

Coweeta LTER 1998 Annual Meeting Presentation Abstracts

Compiled and Edited by Brian D. Kloeppel

*Presenter

Oral Presentation

ARGO, BARRY W.* and BRUCE L. HAINES. University of Georgia, Athens, GA 30602. Climate Effects on Flowering Phenology of Blue Cohosh at Coweeta LTER.

Blue Cohosh, *Caulophyllum thalictroides*, is an early-flowering perennial herb common to Eastern North America. The plant has well established medicinal uses, and is often found to co-occur on moist, rich soils of the southern Appalachians with related species of pharmacological importance. Flowering phenology has been monitored for *Caulophyllum* populations at LTER gradient study sites 218, C427, and 527 in 1996, 1997, and 1998. A GIS model to predict suitable locations for *Caulophyllum* in the Coweeta basin has been very successful, and a second elevational transect was added to the study in 1998. Preliminary results from reciprocal transplants between low (2600ft.) and high elevation sites indicate ecotypic conditioning for phenological response to thermal environment. Preliminary results from a forest floor microsite warming experiment, using chambers functionally similar to those used at other LTER sites, suggest that soil temperature is the primary cue for flowering time, although air temperature may affect flowering duration and floral abortion.

Oral Presentation

BECKAGE, BRIAN* and JAMES S. CLARK. Duke University, Durham, NC 27708. Seed and Seedling Predation Reduces Establishment of Shade Tolerant Species More than Intolerant Species in the Southern Appalachians.

We completed a long-term study of seedling recruitment in a southern Appalachian forest, which found low recruitment beneath both canopy and gaps and virtually no recruitment beneath the dominant understory shrub, *Rhododendron maximum*. We investigated the possibility that seed and seedling predation may limit seedling establishment in the forest understory. We studied seed and seedling predation rates for three dominant tree species, red maple (*Acer rubrum*), northern red oak (*Quercus rubra*), and yellow poplar (*Liriodendron tulipifera*). Predation was studied for four years under all combinations of canopy gap vs. nongap, with vs. without *Rhododendron*, and with vs. without leaf litter. Our results indicate that the large seeded species, northern red oak, only establishes seedlings in mast years, irrespective of other factors. Leaf litter presence reduced seed predation of red maple from about 60% to 20%. However, seedling production was about 50% lower with litter present, despite reduced predation rates. The shade intolerant species, yellow poplar, was unaffected by seed predation. Differences in predation rates could contribute to the coexistence of these forest species by offsetting differences in seed size and shade tolerance.

Oral Presentation

BENFIELD, E.F.^{1*} and J.S. HARDING². ¹Virginia Tech, Blacksburg, Virginia 24061, ²Cawthron Institute, Nelson, New Zealand. Effects of Land-Use History on the Functional Feeding Group Structure of Stream Invertebrates and the Importance of Scale.

We assessed the relative abundance of invertebrate functional feeding groups (FFGs) in forested streams and agricultural streams at three spatial (watershed, basin, and ecoregion) and two temporal (1970s, 1990s) scales. At the watershed level, there was some variability among streams within type but there were consistent differences between stream types. These patterns held at the basin and ecoregion scales though there were some shifts in the relative importance of some FFGs. When land-use history was incorporated into multiple regression models with spatial scale, some FFGs responded differently to spatial scale plus temporal scale than to spatial scale alone. For example, at the river basin scale, land-use in 1990 is the best predictor leaf shredding invertebrate distribution whereas land-use in 1950 was the best predictor of shredder distribution at the ecoregion scale. In contrast, distribution of collector-gatherers and scrapers seemed to be insensitive to differences in spatial scale but were best predicted by land-use in the 1990s. The FFG structure of invertebrates in streams appears to be strongly influenced by land-use at both spatial and temporal scales.

Oral Presentation

Bennett, B.L.¹, E.F. Benfield^{1*}, and J.S. Harding². ¹Virginia Tech, Blacksburg, Virginia 24061, ²Cawthron Institute, P.O. Box 2, Nelson, New Zealand. Land Use Influences on Invertebrate Assemblages in Southern Appalachian Agricultural Streams.

We investigated the role of land use in structuring benthic invertebrate assemblages in agricultural streams in the French Broad River drainage in western North Carolina. We sampled six agricultural streams, three with cleared headwaters and three with forested headwaters, at three points along a gradient (headwaters, a midpoint, and a downstream site). Taxa richness was greater in forested agricultural streams (49) than in cleared streams (41). Benthic invertebrates were also more evenly distributed among taxa in streams with forested headwaters: the three most abundant taxa made up 63% of total density in cleared streams compared to 39% in forested agricultural streams. *Plecoptera* were more abundant in forested agricultural streams, while *Diptera* were more abundant in cleared agricultural streams. Using multivariate analysis of invertebrate density, we found that the sites were organized along a gradient of riparian vegetation and degree of agriculture. This gradient seemed to be related to nitrate concentrations and substrate size. Regressions with GIS historical land use data indicated that past land use may also structure invertebrate assemblages. Land use immediately upstream explained more variation in diversity than the land use of the entire watershed. These results indicate that more than just the present amount of forest in the watershed may be needed to predict the invertebrate assemblages.

Oral Presentation

BOLSTAD, P.V.^{1*} and J.M. VOSE². ¹University of Minnesota, St. Paul, MN 55102, ²USDA Forest Service, Coweeta Hydrologic Laboratory, Otto, NC 28763. Landscape Variation in Soil Respiration.

Soil C flux is an important part of global terrestrial carbon cycling, comprising up to 1/2 the gross carbon flux in many forest ecosystems. Despite its importance, soil C flux has been well-measured at relatively few sites and we have a poor understanding of how flux varies across the landscape. This is true in the southern Appalachian mountains, where large environmental gradients interact with a human dominated disturbance regime to substantially affect net soil C flux. We measured and analyzed temporal and spatial variation in soil C flux in forest and agricultural

ecosystems. We then estimated annual C flux and developed predictive soil C flux models. Respiration was measured and 26 plots over a three-year period, and these data, when combined with temperature, soil sampling, and other field data were used to develop instantaneous, daily, seasonal, and annual soil C flux. There were no differences in total respiration when modeled on hourly or daily mean temperatures. Stand biomass and temperature were the most important driving variables, impacting aggregate respiration on landscape scales more than differences in soil moisture or carbon. Landform and elevation both significantly affected soil temperature, and hence predicted soil respiration. Landform influences were particularly important during leaf-off periods, with north slopes and cove bottoms having cooler temperatures. Respiration varied considerably over the landscape, and was approximately 50% greater at lower elevations relative to upper elevations. Land conversion for forest to agricultural has had a significant impact on annual aggregate soil flux, and has led to a reduction of from a few to nearly 30% in annual regional soil C flux.

