Summer 2004 Coweeta Meeting, 29-30 June
Coweeta External Advisory Meeting
Coweeta Conference Center, Coweeta Hydrologic Laboratory

A Coweeta-selected group of external advisors was invited to this meeting to review the progress of the Coweeta LTER and provide us with a written report on the scientific merit and broader impacts of the research. This meeting report contains a brief biography for each external advisor, a list of Coweeta participants, and the meeting agenda. Attached to the end of this document is the report written by the external advisors.

External Advisors:

- **Scott Collins** – Professor, Department of Biology, University of New Mexico Albuquerque, Lead Principal Investigator Sevilleta LTER and Affiliate Konza Prairie LTER. Primary area of study is plant community ecology, and disturbance dynamics at a landscape scale in grassland systems.

- **Nancy Grimm** – Professor, School of Life Sciences, Arizona State University, Tempe AZ, Lead Principal Investigator Central Arizona-Phoenix Urban LTER. President (2004-5) of the Ecological Society of America. Primary focus is on cycling and retention of elemental nitrogen in the context of patch dynamics and landscape heterogeneity in arid lands.

- **Gary Lovett** – Plant Ecologist, Institute of Ecosystem Studies, Millbrook, NY and Faculty Associate Hubbard Brook LTER. Primary focus is on how perturbations such as air pollution, introduced pests, pathogens and insect defoliators affect forest nutrient cycling.

- **Sander van der Leeuw** – Professor and Head, Department of Anthropology Arizona State University, Tempe AZ and External Faculty Member Santa Fe Institute. From 2001-3, *Rapporteur-Général* of the *Conseil National de Coordination des Sciences de l'Homme et de la Société*, and from 2002-3, Deputy Director for Social Sciences at the *CNRS* and the *Institut National des Sciences de l'Univers*. Primary focus is on archaeological approaches to the study of complexity and structured transformations across time and space including modeling natural and anthropogenic causes of land degradation, environmental perception, policy making and environmental communication.

Attending:

Ball, Becky
Butler, Sarah
Cho, Seong-Hoon
Clark, Jim
Clinton, Barry
Clinton, Patsy
Coleman, David
Deal, Jim
Dietze, Mike
Dye, Susan
Eggert, Sue
Elliott, Kitty
Fly, Jessie
Frost, Chris
Gardner, Ned
Gragson, Ted
Greenstone, Tom
Haines, Bruce
Harper, Carol
Hendrick, Ron
Hersh, Michelle
Hunter, Mark
Ibanez, Ines
Kloeppel, Brian
Knoepp, Jennifer
Koch, Kari
Kominoski, John
LaDeau, Shannon
Leigh, David
Mazzarelli, Lisa
Pearson, Scott
Price, Katie
Pringle, Cathy
Pulliam, Ron
Reidel, Mark
Reynolds, Kitti
Scarborough, Pheadra
Scott, Mark
Steiner, Susan
Vanhook, Duane
Wear, David
Wolosin, Mike

General Comments:
This visit anticipates the mid-term NSF review and the external advisors. The meeting was therefore organized to match as closely as possible the NSF Mid-Term Site Review meeting, and the external advisors were asked to review our site science following the NSF guidelines for LTER site reviews. These are:

> LTER site reviews are conducted to provide mid-term guidance and advice to sites, keeping in mind that sites will be starting the preparation of proposals for the renewal competition to be held two years from the time of the review. While the preferred organizational format follows the sections of the proposal, it is not intended to be a "cookie-cutter" template for material to be supplied to review team participants. There are five overall review criteria for evaluation of each proposal/program. The primary criterion will be scientific merit, which also has a component of network participation and synthesis activities (collectively these two essentially comprise NSF's Review Criterion 1). Information management and technology, site management (including personnel, fiscal, collaborative, and logistical issues), and education/outreach are also important aspects of all LTER programs to be addressed in reviews, with the latter explicitly addressing NSF's Review Criterion 2, or "Broader Impacts." Each of these five criteria are evaluated with respect to quality, productivity and impact.

