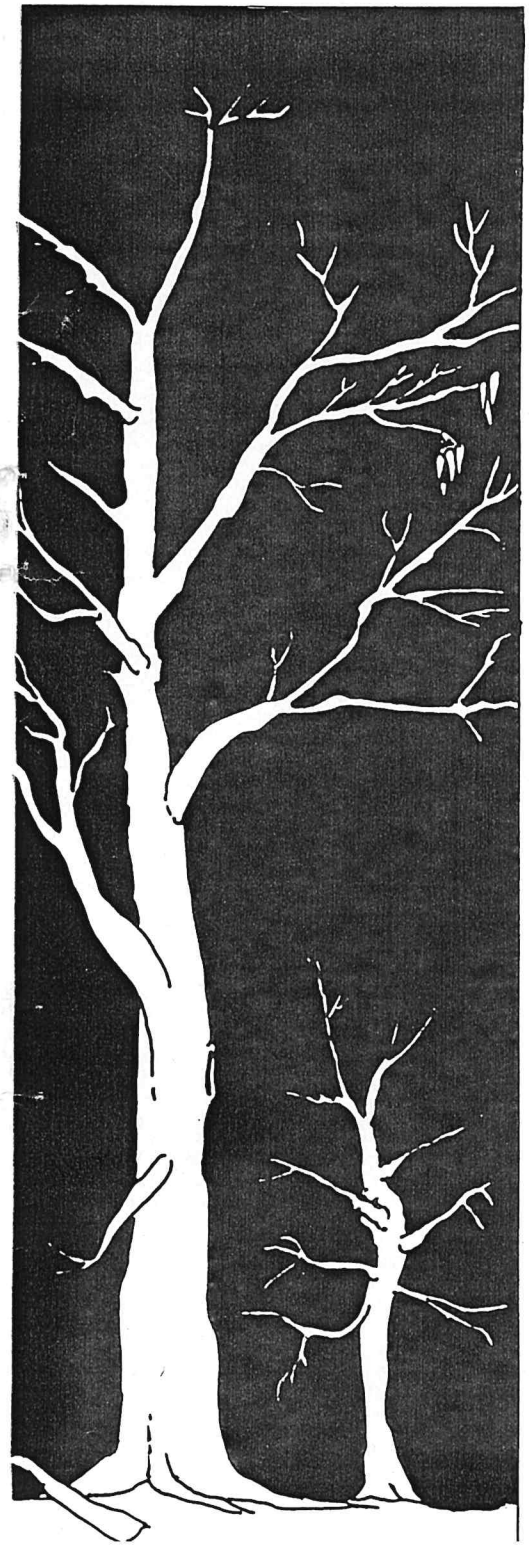

DEPARTMENT OF CONSERVATION
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Research into

RURAL TREE DECLINE

ANNUAL NEWSLETTER

VOLUME TWO

FEBRUARY 1986

I'm pleased to be able to produce volume 2 of the Research into Rural Tree Decline Newsletter. I was encouraged to attempt a second volume because of the very positive response to the first, and because of the large number of people who expressed interest in a second volume. I was able to complete it because of the continuing generous support of the Department of Environmental Biology, and because most contributors took such care to prepare their articles according to the guidelines. Thanks to you all. A few articles are slightly modified to improve reproduction and unfortunately I couldn't include some interesting information because it was not legible after reduction-photocopying.

Please pass on your helpful comments and suggestions to contributors, and circulate the newsletter to other people who may have a research interest in the decline of rural trees. The people whom I contacted about volume 2 are listed at the back; if I have overlooked anyone please let me know. I'm still working on my PhD, but should have finished it by midyear. Whether I can produce volume 3 will be dependent on where I go from there. However a volunteer replacement editor would be most welcome!

Jill Landsberg

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February, 1986.

This is the extended abstract of a poster which was presented at a conference held in Busselton, WA, in September 1985, on 'Nature Conservation: The Role of Remnants of Native Vegetation'. The conference was organized by the CSIRO Division of Wildlife and Rangelands Research and the WA Department of Conservation and Land Management (CALM). The proceedings are to be published.

THE IMPACT OF RURAL DIEBACK ON REMNANT FARM WOODLOTS

F.R.WYLIE[1] & J.LANDSBERG[2]

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Tree decline in rural areas, and the associated hazards of soil erosion and salinity, are among the foremost conservation issues in Australia. About 30% of Australia's forests and woodlands have been cleared or severely modified since European settlement (Wells et al 1984). Since the late 1960's and early 1970's there has been a marked increase in the rate of decline of remnant native vegetation on farmland in many parts of Australia. Tree loss in rural areas involves three elements. The first is the deliberate removal of trees as part of farm management. The second is the death of trees due to old age, coupled with a paucity of recruitment of tree seedlings because of active suppression, grazing, and competition with improved pastures. The third element - rural dieback - is the premature and relatively rapid decline and death of native trees on farms, apparently as a consequence of interacting environmental stresses. Rural dieback affects many different species of trees, of all ages, in most states (Old et al 1981).

A number of features characterise 'healthy' remnants of native woodland. These remnants are usually substantial (several hectares or more) and have been minimally disturbed by man or grazing livestock. There is a high degree of diversity; in vegetation structure, in plant and animal species present and in the age classes of trees and shrubs represented. In such remnants insect grazing pressure on trees is generally light to moderate. Most trees have normal, full-leaved crowns with very few dead or leafless branches and little obvious epicormic growth. Only the occasional tree shows symptoms of disorder and there are relatively few dead trees.

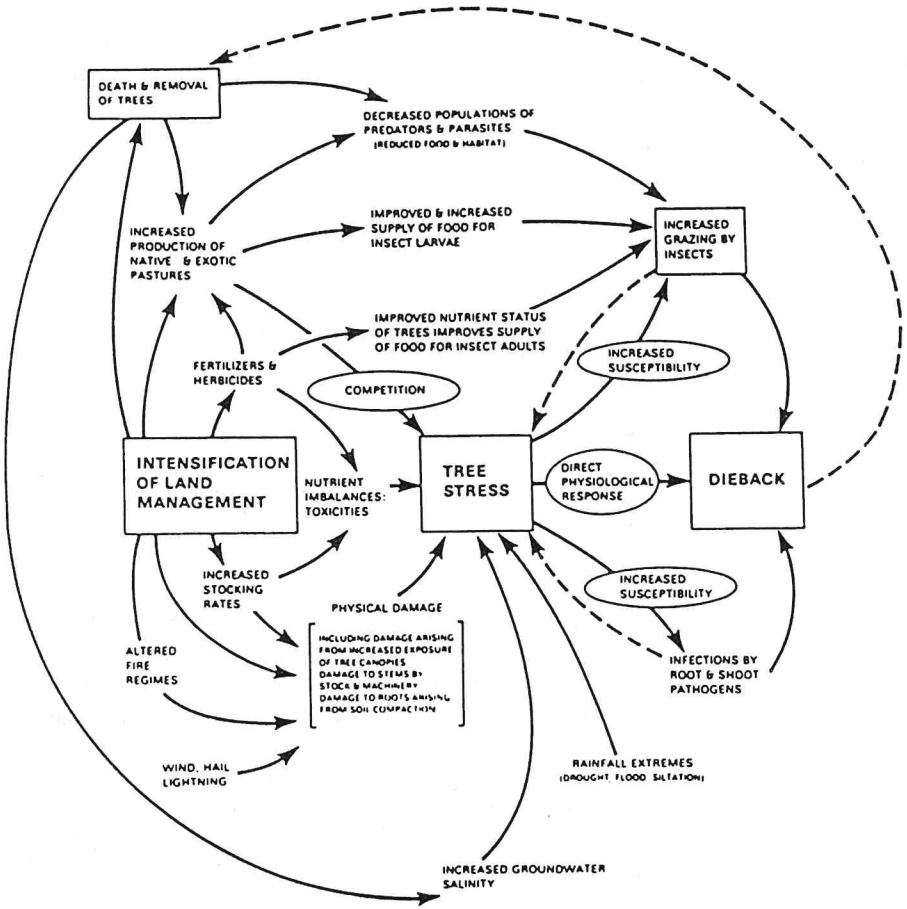
In contrast, remnant woodlots with dieback are usually small and have been severely disturbed. They lack diversity of vegetation structure, floristics, age classes and fauna. In such woodlots the pressure on trees from grazing by insects is usually severe and sustained. Many trees have sparse crowns with some death of both minor and major branches and a high proportion of epicormic growth. Tree disorder is widespread and tree death common.

Research in Queensland (Wylie & Johnston 1984) has shown a direct relationship between the extent of modification of original tree cover and the severity of rural dieback. Deliberate tree clearing, and the intensification of land use associated with it, are pivotal factors in the development of rural dieback.

Remnant woodlots on farms represent ecosystems which are precariously balanced. Once a dieback sequence is initiated, positive feedback can cause an originally stable woodlot to rapidly regress through a series of unstable states to treeless grassland (Fig.1). Small or highly modified woodlots have least buffering capacity and are therefore most at risk. In the long term both smaller woodlots and woodlots which have been structurally or floristically modified have little chance of survival unless supplemented by replanting or by natural regeneration. As land use intensifies dieback will accelerate, and will continue to erode the value of remnants of native woodlands on farms as a conservation resource, unless there is positive intervention to restore ecosystem comlexity. Research to establish the parameters which define a stable woodland remnant is urgently needed.

Rural tree decline has major consequences for conservation of biota, soil and water, at a scale which affects both rural and urban communities. Successful maintenance and rehabilitation of existing farm woodlots, and the establishment of new ones, require an understanding of the dynamics of rural dieback, if its spread is to be arrested and its resurgence prevented.

Figure 1. A conceptual model of the development of rural dieback.



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Native tree dieback in southern Queensland - its occurrence, severity and aetiology

Ross Wylie

Biology Section, Department of Forestry, 80 Meiers Road, Indooroopilly Qld 4068

A major report on dieback in Queensland is nearing completion. It includes the results of an extensive questionnaire survey and associated field studies, involving over 200 landholders in an area stretching from the New South Wales border north to Rockhampton and from the coast west to Longreach. The survey identified areas of severe dieback, tree species affected, factors contributing to tree disorder and landowners' attitudes to trees and tree decline. It also includes the results of a detailed investigation of serious dieback among Casuarina and Eucalyptus along streams in the Mary River catchment in the south-east of the State. Assessment of data from some 220 stream sites in the catchment suggests that increasing streamwater salinity in some sites may be predisposing the trees to insect attack. Relationships have been demonstrated between the extent of tree clearing, streamwater quality and the severity of insect-related dieback at sites in the catchment.

It is hoped that the report will be completed in mid 1986. It will then be submitted to the Queensland Government Committee on Tree Decline in Rural Areas and later published.

Dieback of river red gum (Eucalyptus camaldulensis) on grazing land in western Victoria.

Craig Clifton,
Forestry Section, University of Melbourne, Creswick 3363.

The M.For.Sc. project began in August 1983; field work was completed in July 1985. The study was conducted on a grazing property at Buangor, about 170 km north-west of Melbourne. The aim was to examine the impact of dieback on the nutrition, physiology and water relations of mature rural trees. The contribution of soil compaction to this condition was also studied. Tree loss in the study area between 1947 and 1980 was approximately 0.8% p.a., with more severe decline experienced by box and stringybark eucalypts. No clear differences in crown water relations and photosynthetic rates were observed for healthy and unhealthy trees. Absolute rates of transpiration and photosynthesis must be greater for healthy trees because of their larger, more dense crowns. Unhealthy trees may be under some nutrient stress (especially N,P,K) during the summer growing season. Data suggests that stock have little adverse effect on the physical soil environment of trees not located in camp areas, but occupying paddocks with a fair tree cover. The soil water study was inconclusive, but preliminary analysis suggests that there may be differences in pattern of soil moisture variation between healthy and unhealthy trees and open pasture.

Causes of Eucalyptus wandoo Blakely Decline in the Upper Great Southern of Western Australia.

Paul Brown / Joanna Tippett
Department of Conservation and Land Management, Research Branch
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COMO 6152

This project has been funded by the Rural Credits Development Fund for a two year period beginning in March 1986 and will be conducted in association with the newly formed Tree Research Centre at Narrogin, W.A.

Most surveys of rural tree decline in Australia have been based on broad estimates of the degree of crown decline without detailed description of symptoms. This study will place emphasis on the detailed descriptions of both external and internal symptoms and the assessment of damage caused to E. wandoo by insects and fungi in the Upper Great Southern region of Western Australia. Associations between types of damage and various enviromental conditions will be sought. Groups of individual trees growing at different densities, soil types and obviously exposed to different sources of stress, (eg. salinity, cultivation) will be examined. Trees showing earliest symptoms of decline will be dissected. Some emphasis will be placed on the comparison of healthy with 'dieback' trees.

It is envisaged that by photographically recording both external symptoms and internal state of the tissues a photoguide of diseases of E. wandoo can be produced.