Oral Presentation

CLINTON, BARTON D.^{1*}, E.T. NILSEN², O.K. MILLER², T.T. LEI², S.W. SEMONES², and J.O. WALKER². ¹Coweeta Hydrologic Laboratory, USFS, Otto, NC 28763, ²Virginia Polytechnic Institute & State University, Blacksburg, VA 24061. Overview of Research Results Generated from an Examination of the Regulating Role of *Rhododendron Maximum* Thickets in Tree Replacement.

Rhododendron maximum, a striking feature of mesic southern Appalachian forests, is associated with reduced seedling abundance throughout its range. The mechanism(s) by which *R. maximum* suppresses seedling survival has been the subject of much debate. Possible sources of inhibition include allelopathy, competition for resources, light attenuation, and forest floor and soil physical attributes. The purpose of this paper is to present findings from an experiment aimed at identifying process-level mechanisms associated with *R. maximum* influences on forest composition. Treatments: +Rm 3D beneath and -Rm 3D outside *R. maximum* thickets.

Above and belowground resources - Photosynthetically active radiation (PAR) (75% lower), soil moisture (20% lower), and N-mineralization rates (31% lower) were significantly lower in +Rm. Soil K, Ca, Mg, and Mn were significantly lower in +Rm, and soils were slightly more acidic (pH3D4.75 +Rm and 4.85 -Rm).

Allelopathy - Using bioassays of solution toxicity with throughfall and forest floor leachates, no inhibition of seed germination (*in vitro*) in *Lactuca* or *Lepidium* was found. The same results were found using four native tree species. Growth of two of the three ectomycorrhizal species used in the study (*Suillus pictus* and *Cenococcum*) was unaffected when grown in the presence of a *R. maximum* leaf litter decoction. Only *Pisolithus tectorum* showed any inhibited growth patterns. Overall, based on this study it appears that a direct allelopathic influence on seed germination, root elongation, and ectomycorrhizal growth cannot be considered an important factor.

Mycorrhizal colonization - Percent colonization and ramification indices (# root tips cm⁻¹ root length) were depressed, and the species *Cenococcum geophilum*, a generalist, was elevated in +Rm compared with -Rm. After the first year, percent colonization of *Tsuga canadensis* was 3-fold greater in -Rm (62%) than +Rm (19%), and the ramification index was greater as well (2.83 vs. 0.61).

Seedling survival and gas exchange - Seed rain did not vary between conditions. Incubated substrate show no differences in emerging overstory seedlings: post-dispersal seed loss was not different. Foliar characteristics (chlorophyll content, chlorophyll a:b, and N content) of *Quercus rubra* and *Prunus serotina* did not vary between conditions; however, SLA was significantly higher in seedlings in +Rm. Seedlings of *Q. rubra* and *P. serotina* showed depressed mid-day rates of net photosynthesis in +Rm compared with -Rm, even though temperature and relative humidity were similar between the two conditions. Mean mid-day rates of photosynthesis for *P. serotina* seedlings in +Rm were -0.126 compared with 0.663 $\text{B5mol m}^{-2}\text{s}^{-1}$ in -Rm, and for *Q. rubra* seedlings, rates in +Rm were 0.634 compared with 1.716 $\text{B5mol m}^{-2}\text{s}^{-1}$ in -Rm. Maximum rates of photosynthesis were light limited. Based on light response curves, both species showed similar low-light acclimation across treatments despite having developed under contrasting light environments. Seedlings in +Rm received light quantities near or below their light compensation points throughout the day (mean PAR ~ 5 $\text{B5mol m}^{-2}\text{s}^{-1}$).

Understanding the limitations to seedling establishment imposed by *R. maximum* still requires further investigation. Answers to questions of below competition for water and nutrients and the effect of reduced mycorrhizal colonization will provide key insights into the role of this 91keystone92 species in regulating southern Appalachian forest processes.

Oral Presentation

COLEMAN, D.C.^{1*}, C.J. WRIGHT¹, S.F. TAYLOR¹, and J.A. YEAKLEY³. University of Georgia, Athens, GA 30602; ²Portland State University, Portland, OR 97207. Carbon and Nitrogen Dynamics in Hillslope/Riparian Zones after Human-Caused and Meteorological (Hurricane) Disturbances.

As part of our study of Rosebay Rhododendron as a hillslope regulator of exchange of carbon and nutrients between upland and stream systems, we measured long-term kinetics of decomposition and soil activities in our Rhododendron-cut ("cut") and hurricane-impacted ("storm") plots in Watershed 56 at Coweeta. Leaf-litter decomposition rates in pre- and post- treatment time intervals (1993-95 and 1995-97) were very similar, with Chestnut Oak (*Quercus prinus*) losing 35% of ash-free dry weight over 460 days, and Rhododendron leaves losing 25% over the same time interval. Total soil respiration rates were similar in the first year post-treatment, but then gradually increased in years two and three to 30% greater in the cut plot transects compared to the storm plot transects.

Monthly measurements of net N-mineralization along three transects in cut and storm plots showed moderate differences at 1 m., and as much as four times greater mineralization rates (e.g., 40 vs. 10 $\text{g NH}_4^+ + \text{NO}_3^- \text{-N g.d.soil}^{-1} \cdot \text{mo}^{-1}$) at 5 and 15 m. above the stream. These differences were most pronounced in spring and early summer, and will be discussed in reference to the overall hillslope nutrients and hydrology model results of Yeakley, et al.

Oral Presentation

GARDINER, NED*. Institute of Ecology, University of Georgia, Athens, GA 30602. Overview of Geographic Information System Management in the Coweeta LTER Program.

I will offer a summary of plans to revitalize the coordination activities of the UGA GIS lab over the next 12 months. I am seeking specific comments from investigators. This abstract is from the request we submitted to NSF to fund the work.

We asked NSF for assistance in upgrading and consolidation of geospatial data from all projects. The proposed activities included: (a) bringing all existing data into a standardized set of geographic and filter transfer formats; (b) standardizing/writing consistent metadata files that are tagged to GIS files; (c) integrating geospatial and process-oriented data; and d) providing the ability to query process data by geospatial reference and vice versa.

