Greening Australia

Sandhills of the NSW Riverina

Management and Revegetation Guide



Introduction

Sandhill Pine woodlands are an incredibly diverse, ancient and unique part of the NSW Riverina landscape. The formation of these sandhills occurred over millions of years by the natural weathering of the hills to the east and the deposition and subsequent windblown accumulation of sand adjacent to current and former river channels along the Lachlan, Murrumbidgee and Murray rivers. Sandhills are important cultural sites for indigenous people and have been sources of livestock forage, timber and sand for construction since European settlement.

Early explorers described these sandhills as dense forests that were often too thick to travel through on horseback, supporting a diverse population of small mammals and birdlife. The sandhill woodlands we see today are but a shadow of their former character. Typically dominated by white cypress pine, sandhill woodlands today may contain scattered rosewood, needlewood, wattles, vines, saltbushes and hop bushes, or may be devoid of shrubs.

While it may not be realistic or desirable to return all sandhills to their pre-settlement condition, the hot open sandhills common today, with just a handful of old pine trees offer little refuge or forage for livestock, little shade during summer and virtually no habitat for birds and mammals. Clearing for timber, cropping and ease of management, inappropriate grazing by livestock and rabbits, sand extraction and introduced weeds have taken a heavy toll on sandhills and the vegetation community is in danger of disappearing across the landscape.

This factsheet outlines some of the management options for sandhills including livestock grazing, rabbit control, natural regeneration, hand planting and direct seeding. The focal area is the NSW Riverina, encompassing the areas of Hillston, Griffith, Berrigan, Deniliquin, Hay and the surrounding districts. Despite this distribution, much of the information presented will be relevant to many other parts of southern Australia.



A sandhill pine woodland recently direct seeded to increase the shrub layer near Hay NSW (photo: Graham Fifield, GA)



Grazing management and natural regeneration

Natural regeneration refers to new seedlings germinating from seed that has fallen from mature trees or has been carried in by birds or mammals. Natural regeneration is always the cheapest and easiest way to encourage new trees and shrubs, but requires careful observation of flowering and seed-set, favourable germination conditions and low weed competition. New seedlings may be observed concentrated around mature trees, bird perch points such as power lines or dead trees, and ant nests. Even if there are no obvious sources of seed, don't discount the possibility of natural regeneration as many hard-coated seeds such as wattles, hop bush and emu bush can survive in the soil for years, even decades, waiting for the right time to germinate.

Livestock

Trees and shrubs germinate after heavy or prolonged rain, even during the cooler months on the Riverina. To allow the seedlings to establish, livestock grazing pressure must be controlled. Once seedling plants are identified, it is best to avoid grazing the sandhills until the next generation of trees and shrubs are above vulnerable grazing height. Alternatively, it may be possible to crash graze for a short period of time, even with larger numbers of animals, and then allow long rest periods for desirable plants to recover. This requires very careful monitoring of the grazing impacts of the most vulnerable species and rapid action in removing stock before damage is fatal to the plant.

The best method for managing grazing pressure is to fence sandhills from different soil types on surrounding parts of the farm. In some instances it may also be feasible to fence areas of regeneration of favoured plants or clumps of plants. Incentives to assist with the cost of fencing are sometimes available from regional natural resource management organisations, such as Greening Australia, Local Land Services and Landcare groups. Of course, livestock only form part of the total grazing pressure on sandhills. Rabbits and kangaroos are also major contributors and also need to be managed.

Rabbits

Natural regeneration, direct seeding or hand planting will not be successful unless the time and energy has been invested in rabbit control. Soft sand for digging and the cover of tree roots and stumps have made sandhills the perfect haven for rabbits. Rabbits even in very low numbers (less than 1 per hectare) will prevent native trees and shrubs from regenerating or establishing from direct seeding. Specific advice should be sought based on your soil type, any areas of cultural significance (such as burial sites), or nearby services such as cables or phone lines prior to starting a rabbit control program.

In March 2017 the K5 strain of the calicivirus was released. By itself, the virus was only predicted to have a modest impact in the



White cypress pine seedling regeneration following rabbit control and careful livestock management. Coleambally, NSW. (photo: Mark Robb, Coleambally Irrigation)

Riverina, with the biggest impact being in cooler and wetter areas of NSW. Conventional control techniques will still be required to achieve significant reductions in rabbit numbers. Broad scale rabbit control can be achieved with baited carrots or oats. Pre-feeding is helpful to determine population density and to train rabbits on to the bait. Baiting can be followed by warren destruction and even soil levelling and re-seeding to make the former warren site unattractive for re-colonization. Fumigation can be used for warrens in hard to reach areas where ripping is not feasible, or where warrens open up again after destruction. Shooting may be useful as an additional tool after the other methods have been carried out or to control rabbits that may have been outside of the warren during fumigation or destruction. By itself



however shooting is unlikely to have a significant impact. Further information and advice can be found by contacting your Local Land Services office or at <u>www.pestsmart.org.au</u>.

