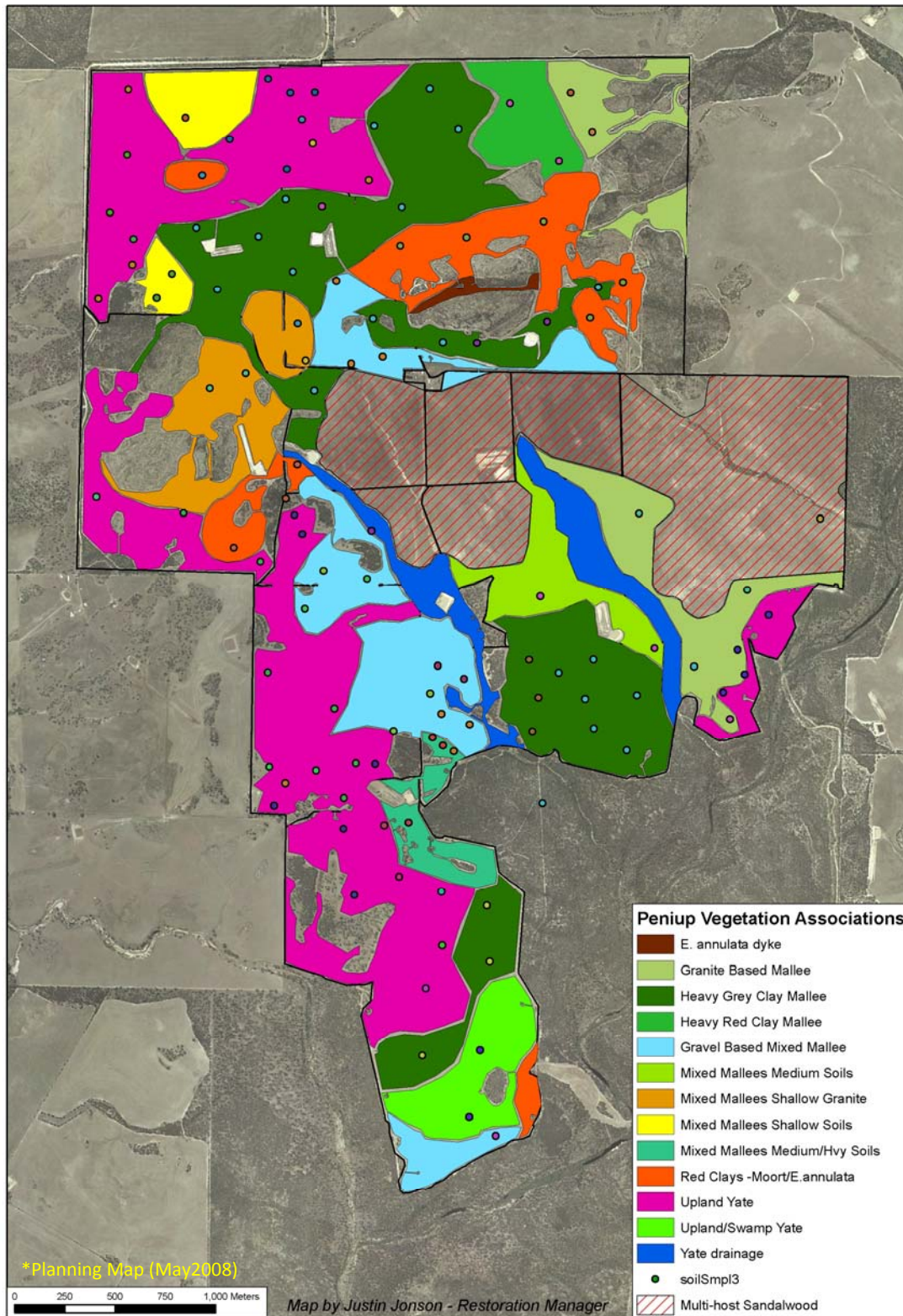


PENIUP RESTORATION PLAN

Prepared by Justin Jonson, Restoration Manager - Greening Australia



Vegetation Association: Upland Yate

Area: 184 ha

% Restored in 2008: 54%

Soil info: The upland Yate (*Eucalyptus occidentalis*) system is characterised by a dark granitic loam. It has high fertility compared with neighbouring soil types. This soil formation is generally friable when moist, but is easily compacted, and impermeable when dry.

