Revegetation case study

(Mallet ridge)

Landscape Goal

Increase woodland patch size to maintain breeding viability of the most sensitive fauna in the medium term (50 years).

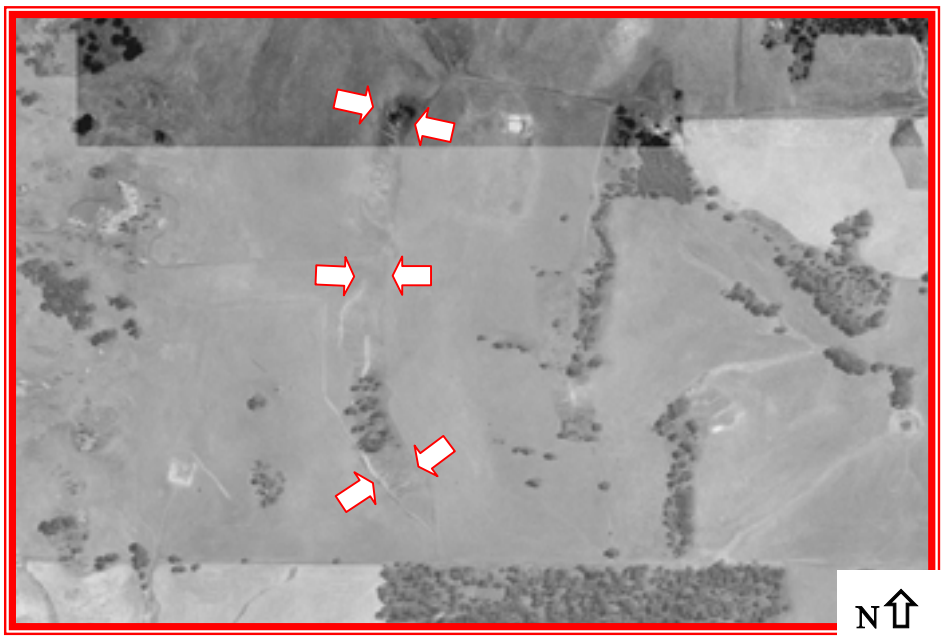
Land manager
(conservation)
OBJECTIVE(S)

Create a natural vegetation association of local provenance brown mallet (*Eucalyptus astringens*).

Land manager
(agriculture)
OBJECTIVE(S)

Reduce surface water run-off from breakaway, increase water use, and protect paddock remnants. In addition, create an agricultural resource based on a local species for later use as high quality fence posts and firewood.

Dongolocking - Central wheatbelt WA



Department of Conservation and Land Management

Bushcare
The National Vegetation Initiative

Site characteristics:

Figure 1. Breakaway slope showing the pallid clay zone at the soil surface of a laterite soil profile.

Figure 2. Breakaway slope showing development of sheet erosion.

Figure 3. Breakaway slope showing bare soil and active erosion. Water run-off is close to 100 % on the bare areas.

Figure 4. Unprotected remnant bush on breakaway consisting of a pure stand of brown mallet (*Eucalyptus astringens*). There is no chance of any regeneration.

Design of revegetation:

Species Selection

Breakaway areas in the central wheatbelt typically have dense stands of mallet. These include one or more of: brown mallet (*Eucalyptus astringens*), silver mallet (*Eucalyptus argyphea*), and blue mallet (*Eucalyptus gardneri*).

Brown mallet was chosen as it was identified as the dominant mallet growing on a fragment of remnant bush on the site. Brown mallet is also a proven timber for use as fence posts, produces excellent quality firewood and produces a tough timber suitable for handle manufacture.

Characteristics to meet objectives

Nature Conservation Objectives

Increasing area to meet minimum viable size for species retention - the revegetation builds on an existing small fragment of remnant bush. Although the resulting size does not meet minimum viable size requirements for the most demanding woodland birds (50 ha for woodland), the revegetation increases local connectivity of remnant bush.

