



SNAMP Water Integration Team meeting notes

Merced, April 8, 2011, Merced, CA

In attendance:

Theresa Becchetti, UCCE
 Lynda Daley, mountain resident
 Bob Dean, Calaveras Co Water District
 Michelle Dooley, DWR
 Lee Ellis, mountain resident
 Rick Ellis, mountain resident
 Tom Efird retired FS
 Carolyn Hunsaker, Forest Service - PSW
 Kim Ingram., UCST
 Jerry Jensen, SAF
 Lacy Kiriakou, UC Merced
 Ethan Kiric, Rep. Jeff Denham
 Susie Kocher, UCST
 Don Lewis, mountain resident
 Marie Lewis, mountain resident
 Anne Lombardo, UCST
 Richard Mahachek, UCCE
 Chris & Carrie Martin

Sarah Martin, UCST
 Connie Nielson, Upper Merced River
 Watershed Council
 Maxwell Norton, UCCE
 Ed Pattison, Calaveras Co Water District
 Bruce Pressly, mountain resident
 Tom Sandelin, Cal Fire
 Phil Saska, UCST
 John Shelton, CDFG
 Rosemarie Smallcombe, MERG
 Steve Smallcombe, MERG
 Anne Steed, Upper Merced River Watershed
 Council
 Jon Sturtevant. Sierra Club
 Anthony Toto, RWQCB-SF

On the web: Rick Bottoms - USFS/ PSW,
 Kelly Larvie - CalFire, Jennie Skancke -
 National Park Service,

I. Welcome and overview – The county director for University of California Cooperative Extension, Richard Mahachek welcomed the group to the facility. Susie Kocher asked those in attendance to introduce themselves and gave the group a brief overview of the Sierra Nevada Adaptive Management Project (SNAMP) its goals, and the science teams involved.

Question: What is the objective of the spatial team?

Answer: The spatial team is working with Lidar data from both sites to provide spatial data needed by the other teams.

II. Forest Service update: Mike Chapel told the group that because SNAMP is an integrated science project, it will help answer some of the pressing questions facing water users and upstream suppliers. The USFS wants to know more about water issues and SNAMP research will provide information to help them think about different ways to get projects done, such as through the USFS’s new ecosystem services approach. A long term hope is for water users to help pay for

fuels treatments as beneficiaries of the water flowing through the forested headwaters. The water team's research will hopefully quantify the water benefits of treatments to help involve end users to support USFS goals of improving water quality and quantity.

Over the phone Tony Rodarte gave an update on the Last Chance project, the SNAMP treatment scheduled on the American River Ranger District. Next month, the district is having a meeting with Sierra Pacific Industries to line out their work.

Question: What is the cost per acre/mile? Projected costs?

Answer: Generally, unit costs are cheaper on stewardship contracts than service contracts. One figure is \$200 – 400 per acre with mastication.

Dave Martin gave an update over the phone on the Sugar Pine project, the SNAMP treatment scheduled on the Bass Lake Ranger District. The project involves Limited Operating Periods (LOPs) for goshawks, owls and fisher. The presence or absence of these species can be determined at time of treatment. The project hopes to produce about 2 million board feet of lumber.

Question: What are the costs per acre?

Answer: The costs of thinning pays for itself. Burning will cost about \$200 per acre and mastication about \$500 an acre.

The SNAMP public participation team plans to host field trips to these project sites during implementation in conjunction with the USFS. Details will be announced when available.

III. Introduction to SNAMP Water Research: Dr. Roger Bales gave an overview of the water team's hypotheses and research methods. The presentation is posted at <http://snamp.cnr.berkeley.edu/documents/361/>. He explained that there are three main research questions that the water team is exploring:

- 1) Where and when is water stored? And how is it routed through the forested catchments?
- 2) What effects do forest treatments have on water quality, quantity (yield), storage & routing through the catchments?
- 3) What is the transferability of information from plot scale to watershed response?

The team's hypothesis' are:

- 1) Fuel treatments will reduce leaf area index (LAI). As LAI decreases, snow accumulation on the ground will increase while evapotranspiration (ET) and snow retention in late spring will decrease. Lower LAI means less interception and more solar radiation. The size and spacing of gaps will also control snow accumulation and melting time.
- 2) A change in snow accumulation will be seen in the magnitude of peak stream flow. Changes in snow retention will be observed in the recession limb of the hydrograph and soil moisture curves. Changes in ET will affect both the timing and magnitude of late-season base flow.
- 3) Changes in water quality will be a function of changes in discharge. Increased turbidity will be a function of stream discharge as opposed to hill slope erosion.

