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C SHEL coastal soil horizons & ecology lab

GRASS Net

Assessing Aggregate Stability Methods to Inform Grassland Restoration


[5]

Relevance

- **Aggregate stability:** the structural integrity of soil clumps
- Aggregate stability is important for **erosion control, carbon storage** [1], **water infiltration, aeration,** and **root growth**
- Understanding the stability of soil aggregates may **help practitioners design and implement more effective restoration strategies**
  - E.g. Selecting plants that enhance aggregate stability
- Aggregate stability can be **measured in many ways in both field and lab**

Research Questions

How well does field data for aggregate stability align with the lab measurements? We hypothesize that lab and field measurements for aggregate stability will be correlated.

Approach

THREE SAMPLING SITES IN CA
with 10 sampling locations at each site

COLLECTING FIELD DATA: SLAKE TEST
Visually assessing level of loss of structural integrity when placed in water (5 measurement points per sample)

COLLECTING LAB DATA: PHOTO-BASED SLAKE TEST
using R to quantify number of pixels to assess loss of structural integrity

[3]


Image of lab measurements


DATA ANALYSIS:
- **Lab Data** was image processed using R
  $STAB_{10}$=A_initial/A_final [2]
  → **Average Stability Index**
- **Field Data** was averaged [4]
  → **Average Stability Class**

STABILITY CLASS	CRITERIA FOR ASSIGNMENT TO STABILITY CLASS
1	50% of structural integrity lost within 5 s of immersion in water
2	50% of structural integrity lost 5-3- seconds after immersion
3	50% of structural integrity lost 30–300 s after immersion, or <10% of soil remains on sieve after five dipping cycles
4	10–20% of soil remains on sieve after five dipping cycles
5	25–75% of soil remains on sieve after five dipping cycles
6	75–100% of soil remains on sieve after five dipping cycles

***Table 1:** field slake test criteria for assignment to stability class [4]*

Objective 1: Variability in Lab Measurements Across Sites

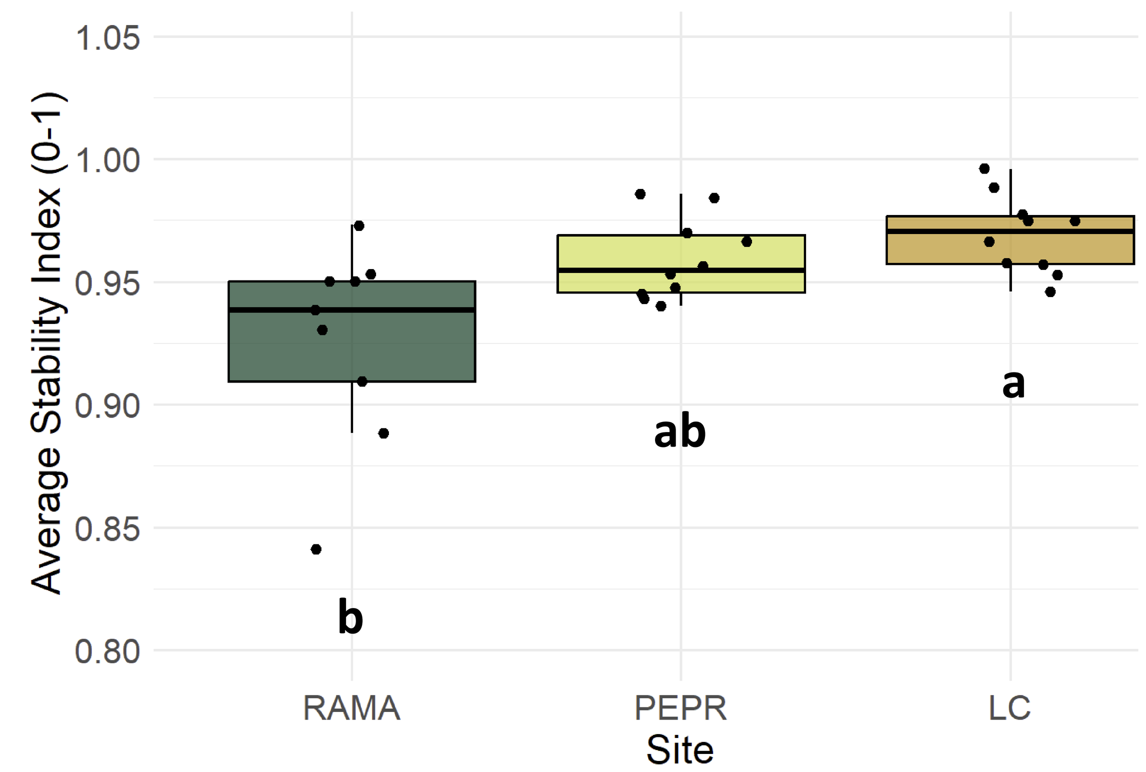

***Figure 1:** variability in average stability index measured in the lab across sites. The three sites include Rancho Marino (RAMA), Pepperwood (PEPR), and Lack's Creek (LC) (n=10 for PEPR & LC, n=9 for RAMA). Sites with same letter labels are not significantly different from each other. (p<0.05)*

