Management issue 9: Impacts of livestock grazing in riparian zones — can they be reversed?

By Amy Jansen and Ian Lunt

Many studies have shown that livestock grazing has negative effects on the function and biodiversity of riparian ecosystems (e.g. Fleischner 1994; Belsky, Matzke & Uselman 1999). We have done a number of studies in the riparian zone of the Murrumbidgee River in western New South Wales, showing that grazing and associated land management practices have had negative impacts on ecological condition (Jansen & Robertson 2001a), terrestrial bird communities (Jansen & Robertson 2001b), wetland frog communities (Jansen & Healey 2003), ant communities and seed predation rates (Meeson, Robertson & Jansen 2002) and herbaceous plant communities (Jansen & Robertson 2005).

While it is often necessary to exclude grazing from riparian zones to achieve any restoration of their function and biodiversity (e.g. Thompson et al. 2003), this is not always possible. It also may not be necessary, particularly in areas of less intensive grazing. Our collaborators, State Forests of New South Wales, decided to implement rotational grazing on all of their leasehold riparian river red gum forests. They proposed that low levels of grazing, for only a part of the year, would not cause any additional impacts on these floodplain forests, and may actually aid in controlling weeds and promoting the growth of native perennial species. We worked with State Forests to establish experimental areas within several forests to test this idea. Two experiments were established: a short-term, large-scale one across several forests on the Murrumbidgee and Edward Rivers, and a long-term, small-scale one in Millewa Forest, on the Edward River.

In both experiments, grazing exclusion plots and unfenced plots were set up to compare the effects of different grazing regimes with recovery from grazing in previously continuously grazing areas. We examined effects on herbaceous plants in both experiments, and also on ant communities in the large-scale experiment. Plant communities were sampled using quadrats, with cover of all herbaceous species recorded, while ant communities were sampled in small pitfall traps, with the ants collected after 48 hours.

Large-scale experiment

This experiment was established in 2001, with five fenced and unfenced plots (each 1 hectare in area) in each of three forests. Plant and ant communities were assessed in spring of each year until 2004 (except 2002 during the severe drought). Figures 1 and 2 show plant and ant community ordinations at one of the sites (results for all three sites were similar). Each point represents a plot, fenced or unfenced, and plots with similar communities are close together in the figures while plots with very different communities are far apart. These figures show that while there were changes from year-to-year in the plant and ant communities, no differences developed over time between the fenced and unfenced plots at any site, for either plants or ants. It seems likely that the stocking rates adopted by State Forests for these sites, and particularly the extremely low stocking during the drought in 2002, may be so low that there is no difference in impact between grazed and ungrazed sites.

Figure 1. *Plant communities in fenced and unfenced plots in Cuba State Forest.*

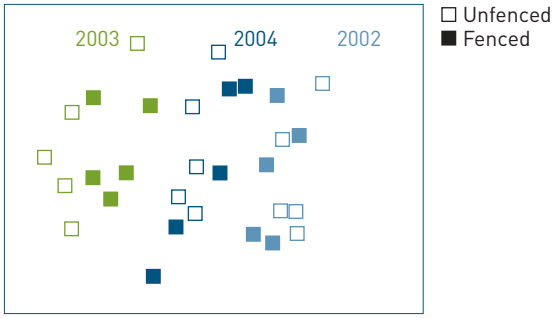
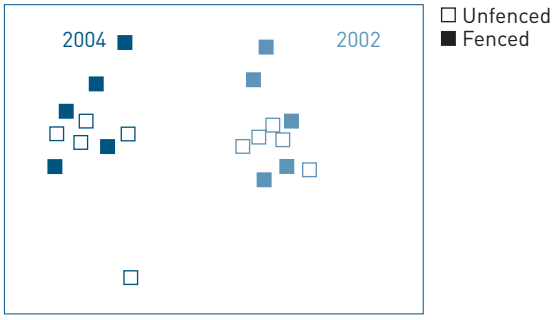


Figure 2. *Ant communities in fenced and unfenced plots in Cuba State Forest.*



In autumn (Photo 1, left), grazing impacts on vegetation cover outside the fence are evident. However, by the next spring (Photo 2, right), these effects have disappeared. Photos Amy Jansen.

Long-term experiment

This experiment was established by NSW State Forests in 1990. Fifteen paired fenced and unfenced plots (each 10 m x 25 m in area) were established in different parts of Gulpa Island State Forest. Plant composition was assessed each spring in six of the following 12 years (until 2002). Figure 3 shows the plant community ordination over eight years from the beginning of the experiment (plant communities were sampled again in 2002 but, due to the drought, were off the scale of this plot).

