## Name of principal investigator:

**Name:** Roger Bales  
**Phone:** 209-724-4348  
**email:** rbales@ucmerced.edu

## Name of institution represented:

University of California, Merced

## Additional investigator(s):

<table>
<thead>
<tr>
<th>Full Name</th>
<th>Office Phone</th>
<th>Office Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bob Rice</td>
<td>209-724-4397</td>
<td><a href="mailto:rrice@ucmerced.edu">rrice@ucmerced.edu</a></td>
</tr>
<tr>
<td>David Peterson</td>
<td>650-329-4525</td>
<td><a href="mailto:dpete@usgs.gov">dpete@usgs.gov</a></td>
</tr>
<tr>
<td>Jacob Flanagan</td>
<td>209 777-5968</td>
<td><a href="mailto:flanagan.jacob@gmail.com">flanagan.jacob@gmail.com</a></td>
</tr>
<tr>
<td>Jan Hopmans</td>
<td>530-752-3060</td>
<td><a href="mailto:jwhopmans@ucdavis.edu">jwhopmans@ucdavis.edu</a></td>
</tr>
<tr>
<td>Keith Musselman</td>
<td>520-820-3217</td>
<td><a href="mailto:musselma@seas.ucla.edu">musselma@seas.ucla.edu</a></td>
</tr>
<tr>
<td>Kevin Arthofer</td>
<td>630 430-305</td>
<td><a href="mailto:kma14@ucla.edu">kma14@ucla.edu</a></td>
</tr>
<tr>
<td>Martha Conklin</td>
<td>209-724-4349</td>
<td><a href="mailto:mconklin@ucmerced.edu">mconklin@ucmerced.edu</a></td>
</tr>
<tr>
<td>Matt Cooper</td>
<td>831-566-9149</td>
<td><a href="mailto:mguycooper@gmail.com">mguycooper@gmail.com</a></td>
</tr>
<tr>
<td>Matt Meadows</td>
<td>209-233-2802</td>
<td><a href="mailto:mmeadows@ucmerced.edu">mmeadows@ucmerced.edu</a></td>
</tr>
<tr>
<td>Mike Goulden</td>
<td>949-824-1983</td>
<td><a href="mailto:mgoulden@uci.edu">mgoulden@uci.edu</a></td>
</tr>
<tr>
<td>Noah Molotch</td>
<td>310-825-2295</td>
<td><a href="mailto:molotch@seas.ucla.edu">molotch@seas.ucla.edu</a></td>
</tr>
<tr>
<td>Otto Alvarez</td>
<td>510 326-6994</td>
<td><a href="mailto:oalvarez@ucmerced.edu">oalvarez@ucmerced.edu</a></td>
</tr>
<tr>
<td>Peter Hartsough</td>
<td>530-752-1210</td>
<td><a href="mailto:phartsough@ucdavis.edu">phartsough@ucdavis.edu</a></td>
</tr>
<tr>
<td>Peter Kirchner</td>
<td>209-834-7628</td>
<td><a href="mailto:pkirchner@ucmerced.edu">pkirchner@ucmerced.edu</a></td>
</tr>
<tr>
<td>Qinghua Gua</td>
<td>209-724-2911</td>
<td><a href="mailto:qguo@ucmerced.edu">qguo@ucmerced.edu</a></td>
</tr>
<tr>
<td>Ryan Lucas</td>
<td>209-201-5020</td>
<td><a href="mailto:rluca@ucmerced.edu">rluca@ucmerced.edu</a></td>
</tr>
<tr>
<td>Wenkai Li</td>
<td>209 756-8815</td>
<td><a href="mailto:liwenkai.kl@gmail.com">liwenkai.kl@gmail.com</a></td>
</tr>
</tbody>
</table>

## 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 carbon fluxes in forested areas across 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.

Subject/Discipline:
Water / Hydrology

Locations authorized:
Studies will be carried out at sites outside of Wilderness in the Wolverton Creek watershed centered at (36o 35' 54.30" N; 118o 43' 50.30" W, 2215 m elevation) and extending to where the creek enters Wolverton Scout Camp.

Conduct up to 2 hours of evapotranspiration measurements in Long Meadow with a 1.3 m high by 1 m diameter plexiglass chamber approximately once a month from July to October. These measurements will be accompanied by qualitative meadow sediment moisture surveys to determine the level of surface saturation at each point.

Collect small diameter soil cores from each of the 12 monitoring wells currently installed in Long Meadow.

Temporary installation for the summer/fall in Long Meadow of a meteorological station. The meteorology station instruments will be deployed on a tri-pod no more than 3 m high and 3 m in diameter and be powered by a small solar panel and battery. The tri-pod will be secured to the surface using 12-18" spikes.

Installation of up to 24 Hobo temperature loggers, ~ 3cm in diameter, in and around the meadow to assess variability in air temperature. These would be shielded by reflective bubble wrap and tied to a small tree branch at approximately 2m above the ground surface.

Transportation method to research site(s):
Road access to the study sites will be by private and University of California Merced vehicles. Travel will primarily be by foot, skis and snowshoes, occasionally pack stock will be used on trails.

Collection of the following specimens or materials, quantities, and any limitations on collecting:
Water, snow, and soil

Name of repository for specimens or sample materials if applicable:
Repository Type: Will be destroyed through analysis or discarded after analysis

Objects Collected:
~20 liters of soil collected from Long Meadow will be analyzed at the UC Merced Environmental Analytical Laboratory or sent out to an authorized laboratory. Samples will be destroyed during analysis or at the end of study.

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

Objects Collected:
~50 liters of water and snow will be collected for chemical analysis. Samples will be destroyed during analysis or at the end of study.

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

- Refer to attached Park-specific Conditions
- Geospatial coordinates for the locations of actual study sites, specimen collections, and/or equipment installations are required by March 1 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.
- Be prepared to explain your research activities (what you are doing and why) to the inquisitive public you may meet in the parks.
- 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.).
- Minimize visual impact of installations and collections.
- Prior to causing any soil disturbance the researcher will discuss their sampling and/or installation plans and locations with the park archeologist (Tom Burge, 559-565-3139 or tom_burge@nps.gov) to ensure that there are no adverse effects to SEKI cultural resources. If artifacts are encountered during sampling, operations at that site will cease and the park archeologist will be notified. Operations can continue after approval by the park archeologist and superintendent.
- All study installations must be removed by the PI at the end of the study and the research permit coordinator must be informed after removal is completed.

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

Koren R. Nydick  
Ecologist/Science Coordinator

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**Approved by park official:**  
Karen Taylor-Goodrich  
Superintendent

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

Principal investigator’s signature  
7–20–11

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**THIS PERMIT AND ATTACHED CONDITIONS AND RESTRICTIONS MUST BE CARRIED AT ALL TIMES WHILE CONDUCTING RESEARCH ACTIVITIES IN THE DESIGNATED PARK(S)**