Landscape position: Generally defined to upland landscape positions.

Hydrology: Good absorption of precipitation when moist

Structural Objective: Open woodland structure dominated by *E. occidentalis* & *A. huegeliana*. Mid and lower story vegetation scattered throughout. Projected foliage cover of tallest stratum will be high (50-70%).

Plant species collected for this association (23):

Tall Trees: *Eucalyptus occidentalis*₁

Medium Trees: *Acacia acuminata*, *A. saligna*, *A. cyclops*, *Allocasuarina huegeliana*, *Hakea laurina*, *A. microbotrya*₁, *Santalum spicatum*₂

Mallees: *Eucalyptus phaenophylla*

Tall Shrubs: *Melaleuca hamata*, *Melaleuca pauperiflora*, *Melaleuca acuminata*, *Templetonia retusa*, *H. lissocarpa*, *Calothamnus quadrifidus*

Mid Shrubs: *Acacia cupularis*, *A. myrtifolia var myrtifolia*, *Melaleuca undulata (lateriflora type)*, *Alyogyne huegelii*, *Senna artemisioides ssp artemisioides*

Low shrubs: *Gastrolobium parviflorum*, *Acacia pulchella ssp goadbyi*

Ground layer: *Austranthonia caespitose*, *Austrostipa sp.*₂, *Kennedia prostrata*, *Gahnia decomposita*

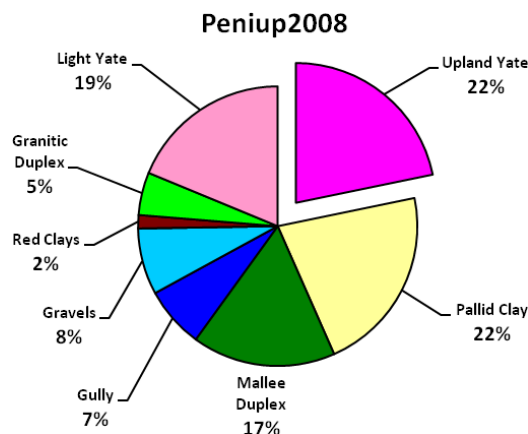
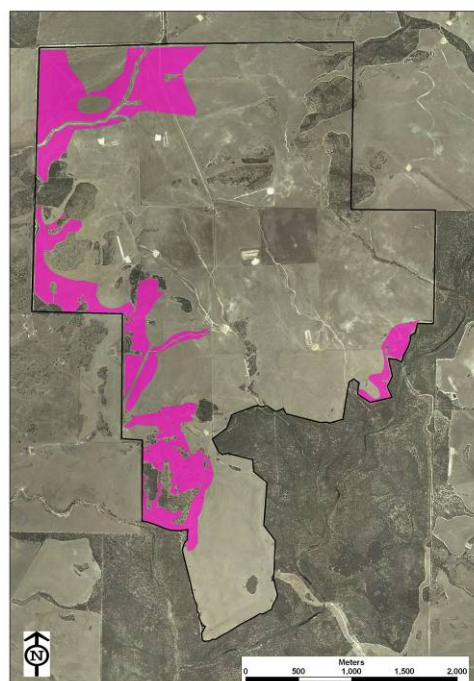
Key:

Nitrogen fixing

Proteaceous species

Planted as Seedlings₁

Hand Seeded₂



Vegetation Association: Pallid Clays

Area: 169 ha

% Restored 2008/2009: 37%

Soil info: As identified in the name, the pallid clay system is defined by a pale 'yellowish', highly leached, gritty clay. It has a relatively deep profile and retains moisture well into summer. It seems to demonstrate low fertility and abnormal pH or sodic levels.

Landscape position: Generally in lower landscape, water gaining position. Lower valley slopes.

Hydrology: It has a tendency to be waterlogged with anaerobic colouring (blue) at depth. Good permeability.

Structural Objective: Open to closed Mallee Heath structure dominated by *E. annulata* & *E. flocktoniae*. Widespread coverage of a *Melaleuca* shrub component, including dense thickets in mid- and lower story structure.

