The Grass Experiment at The Pinnacle Nature Reserve

friends of the pinnacle

Summary of findings from surveys in Spring 2011

The grass experiment at the Pinnacle Nature Reserve aims to discover how to reduce the dominance of exotic grasses and herbs in grassy box-gum woodland ecosystems. It is a collaboration between a local community group, The Friends of the Pinnacle, Dr Don Driscoll, the Australian National University, and ACT Parks and Conservation Service. The experiment consists of ten sites, each with a fenced and unfenced set of five plots (Figure 1). Each plot has been allocated one of five treatments : control, burn, slash, crop, and sugar (see Box over page for description). The sugar treatment locks up nutrients in the soil, which other research has shown disadvantages exotic plant species. We use sugar to discover if nutrient manipulation is a useful approach for weed control at The Pinnacle. We use the other treatments as possible alternative methods to reduce nutrient levels in a cost-effective way. Plant surveys were completed in November 2011 after the first year of applying the treatments (except the burn treatment, which was not applied in 2011). Here, we summarize the first, preliminary, results to emerge from the Grass Experiment. The project is scheduled to continue into 2014.

Key Findings to Date

- Sugar treatments did reduce some exotic species, implying that nutrient excess is an important factor favouring exotic species at The Pinnacle Nature Reserve. So far, none of our other treatments had similar effects to sugar.
- Fencing to exclude herbivores had large effects on the percent cover of native and exotic species, with higher cover inside the fence. However, unexpectedly, there was a slightly higher number of native species recorded outside of the fence, and the occurrence of some native and exotic plant species increased.
- Many of the results showed trends that were not statistically significant, and other results are complex and species specific. There is a clear need to continue to implement the experiment to determine if trends become stronger over time, and to discover if alternative treatments can mimic some of the effects of sugar by reducing weed cover.

Figure 1. One of ten experimental sites. The 5 x 5m plot in the foreground inside the fence shows the crop treatment. We surveyed plant species in three $1m^2$ quadrats within each 5 x 5m plot (see Figure 2).

Comparing native and exotic species

Fences

While the *cover* of native and exotic species was lower outside of the fence, the *number* of native species detected was slightly higher (**Figure 3**). This could mean that some native species were easier to detect in the grazed areas, or that some native species benefit from grazing. Most of the grazing can be attributed to kangaroos.

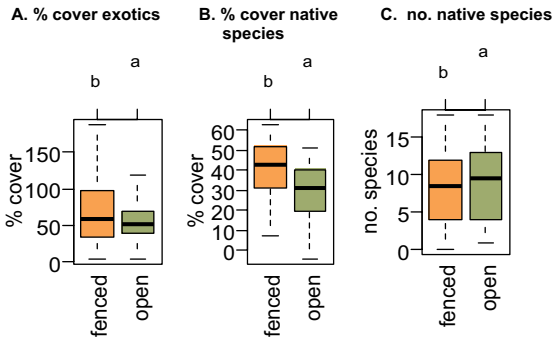

Figure 3. The number of exotic (A) and native species (B, C) differed inside and outside of the fence.

How to interpret Figures 3-6

After statistical analysis, statistically significant effects were plotted using box plots. These give the median value (horizontal line, half of data above this line, half of data below), 25th and 75th percentile (box, encompassing 50% of data points) and "whiskers" which indicate maximum and minimum values. Letters above each box plot* indicate which boxes are significantly different from one another; different letters indicate the results are significantly different. Then we use a comparison of the boxes to decide if the significant difference is important (bigger differences = more important).

**these post-hoc tests done using Tukey method*

Treatments

The percent cover of natives was lower in slashed areas (slash and crop treatments)(Figure 4A), but the number of native species did not differ significantly across treatments. There was a trend towards fewer exotic species in the sugar treatment (Figure 4B). However there was also some evidence that the number of exotic species increased in the slashed areas (slash and crop treatments) (Figure 4B). Possibly the open space created by slashing provides space for weeds to invade. It is not clear at this stage if this short term disadvantage will be counterbalanced by a long term decline in weed cover associated with nutrient loss.

Treatments: what are they?

Control: no treatment.

Burn: to be burnt annually, but no burn in 2011. The first burns were completed in July 2012.

Slash: vegetation slashed and removed in early winter and early summer.

Crop: slashed as for slash treatment, with a crop of sterile ryecorn applied to the surface in winter.

Sugar: 0.5kg/m^2 sugar applied every four months.

Figure 2. Surveying plants in three quadrats inside a slashed plot at the Pinnacle Nature Reserve. Within each 1m^2 quadrat we estimated percentage-cover of every species, and counted the number of sub-quadrats (out of 9), in which each species occurred. These two methods of counting led to contrasting insights.

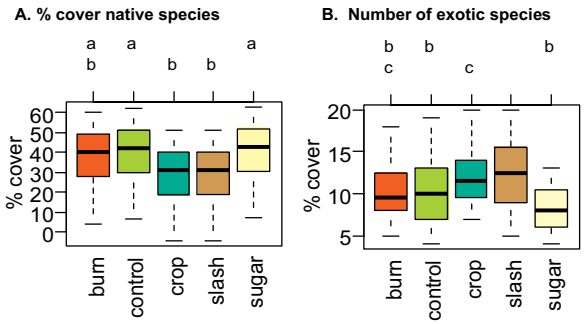

Figure 4. Treatments influenced the percentage cover of native species (A) (but not the number of native species), while the number of exotic species varied with treatment (B).

