Please find below the archived materials from our 08-09 January 2002 Coweeta LTER Science Meeting. The agenda is listed first followed by the compiled research summaries.

Brian D. Kloeppel
10 January 2002

Welcome to The Mountain for the January 2002 Coweeta LTER Science Meeting!

If you have not already done so, please stop by The Mountain main office for check-in or a receipt if you need one. A representative in the office will also be able to answer questions regarding hiking trails and other activities at The Mountain.

Tuesday 08 January 2002

Location: Meeting Hall, The Mountain Retreat and Learning Center, near Highlands, NC

Presentation Equipment: Please note that a slide projector, overhead projector, and digital projector will be available for use throughout the meeting.

10:00 **Introductions, Logistics, and Opening Remarks** (Coleman, Vose, Kloeppel, Gragson, and Nancy Heath from The Mountain)

REU Update - Kloeppel

10:30 Renewal Proposal Presentation, Discussion, and Breakout Group Assignments

12:00 Renewal Proposal Breakout Group Work Sessions

12:30 - 1:15 **Lunch at the The Mountain dining hall**

1:30 Renewal Proposal Breakout Group Work Sessions (continued)

2:45 Renewal Proposal Breakout Group Reports

3:15 **Break**

3:30 Coweeta Watershed 7 Book Volume Update (Swank and Meyer)

3:45 Coweeta Data Management: Past, Present, and Future (Rouhani)

4:15 Status Report for Coweeta GIS: Current status, recap of efforts in 3rd & 4th Quarters 2001, and future efforts (Collins)

5:00 **Pre-Dinner Social at The Mountain** Free beverages provided

Presentation (20 minutes for those who are interested) by Larry Wheeler from The Mountain regarding its history, current happenings, future vision, and anything that people are interested in hearing.

6:00 - 6:45 **Dinner at The Mountain dining hall**

7:00 Graduate Student Poster Session, Open Discussion, and Group Social; Graduate Students Discussion led by Zuckerman et al.; Free beverages provided

Evening Open for Group or Breakout Discussions as Needed

Wednesday 09 January 2002

Location: Meeting Hall, The Mountain Retreat and Learning Center, near Highlands, NC

7:00 - 8:30 **Continental Breakfast at The Mountain dining hall**

8:45 Opening Remarks and Reminders; REU summary if a review committee was needed to prioritize the ; "applications" (Kloeppel)

9:00 Hazard Project Update and Summary (Pringle, Benfield, Helfman, Meyer, et al.)

9:15 Terrestrial Gradient Project Update and Review of Data Collections (Vose and Kloeppel)

9:45 Riparian Project Update and Review of Data Collections (Coleman)

10:15 Coweeta Facilities Update (Kloeppel and Vose)

10:30 **Break**

10:45 Renewal Proposal Discussion

12:30 - 1:15 **Lunch at the The Mountain dining hall**

1:30 Renewal Proposal Final Discussion and Wrap-up

2:00 Working Group Research Planning and Discussion

2:30 Meeting Adjourned

3:00 Tour of Renovated and Expanded Coweeta Analytical Lab - Jim Deal

Co-PIs Not Attending:
Crossley
Elliott
Hendrick
Meyer
Swift
Turner
Wallace
Yeakley

Research Summaries

Co-PIs: E. Fred Benfield, J. R. Webster
Graduate Students: M. A. Neatrour, M. E. McTammany, C. L. Burcher

The Virginia Tech Stream Team has been working on several different projects at Coweeta, in the southern Appalachians, and across the country. In the past year, Jack and Fred completed a leaf breakdown project in watersheds 7 and 14 at Coweeta. Leaf breakdown continues to be faster in streams that had been clearcut (WS 7) than in reference streams (WS 14). Members of the Stream Team have also been investigating carbon sources of the Little Tennessee River including both floodplain and in-stream measurements. This research has led to two manuscripts that are in the final stages of preparation: "The role of floods in particulate organic matter dynamics of a southern Appalachian river/floodplain ecosystem" (Neatrour, Webster, and Benfield) and "Metabolism along a mid-sized southern Appalachian river" (McTammany, Webster, Benfield, and Neatrour).

The Stream Team has also been involved in the Coweeta Regionalization project. Matt McTammany's doctoral research has involved studying 30 streams that represent a gradient of agriculture and reforestation from historical agriculture. Dependent variables measured in his project include physical and chemical properties, biological structure (algae, benthic macroinvertebrates), and ecosystem function (wood breakdown and metabolism) of streams across the southern Appalachians. Matt has completed most of his field data collection and is in the process of analyzing data. We have also sampled fish in each of these streams to broaden our database on the impact of land-use in structuring aquatic communities across the region. In addition, Fred and Matt have been involved in the Hazard Site Project investigating streams identified as likely to experience suburbanization in the next few decades. Last spring, benthic macroinvertebrate samples were collected from the eight hazard sites, and the samples are currently being identified.

