FOREST IMPROVEMENT AND REHABILITATION SCHEME (F.I.R.S.)

PRESCRIPTION '89

1. INTRODUCTION

In the Wagerup E.R.M.P. Alcoa gave a commitment to finance the rehabilitation of dieback affected State Forests adjoining bauxite mines. This led to the initiation of the Forest Improvement and Rehabilitation Scheme (F.I.R.S.) in 1978.

The scheme is funded by Alcoa. Work is prescribed and implemented by the Department of Conservation and Land Management.

F.I.R.S. work is breaking new ground in the integration of site, land use and disease variables. Each annual prescription is therefore regarded as interim.

This prescription sets out objectives and guidelines for F.I.R.S. based on the best information available in July, 1988.

2. OBJECTIVES

The Forest Improvement and Rehabilitation Scheme is applied to unmined forest within the bauxite mining envelope. The objectives are:

- To treat the forest so as to render it less susceptible to dieback disease impact.
- To rehabilitate forest in which the overstorey has been extensively destroyed by disease.
- To prevent erosion which contributed to stream turbidity.
- To identify areas for improvement treatment, in healthy unmined forest.

The overall objective of F.I.R.S. is to maintain or improve the capacity of the unmined forest to produce water, timber, recreation, conservation and/or other forest values. Emphasis will vary according to the management priority for each area.

3. TREATMENT SELECTION

There are four basic F.I.R.S. treatments:

- Stream Zone Protection
- Dieback Protection via Understorey Manipulation
- Rehabilitation of Dieback Graveyards.
- Identification of and Implementation of Improvement Treatment for Healthy Forest.

When planning the F.I.R.S. treatment for a particular compartment of forest the stream zones are selected first. The remainder of the unmined forest is to be given either the Dieback Protection treatment (2), or the Graveyard Rehabilitation treatment (3), or a variation of these two treatments. Improvement treatments of Healthy Forest (4), are to be applied after mining and rehabilitation to some of the protected areas.

The choice between the Dieback Protection and the Graveyard Rehabilitation treatments depends on current dieback impact and on the likely consequences of treatment on dieback impact. Four situations are described below to illustrate how the choice might be made:

- The most simple situation is where the forest is dieback free with a dense population of B. grandis, and where infection from mining is possible. The Dieback Protection treatment (2), is then applied.

- The other simple situation is where the dieback impact is very high, with well over half the jarrah overstorey killed by dieback. The Graveyard Rehabilitation treatment (3), is then applied.

- Where disease impact is low (understorey only affected) the Dieback Protection treatment (2), should be chosen, but will need to be modified to suit the situation.

- Where the overstorey is affected by dieback, but not more than half of it has been killed, there is a risk that applying the Graveyard Rehabilitation treatment will further increase the disease impact. A conservative combination of the Dieback Protection and Graveyard Rehabilitation treatments is recommended. B. grandis numbers should be reduced, if applicable, and then understorey seed and seed of resistant eucalypts introduced. The disturbance to soil and to existing vegetation should be minimal.

The process of choosing the appropriate treatment is depicted in Figure 1. A treatment where little or nothing is done may be most appropriate in some areas where the disease is flourishing.

4. IMPLEMENTATION

A 5 year F.I.R.S. plan is to be developed for each mine site. This will be a rolling plan which must be updated in September of each year. At the same time an annual F.I.R.S. works programme will be drawn up in accordance with approved mining plans and available finance. The "F.I.R.S. Year" is regarded as running from the beginning of January to the end of December. Each plan will be subject to endorsement by Alcoa.

