Coweeta LTER Program 1998 Annual Report

NSF Grant DEB-96-32854
Submitted to the National Science Foundation 01 August 98

Table of Contents

Introduction

Coweeta LTER research focuses on studies along complex environmental gradients to examine the response to disturbance in a landscape perspective. We are examining the causes and consequences of land cover change in the southern Appalachians and are examining three linked components of the landscape: upland forests, riparian zones, and streams. In addition, the regional and socio-economic components of our research include a large scale (56,000 km^2) research approach to better understand the regional interactions of our ecosystems.

This report contains a brief update of these major research projects along with updates on data management and other LTER related research. In addition, we also include information on outreach, cross-site, and LTER/ILTER Network activities in one to two additional pages. We conclude with listings of publications, research grants,

and online data sets and metadata related to our Coweeta LTER project.

Research Accomplishments

Land-Use Change Regionalization Project

Our regionalization land-use change project, initiated with augmentation funding in 1994, has been a steady source of excitement for our site. We submitted a Progress Report in February 1998, which was well-received at NSF, concerning the current status and direction of our regionalization research. A mid-year meeting of regionalization Co-PIs at Coweeta in January 1998 and our Annual Meeting for all personnel in Athens, GA in June 1998 displayed the large amount of research underway along with numerous products (publications and maps) from our research.

Aquatic Ecology Highlights

The aquatic research group has focused on a series of twenty-four sampling sites representing six replicated primarily forested and pasture sites in two different river drainage systems (Little Tennessee and French Broad). Fish and invertebrate quantity and diversity, along with water quality variables, have been sampled at each site over the past two field seasons and have yielded numerous interesting results. As more detailed data of the land cover history of the area upstream of sample points has become available from GIS projects, additional analyses of the stream data have been possible. Results show that though significant differences exist in the species assemblages between primarily forested and agricultural drainage types, the history of the landscape may account for much of the difference between sites within each type of drainage. For example, terrestrial recovery from agricultural use may be relatively rapid, however recovery of stream fauna to their pre-disturbance species and population dynamics may take considerably longer (i.e. decades).

Terrestrial Ecology Highlights

The terrestrial ecology research group has made progress on two main activities. First, Paul Bolstad, Co-PI on the project, has worked closely with all groups in the Regionalization project to distribute the wealth of digitized mapping and land cover products which his lab has produced. Paul is also a member of the three-person carbon cycling team, along with James Vose and Brian Kloeppel, who are quantifying the pools and fluxes of the carbon cycle across the complex southern Appalachian landscape. Two years of intense data collection and one year of summary and analysis have yielded relationships for the effect of slope position, aspect, temperature, and seasonal morphology on foliage, woody, soil, and litter carbon fluxes. These functional relationships, coupled with the more straightforward measurement of carbon pools for each of the above components now allow the development of a first generation carbon cycling model.

In addition to the carbon-cycling work, efforts by Scott Pearson and Monica Turner have focused on the diversity of species, both plant and bird populations, across the landscape in relation to land-use history. Jim Clark's lab has made a significant contribution to understanding the role of fire in land-use change by reconstructing the charcoal and pollen records from cores taken from 12 small bogs and ponds in North Carolina and Virginia. They were analyzed to determine the importance of fire and human disturbance in shaping presettlement and 20th century forests in the southern Appalachians. Prior to European settlement, low charcoal accumulations

occurred, indicating low amounts of burning during the past 2000 years. However, charcoal peaks after European settlement 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.

Socio-Economic Highlights

Our socio-economic group has made significant progress on two fronts. First, an intense mapping and modeling project has digitized select areas from a five state southern Appalachian area. The database contains typical GIS layers such as slope, elevation, aspect, and land cover along with more socio-economic layers such as building density, population distribution, and road systems. These data have been summarized from sets of aerial photos and satellite imagery from both the 1950's and the 1990's. This forty year time period change has then been used as a baseline, along with other socio-economic factors, to predicting future land use change with predictions of population and building distribution and land cover for the year 2030.

Ted Gragson has also been performing an extensive census and population history of our regionalization study area and has found numerous interesting patterns. Rather than population growth and seasonal migration being strictly recent phenomena (from retiree and vacation home construction), they may be a repetition of a pattern set early in the population history of the Blue Ridge Mountains. 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 has been developed from archival census records and other information.

Stream Ecology Projects

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 including gradient, regionalization, and riparian projects. In addition, several stream projects have been inspired by LTER, but are funded from other sources (see listing of Related Research Grants on page 19). 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).

In another series of studies, 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.

Hillslope-Riparian Projects

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. 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.

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.

In the two years following hurricane and *Rhododendron* removal treatments, soilwater nutrient concentrations on the vegetation cut hillslope generally did not vary significantly, although a small increase in NO_3-N was seen in one plot on the vegetation cut slope. In contrast, nutrient concentrations on the storm impact hillslope showed marked changes. NO_3-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 SO_4 (decrease), Ca (increase) and Mg (increase) in the soilwater. In groundwater, SO_4 showed no differential response following the vegetation removal and hurricane events. For other nutrients (NO_3-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.

Terrestrial Gradient and Canopy Gap Projects

The study of forested ecosystems over a complex environmental gradient was initiated in 1991 and has continued to generate many interesting results as well as several new studies that are currently underway. The gradient has five intensive plots, established from a relatively dry oak ecosystem to a mesic high elevation northern hardwoods ecosystem, as well as 20 extensive plots providing greater spatial coverage of these ecosystems across the Coweeta basin.

Several new studies established on the gradient plots include a 15-year small log (bolt) study established by James Vose and D.A. Crossley. During the course of the study, including nine commonly transplanted species on all sites, periodic biomass sampling along with gas flux measurements are being conducted. Two year results indicate surprisingly high decomposition at the high elevation northern hardwoods site, the site expected to exhibit the lowest decomposition rates. This same site exhibits unexpectedly high soil nitrogen mineralization. In a second set of studies, the area of the gradient plots is being enlarged from 20 x 40 m to 80 x 80 m in an effort to map and model single and multiple tree gap dynamics. Seed rain, seed bank

dynamics, seedling dynamics, and overstory survival and growth have already being quantified. This last component will allow a complete analysis of all life stages of the vegetation across the complex gradient. The larger plots have also been used to map and quantify coarse woody debris on the gradient plots.

Our artificially induced forest gap project is nearing completion of the first phase of work. This replicated study conducted on high and low elevation forest sites has monitored the microclimate, seedling dynamics, physiology, and N mineralization of both rhododendron and non-rhododendron study sites. Results show that the impact of rhododendron was highly detrimental to seedling establishment and growth. Several investigators have now established forest gap plots resulting from hurricane Opal which impacted Coweeta on 05 October 95. This progression to more and widespread plots will allow us to investigate the gap dynamics across a larger geographic area and elevational gradient of the Coweeta Basin.

