**CWT LTER Winter Meeting 2014, January 21 and 22, 2015**

Wednesday January 21

8:15 – 8:45 Coffee, tea, light breakfast

8:45 – 8:55 Welcome, agenda overview, logistics

8:55 – 9:15 Overview of 2014 USFS Research – Chelcy Miniat

9:15 – 9:30 Lessons from the panel and external reviews, and network discussions with NSF:

We need a better statement of who we are and what we do.

We need a long term conceptual framework.

Link the past and the present in all we do.

Assume less prior knowledge on the part of the reviewers (only 30% have LTER experience)

Focus more on concepts and ideas, less on methodological details

Highlight our signature publications on our website

Create a methods page on our website?

9:30 – 10:20 Presentation and discussion of draft long term conceptual framework. (previously sent)

Overarching question

Draft conceptual diagrams (two versions) - five core areas, connect past to present

Ecosystem stability, sensitivity, and resilience. State variables of interest.

Topoclimate template and Hydroclimate variability

Disturbance timeline

Highlights from our past

Signature publications, core long-term datasets

10:20 – 10:35 Break

10:35 – 12:00 Working groups to discuss LT framework – one hour, report back, questions to consider:

1. Does the proposed overarching question adequately describe what we do and what we want to do?
2. How can we improve the conceptual diagrams?
3. Are we happy with our ecological definitions?
4. Are we committed to doing both medium-term cross-landscape research in association with long term observational and manipulative research?

Lunch

1:00 – 1:30 Working groups report

1:30 – 2:00 Comments from the external reviewers, Peter Groffman and Paul Hanson

2:00 – 2:15 Introduction to work plan for the 2-year project: the three synthesis projects, and priorities for the other research groups.

2:15 – 3:45 Research and synthesis working groups discuss and plan two year efforts.

3:45 – 4:00 Break

4:00 – 4:45 Research groups report back.

4:45 – 5:00 Wrap up and Thursday preview

5:00 Social hour before dinner

Evening SAC meeting, with external advisors

Thursday January 22

8:00 – 8:30 Coffee, tea, light breakfast
8:30 – 8:45 Introduction to work session on the proposal
8:45 - 10:45 Proposal Revision Working Groups (Topoclimate Controls on Biodiversity [includes TDE], Rhododendron removal, Regionalization, Governance). Charge to the groups: better theoretical justifications, provide connections to the overarching framework and CWT research history, Deemphasize methodological details, NO increase in length, develop ideas for ASM proposals. How does each group plan to revise their proposed research efforts in light of the reviews and this reappraisal of our long term mission and data framework?
10:45 – 11:00 Break
11:00 – 12:00 Groups report back
12:00 – 12:30 Wrap-up, next steps,

12:30 Lunch

Afternoon: Time available for additional collaboration meetings

**Coweeta LTER 2015 Winter Meeting Notes**

January 21 & 22, 2015

*January 21*

USFS Research Overview (Miniat)

Mission

1. Conduct long-term hydrologic & ecological research
2. Develop knowledge, methods, and guidelines to evaluate the effects of natural resource management on forested watersheds
3. Develop a fundamental understanding of the structure and function of forested watersheds

Structure

- Coweeta has 5 scientists and 3 Emeritus scientists, plus 7 USFS professional & support staff; also have 6 UGA/LTER professional/support staff and 3 technicians affiliated with the University of Minnesota
- USDA Forest Service has workforce of ~30,000 employees with $5 billion in FY2014
- Forest Service Research and Development compromised of 500 Forest Service R&D scientists
- At Coweeta, budget shrunk by ~$1 million since 2010

Knowledge Dissemination – FY14

- 93 publications (including LTER); 87% in peer-reviewed journals and 58/93 authored /co-authored by USFS scientists
- 91 presentations at scientific and professional organizations
- 33 tours, reaching 447 stakeholders
- Hosted 4 brownbag seminars