As soon as the areas to be treated are defined, each District Manager must ensure that:

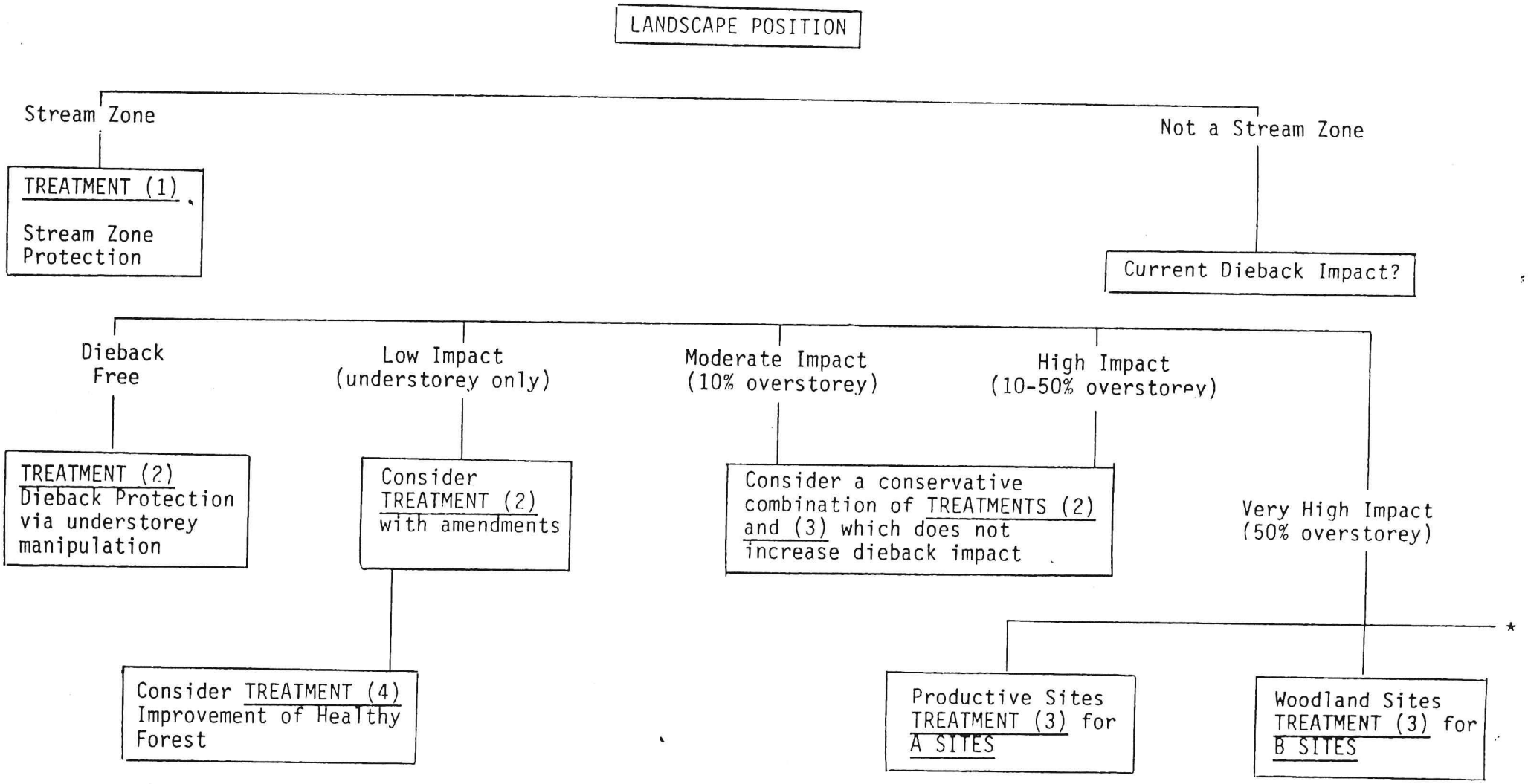

FIGURE 1: SELECTING THE APPROPRIATE F.I.R.S. TREATMENT

* Heath Sites Treatment (3) for C sites

- The appropriate prescription is chosen or written.
- A detailed plan of proposals is prepared.
- A works programme covering manpower, machinery and season is drawn up and priorities assigned.
- Staff responsibilities are made clear.

The following priorities apply:

- Carry-over areas from previous year.
- Banksia control, autumn burn and drainage improvements in DB Free or lightly affected stands.
- Rehabilitation of advanced dieback in pipe-head catchments.

The Regional Leader will review progress each quarter in each District to ensure that programmes are completed according to prescription and budgets not over-spent.

The Regional Leader will prepare a report for Alcoa at the completion of each financial year which will describe: areas treated, costs and treatments used.

