Niwot Ridge Research Area (NWT)

The Niwot Ridge (NWT) Research Area focuses on ecological and hydrological processes in high-elevation areas of the Rocky Mountains. Research began at the NWT LTER site in the 1940's with the return of World War II veterans with extensive experience in cold-region logistics. By the early 1950's a series of climate stations and ecological index sites were established along an elevational transect in four major ecological zones: lower montane (2,200 m), upper montane (2,621 m), subalpine forest (3,021 m), and alpine tundra (3,739 m). The Indian Peaks Wilderness Area was designated by Congress in 1978, with the boundary lines drawn around the Niwot Ridge research area. In 1979 approximately 1,775 acres centered on Niwot Ridge was designated a Biosphere Reserve by the US Congress. The Biosphere is managed by the Arapahoe-Roosevelt National Forest. The Niwot Ridge LTER site was established in 1980 with funding from the National Science Foundation (NSF). The LTER program is based at the University of Colorado-Boulder and is administered through the Institute of Arctic and Alpine Research (INSTAAR) and in cooperation with the Mountain Research Station, with special use permits from the US Forest Service. The NWT LTER has a cooperative agreement with the adjacent City of Boulder watershed (Green Lakes Valley), which is closed to the general public. The NWT LTER site is surrounded by designated Wilderness Areas and by public closures, which allows research into one of the most pristine areas in the US.

Site Description and Characteristics. NWT is located in the Colorado Front Range of the Rocky Mountains and extends up to the Continental Divide at elevations greater than 4,000 m (40° 03' N, 105° 35' W). Climate has been recorded continuously since the early 1950's, the longest high-elevation climate record in the US. Mean annual temperature is -3.8°C and annual precipitation is about 1,000 mm, with snowfall accounting for more than 80% of annual precipitation. Atmospheric CO_2 has been measured since 1967, the third longest record in the world. Niwot Ridge is a 10-km interfluve extending eastward from the Continental Divide, located at an elevation of 3,500 m. Treeline is at an elevation of about 3,350 m. Soils are Cryochrepts and are approximately 2 m in depth over granitic parent material. Soil carbon in the top 100 mm of soil ranges from130 to 200 g kg^{-1} and soil N pools range from 9 to 15 g kg^{-1}. Dominant plant species are the gramminoid *Kobresia myosuroides*, the forb *Acomostylis rossii* (alpine avens), and the gramminoid *Deschamsia caespitosa* (hairgrass) in protected microsites.

Niwot Ridge forms the northern shoulder of the Green Lakes Valley (GLV), where hydrological research has been conducted since the mid-1960's. The GLV is headed by the 9-ha Arikaree Glacier, which drains into a series of paternoster lakes carved by Pleistocene glaciation. Lakes have a seasonal ice cover and discharge is dominated by snowmelt runoff.

Research Focus. The basic goal of NWT is to understand the causes and ecosystem responses of climate change in high-elevation, seasonally snow-covered catchments. The panoramic splendor and complexity of high-elevation ecosystems have inspired and challenged humans for centuries. In our time, the perception that the mountains 'are forever' may provide solace to those seeking stability in a rapidly changing world. However, changes in the abundance and species composition of the native flora and fauna of these mountain ecosystems are potential bellwethers of global change. We are using a suite of short- and long-term experiments to better understand how alpine tundra will respond to changes in climate and nutrient loading, including a 2.6x60m snowfence and factorial fertilization manipulations. Alpine lakes have similar experimental treatments. We partner with other research organizations, which include the DOE-funded NWT Ameriflux program and the NSF-funded Alpine Microbial Observatory.