Impacts of fire, thinning and herbivory on species diversity in Eastern Suburbs Banksia Scrub*.

by Belinda Pellow[2], Judy Lambert[1], and Geoff Lambert[1]

*Taken from an in press publication in the Journal Cunninghamia. "An evaluation of two management options to restore species diversity of Eastern Suburbs Banksia Scrub". Lambert J.[1], Lambert G.[1] & Pellow B.[2]

[1].North Head Sanctuary Foundation, PO Box 896, Balgowlah NSW 2094
[2.]Australian Museum Consulting, 6 College St, Sydney NSW 2010

Eastern Suburbs Banksia Scrub (ESBS) is an endangered ecological community which is thought to become senescent and lose species diversity in its plant cover in the long-term absence of-fire. However, the reintroduction of fire into remnant vegetation within urban areas, where this community often occurs, presents management challenges. In 2012-13 the North Head Sanctuary Foundation (NHSF), in partnership with the Australian Wildlife Conservancy (AWC), conducted a study on two treatments, the use of fire, and selective thinning, as tools for the restoration of senescent ESBS at North Head, Sydney.

Two peri-urban ESBS sites at North Head, Sydney NSW, scheduled for hazard reduction burns to protect assets, were surveyed pre-burn for their floristic attributes. Surveys were carried out in 7 x 7 metre quadrats, one third of which were fenced to assess predation by herbivores. Similar quadrats were established on adjoining unburnt sites from which dominant species were removed through selective thinning.

Prior to the burns, a total of 37 quadrats were allocated by a randomisation process across burn sites (31 quadrats) and thinning sites (5 quadrats). Within the central 5 x 5 metre core of each quadrat, four 1 x 1 metre plots were selected randomly and permanently tagged.

In the immediate post-treatment period, to prevent access by herbivores, fences were established around 10 burned quadrats and all five thinned quadrats. The wire mesh and star-picket fence design included a pegged skirt to deter burrowing.

Thinning was undertaken by removal of the dominant overstorey of *Leptospermum laevigatum* and *Monotoca elliptica* using chainsaws, with as little other disturbance to the site as possible. The process sought to approximate vegetation removal consistent with alternative fire risk management practices. Removal of the dominant species resulted in a nearly 100% opening up of the previous canopy, with only a few low-growing species and *Leptospermum* seedlings remaining.

Quadrat surveys were carried out prior to the burn and at six and 12 months post-treatment to record the following attributes:

- species identification;
- species count;
- classification as "Native" or "Weed";
- developmental stage (seedling, juvenile, mature);

- reproductive status when observed (flowering, seeding, etc.); and
- height in centimetres

Six months after treatment

Data collected six months after the burn showed considerable variation between quadrats. Mean canopy cover and median plant height were the same in thinned and burned plots. There was little difference in the number of plants (all or native) in fenced-burned versus fenced-thinned plots. The fenced-thinned plots were slightly more diverse.

Almost twice as many weeds were found in the thinned plots compared with those in the burned plots. There were also differences in the mix of native species present in burned *vs* thinned plots.

Twelve months after treatment

By 12 months after treatment much more plant growth had occurred. The plots that had been burned had more plants, more plant species and more native species compared with thinned plots. The diversity of species present in burned *vs* thinned plots were almost identical, however, analysis indicated a pronounced lack of overlap of species between burned-fenced and thinned-fenced plots. The median height of plants in the burn plots at 12 months was greater than the median height at 6 months. This difference was not seen with thinned plots.

Effects on ESBS species at 12 months

Twelve months after burning or thinning, the fenced-burned plots had a greater diversity of ESBS indicator species per plot than did fenced-thinned plots. There was also a greater abundance of ESBS plants in the fenced-burned plots than in the fenced-thinned plots.

Impacts of disturbance on weeds

Compared with the native species present, there were relatively few weeds found in both burnt and thinned plots. At both six and 12 months after treatment the fenced-burn plots had fewer weeds and fewer weed species than did the fenced-thinned plots. Despite removal of identified weeds after assessment of the plots at six months, diversity and numbers of weed species were generally greater at 12 months than at six months.

Herbivore predation

The differences between fenced and unfenced quadrats which had been burned were striking Figure 1 and 2. At six months after burning, quadrats with rabbit exclusion fences appeared to be rabbit-free and had significantly more plants than the unfenced quadrats and a slightly greater number of native species. Plant cover was twice as high in fenced quadrats. The median height of native plants in the unfenced plots was slightly smaller (but not significantly so) than those in the fenced plots. However, the frequency distribution of heights at 6 months were highly skewed and indicated a far greater proportion of seedling, juvenile or eaten-down plants in the unfenced plots at 6 months. After twelve months this effect was less pronounced.

By 12 months after fire, the fenced plots still remained rabbit-free. Fenced-burned plots contained almost twice as many individual plants as did the unfenced-burned plots. The number of native plant species present in the fenced-burned plots was 19% higher than in the unfenced-burned plots and plant cover was 160% higher. The species present in both types of quadrats were essentially identical.

These results show that there was a greater increase in floristic richness in the plant cover of burned quadrats than in that of unburned quadrats in which cover of the dominant species was removed by selective thinning instead of burning. There was a highly significant lack of species overlap, with the two treatments affecting emergence of different species in different ways. These results support the proposition that although plant cover of long unburnt ESBS may be species poor, species diversity is maintained in the soil seed bank.

One of the strongest messages to emerge from this small project is the importance of protecting recently burned or cleared areas from predation by rabbits and other herbivores. Plots in the fenced quadrats had more native plants and fewer weeds than plots in unfenced quadrats.

Figure 1 Difference between fenced and unfenced areas 12 months after the burn

Figure 2 Difference between fenced and unfenced areas 30 months after the burn