

Supporting Information:

Monitoring and evaluation of the restoration of a highly degraded remnant of the endangered ecological community Eastern Suburbs Banksia Scrub (ESBS)

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Question: To what extent may this ESBS site be atypical of that sort of community?

Answer: Each site of this community is different - some are relatively floristically 'intact' with relatively low levels of threatening processes whilst others (like this site at York Road) were at a critical level of degradation. The 'typology' of past impacts on a site will, among other factors, influence the resilience / natural recovery capacity of the site (eg. the level of soil seed bank depletion / presence). Sites subjected to 'lower level' of impacts will 'generally' be considered to have high levels of resilience - and traditional assisted natural regeneration techniques can be applied with generally satisfactory outcomes. At other sites, particularly those with a long history of high impact degrading activities, we may need to employ more creative approaches to restoration (to compliment the use of assisted natural regeneration).

The typology of historic and current impacts creates a resilience 'mosaic' effect on highly degraded sites, we believe. We certainly observed this at York Road. Some sections of the site had limited regeneration response, despite the application of similar restoration techniques which resulted in higher levels of regeneration in other areas on the site. Hence, we concluded, that the remnant ESBS seed bank varied across the site as a result of past land use impacts.

The high levels of natural regeneration (both ESBS plant species diversity and density) recorded at the site on York road where unplanned 'deep soil disturbance' had occurred was, we think, an important reminder for all of us implementing restoration in different ecological communities. It is important to consider the natural dynamics of different ecological communities and how these dynamics may influence the nature of the remnant native seed bank. We hypothesised that the high levels of ESBS regeneration achieved in the particular location at York Road may be able to be contributed to the possible presence of different 'layers' of the seed bank in this community - occupying depths in this community type far greater than those encountered on sandstone or shale soils (where traditionally we work with 'surface' seed banks primarily). Our thinking was influenced by consideration of the natural processes that operate within coastal deep soil ecological communities (eg. particularly dune 'blow-out' events and subsequent deposition of native seed material at a new surface 'depth', which may, in time, be covered again by another blow-out event). That was our interpretation anyway.

Anecdotal evidence from other remnant ESBS sites where deep soil disturbance has also been used indicated that, in those cases, the regeneration response was not significant. Similarly, use of deep soil disturbance on different parts of the York Road site are likely to not result in positive regeneration responses (due to the assumed mosaic of remnant seed bank remaining across the site).

Deep soil disturbance, as a restoration tool, may be a valid technique to use for this community in other locations, but the results I think will be influenced to a high degree by the nature and extent of past disturbance and activity on the site. The 'typology' of past impacts on a remnant / site is important. Sites which have a long history of intense/ high impact disturbance, particularly over a long period of time (eg. several decades) are likely, I believe, to have a similar 'mosaic' of *in situ*-resilience (quality of soil seed bank remaining) similar to the York Road site. Therefore, using the deep soil disturbance technique as a tool for facilitating regeneration from a potential deep soil seed bank on such sites is likely to be variable in its success.

Question: Is there a mechanism to bring regional and national funding priorities together?
A way forward?

Answer: Funding for the first few years of restoration on the York Road ESBS site was obtained from impact 'off-setting' funds supplied by the adjacent school development (which cleared a section of degraded ESBS adjacent to the York Road site). \$140,000 was for the removal of the exotic pines that had established across the site over many decades. Overall, the funding for restoration works on this site over 5 years was several hundred thousand dollars. Higher than anticipated ESBS species regeneration (diversity AND density) resulted, but it does raise a very valid consideration about the cost / benefit relationship of this approach. Still, we believe that the use of assisted natural regeneration techniques on the site were ecologically beneficial, and excluded the potential adverse impacts that can be associated with replanting / reconstruction techniques. The assisted natural regeneration techniques used on the site to date assisted in maintaining the genetic integrity of the site, and allowed management time to consider the careful approach to future 'higher level' restoration treatments when needed. It appears valid to be considering new restoration treatment options for the site now - but in a very cautious manner to ensure that no new threatening processes are introduced as a result. So, I think that the cost of restoration work needs to consider two components as these can have a long term influence on the cost effectiveness of a particular restoration treatment:

1. The 'tangible' outcomes / benefits (eg. an increase in native species density and diversity); but also
2. The less tangible benefits that can arise through the opportunity for managers to take a very more timely and considered approach to restoration of a highly degraded site (benefits arising from good risk management, essentially).

Poorly conceived and implemented restoration treatments (especially if they rely on the introduction / planting of plant material to a site) can result in the introduction of plant pathogens (eg. Phytophthora) which can have significant long term adverse impact on the restoration and biodiversity management objectives for a site. Phytophthora had been recorded within the adjacent Centennial Parklands area and the sudden death of most Banksia species on the York Road site within months (prior to restoration commencing) certainly made us sensitive to ensuring that the restoration techniques and approaches used didn't inadvertently contribute towards increasing the effect of such pathogens.

Question: Why were the pines removed at the site?

Answer: The pines were 'blocking' natural regeneration of ESBS species on the site whilst also reducing the viability of the existing remnant ESBS plant species. Hence, they were one of the most significant threatening processes present on the site (but not the only one).