PROJECT SUMMARY

The McMurdo Dry Valleys (MDV) is a polar desert on the coast of East Antarctica, a region that has not yet experienced the climate warming that is now occurring elsewhere. The McMurdo Dry Valleys Long Term Ecological Research (MCMLTER) project has documented the ecological responses of the glacier, soil, stream and lake ecosystems in the MDV to a cooling trend that occurred from 1986 to 2000, which was associated with the depletion of atmospheric ozone. In the past decade, warming events with strong katabatic winds occurred during two summers and the resulting high streamflows and sediment deposition changed the dry valley landscape, possibly presaging conditions that will occur when the ozone hole recovers.

Intellectual merit: Based upon observations over the past decade and predictions of future warming in Antarctica, the overarching hypothesis of the proposed project is: Climate warming in the McMurdo Dry Valley ecosystem will amplify connectivity among landscape units leading to enhanced coupling of nutrient cycles across landscapes, and increased biodiversity and productivity within the ecosystem. In this proposed research, contemporary patterns in ecological connectivity in the MDV will be examined and used as a basis for predictions of future changes. Warming in the MDV is hypothesized to act as a slowly developing, long-term press of warmer summers, upon which transient pulse events of high summer flows and strong katabatic winds will be overprinted. Four specific hypotheses address the ways in which pulses of water and wind will influence contemporary and future ecosystem structure and function. Dramatic increases in connectivity are projected to occur in the next century, e.g. the closed basin lakes of Taylor Valley will likely rise and may begin to coalesce. To better understand this scenario, the MCMLTER project will expand to include the more southerly Miers and Garwood Valleys, where thermokarst erosion is already underway. Because wind-borne transport of biota is a key aspect of enhanced connectivity from katabatic winds, new monitoring will include high-resolution measurements of aeolian particle flux.

Importantly, integrative genomics will be employed to understand the responses of specific organisms to the increased connectivity. The project will also include a novel social science component that will use environmental history to examine interactions between human activity, scientific research, and environmental change in the MDV over the past 100 years. In much the same way as the simplicity of the MDV ecosystems makes the area an ideal location for exploring ecological theory, the simplicity of the area’s human history – in terms of its short timeframe and the small number of people involved – makes it an excellent location for integrating the theory and practice of environmental history with the ecological research of the LTER network.

Broader impacts: MCM scientists will participate in a wide array of outreach efforts ranging from presentations in K-12 classrooms to bringing undergraduates and teachers to the MDV to gain research experience. Planned outreach programs will build upon activities conducted during the International Polar Year (2007-2008), which include development of an interactive DVD for high school students and teachers and publication of a children’s book in the LTER Schoolyard Book Series. A teacher’s edition of the book with a CD containing lesson plans will be distributed. The project will develop programs for groups traditionally underrepresented in science arenas by publishing a Spanish edition of the children’s book, for example.