Chapter 9
Native Vegetation Establishment and Management Techniques

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Greening Australia - Riverina

The need for more vegetation

Across most of south eastern Australia, past clearing or land-use intensification, predominantly for agriculture, has dramatically altered the native vegetation cover over the landscape.

The Riverina has large areas with very low existing tree cover, a virtually extinct shrub layer and a ground layer often (at least seasonally) dominated by exotic annual pasture weed species. This situation was not always the case. In much of the landscape this decline or degradation needs to be reversed in order to address a range of issues and objectives that affect the sustainability of our rural industries and our natural environment.

Determining your objective

Most objectives for revegetating an area or for retaining or enhancing existing remnant vegetation are included in the following broad categories (that can often overlap).

Function –

- Ecological functioning/ biodiversity protection (provision of habitat/ niche/ genetic diversity).
- Hydrological functioning (moderation of recharge/ discharge and soil water flows) and salinity control.
- Provision of landscape stability, perenniality, soil health and protection (and stable production).

Finance -

- Grazing potential and management.
- Wind/ weather protection.
- Timber, firewood, wildflowers, seed, oil, biofuels, by-product production.
- Tourism/ amenity and ecotourism values.
- Real estate and aesthetic values.

Form -

- Local and regional landscape/ aesthetic values and distinctiveness.
- Lifestyle and amenity values (recreation).
- Spiritual/ land ethic values and responsibilities (re-creation).

Making the most of what you already have – making a plan

Before any vegetation establishment or management is undertaken it is important to take stock of what is present and to have a clear idea of which of the above objectives you are trying to achieve for a particular site (refer to Chapter 3).

Principles and priorities to get it right.

The first principle of vegetation management and establishment is to

work with existing remnant vegetation on a site as a base for any future works.

Priority in vegetation management and revegetation at any scale should be to (in decreasing order) -

1. Retain
2. Regenerate
3. Reseed
4. Replace
5. Replant

The second principle of vegetation establishment or management is to **use locally native species from local provenance seed or genetic material as a priority in any revegetation works.**

Putting the principles and priorities into action

1. Retain

The identification and planned retention of any existing remnant vegetation (woodland, shrubland, grassland or wetland) is the most important first step in any vegetation plan.

The retention and management of remnant vegetation provides the backbone for ensuring that local genetic materials are retained and provides the basic matrix for achieving a diverse and healthy vegetation structure and habitat for native animals.

Protection (usually through fencing) and management (of weeds and grazing) of these areas provides:

- a ready source of fresh seed or the opportunity for future seed production and natural regeneration;
- soil seed stores that are able to successfully regenerate when conditions are suitable;
- the opportunity of inducing regrowth and root suckering from those species that respond to root disturbance (see Table 1); and
- reference areas for core and secondary species lists for revegetation in the area.

2. Regenerate.

Where native vegetation has been retained, it must be actively managed to ensure that its condition does not deteriorate and that it regenerates over time. Without regeneration (and gradual replacement) all existing remnant vegetation is only temporary and will be lost. Managing these areas for regeneration is critical to maintaining any effective vegetation cover.

Controlling grazing (domestic, feral and native) and weed suppression are key management actions when trying to regenerate native vegetation. These actions should aim to optimise the natural regeneration potential of existing native vegetation.

Natural Regeneration – Seed Producing Species

Not all species will regenerate under the same conditions, nor will there necessarily be regeneration every year.

The key principles in managing for natural regeneration from seed and optimising any opportunity for seasonal regeneration events are to:

- ensure that the existing trees and shrubs are healthy, flowering, and capable of producing and setting viable seed (refer to Chapter 10);
- remove or manage grazing to favour regeneration opportunities, particularly in seasons and years of above average rainfall (refer to Chapter 7). Areas of high diversity in good condition or in recovery and particularly palatable species (eg. *Callitris* seedlings) may be best

managed by removing grazing and having very long periods of rest;

- carefully monitor the site for early signs of a regeneration event. Good places to look are around seed producing trees, under regularly used perch sites and ant nests;
- avoid disturbing natural, undisturbed areas with intact groundlayers;
- manage weeds – the management (by strategic grazing) or patch removal (by chemical, scalping, burning) of exotic annual grass and broad-leaved weeds can significantly increase the chances of native seedling germination and survival; and
- maintain and manage suitable positions that provide microclimate differences for germination and persistence, such as fallen logs, litter, shrubs, depressions, drainage lines and 'edge' sites.

