Case study: Eradicating St John's Wort from a native grassland at Umbagong District Park

Site: Umbagong 'Inornata Reach' patch, is part of a listed temperate native Themeda grassland (BE04). It extends from a bitumen footpath (to the north of the patch) down to Ginninderra Creek. A small rocky area (**Fig. 1**) is used as the eastern boundary of Inornata Reach. Cocksfoot and other weeds have encroached on the western side of the desire line (behind the photographer), though there is also potentially recoverable remnant grassland in that area.

Fig 1: The rock patch bordering the Themeda grassland beyond. The desire line about where I'm standing.

Management issues:

1) The grassland is infested with St John's Wort (*Hypericum perforatum)*, *Verbascum virgatum*, Plantain *(Plantago lanceolata*) and in some parts (especially the margins of the footpath path and in an 8m wide strip along the riverbank) there are high concentrations of pasture grasses like *Dactylis glomerata* (Cocksfoot) and *Festuca arundinacea* (Tall fescue). Other weeds include *Sanguisorba minor* (sheep's burnet), *Chondrilla juncea* (skeleton weed) and *Hypochaeris radicata* (flatweed). Weed invasion is the main management issue covered in this case study but the other issues inter-relate.
2) Mowing either side of the footpath introduces weed seed but mower width is not excessive – unlike in some other areas of the park. However, it is mown too short and there is lots of exposed soil on path verges.
3) In recent years, park users have started accessing the river via desire lines. These may have started as kangaroo trails. Two were successfully blocked off before much damage was done. Of the two remaining tracks, one goes straight downslope through the grassland, is relatively steep and eroding. As well as erosion, it allows weed incursion and more worrying, has multiplied into lateral tracks into the grassland.
4) There has been rock depletion due to park users throwing rocks into the creek for fun. As this is legless lizard habitat it is another consequence of the more concerning desire line.

5) Bitumen paths (alkaline) change the pH of surrounding soil which, although nothing can be done about this, may favour non-native species adjacent to the path (Buchanan 1989:45-47). pH tolerance must be factored in when trying to establish native grasses nearer the path.

Management strategies for Issue 1): St John's Wort

Inornata Reach is one of our designated 'priority' patches and it is fairly well defined.

To manage the grassland, the landcare group generally holds one or two summer working bees each year targeting St John's Wort (SJW), also removing Verbascum, fleabane and nearby African Love Grass (ALG) in the process. This approach is somewhat 'crisis management'. However, the reason this strategy has been adopted is that Umbagong, covering 66 hectares, has so many remnant native grasslands that the small number of active members is not sufficient to manage them all.

The 'crisis management' method prevents a larger area of quality grassland from deteriorating and succumbing to the more serious invasive weeds like ALG. SJW is included among these serious grassland invaders and this style of management is used to combat it. Volunteers wander over the patch, pulling the SJW (removing roots where possible) or cutting the visible yellow flower stems and bagging seedheads. This successfully reduces seed set and is critical in preventing serious weed invasion of the grassland as a whole. However, while it prevents the situation worsening (or slows it down), the long term effect is not persistent as the following year we are back to square one.

Starting a Bradley Patch

The Bradley Patch in this case study began at the Rocky area on the edge of the patch (**Fig. 1**). At the time it was extremely weedy but it also boasted a tangle of *Glycine tabacina* plants in and around the rocks. Whenever the group held a working bee in this patch, one person invariably started at the rocks. Having removed every bit of SJW in that spot, they joined in the weed seed removal exercise across the broader patch.

According to the Bradley Method, the rocks were the wrong place to start a patch. It wasn't the highest quality area of the grassland - more likely the lowest. However, it had the advantage that it could easily be found again to do follow up and rocks sometimes hide interesting remnants like the abundant Glycine.

Apart from Glycine, the only other native initially in evidence was spear grass (*Austrostipa scabra*), only a small number but its presence suggested it may have been the original dominant grass in this dry spot. A little further downslope was a drift of *Xerochrysum viscosum* from a very successful biodiversity planting by Rosemary Blemings.

The weeds were abundant and included SJW, Verbascum, cocksfoot and plantain. Unfortunately there is not a 'before' photo as it was not a deliberate experiment. Every weeder has their own idiosyncrasy and a personal way of doing things, so the patch was just a subset within the overall working bee. With regards timeframe, the patch has been revisited annually in summer for about ten years.

