SPECIES PERFORMANCE ASSESSMENT

WELLINGTON CATCHMENT

Prepared for

DEPARTMENT OF CONSERVATION

AND LAND MANAGEMENT

and

PUBLIC WORKS DEPARTMENT

BY M^{c}ARTHUR & ASSOCIATES

JUNE 1985

30 AUG 1985

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20th August, 1985

O.9.C. Dwellingup Research

The Manager,
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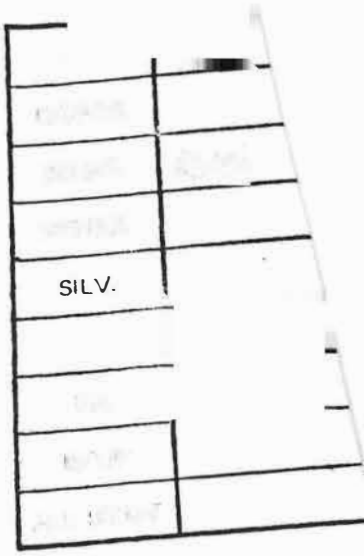
COMO WA 6152

ATTENTION: MR BATINI



Dear Sir,

RE: SPECIES PERFORMANCE ASSESSMENT
WELLINGTON CATCHMENT

I have perused the final report which has now been distributed. Unfortunately references to other figures in figures 2, 3, 4 and 5 were not altered from the Draft. Could all copy holders be advised of the following correction.

FIGURE	ALTER FIGURE NUMBER IN DECISION SQUARE
2	Figure 2 corrects to 3
3	Figure 3 corrects to 4
3	Figure 4 corrects to 5
3	Figure 5 corrects to 6
4	Figure 2 corrects to 3 (3 times)
5	Figure 2 corrects to 3

My apologies.

Yours faithfully,

G.M. McArthur
McArthur and Associates

S P E C I E S P E R F O R M A N C E A S S E S S M E N T

W E L L I N G T O N C A T C H M E N T

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SPECIES PERFORMANCE ASSESSMENT

WELLINGTON CATCHMENT

1. INTRODUCTION

Since 1979, there has been extensive planting of trees within the Wellington dam catchment, on land which has been degraded by increased stream salinity. This change has been stimulated by broad-scale land clearing, which in turn has modified the ground hydrology status. Tree plantings have taken place in low profile salt accumulation zones, and in upper profile water-table recharge zones.

The primary objective of the plantings was to lower the level of the water table of sub-catchments through the transpiration ability of deep rooting trees. The choice of tree species not only considered transpiration ability and salt tolerance but also timber producing potential. Grazing was recognised as being compatable with the primary objective and minimised the potential economic impact of changes in land-use, and had fire control benefits.

2. STUDY OBJECTIVES

This study was initiated with the simple objective of assessing the performance of species in plantings upto 1982. The study was sub-divided into 3 phases:-

(a) 1976-1983 plantings (2580 Ha)
(b) 1983 plantings (450 Ha)
(c) 1982 Souths Arboretum (240 Ha)

The evaluation considered species performance at three levels:-

(a) establishment and survival
(b) future value
(c) management consideration
    (i) of existing stands
    (ii) future plantings

3. METHOD OF ASSESSMENT

3.1 SURVEY ROUTE

Sample points were randomly selected with the objective of ensuring the sample reflected every species/profile/soil situation. In that respect the survey was slightly subjective, within a stratified random sampling system. A survey route was plotted for each farm, utilizing planting and soil maps, together with aerial photographs.

The minimum survey sampling intensity aimed at 1 plot every 5 hectares. In many plantings there was minimal variation within that scale.

3.2 SAMPLE SITE

As the tree stocking varied considerably, a standard area plot was selected. A 10 metre x 10 metre (0.01 hectare) plot was established in the stand. Depending upon spacing, between 4 and 12 trees were assessed. Where a 5th row species occurred, a 10 metre portion was assess (usually 4-5 trees).

Within each plot, inventory information was collected as exampled in ATTACHMENT 1. Managment information was recorded as per ATTACHMENT 2. A modified version combining both was used in a majority of the assessment (ATTACHMENT 3).

Additional observations around the plot, or noticed in the traverse were recorded. Plots were marked in the field and on plans, and often a photograph was taken of significant features.

3.3 DATA COLLATION

The raw data (ATTACHMENT 4) was processed into a simplified summary (ATTACHMENT 5). This summary was sub-divided according to:-

3.3 DATA COLLATION (cont'd)

- species
- profile (lower, mid, upper)
- farm
- soil type

The information recorded will enable retrieval of a variety of information, especially if computerised.

Further summaries were produced:-

- species performance sheet (ATTACHMENT 6)
- Farm - Profile - Plot listings (ATTACHMENT 7)
- Maps showing plot locations (ATTACHMENT 8)
- Farm condition review (ATTACHMENT 9)

Photographs highlighting examples supplied (ATTACHMENT 10)

4. PROJECT OBSERVATIONS

In general, some factors were misjudged in their importance, suitability to objectively assess or segregate species on performance. Some of these may be more relevant when interpreting subsequent performance.

Comments were made, with the objective of assisting future assessments and explaining problems encountered.

4.1 STAND AGE

Most stands were in jeuvenile growth phases, and therefore aspects of maturity are difficult to relate.

- as spacings of 4x4 metres (and wider), dominance or Crown competition was not evident.

  Fast growing species (commonly 5th row - for example:- E. globulus, E. saligna, E. maculata and E. resinifera) invariably did not show the effect because of the lack of between-row crown competition.

4.1 STAND AGE (cont'd)

Branching to 3 metres will not be useful in comparing species at ages before canopy closure is complete. There are species genetic differences in branch size, but significance will not be evident for some time.

4.2 GROUND FUEL

With the exception of the fast-growing species at Piavanini there was minimal ground fuel accumulation. Ground fuel generally consisted of grazed grass, with varying degrees of leaf accumulation. Most tree species either hold their leaves, or drop directly at base of canopy, with minimal lateral distribution. E. camaldulensis would have the widest leaf fall distribution - commencing at heights of 3 metres. The fast-growing species eventually produce a substantial amount of leaf and trash material in a wide crown depositional area.

4.3 ACCESSABILITY

This factor could not be readily assessed, except to note limiting features - primarily mounding. Accessability should be considered at the time of future operations. Several factors must be taken into account:-

- machine widths - compare row widths
- machine stability - mounds common on low profile
  - most slopes unlikely to be limiting
  - creek channels (some deep)
- During winter all low profile areas will be difficult to traverse in machines. Recommend summer operations only.

Most farms permitted all-weather access to light vehicles.

4.4 PASTURE

This factor was difficult to assess. Initially the assessment examined the tree shade effect. This was found too subjective, especially as cloud cover and time of day caused variation. The assessment then addressed the percentage of the ground which sustained pasture. This made the task somewhat easier, using the following guidelines:-

% Pasture	Description
- 25	narrow alley of pasture
25-50	open cross space between trees
51-75	extends to edge of green crown
75 +	extends right to stem

It was difficult to assess the reduction due to leaf-fall, especially as some species have a browse value.

The comments on pasture may not have a lot of value because there is little information on:-

- pasture species (nutritional value)
- pasture condition (nutritional value)
- season of year (autumn is not a good time to assess)
- effect of trees (slow germination, protection)
- animal stockings sustained.

4.5 COMMERCIAL FORESTRY

At the ages of assessment (3-9) evaluation is made on present form, and knowledge of the species on similar sites elsewhere. Only some of the fast-growing eucalypts, and pine species could be converted today (chipwood and pine rounds respectively). Future commercial potential is difficult to assess. Some species develop extensive root-systems before progressing into a single-leader form, and while some species are growing well, unexplained block deaths cast doubts on the ability of these species to sustain this growth. Timber products can be obtained in 10-15 years.

5. MANAGEMENT

During the field survey it was noted that several aspects of land management warranted closer examination. In summarising data, some answers became clearer, however there is a considerable amount of information yet to be collected before clear understandings are possible in some areas.

The following is a review of future management options, based upon observations made during the project.

5.1 LAND REHABILITATION

5.1.1 Reasons for Failure

It is likely that the primary objectives of altering ground water relations through tree planting will be achieved in the medium to longer-term. However, a review of failed and unsuccessful sites has isolated seven areas of concern - most within management control.

5.1.1.1 Stock Damage

This occurs when grazing commences too early, or because of overstocking the area.

The solution lies in STOCK MANAGEMENT. Stock habits in pasture are well known by agriculturists. However, in trees, different circumstances prevail, and the same rules for pasture cannot necessarily be applied. More knowledge is required if the concept of AGROFORESTRY is to be broadly applied. Some of the problems which must be addressed are:-

- tree species
  - browse palatability
  - growth rates
  - browse damage susceptability
- temporary fencing systems

5.1.1.1 Stock Damage (cont'd)

- stock habits in tree environment
  - weather influence (diurnal and seasonal)
  - pasture types and condition
  - movements (transit, camps, watering)

5.1.1.2 Competition

There are instances where plant competition appeared to be the primary cause for failure, or growth retardation. During establishment and early growth, grass competition can be significant. This was most evident in portions of Borlini's (east) where grazing had been excluded to age 3. This competition is as suppressive as overgrazing. There is obviously a fine line between intial grass control (chemical or cultivation), and grazing benefits of stock. The practical solution appears to lie once again with stock management - as grazing has been sustained in some stands from age 2. With slower growing species where early grazing is unacceptable additional weed control measures must be considered.

Tree competition appears more a potential problem, perceived by observations of apparently, competition-related deaths - particularly in the fast growing species (E. globulus and E. saligna). These deaths occur when the tree has attained reasonable proportions (height, diameter) and then suddenly dies. Commonly there is some limitation caused by site (see 5.1.3) but the principal cause of death can be attributed to inability to compete. This is of concern, as the particular species have commercial potential within ages 10-15, and premature deaths (on a broad scale) are not desirable.

5.1.1.3 Species Suitability

Each species has a topographical site preference range. Some species (e.g. E. camaldulensis) have a very wide site growth range - although optimum growths occur in the lower - middle profiles. Others are very sensitive and are limited to a particular profile (e.g. E. rudis is low profile, although no plots were located in upper profile). Species growth ranges are outlined in ATTACHMENT 6, and TABLE R4.

Some species can survive a saline environment, although obviously retarded in growth. Others appear to have inherent salt tolerances, and survive until a salt crust develops. Examples of these species are provided in TABLES R1 and R2.

5.1.1.4 Establishment Conditions

Good ground conditions during the early establishment period are critical for survival. Many failed areas (e.g. Borlini and Oliver) appeared to have remained damp too long. This was difficult to tell in the field assessment, and explanation was obtained from Department of Conservation and Land Management staff and/or records. Mounding and ripping improve survival in every environment, but is particularly noticeable in the lower profile. Planting in a wet environment could be delayed until there is some reduction in water table. The provision of major drainage channels in very flat, water-gaining sites would improve ground conditions for planting.

5.1.1.5 Mechanical and Chemical Damage

Although not many instances of this type of damage were observed, there is need to consider the problem. Some species are sensitive to chemicals.

5.1.1.5 Mechanical and Chemical Damage (cont'd)

The only example seen was the result of chemical firebreak spray drift. E. globulus had died, although the adjacent E. wandoo was unaffected. Tree species selection and firebreak maintenance methods require review, including the use of selective grass control chemicals.

Occasional mechanical damage from mobile equipment was evident. The main point to be made is the consideration of future activities. If gates are to be maintained, then sufficient clear area around them is wise for the movement of equipment. Similarly roads or tracks, particularly if these access cropping areas, or are transit routes.

5.1.1.6 Insects

Many species received degrees of insect attack. In most instances there was little impact on growth however, some species (e.g. E. rudis) are severely damaged annually. Frequently a whole years growth had been killed. E. rudis may have long-term growth problem because of the insect susceptability. New foliage of E. wandoo was often badly attacked, but rarely were deaths attributed to insects.

