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Primary Contact:
Josephine Meier, University of Washington
Bainbridge Island, United States

All Authors:
Josephine Meier, University of Washington **(Primary Presenter)**
Alexander Lowe, University of Washington
Sabine Both, University of New England
Andrew Christopher Oishi, USDA Forest Service
Evonne Aguirre, The City University of New York
Caroline A E Strömberg, University of Washington

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Using Leaf δ13C to Assess Water Use Efficiency within Plant Communities Across a Successional Gradient in Temperate and Tropical Forests

Formatted Title:

Using Leaf $\delta^{13}C$ to Assess Water Use Efficiency within Plant Communities Across a Successional Gradient in Temperate and Tropical Forests

Abstract:

Understanding how plant communities of the past have responded to disturbance events can provide valuable insights when managing our natural resources and assessing human impacts on ecosystems. The geologic record has the potential to reflect these responses through the analysis of functional traits, which relate directly to plant function and ecosystem strategy. There is currently little evidence of how functional traits measurable in fossil leaves vary across succession in different forest types. Because of this, there is a limited ability to identify disturbance as the primary driver of vegetation change within the fossil record. To improve

this ability, this study analyzes the carbon stable isotopic composition ($\delta^{13}C$) of bulk organic matter sampled at the community-scale across successional gradients in a temperate deciduous forest (North Carolina, USA) and compares them against values from a previous study across succession in a tropical evergreen forest (Malaysian Borneo). Leaf $\delta^{13}C$ is representative of a plant's water use efficiency (WUE), an important axis of ecological strategy representing the carbon assimilated per water lost in a plant during photosynthesis. Leaf $\delta^{13}C$ as a functional trait has the advantage that it is often preserved during leaf fossilization and, integrated across a plant community, can be informative about prevalent ecological strategies, functional diversity , and community assembly dynamics. In Borneo, the community-weighted mean of leaf $\delta^{13}C$ to be highest in early-succession plots, indicative of a higher WUE in plant communities closely following a disturbance event. Old growth plots were found to have a lower $\delta^{13}C$, and thus a more conservative WUE. This study will further investigate if this trend is followed within temperate forests, which is important as many mid-late Cenozoic plant assemblages come from what would have been temperate regions. Developing a method of identifying disturbances within the geologic record, will improve the ability to discern drivers of plant community change in the past. This improved knowledge will help guide management decisions across a range of ecosystems.

Video Recording of Presentations:
Yes

Session Chair/Moderator:
No

Judging Presentations:
No