Long-term research to determine ecological effects of atmospheric nitrogen deposition

The National Park Service, concerned over the possibility that acid rain was harming park resources, established a research program to quantify precipitation, lake and stream water chemistry and biological effects in Rocky Mountain National Park in 1981. Loch Vale watershed was instrumented so that chemical inputs and outputs could be quantified over days, weeks, months, and years. Instead of acid rain we found an abundance of nitrate and ammonium in rain and snow. We now have 33 years of continuous records of precipitation, lake, stream and soil chemistry, weather, and stream flow. Many research investigations have revealed strong biological and chemical responses to high nitrogen inputs in alpine and subalpine vegetation, soils, and lakes. The results have been influential in establishing air quality policies and partnerships to reduce emissions of N from agriculture. We now study consequences of climate change AND nitrogen on lake chemistry and ecology and have developed a simple citizen science app that students and others can use to document the presence of algae in mountain lakes.