Our terrestrial research group suffered the untimely death of Co-PI Joshua Laerm, small mammal and amphibian ecologist, in September 1997. Though Josh can never be replaced, his position in the Coweeta LTER program was filled by Ronald Pulliam, terrestrial ecologist, from the University of Georgia.

Data and GIS Management

In October 1997, our Data Manager, Gildo Calabria, was replaced by Ron Rouhani. Gil and Ron overlapped for a one month period during which time Ron was familiarized with the Coweeta LTER Data Management hardware, software, and strategies. Our GIS Manager, Ned Gardiner, has continued to move our GIS data management and organization forward as described below.

During the past year, the following changes and additions have been performed by the Data Manager. The Coweeta web page (home page URL address: http://coweeta.ecology.uga.edu) has been completely modified and updated. The archived data sets have been moved to a MSQL database, which allows the users to query the data sets on the web. A total of nine new data sets have been added to the "Ongoing Research" page. Monthly updates to the ongoing data sets were performed using scripts. The Coweeta LTER bibliography containing 1030 citations including abstracts was placed online (URL address: http://coweeta.ecology.uga.edu/webdocs/html/ronbibform.html). The user may search the citations by using a specific or general query string. A metadata web page was created so that all metadata are now available to the public. The page allows the researchers to display a summary of their ongoing work. An electronic version of the Coweeta brochure was placed online. A 12 Gigabyte hard disk box was purchased and installed on the Coweeta server. In addition, a back-up power supply was purchased for the server and its disks.

A fully interactive web page of our plant tissue and soil sample archive has been placed online (see URL address below). Jim Deal, our Analytical Lab Manager, maintains the cataloging and management of this archive which contains 76 sample sets with over 21,000 samples. Where possible, online descriptions of the sample sets have also been linked to the online laboratory analyses that have been conducted on the archived samples. Forms for submitting new samples and obtaining subsamples from the archived sets are online and are coordinated by Jim Deal and a committee of two other scientists at Coweeta, Brian Kloeppel and Jennifer Knoepp.

Samples Archive

We have fundamentally redesigned our GIS database in the past year. We followed three steps in migrating from an ad-hoc file storage system to a more usable, durable one. First, we archived all GIS data under a simple data directory map. Second, we normalized the database, eliminating redundant information where possible. Third, we standardized the projection, spheroid, and ellipsoid to be used for the entire set of geospatial data. This important planning phase was supported by funding from the University of Georgia (UGA) Office of the Vice President for Research. Over the past year, we have also upgraded our facilities. We joined the UGA Center for Remote Sensing and Mapping Science in a successful bid to NASA for equipment funds resulting in a new GIS server (Sun Ultra 60) and workstation (Dell XPS D333). We leveraged our operating funds with the grant to upgrade our local area network to 100 MB per second.

In the past year, the GIS lab produced analytical results and/or figures from existing GIS layers for several projects: 1) land use adjacent to sites in a study detailing the USA's longest time series of insect production, 2) posters and a master's thesis describing the effects of sedimentation on fish assemblages in the Little Tennessee River, 3) graduate student presentations at the North American Benthological Society meetings in May 1998, 4) a web page describing long term trends in breeding bird populations in the region surrounding Coweeta, and 5) a presentation by our GIS Manager at the ASLO/ESA 1998 meeting regarding new methods being developed for watershed analysis over large regions.

Coweeta LTER Annual Meeting Summary

Our Coweeta LTER Annual Meeting was held on 15-16 June 98 at the Institute of Ecology at the University of Georgia. All personnel (Co-PIs, graduate students, and staff) participated and combined to present 30 oral papers and 6 posters. Abstracts from all presentations were compiled and distributed to meeting participants to promote further interaction and familiarity between this large group of scientists and staff. In addition, abstracts were placed online (URL address: http://coweeta.ecology.uga.edu/webdocs/coweeta/html/98abs.html) as a more permanent record for those on our project as well as for an up to date research summary for others who access our Coweeta LTER web site.

All four of our external scientific advisors (see list below) were able to attend our annual meeting and provided us with some excellent feedback and suggestions in the concluding session.
External Scientific Advisors (with affiliations and area of expertise):
Thomas Heberlein - University of Wisconsin-Madison and NTL LTER site (Socio-economic)
Pat Mulholland - Oak Ridge National Lab (Streams)
Boyd Strain - retired from Duke University (Plant Physiological Ecology)
Keith Van Cleve - retired from Univ. of Alaska - Fairbanks and BNZ LTER site (Forest Soils)

Coweeta LTER Outreach Activities

Our research site has participated in a number of outreach activities during the past year. First, we have generated, with the help of Patricia Sprott at the LTER Network Office, a full color Coweeta LTER brochure (http://sparc.ecology.uga.edu/webdocs/brochure/). This brochure is used for educational and scientific tour groups as well as for program overview for university administrators.

Second, Coweeta personnel have continued to dedicate part of their time to lead tours for a variety of scientists, resource managers, and students to present and discuss research conducted at Coweeta. This past year we provided tours for over 1300 people with topics ranging from climate network operation, to watershed ecology, to terrestrial gradient research, to the impacts of hurricane Opal in October 1995 on our steep mountain terrain.

Third, our site has again been fortunate to receive Research Experience for Undergraduate (REU) positions. This past year, students studied spatial variation in soil nitrogen mineralization, small mammal distribution in relation to substrate (log) availability, and the sociological history of residents of Macon County, NC. Current student research focuses on rhododendron and laurel biomass and nitrogen distribution and the impact of land use history on small mammals and herbaceous plants.

Fourth, Sharon Taylor, LTER Technician, currently serves as the Treasurer and Secretary on the Executive Board of the Little Tennessee Watershed Association which is a multi-agency and public involvement grass roots organization to promote wise land, riparian, and stream management. Coweeta LTER research publications and data sets have frequently been cited to provide scientific-based strategies for various land, riparian, and stream management practices.

Fifth, an article is currently being written by a University of Georgia (UGA) journalist on the Coweeta LTER program for the UGA Research Reporter, a glossy high distribution magazine (30,000 copy distribution list) of the UGA Vice President for Research Office.

Sixth, the Coweeta LTER program has pursued all NSF Schoolyard LTER initiatives to build upon our long term commitment to K-12 education as demonstrated by the second point above. We will hopefully be receiving a $15,000 NSF supplement shortly and also plan to be a part of the Schoolyard LTER Workshop to be held at Biosphere II in Arizona in October 1998.