Jack continues to be actively involved in several intersite research projects including the Lotic Intersite Nitrogen Experiment (LINX), Nitrate Processing and Retention in Streams (NPARS), and the new LINX II project. Each of these experiments uses stable isotopes to follow the movement of nitrogen through stream food webs and retention compartments.

Co-PI: B.D. Clinton

Research on the role of Rhododendron maximum

From 1995 – 98, Erik Nilsen, Orson Miller, and myself through funding provided by USDA CSRS-NRI, conducted a study designed to identify mechanisms associated with competition between Rhododendron maximum and other important hardwood species. A renewal was submitted in 1999 and was funded for an additional 4 years. The purpose was to further explain causes for the lack of regeneration beneath rhododendron. On the initial grant, a combination of several laboratory experiments and a field study revealed several sources of inhibition to seedling establishment in addition to low light, all of which were in the form of an apparent chemical inhibition. The most conclusive were direct and indirect mycorrhizal effects in the form of 1) decreased rates of root elongation from germinating seed (Nilsen et al. 1999), and 2) delayed mycorrhizal infection rates on woody seedling roots, respectively (Walker et al. 1999). The conclusion is that below ground interaction between rhododendron and other hardwood species may explain as much or more of the observed absence of seedling recruitment beneath rhododendron as does low light. The recently funded renewal will allow us to examine more closely the interaction between mycorrhizal species. We have added an additional dimension by including Kalmia latifolia in our studies of the role of evergreen understory in southern Appalachian forests.

Nilsen, E.T., T.T. Lei, J.F. Walker, O.K. Miller, S.W. Semones, and B.D. Clinton. 1999. Allelopathic potential of Rhododendron maximum: Inhibition of seedling survival: Could allelopathy be a cause? Amer. J. Bot. 86(11):1597-1605.

Nilsen, E.T., B.D. Clinton, T.T. Lei, O.K. Miller, S.W. Semones, and J.F. Walker. 2001. Does Rhododendron maximum L. (Ericaceae) reduce the availability of resources above and belowground for canopy tree seedlings? Am. Midl. Nat. 145:325-343.

Walker, J.F., T.T. Lei, S.W. Semones, E.T. Nilsen, B.D. Clinton, and O.K. Miller. 1999. Suppression of ectomycorrhizae on canopy tree seedlings in Rhododendron maximum L. (Ericaceae) thickets in the southern Appalachians. Mycorrhiza 9:49-56.

Co-PI: D. C. Coleman

COLEMAN, DAVID C., BRUCE L. HAINES, JUDY L. MEYER, BRIAN D. KLOEPPEL, SUSAN STEINER, and J. ALAN YEAKLEY. Institute of Ecology, University of Georgia, Athens, GA 30602, and Portland State University, Portland, OR. “Waiting for Godot,” or: Effects of clear-cutting understory and hurricane disturbance on hillslope-riparian processes in the Southern Appalachians.

Following up on our stated plans in the 1990 CWT renewal proposal to link upland and aquatic processes at Coweeta, we set up study sites in the WS 55 and 56 areas, downstream of the litter-exclusion area of Wallace, et al. Before-treatment studies were conducted by Maxwell and Coleman (1995) and Wright and Coleman (1999). The study site dimensions are 30m. laterally (along the stream) x 15 m. vertically (up the slope). Our objectives were to compare effects of understory removal of rhododendron at one site, with no extirpation at the other one. The rhododendron removal occurred in a one-day marathon on August 29, 1995, and the control site became a storm impacted site, receiving microbursts of up to 95 km.h-1, from Hurricane Opal, October 4-5, 1995, after rainfall exceeding 200 mm. the preceding 24 h.

We established transects of tension lysimeters, litterbags, and litterfall traps and blow-through traps in both sites. The installed items in the "storm site" were rendered obscured or broken by the uprooting of all overstory trees, which produced several tip-up mounds. Nutrient losses to ground-water were nearly three orders of magnitude higher in the storm slope compared to the cut slope, reflecting the much greater pedoturbation in the former impacted site (Yeakley et al., in revision). The biotic responses were unexpectedly small, reflecting the insignificant changes in soil organic carbon in both sites. Soil respiration decreased in both sites across 5 years' time, with CO_2 outputs being significantly higher in the cut plot. Followup studies of four years of leaf-litter decomposition and species richness of microarthropods in litter bags set out in three transects in both sites are under way, and will be described briefly in the January 2002 meeting.

