

Windbreaks for Bungendore

Why, Where, When, How and What

by David Watson

Illustrated by Rainer Rehwinkel



Sponsored by Bungendore Community Landcare Group Inc.

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David Watson

March 1994

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FOREWORD TO SECOND REPRINT

This booklet is dedicated to the memory of John Walter, 1935 – 2019, co-founder of Bungendore Landcare, “the man who planted trees”.

More than 25 years after the first edition of this booklet, the advice within still feels relevant. Inevitably, some points demand updating.

p.3 “last century” was referring to the 19th century.

p.9 Whole Farm Planning: All fencing costs are now tax-deductible.

p.13 To Rip or not to Rip?

Whether or not ripping is essential or important for tree planting is debatable. Brian Cumberland from Greening Australia direct-seeded thousands of kilometres of native trees and shrubs successfully without ripping. He thought ripping for trees was a forestry pine plantation practice, not as important for natives.

By contrast, Peter Marshall, forester and truffle grower from Braidwood, has strongly criticized the National Arboretum management in recent years for inadequately ripping the ground for its trees. Peter believes most if not all soil is compacted and airless, inhospitable for tree root growth.

p.14 Weed Control

In recent times the knockdown herbicide Roundup (glyphosate) has been getting some bad press. I now include a note of caution about use of this product.

p.15 Windbreak Design

I highly recommend David Holmgren’s revegetation manual *Trees On the Treeless Plains* (Holmgren Design Services, 1994), now also available as an e-book. David details five different multi-purpose shelterbelt designs including a 7-row belt that we have established at Millpost.

p.17 Direct Seeding

Brian Cumberland has retired but Greening Australia continues direct seeding with contract machinery.

p.18 What to Plant

Having established many shelterbelts at Millpost, our tree planting emphasis has shifted slightly to shade trees. Searing summer temperatures demand more shade for livestock. Deciduous trees provide denser shade than native trees. Planting shade trees is not only an adaptive response to global warming, tree planting in general is a potential remedy. It has been calculated that a trillion new trees would go a long way to capturing excessive atmospheric carbon and thus moderate some of the damaging

effects of climate change. (We may have a better chance of planting trees than controlling carbon emissions.)

Oaks are the pre-eminent deciduous tree. They are drought-resistant, tap-rooted, and long-lived; they provide dense shade, useful fodder and good timber and they build soil. Acorns are readily collected in the streets of Canberra. You can identify the species with a copy of *Trees and Shrubs in Canberra* (L.D. Pryor and JCG Banks, Little Hills Press, 1991).

Burr Oaks (*Quercus macrocarpa*), Portugese Oak (*Q. lusitanica*), Swamp White Oak (*Q. bicolor*), Red Oak (*Q. borealis*), Turkey Oak (*Q. cerris*), Valley Oak (*Q. lobata*) and Sawtooth Oak (*Q. acutissima*) are all growing admirably at Millpost. John Walter planted an avenue of Hungarian Oak (*Q. farinetta*) along Turallo Creek next to the Council Pound/Community Food Forest in Turallo Terrace. They bear a huge acorn crop every year.

Black Locust (*Robinia pseudo-acacia*) is another hardy deciduous tree well worth planting. It can be seen around old stockyards or homestead ruins throughout the district. This spiny, suckering leguminous tree with fragrant white blossoms yields ground-durable fence posts. Honey Locust (*Gleditsia triacanthos*) has similar qualities with the added benefit of nutritious pods for livestock (but avoid really thorny specimens.)

Poplars (*Populus* sp) prefer higher rainfall than we have been getting lately, but once established perform well with the following benefits:

1. fast growth, 2. some will sucker, 3. can be multiplied by cuttings, 4. fodder value for livestock, 5. are fire-retardant, 6. good shelter and allow pasture growth underneath. The Gundaroo Poplar, a hybrid of *P. yunnanensis*, is growing well along Millpost Lane and is renowned for controlling soil erosion. The Silver Poplar (*P. alba*) suckers profusely, feeds livestock and controls soil erosion. You can see gullies coming off Mt. Gibraltar rehabilitated with this species.

Fire-Retardant Species

As the planet continues to heat up, it is becoming increasingly important to factor in flammability when choosing which species to plant, especially close to buildings.

Most deciduous species (oak, poplar, elm, ash, etc.) are to be preferred to pine and eucalypt.

Native plant enthusiasts should consider Acacias (*dealbata*, *pravissima* and *melanoxylon*), *Atriplex*, *Hakea* and *Casuarina cunninghamia*.

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Introduction

Show me a farm around Bungendore that could not be improved with more shelter. Some paddocks are so bare and windswept that the animals have not a single tree for shade, let alone shelter.

Last century some parts of the Bungendore district were naturally treeless. Many areas were overcleared. Attempts to revegetate such an exposed environment could be difficult and expensive. It makes sense to spend some time beforehand learning from other people's experience. Thousands of dollars can be saved by avoiding failures and by using new techniques. Failure (sometimes 100%) in tree plantings is very common, yet easily avoided. The three biggest mistakes people make are: failure to rip the ground; failure to control the grass competition and failure to select the right species.

