Soil Climate Characterization Project: An Application for Monitoring Climate Change.

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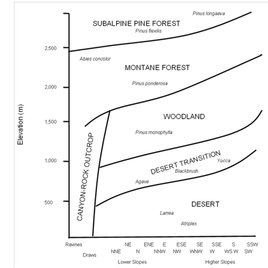
The Spring and Sheep Mountains are two of the most ecologically diverse ecosystems in the Mojave Desert biogeographic region, 24 species are endemic to the Spring Mountains alone. In 2004, the U.S. Forest Service in conjunction with the Bureau of Land Management and the U.S. Fish and Wildlife Service partnered with the Natural Resources Conservation Service (NRCS) and the US Geological Service (USGS) to initiate a project to characterize the climate and soils across the ecological life-zones within the Spring and Sheep Mountains in Clark County, Nevada. Understanding the dynamics of such diverse system requires an understanding of the spatial and temporal interactions among climate, vegetation, and soil. Climate stations were installed along an elevational transect across vegetative life zones ranging from Mojave Desert (Larrea tridentata/Ambrosia spp.) along the West side of the Spring Mountains to a closed-canopy bristlecone pine (Pinus longaeva) assemblage just below 10,000 feet in the Sheep Range of the Desert National Wildlife Refuge. Data collection began in 2007 and continues to this day. This study provides linkages useful in understanding desert ecology and pedology and provides a template for understanding soil moisture, evapotranspiration, solar radiation, groundwater recharge modeling and plant dynamics over time. The monitoring stations along the elevational transect currently are being added to a global network and will provide a basis for identifying change in ecological response to our changing climate. All of the data for the SNOTEL (3 sites) and SCAN (7 sites) are available online with hourly data for the period of record. Thanks to Dr. Karen Vaughan at the NWCC for the interface, discussion and Rainbow pedon image.

SNOTEL: *http://www.wcc.nrcs.usda.gov/snotel/Nevada/nevada.html*
SCAN: *http://www.wcc.nrcs.usda.gov/scan/Nevada/nevada.html*

Pachic Calciustolls

Aridic Argiustolls

Typic Haplocalcids



Hayford Peak SCAN site - at 3,033 meters this is currently the highest climate station in the project on a 30 percent slope with a north aspect, in bristelcone pine.

Rainbow Canyon SNOTEL site, one of three such sites in the project. Measures snow depth and water content in addition to atmospheric and soil variables. 2,405 meters in mixed conifer.

Mountmummy logger site, 3,030 meters on a 30 percent south facing slope, Leon Lato - NRCS.

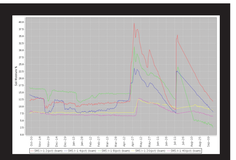
Montane and Subalpine Conifer Forests
Communities of medium to large conifers with winter deciduous trees.

Elevation: 2120 meters or (7,000 feet) to 3,500 meters (11,500 feet).

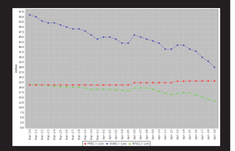
Rainfall: 46 centimeters (18 inches) to 76 centimeters (30 inches). Occurs both as heavy winter snow and summer thunderstorms.

Average Summer Temperature: 50 to 70 degrees F.
Average Winter Temperature: 10 to 30 degrees F.

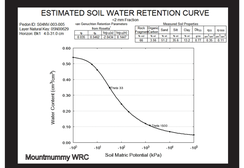
High Elevation



Hayford Peak SCAN site
Volumetric water content for the water year 2008, this is hourly data, note the snow melt is captured with the infiltration rates and consumptive use until the arrival of the summer convection storms. The combination of soil and atmospheric data allows the documentaion of edaphaic relationships.



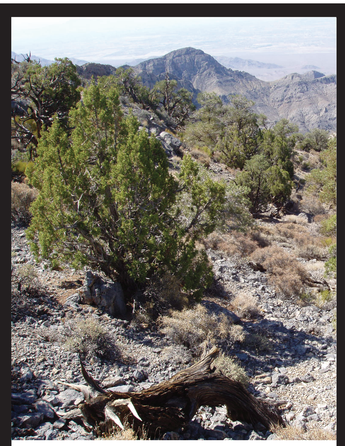
Snow depth and water content for the Rainbow Canyon SNOTEL site, current year's data March and early April, all data sets are available online, with hourly data.



It is important to understand the relationship of water content θ and soil water potential ψ . Each site is described above and below ground to capture the relationships of the different systems along the gradient. The shape of water retention curves can be characterized by several models, we are using the Mualem–van Genuchten model.

Charkiln SCAN site, 6718 feet (2048 meters). Summer moisture (Ustic) with Pinyon - Juniper and Oak. Old, well developed soils with a high cation exchange and good fertility. Productive site with a very strong responce to fire.

Porub Hobo logger site
Mesic blackbrush, 5,400 feet (1,646 meters). A paleoendemic species, which if disturbed does not come back, a few areas do seem to be able to recover.



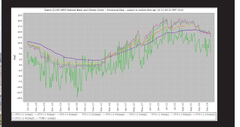
Conifer Woodland and Steppe
Communities range from dense mesic blackbrush and sagebrush to pinyon and juniper trees at higher elevations.

Elevation: 1,450 meters (4,756 feet) to 2,400 meters (7,872 feet).

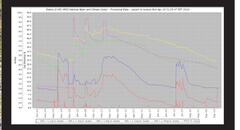
Rainfall: 20 centimeters (8 inches) to 46 centimeters (18 inches). Occurs as light to moderate winter snow and summer and spring rains.

Average Summer Temperature: 65 to 80 degrees F.
Average Winter Temperature: 20 to 40 degrees F.

