Glacial meltwater streams in the McMurdo Dry Valleys: Ecosystems waiting for water

The McMurdo Dry Valleys of Antarctica is comprised of alpine and terminal glaciers, large expanses of patterned ground, and permanently ice-covered lakes in the valley floors, which are linked by glacial meltwater streams that flow during the austral summer. These valleys were first explored by Robert Scott and his party in 1903. In 1968 the New Zealand Antarctic Program began a gauging network on the Onyx River, a 32 km river that is the longest river in Antarctica. As part of the McMurdo Dry Valleys Long-Term Ecological research project and in collaboration with the USGS, our research group has continued to monitor streamflow in the Onyx River and 15 other first-order streams in an adjacent valley. The availability of liquid water is a limitation to the microscopic life that is present in these valleys, and this is strongly controlled by summer climate. we have studied the responses of soil, lake and stream ecosystems through a sustained cooling period that has been driven by atmospheric changes associated with the ozone hole. This cooling period has been interrupted by two warm summers that created "flood events" in the valleys. Many streams have thriving cyanobacterial mats that are freeze-dried through the winter and begin photosynthesis with the onset of flow.  We studied the stream ecosystem response in a formerly abandoned channel, which was experimentally reactivated by a flow diversion in 1994 and in a stream that only flows during the rare flood events. We found that the mats where flow is typically low with episodic periods of high flows typically have diatom communities that are dominated by species of two aerophilic genera, many of which are endemic. These findings suggest that the optimal habitat for invertebrates in mats and sediments is driven by stream hydrology. This finding may help in using diatoms preserved in lake sediments and perched deltas to reconstruct the hydrologic record beyond the limited instrumental record.