Plant species collected for this association (30):

Tall Mallees: *Eucalyptus annulata*, *Eucalyptus conglobata* ssp. *perata*, *Eucalyptus flocktoniae*

Short Mallees: *Eucalyptus phaenophylla*, *Eucalyptus pluricaulis*, *Eucalyptus vegrandis* ssp. *recondite*, *Eucalyptus xanthonema*

Tall Shrubs: *Melaleuca acuminata*, *Melaleuca brevifolia*, *Melaleuca viminea*, *Hakea laurina*

Mid Shrubs: *Hakea verrucosa*, *Acacia harveyi*, *Goodia lotifolia*, *Melaleuca cucullata*, *Melaleuca pauperiflora*, *Hakea nitida*₁

Low shrubs: *Acacia cupularis*, *Acacia myrtifolia* var *myrtifolia*, *Acacia patagiata*, *Gastrolobium parviflorum*, *Melaleuca bracteosa*, *Melaleuca calycina*, *Melaleuca haplantha*, *Melaleuca undulata* (lateriflora type), *Melaleuca subfalcata*, *Melaleuca spathulata*, *Melaleuca torquate*

Dwarf Shrubs: *Melaleuca violacea*

Ground layer: *Carpobrotus modestus*, *Austradanthonia caespitosa*

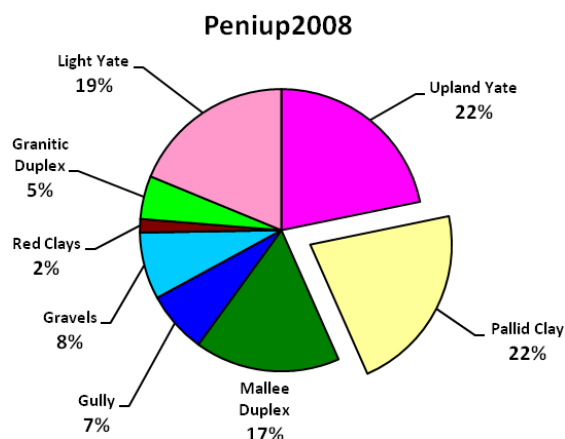
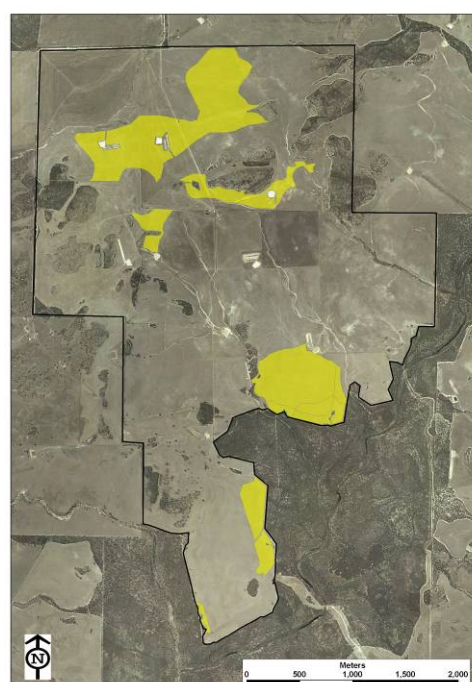
Key:

Nitrogen fixing

Proteaceous species

Planted as Seedlings₁

Hand Seeded₂



Vegetation Association: Mallee Duplex **Area:** 52Ha **% Restored in 2008:** 79%

Soil info: A shallow profile over a medium to hard clay. Clay often red to reddish yellow. A challenging soil type. Fertility is low.

Landscape position: Mid to upper-mid slope position.

Hydrology: Generally a water 'shedding'/exporting soil type. Poor infiltration and water holding capacity.

Structural Objective: Open to closed Mallee Heath structure dominated by *E. captiosa* & *E. flocktoniae*. Widespread coverage of a shrub component is desired, including dense thickets of Proteaceous and Myrtaceous species in the mid- and lower story structure.