References:

Maxwell, R.A., and D.C. Coleman. 1995. Seasonal dynamics of nematode and microbial biomass in soils of riparian-zone forests of the southern Appalachians. Soil Biology & Biochemistry 27: 79-84.

Wright, C.J., and D.C. Coleman. 1999. The effects of disturbance events on labile phosphorus fractions and total organic phosphorus in the southern Appalachians. Soil Science 164: 391-402.

Wright, C.J. and D.C. Coleman. 2002. Responses of soil microbial biomass, nematode trophic groups, N-mineralization, and litter decomposition to disturbance events in the southern Appalachians. Soil Biology & Biochemistry 34: (in press).

Yeakley, J. A., B. W. Argo, D. C. Coleman, J. M. Deal, B. L. Haines, B. D. Kloeppel, J.L. Meyer, W. T. Swank and S. F. Taylor. 2002. Hillslope Nutrient Dynamics Following Upland Riparian Vegetation Disturbance. Ecosystems, in revision.

Co PI: D.A. Crossley
HAW HAW

Co PI: K.J. Elliott
Research Projects with LTER emphasis, FY 2002

1. Functional diversity. Understand the functional significance (productivity, nutrient cycling, water cycling, resistance and resilience to disturbance) of a diverse forest stand. Develop a framework and test methods to define ecosystem diversity from a functional viewpoint. (Jim Vose, Barry Clinton, Jennifer Knoepp, & Brian Kloeppel are collaborators). Remove major structural components (herb layer, shrub layer, shrub+herb layer) from mesic, mixed-oak communities and measure changes in whole system net primary production, and nutrient and water cycles. Permanent plots were established, vegetation sampled, and herbaceous layer vegetation was removed in summer 1998. Plots were resampled, herbaceous layer vegetation was removed, and a third treatment (organic matter addition) was added to experimental design in summer 1999. -- Plot maintenance continued in summer 2000, resampled seedling transects summer 2000. Plot maintenance May and August 2001 (weeding, OM addition) (N-min, soil CO_2, littertraps, dendrobands continued). Plots will be maintained (weeding, addition, litter traps) for experimental integrity growing season 2002.

2. Watershed 7, vegetation dynamics, aboveground biomass and nutrient accumulation. Long-term studies in succession, NPP, & nutrient dynamics of a clearcut watershed (WS7) (Lindsay Boring and Wayne Swank, collaborators). Resampled vegetation plots (winter 1997) and harvested trees for biomass and nutrients by components in summer 1997. Samples were processed for dry weight, leaf area, and nutrient content in 1998. Litter traps were collected throughout the fall 1999- winter 2000. Litter has been sorted, weighed, and leaf mass and LAI have been calculated, paper complete spring 2001. Paper accepted by Canadian Journal of Forest Research. GPS permanent plots fall-winter 2002. Resample site in 2007 (30-years succession). Chapter in progress for WS7 Book.

3. Disturbance regimes in the Coweeta Basin. Established cooperative agreement with University of Maine, Alan S. White to use dendrochronology to understand/describe disturbance history in the Coweeta Basin, April-May 2001. Training in dendrochronology techniques Sept. 2001 at University of Maine. Disturbance History of the Coweeta Basin. Established cooperative agreement, locating plots with large/old trees for dendrochronology, recruit MS level graduate student, aid in study plan development.

Current publications related to above projects.

Elliott, Katherine J., Stephanie Hitchcock, and Lisa Krueger. In press. Vegetation response to large-scale disturbance in a southern Appalachian forest: Hurricane Opal and salvage logging. Journal of the Torrey Botanical Society.

Elliott, Katherine J., Lindsay R. Boring, and Wayne T. Swank. In press. Aboveground biomass and nutrient pools in a Southern Appalachian watershed 20 years after clearcutting. Canadian Journal of Forest Research.

Swank, Wayne T. and Katherine J. Elliott. In preparation. Long-term patterns in forest composition and structure following the chestnut blight. Manuscript will be submitted to Ecology. Coweeta Basin vegetation analyses will examine the role of chestnut; analyses and comparisons of 1934-35, 1969-73, 1988-93 vegetation inventories (Wayne Swank, lead). Data analyses complete.

Boring, Lindsay, Katherine J. Elliott, and Wayne T. Swank. In preparation. Vegetation recovery: species succession, diversity, NPP, nutrient recycling, and physiological changes. Book chapter: Deciduous Forest Ecosystem Recovery From Cutting Disturbance in the southern Appalachians, Swank et al. (Editors). WS7 book.