On the other hand, nothing succeeds like success. Watching trees thrive is great for morale and makes you want to plant more. This booklet has been prepared to inform and inspire you to achieve success. Hopefully you will then become a lifelong member of the revegetation club.

This booklet has also been prepared as a manual to accompany a Windbreak Plan prepared by the Bungendore Community Landcare Group Inc. for a significant portion of the Bungendore plain. (*Figure 1*)

THE BENEFICIAL EFFECTS
OF WINDBREAKS
EXTEND FOR
10 TIMES THE
HEIGHT OF
THE TREES

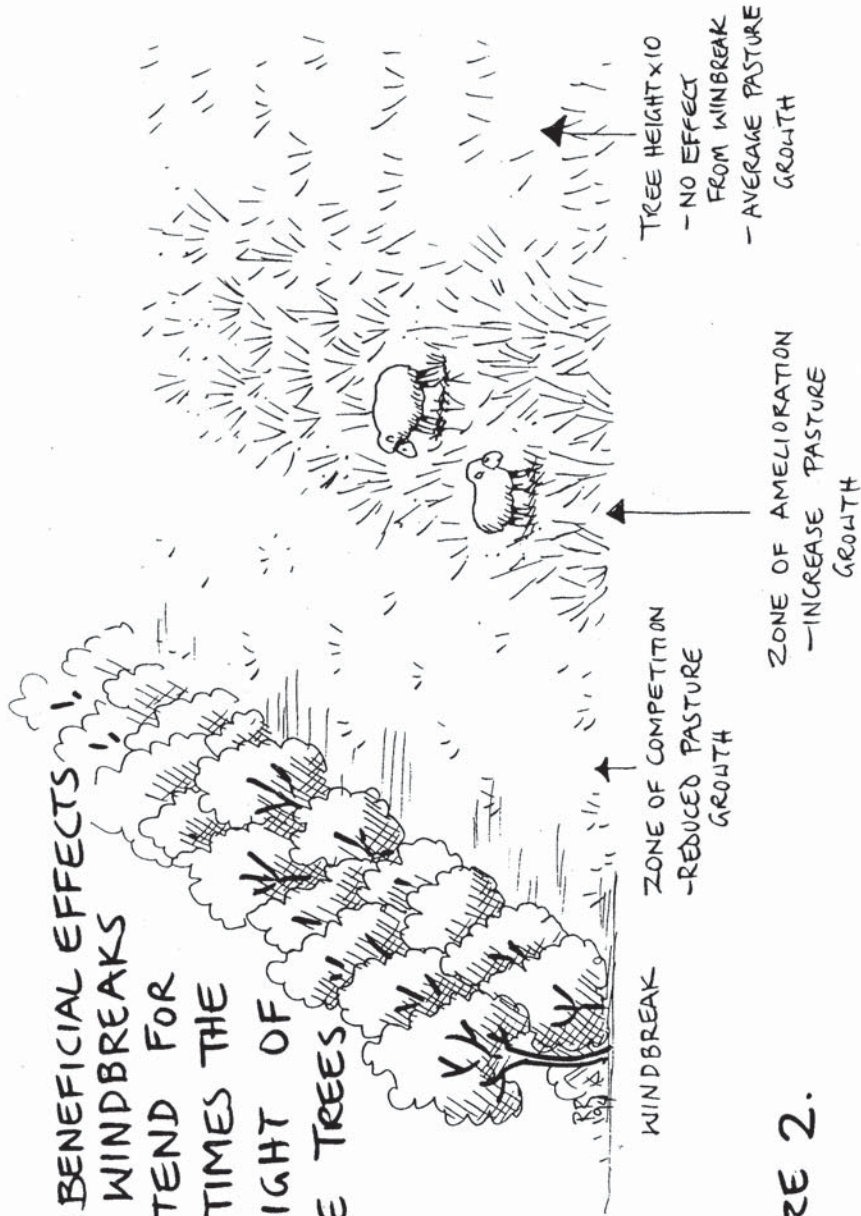


FIGURE 2.

Why Plant Windbreaks?

Economic imperatives

They reckon if you want to rouse a cocky you need to hit the hip pocket nerve. So here I go. Windbreaks make money, no doubt about it. There are five main ways in which they improve profitability :

- 1 Increased carrying capacity.
- 2 Improved livestock performance (fertility, growth, survival)
- 3 Increased crop yields.
- 4 Higher land values.
- 5 Revenue from thinnings or eventual felling.

Let me elaborate on these claims.

1 True, you lose some ground which the trees occupy and yield will be lower for a short distance from the windbreak where the tree roots compete with pasture. But in the sheltered area further away yields increase substantially, mainly because of reduced evaporation. This increase in yield more than compensates for losses closer in and has been found to range between 10% and 20% net increase in livestock carrying capacity. (*Figure 2*) Not only do you get more pasture but sheltered livestock need less of it, especially in cold spells. Heat and cold stress losses on animals have been measured to be 15%.

