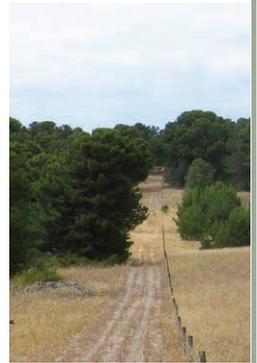


GOOLWA TO WELLINGTON LOCAL
ACTION PLANNING ASSOCIATION INC

BEST PRACTICE GUIDELINE FOR THE
**Removal of
Aleppo Pines**

LOWER LAKES AND COORONG REGION



Government of South Australia
South Australian Murray-Darling Basin
Natural Resources Management Board



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for the Coorong and Lower Lakes Project

February 2009

Cover photographs: Aleppo Pine infestation on Hindmarsh Island (top); local native
revegetation following removal of Aleppo Pines



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1 Aleppo Pines

1.1 Origins

The Aleppo Pine (*Pinus halepensis*) is native to the Mediterranean. It was introduced to South Australia in the late 1800's, initially for timber (it turned out to provide poor timber), and subsequently for windbreaks, dune stabilisation, stock shelter, landscaping, and for memorial plantings since the Aleppo Pine held particular cultural significance after WWII because the Lone Pine at Gallipoli was an Aleppo Pine.



Aleppo Pine leaves and seed cones



Southern Cypress Pine leaves and cone

1.2 Identification

The Aleppo Pine looks similar to Radiata Pine (*Pinus Radiata*) which is widely used in timber plantations. The key difference is that the needle-like leaves of the Aleppo Pine are arranged in pairs whilst Radiata Pine needles are in groups of three. The needles of Aleppo Pines are 6-10cm long, and the cones are 5-11cm long and held on short stalks. Aleppo Pines grow to around 20m in height and commonly branch above the base.

Distinguishing Aleppo Pines from Native Pines

Southern Cypress Pine (*Callitris gracilis*) is native to the Lower Lakes and Coorong region. It has round seed cones, slightly smaller than a golf ball, and the leaves are tiny (less than 0.5mm) and arranged in rings around the stem, making the stem appear segmented.

1.3 Distribution



A dense infestation of Aleppo Pines out-competes all other species

Aleppo Pines grow well in low rainfall environments, on well drained soils, and are tolerant of limestone. The species has spread from plantings into cleared and bushland areas in many parts of South Australia. In the Lower Lakes and Coorong region, Aleppo Pines have established over a large area of Hindmarsh Island as well as other smaller populations on the "mainland."

Aleppo Pines grow only from seeds which are winged, and can be blown by wind for 40m. Sometimes the seeds are spread further by Yellow-Tailed Black Cockatoos. Aleppo Pines grow rapidly and can reproduce from four years of age.

1.4 Impacts

Aleppo Pines have invaded both remnant vegetation and pastures in the Coorong and Lower Lakes region. Once established, they grow quickly and can out-compete other species for moisture and light. As the trees mature they form a thick carpet of needles beneath them. This takes a long time to break down, may present a fire risk, and is not favourable for the germination of many other species including natives and pastures.



1.5 Ecological Value

Aleppo Pine forests provide poor habitat and resources for most native fauna, as they lack hollows and flowers, have a very dense structure and poor ground layer. In some areas, however, they do make up the only significantly large tracts of wooded vegetation and may provide the only habitat for some terrestrial fauna, in particular nesting and perching sites for birds of prey such as Whistling Kites. Most significantly, Yellow-tailed Black Cockatoos eat the seeds of Aleppo Pines. These birds are considered vulnerable in South Australia and are heavily reliant on introduced pines for food as a result of clearance of their native food sources. They are, however, only occasional visitors to the region.

2 Planning Aleppo Pine Removal

2.1 Consider the Environmental Risks Associated with Removal

Wind Erosion

As Aleppo Pines were often initially planted to combat wind erosion, and given the high susceptibility of the region's soil to wind erosion, care needs to be taken to avoid causing erosion. Ensure there is minimal soil disturbance and that adequate ground cover (greater than 70%) is maintained at all times.

Ecological Impact

It is common to find native groundcovers, shrubs and occasionally trees growing amongst infestations of Aleppo Pines. Care should be taken when removing pines to ensure that native species are not damaged through physical disturbance, spray drift or through being wrongly identified.

In some areas, Aleppo Pines may be providing the only habitat for native fauna. Their removal should therefore be undertaken in stages, being replaced by native vegetation through revegetation or regeneration.

