

Riparian Vegetation Reference Index (RiVR): Using Reference Data to Inform Goals and Performance Criteria in Restoration

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Does restoration = recovery?

Percent survival and cover are valuable and straightforward performance metrics,

BUT

These alone do not result in **reference-condition** restoration sites.

If the purpose of restoration is to aid site recovery toward reference condition, we need more robust vegetation-specific metrics and goals.



“Protected” oak tree on 10-year old mitigation site, Livermore, CA

Many projects have limited recovery potential

- Mitigation and restoration projects frequently do not perform in accordance with permitting criteria long-term.
- This is due to:
 - Inadequate application of data to inform recovery goals
 - Short-term performance phases
 - Lack of support for long-term maintenance.

This limits recovery of degraded ecosystems and results in projects that may not optimize results for the investment.

- We need to stop treating restoration like a capital project.
- Linking reference data with performance criteria would be a good step toward resolving this problem.

Linking restoration goals with reference data

- Do your applicants' reference sites reflect best attainable condition?
- How did the applicant locate the reference site and how are they using it?
- Is it an appropriate reference site?
- A database of vegetation reference data, similar to CRAM's reference program, could help regulators could use to make more informed permitting decisions.
- Alliance-based data, aggregated statewide, would allow us to compare site quality scores (similar to CRAM)

Need for quantifiable goals in restoration

Restoration ecologists need reliable guidance concerning the goal state of restoration projects – specifically, we need robust reference data.

We set out to study reference sites to understand the vegetative structure of these sites and use this information in restoration projects.

The resulting dataset, and its output, **RiVR**, are useful for design, permitting, and monitoring.



What is RiVR?

Riparian Vegetation Reference Index

- A quantitative assessment method developed using data from best-attainable-condition riparian reference sites in California
- Consists of structural vegetation metrics that can be used to set restoration goals, design *and* assess restoration sites
- **RiVR** detects detailed aspects of site composition yet is simple to implement
- This makes it simple to link reference site data with performance criteria.
- A Level 2 sampling method and site dataset.
- Presentation outline:
 - Study (2013) and selected data
 - Important takeaways
 - Implications for our work

Why do we need yet *another* protocol?

Essentially, because reference data are not adequately applied in the project performance phase.

- A project plan's reference site may not reflect best attainable condition.
- Success criteria - typically survival and cover metrics – are not always tied to either the selected reference site or to best attainable condition.

AND,

- Current assessment methods are not designed to provide information to be used in planning or implementing restoration projects.

Applying criteria based on reference data from high-quality sites is especially needed for mitigation projects, which tend to take a bare-minimum approach to compliance.