2 All ages and classes of livestock will grow and reproduce better when sheltered. Fat lambs will be ready for market weeks earlier when sheltered, so too will vealers and steers. More twin lambs will be conceived because of higher ewe weights at joining and more will survive. A lamb born around Bungendore in winter only has a 60% chance of survival. Shelter will increase that chance to 80%. Widespread Australian studies have shown that lamb mortality is halved with effective shelter. The critical word here is effective. How to ensure that a windbreak is effective will be explained later.

3 Not all of the Bungendore plain is used for livestock. Vegetables, hay and turf are some of the other enterprises. No doubt the future will bring others. Studies have shown that whatever the crop, they all benefit from shelter. I have the results of studies which measured yield increases for a wide range of crops when sheltered. A chart lists the crop, location, number of years tested and

percentage benefit. For example Rye was tested in the USSR for 12 years and there was a 29% increase in yield on average each year. Apple yield was up 87% in England over 3 years. And so the list goes on for grains, vegetables and fruits. Wherever crops are sheltered the increased yield is significant, sometimes dramatic.

4 Farmers under economic pressure are often advised to get bigger or get out. Getting bigger is scarcely an option around Bungendore any more. Land is selling for about ten times its agricultural value. When you consider that shelter increases the productivity of land by 10 to 20% you can get bigger without buying more land by simply doing better with what you already have. I reckon that you can comprehensively shelter 1000 hectares and so gain 100-200 hectares in carrying capacity, cheaper than you can buy an extra 40 hectares. If you decide one day to get out, sheltered land sells for at least 10% more than exposed land and so it should.

5 Timber from the windbreak can eventually be sold as thinnings, coppice or clearfelling. Firewood, farm timber for posts and poles or even milling timber are some of the options. There could be the opportunity to harvest seed, fodder, also fruit, nuts, honey or even flowers for florists.

Environmental reasons

There are many other reasons for establishing shelter although their economic benefit may be less quantifiable. Carefully designed windbreaks will be a corridor for birds. Many of these birds will serve as predators for harmful insects, particularly the scarab grub. This grub not only eats pasture roots, but later emerges as a Christmas beetle and chomps away on the nearest gum tree.

Strategically placed windbreaks slow down the spread of a grassfire. If you reduce wind speed by a factor of two the rate of fire spread will decrease by a factor of four.

Shelter improves the working and living environment for people. Windy areas (eg Goulburn) are known to have higher than average suicide rates. The windswept Monaro is reputed to have a high level of divorce. Whose mood does not deteriorate after days of constant wind? If we live and work in a sheltered environment our psychological well-being will be reflected in

improved morale, workrate, health and friendships. Who wants to know a cranky old bastard who's been battling a gale?

Trees generally, including windbreak trees, have a valuable role to play in preventing and/or healing dryland salinity. Trees and other deep rooting vegetation lower the water table. A rising water table brings salt to the surface and the salt kills valuable pasture and most other vegetation. Dryland salinity is a potentially devastating land degradation problem around Bungendore.

Windbreaks protect the soil from wind erosion and to a lesser extent water erosion. They will also recycle leached nutrients from subsoil to pasture. It has even been postulated that trees will prevent soil acidification. Deep rooting pasture species are already being suggested for this purpose.

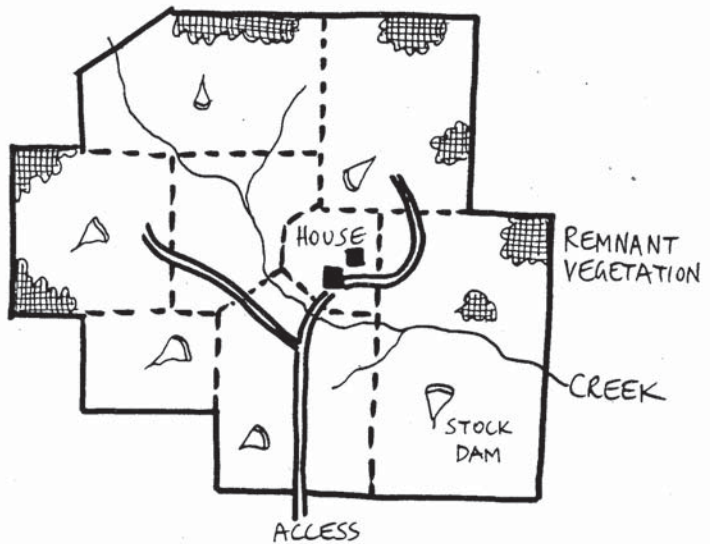
Benefits From shelter

For those of you still unconvinced of the value of windbreaks I will conclude by quoting an impressive list of their potential benefits:

- 1 Aesthetic - landscape appeal, resale value.
- 2 Reduced salting - lower summer water table.
- 3 Reduced erosion from wind and water.
- 4 Habitat for insectivorous birds - fewer pasture insects.
- 5 Wildlife habitat and amenity value
- 6 Recycling of leached nutrients from subsoil to pasture
- 7 Provision of wood - fuel, posts, poles.
- 8 Provision of tree crops - nuts, seeds, fodder, honey.
- 9 Reduced wastage of hay from rain when feeding out.
- 10 Shade for livestock in summer
- 11 Shelter for new born lambs.
- 12 Shelter for newly shorn sheep.
- 13 Decreased energy cost for maintenance of grazing animals.
- 14 Increased pasture production.
- 15 Increased crop yields.
- 16 Barriers to wildfire.