Where Yellow-tailed Black Cockatoos regularly feed on Aleppo Pines, revegetation should begin well in advance of the removal of fruiting pines to ensure there is an alternative food source available. Immature, non-fruiting trees can be removed earlier. The revegetation should include a high proportion of food plants, including local native species of *Banksia* and *Hakea*. Significantly larger areas of revegetation, however, need to be planted to supply the same amount of food as one mature Aleppo Pine.

Wild Fire

Ensure that adequate fire-breaks, access tracks and fire-fighting infrastructure are incorporated into the property plan. Adhere to Country Fire Service fire restrictions when undertaking Aleppo Pine control and burning. If using ringbarking as a form of control, be aware that dead standing trees may pose a higher fire risk than living trees.

2.2 Legalities

In most situations Aleppo Pines are not protected. If the trees, however, are large and/or have been planted, you should contact your local Council to ensure they are not protected under significant tree or heritage protection measures. Native vegetation is protected under the *Native Vegetation Act (1991)*.

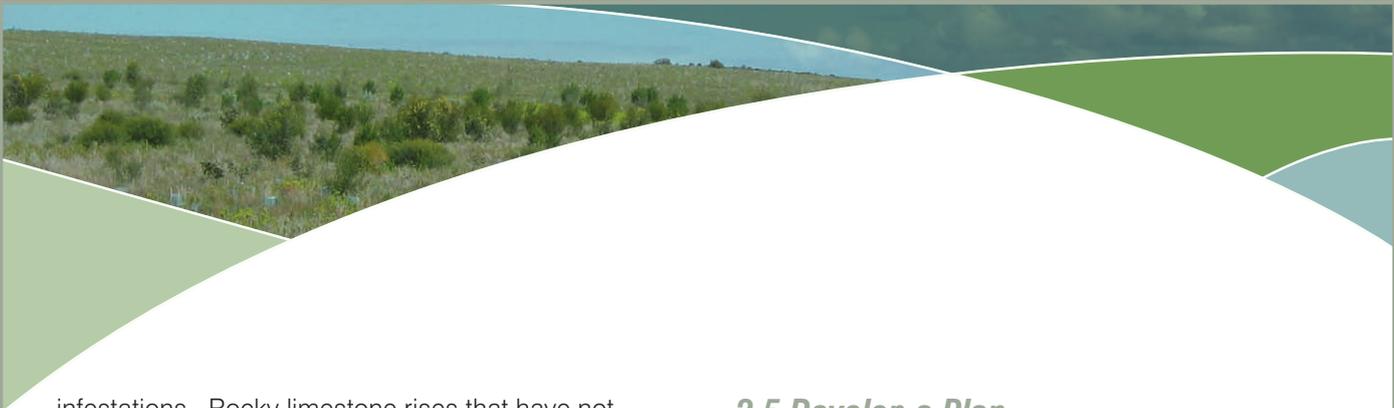
2.3 Undertake a Site Assessment

Assess the Density and Maturity of Aleppo Pines

Assessing the level of Aleppo Pine infestation will help to determine in which areas to begin removal and what is the most appropriate control option. Note what level of infestation occurs in different parts of the property.

Identify Native Vegetation

Isolated and little patches of remnant native trees may occur within Aleppo Pine infested areas, often with natural regeneration of native groundcovers around them if the area has not been grazed for some time. Native groundcovers such as saltbushes, riceflowers, grasses and lilies can also occur around the base of Aleppo Pines, usually in medium density



infestations. Rocky limestone rises that have not historically been cropped often contain a relatively high diversity of native plants.

Identify Native Fauna

Take note of which native fauna - especially Yellow-tailed Black Cockatoos - use the area and consider how they will be impacted if the pines are removed. Different approaches may need to be incorporated for some fauna.

Identify Other Weeds

Whilst Aleppo Pines may dominate an area, other high-threat weeds that should also be controlled may occur among them for example, African Boxthorns, Bridal Creeper and weedy non-local Wattles.

2.4 Prepare a Map of the Site

Based on the site assessment, prepare a map of the site showing:

- fence lines, tracks, houses, powerlines and other infrastructure
- differing levels of pine infestation and condition of remnant native vegetation
- other significant weeds

Your map doesn't need to be complicated or computer-drawn. Using an aerial photo as the base will make mapping easier. Aerial photos can be downloaded from a number of websites, such as Google Earth (www.earth.google.com) or Nature Maps (www.naturemaps.sa.gov.au). Alternatively, you can purchase an enlarged photograph from Mapland.

An example of a property map is included on page 17.

