Shade and Shelter on farms by direct seeding workshop

A demonstration site and field day, establishing shade and shelter belts by direct seeding for resilience to climate change.

Field Day held 11th October 2016
Brad and Danielle Carr’s farm
310 Pinkerton Rd, West Creek

Bass Coast Landcare Network will be demonstrating how to undertake a direct seeding project with a changing climate in mind. They have selected several species from drier areas which will be sown into the site. The workshop will give the participants the opportunity to learn about direct seeding methods and explore ways of adapting revegetation plans within a changing climate.
The project will direct seed Zones Armitage, Dam and Pinkerton which is 2.92 ha of direct seeding. This requires 5kg of seed of which we will be purchased from the South Gippsland seedbank, Leongatha at $750 per kilo. Adrian Tilling will prepare the sites by plough. The landholders will erect approximately 2km of fencing.

The site is swamp scrub EVC, which will be seeded with a standard mix comprising *Melaleuca ericafolia*, *Leptospermum continentale*, *Melaleuca squarossa*, *Eucalyptus ovata*, *Godinea ovata*, *Acacia verticillata*, *Acacia melanoxylon*, *Ficina nodasa*, *Oleria lirata*, and *Allocasurina paludosa*.

The planting will trial some Northern species which may be adapted to climate change. These species include; Yellow Stringybark, *Eucalyptus muelleria* from Warragul, *Kunzea eriacoides* from Mirboo North, *Pultenaea daphenoides* from Hallston and some Mountain Ash, *Eucalyptus regnans* from Strzelecki.
Why do we need shade and shelter on our farms?

Hot winds can accelerate water evaporation from dams and paddocks
Pasture growth is minimal at cold and hot extremes (<5°C >30°C)

Animal welfare considerations
• Heat stress
• Cold stress including wind chill
• Biodiversity

Climate change
• May bring longer hotter heat waves
• Rain events may be more intense
• Lightning strikes are predicted to increase

Hot winds and evaporation
• Windbreaks can slow hot northerly and easterly winds over the surface of farm dams and so reduce evaporation by 20 to 30%
• Windbreaks produce a down wind ‘quiet zone’ which can be five and ten times the windbreak height
• Shade reduces water temperature and therefore evaporation losses
• Trees should be planted two to five times their mature height away from the dam to keep roots out of the dam wall or water.
• Well designed planting can filter water entering the dam, improving water quality
• The plantings should be sited in a positon that does not encourage nutrients from stock camps to foul the dam.

From Rural Water Note RWN04 WA Govt. 2007

More planting hints
• Shading farm dams also reduces the chance of algal blooms.
• The dam wall, spillway and the inflow area (filter zone) should have wetland plants such as reeds and rushes to help control nutrients.
• Aquatic plants, reeds and sedges can also help control wave action from high winds that can erode banks.
The effect of shelter on pasture growth

Wind reduction

• Improved soil moisture conservation
• Reduced wasteful high plant transpiration rates
• Reduced activation of water-conserving mechanisms (stomatal closure) which lead to the shutdown of photosynthesis
• Reduced evaporative loss of dewfall
• Reduced mechanical damage to plants
• Promotion of leaf cell expansion independently of reduced plant moisture deficit

Temperature gain

• Slight improvement in air temperature
• Small increases in soil temperature in light pastures

Shade

• Reduced photosynthesis
• Reduced tillering

Root competition and localised precipitation

• Competition for space, soil nutrients and moisture at the margins of the shelterbelt
• Rain-shadow could reduce soil moisture at the margins of the shelterbelt


So does shelter improve pasture production or not?

In some situations, a shelterbelt may only protect grassland from a fall in production in certain years rather than enhance production in the majority of years. In other words, it offers protection against adverse conditions rather than routinely enhancing growth above normal yields. Very little work, however, has examined the potential long-term savings under these marginal benefit conditions.

HOWEVER

Studies conducted in the U.S.A. on pasture and hay yields over a 14-year period have shown that yields are higher in pastures that are sheltered. Similar studies in Australia have also found an increase in plant biomass associated with shelterbelts.

