McMurdo Dry Valleys LTER International Collaboration

The McMurdo Dry Valleys have a rich history of international collaboration going back decades before the establishment of the MCMLTER. The projects w carry out with our international partners are well integrated, advancing both our collective and respective scientific goals, as well as educational, and outrea objectives. These efforts also promote the tenets of Antarctic research and preserve its legacy. A few of these projects are highlighted below.

Conservation Ecology

International Collaborators: S. Chown, J. Lee, K. Hughes, J. Barnes, P. Barrett, D. Bergstrom, P. Convey, D. Cowan, K. Crosbie, G. Dyer, Y. Frenot, S. Grant, D. Herr, M. Lamers, H. Possingham, K. Reid, M. Riddle, P. Ryan, L. Sanson, J. Shaw, M. Sparrow, C. Summerhayes, A. Terauds

MCMLTER: D. Wall

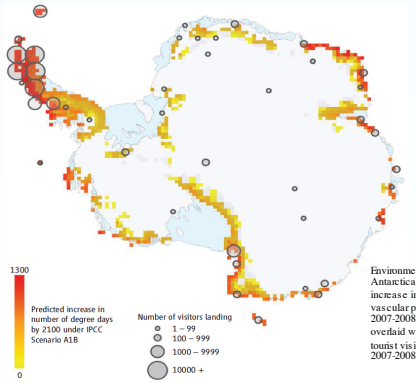
National and International Programs: Australia, France, New Zealand, South Africa, United Kingdom, Antarctic and Southern Ocean Coalition, International Union for Conservation of Nature, International Association of Antarctica Tour Operators, Comission for the Conservation of Antarctic Marine Living Resources, Scientific Committee on Antarctic Research

Project: Challenges to the Future of Conservation of the Antarctic

Major Findings: The Antarctic Treaty successfully regulates one of the globe's largest commons, but is under substantial pressure from:

- Global environmental change
- Marine resource depletion
- Regional warming
- Ocean acidification
- Changes in sea-ice distribution

The scientific community can help address these challenges by investigating the nature, extent, and trajectories of environmental changes and making the outcomes more rapidly and readily accessible to the policy environment



Citation: Chown SL., Lee J.E., Hughes K.A., Barnes J., Barrett P.J., Bergstrom D.M., Convey P., Cowan D.A., Crosbie K., Dyer G., Frenot Y., Grant S.M., Herr D., Kennicutt M.C., Lamers M., Murray A., Possingham H.P., Reid K., Riddle M.J., Ryan P.G., Sanson L., Shaw J.D., Sparrow M.D., Summerhayes C., Terauds A. & Wall D.H. (2012). Challenges to the Future Conservation of the Antarctic. *Science*, 337, 158-159.

Soil Microbial Ecology

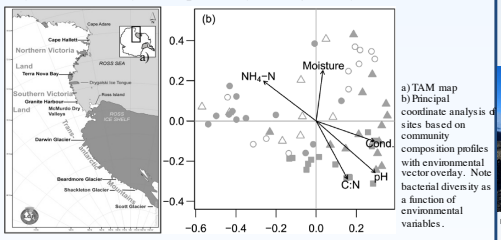
International Collaborators: Charles Lee, Craig Cary, Craig Herbold

MCMLTER: B. Adams, J. Barrett, R. Virginia

National Program: Antarctica New Zealand

Project: Local and regional influences over soil microbial metacommunities in the Transantarctic Mountains (TAM).

Major Findings: Overall community composition is correlated with broad environmental gradients, over hundreds of kms. Subgroups, such as edaphic cyanobacteria, show finer scale heterogeneity in community composition that suggests biogeography at relatively small scales (possibly within valleys, and probably among valleys).



a) TAM map b) Principal coordinate analysis of sites based on community composition profiles with environmental vector overlay. Note bacterial diversity as a function of environmental variables.

Citation: Sokol E.R., Herbold C.W., Lee C.K., Cary S.C. & Barrett J.E. (2013). Local and regional influences over soil microbial metacommunities in the Transantarctic Mountains. *Ecosphere*, 4.

Lake Benthos Primary Production

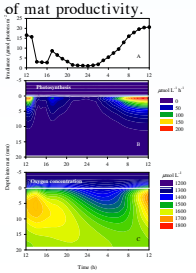
International Collaborators: Ian Hawes

MCMLTER: P. Doran

National Program: Antarctica New Zealand

Project: Primary production of benthic microbial mats in Dry Valley lakes

Major Findings: These gelatinous mats are sufficiently transparent that photosynthetic production occurs to a 17mm depth; diffusion rates are too slow for equilibration of O_2 profiles with instantaneous production and consumption of O_2. Simulation of O_2 dynamics indicates that net O_2 evolution is light limited. These findings provide the basis for long term analysis of mat productivity.



Primary production over time

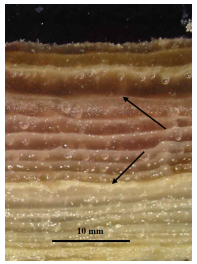


Photo of algal mat

Citation: Hawes, I., H. Giles and P.T. Doran in press. Estimating photosynthetic activity in microbial mats in an ice-covered Antarctic lake using automated oxygen microelectode profiling and variable chlorophyll fluorescence. *Limnology and Oceanography*.