- 4) Using hydrologic models, water thresholds can be defined linking areas treated with aquatic effects and impacts on the forest water cycle. Hydrologic models and spatial data will enable extending responses to the larger watersheds and watershed scale.

The SNAMP project is using a before-after control-impact (BACI) design for its research methods. Some measurement challenges for the water team include access and power issues with the remote locations of the study sites, a complex terrain with lots of variability and the challenges of taking continuous measurements. There are four meteorological stations in the study on open ridge top areas with a collection of weather measurement equipment. Hill slope instruments include snow depth and soil moisture nodes. In stream equipment measures temperature, conductivity, turbidity, and dissolved oxygen. Stream discharge, measured at both peak and base flows, is done through pressure transducers and weirs. Approximately 270 instruments are deployed by the water team to gather data at both study sites.

Question: What are you measuring? Are there other agencies monitoring these things?

Answer: Yes, but other data collection sources are not all inclusive – everyone is measuring different things.

Question: What is the elevation at the equipment sites?

Answer: About 6000 feet, some are higher and some are lower.

Question: Is the treated watershed going to be thinned or burned?

Answer: Some of the treated site will be thinned, some burned, and some will be masticated.

IV. Detecting water-cycle changes: Roger, Phil Saska and Sarah Martin gave an overview of the forest water and energy balance and the team's modeling strategies. The presentation is posted at <http://snamp.cnr.berkeley.edu/documents/362/>.

Forest energy balance: Phil gave a presentation on how energy from the sun is affected by the forest. Radiation, incoming and outgoing, is a main driver of melting snow. The size of the gap between trees determines the amount of shortwave and long wave radiation coming into and exiting the forest. Wind has effects on melting snow too. Differing gap sizes between trees affect the laminar flow above and between the canopy as well as turbulence within and below the canopy. The removal of one tree height (small gaps) appears to lead to the maximum amount of snow accumulation on site. Small gaps may also increase and delay historic peak flows keeping the forest wetter longer. With larger gaps, additional radiation melts out more snow.

Question: Are you monitoring cloud cover?

Answer: No, the incoming radiation sensors catch some of this, but not as much at night.

Question: Is soil moisture being measured?

Answer: Yes, measurements are being made in open areas, at edge of trees and under the canopy. As of right now, there is not much difference between the two. Soil moisture is also affected by the horizontal flow of water beneath the surface.

Forest water balance: Roger Bales described the water budget within forests. One component that is not well understood is the soil moisture below the soil horizon. That is because it is difficult to measure water in deep zones due to rocks which interfere with excavation for instruments. The water team is measuring soil moisture in the shallower zone. They are collaborating with the Kings River Experimental Watershed (KREW) south of the Sugar Pine project on the Sierra National Forest to work on this question.

Question: Does the water balance you are using assume no loss to ground water?

Answer: The water team assumes that this loss is small. Right now, they have no real data for this so they can only “guess” at what the loss is.

Modeling strategies and findings: Sarah and Phil gave an overview on the water team’s approach to modeling. Models are needed to scale up from the data collected to the larger area because processes such as snow accumulation and melt are difficult to quantify using a strictly empirical approach over a large area with a lot of variability. Models can be used to test the research hypotheses by changing parameters to see their effects on the watersheds.

Modeling can be used to understand horizontal bank erosion rates. Shear stress drives sediment transport. Bank erosion is highest closest to the bank where the maximum stream velocity is. During low flows, sediment accumulates at the base of bank slopes. During high flows, where velocity and shear stress is greater, sediment from banks is entrained and transported downstream. Using bank height and channel length, the volume of eroded material can be calculated.

Questions: Regarding leaf area index, wouldn’t this change over time after treatment as vegetation grows back. Is this being measured?

Answer: Yes, we don’t have specific data for this on SNAMP sites, but KREW sites have data that we can infer from and use in REHySS model.

Question: Regarding evapotranspiration, more data is needed in measuring moisture in branches, or a moisture index in fuels; what is SNAMP doing to get these measurements?

Answer: The water team hopes to get sap flow measurements but outside funds may be needed for that. Some Critical Zone Observatory (CZO) sites have this data which can be shared.

Question: How much longer will SNAMP collect water data?

Answer: It depends on available money but until 2014 according to original timeline.

Question: Are you looking at stream bed restoration as a way to maintain more water in the system?

