



Ecological Integrity

Integrating Indicators of Ecological Integrity Across
Diverse Ecoregions: Nevada's Proposed Evaluation

Marianne Denton, Bureau of Water Quality Planning
Nevada Division of Environmental Protection

This Is Only Because Of...

- EPA Region 9
- Karen Vargas
 - Numerous bioassessment interns 2006 – 2011
- Beth Vollmer
- Michelle Murdock
 - Tahoe Regional Planning Agency
- Charles Hawkins
- Jake Vander Laan
 - Western Center for Monitoring & Assessment of Freshwater Ecosystems



Bugs *are* Adorable!



Give me your feedback...

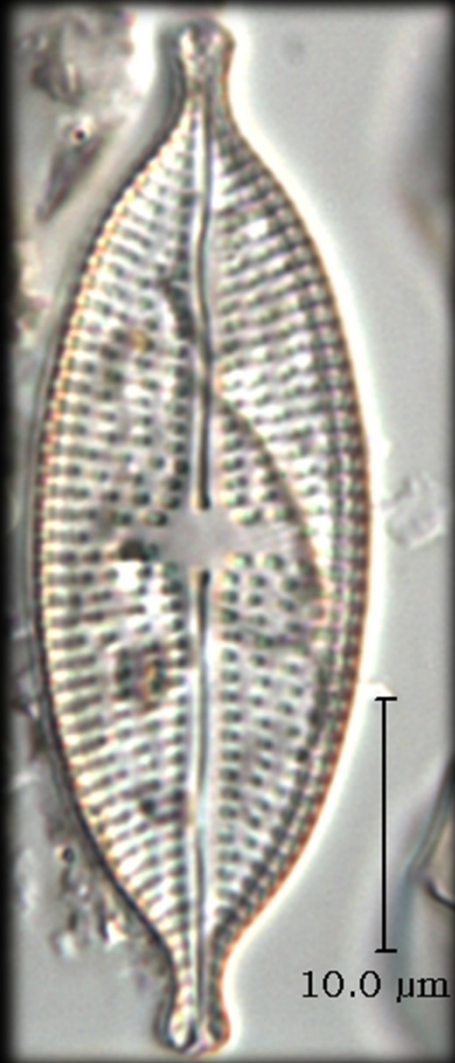
- Write me a note
- Email me
 - dentonm@ndep.nv.gov
- Call me
 - 775.687.9457

So Much To Say!

- I've got some ideas
- I ♥ Nevada, spatially
- Integrate indicators
- Indicate integrity
- Incorporate your ideas



Lofty Goals



Input

- Models
- Indices
- Riparian Habitat
- Chemistry
- Integrate into similar ecosystems