Research

- 16 active (gauged) watersheds with long-term record; original research in the 1940s focused on effects of removing forest cover adjacent to streams on water quality & quantity
- In 1950s experiments on effects of fire, forest conversion to grass or pine plantations, and logging on water quality & quantity
- In 1980s, experiments established to examine the effects of species and species loss on water quality & quantity
- Today long-term data are used to examine patterns and rate of process change, particularly as it relates to climate change

Recent Projects

1. The ecosystem service of water supply: quantifying the role of National Forests in the Southeast (lead author Caldwell)
2. Eastern deciduous forest tree growth response to hydroclimate variability: dendrochronology of six species spanning 85+ years (Elliott et al., Global Change Biology, in review)
    - Species respond to small storms – distribution of rainfall more important than total amount
3. Role of species-rich herbaceous structural layer on ecosystem function: herb layer removal, addition, and control spanning 14 years
    - Additional stimulated in N min (2x) and canopy leaf mass and N, and removal enhanced recruitment of red maple (Elliott et al., Ecosystems, online edition available)
4. Restoration of base cation depleted high-elevation watersheds
    - Led by Knoepp, funded by TVA, which examines mechanisms of assessment and restoration of watersheds with base cation depletion

- Spring workshop described the results of the project to date; 35 people attending from NFS and S&P

5. Long-term changes in streamflow and vegetation in reference watersheds
    - Chestnut decline and now red maple most important species
    - LAI, biomass increased after early 1970ss across all reference watersheds
6. NEE Flux Towers: Eddy Covariance
    - Towers streaming data at CWT and Crossett EF
    - Scaling component C, N, and $H_2O$ fluxes and pools
    - New datasets include soil $CO_2$ flux, stem $CO_2$ flux and DOC
    - Aaron Berdanier, (Clark/Miniat) PhD student at Duke, working with sap flux scaling functions and sap flux drought responses of forest trees
    - John Walker (EPA) installed NOx, NOy sensors to partition biological vs. anthropogenic emission sources
    - *Novick, K.A., Walker, J., Chan, W.S., Sobek, C.M., and Vose, J.M. 2013. Eddy covariance measurements with a new fast-response, closed-path analyzer: Spectral characteristics and cross-system comparisons. Ag For Met. 181:17–32.*
    - *Novick, K.A., Brantley, S.T., Miniat, C.F., Walker, J., and Vose, J.M. 2014. Inferring the contribution of advection to total ecosystem scalar fluxes over a tall forest in complex terrain. Ag For Met. 185:1–13.*
7. Restoring riparian forests in the wake of hemlock mortality (joint USFS/LTER project)
    - Treaments:
        i. Remove rhodo (herbicide stumps)
        ii. Remove litter layer (w/fire)
        iii. Remove rhodo + litter layer
        iv. Control
    - Plot scale work in Coweeta basin; reach scale work in Wine Spring
    - Removal will start mid-February 2015; fire treatments scheduled in April/May
    - MS student at University of Texas at San Antonio (Bush/Elliott) conducting pretreatment seed bank study
    - Kelsey Ream, anMS Student at Illinois (Fraterrigo/Knoepp) looking at belowground C changes in plots, pre-treatment
8. Silvicultural treatments to increase efficacy of biological control on hemlock
    - Contend that if carbon starvation is the mechanism of decline, then improving C balance could enhance efficacy of biological control efforts
    - Created gaps around 1) HWA infested forested; 2) HWA infested forest + biological control, and 3) non-HWA infested forest
    - Preliminary results reveal that infested trees are storing C as sugar rather than starch

<u>Lessons from panel and external reviews</u> (Jackson)

- What is most exciting thing about riparian research? (Groffman)
- Trees are important and influence water quality, stream structure, etc.
- Do we need to do a better job with ecological theory (Warren)
- Where do we go with our proposal to tell a better story? (Jackson)
- We will get dinged more for not showing integration than for not showing detail – Monica Turner from 2104 Coweeta meeting. This ended up being true. This is what we need:
    - A better statement of who we are and what we do
    - A coherent long term conceptual framework