Study Assumptions

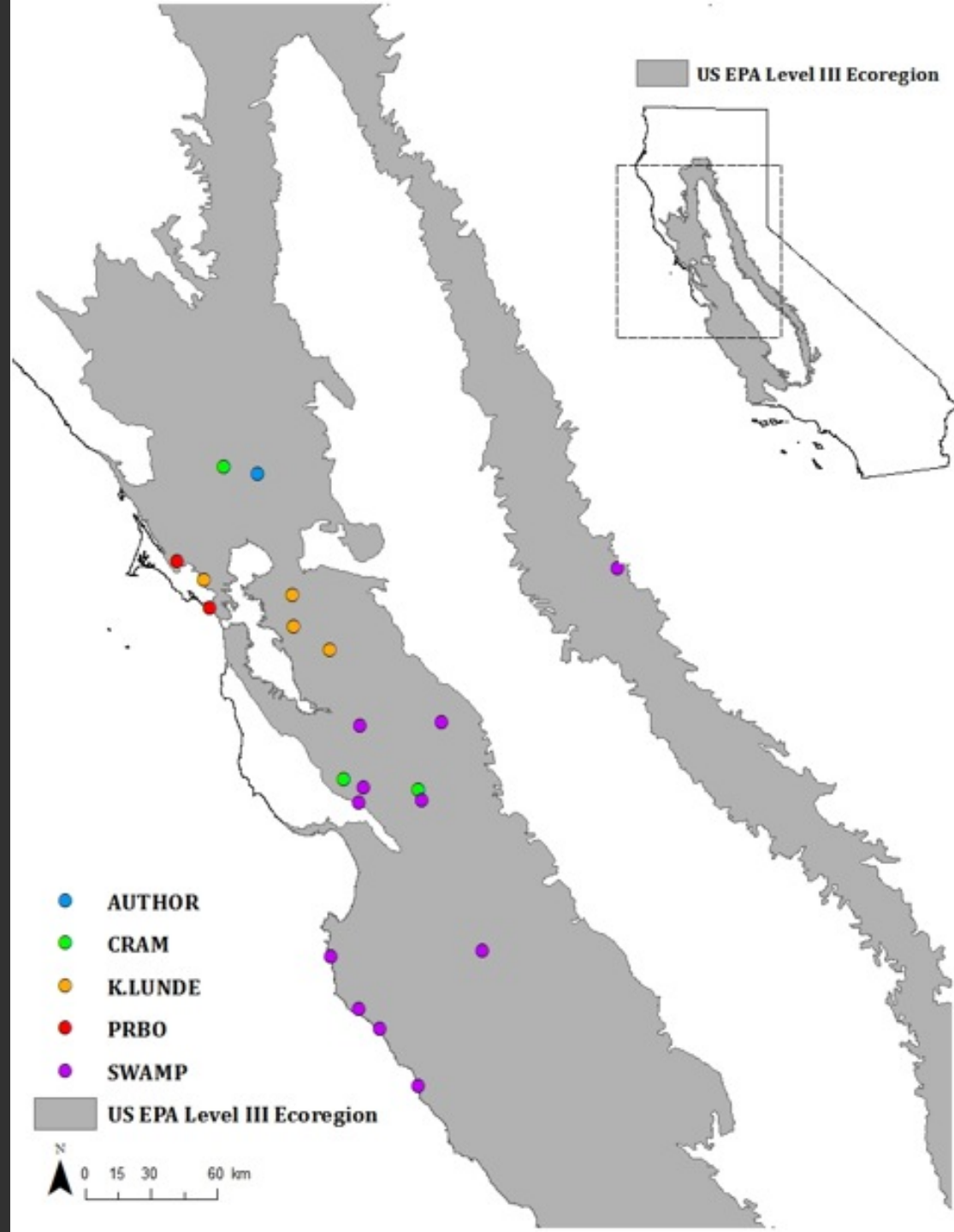
- Many restoration sites do not conform to “if you build it they will come” concept
- Quantifying reference site structure should give us a good model for what our restoration sites should target as a **goal state**
- Structure can be used as a proxy for function
- There should be an identifiable connection between site quality and vegetation characteristics.

Methods

- Performed vegetation census on 21 best-attainable-condition riparian reference sites (ID all woody plants and measure diameter at breast height of all trees)
- Transect defined by extent of allochthonous input (horizontal) and saturation of species-area curve (longitudinal); all transects same size
- Data provide four basic forest structure attributes:
 - Species richness
 - Species relative abundance
 - Size class distribution
 - Stem density
- Also collected relevant site data: bankfull width/depth, stream type, understory and shrub layer characteristics

Reference Site Selection

- EPA California Oak Woodlands/Coastal Sage Scrub Ecoregion
- 15 SWAMP sites
- Three CRAM sites
- Two RBI sites (PRBO)
- One remnant site selected by author (Napa River Reserve)
- Travel time and accessibility constrained site pool



Riparian Vegetation Reference Index

SELECTED RESULTS

Reference site characteristics

- Presence of both large and small trees
- High diversity of woody species (many niches)
- A few dominant species and many minor species (sites conform to the inherent rarity principle)
- Species richness grows with site length (there is a species-area relationship)
- Most of these are basic ecological concepts, but they had never before been applied to riparian woodlands.



Patterns of similarity

- Relative abundance is major factor in reference site composition; *eighty-two percent* of the species on reference sites are minor species
- Most reference sites share similar vegetative characteristics.
- Species richness and alliance appear to be linked.
- Dominants provide critical functions (e.g. primary productivity, system stability), but abundance of minor species in reference sites suggests their importance in these ecosystems.
- These patterns are strong enough to suggest that this type of data could be useful in design, permitting, and development of performance criteria.

Validation

4 ambient sites in urbanized or impacted watersheds were sampled in the study.