Cross-Site Research Projects

There are several cross-site research projects involving the Coweeta LTER site. The first is a cross-site ant ecology project headed by Michael Kaspari at the University of Oklahoma who is being assisted by a post-doctoral scientist, Leeanne Alonso. The project, titled "Climatic Regulation of Ant Assemblages in North and Central America" is being conducted at seven sites, three of which (Coweeta, Andrews, and Sevilleta) are LTER sites. A series of manipulations with temperature tiles at various elevations is being conducted along with line transect sampling to determine ant diversity and abundance. These transects have been co-located with long-term monthly soil moisture transects in four watersheds at Coweeta.

The second project is a cross-site study by Liam Heneghan, Dave Coleman, Xiaoming Zou, Dac Crossley, and Bruce Haines at the University of Georgia. They are studying microarthropod regulations of microbial populations involved in leaf litter decomposition in sites in Puerto Rico, Costa Rica, and Coweeta. Cross-site litter decomposition is being compared along with a quantification of the abiotic and biotic agents affecting this decomposition. This study has already produced several publications listed at the end of this annual report.

The third project is NSF funded and concentrates on fine and coarse root growth and dynamics across a series of sites, both LTER and non-LTER, which is coordinated by Ronald Hendrick at the University of Georgia for the Coweeta sampling. The Coweeta site is located on a Terrestrial Gradient project study site and has benefited from the seven years of baseline information already available on the microclimate, soil solution chemistry, throughfall and litter inputs, and large viewing rhizotrons. The minirhizotrons for this study were installed at Coweeta in September 1996 and the first observations were recorded in spring 1997.

Fourth, the LINX (Lotic Intersite Nitrogen experiment) project is a cooperative study among 11 institutions comparing the dynamics of nitrogen in streams at 10 sites ranging from the North Slope of Alaska to Puerto Rico. The central hypothesis of this project is: "the considerable variability among streams in uptake, retention, and cycling of nitrogen is controlled by key hydrologic, chemical, and metabolic characteristics that determine water retention, degree of nitrogen deficiency, and energy flow through food webs in stream ecosystems." We are using simulation modeling, field tracer (N^{15}) additions, and an intersite comparative approach to address this hypothesis. This study is in its second year and in the progress of data collection at the final site.

Sixth, Dean Urban from Duke University is leading a four site study titled "Environmental variability and forest pattern: a comparison of western and eastern landscapes". Coweeta is providing archived data and is also a field site for this project combining plot level data and landscape scale modeling to explore the sensitivity of these ecosystems to general climate change.

Seventh, Dave Coleman, Coweeta Co-Lead PI, is a co-author and co-editor on the updated Soil Methods Volume. Agreement on a common protocol for soil measurements that can be greatly affected by methodology (e.g., soil microbial biomass) is imperative to assist in cross-site synthesis. The present volume addresses those concerns, and draws upon the expertise of over 40 scientists from virtually all of the LTER sites as well as collaborators from federal agencies.

Eight, Dac Crossley, original Co-Lead PI with Wayne Swank for the Coweeta LTER Program in 1980, has retired from the University of Georgia (UGA). There will be a conference held in his honor on 4-6 October 98 at UGA titled "Invertebrates as Webmasters in Ecosystems".

Ninth, Wayne Swank and Lloyd Swift are collaborating with the H.J. Andrews LTER staff to synthesize and compare cross-site hydrologic characteristics of LTER forested watersheds by summarizing precipitation, baseflow, storm runoff, discharge, and evapotranspiration processes to explain differences and similarities of forested catchments across regions of the U.S.

LTER / ILTER Network Activities

We have participated in several LTER and ILTER network activities outside of the regular coordinating committee meetings attended by our site administrators and the annual data management meetings attended by our computer and management staff.

First, Dave Coleman, Coweeta Co-Lead PI, is chairman of the LTER Publications Committee that is advising on all LTER publications, including the LTER synthesis volumes series, to be published by Oxford University Press.

Second, Lloyd Swift, Coweeta Co-PI, participated in the first major revision of the LTER Climate Committee guidelines which was hosted by the Sevilleta site in October 1997. The revised standards retain Lloyd's original concept developed for the Network in 1981 of maturing levels of climate station design along with allowances for more sophisticated instrumentation and database sharing.

Third, Brian Kloeppel and Ron Rouhani, Coweeta LTER Site and Data Manager, respectively, visited the LTER Network Office in February 1998 to develop the Coweeta LTER brochure attached with this Annual Report. In addition, they also met with Network Office staff and leadership to increase coordination and activity with the LTER Network Office.

Fourth, John Dennis, a videographer from Atlanta, GA, has recently taken video footage and photos at Coweeta (as well as at the Sevilleta) to develop a proposal to NSF for an LTER Network video documentary and short overview videos for each LTER site.

Fifth, Wayne Swank, Coweeta Co-PI, conducted 14 days of invited lectures in May 1998 at Nanjing Forestry University and the Chinese Academy of Sciences in Beijing, China. Topics centered around forest ecosystems and forest environment processes and issues.

Sixth, Brian Kloeppel will be participating in the upcoming Poland ILTER trip with Jim Gosz in September 1998.

Seventh, Wayne Swank will be participating in a scientific exchange in 1999 for a cooperative analysis of hydrologic processes on forested watersheds at Coweeta and Turkey.

Publications of the Coweeta LTER Project (1997 - present)

Published Journal Articles (45 total)

Benfield, E.F. 1997. Comparison of litterfall input to streams. Journal of the North American Benthological Society 16: 104-108.

Bolstad, P.V. and W.T Swank. 1997. Cumulative impacts of landuse in a North Carolina mountain watershed. Water Resources Bulletin 33:519-533.

Clark, J. S., C. Fastie, G. Hurtt, S. T. Jackson, C. Johnson, G. King, M.Lewis, J. Lynch, S. Pacala, I.C. Prentice, E. W. Schupp, T. Webb III, and P. Wyckoff. 1998. Reid's Paradox of rapid plant migration. BioScience 48: 13-24.

Clark, J. S., E. Macklin, and L. Wood. 1998. Stages and spatial scales of recruitment limitation in southern Appalachian forests. Ecological Monographs 68: 213-235.

Clinton, B.D., K.J. Elliott, and W.T. Swank. 1997. Response of planted eastern white pine (*Pinus strobus* L.) to mechanical release, competition, and drought in the southern Appalachians. Southern Journal of Applied Forestry 21: 19-23.