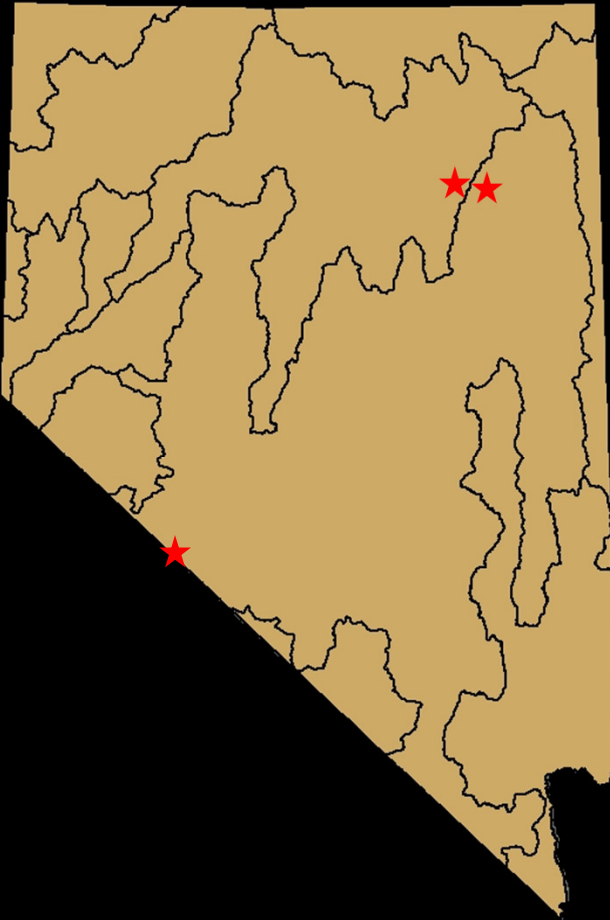
Outcome

- Simple
- Comparable
- Communicable

Resolution

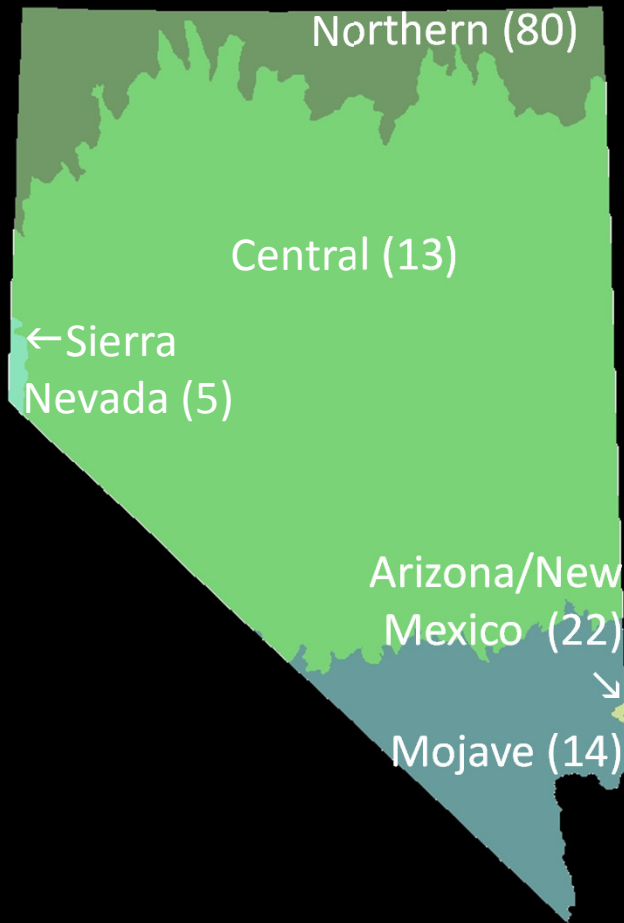
Hydrologic Basins

14



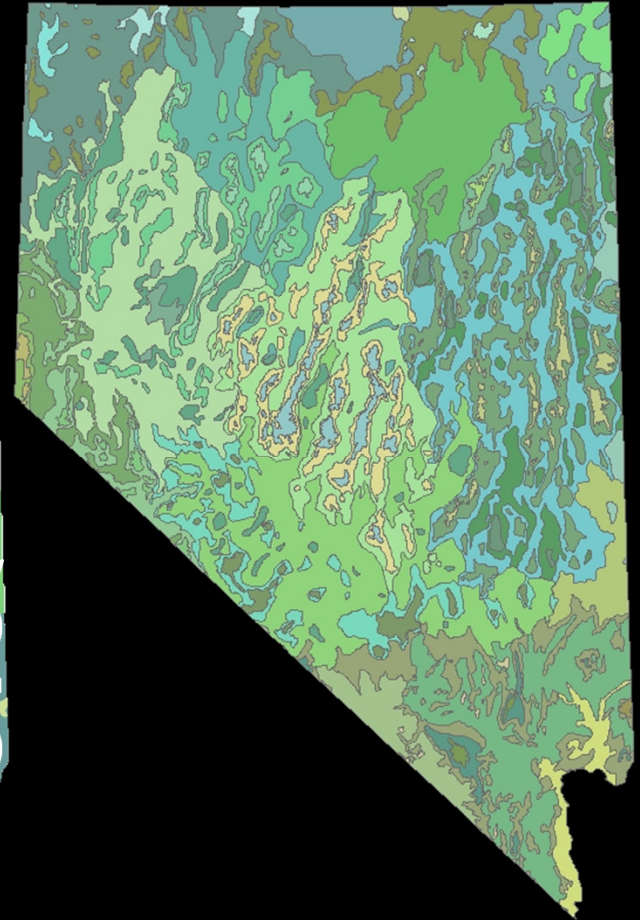
Ecoregion 3

5

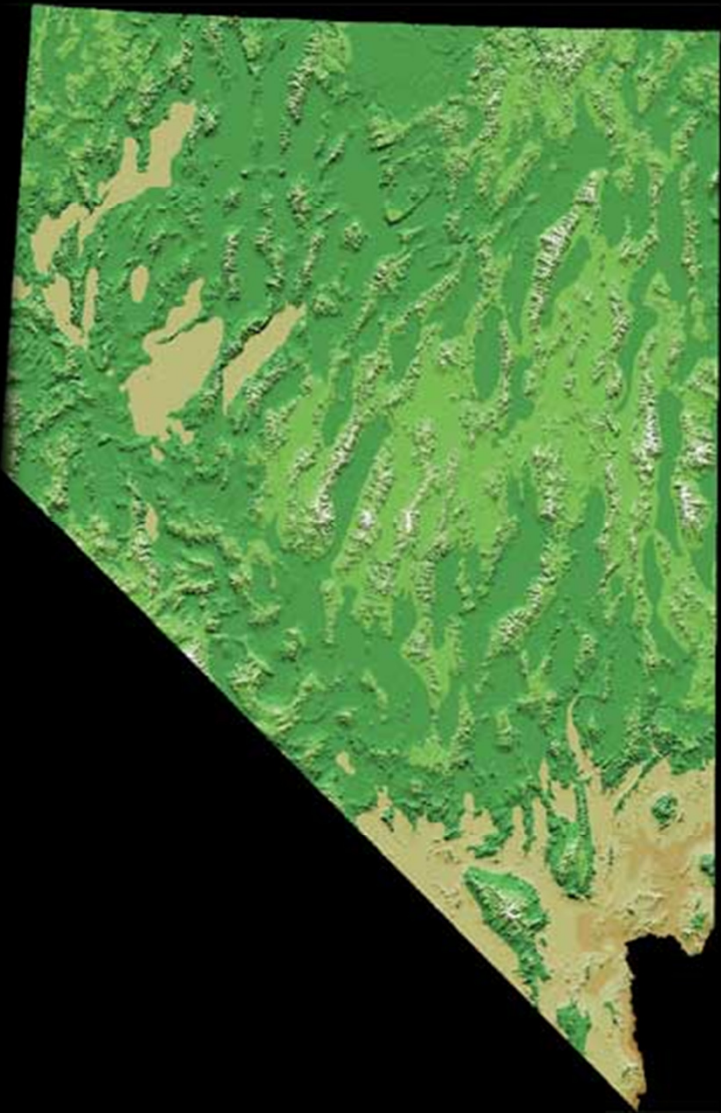


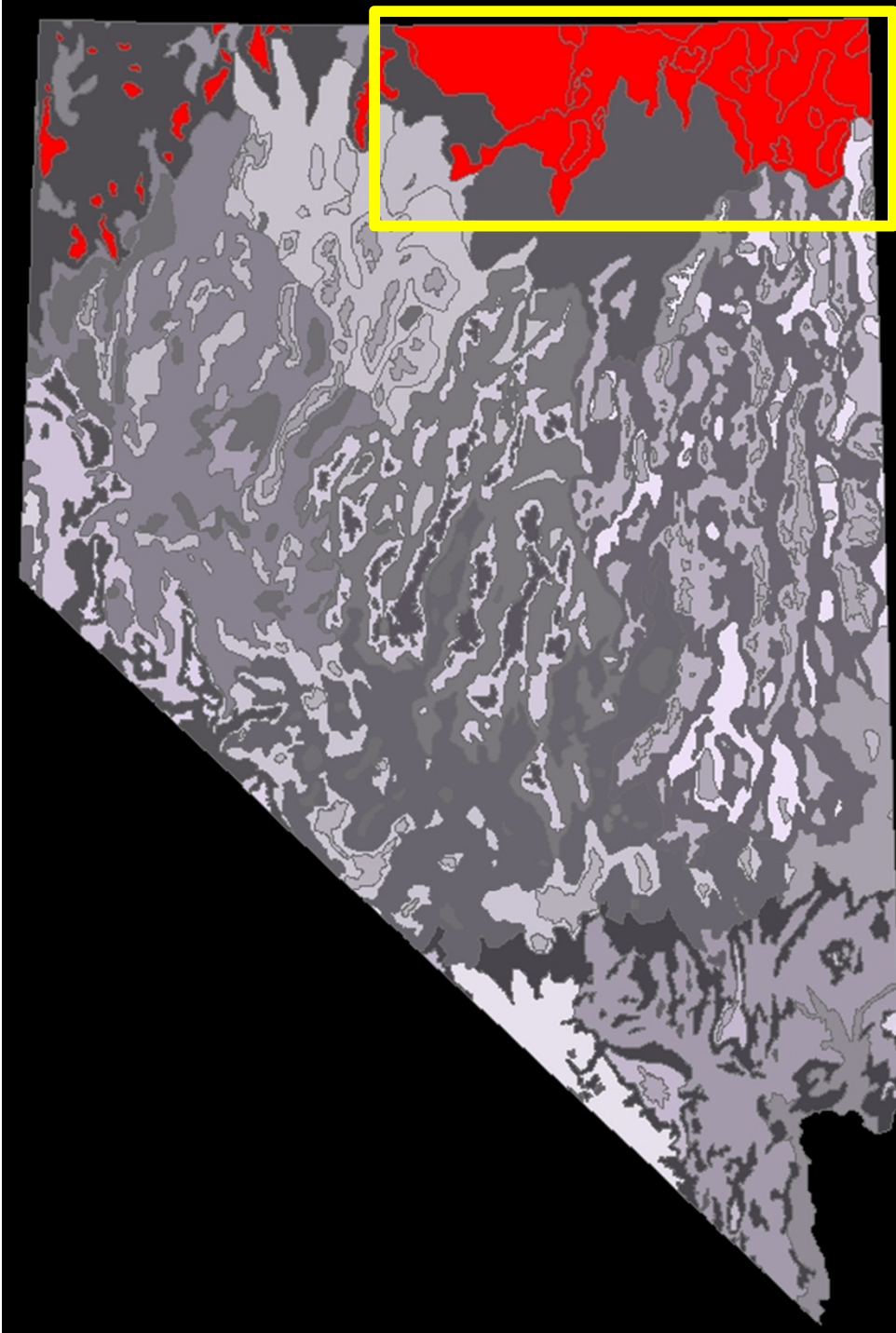
Ecoregion 4

43



Nevada's Basin & Range





Northeast

Hydrologic Basins

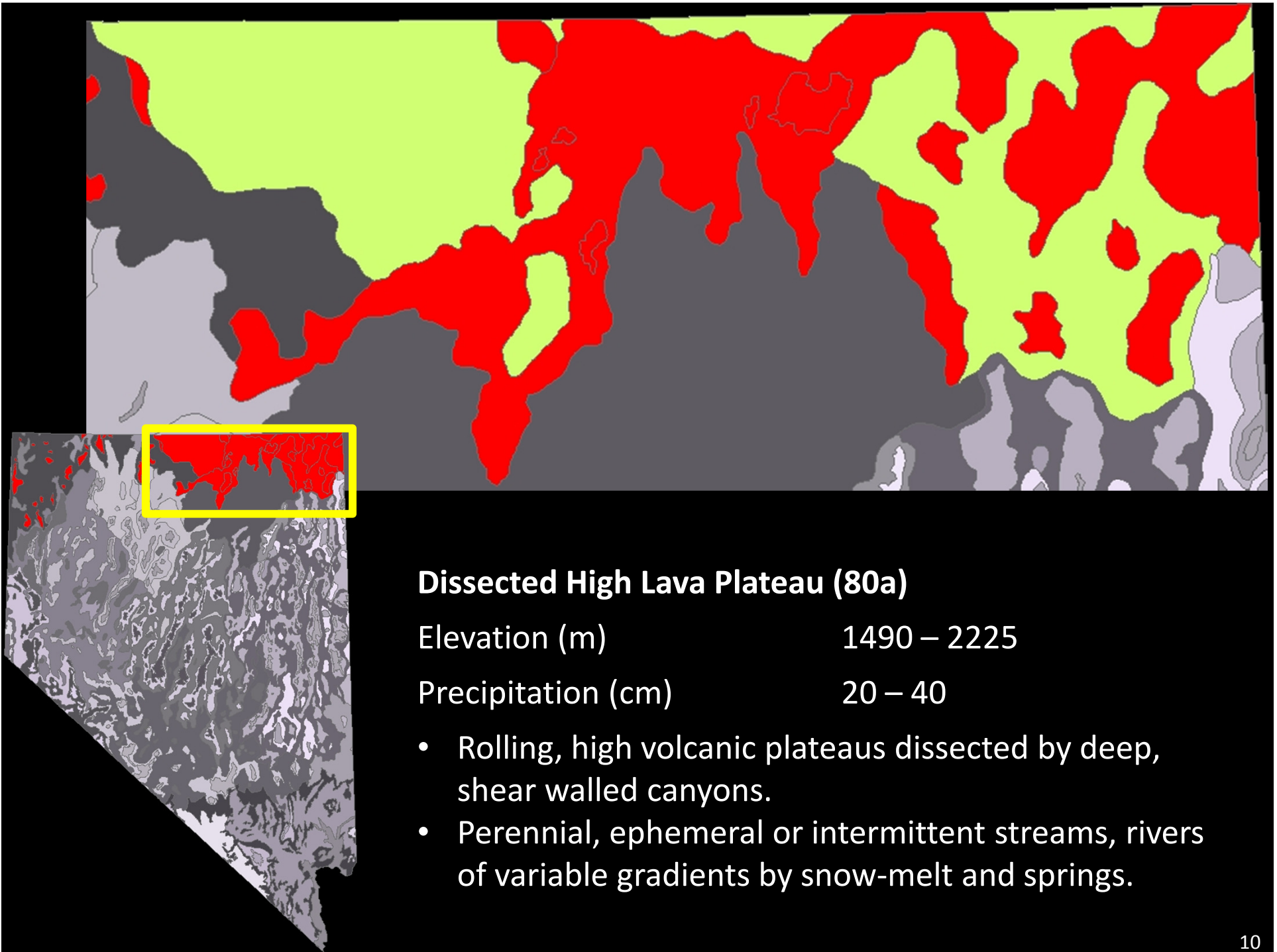
- Snake
- Humboldt
- Great Salt Lake
- Black Rock