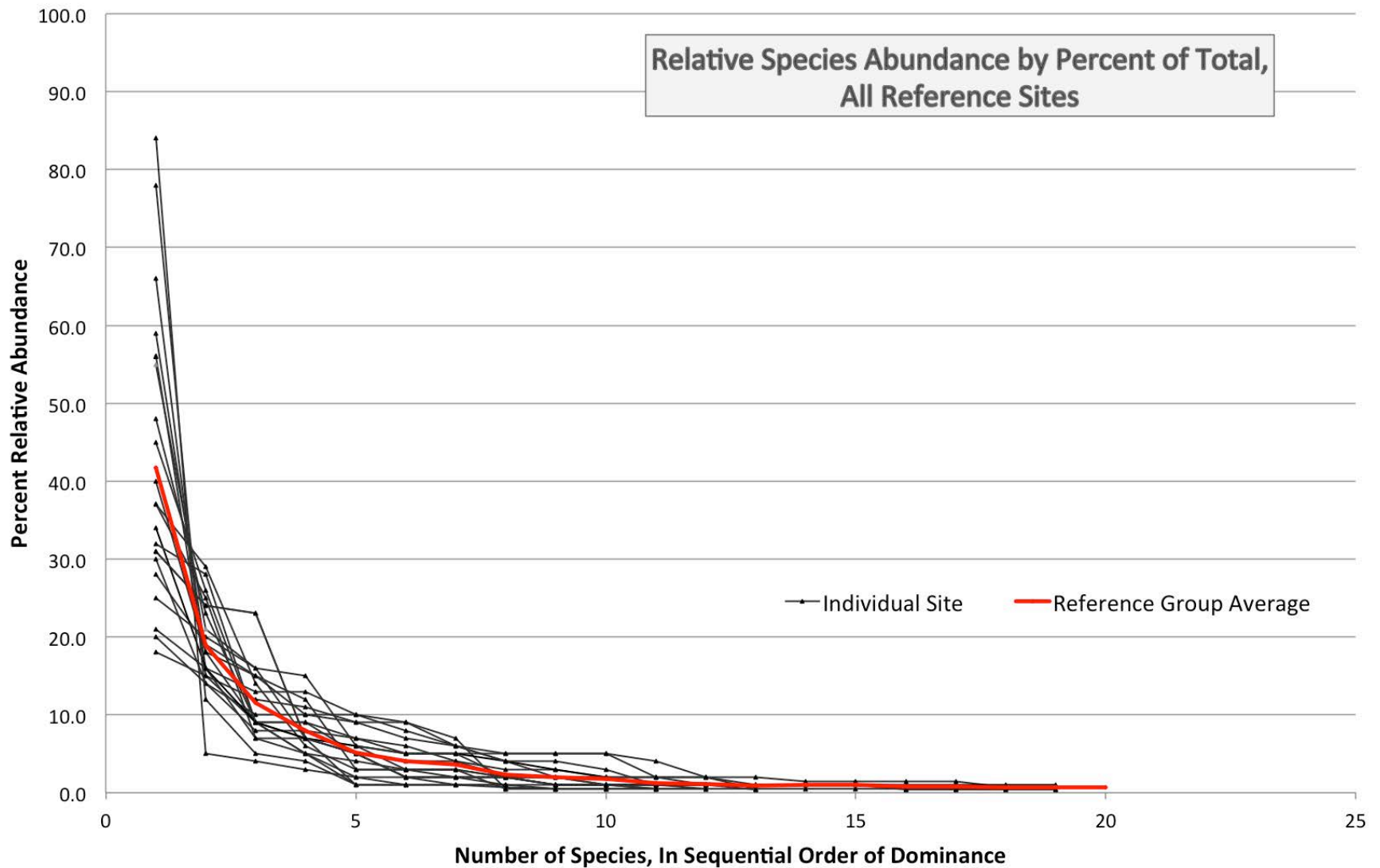


Alameda County ambient site, low understory diversity and only a few dominant species represented. Most cover consists of invasive exotics.

Every ambient site had lower species richness and hyperabundance of dominant species.

