2015 Great Smoky Mountains National Park Science Colloquium

Thursday, March 19, 2015, The Park Vista Hotel, Gatlinburg

1:00 Welcome and Introductions — Paul Super, NPS

1:10 C. Reed Rossell, Jr., H. David Clarke, Steven C. Patch, and Mary Schultz, University of North Carolina at Asheville, and Ed Schwartzman, North Carolina Natural Heritage Program, NC — **Investigating the Status and Condition of Rich Montane Seeps in Great Smoky Mountains National Park.**

1:30 John C. Maerz and Jennifer Asper, Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA — **The Status of Green Treefrog (*Hyla cinerea*) Invasions of Cades Cove, Great Smoky Mountains National Park and Potential Threats to Native Amphibians.**

1:50 Jennifer Asper and John C. Maerz, Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA — **Using Individual Based Modeling (IBM) in the Development of a Management Program for Introduced Green Treefrogs (*Hyla cinerea*) at Great Smoky Mountains National Park.**

2:10 break

2:25 David Mitchell, NEON Inc. Domain 07, Oak Ridge, TN. — **NEON: A Great Smoky Mountains Perspective.**

2:45 Douglas K. Miller, University of North Carolina at Asheville, NC, and Ana P. Barros and Anna M. Wilson, Duke University, Durham, NC — **Eight Years of Catching Hydrometeors in the Great Smoky Mountains National Park and Pigeon River Basin.**

3:05 Clare Aslan, Arizon-Sonora Desert Museum, Tucson, AZ, and Benjamin Sikes, Kansas University, Lawrence, KS — **The relationship between aboveground and belowground forest structure across a diversity of forest types and site histories.**

3:25 William W. Hargrove, J.P. Spruce and S.P. Norman, USDA Forest Service, Southern Research Station — **ForWarn and Decadal Trends in Forest Health**

3:45 Conclusion: Farewell.

Title: Investigating the Status and Condition of Rich Montane Seeps in Great Smoky Mountains National Park.

Authors: C. Reed Rossell, Jr. [1], H. David Clarke[1], Steven C. Patch[1], Mary Schultz[1], and Ed Schwartzman[2] (**edward.schwartzman@ncdenr.gov).**

[1]University of North Carolina, Asheville, NC; [2]North Carolina Natural Heritage Program, Swannanoa, NC.

Abstract: High Elevation Rich Montane Seeps are rare wetland communities endemic to high elevations of the southern Appalachian Mountains. Currently, little information is available on the status and condition of this natural community in the Great Smoky Mountains National Park (GSMNP), particularly as they pertain to disturbance from wild hogs. This study evaluated the status and condition of High Elevation Rich Montane Seeps across the GSMNP, with objectives to 1) describe the plant and salamander species assemblage; 2) estimate the level of hog disturbance; 3) examine the effects of wild hogs on plant and salamander communities; and 4) investigate the habitat attributes that influence wild hog disturbance. We sampled 35 High Elevation Rich Montane Seeps representing 24 separate drainages within hardwood forests above 1067 m (3500 feet) across the park. We established a transect in each seep and sampled plots at 5-meter intervals. Within each plot, we measured hog disturbance, vegetation, the salamander community, and microsite characteristics. Forty-nine percent of seeps and 54% of drainages had some evidence of hog disturbance, and impacted seeps had an average of 34% of their area disturbed by hogs. One hundred eighty species of plants were recorded in the seeps. Wild hog activity negatively affected total plant cover ($P < 0.0001$) and plant species richness ($P = 0.0004$). A total of 315 salamanders, representing 10 species were recorded in the plots. Wild hog activity negatively affected salamander densities ($P = 0.037$). At the seep level, the only habitat attribute that affected hog disturbance was slope ($r = -0.43$, $P = 0.011$, all other $P > 0.05$). These findings suggest that High Elevation Rich Montane Seeps in the GSMNP have been substantially impacted by wild hogs and both plant and salamander populations are at risk of degradation from hog disturbance. In addition, seeps on flatter terrain may be more vulnerable to wild hogs than those on steep terrain. Further surveys of High Elevation Rich Montane Seeps may help identify additional high quality examples and lead to a better understanding of the dynamics of hog disturbance in order to develop and implement protection measures for this rare community.

Title: The Status of Green Treefrog (*Hyla cinerea*) Invasions of Cades Cove, Great Smoky Mountains National Park and Potential Threats to Native Amphibians.

Authors: John C. Maerz (**jcmaerz@uga.edu**) and Jennifer Asper, Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA.