Answer: No, as there aren’t too many meadows in the project sites, but stream bed and meadow restoration would create a situation of more evapotranspiration; it could go either way.

Question: How well will models inform us on system changes due to climate change such as shifts from fir species to oaks?

Answer: Climate change studies are not part of the SNAMP research. The Kings River study is looking at this. Tree species are a parameter in the models being used so researchers will be able to change the species mix and so predict some changes due to climate change.

Question: Looking at the headwaters above timberline, or the parks at mid-slope, etc – how much change can we really have in the Kings River?

Answer: Mid-elevation zone that is ideal for tree growth is what the team is concentrating on. A change may not be detected over an entire range, but in local creeks and canyons you could see a small percentage of change.

Question: Regarding plantations by timber companies, is SNAMP considering this type of vegetation in their model? What land use patterns are being considered?

Answer: The water team is looking for input into what kinds of scenarios to model. Roger is skeptical that the USFS would consider plantation style management, so SNAMP is not modeling this. However, pursuing some scenarios that could be applicable to private lands, such as plantations, could be done through other project moneys. The landscape mosaic is very different throughout the Sierras, so modeling can consider different land use scenarios.

Mike Chapel added that SNAMP will not need to model clear cutting done on private land since they will focus on USFS treatments and the USFS doesn't clear-cut.

Question: Wildfires are catastrophic, how might modeling use fire as a parameter?

Answer: With less confidence because we don't have data from burned areas and it would depend on what grows back. Having Lidar data after a fire would be great data for analysis. There are some vegetation data sets out of McClellan studies, but the water team is unaware of any available water data sets after fires.

V. Discussion: Roger Bales asked the assembled group for input on what kinds of future forest management scenarios are most likely and so most important to model for effects on the water cycle. What management scenarios are reasonable to model? What time scales should modeled? Unfortunately, land managers from the US Forest Service were not in attendance. Participants suggested that it would be fruitful for the team to ask the USFS what scenarios they want modeled and what future maintenance of fuels treatments and roads are likely.

Other suggestions included a the approach of having SNAMP identify the key components or techniques are at a basin scale that will produce the most water and hold it for longer times within the catchments. Then from that, the best methods and schedule of treatments over time could be modeled.

Because the USFS wants to increase understory burning to create forests that are more fire resistant, modeling needs to link with burning practices. It will be important to show the relationships between vegetation treatments and effects on water flow and timing.

Another participant suggested that modeling additional future entries into the forest is less important than modeling treatments occurring at the appropriate scale. There are multiple treatment areas across the landscape. He suggested that there is not really sufficient economic

benefit to re-enter most areas so additional treatments will probably be happening in untreated areas as opposed to treated areas. Another participant disagreed and said that it was possible maintenance treatments could be done economically.

Question: Is the USFS open to grazing to keep understory down in areas that have been treated?

Answer: The cattle industry is marginal in the Sierras right now and generally the vegetation species that come back after treatments tend to not be what cattle want. It is possible that other animal species could graze, but it's not likely and it would have to be subsidized.

Question: Will models show affects of treatments on water quality?

Answer: Models will be used to integrate and interpret the field data.

Question: Can you capture subtleties of differing vegetation management? Can it distinguish between heavy equipment work versus hand work? How detailed is the modeling?

Answer: Models can capture that well at the plot scale, but data becomes tenuous at larger scales. As a side note, a lot of compaction would have to occur as these sites to have a big impact on infiltration because the sites have pretty coarse soils.

Question: Is there adequate water data for other scenarios?

Answer: SNAMP is not measuring every parameter, but we can pick up what seems to be the most obvious. The timing of water releases is very important to fish, farmers and end stream users. If you can focus on that, you might be able to get funds for furthering projects. We need more water late in the season to increase ecosystem services.

Question: Are you able to model the effects of a bark beetle outbreak?

Answer: We can include LAI reduction.

Question: Is REHSSys sensitive enough to pick up Sugar Pine and KREW treatments?

Answer: The team is not sure. Sensitivity tests to measure understory need to be run. Soil sensitivity tests have already been done. There are over 50 parameters involved and in the end maybe only 6 play out, the others offset themselves.

VI: Wrap up: The next steps for the SNAMP water team are

- 1) Modeling – a post doc student is coming to work on REHSSys with KREW data, continued results and calibration,
- 2) Getting all instrumentation in headwater areas on line,
- 3) Field work – upgrading some instruments, final installations of weirs, scour pans and water samplers, and
- 4) Model integration – the hydrologic model is separate from the other models, so they are reviewing these different models and looking at the integration of all models.