As was found in the short-term experiment, plant cover and composition varied greatly between years, but we found little impact from excluding grazing stock. In one year, the cover of annual species was slightly (but significant statistically) lower in the grazed plots than in the ungrazed plots (67% versus 78%), and in another year, there were slightly more annual species in quadrats in grazed than ungrazed plots (5.4 spp. versus 4.2 spp.). Both of these effects were very minor. Similarly, species composition differed significantly between grazed and ungrazed plots in two of the six years, but this was due to relatively small differences in the abundances of common exotic annual species, with species such as *Avena barbata* and *Bromus diandrus* being more abundant in ungrazed plots and *Vulpia* species being more abundant in grazed plots. Importantly, all of these small differences were transient. We found no evidence that grazed and ungrazed plots were becoming more different over time, as we would expect if ungrazed plots were slowly but steadily recovering from previous stock grazing.

The lack of responses to grazing exclusion could be due to a number of factors, including low stocking levels, dry conditions in many years, competition from dense stands of *Eucalyptus camaldulensis*, the degraded initial condition of the experimental area, and shortages of seeds of native species. A seed bank study at the same sites by Honours student, Sally Kenny, found that the soil seed bank did not contain seeds of many extra native species that weren't recorded in the standing vegetation (Kenny 2003).

Conclusions

The main conclusion that can be drawn from these results is that stocking rates and grazing regimes used in State Forests in floodplain forests in the Riverina in recent years are unlikely to cause any more degradation of riparian habitats than has already occurred. However, there is also no evidence that riparian habitats are likely to rapidly recover from past grazing-induced

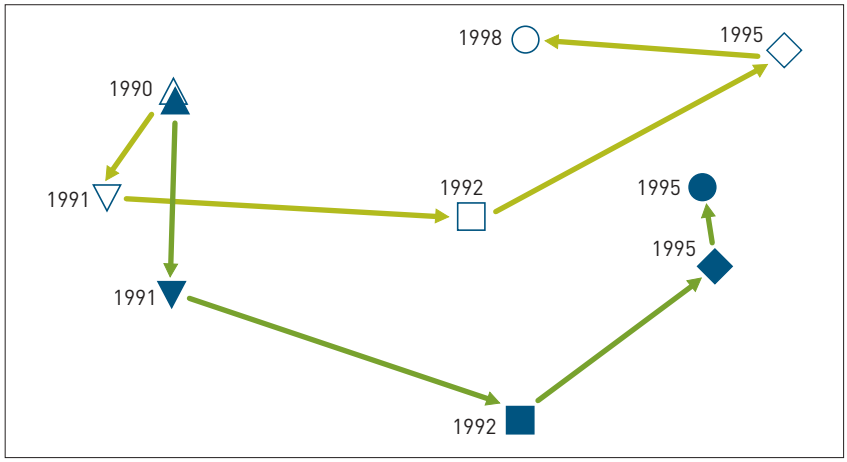


***Figure 3**. Plant communities in grazed and ungrazed plots in Millewa State Forest. Each point represents the average composition of 15 plots. Open symbols represent grazed plots and filled symbols represent ungrazed plots.*

damage, either under light grazing or with total exclusion of grazing.

However, these conclusions must be must be tempered by a number of issues. Firstly, much of the large-scale experiment was conducted in an abnormally dry (drought) period, and more dramatic vegetation changes may be expected in high rainfall periods. Secondly, the long-term experiment was in a relatively dry and highly degraded area where the understorey was dominated by exotic annual species. Different outcomes may have been found if the experiment had been conducted in more intact and more productive parts of the forest.

Thirdly, these findings apply to the floodplain area and not to riverbanks; grazing on riverbanks may contribute to long-term erosion and changes to instream ecosystems. Finally, the grazing strategy adopted by NSW State Forests had excluded stock from many sensitive parts of the floodplain, including wetlands and other key environmental assets. These assets may be far more easily degraded than the parts of the environment than we studied here.

Finally, the key output from this work has been the incorporation of findings into the *Stock and waterways: a manager's guide* publication, as well as a chapter in the *Principles for Riparian Lands Management* book. ■

For further information

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Further reading

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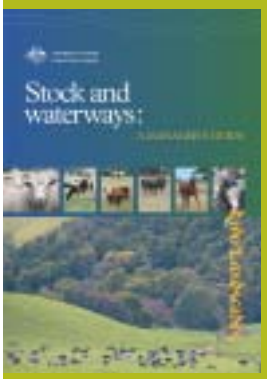
Photo Mike Wagg.

RESOURCES



Resources are available from www.**rivers**.gov.au