(Quote from Trees and Victoria's Resources. December 1981)

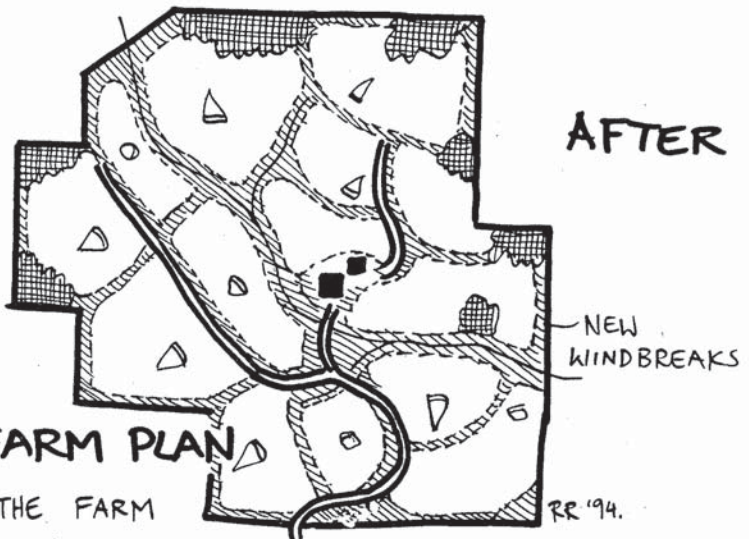
BEFORE



DIRECTION
OF
PREVAILING
WIND



AFTER



WHOLE FARM PLAN

NOTE HOW THE FARM IS NOW FENCED ACCORDING TO LAND-TYPE. WINDBREAKS ARE PLANTED ALONG THE NEW BOUNDARIES. REMNAANT VEGETATION IS LINKED.

FIGURE 3.

Where to Plant Windbreaks

In the past

In the past it was common practice to site windbreaks on the windward side of an existing paddock by erecting an extra fence 5 to 10 metres from a decaying fence. You hoped the trees would be secure from stock before the old fence fell down. This method was defective for two reasons. Firstly, the old fences were invariably laid out on a grid pattern along portion boundaries. No account was taken of the class or lie of the land in this crude lineal carve up. Secondly, when the old fence fell down, stock would eat the lower branches of the windbreak, allowing the wind to rush underneath. It is preferable to permanently exclude livestock from a windbreak to prevent this.

Whole farm planning

Ideally, windbreaks will be a component of your whole farm plan. (*Figure 3*). There is now a powerful incentive for carrying out such a comprehensive farm plan. Provided that your plan is endorsed by a State land management agency, the Tax Department will allow certain fencing costs as an outright deduction. In particular, **the cost of fencing land into land classes or types will be an allowable deduction.** Previously you were only allowed to claim for fencing repairs, fencing off degraded areas or depreciation on a new fence.

There are several reasons why fencing land into classes assists land management. All land can be stocked according to its capacity or capability. Wet areas can be separated from better drained areas to prevent pugging of soil and foot problems in stock.

It is often a sensible step to divide these new classes of land with double, low strain, low cost electric fences which follow the **ridge, contour, stream or lie of the land.** The boundaries between your new paddocks are the natural site for windbreaks.

Siting guidelines

For those who don't go the whole hog and produce a comprehensive farm plan there are four things to keep in mind when siting windbreaks. These four guidelines will also assist anyone drawing up a farm plan.

- 1 Plant at right angles to the prevailing wind.
- 2 Reinforce the terrain
- 3 Link existing vegetation
- 4 Shelter highest value assets first.

Looking at these points in detail,

1 As a general rule, windbreaks should be aligned at right angles (or thereabouts) to the prevailing wind. In our district this means in a generally **north-south direction**. Shelterbelts so aligned ameliorate cold south-westerlies, dessicating westerlies and north-westerlies. Ideally windbreaks are repeated every 400 metres or so. Shorter boomerang shaped windbreaks may be required in the downwind part of the paddock where stock are driven by cold wind and rain.

If you are uncertain about the prevailing wind in your particular spot, look at any old tree. Its shape may give you a clue. If you are in a treeless area, erect a windsock and watch it for a few seasons, or consult a windrose from the nearest weather station. **Windroses** tell you the likelihood of wind speed and direction for different seasons and times of the day. You can calculate when to arrange shearing or lambing according to the odds or align shelter to suit your preferred timing.

2 To maximise shelter, windbreaks should reinforce the naturally sheltered area created by the terrain. In undulating country this means planting along the **ridges**. Windbreaks in gullies have to reach a great height before they have any impact on the passing wind stream. In any case, planting in depressions is usually ill advised because of poor drainage and greater frosting.

3 If you consider windbreaks the backbone of the landscape you might as well build on what you already have. Reinforce existing vegetation by **linking isolated remnant vegetation or by extending and widening old windbreaks**. (Figure 4). Short windbreaks can be worse than useless by increasing the windspeed around either end.