5.1.1.7 Fire

No examples of fire damage were seen during the survey However, the potential is great. Some species create greater fire-risk conditions, and planting these in wide strips adjacent to external boundaries would be unwise.

5.1.1.7 Fire (cont'd)

The planting of species which do not accumulate ground fuel (not necessarily fire tolerant), or special edge tending (fuel reduced buffers) may be appropriate along perimeters or public access zones. Maintaining the outer fringe with grazing capacity will always reduce the risk of fire spread into plantings.

5.1.2 Other Rehabilitation Factors to Consider

5.1.2.1 Species

Invariably salt scald areas have totally failed. Although many of the tree species tested have some tolerance of the salt zone, none survived the extreme cases. From a rehabilitative point of view additional salt resistant species, not necessarily trees, should be considered. There are a number of species recognised as salt resistant which should be used. (See TABLE R1)

5.1.2.2 Species Transpirational Ability

A research project (Dept. of Conservation and Land Management/Public Works Department) is assessing the transpirational status of many species. The checking of this criteria in the field is virtually impossible. The ideal tree has a extensive, and deep root system, a large fully functional crown, and an inherent physiology to sustain transpiration during summer and autumn. The only clue to transpirational capacity is leaf area. Listed in TABLE R3 are species which maintained large crowns. These should be checked against the species being tested in the transpiration research project. Is there a relationship, or could some of these warrant closer

5.1.2.2 Species Transpirational Ability (cont'd)

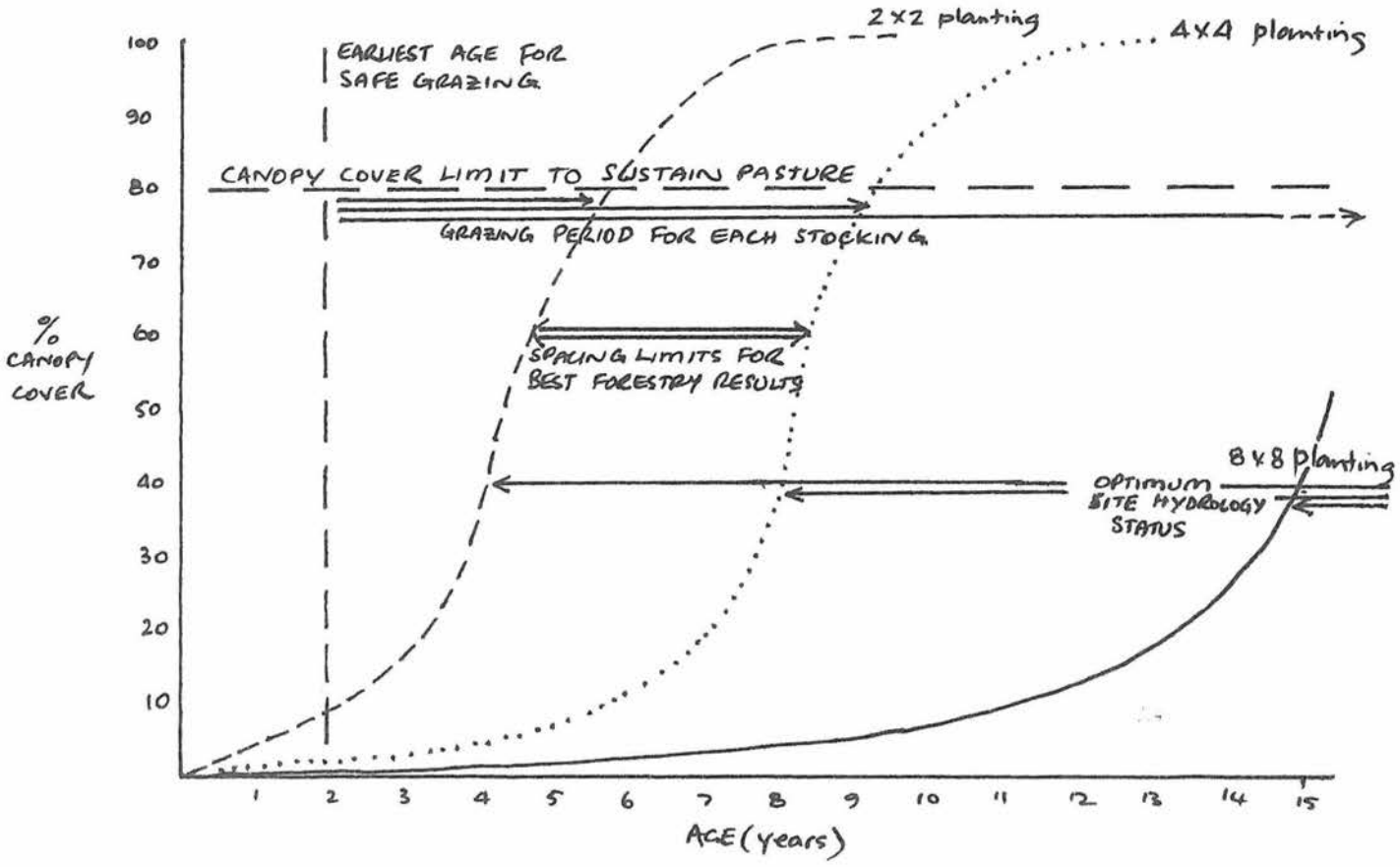
examination. Apparently the transpirational rate for a particular species is relatively constant. Therefore small tests can provide reasonable indications on transpiration rate status.

5.1.2.3 Planting Density

Evaluation of planting spacing is most appropriate in relation to the primary land use option. The significance of the secondary options determines the final planting configuration. Figure 1. is very diagramatic, but shows the conditions where multiple use is maximised, and where individual purposes are maximised.

FIGURE 1

DIAGRAMATIC LIMITS OF LAND-USE



5.1.2.3 Planting Density (cont'd)

Closer spacing benefits the site rehabilitation and forestry objectives. Open spacing improves agricultural objectives whilst reducing the effectiveness of forestry and site rehabilitation. Public Works Department estimate a 40% plant site occupancy is a desirable rehabilitation level. With plantings 4m x 4m, this is achieved in 4-6 years (species differences) but effectively eliminates grazing by 10-12 years, unless pasture regeuvenation measures are initiated. (See Section 5.2.2)

5.1.2.4 Operations

A number of stand modification operations are possible in the stands - either thinning (commercial and non-commercial) or pruning. Any of these reduces the site transpirational load. These operations are therefore questionable in reference to site rehabilitation, but justified for other reasons. A question is posed here - and likely remains unanswered. Onces a stand has reached canopy closure, what level of thinning would be acceptable (reduction in transpiration per hectare) until the retained stems convert the extra growing space into an equivalent leaf area? The answer to this question could form the basis of thinning schedules. The same question could be applied to pruning - although it is accepted that the lower 1/3 - 1/4 of the green crown may be non-functional, at least in mature trees.

5.1.2.5 Natural Regeneration

Many examples of natural regeneration were observed. Disturbed ground (ripped or mounded) in the seed-fall zone of veterans improved the opportunity for natural regeneration establishment. E. rudis, E. wandoo, and

5.1.2.5 Natural Regeneration (cont'd)

E. calophylla exhibited this ability, and examples of E. camaldulensis (older, farm plantings) were seen. The use of natural regeneration may be an alternative, cheaper establishment technique. Seed assessment would be necessary. This system has some problems which detract from the cheapness:-

- there is risk of success as mortality is normally quite high
- regeneration reflects the parent genetics which may not be desirable
- some species (e.g. E. rudis) may not be particularly desirable, and
- growth rates of seed stock is normally slower.

There is potential that this type of regeneration could be useful when preferred species are able to produce viable seed.

5.1.2.6 Direct Seeding

There are circumstances, particularly where grazing is not intended as an option, where direct seeding will be viable. Higher stockings at a relatively cheap cost are possible.

5.2 AGRICULTURAL ASPECTS

5.2.1 Land Capability

Land has a inherent capacity to sustain tree crops as well as a variety of agricultural activities. The type of activities suitable will depend upon soil type, topography, compatability with other activities and operational constraints.

5.2.2 Agricultural Options

Cropping generally requires broad areas for economical scale of operations. Accordingly, the scope for crops with tree planted areas is limited, although it should not be discounted. Situations which would increase the interest of the agricultural sector should be explored.

Examples could be:-

- every 5-6 years use nutrient restoring cash crop
- every 5 years consider grain crop
- special pasture crops

These require larger areas, although bands may be possible. The problem of reduced interception, transpiration variations and potential for surface water flow may have a significant effect on the hydrological balance.

Grazing is suitable under a variety of tree environments. Once trees are established and into their "safe-from-browsing" phase, there is 3-10 years before the impact of the trees renders the pasture virtually useless. The canopy closes, reducing the amount of light reaching the ground, leaf-drop reduces the pasture area, while some species appear to create pasture alleopathy. The protection value of grazing increases until pasture quality drops, and animal condition is not maintained.

Some species have problems reaching a "safe from browsing" height either because of the species having palatable foliage, or because of slow growth in combination with overgrazing. In both cases careful stock management is required to avoid failure. Many examples of this were seen with E. marginata and E. calophylla.

5.2.2 Agricultural Options (cont'd)

The sustaining of pasture depends upon avoidance of canopy closure. A number of options exist to create gaps. A general rule seems to exist in east-west plantings, that a space of 3 times the tree height is necessary to sustain pasture. This can be achieved by gap or row thinning, and in some instances through form pruning. If rows were orientated more north-south, the gap width would be less. North-south plantings on mid and upper slopes are problems in relation to the existing technique of ripping contour planting lines.

The impact of gap creation must be considered (less interception, runoff greater, transpiration reduced evaporation increase). If a compromise planting configuration is desirable (all three land use activities closer to optimum), it warrants block tree plantings (at closer spacing) with wider pasture gaps. Examples of this were seen at Forbes-Robinson-Green (trial area) while several "Failed" sites maintain good pasture between 5th row species. The second example would not have enough tree stocking for rehabilitation value.

5.3 FORESTRY

5.3.1 Assessment

The success of catchment plantings in terms of timber values rests with the potential to produce marketable products. At the time of assessment, few species have current commercial value (E. globulus, E. saligna, E. maculata, E. resinifera) many other species are recognised as having commercial potential on similar sites.

5.3.2 Factors to Consider for Future

5.3.2.1 Spacing

Wider spacings stimulate diameter growth and branch development. Spacings closer to 1000 stems/hectare are optimal for best commercial forest growth.

5.3.2.2 Species

Plantings should aim for balances between species of commercial potential, and preferred transpirational status. Some species are site specific (TABLE R4) and it is possible that species with under canopy tolerance could be established in failed sites, or replanting after commercial thinning.

5.3.2.3 Operations

Several operations are practical to improve the commercial potential. Pruning upgrades butt-log quality or encourages early primary leader development from a multi-stemmed phase. Thinning offers potential for increased log volume. Post-thinning fertilizer application maintains tree growth, and may stimulate crown area recovery. The use of cuttings in establishment (especially wet areas) warrants future trials.

5.3.2.4 Other Forest Values

There are other values which should be considered, in addition to timber commercial status. The potential is greater for these options on difficult sites where "traditional" commercial species are unsuitable.

5.3.2.4 Other Forest Values (cont'd)

These options include:-

- seed orchard stock (eucalypts especially)
- species which have high apiary value
- arboretum value
- eucalypt oil species

6. RECOMMENDATIONS

Although the plantings have the primary objective of improving catchment ground hydrology conditions, it is obvious that there is great potential for multiple use. Findings and observations indicate there is scope for improvement from plantings - in either primary or secondary activities.

Several recommendations have significant affects on one activity, while others interact in complex associations.

6.1 REHABILITATION

There is need to determine the optimum tree stocking levels which can maintain the hydrological balance, yet provide realistic conditions for other activities. The application of this magic number should not be applied broadly. It is suggested that catchment land could be categorized into areas which had a dominant secondary objective. A compromise will not be appropriate on some sites (e.g. rocky ridge-tops, or stream salt scald areas).