- A single question that guides our work
- A clear conceptual diagram
- To link the past and the present in all we do
- To assume less prior knowledge of CWT (only 30% have LTER experience)
- To focus more on concepts and ideas, less on methodological details

<u>Conceptual diagrams</u>

- Took a look at the AND conceptual diagram; beauty of their diagram is that it stays fairly constant; it evolves over time but basic long-term question stays the same
- KNZ proposal: focus on grazing and fire; the CWT Science Advisory Committee (SAC) liked the conceptual diagram
- Need to come up with question; Rhett gave two examples of questions that he and Paul Bolstad put together; this question shouldn't change much over time:
    - Question 1: "How do topo-climatic gradients, diverse floral and faunal communities, climate variability and change, and human actions interact to affect (1) ecosystem productivity, (2) cycling and fluxes of organic and inorganic matter, (3) population and community dynamics, and (4) patterns and impacts of natural and anthropogenic disturbances within terrestrial and freshwater habitats of temperate montane deciduous forests?"
    - Question 2: "How do ecosystem processes and populations respond and evolve in response to natural and human-imposed environmental conditions that change in space and time, focusing on four key properties of the southern Appalachian ecosystem: hydroclimate variability, sensitivity to perturbation, resilience, and spatial scaling properties of both sensitivity and resilience."
- Need to be careful of how to use resilience; many reviewers don't like this term
- Definitions:
    - Topoclimate template – variation in site-scale climate and soil moisture due to topography, lithology, and regional climate patterns
    - Hydroclimate variability – the spatial or temporal variation in climate (e.g. cloud cover, solar radiation, precipitation, humidity, temperature) as well as hydrologic states (e.g. soil moisture) and fluxes through the landscape (e.g. the frequency of droughts, storms, or floods). Hydroclimate variability incorporates topoclimate variability but includes variability driven by climate and land use change.
- Rhett talked about draft conceptual diagram version 2 that Maerz and Bolstad put together; folks like the diagram, but overall everyone agreed that it needs to be simplified
- Need to get away from the idea that every little piece of the proposal needs to be detailed; don't need details about individual PI projects
- Rhett showed disturbance timeline for southern Appalachians; essence is that there have been major disturbances and disease introductions, but overall the system is pretty resilience; folks liked this timeline, but many thought it should be simplified and perhaps only include events that are tied directly to the proposal (e.g. leave out fall cankerworm, rainbow trout introductions, etc.)
- AND had an impressive page where the placed all of their long-term data series; CWT should try and do something similar, emphasizing long-term data that are mentioned in the proposal
- Slide 12:
    - By building on past research we are uniquely poised to: (1) determine ***sensitivity*** and ***resilience*** of selected ecosystem properties/processes to different environmental