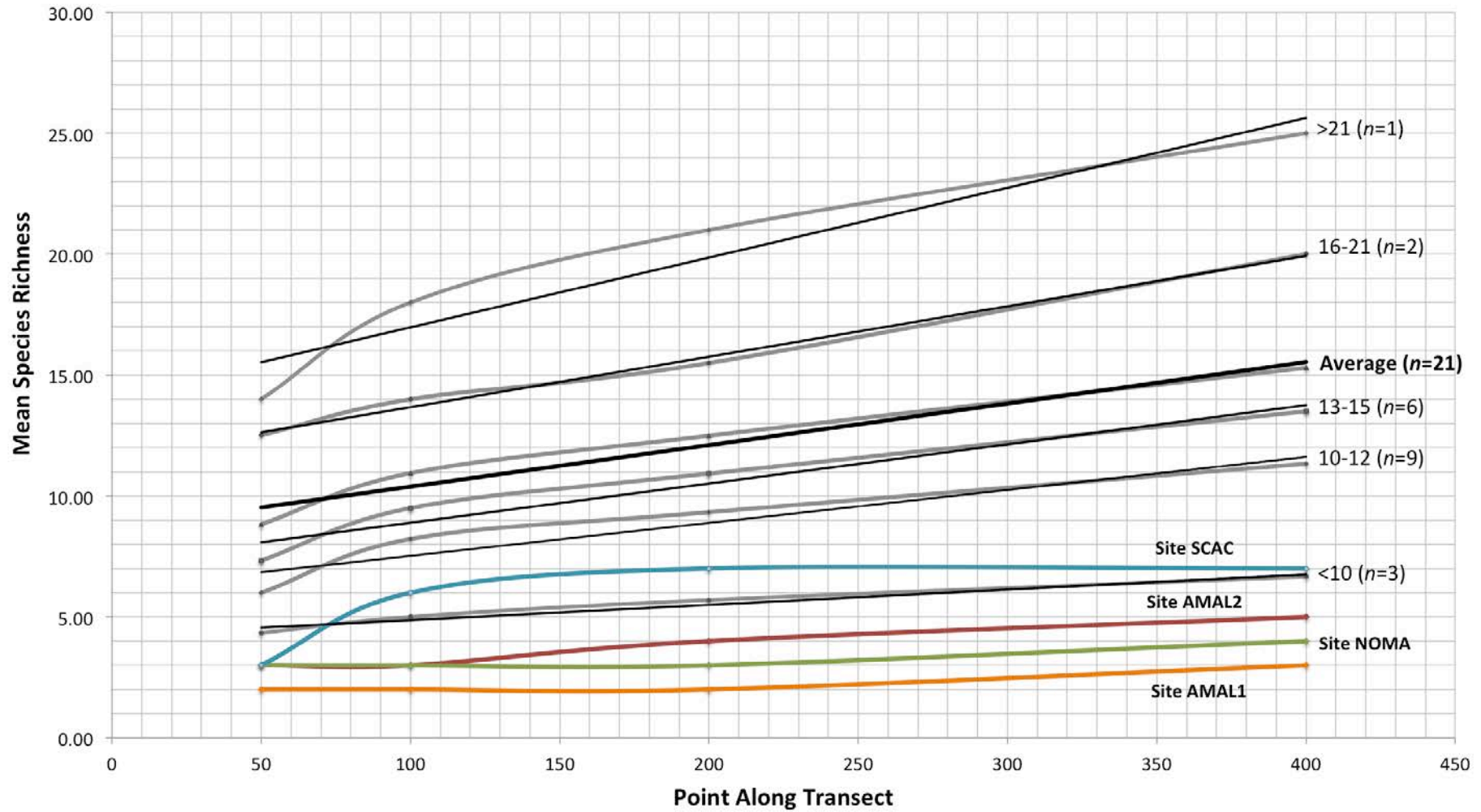
Reference sites with recent disturbances also showed lower species richness and associated skew in relative abundance.

