

Coweeta LTER Science Meeting Agenda
29-30 June 2009
Coweeta Conference Center
Coweeta Hydrologic Laboratory
Otto, NC

Sunday, 28 June

6:00 – 8:00 pm Science Advisors Meeting/Dinner (Band, Bolstad, Clark, Knoepp, Love, Pringle, Vose, Webster, Chamblee)

- Core data discussion
 - Report by Clark, Knoepp, Pringle, Love on terrestrial gradient, etc.
 - Report by Band on K Price site continuation
- LTER website assessment & functionality overhaul

Monday, 29 June

8:00 Coffee and Greetings

8:30 Introductions and Meeting Plan – Ted Gragson, Coweeta LTER Lead PI

9:00 Comments by Jim Vose, Project Leader, Coweeta Hydrologic Laboratory

Research Presentations

Posters will be located in the Coweeta Conference Center lobby during the entire day.

9:20 Beth Cheever - Estimation of microbial and animal mineralization across a gradient of nutrient availability

9:40 John Frisch - Are stream consumer dynamics different on deciduous (*Acer rubrum*) versus evergreen (*Rhododendron maximum*) leaf packs?

10:00 Amy Rosemond - How do detritus-based pathways respond to nutrient enrichment in streams?: what we've learned and what we hope to find out

10:20 – Break

10:40 Bill McLarney and John Chamblee - The upper Little Tennessee Watershed Biomonitoring Program: nineteen years and counting

11:00 Paul Super - Protecting a much-loved park: research, research needs, inventories, and monitoring in Great Smoky Mountains National Park, NC/TN

11:20 Sandra Roberts - Warra LTER site, Australia

11:40 Jennifer Love - Coweeta LTER Schoolyard Program

12:00 - 1:20 Lunch provided by Valley Café

1:20 Carolyn Dehring - The value of conservation restrictions

1:40 Anne Soudril - Thinking about the land. Understanding perceptions of exurban development in the Swannanoa Valley through a PhotoVoice project (Buncombe County, North Carolina)

2:00 Taehee Hwang - Topography-mediated controls on local vegetation phenology estimated from MODIS vegetation index

2:20 Robert Warren II - Climate change: ecologists think global, climate acts local

2:40 Joseph Milanovich - Modeling climate change effects on the function of southern Appalachian stream salamander communities

3:00 - 3:20 Break

3:20 - 3:50 Larry Band - Institute for the Environment and potential collaboration with Coweeta LTER through the Highlands Biological Station

3:50 - 4:20 Jack Webster - Synoptic Sampling summary

4:20 Closing announcements

5:00 - 6:30 Social provided at the Coweeta Residence

6:30 - 8:00 Group Dinner provided at the Coweeta Residence by Valley Café

Tuesday, 30 June

8:00 Coffee and Greetings

8:30 - 9:00 Break-out session – overview and objectives

9:00 - 10:20 Break-out Session

- Synoptic Sampling
- Terrestrial Gradient
- Water Ecosystem Services Manuscript (Gragson and Pringle)

10:20 - 10:40 Break

10:40 – 12:00 Continue break-out session

12:00 Meeting Adjourns

12:00 - 1:20 Group Lunch provided at the Coweeta Residence

1:20 - 2:30 Science Advisors meeting (Band, Bolstad, Clark, Knoepp, Love, Pringle, Vose, Webster, Chamblee)

1:20 – 4:00 Break-out sessions continue as needed

Coweeta LTER 2009 Summer Meeting – List of Presenters

ORAL PRESENTATIONS – Monday 29 June

Estimation of microbial and animal mineralization across a gradient of nutrient availability

Beth M. Cheever, Jack R. Webster, and Erika B. Kratzer

Department of Biological Sciences, Virginia Polytechnic Institute and State University

