

EMAP-Western Pilot Assessment



A research program aimed at improving the science and tools of environmental monitoring



EMAP Objectives

- Estimate current status of and trends in selected indicators of condition ...on a regional basis with known confidence
- Estimate geographic coverage and extent
- Seek associations between biological condition and stresses
- Provide tools

EMAP-West Surface Waters Tools

- Sample Survey Design
 - Probability sampling → inferences about target population
- Ecological Indicators
 - Biological and Stressor
- Reference Conditions
- Assessment methods
 - Simpler to more synthetic

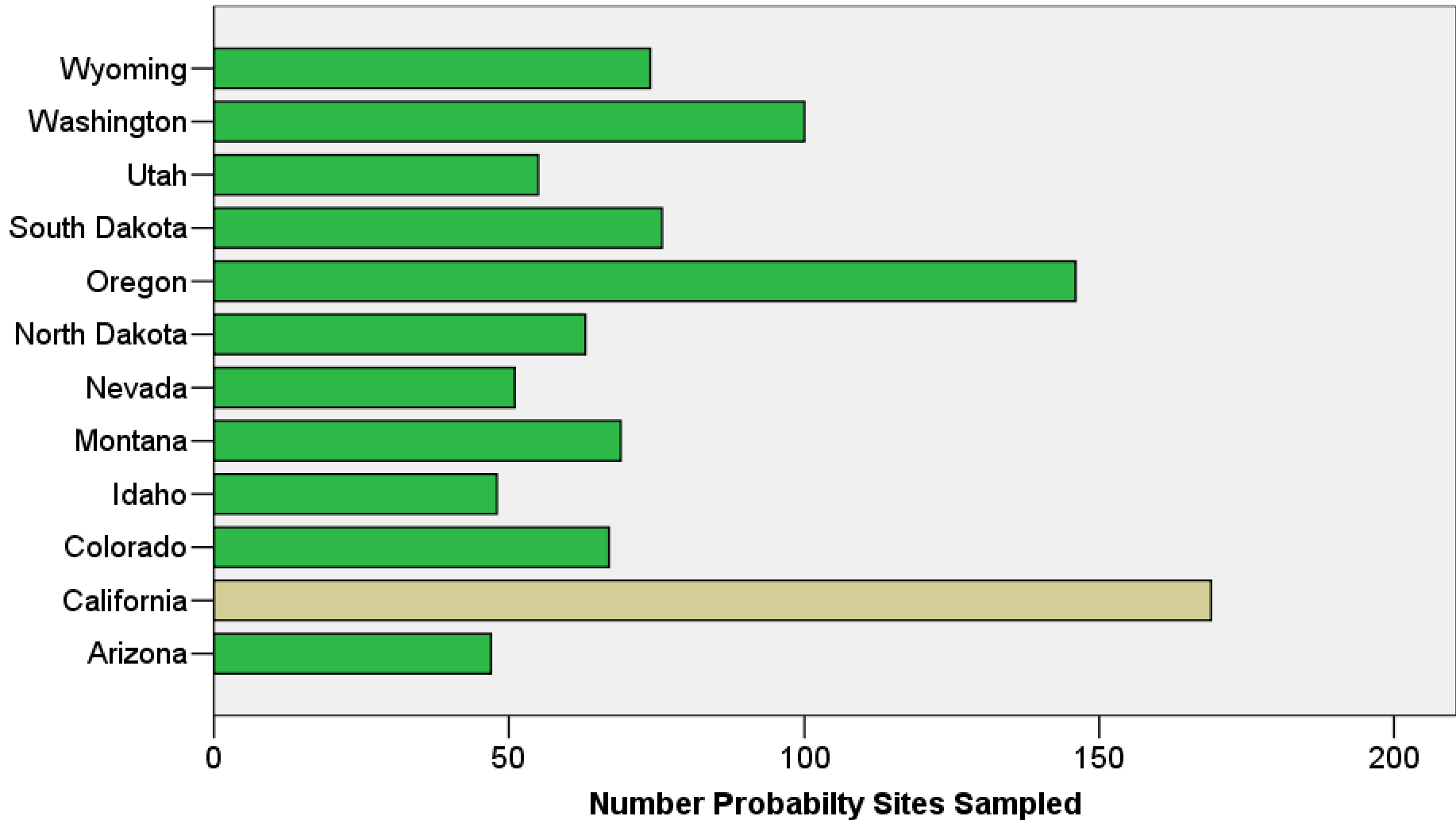
EMAP-West Design

- Sample frame
 - Perennial streams based on RF3
- Sample sizes:
 - ~ 50 per State
 - Special study areas
 - ~160: Missouri Basin
 - ~ 80: S. Calif, N. Calif, OR John Day
 - ~ 60: WA Wenatchee
- Unequal probability sample
 - 5 Strahler order categories: 1st, 2nd, 3rd, 4th+, large rivers
 - Arid and mountainous aggregated ecoregions

