Sierra Nevada Adaptive Management Project
Water Research Team's Integration Meeting Agenda

September 4th, 2014, 12:30 pm to 2:30 pm
http://uc-d.adobeconnect.com/snampwaterit/ and 866-740-1260, code 542-2571

Links
- Intro and overview power point: http://snamp.cnr.berkeley.edu/documents/621/
- Link to Water Team presentation: http://snamp.cnr.berkeley.edu/documents/622/

Link to **Adobe Connect webinar recording: http://snamp.cnr.berkeley.edu/videos/**

In Attendance:

John Buckley – Central Sierra Environmental Resource Center
Clay Brandow – CalFire
Peter Cafferata – CalFire
Marie Davis - Placer County Water Agency
Brittany Dyer – Board of Sups Madera County
Pat Flebbe – USFS, Region 5
Richard Garcia – Sierra Research Institute
Courtney Gomola – Sierra Institute for Community and Environment
Arthur Hinojosa – CA Department of Water Resources
Kim Ingram – UC Cooperative Extension
Susie Kocher –University of California Cooperative Extension
Nicolas Kunz – State Water Res. Control Board
Kelly Larvie – CalFire
Anne Lombardo – UC Cooperative Extension
Sarah Martin – UC Merced
Fadzayi Mashiri – UC Cooperative Extension
Xiande Meng - Sierra Nevada Research Institute
Ed Murphy – Sierra Pacific Industries
Chris Nota – US Forest Service, Region 5
Cliff Raley – USFS, Sierra National Forest
Mahesh Rao – Humboldt State University
Jim Roche – UC Merced
Vance Russell – National Forest Foundation
Mohammad Safeeq – Sierra Nevada Research Inst.
Norma Santiago – Board of Sups El Dorado Co.
Phil Saksa – UC Merced
Mark Smith –US Forest Service
Ben Solvesky – Sierra Forest Legacy
Sudhakar Talanki – CA Dept. of Water Resources
Anthony Toto – Water Quality Control Board
Melissa Thaw – UC Merced
Patrick Womble – UC Merced

I. Welcome and Overview: Susie Kocher from SNAMP's Public Participation team gave a brief orientation to the webinar process and ground rules. Participants introduced themselves and shared a desired outcome for the webinar. Susie described the webinar goals (to share the research findings from the UC Water Team and gather final input before the production of the final report) and gave a brief review of SNAMP. The UC Science Team has postponed the deadline for completing the final SNAMP report. The draft report will be distributed to partners and the public for comment on February 15th. These will be due by April 1st. A final public meeting will be held in mid-April and the final report will be completed by May 31st.

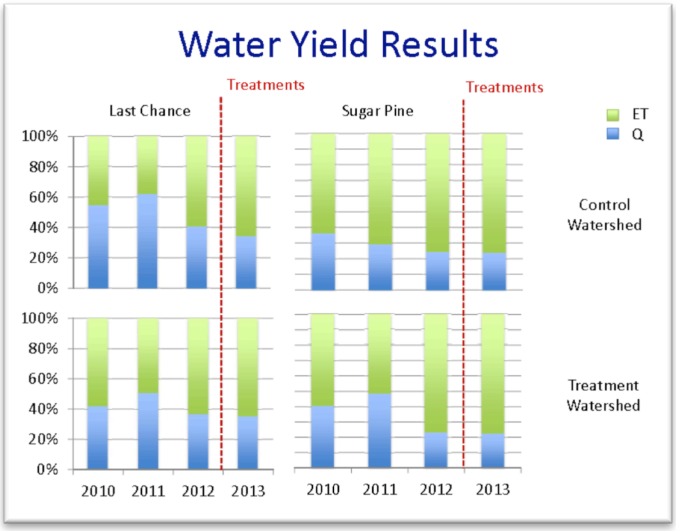
II. Overview of SNAMP Water Research: Dr. Martha Conklin, co-P.I. for the SNAMP water team, gave a brief review of the water team's research on the effects of forest thinning (SPLATs) on water quantity, timing of flow, and water quality using paired snow-rain-transition catchments. Bear Trap Creek is the treated watershed and Frazier Creek is the control at the northern study site on the Last Chance project in the Tahoe National Forest. Big Sandy Creek is the treatment watershed and Speckerman Creek is the control at the southern study site on the Sugar Pine project in the Sierra National Forest. The team has measured multiple years of soil moisture, snowpack, and streamflow to help calibrate the models. The drought has confounded some of the post-treatment effects, as there has been very little rain to test for sediment movement across the land into streams. Light treatments, especially in Sugar Pine, are also making change detection a challenge. The team is modeling headwaters and scaling up to the fireshed level, from 1 km^2 to 40 km^2. The water team will be working to integrate with the other teams at the fireshed level.