The study will complement other tree establishment projects initiated by the Research Officers at the Tree Research Centre at Narrogin.

Measuring Dieback in Rural Trees Using a Dieback Index

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Dept. of Geography,
The Faculties,
Australian National University

Introduction

Observations of rural trees were made during fieldwork for an Honours project relating to natural firewood resources for Canberra. Most firewood in Canberra is derived from remnants of forests and woodlands on the Southern Tablelands and inland slopes cleared for agriculture and grazing in the last 100 years or so. The continued supply of firewood in Canberra relies, in the absence of management for sustained supply, on the natural processes of regeneration, growth and senescence in the forest and woodland communities in the surrounding rural land.

In order to assess the likelihood of a sustainable firewood supply from these informal sources information was collected on landuse history, landowner attitudes, and occurrence of trees and regrowth on a number of properties within the Canberra firewood catchment. From the extensive literature relating to dieback and rural landuse it is apparent that a wide range of factors interact to influence the extent and status of individual trees and tree communities in rural areas. It was thought at the beginning of the study that extent and abundance of mature trees was related to past clearing and the natural distribution of species and that health and longevity of existing trees, and status of regeneration were primarily related to land use and climate factors. From this it is clear that "dieback" is likely to be an important factor in the ongoing supply of firewood in the region. For this reason comprehensive data collected on 250 rural trees included measurement of tree condition using the forms developed by Grimes (1978) to measure status and patterning of dieback in rural trees. This report concentrates on this aspect of the study.

Methods

Thirty $1km^2$ study sites were randomly selected within the Canberra firewood catchment. These study sites were confined to areas shown as "scattered forest" on 1:100,000 topographic maps, and in practice were all located on private rural properties. Within each of these study sites a smaller sampling site of from 1 to 4 ha was randomly located. On each sample site all trees were identified, located and measured. Various other attributes of the site were recorded. For each tree, assessments were made of crown size (CS), crown density (CD), crown position (CP), proportion of dead branches (DB), and extent of epicormic shoot growth (ES) according to the methods and criteria of Grimes 1978. Since these attributes were originally developed to provide an index for growth potential in dry forests of S.E. Queensland, they were modified here in order to more closely reflect dieback status and to allow comparisons between several tree species. Thus a dieback index was developed using the algorithm:

$$DI = CD/2 + DB + (ES \times 2)$$

which emphasised the assessment of dieback based on appearance of the tree, concentrating in particular on dead branches and epicormic shoots in the crown.

Results and Discussion

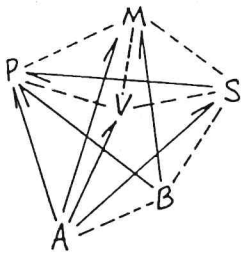
Six species of eucalypts occurred commonly enough to allow statistical comparison: *E. melliodora* (M), *E. pauciflora* (P), *E. macrorhyncha* (S), *E. viminalis* (V), *E. blakelyi* (B), and *E. albens* (A) Although site selection criteria meant that all trees were found in woodland or open woodland formations, these species are characteristically woodland (M,B,P and A) or open forest (S and V) trees. The species are also distributed on an altitudinal gradient, with P and V confined to areas above 850m, A to below 600m and the others mainly occurring between these altitudes. The most widespread and common species was M, followed by B, then S.

Casual observations indicated that the trees ranged from almost dead to almost completely free from dieback and so the range of values for DI was taken to represent almost a complete range of values possible for these trees. The theoretical range for DI is between 2 and 15.5 whereas

the observed range was 2 to 14.5, indicating that the index is fairly reliable, at least in terms of extreme crown conditions.

Assuming that the ranges of values are directly comparable between species (an assumption which was not adequately tested during the study) some clear differences between species in susceptibility to dieback are evident. Comparison of the means for the major species using Students't statistic revealed various trends. In particular A is more significantly affected by dieback than both M and S at p=0.01 and more than P and V at p=0.05, B is significantly more affected than M (p=0.05) and P (p=0.01) and S is significantly more affected than P at p=0.05. A suggested hierarchy of susceptibility to dieback is illustrated below.

DIAGRAMATIC RELATIONSHIP BETWEEN SPECIES IN RELATION TO DIEBACK



---- No significant difference

——→ Species significantly less susceptible to die back

M = E. melliodora
P = E. pauciflora
S = E. macrorhyncha
V = E. viminalis
B = E. blakelyi
A = E. albens

The pattern of susceptibility suggests a geographical basis for differences observed. A and B, most common at lower altitudes and in areas most heavily modified for agriculture, are also apparently most affected. P and V, on the other hand, confined to higher altitudes in areas mostly less severely modified and rarely cultivated, are also relatively less dieback affected. The relatively low level of dieback affects on M appears to be anomalous in the light of its identification as a major species affected in the Southern Tablelands (Kile 1980). A further anomaly is the low susceptibility of S, which on casual observation appears to be the most heavily affected species of all. S is rarely seen without severe branch death and massive epicormic regrowth, and is very commonly observed ringbarked by grazing horses and cattle.

The anomalous position of S may indicate the less than perfect ability of the index to distinguish adequately between species, with its high index value being largely due to the high values for CD for this species. S almost invariably reacts to branch death by producing very thick epicormic growth deep within the crown, a character not so strongly developed in other species. This means that although S is more susceptible to factors causing branch death it is also more vigorous in producing new growth to compensate for the loss. The difference between species, not indicated adequately by the index, is also shown by M which is also susceptible to factors causing dieback but appears to respond with relatively sparse epicormic growth further along the main branches, thus maintaining the appearance of a fairly open crown. This seems to suggest that the efficiency of the index could be improved by the addition of a factor which modifies the DI value according to growth and response characteristics of each species. Such a factor could take the form of a weighting on an existing factor.

Conclusions

Although the data are insufficient to make definite statements, it appears that dieback in rural trees is more closely related to intensity of landuse than type of landuse per se. However some types of landuse (e.g. grain cropping), are inherently more intensive, and tend to more severely modify and disturb natural conditions.

The data collected during this study suggest significant differences between species in their susceptibility to dieback. In some cases this conclusion may be warranted whilst in others there appear to be shortcomings in the DI which lead to an anomalous situation. To refine the index will need the incorporation of some means of accounting for the apparent different levels of susceptibility of different species, and their characteristic responses to dieback.

The occurrence of dieback affected and healthy trees in close proximity, growing under more-or-less identical landuse regimes may indicate a role played by particular events in particular places in initiating dieback or accelerating incipient dieback. Such a possibility would require a lengthy study on its own.

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▶ Dieback - Death of a Landscape

H.H. Heatwole and M.D. Lowman (Univ. New England)

The book Dieback - Death of a Landscape is nearly completed. This overview of the rural dieback syndrome in Australia is aimed at explaining the situation to concerned citizens (not scientists alone), particularly to landowners who contributed funds for dieback research in New England. Publication is scheduled for April 1986 by Reed Inc. Copies should be available soon after that for $19.95.

▶ Chemical Analyses of Eucalyptus Leaves

M.D. Lowman (Univ. New England) and J. Schultz (Penn. State Univ.)

Extensive chemical analyses of eucalypt leaves including several New England dieback species are underway. Factors considered for variability include tree species, leaf age, height in tree, site, and individual tree. These results will considered in relation to the field measurements of herbivory conducted during 1983-6.

▶ Native Tree Dieback and Mortality on
The New England Tablelands of New South Wales

S. M. Mackay, F. R. Humphreys, R. V. Clark,
D. W. Nicholson and P. R. Lind

Research Paper No. 3, For. Comm. N.S.W. 1984

ABSTRACT

'New England Dieback' is defined in this study as a particular group of symptoms of living trees and 'New England Tree Mortality' as the premature death of native trees in rural areas on the New England Tablelands.

Dieback was investigated in 1977 using a road survey, by questioning owners of 15 randomly chosen rural properties between Walcha and Glencoe and by making observations in 30 plots established on the 15 properties. Some plots were re-examined in 1979 to assess tree death rates for the 1977-79 period. In a further experiment, tree crowns were protected from leaf grazing insects for 18 months by application of systemic insecticide.

Symptoms defined as New England Dieback - crown defoliation, secondary shoot development and death of primary and secondary shoots - were found to be the main symptoms of tree decline. Premature death of trees was shown to be strongly associated with high levels of dieback. Based on these findings it was suggested that, under the stress of repeated defoliation, trees may die due to gradual depletion and eventual exhaustion of the energy reserves necessary for crown regeneration.

All 590 live trees examined (20 species of *Eucalyptus* and *Angophora floribunda*) were defoliated to some extent but *E. nova-anglica* and *E. blakelyi* were significantly more defoliated than other species. Significant trends of increasing

defoliation with decreasing levels of dominance and maturity were found for non-epicormic defoliation but not for epicormic defoliation. Tree density was found to have a significant effect on some aspects of dieback but a non-significant effect on others. Dieback was independent of most site, land management and stand characteristics but higher levels were found on northerly aspects, in depressions and on poorly drained sites.

Significant recovery of tree crowns occurred on trees treated with insecticide. Based on this finding and observations made during the survey, insects were implicated as the main defoliating agents. It was concluded that repeated defoliation by leaf grazing insects was a major factor in the dieback and premature death of native trees on the New England Tablelands during the period of these investigations.

▶ Two 'work in progress' reports from Graeme Enders of the Department of Ecosystem Management, U.N.E., Armidale, NSW 2351.:

Research Activities In The Department of Ecosystem Management, U.N.E.

J.A.DUGGIN, G.R.ENDERS, B.N.RICHARDS.

1st April, 1985

Research in progress in this Department is presently covered by a Rural Credits Development Fund Grant; Regeneration and maintenance of native woodlands in dieback affected areas of New England. The following research areas are being investigated, some of which were initiated under funded research into the distribution and intensity of eucalypt dieback per se;

- Leaf-area loss sampling and mensuration from fifteen trees at "Newholme" field laboratory, Tilbuster. This study aims at providing long term information on seasonal variation in defoliation levels.
- Annual monitoring of adult eucalypts at twenty locations throughout the Armidale - Ebor area to assess crown condition and its relationship to season and site factors. A coding system was developed to ensure objective re-assessment.
- Continuing data analysis of a survey of woodlot health over 140 sites throughout the Ebor - Armidale - Walcha area. It is hoped the results of this study will identify correlations between woodlot health and landuse and management factors. A survey of management practices was conducted as part of this study.
- Continuing measurement of growth and crown dynamics in four natural eucalypt regeneration exclosures in the Thalgarrah area to the east of Armidale. A series of tagged shoots are re-measured monthly in one component of this study.
- Survey and analysis of the life-form and distribution of natural eucalypt regeneration on the tablelands, to establish relationships with landuse intensity and duration.

RESEARCH ACTIVITIES IN THE DEPARTMENT OF ECOSYSTEM MANAGEMENT, U.N.E.

J.A. DUGGIN, G.R. ENDERS, B.N. RICHARDS

PROGRESS REPORT 2: Wednesday, 20th November, 1985.

Activity on this project during the months since the last meeting has been constrained by the teaching committments of the participants. However, field survey has continued, along with regular maintenance of the Thalgarrah regen. exclosures.

Our observations suggest that this spring growth season has been one of mild temperatures, abundant moisture, and prolific growth of both vegetation and insect populations. Our anticipations are that relatively high insect numbers over the coming summer will at last give some useful results on the value of the insecticide treatment of the Thalgarrah regeneration. A few more detailed comments on each aspect of our programme are set out below.

* Leaf-area loss sampling. Since the April meeting of this committee we have sampled the fifteen trees involved in this trial twice; one sample to estimate Autumn leaf damage levels, and one more recent sample to estimate Winter/pre-Spring leaf damage levels. The mobile cherry-picker has made this task much easier than using a rifle alone to sample branches, and is less damaging to the trees.

We are currently 'gearing-up' to analyse leaf areas using a digitising table and the UNE DEC20 computer in preference to the old paper-leaf and planimeter method we have been using. This should make area measurements much quicker. We intend to conduct a few precision trials in the near future to assess the apparent advantages of the new method.

It has become apparent from our continued use of crown assessment coding schemes that this leaf sampling gives little indication of actual crown defoliation levels, as it doesn't account for variation in occupation of leaf sites on a stem, but rather gives an indication of the functional area of those leaves which do constitute the tree crown.

* Annual crown assessment monitoring. No further field sampling has been undertaken since the last meeting, as this is carried out over the summer period. With the January 1986 measure we will have data for six consecutive years. This should comprise a useful data set for substantiating the path of crown decline and recovery over that period.

* Woodlot health survey. Tree specific data for this aspect of our programme have been coded and an initial analysis run. We need to do more development work on an index of crown health, but initial results show an encouraging correlation between crown health and land system stratifications. The next part of this work will be to test tree data against site and management data to establish any associative trends, if they exist. This work should have important implications for management of viable woodlots.