For Coweeta to serve its role as a long term ecological research site, GIS coordination requires focused attention and support. Coweeta investigators conduct spatially-explicit research at six institutions in as many states. To benefit researchers and stakeholders not directly participating in LTER activities at Coweeta, we will integrate geographical data and results from all Coweeta investigators. During the current funding cycle, the Coweeta-LTER budget for GIS at UGA has been allocated to analysis needs of researchers. We requested funds to completely integrate and document Coweeta spatial data for the region surrounding the Coweeta Basin. The current GIS web site does not facilitate exchange of results among investigators, the LTER network, unaffiliated scientists, and the public-at-large.

Proposed efforts will remedy the current obstacles to data integration and public access via the world-wide web. Database integration requires two steps: (1) Database management, consisting of creating metadata for all spatial data and building data dictionaries (relations between fields in multiple datasets) for all datasets; (2) Create a more usable GIS web site.

Providing public access to methods and results developed through Coweeta GIS activities will require careful redesign of the Coweeta GIS Web page. The proposed database management activities are vital to our success in providing usable data to other communities of researchers. Without metadata, other users will not be able to determine how best to use our spatial data. Consistent map units and geometry are also fundamental to an integrated GIS data archive. Data dictionaries will facilitate ecological queries using GIS and vice versa. Once the database management is complete, we have three goals for the redesign. First, we will provide summaries, results, figures, and links to other web sites, institutions, and people; Second, we will build on the new format the Coweeta Data Manager established for the rest of the Coweeta web site. Third, we will provide web users with the ability to conduct spatial and informational queries about research conducted at Coweeta and in the southern Appalachian region. GIS will provide a tool for accessing ecological data, and ecological data will reference geospatial data explicitly.

Oral Presentation

GARDINER, NED*¹, JUDY L. MEYER¹, and PAUL V. BOLSTAD². ¹Institute of Ecology, University of Georgia, Athens, GA 30602, ²University of Minnesota, St. Paul, MN 55102. Landscape Stratification for Stream Ecology.

Spatial databases, e.g., land use, hydrography, and elevation, are indispensable for understanding the linkages between watershed land use and ecological functions in stream systems. The objective of this research is to maximize the power of statistical inferences based on biological sampling protocols by controlling for landscape factors

which may be measured a priori to any field data collection. I achieved this by considering principal geographical factors known to directly and indirectly moderate abiotic conditions within streams. Paul Bolstad prepared GIS layers depicting hydrography, roads, buildings, and land cover in the Little Tennessee River Basin (LTRB) of North Carolina and Georgia; I reclassified the land cover layer to depict forested and non-forested areas. I utilized Arc Macro Language (AML) and C code to delineate all watersheds in the LTRB. Standard overlay techniques provided insight into the spatial variability of watersheds of a given order as well as the scale-dependence of that variability when comparing summary data for watersheds of different orders basin-wide. These analyses provided a scalable framework for designing statistical sampling within the LTRB and which should also facilitate inter-basin comparison where similar a priori methods are employed.

Oral Presentation

GRAGSON, TED L.* University of Georgia, Athens, GA 30602. A Settlement History of the Blue Ridge Plateau.

The Blue Ridge Plateau is experiencing dramatic population growth (Macon County grew 17.5% from the 1990 Census to July 1997) and the region is identified as a haven for retirees and seasonal migrants locally referred to as "half-backs", "CAVE people" (Citizens Against Virtually Everything), and "summer people." Growth is expected to lead to transformation of the Blue Ridge landscape, but how much of the resulting transformation will be the result of present growth and how much a legacy from the past? Rather than population growth and seasonal migration being strictly recent phenomena, they may be a repetition of a pattern set early in the population history of the Blue Ridge. The Blue Ridge was settled late relative to other areas of the Southeast such as the Great Valley of east Tennessee and the Coastal Plain by German and Ulster Scot yeoman farmers from central and western Pennsylvania who began arriving to the region between 1800 and 1850. Until after the Civil War, the Blue Ridge had only a third as many inhabitants as the surrounding areas that had been settled in some cases as early as the middle of the 1600s. As for population growth and movement in the Blue Ridge, population grew during the 1820-30 decade by more than 40% and the seasonal arrival of summer people from the coastal plain and elsewhere is a tradition that goes back to the 1830s. A settlement history from 1790 to the present for the 42 counties in northern Georgia, western North Carolina, and southwestern Virginia comprising the cultural Blue Ridge is developed from archival census records and other information.

Oral Presentation

GROSSMAN, GARY*. University of Georgia, Athens, GA 30602. Overview of Grossman Laboratory Fish Studies.

I will provide a general overview of our stream fish studies. First, we have described small-scale environmental heterogeneity that has a significant impact on habitat choice by benthic fishes. Second, we have attempted to use a landscape perspective to determine whether knowledge of individual habitat selection patterns can be used to predict reach scale abundances of benthic fishes (mottled sculpin & longnose dace). Third, our long-term population studies indicate that the abundance of the numerically dominant (& biomass too, Bruce) fish in the drainage (mottled sculpin) is regulated primarily through density-dependent processes although density-independent forces, in the form of the number of high flow events between spawning

and autumn, have a strong impact on annual recruitment. Undoubtedly, I will also describe a few things that I did not mention in the abstract.

Oral Presentation

HELFMAN, GENE^{1*}, DALE JONES¹, JOSH HARPER¹, and PAUL BOLSTAD². ¹University of Georgia, Athens, GA 30602, ²University of Minnesota, St. Paul, MN 55102. The Influence of Riparian Buffer Strips on Fishes: are We Measuring the Right Things?

Discussions of the influence of riparian vegetation on stream health focus on the width of such buffer zones. Policy decisions and environmental regulations similarly use riparian width as the metric of importance. We sampled fishes and stream habitats in 12 stream segments downstream from deforested riparian patches 0 - 5.6 km long, all downslope from densely forested watersheds. We found that the strongest predictors of fish abundance and occurrence were area and particularly length of the riparian patch; patch width was a relatively poor predictor of fish occurrence. Limited riparian clearing may cause minor disturbance to the fish assemblage, but streams in even a heavily forested watershed cannot tolerate disruption of the riparian zone of much more than 1 km in length. Riparian buffer length should be given stronger consideration in stream protection and restoration plans.

Oral Presentation

HILLERISLAMBERS, JANNEKE* and JAMES S. CLARK. Duke University, Durham, NC 27708. Response of Red Maple Ecotypes to Temperature: Implications for Climate Change.

