Grazing strategies give farmers an edge in biodiversity

Although millions of hectares of native pasture are part of livestock production enterprises throughout Australia, relatively little is known about the value of these pastures to the conservation of native biodiversity. An ongoing research project involving the CSIRO and the Victorian Department of Sustainability and Environment is shedding some light on the influence of native pasture grazing strategies on native plant, bird and reptile diversity.

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for CSIRO SUSTAINABLE ECOSYSTEMS

At a glance

- Much still is unknown about the relationship between biodiversity and the management of native pastures.
- Native pastures provide farmers with a valuable source of feed for livestock and can play a key role in natural resource management.
- Many wildflowers, native grasses, birds and reptiles are frequently found in and around native pastures.
- The highest and lowest diversity of plant species was recorded in continuously managed native pastures, suggesting grazing management strategy by itself is not important for determining plant diversity.
- Fertiliser management can be more important than grazing in determining the diversity and composition of native plant species within pastures.

Adopting rotational grazing practices can give farmers who have integrated native pastures into livestock production enterprises improved flexibility to implement and achieve biodiversity conservation goals.

This is one of the preliminary findings of a research project that has been focusing on the impact of grazing strategies on native biodiversity.

Arthur Rylah Institute for Environmental Research (Department of Sustainability and Environment, Victoria) and CSIRO Sustainable Ecosystems scientists have been examining the interactions between biodiversity and the management of native pastures on 24 farms on the grazing lands of the Murray–Darling Basin in south-east Australia.

The properties, located between Cowra in the central-west of New South Wales and Alexandra in central Victoria, include native pastures that are managed using either rotational grazing or set-stocking.

Influences on diversity

There are about three million hectares of native pastures on the south-west slopes of the Murray–Darling Basin — most used and managed for sheep production but their value to the conservation of native biodiversity is not well understood.

Researchers set out to examine whether animal and plant diversity in pastures is more strongly influenced by paddock management such as grazing strategy and fertilisers than by landscape-scale factors including native vegetation cover.

A key aim of the research is to understand the links between grazing management, native pasture structure (which includes the height of pasture, cover of litter and arrangement of tussocks and shrubs) and how birds and reptiles use the pastures. This will help establish whether the prevalence of birds and reptiles in native pastures is influenced by how different grazing management regimes modify pasture structure.

Rotational grazing focus

In particular, researchers have been examining how rotational grazing affects biodiversity compared with more traditional set-stocking grazing management strategies.

Rotational grazing usually provides more 'rest' days than 'graze' days compared with set-stocking or deferred grazing.

Value of native pastures

Native pastures consist of a dominant perennial native plant and generally never (or not recently) have been sown to pastures or crops.

Native pastures provide a valuable source of feed for livestock and can play a key role in natural resource management.

The recent severe drought has highlighted the value of quality native pastures, most of which can regenerate quickly after relatively small amounts of rainfall. This quality is likely to become even more important if seasonal rainfall becomes increasingly variable or parts of the landscape become drier and more arid due to climate change.

Native grasses also play a major role in maintaining ground cover and protecting against soil erosion and can help control salinity by reducing groundwater recharge.

Preliminary results

Researchers established a series of paddock sampling plots on the study properties to gather data relating to birds, reptiles and plants, soil, vegetation and habitat complexity. Paddock and farm management data were also collected.

Even during the 2006–2007 drought many wildflowers, native grasses, birds and reptiles were frequently found in and around native pastures.

Native pastures are important for biodiversity — paddock surveys showed they were host to 16 reptile species, 77 bird species (53% foraging in pasture) and 156 native plant species.

Reptile abundance

More reptiles tended to be in sites with tree cover, although this was mainly due to the abundance of three species of skink.

In contrast, legless lizards *(Delma inornata)* were collected from many sites but tended to be most abundant in open pastures.

Although slightly more reptiles were observed in rotationally grazed plots, reptile abundance and diversity were not obviously related to grazing management.

Bird surveys

Seventy-seven bird species were recorded across the 24 study properties (each property had two survey sites, one in open pasture and another within pasture with a mature tree overstorey). Researchers counted 1876 individual birds in just 192 20-minute surveys.

The most common species were the white-plumed honeyeater (203 individuals), white-browed woodswallow (114), superb fairy-wren (111), yellow-rumped thornbill (108), eastern rosella (100), dusky woodswallow (81), Australian magpie (76), willie wagtail (71) and striated pardalote (61).

Sixty-nine species were recorded in rotational grazing sites (863 individuals) and 64 species in the continuously grazed sites (1113 individuals).

Ground-foraging birds

Native pastures are an important source of food for many bird species: 41 species (372 individuals) were observed foraging for food. Although some woodland birds only forage in pastures with some tree cover, many other species forage actively in open pastures.

There tended to be more bird species recorded per survey in continuously grazed sites but this difference only occurred where trees were present.

Twenty-nine bird species were recorded foraging in the rotational grazed plots (147 individuals), the most common being the superb fairy-wren (27), Australian pipit (23), southern whiteface (12), yellow-rumped thornbill (11) and the Australian magpie (11), while 31 species foraged in the continuously grazed plots (225 individuals), commonly the superb fairy-wren (38), Australian pipit (30), Australian magpie (25) and willie wagtail (14).

Most foraging occurred on short grass (less than 100 millimetres) rather than tall grass (more than 100mm) — very few birds that specialise on longer grass were recorded. The surveys were carried out during drought when there were very few tall grass patches — on average across all sites only 5.5 per cent of pasture was taller than 50mm.