Linking vegetation constructs a wildlife corridor. Many small birds refuse to fly to or colonise isolated clumps of trees. An interconnected series of windbreaks offers the exciting prospect of reintroducing all sorts of birds and other animals that have long since abandoned the cleared landscape.

4 If all land and improvements (except windmills) benefit from shelter, where do you start? The following list of priorities may be useful.

- (a) lambing and calving paddocks
- (b) area for newly shorn sheep
- (c) homestead, gardens and farm buildings
- (d) most fertile soil, best pasture
- (e) roads, yards, other dusty areas
- (f) less fertile areas.

There is a fire insurance aspect to sheltering assets. Provided that the design is right, windbreaks serve as fire breaks. Vegetation should not be flammable or too close to buildings and access for fire fighting vehicles must be retained. Even livestock have been saved in a bushfire by sheltering in the 'shadow' of windbreaks.

Places to avoid

In addition to taking account of guidelines on where to plant, there are certain places that you should avoid. Watch out for power lines and when ripping beforehand, remember underground services. Also remember that whilst roadsides may be a tempting site for windbreaks, the Roads and Traffic Authority is all powerful and roads tend to be widened. Another site to avoid is unsprayed phalaris or other vigorous pasture.

The only place to establish windbreaks is where you have planned them. If you haven't got a plan, then I hope that these guidelines will help you to produce one. You may be lucky and own land within the boundaries of the Windbreak Plan prepared by the Bungendore Community Landcare Group Inc. If not, why don't you get involved with the Landcare Group and produce another Windbreak Plan for your area. We always intended our initial plan to be a prototype. We have aerial photos of the entire Lake George Catchment to assist in planning.

WINDBREAKS ARE THE BACKBONE OF THE LANDSCAPE

ISOLATED REMNANT VEGETATION IS EFFECTIVELY LINKED WITH NEW WINDBREAK PLANTINGS

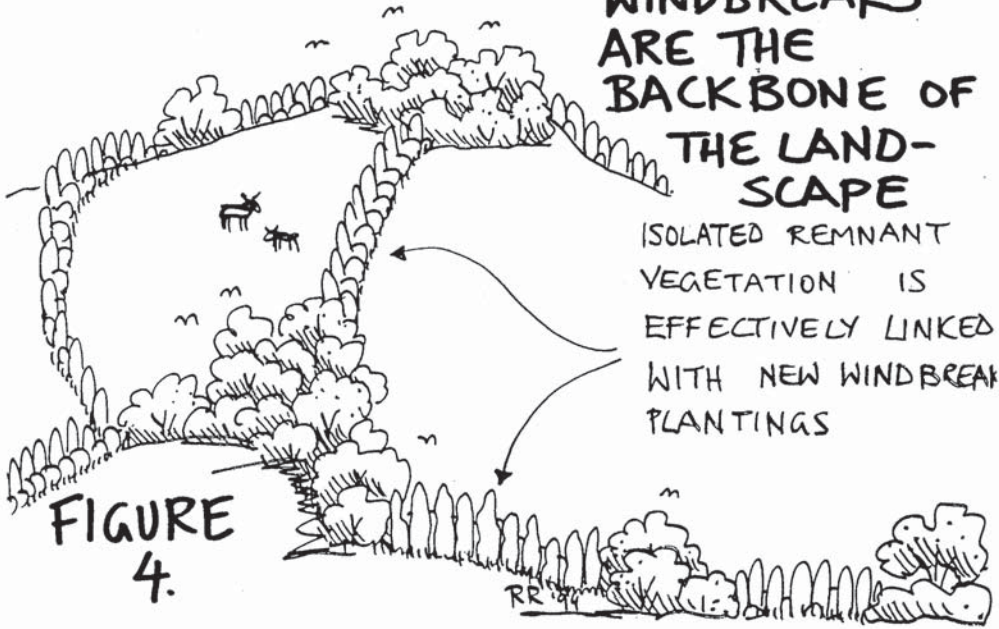
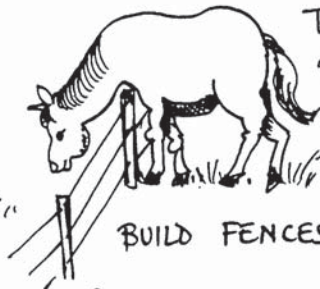
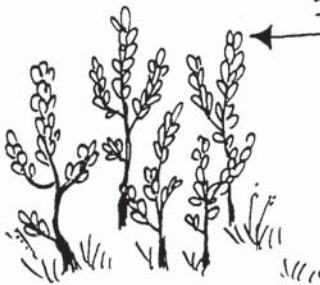


FIGURE 4.

BE SURE TO LEAVE ENOUGH SPACE BETWEEN THE PROTECTIVE

MINIMUM 2 m.
PREFERABLY 3 m.

FENCE AND THE FIRST ROW OF TREES.



BUILD FENCES STRONG

STOCK LOVE YOUNG TREES!

FIGURE 5.

How and When to Establish Windbreaks

There are a number of critical steps to take in site preparation. Failure to carry out any step could mean heartbreak instead of windbreak. There is no return from dead seedlings. Windbreak establishment is a chain only as strong as the weakest link: those links are:

- 1 Ground preparation
- 2 Fencing
- 3 Weed control
- 4 Windbreak design
- 5 Timing.