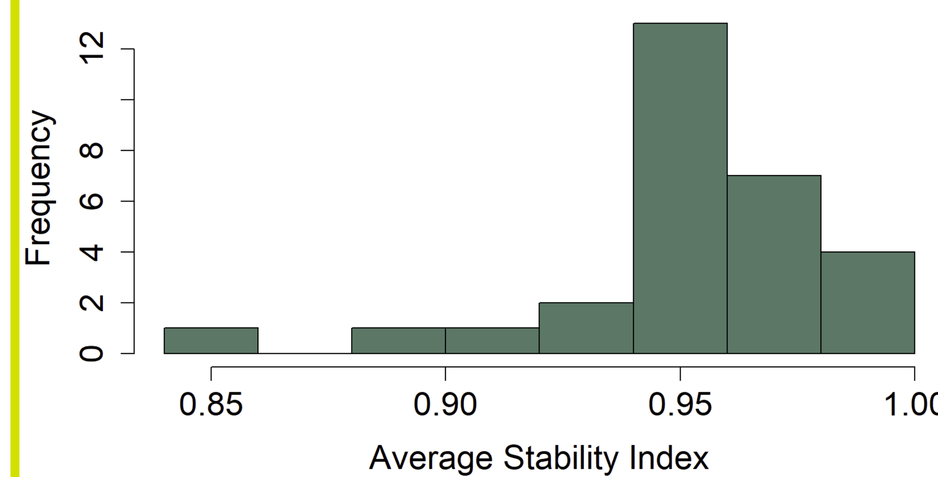

***Figure 2:** average stability index of lab samples (n=29).*

Key Takeaways:
- RAMA and LC lab data are statistically different from each other, but PEPR is not statistically different from either
- Lab data is not highly skewed and there is more variability between samples within a site

	Comparison	z	p value (unadj)	p value (adj)
1	LC – PEPR	1.2870	**0.198108**	0.198108
2	LC – RAMA	3.1387	**0.001697**	0.005091
3	PEPR – RAMA	1.8861	**0.059287**	0.118575

