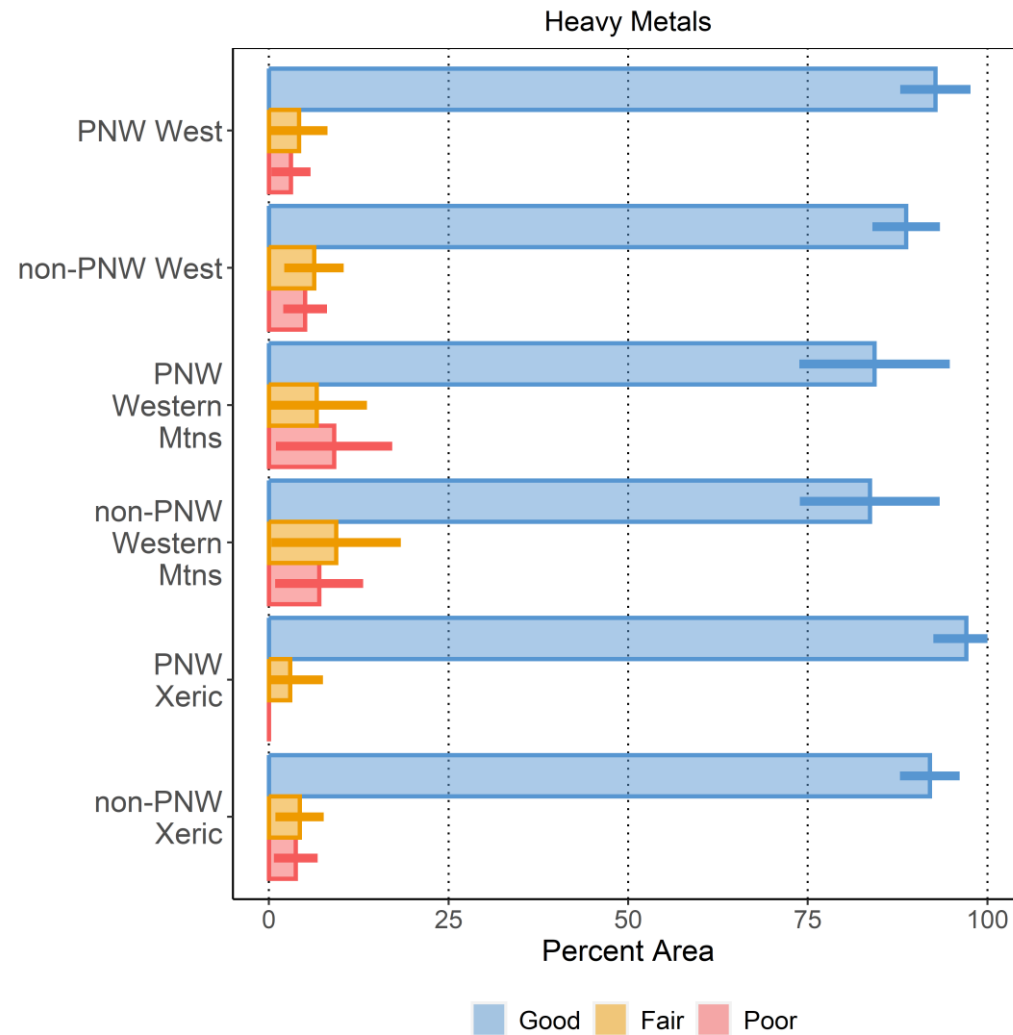


Wetland condition estimates based on each of four physical stressors in the Pacific Northwest (PNW) Western Mountains (WMT) and Xeric ecoregion subpopulations vs the Non-PNW West (Non-PNW) Western Mountains (WMT) and Xeric ecoregion subpopulations. Flow Obstruction (3.5.a) and Water Addition/Subtraction (3.5.b) are Indicators of Hydrologic Alteration. Soil Hardening (3.5.c) and Surface Modification (3.5.d) are indicators of Soil Alteration. Condition categories are Good, Fair, or Poor for all subpopulations. Good condition is when there is a low incidence of the stressor present; Fair condition is when there is a moderate incidence of the stressor present; Poor condition is when there is a high incidence of the stressor present. The 95% confidence intervals are shown for each estimate. PNW n=119, PNW-WMT n=75, PNW-XER n=44; non-PNW West n=195, non-PNW WMT n=105, non-PNW XER n=90.

Chemical Stressors

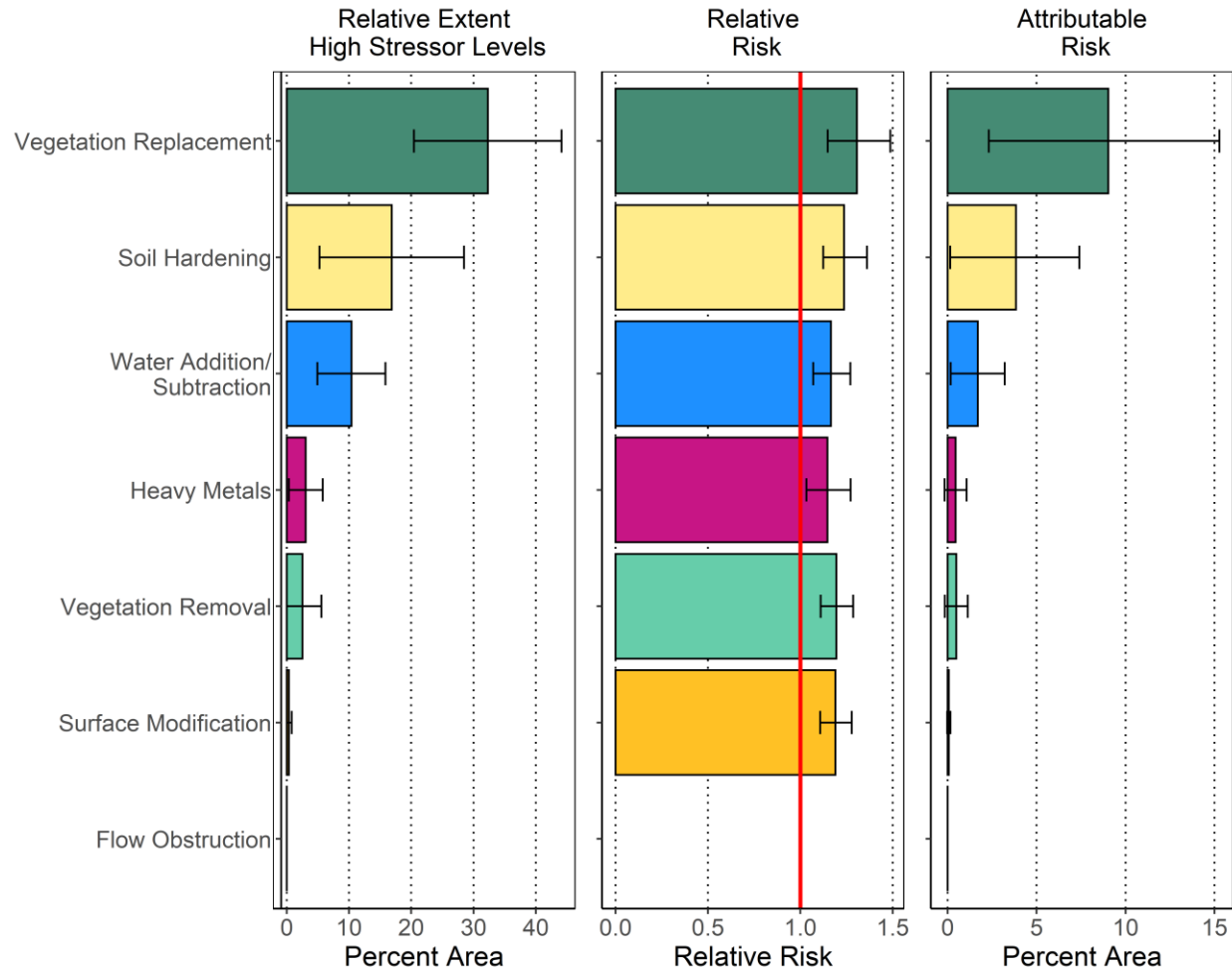
Three Chemical Indicators developed for NWCA