I will discuss these steps in some detail.

Ground preparation.

In my experience, shattering the soil with a bulldozer/ripper or tractor/chisel plough is highly beneficial. It is best to rip in summer or when the earth is dry and will shatter. I find chisel ploughing should be done repeatedly over say a 12 month period, each time a little deeper. If this is done, when you plant the trees they should really take off. I have trees that have reached over 5 metres in height in only a few years after this treatment. Yet alongside I have the same species planted at the same time in unploughed ground, still only 1 metre tall. Anyone who needs proof of the value in ground preparation is welcome to come to Millpost and I will show them.

After ripping with a bulldozer let the ground settle so that air pockets disappear and plants do not collapse after heavy rain. Consider rolling, grading or somehow levelling a ripped site to make it easier to maintain in the long term.

Fencing

Fencing and guarding trees against livestock and vermin is essential. (*Figure 5*) Fencing can account for up to 80% of the cost of a tree project. Bear in mind that tree fences need to be better or stronger than subdivisional fences. Stock will demand entry to treed areas because of the abundant grass in the early years.

Electric fencing is by far and away the cheapest. You must take the trouble to educate your animals off shears or at weaning in a small 'training' paddock. Once animals are 'switched on' to shock treatment, even one and two wire fences have proved effective. The issue is not whether electric fences work, it is whether they are properly erected with plenty of power, earthing and training of stock. On flat ground electric fences for trees can be built for less than \$1000 per kilometre, including labour.

A strategy to cope with rabbits and hares is also necessary. Talk to other tree planters in your area to ascertain the extent of the problem and how they cope. It will generally be cheaper to protect individual trees with three small stakes and a shade cloth type tree guard than to fence with netting around the whole block. (Figure 6) Vermin proof electric fencing is another possibility. You need two bottom offset hot wires only one inch off the ground. Permanent grass suppression is essential to prevent earthing out.

Weed control

Once the site is ripped and fenced, it is time to control grass and weed competition. An initial knockdown can be achieved by heavy grazing, although reducing the site to a billiard table will make seedlings an obvious target for vermin. Spot spraying or spraying along the rip lines may be a preferred option. A knockdown herbicide should suffice for native grasses. For vigorous introduced grasses a knockdown and residual herbicide or follow up treatments may be necessary. Spray when the grass is actively growing. If this is done well before planting it will allow moisture to build up for the tree or shrub when it is planted.

If spraying is not your cup of tea, weedmat or some form of thick mulch may suffice. Remember, though, phalaris is like bamboo and will find its way through thick mulch. The biggest killer of young trees is grass competition. I have planted two windbreaks, each over 300 metres long that were completely wiped out by grass competition. The best way to fertilize a young tree is to weed it.

Windbreak design

The design of the windbreak itself is an often overlooked step in the whole process. It should really be set down on paper before fencing or ripping.

Aim for at least two and preferably three to six rows. If you want to slash in between the rows in the early years to reduce the fire hazard, make the rows 3 metres apart. (*Figure 7*) Plant the outside rows at least 2 and preferably 3 metres from the outside fence. This allows optimum branch development low to the ground. Make the windbreak length at least twelve times the mature height of the trees.

A permeable vertical face on the leading or windward edge is better than a sloping face. The aim is to filter the wind, not direct it upwards. If you direct all the wind up, then it will come down again sooner than if you had let some of it through.

Permeability might only be achieved in the longer term by planting thickly in the rows (every 1.5 - 2.0 metres) and then thinning branches and trees for firewood as required. It is unrealistic to think that you can plant, fence and forget windbreaks if you want them to be fully effective.

Timing

When to plant or sow is debatable. Some people prefer autumn to allow more root growth before summer. I prefer August or September to minimize frost damage. A lot depends on how frost hardy the plants are, how severe the winter is and what soil moisture conditions are like. Some springs may be better than some autumns and vice - versa. If the autumn is dry I reckon you might as well wait until August. Trees don't like being planted into dust.

Here is an 18 month programme for maximising your chances of successfully direct seeding or planting native shrubs and trees.

Autumn - fence the area

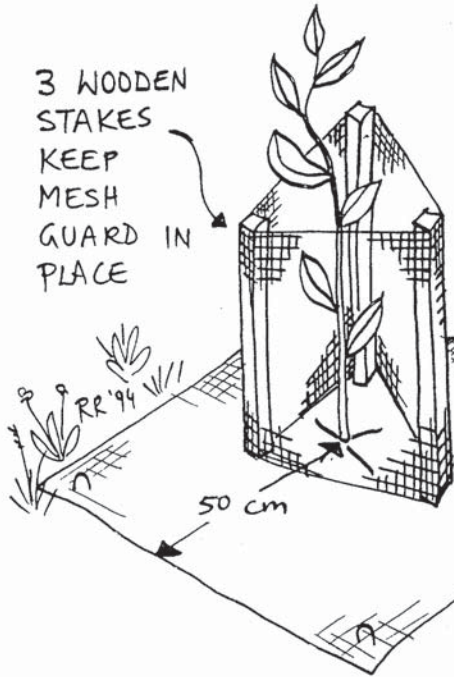
Winter - mob stock

Spring - spray with knockdown herbicide

Summer - rip the ground when dry

Autumn - sow if weeds controlled or spray again

Spring - sow seeds or plant trees.