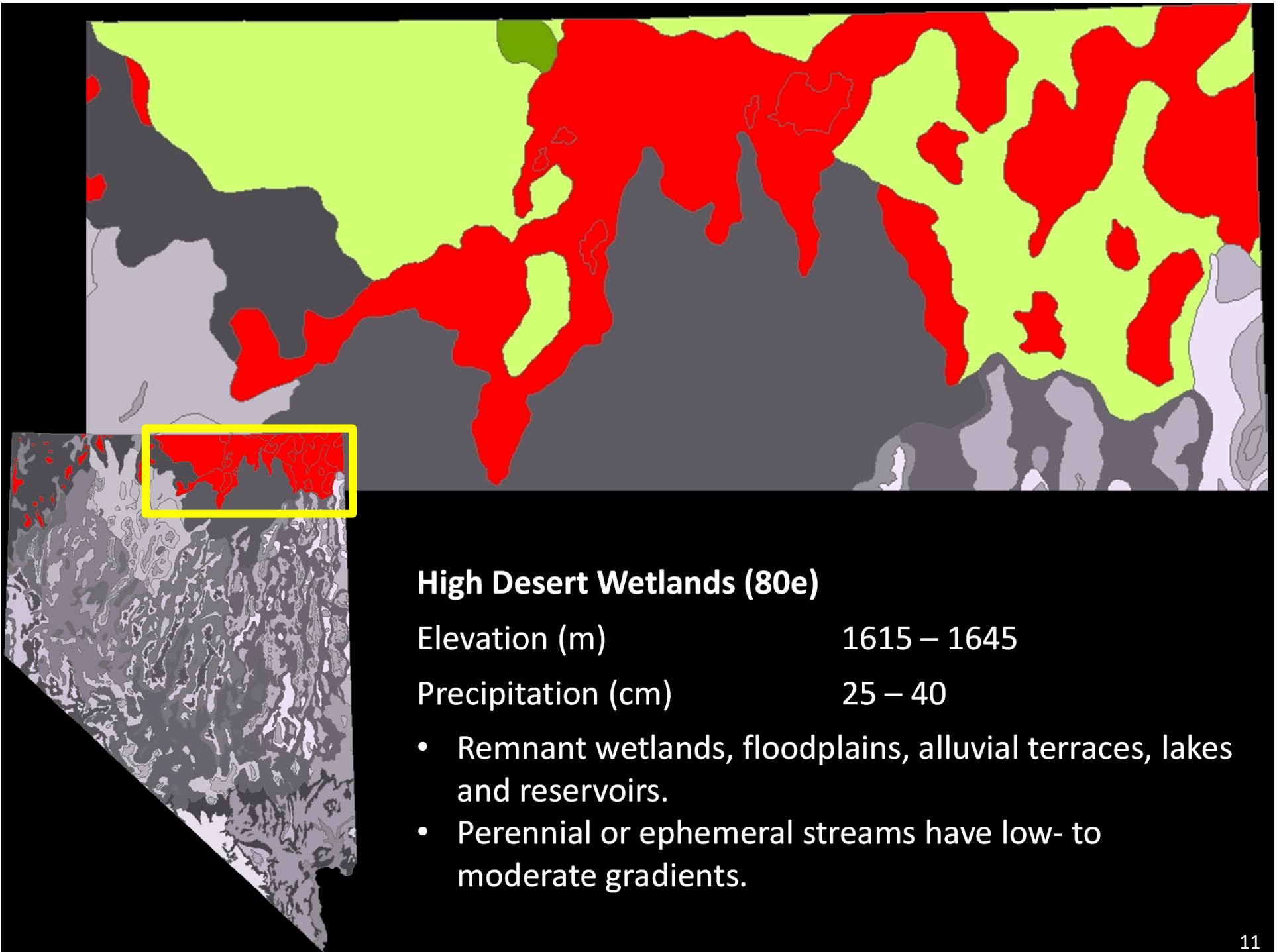
Ecoregion 3

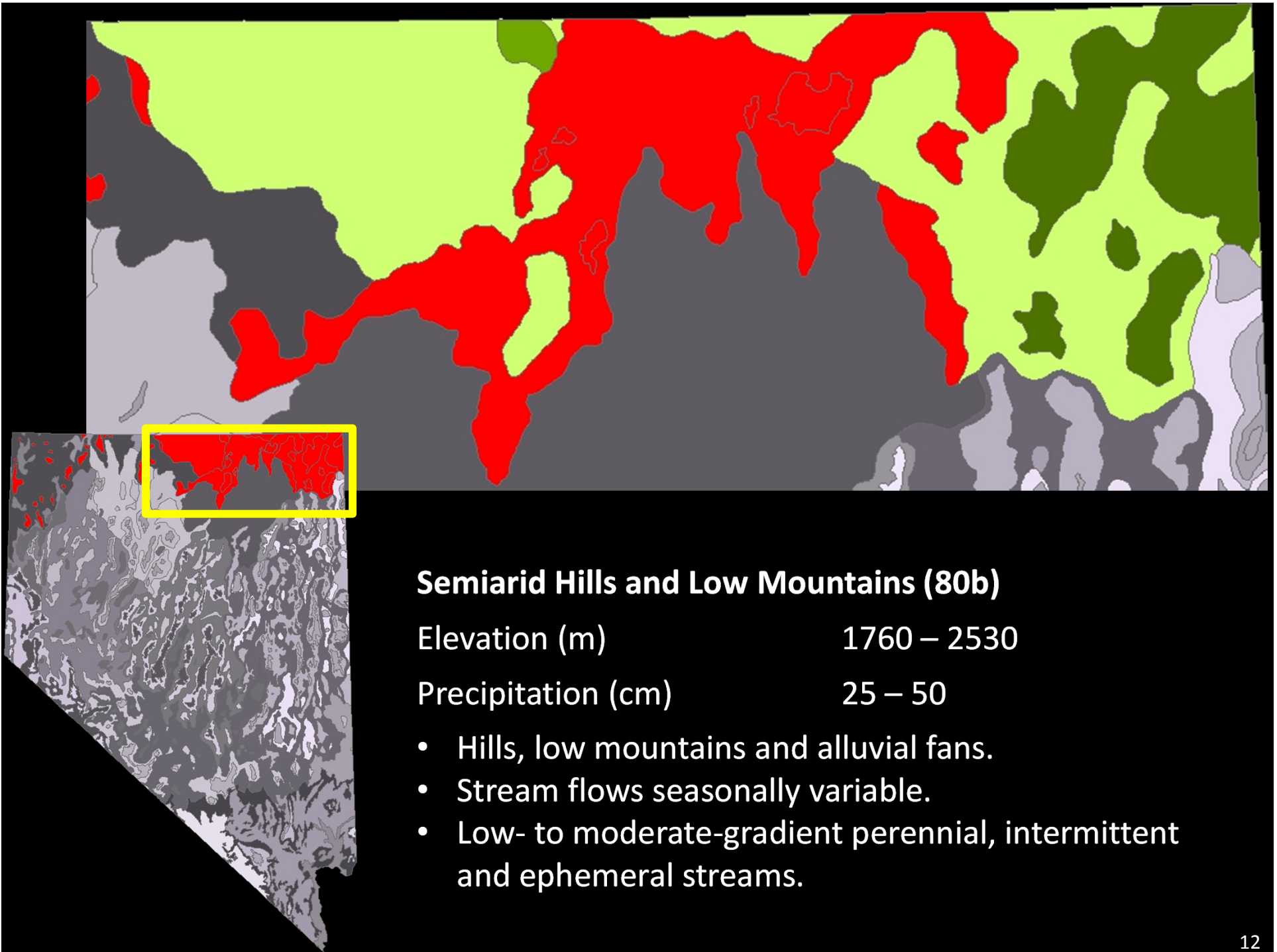
- Northern (80)