2.5 Develop a Plan

Weed Control Principles

The following general principles should be incorporated into your Aleppo Pine Removal Plan:

Begin in the least weedy areas:

The aim of your weed control program should be to maximise the area that is "weed-free". This requires you to begin by removing outlying and low density young pines first, and gradually working in towards older, denser areas.

Care for and promote native vegetation:

Ensure remnant native groundcovers and shrubs growing beneath pines are retained when removing pines as these are a natural bonus to any revegetation program. Where patches of remnant native vegetation occur, carefully remove pines within the patch first, then gradually remove the pines in a ring around the patch, encouraging the remnant natives to regenerate and expand naturally.

Replace habitat:

In most situations it is preferable to undertake removal in stages over several years, replacing Aleppo Pines with native vegetation through either actively planting it or encouraging natural regeneration.

Be realistic about what you can achieve:

It is better to write your plan in stages rather than in years because it is difficult to predict how much effort it will take to achieve what you set out to do, or how much time and resources you will have in the future. When you begin, you should work from the least infested sections, where there will be fewer pines and most will be smaller, towards the older infestation. Over a number of years, you will begin to work in the more densely infested areas, where the pines are larger and sometimes closer together. The work will be harder and possibly less satisfying, but perseverance and taking note of the native species regenerating should offset the more difficult work. As pines are replaced with native vegetation, there



will also be additional work associated with planting and maintaining revegetation, as well as follow-up weed control in cleared areas. Don't be disappointed if you don't ever remove all the Aleppo Pines from a site. Focus on what you have achieved with the area cleared.

Clear other high threat weeds as well:

Remove other weeds in conjunction with Aleppo Pines.

Follow-up weed control:

Monitor areas where control-work has been carried out and remove any re-growth or new seedlings. Note that Aleppo Pines have a high germination rate but low seedling survival rate, so focus on removing seedlings that have survived at least one year. As they can also reproduce as early as four years of age, do not leave follow-up too long.

Where to Start

Apply the weed control principles outlined above in conjunction with your map of the site to develop a staged weed control and native vegetation management plan.

An example of a plan for a hypothetical property is included on page 17.

Selecting the Most Appropriate Method

Across a single site a range of control methods may need to be employed depending on the size of the pines and presence of native vegetation. Chapter 3 outlines what methods should be used.



Low density, young Aleppo Pines such as those in the foreground, are a higher priority to remove than the older, denser pines in the distance.

3 Selecting the Most Appropriate Methods

The following tables outline four common situations and the most appropriate methods to return the areas to native vegetation. More detail about the recommended methods is provided in Chapter 4.

3.1 Situation 1: Young Pines over Introduced Pasture or Ex-Crop

Description

Aleppo Pine Maturity	Predominantly small trees (less than 3m) that have not yet begun to fruit
Aleppo Pine Density	Low, on average more than 30m between trees
Other Vegetation	Introduced perennial pasture such as Perennial Veldtgrass and pasture and crop weeds such as False Caper, Silver Grass and Barley Grass

Considerations for Removal

Environmental Risks	Low: the pines are too young to provide food and too newly established to be providing critical habitat.
Cost vs. Benefit	Low / Good: pines are relatively easy to remove with a good chance of success. Large areas can be cleared quickly. Revegetation is relatively easy to undertake.

Control Method

Hand Pull	Suitable for seedlings up to 1m
Cut Down	Suitable for saplings over 1m to medium sized trees
Slashing	May be suitable for seedlings depending on the type of slasher and thickness of trunks



Revegetation Method

Machine Direct Seeding	Suitable for large areas where sufficient seed is available. May be used in combination with tubestock planting for increased species diversity.
Tubestock Planting	Suitable
Timing	Can be done in the first Winter following pine removal.

3.2 Situation 2: Mature Aleppo Pines with Native Vegetation

Description

Aleppo Pine Maturity	Predominantly medium sized trees (3m to 10m) with fruiting cones; some smaller seedlings
Aleppo Pine Density	Medium; crowns may be touching in some areas but mostly with gaps between pines
Other Vegetation	Ground layers dominated by introduced perennial pasture such as Perennial Veldtgrass and pasture and crop weeds such as False Caper, Silver Grass and Barley Grass. Occasional native groundcovers such as Ruby Saltbush, Native Spinach and Berry Saltbush growing at the base of Aleppo Pines. May be more native vegetation if site has had little stock grazing. Other woody weeds likely to be present.



Native understorey plants growing beneath Aleppo Pines



Native understorey plants growing beneath Aleppo Pines

Considerations for Removal

Environmental Risks	Low: the pines are too newly established to be providing critical food or habitat. Risk of damage to native vegetation during removal.
Cost vs. Benefit	Moderate: pines are relatively easy to remove with a good chance of success but will take more effort to clear the same size area as in Situation 1. Intensive follow-up control needed for first two years as there will be a soil seed bank.