Co PI: G.D. Grossman

To evaluate the relative effects of density-dependent and density-independent forces on fish populations in the Coweeta drainage, we have continued collecting fish density and habitat availability data in permanent study sites (since 1991) on a bienniel basis.

One of my Ph.D. students (Michael Wagner) has constructed a large, two channel experimental stream with a programmable feeder. He has recently completed experiments that elucidate the effects of intraspecific competition and food availability on patch selection by two drift-feeding minnows (the native rosyside dace and the introduced yellowfin shiner).

We had a productive year with 6 LTER-based papers either published or in press. These are summarized below.

We examined the multi-scale effects of resource patchiness on foraging behavior and habitat use by longnose dace (Thompson et al 2001). At the primary scale (individual cobbles) foraging intensity of longnose dace was not correlated with of benthic macroinvertebrate biomass. At the secondary scale (foraging patches), macroinvertebrates only were patchily distributed in the summer, however, during this season, longnose dace preferentially occupied patches with higher macroinvertebrate biomass. At the tertiary scale (reach), benthic invertebrate biomass was patchily distributed in all seasons and longnose dace always were significantly more abundant in reaches with higher macroinvertebrate biomass.

Fausch et al. (2001) examined five regions in which rainbow trout establishment varied from highly successful (Southern Appalachians) to moderate (Colorado, & Hokkaido Island, Japan) or failed (Honshu Island, Japan). We found that in regions with suitable water temperatures, flood disturbance during the period of fry emergence strongly influenced success of rainbow trout introductions. The most successful invasions occurred in environments in which the annual hydrologic regime closely matched that of the native habitat of rainbow trout (i.e., Pacific Coast of North America).

We developed a new optimal foraging model that successfully predicted habitat selection for four drift-feeding fish species in multiple seasons and years, and sites (one species), in

Coweeta Creek (Grossman et al. 2002). The model successfully predicted 11 of 14 cases in three seasonal samples collected over 2 years at 2 sites. Unsuccessful predictions still were within 2 cm/s of the 95% confidence intervals of mean velocities occupied by fishes even though available focal point velocities ranged from 0-76 to 0-128 cm/s depending on site and season.

We evaluated the effects of intraspecific aggression on microhabitat selection by rosyside dace, the most abundant water-column species in Coweeta Creek (Rincon & Grossman 2001). Rosyside dace exhibited 3 levels of aggression. The majority of the individuals were non-aggressive (18 of 30), some were moderately aggressive (9 of 30), and a few were highly aggressive (3 of 30). Fish size was only weakly correlated with aggression class. All small fish were non-aggressive, but larger fish were members of all three aggression classes. Highly aggressive fish occupied the upstream-most position within foraging groups and were at higher focal velocities, which may increase their access to prey.

Grossman et al. (2001) collected gravid female mottled sculpin (Cottus bairdi), the most abundant fish in Coweeta Creek, during 1993-1995 and again in 1998. Female sculpin matured at age 1+ although most females did not mature until age 2+ (oldest female = 7+). Mean fecundity was 71 eggs (9-166). Female length and weight were strongly correlated with female fecundity, although the relationship was not linear. Age had a significant but weaker effect. Female size also significantly affected mean egg size.

We found that female longnose dace collected during March 1999 had not yet begun spawning whereas spawning had commenced in females collected in July 1999 (Roberts & Grossman 2001). Potential fecundity ranged from (1832 ± 572) to (775 ± 415) oocytes per female, and was positively correlated with standard length and somatic mass. Oocyte diameter histograms suggest that female longnose dace potentially spawn 6+ clutches per year.

REFERENCES:
Fausch, K. D., Taniguichi, Y., Nakano, S., Grossman, G.D. & C. R. Townsend. 2001. Flood disturbance regimes influence rainbow trout invasion success among five Holarctic regions. Ecol. App. 11:1438-1455.

Grossman, G.D., McDaniel, K. M., & R. E. Ratajczak. 2001. Demographic characteristics of female mottled sculpin (Cottus bairdi) in the Coweeta Creek drainage, North Carolina (U.S.A.). Environ. Biol. Fish.: in press (10 journal pp.).

Grossman, G.D., Rincon, P. A., Farr, M.D., & R. E. Ratajczak. 2002. A new optimal foraging model predicts habitat use by drift-feeding stream minnows. Ecol. Freshwat. Fish 11: in press (10 journal pp.).

Rincon, P.A. & G. D. Grossman. Intraspecific aggression in rosyside dace (Clinostomus funduloides): a drift-feeding cyprinid. J. Fish Biol.: in press (19 journal pp.).