Completed work is to be recorded on the Bauxite HOCS (1:10,000). The amended plans and Register are to be forwarded to Inventory in June each year.

District staff will maintain fortnightly records of costs and works progress and input this on the 097 report.

A joint Alcoa/C.A.L.M. inspection of works programmes will normally be made each 6 months and written comments exchanged.

5. REVIEW AND CONTROL

This prescription will be reviewed in July each year and updated as necessary, on the basis of:

° Changes in emphasis.

° New research findings.

° The need to correct inadequacies in the existing prescription.

It is acknowledged that the prescriptions contained in the following pages are guidelines only. Due to the nature of each mine site the prescriptions will vary to accommodate the needs of the particular site. However, major deviations from these prescriptions must be operationally trialled so that they can be assessed and input into the annual F.I.R.S. review.

Communication between the mine sites and Research Branch must be maintained so that trials are not duplicated where this is deemed inappropriate.

6. F.I.R.S. CHECK LIST

Prior to any F.I.R.S. work taking place the following information should be consulted or written. Some of this information may not, as yet, be available, but it should become the long term requirement for all F.I.R.S. work.

- land forms
- site vegetation types
- hygiene map
- predicted impact map
- 7-way test

7. F.I.R.S. PRESCRIPTIONS

Treatment (1) - Stream Zone Protection

Preamble

Stream Zones are to be selected so as to prevent turbid water from roads and bauxite pits entering streams. They need to be more extensive and secure in harnessed catchments than elsewhere.

Gravel pits, roads, earth dumps, etc., which may contribute to stream turbidity should be treated to prevent erosion. Treatment may include closure or relocation if appropriate, earthworks if necessary, and stabilising soil with vegetation.

Aim

To protect the existing vegetation in the stream zone so that it can filter sediment and provide a habitat refuge for fauna.

Method

1. Where necessary, and particularly in catchment areas, bare areas within stream zones should be seeded with understorey to enhance their ability to filter out sediment.

2. Where there is a recreation facility within or adjacent to a stream zone it may be necessary to:

   - Fall dead or dangerous overhanging trees.
   - Control erosion from car parks and access roads.
   - Do limited hazard reduction burning to prevent a dangerous hazard adjacent to picnic areas.

3. If adjacent treatment areas are to be burnt it may be necessary to protect the stream zone by either a burnt edge or a fuel reduction burn in cool conditions. Machine graded fire-lines are to be avoided if possible. It is recognised however that some stream zones may need to be hazard reduction burnt for protection management purposes. These burns must be programmed so as to avoid the possibility of erosion. They must also be broken up in both time and space to avoid disturbing an entire stream habitat.

   The W.A.W.A. must be notified of any burns which are to take place in stream zones.

4. Records of all stages of the treatment are to be kept in a central filing system in the District Office.

Treatment (2) - Dieback Protection via Understorey Manipulation

Preamble

Dieback research has shown that Banksia grandis is highly susceptible to Phytophthora cinnamomi as it is a host tissue from which the dieback fungus can readily sporulate and spread. Dieback research has also indicated that a legume understorey should disfavour the survival and spread of P. cinnamomi. The aim of the treatment, therefore is to reduce the population of B. grandis and increase the density of legumes in the understorey, thus tipping the balance in favour of the forest rather than the fungus. It is recognised that there are other factors, such as a highly susceptible site or increased drainage from roads and pits, which increase the likelihood of severe disease expression. However, B. grandis will be replaced by legumes unless it is clear that these other factors over-ride the likely benefits from the F.I.R.S. treatment.

A 3 year investigation into the effectiveness of understorey manipulation was commenced in 1988 by C.A.L.M. Research. Until results of this study are to hand, deferrment of treatment of sites having a high hazard rating may be appropriate.

Aim

To reduce (not eliminate) the B. grandis populations using a combination of machines, fire and herbicide. This treatment should be applied a minimum of 3 years, preferably 5 years, in advance of mining in adjacent areas. Priorities should be assigned accordingly.

Method

One method by which understorey manipulation takes place is currently is use. This is:

STRATEGY A - Manual kill of Banksia, burning, follow-up foliar spraying.