Bird species requiring tall grass patches are rare in these landscapes and overgrazing during drought might be one contributing factor for their decline.

Ground layer plant diversity

Despite drought, 156 native and 97 exotic plant species were observed on the one hectare plots. On average about 17 native and 15 exotic plant species were observed.

The richness of plant species (native and exotic) did not vary among grazing management treatments although it declined with increasing soil nutrient availability (particularly available phosphorus and soil nitrate) and with stocking rate and rose slightly in plots with tree cover.

A key aim of the research is to develop an understanding of the links between grazing management, native pasture structure and how birds and reptiles use the pastures.

Ian McCann

Ground forager: *The Australian pipit was among the most common bird species recorded foraging for food in the study sites.*

Importantly, the highest and lowest diversity of plant species was recorded in continuously managed native pastures, suggesting grazing management strategy by itself is not important for determining plant diversity — other factors such as fertiliser management and livestock grazing intensity are likely to be more important factors.

But within rotationally grazed properties there was a relationship between native plant richness and the ratio of rest days to grazing days — suggesting plant diversity is maximised at intermediate levels of rest, consistent with ideas of intermediate disturbance.

One possible explanation for this is that diversity is limited when rest periods are short due to the absence of those species unable to tolerate frequent grazing and limited under long rest periods due to a

Geoff Brown, Victorian Department of Sustainability and the Environment

Wildlife wonder: *Legless lizards (*Delma inornata*) were collected from many sites in the biodiversity surveys. Reptile abundance and diversity were not obviously related to grazing management.*

Grazing strategies: *Native pastures have been integrated into many sheep production enterprises in the Murray–Darling Basin. Researchers are investigating the value of these pastures to biodiversity.*

build-up of litter and competitive exclusion by dominant plants.

Ground cover declined

Live plant ground cover declined with increasing stocking rate in both rotationally and continuously grazed pastures. Although most of the live cover during the survey period was perennial, average cover ranged from 0.5–70%.

Rotationally grazed pastures, on average, did not support more cover of perennial plant species — a key expectation from previous research.

The results of previous research suggest perennial cover should be favoured by the increased rest periods provided by rotational grazing. The absence of such an effect in this study could suggest rotational grazing has not been implemented for long enough on the properties (pastures were rotationally grazed for 5–11 years).

Influences of the past

Owing to the prevailing dry conditions there have probably been few rainfall events during the past 10 years sufficient for substantial perennial plant establishment.

So, the current abundance of perennial plants in these pastures might reflect past management rather than potential densities under current grazing regimes.

Re-sampling the plots during the next 3–5 years will be essential to resolve these issues.

Grazing management strategy by itself is not important for determining plant diversity.

Grazing strategy and biodiversity

This study has demonstrated that biodiversity values of native pastures can be high regardless of grazing strategy and it appears that rotational grazing might not offer direct benefits over conventional grazing methods in terms of biodiversity conservation outcomes.

But rotational grazing, which varies considerably in its application, can give farmers better flexibility to manage native pastures and by doing so enable them to achieve conservation goals more readily.

In particular, rotational systems with intermediate rest periods (90–120 days) between grazing events of 3–4 days offer potential benefits for the management of native pastures and might in the long-term produce better pasture structure and cover.

Early results of this study also confirm the findings of other research — that fertiliser management and stocking rates are the main determinants of the richness of native plant species within pastures — both factors can modify the composition of the vegetation significantly.

Intensity and biodiversity

Retaining native plant diversity in pastures will depend largely on the level of intensification. As intensification increases, biodiversity declines — this is particularly apparent where superphosphate is used to increase soil nutrients to maximise productivity (see Figure 1).

As soil phosphorus increases, the range of native plants decreases. Managing for maximum productivity tends not to suit native plant species.

Adopting more strategic grazing and concentrating fertiliser on the economic parts of the landscape generally will produce better economic and biodiversity outcomes than applying fertiliser on native pastures.

Another implication of this research is that because plants and animals respond differently to different grazing management systems it is important to have a diversity of such systems in place on a landscape scale to promote increased biodiversity.

Future applications

The final findings of the project will have implications and potential applications for a range of stakeholders, including graziers, agricultural and biodiversity extension officers, landcare co-ordinators and catchment management authorities.

The results might help researchers to develop models to predict the influence of grazing practices on plants, birds and reptiles, relative to other property and landscape features such as rainfall, slope, soil fertility and tree cover. Results also will be used to develop management guidelines and advice for extension and incentive programmes targeted toward conserving biodiversity values in grazed native pastures.

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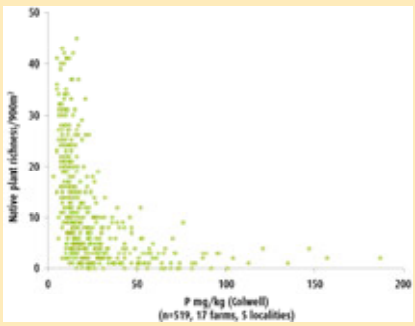
FIGURE 1 Plant richness and phosphorus



* These 519 phosphorus measurements were taken using the Colwell extraction method on 17 properties in five areas on the inland slopes of central Victoria — part of the study area.

Source: Arthur Rylah Institute of Environmental Research.
Illustration: Kondinin Group.