- ▶ Soil Heavy metal index, which assesses 12 heavy metals most closely associated with human activities. The thresholds for good, fair and poor condition do not reflect toxicity levels; rather, they are indicators of human disturbance.
 - ▶ Total N levels
 - ▶ Total P levels
-
- ▶ We did not report on Water chemistry within the PNWCA because only 40% of the sites had sampleable water. Results can be found at <https://www.epa.gov/national-aquatic-resource-surveys/national-wetland-condition-assessment-2016-results>



Condition of wetland area based on the extent of heavy metals in wetland soils in 2016 for the Pacific Northwest (PNW) and the Non-PNW West, and in the Western Mountains (WMT) and Xeric (XER) ecoregion subpopulations. Condition ratings reflect the extent of the presence of any of the target 12 heavy metals. The 95% confidence intervals are shown for each estimate. PNW n=119, PNW-WMT n=75, PNW-XER n=44; non-PNW West n=195, non-PNW WMT n=105, non-PNW XER n=90.

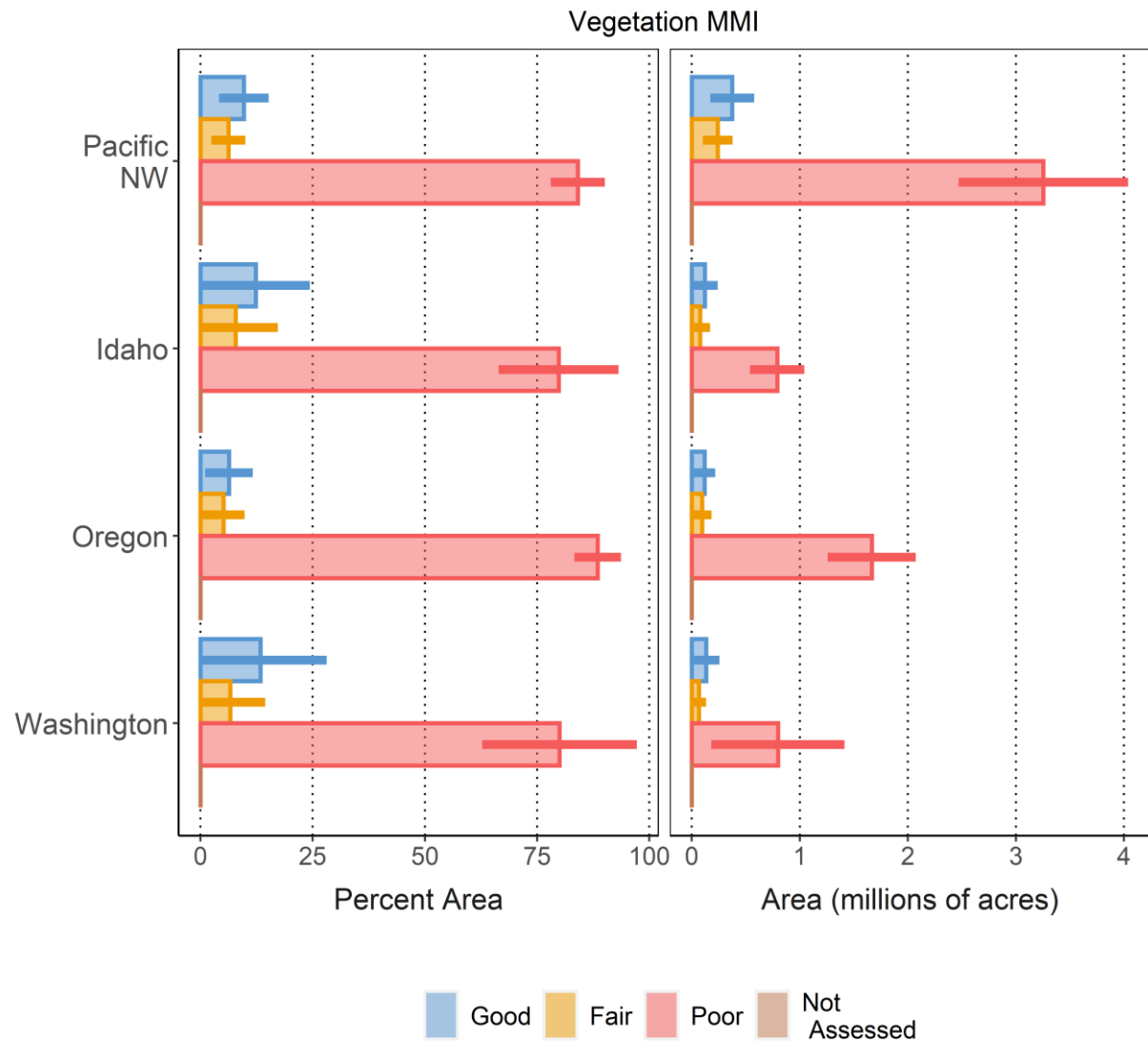
What are the Associations between Stressors and Condition in the Pacific Northwest?