* Thalgarrah regeneration exclosures Field measurements have continued though at a reduced rate over the winter period. Insecticide treatment was necessary on a number of occasions over winter due to the high incidence of sawfly larvae defoliating young trees. Other defoliators began early in the spring, with quite significant leaf damage to juvenile E. caliginosa at Thalgarrah attributable to Sericesthis sp. beetles. Numerous chrysomelid beetles were observed during October, mostly in breeding pairs. There were also cupmoth larvae and Uraba lugens skeletonising caterpillars in low numbers over this time.

The tagged shoot measurements undertaken here will be continued to provide information on leaf age, retention rates and functional leaf area. However a high loss of initially tagged shoots could mean any trends arising from the insecticide treatment may be obscured by lack of replicate data.

Regular growth and crown assessment data from this trial are expected to be examined over the coming summer months, if time and other commitments permit. This should give us a clear picture of seasonal dynamics in crown expansion and leaf growth for tablelands eucalypt regeneration.

An interesting offshoot of this work has been the development of a technique for rapid estimation of individual leaf areas. Leaf area can be rapidly calculated from length and width measurements for standard leaf shapes, to within ± 5% of the measured leaf area. This technique has some valuable applications for our leaf/shoot tagging work.

* Eucalypt regeneration life-form. A re-survey of the twenty established sites for this aspect of our research programme was conducted in April of this year. The immediate result obvious from this was the dramatic growth which had occurred since 1982. Table 1 below depicts mean lignotuber weights for three land-use types for the two surveys 1982 and 1985. In some cases the 1985 mean figures may be lowered by suppression of regeneration growth by an overstorey canopy (particularly the forested sites). In addition to growth, seedling recruitment has occurred over the last two years with an estimated 5% of c. 800 plants measured being non-lignotuberous seedlings.

Table 1. Mean lignotuber weight (grams) for all species, by land-use type.

	Travelling stock reserves	Pastures	Forest and woodland
1982	23.74g	19.77g	23.46g
1985	62.37g	59.41g	58.68g

A useful addition to this research would be the ability to make accurate estimates of lignotuber age by a laboratory method, rather than by inference from cultural history of regeneration sites. We intend to persue this subject in greater detail in 1986, perhaps by the use of radio-isotope measurements.

▶ DROUGHT AND DIEBACK OF RURAL EUCALYPTS

Jill Landsberg, Research School of Biological Sciences, Australian National University, PO Box 475, Canberra City, ACT 2601.

Abstract

I compared water potential and canopy condition in *Eucalyptus blakelyi* (Blakely's red gum) and *E.Melliodora* (yellow box) trees growing on two grazing properties in the ACT, during and after an extreme drought. Some of the trees appeared healthy, others had marked symptoms of dieback. All the trees were drought affected, but the extent was independent of the condition of their canopies at the beginning of the study and recovery was rapid following the breaking of the drought. I concluded that drought was unlikely to have been the major cause of the rural dieback at these sites.

Aust.J.Ecol. (1985) 10, 87-90. Full copies available from the author.

GLEN INNES TREE INJECTION/TRAP TREE PROJECT

E. E. TAYLOR

Report No. 1094, For. Comm. N.S.W. April 1985

The project was set up in November 1978, at three separate sites near Glen Innes (Virginia, Illparran and Ben Lomond). Each site contained 4 separate plots with approximately 40 trees in each plot. The main tree species were *Eucalyptus viminalis, E. blakelyi* and *E. nova-anglica*.

This project ran for six years and is now complete. Originally designed to run for three years, the collapse of the scarab beetle population caused the extension of the project for a further three years.

The purpose of the project was to record the effects of a single annual treatment to some of the trees and compare results with untreated trees. This was to find out whether treated trees gave any protection to nearby untreated trees from defoliating scarab beetles. The treatment was applied by tree injection using Nuvacron® to the same trees throughout the project. Records were made on an annual basis of various aspects of individual tree growth and defoliation.

The treatment gave protection grom leaf eating and sap sucking insects of between 6 and 12 weeks to individual treated trees. It was only during the first year of the project that large numbers of scarab beetles were present. The drought years of 1980, 1981 and 1982 caused a collapse of the scarab population in the project area, from which there has been no recovery so far. However, the treated trees still derived some benefit from the protection against other defoliating insects such as leaf beetles, eucalyptus weevils and the various leaf eating moth larvae.

The total number of trees in the project was 470. When the project ended in November 1984, 117 (25%) of these trees were dead. Of the 470 trees, 364 were untreated and 106 were treated. One hundred and sixteen (32%) of the untreated trees died but only 1 of the treated trees failed to survive.

In the six year period covered by the project there has been a general improvement in the crown foliage of surviving trees. This improvement also occurred in the control plots and is almost certainly due to the drought induced collapse of the scarab beetle population.

Combining all data -

Control Plots - There was an overall improvement of 44%.
Untreated trees in treated plots - Overall improvement of 57%.
Treated trees in treated plots - Overall improvement of 98%.

The growth in diameter for the six year period was as follows:

Control Plots - The combined growth in diameter was 1.9 cm.
Untreated trees in treated plots - Growth in diameter was 2.3 cm.
Treated trees in treated plots - Growth in diameter was 4.4 cm.

These results show almost twice the diameter growth in the treated trees over the untreated, with only a very small improvement in the diameter of untreated trees over controls.

This project clearly indicates that protection of trees from insect attack in the summer period can completely reverse the normal tree mortality rate for that area. This leads to the conclusion that it is insect damage to foliage which a major contributor to "die-back" in the Glen Innes area.

It is intended to produce a comprehensive report on this project in the near future. This will detail much of the data obtained on an individual plot and tree species basis.

▶ The biomass and taxonomic composition of invertebrates in Eucalyptus forests and woodlands in south-west Western Australia.

As part of an ongoing study, Jonathan Majer of the WAIT School of Biology is investigating the biomass of tree-dwelling invertebrates in Jarrah (Eucalyptus marginata) forests and Wandoo (E. wandoo) woodlands in Western Australia.

Quadrats of calico sheets, measuring 5 x 5 m are spread out on the ground under tree canopies and the invertebrates are dislodged by spraying the trees with rapid-knockdown Pyrethrum pesticide. The invertebrates are collected and weighed in order to assess their wet-biomass. They are then sorted to broad taxonomic levels and the ants are sorted down to species.

This study is providing information on the biomass of invertebrates in certain forest and woodland communities. The information may be related to the availability of food for avian and mammalian insectivores and to the degree of herbivory incurred by the trees.

▶ Insect damage to the foliage of jarrah ground coppice

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In November 1984, 600 newly developing leaves on ground coppice of jarrah, Eucalyptus marginata, were tagged within a 50 km radius of Manjimup, W.A. Every three months leaf outline and the area of the lamina damaged by insects and fungi were traced. These traces were then digitized and areas of damage converted to percentages. By November 1985, the mean area of the leaf damaged was 24.9%, comprising 5.3% caused by the jarrah leafminer Perthida glyphopa, 5.9% caused by chewing insects, 13.3% caused by fungus, and 0.4% of unknown cause. Leaf mortality did not exceed 8% on average.
There was considerable variation from place to place in leaf damage. This work will continue in 1986.

▶ Soil and litter invertebrates and litter decomposition in Jarrah (Eucalyptus marginata) forest affected by Jarrah dieback fungus (Phytophthora cinnamomi)

Tony Postle, Jonathan Majer (School of Biology, WAIT) and David Bell (Department of Botany, University of W.A.) have recently completed an investigation into the impact of forest degradation by Jarrah die back disease on soil and litter invertebrates and nutrient cycling.

Litterfall, litter mass, soil and litter fauna population densities, certain microclimatic factors and litter decomposition were monitored over a 21 month period in healthy Jarrah forest (Dieback Control plot DC) and in forest severely degraded by Jarrah dieback disease (Dieback Graveyard plot DG).

Litterfall and litter mass were considerably reduced in DG. Litter mass was lower than would be predicted from litterfall values. The soil and litter microclimates were generally more severe in DG and the population densities of most soil and litter invertebrates were generally low in this plot.

Loss of mass of leaf litter was greater in DG although this was probably not accounted for by changed activity of microorganisms or microfauna. It is postulated that the reduced activity and abundance of invertebrates associated with decomposition is more than compensated in DG by enhanced physical weathering of the litter.

This investigation, the results of which are about to be published in Pedobiologia, volume 29, has important implications for the rehabilitation of areas which have been severely degraded by Phytophthora cinnamomi.

▶ The Effect of Waterlogging on Jarrah (Eucalyptus marginata)

E.M. Davison, Dept. Conservation & Environment,
1, Mount Street, Perth, W.A.
F.C.S. Tay, E.L.S., Murdoch University, W.A.

Jarrah trees die on sites infested with Phytophthora cinnamomi, which have poor drainage characteristics, and following unseasonally heavy rainfall. We are looking in turn at the effect of waterlogging on jarrah, and on infection of jarrah by P. cinnamomi, as well as the effect of aeration on Phytophthora, because when soil is waterlogged the 0_2 concentration drops very rapidly.

When 3 month old jarrah seedlings are waterlogged for up to 14 days under controlled conditions in the glasshouse, the xylem vessels in the tap root cavitate and become permanently blocked by tyloses, and the proportion of blocked vessels is correlated with the duration of waterlogging. As the plants continue to transpire, the rate at which symptoms of wilting and death occur depends not only on the duration of waterlogging but also on the transpiration rate of the plants.

Jarrah grows on generally well drained sites within the Darling Range of W.A. If tree roots respond to waterlogging in the same way as the seedlings, we would expect to find more xylem vessels occluded by tyloses in the sapwood of trees growing on sites with poor drainage, than in tree roots on well drained sites. As jarrah transpires throughout the hot, dry summer we would expect trees on sites with poor drainage to suffer more severe water deficits than trees on well drained sites, at that time of year.

Davison, E.M. & Tay, F.C.S. (1985). The effect of waterlogging on seedlings of Eucalyptus marginata. New Phytol. 101 (in press).

▶ WATERLOGGING INCREASES TREE DECLINE IN SALINE ENVIRONMENTS

The increase in salinity of many soils in southwestern Western Australia is caused by hydrological disturbance, such as land clearing for agriculture and mining, leading to discharge of saline water into drainage systems. An increase in soil salinity is therefore often associated with an increase in waterlogging during the wetter seasons. Many farmers in the agricultural regions of Western Australia, aware of the salinity problem, leave these lowland areas uncleared of native vegetation cover only to find that with time many trees and shrubs are killed by the degenerating conditions. Most of the reports concerning the decline of vegetation associated with cleared land contribute this decline to increased salinity only. The effect of salinity and waterlogging on plant growth has received little attention in Australia.

Research completed at the Botany Department of the University of Western Australia has recently shown that the effect of waterlogging plus salinity is more detrimental to plant survival than just salinity alone. In a controlled glasshouse situation ten Eucalyptus species and two Casuarina species were subjected to four treatments:

1. non-saline, freely drained soil (control)
2. saline, freely drained soil
3. non-saline, waterlogged soil, and
4. saline, waterlogged soil

The salinity of the two salt-water treatments was increased weekly until all plants were killed. Using this method the more sensitive plants are killed earlier than the more tolerant ones. Waterlogging with just tap water did not cause any deaths but did reduce the growth for some species. In all species the death rate was quicker in the saline, waterlogged treatment than in the saline, freely draining treatment. This result shows that the death of vegetation in saline lowlands in the field situation is enhanced by waterlogged conditions.

The most tolerant species used in the experiment were Casuarina obesa and Eucalyptus sargentii. Eucalyptus camaldulensis, which tolerated freely draining saline soil quite well, was a poor performer in saline waterlogged conditions.

Tolerance to saline conditions, therefore, does not necessarily infer tolerance to field situations where saline areas are subject to waterlogging.

Further tests on the effects of salinity and waterlogging are proceeding at the Botany Department using a wider range of native species.

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VEGETATION PATTERNS AND PLANT RESPONSE TO GRADIENTS OF SOIL SALINITY AND INUNDATION

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Introduction

Inundation and edaphic factors are considered to be the primary factors controlling the distribution of tree species at Lake Toolibin, an ephemeral freshwater lake situated in the Central Wheatbelt of Western Australia. Clearing of the catchment surrounding the lake for agriculture has led to changes in the hydrology, causing increased runoff, higher groundwater levels and mobilization of sub-soil salt stores. Thus higher groundwater and subsequent salt accumulation in surface soil during periods of lake dryness (NARWRC 1978). Both prolonged flooding and increased soil salinity are believed to affect tree vigour at Lake Toolibin. The aims of this study were to determine vegetation patterns and their relationships to soil salinity and inundation, and to elucidate possible causes of recent tree mortality.