MESH TREE GUARDS AND WEED MATS HAVE PROVED TO BE EFFECTIVE IN THE BUNGENDORE AREA

3 WOODEN STAKES KEEP MESH GUARD IN PLACE

4 WIRE PEGS HOLD WEED MAT DOWN

FIGURE 6.

GOOD DESIGN IS IMPORTANT!

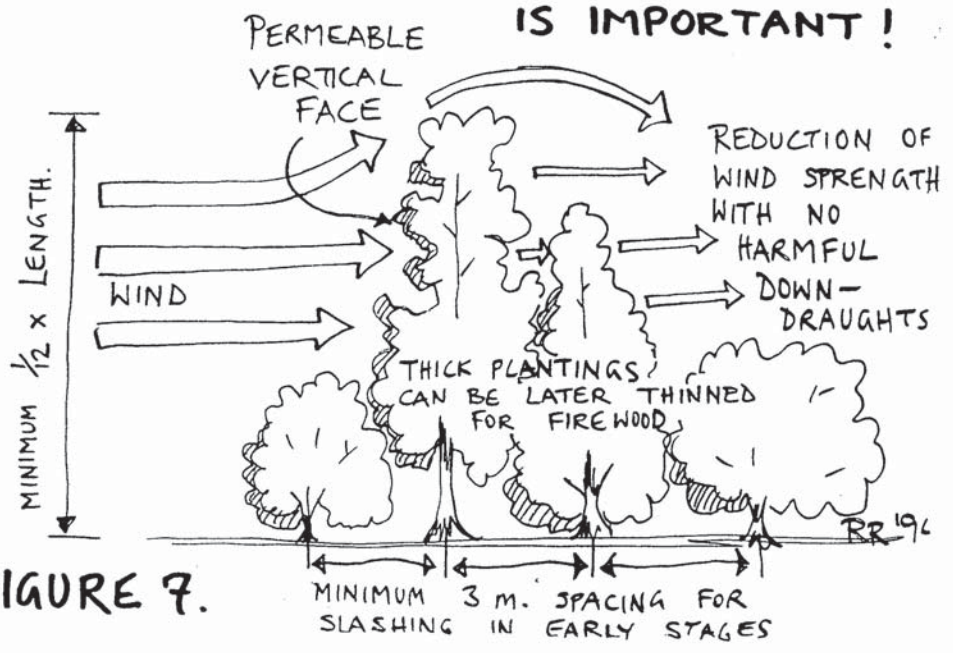


FIGURE 7.

Direct seeding

Direct seeding of native trees and shrubs is a game of chance, but the success rates are improving all the time as the results of trials all over the country come in. It is about ten times cheaper than hand planting and has several other benefits. Direct seeded plants experience no root disturbance. They don't seem to attract vermin in the way that freshly planted seedlings do. There is greater opportunity for natural selection. On the other hand, direct seeding might not produce the uniform result desired in a shelter belt.

We are fortunate to have in Brian Cumberland (*Greening Australia A.C.T.*) a bloke close handy with the machine and the know how to carry out direct seeding at for next to nothing. If you decide to direct seed a windbreak you might consider hand planting a row of shrubs like Melaleuca, Grevillea or Banksia (hard to seed) to add diversity and block underdraughts.



What to Plant

The species to plant in windbreaks are hardy species that have proven themselves in the local environment. The best thing you could do is to collect seed from trees and shrubs that were planted near where you want yours to grow. Preferably, collect seed from plants that survived the severe frosts and drought of 1982-83.

Native versus exotic

Some people may urge you to plant only local or indigenous natives. They will argue that, for "ecological" reasons, non-local natives ("exotic natives") and exotic plants should not be planted. Although there are approximately 500 Eucalyptus species to choose from, they will argue that only the 10 or so local species should be considered.

This argument is romantic ecology. Our environment is forever evolving. Most of the Bungendore plain is now a sea of introduced pasture and weeds. The soils have become more acidic and their chemical fertility has changed. Bird and especially insect populations are radically different from what they were when Europeans first settled here. You cannot turn the clock back.

I am not saying that local natives are a poor choice. Some, especially the Acacias and understory shrubs do very well. But others, such as Eucalyptus blakelyi and E. rubida really struggle. I am arguing against confining the choice to local natives, or to natives at all. Exotic (non-Australian) trees and shrubs have an important ecological role to play, because often they will thrive and provide habitat for birds on sites where natives will not survive due to changes in local ecology.

Hardy survivors

The importance of planting hardy survivors which will reproduce themselves cannot be over-emphasised. The large number of plants required for windbreaks makes it impossible to nurture soft garden specimens. Even with new technology like herbicides, direct seeding and electric fencing, it will take a generation to adequately shelter the Bungendore district. It is a huge task. If the species chosen are borderline or fail to regenerate, not only will the windbreak have gaps, but the next generation will have to turn around and do the job all

over again. We must create a long-term self-renewing landscape, including the windbreaks.

