Forests Department Western Australia
August 1982

DIEBACK REVIEW 1982

PRODUCTION
PROTECTION
RECREATION
CONSERVATION

EXPERT GROUP REPORTS

Internal use only - contents subject to further review

DIEBACK REVIEW, 1982

REPORTS BY EXPERT GROUPS

FORESTS DEPARTMENT, S.H.Q., AUGUST 1982.

For internal use only, contents subject to further reviews.

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DEPARTMENTAL EXPERTS

TERMS OF REFERENCE

Input from a wide cross section of the Department is essential. This needs to be organised to make best use of officer time, as it is appreciated that there are many competing demands on individuals. Large committees are not favoured. Written input is required. The statements should be concise (5-10 typed pages) and address the following aspects:

* the current state of the art;
* existing needs and problem areas with current policy;
* required policy directions for the future;
* research needs;
* staff needs.

Chairmen are to be responsible for submissions of 'expert statements' by the approved deadlines. Suggested procedure is as follows:

* meet to discuss input, allocate tasks, decide priorities;
* prepare and distribute statements within the group;
* edit draft statements (meet if necessary);
* submit final statements to Dieback Review Task Force.

Overlap between groups of experts is not a problem area. It will either confirm areas of common needs or indicate areas where there is divergence of opinion on the subject matter. Co-ordination and evaluation of trade-offs is the responsibility of the D.R.T.F.

1. REGIONAL SUPERINTENDENTS

J. Van Noort (Chairman)

R. Underwood

J. Smart

J. Edwards

TO: DIEBACK TASK FORCE

DIEBACK REVIEW 1982

INPUT FROM REGIONAL SUPERINTENDENTS GROUP

1. CURRENT STATE OF THE ART

HYGIENE IN MANAGEMENT

There is considerable variation in the degree to which hygienic management is applied throughout the forest.

Wherever possible a standard approach should be adopted because differences in approach are confusing, not only to the industry and other users, but also to our own staff.

e.g.,

1.1 Location of the disease outside quarantine. Methods and accuracy of strip survey, boundary survey etc.

1.2 Planning and control of operations. - Coupe selection and operation - split phase logging etc.

1.3 Stockpiling - various levels of achievement.

1.4 Roading - new roads low in profile, or existing roads.

1.5 Washdown - various requirements.

1.6 Training - various levels of effort.

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2. EXISTING NEEDS

2.1 *DIEBACK MAPPING*

There is an urgent need for reliable information on dieback occurrence in advance of all operations wherever they may be.

Need to speed up production if possible, possibly at the expense of some degree of perfection. Need to establish acceptable requirements and develop workable methods of mapping and survey for areas outside quarantine.

2.2 *USE OF QUARANTINE AREAS*

Need to develop operational plans for using quarantined forest following mapping. Prolonged delay in re-entering quarantine will have serious impacts on timber supplies and on the maintenance of the burning buffers in the South.

2.3 *ASSESSMENT OF RESULTS*

The cost and effectiveness of various alternative hygiene measures should be determined.

Need to specify success criteria to assess effectiveness of dieback management strategies.

e.g., One accidental infection does not necessarily mean failure.

2.4 *TERMINOLOGY*

Need for a standard terminology for dieback management. There are various conceptions of the meaning of terms such as :-

- unprotectable forest;
- manageable forest;
- coupe.

2.5 *CONTROL SYSTEM*

Need an operational control system to plan, control and record dieback management.

e.g., HOCS as developed in the South is needed throughout the jarrah forest.

3. POLICY DIRECTION

3.1 *PRIORITIES*

Need for some ranking of Departmental policies to indicate priorities.

e.g., Hygiene management appears to have a higher priority in relation to timber production in the North than elsewhere.

3.2 *REHABILITATION*

Need for policy direction on dieback rehabilitation objectives, techniques, prescriptions and priorities.

4. RESEARCH NEEDS

Need for more research input for solving day to day operational problems and developing operation techniques with respect to dieback management.

Need for prompt dissemination of research findings into the field. Regular update required.

5. STAFF NEEDS

Hygienic management will require more staff for control at the work face.

Need adjustment of cadet intakes as necessary.

A. C. VAN NOORT
(FOR THE GROUP)

August 16, 1982

ACvN:SE

DISTRIBUTION:

SUPT. UNDERWOOD - NORTHERN REGION
SUPT. EDWARDS - BUNBURY
SUPT. SMART - MANJIMUP

2. OPERATIONS

J. Murch (Chairman)

J. Skillen

A. Walker

R. Underwood

82 DIEBACK REVIEW - OPERATIONS COMMITTEE

Part A: The State of the Art

The following operations in State Forest have been reviewed:

1. Hardwood Logging
   - sawlogs
   - concurrent sawlog/pole operation
   - advance pole cutting
   - salvage
   - Bridge Timber
   - fencing
   - firewood
2. Silviculture
3. Regeneration and Rehabilitation
4. Roading
5. Mining - bauxite, coal, tin, sand.
6. Mining - gravel, sand, stone.
7. Service corridors
8. Access
9. Quarantine Management
10. Apiarists
11. Specialist Sections - I & P, Research.
12. Wildflower collections
13. Leases.

Completed checklists are contained in Appendix 1.

Summary of Findings

1. Planning

   1.1 Delays in producing dieback location maps result in insufficient planning leads.

   1.2 Dieback interpretation and mapping is a continuous and heavy demand on divisional officer time which varies with the standards of mapping.

   1.3 Dieback interpretation and mapping is highly variable in expertise, methods and standards. Exception is 70mm photography.

   1.4 Planning the location of access requirements and standards of access is inadequate both inside and outside Quarantine.