Control Method

Hand Pull	Suitable for seedlings up to 1m
Cut Down	Use a chainsaw or handsaw for trees over 1m, maximum height dependant on user's skill and equipment. Ensure fallen trees do not smother native ground covers.
Ring-bark	Suitable for medium to large trees
Slashing	May be suitable for follow-up control of re-growth provided cut stumps are below slasher height



Revegetation Method

Natural Regeneration	Careful weeding around existing groundcovers will encourage natural regeneration. May need to be supplemented with tubestock planting of over-storey species that are not present.
Tubestock Planting	Suitable. Take care during site preparation to not spray-out native ground-covers. If sufficient native groundcovers are present these species do not need to be included in the planting mix.
Machine Direct Seeding	Suitable for large areas where sufficient seed is available and native groundcovers are sparse. May be used in combination with tubestock planting for increased species diversity. Take care not to spray-out or seed through existing native ground covers.
Timing	Best done at least one year following pine removal to allow a season for follow-up control.

3.3 Situation 3: Mature Aleppo Pines Without Much Native Vegetation

Description

Aleppo Pine Maturity	Predominantly large sized trees (over 10m) with fruiting cones. Smaller pine seedlings may make up the ground layer.
Aleppo Pine Density	High, crowns overlapping, stems dense
Other Vegetation	Generally little other vegetation as ground is covered with a dense layer of pine needles and little light penetrates the canopy. Introduced annual grasses and shade tolerant native groundcovers such as Native Spinach and Flax-lilies may be present at low densities.



Stand of mature Aleppo Pines



Ground covered in fallen pine needles and cones

Considerations for Removal

Environmental Risks	Medium: pines may be providing food for Yellow-tailed Black Cockies and perching and nesting sites for large birds. Pines may originally have been planted to combat wind erosion, so there may be a risk of erosion following removal if groundcover is not maintained.
Cost vs. Benefit	High / Poor: a high degree of effort, resources and cost to clear pines. Intensive follow-up will be required for several years following initial removal due to the soil seed bank. If large areas are infested to this level with Aleppo Pines, removal may not be feasible or justifiable from a cost perspective, and containment may be the best option.



Control Method

Professional Tree Removalist	Most suitable for large trees
Ring-bark	Suitable for large trees (ie. 6m or more). When they begin to fall, ring-barked trees will pose a safety hazard which may outweigh the cost saving benefit.
Cut Down	Suitable for small to medium sized trees, dependant on user's skill and equipment. Ensure fallen trees do not smother native ground covers.
Slashing	May be suitable for control of small seedlings and follow-up control of re-growth provided cut stumps are below slasher height.
Spot Spray	May be suitable to control prolific seedling growth following removal of trees. Take care to not damage native groundcovers.
Hand Pull	May be suitable for removing seedling re-growth following removal of trees. If, however, a large area has been cleared, hand pulling may not be sufficient.

Revegetation Method

Tubestock Planting	Suitable. Take care during site preparation to not spray-out native ground-covers which may regenerate following pine removal. Cut stumps and fallen logs may make planting and maintenance difficult.
Timing	Best delayed for three or more years following initial removal to allow for follow-up control and for stumps, timber and mulch to decay. If there is still a significant amount of mulch, this may need to be removed by mechanical or manual raking prior to planting. If ring-barking has been used, delay planting for safety reasons until dead pines have fallen, and to avoid risk of revegetation being damaged. If entire patch of pines is not removed in one stage, revegetation will need to be kept well away from remaining pines and will require constant monitoring for re-infestation.

3.4 Situation 4: Remnant Vegetation with Aleppo Pines

Description

Aleppo Pine Maturity	Predominantly small, non-fruiting trees with some medium-sized and fruiting trees
Aleppo Pine Density	Medium sized trees of low density, but seedlings may be of higher density
Other Vegetation	Predominantly native shrubs, ground-covers and grasses. Native canopy species may or may not be present, depending on past clearance history. Introduced perennial pastures, such as Perennial Veldtgrass, and pasture and crop weeds such as False Caper, Silver Grass and Barley Grass may also be present.

Considerations for Removal

Environmental Risks	Medium: high risk of off-target damage to native vegetation and also soil disturbance during pine removal, which may encourage other weeds to colonise the site.
Cost vs. Benefit	Low / Good: pines are relatively easy to remove with a good chance of success. Active revegetation not required.



