



ECOSYSTEM DYNAMICS

Group Leader: Dr Marilyn Ball

We aim to improve understanding of theory and process in ecological systems and to apply this knowledge to important biological questions such as the maintenance of diversity and responses to global climate change.

Understanding how plant communities have already changed and how they will be affected by future environmental variables requires an interdisciplinary approach. The Group brings together expertise that spans scales from the biophysics of light capture by photosynthetic membranes to the modelling of long-term vegetation dynamics. We aim to link biological processes across scales to understand complex patterns in vegetation.

A common interest within the Group is the role of spatial and temporal heterogeneity in determining the response of plant communities to environmental conditions and, in particular, to global climate and atmospheric change. By predicting what may happen to plant communities under certain conditions, appropriate management regimes can be established.

Ferns may be particularly sensitive to variation in moisture with global climate change.

HIGHLIGHTS

- Much of the public perception of global warming is based on the assumption that warming will mean drying because water will evaporate faster. Our work, showing a general decline in evaporative demand of the atmosphere has challenged that dogma and continues to attract a high profile amongst the international science community. During the year we helped organise a special forum on this topic at the Academy of Science and also extended the research by publishing a paper reporting that declining evaporative demand was also occurring in New Zealand. The general picture that has emerged is that on average, most places have become warmer and effectively wetter. (Roderick ML and Farquhar GD. 2005. Changes in New Zealand pan evaporation since the 1970s. *International Journal of Climatology*. In press.)
- The terrestrial vegetation of continental Antarctica is dominated by mosses and lichens. These organisms are poikilohydric, i.e. they survive frequent drying and re-wetting. As water is only available to these plants above freezing point, we need to know the microclimatic conditions in and around Antarctic moss cushions to predict their potential for carbon gain and growth. Using thermal imaging near the Antarctic stations, Mawson and Casey, we established that mosses in gravel beds warm faster than those on rock surfaces. Imaging studies of chlorophyll fluorescence upon re-wetting dried moss cushions revealed that the Antarctic endemic moss *Schistidium antarctici* recovers several times faster from drying than does the co-occurring, cosmopolitan moss *Bryum pseudotriquetrum*. This will affect the response of these two species to different cycles of drying, re-wetting, freezing, and thawing, and influence their relative responses to warming in association with global climate change.



The moss *Bryum pseudotriquetrum* from Mawson Station, Antarctica.