Date	Time	Activity
Jun 29	9:00-10:00	Welcome to Meeting & Project Overview (Gragson)
	10:00-12:30	1. Analytical/Dendrochronology Lab (Deal/Clinton)
		2. Shope Fork fish (Grossman)
		3. Litter exclusion (Eggert)
		4. Shope Fork wooly adelgid (Hunter)
	12:30-4:30	0. Pick-up bag lunches and continue tour
		1. GAP sites below WS27 Ball Creek (Clark)
		2. Dendrochronology sites (Elliott)
		3. Little Tennessee geomorphic study (Leigh)
		4. Watauga/Darnell Creek Hazard sites & Sediment sampling (Scott – biotic / Reidel – sediment)
	5:00-7:00 pm	Student poster session & social hour (first hour Student-External Advisors only, no PIs)
	7:30-9:00 pm	Working dinner – External Advisors/Science Advisors
Jun 30	9:00-9:30	Characterization of the Socio-Natural Template (Bolstad)
	9:30-10:00	Aquatic Ecosystem Reponses (Webster)
	10:00-10:15	Mid-morning break
	10:15-10:45	Terrestrial Ecosystem Reponses (Pearson)
	10:45-11:15	Forecasting Ecosystem Responses (Clark)
	11:15-11:45	Cross-Site Activities & Other Initiatives (Kloeppel)
	11:45-12:00	Closing Comments – meeting ends
	12:00-5:00	Working lunch/advisors write-up their comments

Research Overviews: General idea is that each presentation will last approximately 20 minutes, then there will be +/- 10 minutes for questions/answers, and shuffling between presenters. One individual has been identified as the ***leader*** for the section. The idea is that this individual will be in charge of the actual presentation and fielding of questions; however, this individual should coordinate with the individuals identified as involved/supporting role and solicit from each 2-3 slides and 2-3 paragraphs of information that can all be worked together into an overview.

1. Welcome & Project Overview ~ **Gragson**, Vose, Kloeppel. Objective is to briefly welcome all then outline more for the benefit of the advisors the organization of the Coweeta LTER research (i.e., 3 initiatives), the location of research (i.e., Coweeta basin, LT/FB riverbasins, region), and the composition and distribution of the research team.

2. Characterization of the Socio-Natural Template ~ **Bolstad** (involved/supporting role: Elliott, Leigh, Kloeppel, Newman, Cho, Wear, Gragson). Objective is to collect coarse grained information on the spatial and temporal variation in factors relevant to land use and land cover change, environmental gradients, and disturbance regimes to identify driving variables for research activities in Aquatic/Terrestrial Ecosystem Reponses and Forecasting Ecosystem Responses. Elements: mapping long-term land-use trajectories, environmental gradients and disturbance regimes.

3. Aquatic Ecosystem Reponses ~ **Webster** (involved/supporting role: Meyer, Leigh, Helfman, Reidel, Benfield, Wallace, Vose, Grossman). Objective is to use a series of integrated studies to quantify land-use influences on historic and present patterns of erosion and sedimentation, as well as the spatial extent and mechanisms driving responses of organisms and ecosystems to anthropogenic disturbance. This research is evaluating responses at the assemblage, population, and organismal levels, as well as the concomitant effects of temporal and spatial heterogeneity. Elements: how different land uses and land-use changes cumulatively affect water quality, quantity, and aquatic biota.

4. Terrestrial Ecosystem Reponses ~ **Pearson** (involved/supporting role: Pulliam, Hunter, Turner, Reynolds, Clark). Objective is to use experimental and observational studies to understand how variation in climatic and site characteristics controls productivity, overstory tree demography, understory herbaceous diversity, microarthropod diversity, and ultimately forest form and function. The study landscapes are located along north/south climatic and biogeographic gradients in the Southern Blue Ridge. Elements: productivity, overstory demography, understory diversity, microarthropod diversity.

