

NATIONAL SCIENCE FOUNDATION  
Review (PI Copy)

**Proposal:**1546686

**PI Name:**Zimmerman , Jess

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**Title:**LTER: LTER5: Understanding Ecosystem Change in Northeastern Puerto Rico

**Institution:**University of Puerto Rico-Rio Piedras

**NSF Program:**LONG TERM ECOLOGICAL RESEARCH

**Principal Investigator:**Zimmerman, Jess K.

**Rating:**Very Good

**Review:**

In the context of the five review elements, please evaluate the strengths and weaknesses of the proposal with respect to intellectual merit.

1.

This is a complex proposal describing an important long-term research program at the Luquillo LTER site. The program consists of a suite of long-term data collections consistent with the criteria of LTER funding. Because of the long-term nature of the data collections, this LTER plan of research can build on that rich history of research, and the proposal describes a range of objectives to do just that. The overarching theme of studying tropical ecosystems in a changing climate is a critically important area of research for ecology and for our planet. Within the conceptual framework of studying the effects of a changing climate, the proposal defines three areas of focus that include drought, hurricanes, and then a third that combines multiple factors including land cover and land use.

This reviewer found the approach that includes monitoring and manipulative studies as proposed to address drought and hurricane disturbances relatively well integrated. The third area of 'climate, hurricane, land cover and land use' seemed less well integrated, and the use of the terms and conceptual diagram in Figure 1 were not as helpful as I would have hoped in seeing how this was a logical, and linked, area of study. This last area of research emphasizes climatology and seems that the LUQ long-term research program is less essential to its success, but rather is simply an additional area of investigation, and one that could be developed anywhere with long-term climatologies available. While the modeling is useful in the hypothesis testing of the other climate-related disturbances, it does not appear to be the third leg of a stool that requires this LUQ program to be carried out.

The intellectual merits rest with the planned research emphasizing disturbance ecology and community dynamics. The research related to stream processes and terrestrial-aquatic linkages is particularly strong, as is community dynamics. Although significant effort will be spent on collecting biogeochemical data, there was less development of the underlying biogeochemical mechanisms that contribute to the responses of these tropical ecosystems. While it is likely that significant work in ecological stoichiometry and metal dynamics likely will emerge from the research, it was not explicitly developed in this proposal.

Much of the proposal was appropriately focused on the past accomplishments of the LEF that contribute to LUQ research, and would continue to do so. This represents a strong momentum for the merits of continuing this tropical research program.

A strength of the proposal is the potential to integrate the manipulative studies of disturbance (TEE, CTE, SDE) with empirical data on ecosystem response to these stressors under ambient conditions in both the Tabonuco Forest and the LTE plots.

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The LUQ is linked to a number of collaborative research programs (e.g., LIDET, LINX, LCZO, etc) which represents important integration of the LUQ research within the region. The nature of these linkages beyond data sharing were not readily apparent in most cases.

2.

The proposed activities explore a number of mechanisms of response in tropical ecosystems to the drought and hurricane stressors associated with a changing climate in this region. They are important scientific questions, and novel in that the answers to the effects of these disturbances over long time periods are poorly understood, and the combination of observational and manipulative studies represents a creative framework to address these questions. The potential to gain insight into the mechanisms whereby these disturbance regimes result in future non-analog ecosystems in tropical forests is potentially transformative.

3.

The research components are logically group among the three primary questions of the proposal, with the work plan for each detailing largely sound and logical approaches. The combination of manipulative and observational studies in support of the proposed modeling likely represents the key framework for the integration of the research proposed. This is not well represented by the conceptual diagram of this LUQ 5 proposed research, nor did the historical figures (Figure 4) seem particularly helpful in understanding the proposed work.

4. The team assembled appears to be highly qualified and experienced to do this research. The proposal details the organization structure and the functioning of the Management Committee in supporting LUQ 5.

5. Resources appear adequate for the planned research.

In the context of the five review elements, please evaluate the strengths and weaknesses of the proposal with respect to broader impacts.

Recent accomplishments in broader impacts include traditional achievements in graduate and undergraduate training. The Schoolyard LTER program is to be applauded and will continue into the new LUQ program which is a strength of the proposal. This leveraged additional funding from the US Department of Education to greatly enhance the development and outcomes assessment of this program, a valuable element of the LUQ contributions. The proposal outlines a strong program of broader impacts initiatives that continues the Schoolyard LTER, Journey to El Yunque, and Natural Resource Career Tracks programs along with student training and experiences and involvement of volunteer interns.

Please evaluate the strengths and weaknesses of the proposal with respect to any additional solicitation-specific review criteria, if applicable

The proposal appears to address data collection in the five core areas. Some of those data are tightly woven into hypotheses of disturbance effects (e.g., population dynamics), others are not (e.g. inputs and movements of nutrients through ecosystems). Clearly additional years of data collection and

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mechanistic research are warranted on the questions posed in this proposal. It was not evident that the historical data to date had been adequately evaluated for insights on the questions being posed for the future LUQ research. This may, however, have been evident in the numerous LUQ papers cited.

Summary Statement

This proposal outlines research questions of high priority to science and society on the effects of a changing climate in tropical forest ecosystems. Particularly emphasis is on drought and hurricane disturbances as priority drivers of ecosystem change. The combination of monitoring, manipulative experiments and modeling promises to yield insights into the questions posed. Linkages within primary questions were more evident than among the three areas of study, and the third area of emphasis (Question III) was less well integrated or dependent on this particularly long-term research site. The team seems well qualified and the additional three years of research is likely to reveal the merits of the LUQ 5 approach.