Roberts, J. H., & G. D. Grossman. 2001. Reproductive characteristics of female longnose dace in the Coweeta Creek drainage (USA). Ecol. Freshwat. Fish 10: 184-190.

Thompson, A. R., Petty, J. T. & G. D. Grossman. 2001. Multi-scale effects of resource patchiness on foraging behaviour and habitat use by longnose dace, Rhinichthys cataractae. Freshwat. Biol.46: 145-161.

Co-PI: B.L. Haines
** N2001, The Second International Nitrogen Conference: Optimizing Nitrogen Management in Food and Energy Production and Environmental Protection. Bolger Conference Centers, Potomac Maryland Oct 14-18, 2001.

Swank, W. T., J. Vose, and B. L. Haines. 2001 Long-term nitrogen dynamics of Coweeta forested watersheds in the Southern Appalachians (presented as a poster, see abstract below).

Long term data (25 years) were analyzed for trends and dynamics of NO3 and NH4 deposition and loss for mature mixed hardwood forest stands. Watershed N saturation was evaluated in the context of altered N cycles and stream inorganic N responses associated with management practices (cutting prescriptions, species replacement and prescribed burning) and with natural disturbances (drought and wet years, insect infestation, hurricane damage, and ozone episodes). Reference watersheds were highly retentive of inorganic N with deposition of < 9.9 kg ha-1 yr-1and stream water exports below 0.25 kg ha-1 yr-1. Reference watersheds were in transition between stage 0 and stage 1 of watershed N saturation as evidenced by significant time trend increases in annual flow-weighted concentrations of NO3 in stream water and increases in the seasonal amplitude and duration of NO3 concentrations during 1972-1994. These stream water chemistry trends were partially attributed to significant increases in NO3 and NH4 concentrations in bulk precipitation over the same period and/ or reduced biological demand due to forest maturation. Evidence for stage 3 of N saturation, where the watershed is a net source of N rather than a N Sink was found for the most disturbed watershed at Coweeta.

** Applied Montology: Comparative Geographies of the Andes and the Appalachians, International Workshop, University of Georgia, Athens 04-06 November 2001.

Swank, W. T., J. Vose, and B. L. Haines 2001 Long-term nitrogen dynamics of Coweeta forested watersheds in the Southern Appalachians. (presented as a poster, see abstract above)

Haines: Tour leader for 27 workshop participants at Coweeta Hydrologic Laboratory on 04 November 2001. Countries represented were Chile, Canada, Peru, Ecuador, Colombia, Costa Rica and USA

Manuscripts submitted:

Argo, B.W. and B.L. Haines. (submitted). Microclimate, microclimate, and flowering phenology of Caulophyllum across an altitudinal gradient in the southern Appalachians. Climate Research.

Argo, B.W. and B.L. Haines. (submitted). Flowering phenology of Caulophyllum in Southern Appalachians, USA: Application of temperature models. Canadian Journal of Botany.

Bonito, G.M., M.L. Cabrera, D.C. Coleman, and B.L. Haines. (submitted 25 June 2001) Modeling the nitrogen budgets of an oak pine and northern hardwood stand. Ecological Modeling.

Co-PI: G.S. Helfman

<u>Impacts of Land Use and Land Cover on Fish Assemblages of the Southern Appalachians</u> (Gene Helfman and Mark Scott).

In LT and the FB watersheds, land use in the 1950s was a better predictor of present-day fish diversity and occurrence than was present-day land use, indicating that past land use activity, particularly agriculture, may result in long-term modifications to aquatic systems, regardless of reforestation. This "legacy effect" shows the importance of large-scale and long-term restoration efforts; localized restoration and current efforts are unlikely to have immediate impacts (Harding et al. 1998). A legacy effect is also evident when comparing historical shifts in fish assemblages; current ratios of endemic to cosmopolitan species are better explained by 1970's land use than by 1990's land use (Scott 2001).

Fish density and diversity are affected more by upstream than by immediate streamside deforestation. Benthic-dependent fish species decrease in relative abundance as non-forested patch length increases upstream. Upstream events can overwhelm the ability of restored local riparian vegetation patches to support stable in-stream fish habitat and assemblages (Jones et al. 1999).

As human land use practices change, upland areas of high endemism are being invaded, displaced, and homogenized, but the initial invaders are not foreign species but instead are native species capitalizing on habitat degradation. The relative abundance of highland endemics is decreasing and that of cosmopolitan species increasing as human impacts increase. Traditional metrics of stream integrity overlook invasion by natives because (1) diversity may initially increase with this invasion, and (2) faunal lists seldom discriminate between upstream and downstream components. Thus the initial steps in deterioration of stream ecosystem integrity are likely to be ignored (Scott 2001, Scott & Helfman 2001, Scott et al. submitted ms.)