The importance of nutrient regeneration by animals to meeting stream inorganic nutrient uptake depends on the relative importance of microbial mineralization and exogenous nutrient supply. We determined the relative importance of animal excretion and microbial regeneration to stream NH_4^+ uptake across a gradient of ambient N availability. Disks cut from chestnut oak leaves collected from each stream were incubated in filtered stream water, spiked to increase $\text{NH}_4\text{-N}$ concentrations, and sampled periodically over four hours to determine microbial uptake rates. Microbial mineralization rates were calculated using these uptake rates and steady state nutrient concentrations. Excretion rates of dominant macroinvertebrate taxa were measured *in situ*. We used animal and leaf biomass estimates to scale these rates to reach-level fluxes. These fluxes were compared to whole stream N uptake as determined by step-wise solute injections. Microbial mineralization rate was similar across sites. However, both microbial mineralization and animal excretion as proportions of uptake varied considerably among streams, ranging from <1-77% and 30-145% respectively.

Are stream consumer dynamics different on deciduous (*Acer rubrum*) versus evergreen (*Rhododendron maximum*) leaf packs?

John R. Frisch and Catherine M. Pringle

Odum School of Ecology, University of Georgia

In the southern Appalachians, macroinvertebrates and salamander larvae are consumers critical to stream food webs, and use deciduous and evergreen leaves as habitat and/or food. A diversity of deciduous trees contribute large amounts of labile litter in autumn, while evergreens (primarily *Rhododendron maximum*) provide smaller inputs of recalcitrant leaves year-round. In-stream, deciduous litter breaks down within months, while *Rhododendron* persists 2-3 years. It is important to understand the role of *Rhododendron* given the uncertainty surrounding predicted changes in its relative abundance: while it may increase in abundance following hemlock extirpation due to ongoing Woolly Adelgid infestations, it could decline if pathogens invade and/or droughts arise. Here we examine consumer biomass, abundance, and presence/absence on single species leaf packs of deciduous *Acer rubrum* and evergreen *Rhododendron maximum*, incubated during autumn in streams draining Coweeta Hydrological Laboratory in North Carolina. Even though our leaf packs were embedded in a matrix of freshly-fallen high-quality deciduous leaves, six of twenty-two consumer taxa occurred significantly ($p < 0.1$) more often on *Rhododendron*; five of these six taxa were predators or long-lived taxa. One stonefly (*Beloneuria*) occurred significantly more frequently on *Acer*. Our results indicate that *Rhododendron* is an important autumn litter resource for some insects (*Anchytarsus*, *Pseudolimnophila*, *Lanthus*, and *Ceratopsyche* spp.), crayfish (*Cambarus* spp.), and salamanders. Consumers found more frequently on *Rhododendron* have similar life history and behavioral traits (long-lived taxa and sit-and-wait predators) and are likely taking advantage of the relatively stable microhabitat provided by *Rhododendron* tubes within the stream environment.

How do detritus-based pathways respond to nutrient enrichment in streams?: what we've learned and what we hope to find out

Amy D. Rosemond¹, Keller Suberkropp², J. Bruce Wallace¹, Vladislav Gulis³, Wyatt Cross⁴, J.M. Davis¹, Jonathan Benstead², and John Maerz⁵

¹ Odum School of Ecology, University of Georgia

² Department of Biological Sciences, University of Alabama

³ Department of Biology, Coastal Carolina University

⁴ Department of Zoology and Physiology, University of Wyoming

⁵ Warnell School of Forestry and Natural Resources, University of Georgia

Previous studies at the Coweeta LTER have revealed striking effects of nutrient enrichment on detritus-based, headwater streams from the microbial to ecosystem level. Changes in ecosystem rates such as carbon processing and export were apparently caused by 1) increased microbial production that 2) drove changes in stoichiometry of organic matter that resulted in 3) increased carbon and nutrient flows to consumers and 4) greatly accelerated export of particulate organic matter and reduced carbon storage. These results are contributing to an expanded view of the effects of nutrients in aquatic systems that include both autotrophic and heterotrophic pathways and can aid predictions of potential alterations in the rates of storage and processing of carbon in rivers and streams faced with chronic nutrient enrichment. Our previous research was based on a 5 year continuous enrichment of a single stream at Coweeta at roughly Redfield ratios of nitrogen and phosphorus (N:P 15:1) compared to a reference stream. Our recently funded proposed research will build on our previous work to fill gaps in current understanding of the *concentrations* and *ratios* of N and P that stimulate heterotrophic response in aquatic systems.