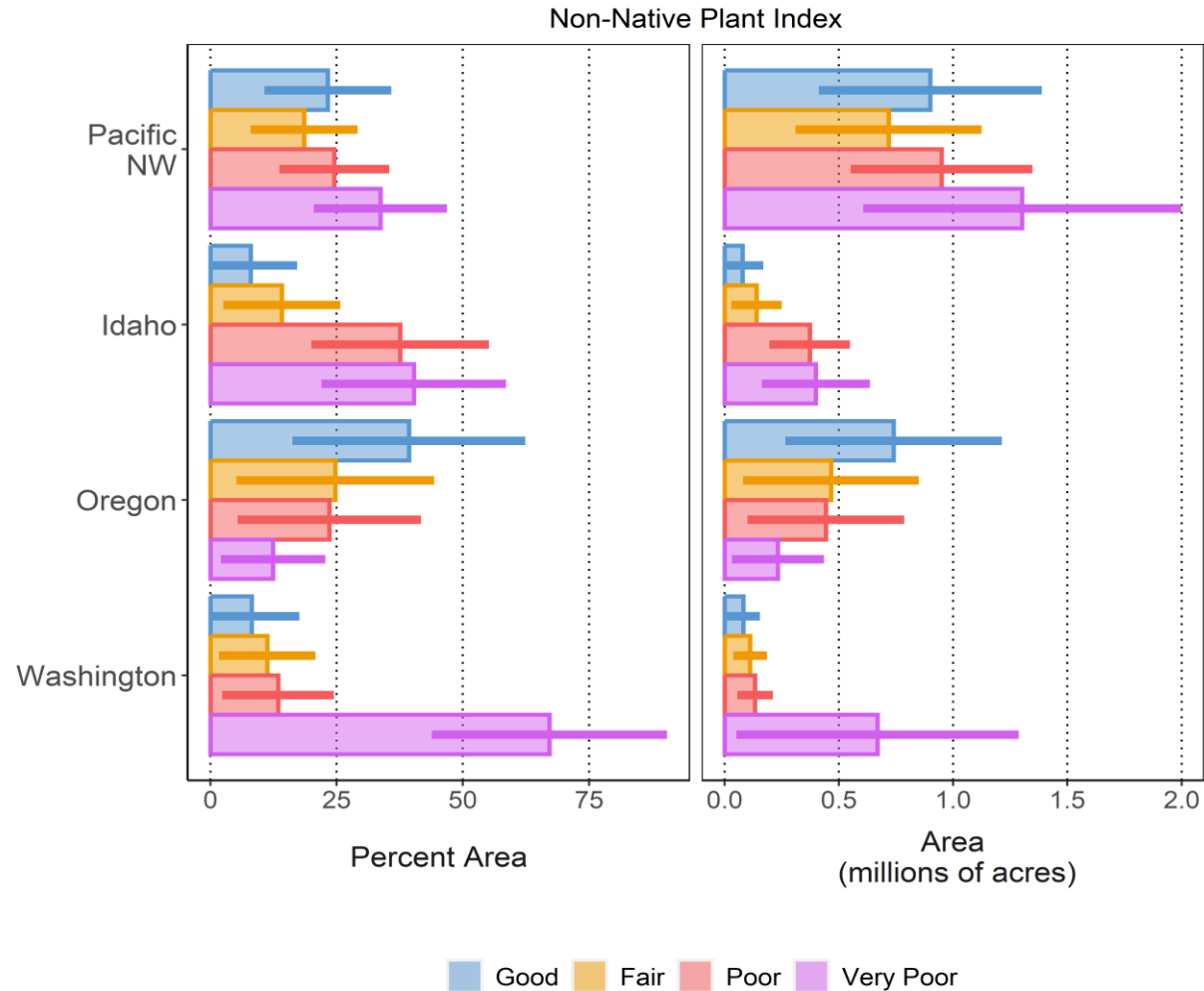
Associations between stressors and condition in the PNW in 2016. **3.7.a Relative Extent** is the measure of the percent wetland area affected by the stressors. **3.7.b Relative Risk** indicates the likelihood that a stressor is causing poor condition. A value >1.0 indicates a likely effect. **3.7.c Attributable Risk** is a measure of the likelihood that removal of a stressor would cause a positive change in the condition of a wetland area.

PNW State Subpopulations

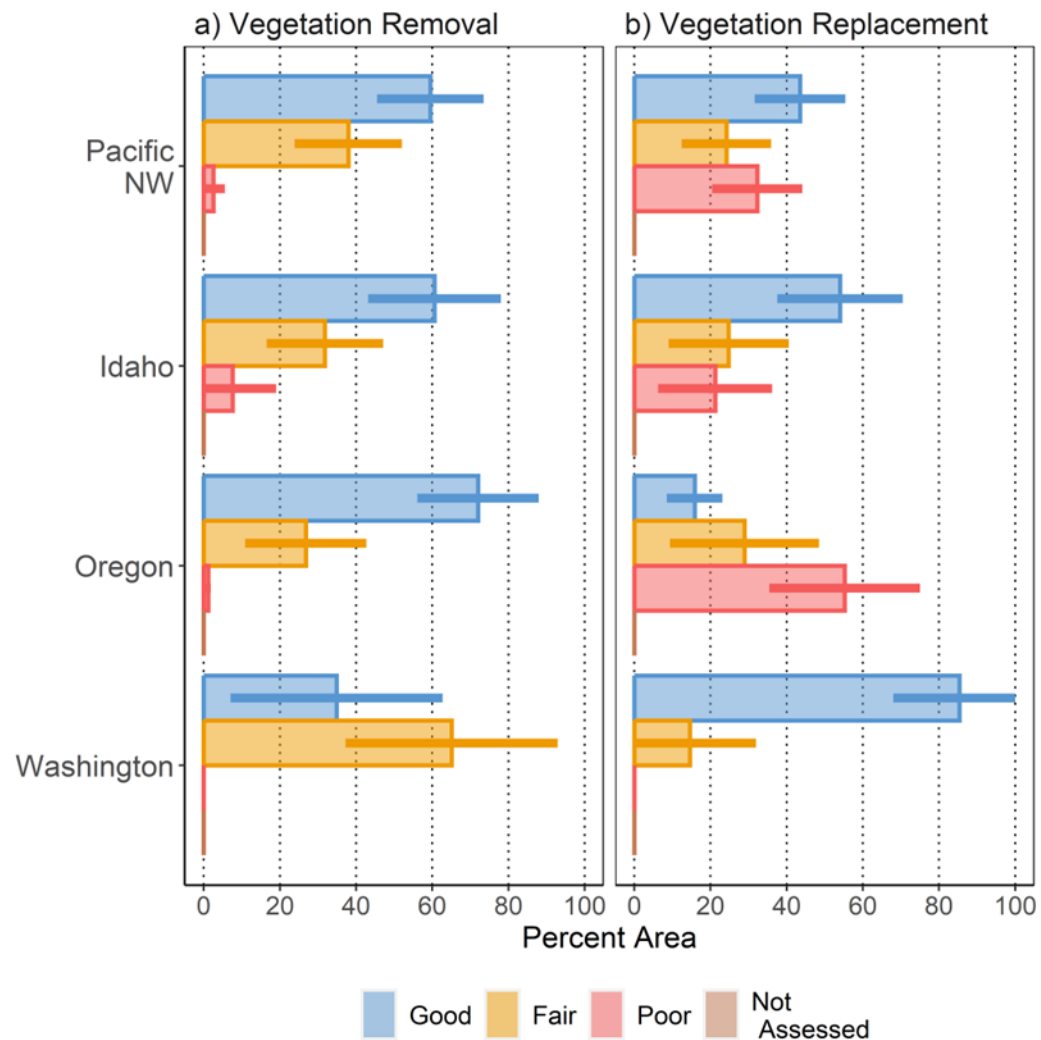
- ▶ Data provided for use by state programs
- ▶ Oregon has the largest wetland acreage, approximately 1.67 million acres
- ▶ Washington has the second largest wetland acreage, approximately 797,464 acres
- ▶ Idaho has the smallest wetland acreage, approximately 790,846
- ▶ Of the 119 sites sampled, ID had 33 sites, OR had 46 sites, and WA had 40 sites
- ▶ Where $N < 50$, confidence limits are large. Sample size was too small to allow assessment by ecoregion within any of the states