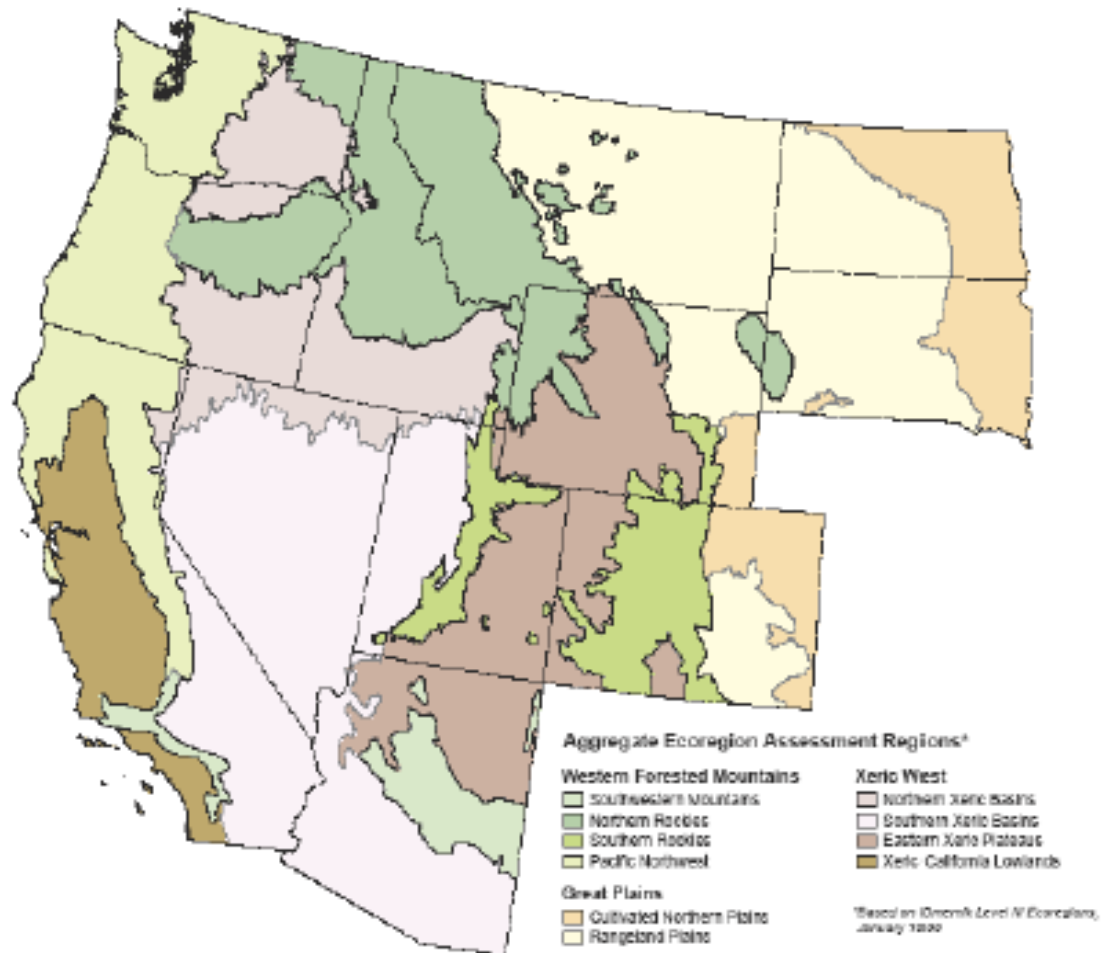
Progress To Date

- ~ 965 probability sites sampled for use in analysis
- ~ 350 reference sites sampled – most in 2004
- Statistical Summary
- Initial Assessment

Probability Sites Sampled By State

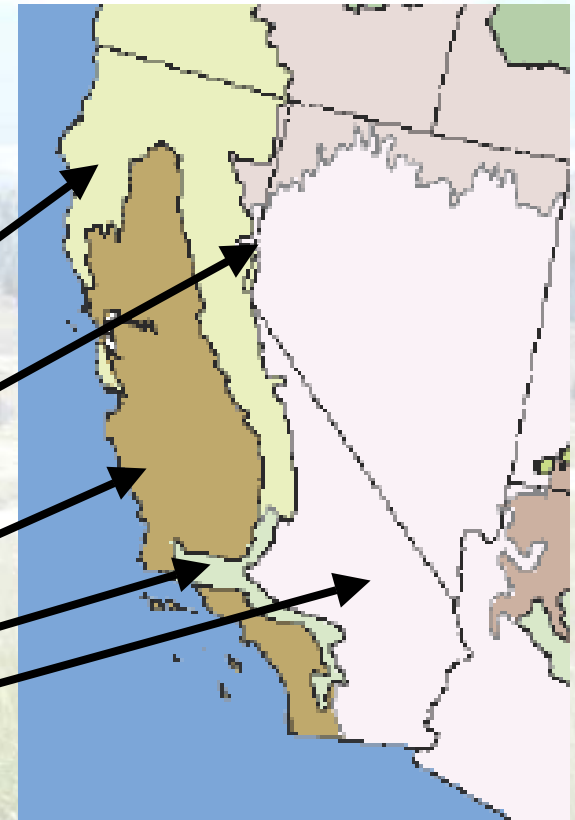


Reporting Units



Reporting Units

- West Wide
- Three Climate Regions
 - Mountains, Xeric, Plains
- Ten Aggregated Ecoregions
 - Pacific NW Mountains
 - Northern Xeric Basins
 - Xeric California Lowlands
 - Southwestern Mountains
 - Southern Xeric Basins
 -



Reporting Units \neq Design Units

- Can be combined
 - Adequate sample sizes in reporting units
 - Same sample frame
 - Same methods
 - Recalculate weights