Abstract: Great Smoky Mountain National Park (GSMNP)'s mission is to manage its diverse resources in ways that leave them generally unaltered by humans. Management includes identifying sources and routes of spread for invasive species and threats to native species. Green Treefrogs (*Hyla cinerea*) are native to the southeastern piedmont and coastal plains. Prior to 2002, *H. cinerea* were not known within GSMNP, but in 2011, were detected within the wastewater ponds near the Cades Cove campground. In 2013-2014 we documented the abundance and distribution of *H. cinerea* to evaluate risks to native species. *H. cinerea* occupied open canopy, relatively permanent wetlands throughout Cades Cove with hundreds to thousands of breeding adults at some sites. Experiments confirmed shade and poor litter quality limit *H. cinerea* tadpole development within forested wetlands. In 2013, *H. cinerea* bred at numerous ephemeral wetlands that support breeding of Eastern Narrow-mouthed Toad (*Gastrophryne carolinensis*), which are sensitive to competition with *H. cinerea*. In 2014, we captured a hybrid between a native Gray Treefrog (*H. chrysoscelis*) and an invasive Green Treefrog. The extent to which *H. chyrsoscelis* and *H. cinerea* hybridize within Cades

Cove is not known, but hybridization with invasive species is a known threat to the conservation of native species. Our work suggests that the narrative of *H. cinerea* invasion of Cades Cove is dubious and likely more complex, and the invasion may pose threats via competition or hybridization to some native amphibian species.

Title: Using Individual Based Modeling (IBM) in the Development of a Management Program for Introduced Green Treefrogs (*Hyla cinerea*) at Great Smoky Mountains National Park.

Authors: Jennifer Asper (**jennifer.asper@gmail.com**) and John C. Maerz, Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA.

Abstract: The mandate of Great Smoky Mountain National Park (GSMNP) is to preserve its resources in ways that will leave them essentially unaltered by human influences. *Hyla cinerea* is a native southeastern amphibian that is not native to GSMNP, but appears to have undergone a recent introduction and remarkable expansion throughout Cades Cove within the past few years. *H. cinerea* were first detected in 2011, and by 2013 occupied multiple wetlands around the cove at breeding densities in the thousands at some sites. Management decisions for *H. cinerea* require a plausible narrative for how this invasion has occurred. Specifically, we need to understand how the species were introduced and spread through the cove and what factors regulate where the populations currently breed. We used Individual Based Models (IBM) to investigate scenarios for the dynamics of this *H. cinerea* invasion within Cades Cove. Individual Based Modeling uses programmed behavior to allow simulate the behavior and success of individuals within populations to determine whether simulated populations produce emergent patterns (known population sizes and occurrences within the Cove). We varied attributes of *H. cinerea* initial population sizes, life history, and dispersal behaviors and capabilities to evaluate potential for a single introduction followed by natural spread to generate current patterns of occurrence and abundance. We also simulated scenarios that include the movement of animals by tourists. By contrasting possible narratives for the introduction and spread of *H. cinerea*, we can identify management actions for control or elimination of *H. cinerea* from the Cove.

Title: NEON: A Great Smoky Mountains Perspective.

Authors: David Mitchell (**dmitchell@neoninc.org**), NEON Inc. Domain 07, Oak Ridge, TN.

Abstract: The mission of the National Ecological Observatory Network (NEON) is to enable understanding and forecasting of the impacts of climate change, land use change and invasive species on continental-scale ecology – by providing infrastructure and consistent methodologies to support research and education in these areas. NEON monitors the responses to change observed in biodiversity, ecohydrology, infectious disease and biogeochemistry through aquatic, organismal, biogeochemical, and airborne sampling. The Terrestrial Observation System (TOS) will collect data on biogeochemical cycles, infectious diseases, and a suite of focal taxa to characterize local patterns, dynamics, and linkages in terrestrial ecosystems. The selected taxa are designed to be widespread, capture a wide range of turnover time, and diverse evolutionary histories.

Title: Eight Years of Catching Hydrometeors in the Great Smoky Mountains National Park and Pigeon River Basin.

Authors: Douglas K. Miller[1] (**dmiller@unca.edu**), Ana P. Barros[2], and Anna M. Wilson[2].

[1]University of North Carolina, Asheville, NC; [2]Duke University, Durham, NC.

Abstract: A high elevation rain gauge has been in place in the Great Smoky Mountains National Park and Pigeon River Basin for nearly eight years as part of a joint study between Duke University, UNC Asheville, and NASA. The presentation will focus on what has been learned over the eight years, a review of the recent IPHEx field experiment, and a look to the future for what will be possible for extending the hydrological record and scientific collaboration.

Title: The relationship between aboveground and belowground forest structure across a diversity of forest types and site histories.

Authors: [1]Clare Aslan (**clare.aslan@gmail.com**) and [2]Benjamin Sikes.

[1]Arizona-Sonora Desert Museum, Tucson, AZ; [2]University of Kansas, Lawrence, KS.

Abstract: Soil community dynamics are fundamental to ecosystem function, yet our understanding of soil processes and characteristics remains spotty. In particular, a more thorough understanding of the relationship between belowground and aboveground forest traits could help with assessment of forest community health and biodiversity trends. Identifying aboveground indicators of belowground conditions could help to streamline data collection and improve our understanding of forest conditions across a wide diversity of sites. We are examining aboveground forest characteristics and soil characteristics in Great Smoky Mountain research sites spanning a diversity of forest types and management histories, to assess whether consistent relationships between aboveground and belowground conditions can be detected. Our preliminary research explored vegetation and soil characteristics across stratified sites. Based on these data, a discriminant analysis correctly predicted the management history of nearly three-quarters of our study sites. We are now assessing the relationship between measured variables and disturbance histories and planning additional, expanded sampling.