A small grove of Drooping Sheoaks and native groundcover amongst Aleppo Pines



Control Method

Hand Pull	Suitable for seedlings up to 1m
Cut Down	Use a chainsaw or handsaw for trees over 1m. Ensure fallen trees do not smother native vegetation. Monitor, and cut and swab any re-growth from stumps.
Ring-bark	Good method for medium sized trees as no soil disturbance results.

Revegetation Method

Natural Regeneration	Careful weed control around the remnant will encourage native vegetation to regenerate and expand in area. Temporary guards may be required to protect regenerating seedlings if kangaroos or pest animals are present.
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4. Methods of Removing Aleppo Pines

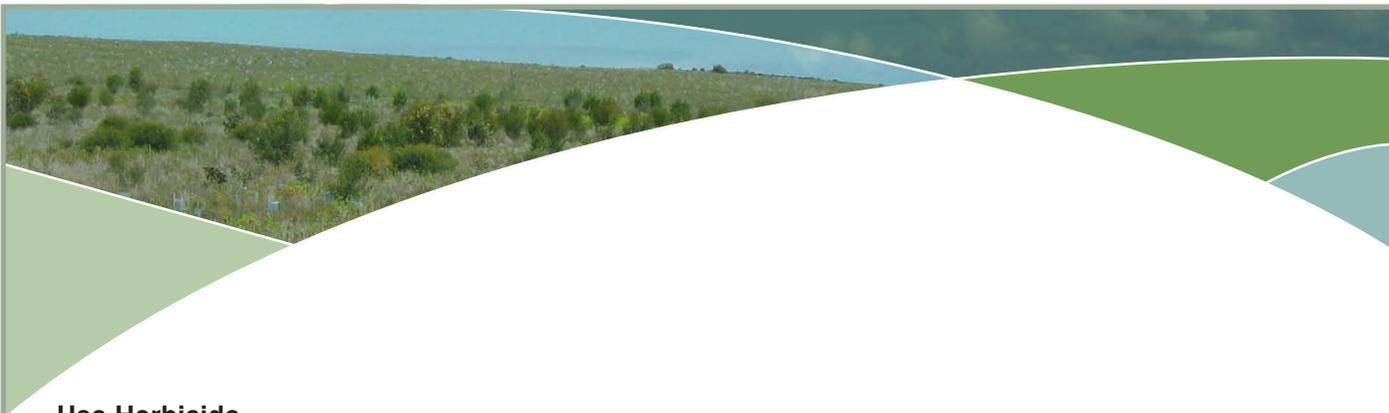
4.1 Recommended Methods

Cut Down

Suitable for	Small to large trees, depending on the skills of the operator, and remnant vegetation and pasture situations
Not suitable for	Very small or very large trees
Method	Use a chainsaw or handsaw to cut through stem as close to the ground as possible. Use angled cuts to direct the fall of the tree. Ensure there is no green growth below the cut. Cross-hatching the top of the stump with a chainsaw will aid the rotting of material. If leaving trees where they fall, cutting them into small lengths will aid in breaking down.
Timing	Any time, but if using a chainsaw follow CFS regulations.
Precautions	Monitor and spot spray, or cut and swab, any re-growth from stumps. Ensure there is no risk to human or animal safety or infrastructure from falling trees.

Hand-pull

Suitable for	Small seedlings up to 1m or more, depending on the strength of the person. Mechanical levers may assist to remove larger seedlings.
Not suitable for	Saplings over 1m. In good quality remnant vegetation, to avoid soil disturbance use secateurs to hand-cut seedlings 0.5m to 1m.
Method	Hold the stem close to the ground and pull directly upwards. Either place one hand on the ground around the base of the seedling, or a foot on each side to minimise the amount of soil disturbed.
Timing	Can be done any time of year, but there is less soil disturbance when soil is moist. Where there are numerous seedlings it is advisable to wait until the break of season following germination, as many seedlings may die-off naturally over summer.
Precautions	Wear gloves for safety and to avoid sticky sap.



Use Herbicide

Suitable for	Swabbing cut stems of branches below a ring-bark or on cut stumps. Spot spray prolific re-growth of seedlings. Drill and fill medium to large trees.
Not suitable for	As Aleppo Pines die readily from other recommended methods, the use of herbicides is rarely required. Not suitable in most remnant vegetation areas.
Method	Paint or dab onto cut stems within 10 seconds of cutting. (This generally requires two people to work together.) When spot spraying ensure all foliage is covered but is not dripping. Use an appropriate herbicide at the recommended rate.
Timing	When pines are actively growing (usually spring).
Precautions	Avoid spray drift (or drip) on to native vegetation. When working close to watercourses use only herbicides approved for that use.