Plant species responses

Fences

Surprisingly, there were opposite effects of fences on individual species, depending on whether *counts* (occurrence in the nine sub-quadrats) or *percent* cover was used as a quantifying method. Five exotic species (only three shown in Figure 5) and one native species occurred more often outside of the fence (Figure 5 A-D). In contrast, using percent cover, three exotic and three native species (two of each shown in Figure 5) had higher cover inside the fence. While the amount of vegetation is reduced by herbivores, this appears to create space for more individual plants.

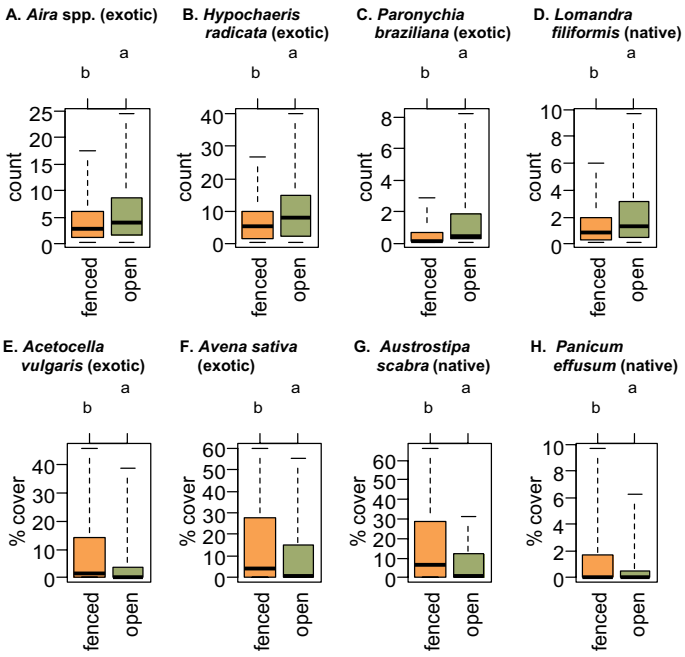

Figure 5. Count (A-D) and percent cover (E-H) of exotic and native species that had significant differences inside compared with outside the fence.

Treatments

The sugar treatment reduced some exotic annual grasses (Figure 6, A and B), but substantially reduced one native species (Figure 6 E), and may have eliminated a second native species (Figure 6 F). Sugar treatment may also have increased one exotic species (Figure 6 D). Slashing (crop and slash treatments) tended to increase some exotic species (Figure 6 B, C), and increased one native species (Figure 6 F). Although both crop and slash treatments were slashed (and in most cases plants showed similar responses to both treatments), there was an additional effect of the crop treatment on one exotic species (Figure 6 D). While Skeleton Weed (*Chondrilla juncea,* Figure 6 D) was more abundant on the slash treatment, it did not have higher abundance on the crop treatment.

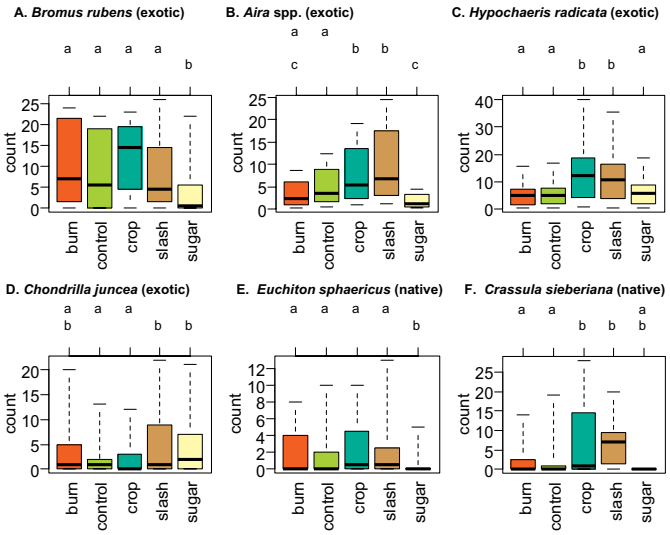

Figure 6. Responses of individual species to treatments.

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Hypochaeris radicata

We sprinkle half a kilo of sugar over each square meter of the sugar treatment

Conclusions

The reduction of weed species in sugar treatments is encouraging; suggesting that the logic underlying our experiment is right and that nutrient manipulation has the potential to reduce exotic weeds at The Pinnacle Nature Reserve. However, in addition to widespread sugar application being prohibitively expensive, we have found that some natives are also reduced, and some exotics increase with sugar application. These early results suggest that sugar application is not a restoration solution. Our crop and slash treatments show an initial increase in some exotic species. We need to discover if these trends continue over time, or if they reverse as nutrients continue to be slashed and removed. We also need to see how plant species respond to our burn treatment. We will continue to apply the treatments and complete our annual plant surveys over the coming years.

Acetocella vulgaris

How you can help

You can volunteer to help with plant surveys, slashing, or a broad range of other park-care activities led by Friends of the Pinnacle. Contact **Don Driscoll** (weedmenace@dodo.com.au) for more information about the grass experiment, or visit the Fotpin website; **www.fotpin.org.au** for information on all of our activities.

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Layout: Sue Cox

ACT Government

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Canberra Labor Club Group

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