Wetland Condition in 2016 as measured by the Vegetation Multimetric Index (VMMI). Condition Categories are Good, Fair, and Poor for the state subpopulations (Pacific Northwest (PNW), Idaho (ID), Oregon (OR) and Washington (WA)). Estimates of condition are presented in both percent area and by area in acres. Each estimate is shown with the upper and lower boundaries of the 95% confidence intervals around each estimate. PNW n=119, ID n=33, OR n=46, WA n=40.



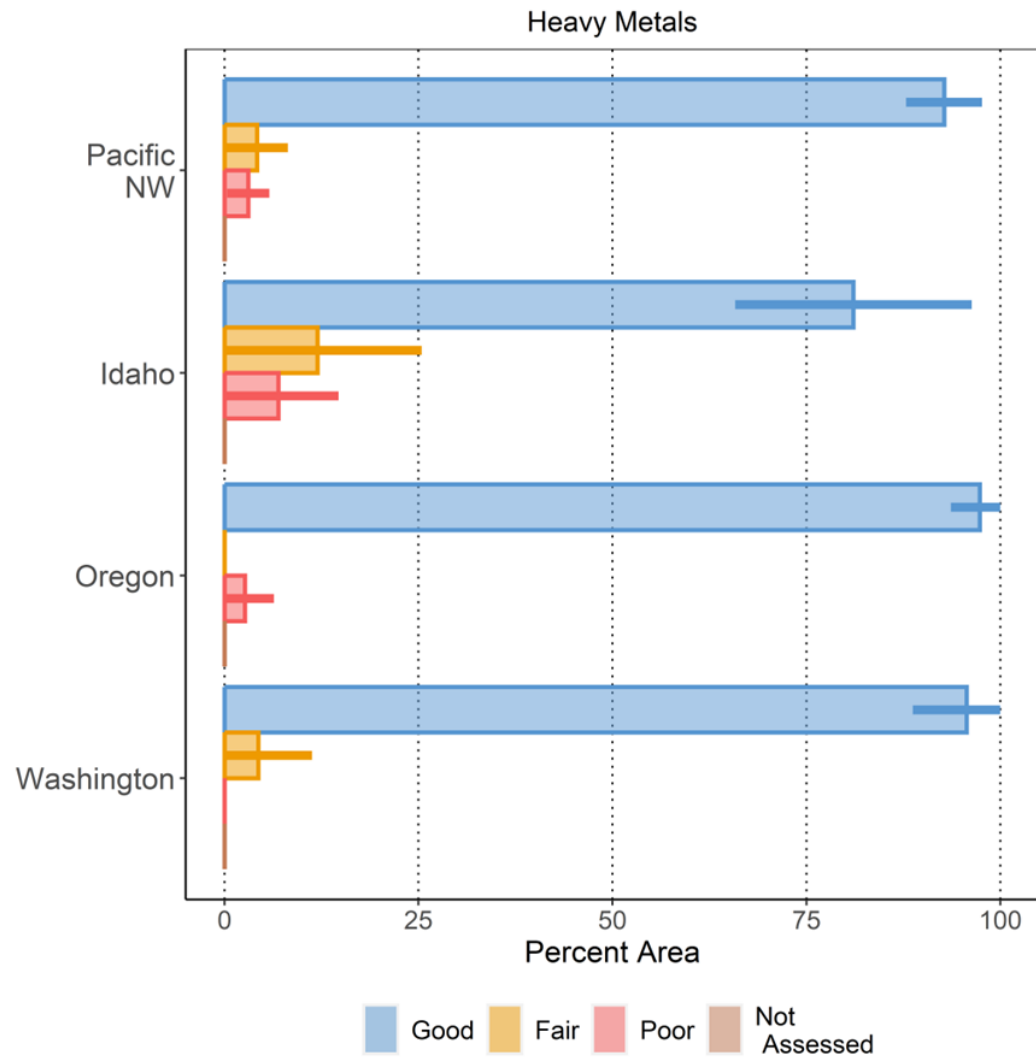
Condition in 2016 due to stress from nonnative plants as measured by the Nonnative Plant Indicator (NNPI). Condition Categories are Good, Fair, Poor and Very Poor for the state subpopulations (Pacific Northwest (PNW), Idaho (ID), Oregon (OR) and Washington (WA)). Estimates of condition are presented in both percent area and by area in acres. Each estimate is shown with the upper and lower boundaries of the 95% confidence intervals around each estimate. PNW n=119, ID n=33, OR n=46, WA n=40.



