

Loch Vale Watershed (LVW)

Loch Vale watershed is an 860 ha alpine/subalpine catchment located entirely within Rocky Mountain National Park, Colorado. Biogeochemical, hydrologic, and biological information have been collected from Loch Vale since 1983. Because Loch Vale is located in a national park, it has had minimal prior direct human-caused disturbances such as settlement, logging, grazing, or water diversions that influence much of the rest of the Rocky Mountains. An open-door policy, coupled with free and ready distribution of high-quality long-term meteorologic, wet-deposition chemistry, discharge, and water-quality records, has attracted many researchers who have contributed greatly to the knowledge of subalpine and alpine structure, function, and flux.

Research over the years has explored questions related to the role of climate and atmospheric deposition, primarily of nitrogen species, in influencing biogeochemical fluxes, and vegetation, soil, and aquatic ecosystem dynamics. Paleolimnological research, conducted in Sky Pond has yielded insight into changes over time related to climate since deglaciation, and atmospheric deposition of nitrogen, metals, and persistent organic compounds.



The primary research objectives of the Loch Vale watershed study are to observe and differentiate natural biogeochemical and biological variability from human-caused disturbance in alpine and subalpine ecosystems through intensive long-term study, and to understand and better quantify the role of climatic variability and climate change on alpine and subalpine processes. The overall program objectives are to share results and information on real and potential threats to natural alpine and subalpine resources with the

public, scientific community, and air, water, and land managers, and to offer a program of graduate education and research that develops future scientists and knowledgeable resource managers.

Site Description and Characteristics Loch Vale is located about 100 km northwest of Denver, Colorado. The western boundary of the watershed is the continental divide; streams drain northeast. Loch Vale ranges in elevation from 3,110 m at the outlet to 4,192 m on top of Taylor Peak. The two main tributaries in Loch Vale, Andrews Creek and Icy Brook, join above The Loch, which is the lowest of four lakes in the watershed. The Loch is below treeline, and Sky Pond, Glass Lake, and Andrews Tarn are alpine tarns. Eleven percent of the catchment is tundra, located primarily on ridgetops. Old-growth Engelmann spruce-subalpine fir forest is located on the valley bottom, and only makes up six percent of land cover. More than 80% of Loch Vale is made up of exposed bedrock, talus, or glacier. Loch Vale is a typical u-shaped

mountain valley, carved from crystalline bedrock (biotite gneiss, schist, and granite) by glacial action over millennia. The most recent glacial activity during the Little Ice Age left behind active rock glaciers and high elevation moraines. Alpine soils support vegetative communities largely dominated by lichen, herbaceous vegetation, grasses and low shrubs and are classified as Cryochrepts and Cryohemists. Forest soils are a meter or less deep, and include Cryoboralfs, Cryumbrepts and Cryochrepts. Small wetlands adjacent to the creeks include Cryaquents and Cryohemists. Tundra and wetland soils have pH values around 4.5, while forest soils have pH values between 3.8 and 4.0. Percent base saturation is greater than 40%. Climate is characterized by long, cold winters with short growing seasons of 3-4 months. Mean annual temperatures are 1.5 °C. Precipitation averages ~120 cm per year, although there is wide variability, with some years receiving as little as 85 cm. More than 65% of annual precipitation comes as snow between November and June, and snowmelt dominates the hydrologic cycle. Approximately 75% of precipitation is lost as discharge; the remainder evaporated, transpired, and sublimated.

