

# **The Role of Natural Legacy on Ecosystem Structure and Function in a Polar Desert: The McMurdo Dry Valley LTER Program**

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The McMurdo Dry Valleys (MCM) region is among the most extreme deserts in the world: far colder and drier than any other LTER site. The biological systems within the MCM are relatively simple with no vascular plants and vertebrates. During MCM-I we investigated the perennially ice-covered lakes, ephemeral streams and extensive areas of soils in order to assess the role of physical constraints on the structure and function of the ecosystem. It is clear that the production of liquid water in both terrestrial and aquatic portions of this environment is a primary driver in ecosystem dynamics. Thus, the role of present day climatic variation is extremely important. However, one of the most significant discoveries of MCM-I was that past climatic legacies strongly overprint the present ecological conditions in MCM. We propose in MCM-II to extend this research by continuing to investigate the MCM as an "end-member" system, but also to better ascertain the role of the past climatic legacies on ecosystem structure and function. Our conceptual model now includes legacy as an important regulator of MCM. A set of eight hypotheses in three major focus areas: hydrology, biological activity and diversity and biogeochemical processes will be tested through our continuation of

monitoring programs and long-term experiments. Understanding the structure and function of the MCM ecosystem requires understanding hydrological responses to climatic both now and in the past. Current patterns of biological activity and diversity reflect both past and present distributions of water, nutrients, organic carbon and biota. Biogeochemical processes responsible for the transport immobilization and mineralization of nutrients and other chemicals provide the linkages between the MCM biota and the physical environment. The timing, duration and location of biogeochemical processes in the past and present are controlled by water availability. Our efforts will continue to focus on the integration of the biological processes within and between the lakes, streams and terrestrial ecosystems comprising the MCM landscape. We plan to continue to use modeling and other integrative studies to synthesis our data and examine our knowledge of the MCM ecosystem.

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