Methods and Materials

Four study sites each covering a range of elevational gradients and tree mortality were chosen for detailed direct gradient analysis. Soil salinity was determined with a chloride specific electrode in 1:5 soil/water suspensions and expressed as % NaCl. Inundation regimes were determined by relating the elevations of each tree at each site to recorded lake levels during 1981, an average rainfall year. The tree species, their elevation, and their rank on a scale of vigour between 0 = healthy and 9 = dead were recorded at each site.

Results and Discussion

Both soil salinity and the annual period of inundation increased with decreasing elevation at Lake Toolibin. Tree species composition and tree vigour varied with elevation above the lake level. The cause of tree mortality of Lake Toolibin also varied depending on the species and the elevation at which they occurred. Sites of low elevation (and prolonged inundation) and high soil salinity displayed low (ie. >5) vigours (eg. Casuarina obesa). However sites of similar elevation (and therefore, similar levels of inundation) but lower soil salinities had high vigour scores (ie. <5), suggesting that soil salinity is the determining factor in tree mortality at these elevations. The cause of mortality at higher elevations could be attributed to both inundation and salinity. Low vigours for Eucalyptus rudis, E. loxophleba, Acacia acuminata and Allocasuarina huegeliana appear to be associated with moderate to high soil salinities and % inundation. The tree species typical of higher elevations, appear to have a lower tolerance toward high soil salinities and prolonged saturation of the root zone compared to Casuarina obesa. Prolonged exposure to high soil salinities during dry periods, without the leaching and diluting of surface salt during winter inflow, probably accounts for the high incidence of tree mortality of lower elevations. However the cause of death at higher elevations can be due to either high salinity or prolonged inundation, or an interaction of these factors, depending on the species and ultimately on the salinity and inundation tolerance of that species.

Reference

Northern Arthur River Wetlands Rehabilitation Committee Progress Report (1978). Unpublished report to the Minister of Fisheries and Wildlife.

Eucalypt regeneration - R.A. Farrow & R.J. Roberts, Canberra

Phytophagous insects have a major influence on the growth and survival of eucalypts and their impact is of major concern to those involved with the re-establishment of eucalypts to restore the loss of trees through rural dieback.

Four study sites have been established on the Southern Tablelands to determine the impact of insects on the survival and growth of different eucalypt species in mixed and monospecific plantings which will simulate woodlots and shelter-belts. The main site was established in 1984 at 'Millpost' 20k east of Canberra and the first season's data are being analysed. Subsidiary sites are now being established at (1) 'Bedervale', Braidwood; (2) 'Gundowringa', Crookwell; and (3) 'Severnside', Berridale. These sites are located in areas where active tree establishment programs are being thwarted by severe insect damage and they represent different pastoral ecosystems.

The project aims at understanding the processes involved in the colonisation of plantation-grown eucalypts by phytophagous insects and the factors determining their distribution and abundance through a study of the community ecology of the eucalypt-pasture ecosystem. Special emphasis will be placed on:- dispersal and colonisation by insects; succession of insect guilds on the eucalypts and identification of key species; environ mental factors regulating the numbers of phytophagous insects on their hosts, with special reference to the role of natural enemies; insect/plant interactions, with special reference to host resistance; and the assessment of the loss of potential growth and biomass of plantation eucalypts through insect feeding. The results of this study should ultimately lead to the development of a pest management strategy for plantation eucalypts.

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EUCALYPT REGENERATION PROGRAMME - NEW ENGLAND TABLELANDS NSW

The thrust of this research will be to understand the mechanisms influencing natural regeneration of eucalypts. In consequence it should then be possible to devise land management techniques to manage tree growth on grazing land and to devise better techniques for deliberate tree establishment.

The work proposed is an extension of work recently completed as part of a M.Sc.(prelim.) thesis (Curtis 1984) at U.N.E. To obtain further basic information on the reproductive strategies of eucalypts the following will be continued:-

(a) Observation of flowering and seed fall patterns in 13 common New England Eucalyptus species over several years;
(b) Surveys of the fate of the seed crop and seedlings in the field (including relating grazing management to seedling recruitment);
(c) Experiments on the fate of eucalypt seed in the soil and on the factors controlling seedling recruitment;
(d) Observations of lignotuberous regeneration and the changes in health of mature trees and saplings.

Field trials are also planned to examine the various methods available to reestablish eucalypts on grazing land, including assisting natural regeneration, direct seeding (a much under researched area on the Tablelands) and planting seedlings.

Ten landholders in the Uralla-Walcha area have set aside areas varying from 5-30 ha for the project. They are all closely involved in the project and assist with time and materials.

As the sites vary greatly in tree cover and pasture type many different approaches are being tried in reestablishing eucalypts and a large number of techniques is being tested.

Publications

Curtis, D.J. (1984) Phenology and Establishment of selected Eucalypts. M.Sc.(prelim.) Thesis, Botany Department, University of New England.

EUCALYPT REGENERATION PROJECT

A progress report from David Curtis, Department of Botany, U.N.E., Armidale, NSW 2351.: JULY 1985

INTRODUCTION

In October 1984 the Eucalyptus Dieback Research Management Advisory Committee set aside the last of the Dieback Public Appeal funds to commence a programme of eucalypt regeneration.

The initial aims of the project were to monitor natural regeneration of eucalypts on farmland near Armidale N.S.W. and to initiate a series of eucalypt re-establishment trials. Ultimately a report is to be produced giving the results of these trials plus recommended techniques for eucalypt establishment on the New England Tablelands.

Ten landholders in the Uralla/Walcha area were approached by the committee to take part in the project. Each was asked to set aside a small part of their property for eucalypt regeneration/re-establishment. The areas set aside range from about 2-30 ha.

The project is progressing well. I appreciate greatly all the time and help each of the landholders involved has given me. Most of the sites have now been fenced. Generally I spend 1-2 days a week in the field, which means I get to each property every 2-3 months.

The sites vary greatly, from being completely without trees, to being well forested and regenerating naturally. Consequently different approaches have been required on each site to re-establish the native vegetation and a large range of techniques is being tested.

The project has attracted considerable interest in the local media and a number of articles have appeared in local newspapers. I hope this continues and that the project inspires other landholders to become involved in native tree protection and establishment.

The following outlines what has been done to date and what is planned in the near future. The first 8 months have been taken up with preparing the sites and beginning trials. This will continue for the rest of the year. I remain open to any suggestions with the project. Anyone wishing to come out and look at the work (or help) is always welcome.

1. NATURAL REGENERATION

(a) Flowering and Seedfall Patterns (Phenology)

Detailed information is lacking on fruit formation and seedfall on most of the local eucalypt species. This information is important if one desires seedlings to establish from seed of the trees present on a site. There is no point doing an expensive soil treatment, hoping to get seedling establishment if this does not coincide with seedfall.

Trees have been marked with plastic flagging tape, usually 3 of each species per site. Trees with good crops of flower buds and/or fruit are preferred, where present. Observations are made on the various flowering stages on the tree at each visit (flower buds, flowers, young fruit, mature fruit etc) plus the health and height of the tree. An estimation is made of the crop size. A series of photographic standards of crop size will be prepared later this year to make crop size estimations more accurate. All this information is recorded on a standardized data sheet.

Seed traps have been made from plastic buckets with nylon mesh in the botton to let water flow out. These are tied between 2 steel fence posts - 2 seed traps per tree - to catch seed. Chicken wire is placed over the top to prevent damage to the mesh from falling branchlets.

The table on the previous page summarizes all the trees tagged so far. Thirteen species have been tagged, ninety-one trees in all, and between 2-12 trees per species. Thirteen trees now have seed traps. This will be increased to 3 per species (about 30 trees in all) in the next 6 months.

These species are the common eucalypt species of the tablelands, and most were badly affected by dieback.

(b) Monitoring Natural Regeneration

When people talk of natural regeneration they are usually referring to regrowth of suppressed lignotuberous seedlings. These seedlings have a woody swelling (a lignotuber) at the base of the stem which allows them to remain alive and to survive stresses such as grazing for many years. Thus much of the regrowth we see along roadsides etc may actually be many years old but was suppressed for one reason or another.

Some of the sites chosen have many suppressed eucalypt seedlings present. On these sites permanent transects 50 x 0.5 m in area have been established and all seedlings have been tagged and mapped. Transects are placed randomly and enough are placed to monitor about 100 seedlings per site.

- Growth, survival, health, competition from grass and promixity to trees will all be monitored.
- Density of seedlings will be estimated.
- Comparisons may in some cases be made with a grazed situation.
- Certain treatments may be tried to encourage seedling growth - e.g. addition of fertilizer or mulch.

To date transects have been established on Ruby Hills (sites 2), Yalgoo (Site 1), and Terrible Vale (Site 1). In the next 6 months transects will be established on Petali and Eastlake sites where seedlings are present. It is hoped to relate seedling growth to proximity to adult trees, grass competition etc.

(c) Seedling Recruitment

Recruitment of seedlings from natural seed fall is a fairly rare event and depends on a heavy seed crop coinciding with favourable weather and soil conditions.

It may be possible to observe recruitment on the permanent transects used for monitoring natural regeneration (see above). However extra techniques will be tried to actively encourage recruitment in some cases.

On Birrahlee (site 2), Yalgoo (site 2) and Terrible Vale (site 2) areas around fruiting trees will be sprayed with "Roundup" herbicide early in spring in the hope that seedlings may establish from natural seedfall over the next growing season. On Ruby Hills (site 2) five standard transects will be sprayed and compared with 5 transects unsprayed.

In the future I would like to experiment with fire as a means of encouraging natural recruitment. The most promising sites at present for this are on Eastlake, and this may be tried later this year.

(d) Seed Viability in Soil

Most eucalypt seeds when they fall, are eaten by ants. However, some escape predation and eventually germinate. In this experiment seed of 3 species will be buried in nylon mesh envelopes, and retrieved at intervals to determine how long the seeds remain viable in the soil. It is hoped to do this later this year.

2. PLANTING AND SOWING TRIALS

(a) Direct Sowing

Direct sowing of eucalypts and other trees is potentially the cheapest and easiest way of revegetating large areas with native vegetation, where natural regeneration is not possible. Eight direct sowing trials have been designed and it is hoped that most of these will be underway by the end of the year. Techniques to be tried include:-

(i) Graze heavily or mow; allow grass to grow; herbicide with Roundup; sod sow mixed eucalypts, wattles etc mechanically with seed mixed with bran.

"Birrahlee" August 22, 1985
"Ruby Hills" 1st Week September, 1985
"Petali" Spring, 1985
"Yalgoo" Spring, 1985

(ii) Sod sow with mulching blade directly into native pasture. "Belhaven" - Puddledock. September/November 1984, October 1985. Seed mixed with sand, Mixture of Eucalypts and Wattles.

(iii) - Grade to remove top soil and hand sow.
- Herbicide spots and hand sow.

"Europambela" October, 1985

(iv) Spot Sowing and planting trial "Terrible Vale" - October 1985. A rocky stringbark slope - fairly badly affected by dieback but still relatively intact. Eight treatments to be tested - combinations of the following.

1) Spot sowing seed by hand: measured number of seed sprinkled in a small spot - 100-200 seeds/spot.

2) Seedling Planting - potted seedlings will be planted

3) Mulch of woodchips (or sawdust or vermiculite), placed over seed or around seedlings

4) No mulch

5) Area to be sown herbicided with Roundup over a 2 m diameter, in September.

6) No herbicide. Grass chipped away by hand.

The existing species will be used i.e. Eucalyptus laevopinea (stringybark), E. melliodora (Yellow Box), Acacia dealbata (Silver wattle). Extra seed or seedlings may also be sown/planted of Angophora floribunda (Apple), E. viminalis (Manna Gum), Jacksonia (Dogwood), Acacia implexa (Hickory Wattle) - all of which occur (or did occur) on the site.

Each treatment will be repeated 12 times.

(v) Major hand sowing trial - "Mirramoona": Berala Paddock - late October Hill top, badly affected by dieback - few living trees - Blakely's Red Gum, Yellow Box.

Area to be sown will be ploughed (with discs) immediately prior to sowing. Plots will be 2 m x 3 m and divided into 6 portions - 6 species to be sown in each plot -

Blakely's Red Gum	(Euc. blakelyi)
Yellow Box	(E. melliodora)
Snow Gum	(E. pauciflora)
Manna Gum	(E. viminalis)
Fern Leaf Wattle	(Acacia filicifolia)
Common Tea Tree	(Leptospermum flavescens)

- Sowing seed in small spots (5 spots/species/plot) will be compared with broadcasting the same amount of seed over the whole plot for each of 9 treatments.

- Treatments to be tested

1. Control - Disc, Sow, Rake (to cover seed)
2. Cover with Sawdust 1 cm thick
3. Cover with Woodchips 1 cm thick
4. Cover with Old Straw 1 cm thick
5. Cover with gravel or crusher sand
6. Cover with vermiculite
7. Cover with vermiculite and black paint
8. Cover with Bitumen emulsion
9. Cover with nutricote and vermiculite.