Climate change may disproportionately affect early life history stages of trees. An accurate assessment of sensitivity at these stages requires knowledge of responses across geographic ranges. We investigated dormancy, germination cues, and seedling growth of *Acer rubrum*. Seeds were collected from a range of elevations in North Carolina, New Hampshire, and Pennsylvania. We tested freshly dispersed seeds for dormancy levels, and found higher levels of dormancy at higher elevations. Seeds from northern latitudes and higher elevations germinated faster (than seeds from southern and lower elevations) at 4BOC, but did not germinate w/o stratification. Stratified seeds were allowed to grow for two months in controlled climate chambers (12BOC, 16BOC, 20BOC, 24BOC, 28BOC). Seedlings originating from all seeds showed highest growth at 24BOC. Seedlings from New Hampshire populations had more variable growth at lower temperatures (12BOC, 16BOC, 20BOC). No significant differences were found in seedling growth for high vs. low elevation seed sources. Results suggest that red maple is most variable in its response to temperature as a dormant seed, and that this life history stage may limit recruitment for red maple if global warming occurs.

Oral Presentation

HUNTER, MARK D.* and R.E. FORKNER, R.E. University of Georgia, Athens, GA 30602. Hurricane Damage Influences Foliar Polyphenolics and Subsequent Herbivory on Surviving Trees.

Hurricane damage can result in tree mortality and variation in both light and nutrient availability for the individuals that remain. In turn, resource availability influences the interactions between plants and other trophic levels, including insect herbivores. Here, we report effects of Hurricane Opal on both the phenolic chemistry and levels

of defoliation on surviving trees at the Coweeta Hydrologic Laboratory in North Carolina. We measured foliar astringency, hydrolysable tannins, and condensed tannins in the foliage of red maple and red oak saplings in three damaged sites, paired with three undamaged sites, following the hurricane. We also estimated inorganic nitrogen and phosphorus availability in the soil, and the accumulated leaf area removed by insect herbivores. The foliar astringency of both red maple and red oak was higher in sites damaged by the hurricane than in control sites. The astringency of red oak foliage was associated with hydrolysable tannin content while the astringency of red maple foliage was associated neither with hydrolysable nor condensed tannins. By the end of the growing season, condensed tannin levels were significantly higher in the foliage of red oak in damaged sites. There were no consistent differences in ammonium, nitrate, or phosphate availability between damaged and undamaged sites. Despite higher foliar astringency of trees in sites damaged by Hurricane Opal, levels of defoliation by insect herbivores were higher in damaged than in control sites on both tree species. Apparent increases in putative defensive compounds following hurricane damage did not protect trees from herbivory.

Oral Presentation

KLOEPEL, B.D.^{1*}, J.G. MARTIN², D.C. FELDKIRCHNER³, S.E. CROWLEY³, J.M. VOSE⁴, and P.V. BOLSTAD². ¹University of Georgia, Athens, GA 30602, ²University of Minnesota, St. Paul, MN 55102, ³University of Wisconsin-Madison, Madison, WI 53706, ⁴USDA Forest Service, Coweeta Hydrologic Laboratory, Otto, NC 28763. Wood Respiration and Biomass Allocation Across an Age Chronosequence in Southern Appalachian Forests.

Allometric equations and chamber-based stem respiration measurements were used to scale wood respiration to the stand scale in five southern Appalachian mixed *Quercus*, *Liriodendron*, and *Acer* study sites. Sites were located on ridge, midslope, and cove positions at the 250 year-old Joyce Kilmer Memorial old growth forest in western North Carolina. In addition, cove sites that were 18 and 90 years old at Coweeta Hydrologic Laboratory were also measured using the same bi-monthly sampling schedule over a two-year period. To scale measurements from the chamber to the tree level, allometric equations for ten species (87 trees total) over a diameter range of 3 to 63 cm were developed at Coweeta Hydrologic Laboratory in western North Carolina during the 1997 growing season. Combined species regressions for total tree sapwood volume and stem surface area versus stem diameter exhibited correlation coefficients (r^2) of 0.909 and 0.960, respectively. These two scalars, along with predicted stem temperature from four western North Carolina study sites, explained more than 86% of the observed variation in stem respiration across all five diverse sites.

Respiration was scaled from the tree- to the stand-level using 0.15 ha vegetation surveys from each study site where tree species and diameter were recorded. For trees larger than the 63 cm diameter of our developed allometric relationships, we used the predicted sapwood volume and stem surface area of our harvested trees from Coweeta Hydrologic Laboratory, knowing that the large *Liriodendron tulipifera* and *Quercus prinus* trees (> 100 cm diameter) at Joyce Kilmer Memorial old growth forest may not be accurately predicted from our stem surface area and stem volume equations. In addition, trees that were larger than our observed diameter range were cored near our stem respiration chamber to compare sapwood depth with that predicted from stem cross sections of smaller harvested trees.

Overall, slope position appears to have little effect on total wood respiration since the greatest stem temperature differences between sites occur in the winter when respiration rates are lowest. Respiration appears to be greater in the old growth cove compared to 18 and 90-year old cove stands due to higher stand-level sapwood volume, but similar respiration efflux per unit volume of sapwood.

Poster Presentation

KNOEPP, JENNIFER D.^{1*}, WAYNE T. SWANK¹, and TODD ACKERMANN². ¹USDA Forest Service, Coweeta Hydrologic Laboratory, Otto, NC, ²University of Georgia, Athens, GA 30602. Coarse Woody Debris Across an Elevation and Vegetation Gradient in the Southern Appalachian Mountains.

Coarse woody debris (CWD) can represent a large stable pool of carbon and nutrients in mature forest systems. As forests age this pool may increase in size and importance in terms of regulating nutrient cycles. During the winter of 1997-1998 the location and quantity of CWD on sites representing the vegetation and elevation gradient within the Coweeta Hydrologic Laboratory were inventoried. All CWD, material at least 1.5 m in length and 10 cm in diameter, on the 0.8 ha expanded LTER gradient plots was located. Location coordinates (x and y) were taken (B1 0.5 m, slope distances) for both ends of each piece of CWD, the width (cm) of each end was also measured. Each piece of CWD was classified by decay class (1-5). Later stages of decay included a moss (m) designation, to identify pieces with greater than 50% moss coverage. Four pieces of each CWD decay class will be sampled from each site, outside the main LTER gradient plot. Bulk density and nutrient concentration of each decay class will be measured. This will allow computation of total weight and nutrient content (kg ha⁻¹) of CWD on these sites.

Oral Presentation

LYNCH, J. A.* and JAMES S. CLARK. Botany Department, Duke University, Durham, NC 27708. How Fire and Anthropogenic Disturbance Shaped Forests of the Southern Appalachian Mountains.

