

NATIONAL SCIENCE FOUNDATION
Review (PI Copy)

Proposal:1637685

PI Name: Lovett , Gary

Title: LTER: Long Term Ecological Research at the Hubbard Brook Experimental Forest

Institution: Institute of Ecosystem Studies

NSF Program: LONG TERM ECOLOGICAL RESEARCH

Principal Investigator: Lovett, Gary M.

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.

The Hubbard Brook LTER is one of the stars of the LTER program. They have made fundamental contributions to our understanding of how large-scale chemical pollution alters ecosystem dynamics, as well as fundamental contributions to our understanding of forest ecology. I think it is very interesting to see the arch of this program play out against our insults to the planet. The program initially focused on the impact of acid rain, one of the dominant (in terms of public visibility) environmental problems of the 1970s and 80s. Now, they are considering climate change, the dominant problem of the coming decades.

The strongest part of the proposal are the various surprises that have been discovered over the course of the LTER. The question of why evapotranspiration has not increased with temperature is surprising, as is the question of the missing nitrogen. The nitrogen question in particular, is a compelling problem and grounded in theory. The LTER sampling allows you to eliminate two possible sinks, providing a rationale to target the others. The stable isotope-doping experiments and the shotgun sequencing seem interesting and appropriate. In addition to looking for the presence of particular genes, it would be interesting to try to look at whether these genes are being expressed. I'd also like to see some direct rate measurements of denitrification rates.

The overarching theme of 'disturbance' is appropriate to this ecosystem; however, I'd like to see a more nuanced approach to disturbance. In particular, this LTER seems to be set up to tackle questions of how disturbance on different spatial and temporal scales interacts in an ecosystem. 'Changing biota' doesn't really seem like a disturbance, especially species moving upslope as the region warms. I could see thinking of an invasion as a disturbance, but upslope movement is endogenous to the system. The question in the latter case is more about what factors currently limit the range of the species and whether the whole ecosystem moves upward together or at different rates. I also really liked the 'multiple-elemental limitation' as an overarching theory and the strong emphasis on phenology.

I thought the food web work was the least compelling aspect of the proposal. The intense variability in caterpillar abundance seems like an important feature of this ecosystem. Understanding what controls caterpillar abundance and what allows their populations to explode would provide an insight into this system. Is there an endogenous driver or are big years a consequence of some external process? The proposal clearly articulates some hypotheses, but the discussion is followed by several biogeochemical questions.

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The proposal is generally strong and most hypotheses are connected to a larger theoretical framework. However, the sheer number of hypotheses concerns me. It tends to give the impression of a scattershot of work that is only loosely connected. The ability to study soil, trees, streams, and animal populations is compelling, but I don't see the work on these different components as strongly connected, especially when you get away from the biogeochemistry presented earlier in the proposal.

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

Focusing on teacher professional development is an efficient use of project funds and personnel time. Most teachers have only a superficial understanding of science, yet the standards are increasingly emphasizing the practice of science as opposed to bulk knowledge of facts. Getting teachers involved is a great approach. Making sure that the training of teachers is aligned with the educational standards in the state is necessary. Similarly, having a clear idea of how lessons developed from LTER results will fit into a curriculum would make sure the lessons get used. The public outreach is good and the PIs have a strong record of bringing their knowledge and results into policy discussions.

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

One of the strongest aspects of this proposal is how the questions addressed in this proposal build on the most compelling results from prior years. There is an effort to have a larger conceptual framework around disturbance, but this fit some questions better than others. There is a strong biogeochemical perspective that helps unite a lot of the work, and phenology is emerging as another organizing factor.

Summary Statement

While there are some pieces that don't quite fit, this proposal makes a strong case for continued LTER funding.