Within the salt-affected zone survival can be improved through better ground preparation techniques, and the use of salt-resistant and high transpiration rate species.

Natural regeneration and direct seeding are techniques where plants (not necessarily trees) can be cheaply established. Some species appear to set seed early. In sites where maximum stocking is desirable, these species will dramatically increase site occupancy.

6.1 REHABILITATION (cont'd)

Some species have high site rehabilitative capacity (e.g. E. marginata, has a very high transpirational status) yet will never reach an advanced stage unless protected for some time from stock, or grass competition. Understanding the balance between a species growth and the competing factors is very important.

6.2 AGRICULTURE

This assessment project did not specifically attempt to evaluate the pasture environment. Many questions were raised and remain largely unanswered. The primary question is - how important is pasture maintenance in a tree environment, especially if the tree-planting effort is to be taken up by the private agricultural sector.

If pasture is important, then some assessment of pasture conditions is required. This would include conditions created, compared to desirable conditions, and would investigate quantities, quality (nutrition value) and seasonal variations. In the tree-environment the rejeuvenation of pasture is an issue already untested. There are a number of obvious solutions, but their impact on the hydrological balance is thought to be undesirable.

If Agroforestry can be practiced, then there are some cropping options which may improve site nutrition and farm income. These would require careful evaluation from the site rehabilitation point of view, but there may be site conditions where this option is practical.

The principal deficiency revealed in the study was the lack of knowledge of the habits of sheep in tree environments. Each farmer followed differing principles, and there were notable examples at each end of the range. This diverse knowledge should be collected, and a set of guidelines prepared for practical application. If the grazing option is to be a

6.2 AGRICULTURE (cont'd)

primary reason why agriculturalists accept tree planting, then it is essential that stock management is better understood. Failure to consider this will result in broadscale tree losses.

6.3 FORESTRY

The planting of trees on reasonable sites for purely rehabilitative benefits will invariably provide advantages in tree growth. Traditional forestry tending practices require more careful consideration as there will be an effect on the transpirational pressures on the site.

The selection of species now has several dimensions. Site objectives and capabilities require balancing between activities and species suitability. The scope for species selection increases with age, as there is potential to establish plants which have under-canopy tolerance. Within each species there is need to examine genetic stock. The open-grown environment encourages large branching or multi-stemmed growth. Breeding may be able to find genotype which have unaltered transpirational capacity, but which develop into better commercial form. The use of cuttings has potential here.

There are many other forestry values which can be obtained from rehabilitation planting, especially if the site does not have a timber producing capacity.

6.4 CONCLUSIONS

This paper has aimed to produce objective information which will aid in future plantings, and management of existing and proposed plantings. The rehabilitation exercise when evaluated against the primary land-use objective should be successful. From other points-of-view the results

6.4 CONCLUSIONS (cont'd)

are not so clear. The ultimate solution seems to lie in the development of a LAND CAPABILITY ASSESSMENT, which will grade land according to the physical constraints, the desired objectives, and segregated into practical activity units. This method will have greater appeal to farmers and foresters, and if the regimes are structured to achieve the hydrological objectives, then a true compromise is possible. The concept of AGROGFORESTRY could be seen as a compromise solution - however, it is only one of many solutions.

It is believed that three broad assessments be considered for catchment rehabilitation planting prior to potential commercial forestry operations commencement.

(a) Age 2-3. Principally a survival assessment, but also a confirmation of early growth factors - whether grass competition control is required, especially in relation to grazing. (See Table 2)

(b) Age 10. This provides information on the stand at or about canopy closure. This is the best period to decide on future operations - thinning, pruning, fertilizer and others. (See Tables 3 - 6)

(c) Age -2 or -1. Prior to establishment, the land should be assessed for capability, and a practical catchment activity plan prepared. The best compromise on a site basis can be developed from this information, and converted to a ground preparation and establishment plan.

The final recommendation is the preparation of a data storage system of information provided in this study, and other relevant to future catchment rehabilitation and management. Prior to data accumulating, it will be possible to quantitatively predict the responses to various options, and have these validated by future assessments.

TABLE R1

SALT RESISTANT SPECIES

OBSERVED		OTHERS RECOGNIZED
only ones showing resistance		
E. camaldulensis E. sargenti E. rudis E. spathulata	none totally resistant	E. kondininensis Tamarix Casurina Callitris
E. platypus		
E. cornuta		

TABLE R2

SALT TOLERANT SPECIES

OBSERVED	OTHER RECOGNIZED
E. camaldulensis	E. dundasi
E. rudis	E. loxophleba
E. sargenti	E. salmonophloia
E. spathulata	Casuarina
E. kondininensis	Callitris
E. platypus	Tamarix
E. occidentalis	Willows
E. cornuta	Poplars
E. robusta	Acacias
E. planissma	Salt Bushes
	Jojoba
	E. eremophila
	E. kochii
	E. floctoniae
	E. gracilis
	E. astringens

TABLE R3

SPECIES WITH HIGH TRANSPIRATION RATES

RESEARCH INDICATIONS (Ref. J. Bartle)

E. sideroxyln
E. manifera
E. marginata
E. wandoo

E. camaldulensis (fair)

LARGE HEALTHY GROWED SPECIES OBSERVED IN FIELD SURVEY

E. accedens
E. robusta
E. baxteri
E. calophylla
E. crebra
E. globulus
E. maculata
E. meliodora
E. muellerana
E. platypus
E. resinifera
E. viminales

TABLE R4

SPECIES SITE PREFERENCE

SPECIES	PROFILE LOW	PROFILE MID	PROFILE UPPER	RECOMMEND FURTHER TRIALS
E. accedens				
E. baxteri				+
E. calophylla				+ (browse free)
E. cornuta				+
E. camaldulensis				+ strains
E. cladocalyx				+
E. crebra				+
E. dundasi				+
E. globulus				
E. kondininensis				+
E. loxophleba				+
E. leucoxylon				
E. maculata				+
E. marginata				+ (browse free)
Melaleuca (Sp.)				+
E. meliodora				
E. muellerana				+ (browse free)
E. occidentalis				
E. planissma				
E. paniculata				
E. patens				+
E. platypus				
E. radiata				+ (oil value)
E. resinifera				
E. rubida				
E. rudis				
E. saligna				
E. salmonofolia				+
E. sargenti				+
E. spathulata				+
E. viminalis				+ (E. huberana)
E. wandoo				+ strains
P. radiata				
P. pinaster				
E. propinqua				

TABLE R5

SPECIES SHOWING NATURAL REGENERATION

E. marginata	-	often killed by browsing
E. rudis	-	may have better leaf-miner resistance, but requires confirmation.
E. wandoo	-	slow starter. Will be browsed.
E. calophylla	-	slow starter. Browse preference.
E. camaldulensis	-	example on Malcom's avenue.

TABLE F1 and F2

F1 - SPECIES WITH FORESTRY PRODUCTS - SHORT TERM

E. globulus
E. saligna

P. radiata
P. pinaster

E. meliodora (honey)
E. robusta (")
E. occidentalis (")
E. calophylla (")

F2 - SPECIES WITH FORESTRY PRODUCTS - LONGER TERM

Above plus

E. wandoo
E. accedens
E. calophylla (Chip)
E. cladocalyx - if large branch development avoided
E. viminalis
E. baxteri
E. camaldulensis (possibly) better form
E. maculata
E. marginata (careful stock management, dieback)
E. meliodora (timber)
E. muellerana
E. resinifera
E. robusta
P. radiata
P. pinaster
E. paniculata
E. patens
E. propinqua
E. radiata (oils)

TABLE F3/F4

F3 - SPECIES WITH EARLY SINGLE LEADER DEVELOPMENT

E. globulus
E. saligna (some stock often forked)
E. resinifera
E. robusta
E. maculata
E. baxteri (some double leaders)
E. camaldulensis
E. cladocalyx
E. muellerana
P. radiata
P. pinaster
E. viminalis
E. cornuta

F4 - SPECIES WITH EARLY MULTI STEM FORM

REMAIN MULTI-STEM	HAVE ADVANCED GROWTH PHASE
E. camaldulensis (variable)	E. wandoo
E. kondininensis	E. accedens
E. planissma	E. calophylla
E. platypus	E. cladocalyx
E. rudis	E. viminalis
E. sargenti	E. crebra
E. spathulata	E. marginata
	E. meliodora
	E. muellerana

TABLE A1

SPECIES SUITABLE FOR WINDBREAKS

SHORT TERM	LONG TERM
E. accedens	-
E. calophylla	-
E. globulus	-
E. resinifera	-
E. robusta	-
E. platypus	+
E. sargenti	+
E. spathulata	+
E. baxteri	-
E. crebra	?
E. planissma	+
E. wandoo	-
Pinus	+

TABLE A2/A3

A2 - SPECIES WITH DENSE CROWNS - SHADE BENEFITS

E. calophylla (often browsed)
E. sargenti
E. kondininensis
E. accedens
E. globulus - becomes sparse with age at low levels
E. baxteri
E. platypus
E. robusta
E. saligna
E. viminalis

Pinus

A3 - SPECIES WITH HIGH SMALL CANOPY

E. camaldulensis
E. rudis
E. cladocalyx
E. cornuta

TABLE A4

SPECIES FUEL (LEAF & TRASH) ACCUMULATION

MINIMAL	POOR	WIDE DISTRIBUTION
E. baxteri	E. globulus	E. camaldulensis
E. wandoo	E. saligna	E. rudis
E. accedens	E. maculata	
	E. robusta	
	E. viminalis	
	E. resinifera	
	E. rubida	

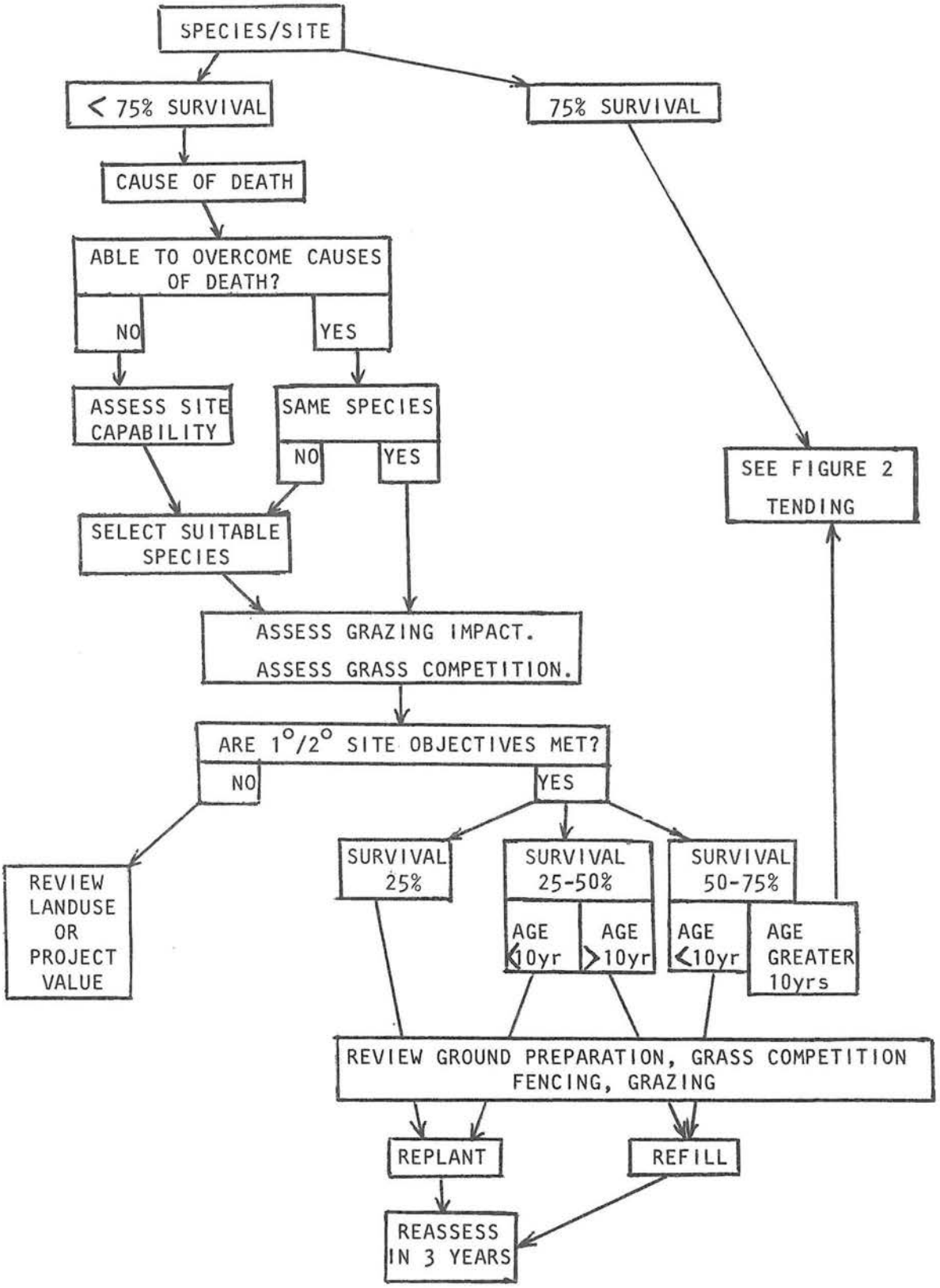
TABLE A5

SPECIES WITH HIGH BROWSE PREFERENCE

E. calophylla)
E. marginata) very common
E. wandoo (less)
E. accedens (not common)
E. cladocalyx (if overgrazed early)
E. resinifera
E. muellerana
Melaleuca (Sp.)