Charcoal and pollen records from cores taken at 12 small bogs and ponds in North Carolina and Virginia were analyzed at 10-50 year intervals to determine the importance of fire and human disturbance in shaping presettlement and 20th century forests in the southern Appalachian Mountains. The sites lie within different forest types, elevations, and occupation histories. Preliminary results from Pink Beds Bog, White Oak Bog, and Days Creek Pond indicated an increase in burning since European settlement as shown by an increased charcoal accumulation since settlement. Prior to European settlement, low charcoal accumulations occurred, indicating low amounts of burning during the past 2000 years. However, charcoal peaks after European settlement in Days Creek Pond, Big Soft Sleep Bog, and Spring Pond suggest the presence of natural fires in forests. Furthermore, high charcoal concentrations occur at the transition between coniferous and deciduous forests of the Holocene and Pleistocene indicating a greater role of fire in these transitional forests. Further analyses of both charcoal and pollen records and the collections of new cores are needed to sharpen the assessment of fire importance in the southern Appalachian Mountains.

Oral Presentation

MAIDENS, DENISE* and JOSHUA LAERM. University of Georgia, Athens, GA 30602.

Notes on the Effect of Size and Level of Decay of Coarse Woody Debris on Relative Abundance of Shrews and Salamanders in the Southern Appalachian Mountains.

We investigated possible relationships between the relative abundance of shrews and salamanders to size and state of decomposition of coarse woody debris (CWD). This relationship has not been quantified in the southeastern United States. Pitfall traps were placed adjacent to logs of three size classes and states of decomposition in a northern hardwood community in southwestern North Carolina. In 1848 trap-nights, we collected five species of salamanders (*Plethodon jordani*, *Desmognathus ochrophaeus*, *Desmognathus wrightii*, *Eurycea wilderae*, and *Gyrinophilus porphoriticu*) and four species of shrews (*Blarina brevicauda*, *Sorex cinereus*, *S. fumeus*, and *S. hoyi*). Three species of rodents (*Peromyscus leucopus*, *Napeozapus insignis*, and *Clethrionomys gapperi*) also were collected. We tested for differences in capture rates of shrews and salamanders between traps placed beside and away from CWD. For traps placed beside CWD, we also tested for differences in rates of capture among three size and decay classes. The effect of size and decay in capture rates differed between shrews and salamanders. Capture rates of shrews were affected by amount of decay, whereas capture rates of salamanders were affected by size.

Oral Presentation

McTammany, M.E.^{1*}, J.S. Harding², E.F. Benfield¹, P.V. Bolstad³, and G.A. Edwards³.

¹Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061,

²Cawthron Institute, Nelson, New Zealand, ³University of Minnesota, St. Paul, Minnesota, 55102. The Impact of Urbanization Type and Degree on Benthic Macroinvertebrates and Stream Quality.

We investigated the impact of urbanization on benthic invertebrate diversity and community composition of 12 streams in western North Carolina which differ in the amount and type of development in their watersheds. Urbanization in the southern Appalachian area affects stream communities based on the type (residential, commercial, or industrial) and degree of development. We quantified urbanization from 1970 until the present using several metrics generated from GIS overlays of land cover, aerial photographs, and field exploration in the study catchments. In addition to land use, quantitative benthic samples of invertebrates and organic matter were taken, and a number of water chemical and geomorphological variables were measured. Invertebrate diversity decreased with increasing urbanization (less forest cover and greater building density). The NCBI values for invertebrates of these streams were positively related to road and building density suggesting dominance by pollution tolerant taxa when urbanization increases. Streams in primarily residential watersheds supported greater diversity than streams in commercial or industrial areas. Physicochemical variables showed similar relationships with land use metrics suggesting some possible mechanisms for the impact urbanization has on benthic macroinvertebrates.

Oral Presentation

MEYER, J.L.* University of Georgia, Athens GA 30602. An Overview of Stream Research at the Coweeta LTER Site.

Research on southern Appalachian streams continues to be a diverse and productive aspect of the Coweeta LTER project involving 7 Co-PIs and at least 15 graduate students. Stream researchers focus on land-water interactions and in-stream

processes, and how they are impacted by anthropogenic and other disturbances. Stream research has been integrated into most LTER project areas. In addition, several stream projects have been inspired by LTER, but are funded from other sources. I will show how stream research is contributing to gradient, regionalization, and riparian projects and briefly describe results from an experiment testing the relative importance of controls on stream periphyton. Light is the primary determinant with nutrients and grazers playing a secondary role. I will conclude with a brief summary of projects inspired by LTER but supported by additional funds. These include fish diversity and sedimentation in the Southern Appalachians (funded by USGS), the Lotic Intersite Nitrogen eXperiment (LINX, NSF and Fulbright), a litter exclusion experiment (NSF), and a nutrient addition experiment (NSF) .

Poster Presentation

NEATROUR, M.* , j.r. Webster, and e.f. benfield. Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061. The Role of Floods in the Exchange of Particulate Organic Matter between a Southern Appalachian River and its Floodplain.

We investigated the role of a flood in the exchange of particulate organic matter between the floodplain and active channel of the Little Tennessee River in western North Carolina. We measured litterfall, leaf decomposition, and floodplain litter (pre-flood and post flood) at 12 sites in three different vegetation classes (shrub, open forest, closed forest). Six of the ten sites that were inundated had less organic matter in post-flood samples than in pre-flood samples ($p < 0.05$). In contrast, none of sites had more organic matter after flooding ($p > 0.05$). These data suggest that floodplain of the Little Tennessee River may be a source of organic matter for the active channel.

Oral Presentation

PEARSON, SCOTT M.* ¹, MONICA G. TURNER², AND PAUL BOLSTAD³. ¹Mars Hill College, Mars Hill, NC 28754, ²University of Wisconsin - Madison, Madison, WI 53706, and ³University of Minnesota, St. Paul, MN 55102. Changing Landscapes: Implications for Population Dynamics of Native Species.

During the 20th century, the extent and spatial pattern of forest cover has changed in the southern Blue Ridge Mountains. These landscape-level changes have resulted in differences in the availability of habitats for forest-dwelling species. We explored the ecological implications of these changes by evaluating maps of forest habitats in four topographic positions (coves, sheltered slopes, open slopes, and ridges) for three time periods (1950, 1970, and 1990). The availability and spatial pattern of forest cover was quantified for each topographic position and time period. A population dynamics model was used to explore the implications of these habitat changes for three species with different life-history strategies. Habitats for lower elevation, cove-dwelling species experienced the greatest degree of habitat change, while habitats on high- elevation ridges changed the least. Low elevation habitats have historically been more fragmented and species restricted to these sites will likely be more variable in their distribution due to habitat fragmentation and local extinctions.