5. Forecasting Ecosystem Responses ~ **Clark** (involved/supporting role: Pringle, Bolstad, Hunter, Pearson, Scott, Gardiner, Helfman, Gragson). Objective is to construct explicit forecast scenarios that move from hypothesis testing to real-world applications. They will draw from our observational data networks and experimental research to reflect the temporally and spatially explicit linkages between land-use legacies and watershed processes. The envisioned applications include conservation planning, landscape management and design, and the assessment of potential changes from land development or climate change. Elements: conceptual and technical integration of research results, multi-scale/multi-process models.

6. Cross-Site Activities & Other Initiatives ~ **Kloeppel** (involved/supporting role: Webster, Clark, Hunter, Coleman, Pringle, Gragson). The LTER program is entering its third decade of existence and this presents unique synthesis opportunities and the chance to partner with colleagues in scientific disciplines other than ecology. Our objective through various LTER and international cross-site initiatives is to use long-term observations and experiments to foster standardization and integrity of core measurements; increase the pace of synthesis through comparative research; promote multidisciplinary and interdisciplinary research; and use the knowledge gained to enhance education, training, policy-making, management and public understanding. Elements: LIDET, LINX-II, Intersite Hydroecology, Saison, Schoolyard, Ag-Trans.

Co-PIs not attending:
Benfield, Fred
Grossman, Gary
Helfman, Gene
Meyer, Judy
Newman, David
Swank, Wayne
Turner, Monica
Wallace, Bruce

Coweeta LTER External Advisory Committee Report & Recommendations

30 June 2004

Scott Collins, Nancy Grimm, Gary Lovett, Sander van der Leeuw

We provide these comments and suggestions on the basis of informal "site visit"-type presentations made by PIs and students of the Coweeta LTER during its summer meeting. Clearly, this is not exactly the format that you will adopt during next year's site visit, but we hope that our suggestions will improve your ability to convey the excitement and excellence of your research to the NSF visiting team. Our report is organized into two sections: comments on the scientific content of your Year 2 report and presentations made during our visit, and suggestions for improving specific aspects of the presentation in anticipation of the mid-term review.

Scientific Content

Overall quality and context of research: First and foremost, it is abundantly clear that a great deal of high-quality research is going on at CWT. We were impressed with the quality of the presentations, both verbal and poster, and with the scientific legacy of the CWT LTER. The latter, however, did not receive the attention it deserves. CWT has earned some bragging rights, so a bit more bragging would be appropriate in the overview presentations. Moreover, highlighting the main scientific contributions of CWT through the years will allow each and every presenter to contextualize his or her presentation in a more consistent way. This context-setting was absent from many of the presentations, such that it was difficult to tell where the individual projects fit within the broader whole of the CWT LTER.

Scientific theme and integration: The CWT conceptual theme has evolved with a shift in the project from a place-based, local emphasis to a thematically based, regional emphasis. Individual research projects can therefore be associated with one or the other of these emphases: with long-term, CWT basin-based studies carrying forward from the early days, or with retrospective or forecasting, regionally based studies aimed at understanding impacts of human landscape interaction characterizing the newer research. Hierarchical Bayes modeling is an exciting framework for integration. We encourage you to seek ways to ensure that this new approach develops in the CWT context, taking advantage not just of the wealth of data but also the expertise of CWT scientists. One way to do this would be for Jim Clark to hold an internal, on-site, training workshop for 'educable' CWT PIs and graduate students on Hierarchical Bayes methods.

We viewed the guiding hypothesis for 2002-2008, as stated on p 4 for the Year 2 Report, as an outgrowth of regionalization efforts that have taken place since 1996, and as a good start on the more theme-based activities that are beginning to characterize CWT research. We have several suggestions on research at the regional scale—including large-scale modeling, scaling and spatially explicit measurement—that are developed in more detail below. Here, however, we want to emphasize that initiative-theme framework described on p 46 of the Year 2 Report would be a good organizer for the presentations to be made during the site visit. In this meeting, however, this framework was not included. Instead, we heard of aquatic and terrestrial responses (which weren't really responses as much as a compilation of aquatic and terrestrial research).