Statistical Summary: Extent and Status

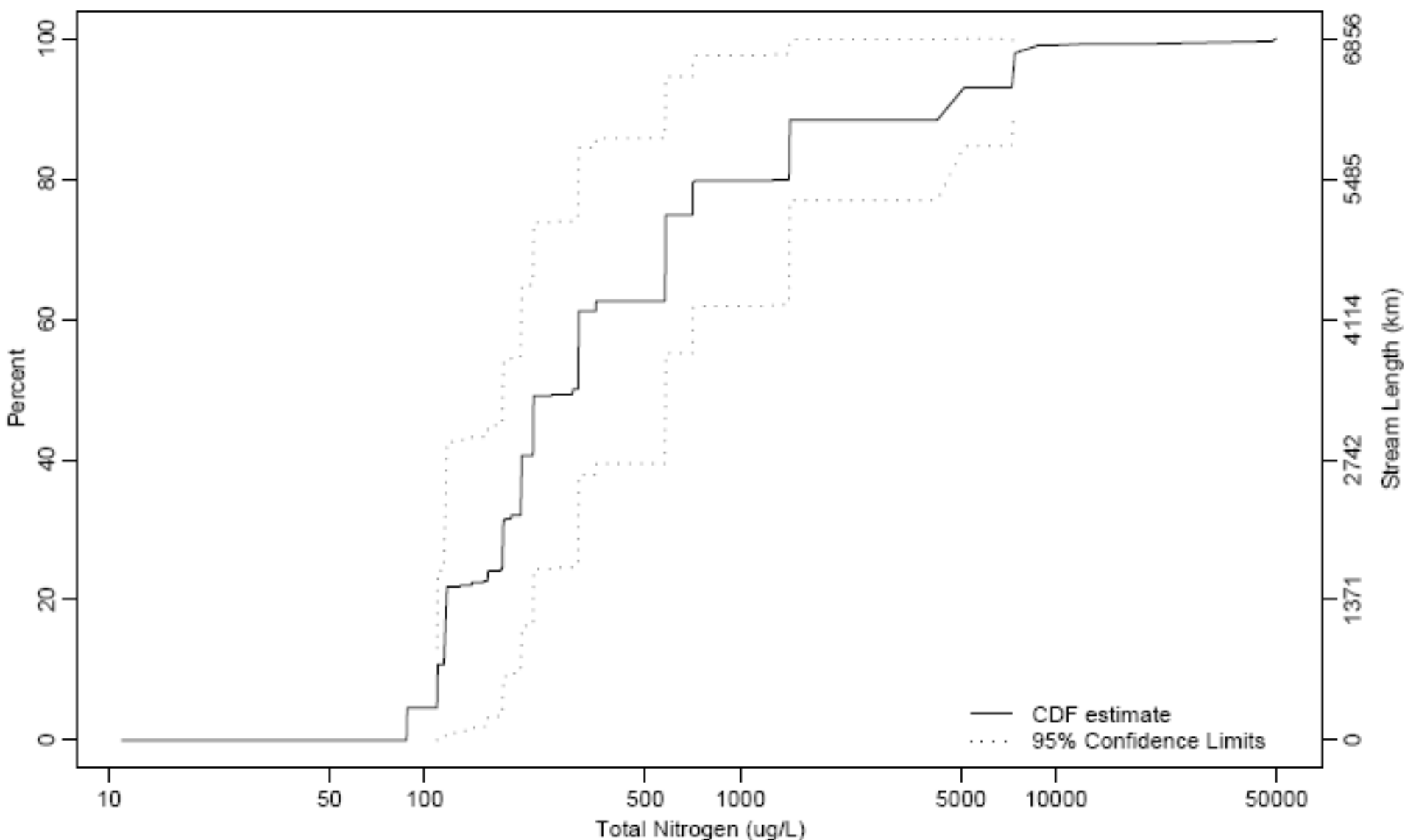
1761 pages

Major Indicators

- Rationale for metric selection
- Metrics for multiple groups
 - Macroinvertebrates (21 metrics), Aquatic Vertebrates (30 metrics)
 - Water Chemistry (20 metrics), Physical Habitat (31 metrics), Fish Tissue Contaminants (4 metrics), Alien Taxa (15 metrics)

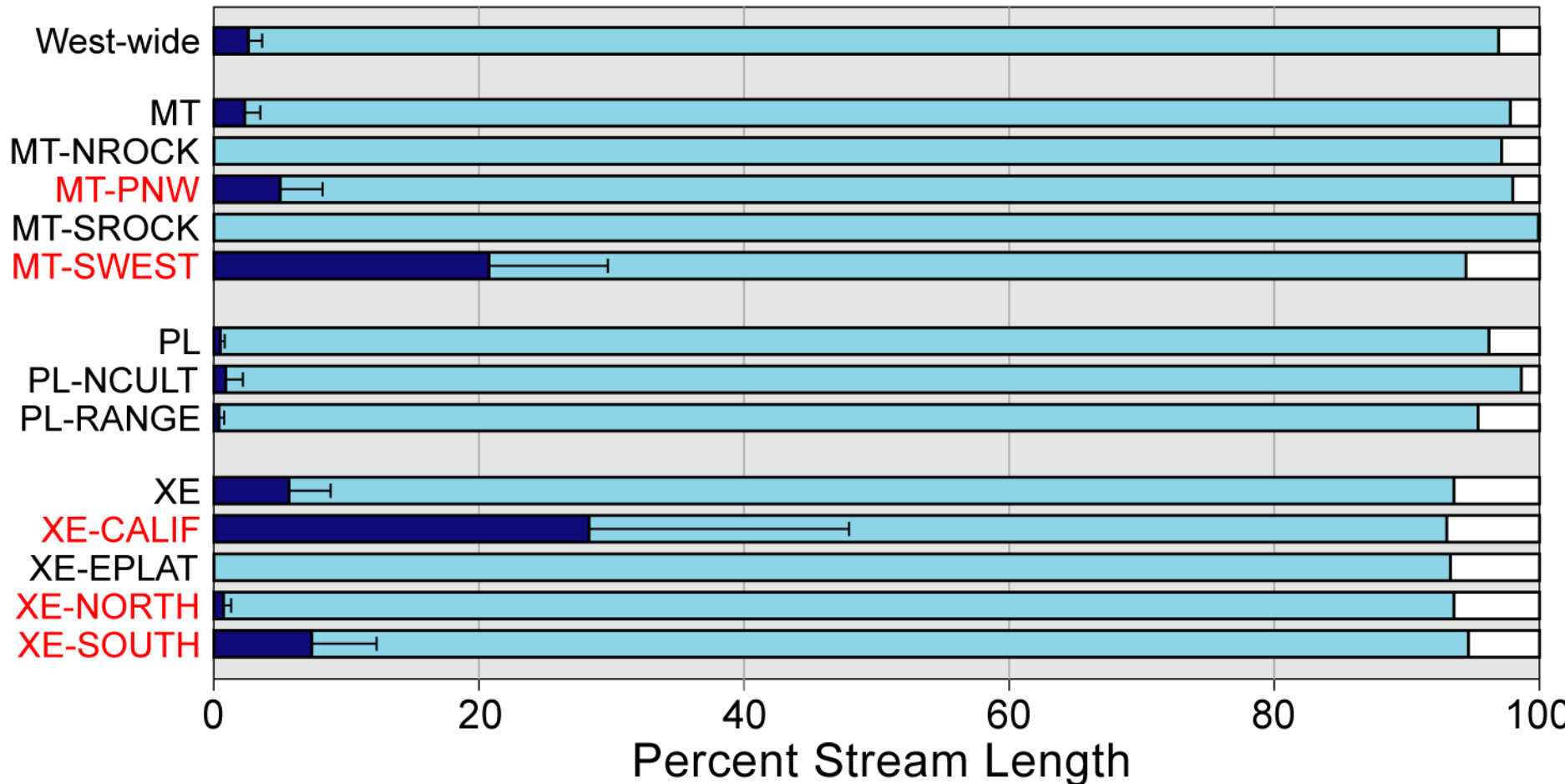
Figure CHEM-95 Indicator: Total_N Subpopulation: XE-CALIF

