2012 Coweeta LTER Summer Meeting and Symposium Report
28 June 2012

Jason P. Love, CWT LTER Site Manager

AGENDA

Tuesday June 26 - Symposium

8:00 Light breakfast

8:30 Welcome (Love/Gragson)
8:40 Summary of Coweeta Hydrologic Laboratory research (Ford)
8:55 Environmental controls on the activity and abundance of ammonia oxidizing microorganisms in Coweeta soils (Norman)
9:15 Nitrogen cycling "hotspots": An approach for watershed scale assessments (Baas)
9:35 Long-term sulfur cycling at Coweeta Hydrologic Laboratory, NC (Knoepp)
9:55 Effects of Hemlock Mortality and Nitrogen Deposition on Ecosystem Nitrogen and Phosphorus Cycling (Fraterrigo)

10:15 Break and Poster Session (1 hour)

11:15 Future species composition will affect forest water use after loss of eastern hemlock from southern Appalachian forests (Brantley)
11:35 Listening to Nature, Listening to Community: Progress from the Coweeta Listening Project (CLP) (Heynen)
11:55 Magnifying Complexity: Using the Integrative Framework to understand exurbanization in Macon County, North Carolina (Vercoe)

12:15 Lunch (1 hour)

1:15 Variation in hydrologic and sediment transport behavior among the nine intensively monitored watersheds in the Upper Little Tennessee River Basin (Jackson)
1:35 The "Ring of Asphalt" and Changing Precipitation in Southern Appalachia: A regional perspective (Shepherd)
1:55 Evaluating and Exploring Patterns of Satellite-predicted Forest Phenology in the Southern Appalachians (Prebyl)
2:15 Has climate warming moved a hybrid zone between low and high elevation salamanders species upslope? (Pechmann)
2:35 Ontogenetic niche shifts in eastern U.S. trees (Zhu)

2:55 Break and Poster Session (45 minutes)

3:40 Riparian disturbance restricts connectivity of Appalachian stream salamander Populations (Cecala)
4:00 Competition for facilitation: Seasonal seed segregation in ant-plant mutualisms (Warren)
4:20 Long-term trends from the LTWA/LTLT Biomonitoring Program: A preliminary analysis (Dehring & Chamblee)
4:40 Suspended Development: Differential Effects of Land Clearing and Human Habitation on Birds (Beasely)

5:00 Social and poster session at Coweeta Dorm

6:30 Dinner at Coweeta Dorm

Wednesday June 27th – Coweeta LTER Meeting for PIs, Graduate Students, and Technicians

8:00 Light breakfast

8:30 Welcome

8:35 The Coweeta Hazard Site Project (CHSP): A Long-Term Study of Stream Ecosystems and How They Respond to Different Land Use Trajectories in the Southern Appalachians (Sullivan)

8:55 Update on NASA climate change/songbird research at Coweeta (Hepinstall-Cymerman)

9:05 Opportunities to link science and conservation (Love)

9:15 Open discussion and debriefing on presentations

10:00 Break

10:30 Coweeta LTER Terms of Reference moving into the 2014 Renewal

12:15 Lunch

1:00 Conference room is available in the afternoon for working & discussion groups

4pm Adjourn

2012 Coweeta LTER Summer Symposium
26 June 2012

Oral Presentation Abstracts

Environmental Controls on the Activity and Abundance of Ammonia Oxidizing Microorganisms in Coweeta Soils

J.S. Norman & J.E. Barrett

Department of Biological Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA

Ammonia Oxidation is the rate-limiting step of nitrification, a critical nitrogen transformation that controls nitrogen mobility in terrestrial ecosystems. Ammonia oxidation is performed by two phylogenetically disparate groups of microorganisms, Ammonia Oxidizing Bacteria (AOB) and recently-discovered Ammonia Oxidizing Archaea (AOA). We used net-nitrification incubations and culture-independent PCR-based techniques to investigate environmental controls on the abundance and acitivity of these organisms in Coweeta soils. We found a strong positive relationship between soil pH and AOB abundance, while AOA abundance peaked at low pH (~5.3) conditions. Furthermore, we found that AOA abundance was better predicted by ammonium (NH_4^+) availability, while AOB abundance was better predicted by ammonia (NH_3) availability, which we calculated from temperature and edaphic conditions at each site. We detected growth in each group during net-nitrification incubations, indicating that both AOA and AOB are active in Coweeta soils. Since these groups demonstrate fundamentally different ammonia oxidation kinetics, these findings contribute to a better understanding of nitrifrication as a process in Coweeta Soils.

Nitrogen cycling "hotspots": An approach for watershed scale assessments

Peter Baas[1], Jacqueline Mohan[1], Daniel Markewitz[2], & Jennifer D. Knoepp[3]

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The high level of spatial and temporal heterogeneity in nitrogen cycling processes hinders our ability to develop an ecosystem-wide understanding of this cycle. This study examines how the incorporation of spatial "hotspots" of soil moisture, carbon, nutrients, and soil texture can better explain ecosystem nitrogen cycling. Sites (80 m x 80 m) distributed over an elevation gradient (788 m-1389 m) and regionally representative vegetation gradient. Starting in November 2010, surveys assessing soil moisture (bimonthly) using electromagnetic induction (EMI) and soil nutrient and carbon content (extractable NH_4^+, acid extractable PO_4^{3+}, total C, and total N) (quarterly) using near infrared reflectance spectroscopy (NIRS). Soil texture analysis was conducted in June of 2011. As indicators of potential nitrogen cycling rates, quarterly laboratory

assays were conducted for potential denitrification and nitrification from March 2011 through March 2012. Stepwise multivariate regression analysis with minimum corrected Akaike Information Criterion (AICc) was used to determine the most appropriate model of predictors for nitrogen cycling processes. Overall, NIRS data was able to explain 38-44% of the potential denitrification rates ($p<0.01$) and 88-98% of potential nitrification variability ($P<0.01$). EMI data was significantly related to soil moisture, explaining 20%-52% of the variability. Multivariate regression combined with AICc analysis, revealed that conductivity and clay content explained 45% (0-5 cm) and, when also including P, 74% (10-20 cm) of the potential denitrification variability ($p<0.05$). This study showed the potential of geophysical tools in developing an ecosystem level understanding of the nitrogen cycle.