- Each treatment will be repeated 4 times
- Two additional treatments will be tested:

10. Cover plot with brush - twigs of eucalypts laden with fruit.

11. Sow into ashbed of burnt timber.

(vi) One more sowing trial is yet to be designed for "Salisbury Court" site. This will probably involve burning/ploughing ground preparation, various mulches and mechanical sowing.

(b) Planting Seedlings

Two planting trials have been established. Others are planned later this year and early next year.

i) "Ruby Hills" - Dam site

This was outlined in the last progress report. It involved 190 seedlings of 8 native tree and shrub species. Second measurements were taken this month. Grevillea Canberra Gem, Black Sallee and Eucalyptus crenulata seem to be doing quite well despite snow, frost etc. The Melaleucas have been the worst affected species. Some trees trebled and doubled in height before winter. Few actual deaths so far, but some grub, hare, and frost damage and possible waterlogging problems in places.

ii) "Salisbury Court"

Hilltop site badly affected by dieback with few living trees - Blakely's Red Gum and Yellow Box. Square 5 ha paddock fenced in late summer 1985 - mainly native pasture.

Seedlings planted in 2 lots of 4 rows - along the eastern and western fences. Seedlings and volunteer labour for planting were kindly supplied by the New England Community Tree Planting Scheme. In this trial we are testing the value of Terrasorb - a water absorbant substance reputed to increase growth, and the use of tree guards made from 2 litre drink cartons.

456 seedlings were planted 24/3/85, of 8 species: Silver Wattle (Acacia dealbata), Fern leaf wattle (A. filicifolia), River She-Oak (Casuarina cunninghamiana) Eucalyptus acaciiformis, Blakely's Red Gum, Yellow Box, Manna Gum and Leptospermum sp. Species local to the site or the area were generally chosen, the number of seedlings planted depended on availability. Each seedling was mulched with two buckets of woodchips.

At last check (4/7/85), after many severe frosts, many of the unguarded she-oaks had been frost damaged. Hares had nipped some trees although had not actually killed any. Seedlings with the guards seemed to be doing better than unprotected ones. Eucalyptus acaciiformis seemed to be quite successful.

(iii) "Terrible Vale" - October 1985

Planting to be done in conjunction with direct seeding trial (see section 2(a)(iv) above).

(iv) "Yalgoo" - October-November 1985

- New England Peppermint site beside Uralla-Walcha Road
- Mixed planting - 300-400 trees
- To compare species

(v) "Berala" - 1985/86 spring-summer period

- plantings amongst newly planted pines
- to be planned in detail

(c) Open Rooted Seedlings

2 beds 1 m x 2 m have been built containing about 3000 seedlings of 10 Eucalypt, Acacia and Casuarina species. They are about to be thinned out. If these seedlings grow sufficiently they will be planted out later this year or early next.

3. OTHER WORK

(a) Site Data

Information for each site is gradually being collated. This includes:- locality; landuse; geology; soil type; slope; aspect; previous history (including historical photos); paddock size and shape; plant community; detailed species lists of trees, shrubs and herbs; tree, shrub and regrowth density; degree of dieback and rainfall.

(b) Seed Collection

On most visits to the field my car usually comes home loaded to the brim with seed laden eucalypt branchlets. My garage is stuffed with drying fruit and twigs and a store of seed is accumulating slowly. Some of the people involved in the project have begun collecting seed also which is marvellous and a great help. If anybody else would like to help collect seed I'd be only too pleased to show them how.

(c) On Site Nurseries

Kim Barnet has caught the bug and has begun propagating his own gum trees on "Mirramoona". If anyone else would like to begin growing their own trees I'd be happy to help in any way I can.

(d) Dieback Booklet

Chris Nadolny and I are gradually converting his M.Sc. thesis entitled "Eucalypt Dieback on the Northern Tablelands of N.S.W." into a 50-100 page booklet. We hope to have this finished by the end of the year for public circulation.

(e) Grazing Behaviour of Animals

John Taylor loaned me some very interesting papers from the USA on using grazing animals to increase tree growth (chiefly Douglas Fir and other conifers) by eating down competing grasses. Grazing had to be carefully managed and employed at certain periods of the year. This is a topic well worth looking into and I am open to suggestions on how to approach it. If we could say, for example, "graze x sheep to the acre (of a certain age, sex and type) for x weeks in a certain season when the seedlings are at a particular height, to eliminate competition from weeds" - it could reduce the need for using herbicides and hence lower costs.

* * * * * *

* Propagation of sandalwood Santalum spicatum. J.E.D. Fox, S.R. Wijesuriya and D.R. Barrett. School of Biology, Western Australian Institute of Technology, Kent Street, Bentley 6102.

Three papers were produced in 1985*

1. Wijesuriya, S.R. and J.E.D. Fox (1985). Growth and nutrient concentration of sandalwood seedlings grown in different potting mixtures. Mulga Research Centre Journal 8, 33-40.

2. Barrett, D.R., S.R. Wijesuriya and J.E.D. Fox (1985). Observations on foliar nutrient content of sandalwood (Santalum spicatum R.Br.DC). Mulga Research Centre Journal 8, 81-91.

3. Fox, J.E.D. and S.R. Wijesuriya (1985). Sandalwood planting with property owners. Mulga Research Centre Journal 8, 123-127.

(* The Mulga Research Centre Journal is available from The Bookshop, WAIT, Kent Street, Bentley 6102 at $6.00).

* Assessment of the health of tuart Eucalyptus gomphocephala in the Perth metropolitan area. This tree shows severe decline in the coastal strip, particularly south of Perth. Remedial plantings are being undertaken funded by the Department of Conservation and Environment. J.E.D. Fox, K.A. Meney, M.P. Colquhoun, School of Biology, WAIT, Kent Street, Bentley 6102.

A report was produced in January, 1985, which is available from the Department of Conservation and Environment, Perth W.A.
Fox, J.E.D. and J.N. Dunlop (1985). Tuart Study Preliminary Investigations 1984. pp. 31 + 19.

* Natural Regeneration and Stability in Mulga (Acacia aneura). Several long term study sites are under measurement to assess the responses of mulga to cutting, grazing and fire. J.E.D. Fox and D.R. Barrett, School of Biology, WAIT, Bentley 6102.

The following papers were presented during 1985

1. Fox, J.E.D. (1985). Fire in mulga - Studies at the margins. In: Proceedings Fire Ecology and Management in Western Australian Ecosystems (Ed. J. Ford) WAIT Environmental Studies Group Report No. 14 47-60. Bentley May 1985.

(This Report is available at $10.00 from Secretary, Environmental Studies Group, School of Biology, WAIT, Bentley 6102).

2. Fox, J.E.D. (1985). Vegetation: Diversity of the mulga species. The Mulga Lands Symposium, Brisbane, November 1985.

(This Symposium will be published by the Royal Society of Queensland in 1986).

Potter Farmland Plan - Summary for first year of operation

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Funded by the Ian Potter Foundation, the Potter Farmland Plan brings together a unique blend of private enterprise, community and government to tackle land degradation. Its aim is to establish practical demonstrations on real farms of measures that address long-term degradation of the land, and to show how these measures can be best planned to complement farm management.

The project began in Hamilton, western Victoria in November 1984. Three demonstration areas were defined at Wando Vale, Melville Forest and Glenthompson, and landowners were invited to meetings in each area in early January 1985, at which they were asked to volunteer their farms for participation in the project. The response was encouraging, with 48 landowners coming forward. After two rounds of inspections, fifteen properties were selected.

A hectic first year saw 55 km of fencing constructed, 27 ha seeded with trees, 13 ha seeded with deep-rooted, salt-tolerant pasture, and 30,000 trees planted in shelterbelts, woodlots, clumps and wildlife corridors. Wet weather in late spring and early summer has been good for trees if nothing else - survival rates average 98% and summer growth rates should be high.

Whole Farm Planning is the key feature of the Potter Farmland Plan approach to tackling land degradation. It involves a critical analysis of the existing layout of the farm in relation to such things as erosion, salinity, water supply, wildlife habitat, shelter and uses to which various soil types are put, with a view to making changes to enhance the long-term productivity and economic viability of the farm.

In practice the planning steps are as follows:

- farm layout is examined inthe light of natural boundaries and particular management or degradation problems, and inappropriate subdivisions are modified to create a new layout which also takes into account access, land capability and fire protection.

- land use contraints are identified for each management unit, and a water supply strategy is prepared to complement the new layout.

- a revegetation planis devised. Erosion-prone, saline or discharge areas are excluded from stock and revegetated where appropriate, as are primary recharge zones where they can be identified, using various combinations of trees and deep-rooted pastures. Shelterbelts, woodlots,clumps, natural regeneration and individual trees are located and linked together to provide shade and shelter, wildlife habitat and farm wood supply in a pattern which is in harmony with the landscape. The plan consists of an overlay over a large-scale aerial photograph.

Indigenous species grown from local seed are used wherever possible on demonstration properties, but in areas where the natural environment has altered (such as salty gullies) or in situations where local species cannot fulfill a desired role, the best species for the job will be used. Tagasaste and casuarina hedgerows have been established around holding paddocks at Wando Vale, woodlots of durable hardwoods for supply of farm timbers and fuelwood have been established at Glenthompson.

Participating landowners contribute at least one-third of on-groundcosts and must be prepared for field days, "stickly beaks" and monitoring long after the three year implementation phase of the project is complete. Above all, the Potter Farmland Plan

is a demonstration project. Its demonstration value will be enhanced by field days and farm walks at a local level and production of printed information and audio-visuals for wider circulation, to ensure that the lessons learned during the project are available to interested people throughout the community.

Practicality and Costs of Direct Seeding, Machine Planting and Hand Planting Trees on Farms

SJA Burke and A M Lyons
Department of Conservation, Forests and Lands

Many farmers whilst realizing the need to plant more trees on their farm to make them more attractive and productive do not get around to it for two reasons:-

(i) the costs involved are too high
(ii) and the time required is too much, usually activities required for tree establishment occur at particularly busy times of the farm calender.

Two methods which can enable farmers to establish trees quickly and cheaply on their farms have become popular in recent years namely Direct Seeding and Machine Planting.

Direct seeding is the sowing of seed directly onto the site to be treed.
success is good site preparation incorporating effective weed and grass control and the creation of a receptive seed bed. Following this seeds can be spread on to the surface. A variety of seed drills have been used to successfully sow tree seeds. Usually the sowing tynes are lifted up so that the seed is dropped onto the surface. Alternatively for smaller scale projects seed may be adequately spread by hand.

Perhaps less well known is the technique of planting tree seedlings using mechanical tree planters.

Conventional and modified agricultural/horticultural and forestry machinery has been used to successfully carry out site preparation and planting of native hardwood species. Scope exist for further development and wider use of such machinery.
Whilst it is realized that these techniques will never totally displace hand planting as a major means of tree establishment, they have great potential in many circumstances for re-establishing trees over a large area both quickly and cheaply. The following table attempts to state clearly the 'pro's and con's' of these three techniques to help you to make the right choice.

	Direct Seeding	Machine Planting	Hand Planting
Suitable Application	- good for multiple species - machine seeding suited to large scale reforestation and shelterbelts - hand seeding suited to smaller projects	- large scale reforestation including shelterbelts and woodlots	- small shelterbelts and woodlots - amenity and group plantings
Topograph/site conditions required	VARIABLE - machine seeding limited by slope and terrain - hand cultivations seeding is feasible on steep slopes and broken rocky terrain	LIMITED - limited by slope and terrain according to machine capability	FLEXIBILE - not constrained by topography or conditions
Machinery/equipment	VARIABLE - hand seeding operation requires no equipment - machine seeding may use traditional agricultural seeders - specialized tree seeders have also been developed	VARIABLE - specialized machinery - developed specifically for tree planting - modified forestry machinery - softwood forestry planting machines modified to suit tubed nursery stock and farm tractors - agricultural machines - existing or modified	SIMPLE - range ofhand tools to suit site conditions
Planting stock/seed	- locally collected or purchased many species may be sown simultaneously - seed of some species requires treatment before sowing	- nursery raised harwood species, limited to one/two species per run	- nursery raised hardwood species - planting operations becomes more complex as number of species increase
Minimum standard on site preparation required	VERY HIGH - high quality seed bed required, cultivated weed and grass-free site	MEDIUM - HIGH - a reasonable standard of operation is required especially on difficult sites (heavy clays, rocky terrain) to facilitate operation of planting machines	LOW - feasible to plant with minimal cultivation and grass/weed control, however these aid plant vigour
Timing of planting/sowing operations	AUTUMN OR SPRING - optimum germination conditions vary between species according soil temperature and moisture	AUTUMN, WINTER AND SPRING	AUTUMN, WINTER AND SPRING
Planting/sowing speed	FAST - machine seeders effective at normal tractor operating speeds (8-12kph) - hand seeding effective at slow walking pace	FAST - machine planting effective at tractor operating speed (5-8kph), slower for agricultural machinery	SLOW - 20 trees per hour for tubed stock or difficult ground