Empirical Cumulative Distribution Estimate



Subpopulation: ALL Indicator: Other Aliens - Asian Clam

Present Absent Not Assessed
UCB for Present





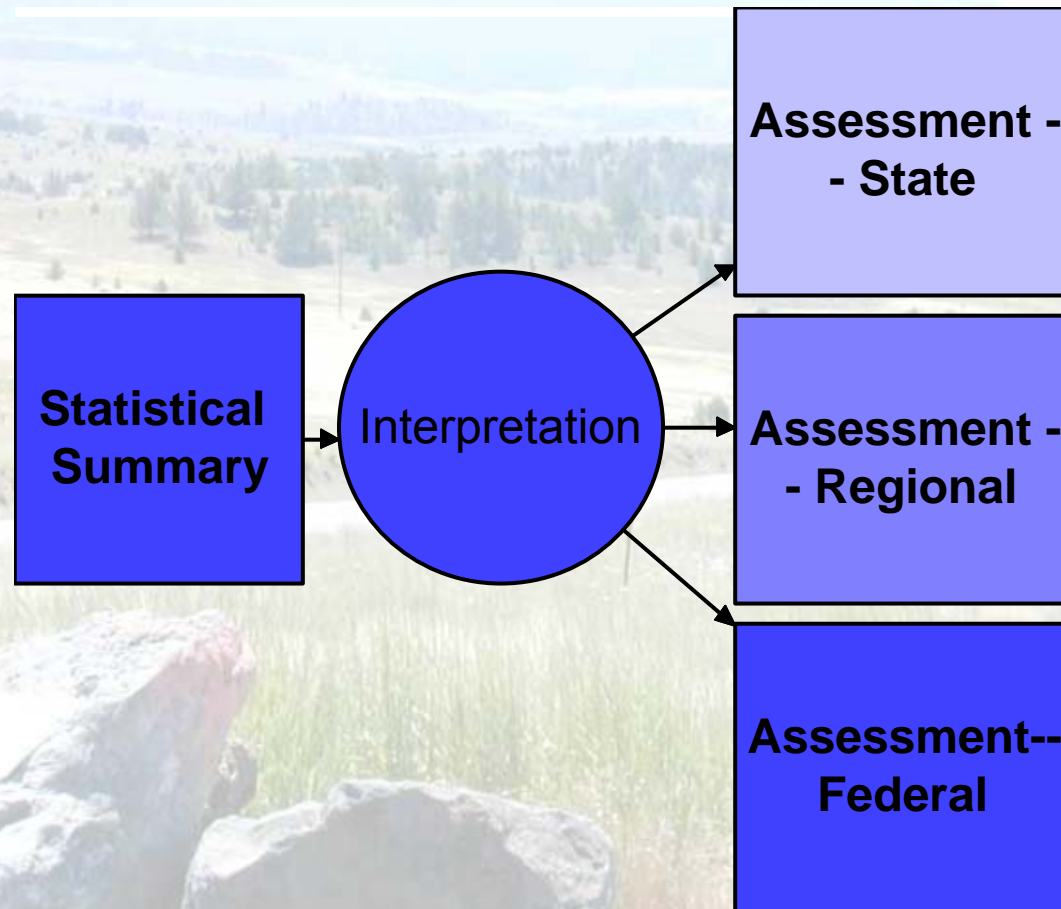
Initial Assessment: Condition and Association

56 Pages

Major Indicators

- **Biotic Condition** - Biotic Integrity of Aquatic Vertebrates, Macroinvertebrates, Loss of Macroinvertebrate Taxa
- **Chemical Stressors** - Total Phosphorus, Total Nitrogen, Mercury in Fish, Salinity
- **Physical Habitat Indicators** - Riparian Disturbance, Riparian Vegetation, Streambed Stability, In-Stream Habitat Complexity
- **Biological Stressors** - Alien Vertebrate Species, Alien Crayfish, Asian Clam