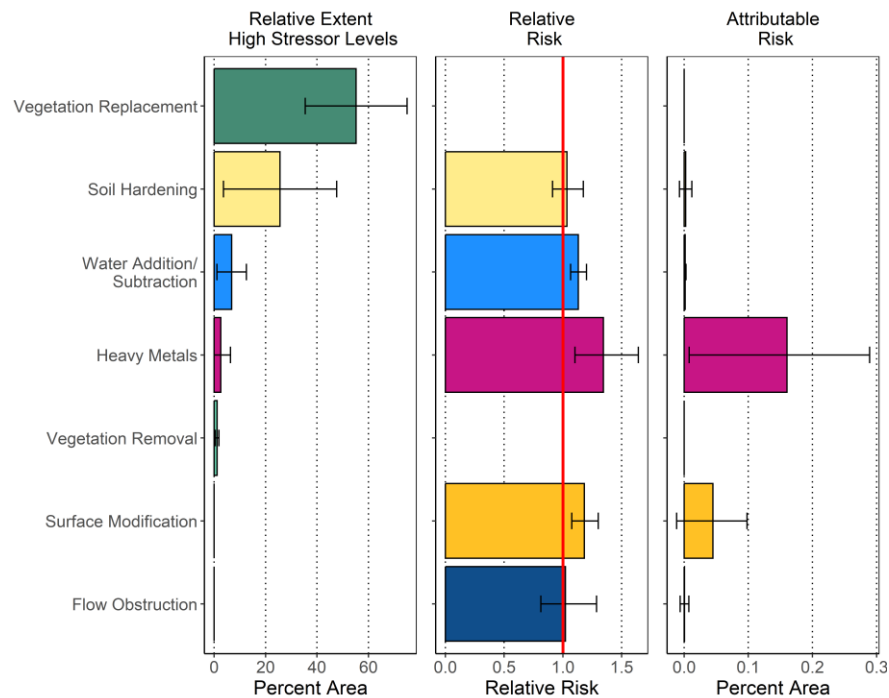
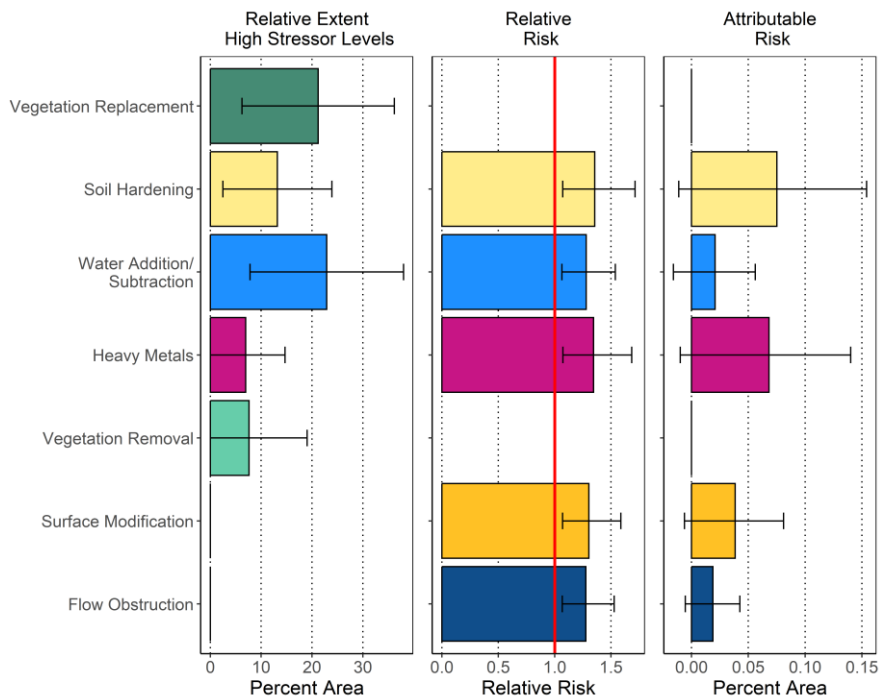
Wetland Condition in 2016 as measured by the extent of two Vegetation Alteration stressors: Vegetation Removal (4.3.a.) and Vegetation Replacement (4.3.b.). Condition Categories are Good, Fair, and Poor for the state subpopulations (Pacific Northwest (PNW), Idaho (ID), Oregon (OR) and Washington (WA)). Good condition is when there is a low incidence of the stressor present; Fair condition is when there is a moderate incidence of the stressor present; Poor condition is when there is a high incidence of the stressor present. Estimates of condition are presented in percent area. Each estimate is shown with the upper and lower boundaries of the 95% confidence intervals around each estimate. PNW n=119, ID n=33, OR n=46, WA n=40.



Wetland Condition in 2016 as measured by the extent of four physical stressors. Hydrologic stressors include Flow Obstruction (4.4.a.) and Water Addition/Subtraction (4.4.b); soil stressors include Soil Hardening (4.4.c.) and Surface Modification (4.4.d.). Condition Categories are Good, Fair, and Poor for the state subpopulations (Pacific Northwest (PNW), Idaho (ID), Oregon (OR) and Washington (WA)). Good condition is when there is a low incidence of the stressor present; Fair condition is when there is a moderate incidence of the stressor present; Poor condition is when there is a high incidence of the stressor present. Estimates of condition are presented in percent area. Each estimate is shown with the upper and lower boundaries of the 95% confidence intervals around each estimate. PNW n=119, ID n=33, OR n=46, WA n=40.

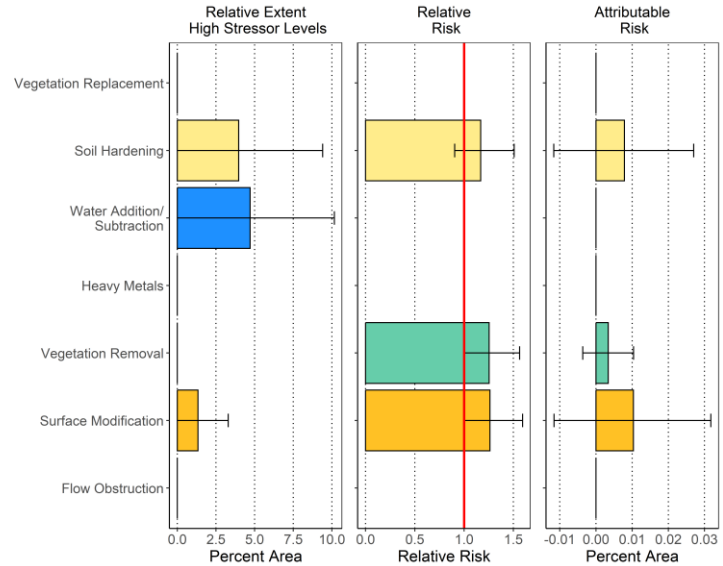


Wetland Condition in 2016 based on the extent of chemical stressors measured as Soil Heavy Metals, based on the Heavy Metals Index. Condition Categories are Good, Fair, and Poor for the state subpopulations (Pacific Northwest (PNW), Idaho (ID), Oregon (OR) and Washington (WA)). Condition Category ratings reflect the extent of the presence of any of target 12 heavy metals. Good condition is assigned to wetlands having none of the target 12 metals present in levels above threshold. Poor condition is assigned to wetlands having 3 or more metals present in levels above threshold. Estimates of condition are presented in percent area. Each estimate is shown with the upper and lower boundaries of the 95% confidence intervals around each estimate. PNW n=119, ID n=33, OR n=46, WA n=40.