Long-term sulfur cycling at Coweeta Hydrologic Laboratory, North Carolina, USA

Jennifer D. Knoepp, James M. Vose, Wayne T. Swank, & Chelcy R. Ford

USDA Forest Service, Southern Research Station, Coweeta Hydrologic Laboratory, Otto, NC

In the U.S.A., the Clean Air Act of 1970 and the Clean Air Act Amendment of 1990 (US Public Law 101-549) (CAAA) were implemented to improve air quality and decrease emissions of atmospheric pollution, including sulfate sulfur. Studies examining the biogeochemical cycling of nutrients and pollutants, including measurements of bulk precipitation and stream chemistry, began at Coweeta Hydrologic Laboratory in 1972. The Coweeta Hydrologic Laboratory is a 2185 ha basin located in the Nantahala Mountains of western North Carolina, U.S.A., wherein elevations range 675–1592 m. Precipitation inputs vary along the elevation gradient within the Coweeta basin; annually, low- and high-elevation watersheds receive 148 and 237 cm of precipitation on average, respectively. Although sulfate concentration does not vary across this gradient, due to the increased rainfall amount, high elevation watersheds receive increased SO_4 deposition. Our analysis shows that following the implementation of the CAAA, bulk precipitation SO_4 concentration decreased by 28% from an average annual concentration of 41μeq L^{-1} from 1973 to 1990 to an average of 30 μeq L^{-1} in 1991 to 2008. This decline in sulfate input resulted in increased water quality, as stream SO_4 concentration decreased; however, the magnitude and timing of the decreases in stream sulfate concentrations differed between the high- and low-elevation watersheds. Stream SO_4 concentrations in a low elevation watershed declined by 27%, from an average of 11 μeq L^{-1} during the 1973 to 1990 period to 8 μeq L^{-1} post 1990; whereas, in the high elevation watershed stream sulfate declined by only 15% with pre-1990 concentrations of 26 μeq L^{-1} declining to 22 μeq L^{-1} after 1990. This difference is due to greater retention of bulk sulfate deposition by the low elevation watershed which increased from 80% to 86% in 1973-1990 and 1990–2008, respectively while retention by the high elevation watershed increased from 41% to 44%, reflecting little change as a result of declining deposition. Temporally, changes in stream SO_4 export from the low elevation watershed coincide with changes in SO_4 inputs; however, changes in SO_4 export from a high-elevation watershed manifest after a year from when changes in SO_4 inputs occur. This pattern may reflect differences in soil SO_4 adsorption patterns and processes within the two watersheds. For example, the ratio of irreversibly to reversibly adsorbed SO_4 may be greater in the low elevation watershed. We examined the impact of the CAAA using long-term precipitation and stream sulfate data at Coweeta Hydrologic Laboratory and found that reductions in sulfate emissions

resulted in decreased sulfate deposition and decreased stream sulfate concentrations however, data show that high- and low-elevation watersheds respond differently suggesting high elevation sites have greater sulfate sensitivity.

Effects of Hemlock Mortality and Nitrogen Deposition on Ecosystem Nitrogen and Phosphorus Cycling

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Multiple interacting stressors are generating unprecedented challenges to ecosystem resilience, necessitating efforts to understand how ecosystems will respond to concurrent biotic and abiotic changes. To assess these challenges, we examined the effects of eastern hemlock (*Tsuga canadensis*) mortality due to infestation by hemlock woolly adelgid, an exotic insect, on nitrogen and phosphorus cycling at three elevations (low, mid, high) subject to increasing atmospheric nitrogen deposition in mixed hardwood stands in western North Carolina. We found that total forest floor and mineral soil nitrogen increased and forest floor and soil carbon to nitrogen ratio decreased with elevation, suggesting that high elevation stands are accumulating available nitrogen. Subsurface leaching of inorganic nitrogen increased with nitrogen availability in reference stands as expected, but there was no relationship between nitrogen loss and availability in stands experiencing hemlock decline. Greater bioavailable soil P stocks in high elevation stands appear to have modulated ecosystem response to hemlock decline. Soils from high elevation stands, where N availability was greatest, had 139% larger organic P pools and 55% smaller residual and refractory P pools than soils from low elevation plots with less N available. Moreover, high elevation stands containing declining hemlocks had significantly greater foliar P concentrations and fluxes of P from the forest floor than reference plots at similar elevations; there were no consistent differences between stands at low and mid-elevations. Higher foliar nitrogen and phosphorus as well as increased hardwood growth in high elevation stands suggest that hemlock decline has liberated P and thereby stimulated nitrogen uptake by healthy vegetation within this mixed forest. This interaction may contribute to decoupling the relationship between nitrogen deposition, resulting in increased N retention and decreased ecosystem nitrogen loss.

Future species composition will affect forest water use after loss of eastern hemlock from southern Appalachian forests

Steven T. Brantley[1], Chelcy R. Ford[2], & James M. Vose[2]

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Infestation of eastern hemlock (*Tsuga canadensis* (L.) Carr.) with hemlock woolly adelgid (HWA) has caused widespread mortality of this key canopy species throughout much of the

southern Appalachian Mountains in the past decade. Our objective was to estimate changes in stand level evapotranspiration (E_t) since HWA infestation and predict future effects of forest regeneration on forest E_t in declining eastern hemlock stands. We used a combination of community surveys, sap flux measurements, and empirical models relating sap flux scaled leaf-level transpiration (E_L) to climate to estimate the past and future effects of hemlock mortality on forest E_t. From 2004 to 2010, eastern hemlock die-off reduced annual forest E_t by 26% and reduced winter E_t by 70%. Hemlock is being replaced by species with less conservative transpiration rates, such as sweet birch (*Betula lenta* L.). As a result, we predict rapid recovery of annual stand E_t and a long-term increase in forest E_t. The dominance of deciduous species in the canopy will likely result in permanent changes to seasonal patterns of forest E_t, with potential decreases in summer stream discharge and increases in winter stream discharge.

Listening to Nature, Listening to Community: Progress from the Coweeta Listening Project (CLP)

Nik Heynen

Department of Geography, University of Georgia, Athens, GA

This presentation will discuss the progress and results from the "Coweeta Listening Project" (CLP), which was established to make the scientific results of the Coweeta LTER more meaningful and useful to individuals in all walks of life living in, and around, Macon County, North Carolina. The Coweeta Listening Project (CLP) seeks to translate long-term ecological science done within the Southern Appalachians into forms of knowledge that can have meaningful ramifications for a wide range of groups (citizens, public institutions, etc.). The CLP has five objectives: 1) Facilitate communication between Coweeta LTER researchers and the community. We want to learn about the concerns, interests, and objectives of local residents, environmental organizations and policy makers and incorporate their feedback into our research; 2) Communicate Coweeta LTER research so that a clear link is made between science, policy and the community; 3) Serve as a non-partisan information clearinghouse for the community, posting materials and event notices related to a spectrum of ecological issues; 4) Provide information about how the community can use research results, archived sources, and collaborative tools in order to participate more effectively and knowledgeably in personal and community-based decision making regarding land use and land change; 5) Respond to community feedback and grow to better serve the community and LTER scientists. Ultimately, the CLP seeks to improve understanding of the steps necessary for translating scientific results about ecological issues into more democratically produced forms of information that can benefit larger proportions of local communities.

