Context-dependent host-microbe interactions in stochastic environments

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Classic ecological theory predicts that environmental variation will tend to have negative consequences for long-term population growth rates (cite). Because population growth is a multiplicative process, the stochastic population growth rate is best characterized by the geometric mean, which incurs a cost of variance compared to the arithmetic mean. A population will increase if the long term growth rate (λ) is > 1, and can be expected to decrease if $\lambda < 1$. There are two pathways to increase population growth; it can increase λ or decrease variance (cite). This observations stimulated the development of the demographic buffering hypothesis, where vital rates that are most important to population growth may be selected to be buffered from environmental variability (cite). While this has been recognized for some time, demographic studies that examine variance relationships are limited due to the need for long term data (cite).

Climate projections indicate that environmental variability is expected to increase along with increases to mean temperatures (cite). Contributions from demographic buffering in natural populatiomay become more important under this scenario and will be important for projecting species responses to climate change (cite). In particular it is unclear how commonly demographic buffering occurs, what mechanisms contribute to demographic buffering, and how species interactions may provide resilience to environmental variability (cite).

Microbial symbionts are common across a broad range of taxa in nature (cite). Microbial symbionts provide protection from environmental stresses including (cite). Commonly, the benefits from these symbioses are context dependent where they vary under different environmental conditions (cite). Symbionts may provide benefits under harsh conditions when they are needed by their hosts, but be neutral or even costly under benign conditions (cite). This can make it difficult to quantify the net effect of a given interaction, but it also allows for the possibility that the interaction strength can vary through time (cite). If the context dependence is

Using long term data, we test the hypothesis that

Do continuous models have the same cost of variability?

Results

Discussion

References

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Table 1. Comparison of the fitted potential energy surfaces and ab initio benchmark electronic energy calculations

Species	CBS	CV	G3
1. Acetaldehyde	0.0	0.0	0.0
2. Vinyl alcohol	9.1	9.6	13.5
3. Hydroxyethylidene	50.8	51.2	54.0

nomenclature for the TSs refers to the numbered species in the table.

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Materials and Methods

Plant propagation and endophyte treatment. Seeds from naturally infected populations of seven species of cool-season grasses (Agrostis perennans, Elymus villosus, Elymus virginicus, Festuca subverticillata, Lolium arundinaceum, Poa alsodes, and Poa sylvestris) were collected in the Spring of 2006?????? for Lilly Dickie Woods and Bayles Road in Brown. Co. IN. Seeds with shared maternal ancestry were either experimentally disinfected by heat treatments or left naturally infected to reduce confounding genotype effects. Seeds were surface sterilized with XXXX and cold stratified for XXXX weeks, then germinated in the XXXX for XXXX weeks. They were then grown in the greenhouse at Indiana University for XXXX weeks.

Experimental design. We collected long-term demographic data from experimental plots established in 2007. We established 10 plots for *Lolium arundinaceum*, *Festuca subverticillata*, *Elymus virginicus*, and *Elymus villosus* and 18 plots for *Poa alsodes* and *Poa sylvestris* with 25? individuals.

$$
\begin{aligned}
(x+y)^3 &= (x+y)(x+y)^2 \\
&= (x+y)(x^2+2xy+y^2) \\
&= x^3+3x^2y+3xy^3+x^3.
\end{aligned} \qquad [1]
$$

Data analysis. We used statistics

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