Scott, M. C. 2001. Integrating the stream and its valley: land use change, aquatic habitat, and fish assemblages. Dissertation, Univ. of Georgia.

Scott, M. C., and G. S. Helfman. 2001. Native invasions, homogenization, and the mismeasure of integrity of fish assemblages. Fisheries 26 (11): 6-15.

Scott, M. C., G. S. Helfman, M. E. McTammany, E. F. Benfield, and P. V. Bolstad. submitted. Multiscale influences on physical and chemcial stream conditions across southern Appalachian landscapes. Under review in J. American Water Resources Assoc.

Co PI: M.D. Hunter
Mark D. Hunter: Interactions Among Plants, Herbivores, and Ecosystem Processes

During 2001, we have focused upon two related questions in our Coweeta research:
Q1. What are the effects of canopy herbivory on forest-floor ecosystem processes?
Q2. What determines the densities of insect herbivores in forest canopies?

To answer question 1, we continue to build upon our previous work in which we demonstrated that nutrient availability in soils and streams is influenced by the deposition of insect frass on the forest floor. We have shown that nitrate pulses in the soil follow insect herbivory in the canopy and that soil flora and fauna respond positively to herbivore-derived nutrient inputs. We are expanding this work to include experimental manipulations of potted trees as well as continued sampling within the Coweeta basin. We are attempting to assess a) potential changes in nutrient availability caused by root mortality, b) the relative effects of reduced nutrient uptake and frass deposition on nutrient availability, and c) potential feedback loops between frass-derived nitrogen and subsequent foliage quality of trees.

To address question 2, we have established long-term monitoring of insect herbivores in the canopies of mature oak trees at Coweeta. Using singe-rope techniques, we are climbing canopy trees at seven elevations within the basin, and counting densities and diversities of insect herbivores. We are also measuring the nutrient and phenolic chemistry of leaves and making estimates of insect mortality. We hope to establish the relative importance of climatic factors, nutrient availability, plant quality, and predation pressure on densities of insects along the gradient in elevation. We have also established experimental plots using saplings in which the exclusion of birds is crossed with the addition of nutrients in a factorial design.

Our ultimate goal is to understand a) the factors that influence the distribution and abundance of herbivores in the canopy at Coweeta, b) the effects of those herbivores on nutrient dynamics in the soil, and c) potential feedback loops operating between the canopy and the soil mediated by herbivore activity.

Coweeta-Related Publications (last 12 months):
2002 Hunter, M.D. Maternal effects and the population dynamics of insects on plants. Agricultural and Forest Entomology 4: (in press).

2002 Coleman, D.C., M.D. Hunter, J. Hutton, S. Pomeroy, & L. Swift Jr. Soil respiration from four aggrading forested watersheds measured over a quarter century. Forest Ecology and Management (in press).

2001 Hunter, M.D. Multiple approaches to estimating the relative importance of top-down and bottom-up forces on insect populations: Experiments, life tables, and time-series analysis. Basic and Applied Ecology 4: 293-310.

2001 Reynolds, B.C. & M.D. Hunter. Responses of soil respiration, soil nutrients, and litter decomposition to inputs from canopy herbivores. Soil Biology and Biogeochemistry 33: 1641-1652.

2001 Salmore, A.K. & M.D. Hunter. Environmental and genotypic influences on alkaloid production in Sanguinaria canadensis. Journal of Chemical Ecology 27: 1729-1747.

2001 Salmore, A.K. & M.D. Hunter. Elevational trends in alkaloid production in Sanguinaria canadensis. Journal of Chemical Ecology 27: 1713-1728.

2001 Hunter, M.D. Insect population dynamics meets ecosystem ecology: Effects of herbivory on soil nutrient dynamics. Agricultural and Forest Entomology 3: 77-84.

Co PI: B.D. Kloeppel

A) Coweeta LTER Riparian Manuscript:

Revised manuscript due to Ecosystems 31 January 2002

YEAKLEY, J. ALAN, COLEMAN, DAVID C., BRUCE L. HAINES, JUDY L. MEYER, BRIAN D. KLOEPPEL, JAMES M. DEAL, and SUSAN STEINER. Institute of Ecology, University of Georgia, Athens, GA 30602, and Portland State University, Portland, OR. Effects of clear-cutting understory and hurricane disturbance on hillslope-riparian processes in the Southern Appalachians.

B) Tree Foliar Acclimation Project:

Independently funded grant by NSF

Cooperative project by Bolstad, Kloeppel, Vose, et al.

Field Data Collection Completed in fall 2001. Data summary and manuscript preparation in 2002.