Aeolian Connectivity & Transport Markers

International Collaborators: Craig Cary

MCMLTER: B. Adams, J. Barrett. A Fountain, D. McKnight, J. Priscu, R. Virginia, D. Wall

National Program: Antarctica New Zealand

Projects: Local and Regional distribution of nutrients, soil organisms and black carbon

Major Findings: Aeolian transport processes can be quantified using black carbon as a transport marker. Directly addresses MCM 4 hypotheses 1 and 2. Increased aeolian activity will alter productivity and biodiversity via:

- Increased productivity
- Increased biodiversity via increases in dispersal rates and improved habitat suitability

Particle collector deployed in Miers Valley (A. Kahn)

Black carbon measurement on Commonwealth Glacier (C. Chen)

Citation: Nkem J.N., Wall D.H., Virginia R.A., Barrett J.E., Broos E.J., Porazinska D.L. & Adams B.J. (2006). Wind dispersal of soil invertebrates in the McMurdo Dry valleys, Antarctica. Polar Biology, 29, 346-352.

Citation: Sabacka M., Priscu J.C., Basagic H.J., Fountain A.G., Wall D.H., Virginia R.A. & Greenwood M.C. (2012). Aeolian flux of biotic and abiotic material in Taylor Valley, Antarctica. Geomorphology, 155, 102-111.

Stream and Glacier Connectivity

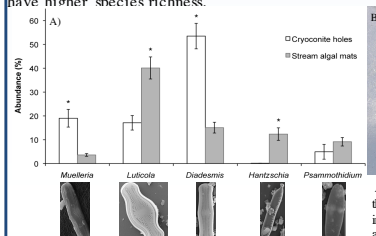
International Collaborators: Elizabeth Bagshaw, Martyn Tranter

MCMLTER Collaborators: W.B. Lyons, A. Fountain, D. McKnight

National Program: United Kingdom

Project: Environmental factors influencing diatom communities in Antarctic cryoconite holes

Major Findings: Diatoms grow in cryoconite holes, which melt out into streams, and subsequently lake environments. Cryoconite holes can serve as refugia for diatoms. There is a species diversity gradient that decreases with distance from the coast. Cryoconites adjacent to streams with high diversity have higher species richness.



A) Mean relative abundance of the most abundant diatom genera in cryoconite holes and stream algal mats.
B) Cryoconite hole (D. Taylor)

Citation: Stanish L.F., Bagshaw E.A., McKnight D.M., Fountain A.G. & Tranter M. (2013). Environmental factors influencing diatom communities in Antarctic cryoconite holes. *Environmental Research Letters*, 8, 045006.

Terrestrial Observation Network

International Collaborators: E. Butler, C. Cary, N. Gilbert, D. Bergstrom, N. Cannone, A. Cho, M. Gill, J. Gillies, M. Gulgielmin, I. Hawes, D. Hik, I. Hogg, C. Howard-Williams, O. S. Kim, C. Lee, F. Morgan, H.-J. Noh, C. Poirot, S. Robinson, L. Selbmann, B. Storey, A. Terauds, M. Vandegehuchte

MCMLTER: All MCM PI's

National Programs: Antarctica New Zealand, Australian Antarctic Division, Korean Polar Research Institute, Programma Nazionale Ricerche in Antartide (Italy),

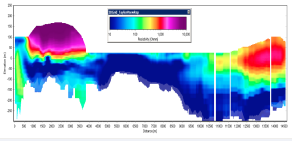
Project: A Terrestrial Observation Network for the McMurdo Dry Valleys, Antarctica

Major Findings: To inform predictive models of how Antarctic terrestrial ecosystems and their biodiversity will respond to future global changes, we developed a multinational, interdisciplinary, long-term monitoring and observation network. This allows us to -

- Coordinate measurement standards and protocols
- Develop tools for assessing current environmental protection guidelines
- Coordinate data management systems to maximize data utility

Citation: Levy J., Lyons, W.B. & Adams B. (2013). Understanding Terrestrial Ecosystem Response to Antarctic Climate Change. Eos, Transactions American Geophysical Union, 94, 33-33.

L-R: Ed Butler (Antarctic New Zealand), Steven Chown (South Africa), Diane McKnight (USAP), Alex Terauds (Australia)



SkyTEM resistivity profile from Canada Glacier (left) to New Harbor to depths of 300m. Blue color suggests subsurface hydrological connectivity

SkyTEM

International collaborators: Esben Auken, Kurt Soerensen and SkyTEM team

National Program: University of Aarhus, Denmark and SkyTEM.com

MCMLTER: Ross Virginia, Jill Mikucki

Other Co-PIs: Philip Kyle, Slawek Tulaczyk

Project: Airborne transient electromagnetic imaging of dry valley subsurface environments

Major Findings: First use (2011-12) of a novel airborne transient electromagnetic (TEM) system, SkyTEM, to map and detect variations in subsurface resistivity in Taylor Valley. SkyTEM revealed unexpected, extensive subsurface unfrozen brine networks. The brines are widespread below glaciers, lakes and permafrost in this region showing a previously unknown Antarctic groundwater system.