Question: *Could you please define SPLAT?*
Answer: *SPLATs are strategically placed landscape area treatments. The general approach is to treat about 30% of the forest to reduce the fire behavior in areas that are not treated. SPLATS are like speed bumps on the landscape to slow fire across larger untreated areas.*

III. Water Quantity Findings: Phil Saksa, a PhD candidate at UC Merced and member of the Water Team, discussed findings regarding treatment effects on water yield. They installed two meteorological stations at each site, one at high elevation to capture snow dominated conditions and one lower down in a rain dominated environment. Snow depth and soil moisture were measured through distributed networks to capture variability. The four headwaters each had stream instruments at the outlet to measure sediment and discharge.

The team has three years of pre-treatment data (2010, 2011, 2012) and only one year post treatment (2013). Precipitation was an average year, a wet year, and two dry years respectively. This variability is good for modeling, but more complicated for detecting treatment effects. Model integration of the data across all years will be important to detect changes. Streams in the two sites appear to have different contributions from groundwater, which affects their conductivity in low flow. However, it is less than a 10% contribution to the total flow.

Treatments included mechanical and hand thinning, mastication, and prescribed fire. In the Sugar Pine project, the treatments were quite a bit lighter than at Last Chance. Commercial thinning was done in the headwater catchments, but in much of the rest of the area, thinning was done by hand along with mastication. With a lighter treatment, the team expected less of a response.



The goal in assessing water yield was to identify how much of the precipitation falling on a watershed flowed off as streamflow and whether treatments affected this ratio. About 40-50% of precipitation came out in streams during the average year of 2010 (lower in Sugar Pine). During the wet year of 2011 it increased to 50-60% (except in Speckerman Creek, which has a higher groundwater source). In the two dry years, 30-40% of precipitation reached the streams. They didn't see much change after treatment – the two dry years were similar. Efforts to graph relationships between streams in the treated and untreated watersheds, looking for any constant relationship, were compounded by having three years of pre- and only one year of post-treatment data and by a different amount of precipitation each year. As a result, the team did not find any significant relationships.

The preliminary conclusion is that large climate variability throughout the four years masked any potential change detectible from the treatment. A dry year after any treatment makes it difficult to identify effects. After a few more wet or average years the team may be able to draw more conclusions. They will also potentially draw conclusions through modeling.

Question: *Can you clarify the scale used here in the above graph? How does the percentage work?*
Answer: *The green area represents evapotranspiration and evaporation. The blue area represents discharge or water yield. The blue and green areas represent percentages of total precipitation. Ground water is considered to play less than a 10% role.*

Question: *With the climate variability you experienced, you cannot provide a clear conclusion regarding increased water yield following treatments?*
Answer: *Yes, this is common in studies performed in dry years, with a few wet years and more time we might draw different conclusions. We can use models to help us, and years of actual data from this study have helped us improve their accuracy. We are able to model water yield with two different levels of vegetation, before and after treatments.*

Question: *Could these same results be applied to other watersheds with the same conclusion?*
Answer: *For this specific time period, yes. It also depends on the level of treatment. We don't know exactly how much vegetation was removed. We will use modeling to make the thinning more aggressive.*

Question: *Are there plans to keep monitoring? Why is it a preliminary conclusion?*
Answer*: Analysis of data and modeling are still in progress. We plan on drawing further conclusions with modeling and will use both modeling and observations for the final conclusions. Separate from that, we are looking for more funding to continue monitoring beyond the duration of SNAMP. The northern control site experienced the American Fire, which will not allow us to answer additional questions about vegetation density-water relationships. Conclusions could continue to be drawn for Sugar Pine, provided monitoring continues after SNAMP.*

Question*: There has been concern that the intensity of treatment wasn't aggressive enough to produce water results. So, is it valid to model an increased reduction of vegetation when there are other variables that could change when you do more aggressive treatments? Soil effects, etc?*
Answer*: Our plan is to do modeling of more aggressive treatments and then do them on the ground through another project. We will look at effects on the ground to see if the modeling was right. This project will serve as the example for light thinning.*

IV. Water Quality/Sediment Findings: Sarah Martin, a PhD candidate at UC Merced and member of the Water Team, reviewed water quality findings, mainly focusing on sediment. (The team recently provided much of this information in a report to DWR.) SPLATS were light and far from streams, decreasing expectations of increased sediment movement as a result of increased flow in the streams. Research done nearby, at the Kings River Experimental Watershed, did not show much sediment connectivity between hillslopes and channels, even in areas with logging and roads. As a result, the water team expected changes in sediment transport to be a result of in-channel processes and bank erosion. Low precipitation in years following treatments may have masked potential changes in water quality/sediment load.

