Natural regeneration - case studies in bushland

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This Note looks at some case histories of natural regeneration in bushland remnants. Note 13 'Natural regeneration: principles and practice' and Note 16 'Natural Regeneration - case studies on the farm' should be used in conjunction with this Note.

The advantages

Natural regeneration in bushland has many advantages over natural regeneration in farm areas, however, both have important roles to play in restoring wildlife habitat on private land. The advantages of natural regeneration in bushland include:

- a larger degree of protection from climatic factors such as harsh sun and wind.
- a larger, more diverse, seed bank already in the soil, allowing a greater variety of trees, shrubs, grasses, herbs and groundcovers to appear.
- the presence of natural predators such as birds and gliders that help control the extent of insect attack.
- soil conditions which may be more favourable for seed germination and seedling growth. Germination in exposed areas may be impaired by compacted, unstable soils.

A number of factors, both natural and artificial, are believed to be involved in the process of encouraging natural regeneration in bushland.

The issues

The removal or reduction of livestock can encourage natural regeneration to occur by decreasing the grazing and browsing pressure on mature and seedling plants. The heavy hooves of stock, including cattle, horses, sheep and goats, can compact soil and destroy soil structure. These soil changes may prevent or restrict germination. The dung of these animals may also introduce weed species and increase soil fertility, favouring competitive weed species.

Weed control may help initiate natural regeneration by removing competition. Weeds can be very efficient at occupying spaces, particularly those that have been disturbed, and using up available resources such as nutrients, light and water. They can successfully outcompete native species in the 'race' to grow and colonise.

Pest animal control may be an important factor to consider when encouraging natural regeneration in your remnant bush. The most effective approach is to produce a control program and to involve your neighbours in the program. Refer to LFW Notes 24, 25 and 31. Care must be taken to minimise ***disturbance*** to bush areas and their wildlife. For example, ripping a rabbit warren may not be appropriate. Invertebrates may consume young seedlings when they are most vulnerable.

Fire may be used as an ecological tool for encouraging natural regeneration. It has played an important role in determining the composition and structure of much of Australia's vegetation. However, its occurrence in remnant vegetation is now often lacking. Fire can stimulate regeneration by removing competitive weed species, triggering seed release, stimulating flowering, breaking seed dormancy and cracking open hard seed cases. Many native plants have mechanisms to regenerate after fire. Rainforest can be damaged by fire. ***Smoke*** from fire can also trigger germination in some species and flowering in others. However, burning too frequently or at the wrong time can simplify understorey and cause local extinctions of plants and animals.

Microhabitats such as leaf litter, logs, crevices in rocks and depressions in the ground can supply small protected areas where seeds have a greater chance of germinating. Stable temperatures, increased moisture content, correct humidity and protection from the wind are important for seeds during germination and for the survival of small seedlings. Moss and lichen mats may also assist seedling establishment by providing a sheltered 'nursery' for seeds. Moss and lichen are important for their ability to bind bare ground, maintain soil moisture, provide a stratum in which seeds can germinate and to provide important habitat for many invertebrates.

The variability in seasons can play a vital role in determining when and at what rate natural regeneration occurs. Most seed germination occurs in autumn and spring when conditions are at their best. Natural regeneration may be more successful in 'good years' with

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above average rainfall when the soil is warm. Unfortunately, these conditions also encourage an increase in weed seed germination. Germination may fail to occur in a vegetation community during a ***drought*** and a ***flood*** may kill seedlings. However, some species, such as River Red Gum, respond to flooding which may initiate large-scale regeneration.

Succession plays an important role in the regeneration of vegetation. ***Pioneer species*** (the first colonisers) can include plants such as peas, dogwoods and wattles. These plants occupy an area very quickly and create an environment that is more favourable to other plants, such as eucalypts.

Wind and insects are essential for ***pollination*** and ***seed and spore dispersal***. Pollinators such as butterflies, wasps and native bees, allow flowers to become fertilised and, consequently, to set seed. Attract pollinators to your bush by maintaining a diversity of habitats including flowering plants.

The relationship between plant species is important in the regeneration of some native species. For example Cherry Ballarts (*Exocarpos cupressiformis*) seem to be partially ***dependent*** on various species ranging from native grasses to wattles. Their roots parasitize roots of other plants from which they obtain valuable nutrients.

Wildlife plays an important role in the processes of natural regeneration. Seeds may germinate after they pass through the ***digestive system*** of many species of birds and are passed out in their droppings. Attracting these birds back to your bush by encouraging diversity of habitats may assist regeneration. ***Perches*** have a role in seed dispersal by encouraging birds to stop, at which point they may produce droppings that may contain seeds. Ants can also play a beneficial role in ***seed dispersal*** and germination. Some seeds even produce ant attracting structures. By carrying the seeds around or taking them down their tunnels or other cavities in the soil, ants aid the dispersal and germination of a large number of Australian plants. However, some ants may take up to 100% of the year's crop of seed for food and nest building and this may prevent germination. Light raking of the soil during seed fall may hide sufficient seed from ants that consume seed. This ***disturbance*** action is usually carried out by native animals such as bandicoots, Lyrebirds and Mallee Fowl. However, many of these species are lacking from remnants, and light raking of the soil may replace this action. Attracting these animals back to your remnant is important action you could take in trying to return the balance of the bush. Seed dispersal can also be aided by wildlife by acting as a ***vector*** for movement. Spiky seeds can get caught in fur, skin and feathers. Attracting ***natural predators*** that feed on herbivores (grubs, caterpillars, crickets etc.) can help reduce attacks on seedlings as well as mature plants.