Poster Presentation

PEARSON, SCOTT M.*¹, MONICA G. TURNER², ALAN B. SMITH¹, and PAUL V. BOLSTAD³. ¹Mars Hill College, Mars Hill, NC 28754; ²University of Wisconsin, Madison, WI 53706; ³Department of Forestry, University of Minnesota, St. Paul, MN

55102. Species Diversity in Forests Established Before and After 1950 in a Southern Appalachian Watershed.

Forest cover in many southern Appalachian watersheds has increased since the early 1900s due to changing patterns of land use. Changing economics led to the abandonment of pastures and croplands on sites with steep slopes and less-fertile soils. Since 1950, land cover on many sites has changed from nonforest to forest, resulting in greater coverage and less fragmentation of forest habitats. We hypothesized that sites with younger, aggrading forests may not yet support many of the plant species present in older forests. Therefore, we compared the diversity and abundance of vascular plants at two types of presently forested sites: (a) sites with forest established pre-1950 and (b) sites with forest established after 1950. We found that species richness for both woody and herbaceous plants was lower at sites with post-1950 forests. Species with limited dispersal capabilities or specialized habitat needs were absent from these sites. Generalist species were frequently present in these young forests but in lower densities. Many exotic, weedy species persisted in post-1950 forests. Differences between the two types of forests were mitigated by topographic factors, proximity to older forests, and land use history. These results help interpret land-cover change from an organism-based perspective.

Poster Presentation

REYNOLDS, B.C.* , D.A. CROSSLEY, JR. and M.D. HUNTER. University of Georgia, Athens, GA 30602. Differences in Leaf Litter Decomposition and Microarthropod Assemblages along an Elevation Gradient.

Decomposition rates of mixed species leaf litter were measured along an elevation gradient at the Coweeta Hydrologic Laboratory, Macon County, North Carolina. Litterbags containing air-dried leaves of both *Acer rubrum* L. and *Quercus rubra* L. were placed at 10 sites on each of three plots along the gradient and sampled monthly. Microarthropods were extracted and sorted into 4 categories: Collembola, mesostig mites, oribatid mites, prostigmatid mites, and others. Litter was dried and weighed to determine mass loss. Decomposition rate constants were calculated on a yearly basis for the three plots. Relative abundance of the four microarthropod groups was determined and compared along the gradient.

Oral Presentation

ROUHANI, RON.* University of Georgia, Athens, GA 30602. Summary of Coweeta LTER Information Management and Web Page Development.

I will be presenting a summary of the current status of several Coweeta LTER information management projects. Specific topics will include computer security, data sets, metadata, and the Coweeta Bibliography. A review of the numerous improvements to the Coweeta web page will also be presented.

Poster Presentation

SALMORE, ALISSA and MARK D. HUNTER. University of Georgia, Athens, GA 30602. Limits on resource acquisition define nutrient and energy budgets for plants.

The presumably costly investments of growth, reproduction, and defense are assumed to occur sequentially or with inverse relationships as a trade-off. This concept of trade-offs implies that plant strategies maximize fitness within a given environment. Moreover, these optimal strategies necessarily vary under genetic and

environmental heterogeneity. We are investigating the potential trade-offs between defense and reproduction in the wildflower *Sanguinaria canadensis* (bloodroot) along an environmental gradient. *S. canadensis* produces highly bioactive alkaloids as defense against predators and pathogens; in addition, bloodroot invests in oil-rich appendages for its seeds which enhance dispersal and stimulation of germination by ants. Individual plants will be collected along an altitudinal transect, and propagated in a greenhouse experiment that will use shade, fertilizer, and pathogen-innoculation to manipulate alkaloid (rhizome) and lipid (seeds/elaiosome) levels. Following these treatments, rhizome tissue and seeds will be chemically analyzed using HPLC and GC. We hypothesize that *S. canadensis* will demonstrate variation in the level of defensive alkaloids produced corresponding to altitude and genotype, and that the level of alkaloid production will influence reproductive investment, as evidenced by the amount of viable seeds and the lipid composition of elaiosomes produced.

Oral Presentation

SCHOFIELD, KATHARINE*, KATHERINE DOWELL, EMMA ROSI, CATHERINE PRINGLE, AND JUDY MEYER. University of Georgia, Athens GA 30602. Effect of Macrobiotic Exclusion on Benthic Communities: the Role of Fishes and Crayfishes in Southern Appalachian Streams

We examined the role of macrobiota in structuring the benthic communities of two low-order southern Appalachian streams, one draining intact forest (Ball Creek) and one draining pasture (Jones Creek). Fishes and crayfishes were excluded from areas of both streams using an electric exclusion technique; chlorophyll *a*, ash free dry mass (AFDM), and invertebrates were sampled over a 40-day period. In both streams, chlorophyll *a* and AFDM were higher in exclusion than control areas, although these trends were not consistently significant across all sampling dates. In Jones Creek, significantly more large (> 4 mm) aquatic insect larvae were found in exclusion than control areas, most likely due to exclusion treatments providing a refuge from macrobiotic predators. This refuge effect was also evident in Ball Creek, where exclusion treatments contained significantly more filterers. Results indicate that macrobiota influence the structure of southern Appalachian benthic communities, by decreasing the amount of organic matter (algal and detrital) available for other consumers and by preferentially preying on certain sizes and taxa of invertebrates. Compared to some low-order tropical streams, however, macrobiotic influences are low. Weaker effects may be attributed to decreased abundance of macrobiota and increased influence of benthic insects in southern Appalachian streams.

Oral Presentation

SCOTT, M.C.* and G.S. HELFMAN. University of Georgia, Athens, GA 30602-2202. Stream Fish Assemblage Composition: Comparisons Among Forest, Agriculture, and Urban Land Uses.

Streams in the Little Tennessee and French Broad river basins of the Southern Appalachians drain watersheds that are largely forested. However, agriculture and urban development can have measureable effects on fish assemblages. Ongoing work focuses on 36 streams in the two basins divided equally among the three land use types. Preliminary results suggest that in disturbed watersheds, cool-water, benthic species native to the upland region are being replaced by warm-water, pool-dwelling species often more common in lowland streams. Such assemblage

composition shifts may result from changes in physical habitat and water quality due to anthropogenic land use change.