Turbidity instruments in the water column and scour pans with pressure sensors placed below the stream bed were used to detect sediment movement. They showed, under conditions of normal disturbance, accumulation and depletion cycles were connected to low and high flows respectively. High disturbance conditions such as the wildfire experienced recently in the northern site, may produce different results.

Sarah presented a hysteresis analysis, noting that the shape of the curve is tied to the lag time between the sediment and discharge peaks. Curves can be classified into a number of different patterns. A clockwise pattern occurs when turbidity peaks before discharge, indicating that sediment is fairly localized and easy to transport from in-channel sources. The most sediment moves in fall, after summer build up, even if fall flows are not the highest. Scour pan data show episodic movement, but in the long term there was not much of a net increase or decrease in the channel bed elevation, indicating longer term stability.

The variation in water years, allowed the team to look at trends in baseflow and ties to groundwater. Stable water isotope, conductivity, and ion concentration data were used to define groundwater storage. In dry years, the base flow conductivity increases because groundwater that is in contact with rocks has more minerals dissolved in it. This increase is more pronounced at Sugar Pine as a result of higher ratio of groundwater in the stream channel. This increase during dry years is believed to be a result of ground water, as opposed to increased evaporation, because stable water isotopes in the stream do not indicate that substantial evaporation occurred.

Watershed Modeling Results: Phil Saksa discussed the team's modeling efforts, designed to simulate real conditions beyond the observed. This is a way to test the effects of heavier treatments, fire, increased rain, etc. with models fine tuned by years of real data. They used RHYESS, the Regional Hydro Ecological Simulation System, for modeling, including information on vegetation, soils, bedrock, topography, rain, temperature, humidity, albedo (surface reflectivity), etc. They produced estimates for snow (30 sensors per site), soil moisture (80 sensors per site up to a meter depth), and flow thereby capturing as much of the water cycle as possible. The model can grow vegetation 30 years out using extreme historical climate events and accurate vegetation maps, created by the Spatial and Forest Health Teams, using Lidar and forest plot inventories. The relationship between reduced vegetation and increased water yield is not linear. Modeling to date indicates that a 2/3rd decrease in vegetation (close to historic pre-fire suppression conditions) would yield about a 10% increase in flow. But a 1/3rd reduction in vegetation yields less than 10% increase in flow, as remaining thirsty trees may consume more water and evaporation may increase. Depth of litter on the forest floor is important and needs to be considered, as it affects infiltration and evaporation. Lack of duff and litter as a result of a severe burns causes the greatest evaporation according to the model.

Wildfire models, including FarSite and the Forest Vegetation Simulator, were used by the Forest Team to help account for the variable nature of fire on the landscape. Wildfires could provide an additional increase in water quantity and a corresponding increase in sediment. However, modeling shows that increased losses to evaporation post wildfire actually decrease water yield. The Water Team is currently waiting for a new post treatment forest vegetation map for the Last Chance site to continue their evaluation of the treatment effects. The team has worked out how to model at the fireshed scale. Work on Sugar Pine maps will follow.

Question: *When you discuss removing 66% of the vegetation are you referring to trees per acre, basal area?*
Answer: *We are referring to biomass as it refers to leaves/Leaf Area Index.*

Question*: How to apply this observed and modeled information?*
Answer*: Only vegetation is changed year to year in the model, helping us understand the effects of vegetation, thereby comparing the value of thinning treatments.*

Question: *How do models distinguish between over and understory?*
Answer: *We are using both layers and can change them independently. The forest team deals in stems and converts that to leaf area for us.*

Question*: How do you figure in increased growth of the understory when the overstory is removed, or as a result of increased nutrients from a fire? Surface and ladder fuels recover faster than the trees.*
Answer: *We anticipate that the understory will need to be treated more often than the overstory.*

Question: *How long will this increased water yield last?*
Answer: *30 years is expected to be the life of the treatments. But this is where our 20 -30 year modeling will come in to help us understand this. Many variables affect water yield. In the 30 year modeling efforts weather/climate conditions can also be varied to provide a range of expectations.*

Question: *When was your pre treatment and post treatment LiDAR flown?*
Answer: *The Northern site pre-treatment flight was in September 2008. The Northern site post-treatment was partially flown November 2012. The remaining area was flown August 6-10, 2013, by chance immediately prior to the American Fire. The Southern site pre-treatment flight was September 2007. The Southern site post-treatment flight was November 2012.*