drivers in southern Appalachia; (2) make predictions regarding environmental and/or social conditions necessary for ***state changes (ecological thresholds)*** to occur; & (3) identify state changes (or the lack thereof) in our long term data as we continue to collect it.
    - When developing hypotheses/asking questions about sensitivity and resilience it is important to be clear on the sensitivity/resilience *of what to what?* (Carpenter et al. 2001). For example, what are the specific ecosystem processes or properties that we predict will be sensitive or resilient to a key environmental drivers (e.g., hydroclimatic variability). Moreover, what are the mechanisms behind sensitivity and/or resilience?
    - Part of this is figuring out how to quantify or describe **ecosystem states** (what variables?) as well as **ecological thresholds**.
- Sensitivity definitions:
    - *responsiveness of an ecological state to disturbance or a change in external drivers* (definition used Konza LTER proposal;
    - the degree to which a stressor impacts a system (Mumby et al. 2014) – Mumby et al. (2014) treat *sensitivity* as one of three components of *vulnerability* –which they define as explicitly including exposure, adaptive capacity and sensitivity;
    - In their recent paper on "Riverine macrosystems ecology," McCluney et al. 2014) propose that *sensitivity* is one of three important properties of riverine macrosystems providing the following definition: *changes in one part of a basin influence a distant part of that basin*.
    - For a hydrologist or a modeler, sensitivity is a slope, or derivative: i.e. the amount of change in the dependent variable divided by the amount of change in the stressor variable.
- Resilience definitions:
    - *ability of a system to absorb and/or recover from disturbance or change in drivers and maintain a relatively constant ecological state* – Konza LTER proposal definition;
    - *the capacity to recover from a disturbance even though biota and ecological processes have been diminished* (referred to as the 'Westman-Webster' definition (Westman 1978; Webster et al. 1983) by Lake (2013). In the case of more recent scientific contributions on lake eutrophication – **thresholds** in phosphorus concentrations result in regime shifts to alternative states – possibly irreversible. The concept of resilience changed when the three ingredients of thresholds (regime shift, alternative states, and resilience) began to be considered.
    - *the magnitude of perturbation required to cross a threshold* (Carpenter et al 2001 - almost identical to definition of resistance);
    - *defined by three characteristics: (i) amount of change a system can undergo (and therefore the amount of stress it can sustain) and still retain the same controls on function and structure; (ii) the degree to which the system is capable of self-organization; and (iii) the degree to which the system expresses capacity for learning and adaptation* (Walker et al. 2002).
    - Engineering resilience – *defined as the intrinsic ability of a system to adjust its functioning prior to, during and following changes and disturbances so that it can sustain operations under both expected and unexpected conditions* (Hollnagel 2010 - definition that has elements of both resistance and resilience).
- Most PIs thought the Konza definition captured the definition of resilience well
- The last slide Rhett showed concerned the recent Steffen et al. paper that appeared in Science that looked at Planetary boundaries; interesting to note that biogeochemical processes

(phosphorus and nitrogen loads) were 2 of the factors they examined, as well as water use and land use change; something to think about when writing the proposal

Group reports

Group 1, which included Peter Groffman (Clark)

- No one in group thought that big question and model was big issue; focused on exciting research that has a connection on what has taken place in the past
- Resident climatologist had 5 pieces of hydroclimate variability that were important;
    - Global climate change
    - Need 4 others
- Need long term examples of real data; need to tell a story
- Some of the social scientists raised the point that exurbanization is not really in this proposal and does it need to be included back as its own section as it was included in the CWT VI proposal
- One of the things group 1 thought would be valuable was to share figures, etc. of long term research to help get into the details of what we are talking about

Group 2: (Heynen)

- Focus on topoclimate, socioecological
- Magnitude, direction, rate of change – need to include these terms
- Conceptual diagram – draft diagram 2 is busy, but overall like this diagram; nervousness about stealing too much from AND and KNZ
- Variability as opposed to ?

Group 3 (Pearson)

- Talked about overarching question – look at two questions from Rhett's slide (slide 2);
- Restated as: "The southern Appalachian encompasses high diversity in geophysical and biological systems that has been subject to strong hydroclimate variability and disturbance over time. Unique, long term trends in climate, streamflow, canopy, . . .
    - How does this high diversity impact sensitivity of ecosystem properties and tendency to recover?
    - What are the spatial and temporal scales of sensitivity and direction of change of ecosystem properties (relative to initial conditions) to different disturbances agents and how has this been changing over time?
    - Given different degrees of hydroclimate and human activity, what are the potential thresholds and tipping points for different ecosystem properties within the diverse geophysical and biological conditions of the southern Appalachians? (Space/time scales); don't have degree of change like the west with drought, change in species, etc. but are changes lurking on the horizon?
- Definitions
    - Sensitivity – magnitude of first order response to a disturbance
    - Perturbation – response of a system to a short term (pulse) disturbance
    - Ecosystem stability – scale and intensity of 1$^{st}$ and higher order changes in ecosystem properties resulting from the change in short term (perturbations) or long term changes in driving variables (e.g. climate, human activity,) and their interactions. The tendency of the system to dampen, maintain, or accelerate, response to short or long term changes.