Plant species collected for this association (46):

Tall Mallees: *Eucalyptus captiosa*, *Eucalyptus conglobata* ssp. *perata*, *Eucalyptus falcata*, *Eucalyptus flocktoniae*, *Eucalyptus thamnoides/megista*

Short Mallees: *Eucalyptus phaenophylla*, *Eucalyptus pluricaulis*, *Eucalyptus uncinata*, *Eucalyptus vegrandis* ssp. *recondita*, *Eucalyptus xanthonema*

Medium Trees: *Banksia media*, *Hakea laurina*

Tall Shrubs: *Hakea nitida*, *Hakea trifurcata*, *Acacia assimilis* ssp. *atroviridis*, *Kunzea preissiana/jucunda/affinis*, *Melaleuca depauperata*, *M. hamata*, *M. sp. affin. pentagona*

Mid Shrubs: *Acacia myrtifolia* var *myrtifolia*, *Allocasuarina humilis*, *Calothamnus gracilis*, *Melaleuca haplantha*, *M. subfalcata*, *Senna artemisioides* ssp. *stricta*

Low shrubs: *Acacia gonophylla*, *Acacia pulchella* ssp. *goadbyi*, *Acacia sphacelata* ssp. *sphacelata/recurva*₂, *Calothamnus sanguineus*, *Daviesia* sp. *aff. purpurascens*, *Melaleuca tuberculata* var *macrophylla*, *Hakea prostrata*₂

Ground layer: *Acacia aemula* ssp. *aemula*₂, *Acacia bidentata*₂, *Acacia moirii* ssp. *moirii*₂, *Acacia varia* var *parviflora*, *Acrotriche ramiflora*, *Anigozanthus humilis*, *Chorizema aciculare*, *Gompholobium tomentosum*, *Hovea pungens*, *Melaleuca carrii*, *Melaleuca* sp. *affin psammophila*, *Urodum dasyphylla*,

Other: *Carpobrotus modestus*, *Patersonia occidentalis* (small form)

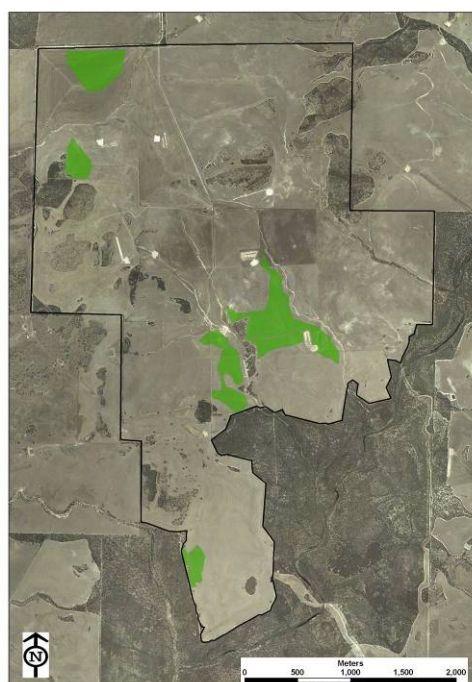
Key:

Nitrogen fixing

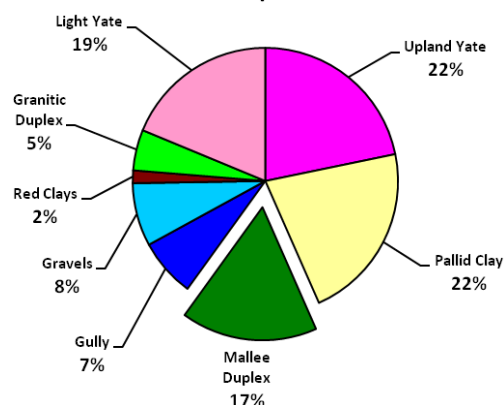
Proteaceous species

Planted as Seedlings₁

Hand Seeded₂



Peniup2008



Vegetation Association: Gully System **Area:** 46Ha **% Restored in 2008:** 38%

Soil info: Variable in profile depth and consistency. Sand-bar patches scattered throughout drainage lines.

Landscape position: In proximity to drainage, or gully lines.

Hydrology: Area of water gathering and export.

Structural Objective: This system aims to be thick with vegetation and dense with coverage. High use by fauna. Yate (*E. occidentalis*) overstory with thickets throughout.