   1.5 There exists no overall inter-regional control of planning and co-ordination of Policies and Strategies.

   1.6 Planning for operations inside Quarantine does take place due to a greater input and a higher priority.

2. Hygiene Practices and incorporation of hygiene in prescriptions

   2.1 Very few operations occur where no hygiene is prescribed.

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2.2 There is no overall uniformity in the prescribing and application of hygiene. The techniques, standards and controls used vary significantly between Divisions and Regions. Responsibility and implementation is at the Divisional level with no overall guidance and control.

2.3 Hygiene techniques often do not keep pace with the latest research findings.

2.4 Hygiene can be a heavy demand on manpower and equipment resources and is costly but the effectiveness of actions taken is not known due to poor feedback and lack of adequate control systems.

2.5 Logging methods are being modified resulting in significantly improved hygiene, although standards and methods vary considerably.

2.6 A relatively high degree of hygiene is incorporated into the once only operations such as construction phase for service corridors.

2.7 On going operations such as maintenance of service corridors including roads, tend to have outdated or insufficient controls and prescriptions.

2.8 Hygiene in mining varies between operations. Hygiene is prescribed and implemented in the Drilling and exploration phases.

Hygiene is lacking during mining and rehabilitation.

2.9 Control of general access outside Quarantine is generally ineffective or not applied for both F.D. and outside bodies. No overall guidance or detailed strategy for Regions or Divisions to follow.

3. Training

3.1 Training of F.D. personnel is not taking place continuously on a planned, and organized basis. Training is mainly on a divisional basis with insufficient overall guidance and information.

3.2 Training of the timber industry and other forest users does occur on an informal basis to varying levels.

Part B: Needs and Problem Areas

The group sees these as:-

(i) Knowledge about the biology of the fungus. All staff and operators need a continuing update on research findings on P.c. survival, spread, reproduction, host and environment relations and interactions with manipulatible forest factors.

(ii) Knowledge about the where-abouts of the fungus. Good dieback maps, produced to a defined standard, routinely

updated, are fundamental to hygiene practice and planning. Standard procedure for demarcation of disease categories and buffers is required.

(iii) Hygiene techniques. Operations people want better information and skills on hygiene and the means of measuring hygiene practice and planning.

(iv) Training. Superior methods of disseminating information on (i), (ii), and (iii) and ensuring they are understood.

(v) Inhibition processes in the forest.

(vi) Means of eradication of spot infections

(vii) Dieback Rehabilitation

(viii) Funds for above (i) - (vii).

(ix) Effective control system to ensure uniform aims, priorities and practices within F.D. and other organizations.

Part C: Policy

Policy incorporating hygiene exists for most major operations and is followed to a degree. Policy is not sufficiently understood or implemented by Divisions.

Existing Policy is insufficiently positive using words such as "consider".

Part D: Research Needs

Operations group would like to see research into:

- Instant P.c. detection technique
- Fungus eradication on roads and road verges.
- Fungus eradication in the forest.
- Road stabilisation.
- Washdown techniques and equipment.
- Road maintenance (grading) techniques.
- Stockpiling to avoid moist soil operations (logs, gravel, bauxite etc).
- Rehabilitation techniques (particularly species and provenance, nutrition).
- Use of herbicides for banksia eradication.
- Techniques for P.c. inhibition where understory only is affected.
- Dieback demarcation in the absence of indicator species.
- Definition of high/low impact sites.

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- Utilization research to enable better jarrah thinning.
- Logging equipment research (skidders, loaders, trucks etc) to develop equipment which sheds soil rather than picks it up.
- Logging techniques which do not necessitate contact with the soil.

Part E: Staff Needs

The operations group sees the need for:

One	Inspector level Dieback Operations Officer
Three	Interpreters to work on DB mapping outside QT
Three	Staff to operate a P.c. sample testing laboratory at Bunbury or Manjimup.
Two	Professional staff full time on Dieback training.
Two	Research officers and two T/As to work on operations research.

One per division

extra field staff officer (about A/F) to work exclusively on DB management, training, operational trials and liaison with other forest users.

OPERATION HARDWOOD LOGGING (SAWLOG ONLY)

Is there a Policy? Yes ✓ G.W.P. — Post Quarantine reports

Does it incorporate hygiene? Yes (briefly) Reduce winter logging, increase stock-

Is the policy adequate? Yes. piling. No logging will be permitted... etc.

Is the policy correctly interpreted? Yes

Is there a strategy? Yes Forester Manual (1970)

Does it incorporate hygiene? Yes (briefly)

Is the strategy adequate? No. Strategies in G.W.P. (Part II) are variable. and imprecise. Region and Divisions formulate their own strategies.

Is hygiene considered at the PLANNING stage? Yes, but variable. 3-5 year Resource Planning by Regions - Hygiene low consideration. 12 month Logging Operation plan by Divisions - Dieback location road selection and hygiene is main consideration.

Is hygiene incorporated in the PRESCRIPTION? Usually, but not always (See attached checklists for all Mills)

What is the PRESCRIPTION for this operation?

The "ideal" prescription is detailed in J81 and includes.

1. Preparation of a good dieback map. Variable standards used.
2. Planned roading low in the profile and self draining coupes.
3. Roadworks in advance
4. Construction and use of strategic wash down points.
5. Split-Phase logging
6. Stockpiling to minimize moist soil operations
7. Post logging control of access.

Department has adopted J81 as the optimum hygiene target and are working towards achieving all of above features. Variable application between Regions

Divisional 12 month plan specifies details of mapping, planning, demarcation, roading, and logging.

Variable stockpile targets between mills.

Is hygiene TRAINING effective? Yes when done. Some field and lecture training in hygiene and biology. Insufficient training of Industry and Departmental personnel. Overall Training Department with formats and handouts required.

Is hygiene IMPLEMENTED as prescribed? See attached sheets. Appendix 2.