Ring-bark

Suitable for	Medium to large trees. Useful in remnant areas where soil disturbance is a concern.
Not suitable for	Large trees close to infrastructure such as fences, roads, powerlines, sheds and houses, or in areas regularly used by people or stock.
Method	Use a hatchet to remove a ring of pine bark as close to the base of the tree as possible. Ensure a complete ring is removed down to the woody layer and that there is no green growth below the ring.
Timing	Can be done any time of year.
Precautions	Undertake a risk assessment before ring-barking. Avoid working in areas where ring-barked trees have yet to fall, especially on windy days. A ring-barked tree may take between 2-5 years to fall, depending on conditions.

Use Professional Tree Removalist

Suitable for	Most situations but in particular for very large trees and trees close to infrastructure
Not suitable for	Specialist bush management contractors may be more experienced in remnant vegetation areas for small to medium pines.
Method	Contract a professional tree removalist to use one or a combination of the recommended methods.
Timing	Anytime, depending on the method to be used
Precautions	Seek a quote before contracting. Ensure contractor uses appropriate methods to avoid environmental damage.

Slash

Suitable for	Small seedlings, depending on the thickness of the stems and features of the slasher. May be useful for controlling secondary germination of pines following initial removal.
Not suitable for	Saplings or larger trees; rocky or steep sites. If cut stumps are present ensure these are below the height of the slasher.
Method	Slash as per normal, although in some situations it may be preferable to back over trees. Slash as close to the ground as practical.
Timing	Any time, in accordance with CFS regulations
Precautions	Thoroughly inspect the area for stem size, and obstacles that may damage the slasher which may be obscured in the grass. Avoid slashing remnant native vegetation except native grasses.



4.2 Methods Not Recommended

Mechanical Uprooting

Uprooting Aleppo Pines, other than those small enough to be pulled up by hand, is not recommended due to the amount of soil disturbance which can potentially result in:

- Damage to native groundcovers
- Encouraging further weed colonisation
- Soil erosion

Burning

Burning standing trees is not recommended due to:

- The risk of the fire getting out of control
- Heat intensity of the fire damaging native vegetation
- Lack of ground cover following the fire, resulting in soil erosion.

4.3 Disposal of Dead Aleppo Pines

Dead hand-pulled, cut, or fallen Aleppo Pines can be left to break down where they fall. From medium to large trees, however, there may be a significant amount of material that may smother native vegetation, prevent natural regeneration, and inhibit access for follow-up control and revegetation. Medium to large trees can be piled and burnt. If left unburnt, piled trees may harbour pest animals. If medium to large trees are left where they fall, cutting the trunks and branches into short lengths can aid breaking down. Where native vegetation is present, take care to not drag trees and damage native vegetation.

5 Revegetation Following Pine Removal

5.1 Revegetation or Regeneration?

Active planting of native vegetation will be required for some, but not all sites, and in many cases a combination of approaches should be used. As a rough guide, when Aleppo Pines are removed:

Where diverse remnant native vegetation occupies 20% or more of an area, natural regeneration should be encouraged.

Where introduced pasture species and pasture and crop weeds occupy 80% or more of an area, active revegetation is required.

Where native groundcovers are plentiful but the diversity of species is low (less than 10 species), active revegetation should be used to replace missing species (middle and overstorey).



Staged Aleppo Pine removal and replacement with local native vegetation



Active Revegetation Methods

Method	Machine Direct Seeding	Hand Direct Seeding	Tubestock Planting
Details	A machine is used to sow a single row of mixed seed. Seeding rows on average 3m apart, using 1 to 1.5kg seed/ha.	A pinch of seed is dropped into scraped soil and buried shallowly. Usually 1000 seeding spots/ha or greater.	Specialised planting equipment available. Usually planted at densities of 1000 seedlings/ha or greater.
Suitable for	Arable soils with little native vegetation	All sites	All sites except shallow soils
Success	Usually successful. Seasonal conditions impact the density of germination.	Variable success rates; can be as low as 10%	Usually successful, provided standard methods are used.
Diversity of species	Species are limited to those for which adequate quantities of seed are available, and readily establish using this method.	A greater range can be established than with machine direct seeding because less seed is required.	Greatest range of species can be established by this method, including species established by cuttings.
Cost / Effort	Low cost and effort	Least cost and effort	High cost and effort relative to other methods

It is common to use a combination of machine direct seeding and tubestock planting to keep costs down while establishing a wide diversity of species.

5.2 Revegetation Design and Layout

Rows or Random?