Group 4 (Band)

- Medium term cross-landscape vs. long-term observational manipulative research
    - Consensus that both are needed

    - Interpreted as, "What is the appropriate balance between within vs. outside basin research?
    - Within – Long-term data on site, "control"
    - Outside – dynamics of private lands, less control, greater effort required
    - Discussed history of CWT LTER and the influence of the "regionalization" supplement of the mid-1990s.
- Proposed overarching question
    - Favored 1st version of the question
    - Debated phrasing: topo-climate, environmental gradient; ecosystem states, properties, dynamics, sensitivity/resilience, disturbance/recovery
    - Differences of opinion about how to verbally express a consensus about relevant spatial climatic and edaphic gradients
    - Tension between site-specific
    - We should strive to use terms and phrases from previous proposals to reinforce continuity of research efforts
- Revised version of overarching question: "How do human and and natural *disturbances* interact with and affect ecological processes and ecosystem *states* in temperate montane deciduous forests." – this is parallel to USFS Coweeta mission statement
- Conceptual Diagrams
    - Group favored 2nd conceptual diagram; could be graphically simpler, more discussion about larger orange box on bottom
    - Discussion about whether the diagram should depict "real world process" or "work flow/process" or "important parts of the world in our work"
    - Agreed that the conceptual diagram is important for readers; text from rest of document should map to the diagram and we should strive to use consistent terminology in diagram and text

<u>Summary of Paul Hanson and Peter Groffman</u>

Hanson

- Most diverse LTER in terms of disciplines and institutions (except for maybe Antarctic)
- Even though different opinions on language, etc. it seems everyone agrees to basic
- Based on discussion – looks like CWT has great material, just need to work on how you package it; need to ask if there is diversity in governance, etc.

Groffman

- How do we avoid having sites getting into trouble? NSF wants sites to tell a coherent story based on long-term data that is reflected in conceptual model. NSF also wants to see state of the art quantitative tools. In essence, they are looking for the following 3 elements:
    1) Compelling story
    2) Use of long-term data
    3) Use of quantitative tools
- Example of overarching story – Coweeta is diverse but resilience even though major tree species died, etc. But there are symptoms that system could be pointing to drastic change (e.g. trees responsive to drought in all landscape positions); therefore we need to do a TDE
- Another example story – system resilience in terms of chestnut dying but system doesn't change radically, therefore need riparian rhodo manipulation
- What matters in the Coweeta story?
    - Disturbance matters

    - Place matters
    - People matter
    - Climate matters
- First two pages need to tell a good story. This is where you "hook" the reviewer.
- CWT VII proposal wasn't a chorus, more of a jazz ensemble that never got in rhythm. Maybe failed is because there were too many cooks in the kitchen. Can't write a proposal by committee. Not everything in the site needs to be crammed in the proposal.
- Goal should be to have draft ready by summer meeting for PIs to review. Should have a draft ready for external reviewers by September.
- Groffman – In proposal writing, we meet quarterly. Might need to think about quarterly research meetings.

<u>Two-year project</u> (Jackson)
Synthesis projects:

1. Need to analyze and synthesize long-term carbon data from gradient plots
2. Need to write a paper showing how short term extensive data can inform long-term intensive data
3. Larry and Paul working on RHESYS model across a broader landscape

Research groups

1. Governance and social scientists
2. Rhodo removal
3. TDE

Need to think of two years but plan for another 4 years. How will project set you up for next 4 years?