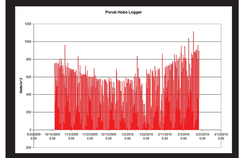
Intermediate Elevation



Charkiln SCAN site, 6718 feet (2048 meters). Soil and air temperatures for the 2008 water year.



Charkiln SCAN site, 6718 feet (2048 meters). Soil moisture (% volumetric) and precipitation for the 2008 water year, same period as the graph above.



Porub Hobo logger site, 5,400 feet (1,646 meters). Solar insolation from mid Oct 2009 to Mar 22, 2010. With almost no shade these fan piedmonts provide very little protection to species on the edge of thier range. Small changes may have large results.

Middle Trout Hobo logger site
Thermic blackbrush, 4,228 feet (1,289 meters). A shallow soil with a petrocalcic horizon occuring above 10 inches. Although standard depth for soil temperatures is normally 50 cm, in this case the sensors are placed on the restrictive layer at 26 cm.

Lower Trout Hobo logger site
Thermic - Aridic creosote and white bursage 3,194 feet (974 meters). All species are highly adapted in this region. It is difficult to assess drought conditions as this system is a drought.

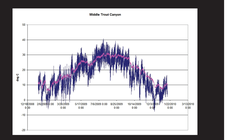
Mojave desert
Communities composed of drought tolerant species composed primarily of Creosote, low diversity small-leaved shrubs and warm season grasses.

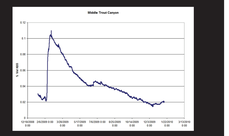
Elevation: 850 meters (2,788 feet). to 1,450 meters (4,756 feet).

Rainfall: 5 centimeters (2 inches) to 20 centimeters (8 inches). Occurs as spring and winter rains with minor summer and fall moisture.

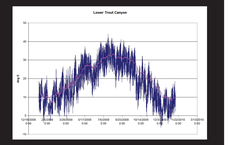
Average Summer Temperature: 80 to 90 degrees F.
Average Winter Temperature: 40 to 50 degrees F.

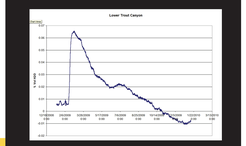
Low Elevation





Middle and Lower Trout Canyon Hobo logger sites MTC Thermic blackbrush, 4,228 feet (1,289 meters). LTC Thermic creosote, 3,194 feet (974 meters). One years data (hourly), 2009 to 2010 with the top graph in each case is air temp in deg C, and soil temp in deg C at 26 cm (MTC), and 50 cm (LTC). The lower graph is volumetric soil moisture θ for the same period.





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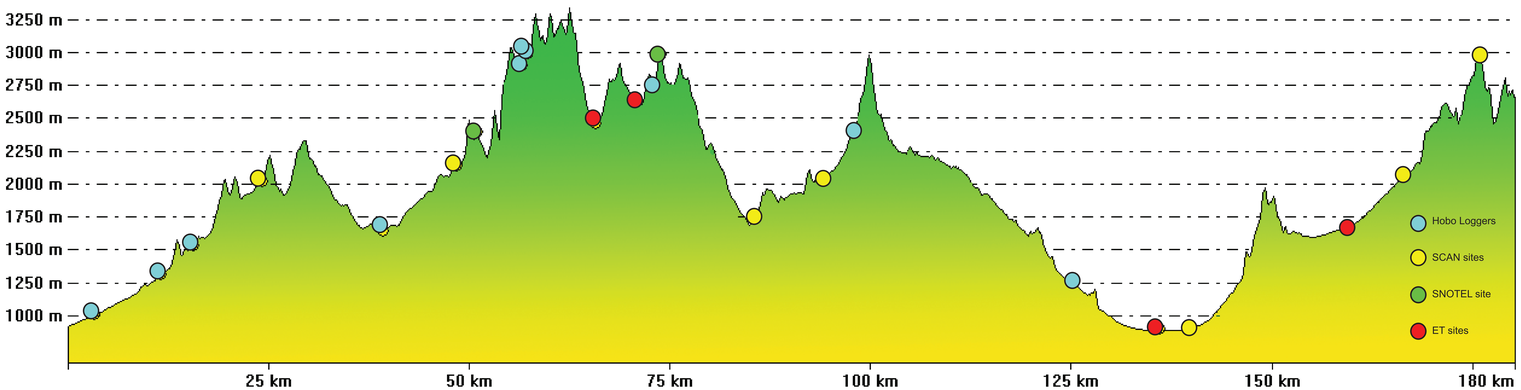
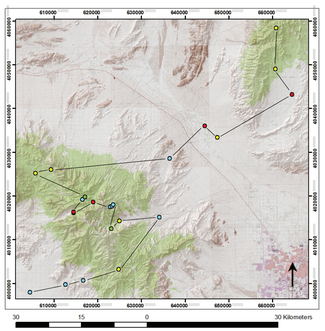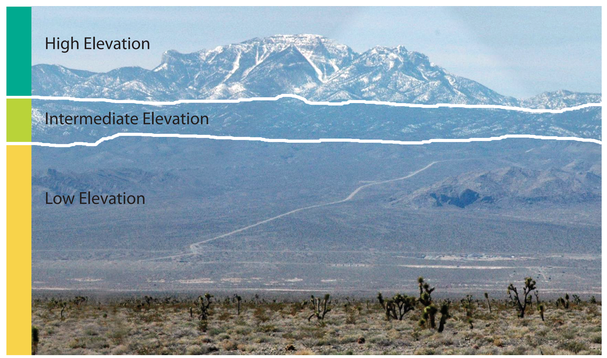
Project location in Southern Nevada