The research on human impacts clearly is related to the concept of disturbance. However, presenters were fairly loose with the term "disturbance" essentially using it interchangeably with

human activity. We encourage you to think carefully about how—or even whether—you use the term disturbance.

Research at the Regional Scale: Regionalization presents a challenging and potentially very productive research direction for this project. It builds well on past research, takes advantage of the history of land use changes in this area, and provides a natural context for interaction with social scientists. You are clearly thinking on large spatial and temporal scales and considering the relevance of your work to the social and economic changes taking place in the southern Appalachians. Despite the promise of this research, we are concerned about the direction and integration of the regionalization efforts that were presented.

First, we feel that there is a lack of integrative measurements and models at the regional scale. These larger scale models and measurements provide context for the site-specific and process-level work. Examples of integrative measurements could include large- watershed nutrient budgets, which are useful for understanding the sources and fates of nutrients such as nitrogen that are transported both by human activities and natural processes. These budgets would be a logical extension of the small-watershed nutrient budgets which have been done so well at Coweeta in the past. Other possible larger-scale integrative calculations include regional estimates of carbon storage and soil erosion. We feel that the regionalization effort would benefit from the development of an economic/ecological model that would allow you to predict how changes in economic conditions (such as tax laws) lead to changes in land use and thus to changes in ecological systems. This would clearly be a long-term, complicated project, but thinking about possible structures for such a model now would help provide direction and integration to the regionalization effort. A model of forest dynamics linked to watershed processes would also be very useful, allowing you to predict, for instance, how the loss of hemlock due to hemlock wooly adelgid will affect forest community composition and nutrient and sediment yields from watersheds.

Second, we think that changes in fragmentation in this landscape present a nice opportunity for novel research at the regional scale. You demonstrated very nicely how the area has changed from almost totally forested in pre-European times to heavily agricultural by the start of the 20th century to predominantly forested at present, and has the potential to become fragmented by residential and commercial development in the coming decades. You might consider initiating a research focus on the responses of wildlife, plant communities, and ecosystem processes to these cycles of forests fragmentation and defragmentation.

A related subject is quantification of the legacies of past land uses. While you are clearly thinking about how past land use affects current ecosystem function, we saw little direct study of that subject. What are the long-term consequences of the very interesting footprints of Cherokee villages that you have mapped? What is the legacy of past agricultural land use, or of current urbanization? And finally, how do these legacies map onto one another in space? You might think about quantifying these legacies in terms of how they affect current or future ecosystem services, such as nitrogen retention in watersheds, prevention of soil erosion, sequestration of carbon, or maintenance of biotic diversity. To date, CWT scientists have published some interesting research on legacies of past land use, but these need to be synthesized in a spatial context to generate a scaled-up and spatially explicit picture of regional land-use legacies. It will be important for ongoing research studies that feed into this regional effort to standardize research designs. For example, the geomorphic studies we heard about on the field trip utilize a single-scale design to attribute differences between streams to watershed land use. We suspect that a multi-scaled approach, with several reaches embedded in local (riparian) to subwatershed

to watershed units of variable land-use histories, would be much more revealing. The point is that experiments and measurement should be designed with a view to scaling to the regional level.

Spatialization: All the dynamics involved in social-environmental research are multi-scalar, both in time and in space. The research design should take this into account. In the temporal dimension, this implies that it should be able to take the second order changes (changes in the nature and structure of the dynamics themselves) into account. That in turn requires the study of the long-term evolution of the area and its legacies.