C) International NSF Grant for Research in Poland

Manuscript in preparation

Submitted Manuscript Due 15 February 2002 to Environmental Science and Technology

Oleksyn, J., B.D. Kloeppel, S. Lukasiwicz, and P.B. Reich. 200_. Restoration of a degraded urban Aesculus hippocastanum site using mulching and fertilization.

Two other projects in the data collection phase:

1) Evaluation of natural and common garden gradients in Norway spruce in the Tatra Mountains of southern Poland and northern Slovakia (with J. Oleksyn and J. Modrzynski)

2) Long-term water-use efficiency and climate change in the lowland old growth forests of the Bialowiezia National Park in eastern Poland (with A. Korczyk and J. Oleksyn)

Co PI: J.D. Knoepp
Sina and I worked on digging 'big pits' on the terrestrial gradient plots to provide better soil bulk density and nutrient data. However, all pits were not completed and data are not yet available and lab analyses are on hold until the Analytical Lab Construction is finished.

Co PIs: S. Pearson and M. Turner
Accomplishments during the year 2001 included analyses of previously collected data, an expansion of modeling efforts, and initiation of new field projects.

Analyses were completed on the data collected by Norman Hicks in the late 1990s. Hicks and Pearson submitted a manuscript that detailed findings on the response of terrestrial salamander communities to past land uses. Contrary to expectations, we found no major differences between salamander communities in forest stands that were previously farmed (high intensity use) and stands that had been logged but not cleared for agriculture (medium intensity). Stands that had not received heavy human use (low intensity) generally had high salamander populations compared that those that had been logged or farmed. Two undergraduates at Mars Hill College used data from this same field effort to test for differences in abundances of wolf spiders and in differences in the tree community among these sites. One of these students was supported by REU funding.

Pearson and Turner increased the scope of modeling efforts using the POPDM model, a spatially explicit model designed to explore the effects of varying plant life history characteristics on population persistence in fragmented landscapes. In a related endeavor, Turner led efforts to quantify how changes in forest cover, as documented by Bolstad and Wear, have altered the abundance and spatial pattern of forest community types in the Southern Blue Ridge.

Three new field projects were also started. Pearson is collaborating a colleague and graduate student at Western Carolina University to examine differences in breeding bird communities found in forest stands that vary in land use history (see first paragraph above for the categories of land use history). Bird censuses were conducted at an array of sites in the French Broad River Basin in 2001. This work will expand to sites in the Little

Tenn. Basin next summer. Pearson is also collaborating with Kitty Reynolds in monitoring avian responses to the creation of canopy gaps in the CWT watershed. Before-treatment data were collected this past summer. The second major field project involves measuring soil nutrient pools and nitrogen mineralization at sites having different land use histories. This work is being done by Jen Fratterigo, a graduate student with Turner at UW-Madison. Jen completed a pilot project to quantify the scale of variation with and between study plots.

Co PI: C.M. Pringle

I**. Stream trophic dynamics in southern Appalachian Streams** (Pringle/Meyer Collaboration): We have made considerable progress in our investigations of fishes and crayfishes in the trophic dynamics of streams draining different types of land-use. Over the last year, this project has involved two graduate students: K. Schofield and A. Sutherland. It has formed the basis of Schofield's dissertation which she successfully defended this year. One paper is in print, one submitted and two papers are in manuscript and will be submitted in early 2001 (see 'IV' below). A new graduate student, S. Dye, has been recruited to replace Schofield on the project. Dye will pursue field work on interactions of nutrients and stream macroconsumers: Bottom-up and top-down effects in two Appalachian streams with different macroconsumer assemblages.

II. **A comparison of stream and terrestrial decomposition at the Coweeta and Luquillo LTER Sites:** (Hunter/Pringle/Coleman Collaboration): The stream portion of this project involved two graduate students: N. Powell and E. Greathouse. The Coweeta portion of the project formed the basis of Powell's masters thesis which she successfully defended this year. The manuscript resulting from her research will be submitted this year (see 'IV-A,C' below). Another manuscript dealing with inter-site comparisons (i.e. at Coweeta and Luquillo) of stream decomposition is in prep.

III. Hazard Site Project long-term research on the biology, chemistry and geomorphology of southern Appalachian streams at high risk of development. (Meyer, Pringle,

Helfman, Benfield, Bolstad,Wear Collaboration). This project has involved two graduate students: N. Gardiner and A. Sutherland. Gardiner successfully defended his

dissertation this year and the development of the and intitial findings are summarized in a chapter of his dissertation which will eventually be submitted to Ecological

Applications (see 'IV-C' below).