Next, those in the room were asked what worked well about the meeting. They said:

- The UC Science team was very forthcoming with info;
- It is a good room
- It's nice to be in Merced instead of Sacramento for a change.

What could be done differently:

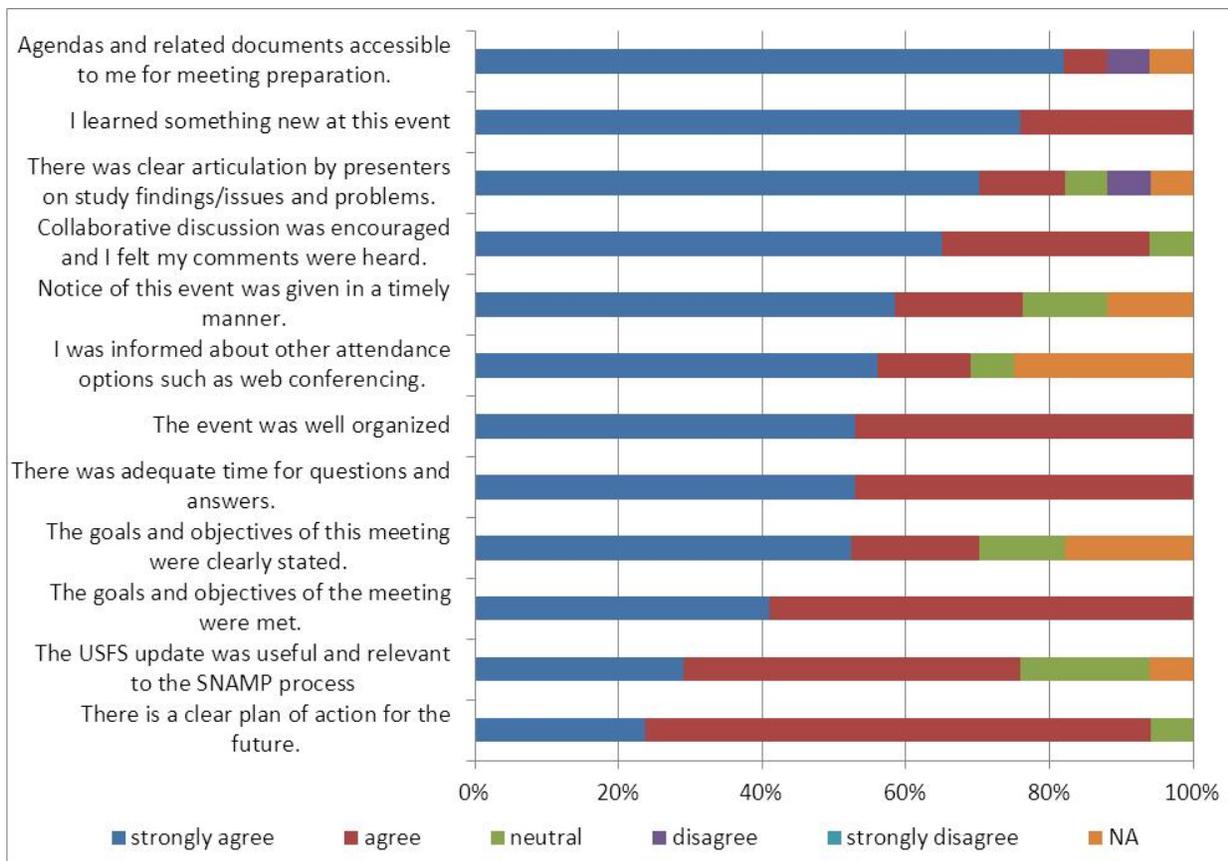
It would be nice to get a broader context of what the other teams are doing and how all of the teams integrate together for those new to SNAMP

We need to have local FS site representatives here in order to interact with them on a more personal basis – nothing bad to say against having Mike Chapel here though ☺

Suggestion: It would be good to have UCM professors and students come to these local events.

*Next Steps:*The scheduled field trip to the Kings River Experimental Watershed will be postponed due to the heavy snows this winter that will make access to the site difficult as early as the planned June 9th date. Notice of a new date will be sent out shortly.

Evaluation: 17 attendees at the meeting filled out evaluation forms. Their responses are summarized below:



Additional written comments:

- Ran a little late but everyone seemed ok with that.
- Some good articulation, some not so good - too detailed
- Good location for me