Plant species collected for this association:

Upper Landscape Position Zone (13):

Trees: *Eucalyptus occidentalis*₁

Medium Trees: *Acacia cyclops*₁, *Allocasuarina huegeliana*, *Banksia media*₁, *Hakea laurina*₁

Tall Shrubs: *Callistemon phoeniceus*₁, *Melaleuca elliptica*

Mid Shrubs: *Calothamnus quadrifidus*₁, *Templetonia retusa*, *Hakea nitida*₁, *H. corymbosa*₁

Low shrubs: *Acacia mimica var angusta*

Ground layer: *Gahnia decomposita*

Mid Landscape Position Zone (18):

Trees: *Eucalyptus occidentalis*₁

Tall Mallees: *Eucalyptus conglobata ssp. perata*

Medium Trees: *Acacia cyclops*₁, *Allocasuarina huegeliana*, *Banksia media*₁, *Hakea laurina*₁

Tall Shrubs: *Callistemon phoeniceus*₁, *Hakea nitida*, *Melaleuca acuminata*, *Melaleuca elliptica*, *Santalum murrayanum*₂

Mid Shrubs: *Calothamnus quadrifidus*₁, *Alyogyne huegelii*, *Melaleuca hamata*, *Acacia patagiata*

Low shrubs: *Melaleuca subfalcata*, *Senna artemisioides ssp artemisioides*

Ground layer: *Gahnia decomposita*

Lower Landscape Position Zone (18):

Trees: *Eucalyptus occidentalis*₁

Medium Trees: *Acacia cyclops*₁, *Acacia saligna*, *Banksia media*, *Hakea laurina*

Tall Shrubs: *Callistemon phoeniceus*₁, *Hakea nitida*₁, *Leptospermum erubescens*, *Melaleuca acuminata*, *Melaleuca viminea*, *Santalum murrayanum*₂

Mid Shrubs: *Alyogyne huegelii*, *Calothamnus quadrifidus*₁, *Acacia patagiata*

Low shrubs: *Melaleuca spathulata*, *Senna artemisioides ssp artemisioides*

Ground layer: *Carpobrotus modestus*, *Gahnia decomposita*

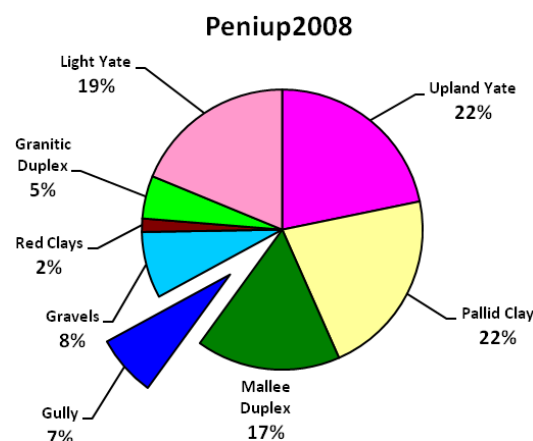
Key:

Nitrogen fixing

Proteaceous species

Planted as Seedlings₁

Hand Seeded₂



Vegetation Association: Gravels

Area: 78Ha

% Restored in 2008: 24%

Soil info: This association is typified by sandy gravels and gravelly sands. They are generally of moderately fertile and easy to re-establish plant communities on. Variable depth. Sometimes over lateritic hardpan.

Landscape position: Generally mid slope.

Hydrology: Good infiltration. Sometimes hydrophobic at surface. Good water availability at depth.

Structural Objective: Open to closed Mallee Heath structure dominated by *E. captiosa*, *E. thamnoides*, & *E. falcata*. Widespread coverage of a shrub understory desired, including dense thickets of prickly acacias in the mid- and lower story structure.

