

Modelling the battle of the grasses

BEYOND the forest, in the grasslands of Australia's semi-arid and arid interior, the ecological balance could also be disrupted as carbon dioxide concentrations rise.

Dr Mark Howden of the Bureau of Rural Sciences is seconded to the Division of Wildlife and Ecology to model the effects of greenhouse warming. He says rising carbon dioxide levels in the atmosphere could change the dynamic balance between C3 and C4 grasses, with accompanying effects on animal species.

C3 and C4 grasses employ different photosynthetic systems. The C4 system, under the current climatic regime, tends to use water more efficiently. An example of a C3 grass is kangaroo grass (*Themeda triandra*); an example of a C4 grass is wallaby grass (*Danthonia richardsonii*).

Howden says a simple competitive index predicts the existing distribution of C4 and C3 grasses. The current line of demarcation – where C4 and C3 grasses are equally represented at the species level, but not necessarily in abundance – runs across the continent at the latitude of Balranald in south-western New South Wales.

North of this line, C4 species become increasingly dominant, with C3 grasses a common component of grasslands as far north as the mulga lands of Queensland, where winter rains allow them to compete. Conversely, C3 grasses are more common south of Balranald, and there are few C-4 species around the latitude of the Victorian coast.

Some previous studies suggest that the doubling of carbon dioxide levels expected in about 100 years from now would result in dominance of the whole of Australia by the C3 grasses due to increased photosynthetic rates. This would have enormous consequences for biodiversity conservation and agriculture. But other studies which have looked only at warming by itself suggest that C4 grasses will just become slightly more dominant in the southern parts of the mainland.

Howden used the predictive competition index in studies which combine both the effects of increased carbon dioxide and the warming which is expected to accompany these increases. These studies suggest that C4 grasses will become slightly more



Bandicoot grass (*Monachather paradoxa*) is a C3 grass. Differences in the photosynthetic systems of C3 and C4 grasses will influence their distribution in response to rising carbon dioxide levels in the atmosphere.

dominant, with the current distributions of C3 versus C4 grasses moving about 250 km southwards. The full impact of such changes needs further study but there are likely to be implications for conservation and agricultural production.