Is there a CONTROL SYSTEM AND FEEDBACK? Sawmilling licenses are endorsed with provisions for dieback hygiene but this control method is not utilized to the full. Some road closure. No post logging mapping for P.c. No overall hygiene control over planning, prescriptions or training.

OPERATION HARDWOOD LOGGING (INTEGRATED SAWLOG/POLES)

Is there a Policy? Yes

Does it incorporate hygiene? Yes

Is the policy adequate? No

Is the policy correctly interpreted? Yes

Is there a strategy? Yes

Does it incorporate hygiene? Yes

Is the strategy adequate? No. Specific plans for complete integration of pole harvesting are required in G.W.P. Part II

Is hygiene considered at the PLANNING stage? Yes

Is hygiene incorporated in the PRESCRIPTION? Yes

What is the PRESCRIPTION for this operation? Follows Jarrah 81. or H.O.P.

1. Coupes are logged under a split-phase method for both sawlogs and poles.
2. Poles are put aside on the landing and loaded out by the sawlog contractor or/later by a pole contractor.
3. Machinery cleanliness.

Is hygiene TRAINING effective? Covered under sawlog operations.

Is hygiene IMPLEMENTED as prescribed? Usually but not always

Is there a CONTROL SYSTEM AND FEEDBACK? The pole license system offers the opportunity to regulate pole-getting operations to this method. See sawlog operations.

OPERATION HARDWOOD LOGGING (POLES)

Is there a Policy? Yes (G.W.P. Part II. No logging will be permitted..etc)

Does it incorporate hygiene? Yes.

Is the policy adequate? No. Pole getting logging operations should be phased out in favour of integrated operations. except pole thinning for silviculture.

Is the policy correctly interpreted? Usually, but not always.

Is there a strategy? Yes. (J. Edwards letter)

Does it incorporate hygiene? Yes. Stockpiling with no winter snigging or carting.

Is the strategy adequate? Other aspects of strategy are subject to Divisional control.

Is hygiene considered at the PLANNING stage? Yes. Poles will only be logged in advance of sawlogs and pole-getting will not compromise hygiene in the sawlog operation. Often Planning is more rushed because of advance pole ops.

Is hygiene incorporated in the PRESCRIPTION? Yes.

What is the PRESCRIPTION for this operation?

1. Operate in advance of sawlog operations only after dieback mapping, demarcation, coupe planning (sub-coupes etc.) is completed.
2. Poles are snigged to roadside and left.
3. Machines are washed down between sub-coupes.
4. Poles are loaded out after sawlog operations are completed on a split-phase system.
5. Carting may be restricted to safe access periods.

Is hygiene TRAINING effective? No. Insufficient training done.

Is hygiene IMPLEMENTED as prescribed? Usually but not always.

Is there a CONTROL SYSTEM AND FEEDBACK? Pole licenses offer a mechanism for a control system but is not used for this purpose. No post logging assessment.

OPERATION HARDWOOD LOGGING (SALVAGE LOGGING)

Is there a Policy? Yes G.W.P.

Does it incorporate hygiene? No

Is the policy adequate? Yes

Is the policy correctly interpreted? Yes

Is there a strategy? Yes

Does it incorporate hygiene? Yes - No operations where there is a risk of disease spread.

Is the strategy adequate? Yes.

Is hygiene considered at the PLANNING stage? Yes - follows main mill operation, areas to be cleared for mining or advanced dieback.

Is hygiene incorporated in the PRESCRIPTION? Yes

What is the PRESCRIPTION for this operation?

1. In areas where G.P. sawlogs have been logged under spit-phase method, salvage logs are taken only from bush-landings.
2. Washdown of vehicles)
3. Restriction of access routes)
4. Temporary cessation of hauling) All are prescribed where required.
5. Dry soil logging only)
6. No hygiene in areas to be cleared.

Is hygiene TRAINING effective? Variable

Is hygiene IMPLEMENTED as prescribed? Yes or assumed.

Is there a CONTROL SYSTEM AND FEEDBACK? The renewal of Forest Produce Licenses on a regular basis offers mechanism for control. Regular inspections. Control on coupe basis. No feedback.

OPERATION HARDWOOD LOGGING (BRIDGE TIMBER)

Is there a Policy? Yes (New Draft ex J. Edwards)

Does it incorporate hygiene? Yes

Is the policy adequate? Yes

Is the policy correctly interpreted? Not yet.

Is there a strategy? Yes

Does it incorporate hygiene? Yes

Is the strategy adequate? Yes

Is hygiene considered at the PLANNING stage? Usually but not always

Is hygiene incorporated in the PRESCRIPTION? Usually but not always.

What is the PRESCRIPTION for this operation?

This is not a formal prescription (proposed)

1. Operate in advance of sawlog areas only after dieback mapping, demarcation, coupe planning (sub-coupes etc) is completed.
2. Bridge timber is loaded out after sawlog operations are completed.
3. Carting may be restricted to safe access periods.

Is hygiene TRAINING effective? Very little is done. No formal training format.

Is hygiene IMPLEMENTED as prescribed? No!

Is there a CONTROL SYSTEM AND FEEDBACK? The license (F.D. 202) offers the opportunity to control the operation but this is not yet done.

OPERATION HARDWOOD LOGGING (FENCING MATERIAL)

Is there a Policy? Yes

Does it incorporate hygiene? Yes

Is the policy adequate? Draft improvements with Superintendents

Is the policy correctly interpreted?

Is there a strategy? Yes. Regional or Divisional strategies exist.

Does it incorporate hygiene? Yes. No operations where there is risk of disease spread.

Is the strategy adequate? No

Is hygiene considered at the PLANNING stage? No. Except to direct to areas to be cleared or advanced dieback.

Is hygiene incorporated in the PRESCRIPTION? Not in detail.

What is the PRESCRIPTION for this operation?