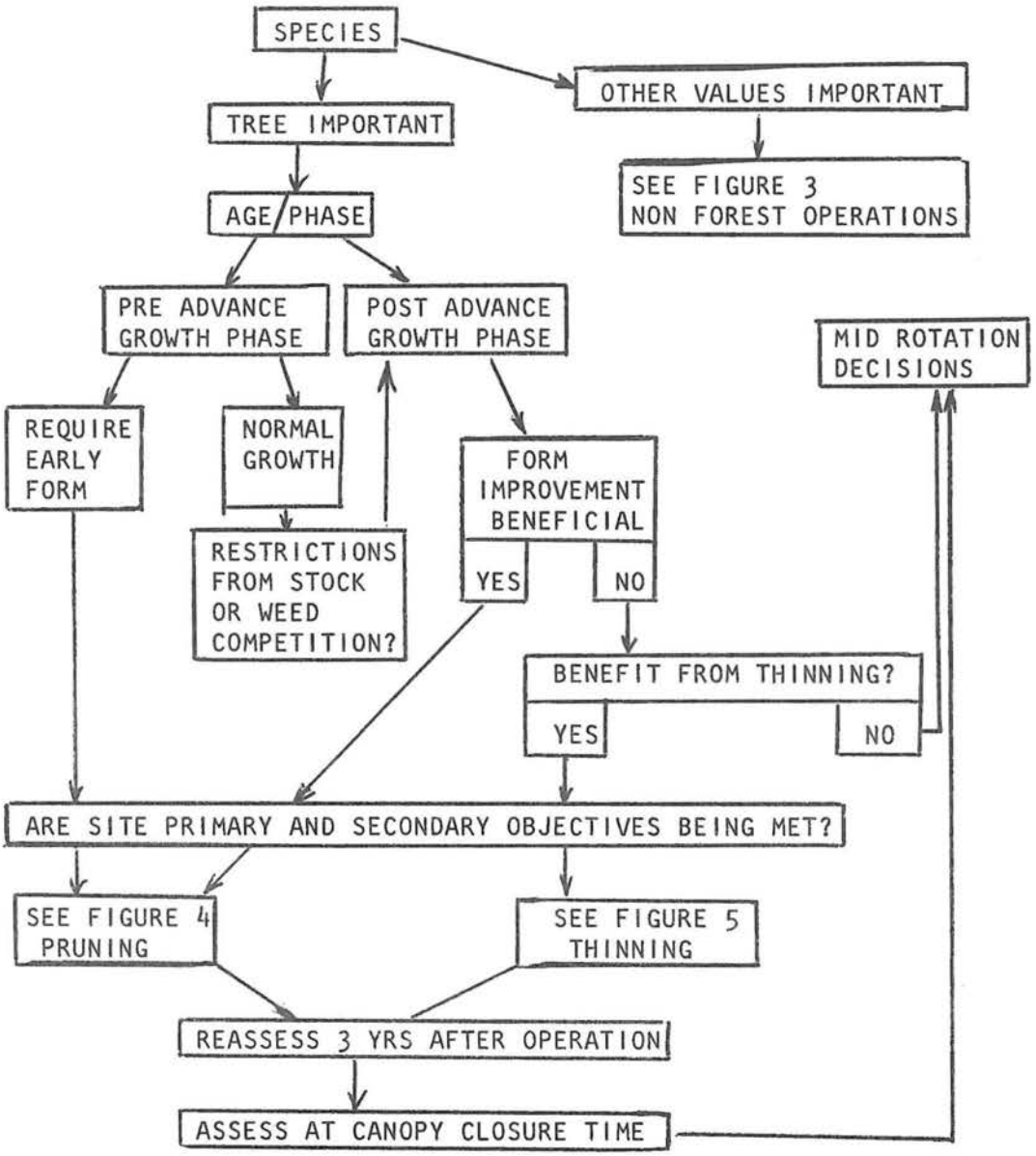
CATCHMENT MANAGEMENT OPERATIONS GUIDE

FIGURE 2 - OPTIONS FOLLOWING SURVIVAL ASSESSMENT



CATCHMENT MANAGEMENT OPERATIONS GUIDE

FIGURE 3 - STAND TENDING



CATCHMENT MANAGEMENT OPERATIONS GUIDE

FIGURE 4 - NON-FOREST OPERATIONS

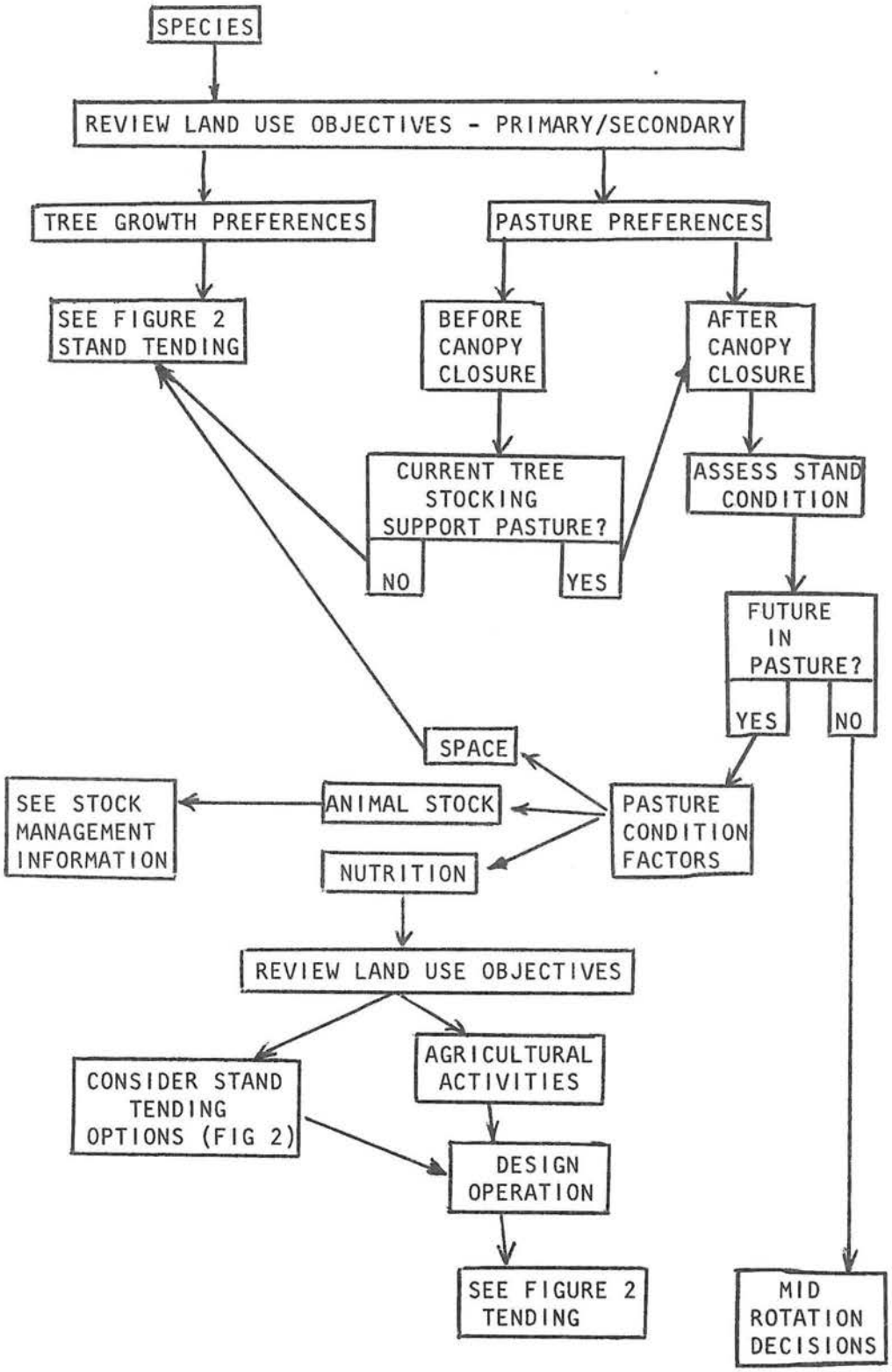


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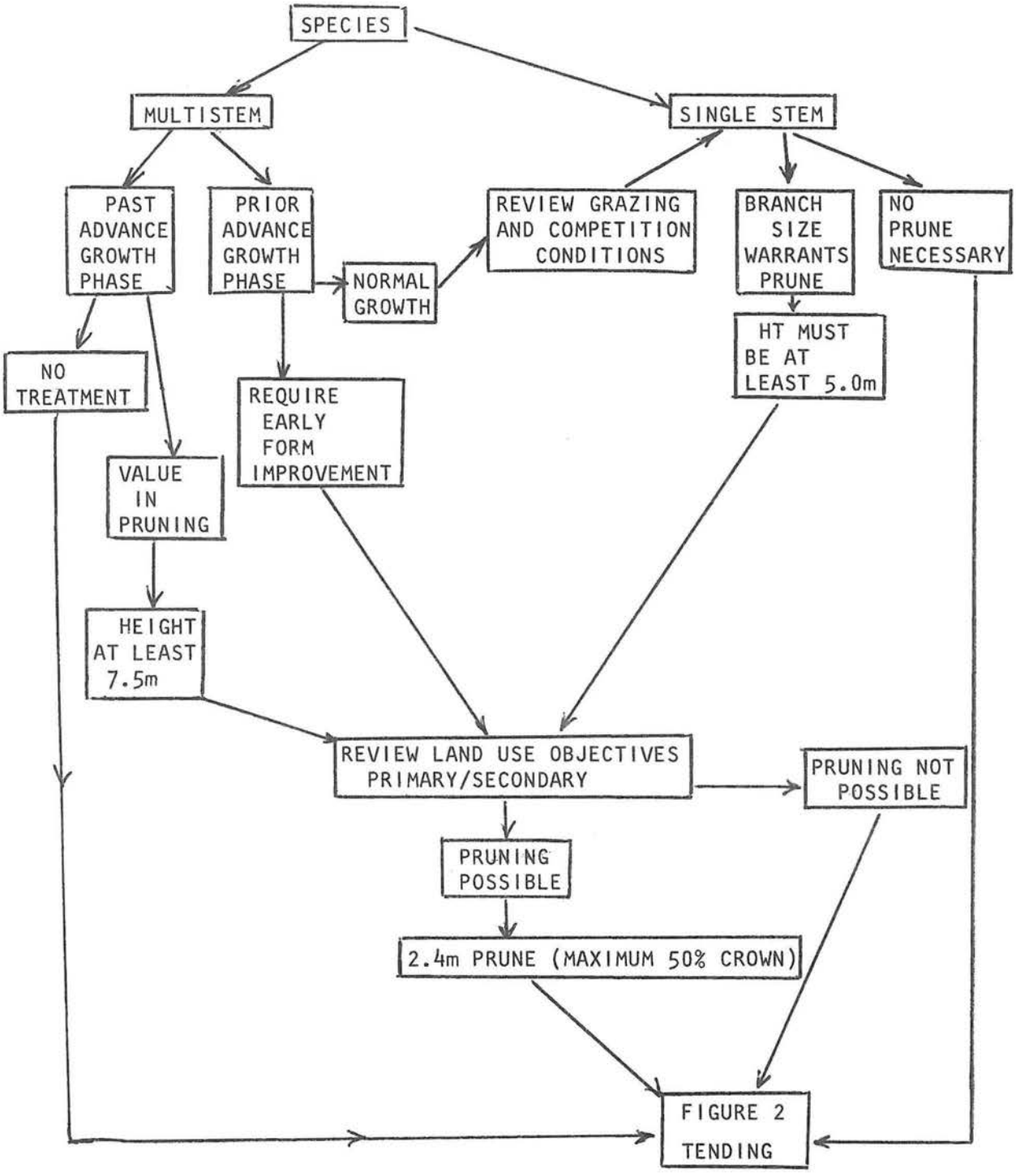
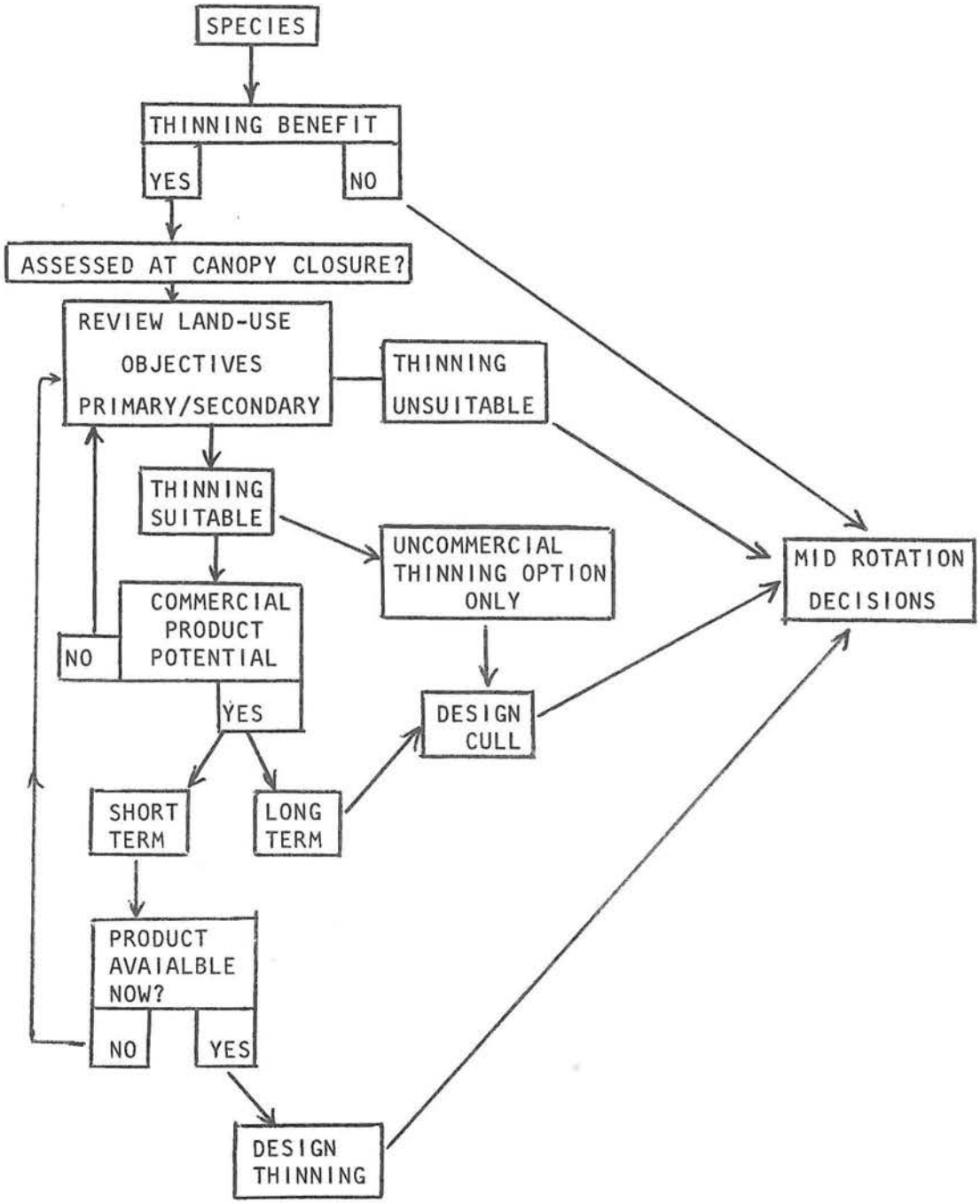
FIGURE 5 - PRUNING



CATCHMENT OPERATIONS MANAGEMENT GUIDE

FIGURE 6 - THINNING



INVENTORY - ATTACHMENT 1

FARM | PROFILE TYPE 1 | SPECIES | P. YR

PLOT NO. | SOIL TYPE 2 | STOCKING

HISTORY | SOIL DEPTH (See coding sheet)

NO	HT CLASS	DIA CLASS	STATUS 3	BOLE 4	BR SIZE 5	BR RETENTION 6	CR HEALTH 7	CR SHADE 8	SEED 9	SURVIVAL 10	DAMAGE CR INSECT ← 11	BOLE INSECT	WIND DAMAGE	ANIMAL DAMAGE →

MANAGEMENT - ATTACHMENT 2

FARM | PROFILE TYPE 1 | SPECIES | P. YR

PLOT | SOIL TYPE 2 | STOCKING

HISTORY | SOIL DEPTH (see coding sheet) | PERFORMANCE RATING 16

BASAL AREA	- GROUND FUEL - TYPE 12	HT/D	%	COMMERCIAL POTENTIAL 13	ACCESSABILITY 14	OPERATIONAL COMMENTS 15

ATTACHMENT 3

PLOT NO	TREE HT	DIAM	STATUS	BOLE	BRANCH	RETENTION	CROWN HEALTH	PASTURE %	SEED	SURVIVAL %	DAMAGE	GROUND FUEL	COMMERCIAL	ACCESS

(NORMAL)

PLOT NO	HT	STATUS	BOLE	BRANCH	RETENTION	CROWN HEALTH	PASTURE %	SURVIVAL %	DAMAGE	COMMERCIAL

(SOUTHS ARBORETUM)

PLOT NO	HT	BOLE	CROWN HEALTH	PASTURE %	SURVIVAL %	DAMAGE	COMPETITION

1 Multi

5 Single

(BORLINI)

ATTACHMENT 3

PLOT DESCRIPTION

FARM

PLOT NO.

PROFILE (TOPOG)

SOIL TYPE

SPECIES

P. YEAR

SPECIAL CONDITS
(AGROFRO MOUNDED)

ATTACHMENT 1/2/3 - CODING SHEET

ITEM		1	2	3	4	5	6	7	8	9	10
TITLE		PROFILE TYPE	SOIL TYPE	STATUS	BOLE	BR SIZE	BR RETENTION	CR HEALTH	CR SHADE	SEED	SURVIVAL
CODES	1	Low slopes	Salt pan	Dead	Multi Stem	5 + cm	Non Comp.	Deaths	- 10%	Nil	- 25%
	2		Clays	Suppress	Forked	4 - 5	All 3m	Sparse	10 - 25%	Buds	25 - 50%
	3	Mid slopes	Loams	Sub Dom	Def. Single	3 - 4	75 - 50%	Mod	25 - 50%	Flowers	50 - 75%
	4		Sands	Co Dom	Undam - short	2 - 3	50 - 25%	Healthy	50 - 75%	Caps Sparse	75+ 60 — 80%
	5	up slopes	Gravel	Dom	Undam - long	-2	less 25%	Vigorous	75%+	Caps Profuse	80%+

	11	12	13	14	15	16
	DAMAGE	FUEL TYPE	COMM. POTENTIAL	ASSESS-ABILITY	OPERATIONAL COMMENTS	DIAMETER