D'Angelo, D. J., S. Gregory, L. Ashkenas and J. L. Meyer. 1997. Physical and biological linkages within a stream geomorphic hierarchy: a modeling perspective. Journal of the North American Benthological Society 16(3): 480-502.

Elliott, K.J., L.R. Boring, W.T. Swank, B.R. Haines. 1997. Successional changes in plant species diversity and composition after clearcutting a southern Appalachian watershed. Forest Ecology and Management. 92: 67-85.

Elliott, K.J. and D. Hewitt. 1997. Forest species diversity in upper elevation hardwood forests in the southern Appalachian. Castanea 62: 32-42.

Golladay, S.W. 1997. Suspended articulate organic matter concentration and export in streams. Stream organic matter budgets. Journal of the North American Benthological Society 16: 122-131.

Grubaugh, J.W., J.B. Wallace, and L.S. Houston. 1997. Production of benthic macroinvertebrate communities along a southern Appalachian river continuum. Freshwater Biology 37: 581-596.

Hall, R.O., J. Peterson and J.L. Meyer. 1998. Testing a nitrogen cycling model of a forested stream using a ^{15}N tracer addition. Ecosystems 1(3): 283-298.

Hardt, R.A. and W.T. Swank. 1997. A comparison of structural and compositional characteristics of Southern Appalachian young second-growth, maturing second-growth, and old-growth stands. Natural Areas Journal 17(1): 42-52.

Hu, S., D.C. Coleman, C.R. Carroll, P.F. Hendrix, M.H. Beare. 1997. Labile soil carbon pools in subtropical forest and agricultural ecosystems as influenced by management practices and vegetation types. Agriculture, Ecosystems an d Environment. 65: 69-78.

Hutchens, J.J., Jr., E.F. Benfield, J.R. Webster. 1997. Diet and growth of a leaf-shredding caddisfly in southern Appalachian streams of contrasting disturbance history. Hydrobiologia 346: 193- 201.

Ives, A. R., M. G. Turner, and S. M. Pearson. 1998. Local explanations of landscape patterns: can analytical approaches approximate simulation models of spatial processes. Ecosystems 1:35-51.

Johnson, D.W., R.B. Susfalk, R.A. Dahlgren. 1997. Nutrient fluxes in forests of the eastern Sierra Nevada mountains, United States of America. Global Biogeochemical Cycles 11: 673-681.

Jones, J.B., Jr. 1997. Benthic organic matter storage in streams; influence of detrital import and export, retention mechanisms, and climate. Stream organic matter budgets. Journal of the North American Benthological Society 16: 109-119.

Kloeppel, B.D., S.T. Gower, I.W. Treichel, and S. Kharuk. 1998. Foliar carbon isotope discrimination in *Larix* species and sympatric evergreen conifers: a global comparison. Oecologia 114: 153-159.

Knoepp, J.D. and W.T. Swank 1997. Forest management effects on soil carbon and nitrogen. Soil Science Society of America Journal 61: 928-935.

Knoepp, J.D. and W.T. Swank 1997. Long-term effects of commercial sawlog harvest on soil cation concentration. Forest Ecology and Management 93: 1-7.

Lamberti, G.A. and A.D. Steinman. 1997. A comparison of primary production in stream ecosystems. Stream organic matter budgets. Journal of the North American Benthological Society 16: 95-104.

Lipp, C.C. and E.T. Nilsen. 1997. The impact of freeze-thaw cycles on the hydraulic conductivity of *Rhododendron maximum*, an evergreen understory plant. Plant Cell and Environment 20: 1264-1272.

McCay, T.S., M.A. Menzel, J. Laerm, and L.T. Lepardo. 1998. Timing of parturition of three long-tailed shrews (*Sorex* spp.) in the southern Appalachians. American Midland Naturalist 139: 394-397.

McNulty, S.G., J.M. Vose, and W.T. Swank. 1997. Regional hydrologic response of loblolly pine to air temperature and precipitation changes. Journal of the American Water Resources Association 33(5): 1011-1022.

Menzel, M.A., M. Monroe, T.S. McCay, and J. Laerm. 1997. Use of abandoned mines in North Georgia as hibernacula by the eastern pipistrelle (*Pipistrellus subflavus*). Georgia Journal of Science 55: 224-230.

Meyer, J.L. 1997. Stream health: incorporating the human dimension to advance stream ecology. Journal of the North American Benthological Society 16: 439-447.

Meyer, J.L., J.B. Wallace, and S.L. Eggert. 1998. Leaf litter as a source of dissolved organic carbon in streams. Ecosystems 1: 240-249.

Mulholland, P.J. 1997. Dissolved organic concentration and flux in streams. Stream organic matter budgets. Journal of the North American Benthological Society 16: 122-131.

Mulholland, P.J., E.R. Marzolf, J.R. Webster, D.R. Hart, and S.P. Hendricks. 1997. Evidence that hyporheic zones increase heterotrophic metabolism and phosphorus uptake in forest streams. Limnology and Oceanography 42(3): 443-451.

Pitelka, L. F., J. Ash, S. Berry, R.H.W. Bradshaw, L. Brubaker, J.S. Clark, M.B. Davis, J.M. Dyer, R.H. Gardner, H. Gitay, G. Hope R. Hengeveld, B. Huntley, G.A. King, S. Lavorel, R.N. Mack, G.P. Malanson, M. McGlone, I.R. Noble, I.C. Prentice, M. Rejmanek, A. Saunders, A.M. Solomon, S. Sugita, and M.T. Sykes. 1997. Plant migration and climate change. American Scientist 85: 464-473.

Plague, G.R., J.B. Wallace, and J.W. Grubaugh. 1997. Distribution and trophic variability of *Pteronarcys* spp. (Plecoptera: Pteronarcyidae) along a stream continuum. The American Midland Naturalist 139:224-234.

Reynolds, B.C. and D.A. Crossley, Jr. 1997. Spatial variation in herbivory by forest canopy arthropods along an elevation gradient. Environmental Entomology 26(6): 1232-1239.

Schowalter, T.D., Y.L. Zhang, and T.E. Sabin. 1998. Decomposition and nutrient dynamics of oak (*Quercus* spp.) logs after five years of decomposition. Ecography 21: 3-10.

Sinsabaugh, R.L. 1997. Large-scale trends for stream benthic respiration. Stream organic matter budgets. Journal of the North American Benthological Society 16: 119-122.

Stone, M.K. and J.B. Wallace. 1998. Long-term recovery of a mountain stream from clear-cut logging: the effects of forest succession on benthic invertebrate community structure. Freshwater Biology 39: 151-169.

Swank, W.T. and J.M. Vose. 1997. Long-term nitrogen dynamics of Coweeta forested watersheds in the southeastern United States of America. Global Biogeochemical Cycles 11(4): 657-671.

