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**Primary Contact:**
Melanie Cham, Wesleyan University
Middletown, United States

**All Authors:**
Melanie Cham, Wesleyan University **(Primary Presenter)**
Alexander Lowe, University of Washington
Dana Royer, Wesleyan University
Caroline A E Strömberg, University of Washington
William Rember, University of Idaho
Sophia Ronan, University of Washington

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Ecological Strategy of Pacific Northwest Forests During the Miocene Climatic Optimum

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Ecological Strategy of Pacific Northwest Forests During the Miocene Climatic Optimum

**Abstract:**

The U.S. Pacific Northwest (PNW) hosts an extensive suite of Miocene-aged fossil plants sites, with the potential to document changes in plant community ecology in response to regional climatic change during the Miocene Climatic Optimum (MCO; 17-14 Ma) and the ensuing Middle Miocene Climatic Transition (MMCT; ~14 Ma). The MCO was the most recent period of sustained global warming and thus provides some analogy to anthropogenic climate change. An important component of characterizing plant community ecology is the diversity and prevalence of ecological strategies present within a community. Many previous paleoecology studies rely on a nearest living relative approach to infer components of ecological strategy (e.g., plant functional types) from fossil plant assemblages. In contrast, much work in neo-ecology stresses the importance of functional traits in elucidating prevalent ecological strategies and functional diversity within plant communities.

Here we take advantage of exquisitely preserved leaf compression fossils from Clarkia, northern Idaho (~16.9 Ma), representing the height of the MCO, to measure leaf functional traits and elucidate ecological strategies of dominant species in this ancient temperate mixed conifer-deciduous-evergreen forest. We focus on 13 species, representing the most abundant angiosperm taxa in the assemblage, including Betula, Castanea, and Quercus. We reconstruct assimilation rates using gas exchange modeling, address leaf hydraulic efficiency by measuring leaf vein density, and reconstruct water use efficiency by accounting for the ratio of carbon assimilation to transpirational water loss. As these species are prevalent in many other Miocene floras of the PNW, this study provides a benchmark by which to interpret changes in the dominance or presence of these species through time and, by inference, how Miocene climatic changes impact the functional composition and diversity of this forest type. We are also providing an example of how present-day mixed deciduous forests may respond to current anthropogenic changes in $CO_2$.

**Video Recording of Presentations:**
Yes

**Session Chair/Moderator:**
No

**Judging Presentations:**
No