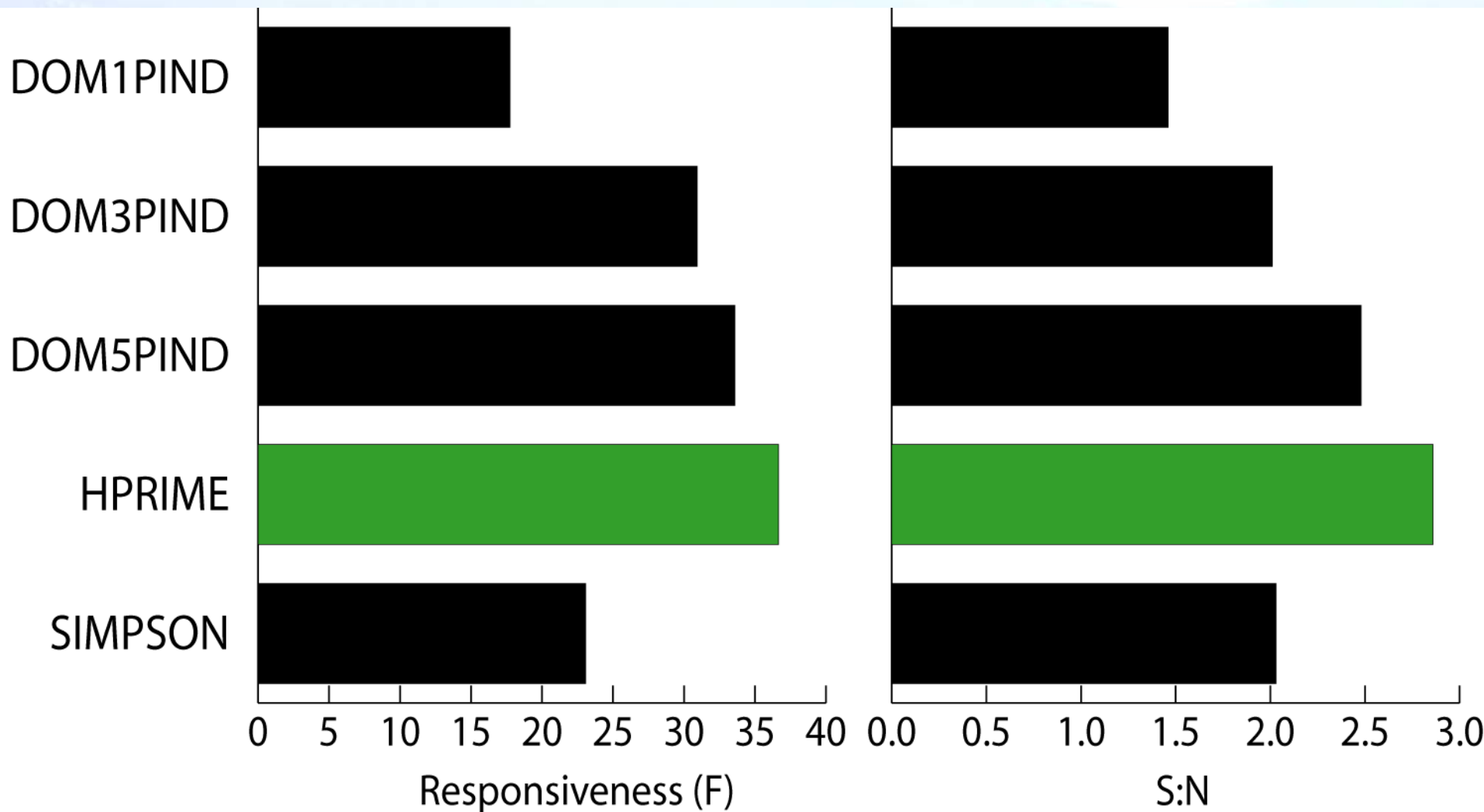
Indicator Development – Multiple Organizations



Indicator Development – Biotic Integrity of Macroinvertebrates

- Start with 76 Candidate Metrics in 6 Classes
 - Richness, Diversity, Composition, Feeding Groups, Habit, Tolerance
- Screen to find best in each class
 - Range, S:N, Responsiveness, Redundancy
- Score
 - Metrics – 5th and 95th percentiles by ecoregion
 - Indicator – Scale to 100
- Label
 - Breakpoints for disturbance classes by ecoregion

Macroinvertebrate Diversity Metrics – Xeric Ecoregion



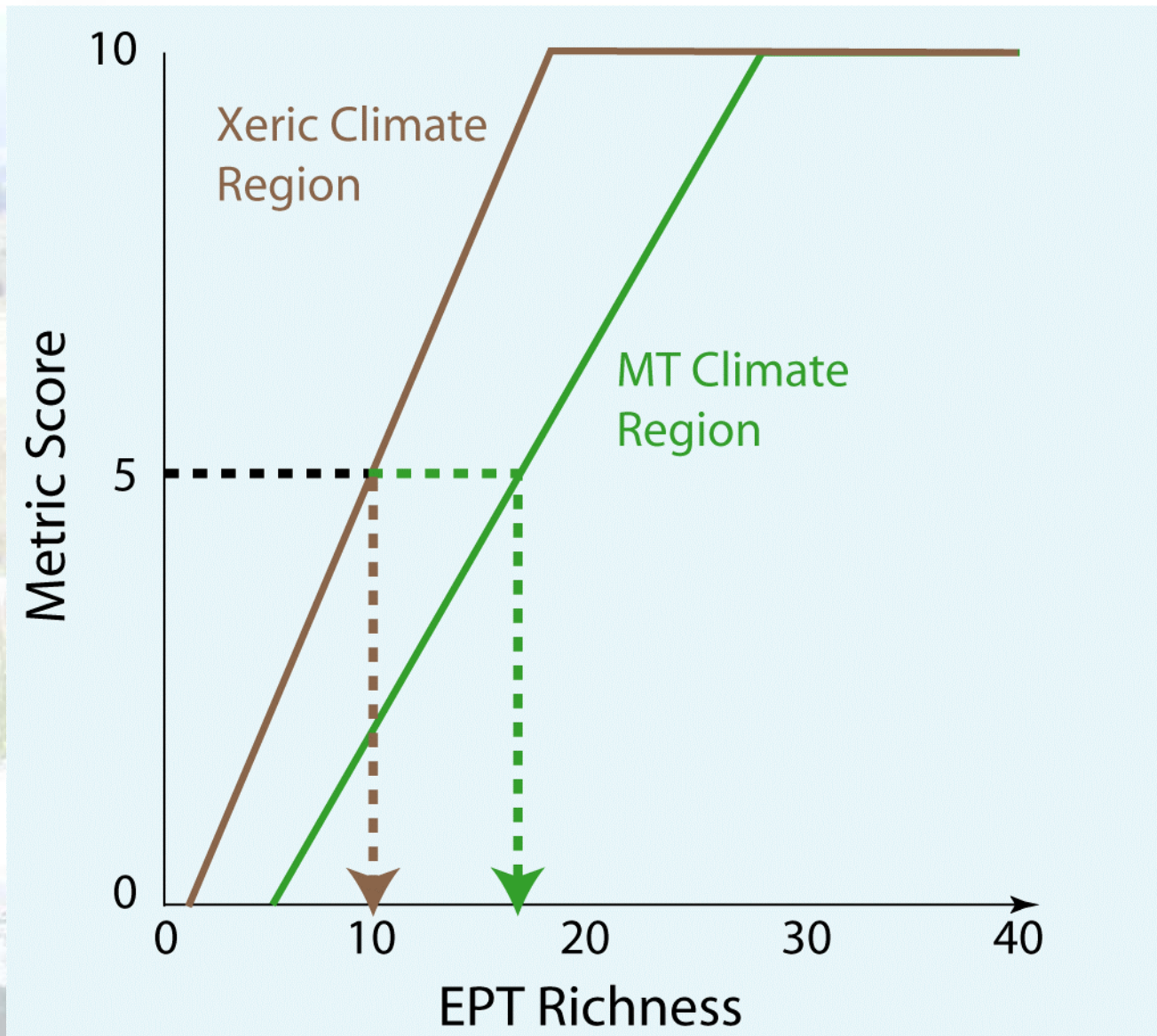
Metrics Used for Macroinvertebrate Biotic Integrity