Design points to consider

• One aspect of design to keep in mind is the common misconception that a sloping cross-section profile enhances windbreak effectiveness. Steep sided belts shelter a larger area because they provide a greater height barrier to wind flow and a lower density on the windward side. Sloping profiles on the windward side can actually reduce the distance over which protection is provided.

• Taller species should be placed in the centre of a belt. Lower growing species can be placed on each side. The cross sectional profile of a break that consists of shrub species on both sides, it is a more valuable design for
wildlife habitat and is more practical. Large tree branches are less likely to fall on and damage fences if the trees are located in the centre of the belt.

- Considerations when deciding spacings between plants should include the time taken for the plants to reach the desired density level and the size of the species selected. Medium to tall trees are usually spaced 3 to 4 metres apart. Large shrubs can be spaced between 2.5 to 4 metres while smaller growing shrubs are generally placed 1.5-2.5 metres apart.

- Plants should be placed closer together in belts with fewer rows to obtain the desired level of density. This will also provide protection more quickly. Staggering trees in alternate rows can obtain more uniform density and a reduction in gaps so that they are not directly opposite each other.

From Shelterbelt Design AgNote Number: LC0136 Published: May 2006 Updated: October 2009

Animal health and welfare

- The provision of shelter also has some more direct benefits for stock. Stock in a sheltered paddock are less exposed to harsh climatic conditions as the shelterbelt creates a microclimate that protects stock from weather condition extremes.

- The provision of shelter can reduce the effects of hot, cold and windy conditions. The energy stock would normally expend on maintaining their body temperature can then be utilised for increased wool, meat and milk production.

- Higher rates of pasture productivity and lower amounts of energy expended on body temperature maintenance by stock can lead to higher levels of condition, higher birthing rates, higher stocking rates and/or lower requirements for supplementary feeding.

- The provision of shade can also increase ram fertility over the warmer months while research has found that cattle within sheltered paddocks have an average 2% higher calving rate and that the amount of feed required to maintain body temperature is substantially reduced.

Designing a Windbreak

- When considering where to plant your windbreak it is important to take into account the topography of your land, where the prevailing wind direction is and which areas are in need of shelter.

- An effective windbreak should be planted at right angles to the prevailing direction of cold winter and hot summer winds.

- Species choice is important and should be chosen from native species. Utilise a diverse range of species of various heights to create moderately dense foliage coverage from ground level to tree tops.

- Windbreaks should consist of a minimum of 2 rows, preferably 5 rows. Rows should be space between 2-4m apart. The tallest trees should be in either the centre or windward row and be planted 3-6m apart. Smaller trees and larger shrubs should be planted on the outer rows, spaced 2-4m apart. The smallest shrubs should be planted on the outer edges 1-2m apart.

- The length of the windbreak should be at least 10 times the height of the tallest trees. The area protected by a windbreak is generally 15-20 times the height of the tallest trees.
What to plant?

The Climate Change Adaptation project is keen to promote ‘thinking outside the box’ on species choice, both to ensure longevity of the plants under a climate change situation and promote the preservation of species that may be impacted by climate change and therefore vulnerable in their historical range. Whilst planting from the areas EVC promotes biodiversity and local trees are adapted to local conditions, shelter plantings could also include a few species that are not endemic. These species could include:

• E. cephalocarpa
• E. pryoriana (E. viminalis ssp. Pryoriana)
• Busaria spinosa (whether included in the area EVC or not)
• A. melanoxylon (again, irrespective of EVC)
• E. mannifera
• And possibly E. kitsoniana.

These are all possibilities for more exposed positions – with the boggier areas planted to the usual suspects – E ovata, strzleckii, and viminalis, with maybe banksias and bottlebrush in the mid story.

More Info?

