**FORECASTING LICHEN CLIMATE RESPONSES FROM ECOPHYSIOLOGICAL TO LANDSCAPE SCALES**

Robert J. Smith1\*; Linda H. Geiser1; Maria Valentin2; Abigail Meyer2; Jean Pengra3; Daniel Stanton2

1 USDA Forest Service, Air Resource Management Program, USA; 2University of Minnesota, USA; 3Macalester College, USA \* E-mail: [robert.smith3@usda.gov](mailto:robert.smith3@usda.gov)

How will atmospheric changes alter the functioning, persistence and distribution of forest lichens? Here, we integrate physiological, community and landscape-level responses of epiphytic macrolichens in US forests, to forecast their climate-driven dynamics. At a local scale, whole-ecosystem warming and drying caused photobiont loss, deterioration of photosynthetic efficiency, net C losses, and gross biomass declines. We show that physiological responses depended on individuals’ sizes, suggesting unequal impacts among demographic cohorts. Species’ physiological limits, when combined with local climate exposure, make communities vulnerable to compositional shifts. Highest vulnerability was predicted at low-elevation and southerly US sites exposed to warming and drying. This expectation was tentatively supported by lichen community changes observed in foothills and montane sites resurveyed over a 20-year period in the northwestern US. Promisingly, we found that hypothetical air-quality improvements (lowered reactive-N deposition) could help offset the community-level effects of climate warming expected in the next century. We conclude by mapping dispersal pathways by which flagship lichen species might track favorable climates, as constrained by suitable forested habitats in a landscape mosaic. Overall, the cross-scale integration of experiments, long-term observations and spatial forecasts can help refine expectations of lichen dynamics under varying climates in coming decades.