1. Fence post operation follows:
   - 1.1 Logging operation exclusively in S. Region.
   - 1.2 Areas cleared for mining or advanced dieback in N. Region.
2. Where sawlogs have been logged under a split-phase prescription only material on landings can be cut.
3. Access may be restricted.

Is hygiene TRAINING effective? No. Rarely is any training carried out.

Is hygiene IMPLEMENTED as prescribed? Yes. However illegal fencepost operations also occur.

Is there a CONTROL SYSTEM AND FEEDBACK? The F.P. license offers a mechanism for control but this is rarely used. Control by coupe system. No weekend control.

OPERATION HARDWOOD LOGGING FIREWOOD - Industrial, other Commercial, public

Is there a Policy? Yes

Does it incorporate hygiene? No

Is the policy adequate? No

Is the policy correctly interpreted?

Is there a strategy? Yes

Does it incorporate hygiene? Yes

Is the strategy adequate? Yes - no operations where there is a risk of disease spread.

Is hygiene considered at the PLANNING stage? Yes variable.

Is hygiene incorporated in the PRESCRIPTION? Partial - variable

What is the PRESCRIPTION for this operation?

Operations confined to

1.1 areas to be cleared for mining

1.2 advanced dieback

where vehicle cleanliness not prescribed.

2. 4-5 years behind mill in diebackfree forest in dry soil conditions.

Operations variable between Divisions. No standardised guidelines.

3. Public directed to specific dieback areas but poor control. Large numbers at weekend not guided.

Is hygiene TRAINING effective? No

Is hygiene IMPLEMENTED as prescribed?

Is there a CONTROL SYSTEM AND FEEDBACK? Partial for Commercial - coupe and officer inspection.

No weekend control of public.

OTHER FOREST MANAGEMENT

OPERATION SILVICULTURE

Is there a Policy? Yes

Does it incorporate hygiene? No

Is the policy adequate? No

Is the policy correctly interpreted? No

Is there a strategy? No

Does it incorporate hygiene? No

Is the strategy adequate? No

Is hygiene considered at the PLANNING stage? Yes - with respect to timing of operations and access routes to be followed

Is hygiene incorporated in the PRESCRIPTION? Yes

What is the PRESCRIPTION for this operation?

Jarrah 81 Covers 1. vehicle and machinery cleanliness

2. rules for silviculturists (treemarkers etc)

Jarrah 81 used in North Region.

Variable divisional control elsewhere regarding access restriction, vehicle cleanliness and timing.

Is hygiene TRAINING effective? Only in operations associated directly with industry.

Is hygiene IMPLEMENTED as prescribed?

Is there a CONTROL SYSTEM AND FEEDBACK? Intermittent inspect to ensure prescription being followed.

SOUTHERN REGION

F.D. / INDUSTRY

OPERATION REGENERATION & REHABILITATION

Is there a Policy? No

Does it incorporate hygiene?

Is the policy adequate?

Is the policy correctly interpreted?

Is there a strategy? No

Does it incorporate hygiene?

Is the strategy adequate?

Is hygiene considered at the PLANNING stage? No. Coupes are prepared for regeneration/rehabilitated as they become available, rather than in a planned sequence to minimize dieback spread.

Is hygiene incorporated in the PRESCRIPTION? Yes. (briefly)

What is the PRESCRIPTION for this operation?

Rehabilitation (of snig tracks and landings)

1. Industry to notify Divisional office of intention to enter.
2. Washdown before commencement of each coupe.
3. Washdown between landings if required.

Regeneration preparation

1. Scrub rolling restricted to dry soil conditions.
2. Sections 2-7 of "Dieback Hygiene Manual" to be followed in selection and construction of perimeter tracks.
3. Locate and signpost an official dieback washdown site near each regeneration coupe.

Is hygiene TRAINING effective? Very little done for these operations.

Is hygiene IMPLEMENTED as prescribed? Yes

Is there a CONTROL SYSTEM AND FEEDBACK? No

Main Activities

Roading for logging (by Industry)
Roading for mining (by Miners)
Roading for access/burning etc (by FD)
Roading for access (farmers, beekeeper)
Major roading by M.R.D. & Shires

OPERATION ROADING

Is there a Policy? No (Except roading associated with logging)

Does it incorporate hygiene?

Is the policy adequate?

Is the policy correctly interpreted?

Is there a strategy? No (Except for Foresters Manual 1970 approximately)

Does it incorporate hygiene?

Is the strategy adequate?

Is hygiene considered at the PLANNING stage?

Usually but not always.
Disease information is unreliable.

Is hygiene incorporated in the PRESCRIPTION?

Usually but not always. Great variation in prescriptions.

What is the PRESCRIPTION for this operation?

No standard prescription for roading operations on S.F. exists. (except roading for logging) Prescriptions are compiled by Divisions as required. Most Divisions are following the J81 prescription in part for roading for logging.

Prescriptions usually include the following:

1. Roads to be low on the profile
2. Avoid crossing dieback categories.
3. Road alignment demarcated on foot.
4. When crossing dieback to diebackfree, road to be stabilized.
5. Road construction in dry soil conditions only.
6. Specifications for hygiene during construction.
7. Specifications for roads to be used under dry soil conditions.
8. Specifications for roads to be used under wet/moist soil conditions.
9. Profile falling to assist road drying.
10. "In-Situ" gravel used.
11. Hygiene during culvert installation.
12. Specifications for hygiene during maintenance grading.

Is hygiene TRAINING effective? No! Detailed training for supervisors (F.D. and outside) and operators required. Operator briefing format and checklist required. Handout needed. Dieback Hygiene Manual is out of date for roadworks.

Is hygiene IMPLEMENTED as prescribed? Yes for construction.
Often No for maintenance.

Is there a CONTROL SYSTEM AND FEEDBACK? No Intermittent inspections only.