Magnifying Complexity: Using The Integrative Framework to understand exurbanization in Macon County, North Carolina

Karen Allen[1], Shannon Nicole Bonney[2], Peter Brosius[1], David Charles[3], Brian Crawford[4], Jennifer Ann Demoss[1], Dean Hardy[1], Sara Heisel[2], Nik Heynen[3], Rebeca G. de Jesús-Crespo[2], Nathan Nibbelink[4], Lowery Parker[3], Catherine Pringle[2], Alana Shaw[3], Levi Van Sant[3], Richard Vercoe[3], &

Meredith Welch-Devine[1]

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This paper applies an integrative framework to illuminate and discuss the complexities of exurbanization in Macon County, North Carolina. The case of Macon County, NC, highlights the complexity involved in addressing issues of exurbanization in the southern Appalachian region. Exurbanization, the process by which urban residents move into rural areas in search of unique natural amenities and idealized lifestyles, can often dramatically impact the local economy, culture, and environment. Within Macon County complex debates and tensions among multiple stakeholder parties struggle to address local residential development. How can better problem definition benefit rural communities in addressing exurbanization pressures and effects? We assert that a key factor in the shortcomings of previous solutions is the shortsightedness inherent in policy that attempts to treat individual symptoms without being able to adequately characterize the underlying problem. The goal of the integrative framework is to initiate an iterative process of transparent negotiation, which recognizes a range of potential choices to be considered and to embrace the social complexities that can at times overwhelm scholars and practitioners, inviting simplification and polarization of the issues. This new and emerging framework offers a novel way of approaching conservation and development issues where other frameworks have failed. It helps acknowledge the difficult choices (trade-offs) that have to be made in a material process like exurbanization. Trade-offs will be necessary in any negotiation related to conservation. Therefore, conflict surrounding specific values (for example, cultural, financial, or ecological) must be acknowledged upfront in order to move deeper into issues of plurality. Given the complexity, understanding how the process of exurbanization is being played out within Macon County provides not only an opportunity to demonstrate the functionality of an integrative approach, but also a call for further study of exurbanization dynamics.

Variation in hydrologic and sediment transport behavior among the nine intensively monitored watersheds in the Upper Little Tennessee River Basin

C. Rhett Jackson & Bob Bahn

Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA

From late summer 2010 through early fall 2011, hydrology and water chemistry were monitored in nine watersheds varying in spatial distributions of human land use. Monitoring included continuous recording of water level and specific conductivity, regular baseflow sampling, and stormflow sampling with an ISCO automated sampler. Rating curves were developed to convert the stage time series into flow time series. The nine watersheds included two fully forested watersheds, three watersheds with small farms and rural residences in the valleys (classic S. Appalachian land use), three watersheds with small farms and rural residences in the valleys but also with homes built on the hillslopes and ridges (mountainside development), and one

watershed draining urbanized areas of the City of Franklin, NC. We analyzed these data to test the following hypotheses: that different land use distributions would produce different hysteretic behavior of sediment concentrations during storms, that the slope of the sediment rating curves would increase with increased valley and mountainside development, and that the high and low flow durations would become more extreme with increased valley and mountainside development.

The "Ring of Asphalt" and Changing Precipitation in Southern Appalachia: A regional perspective

J. Marshall Shepherd & Chris Strother

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A generation of studies (see Shepherd et al. 2010) has confirmed that urban land cover and aerosols can modify the atmospheric component of the water cycle, particularly precipitation. To our knowledge, no study has examined this problem from the perspective of Southern Appalachia. The Coweeta LTER and its focus on exurbanization has forged a new research pathway to examine how urban land cover growth in the region has modified the accumulation and intensity of precipitation. Results from the analysis of the National Land Cover Dataset (NLCD) clearly indicate a proliferation of urban land cover in Southern Appalachia from the 1980's to the present (i.e. the "ring of asphalt"). We have also analyzed cumulative rainfall and trend data from Oregon State-PRISM, North American Regional Reanalysis, and the U.S, Historical Climate Network. Analysis suggests that areas of intensive urban land cover expansion are associated with positive rainfall anomalies and positive trends. We will present these findings and discuss future directions and challenges (e.g., How is the Coweeta rainfall climatology influenced by urbanization and other hydrometeorological forcing? Are there physical and social vulnerabilities to possible urban rainfall effects?).

Evaluating and Exploring Patterns of Satellite-predicted Forest Phenology in the Southern Appalachians

Thomas J. Prebyl & Jeffrey Hepinstall-Cymerman

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Current research indicates that warming global temperatures are capable of altering phenological cycles in deciduous forests. Potential climate inducted changes to deciduous forest phenology are particularly important as they form the base for higher level trophic interactions and affect carbon and water cycles. Remote sensing technology provides an efficient means to monitor changes in vegetation phenology continuously through space and time, though application is limited by the difficulties in relating satellite signals to local phenological events. In this research we employed MODIS satellite data to predict the timing of spring leaf emergence for the years 2001 – 2012 and validated this approach by comparing to intensive ground observations we collected at the Coweeta Hydrologic Laboratory. Additionally, we used a network of 50 temperature loggers and 7 long term climate stations to create a spatially explicit

daily temperature model for our study region. Finally, we utilized a multimodel inference approach to test hypotheses regarding the relative influence of spring temperatures, winter temperatures, and photoperiod on the timing of satellite-predicted spring forest phenology. Our evaluation of MODIS satellite data indicates that on average predicted dates of leaf onset are accurate to within 3 days. We also find that warmer spring temperatures advance spring leaf emergence, however the magnitude of the response to warmer temperatures varies widely at a local scale both within and among species.

Has climate warming moved a hybrid zone between low and high elevation salamander species upslope?

