



# Senator Beck Basin 'Mountain System' Observatory

## Center for Snow & Avalanche Studies - Silverton, CO



**Senator Beck Basin Study Area**

The Senator Beck Basin Study Area (SBBSA) is being developed and operated by the Center for Snow and Avalanche Studies as a mountain system observatory, with an emphasis on the role of the seasonal snowcover in driving mountain system behaviors. SBBSA is located in the western San Juan Mountains of Southwest Colorado, at the headwaters of the Uncompahgre River, and centered at 37° 54' 30" N x 107° 43' 30" W. The 290 ha SBBSA exhibits physical and climatological attributes that reflect its continental continental position, high elevation, and comparatively southerly latitude. Elevations range from 13,510' (4,118m) to 11,000' (3,353m). The San Juan Mountains have been described as a "radiation snow climate", where highly dynamic energy balance fluctuations dominate snowpack processes. Further, the San Juans exhibit a bi-modal precipitation regime, with winter snow and summer monsoonal rain peaks. The San Juan Mountains are also home to over 100 identified rock glaciers, many of which contain ice cores and remain remain active. The SBBSA contains a lobate rock glacier that may remain active and may contain an ice core.

Basin landcover is typical of alpine basins throughout the San Juan Mountains but, unlike adjoining basins, no active roads are present and early 20th Century mining activity resulted in only minor disturbances. All mining claims within the SBBSA have been acquired and returned to US Forest Service ownership, and the SBBSA is operated under a Special Use Permit issued to the CSAS by the Uncompahgre National Forest. The SBBSA's namesake derives from the historic Senator Beck (Dem, KY - 1822-1890) mine, and the the Swamp Angel Study Plot adjoins the Swamp Angel Lode, apparently named for a Civil War cannon in the battle of Charleston. Two micro-met stations and snow study plots have been have been developed in the Basin, and a stream gauging station has been installed at the Basin pour-point. A third micro-met station has been developed at a nearby summit to the east to east to obtain 'free air' wind measurements. SBBSA 'research infrastructure' also includes a plant community baseline study performed in 2004 that documents current plant community community distributions and conditions.



**Center for Snow and Avalanche Studies**

The Center for Snow and Avalanche Studies enhances the interdisciplinary investigation of the alpine snow systems behavior and role in human-environment relationships by offering resources - people, information, and facilities - for field-based research and education.

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Chris Landry - [clandry@nsasnowstudies.org](mailto:clandry@nsasnowstudies.org)  
 PO Box 190  
 Silverton, CO 81483  
 (970) 387-5080  
[www.snowstudies.org](http://www.snowstudies.org)

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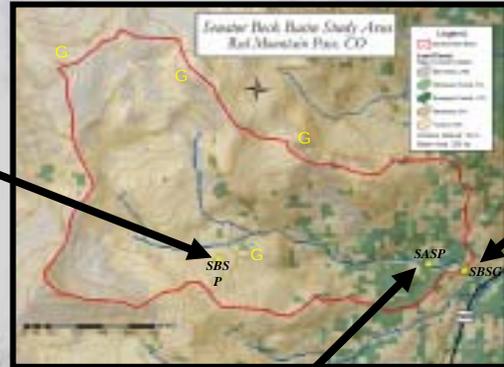
The Center for Snow and Avalanche Studies was founded in 2002 utilizing seed money from the American Avalanche Association, the James Family Foundation, contributions by Friends of the CSAS, Boulderian Family Charitable Fund, and in-kind donations of equipment and services. In 2003, US Forest Service Rural Development, Forestry and Communities Grant funds were requested and obtained on behalf of the CSAS by the Mountain Studies Institute, our sister organization in mountain ecosystem system research and education in Silverton, Silverton, Colorado. In September 2004 the CSAS was awarded its first National Science Foundation research grant (Grant No. ATM-0431955), in collaboration with Dr. Tom Painter of the National Snow and Ice Data Center. "Friends" also continue to provide operating funds.