Natural plant associations - Brown mallets usually occur as a single dominant species on breakaways. They have a strong allelopathic characteristic and exclude most other plant species, including native grasses. A pure stand of brown mallet was planted to represent its natural habit.

Provenance protection - local seed from plants growing within 15 km of their natural seed source was collected for the revegetation site to ensure protection of local genotypes from inter-breeding with introduced genetic stock. Where a species is already being used commercially (eg brown mallet), it is particularly important to maintain different provenances as a source of potential genetic improvement.

Incorporation of paddock based remnant vegetation - values associated with paddock remnant vegetation, regardless of area include: provision of age structure to the vegetation, provision of a potential source of 'small fauna' eg invertebrates, and conserving unique sources of plant and animal genetic material (diversity).

Contour planting to increase habitat value - in addition to contour ripping to minimise erosion, planting on the contour was considered to facilitate retention of litter within the site, especially in the event of a rainstorm.

Ecosystem process objectives

Level of diversity - the planting of a single species at this site represents that of (or close to) natural conditions for this particular landscape unit.

Replacability / stability - Ability to maintain water use and provide a future timber product, given the threats of, for example, episodic fire events, drought conditions and insect attack, were key objectives.

Brown mallet is an 'obligate seeder' species. This means that it will only regenerate from seed (and will not resprout after a hot fire). Fire must be excluded from brown mallet until seed production is sufficient to maintain a viable population.

Hydrological issues - gravel breakaways are recharge areas with high levels of stored subsoil salt. Drying of the soil profile with a highly suitable species such as brown mallet, together with contour ripping, will minimise leaching of salts into subsoil aquifers and also minimise surface water run-off, particularly in rain storm events.

Agricultural land use objectives

Reduction of surface water run-off – contour ripping at 2 and 3 m intervals to a depth of about 70 cm will eliminate most, if not all, surface water flow from the site.

Increase water use – planting spacings of 2 x 2 m and 3 x 2 m gives a tree density of 2 500 and 1 666 per ha respectively. It is considered that these densities will greatly assist with increased water use and also drying of the soil profile.

Protection of paddock remnant bush - a small fragment of unprotected bush was incorporated into the revegetation.

Fencing material resource – sapling brown mallet can be extracted at about 4-6 years age for use as fence droppers. Saplings are particularly suitable as they are almost all sapwood, enabling superior uptake of treatment solution. Pressurised treatment with creosote is a necessary requirement to prevent termite attack of brown mallet. Sapling extraction is also compatible with thinning regimes recommended for improving girth of remaining trees. A further thinning can be undertaken at about 8 - 10 years of age to extract poles suitable for fence posts.

Firewood resource – brown mallet wood is very dense and has a low ash residue after burning. It also has a very straight grain enabling short sawn lengths to be easily split with an axe. Firewood can be sourced from any individual trees not meeting fence post standards during the fencing material extraction or thinning phases.

Minimising of competition with paddock production - *Eucalyptus loxophleba* subsp. *loxophleba* (york gum) was used as a border species. This species has been observed to compete less with adjoining areas than brown mallet.

Establishment:

Seeding method - seedlings were selected in preference to direct seeding. This decision was based on the harshness of the site (ie steep, shallow topsoil and eroding). Conservation of seed was also a major consideration. All seed was selected from trees showing superior form amongst numerous populations. This was only achieved by sourcing seed from limited large areas of farm based remnant vegetation. Thus, high quality seed was scarce and its use had to be minimised.

Contour ripping - as the site was a breakaway and steep by nature, contour guide lines were surveyed at about 8 m intervals for ripping. Ripping was performed with a double tine bulldozer (D8) to a depth of 70 cm and was completed on 28 July 1999. Rip line spacing was 3 m for half of the area (southern section) and 2 m for the other half (northern section). The contour ripping was essential to prevent erosion from surface water run-off (close to 100 % run-off). The closeness and depth of the rip lines will also ensure water run-off is eliminated.