Fertilizer application	DIFFICULT - soluble fertilizers generally leached away before germination - slow release granulated fertilizers are feasible for hand seeding, however granule size can create problems with machine seeders - seed coating with fertilizer has proved ineffective	VARIABLE - dependent on machine design - unsuitable granular fertilizers	READILY APPLIED - application rate and position controlled - suitable for all types of fertilizers(granular, tablet, liquid)
Labour requirements for planting/sowing operations (man hours/ha)	LOW - machine seeders (½ man hour/ha) - hand seeding (2 man hours/ha)	LOW - 2 man operation (tractor driven, planter) - agrucultural machines - 8 man hrs/ha - modified forestry machines - 2 man hrs/ha - specialized machines 2 man hrs/ha	HIGH - very labour intensive 25 man hrs/ha
Reliability/success rate	LOW - MEDIUM - plants vulnerable in early stages of germination and emergence to climatic extremes and pests	MEDIUM - HIGH - reliability of planting technique up to 97% - uniform planting technique maintained	MEDIUM - HIGH - reliability solely dependent on operator - planting technique varies with operator efficiency
Initial stocking	DIFFICULT TO CONTROL - thinning or restocking frequently reqired	EASY TO CONTROL - expacement relatively fixed within planting lines	EASY TO CONTROL - expacement with planting lines variable
Vigour of established plants	HIGH - trees have superior root systems since they are not transplanted during their development. - trees exhibit superior vigour on most sites compared with planted stock	MEDIUM - LOW - dependent on quality of stock and operator technique - container stock may be root bound - root damage caused by transplanting	MEDIUM - LOW - as for machine planting
Level of maintenance	VARIABLE - thinning overstocked or restocking failed areas may be necessary - weed/grass control occasionally required - watering increases percentage survival of germinants	MEDIUM - LOW - weed/grass control may be necessary - watering not generally required except during drought when spring plantings precede hot dry summers	MEDIUM - LOW - as for machine planting
Aesthetic quality of established stands	HIGH - stands have a natural appearance	MEDIUM - stands tend to have regular appearance	MEDIUM - HIGH - stands tend to have regular plantation appearance - the versatility of planting expacement allows for natural configurations

Estimated costs	Machine seeding	- agricultural machines	-$2.40 /tree ($1200 per ha)
- using standard hire rates	- 71 ¢/tree ($357/ha)	$1.50/tree ($750 per ha)	
establishment and	Hand seeding	- modified forestry machines	
maintenance works for two	- 74¢/tree ($370/ha)	$1.50/tree ($750 per ha)	
years under normal seasonal		- specialized machines	
conditions including		$1 30/tree ($650 per ha)	
- ripping and weed control	possible retreatment costs		
(cultivation or application	- thinning ($140/ha)		
of herbicides)			
- purchase of seed, trees	- reseeding (cost variable)		
(1000 rate) and fertilizer			
- planting/seeding			
- post planting weed control			
- on costs			

A. J. HART B.Sc. (For.), Dip. For.

REVEGETATION OF ROADSIDE VERGE TRIAL : WONGAN HILLS SHIRE, W.A.

JUNE, 1983

The trial referred to in this article arose from a request from the Wongan Hills/Ballidu Shire to assist in revegetating road-side verge areas on a section of road (see locality plan) which had been widened and resurfaced.

SITE

This treatment had virtually removed any residual native vegetation. As photos indicate, the trial site is one of a long uniform slope from ridge top to gully bottom typical of many drainage systems in rural areas of W.A. The lower slopes and flats are typically salt affected, aspect is easterly.

A fortuitous situation which was encountered was that roadworks had left surplus loamy gravel on the vergeside which had been generally spread from road shoulder to fenceline.

SOILS

The soils were variable, being:

1. Upland on western end of trial area
   - R/YBr gravels with a thin sand cover in some areas;
   - area estimated at 0.32 ha (= 800m of road);
2. Sandy soils for the rest of the 2.0 km;
   - area estimated at 0.48 ha.

At the time of sowing their moisture content was in places near field capacity (estimated) and generally quite stable due to this feature.

Rainfall - winter and estimated to be approximately 435mm per annum, occurring generally over a short growing period of 4-5 months.

SITE PREPARATION

1. Weed eradication

"Sprayseed" @ 10-12 litres/ha + "Glean" @ 20-25gms/ha was applied twice to the trial area to knock down annual grasses such as capeweed, wild oats, rye grass and other various annual grasses. The last spraying was a few days prior to sowing.

2. Ripping

A single tyne rip was made on the verge area over the top of spread surplus gravel. The rips were of various lengths of 10-12m between lifting of the ripper to avoid possible erosion. Depth of the rip was approximately 0.5m.

Prior to sowing, the tractor wheel was used to consolidate the rip slightly and which gave a shallow rounded seed bed in which seed could lodge.

Small areas were left unripped and unfirmed for comparison of effectiveness.

FERTILIZERS

Two (2) fertilizers were chosen in which to mix seed of species selected for the different soil type.

Type 1 was "Agras" No. 2 (granulated) - 71kg used

Type 2 was C.H. Bailey's 3-1-1 - 40kg used.

(3-1-1 refers to proportion of N P K)

A mixture (40kg of 3-1-1 and 5kg "Agras") was used over sandy soils in the lower parts of the topography.

SEED SPREADING MACHINERY

1. "VIGRAN" fertilizer spreader attached to 2 P.L. & P.T.O. of Massey Ferguson 65 rubber-tyred tractor.
   This type of spreader was chosen becasue of the "platypus tail" type spreading tool. This enabled close control over:
   i) overall width of seed spread through controls on the machine; 2.5-3.0m wide spread was desired.
   ii) spreader located relatively low to the ground to minimize drift due to consistent winds in unprotected surroundings (see photo).
   iii) hopper consists of an open shallow inverted cone with an agitator at the bottom so that dispersal of seed in the fertilizer could be optimized.

SPECIES SELECTION

For this aspect of the trial, soil types were the major consideration with adjustment for topography.

The species selected for each site/topographic locality are shown in Appendix 2 with weights of each used.

The species were chosen on the basis of suitability to site and also to provide, if possible, a range of heights at maturity.

METHOD OF SOWING

For each site, seed lots as shown were carefully admixed with each fertilizer to be used and placed in the hopper.

Tractor speed was kept to approximately 2-3 km/hr which was compatible with P.T.O. speed to give the required cover of target areas.

RESULTS

1. On the assumption that all seed was distributed evenly, the rate of application of fertilizer with seed was:

   i) gravelly upland areas (area 3,200m²)

   141 kg/hr (fertilizer)

   + 1.743kg seed/ha (legumes - 1.156 kg/ha
   (eucs. - 0.413 kg/ha
   (shrubs - 0.280 kg/ha

   ii) sandy lower slopes (area 4,111m²)

   137.5kg/ha (fertilizer)

   + 2.0675kg seed/ha (legumes - 1.375 kg/ha
   (eucs. - 0.413 kg/ha
   (shrubs - 0.280 kg/ha

2. The success of the trial in quantitative terms relies on statistical sampling of treated areas.
   Accordingly, milacre plots were randomly assessed for germinants in each of the soil/topographic situations involved, along the road verge. To keep the assessment subjective, milacre plots were assessed at approximately every 32-50 metres along the verge.
   The assessments of October 24, 1983 (116 days after sowing) are set out in Table 1.

COMMENTS ON RESULTS

1. Germination and establishment on upper slope gravels were poor and have remained so despite resowing in 1984.
2. Best germination occurred on mid to lower slopes where moisture levels were better and having an easterly aspect.
3. There does not appear to have been a benefit conferred by firming the riplines.
4. Seedlings currently (January, 1986) range from 0.5m to over 3m in the case of Acacia species.
5. For more realistic appraisal of this trial, a further assessment of milacre quadrats is required.

If any further information is required, please contact the Information Branch of C.A.L.M. at Hayman Road, Como, W.A. 6152, or the author.

TABLE 1

SUMMARY OF PROGRESS RESULTS OF DIRECT SEEDING OF VERGE - 1983
AS AT 24/10/83 (SOWN: 30/6/83)

Topographical position	Site treatment	Environmental condition	Germinating species	Soil type (estimated current stocking)	Sample %
U/slope to M/slope	Rip & firm	(a) sheltered	Acacia pulchella Hakea laurina	A) Sandy soil - 219 i.e. 1/m approx. Sandy soil - 55 i.e. 1/4m	1.82
		(b) unsheltered		B) Sandy gravels - nil	1.56
M/slope to L/slope	Rip & firm	(a) sheltered	Acacia acuminata Casuarina obesa	A) Sandy soil - 384 i.e. 1/4¼m Sandy soil - 192 i.e. 1/9m	1.04
	Unripped	sheltered	Acacia acuminata Calothamnus rupestris Eucalyptus camaldulensis	A) Sandy soil - 384 i.e. 1/4¼m Sandy soil - 192 i.e. 1/9m Sandy soil - 192 i.e. 1/9m	1.04
M/slope to L/slope	Ripped only	(b) unsheltered	Nil	B) Sandy gravels - nil	1.32
M/slope to L/slope	Unripped only	unsheltered	Acacia acuminata Acacia pulchella	Sandy gravels - 76 i.e. 1/14½m Sandy gravels - 76 i.e. 1/14½m	1.32

U/slope = upper slope; M/slope = mid slope; L.slope = lower slope

APPENDIX 2

RECOMMENDED SPECIES FOR EACH SOIL TYPE

1. Gravels - upslope

1.1 Legumes - Acacia acuminata 160gms), 160gms), 50gms) Pre-treated
" pulchella
" podalyriaefolia

370gms

1.2 Eucalyptus - E. loxophleba 30gms)
E. gardneri 40gms), Non-
E. dundasii 25gms), pelletted
E. leucoxylon rosea 25gms)

120gms

1.3 Shrubs - Callistemon phoeniceus 20gms
Calothamnus rupestris 15gms
Hakea laurina 25gms
Leptospermum ellipticum 8gms

68gms

Total quantity = 558gms

2. Sandy Soils - Lower Slope

2.1 Legumes - Acacia acuminata 250gms
Acacia saligna 250gms
Acacia podalyriaefolia 50gms

550gms

2.2 Eucalypts and others

- E. cladoxalyx nana 30gms)
E. platypus heterophylla 20gms)
E. camaldulensis
(c.v. Pilbara) 20gms)
E. gardneri 45gms)
E. leucoxylon rosea 25gms)
Casuarina obesa 25gms)
Non-pelletted

165gms

2.3 Shrubs - Leptospermum ellipticum 10gms
Callistemon phoeniceus 20gms
Calothamnus rupestris 20gms
Melaleuca incana 12gms
Hakea multilineata 50gms

112gms

Total quantity = 827gms

Revegetation by Direct Seeding of Eucalypts in S.W. Western Australia

A.J. Hart, CALM, Como

Introduction

Two (2) trial sowings using a mechanical seed sower behind an MF 168 tractor were made in 1983 and 1984 in the Kent River headwaters area.

Description of Trials

1. 1983 Trial

1.1 Date of sowing 22 July 1983

1.2 Rainfall - Winter approx 500-550mm p.a.

1.3 Area 4-5ha

Site Preparation

1.4 Ripping to approximately 50-60cms had been carried out prior to sowing generally on the contour at 4m intervals. "Vorox" spraying had been applied but effects not very impressive at time of sowing although weed growth had not been excessive to the time of sowing.
Rate of applications is not known exactly but assumed to be approximately 5-7 litres/ha.

Soil Condition & Type

1.5 The area sown consisted essentially of fine Y/R/Br sandy loams - with increasing amounts of lateritic gravel included upslope.
Sufficient rain had fallen (and fell after sowing) to make sowing conditions ideal. Ploughing depth estimated at 20-25cms over the ripline. The plough was lifted at intervals to avoid wash in the furrows.

Fertilizer Rate

1.6 Approximately 30gms per drop of seed of super (granulated) fertilizer.

Seed Sowing Rate

1.7 See attached. No. spots/ha = 1250.

Time of Operation

1.8 Approximately 4½ hours including species changes and super refills.

Tractor Type

1.9 Massey Ferguson 168 'multi-power' (rubber tyred) operating at 8-900 revs/min.

Results

1.10 As shown in Table 1 and Diagram 1. Notes on Diagram 1 indicate that extra seed per drop do not improve stocking markedly. In fact, it could be deleterious due to extra competition.

(Sorry, diagram 1 was too faint to reproduce (ed))

2. 1984 Trial (same area)

2.1 Date of sowing 4 September 1984

2.2 Area = 5-6ha

2.3 Weed control - late application of Vorox AA(F.B.) @ approximately 2.5 litres/ha, 10 days prior to sowing.

2.4 Site preparations as for 1983

2.5 Soil type as for 1983

2.6 Fertilizer rate - approx 20gms/drop of seed of 'Agras' super (granulated)

2.7 Seed Sowing Rate - see Table 2

2.8 Machinery - as for 1983

Results

2.9 Suprisingly good considering the lateness of sowing and late weed control.
Rain during seeding is considered to have interfered with seed and super distribution. This fault has since been rectified.