**SBSP Instrumentation:**

- Wind speed & direction
- Snow depth
- Multi-spectra radiation
- Air temperature & humidity
- Snow temperature gradient
- Soil temperature (summer '05)
- Soil moisture (summer '05)

**Senator Beck Study Plot**  
12,200' - 3,719m



**SBSG Instrumentation:**

- Noched, broad-crested weir
- Staff gauge
- Stage transducer
- pH
- EC and water temp.

**Senator Beck Stream Gauge**  
11,030' - 3,362m

**Putney Station**

Wind speed & direction, air temp & RH

**SBBSA Baseline Study**

A plant community baseline inventory was performed for the CSAS in July and August 2005 by the Colorado Natural Heritage Program. Vegetation and soil surface characteristics were documented along three elevation bands in twenty-three 100' transects. Each transect consisted of ten 0.10 m<sup>2</sup> Daubenmire frame micro-plots at 10' intervals (as seen above). The largest number of species were found in the mid-elevation transect, and the upper and lower transects exhibited statistically and ecologically significant differences in species composition and abundance. Survey cap monuments were placed at each end-point of each transect to enable repeat studies. A complete Baseline Inventory report is available upon request.

Initial planning to develop a GLORIA multi-summit monitoring program in the SBBSA has begun with the assistance of principals at other American GLORIA projects and with the Mountain Studies Institute of Silverton. Potential summits are shown as "G" on the map to left. Field evaluation of potential sites will occur in summer 2005.

**SBBSA Data**

All sites are equipped with Campbell Scientific™ CR10-X dataloggers. Measurements are executed on 5 second intervals. Dataloggers at the SASP and SBSP sites are supplemented by Campbell Scientific™ multiplexers. Data are acquired routinely from all sites via an RF network network through a telephone-to-RF base station located at the St. Paul Ski Lodge on Red Mountain Pass.

Data are processed in 1-hour, 3-hour summary, and 24-hour (calendar day) summary arrays. At SASP and SBSP an additional 'solar noon' array is collected to capture diffuse shortwave radiation measurements using a shadowed shadowed pyranometer and the Swiss's ASRB program shadow-band design.

By spring of 2005 SASP will also be equipped with a CIMEL™ automatic tracking sun photometer. Data from the SASP photometer will be available via AERONET, a global network of photometers. SASP will be among the highest elevation AERONET sites.

It is our intention that by spring 2005 SBBSA data will be available near-real-time on the Internet. It is also the CSAS's intention to operate the SASP and SBSP sites year-year-round beginning in year 2005.



**SASP Instrumentation:**

- Precipitation & snow depth
- Wind speed & direction
- Multi-spectra radiation
- Air temperature & humidity
- Snow temperature gradient
- Soil temperature & moisture (summer '05)
- Barometric pressure

**Swamp Angel Study Plot**  
11,050' - 3,368m

**Radiative Effects of Desert Dust Deposits in Alpine Snow**

NSF Grant No. ATM-0431955

CSAS and the National Snow and Ice Data Center (NSIDC) (NSIDC) have begun a collaborative study of an important and hitherto understudied interaction in mountain systems - the effects of desert dust deposits on mountain snowpack albedo albedo and hydro-logic behaviors. Desert dust deposition events are common in the San Juan Mountains, situated downwind of the Colorado Plateau, and this relationship of up-up-wind deserts and mountain ranges occurs in major mountain mountain ranges throughout the world.

Variations in snow surface albedo are being monitored at plot, plot, basin, and range scales using a variety of observation platforms beginning with energy balance instrument arrays at the SASP and SBSP sites and extending to MODIS imagery. This study will enhance interpretation of albedo data obtained from remote sensing. Snowmelt processes driven by dust layers layers will be monitored at slope-to-basin scales and correlated correlated to variations in the basin hydrograph.