1	Severe	Dens. Grass	Nil	Impossible		<50 mm
2	Frequent	Sparse Grass	Minor	Restricted		50 - 100 mm
3	Evidence	Nil	Chipwood	Row OK		100 - 150 mm
4	Minor	Leaf	Poles	Across row		150 - 200 mm
5	Nil	leaf/twig	sawlog	unrestricted		200+mm

ATTACHMENT 4

EXAMPLES OF RAW DATA SHEETS

A. - STANDARD INFORMATION SHEET

B. - BORLINI SHEET

C. - SOUTHS ARBORETUM SHEET

	HT	Dia	Stat	Bole	Br	Pod	CH	%P	S	%G	Damage	Fuel	Comm	Acc
PAV-4 Wandoo only - sands - midslope. 4x4.														
W	4	1	4	2	4	2	4	75 +	2	25 - 50	Ø	grass leaves	✓	✓
	2	↓	3	2	↓	↓			1					
	3		4	2					1					
	5		5	2					2					
	2		3	3					1					
PAV 5 [illegible] - 1/4 midslope - Sands [4x4]														
Rud.	6	2	4	2	4	2	4	50 - 75 (leaves)	1	75 +	leaf miss. small	grass leaves	✓ cull thin	✓
	5	1	3	2	3	↓	↓		↓					
	6	1	4	2	4									
	2	1	2	↓	↓									
	6	1	4											
	6	1	4											
Res	5	2	4	2	4	3	4	75 +	4	25 - 50	Ø	grass	✓	✓
	5	2	↓	4	↓	↓	↓		2					
	5	2		2					2					
	6	2		2					2/4					
PAV6 - Acadoms/globulus - midslope grav. sands 4x4														
Ac	5	2	4	3	3	2	4	50 - 75	2	50 - 75	Ø	grass leaves	✓	✓ PHOTO 7
	4	1	4	2	4	↓	↓		1					
	5	1	4	2	4				2					
	6	2	5	2	3				1					
	3	1	4	2	4									
Glob	13	4	4	2	3	3	4	75 - [illegible]	1	50 - 75	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	5	5	5	↓	↓	↓		↓					
	12	5	4	2										
	10	5	4	5										

(A)

PAVIANNI

BOSLIN I (B)

		Bile	Green	o/o pat	o/o shade	Dance	Lamps
9	Calo: thylla Wandoo 5th mounded. failed (ph 29) profile soil 1						
(10)	Mucilata Globulus 5th not mounded failed 25% of Globulus survived 1-3m. on soil 2. profile 1/2 soil 1/2. profile						
(11)	Robusta 5th Leucophleba. profile 2 soil grey 4,						
1	1.0	5	2	100%	5%	2A 3I	grazing and with mould,
2	.5	5	↓	↓	↓	↓	maybe may have
3	.2	1					salt been like.
4	.2	1					Waterlogg
	Leucophleba						
	1-2m	5	3	100%	15%	3I.	85% survival
(12)	Robusta 5th Leucophleba profile 1/2 soil 2 failed where slight nat. elevation in profile survival of Leucophleba						
	Wandoo Grading Radius. profile 1 soil 2.						
(13)	Wandoo Leucophleba. Profile 1/2 soil 2. failed						
Sect 2.							
	Radius Canaliculata 6 prof 3/2 Soil 4/5 grey.						
1d 1	1	5	3	100%	5%	3I	
2	1		3			3I	80%
3	.5		2			2I	Surv
4	.5		2			2I	
5	.5	↓	2	↓		2I	
6	.2		2			2I	
	Canaliculata failed 0.5m						