Figure 1: Regeneration resulting from controlled grazing and destocking.

Induced Regeneration – Root Suckering Species

There may be species on site that do not regenerate readily from seed or regularly produce seed. Some of these species can be stimulated to regenerate by root suckering or vegetative regrowth (Table 1).

Table 1: Species that respond to root disturbance by root suckering (in descending order of response and reliability, based on personal observation and trialing).

Common Name	Botanical Name
Rosewood	*Alectryon oleifolius*
Emubush	*Eremophila longifolia*
Sandalwood	*Santalum lanceolatum*
Cooba/Native Willow	*Acacia salicina*
Hooked Needlewood	*Hakea tephrosperma*
Butterbush	*Pittosporum phylliraeoides*
Native Jasmine	*Jasminum lineare*
Boree	*Acacia pendula*
River Cooba	*Acacia stenophylla*
Yarran	*Acacia homalophylla*
Bulloak	*Allocasuarina luehmannii*
Sugarwood	*Myoporum platycarpum*

Root suckering can be stimulated by using a tractor mounted single tyne ripper to break or damage surface roots (10-30 cm deep) in a single pass some distance out from the dripline but within the visible root zone of the tree. Care must be taken not to break tree roots on all sides of a single tree in the one year as this may make it more susceptible to wind damage. Best results occur after ripping in spring.

3. Reseed

Where native vegetation has been retained and managed some elements of its natural complexity may still be missing that are essential for ecosystem function. The missing floristic and structural components of the original vegetation need to be re-established.

The broad scale reintroduction of pre-treated shrub seed by direct seeding may be the most significant and cost-effective management action.

Appropriate grazing management to allow regeneration is essential.

There are several different direct seeding methods and a range of different tools and machines that may be appropriate for different sites.

The main methods of direct seeding are:

1. **Hand Direct Seeding** - a fire rake-hoe is used to scalp the soil surface, creating a tilth for the seedbed, followed by a light rake to cover the seed. This method is best used for smaller scale works when you want to minimise the level of disturbance to a site; and
2. **Machine Direct Seeding** - the dispersal of the pre-treated seed is by various types of specialised (eg. Rodden, Kimseeder, Agricultural Airseeder) or modified (eg. tractor bucket, ripper tynes, rabbit bait layer) machinery. Machine Direct Seeding is best suited to where consistent seed dispersal over a relatively large area is required.

The selection of the machinery type and method of preparation is dictated by the quality of the site, the level of tree cover and access, and the soil and site conditions. It will also vary depending on the amount of seed available.

Figure 2: Regeneration seven months after direct seeding.

The advantages and limitations of various direct seeding options is shown in Table 2.

The general timeline management sequence for direct seeding is given in Figure 5.

The real advantage of direct seeding is that germination and growth can occur at any time when conditions are suitable, not just at the time we think is the usual growing season. It is advisable to monitor direct seeding lines for weed growth and maintain weed control if the first season 'fails'.

Figure 3: Adding seed to a direct seeder.

The general prerequisites for successful direct seeding are the same as for an agricultural crop.

- Source locally provenanced **seed**, that is viable and appropriately treated.
- Prepare the **seedbed** appropriately for the site and the seed. This is usually achieved in one pass by the direct seeding machine, pre-seeding cultivation is usually only required where an air seeder or similar is being used. Deep ripping would only be used in some specific soil situations and would then require some time to settle before sowing. Gypsum application may be helpful in some clay soils.
- **Control weeds.** Herbicide application in the growing season prior to sowing

is imperative to prevent weed seed build up and maintain soil moisture. A further application prior to or at the time of sowing is essential. Follow up or spray-topping may be required if there is subsequent weed germination.

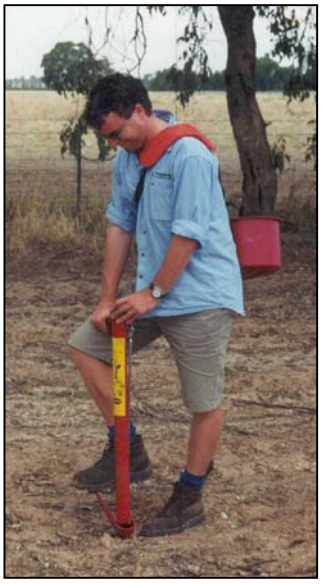
- Late winter or early spring usually provides the optimum **soil moisture** and opportunity for growth in warming soils, provided weeds are controlled. This requires that the autumn/winter 'break' weed seed germinants are sprayed on emergence and then direct seeding is left until spring. Sowing in autumn to midwinter can introduce the risk of losses associated with waterlogging, frost and inadequate weed control. Direct seeding later in the year reduces these risks and is benefited by increased seedling growth rates.
- **Control grazing.** All emerging seedlings are vulnerable to even low level grazing and are actively selected by both domestic and feral animals.
- **Control insects.** In some circumstances, predation of seeds and seedlings by ants and other insects may need to be controlled.