***Table 2:** Kruskal-Wallis test results for lab measurements*

Objective 2: Variability in Field Measurements Across Sites

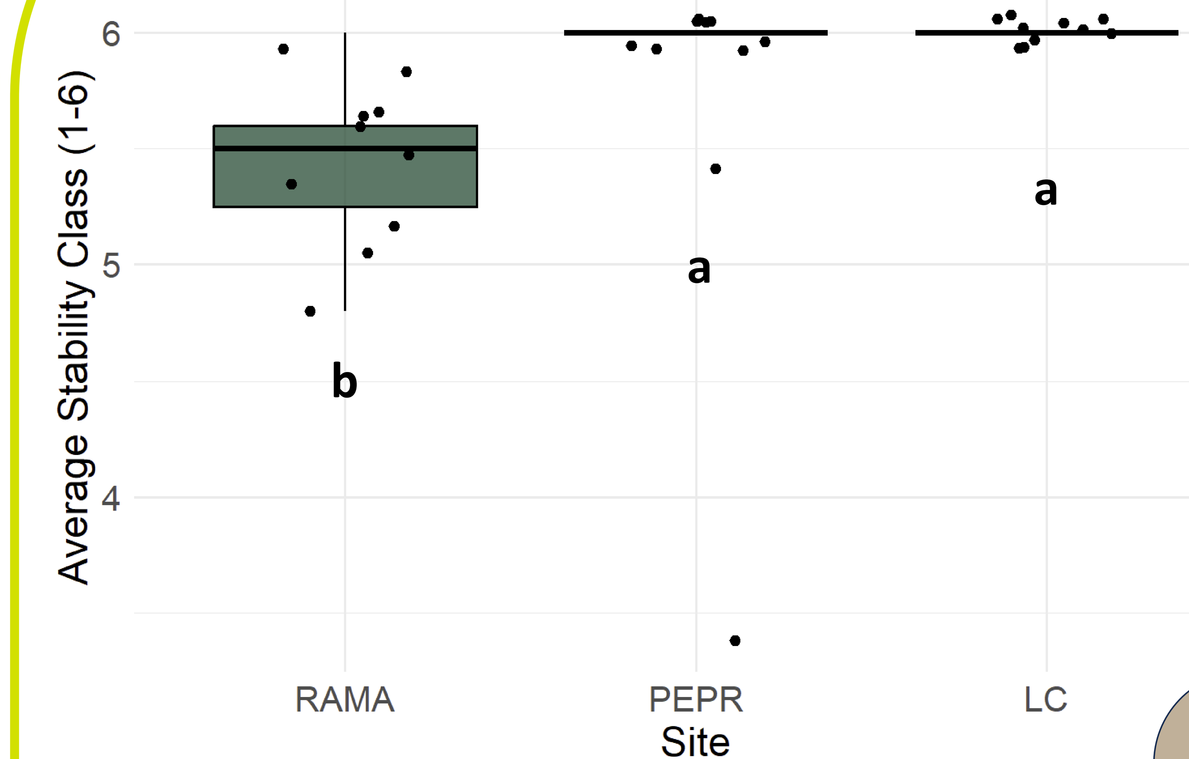

***Figure 3:** variability in average stability class measured in the field across sites. The three sites include Rancho Marino (RAMA), Pepperwood (PEPR), and Lack's Creek (LC) (n=10 per site) Sites with same letter labels are not significantly different from each other. (p<0.05)*

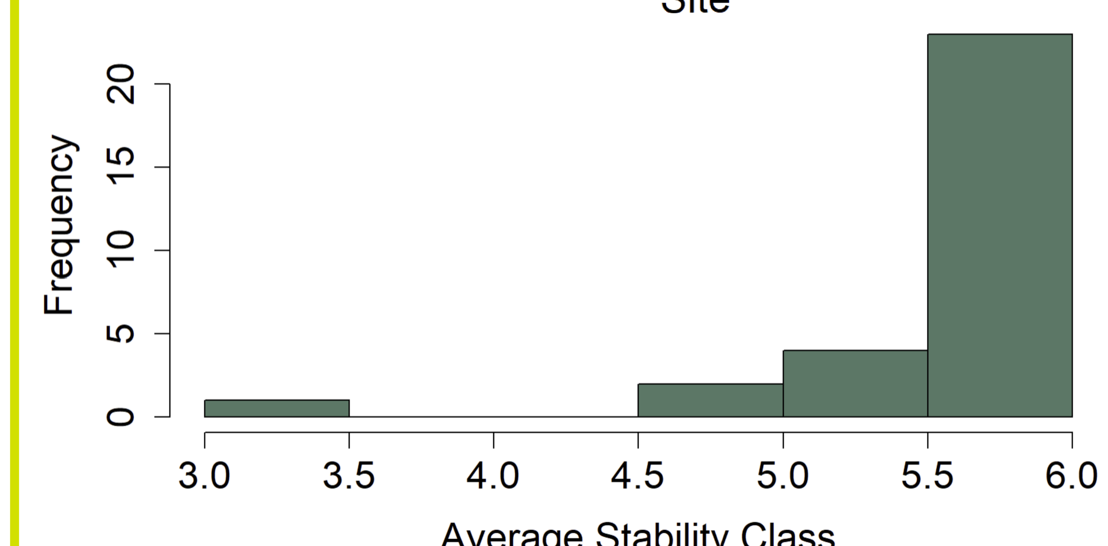

***Figure 4:** average stability class of field samples (n=30).*

Key Takeaways:
- RAMA lab data is statistically different from PEPR and LC, which are not statistically different from each other
- Field data is highly skewed and there is less variability between samples within a site

	Comparison	z	p value (unadj)	p value (adj)
1	LC – PEPR	1.030242	**0.302896**	0.302897
2	LC – RAMA	3.826613	**0.000130**	0.000390
3	PEPR – RAMA	2.796371	**0.005168**	0.010336