Question: *What were the treatment details? Given the multiple references to the "light thinning" that was done, where are the details of the treatments that were tested (e.g., canopy cover reduction, basal areas reduction, openings and sizes, etc.)?*
Answer*: These were SPLATS, and the data for how much of the canopy was removed are still being analyzed by others. There was a good description during the Forest Team in person IT meeting on May 15th. All the presentations were recorded. You can see them at http://snamp.cnr.berkeley.edu/events/may-15-2014-ffeh-it-meeting. The Sugar Pine project treated about 2000 acres of a 5000 acre area including thinning trees on over 1000 acres, masticating brush on over 600 acres, maintaining fuel breaks on 40 acres, working in 40 acres of plantations, and prescribed fire on about 200 acres.*

Scaling up to the Fireshed Level – All SNAMP research teams will be reporting at the fireshed scale to facilitate integration and comparative analysis of resources. The Water Team is using the headwater models to scale up to the fireshed level where changes are expected to be less significant. They have developed the analysis process but don't have results yet. Variations in geology beneath the headwater streams in each area may account for some differences in groundwater behavior. In Last Chance, much of the geology is part of the Shoo Fly Complex which has a low water storage and flow potential. Overall, Bear Trap's geology is similar to its fireshed, so calibrations should translate easily. Frazier is different, so they will use different calibrations from a nearby watershed with similar geology. The southern site is more uniform with mainly Bass Lake Tonalite, which has high storage and flow potential, and a small amount of Quartite/Phyillite, with low potential similar to its fireshed. Subsurface storage indicates that it would take the same amount of time to drain the groundwater from our headwater catchment, about 400 days without rain. The headwaters and firesheds are behaving similarly both geologically and hydrologically which gives us confidence in the scaling up process. MODIS will be used to detect snowcover depletion at the larger fireshed scale.

Discussion and Next Steps: Dr. Roger Bales discussed other water research projects that will add to the knowledge SNAMP has accumulated. Important questions remain. How will recent fires affect water yield in the years to come? How will climate change affect yield, as warmer temperatures increase growing seasons and vegetation growth. What was the historical water yield? The team has improved their equipment, making it more modular, to increase their ability to get an accurate measurement of the distributed water balance across the Sierra. The Water Team is also looking for opportunities to study stronger vegetation removal treatments.

- Stanislaus/Tuolumne Experimental Forest – The Pacific Southwest Research Station has studied snow and soil measurements around thinning. They see some increases in snow on the ground with these thinning patterns, although once again the recent drought has affected results.
- Kings River Experimental Watershed - Carolyn Huntsinger (PSW) has done a great deal of monitoring around thinning: http://www.fs.fed.us/psw/topics/water/kingsriver/
- American Fire - Through partnerships around the American fire, more sensors have been put in place. They are always looking for more partners to work with.
- Yosemite National Park - Work is being done by fire ecologist Dr. Scott Stephens at UC Berkeley in the Illilouette Basin in Yosemite, which has had several fires,.
- Rim Fire - Some work is being done at lower elevations around the Rim fire through Jim Roche. That fire occurred more in the rain zone then the snow zone.
- Sierra Watershed Ecosystem Enhancement Project http://ucanr.edu/sweep/. In Region 5 and the Tahoe NF area, work will be done in the next 5 years near French Meadows Reservoir. They are beginning to install instruments at higher elevations in more snow dominated areas.
- Sierra Pacific Industries - Working with SPI at some lower elevations.
- Highway 50 - Possible Highway 50 corridor studies are coming up.

The team plans to wrap up their modeling in the next couple of months. The new pre-treatment vegetation maps they have received will allow them to finish their headwater modeling calibrations, so they can move on to the fireshed scale models. They are expecting post treatment vegetation maps from SNAMP's fire modeling team for the Last Chance site soon. Work on the Sugar Pine post treatment maps will follow. They continue to work on writing the water chapter for the final SNAMP report.