Plant species collected for this association (24):

Tall Mallees: *Eucalyptus captiosa*, *Eucalyptus falcata*, *Eucalyptus thamnoides ssp megista*, *E. pluricarpa*₁

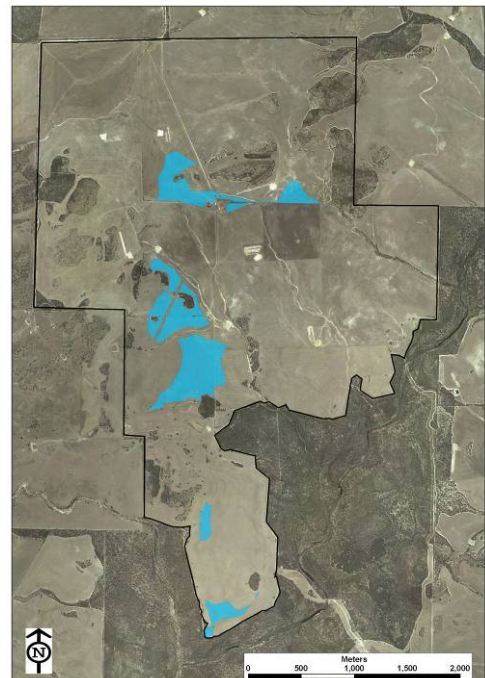
Tall Shrubs: *Hakea laurina*, *Hakea nitida*

Mid Shrubs: *Acacia myrtifolia var myrtifolia*, *Allocasuarina humilis*, *Melaleuca bracteosa*, *Melaleuca subfalcata*

Low shrubs: *Acacia gonophylla*, *Acacia pulchella ssp. goadbyi*, *Daviesia sp aff. purpurascens*, *Gastrolobium spinosum var spinosum/inerme*, *Melaleuca tuberculata var macrophylla*, *Eremaea pauciflora*, *Hakea prostrata*₂

Very Low shrubs: *Acacia aemula ssp. aemula*₂, *Acacia lasiocarpa ssp bracteolata*, *Acacia moirii ssp. moirii*₂, *Acacia varia var parviflora*, *Anigozanthus humilis*

Other: *Kennedia eximia*, *Kennedia prostrata*, *Austradanthonia caespitosa*



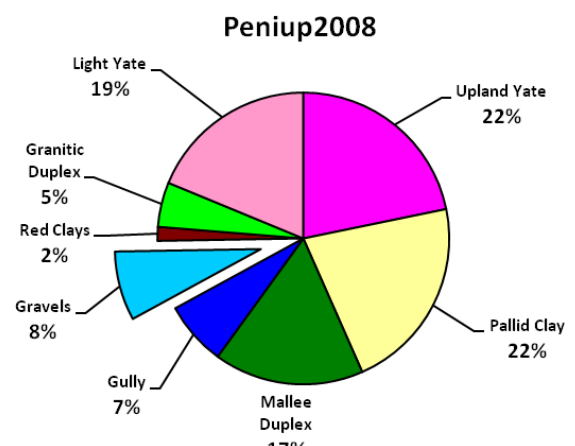
Key:

Nitrogen fixing

Proteaceous species

Planted as Seedlings₁

Hand Seeded₂



Vegetation Association: Red Clays

Area: 69 ha

% Restored in 2008: 22%

Soil info: These are very hard setting red clay soils. At times they also have rock in patches as well. Fertility is moderate. These soils are challenging for native plant re-establishment.

Landscape position: No defined characteristics, except when expressed as dolerite dikes.

Hydrology: Generally a water 'shedding'/exporting soil type. Poor infiltration and water holding capacity.

Structural Objective: Open to closed Mallee Heath structure dominated by *E. annulata*. Widespread coverage of a shrub component is desired, including dense thickets in the mid- and lower story structure.

Plant species collected for this association(29):