In the spatial dimension, it means that local phenomena should at all times be related to their wider context. In effect, local phenomena should be seen as instances of spatially more encompassing dynamics. Ideally, this means that the local sampling sites are chosen as a function of the dynamics at the more encompassing scales. In the present state of research, that is clearly not possible. However, a major effort should be made to contextualize each and every one of the local sites concerned. **For this purpose, it seems to us that attracting a human geographer who is well versed in spatial statistics, GIS manipulation and (ideally) multi-agent modeling would be a high priority if the project is to realize its aim of 'going regional'.**

Such contextualization should place each site's dynamics in the context of the combined social-environmental dynamics at other, more encompassing, levels. To do so, one must necessarily move from the most encompassing to the least encompassing level. It seems to us that you have ample environmental data at most of the more general levels, but are missing many categories of data of a more social, cultural and socioeconomic nature. First and foremost, one would need a regional-scale model of the area's economic dynamics as relating to climate and the environment. To make such a model, one would need input and output data for the region as a whole, as well as detailed demographic data. One will need to know the evolution of the age distribution of the population, for example, of its socio–professional categories, of the spatial distribution of the population, of its wealth categories, of its education levels, etc.

Once such data are available in the most detailed form possible, probably from the census, GIS-based modeling techniques will enable you to interactively construct spatial models of the social-environmental dynamics that relate these, and other, parameters in the operation of the socio-economic system. That in turn allows you to elicit the role of the particular spatial configuration of the different characteristics of the region in driving the dynamics, and to do so in considerable detail due to the GIS's capacity for spatial up-and downscaling.

In essence, this would enable you to extend the picture that you are beginning to create for the Cherokees up to the present. You would be able to identify the evolution of the footprints of the settlements, the stress this causes at different points in the landscape and on different resources due to exploitation and pollution, etc. But because many of these dynamics are relatively long-term, notably the demographic, health and settlement dynamics, this would also give you a way to project into the future a number of the constraints that the Southern Appalachian socio-environmental system will be subjected to in the next ten or twenty years.

Once the resources, the people and all the other dimensions of the system have been spatialized, it will be possible to transform these into a multi-agent model, and then also take culturally and socially determined preferences in choice and individual behavior into account.

Among the cultural data, one would ideally like to gather data on the perception of the environment and its resources by different cultural groups in the area, as well as their values and priorities. This would enable one to assign different decision-making values to the different components of the population who compete with each other for the same space and resources,

and thus bring into the model different behaviors. For this, anthropological research is very useful.

PIs and graduate students: Many excellent scientists are active participants in CWT, and a good range of disciplines and institutions is represented (but see caveats above). We did not hear much about interactions but the Science Advisory Committee members seem to interact well and there are numerous collaborations. As noted earlier, the regionalization research and the Hierarchical Bayes modeling approach represent opportunities for increasing this interaction. It would probably be wise to think about adding more junior and female scientists to the team, and inviting women scientists to be part of the internal Science Advisory Committee. Graduate students were reasonably well engaged with the project and aware of one another; their work was often a central component of the research presented. Graduate students we spoke with appreciated the benefits of being associated with an LTER project and were taking good advantage of the opportunities afforded by the CWT LTER. Finally, we note that the interactions between academic and governmental scientists appear seamless and include collaborations and active participation of USFS personnel in research projects.

Suggestions for mid-term review

The field and synthesis presentations covered a tremendous amount of interesting information. This section is more about the presentation of that information rather than content. Essentially, you need to determine the purpose of the synthesis and field presentations. We saw presentations that were synthesis oriented and others that were almost laundry lists of research activities. Laundry lists should be avoided, as should a large number of short presentations (ESA meeting style). In the field we spent lots of time and detail on one or two experiments rather than getting a broader example of multiple related activities. The best approach might be a mixture of (14-16) short project-specific presentations in the field and (4-6) broadly synthetic and interrelated presentations following or preceding the field trip. The purpose is to provide a coherent body of work that directly addresses the specific research areas within the overarching goal of the project. If necessary or desired, a full listing of all research projects could be put on the web on a special set of pages for the site visit team.