SOUTH ARBORETUM - EAST

	Ht	Stalk	bole	Bch	Ref	C/H	%P	%S	Sam	Comm
1.	4 2	5 4	3	5	1	2	80%	55%	2I A	?
2	4-5	5 2	1			2			2I A	no.
3	5-5	5 2	1			2			2I A	
4	3 2	4 4	4			3			3I	
5	3	5	4		2	2			2I	
6	3 2	4 4	4		1	3			3I	
6	6	5	5	5	1	4		55%	4I	✓
Amph	Globulus	5th		yellow	6=4		profile 3			
1	5	5	2	5	1	4	80%	50%	4I	
2	3	3	3			5			3I	
3	4	4	2			4			4I	✓
4	4	4	2			4			4I	poked
5	1	3	2			3			3I	
6	4	4	5	✓	✓	3			3I	
	6	5	5	5	1	4		95%	4I	✓
Pinus	Globulus	5th		2 profile)		Soil		2/0	yellow	
	3	4	1	5	1	3	75%	100%	3I	nil.
	3	3	3			3				
	2	3	2			3				
	3	4	2			3			2I	
	3					2			1I	
	2		2			2			3I	
			2			3			3I	
			3			2			2I	
			2	✓	✓	3			3I	
	5	5	5	5	1	4		90%	4I	
Pinus	Globulus	5th		profile 2		yellow sandy silt (clay?)				
	7	6	1	5	1	4	75%	100%	3I	
	2		1			3			3I	no.
	2		2			3			3I	
	2		1			3			2I	
	2		2			3			3I	
	1		2			2			2I	
			2			3			2I	
	2		1			3			2I	
	3		2			3			3I	
	4		5	5	1	4		100	4I	

moribund

moribund

moribund

to object.

ATTACHMENT 5

PLOT SUMMARY SHEETS

BY - SPECIES
- TOPOGRAPHIC PROFILE
- FARM

CODING - SOILS (as per ATTACHMENT 1/2/3)
- TOP HEIGHT (5 tallest trees in plot)
- DIAMETER (as per ATTACHMENT 1/2/3)
- FORM (1 = single stem, 2 = multi-stem)
- SEED (as per ATTACHMENT 1/2/3)
- HEALTH (as per ATTACHMENT 1/2/3)
- SURVIVAL
  - 1 -25%
  - 2 25-50%
  - 3 50-75%
  - 4 + 75%
- PASTURE

ATTACHMENT 6

SPECIES PERFORMANCE SUMMARIES

WELLINGTON CATCHMENT PLANTINGS

NOTES for species pages

PLOTS - Number of sample plots
- by Farm and Site profile

Farms - 1 STEINS
- 2 MALCOMS
- 3 FORBES - ROBINSON - GREEN
- 4 MARINGEE
- 5 BORLINI
- 6 SOUTHS
- 7 SOUTHS ARBORETUM
- 8 OLIVER
- 9 PIAVINNI

GROWTH and DEVELOPMENT

PROFILES - LOW
- MID
- UPPER

\# - Number of plots (f = failed no. plots)

T.Ht = top height for plot (meters)

%S = % survival for stand

E. Accedens (Powder bark wandoo)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile		0	5		5	10		3	0
mid profile		7	10		2	3		0	8
upper profile		4	4		0	0		0	0

2. Growth and Development

- commences seeding on better sites as early as year 3.
- consistent growth on mid and upper profile within stands.
- low profile growth more variable - mounding benficial.
- spacing not important in form (sampled 2 x 2 - 8 x 4m)

Species Performance Summary

	Low Profile			Mid Profile			Upper Profile		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
2	4	1	25-50	-	-	-	-	-	-
3	12 (f1)	2	25-50	3	4	50-75	-	-	-
5	4 (f1)	4	50-75	10	5	50-75	5	5	75+
6	3	4	50-75	15	5	75+	4	4	50-75

3. Survival

- see table.
- insects cause minor crown damage (leaf attack).
- stock occasionally browse.
- grass competition in early years retards growth (Borlini).
- some wind damage (leaders broken) on larger specimens.

4. Timber Value

- not evident at this stage - dominant leader development will be important.
- generally multi-stemed.
- considerable prune/cull require if aim for primary leader encouragement at early stage.
- pruned in F.R.G. (Agroforestry trial) recently for future examination.

5. Agricultural Value

- good windbreak - low, dense, crown, large leaves.
- leaf drop at base - minimum pasture loss.
- not a favoured browse species.
- some pasture germination retarded suspected.
- has aesthetic value.

6. Salinity Tolerance

- No plantings in true Saline zone, but only failures in very moist zone (Olivers).

7. Recommendations

Require to test thinning, pruning responses, A native species, healthy, early agricultural value, timber potential.

E. Baxteri (brown stringybark)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile						0	0		
mid profile						1	1		
upper profile						0	0		

2. Growth and Development - Seed by 3rd year
   - Consistant growth - good early growth.

Species Performance Summary

	Low Profile			Mid Profile			Upper Profile		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
3		Nil		2	4 (South Arboretum)	50-75		Nil	

3. Survival - healthy generally
   - some crown insect damage - not serious
   - not browsed significantly

4. Timber - good form, some tendancy to double leader.
   - good branching habit.

5. Agriculture - not browsed
   - crown not widely spreading (columnar)
   - leaf drop under canopy limited
   - will develop into a large, high canopy tree
   - suitable for early windbreak

6. Salinity - no plantings in saline zone.

7. Recommendations - further plantings because of timber potential, and early product suitability.

E. Calophylla (marri)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile	1	0	5	0	1	0	0	1	0
mid profile	2	3	2	0	0	3	0	0	5
upper profile	0	11	7	1	0	1	1	0	2

2. Growth and Development

- floral cycle stimulated by 5 years.

Species Performance Summary

	Low Profile			Mid Profile			Upper Profile		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
2	1 (f1)	-	-	-	-	-	1	2	50-75
3	-	-	-	3	2	50-75	1	1	-25
4	-	-	-	-	-	-	1	2	50-75
5	4 (f3)	5	75+	2	3	75+	7	4	50-75
6	-	-	-	5 (f4)	4	50-75	13 (f1)	5	50-75

3. Survival

- insects attack crown - not major problem
- commonly browsed - significant limitation early
- once into advanced growth stage - good growth
- good establishment, survival dependent upon competition or grazing pressures

4. Timber

- generally multi-stemed - but a dominant leader can develop by age 5-6.
- browsing affects survival, damages form, and retards development into advanced growth.

5. Agricultural

- preferred browse species.
- leaf drop limited at base of crown.
- dense compact crown - although not a good windbreak unless closely spaced. Foliage removed to browse height.

E. calophylla (cont'd)

6. Saline

- not tested in salt zone.

7. Recommendations

- requires stock management until advanced growth stage attained.
- healthy on a range of sites, and known to survive long periods.

E. Camaldulensis (River Red Gum)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile	8	18	24	3	10	13	13	9	0
mid profile	1	6	17	2	5	3	0	1	4
upper profile	0	2	1	0	0	0	0	0	0

2. Growth and Development

- Variable - especially between provenances.
- Floral cycle develops by 5 years in dominants
- E. cam - E. rudis hybrid strain better than other E. cam. provenances. It does not have the same susceptability to leaf minor as E. rudis.

Species Performance Summary

	Low Profile			Mid Profile			Upper Profile			Salt pan		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
2	5 (f1)	3	50-75	-	-	-	-	-	-	2 failed		
3	22 (f3)	3	50-75	3	4	50-75	-	-	-	-	-	-
4	7	4	50-75	3	4	50-75	-	-	-	1 failed		
5	20 (f2)	6	50-75	17	6	50-75	10	6	75+	2 (f1)	3	50-75
6	22	6	50-75	11	6	50-75	2	6	75+	-	-	-
7	1	4	50-75	-	-	-	-	-	-	-	-	-
8	2	5	50-75	-	-	-	-	-	-	-	-	-

3. Survival

- good generally - establish and grows easily
- extends into low profile and survives a saline environment better than most species - survival improves with mounding.
- foliage attacked by insects, which may retard growth.
- as height increases above 6m, wind damage is reasonably common.
- The E. cam - E. rudis strain has better branching habit (less, and smaller diameters) and this permits stock to rub against the bole. Generally this is not a problem - except where rams in the stand. The bark thickness cannot sustain continual abuse, and damage occurs.

4. Timber *E. camaldulensis (cont'd)*

The E. cam - E. rudis strain has the best form for future timber value. The other provenances are often forked, or multistemed, with bendy primary boles. This may be minimised in time.

The trial at F.R.G. shows two other strains with fair form, and surviving are Wiluna, and Tennant CK. Rarely are the broad-scale planting provenances known. Silverton provanance reasonable.

5. Agriculture

- not a good species for pasture retention
- wide spreading crown - shade effect
- starts dropping leaves early - widely
- not a preferred browse species - leaves cover ground
- seems to have a restrictive effect on pasture

6. Salinity

- goes well in saline environment, improved if mounded.

7. Recommendations

Not suitable for use if patures are to be sustained
Good rehabilitative value to low profile
Has commercial value - if use E. cam - E. rudis strain
A better comparison of provandance and site suitability is required.

E. cladocalyx (sugar gum)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile						0	0		
mid profile						0	2		
upper profile						1	0		

2. Growth and Development
   - flowers by age 6
   - appears good growth 6-7m in 6 yrs

Species Performance Summary

	Low Profile			Mid Profile			Upper Profile		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
2	-	-	-	2	4	-25	-	-	-
3	-	-	-	-	-	-	1	6	25-50
6	-	-	-	-	-	-	1	7	75+

3. Survival
   - see table
   - No limiting factors

4. Timber
   - good form
   - branching not excessive

5. Agriculture
   - foliage browsed in smaller individuals
   - not a good windbreak, but will develop large crowns - shade

6. Salt - not tested

7. Recommendations

   A species worth considering more - has a good reputation - agricultural and timber valves.

E. crebra (narrow-leaved red ironbark)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile						0			
mid profile						1			
upper profile						1			

2. Growth and Development
   - by age 3 hts 2-3m
   - floral cycle starts by age 3
   - still in jeuvenile form

Species Performance Summary

	Low Profile			Mid Profile			Upper Profile		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
3				1	3	50-75	1	2	50-75

3. Survival
   - generally adequate - considering gravelly sites (Souths)
   - no insect attack

4. Timber
   - poor form at this stage
   - require form pruning, or wait until primary bole development

5. Agriculture
   - not browsed
   - low compact crown - suitable for windbreak - not expected in longer term
   - glaucaus foliage - has aesthetic value

6. Salinity - not tested

7. Recommendations

   Worth more trials for timber and agriculture value.

E. globulus (southern blue gum)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile	1	6	7	3	13	2	6	4	0
mid profile	0	17	8	1	0	9	6	0	6
upper profile	1	8	5	0	0	2	0	0	3

2. Growth and Development

- does not develop floral cycle to age 6 - usually jeuvenile foliage still present
- outstanding height/diameter development
- usually consistent size on each site

Species Performance Summary

	Low Profile			Mid Profile			Upper Profile		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
2	12 (f6)	4	50-75	6 (f2)	6	50-75	-	-	-
3	1	5	75+	9	7	50-75	-	-	-
4	8	5	50-75	1	10	50-75	-	-	-
5	7	9	50-75	8	9	50-75	7	8	50-75
6	6	11	50-75	21	10	50-75	12	11	75+
7	1	10	75+	-	-	-	-	-	-

3. Survival

- establishment excellent except in saline zones
- occasionally suffers sudden block deaths - attributed to a wide range of environmental factors (shallow soils, excessive moisture, salinity competition and possibly nutrition).
  Insects (borers) common in dying trees - but thoguht to be secondary, although may finally kill the tree.