Question*: In terms of the potential project areas, the El Dorado will be one site for the Cohesive Strategy Landscape Project, targeting the south fork of the American River. If we monitored it and came up with a documented increased water yield it could be used for the Iowa Hills Reservoir Project in the planning stages. We are looking for evidence to present to other elected officials that ties the*

relationship with forest fuels management and water yield. The time is ripe to study this area. Lauren Crabtree, forest supervisor in the area, may be important to contact.
Answer: *We do have new information now that we could share with you. Research presented here adds support to the hypothesis of increased water yield through forest management. SNAMP is refining the hypothesis. There is a 2013 report in particular which we can share. We are doing some work in the area already and we have joined some of the discussions with the Forest Service in this area. Feel free to contact any of us at SNAMP, Susie, Roger, etc.*

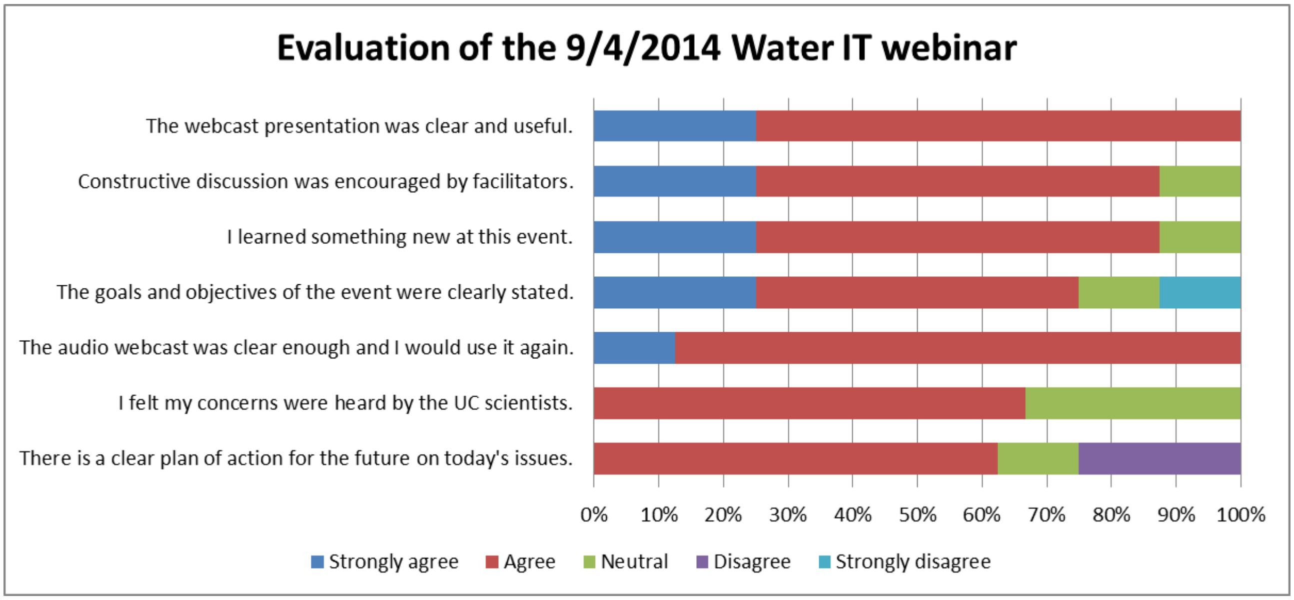
Question: *Are there any separate efforts to model just snowpack at watershed or fireshed scale?*
Answer: *Yes, Jim Roche is setting up ISNOBAL to look at snowpack in the Tuolumne basin specifically.*

Questions: *Does field based data let you control climate or short term thinning effects?*
Answer*: Using the numerical models we estimate short term as well as long-term effects of thinning under similar climate.*

Question*: Will there be new input data for watershed assessment, such as NEON or LiDAR?*
Answer*: NEON is proposed to be focused further south, in the Kings River Experimental Watershed vicinity.*

Question*: Can you explain the increased water yield at 66% vegetation removal versus the lack of increase in water yield at 33% vegetation removal?*
Answer: *There are two separate scenarios being modeled with each vegetation removal, one scenario where the litter layer on the soil is maintained (simulating thinning) and one where the litter layer is mostly consumed (simulating high-intensity wildfire). When a good litter layer is retained, a water yield increase of about 5% to 10% is seen when 33% to 66% of vegetation is removed. Without a litter layer, water yield actually decreases about 5% at the lower levels of vegetation removal (33%) due to increased evaporation. Water yield did not change with a higher level of vegetation removal (66%), as the increased evaporation is offset by the decrease in transpiration.*

Susie Kocher closed the webinar and encouraged participants to fill out the online evaluation. Eight did so and the results are presented below.


Evaluation of the 9/4/2014 Water IT webinar
The webcast presentation was clear and useful.
Constructive discussion was encouraged by facilitators.
I learned something new at this event.
The goals and objectives of the event were clearly stated.
The audio webcast was clear enough and I would use it again.
I felt my concerns were heard by the UC scientists.
There is a clear plan of action for the future on today's issues.
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Agree
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Disagree
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