Ripping with a D8 bulldozer achieved excellent results. It however, was expensive. The cost was about $250 per ha.

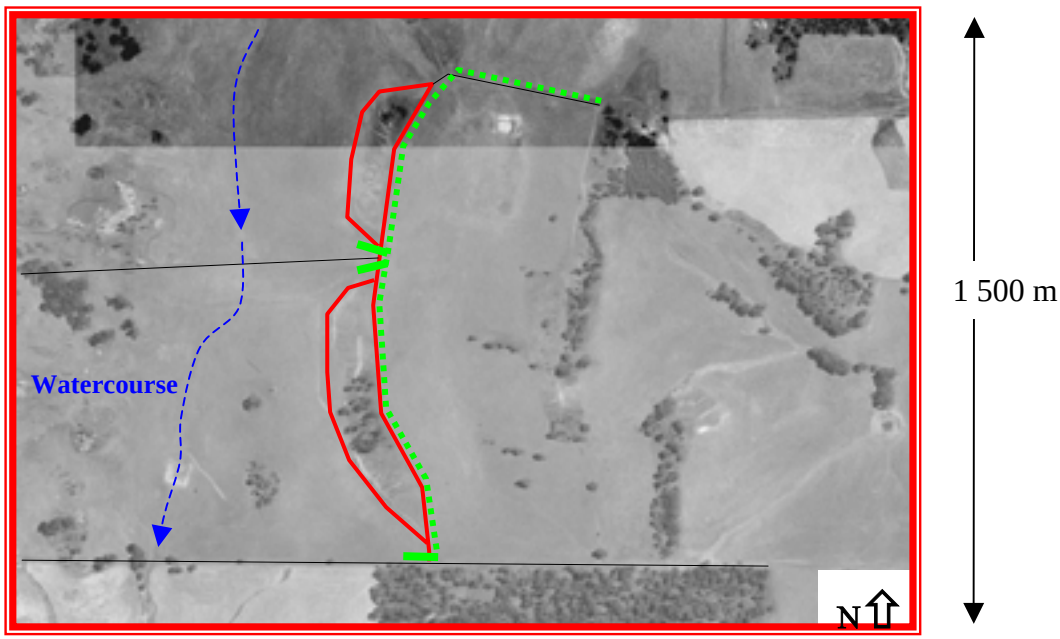
The high clay content of the site presented difficulties in terms of preparing the site for planting. Surface clay broke into boulders, with very little topsoil to plant into. An attempt to crush boulders with a second pass of the bulldozer tracks and also with a 2WD rubber tyred tractor proved unsuccessful. The moisture content of the clay held the boulders together and formed a flat sticky highly impervious clay layer above the rip line. It is recommended to rip in summer to enable crushing of surface clay boulders.

Weed control - circumstances only allowed for this site to be blanket sprayed with 1 L of glyphosate in mid to late July. The lateness of planting (ie the need to plant seedlings) precluded the use of a residual herbicide (residual herbicide requires a withholding period).

It was necessary to spray the site with label rates of Fusilade® in early October in an attempt to control seed set of the grass weeds present. There were no known herbicides available for the control of broad leafed weeds that were safe to overspray brown mallet.

Planting method - 'pottiputki' hand planters were used. This method was the only option at this site. Seedlings were directed slightly to one side of the rip line to minimise the risk of seedling roots entering air pockets. This was a particular concern at this site as the high clay content soil tended to break up into large boulders when ripped.