Tall Mallees: *Eucalyptus annulata*, *E. conglobata*, *E. thamnoides*

Short Mallees: *Eucalyptus vegrandis* ssp. *recondita*

Tall Shrubs: *Hakea nitida*, *Melaleuca acuminata*

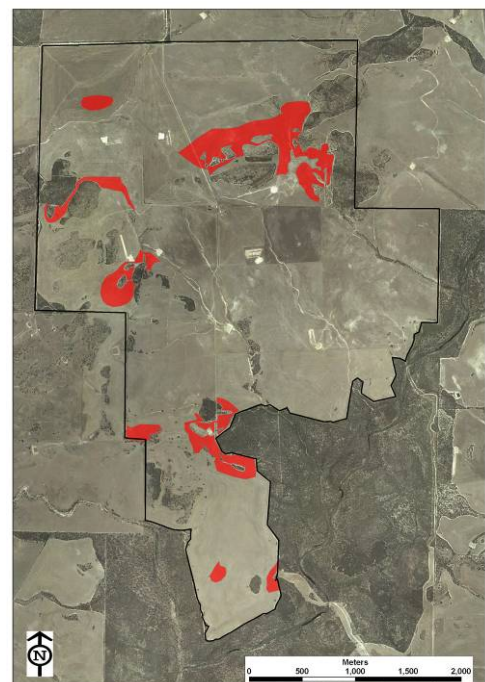
Mid Shrubs: *Acacia harveyi*, *Melaleuca cucullata*, *Melaleuca hamata*, *Melaleuca pauperiflora*, *Templetonia retusa*, *Hakea verrucosa*

Low shrubs: *Acacia mimica* var *angusta*, *Acacia myrtifolia* var *myrtifolia*, *Melaleuca undulate* aff *lateriflora* form, *Melaleuca calycina*, *Melaleuca haplantha*, *Melaleuca subfalcata*, *Melaleuca torquata*

Very Low shrubs: *Acacia sphacelata* ssp *sphacelata/recurva*, *Dodonaea concinna*, *Gastrolobium parviflorum*, *Goodenia scapigera*

Ground Cover shrubs: *Acacia bidentata*, *Acacia glaucoptera*, *Stackhousia monogyna*,

Other: *Carpobrotus modestus*, *Thysanotus manglesianus*, *Austradanthonia caespitosa*



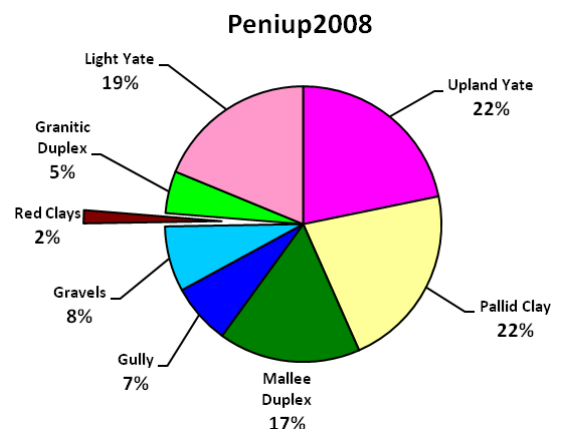
Key:

Nitrogen fixing

Proteaceous species

Planted as Seedlings₁

Hand Seeded₂



Vegetation Association: Granitic Duplex **Area:** 57 ha **% Restored in 2008:** 22%

Soil info: These granitic duplex soils are a hybrid between the Yate granitic loams and the Mallee Duplex soil types. They are generally gritty and more fertile than other soils.

Landscape position: Near granite outcrops on rises.

Hydrology: Good infiltration and holding capacity.

Structural Objective: Open to closed Mallee Heath structure dominated by *E. flocktoniae*. Widespread coverage of a shrub component is desired, including dense thickets in the mid- and lower story structure.

Plant species collected for this association (30):

Tall Mallees: *Eucalyptus flocktoniae*, *Eucalyptus lehmannii*

Short Mallees: *Eucalyptus phaenophylla*, *Eucalyptus pleurocarpa*, *Eucalyptus pluricaulis*, *Eucalyptus uncinata*, *Eucalyptus xanthonema*

Medium Trees: *Acacia lasiocalyx*, *Allocasuarina huegeliana*, *Hakea laurina*

Tall Shrubs: *Leptospermum erubescens*,

Mid Shrubs: *Acacia assimilis ssp atroviridis*, *Calothamnus quadrifidus*, *Hakea verrucosa*, *Melaleuca depauperata*, *Templetonia retusa*

Low shrubs: *Acacia mimica var angusta*, *Allocasuarina humilis*, *Melaleuca spicigera*, *Melaleuca subfalcata*

Very Low shrubs: *Acacia gonophylla*, *Acacia sp. affin redolens*, *Acacia sphacelata ssp sphacelata/recurva*, *Melaleuca tuberculata var macrophylla*

Ground Cover shrubs: *Acacia bidentata*, *Kennedia eximia*, *Orthrosanthos multiflorus*, *Stackhousia monogyna*