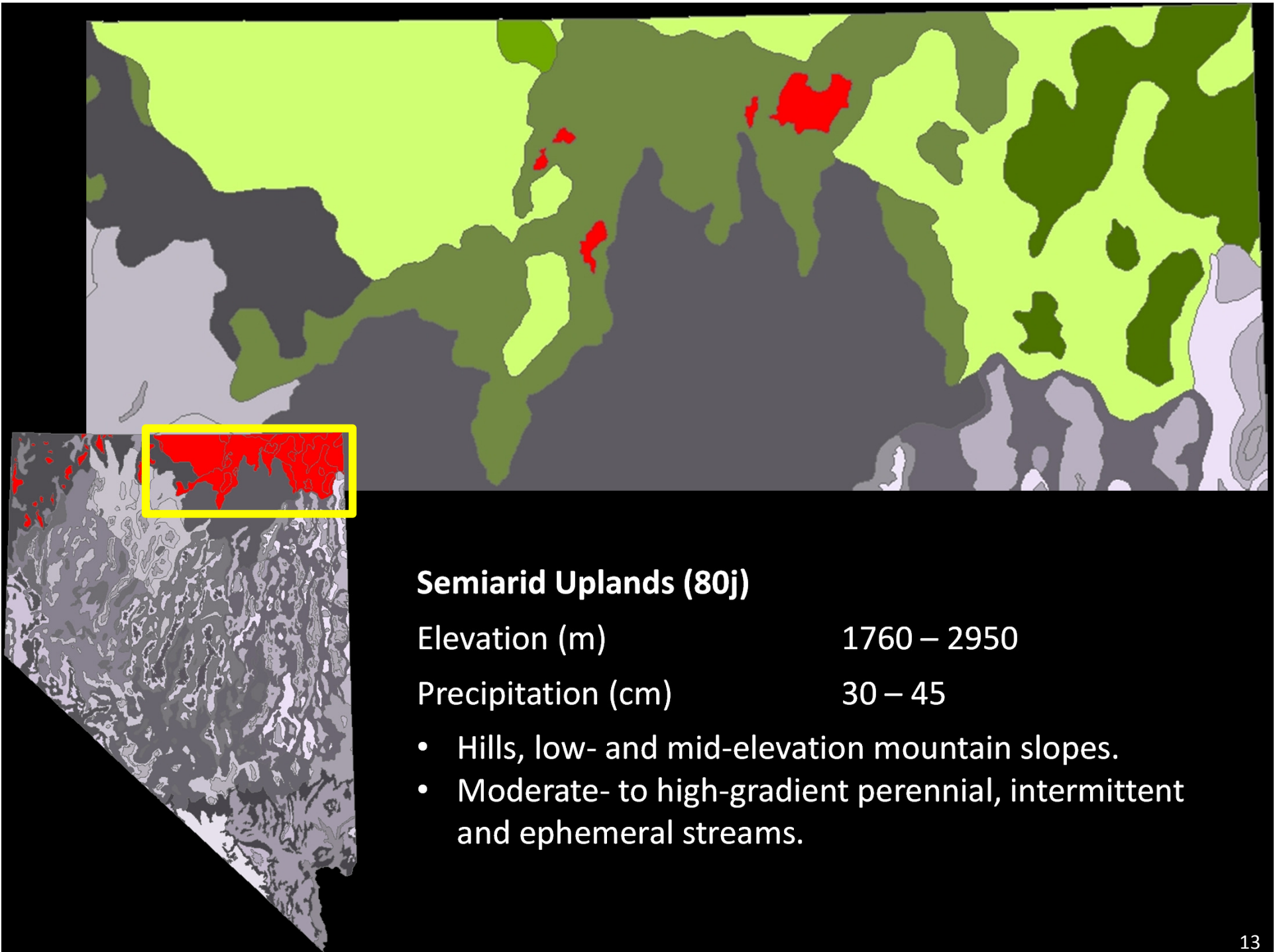
Ecoregion 4

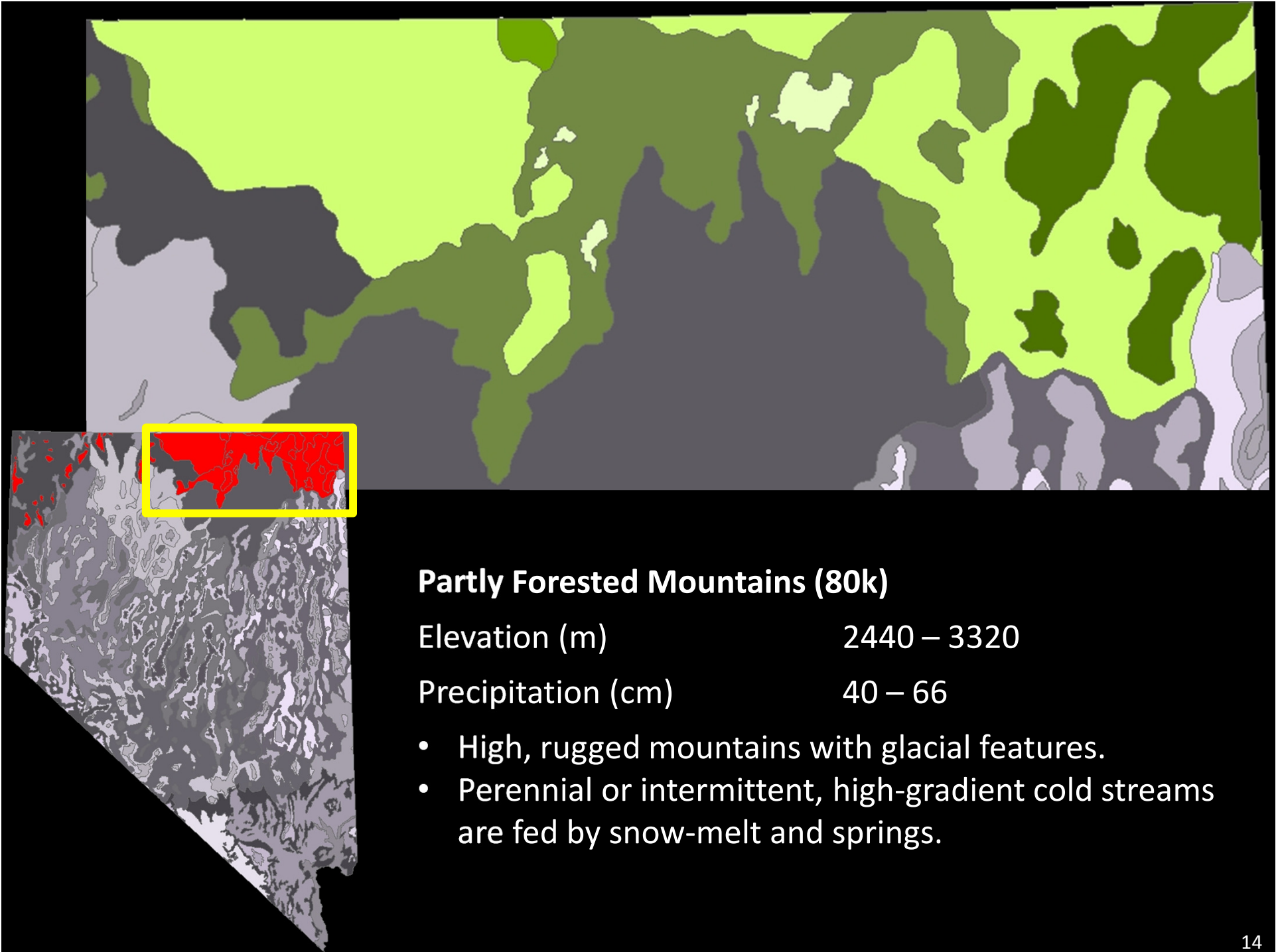
- Dissected High Lava Plateau
- High Desert Wetlands
- Semiarid Hills & Low Mountains
- Semiarid Uplands
- Partly Forested Mountains

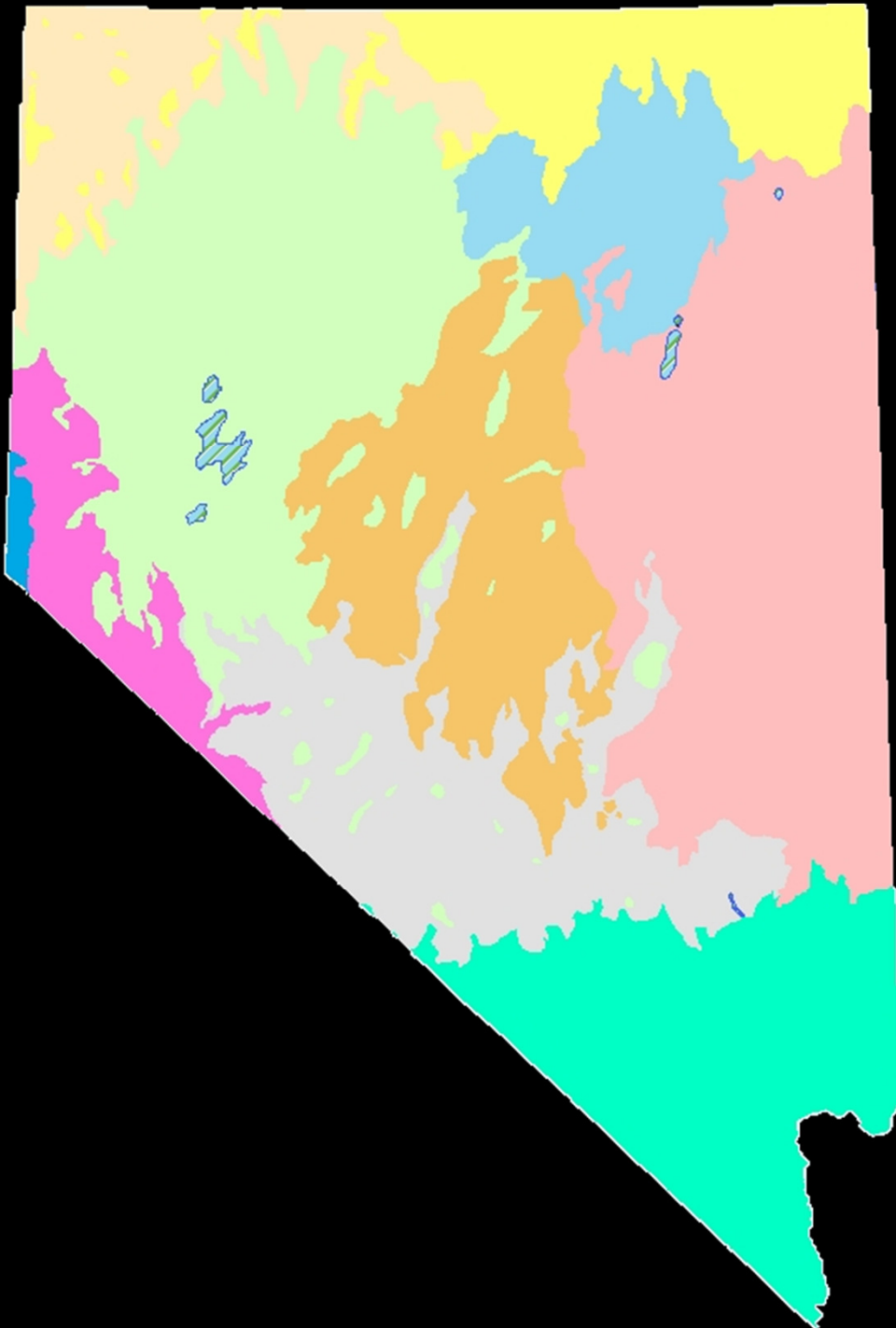












Eco 3	Eco 3.5	Streams/ Biosites
Northern (80)	Northeast	28/59
	Northwest	37/39
Central (13)	Upper Humboldt	48/49
	Carbonate	24/32
	Central	29/46
	Lahontan	23/68
	East Sierra	37/73
	Tonopah	0/0
	Sierra Nevada	38/95
	Mojave	9/18

Why the Effort?



Northeast

Sierra Nevada

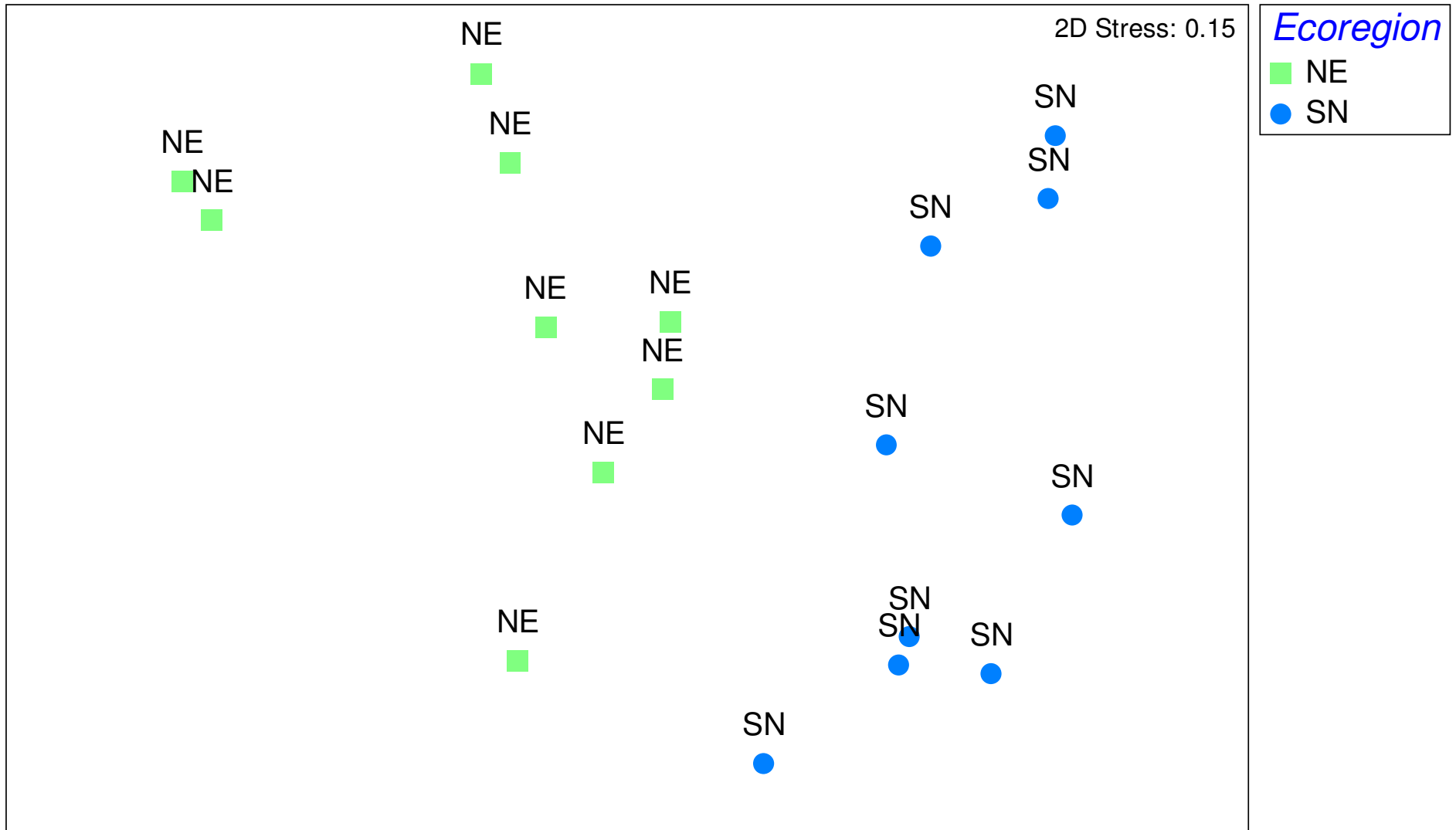
Ecoregion

- Nine randomly selected streams from each ecoregion.
 - Across the elevation gradient.
 - Sampled with full EMAP or SWAMP protocols.
 - From previous probabilistic surveys.
- Ecological indicators & stressors.
 - Xeric
 - Western Mountain