Oral Presentation

SUTHERLAND, A.B.* , J.L. MEYER, and E.P. GARDINER. University of Georgia, Athens, GA 30602-2202. Effects of Land-Use on Sediment Regime and Fish Assemblage Structure in the Southern Appalachians.

We examined the relationship between catchment land use, sediment regime, and fish assemblage structure in four streams in the upper Little Tennessee River basin. Study reaches were 100 meters long, draining similar areas (2000-3000 ha). Agricultural sites were 78 and 87% forested and reference sites 97 and 99% forested. Bedload and suspended-load were measured to assess sediment transport and composition at baseflow and stormflow. Streambed surveys were conducted to determine changes in percent cover of different substrate types. Differences in fish communities were determined from samples taken in fall of 1997. Bedload transport was 10-15 times greater and suspended-load was 4-5 times greater in agricultural sites. Substrate composition was more variable in agricultural sites than in forested sites. Abundance and diversity of fish species requiring clean gravel-cobble were higher at forested sites. Fishes tolerant of disturbance dominated agricultural sites. Recruitment of *Cottus bairdi*, a representative benthic spawner/invertivore, was significantly higher in forested sites. Increased suspended sediment is one of many potential mechanisms linking land disturbance and fish assemblage shift. Using *Cottus bairdi*, we are currently examining the effect of increased turbidity on the growth and mortality of fish larvae.

Poster Presentation

TAYLOR, SHARON F.^{1*}, BRIAN BECKAGE², BRIAN D. KLOEPEL¹, DAVE C. COLEMAN¹.
¹University of Georgia, Athens, GA 30602 USA, ²Duke University, Durham, NC 27706 USA. Riparian Zone Seedling Establishment, Growth, Dynamics, and the Influence of *Rhododendron maximum*.

To study seedling establishment, growth, and dynamics in riparian zones where *Rhododendron maximum* is a dominant species, one m² quadrats have been established. There are four sites which include one *Rhododendron* removal site, one hurricane disturbed site, and two control sites. Each of these four sites have ten randomly located natural regeneration one m² quadrats. An initial vegetation survey was conducted in May 1997 and quadrat physical characteristics were recorded. Subsequent surveys were taken 3 October 1997 and May 1998. During each census, seedling species, density, age, and annual height growth were recorded. Initial analysis shows little regeneration and high mortality in the control sites for all species. *Acer rubrum* and *Liriodendron tulipifera* are prevalent in the treatment removal quadrats while *Liriodendron tulipifera* and *Betula lenta* dominate in the hurricane removal quadrats. This study will continue through a third growing season (1999) and analyses will include the effects of physical characteristics on the quadrats such as aspect, slope, distance from stream, soil moisture, and photosynthetically active radiation.

Oral Presentation

THOMAS, T.* and J.W. FITZGERALD. University of Georgia, Athens, GA, 30602. Sulfur Processing and Sulfur Pool Sizes in the Riparian Zone of Watershed 55.

We examined the fate of precipitation born sulfate in forest soil and sediment. The sulfate adsorption and organic S formation potentials were estimated. Overall, the potential for adsorption of sulfate was greater than the formation potentials. Twenty-nine to sixty percent of the added sulfate was adsorbed in the soil. Of the recently formed organic S, the majority was ester sulfate (74-84%). The sediment samples had the greatest formation potentials when related to carbon concentration. The intrinsic sulfur pools of these samples were also measured. Total S (ester and carbon bonded S) ranged from 121 mg S / g dwt to 758 mg S / g dwt. With one exception, the majority of the total intrinsic S was carbon bonded (44-73%). No stream distance dependent or seasonal trends have been seen with adsorption and formation potentials or with intrinsic S concentrations.

Oral Presentation

Wagner, P.F.* and E.F. Benfield. Virginia Tech, Blacksburg, Virginia 24061. The Long-term Effects of Logging on Aquatic Insect Assemblages in Southern Appalachian Streams.

We investigated the persistence of logging disturbance on aquatic insect assemblages in southern Appalachian streams by examining aquatic insect biodiversity in streams draining old growth forests and forests logged 25 to 85+ years ago (YA). We collected aquatic insects in 16 second order streams draining the Joyce Kilmer-Slickrock wilderness areas of North Carolina and in streams in the Coweeta LTER site (NC). Biodiversity of aquatic insect assemblages was greatest in streams draining catchments logged 85+ YA and lowest in streams draining catchments logged 25-50 YA. Biodiversity in streams draining catchments which had never been logged was greater than in streams draining catchments logged 25-50 YA but less than in streams draining catchments logged 85+ YA. These data suggest that aquatic insect assemblages continue to be influenced by logging long after surrounding forests have re-grown.

Oral Presentation

Webster, J.R.^{1*}, J.L. Tank¹, P.J. Mulholland², N.B. Grimm³, E. Marti³, B. Bowden⁴, and M. Valett¹. ¹Department of Biology, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061, ²Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee, ³Department of Zoology, Arizona State University, Tempe, Arizona, and ⁴Department of Natural Resources, University of New Hampshire, Durham, New Hampshire. Terrestrial Biomes and Stream Hydrology.

Stream hydrology was studied in five U.S. streams. Ball Creek, NC, Walker Branch, TN, and Bear Brook, NH, are located in deciduous forest; Sycamore Creek, AZ, is in desert; and Gallina Creek, NM, is in semi-arid montane forest. At each site chloride was released at a constant rate for 1 to 3 h and monitored at three sites downstream. The data were used with a transient storage model to estimate hydrologic characteristics. Discharge ranged from 4 (Bear Brook) to 43 (Ball Creek) L/s. The ratio of transient storage to surface area (A_s/A) was fairly consistent for the three deciduous forest sites, ranging from 0.25 to 0.47, however this ratio was much higher for Sycamore Creek (1.00) and lower for Gallina Creek (0.07). The turnover time of surface water was 11 to 17 min except in Gallina Creek where it was over 2 h and Bear Brook where it was only 20 s. Similarly, the turnover times of water in transient storage were generally 4 to 11 min but only 9 s in Bear Brook. These results suggest major differences in the hydrologic pathways of these streams, and

we anticipate these hydrologic differences will help explain many differences in nitrogen dynamics.

Oral Presentation

WRIGHT, C.J.* and D.C. COLEMAN. University of Georgia, Athens GA 30602. Phosphorus Fractionation in Surface Soils Following Hurricane Damage and Single Species Tree Harvest.