Other: *Austradanthonia caespitose*, *Thysanotus manglesianus*

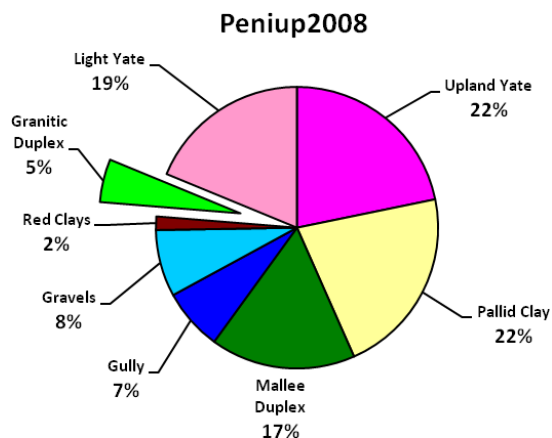
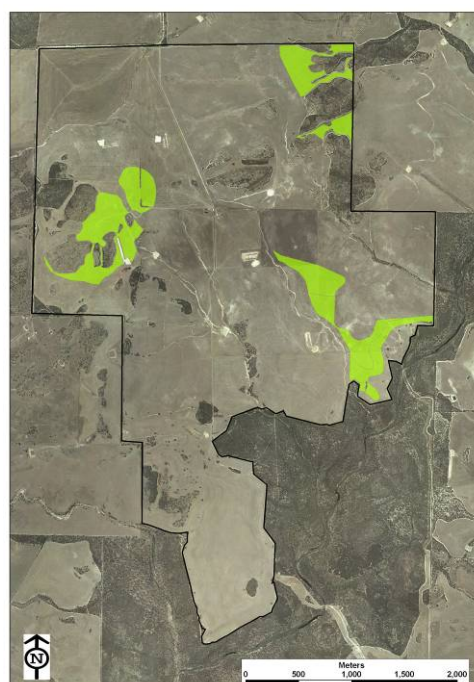
Key:

Nitrogen fixing

Proteaceous species

Planted as Seedlings₁

Hand Seeded₂



Vegetation Association: Light Yate

Area: 61Ha

% Restored in 2008: 76.5%

Soil info: This soil type is generally a sandy gravel with good fertility.

Landscape position: Mid slope.

Hydrology: Good infiltration and water holding capacity. Good water availability at depth.

Structural Objective: As this is a novel ecosystem, the goal structure is a hybrid between an open woodland structure dominated by *E. occidentalis* & *A. huegeliana* and mallee heath dominated by *E. falcata* & *E. thamnoides*. Widespread coverage of a shrub understory desired, including dense thickets of prickly acacias in the mid- and lower story structure.

Plant species collected for this association (33):

Tall Trees: **Eucalyptus occidentalis*

Medium Trees: *Allocasuarina huegeliana*, *Acacia microbotrya*₁, *Santalum spicatum*₂, *Banksia media*₁, *Hakea laurina*₁

Mallees: *Eucalyptus falcata*, *E. captiosa*, *E. thamnoides*, *E. pleurocarpa*₁, *E. pluricaulis*, *E. phaenophylla*, *E. xanthonema*

Tall Shrubs: *Callistemon phoeniceus*, *H. nitida*₁, *H. corymbosa*₁, *Templetonia retusa*, *Calothamnus quadrifidus*₁

Mid Shrubs: *Acacia myrtifolia* var *myrtifolia*, *A. gonophylla*, *A. pulchella* ssp *goadbyi*, *Daviesia* sp *affin purpurascens*, *Gastrolobium parviflorum*, *G. spinosum* var *spinosum/inerme*, *Melaleuca tuberculata* var *macrophylla*, *Banksia caleyi*₂

Low shrubs: *Acacia aemula* ssp *aemula*, *A. lasiocarpa* ssp *bracteolata*, *A. moirii* ssp *moirii*₂, *A. varia* var *parviflora*, *Anigozanthus humilis*

Ground layer: *Austranthonia caespitose*, *Kennedia prostrata*, *Kennedia eximia*, *Gahnia decomposita*

Key:

Nitrogen fixing

Proteaceous species

Planted as Seedlings₁

Hand Seeded₂