The upper Little Tennessee Watershed Biomonitoring Program: nineteen years and counting

Bill McLarney¹ and John Chamblee²

¹ Little Tennessee Watershed Association

² Coweeta LTER Information Manager, University of Georgia

Nearly nineteen years of Index of Biotic Integrity (IBI) fish data have been collected from 474 surveys across 156 sites in the upper Little Tennessee watershed. Dr. Bill McLarney and the Little Tennessee Watershed Association has partnered with Coweeta LTER to curate and host this valuable long-term dataset. We will discuss the background of this project, talk about how the data are structured, and hopefully get folks excited about the research possibilities that exist with such a rich dataset.

Protecting a much-loved park: research, research needs, inventories, and monitoring in Great Smoky Mountains National Park, NC/TN

Paul E. Super¹, Keith Langdon²

¹ Appalachian Highlands Science Learning Center, NPS, North Carolina

² Great Smoky Mountains National Park, NPS, Tennessee

Over 210,000 hectares straddling the North Carolina-Tennessee state line were designated as Great Smoky Mountains National Park (GRSM) 75 years ago this year. As a unit of the National Park Service (NPS), the Smokies is bound by the mission to "...to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations [National Park Service Organic Act of 1916 (16 USC 1)]." GRSM has long attracted scientific study and GRSM staff has sought to make us of this research to guide its management. In 1992, GRSM was selected as one of the first four

“pilot parks” for the new Inventory and Monitoring program being tested by the NPS. The GRSM monitoring program is currently undergoing review. In 1997, GRSM launched the first ever inventory of all plant, animal, and fungal species within a conservation area in North America: the All Taxa Biodiversity Inventory. Georeferenced specimens are collected by taxonomic experts themselves or by trained volunteers and distributed to participating taxonomists, with records entered into an access database, now available online. Nearly 17,000 species have been documented. A soils map—documenting 20 new soil types—and updates of vegetation and geology maps have recently been completed to assist with modeling of species distributions. GIS models of atmospheric deposition, surface temperature, and disturbance history have also recently been developed. In 2001, GRSM was selected to host one of the first 5 Research Learning Centers in the NPS: the Appalachian Highlands Science Learning Center. This program to facilitate research in the park and to improve the retention of research findings, seeks to develop new research partnerships for GRSM. The National Ecological Observatory Network (NEON) has selected a site on the Tennessee side of GRSM for one of its relocatable observatories to study the impacts of climate change, land-use change, and invasive species on ecology, expected to be launched in 2011.

Warra LTER Site, Australia

Sandra Roberts

Forest Research and Development, Forestry Tasmania

The Warra LTER was established in 1990 to enable ecological and silvicultural research in native, eucalyptus-dominated forests in southern Tasmania. Results of research will assist in the management of forests for a range of values including wood production and nature conservation. A selection of the research projects will be described including silvicultural system trials, fire impact studies and hydrology monitoring.

Coweeta LTER Schoolyard Program

Jennifer E. Love

Coweeta LTER Schoolyard Coordinator, University of Georgia

The Coweeta LTER Schoolyard program continues to work with local middle schools in North Carolina and Georgia. The program is taking a new direction in order to reach more students through citizen science and science boxes. The citizen science initiatives, such as stream salamander monitoring, take place on school grounds to allow more students to participate in the project. The science boxes consist of equipment such as metric tapes and kick nets, as well as lesson plans that correlate to science curricula in each state. It is our hope that these new initiatives will not only help teachers meet their curriculum objectives, but also engage students in real and relevant science.