P.W.D. - DIRECT SEEDING TRIAL - H. PARSONS - LAKE NUNIJUP (1983) Table 1

PROGRESS REPORT (as at 1/2/84) - ELAPSED TIME: 193 days

Species	Seed type used	Ave. seed No./spot (germinable)	Germ^{n} %age (lab. test)	Area sown (ha) Est^{d}	Est^{d} No. spots Sown	No. Spots Assessed	No. Spots Stocked	Percent assess-ment	Est^{d} total stocking	Average No. seed-lings/ spot	Est^{d} tree percent	Average ht of seedlings (cms)	Comments
1. Eucalyptus cladocalyx 'sugar gum'	Seed & chaff	52.4	85.7	0.700	875	90	58	10.29	563 (64.34%)	1.2	2.29 (1050) (45850)	20.25	Best on loamy sandier gravels
2. Eucalyptus maculata 'spotted gum'	" "	21.0	94.3	0.90	1125	90	38	8.00	475 (42.2%)	0.92	4.39	5.00	" " " " "
3. Eucalyptus occidentalis 'flat-topped yate'	Pelletted with Kaolin & fine peat moss &	7.0	75.0 (crushed) 84.6 (uncrushed)	0.700	875	90	35	10.29	340 (38.9%)	0.44	4.44	5.25	Height growth better on wetter and saltier section of trial
4. Eucalyptus paniculata				0.810	1013 (failed)								* Poor quality seed regarded as cause of failure
5. Eucalyptus patens	Seed & chaff	10.7	100.0	0.3	375	30	14	8.00	175 (46.7%)	0.87	8.13	10-15	Better on loamy gravels
6. Eucalyptus wandoo	Pelletted	8-12.8	33.3 (crushed) 28.19 (uncrushed)	1.05	1313	111	18	8.45	213 (16.22%)	0.189	1.82	5-10	" " " "
			Totals	4.46	5576		1766						

NOTE: (1) Total stocking = 1,766 estimated

(2) Calculated spacing (average)

= 4.5 x 4.5m excluding Eucalyptus paniculata area

= 4.99 x 4.99m including " " "

P.W.D. DIRECT SEEDING - LAKE NUNIJUP 4/9/84 Table 2

Species	Seed Type Used	Av. No. Seed/Spot (Germinable)	Germ^{n} %age (lab test)	Area Sown (ha) Est^{d}	Est^{d} No. Spots Sown	Stocking Assess 27/8/85 Elapsed Time 357 days	Comments
1. Euc occidentalis 'Swamp yate'	Seed & Chaff	12.0	88.00	2.10	2625	60% (=1575)	1. Lateness of weedicide treatments lead to poor seed bed preparation by the machine since weeds had not been killed properly.
2. Euc. cladocalyx 'Sugar gum'	Seed & Chaff	24.0	94.10	1.40	1750	25% (= 538)	2. Advent of rain during seeding caused some problems with seed & super distribution & may be the cause of failures in some areas.
3. Euc maculata 'Spotted gum'	Seed & Chaff	32.0	87.00	0.80	1000	NIL	3. Availability of 'Fusilade' 212 weedicide should considerably enhance success of this type of seedling establishment.
4. Euc. accedens 'Powder Bark Wandoo'	Seed & Chaff (Kaolin pelletts)	3.00	20germs/ gram	0.70	875	NIL	4. More intense assessment of success required.
			Totals	5.00	6250		

NOTE: 1 Total weight of seed used = 1.305kg approx

2 "germs" = germinant numbers/grm weight

▶ *Rehabilitation Project on Soda affected Caneland near Mackay Central Queensland.*

R J Manderson
Qld Department of Forestry
P O Box 582, MACKAY Q 4740

A half hectare trial planting of about 15 species of trees and shrubs has commenced on soda affected caneland near Mackay in coastal central Queensland.

Plantings were carried out in November 1985 and initial survival results should be available within a year. If successful, the landholder intends carrying out further plantings on a worse affected area.

Officers from the Queensland Department of Forestry in Mackay advised the landholder on suitable species and establishment techniques. Species included:

Casuarina crista
Casuarina cunninghamiana
Euc. camaldulensis
Euc. citriodora
Euc. robusta
Lagunaria patersonii
Melaleuca armillaris
Casuarina glauca
Euc. orgadopholoia
Euc. tereticornis
Euc. moluccana
Euc. sideroxylon
Mel. quinquinervia
Callitris columellaris

The aim of the trial is to attempt to rehabilitate land which has become useless for crops and to determine species tolerant of high alkaline soil conditions. If successful such success could be applied to rehabilitate other areas in the region now lying waste.

▶ From J.Venning of the South Australian Department of Environment and Planning, GPO Box 667, Adelaide, SA 5001.:

08-216777.

We have not continued to assess and monitor rural tree decline in South Australia over the last year. However, we are still evaluating direct seeding and natural regeneration methods in order to develop techniques suitable for South Australian conditions.

The Department of Environment and Planning has published the following reports during 1985 on various aspects of its five year revegetation research programme.

Venning, J. (Ed.) (1985). Proceedings of a Revegetation Workshop on Direct Seeding and Natural Regeneration Techniques held in Adelaide, 27-29 March 1985.

McMurray, S. (1985). Post-emergent Herbicides for Weed Control with Direct-Seeded Native Species.

Venning, J. and Croft, T.S. (1985). 1984 Revegetation Trials.

Venning, J. (1985). Natural Regeneration: Case Study II.

Researchers may be unaware of two major projects currently being undertaken in Victoria. Both are practical action projects promoting planting and natural regeneration of trees.

Project Branchout is the name of the Loddon Campaspe Revegetation project. The area covered is the catchment of the Loddon and Campaspe Rivers in Central and Northern Victoria with the two main centres being Bendigo and Maryborough. Under the guidance of a management committee comprising farmers, government officers, council representatives and community groups, Project Branchout is actively promoting regeneration schemes. With substantial grants from the Victoria's 150th Committee and the Commonwealth Employment Program collaborative projects have been instigated with local farmers and councils. The group may be contacted through the Manager, Rod May, (054) 43 5141.

Potter Farmland Plan is a scheme managed by the Potter Foundation with input from the Department of Conservation, Forests and Lands. The Plan is to develop a number of farms under a plan allowing for re-establishment of individual trees in paddocks, establishment of windbreaks and the establishment of protection/conservation zones along streams. Landholders and the Foundation share in the costs of the work. Two areas near Hamilton in Western Victoria are currently being used with a number of collaborating farmers in each area. The Foundation may be contacted through Andrew Campbell (055) 72 2777.

CHRIS BOROUGH

CSIRO Division of Forest Research, PO Box 4008, Queen Victoria Tce., ACT 2600.

FARM TREE RESEARCH CENTRE, WESTERN AUSTRALIA

Paul Brown, Farm Tree Research Centre, c/- Department of Agriculture, 10 Doney Street, Narrogin 6312.

The Farm Tree Research Centre was established by the W.A. Government in late 1984 to provide technical information on revegetation methods for use in rural areas and the management of existing vegetation within th 600 - 300 mm annual rainfall zone in the W.A. Wheatbelt. In 1986 the following project areas will be given high research priority by the centre:

1. Direct seeding as a cheap broadscale revegetation technique.
2. Broadscale surveys to identify which species and plant communities are naturally regenerating in the Wheatbelt.
3. The interaction of herbicides and trees.
4. Causes of Eucalyptus wandoo decline in the Upper Great Southern.

RURAL LAND SCOPE EVALUATION AND PLANNING FOR REVEGETATION

Mr. Vivian T. Read
Department of Geography
University of Western Australia
(Ph.D. Research Project)

Recent research efforts are apparently deficient in identifying the most appropriate positions in the landscape for revegetation. This deficiency is addressed in the current project with the final objective of preparing regional plans for revegetation strategies. Revegetation is considered for a range of purposes including retardation of processes causing land degradation, the provision of commercially valuable products and to supplement habitat for nature conservation.

The project focuses on the Bannister River catchment which is located 100km S.E. of Perth. Approximately one half of the catchment is currently under native vegetation. Ecological relationships derived from this area will be used for regional extrapolation to areas with more urgent requirements for revegetation.

The first stage will be to determine a basis for mapping. Direct gradient analysis will be used for vegetation ordination in the uncleared areas. Generalized linear models will be developed to predict the probable former occurrence of species associations in adjacent agricultural landscapes. This approach should provide an ecologically relevant mapping scale.

The second stage will be to evaluate the landscape units. Included in this will be further modelling to extrapolate survival and growth rates for tree species in relation to landscape position. The general methodology and nomenclature will follow "Land Evaluation for Forestry" (F.A.O., 1984).

The third stage will be to develop an interactive planning process with the land holders to encourage cooperative interest in the approach to land evaluation and implementation of the preferred planning option.

PLANNED RESEARCH ON THE STATUS OF WOODLAND IN THE W.A. WHEATBELT

The Reserve Dynamics programme currently underway in CSIRO Division of Wildlife and Rangelands Research at Helena Valley W.A. is studing the dynamics and management of vegetation remnants within the W.A. wheatbelt. Only a small percentage of this area remains as native vegetation, and most are small and relatively isolated. Woodland types such as those dominated by Salmon Gum (E. salmonophloea) or York Gum (E. loxophleba) are relatively poorly represented in the remaining remnants due to preferential clearing. Certain wildlife species are dependent on these woodlands (e.g. hole-nesting birds).

We wish to start a project to examine the current status of Salmon Gum in the wheatbelt. The project will include a size class analysis of existing populations and an analysis of spatial relationships to determine the principal mode of regeneration of the species - i.e. is it a gap-phase species or does it require larger-scale disturbance to regenerate. Further studies will be carried out to determine factors affecting seed production, germination and seedling establishment. The influence of stock grazing on regeneration will also be studied.

We put this project forward as a potential Ph.D. project and would be interested to hear from anyone who may wish to supervise this project jointly with us or who can put potential students in touch with us. Depending on response, funding may be available. Our programme currently has a list of potential student projects, and we will be happy to send it to anyone interested.

Dr Richard J. Hobbs
CSIRO
Divison of Wildlife & Rangelands Research
LMB 4
P.O. MIDLAND
W.A. 6056

▶ CONSERVATION OF RARE PLANTS ON PRIVATE LAND

Introduction:

This project was conducted by the Conservation Council of Victoria with funds from the National Estate Programme. The project was initiated due to concern that no organisation in Victoria had the responsibility for flora protection on private land. There has been years of neglect, only highlighted by the LaTrobe University Botany Department "Register of Rare and Endangered Plants" which identified the location and conservation requirements of Victoria's rare flora. There is also concern that existing rural conservation schemes give insufficient attention to rare species and retention of remnant native vegetation.

AIMS:

a) To assess the ecological, managerial and administrative problems inhibiting effective rare plant conservation.

b) Develop a proposal for alleviating these difficulties.

c) Prepare practical information materials for landowners and land managers about how to protect rare plants and where to obtain advice and assistance.

RESULTS:

The conservation of a number of rare plants have been examined. These include Casuarina obesa, Discaria pubescens (Anchor Plant) Adiantum diphanum (Filmy Maidenhair) Prosophyllum diversiflorum (Gorae Leek Orchid) and Gnephosis baracchiana. Case studies are being prepared to illustrate the problems facing rare plants on private land in general, as well as to initiate action on these species on a practical level. A guide to landholders has also been prepared, outlining sources of advice, finance and practical assistance. Several guide sheets are also in preparation on indigenous planting (inc. seed collection techniques) and practical guidelines for protecting rare plants. These shall hopefully be included in a publication about conservation on the farm being co-ordinated by the Land Protection Service (Dept. Conservation, Forests & Lands). (Mr. Rob Youl, 817 1381).

Finally, as part of a general report on suggested government initiatives on rare plant conservation, the most appropriate forms of financial assistance are discussed. This work is seen as a precursor to a more detailed agro-economic study of the role of incentives to achieve flora conservation on private land. This project is being evaluated by the National Estate Committee for funding.

Further National Estate funds have been requested to produce a series of species and habitat specific management guidelines for landholders and managers who control rare flora sites. This work will be conducted in conjunction with the LaTrobe University Botany Department (Dr. Bob Parsons and Mr. Neville Scarlett).

Contact: The project will be completed early January.
Follow up projects may be underway by March 1986.
For more details: Peter Durkin or Michael Hogan,
Conservation Council of Victoria,
285 Little Lonsdale Street,
Melbourne, 3000.
Phone: (03) 663 1561.

▶ Can anyone help the Capricorn Revegetation Project with references, or other information?