Joseph Pechmann[1], Jeremy Hyman[1], Robert Warren[2], Kenneth Kozak[3], & R. Haven Wiley[4]

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We and Nelson Hairston, Sr. studied a hybrid zone between *Plethodon shermani*, a high-elevation salamander, and *P. teyahalee*, a low-elevation salamander, in the Nantahala Mountains of NC from 1976-present. *Plethodon shermani* is characterized by red legs, *P. teyahalee* by white spots, and hybrids by intermediate phenotypes. We scored the amount of red and the amount of white spotting separately for approximately 20 *Plethodon* along an altitudinal gradient at 686, 777, 869, 960, and 1052 m annually during September. Subtracting the white score from the red score provided a phenotype index. We used autoregressive-moving-average time series models to test the hypothesis that climate warming has favored upward expansion of low elevation (*P. teyahalee*) phenotypes. The average amount of white spotting relative to red legs increased at the highest elevation whereas the reverse occurred at the lowest elevation at a similar rate, indicating expansion of the hybrid zone in both directions. The center of the hybrid zone has either remained stationary or moved downslope over time. Mean temperatures at the study site have increased since 1976 but there was no significant trend in precipitation during this period. Including measures of mean annual temperatures in models either did not improve model fit or showed that representation of the high elevation phenotype increased after warm years, depending on elevation. Although expansion of the hybrid zone could eventually eliminate pure parental genotypes, especially of the less widespread *P. shermani*, we found no evidence that changes in the hybrid zone were correlated with climate warming in the expected directions.

Ontogenetic niche shifts in eastern U.S. trees

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Biogeographic responses of plant species to climate change are determined by the requirements of juveniles, which can limit spread to new environments. By contrast, most models of climate response are calibrated to adults, which may not reflect the climate that determined their original establishment. Despite a large literature on ontogenetic niche shifts in animals, there is little direct evidence for plants that could provide insight on its consequences for migration potential. Using USDA Forest Service's Forest Inventory and Analysis (FIA) data, we built a species distribution model to jointly quantify juvenile and adult trees' abundance distributions in relationship with the two most commonly used climatological variables, temperature and precipitation. To accommodate the mismatch between fine scale biological processes and coarse scale climate variables we introduced an aggregation approach to climate calibration. The fitted model allowed us to compare differences between juveniles and adults in climate relationships. All species show similar climate optima for juveniles and adults. However, some species showed broader climate calibrations for adults, whereas others showed broader climate calibration for juveniles. The differences could be partly a consequence of ontogenetic niche differences and partly due to other factors that impact climate response. Ontogenetic climate expansion would be suggested when adult niches are broader than juvenile niches. This could be expected if adults integrate over fluctuating windows for juvenile establishment in the past, while juveniles more narrowly reflect the current climate conditions. Seedlings can have narrower niche requirements owing to limited root systems, low carbon reserves, and reduced photosynthetic capacity. On the contrary, niche contraction could be suggested by adult niches that appear narrower than those of juveniles. This could occur if seeds can establish in sink populations, where they ultimately do not replace themselves due to competition or herbivory. We demonstrate for a large number of species across eastern North America how climate calibrations of both adults and juveniles are impacted by climate change and the emerging role of new competitive environments and natural enemies.

Riparian disturbance restricts connectivity of Appalachian stream salamander populations

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Movement and dispersal among populations can be critical for long-term population maintenance particularly in the context of environmental change. For organisms with movements restricted to streams, barriers to movement can be particularly effective at fragmenting and isolating stream fragments. Although research has identified several types of in-

stream barriers to connectivity of stream populations, the role of out-of-network conditions on in-stream dispersal is less understood. We investigated the potential for canopy gaps to fragment stream salamander populations by looking at the willingness of individuals to move across canopy gaps. We used capture-mark-recapture of displaced larvae and adults *Desmognathus quadramaculatus* individuals to estimate return rates across canopy gaps of varying widths. We found that *D. quadramaculatus* individuals were 6.3 times more likely to return to their capture location along a fully forested stream than they were to return if it required crossing a forest gap, and this effect was present with gaps as small as 13 m. Because small gaps can dramatically reduce the movement of both adult and larval salamanders, even local streamside activities such as roads and power lines could create barriers to significantly fragment stream populations in otherwise fully forested areas. Although streams are often considered to have high permeability to aquatic movement, our study demonstrates that riparian disturbance can greatly reduce this permeability. Given that riparian removal is only a first step in the process of land-use conversion, our results likely indicate conservative estimates of the overall impacts of exurban and residential land-use conversion on stream salamander movement.

Competition for facilitation: seasonal seed segregation in ant-plant mutualisms

Robert J. Warren & Mark Bradford

Yale School of Forestry and Environmental Sciences, Yale University, New Haven, CT

Competition and cooperation structure ecological communities, though consideration of mutualistic interactions is more recent in ecological theory and research. Most mutualisms are diffuse with multiple participants (e.g., pollination) and members may compete for mutualists, but competition and cooperation often are studied independently. In eastern North America, many woodland herbs depend on ant-mediated seed dispersal and many ants retrieve seeds. We use meta-analysis of published data, experimental seed introductions and video-taped ant-seed interactions to investigate facilitated seed dispersal and ask if ants compete for seeds and if plants compete for ants. Size matters in seed selection by ants, and we use metadata to demonstrate that ant-dispersed plant species segregate the dispersal season with seed size increasing across species from early spring to summer, whereas other woodland plants exhibit no temporal bias in seed size. This pattern may occur because alternate ant scavenge items (e.g., dead insects) become more available as the season progresses, and only larger seeds may remain attractive to ants. Indeed, the placement of a large, late seeds in trays with small, early seeds consistently inhibits ant removal of the smaller seeds from spring through summer. One possibility is that seed size corresponds with the foraging time of individual ant species in the seed-dispersing guild, but only one genus, *Aphaenogaster*, dominates seed removal throughout spring and summer regardless of seed size. *Aphaenogaster* spp. showed no signs of aggressive or territorial behavior toward other ants at seed stations, but dominated seed removal via considerably higher foraging densities than other ant species. Overall seed removal remained consistent from spring to summer, but only because the foraging density of *Aphaenogaster* ants increased significantly; per capita seed removal dropped significantly as the season progressed. Our results indicate that plants with smaller seeds drop them early in the ant foraging season when dispersers are few, but also when the more desirable larger seeds, and alternate scavenge, are absent. For the ants, *Aphaenogaster* spp. dominate seed removal regardless of seed size or

seasonal timing without demonstrating any aggressive or territorial behavior toward other ants but through sheer density of foraging workers on the forest floor.

Long-term trends from the LTWA / LTLT Biomonitoring Program: a preliminary analysis

Carolyn A. Dehring[1], John F. Chamblee[2], & William O. McLarney[3]

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We use data from Bill McLarney's twenty-year multi-site survey of fish diversity and abundance to mine for longitudinal trends in the proportional change of key species across the Little Tennessee River basin. By using relatively simple models that use sampling sites as fixed-effect controls, we provide preliminary results showing long-term increases in the relative abundance of both Yellowfin Shiner (*Notropis lutipinnis*) and Central Stonerollers (*Campostoma anomala*). While we recognize the need for additional data and more sophisticated analytical approaches, these results show not only the value of this long-term community-driven data set, but also the importance of close collaboration between LTER scientists and local conservation leaders in developing analytical frameworks and approaches.