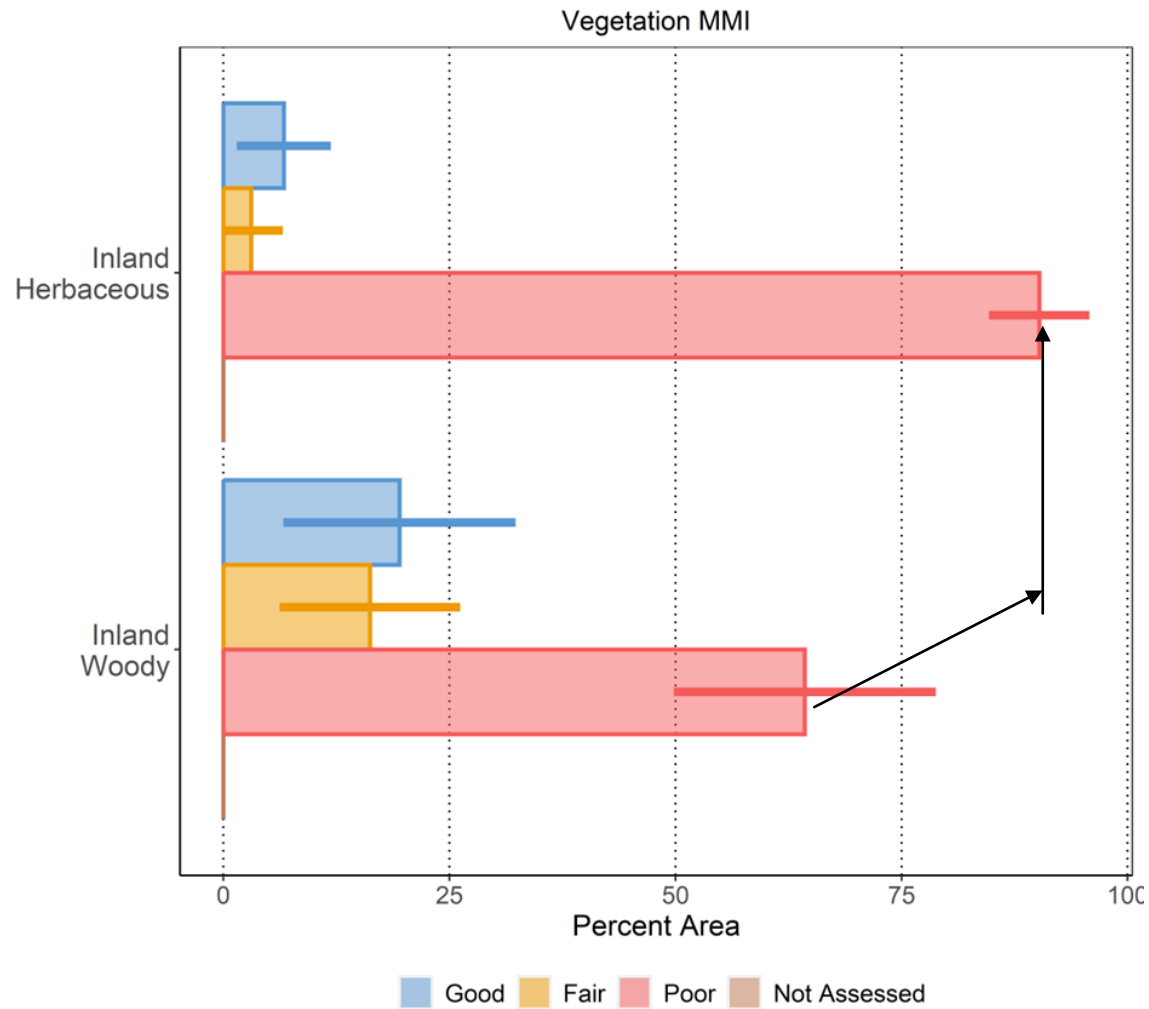
IDAHO

OREGON

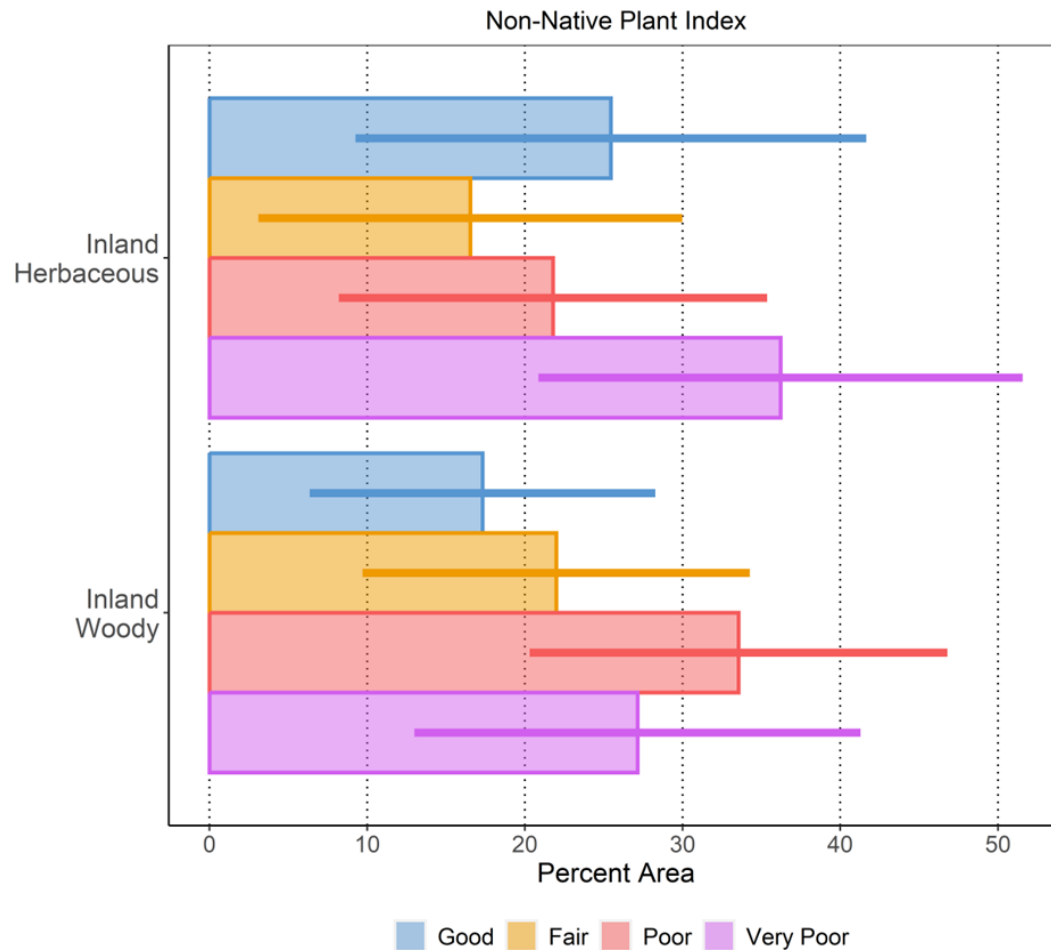


WASHINGTON

Condition in the PNW based on wetland type

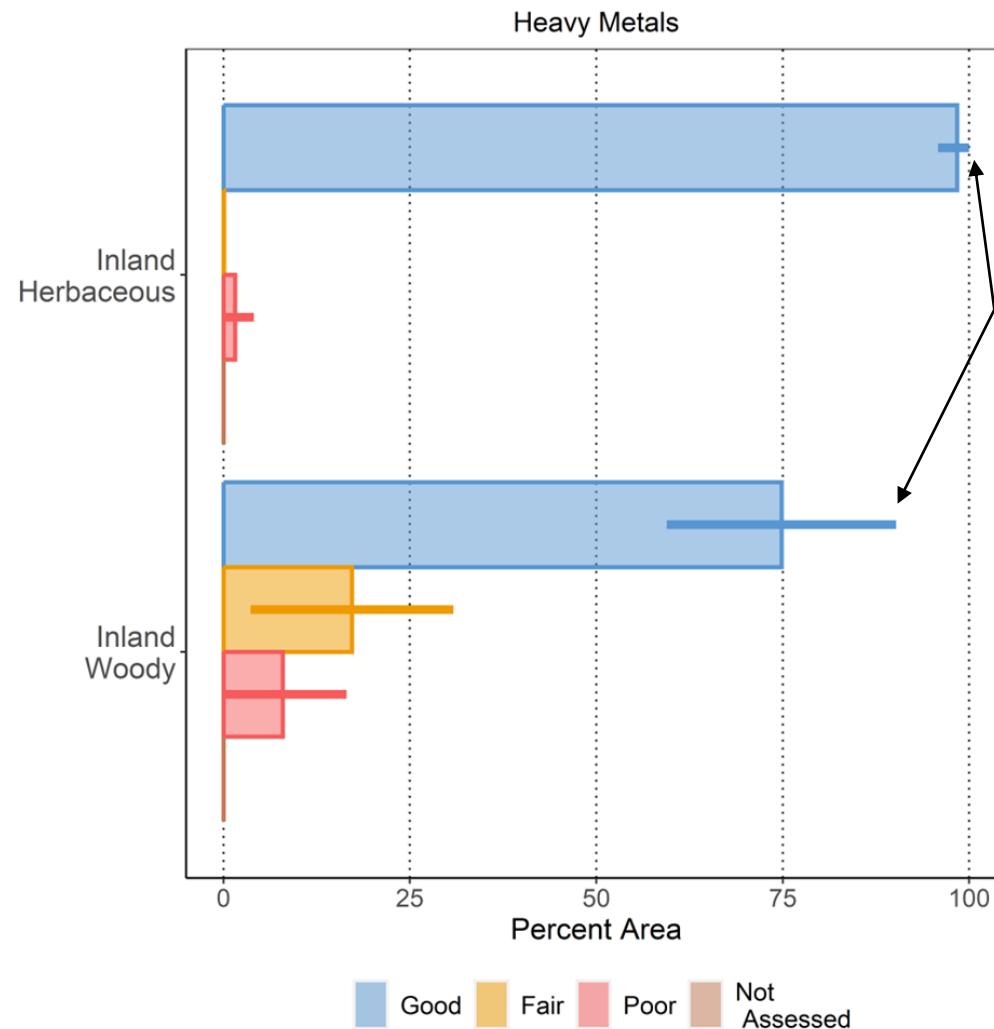


Condition by PNW Wetland type in 2016 as measured by the Nonnative Plant Indicator (NNPI).



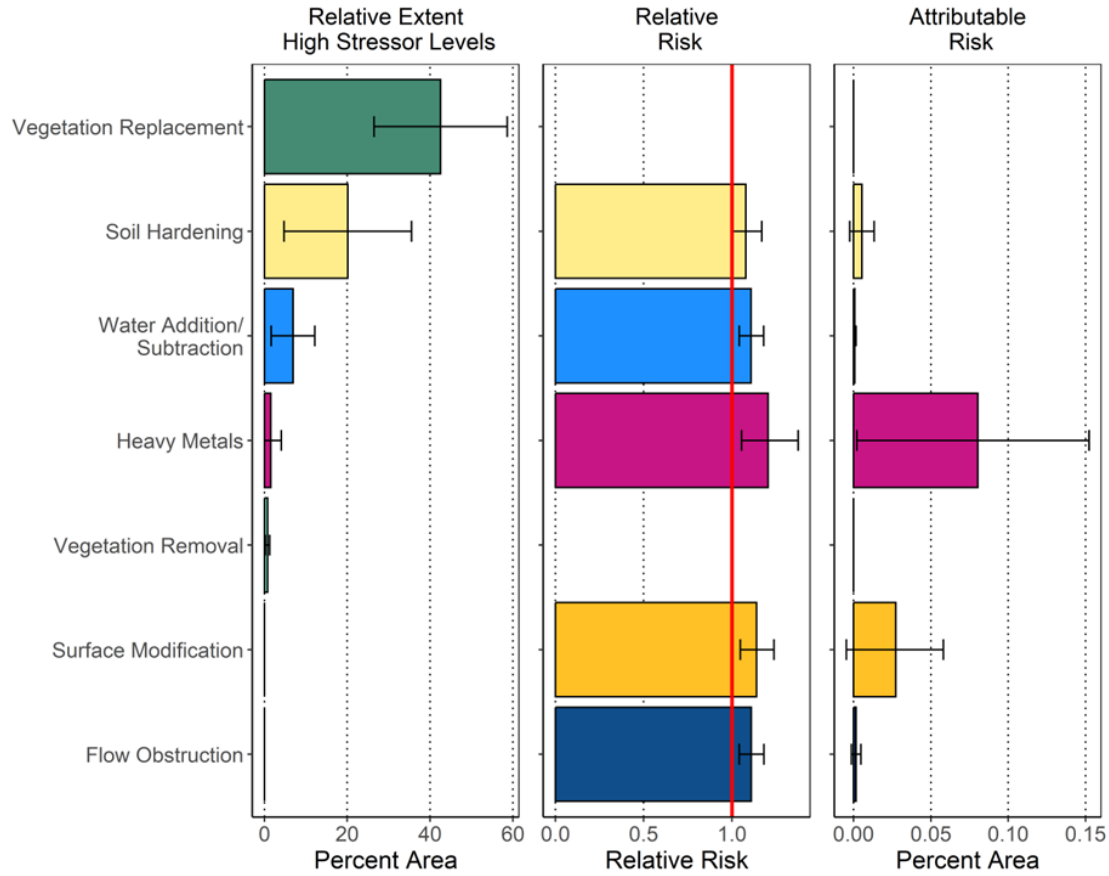
Condition Categories are Good, Fair, Poor and Very Poor for the most common Wetland group subpopulations in the Pacific Northwest (Inland Herbaceous wetland (PRLH) and Inland Woody wetland (PRLW)). Estimates of condition are presented in percent area. Each estimate is shown with the upper and lower boundaries of the 95% confidence intervals around each estimate. Inland Herbaceous n=49; Inland Woody n=56.

