

Herbivory distribution parameters across space and time

Working Title: Herbivory distribution parameters

Leaders: Lee Dyer (open for others)

Co-leaders: HerbVar Steering Committee

Abstract: Distributions are interesting and useful because they provide a comprehensive summary of populations or (more frequently) of samples or of sampling, revealing patterns that are not immediately apparent from raw data. Estimated distribution parameters can serve as exogenous and endogenous variables in statistical models, as inputs for analytical models, or as estimates for simulation models. For example, the inverse discrete Pareto distribution fits global herbivore diet breadth data, and the alpha parameter from these distributions is an excellent measure of dietary specialization for a sample. Fitting herbivory data to different distributions can be enlightening on its own, but it may also yield useful parameters for other models. Additionally, characterizing distributions of residuals from standard statistical models used to analyze herbivory data allows us to consider alternative inferential approaches. We have used phase 1 and 2 herbivory data, along with simulations, to examine fits of different distributions. We have also explored the relevance of “hurdle” approaches to examining presence/absence of herbivory versus distributions of herbivory when it occurs on a leaf or plant. We have already estimated statistics that comprise three components of herbivory distributions: central tendency, dispersion, and skew. Thus far, analyses revealed that the effects of exogenous variables on dispersion and central tendency are quite different than effects on traditional measures of mean and variance. We will estimate these same latent variables and additional distributional approaches at different hierarchical levels (e.g., leaf, plant, site, region) to further explore how herbivory distributions change in space and time. Our focus is on causal relationships among distribution parameters, herbivore diversity, and other variables already examined, including latitude, plant size, and time. For asking questions about how herbivory changes over different gradients, there is no one distribution parameter that has primacy, rather it depends on the question, but there is no reason to leave out any of the rich information of sample distributions.

Data: Phase 1 and 2 herbivory datasets and simulation results

Included variables: All statistical models will be causal models, so while there are exogenous variables in the models, the endogenous variables are not modeled as traditional “response” variables. Endogenous variables include entire distributions,

moments of distributions, latent variables Herbivory mean, variance, skew, and Gini at the multiple levels of organization

Predictor variables: See above – variables will be modeled in a causal framework.

Authorship model: Traditional. The lead authors invite additional contributors as necessary.

Timeline:

Initial discussions and coding: completed

Further coding and analyses: Nov 2024 – February 2025

Writing: Now – May 2025

Submission: Summer 2025