4. Replace, and

5. Replant

Replacing missing elements of a degraded vegetation community and replanting, linking or expanding into new areas with the species that would have occurred on those sites, usually only differ in the scale of the works, their implementation is basically the same. Usually, replacing only involves planting tubestock of one or a few species in scattered locations across a site. Replanting usually entails the gross disturbance of a site at a large scale with the objective to re-introduce to the area those species that would have originally occurred. This can either be achieved by:

- **Hand Planting**, using a shovel or hand tool (eg. Potti Putki or Hamilton planter) for the placement of seedlings. With good soil preparation, correct equipment and good seedling quality, 1000 plants can easily be planted by one person in one day.
- **Machine Planting.** There are a range of commercial and modified tractor mounted tree planting machines available that have a number of different benefits and constraints depending on the site, soil conditions and the scale of the job. Many machines now come with some form of watering mechanism. Most of these machines require a finer soil tilth for satisfactory planting and some will only work effectively in free flowing, relatively dry, rotary-hoed soil. Under optimum conditions one of these machines with two operators can plant up to 20,000 plants per day (depending on planting



- density)(Table 2).

Figure 4: Hand planting using a Potti Putki.

Sometimes a combination of planting and direct seeding methods can offer the best solution for a particular site.

The direct seeding of hard seeded understorey species followed by planting canopy species widely apart is one very efficient way of getting broadscale revegetation across a site. Not only is it time efficient but it also ensures that seed from canopy trees (such as Eucalypts or *Callitris* that are relatively time consuming to collect or dependant on particular seasonal conditions for reliable germination) are used most efficiently.

Whatever the method used, the objective for most rehabilitation projects should be to mimic the diversity and patchiness of natural systems. Try to create diversity by deliberately crossing direct seeding lines, creating patchiness and clumps by planting and mixing species across the planting site in a random fashion.

The guidelines for effective seedling establishment, whether by hand or machine planting, are effectively the same.

Site Selection and Planning

- Select your site and be clear about what you are trying to achieve (have a reference site in mind that is similar in soil and other attributes).
- Assess site conditions for potential weed, waterlogging, non-wetting soils, erosion or salinity risks, rabbits or other vermin problems.
- Assess how your revegetation fits with other vegetation and management considerations on the property.
- Draw up a required species list for planting on the site from the vegetation profiles and species lists in this Guide and local reference sites.
- Calculate the amount of seed and number of seedlings required based on a mean density of canopy trees from a good quality reference site. Work on a ratio of 20 to 50 percent canopy trees to a diverse mixture of 50 to 80 percent understorey trees and shrubs depending on the vegetation community you are trying to mimic.
- Order seed and or seedlings from a nursery or local seedbank up to twelve months before planting or sowing and secure order with a deposit. Specify both the species and provenance of seed or provide your own seed (note, significant lead time is required to ensure that seed supply and provenance matching for plantings can be achieved).
- Specify the type of seedling container required (refer to Chapter 10). Hykos are becoming the industry standard.
- Determine and plan the time of planting and the site preparation plan. The optimum planting time across most of the Riverina is in late winter to early spring.

A suggested planting management timeline is given in Figure 5.

Site Preparation and Follow-up

The degree, type and timing of site preparation activities will vary greatly depending on the soils, site conditions, intended methods and scale of planting to be undertaken. The basic considerations that need to be taken into account in site preparation are:

- Fencing - potentially a major cost in any revegetation activity and should be planned to get multiple management benefits if possible. There are also tax implications that need to be considered.
- Deep-ripping (cultivation) provides the greatest advantage in heavy clay or hard panned clay-loam or duplex soils to assist in moisture penetration and deep root growth of young seedlings. It is best achieved using single or preferably multi-tyne rippers to a depth of up to 50 centimetres. Ripping should be timed to when soil conditions allow soil shattering to occur and allow time for the soil in the riplines to settle. Ripping clay soils in wet conditions should be

avoided so that 'smudging' does not occur. Multiple, adjacent (within 50cm) passes may be required when using a single tyne ripper. Deep ripping may not be required in sandy or deep loamy soils. Rotary-hoeing the planting lines is advantageous in all soils particularly when a fine tilth is required for hand or machine planting. Mounding of planting beds may be required on some heavy clay soils prone to waterlogging, discharge or salinity.