Group Reports
Social

- Trouble generating long-term social data sets because of regs regarding privacy, IRB protocols, etc.
- Continue plugging away at publications

Rhodo Removal

- Much of discussion involved planning for upcoming removal of rhodo and how to prep for it
- LTER proposal did not have hypothesis, but USFS proposal did – will revisit this and make sure it is re-inserted in the proposal
- Will make sure that rhodo removal ties into long-term data story
- Can also tie in LiDAR data that show trees in rhodo are 6 m shorter; rhodo impacts productivity of overstory trees
- Annual meeting will have rhododendron synthesis and in August will have workshop with Nature Conservancy and other interest groups concerning rhodo removal research

TDE & Biodiversity

- Do we still want to do a TDE – yes
- Do we want a prototype – no
- Kim has implemented a prototype in Indiana that seems to be working well
- Talked about long-term data that could motivate questions in original plan; Kim is going to take a look at long-term trends in air temperature using data from CWT USFS climate stations and LTER sensor array at the terrestrial gradient plots, etc.
- Is there a way to leverage long-term carbon data and how that relates to long-term trends in vegetation data?

- Density dependent feedbacks on oaks (Clark)
- Will examine nitrate export and long-term vegetation change
- Jim Clark will look at FIA data and soil moisture
- Peter and Paul had these questions: Is there a process to empower students in this phase so they can ask questions? Does research happen in individual labs or across collaborative groups? If the former, why and can we get to the latter.

Regionalization

- Going to focus on 24 nested watersheds, focusing on soil moisture; look at land-use drivers and legacies on selected group of watersheds (Little T and French Broad)
- How can we get social levels and land use levels down to the same landscape level
- Will explore the legacy of agricultural abandonment
- Set of model test based on regional hydrology using RHESYS
- Biotic responses from landscape to regional - probably won't do this
- Hydroclimatic and land use scenarios – plan to look at scenarios from 1950 to 2050
- Ring of asphalt – what impact will development have on regional climate (Shepherd)
- Can tie in long-term data showing modeling of LAI and streamflow on WS17 and 18 to show how well model fits and that we are using RHESYS in watersheds using historic land use scenarios

*January 22*

Coweeta LTER Management (Jackson)

- Summer meeting will be sometime during first week of June.
- Ted is still heavily involved, though Rhett is orchestrating work on the proposal. Rhett and Ted meet once a week to make sure institutional knowledge is passed on.

<u>Groups Reports Day 2</u>

Groups should work on tightening up their sections, tying to theory, etc. Also think of cross-site collaboration and prepping for ASM.

*Rhododendron Removal* (Jackson)

Chestnut loss (and possible prior logging) led to expansion of rhododendron. (previous CWT research).
Rhodo accumulates recalcitrant litter, alters soil chemistry and biology, inhibits tree establishment, and alters ground level microclimate (light and moisture). (previous CWT research).
Previous (Barry Clinton) studies of forest gaps with and without rhodo showed that rhodo inhibited tree recruitment.
As a recalcitrant leaf litter, rhodo serves important functions as moderating instream food resources and providing instream cover for macroinvertebrates.
Removal of rhodo will open up soil nitrogen cycle changing nitrifier communities, altering relative composition of oligatrophs to copiotrophs.
Conceptually, the experiment examines soil, forest, and stream sensitivity to changing rhododendron coverage.
At the stream level, we expect rhodo removal to release nitrogen, increase light, and these changes in basal resources will shift the streams from heterotrophic to autotrophic, depending on phosphorus availability. Algae will no longer be controlled by light, but by consumers.
We may find resilience in stream processes due to compensatory stream mechanisms.
Are we moving towards a forest state change?
Groffman: Good that rhodo story starts with logging/chestnut and ties into long-term data. But need to find some clever quantitative model or state change. If you could show the combination of logging,

chestnut blight, and hemlock decline has led to a state change in the riparian forests, would create a compelling story.
ASM Working Group Ideas: Perhaps look at how exurban streams can inform urban streams. Perhaps another idea is to formalize Jim Clark's demography work on the 4 forested LTER sites.