***Table 3:** Kruskal-Wallis test results for field measurements*

Objective 3: Comparison of Lab and Field Measurements

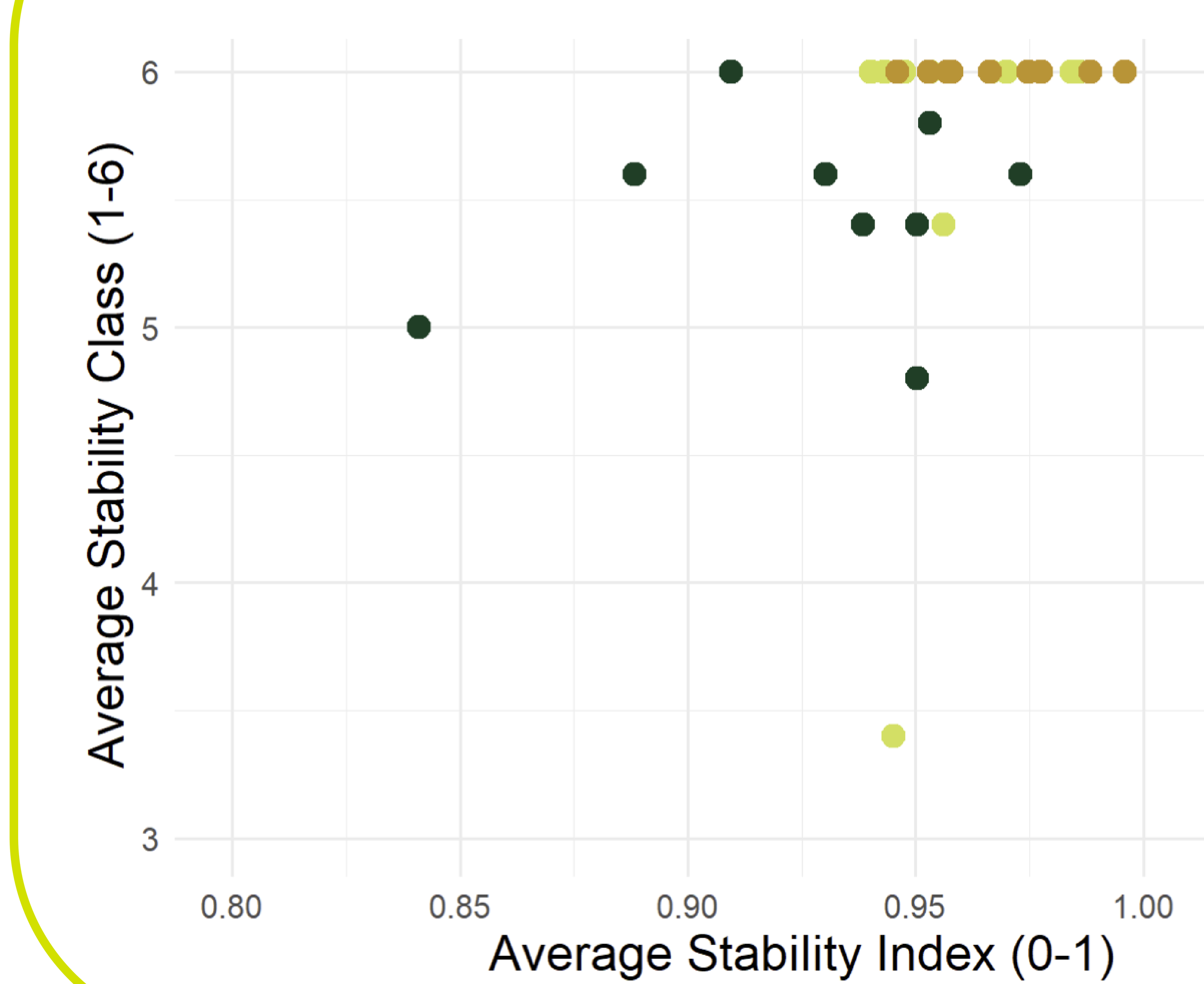

***Figure 5:** relationship between average stability index and average stability class. Points are organized by color to show site. See key for site (n=29).*

SiteInitials
- LC
- PEPR
- RAMA

H_o	No relationship
t value	1.886
p value (linear)	**0.070**

***Table 4:** curvilinear regression results for linear correlation between average stability index and average stability class*

Key Takeaways:
We found no linear correlation between lab and field measurements for aggregate stability

A log transformation did not resolve the issue

Next steps: look at alternate ways to analyze data

Discussion

- The photo-based slake test used in the lab was useful for collecting average stability index data for both comparison of samples within a site and between sites.
- The field slake test was useful for comparison between sites, but lacked the variability necessary to compare samples within a site.
- We found no linear correlation between lab and field measurements for aggregate stability. This was likely due to how skewed the field data was.
- Field measurements for aggregate stability are valuable if practitioners are using them for site selection, but aren't as useful on a smaller spatial scale.

References & Acknowledgements

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[1] S.B. Bird, et. al, *Journal of Environmental Pollution,* vol 166, issue 3, March 2002.
[2] E. Padula and C. Decock, "Soil Aggregate Stability SOP" Oct 2, 2023.
[3] Image of field slake test. Photo credit to Kylee Nielson
[4] C. Holifield Collins, et. al, *Journal of Arid Environments,* vol 117.
[5] Photo credit to Dr. Yamina Pressler