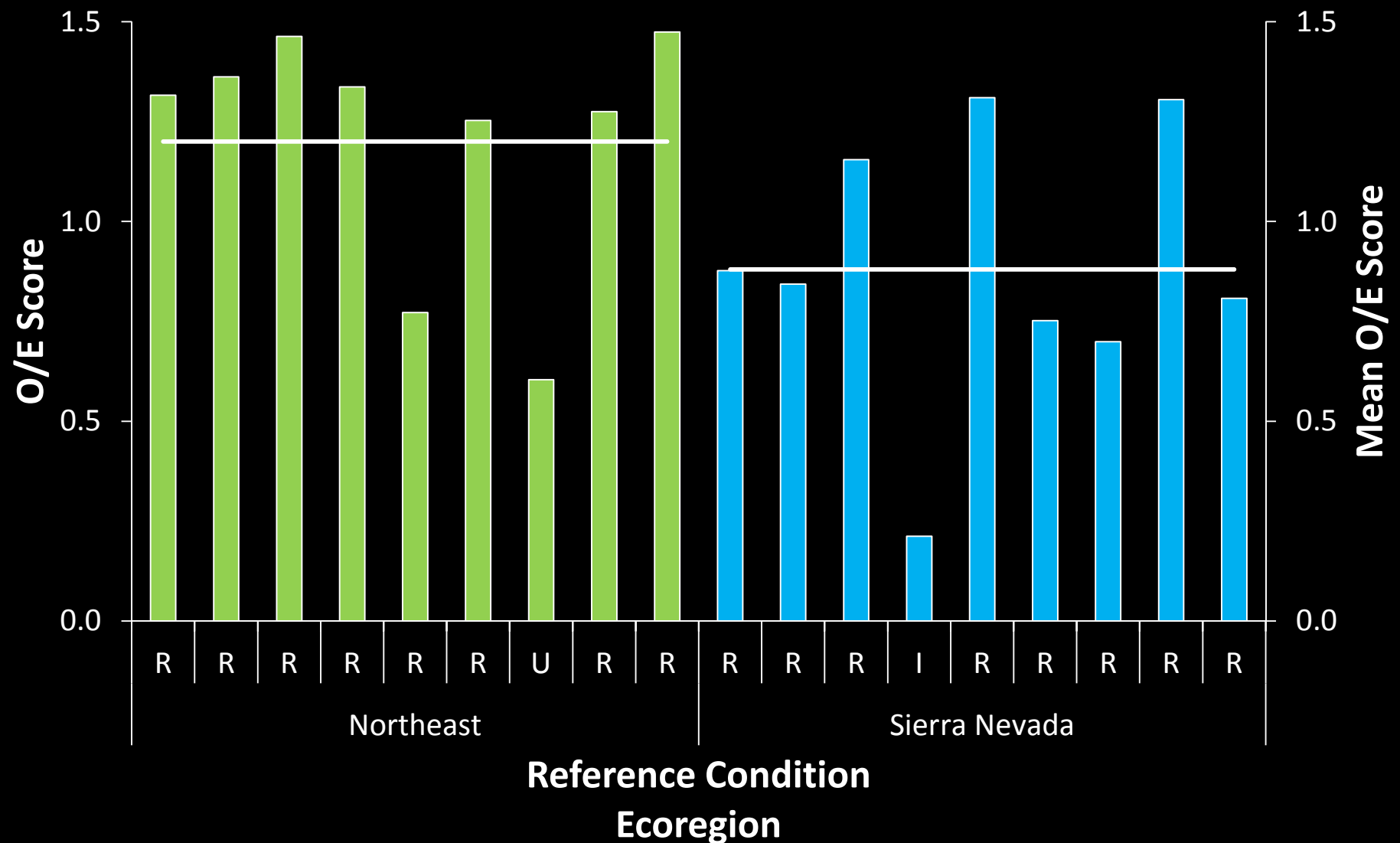
Benthic Community Similarity

Transform: Log(X+1)