Condition of PNW Wetlands in 2016 based on estimates of the extent of Heavy Metals

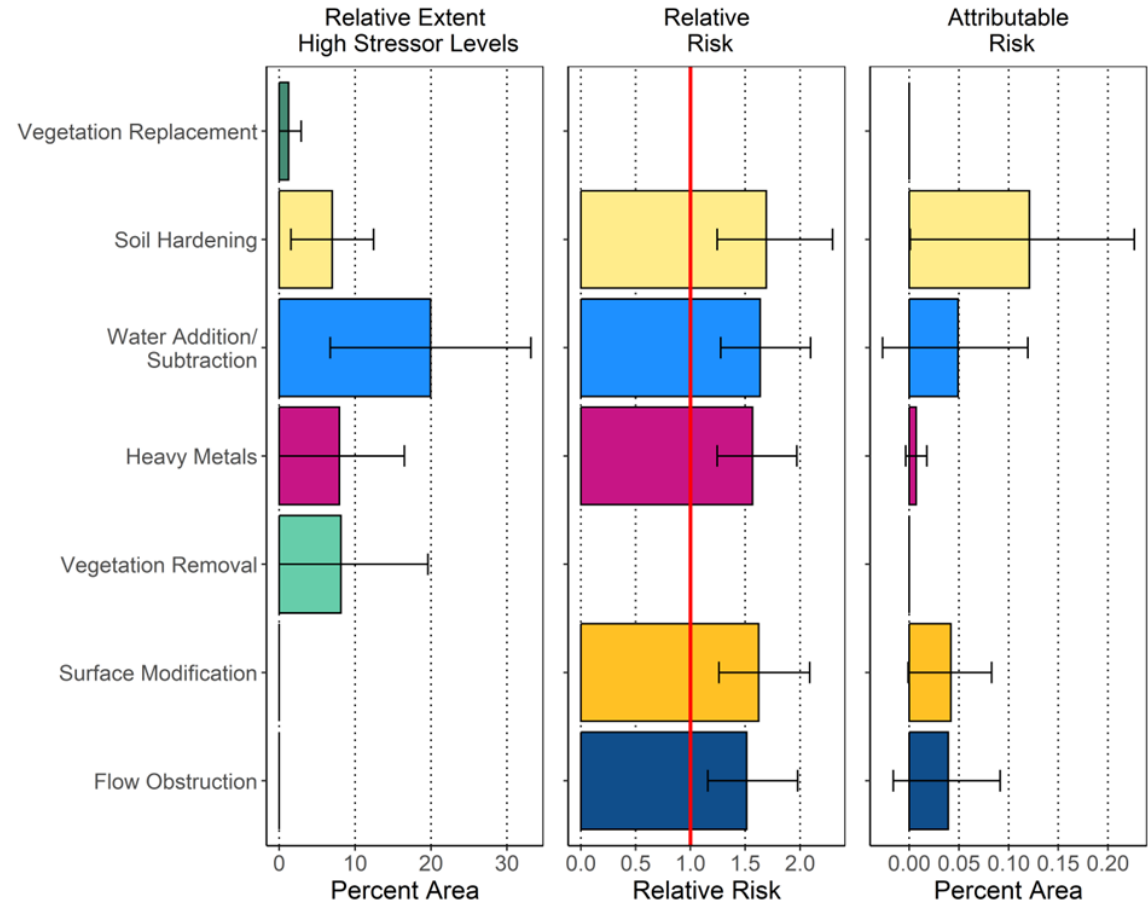


Condition ratings reflect the estimated extent of the presence above threshold of any of 12 heavy metals. Condition is considered good when none of the 12 metals is present at levels above benchmark and is considered poor if any of 3 or more metals exceed benchmark. Condition Categories are presented in percent area, with upper and lower boundaries of the 95% confidence intervals around each estimate.

What are the associations between Stressors and Condition in the Pacific Northwest based on Wetland Type?



Inland Herbaceous



Inland Woody

Associations between stressors and condition by wetland type in the PNW in 2016. Relative Extent is the measure of the percent wetland area affected by the stressors. Relative Risk indicates the likelihood that a stressor is causing poor condition. A value >1.0 indicates a likely effect. Attributable Risk is a measure of the likelihood that removal of a stressor would cause a positive change in the condition of a wetland area.

Important findings

- ▶ The differences in wetland condition in the West ecoregion (mostly poor) compared to national results follow a similar pattern in 2016 that was observed in 2011.
- ▶ The improvements in the geospatial data frame, as well as the increases in sites sampled, provided greater clarification in analyzing the results.
- ▶ There are differences in condition based on ecoregion. The XER ecoregion has more wetland area in poor condition (97%) than does the WMT ecoregion.
- ▶ There are some differences between condition in the PNW and the non-PNW West.
- ▶ Likewise, there are condition differences between different wetland types.
- ▶ Analyses of the relationship between stressors and condition should be cautiously considered, since there are assumptions involved which may not be true. However, where a relationship appears, it could provide a good source for further investigation by wetland managers.
- ▶ Likewise, more targeted, detailed, small scale studies can investigate cause and effect where relationships between stressors and condition appear.

The work continues...