The Climate Change Adaptation project has a page on the Sustainability Gippsland web page.

www.sustainabilitygippsland.com/group/agricultural-climate-adaptation-project-southern-gippsland

go to the information page and find the pdf docs on Revegetation guidelines and the Economic benefits of native shelter belts.
Direct seeding

What is direct seeding?

Basically, it is sowing seed of the desired species into the final location instead of raising them as seedlings prior to planting out.

Why use direct seeding?

- It is a lower cost method of establishing trees compared to planting seedlings.
- Root systems develop naturally and are not so prone to misshapen roots which often happens with tubed stock. Better root systems generally mean trees survive better, grow better and are not so subject to blowing over.
- Large areas can be established quickly, with relatively low labour input.

Disadvantages of Direct Sowing

- Germination percentage of seed sown can be very low if site preparation is not right.
- Adverse seasonal conditions may cause low survival rates.
- Competition from grass and weeds can cause low survival rates.

Direct seeding methods

Mechanical

The site is prepared using a grader blade, plough or purpose-built direct seeding machine that can be towed behind a tractor. This technique can prepare large areas in a short time. Direct seeding machines such as the Rippa Seeder shown here are generally a one-pass machine, scalping the topsoil, placing the seed, and pressing the seed into the fresh soil with a press wheel. This technique is suitable for areas which are not too steep. Areas can be prepared before fencing for ease of access.

If a plough is used to prepare the site, the site should be sprayed beforehand to remove weeds in the late winter, and then a mouldboard plough is used to invert the soil to create a seed bed and bury weed seeds. The seed is then mixed with a bulking agent such as sand, and hand-broadcast on the site. It is often recommended that you then drive over around 50% of the site, to ensure good seed/soil contact.
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The site can be scalped with a grader blade removing the weeds and the weed seed containing layer of topsoil. Be aware of the soil conditions if scalping is being used. Don’t scalp too deep as the lack of healthy soil may affect germination and in sandy soils the walls may collapse over the seed. This can also lead to erosion problems.

The seed can be hand broadcast, or for larger areas, spread from a small super spreader or similar. The seed can be collected from remnant bush near the site, or be obtained from a local seed bank. Choose plants that suit the soil type, aspect and rainfall of the site. Seeds from the local area are most likely adapted to the conditions of the project site. Try to include a diverse range of local species that will create good shelter and habitat as well as being self-sustaining. Consider the rate of seed sow-
ing and the likely outcome. Creating dense rows may cause competition between seedlings. Ensure healthy, ripe seed is used otherwise germination may be poor. Avoid using old seed where possible.

Ensure correct pre-treatment is applied to seeds before sowing. This can include soaking, scarifying, stratifying, leaching or smoke treatments.

It is advisable for hard coated seed such as Acacia, Senna, Hardenbergia, Pultenaea, Templetonia etc to be covered by boiling water and allowed to cool before sowing. Fine seeds such as Myrtaceous varieties, Melaleuca, Eucalyptus, Callistemon, require no pre-treatment. Seeds from Callitris, Bursaria, and some of the cold climate eucalypts can benefit from cool, moist stratification.

As seed is often very small, it is generally mixed with a carrier to help achieve desirable sowing rates. Suitable carriers may be:

- bran or pollard
- sawdust
- dry sand
- vermiculite

In the photo below, Geoff Trease has two seed mixtures in separate containers. The larger yellow bucket contains understory species. This is spread evenly across the whole area. The smaller ice-cream container has the overstory eucalypts and small pinches of this mix are added to the site approx. two to five metres apart. The seeds are mixed at about a ratio one-part seed to ten parts carrier.

**Hand Direct Seeding**

A hoe or mattock is used to scalp the soil surface, creating a tilth for the seedbed, followed by a some means of covering the seed-carrier mixture. This can be as simple as treading on the area. It is possible to pre germinate the seed in a fine seed raising mix and this can be applied in small handfuls to the hoe or mattock chipped site. This has the advantage of both covering and mulching the seeds.

This method is best used for smaller scale works or for steep sites or sites inaccessible by tractor or when you want to minimise the level of disturbance to a site.