Suspended Development: Differential Effects of Land Clearing and Human Habitation on Birds

Camille Beasley & Jeffrey Hepinstall-Cymerman

Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA

Urbanization affects and alters bird communities substantially, but the mechanisms behind specific impacts are not well understood. Opportunely, a landscape phenomenon has emerged which allows us to separate different stages of development. Suspended developments are residential projects that had roads and basic infrastructure installed and house lots cleared, but were abandoned when the housing market crashed circa 2008. These sites have had structural changes to the original forested landscape but no human habitation, and therefore represent a transition between forest and residential development that is usually ephemeral. We studied avian community composition and nest predation in undisturbed forests, suspended developments, and established residential sites in Macon County, NC, allowing us to disentangle which changes are caused by structural habitat alteration and which are caused by human activities. We sampled eight replicates of each landscape type using double-observer point counts and artificial nests distributed throughout each site. We used clay eggs and trail cameras to identify nest predators. To further investigate mechanisms, we measured a suite of site characteristics on-site and using ArcGIS. We found significantly higher species richness and relative abundance in suspended developments and residential sites, supporting the intermediate disturbance hypothesis. Species occupancy modeling indicated some species exhibit strong responses to specific components of development, while others are minimally affected by the process. We found no relationship between nest predation rates and landscape type, as site

variability was high. Model selection with AIC indicated that the primary mechanisms responsible for changes in species composition are the amount of clearing and edge, housing density, vegetation density, proximity to urbanized areas, and the presence of pets and feeders, but these differentially affected bird and predator species. These findings will inform planning and conservation efforts in areas expected to experience future conversion of forest to residential development.

The Coweeta Hazard Site Project (CHSP): A Long-Term Study of Stream Ecosystems and How They Respond to Different Land Use Trajectories in the Southern Appalachians*

*Presentation scheduled for Wednesday, June 27th

Jeremy Sullivan[1], Edward Gardiner[2], Paul Bolstad[3], David Leigh[4], Mark Scott[5], E. Fred Benfield[6], David Wear[7], Rebecca Bixby[8], Ted Gragson[9], & Cathy Pringle[1]

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[6]Department of Biological Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA
[7]USDA Forest Service, Southern Research Station, Center for Integrated Forest Science and Synthesis, Raleigh, NC
[8]Department of Biology, University of New Mexico, Albuquerque, NM
[9]Department of Anthropology, University of Georgia, Athens, GA

Southeastern landscapes of the United States are expected to undergo dramatic changes in land use over the next 50 years due to increasing human population and exurbanization. The goal of the CHSP is to identify the land use variables which are driving stream condition along two landscape trajectories: forested lands being converted into low density residential lands, and agricultural lands being converted into suburban and commercial lands. This research builds on a 30-year (2000-2030) proactive sampling strategy; whereby the hazard sites are sampled every five years. We predict physical, chemical and biological responses of streams to exurbanization in line with "urban stream syndrome", with a general positive relationship between level of urbanization and magnitude of responses (increased nutrient loading, decreased channel complexity, increased presence of tolerant invertebrates, etc.) through space and time. Most previous studies that have examined the ecological effects of land use have substituted space for time, with the unstated assumption that locations in different land uses can be viewed as equivalent to the change of a single location over time from natural to developed lands. By coordinating the collection of physical, chemical and biological samples (2010-2011) and analyzing previous hazard site datasets (2000, 2005); we will add a temporal component to the approach in order to characterize the effects of land-use change on stream ecology.

Poster Abstracts

Sediment Source Ascription of Forest Roads in the Upper Little Tennessee River Basin

Seth Younger & David Leigh

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Geochemical fingerprinting and a spatially distributed soil erosion model will be used to estimate sediment proportions by source for catchments with, and without unpaved roads in the Upper Little Tennessee River Valley. Sediment source ascription is important because sediment is labeled as one of the most important non-point source pollutants affecting streams and water bodies in the southeastern United States. The influx of fine sediment (<2 mm) in streams degrades biotic health in addition to transporting absorbed pollutants. The ability to trace the sources of fine sediment is a valuable contribution to watershed management, allowing sources to be mediated with better management practices. USDA Forest Service Roads represent surfaces of geologically fresh material, rich in minerals that should be preserved in transport, and distinguishable in sediment deposits and the water column. Soil samples will be collected from sources of active erosion, and channel deposits near watershed outlets. An end member mixing model using multivariate statistics will at a minimum allow for determination of the proportions of sediment from roads and non-road sources. The Water Erosion Prediction Project model (WEPP) will be ran using LiDAR elevation data and field survey of road culvert routing and better management design features. Comparison of sediment ascription proportions to results of the Water Erosion Prediction Project model will provide consensus for modeled results. The hypothesis are that road sediment will be distinguishable due to higher concentrations of weatherable minerals from road gravel, this difference will allow for distinguishing road and non-road sediment proportions, and that the WEPP model will provide a similar estimate of road contributions to the bed load and suspended load sediment.

Steep Slope Mapping, Local Ordinances, and Environmental Politics in Exurban Appalachia

Seth Gustafson & Nik Heynen

Department of Geography, University of Georgia, Athens, GA

We are investigating the continuing politicization of southern Appalachian exurbanization through steep slope regulations aided by state landslide maps. The maps and laws in question have a prominent role in the recent urban political ecological developments in Macon County, North Carolina. Long standing but newly invigorated land rights activist opposition to these maps and laws has impeded the passage of regulation. This poster will detail some of the political conflict, some residents' concerns about the politics of the ordinance, and more broadly,

an early interpretation of what Macon County reveals about environmental politics in politically divided and urbanizing areas.

Development of a model to couple leaf litter decomposition and nutrient dynamics in forested headwater streams

Laurence Lin & J. R. Webster

Department of Biological Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA

Numerous studies of nutrient processes in streams have been done at Coweeta. Here, we synthesized previous studies to construct a series of models that simulate the biotic processes affecting dissolved nutrients and leaf detritus in Hugh White Creek, a stream dominated by heterotrophic processes. The models predict nutrient dynamics in the water column, as well as detritus dynamics and microbial pool. In our models, we consider two mechanisms of nutrient acquisition by microbes: immobilization and mining. Microorganisms use nutrients from the water column as the secondary nutrient source when immobilization predominates, while in mining they obtain nutrients from the leaves by increasing the decay rate and respiring the excess carbon. Numerical solution of the model is accomplished using the fractional-steps method and simulated with parallel processing. Simulated nutrient concentration patterns were similar to observed patterns. Nutrient mining by microbes may be important when nutrients limit decomposition. It is also important to consider different quality components of leaf material for predicting nutrient dynamics in the late stage of decomposition.