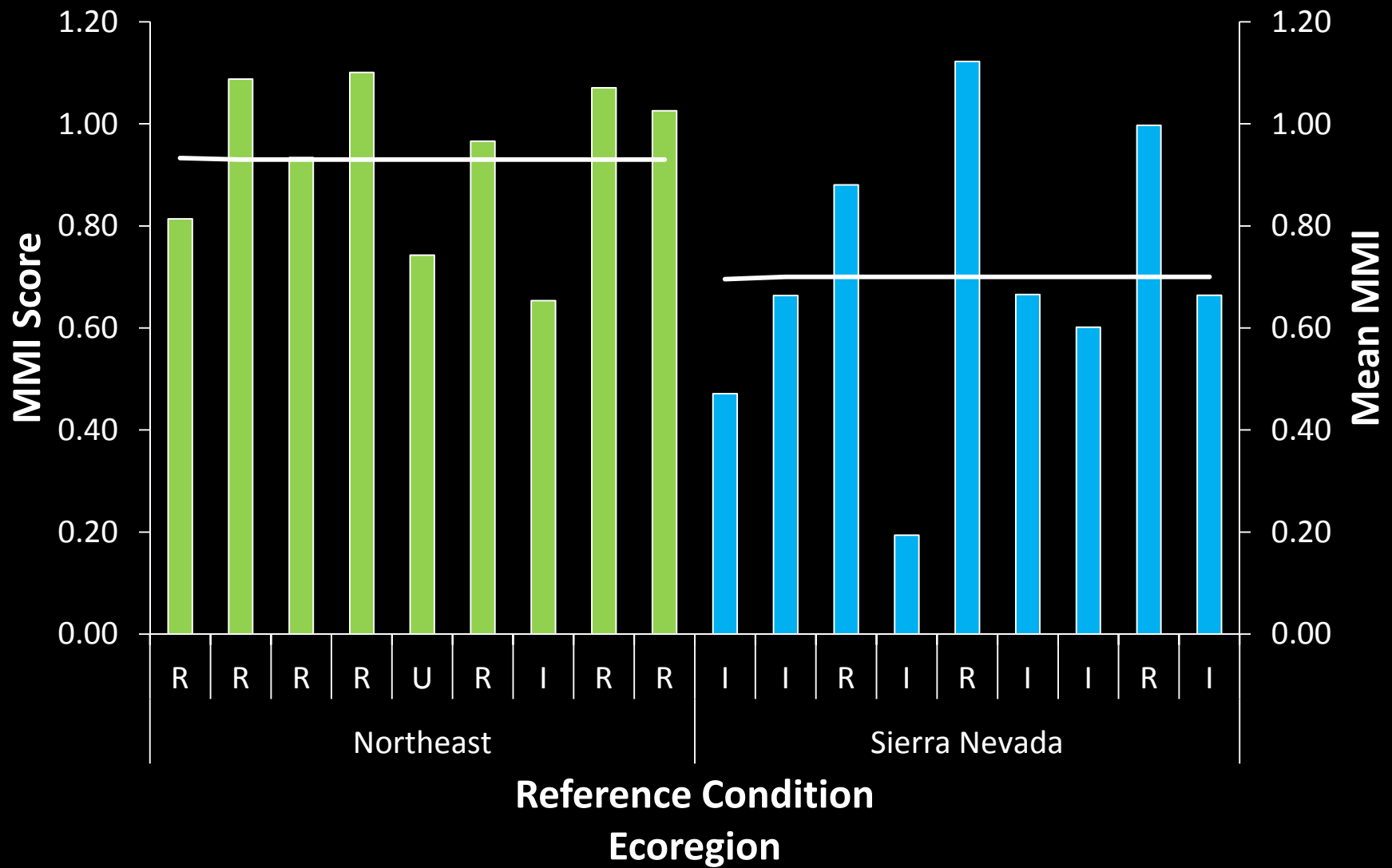
Resemblance: S17 Bray Curtis similarity



Observed/Expected

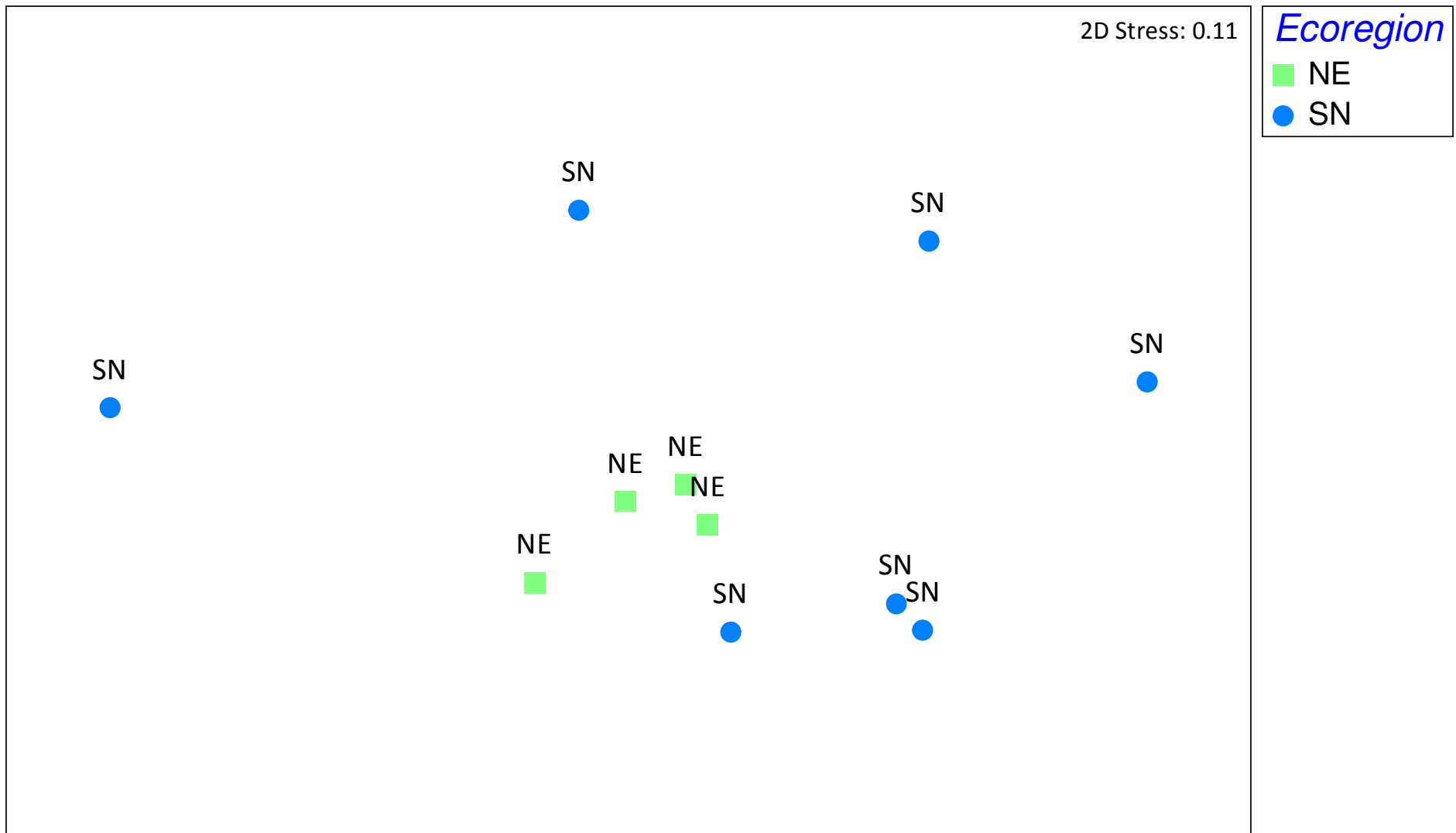


Multimetric Index

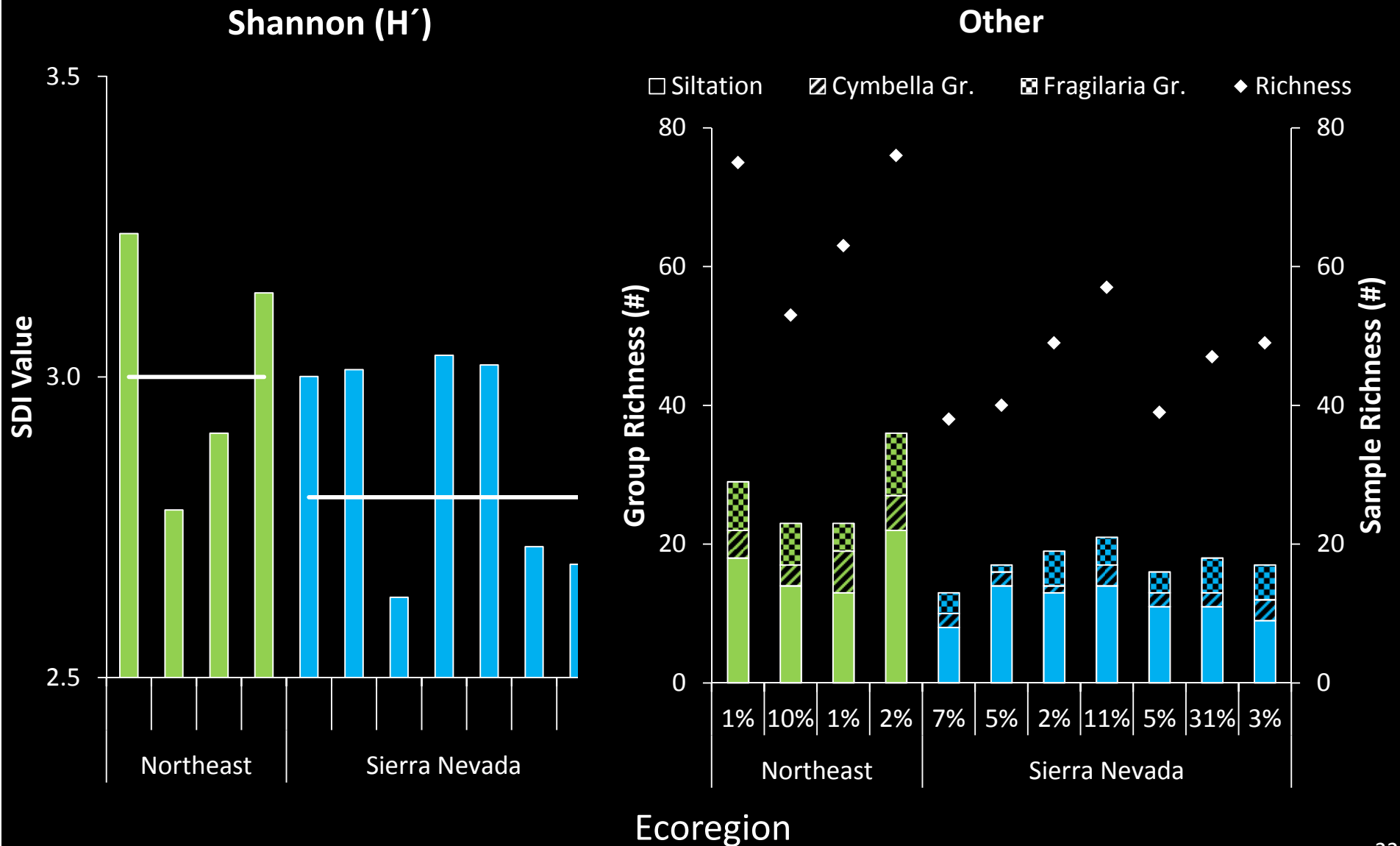


Periphyton Community Similarity

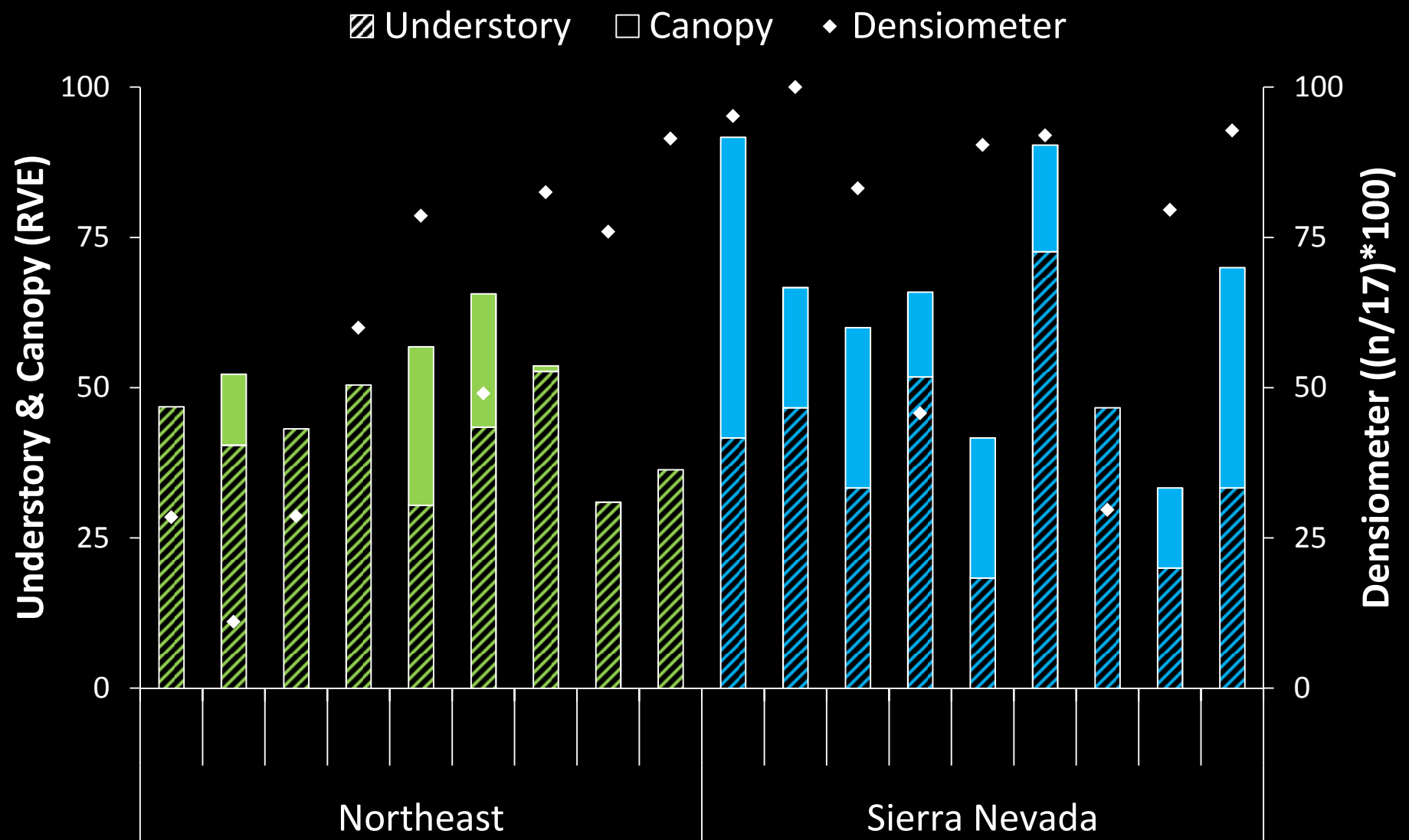
Transform: Log(X+1)
Resemblance: S17 Bray Curtis similarity