OPERATION MINING - Bauxite, Coal, Tin, Mineral Sands

Is there a Policy? Yes

Does it incorporate hygiene? No

Is the policy adequate?

Is the policy correctly interpreted?

Is there a strategy? Yes

Does it incorporate hygiene? Yes

Is the strategy adequate? No. To guide mining into disease affected areas.

Is hygiene considered at the PLANNING stage? Marginally by the Company for F.D. input for location of conveyor and haul roads to minimize spread. Nil hygiene planning for mining operations. Hygiene planning is considered for exploration. in bauxite and coal.

Is hygiene incorporated in the PRESCRIPTION? Partly.

What is the PRESCRIPTION for this operation?

1. Drilling and exploration - Hygiene prescription - Dieback map, self draining coupes, dry/wet soil conditions, lesser extent for coal & tin. / Nil for Min sand
2. Clearing and removal of forest produce - marginal hygiene) Higher standard for
3. Mining operations and roadworks - marginal hygiene) Worsley ops.
4. Rehabilitation - marginal hygiene

Is hygiene TRAINING effective? Drilling and exploration - Yes.
Remainder - No.

Is hygiene IMPLEMENTED as prescribed? Drilling and exploration - assumed Yes.

Is there a CONTROL SYSTEM AND FEEDBACK? No except F.D. checking intermittently.

OPERATION MINING (GRAVEL, SAND AND STONE)

Is there a Policy? Yes

Does it incorporate hygiene? Yes (Ensure dieback hygiene methods are used in the excavation, transport and spreading phases of the op.)

Is the policy adequate? Yes (if exploration phase included)

Is the policy correctly interpreted? Yes

Is there a strategy? Yes

Does it incorporate hygiene? Yes briefly (Ensure gravel sand and stone from dieback sites are used only in affected areas).

Is the strategy adequate? No. Reference needed to - access, seasonal operations, consolidation of available resource

Is hygiene considered at the PLANNING stage? Usually but not always

Often there is insufficient time for detailed planning.

(alternative sites, sampling, controlled access etc)

Is hygiene incorporated in the PRESCRIPTION? Usually but not always

What is the PRESCRIPTION for this operation?

No standard prescription for Departmental activity exists.

Prescriptions are compiled by Divisions as required.

Prescription usually (but not always) include:

1. Statement of dieback status of pit.
2. Washdown of vehicles before initial entry
3. Access routes specified and disease status noted. Access routes to be upgraded.
4. Exploration and operations preferred in drier months.
5. Washdown of equipment which is to be used for rehabilitation.
6. Drainage of pit during rehabilitations.

* A detailed standardized prescription is required.

Is hygiene TRAINING effective? No. 1. Operator briefing format and checklist required. 2. Handout to accompany license needed to specify hygiene requirements.

Is hygiene IMPLEMENTED as prescribed? Usually but not always.

Is there a CONTROL SYSTEM AND FEEDBACK? Renewal of liceses and leases offer opportunity for control but rarely is this used.

Intermittent inspections occur but usually without clear direction.

Inspection checklist required.

OPERATION SERVICE CORRIDORS

Is there a Policy? Yes

Does it incorporate hygiene? No

Is the policy adequate?

Is the policy correctly interpreted?

Is there a strategy? Yes

Does it incorporate hygiene? Yes

Is the strategy adequate? No. Guide corridors to areas with minimum risk.

Is hygiene considered at the PLANNING stage? Yes.

Is hygiene incorporated in the PRESCRIPTION? Yes - Divisional basis

What is the PRESCRIPTION for this operation?

No standardized Departmental prescription.

Variable Divisional prescriptions for construction and maintenance and based on dieback maps, vehicle and machinery cleanliness, dry/wet soil conditions.

Is hygiene TRAINING effective? Variable standards and level. As required for each project for supervisors. No organized training.

Is hygiene IMPLEMENTED as prescribed? Assumed to be as per prescription. Dieback maps inadequate for some routes.

Is there a CONTROL SYSTEM AND FEEDBACK? O.I.C. prescription inspects intermittently. No checklist. Variable standards.

1. F.D. I & P, Research, F.D. staff in various surveys, patrols and inspections

2. Outside bodies - research, surveyors, policing bodies, emergency organizations.

OPERATION ACCESS BY BODIES USING CONVENTIONAL VEHICLES * Outside Quarantine

Is there a Policy? Yes

Does it incorporate hygiene? Considers hygiene

Is the policy adequate? Policy should be adopted which protects diebackfree forest.

Is the policy correctly interpreted? Not implemented adquately

Is there a strategy? Yes

Does it incorporate hygiene? Yes

Is the strategy adequate? Yes

Is hygiene considered at the PLANNING stage? No Planning to identify high quality diebackfree forest for restricting access.

Is hygiene incorporated in the PRESCRIPTION? No with few exceptions.

What is the PRESCRIPTION for this operation?

HYGIENE — Access restriction)
Vehicle cleanliness) Variable under Divisional control.
Timing)

Is hygiene TRAINING effective? No

Is hygiene IMPLEMENTED as prescribed? Marginally

Is there a CONTROL SYSTEM AND FEEDBACK? No

OTHER FOREST MANAGEMENT

OPERATION QUARANTINE MANAGEMENT PATROLS & QUARANTINE ENFORCEMENTS, GENERAL ROAD ACCESS

Is there a **Policy?** Yes

Does it incorporate hygiene? Yes

Is the policy adequate? Yes

Is the policy correctly interpreted? Yes

Is there a **strategy?** Yes

Does it incorporate hygiene? Yes

Is the strategy adequate? Yes

Is hygiene considered at the **PLANNING** stage? Yes

Is hygiene incorporated in the **PRESCRIPTION?** Yes - on permit document in prescriptions.

What is the **PRESCRIPTION** for this operation?