4. Timber

- form and size excellent - including branching
- future product only accepted as chipwood (short-rotation)
- principally a 5th row planting

E. globulus (cont'd)

5. Agriculture

- initially a good wind-break - eventually a high crown
- to jeuvenile stage virtually holds its foliage
- by ages 5-6 starts accumulating leaf and trash
- not browsed

6. Salinity

- not really tested, although shows foliar effects when in proximity. Also dropped in height in these areas.

7. Recommendations

Appears good, but wary on its sensitiveness and overall suitability as a commercial timber, and agricultural benefits in longer term.

E. kondininensis

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile			3				1		
mid profile			-				-		
upper profile			-				-		

2. Growth and Development
   - floral cycle commences by age 5
   - slow growth (3-4m in 5 yrs) in poor sites

Species Performance Summary

Low Profile

Age	#	t.Ht.	% S
2	1	2	25-50
5	3	4	50-75

3. Survival
   - ground conditions (drainage and/or salinity) limiting
   - mounding improves survival
   - possible insect attack

4. Timber
   - poor form (mostly multi-stemed)
   - not known as a commercial timber species

5. Agriculture
   - compact crown - suitable as windbreak early
   - not browsed

6. Salinity
   - has a good reputation for salt tolerance. Not exhibited in plots, although grew close to saline zones reasonably well.

7. Recommendations

More plantings on slightly better sites may be worthwhile.

E. Loxophleba (York Gum)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile				2	7				
mid profile				1	2				
upper profile				0	0				

2. Growth and Development

- floral cycle not commenced by age 5
- very slow growth - on poor sites

Species Performance Summary

	Low Profile			Mid Profile		
Age	#	t.Ht.	% S	#	t.Ht.	% S
2	7 (f4)	2	75+	2	2	50-75
4	2	4	75+	-	-	-

3. Survival

- generally uniform (where it survived)
- not affected by animal browsing
- insect attacks occasionally

4. Timber

- poor form
- has potential

5. Agriculture

- not browsed
- recognized for future shade value

6. Salinity

- not tested

7. Recommendations

A native speices with aesthetic and other values - worth trying more frequently on better mid-profile sites (closer to natural sites)

E. maculata (spotted gum)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile	1				2	0	0		
mid profile	-				2	3	2		
upper profile	-				0	0	0		

2. Growth and Development
   - floral cycle commence by age 6
   - uniform in stands

Species Performance Summary

	Low Profile			Mid Profile			Upper Profile		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
2	-	-	-	2 failed			4 failed		
3	-	-	-	7	4	50-75	-	-	-
7	1	6	75+	-	-	-	-	-	-

3. Survival
   - some insect damage (bole-borers)
   - failed in low profile environment (Borlini)

4. Timber
   - too few examples to make definitive statements, although has a good reputation. Has good heights, form and diameter

5. Agriculture
   - high crown early
   - not browsed

6. Salinity - not tested - failed close to sale zones

7. Recommendations
   - Should be tried more frequently on low-midslopes, when well drained.

E. Marginata (jarrah)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile			0			0			
mid profile			3			4			
upper profile			8			5			

2. Growth and Development
   - floral cycle not commenced by age 5
   - height limited usually by overgrazing
   - healthy once released from grazing pressures or grass competition
   - establishes satisfactorily

Species Performance Summary

	Low Profile			Mid Profile			Upper Profile		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
3	-	-	-	4 failed			4	3	50-75
5	-	-	-	3 failed			4 (4f)	3	24-50

3. Survival
   - heavy browse species - failures, principally attributed to this
   - some insect attack on young foliage (minor damage)
   - grass competition restricts growth

4. Timber
   - long term potential - dieback ?
   - timber value delay until advance growth phase commences
   - compact low crown in early years

5. Agriculture
   - heavy browse species
   - once advance growth reached, wind-break effect lost (browsed lower bole)

6. Salinity - not tested

7. Recommendations

E. marginata (cont'd)

- keep stock from area if wishing to encourage height as well as improve survival
- use of advance growth seedlings?

E. meliodora (yellow box)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile					0	0	1		
mid profile					0	0	1		
upper profile					2	6	0		

2. Growth and Development
   - floral cycle not commenced by age 5
   - consistent within site

Species Performance Summary

	Low Profile			Mid Profile			Upper Profile		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
2	1 (f1)	1	75+						
3	1	3	50-75	1	3	50-75	6	3	75+

3. Survival
   - healthy - no major limitations
   - not suitable in lower profile (Borlini) - grass competition

4. Timber
   - multi-stemed
   - has potential

5. Agriculture
   - low compact crown in early years
   - eventually a spreading crown
   - not browsed significantly
   - honey producer

6. Salinity - not tested

7. Recommendations

   Could be more extensively planted on better mid-slope sites.

E. Muellerana (yellow stringybark)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile				0					
mid profile				0					
upper profile				1					

2. Growth and Development

Where survives has good height (5m in 4 yrs) and form. Develops seed by 4 years.

3. Survival

Very poor - may be browsed heavily, or find environment difficult. Not many survive the establishment stabilisation period.

4. Timber

Has potential, good form

5. Agriculture

survival a problem - generally stock browsed

6. Salinity - not tested

7. Recommendations

Further detailed examination of establishment conditions, and survival records.

Should have potential if survival improves.

Limited plantings - more trials.

E. Occidentalis (flat-topped yate)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile	1		0	4	12		4		
mid profile	0		0	0	0		0		
upper profile	0		1	0	0		0		

2. Growth and Development

- floral cycle develops early - honey value?

Species Performance Summary

	Low Profile			Upper Profile		
Age	#	t.Ht.	% S	#	t.Ht.	% S
2	10 (f1)	2	25-75			
3	1	7	25-75			
4	4	5	75+			
5	-	-	-	1	4	-25

3. Survival

- better on low-mid profiles
- crown foliage subject to insect damage
- generally health satisfactory
- some stock browsing

4. Timber

- form indicates straight logs possible - commercial value? (Tannin)
- branching not excessive

5. Agriculture

- leaf drop similar to E. camaldulensis
- has browse value
- crown elevated early - and sparse (poor shade)

6. Salinity

- mounding improves survival
- not seen in true saline environment

E. occidentalis (cont'd).

7. Recommendations

- more a site rehabilitation species
- possibly could be tried elsewhere on suitable sites

E. Planissma

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile	1								
mid profile	0								
upper profile	0								

2. Growth and Development
   - floral cycle commences early
   - multistem form
   - heights 2m at age 8 (steres)

3. Survival
   - average (50-75%)
   - foliage subject to some insect damage

4. Timber
   - poor potential

5. Agriculture
   - suitable as a windbreak in conjunction with fast-growing species

6. Salt - not tested

7. Recommendations
   - doesn't stand out in any particular regard
   - possibly saline zone suitability

E. platypus

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile	1					7	4		
mid profile	0					0	0		
upper profile	0					0	0		

2. Growth and Development
   - floral cycle established by age 5
   - multi-stemed

Species Performance Summary

	Low Profile			Salt Pan		
Age	#	t.Ht.	% S	#	t.Ht.	% S
3	10	3	50-75	1	2	25-50
8	1	5	25-50	-	-	-

3. Survival
   - considering the harsh environments - fair survival
     - consistent within stands
   - insects or browsing not problems
   - mounding assists survival

4. Timber
   - poor

5. Agriculture
   - suitable for windbreak

6. Salinity
   - one of the better species - although will not grow in the salt pan

7. Recommendations

   Certainly its value lies in saline environment rehabilitation and windbreak use.

E. resinifera (red mahogany)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile		4	1	0	2	0	0	3	0
mid profile		5	4	3	0	2	4	4	5
upper profile		11	1	0	0	6	0	1	1

2. Growth and Development
   - floral cycle develops early (by 3)
   - generally good form - dominant leader, small branches

Species Performance Summary

	Low Profile			Mid Profile			Upper Profile		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
2	2	failed							
3	1	4	25-50	8	4	50-75	5	4	75+
4	2	failed		4 (f1)	4	25-50	2	4	50-75
5	1	5	-25	3 (f1)	6	50-75	1	3	-75
6	4	6	50-75	10	7	50-75	12	7	75+

3. Survival
   - some browsing evident
   - low profile - not successful without mounding
   - some insects noticed - not serious
   - commonly a 5th row species

4. Agriculture
   - more compact crown than E. Globulus, E. Saligna
   - finer branches
   - foliage palatable
   - trash/leaves development or ground by 6 yrs

5. Salinity - not tested

6. Recommendations

   Of the fast growing species it is one of the slowest, but its survival and long term potential, combined with short-term suitability, make it a useful species in the upper profiles.

E. robusta (swamp mahogany)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile				5	9	0	0	14	
mid profile				2	3	9	2	0	
upper profile				0	0	2	0	0	

2. Growth and Development
   - floral cycle develops early
   - consistent within stand
   - always healthy
   - good form, although heavy branching

Species Performance Summary

	Low Profile			Mid Profile			Upper Profile			Salt pan		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
2	5 (f4)	2	50-75	1 (f2)	1	-25						
3	14	2	25-50	11	5	50-75	1	4	75+	deaths in salt		
4	4 (f1)	5	75+	2	4	50-75						

3. Survival
   - good on a variety of sites
   - mounding improves low profile situation

4. Timber
   - has good form
   - reasonably fast growing

5. Agriculture
   - large dense crown - windbreak
   - not browsed

6. Salinity
   - fails on poor sites
   - generally survives low profile situation

7. Recommendations

   Has timber potential, and site ameleoration values.

E. rubida (candlebark)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile						0	0		
mid profile						1	2		
upper profile						0	0		

2. Growth and Development
   - floral cycle not commenced
   - growth 5m in 3 years

3. Survival
   - good (50-75%)
   - generally healthy

4. Timber
   - limited potential on current form, although recognized as a suitable species

5. Agriculture
   - in jeuvenile stages satisfactory
   - long term bark/leaves/trash problems

6. Salinity - not tested

7. Recommendations

   Should be tried more frequently.

E. rudis (W.A. flooded gum)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile	4	10	14	2	28	14	11	16	5
mid profile	0	4	3	1	7	1	1	0	2
upper profile	0	0	2	1	0	0	0	0	0

2. Growth and Development

- floral cycle commences in 5 yrs
- very variable in growth
- usually spindley

Species Performance Summary

	Low Profile			Mid Profile			Upper Profile			Salt pan		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
2	25	2	50-75	7	1	50-75						
3	26 (f2)	3	50-75	2	4	50-75				3 (f2)	2	50-75
4	8	3	50-75	2	5	75+						
5	13 (f1)	5	50-75	4	5	75+	1	7	75+			
6	18	5	50-75	6	5	50-75						
8	1	7	50-75									

3. Survival

- establishment on wet sites good
- very badly affected by leaf minor early. Actually can kill a years flush - causing resprouting
- has good natural regeneration ability on disturbed ground

4. Timber

- not recognized as a timber species

5. Agriculture

- appears suitable for site ameloration, but has bealth problems and very spindley crown

6. Salinity

Best survival if mounded.

7. Recommendations

Site rehabilitation value only - possibly health problems limit that value.