Soil phosphorus was fractionated into resin P (bioavailable P), bicarbonate P (labile, inorganic P), and microbial P following disturbance events along a riparian hillslope at the Coweeta LTER. Annual measurements of organic phosphorus were also taken, pre- and post- disturbance. Soils were sampled along three transects located 1, 5, and 15 meters distance from the stream and separated into 0-5 and 5-10 cm depths for all analyses. Resin P levels were low for all seasons and transects, ranging from 0.38 - 4.0 mg PO₄-P/g dry soil. Bicarbonate P levels were also low for all transects and sampling dates, ranging from 0.5 - 8.0 mg PO₄-P/g dry soil. Microbial P (kp 3D 0.4) exhibited greater variation than other labile forms of P measured in this study and ranged from 4.5 - 18 mg PO₄-P/g dry soil. Levels of organic P were quite high, ranging from 180 - 348 mg PO₄-P/g dry soil. As with most forest ecosystems, soil phosphorus forms were predominantly organic P rather than labile P, indicating a rapid recycling of this element through the soil system back into biomass.

Oral Presentation

WYCKOFF, P.H.* and J.S. CLARK. Duke University, Durham, NC 27708. A Bayesian Solution to Estimating Uncertainty in Tree Growth-Rate/Mortality Relationships.

Tree growth rate may be a predictor of mortality risk and, thus, has long been a basis for killing trees in forest simulation models. Field data needed to parameterize these models include both the underlying mortality rate - the fraction of trees that die in any given year - and growth rates of living and recently dead trees. Mortality rate is difficult to estimate, and error in mortality rate can propagate to large (and unknown) error in the function describing how mortality risk is affected by growth rate. We used a series of conjugate priors, starting with information obtained from tree counts and updated with sequential, long-term census data from tree populations in the southern Appalachians. The posterior beta density for mortality rate obtained from this analysis was used when estimating uncertainty in growth-rate/mortality relationships. We then fit a nonparametric and several parametric models to tree ring data linking growth and mortality and used maximum likelihood techniques to assess relative model performance. Confidence intervals were bootstrapped and reflect uncertainty in both the underlying mortality rate and the growth rates of living and recently dead trees. Our Bayesian approach results in confident estimates of both underlying mortality rate and the risk expected for any given growth rate.

Oral Presentation

YEAKLEY, J.A.* Portland State University, Portland, OR 97207-0751. Overview and Summary of Riparian Research in the Coweeta LTER Program.

In the two years following the vegetation cut and hurricane impacts, soil moisture decreased on the vegetation cut hillslope relative to the storm impact hillslope. Groundwater levels did not vary on either hillslope. Leaf-litter decomposition rates in pre- and post-treatment time intervals (1993-95 and 1995-97) were very similar.

For all seedlings measured, initial analysis showed little regeneration and high mortality in the control sites. *Acer rubrum* and *Liriodendron tulipifera* seedlings were found prevalent in the treatment removal quadrats while *Liriodendron tulipifera* and *Betula lenta* seedlings dominated the hurricane removal quadrats. Total soil respiration rates were similar in the first year post-treatment, but then gradually increased in years two and three to 30% greater in the cut plot transects compared to the storm plot transects. In soilwater measurements, however, no significant changes were observed in DOC on either hillslope.

Monthly measurements of net N-mineralization along three transects in cut and storm plots showed moderate differences at 1 m, and as much as four times greater mineralization rates at 5 and 15 m above the stream on the storm slope. These differences were most pronounced in spring and early summer. Resin P levels and bicarbonate P levels were low for all transects and sampling dates. Microbial P exhibited greater variation than other labile forms of P measured in this study. Levels of organic P were high; soil phosphorus forms were predominantly organic P rather than labile P. Overall, the potential for adsorption of sulfate was greater than the formation potentials. In a nearby experiment, twenty-nine to sixty percent of the added sulfate was adsorbed in the soil. The sediment samples had the greatest formation potentials when related to carbon concentration. Intrinsic sulfur pools showed a majority of the total intrinsic S was carbon bonded. No stream distance dependent or seasonal trends were seen with adsorption and formation potentials or with intrinsic S concentrations.

In the two years following these events, nutrient concentrations on the vegetation cut hillslope generally did not vary significantly, although a small increase in NO₃-N was seen in one plot on the vegetation cut slope. In contrast, nutrient concentrations on the storm impact hillslope showed marked changes. NO₃-N concentrations showed consistent increases of at least two orders in magnitude in all lysimeters on the storm impact hillslope. Marked and persistent changes were also seen in SO₄ (decrease), Ca (increase) and Mg (increase) in the soilwater. In groundwater, SO₄ showed no differential response following the vegetation removal and hurricane events. For other nutrients (NO₃-N, Ca and Mg), however, responses in groundwater were similar, although of lesser magnitude, to soilwater. Nutrient concentrations varied seasonally, with major changes occurring in summer and early autumn in both soilwater and groundwater.

Oral Presentation

YEAKLEY, J.A.^{1*}, B.W. ARGO², D.C. COLEMAN², B.L. HAINES², J.L. MEYER², and W.T. SWANK³. ¹Portland State University, Portland, OR 97207-0751, ²University of Georgia, Athens, GA 30602, ³USDA Forest Service, Coweeta Hydrologic Laboratory, Otto, NC 28763. Hillslope Nutrient Flux in Response to Both Human and Natural Vegetation Disturbances in a Southern Appalachian Watershed.

As part of an experiment to determine the effect of removing near-stream *Rhododendron* on hillslope nutrient and carbon flux, transects were established on adjacent hillslopes in a first order watershed at the Coweeta Hydrologic Laboratory. For two years, background dynamics were determined for nutrients (K, Na, Ca, Mg, NO₃-N, NH₄⁺N, O-PO₄, SO₄) and dissolved organic carbon (DOC), as well as for soilwater and riparian groundwater hydrology. In August 1995, the *Rhododendron* thicket in the near-stream area of one hillslope was basally cut. In early October 1995, Hurricane Opal uprooted several dominant canopy trees on the other hillslope.

In the two years following these events, soil moisture decreased on the vegetation cut hillslope, but remained steady on the storm impact hillslope. Groundwater levels did not vary on either hillslope. Generally, nutrient concentrations on the vegetation cut hillslope did not vary significantly. In contrast, nutrient concentrations on the storm impact hillslope showed marked changes. NO_3^- concentrations showed consistent increases of at least two orders in magnitude in all lysimeters on the storm impact hillslope. Marked and persistent changes were also seen in SO_4 (decrease), Ca (increase) and Mg (increase). After two years, these elevated nutrient concentrations have not returned to background levels.