Kangaroos

Kangaroos are an iconic part of the landscape and may congregate on sandhills due to the shade and protection afforded. Kangaroos add to the total grazing pressure on palatable grasses and shrubs which offers a competitive advantage to less palatable plants (often called weeds). In extreme circumstances it may be beneficial to reduce kangaroo numbers in order to achieve specific regeneration and restoration outcomes. Strict licensing conditions exist and approval must be sought from NSW National Parks and Wildlife Service prior to any reduction in kangaroo numbers.

Induced regeneration and root suckering

Many species of trees and shrubs growing on sandhills do not seed every year, or even every few years (e.g. rosewood), and those that do may only regenerate successfully when soil moisture, grazing pressure and favourable weather conditions all align. For these species it may be advantageous to encourage new plants to regenerate from the root system. Drawing a ripper tyne around the parent tree at a depth greater than 100mm severs the surface roots and many species respond by regenerating new shoots from the damaged portion. While these plants are genetic clones of the parent plant they perform a valuable role as the next generation and may in turn regenerate from seed in future years when conditions are right. After a few years, suckers offer a dense mid-storey habitat providing shade and shelter for livestock and habitat for birds and other wildlife.



Root suckering from butter bush (Pittosporum) following ripping. (photo: Graham Fifield, Greening Australia)

The following table outlines suitable management actions to revegetate a range of common sandhill tree and shrub species.



Recommended management actions for common sandhill tree and shrub species



* Species are semi (hemi) parasitic and require a host tree to survive in the long term



Direct Seeding

Sowing seeds of native species directly into the soil using a direct seeding machine has several advantages compared with transplanting; it is cheaper, faster, and plants often establish and grow more vigorously. A whole paddock can be transformed in just one day with a bag of seed and an experienced operator. Direct seeding is considerably lower risk than planting, as the seeds will sit dormant, sometimes for many years, waiting for the right conditions to germinate. Conversely, trees, once planted may have to be watered during dry conditions or they may not survive. Direct seeding does have disadvantages

however. For example, young shoots are very susceptible to weed competition and browsing by animals during the first 18-24 months.

In the Riverina of NSW the best time to sow native trees and shrubs is typically June and July to encourage early germination and growth while there is winter soil moisture, increasing day length, and before the heat of summer arrives. To get the best results from direct seeding, experienced contractors should be used.

The two most common seeding machines at the time of publication are the Burford and the KB tree seeders. Both machines have the ability to sow different sized seeds at different depths. For example, larger seeds such as wattles or hop bush are sown to a desired depth (20-40mm) while smaller and finer seeds (eg. Eucalyptus, Atriplex, Allocasuarina) are sown closer to the surface (0-20mm).

The KB is a single tyne machine utilizing an in-line coulter disc, sowing point and two or more floating seed pipes, creating a very low level of soil disturbance. For this reason it might be the preferred option in sites with high quality native ground layer and with low biomass. It has the ability to cultivate the soil to a depth of 200mm which can be useful for heavy-setting or compacted soils. The small level of disturbance means it is hard to see where seeds have been sown just 6 months after seeding. The narrow V-shaped seedbed is however prone to shifting and previous experience suggests it may take one or two showers of rain to settle the seed bed fully.

The Burford seeder uses an off-set disc to scalp a trench approximately 200mm wide and 40-100mm deep. The top soil, often laden with fertilizer, dung and weed seed is discarded to one side. A sowing point creates a narrow slot to place the larger seeds and two metal bars trailing either side bury this seed and create a fine soil tilth. The fine seed is dropped within this tilth before being rolled flat by a press wheel. The Burford has the advantage of creating a very flat and stable seed bed, but the level of soil disturbance is higher. It may be useful for sites with a higher biomass or exotic dominated understory. It cannot relieve compaction within heavy-setting or compacted soils.



Direct seeding using a single point tree seeder (KB engineering) with spray line through barley grass. (photo: Graham Fifield, Greening Australia)



Direct Seeding 6 months after sowing using a Burford seeder near Hay, NSW. (photo: Haydn Burgess, Greening Australia)

Hand Planting

In the previous table we identified many sandhill species which do not lend themselves to direct seeding due to poor seed set, difficulty in collecting large volumes of seed, or are unreliable to germinate. For this reason it is often useful to supplement direct seeding with nursery-raised tubestock to increase the species diversity used in revegetation.