Geomorphic Map of the Upper Little Tennessee River Valley

Jacob M. McDonald & David S. Leigh

Department of Geography, University of Georgia, Athens, GA

A geomorphic map of the Upper Little Tennessee River valley was constructed based on soil survey maps and manipulation of digital elevation models (DEM) derived from light detection and ranging (LiDAR) data. Soil survey map units from the USDA were generalized into similar landform categories (floodplain, low terrace, high terrace, colluvium, residuum, etc.) to provide a general geomorphic map of the valley. Next, a longitudinal profile was derived from the headwaters down to the main stem of the river to establish the average elevation of alluvium adjacent to the stream channel. This longitudinal gradient was used to generate a planar surface representing the valley "bottomland". Bare earth LiDAR data points within the same area of bottomland were reclassified into a 3-meter gridded DEM and the bottomland planar surface was subtracted from the LiDAR DEM to identify subtle topographic variations that correspond to landform features such as natural levees, splays, paleochannels, terraces, and floodplains. Landforms (e.g. overbank deposits and paleochannels) were manually digitized from the subtracted grid. Analysis of a slope map derived from the LiDAR DEM enabled identification

and delineation of river terrace surfaces above the valley "bottomland". The resulting geomorphic map will provide guidance for the ongoing study of channel and floodplain evolution in the valley.

Estimating preferences for water quality and land use regulations in Macon County, NC

Rebecca Moore& Karen Allen

Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA

We describe an on-going project to estimate the benefits to Macon County residents of improving water quality in the region. Our project works in tandem with other researchers in the Coweeta LTER who have projects measuring overall stream health in the Upper Little Tennessee watershed. The current project contributes to an overall understanding of the ecosystem services provided to human communities by healthy streams, and the value of these services to local residents. In particular, the research examines how changes in water quality, biodiversity, and riparian zones affect the use and non-use benefits residents receive, and how different regulatory mechanisms that underlie these changes affect the overall willingness to pay for improved stream health. This poster describes the design of the stated-choice experiment that will be used to collect the preference data, with an emphasis on how this design contributes to related Coweeta research. The data collected with this experiment will be used to estimate the average value a household places on increasing watershed-based ecosystem service flows. Using these values, a policymaker could confidently assess whether or not a certain development criteria would be worth its cost in dollars for the betterment of the local environment.

Organic matter processing under an inundation gradient in perennial stream ecosystems

Robert M. Northington & Jackson R. Webster

Department of Biological Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA

Changes to water availability potentially affect important ecosystem functions such as in-stream organic matter processing. Although organic matter dynamics in perennially intermittent systems have been well-studied, we address a similar issue in perennially wet systems. Specifically, the objective of this work was to determine how organic matter processing in perennial streams is altered by a sustained decrease in surface flow over time. We addressed this using leaf breakdown in headwater streams at the Coweeta Hydrologic Laboratory. Leaf packs for both fast (Red Maple) and slow (White Oak) species were created using large and small mesh bags, a total of four leaf pack types. A gradient of wetness from the stream to upslope sections were used as sites for leaf packs. Additional packs were placed in downstream reaches where surface flow had been experimentally reduced in each stream. Preliminary data suggest a strong relationship

between breakdown rates and site, depending on the type of leaf pack. This work will provide insight into how alterations in precipitation regime can influence usage of organic matter in affected ecosystems.

Land-use as an influence on runoff generating processes: A comparison of agricultural and forest land-uses in the Southern Appalachian Mountains

Joshua S. Rice & Ryan E. Emanuel

Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, NC

The hydrological processes giving rise to runoff on relatively undisturbed, vegetated hillslopes have been extensively studied and are reasonably well understood. However, the proportion of land that can be considered relatively undisturbed is steadily decreasing as human activities on the landscape spread in response to the demands of a rapidly growing population. As land-use expands into mountainous headwater catchments where many of the worlds' major river systems are born, it becomes prudent to examine the potential influence of land-use on runoff generating processes. Here we investigate the relationship between land-use and runoff generating processes at the hillslope scale within the Upper Little Tennessee River Basin in the southern Appalachian Mountains as a component of the Long Term Ecological Research (LTER) program at Coweeta Hydrologic Laboratory. Using hydrometric data and stable isotopes of oxygen and hydrogen as conservative tracers for precipitation, groundwater, soil water and stream water, we evaluate processes involved in runoff generation along the hillslope-to-stream continuum at sites representing two of the dominant land-use types in the southern Appalachian Mountains. We present preliminary results and analyses based on hydrometric and stable isotope data obtained between August 2011 and May 2012. These results are considered in the context of land-use at the hillslope and basin scale using a characterization of trends in physical landscape structure and land-use based on remotely sensed data.

Catchment Isotope Ecohydrology: The Influence of Vegetation and Topography on Runoff Generation in Forested Headwater Catchments

Nitin K. Singh & Ryan E. Emanuel

Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, NC

The combined influence of topography and vegetation on runoff generation and streamflow in headwater catchments remains unclear. We focus on the complex inter-relationships among catchment runoff generation factors using natural stable isotopes of hydrogen (^{2}H) and oxygen (^{18}O). We studied two pairs of small (< 15 ha) forested catchments at the Coweeta Hydrologic Laboratory (CHL) in the southern Appalachian Mountains. Each catchment pair consists of one broadleaf deciduous watershed and one evergreen coniferous watershed. Beginning in June 2011, we collected monthly water samples (1) at 25 m intervals along each stream, (2) from shallow groundwater wells, and (3) from rain gauges located across CHL. Results show high spatial and temporal variability in $d^{2}H$ and $d^{18}O$ among stream and well waters. We attributed some of the temporal variability in $d^{2}H$ and $d^{18}O$ to seasonal and storm-scale variation in precipitation isotopes, and we linked additional temporal variability to mixing of water sources and isotopic fractionation within the watersheds. Within catchments we observed spatial variability that included increasing $d^{2}H$ and $d^{18}O$ with increasing contributing area. Among catchments, we also observed that stream water isotopes were lighter and more variable in $d^{2}H$ and $d^{18}O$ in evergreen-dominated watersheds than in deciduous-dominated watersheds. Among all catchments, stream water at the bases of hillslopes was similar isotopically to nearby hillslope groundwater, suggesting distinct contributions of hillslopes to runoff. Understanding the combined role of topography and vegetation in runoff generation will help scientists and managers to better assess the impacts of vegetation activity and disturbance on water supplies downstream of forested headwater catchments.