The value of conservation restrictions

*John F. Chamblee*¹, *Peter F. Colwell*², *Carolyn Dehring*³, and *Craig Depken II*⁴

¹Department of Anthropology, University of Georgia

²Department of Finance, University of Illinois

³Department of Insurance, Legal Studies, and Real Estate, University of Georgia

⁴Department of Economics, University of North Carolina Charlotte

The objective of this paper is to examine the price effects of conservation land use restrictions. Conservation restrictions occur when the owner of land grants title to a grantee for the purposes of conservation, or when the owner grants some of the rights to use the land, but retains the right of disposition. With the latter method the grantee is given an easement that "runs with the land," meaning future owners of the property are similarly bound by the terms of the easement.

The analysis reveals how the value of donated parcels compares to similar properties before the donation. It also reveals the extent to which property burdened with conservation easements sells for less than a comparable property without such restrictions. Finally the analysis measures the benefits or costs that accrue to nearby property following donation activity. The results suggest that prior to a donation, land near properties on which donations are ultimately placed appears to be associated with lower value. The results also suggest that properties burdened with conservation restrictions sell for a significant discount relative to comparable property. Finally, proximity to parcels on which conservation restrictions have been placed appears to be associated with higher value.

Thinking about the land. Understanding perceptions of exurban development in the Swannanoa Valley through a PhotoVoice project (Buncombe County, North Carolina)

Anne L. Sourdril and John F. Chamblee

Department of Anthropology, University of Georgia

Social scientists, policymakers, and the public need to understand how inhabitants of exurbanized areas think about and perceive their land. This study used a combination of the PhotoVoice and participatory GIS method to capture these perceptions. Our results show that while exurban development is commonly discussed as a phenomenon related to "sprawl", people do not actually perceive development as systemic, but instead focus on development patches that are located in restricted locations. As a consequence, they focus on the protection of nearby land – creating associations and relationships with their neighbors – and thereby providing at the same time a revitalization of their community and territory. While these approaches do support increased social networking and some local environmental protection, they do not necessarily foster the creation of policies with broader impacts.

Topography-mediated controls on local vegetation phenology estimated from MODIS vegetation index

Taehee Hwang, Conghe Song, and Lawrence Band

Department of Geography and Institute for the Environment, University of North Carolina at Chapel Hill

Near real-time remote sensing imagery are useful tools to integrate spatial phenological signals across different scales. In this paper, we used the 8-year moderate-resolution imaging spectro-radiometer (MODIS) vegetation indices (2001 ~ 2008) to find the topography-mediated vegetation phenology at the Coweeta LTER site. A simple post-processing analysis using multi-year trajectories provides a very efficient way to filter out false data points. Four local phenological variables (mid-days of leaf-on/off, lengths of leaf-on/off) were estimated by fitting time-series of transformed vegetation indices with a difference logistic function, related with local topographical variables by the multiple regression analysis. Elevation has most explanatory power for all phenological variables. With elevation, the mid-day of leaf-on shows a strong linear relationship, while other three variables show quadratic responses. Radiation proxies (transformed aspect or potential relative radiation) also have some explanatory power except for the mid-day of leaf-on variable. Even though not so much effect of hillslope positions on vegetation phenology are shown at this coarse resolution (about 250 m), interannual variations of vegetation

phenology between very wet and dry years shows that more extended periods of leaf-on/off were found without shifting mid-days of leaf-on/off. These topography-mediated controls on local vegetation phenology are closely related to micro-climatic variations, vegetation community types, and hydrological positions at this study site.

Climate change: ecologists think global, climate acts local

Robert J. Warren II and Mark A. Bradford

Yale School of Forestry and Environmental Studies, Yale University

An enormous discrepancy exists between climate trends at global and regional scales but ecological researchers commonly assume global and annual means in explaining local or regional ecological patterns. We illustrate the problem with such assumptions with a case study of climate trends (1931-2004) in the southern Appalachian region. We tested whether regional warm and cool season temperature and precipitation trends reflected that of the global mean or the North Atlantic Oscillation (NAO) index, and whether global temperature trends or NAO better predicted stream salamander abundance in the region. Our results suggest that more than half of the climate change research in the ecological literature assumes annual global means rather than regional climate when explaining ecological trends. These results are disconcerting in light of our findings that global trends poorly correspond with southern Appalachian temperatures and precipitation as well as salamander abundance.