- Effective weed control is possibly the strongest determinant for the successful establishment of young tree or shrub seedlings.
- Watering seedlings before planting is essential to allow them to be easily removed from their containers and to provide them with an effective moisture reserve. If seedlings are not watered as part of the mechanical planting exercise then follow-up watering should occur as soon as possible after planting. The finer the soil tilth, the less water (and time) required. Few deep waterings are preferable to regular shallow waterings. Avoid watering in heatwave conditions as it is more likely to kill seedlings.
- Guards can provide protection from wind and grazing, and act as a shield when weed spraying around the seedling (depending on their type). However, sometimes the scale of the project makes this unfeasible. Guards may be either specially manufactured plastic or mesh guards, milk cartons, rabbit netting, tyres or some other improvisation, all with various advantages and disadvantages.
- Ongoing monitoring and maintenance of newly planted seedlings in the initial growing season is essential to assess and manage weeds, feral animals, insects and water requirements.

Conclusion

The key to getting the most from any vegetation management and revegetation program is to:

- Assess what you have and work with it (even when it appears not to be much).
- Carefully set your objectives for each site.
- Establish the most appropriate strategies and techniques to meet each site objective.
- Plan and prepare your implementation well in advance.
- Be patient and prepared for adjustments and contingencies along the way.
- Appreciate the joy and frustration of being part of a dynamic natural system.

And most of all enjoy what you're doing in being part of Greening Australia.

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Direct Seeding												
Arrange Seed/Plant Supply												
Weed Control												
Seeding										*in wet years*		
Planting												
Arrange Seed/Plant Supply												
Weed Control												
Ripping,												
Planting/Watering												
Follow Up												

Figure 5: Plant and direct seeding timeline.

Table 2: Machine Planting methods and machine, suitable application and limitations.

Machine/ Tool Type	Suitable Application/ Advantages	Limitations
Hamilton type hand tool	Forest tubes, small well prepared sites and appropriate soil moisture.	Plug blocks in wet conditions and collapses in dry conditions. Constant bending.
Potti Putki type hand tool	Well prepared sites at any scale. Fast/ efficient- eliminates bending when kidney trays are used.	Blocks in wet clay soils.
Shelterbelter type-tractor mounted (linkage), trench and hand placement	Allows random seedling spacings and a range of seedling sizes. Relatively cheap and light to transport.	Requires follow up watering and good soil flow conditions at planting.
Ferrari type- tractor mounted (linkage), plug wheel with water	Sturdy. Works well in wet or dry conditions. Waters in seedlings of a range of sizes.	Set plant spacings (limited adjustment). Heavy to transport.
Sylvan type- tractor mounted (linkage or towed and hydraulic) vegetable planter with water injection	Large scale, well prepared sites. Fast under ideal conditions. Saltbush or similar plantations.	Limited to cells/ plugs or well grown Hykos. Requires excellent soil tilth or prone to breakages.

Table 3: Direct seeding machines and methods, application and limitations.

Machine/Method	Suitable Application/Advantages	Limitations
Hand/ Rake Hoe	Strategic, scattered or small sites, rough terrain or difficult access and timbered sites with intact ground layers.	Labour/ time intensive for large areas.
Blade scalping/ ripping	Scattered seeding, large sites with patchy weeds.	Creates some disturbance and weediness.
Rodden type (scalping blade and tynes)	Paddock scale,4WD towed-manoeuvrable and good access for single scattered rows or multi lines.	Not suited to heavy clay soils or wet conditions.
Kimseeder (mounding blades and press wheel)	Heavy clay/ waterlogged/ scalded / saline sites- broadacre saltbush etc	Tractor mounted (hydraulics), heavy, high seed use
Airseeder	Broadscale cleared, open sites. Efficient seed and time use on large previously cleared areas.	Limited to good soils and sites with access and equipment.

References and further reading

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