*Regionalization* (Bolstad)
Spent most of time trying to create narrative story. Finally settled on 1) can't tell complete story without input from other groups and 2) try to tease out and quantify the time series diagram that Rhett put together showing disturbance, disease introductions, etc. since the 1800s. Selected 3 variables: soils moisture, low flow, high flow and trajectories across the watershed. Very few places that are pristine. Have land use histories in some watersheds from 1907 to present. From 1985 to present have NLCD level classification for entire southern Appalachian region. Have reasonably good set of permanent plot data since 1930s. Hydrology record at Coweeta since 1930s. USGS gauges go back to early 1900s. Clark made the suggestion of simplifying time series graph and include only items that are addressed in the proposal (e.g. leave out elm spanworm and fall cankerworm ).

*TDE/Biodiversity* (Novick)
Talked more about what we are going to do in the short-term. All have a lot of individual ideas that will be continued to be discussed at future virtual meetings/conference calls. Jason gave overview of long-term LTER plots. Jim will share some results of seedling and seed rain data from long term plots. Kim will look at air temperature from these long-term plots (gradient plots and continuous soil moisture plots). Nina and Jennifer will look at soil carbon composition and plant data to see how vegetation may influence soil carbon. In WS7 there is a pattern of long-term C decline in 10-30 cm layer – try to figure out why C is declining in these soils looking at temperature, insects, and chestnut decline.
Groffman: How do these questions arise from long-term data? Another potential ASM topic is carbon in soils. Need to make sure tell the story of soil moisture and why it is an important metric to look at.
Pearson: Need to include that humans are altering soil moisture through altering flowpaths via roads, houses, etc.

*Social/Governance* (Heynen)
Think that social science should have its own section as it was a reviewed well in the original proposal.
Story: Begins in indigenous culture and can go back to President Andrew on how governance can impact land use (Trail of Tears). Nik spoke to Chief Hicks about how CWT can interact with the tribe. Also have close ties with LTLT that has implications for linking science and decision making. Cross-site: 1) AND, JOR, and GCE included as part of a way to expand CWT Listening Project model. Nik is getting more involved with GCE and is looking at developing a CWT Listening Project model at GCE. 2) Steep slope ordinances and how it compares with buffer zones in marshes and coastal zones that might be interesting to pursue.
Groffman: How can tie into long-term data? Even though social data may only be 4 years, you are trying to build a 50-year record, which is compelling.

<u>Next steps</u>
By middle of next week, each group leader needs to provide a synthesis to Rhett and start thinking of deadlines.

Groffman: Enjoyed learning about the research and looking forward to reading the proposal.

Attendees: Brian Burke, Brian Herndon (IM), Cathy Pringle, Chelcy Miniat, Chris Oishi, Craig Depken, David Leigh, David Tarboton (visiting scientist), Jack Webster, Jason Love (Site Manager), Jeb Barrett, Jeff Hepinstall-Cymerman, Jen Fraterrigo. Jennifer Knoepp, Jennifer Rice, Jim Clark, Kim Novick, Kitty Elliott. Larry Band, Marshall Shepherd, Meredith Welch-Devine, Nik Heynen, Nina Wurzburger, Paul Bolstad, Paul Hanson (External Reviewer), Peter Caldwell, Peter Caldwell, Peter Groffman (External Reviewer), Rhett Jackson, Robert Warren, Scott Pearson, Seth Wenger, Steve Holloway, Taehee Hwang, Ted Gragson, Wayne Swank, Ryan Emmanuel (attended via webinar the 1st day)

Unable to attend: Carolyn Dehring, Brian Strahm, Amy Rosemond

Notes submitted by Jason Love, Coweeta LTER Site Manager; 1/30/2015