Laid down in permit document is

1. Time of entry
2. Access routes
3. Vehicle cleanliness and washdown points.

Prescriptions vary between Divisions.

Is hygiene **TRAINING** effective? Yes - in areas where training is attempted.

F.D. staff - Divisional and organized schools but limited number of participants.

F.D. employees - Divisional training. Limited training to outside bodies.

Is hygiene **IMPLEMENTED** as prescribed? Yes

Is there a **CONTROL SYSTEM AND FEEDBACK?** Yes - recording of useage and routes by each permit holder. No direct sampling of routes used.

OPERATION APIARISTS

Is there a Policy? Yes - Siting to consider access to Quarantine and dieback areas.

Does it incorporate hygiene? Yes

Is the policy adequate? No

Is the policy correctly interpreted? Yes

Is there a strategy? No

Does it incorporate hygiene? No

Is the strategy adequate? No

Is hygiene considered at the PLANNING stage? No

Is hygiene incorporated in the PRESCRIPTION? No except for sites within Quarantine.

What is the PRESCRIPTION for this operation?

Quarantine areas -access restriction.

Is hygiene TRAINING effective? No

Is hygiene IMPLEMENTED as prescribed? Yes within Quarantine.

Is there a CONTROL SYSTEM AND FEEDBACK? No outside Quarantine. Permit used inside Quarantine.

OPERATION 1. INVENTORY AND PLANNING 2. RESEARCH

Is there a Policy? Yes

Does it incorporate hygiene? No

Is the policy adequate?

Is the policy correctly interpreted?

Is there a strategy? Yes

Does it incorporate hygiene? Yes

Is the strategy adequate? No - broadly aims at pine inventory in winter and hardwood inventory in summer.

Is hygiene considered at the PLANNING stage? Yes but variable.

Is hygiene incorporated in the PRESCRIPTION? Yes

What is the PRESCRIPTION for this operation?

HYGIENE — Access restriction) variable under divisional control
vehicle cleanliness)
Timing of access)

Is hygiene TRAINING effective? No specific training for section. Past Divisional and Interpreters knowledge used.

Is hygiene IMPLEMENTED as prescribed? Yes. Not fully known.

Is there a CONTROL SYSTEM AND FEEDBACK? No

OPERATION WILDFLOWER COLLECTIONS

Is there a Policy? Yes

Does it incorporate hygiene? Ambiguous - subject to necessary management condition

Is the policy adequate? No

Is the policy correctly interpreted? Not known

Is there a strategy? Yes

Does it incorporate hygiene? Ambiguous

Is the strategy adequate? No

Is hygiene considered at the PLANNING stage? sometimes timing of operation and access route

Is hygiene incorporated in the PRESCRIPTION? No prescriptions

What is the PRESCRIPTION for this operation?

No prescription except for endorsements on licenses prescribing access restrictions) vehicle cleanliness) Timing of access) No standard prescription variable under divisional control.

Is hygiene TRAINING effective? No - some informal training when licenses are endorsed

Is hygiene IMPLEMENTED as prescribed? No knowledge due to lack control/ feedback system.

Is there a CONTROL SYSTEM AND FEEDBACK? No endorsement of license offers opportunity for control but rarely used.

OPERATION Leases - communication sites/grazing leases

Is there a Policy? Yes - circulars

Does it incorporate hygiene? No

Is the policy adequate?

Is the policy correctly interpreted?

Is there a strategy? Yes

Does it incorporate hygiene? No

Is the strategy adequate?

Is hygiene considered at the PLANNING stage? Yes - in

(a) Development of communication site

(b) Access to some leases e.g. inside quarantine.

No other consideration.

Is hygiene incorporated in the PRESCRIPTION? No

What is the PRESCRIPTION for this operation?

No

Is hygiene TRAINING effective? No

Is hygiene IMPLEMENTED as prescribed? No

Is there a CONTROL SYSTEM AND FEEDBACK? No

3. PLANNING

G. Heberle (Chairman)

A. Lush

G. Malajczuk

DIEBACK PLANNING REVIEW 11/8/82

1. Current Status: I & P Involvement in Dieback Work

1.1. Dieback free maps prepared from 70mm photos

Current capacity about 50,000 ha each year.
Due to expense (up to $10/ha?) and low capacity only used in quarantine areas and for special areas outside quarantine.

1.2. Dieback mapping by other than 70mm photos

Negligible dieback mapping by I & P since about 1973. Divisions map cutting coupes prior to cutting but inadequate records kept of this mapping.

1.3. Dieback planning involved in all forest operations ie. logging, S.E.C. lines, mining, mining exploration, burning, roadworks, fire suppression, construction of dams etc.
Currently dieback maps (70mm) prepared for most planned operations in quarantine except burning.
Updated dieback maps for operations outside quarantine often not prepared except for logging. Old dieback maps (pre 1973) with some additional field mapping used for such operations.

1.4. Dieback risk map The HOCS system has maps for all forest blocks based on 1973 dieback maps. Now preparing new dieback risk maps (hygiene maps?) for quarantine areas covered by 70mm dieback free maps.

1.5. Quarantine logging Trials Detailed planning done for these. New 70mm dieback free maps used.

1.6. Quarantine areas No new areas quarantined since 1.78. Some additional areas suggested for quarantine.

1.7. Dieback rate of spread, intensification. No work done since about 1973.

1.8. Dieback recognition A draft manual and booklet prepared 1981.

1.9. Foresters Manual, Operations Plan, Jarrah 81, Industry Control notes. Some involvement in preparing these.

1.10. Hardwood Logging Plans These mention dieback and take account of roading, burning, dieback photography, seasonal constraints etc. One year plans and 3 years + plans prepared.