Development of the Upper Little Tennessee and Upper French Broad River Systems during the Middle to Late Holocene

Jacob M. McDonald & David S. Leigh

Department of Geography, University of Georgia, Athens, GA

This project focuses on the development of the Upper Little Tennessee River (ULTR) and Upper French Broad River (UFBR) during the Holocene. The main objective of this project is to determine how the ULTR and UFBR have responded to climatic and anthropogenic disturbance in terms of channel form and rates of lateral migration and overbank sedimentation. Specifically, this research will compare channel form, and rates of lateral migration and vertical accretion of middle Holocene to late Holocene and pre-settlement to post-settlement time periods to test the hypothesis that late Holocene climatic modulations around the Medieval Climate Anomaly were expressed as changes in lateral migration and sedimentation rates. This project will also determine whether Native American land use practices had a quantifiable impact on overbank sedimentation rates in order to develop an understanding of when humans became more

important than 'natural' processes. The preliminary results presented on this poster highlight two sites that have been cored to determine paleochannel morphology. The morphology of these paleochannels will be compared to modern channel morphology to develop an understanding of fluctuations in one to five year recurrence interval flood magnitude. This research looks to provide valuable insight into the developmental history of Southern Blue Ridge Mountain streams that will help guide proper management goals for river managers as well as land owners.

Management of social-ecological systems experiencing rapid residential development for human land use and bird conservation

Paige F. Barlow[1], Michael J. Conroy[1], John F. Chamblee[2], & Jeffrey Hepinstall-Cymerman[1]

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The southern Appalachian region has experienced dramatic rates of development during the last fifty years. Development in Macon County, North Carolina, has largely consisted of the construction of vacation and retirement homes in traditionally undeveloped sites. As new residents settle, diverse land use values are brought to communities, and intact forests are fragmented and simplified. The purpose of this project is to: (1) determine the effects of land use on avian communities in Macon County and (2) structure and clarify land use decision making by Macon County landowners with suitable habitat for forest birds. Over two field seasons, we sampled avian communities across a range of land uses in Macon County using point counts. We used data from site revisits and multiple observers to estimate probabilities of false positive and false negative detections and to estimate multi-scale effects of land use on avian occupancy. We conducted a structured decision making (SDM) study with owners of large forested properties in Macon County. Through focus groups, we elicited objectives held by landowners with diverse values and socio-demographic backgrounds, identified management options, and evaluated management options relative to objectives and expected outcomes while incorporating uncertainty. We detected 85 avian species at 274 sites. From our candidate set of occupancy models, we identified plausible models. We quantified the effects of land use on species of conservation concern and differentiated guild responses to land use characteristics. We predicted occupancy probabilities across a range of land use features. Accuracy was improved by accounting for two kinds of imperfect detection. We increased understanding of the multiple land use objectives held by Macon County landowners and the relative value landowners place on expected outcomes of decisions. SDM results can support future decision-making for the economic, social, and environmental health of this region as it continues to experience development.

A Bird's Eye View of Climate Change: Research and Teaching of Decision-Making Skills Using Vertebrates

Jeffrey Hepinstall-Cymerman[1], Robert Cooper[1], Michael J. Conroy[1], J. Marshall Shepherd[2]
Joanna Hatt[1], Mason Cline[1], Rachel Mahan[1], & Kirk Stodola[1]

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We developed a two semester multi-scaled approach to teaching students how to solve problems related to effects of climate change on ecological systems (e.g., birds, amphibians, insects, vegetation phenology) in southern Appalachian forest ecosystems. The first course orients students to geospatial data and models, ecological modeling, and experimental design. This course helps students to develop testable hypothesis and models about how climate change may affect our study system. Students then design field studies necessary to test their hypothesis and conduct the field research in the summer semester course. The students then analyze their data using sophisticated modeling approaches and prepare their results in the form of a scientific report. Students each year will build on the data from previous years and update their models to reflect the new data gathered in an adaptive management approach. Current field projects (summer 2012) are addressing the following questions: What are the nest predators of Black-throated Blue Warblers at different elevations? What is the relationship between spring phenology and caterpillar abundance at the time of BTBW nesting and does this affect nest productivity? Are snakes more important nest predators at lower elevations? And is there a differential rate of water loss in two species of Plethodontid salamanders that occur at different elevations in the southern Appalachians?

Consequences of climate change for fledgling survival of Black-throated Blue Warblers (*Setophaga caerulescens*) in the southern Appalachians

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For many avian species, the most critical life stage is the period after the individual has departed the nest, or the post-fledging period. Few studies have examined this period or the mechanisms underlying fledgling survival. The Black-throated Blue Warbler (BTBW) is an insectivorous, Neotropical migrant songbird that breeds in interior forests. BTBWs depend almost entirely on insect larvae to provision their young. Warmer spring temperatures caused by climate change could result in a temporal advance in plant leaf-out and subsequent larval insect emergence. If a phenological mismatch between the BTBW and its larval insect prey occurs, this mistiming could influence demography and population dynamics for this species. Our study focuses on prey availability and its effects on BTBW fledgling survival in the Nantahala National Forest of western North Carolina. In 2011, 27% of nest attempts fledged at least one offspring. Eighty percent of nests that fledged young produced at least one fledgling that survived to

independence. Although one offspring per pair does not achieve individual replacement, this survival rate was higher than expected, since 2011 larval insect availability was lower than average. Monitoring of fledgling survival and larval insect availability for the 2012 field season is currently in progress. Results of this research will aid in our ability to predict how changes resultant from increased climatic variability may affect productivity of the BTBW and other migrant species.