E. saligna (Sydney Blue gum)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile	0	14	8	6	0	19	13	7	2
mid profile	3	7	17	7	3	2	13	0	8
upper profile	0	0	9	7	0	1	0	0	1

2. Growth and Development
   - floral cycle commence by 5th year
   - excellent growth

Species Performance Summary

	Low Profile			Mid Profile			Upper Profile			Salt pan		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
2				4 (f1)	2	25-50						
3	39 (f10)	4	50-75	2	5	50-75	1	5	50-75			
4	6 (f3)	4	50-75	7	5	25-50	7	5	50-75			
5	8	6	50-75	15 (f3)	7	50-75	9	6	50-75			
6	16	7	50-75	18 (f1)	10	75+	1	12	50-75			

3. Survival
   - variable - establishment good
     - suffers from sudden deaths as E. globulus. Certain site sensitivity with insect attack secondary.
   - best on mid profile - well drained

4. Timber
   - good form and growth
   - good potential

5. Agriculture
   - crown elevated, although compact
   - browsed lightly

6. Salinity - not suitable

7. Recommendations

On midslope best performances

Although greater varability over all sites, it has better timber potential than E. globulus (product value)

E. sargenti

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile	2		1	2	12	2	6		
mid profile	0		0	1	0	0	0		
upper profile	0		0	0	0	0	0		

2. Growth and Development
   - usually established in harsh environment
   - floral cycle not common in age range

Species Performance Summary

	Low Profile			Mid Profile			Salt Pan		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
2	5	1	25-50	4 (f2)	2	25-50			
3	7	3	50-75				1	3	50-75
4	2	4	50-75	1	4	75+			
5	1	6	50-75						
8	2	6	75+						

3. Survival
   - good considering environment
   - insects attack crown foliage

4. Timber
   - no potential

5. Agriculture
   - can produce low, dense crown suitable for windbreak

6. Salinity
   With mounding survives

7. Recommendations
   Best value in site rehabilitation

E. Spathulata

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile				1	2	2			
mid profile				0	0	0			
upper profile				0	0	0			

2. Growth and Development
   - floral cycle developed by age 5
   - low, dense crown - multi-stemmed

Species Performance Summary

	Low Profile			Salt Pan		
Age	#	t.Ht.	% S	#	t.Ht.	% S
2	1	failed		1	failed	
3	2	4	50-75			

3. Survival
   - on difficult (low profile) sites - appears satisfactory
   - mounding assists
   - health adequate

4. Timber
   - nil potential

5. Agriculture
   - site rehabilitation good
   - windbreak value
   - grazing some problems

6. Salinity
   - reasonable

7. Recommendations

low profile rehabilitation value

E. Viminalis (manna gum)

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile					2	14	5		
mid profile					1	11	9		
upper profile					1	3	0		

2. Growth and Development
   - Seed cycle develops by age 4

Species Performance Summary

	Low Profile			Mid Profile			Upper Profile		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
2	-	-	-	3	2	3	1	4	3
3	18	5	50-75	20	6	50-75	3	5	50-75

3. Survival
   - not damaged, although appears to be periodically susceptable to scale and/or leaf minor - not excessive or growth-limiting.

4. Timber
   - form fair, possibly better in long term
   - large branch potential

5. Agriculture
   - leaf fall restricts pasture
   - likely to develop a large crown

6. Salinity - not really tested

7. Recommendations

   If commercial timber value confirmed could be useful.

E. Wandoo

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile	1	4	12	3	16	23	2	6	1
mid profile	5	7	17	5	1	13	2	2	10
upper profile	1	2	10	4	1	0	1	1	3

2. Growth and Development

- rarely seeds, although possible on dominants by age 5
- not good for early height growth
- not seen out of multi-stemmed, stunted form
- quite variable in condition

Species Performance Summary

	Low Profile			Mid Profile			Upper Profile		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
2	9 (f7)	1	50-75	1	1	75+	1	1	25-50
3	24 (f2)	2	50-75	17	3	50-75	2	3	50-75
4	3 (f3)	2	50-75	4 (f1)	3	75+	4	2	50-75
5	11 (f1)	4	75+	16 (f1)	3	50-75	10	4	75+
6	6	5	50-75	17 (f2)	4	50-75	6	3	50-75
8/9	6	5	50-75	3	3	75+			

3. Survival

- good establishment
- improves with mounding in low profile
- damaged crown shoots by insects
- often heavily browsed by stock
- very moist sites unsuitable

4. Timber

- once in advanced growth the potential may be there. Not evident from assessment

5. Agriculture

- low compact crown
- stock browse considerably - young growth only

6. Salinity - not suitable.

7. Recommendations

With stock management, it is suitable on mid slope sites.

OTHER SPECIES

E. CORNUTA (Yate)

PLOTS - 4 - Souths Arboretem - all low profile - Age 3

GROWTH - Age 3 - Hts 4-6m
- floral development by Age 3
- consistent on site

SURVIVAL - 50 - 75%
- extends into saline zone - but not in pan
- healthy where survives

VALUE - rehabilitative
- possible apiary

E. DUNDASI

1 plot - failed to establish. Cause unknown
consider more planning on upper slopes

E. LEUCOXYLON (yellow gum)

1 plot - (Meringi) low profile
Age 4 - 5m Height - no mounding
could be considered for future aesthetic values

MELALEUCA PREISSIANA (paperbark)

1 plot - (Souths Arboretum). Low profile - mounded
Age 3 - 2m high
less 25% survival - principally from stock browsing
survival $<$10% in very wet flat zone

E. PANICULATA (grey ironbark)

1 plot - Souths Arboretum - upper profile
Age 3 - height 4m
survival 75% +
has timber value - further trials warranted

E. PATENS (W.A. blackbutt)

1 plot - Souths Farm - low profile
Age 3 - height 4m
75% + survival

1 plot - Borlini - low profile
total failure - cause unknown

Should have potential on good soils, although not likely in damp sites with poor drainage.

OTHER SPECIES (cont'd)

E. PROPINQUA (grey gum)

1 plot - Souths Arboretum - low profile
Age 3 - height 5m
75% + survival

Suitable for better sites

E. RADIATA (narrow leaved peppermint)

7 plots - Souths - low profile - hts 1m - 50-75% S

1 plot - Souths - mid profile - ht 6m - 75% +S

has potential - foliage oils

E. SALMONOFOLIA (salmon gum)

1 plot - Souths - low profile)
) failed from grass competition
1 plot - souths Arboretum - low profile)

P. pinaster

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile	0				0		0		
mid profile	0				1		0		
upper profile	1				0		1		

2. Growth and Development
   - stock damage possible (F.R.G.) and grass competition significant (Borlini)(1m in 2 yrs)
   - Stems plot doing well (8m in 9 yrs). Well below p. Radiata an same site (South Arboretum)

3. Survival
   - Site and stock important

4. Timber
   - Suitable for thinnings and older sawlog potential

5. Agricultural

   Able to be pruned to windbreak advantage as well as commercial timber value.

6. Salinity - not tested

7. Recommended

   May prove useful on sands.

P. radiata

1. Sample Plots

Farm	1	2	3	4	5	6	7	8	9
low profile	I				O		O		O
mid profile	I				I		O		I
upper profile	O				O		I		O

2. Growth and Development

- site selective - require soil depth and reasonable soil types (sandy loams at least).
- better than most species on same site

Species Performance Summary

	Low Profile			Mid Profile			Upper Profile		
Age	#	t.Ht.	% S	#	t.Ht.	% S	#	t.Ht.	% S
2	1	1	50-75	-	-	-	-	-	-
3	-	-	-	-	-	-	1	4	75+
6	-	-	-	1	8	50-75			
8	1	12	50-75	-	-	-	-	-	-
9	-	-	-	1	9	75+	-	-	-

3. Survival

- stock will affect, as will grass competition
- no insect affect

4. Timber

- good potential range of products from thinnings

5. Agriculture

- browsed, bark damage possible (before age 5)
- can be shaped (farm pruning)

6. Salinity

- not tested

7. Recommendations

Preferred pine species on reasonable sites.

ATTACHMENT 7

SUMMARY OF PLOTS BY FARM and PROFILE

FARM	PROFILE LOW	MID	UPPER	TOTAL
STENES	23	12	4	39
MALCOMS	56	56	38	150
MARINGI	33	23	13	69
OLIVER	58	9	2	69
PAVIANNI	9	48	11	68
FORBES) ROBINSON) GREEN)	78	86	53	217
BORLINI	129	19	4	152
SOUTHS	122	71	28	221
SOUTH ARBORETUM	80	33	3	116
TOTAL	588	357	156	1101

ATTACHMENT 8

SKETCH MAPS SHOWING

PLOT LOCATIONS

Held at Department of Conservation and Land Management, Bunbury Regional Office.

ATTACHMENT 9

FARM CONDITION REVIEW

STENES

PLANTING ZONE

- West 1979, all low profile
- Central 1976-77, low profile to lower slope
- East 1979, narrow valley to midslope.

GROUND CONDITIONS

- ripped planting lines
- mounded only in very wet area (Central)

OBSERVATIONS

- E. globulus deaths from spray
- E. camaldulensis - grass effects (West)
- E. globulus, P. pinaster - stock protection value of stands (Central)
- failed plots - overgrazed?
- E. maculata deaths - Central
- E. planissma - single plot
- E. camaldulensis - strains - (East - plots 3, 4, 6)
- E. globulus - merchantable sizes.

MALCOLM

PLANTING ZONE (1979-80)

- NW, SW and S of Central zone all low profile
- bulk of Central zone mid-profile with some portions in upper profile.

GROUND CONDITIONS

- low profile areas mounded
- ripped planting lines elswhere
- very wet zone in NW - failures

OBSERVATIONS

- shallow soil depths E. globulus (Central, South)
- E. camaldulensis natural regen. (Central avenue)
- E. globulus, E. saligna - quality stands (Central - North)
- Pasture problem developing with canopy closure (E. camaldulensis, E. wandoo and 5th Row species).
- Good marri stands.

FORBES - ROBINSON - GREENS

PLANTING ZONE (1980)

- predominantly lower profile
- midslope and upper zones represented in central and north

PREPARATION

- mounded low profiles

OBSERVATIONS

- Large plantings E. camaldulensis, E. rudis strain
- Agroforestry trial interesting
- E. camaldulensis provenances trial
- E. marginata shows good growth where not over-grazed. Otherwise heavy losses.
- E. wandoo trial (N east) require evaluation.

MARINGEE

PLANTING ZONE (1981)

- West - low profile
- East - midslopes to upper slopes (in north)

GROUND CONDITIONS - mounded low profile

OBSERVATIONS
- minor species failure (wet areas or heavy grazing)
- pastures not affected by trees

BORLINI

PLANTING ZONE (1983)

- West - mostly low profile
- Central - low profile
- East - mostly low profile, some midslope to North-West.

CONDITIONS

- mounded low profile
- West heavily grazed
- NE not grazed - heavy grass competition

OBSERVATIONS

- failures in West attributed to ground conditions and heavy (early) grazing
- pine plots show effect of mowing and grass competition.
- E. camaldulensis going well in low profile when mounded

OLIVERS

(1981 - 1982)

PLANTING ZONES
- low profile, although extends into low ridges in the S.E.

CONDITIONS
- mounded low profile
- Bingham River flat very wet

OBSERVATIONS
- species sequences different from maps
- E. robusta doing well in low profile
- E. rudis survival good - although affected by leaf-miner.

PIAVANNI

(1979)

PLANTING ZONE

- lower slopes of Bingham River
- midslopes dominant in west
- mid and upper slopes in east

OBSERVATIONS

- E. calophylla and E. marginata failures attributes to grazing
- P. radiata doing well - but not as well as E. globulus, E. saligna and E. maculata
- E. camaldulensis doing well

SOUTHS

(1982)

PLANTING ZONE
- South - low profile
- East - low, middle and upper profile
- West - gully lines and midslopes.

GROUND CONDITIONS
- mounded in wet zones

OBSERVATIONS
- E. camaldulensis varieties (plot South 19)
- E. rudis natural regeneration (South)
- E. meliodora, E. crebra, E. occidentals doing well (North-East)
- E. marginata grazed out

SOUTHS ARBORETUM

PLANTING
- principally low profile - some midslopes on fringes

OBSERVATIONS
- E. wandoo trial require survey
- P. pinaster versus P. radiata
- E. camaldulensis provenances
- E. cornuta successful
- E. viminalis same as E. huberana
- E. propinqua good growth
- E. camaldulensis - silverton provenances doing well in low profile
- E. sargenti, E. platypus, E. occidentalis doing well

ATTACHMENT 10

SELECTED PHOTOGRAPHS TAKEN

DURING SPECIES PERFORMANCE ASSESSMENT

Held at Department of Conservation and Land Management, Bunbury Regional Office.