Method

Working bees organised in this area focussed on 'St John's Wort removal', so this was the first weed tackled at the patch. All SJW in the rock patch was removed, from the obvious flowering or seeding stems to the tiniest visible fragment. This was done by hand weeding using a narrow trowel, mini hand mattock and fingers to follow lateral roots as far as practicable. Later the preferred tool changed to a weeding knife. After removing the SJW, loose seed was harvested from the spear grass (conveniently seeding at the same time) and this was scratched into the soil disturbed by weeding. Disturbed soil was tamped down. Being a dry area, there was some 'natural' bare soil. Leaf litter was scattered and weeds were upturned over bare and disturbed soil.

Our working bees in that area were infrequent, once, at most twice a year, duration two hours, but each time the group worked there, this patch received its annual follow up.

The SJW became less rampant after the first two years and attention was extended to other weeds in the patch. There were some large cocksfoot grasses by the path upslope, raining weed seed down on the patch. These were removed and again spear grass seed was scratched into the disturbed soil. The other main weed, Verbascum, was also tackled,

removing as much of the tap root as possible. A weed that was deliberately not removed was plantain. It seemed the lesser of the evils, easily removed and it was keeping a bit of soil cover while waiting for natives to (hopefully) grow. As the SJW and other weeds started to weaken, the patch also extended in area, a little out beyond the rocks: up to the footpath, east to the desire line, west to the main Themeda patch and downslope to the river.

Result

The last two years or so, this patch around the rocks has been completely SJW free, with only occasional Verbascum seedlings emerging. Finally, this year all the plantain (*Plantago lanceolata*) was removed as well.

The dominant grass is now spear grass instead of cocksfoot. Spear grass seed sown a few years ago has now matured into plants that yield yet more seed that can be sown on disturbed soil downslope. *Themeda triandra* is also present but less dominant. Red leg (*Bothriochloa macra***)** and *Austrodanthonia* are starting to appear (both from random pinches of nearby seed that was scattered on occasion). During an Inornata Reach biodiversity planting, some members planted *Chrysocephalum apiculatum* which has survived. *Xerochrysum* is colonising up the slope and has reached the rocky area. There is a clump of *Lomandra filiformis*. *Wahlenbergia sp.* and (a single) *Tricoryne elatior* have miraculously appeared as has a rockfern. In the patch extension zone there is red leg, hairy panic (*Panicum effusum*) and cotton grass (*Digitaria brownii*).

The rocks were once 'the worst' area of Inornata Reach. It's a dry site and there's still exposed soil but weeds are not re-growing and it's now perhaps one of the best quality spots in the grassland (**Fig 1**). Unlike the rest of Inornata Reach, SJW has been completely eradicated in this limited spot. It's possible there may still be SJW seed in the seedbank – time will tell if it ever germinates. The occasional SJW is also found in the patch extension zone.

This achievement has taken a long time in years, but very little time in hours (given the infrequent working bees in that area). Had this strategy been used by the entire group instead of one person, might St John's Wort be completely eradicated in this whole area by now?

Another positive result is psychological. Landcarers can easily become demoralised by the never-ending weeds, forever encroaching and multiplying. We always seem to be on the back foot, always in crisis mode, repeating the same exercise we did the year before. However, watching a weedy area recover and thrive is magical. No matter how small scale, it feels like a victory, and gives you the knowledge and confidence that the bush can be brought back.

Plant Morphology and Reproduction

Most people who weed SJW know it has rhizomes and many plants above ground are actually connected under the soil. Sometimes inconspicuous plants only have thin roots (some are seedlings, others are stems attached to a lateral root of the parent plant). However some of these inconspicuous leaves have a surprisingly thick taproot underground, presumably storing energy to send up flowering stems the following year.

When we roam about a grassland pulling up SJW, we are attracted by the visible plants displaying yellow flowers that will shortly seed and we inevitably leave behind smaller plants without flowers, hidden under the grass (**Figs 2 & 3**). When we pull up a flowering crown, any lateral roots that break off will become a new plant, so our single plants multiply if we don't systematically remove all visible fragments of SJW from the area, and follow up in the same spot each year.

According to WeedsAustralia, mature plants can produce 30,000 seeds and seeds can remain dormant in the soil for 10 years before germinating (Campbell *et al*. 1995), though the majority of seeds germinate within the first few years (Parsons & Cuthbertson 2001). (Reference: https://weeds.org.au/profiles/st-johns-wort).

Seed capsules disperse when they stick to animal fur. They can also be moved long distances by water and machinery and over short distances by wind.