Let's consider the ideal characteristics of a shelter tree:

1 Survival

- (a) short term: frost hardy and suited to seasonal moisture conditions.
- (b) long term: suited to soil, climate, able to withstand insect attack and to regenerate, eg after fire.

2 Fast growth

3 Tall

4 Permeable

5 Uniform

A short list

The list of trees that will satisfy these criteria, and which have proven themselves around Bungendore, is a short one. The serious search for appropriate shelter species has only been under way for a decade or so. No doubt more will join the list as time passes. In the meantime, beware, be cautious, don't mass-plant untried species. Likewise, don't mass-plant a single, though tried, species. Insects like nothing more than building up a head of steam on a single-species planting. Perhaps the best policy is to plant 4 or 5 different tall, long-lived species in sequence. Some of the species which satisfy the above criteria are *Eucalyptus camphora* (ovata), *E. macarthurii*, *E. mannifera*, *E. viminalis*, *Casuarina cunninghamiana* and various Poplar species.

Here is a more extensive list of plants to suit a variety of sites and conditions. This list includes the afore-mentioned tried-and-trues as well as some others which show potential for Bungendore.

Survivors

- (a) Frost-hardy and suited to the Bungendore plain, where very wet conditions may prevail:
Acacia dealbata, *melanoxydon*, *pravissima* and *floribunda*.
Callistemon pallidus, *Melaleuca ericifolia*, *Casuarina cunninghamiana*.
Eucalyptus camphora (ovata), *aggregata*, *stellulata*, *viminalis*.
Various Poplar species.

(b) Suited to drier sites, relatively insect-tolerant and should regenerate, eg after fire:

Acacia dealbata, *decurrens*, *boormanii*, *cardiophylla*, *mearnsii*, *rubida*, *implexa*.

Banksia marginata, *Bursaria spinosa*, *Hakea* sp., *Grevillea* sp.

Eucalyptus acaciaformis, *cinerea*, *macarthurii*, *mannifera*, *viminalis*, *pauciflora*, *melliodora*, *polyanthemos*, *nicholii*.

(N.B. *Eucalyptus melliodora* and *E. polyanthemos* (Yellow and Red Box) are included not because they have been performing brilliantly in recent years, but because they are the best local timber and hopefully if trialled often enough on different sites they will find a new niche.)

Fast growers

Acacias, Poplars, Willows, various Eucalypts, such as *E. viminalis*, *E. camphora*, *E. macarthurii*. *Pinus radiata*, the ubiquitous green weed, deserves a place in any windbreak list because of its rapid growth. A strategy to reduce its fire vulnerability is worth considering, perhaps by high pruning, and planting non-flammable understorey with it, eg *Tagasaste*.

Tall species

Poplars, Elms, *Pinus radiata* and the Eucalypts.

Permeable

Casuarinas are ideal for permeability. Most Eucalypts are good; as are Poplars, especially in winter. The dense growth of Cypress and other conifers make them unsuitable, unless dense shelter is required for a short distance. (Beware fire threat though.)

Uniform

Poplars, Willows and other species grown from cuttings; also Casuarinas and to a lesser extent Eucalypts.

You may decide to steer clear of Eucalypts because of the severe threat of insect predation in your district. Shelterbelts can be quite effective with lots of

deciduous trees. Hedgerows and shelterbelts in the northern hemisphere are usually composed of deciduous species. Bungendore itself has some fine examples of Hawthorn hedgerows and thick copses of Elms which provide valuable shelter. Carwoola has a shelterbelt of Osage Orange (*Maclura pomifera*); there are many other deciduous trees which not only provide shelter but also fruit, nuts, timber, fodder or forage as well, eg Quinces, Kentish Cherries, both of which sucker to advantage, Oaks, Honey Locust, Pears, Crabapples, Hazels and Black Locust. There are even evergreen exotics which provide nuts: Stone Pine (*Pinus pinea*) and Evergreen and Cork Oaks (*Quercus ilex* and *Q. suber*.)

Beware of these

Finally: a few warnings

Eucalypts with blue leaves are often preferred by insects, eg *Eucalyptus bicostata*, *E. bridgesiana*, *E. cinerea*, although *E. crenulata* and *E. parvifolia* are doing OK at Millpost. Some people have suggested planting *E. bridgesiana* as a decoy or sacrificial row.

Don't plant *Tagasaste*, *Pinus radiata*, *E. melliodora*, *E. polyanthemos*, *E. sideroxylon* or *E. macrorhyncha* in wet areas.

We are fortunate to have Canberra close by as an inspirational example of what can be achieved in harsh conditions. A determined tree-planting effort has converted what was a windswept plain with some open woodland into a remarkably sheltered city microclimate.

Average annual wind mileages dropped at Yarralumla from 43,000 in 1930 to 25,000 in 1960, and from 37,500 at Duntroon in 1911 to 20,000 in 1930. Implementation of the Windbreak Plan for the Bungendore Plain will surely reap similar rewards.