1. Select area of uniform treatment

2. Work through F.I.R.S. check list

3. Identify - dieback categories and B. grandis populations

   Assess - legume occurrence and site suitability for legume establishment and jarrah lignotubers occurrence, by carrying out a 25 m. x 10 m. diameter transect in each treatment 2 area.

   Note: Details of this assessment will be available during 1988 and will be included in next year's prescription.

4. Using rubber tyred machine or chain-saw, push or cut down all B. grandis greater than 4 cm. dbhob. Any mechanical work must be carried out in dry soil conditions.

5. Prepare tracks and edges for burn. Carry out falling of stags within 100 metres of burn boundary and where dangerous to F.I.R.S. operations.

6. Carry out erosion control works as required and close unwanted roads. Avoid draining water into dieback-free or lightly affected areas.

7. Burn at least 1 year after the above when banksia cones are dry and seeds have germinated. Burn in autumn or spring using the following guidelines:

   - Forecast conditions
     SMC 10% - 15%

   - Actual conditions at lighting
     SMC 14 - 15%

   - Tower wind speed less than 15 kilometres per hour
     SDI as per standard prescribed burning conditions

   - Autumn is preferred where acacia establishment is warranted. Autumn or spring conditions may be utilised where the burning objective is for fuel reduction only.

   On sites determined from the results of the acacia occurrence and site suitability assessment, apply legume seed where necessary at 0.25 kg/ha, of major mix, the following winter after rain. Sites should be lightly scarified and seeds should be treated with a low toxicity ant repellent and scarified prior to application. The following is a guide to species which should be added to different sites, though it is probably best to have a basic mixture of local legumes and to add the following in greater proportions for the specific sites.

Site	Species
Moisture gaining	Acacia extensa, A. alata
Havel T & Q	A. urophylla, Bossiae aquifolium, Kennedia coccinea
Havel P & S	A. pulchella, A. lateriticola, Kennedia prostata (if seed available)

Where there are insufficient jarrah lignotubers (i.e. less than 1,000 spha), jarrah seeding will be done after burning with legume seeding.

8. Record the following details about the burn on the F.I.R.S. register.

- Date of burn
- SMC
- RH
- SDI
- Time of ignition
- Winds and temperature during the burn
- Rate of spread

9. In the spring-summer, 3 to 6 months following burning, use Round-up to poison any B. grandis coppice from cut stumps or lignotubers.

10. The timing of subsequent burning is dependent upon the objective of the burn:

i) Reduce fuel below 8 tonnes per hectare.

ii) Maintain B. grandis at a height that it doesn't seed i.e. 4 cm. dbhob.

iii) Regenerate legumes.

Further research on objective (ii) and (iii) will be necessary to determine just when is the appropriate time to carry out this burning so as not to affect jarrah establishment. Prior to any subsequent burning an assessment of banksia regeneration and the extent and quality of jarrah/marri regeneration should be carried out.

11. Records of all stages of the treatment are to be kept in a central filing system in the District Office.

12. Research/Operational Trials (T2)

Name: Minimising dieback impact in forest retained after mining.

Objective: To provide a scientific base from which prescriptions for the implementation of F.I.R.S. treatment (2), as a dieback control measure can be developed.

Description: The following questions will be addressed by appropriate field experiments:

- Will disease expression be intensified or controlled by treating sites in certain ways?

- Does removal of understorey and/or overstorey result in a 'wetter' or 'warmer' site of greater disease hazard?

Principal Investigator: Dr. Stuart Crombie, C.A.L.M.

Commencement: Autumn, 1988.

Duration: 3 years.

Treatment (3) - Rehabilitation of Dieback Graveyards

Preamble

Rehabilitation on advanced dieback areas should not be expected to grow fast, as the underlying causes of dieback disease also lead to less than ideal conditions for tree growth. In most areas intensive effort to establish fast growing trees is inappropriate.

Planting of eucalypts is suitable only on those advanced dieback sites where tree growth is expected to be good. On most sites planting and fertilising will encourage shoot growth at the expense of root development. Root development is considered the priority for survival and growth on infertile upland sites and to facilitate root development trees should be grown from seed on site. It is hoped that trees will develop their above ground parts only when they are capable of supporting that shoot growth.