IV. **Products:**

A. Publications, dissertations, and theses:

(1) Schofield, K. A., C. M. Pringle, J. L. Meyer, and A. B. Sutherland. 2001. The importance of crayfish in the breakdown of rhododendron leaf litter. Freshwater Biology 46: 1-14

(2) Schofield, K. A. 2001. Top-down interactions in southern Appalachian streams: an examination of temporal and spatial variability. Ph.D. Dissertation , University of Georgia, Athens, GA, 251 pages.

(3) Powell, N. L. 2001. The role of crayfish in leaf decomposition across a range in leaf litter qualities. Masters Thesis, University of Georgia, Athens, GA 3, 63 p.

B. Manuscripts submitted:

(1) Schofield, L., C. M. Pringle and J. L. Meyer. Submitted. Direct and indirect effects of increased bedload on algal and detrital based stream foodwebs. Ecological Applications.

C. In manuscript:

(1) Powell, N. L., C. M. Pringle, M. D. Hunter, and D. C. Coleman. The role of crayfish in leaf decomposition across a range in leaf quality. Oecologia.

(2) Schofield, K. A., C. M. Pringle, J. L. Meyer, E. J. Rosi, and K. D. Kearns. Top-down interactions in a human-modified landscape: Does watershed disturbance reduce stream macroconsumer impacts? Ecol. Appl.(?).

(3) Schofield, K. A., C. M. Pringle and D. D. Schofield. In ms. Revisiting the use of electricity for experimental exclusion; Past, present, and future. Can. J. Fish Aquat. Sci.

(4) Gardiner, E.P., A. Sutherland, M.C. Scott, J.L. Meyer, G.S. Helfman, C.M. Pringle, P. V. Bolstad, and D. N. Wear. Linking stream ecosystems and landscape trajectories in the southern Appalachians. Ecol. Appl.(?).

Co-PI: B.C. Reynolds

Coweeta LTER Research Summary

December, 2001

Reynolds, B.C., A. Brennan, and S. Madson

Introduction

An ongoing field of research in forest ecology is the effect of gap size on forest dynamics. Evidence is mounting that the current “gap dynamic” model, using gaps 30m in diameter, is insufficient to explain diversity in many forests. A study being conducted at Coweeta by Jim Clark et al. will examine the effects of larger gaps on the dynamics of forest stands. Our studies on soil microarthropod communities will take advantage of the experimental gap creation to examine the effects of different size gaps on community structure of common soil microarthropods, taxa which are known to be integral in the decomposition of forest litter.

Methods
Our sites are within the gap site established by Clark et al., below LTER site 427. The area is considered a mixed-oak stand, with Quercus rubra, Quercus alba, Acer rubrum, Acer pennsylvanicum, Carya sp. and sprouts of Castenea dentata making up the majority of overstory species. Understory vegetation includes Rhododendron maxmimum, R. calendulaceum, and Vaccinium sp. (Pearson et al., unpublished data).

Madson and Reynolds established microarthropod sites in 3 areas which will be large gaps (40 m diameter) and 2 areas which will be smaller gaps (20 m diameter). Each site consists of 10 plots, 1 m2, along existing transects, most within 2 m of Clark's existing seed collectors and seedling plots. Micrarthropod cores, 5 cm x 5 cm, are taken within each plot. Soil temperatures are taken at half of the plots with a standard soil thermometer. Soil organic matter determinations will be done on a subset of the cores beginning with the November, 2001, collection. Microarthropods are sorted into the following categories: collembola, oribatid mites, prostigmatid mites, mesostigmatid mites, and other.

Sampling has been done for July and November of 2000, and May, July, and November of 2001. A spring sampling is planned immediately prior to gap creation, which is now expected to occur in April, 2002. Follow-up sampling would occur immediately after gap creation, providing a unique data set on effects of gaps on soil microarthropod communities (Madson, personal communication). Sampling would continue on a seasonal basis for two years following the gap creation.

Results
Microarthropod sorting and data analyses done by Brennan and Reynolds on soil cores collected in July and November, 2000, indicate that seasonal differences in number of collembola and oribatid mites are greater than differences among plots (Brennan, Madson and Reynolds 2001). Samples from May, 2001, have been counted but the data are yet to be analyzed.

References
Brennan, Amanda L., Stephanie Madson, and Barbara C. Reynolds. 2001. Effects of Canopy Gaps on Soil Microarthropod Communities. Poster for Coweeta Annual Summer Meeting, June 2001. Athens, GA

Updates not received from the following Co-PIs:

Bolstad, Clark, Gragson, Hendrick, Meyer, Newman, Pulliam, Swank, Swift, Vose, Wallace, Wear