Modeling climate change effects on the function of southern Appalachian stream salamander communities

Joseph R. Milanovich¹, John C. Maerz¹, Nate Nibbelink¹, and Amy R. Rosemond²

¹D. B. Warnell School of Forestry and Natural Resources, University of Georgia

²Odum School of Ecology, University of Georgia

Changes in biodiversity are predicted to have a major impact on ecosystem processes. A fundamental challenge for ecologists is to determine the influence of species on ecosystem processes prior to declines or losses, and to determine whether there are species that may compensate for the loss of other species. The southern Appalachian Mountains are a global hotspot for stream plethodontids. Plethodontids are the numerically dominant vertebrate predators of high-elevation first order streams, and as such are hypothesized to be influential in the capture and retention of nutrients and the flow of energy to higher trophic levels. Our objectives were to determine the potential consequences of a reduction of stream salamander diversity to nutrient capture and retention within first and second order streams at the Coweeta Hydrological Laboratory. To meet this objective, we used ecological stoichiometry to estimate the amount of nutrients captured and exported by a stream salamander community, generated predictive models of species loss under climate change scenarios, and used field removal experiments to determine whether predicted species losses alter nutrient capture and retention or whether there is compensation by other salamander species or stream fauna. We found stream plethodontids are significant nutrient reservoirs when compared to other stream taxa and are influential to stream nutrient cycling; however, models project a decline in suitable habitat associated with climate change scenarios for many species within the Coweeta basin. Further, our results suggest that while subordinate plethodontid species respond positively to the loss of the dominant species, there is still a net loss of salamander biomass produced within streams. These results suggest that the potential loss of some salamander species from the region that includes Coweeta could have significant implications for stream function including the capture, retention and ultimately export of nutrients.

POSTERS – In the lobby of the Main Office

Convergence of microbial community function in common environments is associated with loss of function in alternate environments

Ashley D. Keiser, Michael S. Strickland, and Mark A. Bradford
Yale School of Forestry and Environmental Studies, Yale University

Consisting of populations with short generation times, it is commonly assumed that there is a high degree of functional redundancy within soil communities with respect to broad-physiological processes (e.g. organic carbon decomposition). However, microbial communities display biogeographic patterns, even at fine scales. New work shows that these biogeographic patterns extend to microbial community function, with functioning influenced by differences in resource histories. We examined whether a common resource history might cause functionally dissimilar communities to converge functionally. Next, we tested whether functional convergence (partial or complete) is associated with a reduction in function in alternate environments (a functional ‘trade-off’). We used a 6×2 (soil community inoculum \times litter environment) full-factorial design under controlled, laboratory conditions. Our results suggest that distinct microbial communities can converge functionally when exposed to a common environment, and that convergence is associated with loss of function in alternate environments.

Modeling tree demography and interacting disturbances using long-term seedling experiments

David M. Bell^{1,2}, *James S. Clark*^{1,2,3}, *Michelle H. Hersh*^{1,3}, *Inés Ibañez*⁴, and *Jacqueline Mohan*⁵

¹ University Program in Ecology, Duke University

² Nicholas School of the Environment, Duke University

³ Department of Biology, Duke University

⁴ School of Natural Resources and Environment, University of Michigan

⁵ Odum School of Ecology, University of Georgia

Community composition of eastern deciduous forests will shift as temperature and precipitation regimes change in response to anthropogenic climate change. Early and late season frosts can cause premature leaf abscission and drought can lead to carbon starvation or catastrophic cavitation of the xylem. Seedling responses are further complicated by interactions with other factors, such as hurricane disturbance, deer herbivory, and rising atmospheric CO₂. High-dimensional trade-offs result in complex responses in community composition, making prediction difficult with traditional statistical and experimental approaches. Using data from a series of long-term seedling experiments in the Southern Appalachian Mountains (Coweeta LTER) and the North Carolina Piedmont (Duke Forest), we propose to examine the influences of climatic variability and experimental forest manipulations on seedling growth and survival using a hierarchical Bayesian approach. We modified an existing forest demographic model to analyze tree seedling demography and the influences of environmental covariates, annual variation in frost and drought events, experimental treatments, and random individual temporal effects (RITEs). Examinations of these interacting effects will help inform predictions regarding future forest dynamics as climate changes and forests are altered by human and natural disturbance.