Periphyton MMI Candidates

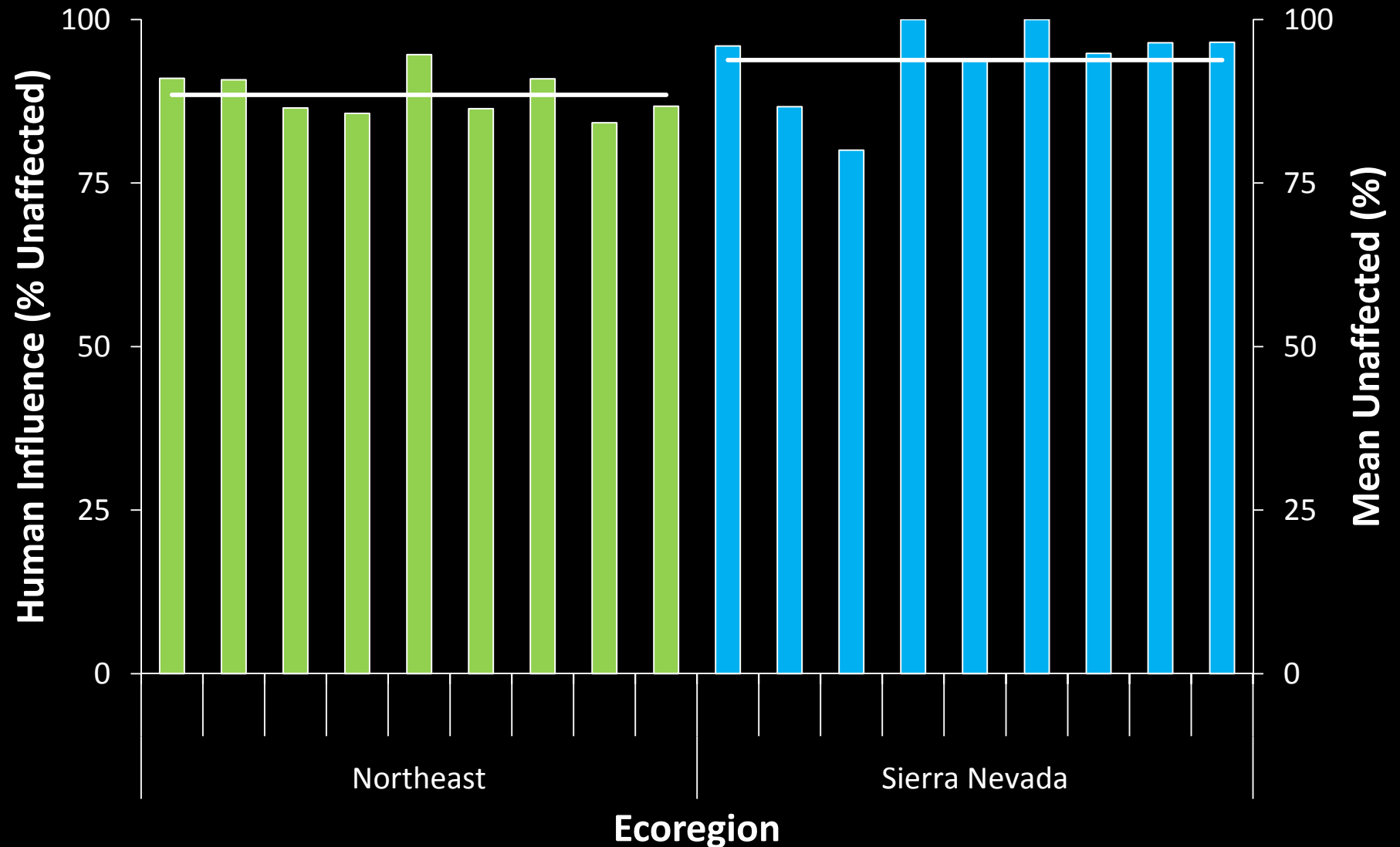


Riparian Vegetation

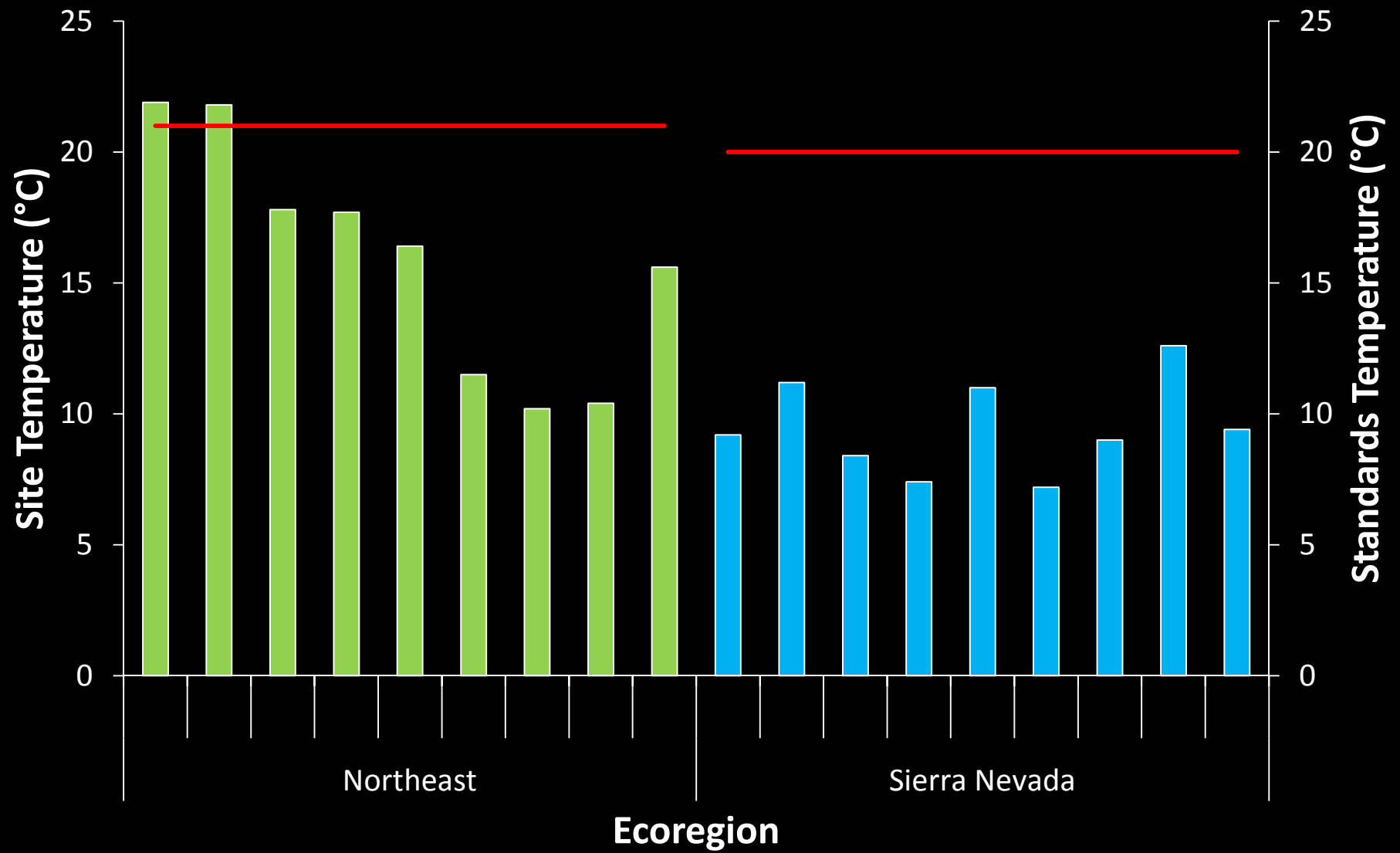


Human Influence

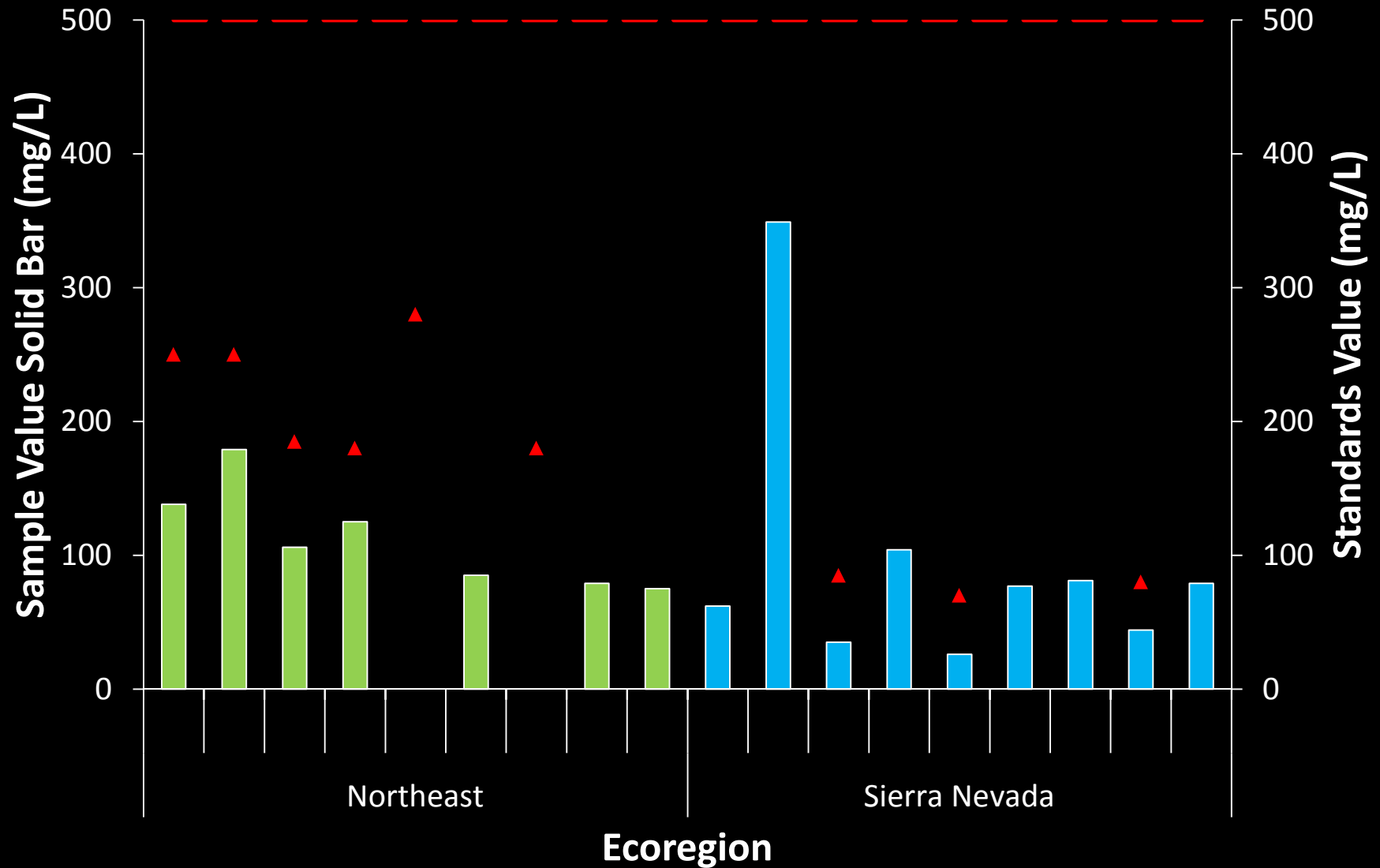
(Unaffected Riparian Visual Estimate & Watershed Activity)



