Soil Erosion Potential

Introduction

AIM uses aggregate soil stability as an indicator of the potential of soil to erosion (J. E. Herrick et al. (2021), J. Herrick et al. (2001)). This metric has been shown to correlate strongly to the effects of rain, and wind, on the loss of soil from areas (J. Herrick et al. (2001)). While the relationships between soil erosion, plant cover and functional type (Cerda (1998), Greene et al. (1994), Torre-Robles et al. (2023)), landform position (Swanson et al. (1988), Torre-Robles et al. (2023)), slope shape (e.g. concave, convex) (Canton et al. (2009), Torre-Robles et al. (2023)), soil texture (@), and the cover of biocrusts are oftentimes complex (Leys & Eldridge (1998)), the quantitative observation that soils with low stability have greater rates of erosion are always evident (J. Herrick et al. (2018)).

For this report, soil aggregates refer to relatively large coherent portions of soils (> 2mm diameter). Soil aggregates are continually being created by processes, such as the initial attraction of negatively charged clay and positively charged salts on silt particles, followed by cementation. Cementation is often achieved through organic matter, calcium carbonates, which then leads to biological processes. These involve the creation of numerous long molecules (generally polysaccharides), by organisms such as bacteria especially filamentous cyanobacteria and fungal hyphae, which act as 'glue' between these particles (Moonilall (n.d.)).

Soil aggregates are continually being broken apart by THESE PROCESSES. When many more soil aggregates are being broken apart than are created areas become susceptible to erosion from water, or wind (Leys & Eldridge (1998)).

... Current concerns regarding soil stability are to be compounded with climate change (Munson et al. (2011)), soil crusts, perhaps with the exception of 'light' cyanobacteria, are slow to regenerate. More episodic, and intense rainfalls, badddd. (Chen et al. (2018))

Soil stability measures are on a scale of 1-6, where '1' indicates little to no stability and '6' indicates very high stability. While it is tempting to treat these values as *continuous*, it is generally inappropriate to do so. These values represent data which are *ordinal categorical variables*, and while these types of information *can* readily be, and are oftentimes, treated as continuous values they should meet a few conditions first.

One condition where ordinal variables can be transformed is when the values they represent are at equal distances from each other, *e.g.* if we estimate the number of number of jelly beans in a jar from 1-10, where 1 encompasses 1-10 beans, and 2 21-30 beans etc., However, our rankings of 0-6 all show different 'distances' between them. For example

> "Stability class 4: 10–25% of soil remains on sieve after five dipping cycles;
> Stability class 5: 25–75% of soil remains on sieve after five dipping cycles" — AIM 2021

As can readily be seen, from these two classes which are the most similar, breaks are of wildly different sizes (15% and 50%), and clearly violate this assumption.

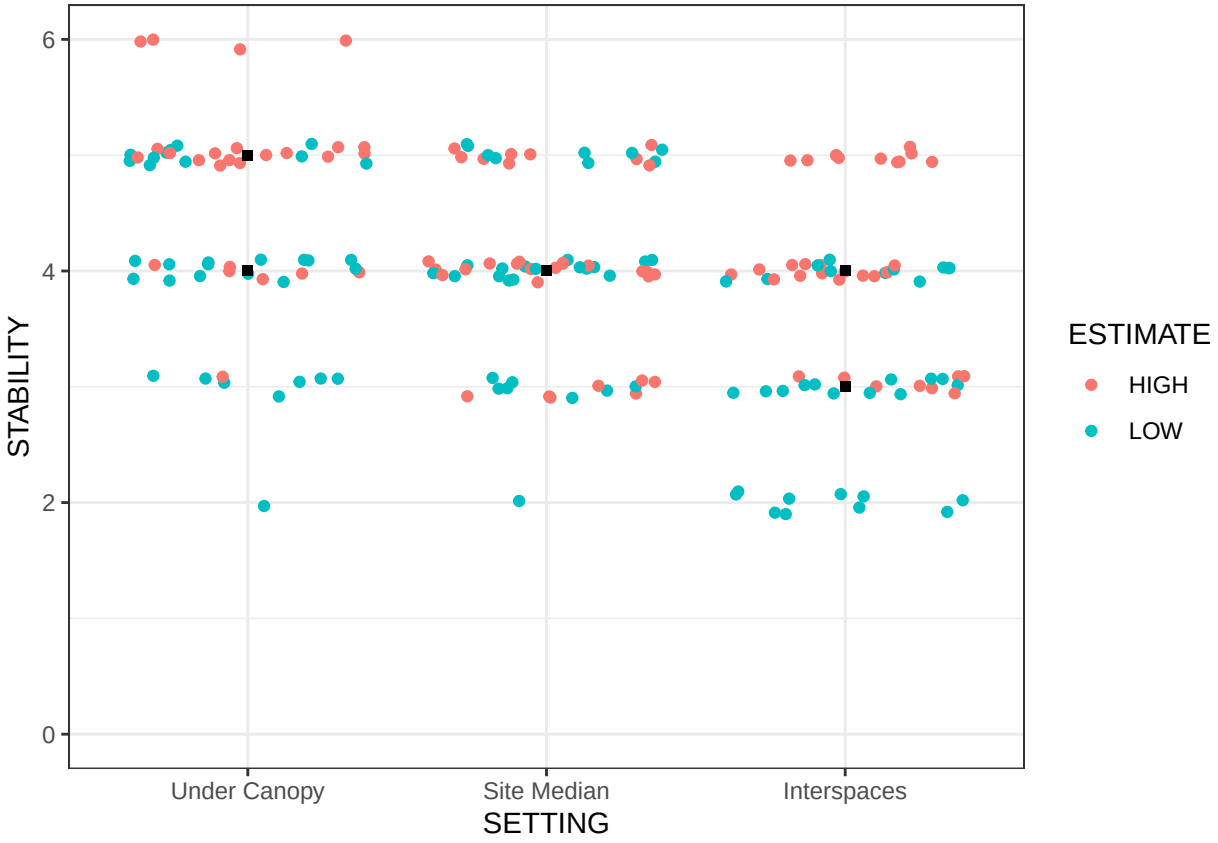
Another condition where ordinal values can be treated as continuous is when they represent a great range. E.g. if you had a quiz of 100 questions, and you can get each answer either 'Correct', or 'Wrong', we could turn your score into a continuous value, and combine it with other scores to get an aggregate. Lenient opinions differ on whether you should have 10+ or 5+ classes to do this.

Finally, we have few replicates per site. Soil stability is measured at only 18 locations per plot, much less than the typical 150 measurements for many vegetation attributes.

Methods

Nearly all Ecological Sites Descriptions contained soil stability values for their locations: 1) A site median, 2) Interspace (the distance between plant canopies) median, 3) an Under Canopy (space beneath plant cover) median. To calculate these estimates for ESD's which were missing them, the mode of the medians for eahc of the three variables were calculated.

The median was also calculated for each of these three attributes at each Ecological Sites which lacked descriptions.



Results

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