Coweeta LTER 2009 Summer Meeting Summary

June 29-30, 2009

Monday June 29

Introduction

- Lead PI Ted Gragson started the meeting with introductions. Roughly 75 PIs, graduate students, Coweeta staff, and cooperators were in attendance.
 - While Coweeta LTER has done a good job of producing a great quantity of individual papers, we need to do a better job following through in publishing collaborative research, including synthesis papers
- Coweeta Hydrologic Lab report by Project Leader Jim Vose:
 - Coweeta is celebrating its 75th anniversary
 - There will be an open house on July 25th
 - A science symposium will be held November 3-4 at the Dillard House in Dillard, GA
 - As part of the 75th celebration, Coweeta is updating the Coweeta brochure and video
 - New Initiatives
 - An eddy flux tower is being installed near the main office in cooperation with Duke University and the EPA
 - Coweeta is also working on remote stress monitoring with Duke
 - Field studies involving the restoration of eastern hemlock are in the works
 - Coweeta is working on a synthesis of climate change and forest management interactions
 - New People
 - Post-doc in ecophysiology and carbon flux
 - Visiting hydrologist from China for year-long stay
 - There is new funding for USFS for bioenergy and climate change
 - **Reminder: send your recent Coweeta publications to Kathy Flowers, including theses and dissertations**

Presentations

- There were a dozen presentations, on topics varying from an overview of research in Great Smoky Mountains NP to modeling the effects of climate change on salamanders
- Larry Band – Larry is the new Director for the Institute for the Environment. There is an opportunity for Coweeta LTER PIs to work with undergraduates through the Institute's intern program through the Highlands Biological Station. Coweeta had two interns for fall 2008. Please contact Larry or Jim Costa, Director of the Highlands Biological Station, if you are interested in this opportunity.
- Jack Webster, Rhett Jackson, and David Leigh – Jack and Rhett presented data from the winter synoptic sampling. A publication is planned for the synoptic; while the stream nutrient and geomorphology data alone are likely not worthy of publications, including land cover, parcel information, etc. would make it an interesting paper.

Tuesday June 30

Break-Out Sessions

Transition from Synoptic Sampling to Longitudinal Sites

- There was good discussion among PIs about the need to cooperate and compromise to link the terrestrial plots with the streams
- Rhett Jackson and David Leigh need larger streams (4th order and above) for their work, while Jennifer Knoepp, Jack Webster, and others need headwater streams to link land use to water chemistry
- If water samples are taken from larger streams, the water chemistry signal from a particular land use might be washed out
- To compromise, it was agreed that water samplers would be placed on smaller headwater streams for 1 year, then moved to the larger streams (4th order) the next year
- Since nutrients such as phosphorus break-down in a short period, the ISCO water samplers cannot be used to measure most stream chemistry variables; instead, grab samples will be taken during each visit to the samplers (approximately once a week = 52 samples)
- It still needs to be worked out whether the samplers will run based on continuous flow or based on capturing storm events
- The group all agreed that it was a good idea to start talking about authorship up front, before the project gains steam
- The analytical lab should have most samples analyzed in mid-August; it is suggested that we have a phone conference sometime in late August and then a “field trip” on a weekend in early September to select the final sites (several PIs have classes during the week this fall and a weekend trip is their only option).

Water Ecosystem Services Manuscript (Gragson and Pringle)

- Cathy Pringle and Ted Gragson led an initial discussion on developing a manuscript centered on water ecosystem services in Southern Appalachia
- Good interest by a diverse group of investigators brainstormed on the orientation and content of the potential manuscript
- An email list of interested participants, and Cathy agreed to write-up the notes and circulate to move the discussion forward.