Tank, J.L., J.R. Webster, E.F. Benfield, and R.L. Sinsabaugh. 1998. The effect of leaf litter exclusion on microbial enzyme activity associated with wood biofilms in streams. Journal of the North American Benthological Society 17:95-103.

Vose, J.M., K.J. Elliott, D.W. Johnson, D.T. Tingey, and M.G. Johnson. 1997. Soil respiration response to three years of elevated CO2 and N fertilization in ponderosa pine (*Pinus ponderosa* Doug. ex Laws.). Plant and Soil 190: 19-28.

Wallace, J.B., T.F. Cuffney, S.L. Eggert, and M.R. Whiles. 1997. Stream organic matter inputs, storage, and export for Satellite Branch at Coweeta Hydrologic Laboratory, North Carolina, USA. Stream organic matter budgets. Journal of the North American Benthological Society 16: 67-74.

Wallace, J.B., S.L. Eggert, J.L. Meyer, and J.R. Webster. 1997. Multiple trophic levels of a forest stream linked to terrestrial litter inputs. Science 277: 102-104.

Webster, J.R., and D.J. D'Angelo. 1997. A regional analysis of the physical characteristics of streams. Stream organic matter budgets. Journal of the North American Benthological Society 16: 87-95.

Webster, J.R. and J.L. Meyer (eds.). 1997. Stream organic matter budgets. Journal of the North American Benthological Society 16: 3-161.

Webster, J.R. and J.L. Meyer. 1997. Stream organic matter budgets - introduction. Journal of the North American Benthological Society 16: 5-13.

Webster, J.R. and J.L. Meyer. 1997. Organic matter budgets for streams: a synthesis. Journal of the North American Benthological Society 16: 141-161.

Webster, J.R, J.L. Meyer, J.B. Wallace, and E.F. Benfield. 1997. Organic matter dynamics in Hugh White Creek, Coweeta Hydrologic Laboratory, North Carolina. Journal of the North American Benthological Society 16: 74-78.

Published Book Chapters (5 total)

Clark J.S., and W.A. Patterson. 1997. Background and local charcoal in sediments: scales of fire evidence in the paleorecord. Pp. 23-48. In: J.S. Clark, H. Cachier, J.G. Goldammer and B.J. Stocks, eds. Sediment records of biomass burning and global change. Springer Verlag, Berlin, Germany.

Coleman, D.C., P.F. Hendrix, and E.P. Odum. 1998. Ecosystem Health: An Overview. pp. 1-20 in: P.H. Wang (ed.) Soil Chemistry and Ecosystem Health. SSSA Special Publication No. 52, Madison, Wisconsin.

Meyer, J.L. 1997. Conserving ecosystem function. pp. 126-145 In: R.S. Ostfeld and S.T. A. Pickett (eds.). The Ecological Basis of Conservation: Heterogeneity, Ecosystems, and Biodiversity. Chapman and Hall Publishers.

Mulholland, P.J. and 9 others (including J.L. Meyer). 1997. Effects of climate change on freshwaters of region 5, southeastern U.S. and Gulf Coast of Mexico. Hydrologic Processes, Vol. II, 949-970.

Pearson, S. M. and R. H. Gardner. 1997. Neutral models: useful tools for understanding landscape patterns. Pp. 215-230 in J. A. Bissonette (ed.). Wildlife and landscape ecology: effects of pattern and scale. Springer-Verlag; New York.

Dissertations and Theses (14 total)

Bennett, B.A. 1998. Forested versus agricultural headwaters: influences on downstream invertebrate assemblages in southern Appalachian streams. M.S. Thesis. Department of Biology, Virginia Polytechnic Institute and State University, Blacksburg, VA.

Dail, D.B. 1997. Sulfur transformations at the soil-water interface and in stream sediments. Ph.D. Dissertation, University of Georgia, Athens, GA.

Davis, J.P. 1998. Fine root dynamics along an elevational gradient in the Southern Appalachian Mountains, USA. M.S. Thesis, University of Georgia, Athens, GA.

Hansen, R.A. 1997. Effects of habitat heterogeneity and composition on the abundance, diversity and functional impact of the Oribatid mite assemblage in leaf litter. Ph.D. Dissertation, University of Georgia, Athens, GA.

Harper, C.A. 1998. Analysis of wild turkey brood habitat within the Southern Appalachians. Ph.D. Dissertation, Clemson University, Clemson, SC.

Harrison, B.A. 1997. The Georgia public and its forests: attitudes and knowledge regarding forest resource use. M.S. Thesis, University of Georgia, Athens, GA.

Katz, R.T. 1997. Using landscape ecosystem classification to manage neotropical migratory birds in the mountains of Western North Carolina. M.S. Thesis, Clemson University, Clemson, SC.

Lachnicht, S.L. 1997. Habitat variation and effect on benthic invertebrate communities in a high elevation second order stream in the Appalachian Mountains. M.S. Thesis, University of Georgia, Athens, GA.

McTammany, M.E. 1998. The impact of different degrees and types of urbanization on benthic macroinvertebrates in southern Appalachian streams: potential mechanisms of land-use impact. M.S. Thesis. Department of Biology, Virginia Polytechnic Institute and State University, Blacksburg, VA.

Romitelli, M.S. 1997. Energy analysis of watersheds. Ph.D. Dissertation, University of Florida, Gainesville, FL.

Rosi, E.J. 1997. The trophic basis of production along a river continuum: temporal and spatial variability in the flow of energy in aquatic macroinvertebrate communities. M.S. Thesis, University of Georgia, Athens, GA.

Thomas, T. 1998. Determination of sulfur processing potentials and *in situ* organic S pools in a forested riparian zone. M.S. Thesis, University of Georgia, Athens, GA.

Winter, K.A. 1997. Cultural and natural resource management in the buffer zone of the Cotacachi-Cayapas Ecological Reserve, Ecuador. M.A. Thesis, University of Georgia, Athens, GA.

Wright,C.J. 1998. The effects of man-made and natural disturbance events upon soil microbial biomass, soil fauna, soil nutrient cycling, and litter decomposition in the southern Appalachians. Ph.D. Dissertation, University of Georgia, Athens, GA

Other Publications (4 total)

Fisher, A. 1997. Leaf litter. Popular Science 251: 18.

Ross, G.N. 1997. Preliminary inventory of the butterflies of Coweeta Hydrologic Laboratory, Nantahala National Forest, North Carolina. News of the Lepidopterists Society 39(4): 70-71, 88.