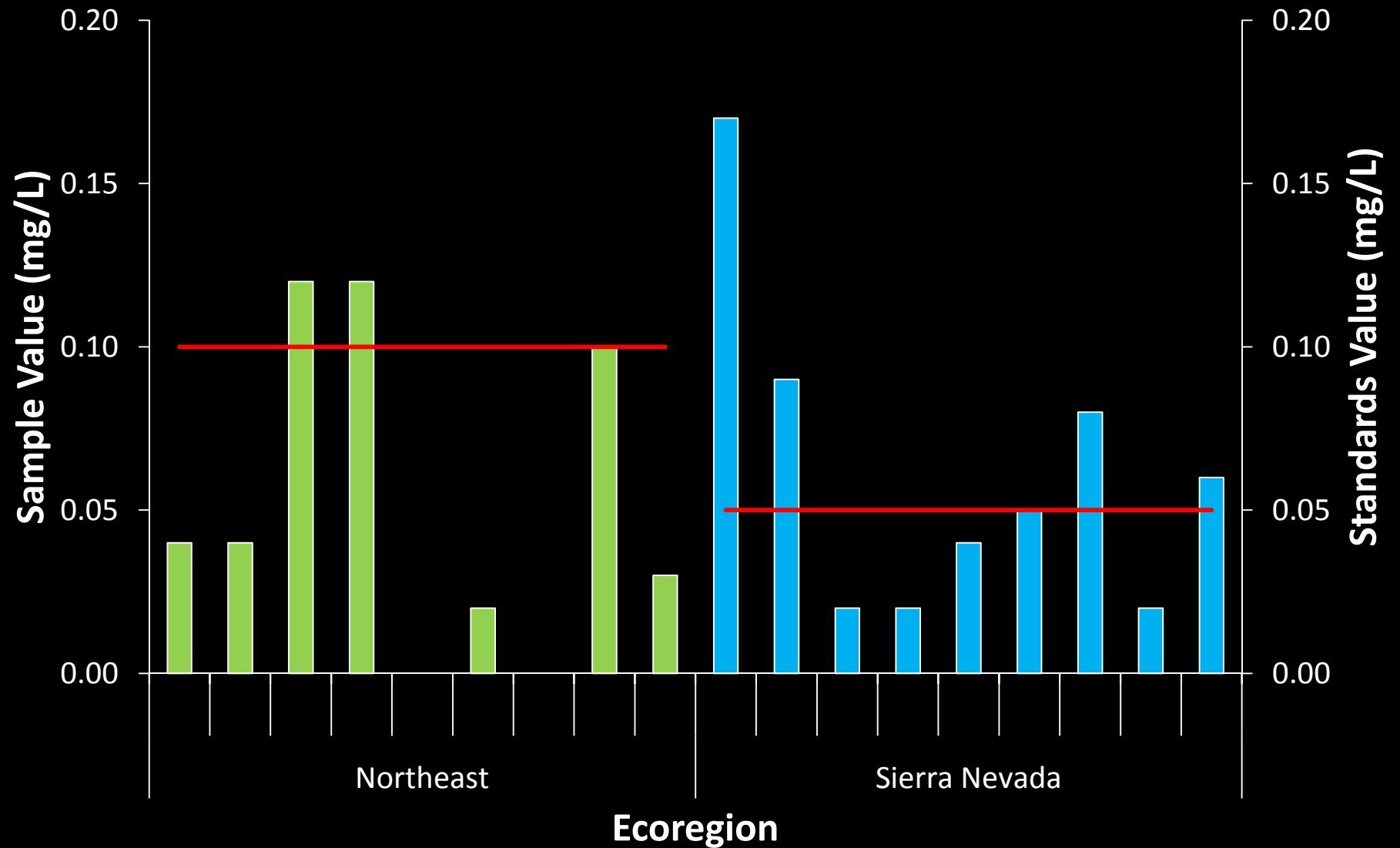
Temperature



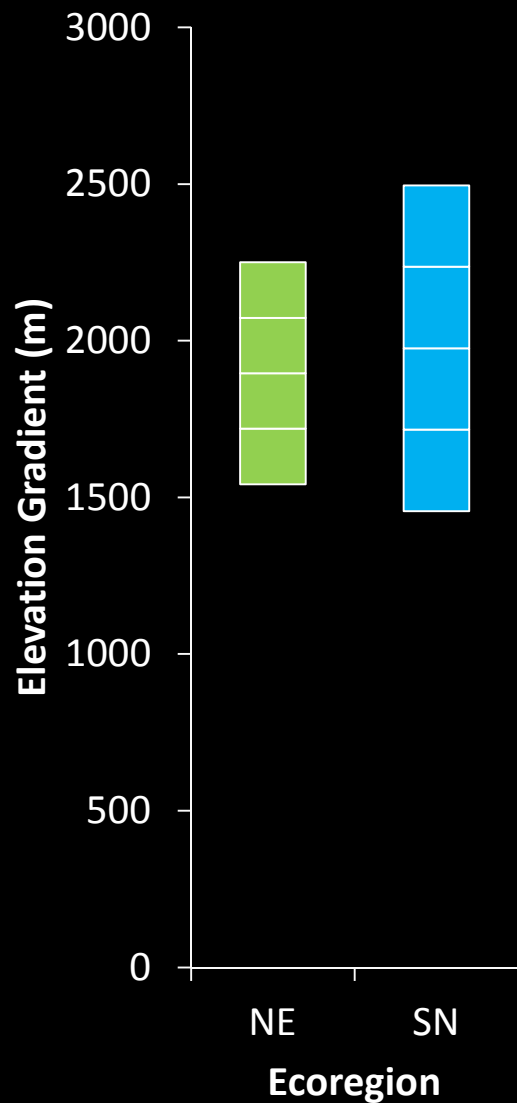
Total Dissolved Solids



Phosphorus

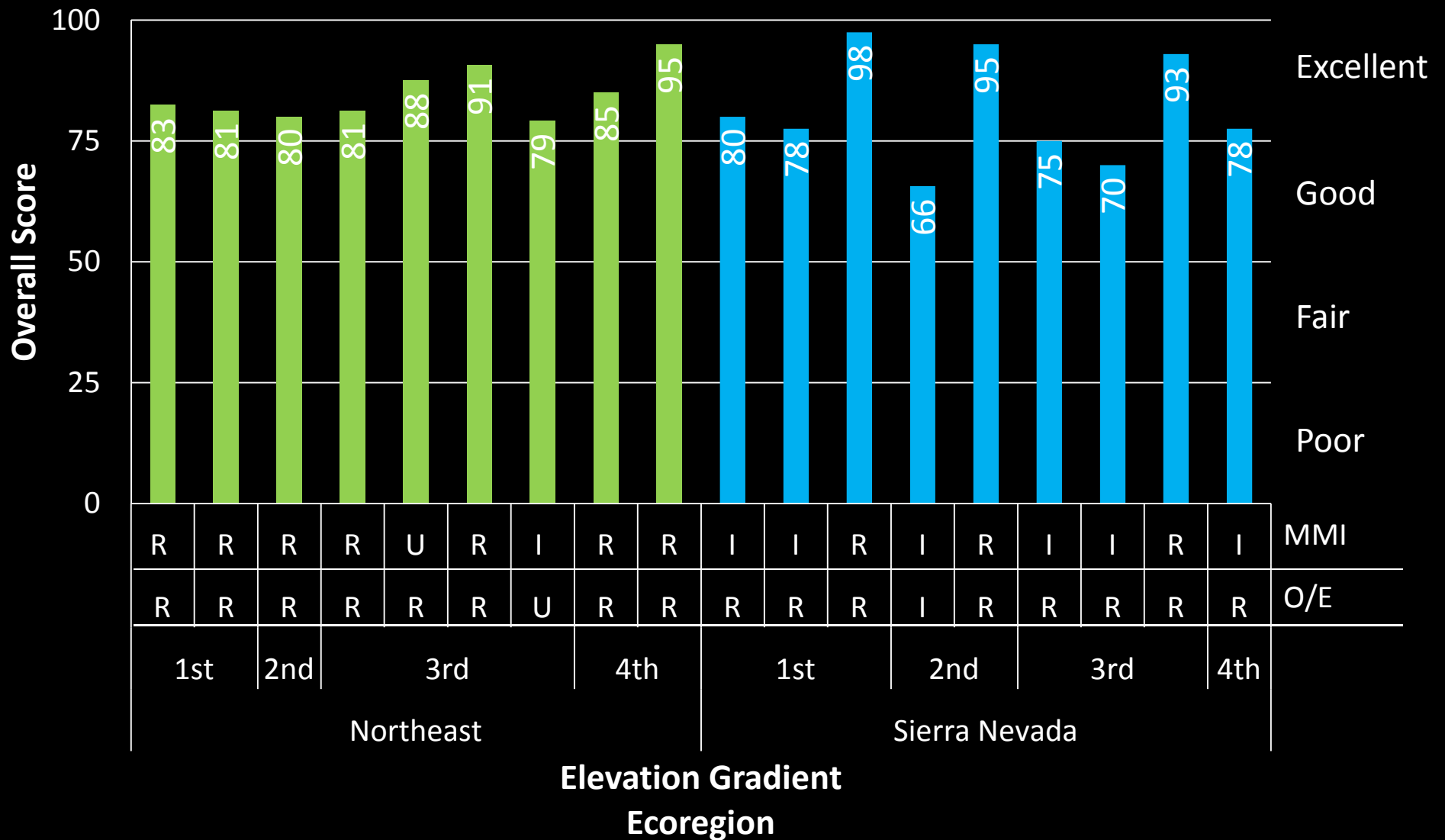


Putting It All Together



Indicator	Value	Scoring
O/E MMI	0 – 1.0	Converted to a 0 – 100 scale and ranked as quartiles
Shannon Future Periphyton MMI	0 – 3.5	Converted to a 0 – 100 scale and ranked as quartiles
Riparian Habitat	Values averaged over 11 transects	Converted to 0 – 100 scale and ranked as quartiles
Temperature	In-situ value	Below standard = 4 Exceeds standard = 0
Phosphorus Total Dissolved Solids	Laboratory Results	Below standard = 4 Exceeds value to maintain existing higher quality = 2 Exceeds standard = 0

Overall Ecological Integrity Score



So now I need to know...

- What indicators best reflect overall ecological integrity?
- Should different indicators be weighed more heavily?
- Should different indicators be weighed differently by Ecoregion 3.5?
- Too much, too little or just right?





Thank you!

WaterbodyName	Watering of Livestock	Irrigation	Aquatic Life	Contact Recreation	Non-Contact Recreation	Municipal or Domestic Supply	Industrial Supply	Propagation of Wildlife	Enhancement Water Quality	O/E	MMI	Ecological Integrity
Salmon Falls			1,2,6	2						R	R	82.5 Excellent
Salmon Falls			1,2,6	2						R	R	81.3 Excellent
Piney										R	R	80.0 Excellent
Walker Gulch										R	R	81.3 Excellent
Snow Canyon						5				R	U	87.5 Excellent
Camp			1							R	R	90.6 Excellent
Meadow										U	I	79.2 Excellent
Deadman's	No Designated Beneficial Uses									R	R	85.0 Excellent
Caudle										R	R	95.0 Excellent
Unnamed trib to Edgewood										R	I	80.0 Excellent
Glenbrook			2						2	R	I	77.5 Excellent
Incline			2,3,4	4				4	2	R	R	97.5 Excellent
Logan House										I	I	65.6 Good
Wood			7							R	R	95.0 Excellent
Secret Harbor										R	I	75.0 Excellent
North Canyon										R	I	70.0 Good
Third			2,3,4,7	4				4	2	R	R	95.0 Excellent
Slaughterhouse										R	I	77.5 Excellent
	1	Temp	Fully Supporting							Reference		
	2	Total P	Not Supporting							Undetermined		
	3	DO	Insufficient Info.							Impaired		
	4	pH	Not Assessed									
	5	TDS										
	6	TSS										
	7	Zinc										