Fig 2: inconspicuous above-ground leaves are easily missed when poison dabbing or removing seedheads but they can be connected to a substantial root system (this root was weeded in February).

Fig 3: St John's Wort remaining between native grasses after 'crisis management' weeding (photo taken in January)

What can we learn from this?

Why does the usual landcare method of removing plants in a grassland (mostly in summer when visible yellow flowers appear) not work on SJW? I have worked in many landcare groups since the 1990s and this is how each group I've worked for has weeded SJW (sometimes dabbing rosettes with glyphosate in spring as well). [1]

The 'crisis management' method of weeding SJW is carried out in high-quality native grassland (not in weedier areas). Other than this, it does not conform to 'The Bradley Method', which says that random removal across a large patch should only be done if your quality area contains *rare* individual weeds or scattered groups of *4 to 5 weeds*. The level of infestation we are seeing at Inornata Reach (and at many other landcare group SJW management areas) is more serious than this.

Where weeds are established in otherwise quality bushland, the Bradley Method involves identification of core high-quality bushland and systematic weeding out from this core in a strip about 3m deep, towards weedier areas.

Other characteristics of the Bradley Method are:

> "Remove **all species of exotics** from areas weeded. **Never single out a particular weed species** as your pet hate, forgetting all others in the pursuit of it..." (Bradley, 2002: 38)
>
> "[Concentrate], not on eradicating weeds, but on enabling native plants to grow, unhampered, in the environment that suits them best … **direct your mind always, not to the slaughtered weeds, but towards the growing natives**." (ibid:16)
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> "Weed control means just killing weeds while **bush regeneration means growing a native community**. This is an important difference between bush regeneration and weed control programmes." (Buchanan 1991:7)

The 'crisis management' method is therefore very different to the Bradley Method. The value of 'crisis management' is not disputed. It is vitally important for keeping the most serious invaders at bay in high quality areas and for spot weeding to prevent mowers spreading weeds throughout the park. But it is only part of the solution.

Ultimately, removing *all* exotic species is important for success. Non-native species can manipulate nutrient cycles, alter the soil biota and emit chemicals that suppress native plants and inhibit seed germination. For example, Cocksfoot Grass, a weed of this grassland, secretes toxins from its roots to suppress other plants (Li et al 2016). SJW is known to produce poisons toxic to stock to prevent grazing and while I was not able to locate a study about it, it may well wage chemical warfare on plants as well. If we are able to recover the native soil biota by removing all exotics we might have longer-term success.

St John's Wort in particular cannot be defeated by the crisis management approach, as even if we prevent those 30,000 seeds per plant from building up in the soil, by failing to remove every fragment of SJW we can see in a given spot all we are doing is allowing the plant to reproduce vegetatively.

A two-pronged approach to St John's Wort control

For St John's Wort to be eradicated in high quality grassland we need to incorporate the Bradley Method into our methodology. Harvesting St John's Wort seeds as damage control is important to reduce it in the seed bank and prevent new plants from germinating, but simultaneously, any grassland patch we work on should have at least one core patch where the Bradley Method is carefully followed. This could either be done by dividing the working bee into two timeslots or into two teams: one working on the Bradley Patch and the other working on the broader 'damage control' area. There are always some who are less interested in detailed work or who are less physically capable of such work

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[1] Note Parkcarers (not landcarers) are also allowed to spray **fluroxypyr**, a selective broadleaf herbicide that doesn't kill monocots (eg, grasses). Spraying is appropriate in some cases, eg, to prevent spread of weeds by mowers or where an infestation is adjacent to high value grassland. However, it's debatable whether spraying native grassland is desirable. Spraying is inconsistent with the Bradley Method as native broadleaf forbs can also be killed and because spraying targets a specific weed and does not remove all exotics. Spraying also means landcarers can get away with not acquiring intimate knowledge of species at their site, yet this detailed knowledge is what sets landcarers apart from traditional broadscale weed controllers whose methods create disturbance, sometimes doing more harm than good (see 'Bringing Back the Bush').

(eg, knee or eyesight issues). By incorporating Bradley patches, over time the patches will expand and the damage control area will shrink, which may actually reduce our workload, or enable us to extend into other areas.

I therefore propose a two-pronged approach for restoring our native grasslands:

1) spot weed (or herbicide) and deseed the serious invaders at priority grassland sites and in seed source areas (eg, mowing areas, or sources of wind-dispersed weed seed, such as fleabane).