Vose, J.M., W.T. Swank, B.D. Clinton, R.L. Hendrick, and A.E. Major. 1997. Using fire to restore pine/hardwood ecosystems in the Southern Appalachians of North

Carolina. In: Greenlee, Jason M. eds. Proceedings: First conference on fire effects on rare and endangered species and habitats, 1995 November, Coeur d'Alene, Idaho. Fairfield, WA. International Association of Wildland Fire pp. 149-154.

Warwick, H. 1997. Leave those leaves alone. BBC Wildlife 15: 58.

Manuscripts Accepted and In Press (36 total)

Bolstad, P.V., W.T. Swank, and J.M. Vose. 199_. Predicting southern Appalachian overstory vegetation with digital terrain data. Landscape Ecology 00: 000-000.

Bolstad, P.V., L.W. Jr. Swift, F. Collins, and J. Regniere. 1998. Measured and predicted air temperatures at basin to regional scales in the southern Appalachian Mountains. Agriculture and Forest Meteorology 00: 000-000.

Clark, J.S. 1998. Why trees migrate so fast: confronting theory with dispersal biology and the paleo record. American Naturalist 00: 000-000.

Clark, J.S., B. Beckage, P. Camill, B. Cleveland, J. HilleRisLambers, J. Lichter, J. MacLachlan, J. Mohan, and P. Wyckoff. 1998. Where does recruitment limitation occur in forests? American Journal of Botany 00: 000-000.

Clark, J.S., M. Silman, R. Kern, E. Macklin, and J. HilleRisLambers. 1998. Seed dispersal near and far: generalized patterns across temperate and tropical forests. Ecology 00: 000-000.

Coleman, D.C., L. Heneghan, and D.A. Crossley, Jr. 1998. Biodiversity and decomposition in tropical and temperate forests. ISSS Proceedings, Montpellier, France.

Dale, V.H. and S.M. Pearson. 199_. Modeling the driving factors and ecological consequences of deforestation in the Brasilian Amazon. Pp. xxx in D.J. Mladenoff and W. Baker, eds. Development of forest and landscape modeling approaches.

Dolloff, C.A., and J.R. Webster. 199_. Particulate organic contributions from forests to streams: debris isn't so bad. Conference Proceedings "Riparian Management in the Continental Eastern United States."

Elliott, K.J., W.T. Swank, J.M. Vose, and P.V. Bolstad. 1998. Long-term patterns of a southern Appalachian forest, vegetation-site relationships. Journal of Vegetation Science 00: 000-000.

Ford, W.M., J. Laerm, and K. Barker. 199_. Soricid response to forest stand age in southern Appalachian cove hardwood communities. Forest Ecology and Management 00: 000-000.

Grossman, G.D. and R.E. Ratajczak. 199_. A long-term (1983-1992) study of microhabitat use by fishes in a southern Appalachian stream. Canadian Journal of Fisheries and Aquatic Sciences 00: 000-000.

Grossman, G.D., R.E. Ratajczak, M.S. Crawford, and M.S. Freeman. 199_. Effects of environmental variation and interspecific interactions on assemblage structure and

microhabitat use in a southern Appalachian stream fish assemblage. Ecological Monographs 00: 000-000.

Hall, R.O. and J.L. Meyer. 1998. The trophic significance of bacteria in a detritus-based stream food web. Ecology 79(6): 000-000.

Hansen, R. and D.C. Coleman. 199_. Litter complexity and composition are determinants of the diversity and species composition of oribatid mites (Acari: Oribatida) in litterbags. Applied Soil Ecology 9(1-3): 000-000.

Harding, J.H., E.F. Benfield, P.V. Bolstad, G.S. Helfman and E.B.D. Jones, III. 199_. Stream biodiversity: the ghost of past land use. Proceedings of the National Academy of Science 00: 000-000.

Harding, J.S. and E.F. Benfield. 199_. Linking land-use history and the viability of an herbivore in Appalachian streams. Hydrobiologia 00: 000-000.

Heneghan, L., D.C. Coleman, X. Zou, D.A. Crossley, Jr., and B.L. Haines. 1998. Soil microarthropod community structure and litter decomposition rates: an across-site study of tropical and temperate sites. Applied Soil Ecology 00: 000-000.

Heneghan, L., D.C. Coleman, X. Zou, D.A. Crossley, Jr., and B.L. Haines. 1998. Site-specific contributions to decomposition dynamics: tropical and temperate comparisons of a single substrate (*Quercus prinus* L.). Ecology 00: 000-000.

Hicks, N.G., M.A. Menzel, and J. Laerm. 1998. Bias in the determination of temporal activity patterns of syntopic *Peromyscus*. Journal of Mammalogy 00: 000-000.

Hunter, M.D. and R.E. Forkner. 1998. Effects of abiotic disturbance on the foliar tannins of Quercus rubra L. and subsequent defoliation by insect herbivores. In: Diversity and Adaptation in Oak Species (Ed. K.C. Steiner). The Pennsylvania State University Press.

Laerm, J., W.M. Ford, T.S. McCay, M.A. Menzel, L.T. Lepardo, and J.L. Boone. 199_. Soricid communities in the southern Appalachians. Symposium on Appalachian Biogeography. Virginia Museum of Natural History 00: 000-000.

Laerm, J., W.M. Ford, M.A. Menzel, and T.S. McCay. 199_. Analysis of distribution and habitat associations of the pygmy shrew, *Sorex hoyi* winnemana Preble, in the southern Appalachians. Symposium of the Third Colloquium on Conservation of Mammals in the South. North Carolina Biological Survey pp. 000-000.

Laerm, J., W.M. Ford, M.A. Menzel, and T.S. McCay. 199_. Elevational and habitat segregation in *Sorex cinereus* and *S. longirostris* in the southern Appalachians. Brimleyana 00: 000-000.

Laerm, J., G. Livingston, C. Spencer, and B. Stuart. 199_. Condylura cristata (Insectivora: Talpidae) in the Blue Ridge province of South Carolina. Brimleyana 00: 000-000.

Laerm, J., M.A. Menzel, and J.L. Boone. 199_. Mensural discrimination of Sorex longirostris Bachman and Sorex cinereus Kerr (Insectivora: Soricidae) in the southeastern United States. Brimleyana 00: 000-000.

Laerm, J., C.H. Wharton, and W.M. Ford. 199_. First record of the rock shrew, *Sorex dispar* (Insectivora: Soricidae), in Georgia. Brimleyana 00: 000-000.

Martin, J.G., B.D. Kloeppel, T.L. Schaefer, D.L. Kimbler, and S.G. McNulty. 199_. Aboveground biomass and nitrogen allocation of ten deciduous southern Appalachian tree species. Canadian Journal of Forest Research 00: 000-000.