Planting an area using random spacing so that there is a mix of open and dense vegetation results in “natural-looking” revegetation but is best suited to small sites (2ha or less). Large sites are easier to maintain when planted in rows averaging 3 metres apart. This allows for easier access for slashing and weed control in the first few years. The range of species used in the planting mix will help to create a more naturally variable structure, as will future regeneration from the plantings. Other methods that can be incorporated to increase the structural variability are:

- Have the rows follow the contours of the land rather than being straight.
- Waver the rows so that they vary between 2 and 4 metres apart.
- Plant at unequal spacings along the row, for example plant three seedlings half a metre apart, the next one 4 metres away, the next 1m, and so forth.

- Become familiar with the size and height of each species and plant accordingly. Trees may need to be spaced wider apart to allow better understorey development and natural regeneration later on.
- Have 2m wide rows, with a 2m gap between, and plant anywhere within the row, creating clusters and open spaces.
- Plant several of the same species close to one another to create “groves” and encourage microhabitats.
- Secondary planting can be done between the rows.

Firebreaks and Access Tracks

Larger sites should include access tracks, and may require firebreaks to be incorporated.



5.3 Choosing the Right Plants

Species Selection

Only species native to the local area, and naturally occurring on the same soil type and land form, should be used for revegetation. These are best adapted to the site conditions, giving them a good chance of survival, and the resulting revegetation will better replicate the original vegetation type, as well as providing food and habitats suitable for native fauna.

To find out which species are suitable for your site contact your Local Action Planning group or local Landcare Group, see the *Revegetation Guidelines for the Lower Lakes* or *Trees for Life* (see Help!).

Provenance

Generally, seed should be collected from as near as possible to the revegetation site. If there are few plants of a species remaining close by, however, and the genetic diversity is low, seed from further away may be used.

5.4 Site Preparation

Weed Control

Assuming Aleppo Pines and other high threat weeds have already been removed, introduced ground layer weeds still need to be controlled before planting, or they will compete for moisture and light. Two to four weeks prior to planting, areas dominated by annual grasses should be sprayed out once or twice with a non-selective herbicide, in spots or 1m wide rows, as per the revegetation design. Areas which are dominated by perennial grasses should ideally be first slashed, then the regrowth sprayed out in rows in late spring, the season before planting, and sprayed again two to four weeks before planting. Be mindful of the erosion risk on susceptible soils when spraying out areas dominated by introduced weeds as ground cover will be removed when the weed species die. Also watch out for and avoid native species that may be amongst weed infestations.

Pest Animal Control

Rabbits and hares can cause severe damage to revegetation. If you haven't already done so, begin a pest animal control program in coordination with adjoining landholders in the summer before revegetation is begun.





5.5 Planting

Timing

Both direct seeding and tubestock planting should be carried out in winter, but the exact timing will depend upon seasonal conditions. Seeding is usually done slightly later than tubestock planting as seeds require some soil warmth to germinate. Whichever method is used, the timing needs to have allowed for weeds to have germinated and been controlled at least once (preferably twice), before planting.

Guards

Whether the seedlings require guards or not, and the type of guards, depends on local populations of rabbits, hares and kangaroos, with larger guards required for the latter. Some species are more favoured than others for grazing, with Banksias and She-oaks being highly favoured, while prickly species are usually left alone. Groundcovers, grasses and low bushes rarely require guards.



Direct seeding machine.

5.6 Maintenance

Weed Control

Control of grasses and broadleaf weeds will be required in revegetation areas for the first few years following planting. Also monitor for and control new infestations of Aleppo Pines and other woody weeds. Slashing may be used for the first few years to reduce grass growth and seed set between rows.

Pest Insects

Red-legged Earth-mites can devastate direct seeding soon after germination. White snails may impact on young revegetation. Monitor for both and control as required, using similar methods to those used for crop and pasture situations.

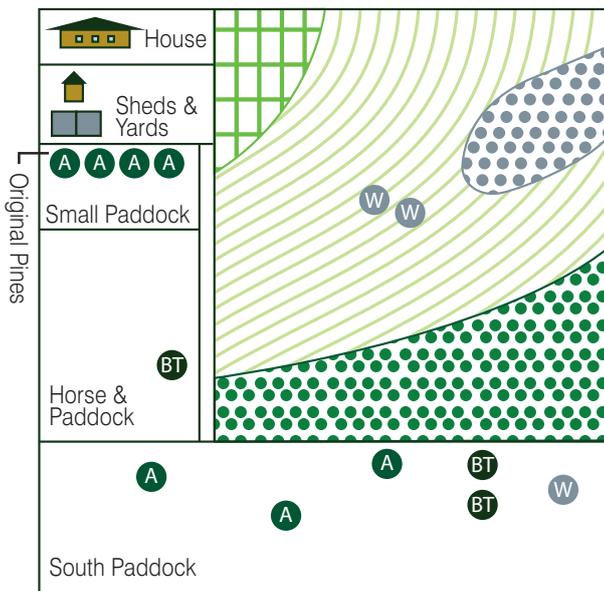
Pest Animal Control

Maintain pest animal control programs to minimise damage to revegetation and fauna.



