APPLICATION FOR A SCIENTIFIC RESEARCH AND COLLECTING PERMIT
United States Department of the Interior
National Park Service

All or some of the information you provide may become available to the public.

Name of the National Park Service area you are applying to: Sequoia & Kings Canyon NP

Type of application: Renewal application

Please enter numbers for permit renewal or modification requests:
Previously assigned NPS study number: SEKI-00153
Previously assigned NPS permit number: SEKI-2007-SCI-0001

Contact information for the current principal investigator

Principal investigator: Roger Bales

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Office fax:

Name of the current institution represented
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Additional investigators or key field assistants (first name, last name, office phone, office email)

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Scientific Study Information

Project title (maximum 300 characters)
Water balance & carbon cycling across the snow line in forested landscapes

Purpose of the study (maximum 4000 characters)
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 compliment 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.

Summary of proposed field methods and activities (extract from the study proposal where appropriate - maximum 4000 characters)

Existing observatory installations will be used to support ongoing investigations and include the following: Six pressure transducers placed in Wolverton Creek and Clover Creek and their tributaries, two meteorological stations, near Wolverton and Panther meadows, and a soil moisture transect with associated data logging and transmission equipment in Wolverton Meadow, four water flux monitoring stations each consisting of, six ultrasonic snow depth sensors, 9-12 soil moisture and temperature sensors, two radiometers and two sap flow probes and associated data logging equipment. Water depth transects with a total of twenty-four piezometers and wells with pressure transducers in Wolverton Meadow. There are also four automated water samplers deployed seasonally in the watershed, on Wolverton Creek above the water-plant, Long meadow creek above and out of site of the upper trail crossing, and the creek flowing north out of Panther meadow.

Proposed 2008 research:

Snow distribution surveys are planned to document snowpack properties including: qualitative observations of stratigraphy, crystal type, grain size, snowpack temperature, and density and depth (SWE). The surveys planned for peak accumulation and ablation periods.

Teams of 4 â 6 people will be required for the Wolverton basin-scale surveys. Each survey will require 3 â 4 field days. Detailed snowpack characteristics will be measured and documented at the two lower sites and the upper elevation Panther Meteorological (met) station. Snow pits will be constructed radially outward from a pre-determined tree bole at each of the lower Wolverton sites and the upper met station such that the snowpack beneath three different canopy conditions (open, edge, under canopy) may be observed. All snow pits will be backfilled to maintain site safety and snowpack integrity. The survey teams will conduct multiple snow depth measurements at pre-determined locations using aluminum probes and Federal samplers. Sample locations will be distributed across the basin on a 250 x 250 meter grid, with additional single measurements made at a finer spatial scale around 30 to 40 selected trees at the met station locations, trees will be marked with either flagging tape or 1.5â aluminum tree tags using 2.5â aluminum nails.

Vadose zone studies are proposed for the upper watershed of Wolverton creek near Panther Meadow using a similar but smaller installation to what has been deployed in Long Meadow by placing a constellation of 3 to 6 piezometers on the hill-slope above and in panther meadow. Installation of the pieziometers will be done in a manner to avoid damage to meadow vegetation and will not be visible from trails.

To simulate snow melt and ion flux through the soil column we propose experiments using up to 1 liter of table salt (NaCl) over a 1m2 area enclosed with wooden stakes and plastic walls of an area of 1m3 in four locations. These experiments would be conducted over existing soil moisture instrumentation at the sites near the Panther Meadow met station and use snow moved from nearby locations to the plot enclosures during the end of the spring melt period. Plot locations are devoid of perennial vegetation or grasses and the low concentrations of NaCl will have minimal biological effect (Wood and Dykes 2002). The enclosures will not be visible from any trail and will be removed immediately after completion of the experiment deployment of one to two weeks.

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Watershed Gauging

In conjunction with the United States Geological Survey (USGS) we propose placing a conductivity temperature and depth sensor at the old USGS gauging station at Potwisha to measure the integrated discharge and conductivity of the Marble Fork of the Kaweah River.

References:


<table>
<thead>
<tr>
<th>Study Schedule</th>
<th>Field Schedule</th>
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<tbody>
<tr>
<td>Initial starting date of the study:</td>
<td>Date to begin study within the park this application year:</td>
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<tr>
<td>Estimated date the entire study may end:</td>
<td>Date to end study within the park this application year:</td>
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<td>Dec 31, 2008</td>
<td>Mar 20, 2009</td>
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<td>Will field study need to continue within the park next year:</td>
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<td>Yes</td>
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Activity Type: Research

Do you anticipate receiving funding assistance from the U.S. Federal Government for this study? (Yes or No)

Yes

If yes specify the agency(s):

National Science Foundation

Where will data, maps, photos, etc. (not specimens) reside upon completion of this study?

The infrastructure and services for storage and distribution of existing and future data is operational and available at:
https://eng.ucmerced.edu/people/rbales/mhrg/index_html

General public information regarding the research is available at:

https://snri.ucmerced.edu/snri/index.html

Location(s) where you propose activities will take place within the National Park System area(s):

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

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the vicinity of Bear Hill (36o 33â 37.00â N, 118o 46â 02.00â 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.

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<tr>
<th>Your proposed method of access (vehicles, aircraft, boat, snowmobile, foot, etc.):</th>
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<td>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.</td>
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Handling or Collection of Specimens

Would you like to handle or collect specimens? Yes
If you respond “Yes”, please complete this entire section of the application (otherwise you may skip the remainder of this section).

Scientific description of specimens to be handled or collected (include taxonomic group or name, or type of material; sample size, quantity, frequency, and location):

A set of approximately 24 soil 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.

Proposed disposition of specimens identified for handling or collection:

Will be destroyed through analysis or discarded after analysis

If you propose that specimens or materials be retained permanently, they will become part of National Park Service collections. You may request that such specimens or materials be loaned to one or more non-NPS institutions for management. If you do make this request, you accept responsibility for obtaining and submitting to NPS the signature of the official at each proposed repository using the form attached as Appendix A.

Certification

I certify that this application is accurate and complete. I understand a formal study (research) proposal for new or modified studies must be provided to NPS before this application can be considered. I authorize the National Park Service to seek peer reviews of my proposal.

Signature of principal investigator: _______________________________ Date: __________________

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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.

Proposed disposition of specimens identified for handling or collection:
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One or two 5mm tree cores will be collected from each of the sap flow monitored trees at the water flux sites.

Proposed disposition of specimens identified for handling or collection:

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