McCay, T.S., J. Laerm, M.A. Menzel, and W.M. Ford. 199_. A comparison of methods used to sample shrews and the importance of habitat structure. Brimleyana 00: 000-000. Pearson, S.M., A.B. Smith, and M.G. Turner. 199_. Forest fragmentation, land use, and cove- forest herbs in the French Broad River Basin. Castanea 00: 000-000.

Pearson, S.M., M.G. Turner, and D.L. Urban. 199_. Effective exercises for teaching landscape ecology. In J.M. Klopatek and R.H. Gardner. Landscape Ecological Analysis: Issues and Applications. Springer-Verlag.

Rincon, P.A. and G. D. Grossman. 199_. The effects of rainbow trout (*Oncorhynchus mykiss*) on the use of spatial resources and behavior of rosyside dace (*Clinostomus funduloides*). Archiv. Hydrobiol. 00: 000-000.

Swank, W.T. 199_. Multiple use forest management in a catchment context. Proceedings of the ARC - LIMERSC International Conference on Integrated Catchment Management, September 11-13, 1996. Aberdeen, Scotland, UK. Tank, J.L. and J.R. Webster. 199_. Interaction of substrate availability and nutrient distribution on wood biofilm development in streams. Ecology 00: 000-000.

Turner, M.G., S.R. Carpenter, E.J. Gustafson, R.J. Naiman, and S.M. Pearson. 199_. Land use. Pp. 000-000 in M.J. Mac, P.A. Opler, C.E. Puckett Haecker, and P.D. Doran, eds. Status and trends of the nation's biological resources. U. S. Dept. of Interior, U.S. Geological Survey, Washington, DC.

Yeakley, J.A., W.T. Swank, G.M. Hornberger, P.V. Bolstad, and J.M. Vose. 199_. Soil moisture modeling in humid mountainous landscapes. In: J.P. Wilson and J.C. Gallant, eds. Terrain Analysis: Principals and Applications, GeoInformation International, Cambridge, U.K.

Yeakley, J.A., W.T. Swank, L.W. Swift, G.M. Hornberger, and H.H. Shugart. 1998. Soil moisture gradients and controls on a southern Appalachian hillslope from drought through recharge. Hydrology and Earth System Sciences 2: 31-39.

Coweeta LTER Presentations at Regional, National, and International Meetings

February 1997: Colloquium at Bodega Marine Laboratory, University of California-Davis, Davis, CA.

March 1997: US-IALE, Durham, NC.

April 1997: Association of Southeastern Biologists Annual Meeting, Greenville, SC.

May 1997: North American Benthological Society Annual Meeting Annual Meeting, San Marcos TX.

June 1997: American Society of Ichthyologists and Herpetologists Annual Meeting, Seattle, WA.

June 1997: North American Forest Ecology Workshop, Raleigh, NC.

August 1997: Ecological Society of America Annual Meeting, Albuquerque, NM.

September 1997: Symposium in Wengen, Switzerland.

October 1997: IGBP Workshop, San Diego, CA.

October 1997: Conference on Diversity and Adaptation in Oak Species, Pennsylvania State University, University Park, PA.

November 1997: International Association of Landscape Ecologists Conference, Durham, NC.

November 1997: Southern Appalachian Man and the Biosphere Annual Meeting, Gatlinburg TN.

December 1997: Entomological Society of America Annual Meeting, Nashville, TN.

January 1998: Ecology Seminar, University of Minnesota, St. Paul, MN.

February 1998: American Association for the Advancement of Science, Philadelphia, PA.

February 1998: Ecology Seminar, State University of New York at Stony Brook, Stony Brook, NY.

March 1998: International Association for Landscape Ecology Annual Meeting, East Lansing, MI.

March 1998: Conference on Riparian Management in the Continental Eastern United States, Columbus, OH.

April 1998: Colloquium at the Joseph Jones Research Center, Ichauway, GA.

April 1998: Botany Department Colloquium, University of Georgia, Athens, GA.

May 1998: 7th International Symposium on Society and Resource Management, Columbus, MO.

June 1998: North American Benthological Society Annual Meeting Annual Meeting, Prince Edward Island, Canada

June 1998: North American Forest Biology Workshop, Victoria, British Columbia, Canada

June 1998: The Land-Water Interface: Science for a Sustainable Biosphere. Supported by the American Society of Limnology and Oceanography / Ecological Society of America, St. Louis, MO.

August 1998: XXVII Societas Internationalis Limnologiae Congress, Dublin, Ireland.

August 1998: Ninth North American Forest Soils Conference, Tahoe, CA.

August 1998: 16th Congress of International Society of Soil Science, Montpellier, France.

Coweeta LTER Related Research Grants
Excludes 1996-2002 CWT LTER grant from NSF (DEB 96-32854) for $6,030,489
(12 total for $3,007,523 representing 5 funding agencies)

Bolstad, P.V., P.B. Reich, and J.M. Vose. Acclimation/adaptation of leaf respiration in eastern deciduous forests: a biome-wide study. Funded by National Science Foundation for $375,000 from 1998 through 2001.

Coleman, D.C., and J.M. Vose. Supplemental funding for "Long-term studies of disturbances as they affect ecological processes in landscapes of the southern Appalachians (DEB 96-32854)." Funded by National Science Foundation for $49,793 for 1998.

Coleman, D.C., and J.M. Vose. Curatorial funding for "Long-term Studies of disturbances as they affect ecological processes in landscapes of the southern Appalachians (DEB 96-32854)." Funded by National Science Foundation for $31,769 for 1998.

Geron, C., W.T. Swank, and J.M Vose. Water, soil, and air quality impacts of riparian ecosystem restoration. Funded by Environmental Protection Agency for $150,000 from 1997 through 1999.

Hunter, M.D. Short- and long-term effects of hurricane Opal on a forest ecosystem. Funded by National Science Foundation SGER Grant, Long-term Studies in Environmental Biology Program for $24,961 from 1996 through 1998.

Kloeppel, B.D. and D.C. Coleman. REU Supplement to LTER program at Coweeta Hydrologic Laboratory (DEB-96-32854). Funded by National Science Foundation for $15,000 from 1997 to 1998.

Kloeppel, B.D. and D.C. Coleman. REU Supplement to LTER program at Coweeta Hydrologic Laboratory (DEB-96-32854). Funded by National Science Foundation for $10,000 from 1998 to 1999.

Kloeppel, B.D. and D.C. Coleman. Schoolyard Supplement to LTER program at Coweeta Hydrologic Laboratory (DEB-96-32854). Funded by National Science Foundation for $15,000 from 1998 to 1999.