6 Example Aleppo Pine Removal Plan

Weed Map of “Pine View”



Legend

- Limestone Ridge remnant vegetation & low density pines
- High density pines
- Low density pines
- Medium density pines
- Isolated Aleppo Pines
- Boxthorn
- Western Coast Wattle



Pine Removal and Revegetation Plan for “Pine View”

Stage	Paddock, zone	Activity
Stage 1	Whole property	1a. Remove African Boxthorns
	South Paddock	1b. Remove Aleppo Pines and Western Coast Wattle (WC Wattle) 1c. Continue grazing cattle
	Back Paddock, limestone ridge	Remove Aleppo Pines and WC Wattle on ridge and within 10m of ridge.
Stage 2	Back Paddock, low density pines	3a. Remove Aleppo Pines and WC Wattle working northwards from southern fence line 3b. Revegetate entire area once all pines removed using machine direct seeding supplemented with tubestock planting
Stage 3	Back Paddock, medium density pines	4a. Remove Aleppo Pines and WC Wattle in 50m deep swathes along perimeter with Stage 3 area and around limestone ridge. 4b. Revegetate cleared areas using tubestock in stages, leaving a 10m buffer between revegetation and uncleared pines.
Stage 4	Back Paddock, high density pines	5a. Ring-bark large pines, cut down medium pines and hand pull small pines within 10m of perimeter with Stage 4.
	Small Paddock	5b. Contract professional to remove all pines within 20m of fence lines including original stand in 'Small Paddock'
		5c. Maintain cleared buffers by slashing

Note: under this plan, the entire property will not be cleared of Aleppo Pines, however the majority of the pines will be cleared, leaving only a small area of old mature pines which will be contained in the north-western corner. The landholders will have to constantly monitor for new seedlings in the revegetation areas, but this will require far few resources than removing the mature pines.



7 Help!

Contacts

Goolwa to Wellington Local Action Planning Association

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Ph: 8536 4551
Web: www.gwlap.org.au

Coorong District Local Action Plan Committee

PO Box 1021
Tintinara, SA 5266
Ph: 8757 2100

Murray Mouth Estuary Restoration Project and Hindmarsh Island Landcare Group

Ph: 8555 5772

Natural Resource Management Officers, SA Murray-Darling Basin Natural Resources Management Board

(Pest plant and animal control),
Mt Barker Ph: 8391 7520,
Murray Bridge Ph: 8532 1432,

Tailem Bend

Ph: 8572 3611
Web: www.samdbnrm.sa.gov.au

Trees for Life (Bush for Life)

Ph: 8406 0500,
Web: www.treesforlife.org.au

8 Resources

Plant Identification

Bonney, N. (2004) *Common Native Plants of the Coorong Region: Identification, Propagation, Historical Uses*, Australian Plants Society (SA Region) Inc.

Dashorst, G. R. M. & Jessop, J. P. (1998) *Plants of the Adelaide Plains & Hills*, Second Edition, State Herbarium of South Australia

Prescott, A. (1988) *It's Blue with Five Petals – Wildflowers of the Adelaide Region*, A. Prescott.

Weed Control

Robertson, M. (2005) *Stop Bushland Weeds: A Guide to Successful Weeding in South Australia's Bushland*, 2nd Edition, The Nature Conservation Society of South Australia Inc.

Revegetation

Bonney, N. (2003) *What seed is that?* Revised Edition, Neville Bonney, Tantanoola, SA.

Goolwa – Wellington LAP, Coorong District LAP & Department for Environment and Heritage: *Revegetation Guidelines for the Lower Lakes*.

Mercer, K. (2006) *Corridors and Buffers for the Goolwa to Wellington LAP Region*, Goolwa to Wellington Local Action Planning Board Inc.

Fauna

Simpson, K & Day, N (2004) *Birds of Australia: Seventh Edition*, Penguin Group (Australia), Victoria.

Yellow-tailed Black Cockatoos www.deh.sa.gov.au/biodiversity/yellowtailed.html