Metric Class	Mountains	Xeric
Composition	Non-Insect % Individuals	Non-Insect % Distinct Taxa
Diversity	Percent of Individuals in Top 5	Shannon Diversity
Feeding	Omnivore % Distinct Taxa	Shredder Distinct Taxa Richness
Habit	Burrower % Individuals	Clinger % Distinct Taxa
Richness	EPT Distinct Taxa Richness	→
Tolerance	Tolerant % Distinct Taxa	Non-Tolerant % Distinct Taxa

Metric Scoring

- Scoring by climate region
- Use all probability sites
- Each Metric Ranges from 0 to 10
- 0 is 5th percentile for all sites
- 10 is 95th percentile for all sites
- Linear interpolation in between

Metric Scores Vary By Climate Region



Index Labels

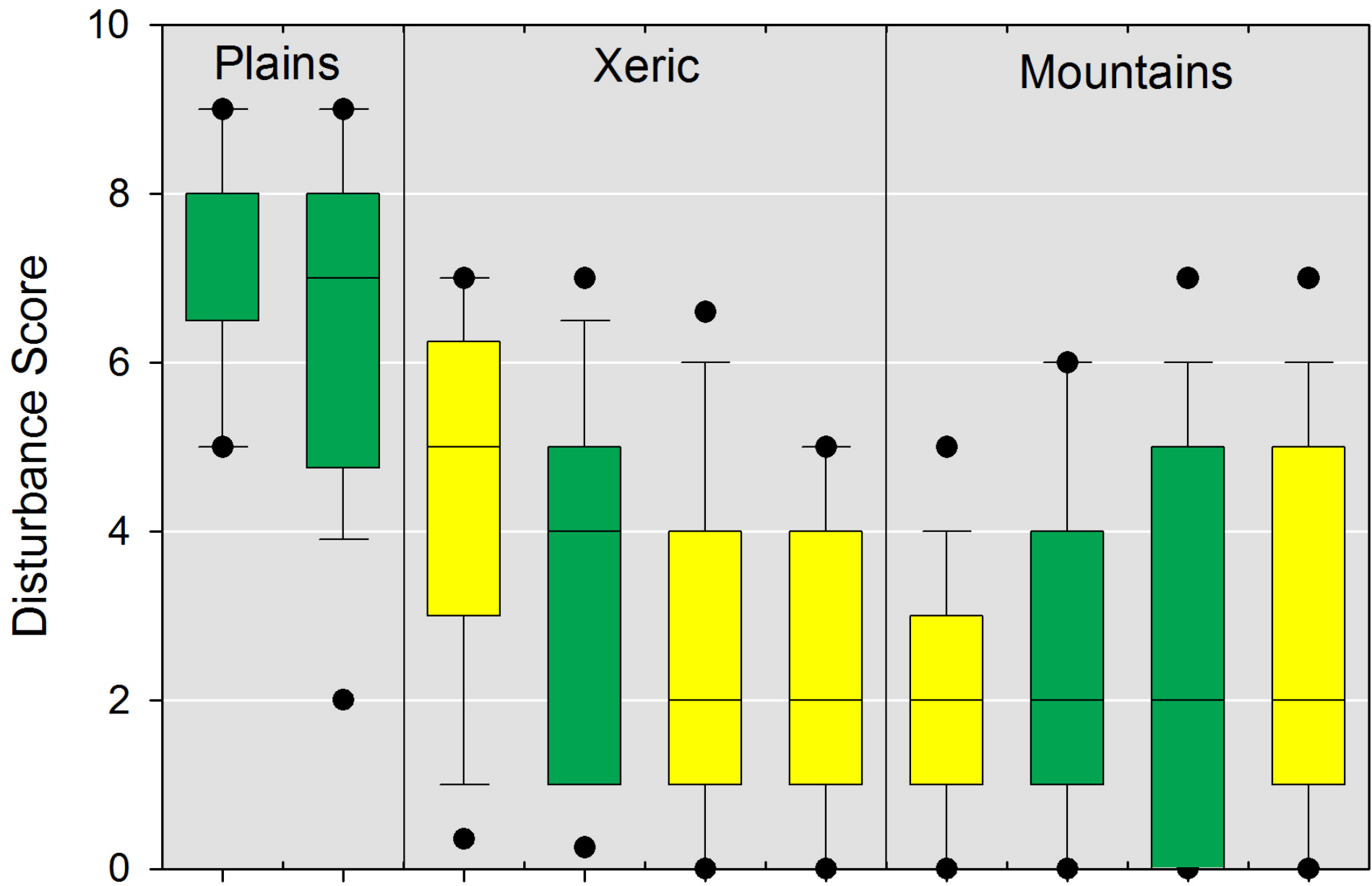
- Index is the sum of Metrics
- Ranges from 0 to 100
- “Most Disturbed” is 0 to 5th percentile for reference sites within the climate region
- “Least Disturbed is 25th to 100th percentile for reference sites within the climate region
- All others are “Intermediate”