2) For more long-term gains, we should add a second prong and each time we work in a priority grassland we should spend part of the time on a 'Bradley patch', doing follow up and extending it.

This second prong method has the added advantage that, because all non-natives have to be removed, landcarers are forced to enhance their plant identification skills of both natives and exotics. Concerns have been expressed that volunteers are not botanists and don't have the level of identification expertise required. To address this, site-specific plant inventory lists for each patch can be prepared by more experienced members to assist those less experienced. See an example prepared for this site. It is continually updated as new species are found and it includes a comments column on distinguishing lookalikes, weed removal techniques, etc (see Inornata Reach plant inventory document).

As well as improving identification skills, some other advantages of the Bradley method include:

- Landcarer morale – actually 'winning' ground instead of going over the same ground each year
- Observation skills - more closely observing what's happening at patch level, what works, what doesn't, what grows where, plant/insect relationships, etc.
- Gaining knowledge of a wider range of weeds, their vulnerabilities, competitive strengths and best removal tactics.
- 'Quality' patches to showcase, which come with their own species lists (both weeds and natives).

For newer recruits or volunteers less keen on detailed work, they will make a useful contribution even if they choose to confine their activity to the first prong method.

Recording Progress

First impressions are that the Bradley Method is a painfully slow and inefficient use of labour. However, the Bradley sisters found that after the initial weeding, the labour required dropped dramatically during the follow up phase. They recommended keeping records to correct the misperception that this method is inefficient (Bradley, 2002:17; 49-50), as did Buchanan (1991:233).

Ku-ring-gai Municipal Council compared the cost and labour hours over ten years of weeding two similar areas. The first area was weeded using 'traditional' methods (e.g., machinery, poisoning). In the other, minimal disturbance regeneration methods were used. In the first year, labour hours were significantly higher in the minimal disturbance area. However, after the first year, labour hours substantially reduced and were at almost zero by the fourth. By contrast, the 'traditional' method encouraged weed re-colonisation and required an on-going maintenance program and had higher number of labour hours in every year except the first. The Council's graph indicates that over the 10-year period, the traditional plot required 31.7% more labour hours than the minimal disturbance area. Not only that but native species biodiversity was 100 in the minimal disturbance area but the traditionally weeded area had only 10-20 species (Buchanan, 1991: 233-234).

The habitat type in the Ku-ring-gai example is not given and probably wasn't native temperate grassland, but the same labour pattern is likely to apply: high initial labour for the Bradley Method with rapidly decreasing effort during follow-up, while spot weeding to remove visible flowering plants requires higher on-going maintenance. It is unclear whether native species diversity would be affected.

Because initial progress is so slow, it is important to record volunteer hours spent on the 'Bradley' Patches. This will help quantify whether or not it is time well spent. The table used at Umbagong is in the Inornata Reach Plant Inventory.

Management strategies for desire lines (**Issue 3)**

Management also needs to address park user threats via bush etiquette information explaining why people should stick to formed paths. Prompt action is needed to block them off before they get to the stage shown in **Fig 4**. This desire line runs through native grassland at the edge of the patch in this case study. We recently blocked it off with tree branches and printed a sign with a Landcare logo: "*Erosion Control Area. Alternative track 30m [arrow]. This area is critically endangered native grassland. Please help protect it by using formed paths*" (**Figs 5 & 6**). Longer term, quality signage might provide park visitors with more quality information about park values and how to preserve them.

Fig 4: Desire line down a steep slope through native grassland to the creek

Fig 5: 'Erosion Control Area' sign.

Fig 6: Tree branches and bark blocking off the track

References

Bradley, J. 2002. “Bringing Back the Bush”. Reed New Holland.
Buchanan, R. 1991. “Bush Regeneration”. TAFE, NSW.
Li, S., Z. Nie, Z & D. Zhang, 2016. “Competition between cocksfoot (*Dactylis glomerata*) and companion species: Evidence for allelopathy”, Field Crops Research Volume 196, Sept 2016, pp. 452-462.
WeedsAustralia website: https://weeds.org.au/profiles/st-johns-wort

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Accompanying documentation

Prepared to assist the implementation of Bradley Plots and to overcome barriers such as the need for a higher standard of plant identification skills.

1. Example of a site-specific plant inventory and a record keeping template
2. A summary of the Bradley Method applied to grassland
3. Know Your Weed: weed profile (template and St John’s Wort weed profile example)