Effects of residential development on breeding bird communities and habitats in the Southern Blue Ridge Province

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Residential development is a leading force of landscape change in Southern Appalachia. Housing construction alters the abundance and spatial distribution of habitat, and these changes will favor some species at the expense of others. Moreover, the degree of habitat alteration varies widely among sites. In 2009 and 2010, we censused breeding bird communities along gradients of elevation and housing density at 80 sites in two North Carolina counties adjacent to the Tennessee border. Seventy-five species were recorded, and the patterns of occupancy were studied for the 39 most abundant. At each site, the relative density of vegetation in four vertical strata (herbaceous, shrub, subcanopy, canopy) were quantified from the NC Phase III (2005) LiDAR dataset by calculating the percentage of LiDAR returns in each stratum. Housing density was measured from aerial photography. We used non-metric multidimensional scaling (NMDS) to identify the similarities among sites based on bird species co-occurrences. Then, vectors of elevation and the four vegetation strata were fitted to the NMDS ordination to reveal how these environmental factors varied with bird species composition. The results reveal the influence of elevation and vegetative structure these breeding bird communities. “Edge” species were more common at sites with higher shrub and herb cover and less canopy while “forest-interior” species were more abundant at sites with higher canopy densities. High-density sites (3.0 houses/ha) had bird species associated with shrub habitats, but the species composition of sites with ≤9.0 houses/ha depended on forest vegetation retained around the houses. Housing developments with 0.67 houses/ha can retain forest-interior species if the forest canopy is preserved.

Predicting effects of differing N:P enrichment ratios on two larval salamander species based on diet composition, life history, and stoichiometry

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Nutrient enrichment has complex effects on detrital food webs, characterized by shifts in stoichiometry and carbon loss. We are testing the effects of N:P delivery ratio on population-level parameters in two salamanders (*Desmognathus quadramaculatus* and *Eurycea wilderae*) by experimentally enriching five streams at different ratios (2:1 to 128:1). To predict treatment effects, we developed a conceptual model using differences in salamander nutrient content, salamander prey nutrient content, salamander prey feeding mode (e.g. predator, shredder, etc.), and prey life histories. Pre-treatment data for *D. quadramaculatus* revealed that collector-gatherers comprised the largest percentage of diet (32.5%) followed by predators (24.2%), collector-filterers (23.7%) and shredders (10.3%). Previously published data indicate that *E. wilderae* diets are dominated by collector-gatherers. *D. quadramaculatus* has greater P requirements than *E. wilderae* and may benefit more from enrichment-induced changes in prey that are shredders and predators. We predict that differences in life histories and nutrient content of prey items may lead to differential responses of these salamander species to nutrient enrichment. Understanding differential responses is important as it could change population and community structure, altering headwater ecosystems.

People and the Land in Southern Appalachia: A Thousand-Year Land-Use Legacy

Elizabeth E. Nixon & John F. Chamblee

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We present an educational poster in which graphic art and historic narrative are combined in a fictional landscape to illustrate the long-term effects of human decision making. Ten panels illustrate a thousand year history of land use, illustrating three successive waves of settlement, occupation, and selective abandonment. Each new era brought with it more intense ways of using the landscape and greater impacts on streams, forests, valleys, and mountains. Through time, the consequences of land use have become more noticeable and more permanent and the illustrations show how even subtle changes may be visible for centuries beyond the departures of those who made them.

Results of the Western North Carolina Towns and Mounds Project

Benjamin A. Steere

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Western North Carolina has a rich history of archaeological research. However, archaeological data regarding prehistoric Native American mounds and Cherokee town sites have not been systematically compiled, hindering efforts for research and preservation. In 2011, the CWT LTER and the Eastern Band of Cherokee Indians Tribal Historic Preservation Office (EBCI THPO) began a project to build a database and GIS containing location data and archaeological information for all mound and town sites in western North Carolina. This project involves close collaboration among the Cherokee community, the EBCI THPO, the Cherokee Preservation Foundation, the Coweeta LTER, and archaeologists working in western North Carolina. Our preliminary research has produced new data for interpreting settlement patterns and new opportunities for preservation and public outreach.

Business Meeting Notes
June 27, 2012

Update on NASA grant Climate Change Bird Research (Hepinstall-Cymerman)

- Hepinstall-Cymerman, Bob Cooper, Mike Conroy, and Marshall Shepherd received a NASA Climate Change Education (GCCE) grant (now called NASA Innovations in Climate Education (NICE)
- They ask the question: How will ecological systems respond to global climate change across multiple spatial scales?
- Target Audience: Undergraduate students in Forestry & Natural Resources, Ecology, Geography who might be considering graduate school
- Undergraduate research includes 1) Education of undergraduate students in global climate and Earth Systems science and technology and developing predictive models relating ecological processes to climate change; 2) Provide research experience with Earth Observation data coupled with field data collection; and 3)Integrate research to create predictive models, provide adaptive feedback, and support management decisions
- Research includes: Ongoing long-term (9 years) study by Bob Cooper and his students on Black-throated Blue Warbler Demography in and around CWT basin and Plethodon salamander research of John Maerz in CWT basin
- 2011 - 6 undergraduate students in the field for 2 months doing 3 separate projects
- 2012 - currently have 6 undergraduates in the field
- Two 2011 students used their summer research for Senior Thesis
- Two 2011 students are now in graduate programs (with a third likely after he graduates this fall)
- Four 2012 students expect to use their summer research for Senior Thesis or equivalent courses in the fall

2012 Teacher Quality Improvement Grant (Hepinstall-Cymerman)

- 2012 Three day workshop
- Took 11 6-12th grade teachers from "High-Need" Georgia School systems up to Coweeta to expose them to ecological climate research
- Work with them to develop curricula for use in their classrooms to expose students to both climate change science and practical ways they can explore their changing environment around them
- Steven Brantley and Jason Love gave them tours of the Coweeta Facilities and Eddy Flux tower
- Graduate and undergraduates working on BTBW project gave them overviews of their projects and we visited their field sites

Opportunities to Link Conservation and Science (Love)

- There may be an opportunity to collaborate with the Land Trust for the Little Tennessee (LTLT)
- In 1999, there were no lands conserved along the mainstem of the Little Tennessee
- Today, over 20,000 acres have been directly or indirectly conserved by LTLT
- However, there are still a lack of "connection" between the valley streams and the headwater streams

- The lack of buffers is the biggest problem facing streams in the Little T basin
- LTLT is interested in conducting whole watershed buffer restoration; this would be a good opportunity for Coweeta LTER scientists to examine the impacts of the restoration
- Which streams should be targeted for restoration? How will stream temperature and sediment loads be impacted? Will we see an increase in biological connectivity and biodiversity?
- LTLT is working with other organizations to educate the public about riparian buffers through a "Shade Your Stream" campaign that will have a brochure, two billboards, and landowners guide, and a website
- A discussion ensued following this presentation
- Several PIs expressed their support for this idea, particularly if LTER researchers could have access to private lands to conduct research

Coweeta LTER Terms of Reference (Gragson)

- As part of the 2011 midterm report, the reviewers noted that we don't have a formal "Charter" explaining the governance of the Coweeta LTER
- Ted presented a 3 page draft Charter and requested comments/edits from PIs

Meeting ended at 1pm. Afterwards there were small break-out sessions.