Case Histories

Case 1: David & Jean Edwards, "The Springs", McKillop (Mt. Evelyn). WET FOREST.

Method: "Bradley" method (i.e. weeding from the most intact areas towards more weedy areas) followed by selective replanting with indigenous, local provenance species. Bush mulching, allowing plants to seed and regenerate. Annual walk-and-weed to retain good areas where birds drop unwanted seeds (especially berries).

The property has springs which are the source of one of the tributaries of the Stringybark Creek. It includes a southerly slope which has probably ***never been grazed*** and is in good condition with mature Messmates (*Eucalyptus obliqua*) and Narrow-leaved Peppermints (*Eucalyptus radiata*), a sparse middle storey and small shrubs, grasses and herbaceous plants. Common Bird-orchids occur on several of the informal tracks. The sparse middle-storey is probably due to the slope not being ***burnt*** for a very long time - probably not since the 1920s.

At the time of purchase, in 1971, parts of the gully were covered with impenetrable mounds of blackberry up to ten metres long. A ***weed control program*** was initiated by spraying with accurate equipment at the optimum time of the year (between flowering and berry formation - usually between Christmas and New Year). This allowed the wet gully, with its Scented Paperbark (*Melaleuca squarrosa)*, Red-fruited Saw-sedge (*Gahnia sieberiana)*, Rush (*Juncus procerus)* and Coral Fern, to flourish. Annual spot-spraying across the property has maintained control.

On the south side of the creek, some mature Narrow-leafed Peppermints died following a Bell Miner (bird) -Psyllid (insect) infestation in 1981. This demonstrates a tip in the balance of ***natural predators*** and herbivores. The death of these trees opened up the forest to more light and allowed the growth of ***pioneer species*** such as Dogwood (*Cassinia aculeata*) as well as more flowering plants like Austral Bluebell (*Wahlenbergia gracilis*) and Creamy Candles (*Stackhousia monogyna*).

A similar result follows the deliberate removal of environmental weeds such as *Pittosporum undulatum*. David controls this species by frill-cutting and poisoning ("frill" bark with tomahawk and fill "cups" with herbicide). As it dies, *in situ*, and gradually drops its leaves, the ***ground layer*** and shrubs increase through natural regeneration.

Part of the steep gully was deliberately burnt with a hot ***fire*** on Anzac Day 1988. This converted a species-poor understorey to a riot of colour and diversity with wattles, Golden Bush-pea (*Pultenaea gunnii*) and numerous small flowering plants and creepers. Silver Wattle (*Acacia dealbata*) has since become dominant.

Every three or four years there is a big seed set on Cherry Ballarts (*Exocarpus cupressiformis*) and they grow, clustering around the Silver Wattles, which on this property, they seem to be ***dependent*** on. Jean successfully transplanted a very small Cherry Ballart and a young Silver Wattle a couple of metres apart into a cleared area.

Smaller understorey plants take much longer to establish, possibly because of ***competition*** from the grasses, or possibly because there is not such a great seed source nearby. Where small clumps of Rough Coprosma (*Coprosma hirtella*) and Tasman Flax-lily occurred, these have expanded. Some plantings from local stock has been done and some of these are now starting to self-seed and regenerate.

Another interesting form of natural regeneration which has occurred on the property over the last twenty years is the spread of tree ferns (mainly *Cyathea australis* but some *Dicksonia antartica*). This is possibly due to the ***spread of spores by wind*** and perhaps other vectors. In 1971 the tree ferns were confined to a thin line along the creek. Over time they have appeared in clumps in the gully above the springs. Where there was formerly an infestation of Holly (*Ilex aquifolium*) covering a couple of acres on the moist south-facing slope, and these have been removed, tree-ferns have taken their place in the wetter places.

And what are the pleasures and rewards of restoring the quality of bushland? Yellow-tailed Black Cockatoos which regularly fly low over the property in flocks of up to forty birds are now feeding on the hakea and banksia seed; rosellas feed on the Burgans; White's Thrush (Australian Ground Thrush) is seen occasionally in the damper, more dense parts of the property, as are antechinus; an Eastern Whipbird calls occasionally from the gully and many Swordgrass Brown and other butterflies enliven the summer months.

Case 2: Won Wron State Forest, South Gippsland. HEATHY WOODLAND.