Nursery raised plants are relatively soft, tender and attractive to grazing animals and some form of protection is often required. Corflute guards offer relatively affordable and long-lasting protection, while milk carton guards can be useful in sites with limited or no browsing pressure. Corflute guards have however been known to 'cook' plants within them in the height of summer so models with ventilation holes should be used where possible. Depending on the available budget 1200mm tall guards have proven very effective, particularly for white cypress pine, but are significantly more expensive than the more commonly used 450mm tall guards. Field observations suggests that needlewood, hop bush and sugarwood are rarely grazed



Direct seeding used in combination with hand planting and tree guards. (photo: Graham Fifield, Greening Australia)

while wattles, pines and casuarinas are favoured and require more protection once planted.

Site preparation

Effective and thorough site preparation will greatly increase the chance of revegetation success. Weed control for direct seeding is ideally started in the autumn with an application of knock down herbicide followed by a second application 2-4 weeks prior to, or at the time of seeding. Seeders fitted with spray nozzles offer a convenient and efficient means of seeding and spraying at the same time, but the spray effectiveness can be reduced by soil disturbance from the discs, tynes and press wheel causing sand to 'de-activate' the herbicide where it is disturbed or moved.

Trials involving residual herbicides undertaken by Malcolm Taylor (Agropraisals) showed excellent lasting weed control using Isoxaflutole (Balance[™]), Halosulfuron (Sempra[™]) and Imazethapyr (Spinaker[™]). The tolerance of western black wattle (Acacia hakeoides) was the only species tested however and further trials are required to test the tolerance of a broader range of different sandhill species such as those presented in the table previously.

While sandhills rarely suffer from soil compaction to the same extent as clay soils, field observations suggest that hard crusts of soil exist at different layers throughout the profile. Augering individual holes or ripping may be beneficial prior to hand planting to break through these crusts allowing water and roots to penetrate quickly. Knockdown herbicide applied along rip lines or around planting holes will reduce competition for available moisture and greatly improve growth and survival of planted trees. Sandhills should be assessed for sites of cultural significance, such as indigenous burial sites, and utilities such before any significant soil disturbance is undertaken.

Site maintenance

Once natural regeneration, root suckering, hand planting or direct seeding has been undertaken, there are a range of activities which will assist the long-term results. The most important being to remain vigilant for rabbit activity and controlling livestock access to the site. Beyond this, tubestock will benefit from watering, approximately once per month during the warmer months in the absence of significant rain. Knockdown herbicide can be carefully applied around planted trees using a shielded sprayer or by using the tree guard to protect the tree.

Weed control after direct seeding is difficult as young seedlings emerge and are sometimes crowded by fast growing broad leaf weeds and annual grasses. Grass selective herbicide (e.g. Fusilade[™] and Verdict[™]) may be applied over direct seeding lines to control grass weeds. Some operators have reported success applying low rates of knockdown herbicide in winter, when trees and shrubs are dormant as signalled by leaves with a reddish colour, but while weeds are actively growing. Test a small section first before treating the whole site.

6 GREENING AUSTRALIA



Fire

Some managers have reported using cool burns to control the rapid growth of fast-growing grasses such as annual rye grass and oats, and broad leaf weeds such as smooth mustard. By burning around mature trees, taking care not to burn the tree itself, a more receptive seed can be created for seeds dropped by birds such as emu bush, wilga and butterbush. The best results have been achieved where there are perennial grasses such as bottlewashers and spear grass present on the site.

Conclusion

Sandhills can be a challenging part of the landscape to manage with their tendency to attract kangaroos, rabbits and weeds. They are however an iconic and unique part of the Riverina landscape with many species of plants and animal occurring nowhere else. With grazing management and revegetation, it is rewarding to see the increase in native plants, birds and mammals. Livestock will benefit from the increased forage, shade and shelter available. Such is the climate of the Riverina that natural regeneration events for trees and shrubs were probably limited to above average rainfall years such as those that coincide with La Nina weather cycles. Strategic use of herbicide and cultivation greatly increases the probability of success but it is important to be realistic about the outcome and stay positive, the results over time can be outstanding!



A handful of punty bush (Senna sp) germinating through leaf litter. (photo: Annabel Lugsdin, Murrumbidgee Landcare)



References and Further Reading

Native Vegetation Guide for the Riverina; notes for land managers on its management and revegetation. Written by Kent, Earl, Mullins, Lunt and Webster (2002) Johnstone Centre, Charles Sturt University NSW. 413 pages.

Pestsmart website. <u>www.pestsmart.org.au</u> Information for managers on control techniques, animal welfare considerations, news and videos.

NSW National Parks and Wildlife Service – kangaroo licensing information, regulations and local office contact information: <u>https://www.environment.nsw.gov.au/wildlifelicences/licence-harm-kangaroos.htm</u>

Greening Australia, environmental not-for-profit organization specializing in revegetation services, seed banking, direct seeding, nurseries and community engagement. <u>www.greeningaustralia.org.au</u>





Before and after photos of a revegetated sandhill near Deniliquin, NSW. (photos: David Parker OEH)

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