Dear Jill,

Mr D Chapman of the Soil Conservation Services Branch of Queensland Department of Primary Industries has referred us to you with regard to Rural Tree Decline. The Capricorn Revegetation Project, being managed by GREENING AUSTRALIA, aims at establishing 100 000 trees throughout Central Queensland in the 52 week period to mid October 1986. Using Community Employment Programme funding, the project will determine the suitability of a large number of different species of trees for addressing particular land degradation problems. Trial plots will be established on as many major soil types as possible from the Capricorn Coast to west of Emerald.

As part of the resources for the project we are searching for publications concerned with tree decline, dieback, soil erosion, salinity and species performance, if you can help us in this regard with copies of papers or references we will be pleased to apply them to our trials.

Could you please include us on your mailing list to receive on going copies of your publication "Rural Tree Decline". As we are keen to share the experience of our project, please advise of guidelines for the submission of articles to this newsletter.

Thanking you
Yours sincerely

Neil HOY
Project Manager

GREENING AUSTRALIA Qld Inc
Capricorn Revegetation Project
P O Box 864
Rockhampton Q 4700

Tel (079) 21202, 279583 a/h 21668

3 January 1986

conservation & sustainable development are mutually dependent

▶ Brian Roberts, School of Applied Science, Darling Downs Institute, PO Box Darling Heights, Toowoomba, Q 4350, is president of the newly formed Soil Conservation Association of Australia. This is what it's all about:

THE SOIL CONSERVATION ASSOCIATION OF AUSTRALIA

- A NEW ORGANIZATION TO PROMOTE SOIL CONSERVATION AND LAND MANAGEMENT NATION-WIDE

At the Fourth Australian Soil Conservation Conference held on 25th October, 1985 at Maroochydore, Queensland, the Soil Conservation Association of Australia was formed. The conference passed the following unanimous resolution: "That this conference supports the Soil Conservation Association of Australia as an additional vehicle to promote soil conservation".

The inaugural executive committee of the Association is:

Chairman:	Dr. Brian Roberts, Darling Downs Institute of Advanced Education, Queensland.
Secretary:	Dr. Shankariah Chamala University of Queensland.
Treasurer:	Mr. Bob Mijnarends*, Queensland Department of Primary Industries.
Members:	Mr. Alex Mitchell, Soil Conservation Authority, Victoria. Mr. Col Short, Soil Conservation Service, New South Wales. Mr. Ian Grierson, Roseworthy, South Australia. Mr. Bob Richards (interim), Conservation Centre, Northern Territory.

* Co-opted under powers accorded the executive. The Association has an account (No. 313 134) at the Commonwealth Bank, Toowoomba.

The executive was empowered to expand the Association through a membership drive and the development of a draft constitution, using portion of the first year's membership fees for these activities.

Membership would be open to anyone who subscribes to the objectives of the Association.

Rationale

Land deterioration has been recognized as Australia's prime environmental problem in recent years. The growing number of concerned landholders and landuse officers seeking to mobilize action to combat deterioration have long sought a nation-wide body. Many of these experienced and informed individuals hold membership of existing societies. Many of these societies include land use issues in their activities but they often cater more for the research specialist than for those concerned with the real need for influencing high level decision-makers on land use policy and landcare.

The need for action has led to some groups to establish their own awareness movements to get the message across. Now the Soil Conservation Association of Australia can mobilize and co-ordinate the presently dispensed attempts of landholders, specialists and members of the general community to get soil conservation and land use into its proper place in our national and state priorities.

The purpose and objectives of the new Association are:

Purpose

The Soil Conservation Association is dedicated to encouraging the wise use of the soil and its associated land and water resources. In this way, those resources can be used indefinitely to produce our needs from private and public land without degrading the soil and the environment.

While responsibility for proper land use rests with the whole community, four groups are especially important:

. land users, all of whom have a special responsibility to act as "stewards" of the soil and to maintain, and where possible, enhance its capacity to be used for their own and the community's benefit and for the welfare of future generations;

. parliamentarians, members of government policy committees and policy advisers, all of whom influence either directly or indirectly the laws and policies which affect the use of soil and water resources and the allocation of public funds;

. scientists, industrialists and soil conservationists who undertake research and extension and advise governments and land users;

. educators at all levels.

The Association provides a forum to promote an understanding of our fundamental dependence on the conservation of soil and water

Objectives

. increase government and community awareness of the critical need for protecting soil and water resources for present and future generations;

. encourage the adoption of systems of land use and management in accordance with the capability of the land for sustainable use.

. improve communications between urban and rural communities to promote an understanding throughout the community of the need for wise land use;

. encourage the development and implementation by government of long-range soil conservation policies;

. examine land use policies and activities and, where necessary, recommend measures to be taken;

. provide information to members on soil conservation issues by way of meetings, publications and regular conferences;

. provide a forum through which members can share practical experiences in achieving soil conservation and erosion control;

. encourage soil conservation research and demonstration projects;

. work closely with other organizations in support of mutual interests.

SOIL CONSERVATION ASSOCIATION OF AUSTRALIA

MEMBERSHIP APPLICATION

The Secretary,
Soil Conservation Association of Australia,
C/- Dr. Brian Roberts,
Darling Downs Institute of Advanced Education,
P.O. Darling Heights,
TOOWOOMBA. QLD. 4350.

Dear Sir,

I hereby make application for membership in the current year.

NAME: _____

TITLE: _____

ADDRESS: _____

SIGNATURE: _____

I enclose $20* for the annual membership fee. (Cheques to be crossed and made out to Soil Conservation Association of Australia).

* $100 for corporate membership of organizations.

Brian also mentioned two additional publications, which I'm sure he'll be able to send to interested readers. They are:
'How Free is Freehold?' (23pp), and 'Christian Land Stewardship for Australia' (50pp).

These are the people to whom I sent letters soliciting material for volume 2. (They comprise people who responded to volume 1, and others suggested by volume 1's readers.)

I received contributions from :

I.J. Abbott, COMO, WA 6152.
D.R. Barrett, BENTLEY WA 6102.
D. Bell, NEDLANDS WA 6009.
P. Brown, NARROGIN WA 6312.
S.J.A. Burke, HAMILTON VIC 3000.
A. Campbell, HAMILTON VIC 3000.
C. Clifton, CRESWICK VIC 3363.
D. Curtis, ARMIDALE NSW 2351.
E.M. Davison, MURDOCH, WA 6150.
J.A. Duggin, ARMIDALE, NSW 2351.
P. Durkin, MELBOURNE VIC 3000.
G. Enders, ARMIDALE, NSW 2351.
R. Farrow, CANBERRA CITY, ACT 2601.
J.E.D. Fox, BENTLEY WA 6102.
R.H. Froend, NEDLANDS WA 6009.
A.J. Hart, COMO, WA 6152.
H.H. Heatwole, ARMIDALE NSW 2351.
R.J. Hobbs, MIDLAND WA 6056.
M. Hogan, MELBOURNE VIC 3000.
N. Hoy, ROCKHAMPTON QLD 4700.
M. Lowman, ARMIDALE, NSW 2351.
A.M. Lyons, HAMILTON VIC 3000.
S.M. Mackay, BEECROFT, NSW 2119.
J.D. Majer, BENTLY WA 6102.
R. Manderson, MACKAY, QLD 4740.
S.K. McMurray, ADELAIDE SA 5001.
J. Morse, CANBERRA CITY ACT 2601.
A. Postle, BENTLY WA 6102.
V.W. Read, NEDLANDS WA 6009.
B.N. Richards, ARMIDALE, NSW 2351.
B.R. Roberts, TOOWOOMBA, QLD 4350.
R.J. Roberts, CANBERRA CITY, ACT 2601.
F.C.S. Tay, MURDOCH WA 6150.
E.E. Taylor, BEECROFT NSW 2119.
J. Tippett, COMO, WA 6152.
P. van der Moezel, NEDLANDS WA 6009.
J. Venning, ADELAIDE, SA 5001.
S.R. Wijesuriya, BENTLEY WA 6102.
F.R. Wylie, INDOOROOPILLY, QLD 4068.

These people expressed interest in the newsletter, although they couldn't contribute to this volume :

M.P. Austin, CANBERRA ACT 2601.
J. Banks, CANBERRA, ACT 2601.
D. Bennett, NORTHAM WA 6401.
D.J. Bevege, BEECROFT, NSW 2119.
J.D. Blyth, COMO WA 6152.
C. Borough, CANBERRA, ACT 2600.
J. Bowon, SANDY POINT VIC 3959.
P. Bridgewater, CANBERRA ACT 2601.
D.M. Cameron, SAMFORD, QLD 4520.
D.G. Chapman, ROCKHAMPTON QLD 4700.
S. Davidson, DICKSON ACT 2602.
D. Debenham, TARWIN LOWER, VIC 3956.
D.L. Dixon, TARWIN LOWER VIC 3955.
S. Farrel, KEW VIC 3101.
P. Gullen, CANBERRA ACT 2601.
A.J.M. Hopkins, WANNEROO WA 6065.
L.R. Jelbart, TARWIN LOWER VIC 3959.
J.J. Landsberg, QUEEN VICTORIA TCE., ACT 2600.
The Librarian, WANNEROO WA 6050.
R. Loyn, HEIDELBERG, VIC 3084.
C.P. Margules, CANBERRA ACT 2601.
J. Mascardri, CALDERMEADE VIC 3984.
Z. Mazanec, WEMBLEY, WA 6014.
J. Morris, MELBOURNE, VIC 3001.
J. Ridsdill-Smith, WEMBLEY WA 014.
D.A. Saunders, MIDLAND WA 05.
D.W. Stringer, BAIRNSDALE VIC 3875.
H.J. Swart, PARKVILLE, VIC 3052.
R.M. Thackway, CANBERRA ACT 2601.
B. Walker, LYNEHAM ACT 2602.
T.C.R. White, WAGGA WAGGA NSW 2650.

I received no replies from these people :

E. Adamson, MELBOURNE,VIC 3000.
J.R. Bartle, COMO, WA 6152.
B. Bayly-Stark, SANDY BAY, TAS 7005.
R.A. Boyd, ARMIDALE, NSW 2351.
G. Brown, DARWIN, NT 5794.
P. Bulman, MURRAY BRIDGE, SA 5253.
M.W. Burns, MUSWELLBROOK, NSW 2333.
D. Campbell, BEECROFT, NSW 2119.
A.J. Campbell, ARMIDALE, NSW 2350.
S. Crombie, ARMIDALE, NSW 2357.
R.L. Davidson, ARMIDALE, NSW 2357.
G. Davis, WINNELLIE, NT 5789.
J. de Salis, OSBORNE PARK WA 6017.
T.H. Dendy, ADELAIDE SA 5001.
A Dohle, ELLERSLIE VIC 3311.
G.W. Douglas, SPRINGVALE, VIC 3171.
A.W. Drayton, TIMBOON VIC 3268.
A. Fearnside, CANBERRA, ACT 2601.
H. Ford, ARMIDALE NSW 2350.
J. Fryer, WESTON, ACT 2611.
M. Gallen, WINNELLIE, NT 5789.
P.J. Greig, MELBOURNE, VIC 3000.
K. Griggs, LEONGATHA VIC 3953.
R. Haney, FINGAL, TAS 7214.
B.R. Hardy, SEACLIFF SA 5049.
J.T. Jacka, DUMBALK VIC 3395.
P.J.M. Johnston, BRISBANE, Q 4000.
G. Kile, HOBART TAS 7000.
P. Kimber, PERTH, WA 6000.
A.G. Landy, WALKERVILLE VIC 3959.
The Librarian, CRESWICK VIC 3363.
R. Liley, FISH CREEK VIC 955.
J.A. Lothian, ADELAIDE, SA 5001.
M. Mackinnon, CASTERTON VIC 3311.
P.J. McNamara, COMO, WA 6152.
G. Morvell, CANBERRA CITY, ACT 2601.
C.H.L. Murray, BAIRNSDALE VIC 3875.
C. Nadolny, ARMIDALE, NSW 2357.
D. Peake-Jones, ADELAIDE SA 5001.
M.A. Picard, ADELAIDE, 5000.
F.D. Podger, HOBART, TAS 7000.
E.W. Pook, CANBERRA CITY, ACT 2601.
C.H. Pratten, SYDNEY, NSW 2000.
L.J. Righetti, YANDOIT VIC 3461.
A.D. Sands, QUIRINDI, NSW 2343.
J.A. Simpson, BEECROFT NSW 2119.
A. Smith, ARMIDALE NSW 2351.
J. Spiers, CASTERTON VIC 3311.
T. Stadler, DYNNRNE, TAS 7005.
R.R. Steel, BRACKNELL TAS 7302.
J.F. Taylor, HARDEN, NSW 2587.
A. Thatcher, MELBOURNE, VIC 3000.
J. Waters, CAVINISH VIC 3408.
K.F. Wells, CANBERRA ACT 2601.
J.B. Williams, ARMIDALE, NSW 2351.
R. Youl, MELBOURNE, VIC 3001.