Vose, J.M. and W.T. Swank. Phytoremediation of contaminated soil and groundwater: Estimating transpiration in poplar seedlings. Funded by Department of Defense for $134,000 from 1997 through 1999.

Wallace, J.B., J.L. Meyer, and J.R. Webster. Stream ecosystem response to decoupling terrestrial-aquatic linkages. Funded by NSF for $800,000 from 1 September 1996 through 31 August 2000.

Webster, J.R., P.J. Mulholland, J.L. Meyer, and B.J. Peterson. Nitrogen uptake, retention and cycling in stream ecosystems: an intersite N^{15} tracer experiment. Funded by National Science Foundation for $1,100,000 from 1 September 1996 through 31 August 1999. One post-doc funded by a Fulbright Scholarship.

Welch, R.A., T. Jordan, M. Remillard, J. Alberts, and D.C. Coleman. Enhanced remote sensing capabilities for integrated assessments of environmental change. Funded by NASA (Research Announcement 97-MTPE-05) for $302,000 for 1997.

Data Management Metadata and Data Set Summary

New Data Sets Online (18 new and expanded data sets)
The following list includes new and significantly expanded online data sets. These are in addition to 76 other archived data sets that have been previously online.

Stream Research Data Set
1. Dissolved organic carbon (DOC)

Hillslope-Riparian Data Sets
1. Microclimate
2. Dissolved organic carbon (DOC)
3. Riparian soil water chemistry

Terrestrial Gradient Data Sets
1. Microclimate
2. Annual rates of fine root appearance and disappearance
3. Seasonal dynamics of fine root length
4. Fine root length (raw data)
5. Root mass (raw data)
6. Tree population dynamics along environmental gradient**s**

Forest Gap Data Sets
1. Microclimate

2. Soil moisture (TDR)
3. Photosynthetic active radiation (PAR)

Regionalization Data Sets

1. Joyce Kilmer tree stem temperature
2. Coweeta WS02 tree stem temperature
3. Coweeta WS18 tree stem temperature
4. Coweeta WS27 tree stem temperature
5. Coweeta Basin tree allometry

Metadata Listing (67 total)

The following list of metadata sets is accessible to the greater scientific community and the general public via our web page (see URL address below). Most research projects have metadata available. Those projects that are completed have publicly available linked data sets. Other projects that are currently being analyzed or are in the data collection phase have password protected data sets.

Metadata URL address:
http://coweeta.ecology.uga.edu/webdocs/meta/ronmeta.html

Stream Research Metadata

1. Geomorphology
2. Dissolved organic carbon (DOC)
3. Fish collections
4. Fish habitat availability
5. Leaf decomposition
6. Benthic organic matter (BOM)
7. Effect of macrobiotic exclusion on benthic communities
8. Space use by mottled sculpin and prey patch dynamics in a southern Appalachian stream
9. Effects of spatial and temporal heterogeneity on habitat use by longnose dace (*Rhinichthys cataractae*) at multiple scales (I. Physical habitat availability)
10. Effects of spatial and temporal heterogeneity on habitat use by longnose dace (*Rhinichthys cataractae*) at multiple scales (II. Physical habitat use)
11. Effects of spatial and temporal heterogeneity on habitat use by longnose dace (*Rhinichthys cataractae*) at multiple scales (III. Prey availability)
12. Effects of spatial and temporal heterogeneity on habitat use by longnose dace (*Rhinichthys cataractae)* at multiple scales (IV. Prey on foraged-upon stones)
13. Age, growth, and reproduction of mottled sculpin (*Cottus bairdi*) in the Coweeta Creek drainage
14. Spatial and temporal patterns of habitat use by fishes in upper Coweeta Creek
15. Spatial and temporal patterns of habitat availability in upper Coweeta Creek
16. Spatial and temporal variability of fish species distributions in upper Coweeta Creek
17. Spatial and temporal variability of macroinvertebrate drift in upper Coweeta Creek
18. Critical velocities of drift-feeding fishes in upper Coweeta Creek
19. Competitive interactions between *Clinostomus funduloides* and *Luxilis coccogenis*
20. Effects of land-use on sediment regime and fish assemblage structure in the southern Appalachians (fish data)
21. Effects of land-use on sediment regime and fish assemblage structure in the southern Appalachians (habitat data)

22. Effects of land-use on sediment regime and fish assemblage structure in the southern Appalachians (sediment data)
23. Mesoscale variation in fish populations in two small Appalachian streams (fish population Data)
24. Mesoscale variation in fish populations in two small Appalachian streams (habitat availability)
25. Mesoscale variation in fish populations in two small Appalachian streams (macroinvertebrate data)
26. Mesoscale variation in fish populations in two small Appalachian streams (light data)
27. The impact of urbanization magnitude and type on benthic macroinvertebrates in southern Appalachian streams
28. Influence of land use on invertebrate assemblages in southern Appalachian agricultural streams.

Hillslope-Riparian Research Metadata
1. Microclimate
2. Stream dissolved organic carbon (DOC)
3. Soil moisture (TDR)
4. Litter decomposition
5. Microbial biomass
6. Effects of *Rhododendron* removal
7. Riparian litterfall
8. Riparian zone seedling
9. Soil phosphorus fractionation
10. Sulfur processing
11. Soil water chemistry

Terrestrial Gradient Research Metadata
1. Microclimate
2. Soil nitrogen transformation
3. Litterfall
4. Dendrometer bands
5. Soil moisture (TDR)
6. Annual rates of fine root appearance and disappearance
7. Seasonal dynamics of fine root length
8. Fine root length (raw data)
9. Root mass (raw data)
10. Canopy gradient thrufall
11. Canopy cradient frass
12. Soil chemistry along the canopy gradient
13. Tree population dynamics along environmental gradients

Forest Gap Research Metadata
1. Microclimate
2. Dendrometer bands
3. Soil moisture (TDR)
4. Photosynthetic active radiation (PAR)

Regionalization Research Metadata
1. Joyce Kilmer tree stem temperature
2. Coweeta Watershed 2 tree stem temperature

3. Coweeta Watershed 18 tree stem temperature
4. Coweeta Watershed 27 tree stem temperature
5. Coweeta Basin tree allometry
6. Diversity of freshwater fishes in two southern Appalachian river basins
7. Southern Appalachian tree stem respiration
8. Effects of past land use upon small mammal and herpetofauna of cove forest communities in the Pisgah National Forest
9. Land use history of Macon County, North Carolina since first white settlement
10. An inquiry into the role of trout stream access on land valuation
11. Characterization of human disturbance regimes in southern Appalachia