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Name of institution represented:
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Project title:
Water balance & carbon cycling across the snow line in forested landscapes

Purpose of study:
The purpose of this project is to develop strategies to accurately measure and model water and nutrient fluxes in forested areas and meadows near and above the rain-snow transition using a blend of remotely sensed and ground-based information. This will result in more-accurate estimates of snowpack, snowmelt and the partitioning of snowmelt into runoff, infiltration and evapotranspiration, plus the interaction of the water cycle with bi-directional fluxes of carbon between forests and the atmosphere. Our basic hypothesis is that strategically placed instrument clusters, designed to complement satellite remote sensing information, provide the basis for more accurately and efficiently measuring and scaling water balance components, and thence basin-scale fluxes, than does an approach that relies on widely distributed snowpack and weather-station point measurements of the type now available. A corollary to this is that water balance estimates provided by the measurement system will improve forecasts of snowmelt runoff and other water balance components using emerging hydrologic models, and thence provide a more-accurate projection of mountain water supply and the timing of its runoff. It is expected that this new information will also provide significantly improved indices that will enable better management of forest and aquatic habitats, as water storage amounts and fluxes provide important indicators of how the systems can and do respond to climate variability and change.

Subject/Discipline:
Water Resources

Locations authorized:
Studies using telemetry, soil moisture, piezometers, and wells will be continued at existing sites in Wolverton Meadow. Four water flux sites of approximately 100 square meters will be completed on an elevational gradient. Two of these are 105m and 240m SSW of the Wolverton parking lot and two are located 290m NNW and 120m WNW of Panther Meadow in non-wilderness areas. Instruments have been deployed in Wolverton Creek 70m above the water treatment plant, the outlet of the meadow 60m below the Wolverton road, in the other tributaries that join the creek before entering the meadow, and in the tributary that flows through the meadow. Pressure transducers and associated logging equipment have also been placed in Clover Creek at the bridge where the trail crosses 2 kilometers below Wuksachi and will be placed in the vicinity of the bridge over the Marble Fork of the Kaweah River on the Crystal Cave road and the old USGS gauging station at Potwisha. Vegetation in the Wolverton Creek Drainage is classified by Sequoia National Park as largely Red Fir Forest in the upper reaches, with selected areas of White Fir-Mixed Conifer Forest. Areas classified as Ponderosa-Mixed conifer Forest lie on either side of the large meadow. It is proposed to place an additional instrument clusters in the vicinity of Bear Hill (36o 33’ 37.00” N, 118o 46’ 02.00” W, 2010 m elevation) and sites in non-wilderness areas in the general vicinity of Wolverton, and extending through the non-wilderness area as far south as Panther Meadow and as far east as Panther Gap. Seismic survey authorized in Long Meadow.
**Transportation method to research site(s):**

Access to the proposed sites in the vicinity of Wolverton will be by vehicle on the existing road that extends off Generals Highway, which includes the Wolverton parking loop, as well as by foot and pack stock on the existing trails around Wolverton. For those proposed sites in the non-wilderness areas extending south to Panther Meadow and east to Panther Gap, access will be by foot, snowshoes, or skis on the existing trail and pack stock. Access to the proposed Bear Hill instrument cluster will be by foot, snowshoes, or skis on the trails originating at Generals Highway.

**Collection of the following specimens or materials, quantities, and any limitations on collecting:**

- Water samples of up to 5 liters per week from various locations in the Wolverton Basin
- 1-2 5mm tree cores from each of the sap flow monitored trees at the water flux sites
- Approximately 24 soil samples of 2 liters each will be collected from soil pits at instrumentation sites
- Perform seismic survey of Long Meadow
- Soil nutrient data using 144 ion exchange resin bags (about 3 CC each)distributed among six trees & placed 5-10 cm into the soil; installation of 24 tidbit temperature sensors at each of two trees

**Name of repository for specimens or sample materials if applicable:**

**Repository Type:** Will be destroyed through analysis or discarded after analysis

**Objects Collected:**

Water samples of up to 5 liters per week will be collected for analysis from various locations in the Wolverton Basin at the Sierra Nevada Research Institute Laboratory on the UC Merced campus.

**Repository Type:** Will be destroyed through analysis or discarded after analysis

**Objects Collected:**

One or two 5mm tree cores will be collected from each of the sap flow monitored trees at the water flux sites.

**Repository Type:** Will be destroyed through analysis or discarded after analysis

**Objects Collected:**

A set of approximately 24 soil and samples of 2 liters each will be collected from soil pits at instrumentation sites and analyzed at the Sierra Nevada Research Institute Laboratory on the UC Merced campus.

**Specific conditions or restrictions (also see attached conditions):**

- Refer to attached Park-specific Conditions
- A copy of field notes, and/or a digital table showing identification, location coordinates, and dates of samples collected or recorded may be required within 90 days following the year in which the permit was issued.
- Check in at nearest ranger station at start of field season, and show Research and Collecting Permit.
- Please, bear in mind that performing research in a National Park, especially in wilderness, will bring field workers into contact with natural hazards. Field personnel must employ best safety practices and be aware of their working environment at all times (See Park-specific Conditions for more information.).
- When possible, avoid collecting within sight of the public.
- Collections must not significantly impact any sampled site, either visually or by derogating the resource.

**Recommended by park staff (name and title):**

Harold W. Werner
Wildlife Ecologist

**Approved by park official:**

Craig C. Axtell,
Superintendent

**Date Approved:**

October 24, 2008

I Agree To All Conditions And Restrictions Of this Permit As Specified
(Not valid unless signed and dated by the principal investigator)