Layout of revegetation:



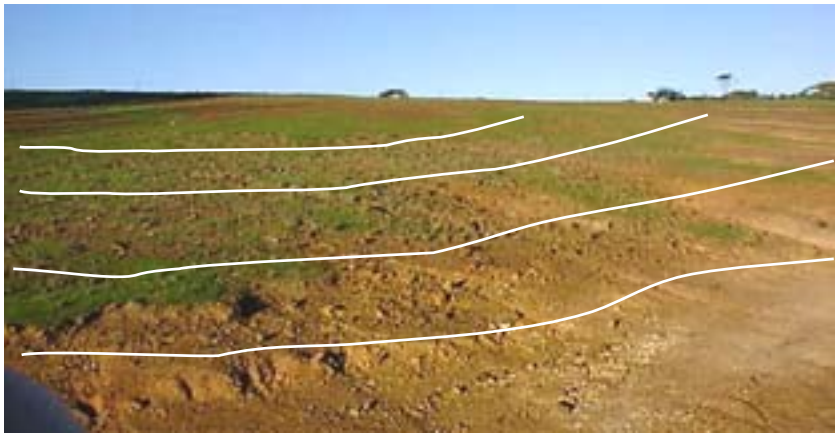
Revegetation boundary.

Access (vehicle / machinery and stock).

Farm track.

Existing fencelines.

Area of revegetation: 3 ha.
Total area protected: 5 ha.



White lines indicate contour guide lines for ripping

Contour ripping was at 2 m and 3 m spacings. This has eliminated surface water run-off from the site.

Planting density: seedlings were established in two densities to allow future comparison of productivity. These were 2 500 plants per ha (2 m x 2 m) and 1 666 plants per ha (3 m x 2 m).

Success of revegetation:

- *Seven month old mallet seedlings (March 2000).*
- *Survival was 96 %.*
- *Above average summer rainfall assisted with establishment success.*

Figure 5 and 6. 2 m spacings (northern section).

Figure 7 and 8. 3 m spacings (southern section). Planting also included large gap areas within the remnant bush.

Monitoring:

Establishment

Establishment success - plant counts and general health of seedlings.

Management

Weed cover and type - monitor during the year of planting including the first summer and second year.

Thinning and pruning for production - monitor tree growth and establish appropriate times to thin and or prune in both the 2 x 2 m and 3 x 2 m plots of brown mallet.

Outcomes

Nature conservation

Fauna utilisation of site - monitor focal species birds utilising site and / or other fauna.

Photo monitoring sites - these are intended to be a visual representation of ecosystem development.

Agriculture

Water use - monitor revegetation growth rates (leaf area index) as a measure of water use.

Surface water run-off - monitor the extent of run-off accumulating in existing surface water drains beneath revegetation area. In addition, erosion resulting from surface water flow can be monitored.

In Brief – Cost of establishment per ha (2000)

Materials and activities required for establishment	**Options ($ per ha)**	**[1]Totals**
Brown mallet seedlings @ 34c each @ 1666 per ha (2 m x 3 m spacing) @ 2500 per ha (2 m x 2 m spacing)	 $566.44 $850.00	
Ripping – D8 Dozer	$250	
Weed control using 1 L glyphosate and 2 L of simazine per ha.	$18 + contract spray rate or wear and tear on own machinery.	
Planting @ 10c each @ 1666 per ha @ 2500 per ha	 $166.60 $250.00	
Fencing @ $1240 per km (materials only) + construction cost.	Different for each site.	

[1] Totals are left blank intentionally. This is to allow for individual choice of options.

In Brief – multiple objectives achieved

Nature conservation	❖ Increased area of natural habitat. ❖ Incorporated natural plant associations. ❖ Maintained local provenance protection. ❖ Protection given to paddock remnant bush. ❖ Contour ripping to facilitate retention of litter.
Ecosystem processes	❖ Natural level of diversity. ❖ Stability / replacibility of system accounted for. ❖ Increase in water infiltration where it falls and a future substantial increase in water use.
Agricultural land use	❖ Elimination of surface water run-off (no need for surface water drainage structures). ❖ Reduction in recharge and thus, ground water pressure head on productive agricultural areas. ❖ Brown mallet is a future source of fence posts (in 8-10 years) and droppers (4-6 years). ❖ Brown mallet is a future source of high quality fire wood (high density, straight grain is easy to split and has low ash). ❖ Border species (york gum) used to minimise competition with surrounding land use.

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