Method: Fuel reduction burn resulting in regeneration of a greater variety of species.

Won Wron State Forest was burnt in a fuel reduction ***fire*** in autumn 1992. Three different sites were observed and the response was different depending on the fire ***intensity***.

The first site was a heathy woodland and the fire was ***hotter than anticipated with partial crowning***. This encouraged species, such as eucalypts and banksias, to resprout and species with hard seeds, such as wattles, to germinate and regenerate. Another fire in the next couple of years could be detrimental to many species ***because many have not reached the age where they produce quantities of seed***. By November 1993, when the photo was taken, the Grass-trees had flowered and the sedges were regenerating from rhizomes (underground stems). There was epicormic growth on the eucalypts.

The second site was a stringybark forest which experienced an ***intense crown fire***. This encouraged a mass of eucalypt regeneration from seed. The intensity of the fire on the forest floor also led to the germination of soil-stored seed including peas and heath. In fact, the regeneration was so vigorous that 70-80% of the soil surface was covered in 18 months after the fire.

The third site had a ***cooler fire*** which meant there was no eucalypt regeneration from seed or epicormic growth. The fire was hot enough to kill most shrubs. Species afforded some soil protection, such as orchids and tuberous lilies, were advantaged.

Native grasses, shrubs and trees started to regenerate once stock was removed from this property.

Case 3: Engerbretson's property at Heathcote Junction. GRASSY WOODLAND.

Method: Removal of livestock.

When this property was first purchased by the Engerbretson family, there was no obvious ground flora due to ***grazing*** by stock. When horse and cattle grazing was removed from this bushland, native tussock grasses returned from rootstock. Trees and shrubs also started to regenerate. The resulting understorey is excellent wildlife habitat, it is visually attractive and now the family has a lovely place to go for a picnic. The chances of soil loss through erosion is also minimised.

Case 4: After Ash Wednesday fires. HEATHLAND, DRY FOREST.

On 16 February 1983, various sites within Victoria were burnt by 180 ***fires***, eight of these being major wildfires. The ability of the flora and fauna to re-establish itself was incredible and the following photos, taken 8-10 months after the day, demonstrate this remarkable regeneration of the bushland.

Buds shooting from beneath the bark (epicormic shoots) of eucalypts after defoliation by fire.

Red Beaks (Lyperanthus nigricans) are orchids that are dependent on summer fires to initiate flowering

Case 5: Tongalong Ridge, Barmah State Forest. DRY WOODLAND.

Method: Exclusion of grazing by introduced animals and native kangaroos.

The lack of regeneration of understorey and ground plants was evident in most of the higher 'box woodland ridges' in Barmah State Forest, a situation that is quite common in the box woodlands of the northern plains. Shrubs, such as bulokes and wattles, and some native grasses tend to be palatable and disappear when ***grazing*** pressure is high. The only chance these species may get to regenerate is exclusion of grazers, introduced and native. Once established, native grazers, such as kangaroos, may be allowed to enter the ecosystem once again.

Plot outside exclusion area showing very little regeneration. Notice the wattles are grazed and the lack of grasses.

In the summer of 1992/1993 a large exclusion plot was created at Tongalong Ridge to protect an area of Box/Buloke grassy woodland, using fencing that excluded kangaroos, rabbits, hares and cattle. Another plot was marked which did not contain any fencing and was used for comparisons.

Within a couple of years there was an incredible increase in the overall level of vascular plant material in the exclusion plot. Surveys (quadrats) done in early 1995 indicated the most evident changes were increases in the abundance of shrubs, grasses and herbs. These surveys need to be repeated in spring to pick up any differences in the annual plants. Perennial native grasses regenerated from seed and basal stock and as a result, out-competed some of the weeds such as Patersons Curse. Buloke (*Allocasuarina luehmannii*) regenerated by suckering, from seed and by resprouting from basal stock that had been grazed for more than fifty years[1].

Exclusion site showing regeneration of plants and general increase in biomass (plant matter)

There was also a significant difference in the diversity and abundance of moss species. There were about 12-15 species in the exclusion plot and about 6 species in the non exclusion zone. Stock camps and areas of intense grazing had as low as 1-2 species. However, even though the diversity was reduced, many mosses are adapted to colonise bare ground and the number of individual plants in the non-exclusion plot was higher[2].

Lack of ground flora in non-exclusion plot

Native grasses in exclusion plot

In this case there was enough seed and rootstock present for regeneration of most species to occur. In some cases there may not be a bank of seed available and subsequent planting of shrubs, grasses and herbs may need to occur. In many circumstances, a weed control program may also have to occur to give the local plants a head start in regenerating. Experiment with different techniques. For example, pick up some of the organic matter from around the base of a bush or tree, which is growing in nearby less disturbed areas, dry it for a month, place it in your exclusion plot and burn it. With any luck, particularly if the ***season*** is good, seeds will be triggered to germinate.

And, most importantly, be patient! If you don't get results this year, you might next year.

References and further reading

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