2. Existing Planning Needs

2.1. Dieback location maps of adequate and practical accuracy to be used in planning all forest operations.

2.1.1. It would be good to have 100% accurate dieback maps prepared from 70mm photos for all operations but this is not practical at present as only about 50,000 ha/year can be mapped and the accurate life of the maps may be as short as 5 years.
If forest has not been quarantined/quasi quarantined there may be a lot of incipient infections and the dieback free maps may therefore be less reliable than usual.

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2.1.2. Needs investigations to improve the practicality of the 70mm system as now applied.
How can the current low productivity (10,000ha mapped per year per 2 man crew) be improved? How accurate are the dieback free maps in fact? How accurate do they need to be for various operations?

2.1.3. An annual programme of dieback mapping by other than 70mm photos by I & P staff needs consideration. Procedures and standards etc. need to be defined.

2.1.4. Need to review "dieback types" to be shown on maps. May need different types on maps for different purposes. Current 70mm maps do not indicate the severity of the dieback.

2.2. Most staff and many employees would benefit from training in dieback recognition. Need to draw up training programmes, booklets, films? etc.

2.3. Need for monitoring of dieback spread and intensification and for predicting site dieback susceptibility and impact.
Need to monitor success of dieback hygiene in various operations, locations, seasons, operators etc. so that action can be taken where necessary.

We should know at reasonable accuracy what the current area of dieback is and current rate of increase. Also which areas are resistant/tolerant.

2.4. Need to classify the forest by various values eg. monetary value, conservation value etc. Re-instatement of IMU (Intensive Management Unit) approach should be considered. So that mining, S.E.C. lines etc. can be directed where possible, away from such areas. Perhaps so can apply better diebackhygiene (eg. 70mm dieback mapping) to such areas. May be th A.P.I. forest type maps (all were prepared before 1965) should be updated or replaced with new forest type maps. Should separate pole and non pole forest, graveyard and non-graveyard dieback forest, wandoo, jarrah, karri, dominant stands etc.

2.5. Benefit in having dieback, contour, susceptibility, dieback impact information, and other information in computer so can simulate dieback spread, select best alignment for S.E.C. lines etc.

Should include quarantine entry information. Must be able to manipulate and assimilate data relevant to dieback eg. by using FMIS.

2.6. Need closer contours than available for much of forest at present to use in planning logging, drawing dieback risk maps etc. The 2 metre contour orthophotomaps of the Collie basin and some townsites are excellent. Extended coverage of orthophotomaps would assist.

2.7. Would be great benefit in having each division draw up a brief annual Dieback Control Working Plan along the lines of the divisional Fire Control Working Plans.

2.8. Planning is directed mainly at protecting the forest against disease.

Needs to be more dieback rehabilitation planning. Would require maps showing dieback impact to date eg. understorey only or graveyard. Information on tolerance/susceptibility of various tree species and forestry potential of these species would also be needed.

2.9. Planning needed at various timescales eg. short term (1 or 2 year?), mid term (3 year to 9 year?) and long term (10 years + ?). Needs to be plans for all relevant activities in the forest eg. logging, burning, dieback photography, mining, roading, rehabilitation etc.

2.10. Need good information on site factors affecting logging eg. summer/winter bush.

2.11. There is a need for maps predicting site susceptibility (probability of an infection succeeding by season) and dieback impact (proportion of understorey/overstorey likely to die in a specified period after infection). These maps would incorporate soil, vegetation, geological and contour information.

2.12. Socio economic information is required eg. present and future recreational pressures on various parts of the forest. Popular routes through the forest. Cost/benefits of protecting various parts of the forest.

3. Problem areas with current policy

3.1. 70mm dieback mapping should be directed to where it is of most use. No point in making dieback maps which will be little or never used. Particularly if there are areas nearby where dieback hygiene is inadequate due to use of inaccurate dieback maps. Should only map quarantine areas when and where there is a need for the maps. Otherwise map outside quarantine where maps are needed.

3.2. The Department can be proud of its expertise and performance in Safety and Fire Control. Three reasons for this would be the commitment of the staff and employees, good training programmes and an adequate management structure. It is doubtful whether dieback control is at anything like the same level of expertise. All three areas would benefit from attention, particularly management structure. There is a need for a full time Inspector Dieback in State Headquarters with adequate support staff including at least one senior field officer in each region eg. Dieback Control Forester.

3.3. Dieback and dieback risk nomenclature. Needs sorting out. Drafts have been circulated for some time.

3.4. Current policy on re-entry of operations into quarantine needs clarification. Burning and related road works has been allowed in quarantine, sawlog logging of trial areas has been allowed, as has Wundowie firewood logging, Worsley Alumina has constructed a conveyor line, the S.E.C. is to construct a pipeline and a small area near Collie has been excised from quarantine for coal mining.

Mining operations probably can keep out of quarantine for more than 10 years, but exploration will continue in quarantine.

Access for public utilities including construction of S.E.C. lines and at least one dam is likely in the next 5 - 7 years. S.E.C. pole resources outside quarantine are diminishing rapidly and quarantine resources will be needed in some divisions in less than 2 years.
Further Hardwood sawlog from quarantine will be essential in about 1984 in the southern region (Deanmill, Pemberton/ Northcliffe/Shannon, Jardee/Quininup), in about 1985 in the central region (Collie, Wilga, Kirup, Nannup) and in about 1985 in the northern region (Dwellingup, Jarrahdale, Welshpool).

4. Required Policy Needs for the Future

4.1. Revise 70mm mapping policy as per 3.1.

4.2. Move up dieback control in the Departmental priorities aiming at improving performance to the high level currently achieved in safety and fire control. Would require increase in staff working on dieback control and research and more expenditure on dieback training.

4.3. Draw up a policy for dieback mapping by other than 70mm photos.

4.4. Publish a Foresters Manual pamphlet covering dieback control as soon as possible. Publish dieback recognition information.