Relative abundance is critical in reference sites



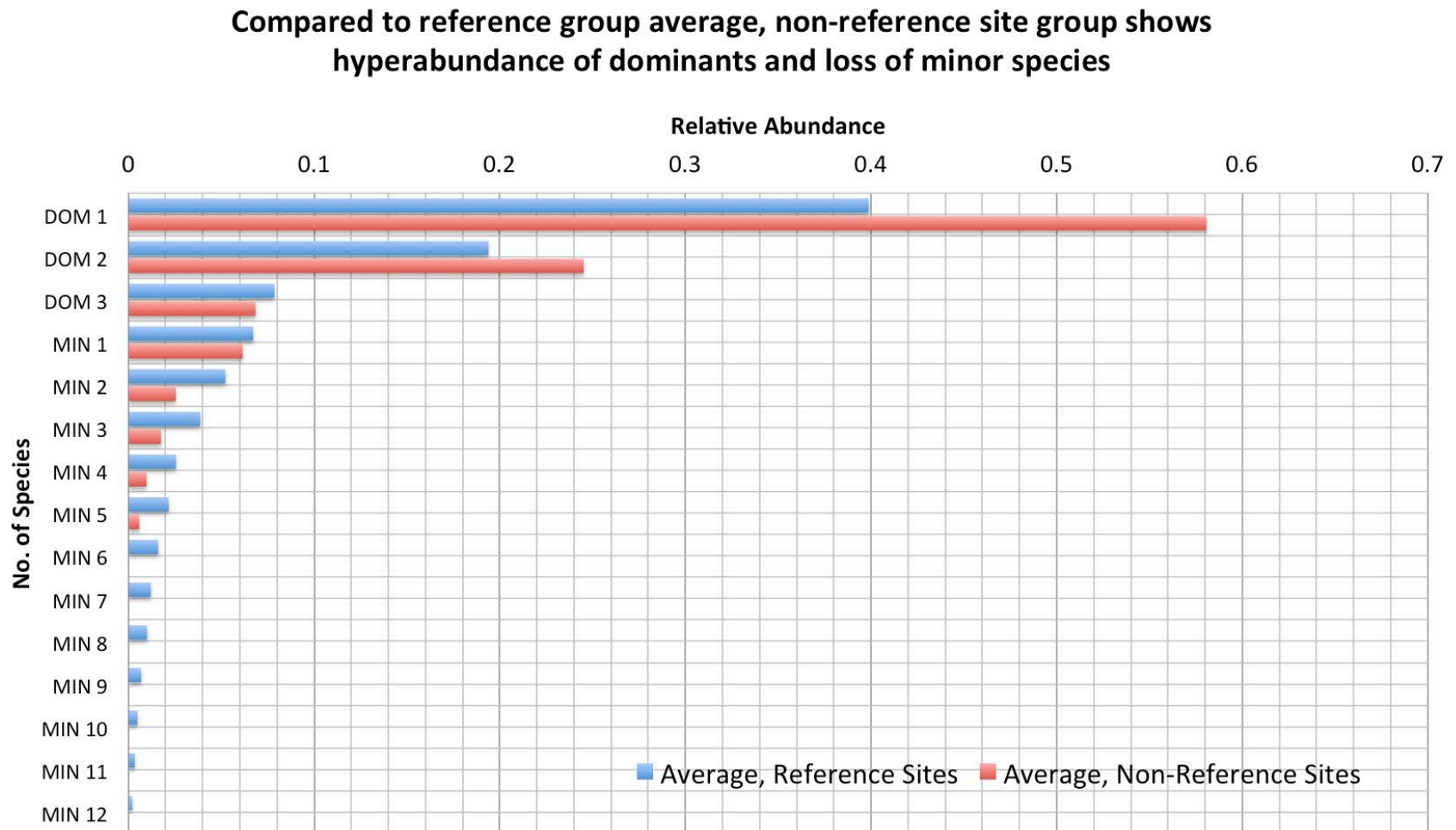
Species richness on reference and disturbed sites

Species Richness for Non-Reference Sites as Compared to Reference Richness Categories



Point Along Transect

Comparison of average relative abundance between reference group and non-reference group



Benefits of reference condition metrics in permitting

- RiVR metrics could be used as an additional tool for guidance for more ecologically functional projects.
- Use of **reference condition** as a goal state, in addition to percent survival and cover, would make performance criteria much more robust while not unnecessarily complicating sampling.
- Vegetation is a good place to start, as it is easy to quantify.



Opportunities / Next Steps

- More sampling is needed!
 - Much more data needed to strengthen and diversify dataset
 - More data could lead to refinement of protocols
 - Data can tell us much more about the condition of our most pristine riparian systems, and that's a good thing!
- Updates to CRAM database now allow sites to be selected by dominant species, which can help make further data collection more efficient
- Ideas for further development welcomed!

A scenic view of a rocky stream flowing through a forest. The water is clear and flows over large, grey, flat rocks. The surrounding trees have green and yellow leaves, suggesting an autumn setting. The text is overlaid on the center of the image.

Thank you.

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