

ILTER: Long-Term Ecological Research at the H.J. Andrews Experimental Forest (ILTER8)

Sponsor: National Science Foundation

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Overview:

The Andrews Forest LTER program is an integrated, interdisciplinary, 40-yr LTER program of research, education, and outreach dedicated to understanding how forest mountain ecosystems function, as driven by social and ecological processes. Andrews Forest research addresses fundamental ecological questions informed by ecological theory and social challenges. Andrews Forest LTER research integrates many approaches to research including long-term measurements, experiments, analyses, and modeling.

Intellectual Merit:

In the eighth cycle of the Andrews Forest LTER program (ILTER8: 2020-2026) the program will continue to be guided by a central question, "How do climate, natural disturbance, and land use as influenced by values and decisions interact with biodiversity, hydrology, and carbon and nutrient dynamics?" Recent analyses and syntheses of Andrews Forest long-term studies identified knowledge gaps requiring further research and data collection. In particular, we have discovered that microclimate conditions are highly spatially heterogeneous, and driven by fine-scale features such as forest canopy structure and fine-scale topography. Also, preliminary results indicate that the influence of warming temperatures on biodiversity may be strongly mediated by interactions among species. In response, ITER8 investigates the theme of "interactions," focusing on four interaction types, which represent uncertainties in predictions of change:

(1) how forests modulate the expression of regional climate to create local microclimate patterns in mountains; (2) how microclimate and legacies of land use and disturbance influence populations, communities and ecosystem processes; (3) how species interactions amplify or reduce responses to microclimate; and (4) how values filter the use of science in land use decisions.

ILTER8 also expands on the ecological concept of microclimate, derived from analyses of long-term data, and defined as fine-scale temporal and spatial variation of temperature and moisture in, and under the forest canopy and across the forest landscape. ITER8 also establishes several new studies to examine how climate stress effects may propagate across levels of ecological organization, including responses of tree canopy physiology and microbiomes to heat and moisture stress; cascading consequences for disturbance susceptibility, mortality, and forest productivity; altered seed production cycles and effects on mammals and top predators. A new integrated cross-taxa mechanistic experiment will elucidate how biotic interactions – particularly competition and facilitation – might amplify or dampen species responses to a changing climate. Finally, work on conservation ethics will examine how values affect the ways science is used in land-use decisions.

Broader Impacts:

The Andrews Forest LTER will continue collaborative experiments, demonstrations, field discussions, workshops, and seminars to connect our science to forest management and policy. The Andrews Forest LTER will also conduct a variety of STEM development activities for K-12, undergraduate and graduate students, teachers, and the public. Andrews Forest Schoolyard LTER will continue the successful model of engaging Oregon K-12 teachers in Andrews Forest science and professional development opportunities; working with teachers extends our impact on K-12 education exponentially. Site-based

education programs will give ca. 400 middle and high school students per year opportunities for hands-on inquiry at the Andrews Forest. As a research community comprising 42% women and underrepresented groups, the Andrews Forest LTER program will contribute to diversity and inclusion efforts. REU students, including students from disciplinarily diverse and traditionally underrepresented backgrounds, will conduct supervised research with mentors, and design and implement individual research projects.

The Andrews Forest LTER program will continue to engage the public through international, national, and regional media, tours, classes, and on-site programs (~1500 people/yr), the interactive Discovery Trail, and social media interactions (newsletter, website, Facebook, and Twitter). The arts and humanities program (LTEReflections) will host several dozen public events and gatherings and ~50 residencies for writers, musicians, and humanities scholars, leading to Andrews Forest-inspired writing, music, and art. The program anticipates that science conducted at the Andrews Forest will continue to inform forest policy – which will be particularly important given ongoing revisions to regional federal forest management plans.