Field presentations: Given the challenges of getting a group from place to place, plan no more than 4 stops and have several (3-5) related presentations at each stop. Each person should speak for no more that FIVE minutes. Introduce the project and a cool result. Allow FIVE minutes for questions for each field presentation and the questions will be used as a guide to the team's interest in details of the project and an opportunity to discuss how it fits in with other past, present or proposed projects. Each field presentation should be accompanied by a one page (max!) summary that includes an abstract and 1-3 figures. All one-pagers MUST be prepared in time to be included in the materials that are given to the site visit team. Organize these one pages in the book in order of the presentations in the field. The overview document should be sent to the team at least a week before they arrive so they will have something to read on the plane. In the field, presenters should have larger versions of their graphs which they can point to during the presentation.

Also, you should decide now if you want the synthesis talks before or after the trip. If before, then the field trip has more context but the order of presentations and type of information in the field needs more structure to follow on the structure of the synthesis talks and overall

theme. You do not want the continuity of your presentations to break down in the field presentations. If you do the field trip first, there can be less organization in the field presentations and you can use them to highlight the variety of long-term empirical and manipulative experiments that are taking place. Remember to emphasize the LTERness of your research when appropriate. For example, the gap study can only be done because of long-term research beyond initial funding and USFS cooperation and site security. LTER should conduct research that can only be done in an LTER context, long-term and integrated. If a project is funded by a separate grant, brag about that and then mention, when appropriate, that LTER will continue to collect data after the grant runs out, another advantage of working as part of an LTER site.

Synthesis talks: Develop and use at least one common slide that shows the overall conceptual framework and that integrates the key components of the project. Have each speaker use that slide early in their presentation to show how each part fits into the big picture. Repeating a graph from an earlier presentation, poster or from the field trip can also link the presentations or the individual projects into the big picture, or be used to make a different point. There were several good synthesis presentations using results from many different individuals in the project. In the synthesis presentations, refer to other talks or posters that will be shown or field presentations.

We suggest two overview talks the first evening of the site visit, Coweeta Hydro Lab (Vose) and Coweeta LTER (Gragson) on history, theme, regional setting, accomplishments, etc. These talks will set the stage for the field and synthesis presentations. To show continuity and conceptual connections, the PI should introduce all presenters and have that brief introduction explain the context, why the person is speaking, where it fits into the overall conceptual framework. In a couple of places later in the field trip, summarize briefly what was heard at the previous stops and then introduce next speaker, etc. These summaries help the review team see the big picture, and they remind the speakers to fit their presentations into the big picture. If a speaker forgets a key point, then find a way to say it for them after their talk or in the next introduction. By having one person do all intros and synthesis throughout the site visit you demonstrate integration, coherence and leadership which a site visit team is usually looking for.

- Use a common powerpoint background for all synthesis presentations. It wouldn't hurt to use a common font, too, for paragraphs, bulleted lists, etc.
- Provide a slide that summarizes the 3 or 4 major contributions of Coweeta LTER research to ecology. Throw in some information about planned projects so that the team can be asked for advice about research you are thinking about doing in the future.
- Forget the lab tour. Plan some time for your data manager to meet independently with the reviewer data manager. One thing that worked for the SEV site review was the IM reviewer came in early (at mid-day) and met with our IM person one-on-one.
- Plan for lots of questions. Set aside no more than 45 minutes for each synthesis talk, with the talk being strictly held to 30 minutes and 15 minutes for questions and discussion. Leave lots of discussion time in the program to keep on schedule.
- You will need lots more posters. Plan for a poster session and mixer after the first full day, and nothing after dinner.
- Leave a few 30-minute time blocks for the site visit team to go into Executive Session so they can start their feeding frenzy.

- Given that at least 5 other sites will get site visits in the same year, communicate with those PI's on scheduling. For those sites with earlier visits, contact the PI's to see what worked and what didn't.
- One thing you might think about mentioning in the overview presentation would be how you fit in with, or are participating in, the LTER planning grant synthesis activities that might be underway by the time your site visit occurs.