Tree species for rehabilitation need to be selected to suit the particular advanced dieback sites so that long term growth is maximised. The success of different species beyond the establishment phase needs to be rigorously evaluated on different sites.

Aim

Rehabilitation should aim to increase the potential for recreation and fauna conservation, without compromising the primary land use of water production where applicable. Rehabilitation should also aim to improve the timber production potential, but the amount of effort should be appropriate to the expected tree growth. Where natural regeneration is occurring the treatment should aim to encourage the regeneration and supplement it if necessary.

Method

1. Select area to receive a rehabilitation treatment over one season.

2. Work through F.I.R.S. check list.

3. Identify
   - Advanced dieback boundary
   - Site types
   - Area of good natural regeneration
   - Areas of upslope or dieback-free or lightly affected forest
   - Areas where more than 50% of the original jarrah canopy remains

4. Subdivide area into -

   A Sites - potentially productive sites
   B Sites - woodland sites
   C Sites - heath sites

   Note: A definition of A as opposed to B sites will be quantified before the next review.

5. Site Preparation -

   A Sites - may undergo more intensive site preparation through the creation of ash-beds and the preparation of rip lines for planting. However, where trees are healthy and growing well, they are not to be fallen.

   B Sites - tree planting should be restricted to ash-beds. If there is little understorey, scarifying for seedling establishment is mandatory.

   C Sites - establish a comprehensive understorey if possible by application of seed and fertiliser together with comprehensive scarifying.

6. Carry out felling of stags within 100 metres of burn boundary and where dangerous to F.I.R.S. operation.

7. Carry out erosion control works as required and close unwanted roads especially when adjacent to stream zones. Avoid draining water into dieback-free or lightly affected forest.

8. Burn to reduce the hazard for young rehabilitation or to create ash-beds.

9. A Sites - spread 1 kg seed (F.I.R.S. mix) with 500 kg/ha. of Super No. 1 (including Copper) by tractor. Plant 625 spha and fertilise using 200g of DAP/plant, following the onset of winter rains.

   B Sites - plant on a 2 metre grid within ash-beds and fertilise with 200g DAP/plant. Seed with 1.5 kg/ha. understorey (Rehab major mix) and .4 kg/ha. eucalypt seed, bulked with 500 kg/ha. of Super No. 1 (including Copper) following winter rains.

   C Sites - seed understorey at 2 kg/ha. and fertilise with 1,000 kg/Super No. 1 per hectare.

   Note: All seed must be treated with a suitable low toxicity ant repellent. Understorey species mix to contain predominantly:

   A. pulchella
   A. saligna
   A. extensa

10. Tree species to be used on graveyard sites should include:

   E. calophylla
   E. patens
   E. megacarpa

where appropriate.

Eucalypt seed may be included in the seed mix for A sites at the rate of .4 kg/ha. This mix may include E. marginata at the discretion of the District Manager.

11. Records of all stages of the treatment are to be kept in a F.I.R.S. central filing system in the District Office.

12. Research/Operational Trials (T3)

Name: Dieback graveyard rehabilitation
Seeding/fertilising and planting legumes.

Objective: To determine whether rates of seed and fertiliser application and planting intensity are major determinants in the success of graveyard rehabilitation.

Description: A series of experimental sites have been treated with various rates ranging from:

- 0.5 - 2 kg/ha. understorey seed
- 0.5 - 1 tonne of broadcast superphosphate
- 625 - 1,250 spha trees

Site assessments have been carried out prior to treatment and will be assessed again 1 year after establishment.

Principal Investigator: John Day, Alcoa.

Commencement: June, 1987 at Jarrahdale mine site.

Treatment (4) - Identification and Implementation of Improvement Treatment for Healthy Forest

1. 3 to 5 years after a particular area has been mined and rehabilitated the remaining adjacent forest should be surveyed to identify areas for improvement treatment. This time scale is necessary to allow any new dieback infections time to express themselves.

2. Where thinning is proposed, it should be added to the District's J.S.I. programme. If there are additional costs to this treatment due to the mining operation, they should be borne by Alcoa.

3. In areas which are known to be protectable, a combined thinning and understorey manipulation treatment may be carried out prior to mining.