Definitions of Reference Condition

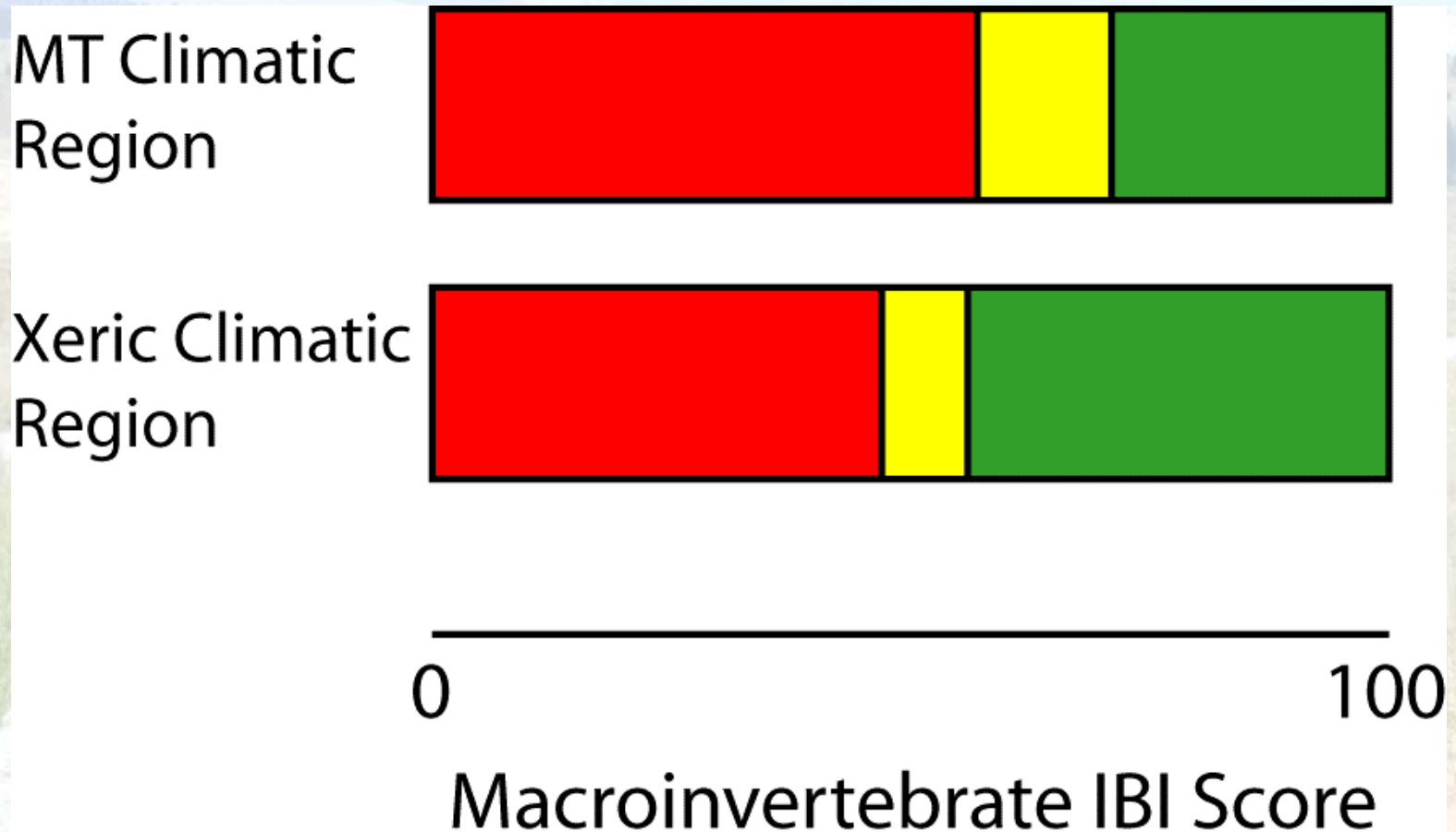
For EMAP-W we recognize that multiple definitions exist, and that these 3 are especially pertinent:

- **Minimally Disturbed Condition** - condition of streams in the absence of significant human disturbance (e.g., “natural,” “pristine” or “undisturbed”)
- **Least Disturbed Condition** –found in conjunction with the best available physical, chemical and biological habitat conditions given today’s state of the landscape - defined by a set of explicit criteria to which all reference sites must adhere
- **Best Attainable Condition** – this condition is equivalent to the ecological condition of (hypothetical) least disturbed sites where the best possible management practices are in use

