

NATIONAL SCIENCE FOUNDATION  
PO Comments

Proposal:1546686

PI Name:Zimmerman , Jess

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**Comment:**

Program Evaluation and Recommendation:

This proposal to continue Luquillo LTER research asks important questions about how disturbance and climate influence the Luquillo Experimental Forest in Puerto Rico. The research team is a strong one, and the study of disturbances (drought and hurricanes) is well integrated across forests and streams. Integration of observational research with manipulative experiments is strong, and is the key focus of the proposal. The large-scale manipulations that will be continued or initiated are ambitious, and provide a potentially powerful test of the mechanisms underlying integrated responses to disturbance. The proposed studies and experiments are well designed and fairly well described. Broader impacts of the project are not described in satisfying detail, but are diverse, productive, and strongly focused on engagement of groups under-served in science. Data management at the Luquillo LTER site is in fine shape and thoroughly meets LTER-network standards.

The NSF working group agrees with the concerns raised by specific reviewers. They are important, and some have been persistent. As a result, we take some space here to elaborate on them.

The model presented in Figure 1 does not lead conceptually or logically to the hypotheses and predictions that motivate the proposed activities. The strength of the research is its integration of observation and experimentation, but this is not captured in the model. Neither is the focus on novel ecosystems captured in this model. How does this model present or lead to a cohesive understanding of how a tropical forested ecosystem responds to disturbance?

The Luquillo Experimental Forest benefits from 9 decades of research, but no evidence is provided that historical data have been evaluated and analyzed to inform future research. Is there evidence in these data for legacy effects, for example, or will those only be manifest in response to future changes?

The ecological effects of disturbance (magnitude, frequency, synchrony) have been well studied, as have contingency and legacy effects. These are general ecological concepts, and it is admirable that they lie at the heart of the research proposed. Yet little literature outside of Luquillo informs this research. The proposal misses the opportunity to benefit from extensive research on disturbance, drought, contingency, and legacy effects. This insularity also reduces the relevance of results from Luquillo to other communities and ecosystems regardless of whether they are tropical or not and forests or not. The proposal attempts to make the case that the research has wide application of results. Without a broader consideration of key findings in these major fields of study,

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the proposal fails to follow through on this early promise. The widespread study of disturbance, contingency, and legacies also underscores reviewers' concerns that the research proposed breaks little new ground.

The role that modeling and models play in the Luquillo research needs careful attention. Ideally, models - whether developed from prior findings or not - should guide the development of new questions, predictions, experiments, and observations. Here, models are presented as an afterthought. None of the models mentioned is described in enough detail to understand what it contributes to the research. No mention is made of accounting for uncertainty in observations or processes. No mention is made of model-data assimilation or of model validation. The short and vague statements included in the proposal ('we will develop a trophic model') are inadequate, as is the role that models play in guiding the research.

Eight separate hypotheses are presented in the proposal, but very few of them are testable as stated. They make vague predictions - short-term drought will alter spatial dynamics; changes in vegetation composition will induce changes in heterotroph communities; decreased woody litter inputs with increasing frequency of severe storms will change the composition of soil microbial communities; a greenhouse-enhanced climate will drive changes at the global-to-regional scales, resulting in new, unique climate regimes forcing ecological change - and in too few cases are work plans presented in enough detail to know what data will be collected to test these hypotheses or how the data will be analyzed. There are some exceptions, but in too many cases is it unclear how responses will be detected. Accompanying this concern is the near absence of details relating to studies of metacommunity structure or a hierarchical partitioning of biodiversity.

The proposal describes an immense amount of work. An obvious concern is that there will not be adequate funds to continue collection of data in the five LTER core areas, continue ongoing experiments, and initiate new experiments. The research is fairly well focused, but would it be wise to concentrate on short-term responses to drought and hurricanes over the next three years, and then to use these results to design longer-term experiments?

Reviewers had few comments on the project management plan, and the LTER program has only one. It is hard to understand how a Science and Education Advisory Committee can provide advice when the members of this committee are researchers engaged in the project. Won't they be advising the lead PIs on the value of their own research? As described, this seems like an unnecessary committee.

The Luquillo LTER has had uneven success over the past 15 or so years, characterized by a series of significant scientific concerns. These include several of the concerns raised about this proposal - the lack of convincing conceptual framework, lack of (evidence of) quantitative synthesis of long-term data, an inadequate description and use of modeling, and unconvincing efforts to extend the relevance of the research beyond the Luquillo Experimental Forest. These lingering concerns must be addressed over the coming three years.

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Reviews of this proposal are supportive. Much of the research proposed is solid and addresses important questions for tropical ecosystems. Concerns remain, and these must be addressed over the next three years before submission of a proposal in 2018. They are not major enough now to terminate the site. The LTER program recommends funding at the requested levels for the coming three years.