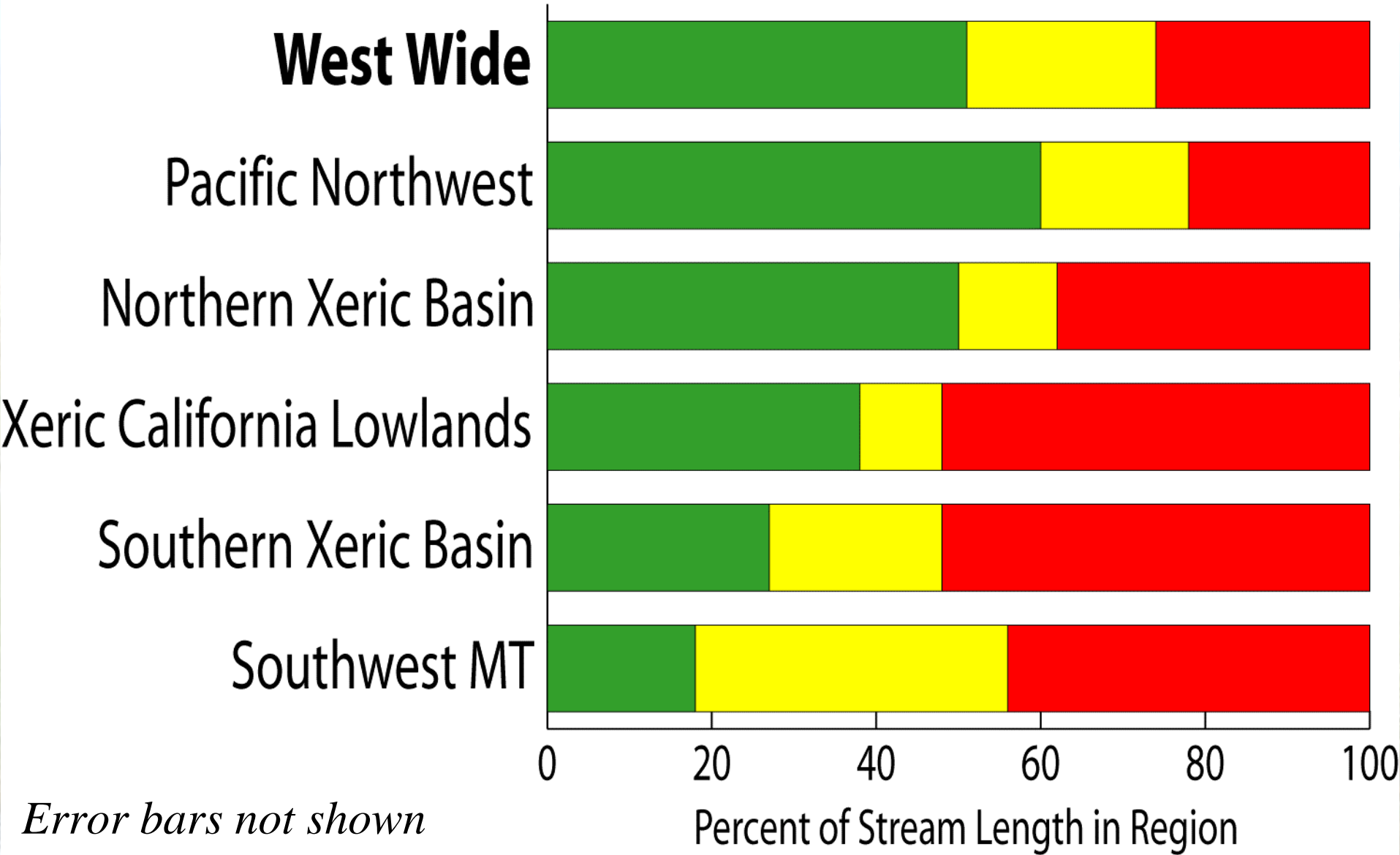
“Least Disturbed” Varies Across the West



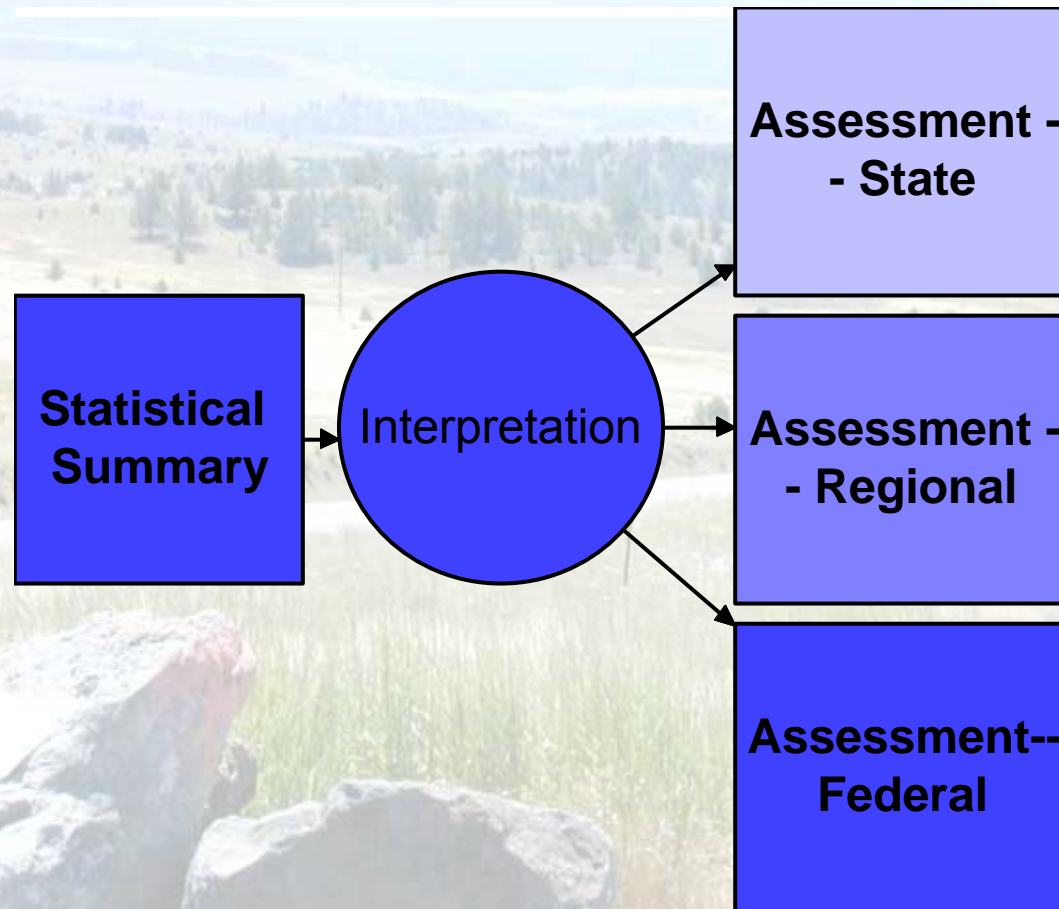
MMI Labels Vary By Climate Region



Macroinvertebrate - Biotic Integrity



Indicator Development – Multiple Organizations



Key Points

- Reporting Units \neq Sampling Design Units
- “Answer” is the outcome of the process of indicator development.
 - Our steps are explicit
 - Yours may differ, but need to be equally explicit.

A scenic landscape with rolling hills, a gravel path, and mountains in the background. The foreground features a gravel path and large rocks. The middle ground shows a grassy field with a fence line. The background consists of rolling hills and mountains under a clear sky.

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