4.5. Extend quarantine areas as a dieback control measure not just as a 3 year quarantine before mapping eg. quarantine after cutting to keep dieback free.

4.6. Implement active road closures in areas where it is practical and providing that the benefits out weigh the disadvantages.

4.7. Develop policies, management techniques, mapping programmes for pathogens other than Phytophthora cinnamomi eg. Phytophthora citricola, Armillaria.

5. Research Needs

5.1. Why do plant species vary in their susceptibility to P.c. in any particular environment. Why do particular species vary in their susceptibility in different environments = landform, microclimate.
List all common species (natural and introduced) by dieback susceptibility classes by landform classes or whatever.
Map the forest into dieback susceptibility/impact classes.

5.2. Develop a quick accurate P.c. test for use at divisional level.

5.3. What is rate of spread uphill, downhill on various landforms/ microclimates.

5.4. What affect does dieback have on growth rates of various forest species on various landforms/microclimates.

5.5. How long does it take for dieback symptoms to show by species, landforms/microclimates.

5.6. Quantify - who spreads most dieback in each division.
Is it timber companies, ourselves, mining companies, farmers

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recreationists, trailbike riders etc.

Where should we be directing our training and publicity? What are some good measures of dieback spreaders eg. amount of soil shifted per year?

5.7. How much dieback spread is unavoidable natural downhill spread and how much is due to new infections artificially spread.

5.8. Research into areas currently classified as suspect and uninterpretable with the aim of reclassifying them as dieback or dieback free.

5.9. Methods and costs of eradicating and excluding dieback at garden scale and field scale.

5.10. Silvicultural treatments to control or disfavour dieback.

5.11. Prediction of dieback spread and impact.

5.12. Dieback rehabilitation data. Disease tolerance/susceptibility and forestry potential for various species.

5.13. Cost benefit data for dieback hygiene. What standard of road is really necessary in each season. What type of washdown is adequate. How much spread of dieback is acceptable? What is the cost of a new dieback infection as a result of poor hygiene?

5.14 Tree breeding research to find resistant or tolerant strains of jarrah and other indigenous species.

6. Staff Needs for Dieback Work

6.1. All staff should be adequately trained in dieback knowledge depending on their jobs. Annual and career training programmes should be drawn up.

6.1.1. Dieback control should be adequately covered in the Foresters Manual.

6.1.2. There should be publications on dieback control in various operations inside and outside the department eg. dieback control in mining, by apiarists, S.E.C., roadworks (by FD., timber industry, shires, Main Roads etc.)

6.1.3. There should be publications on dieback recognition. To assist in training and operations.

6.1.4. There should be a book summarising the latest knowledge about dieback, dieback research etc. Revise it as necessary.

6.2. In addition to the 70mm dieback mapping groups (which may need increase in staff), some other I & P staff should be engaged in mapping dieback by other than 70mm photos.

6.3. Dieback Control needs adequate staffing See point 3.2.

See also attachment with [illegible]

105216/4/78-20M-MS/3998

Form F.D. 808

FORESTS DEPARTMENT

MANJIMUP REGIONAL Office,

To C. EBERLE, BUNBURY
G. MALAJCZUK, COMO

10 August 19 82

Western Australia

Reference-H.O.

Local F20/1

SUBJECT: DIEBACK REVIEW 1982 - PLANNING

Good forest management is dependent on good planning and two elements of planning must be clearly understood to appreciate the impact that dieback has on it:

Inventory of Resources
- forest types (species and quality)
- topography (summer/winter logging)
- dieback status etc.

Management of Resources over Time.
- operational planning (immediate for Dieback demarcation, logging, mining, burning, roading etc.)
- mid term planning (5 year logging, 3 - 9 year burning, 3 - 5 year mining).
- long term planning (long term sawlog yields, 15 - 20 year mining and burning).

In addition, the means to gather, manipulate and assimilate all of the data inherent in the above must be available.

- See attached tables for review data.

A.R. LUSH
R/L PLANNING

ARL:SAL

10/8/82

Current State of the Art	Existing Needs & Problem Areas	Required Policy Direction	Research Needs	Staff Needs
1. RESOURCES				
1.1 Forest Types				
- specie mapping good. - quality mapping fair to good	Clear identification of higher quality areas to match area to be logged with capacity to map dieback.		Determine logging prescription to fit forest structure, hydrological and Dieback needs.	
	Identification of areas regenerated and requiring protection from burning/roading/logging operations.	Definition of areas to be protected and tended.		
1.2 Topography				
- upland and lowland situations identified in the field. Rarely anticipated from photos or contour maps prior to operations.	Clear identification of good summer and winter logging areas. Clear identification of "high consequence" areas to aid road construction/maintenance, logging etc.	Definition of risk that can be taken, in light of consequences resulting from introduction of P.c.	Define "high risk"/"high consequence" areas.	
1.3 Dieback Status				
- interpretation and mapping of dieback location progressing slowly from 70mm photography.	Interpretation and mapping is slow, requiring effort to improve productivity through increased staffing and/or efficiency.	Reallocation of staff to be commensurate with the importance of dieback control.	Investigate alternative mapping techniques.	Adequate staffing, both operational and supervisory, to employ total dieback management.
- alternative dieback maps inadequate.				
- mapping management categories as a result of Dieback location is progressing using Regional definitions.	Clear identification of management categories and operational constraints is required.	Definition of management categories.		

Current State of the Art	Existing Needs & Problem Areas	Required Policy Direction	Research Needs	Staff Needs
2. TIME				
2.1 Operational Planning				
- Dieback photography and interpretation programmes are prepared annually.	Need to formalise the integration of logging, burning and photography.	Determine priorities for resolving conflict of logging, burning and photography	Determine cost effectiveness of mapping varying cell shapes and sizes.	
- Dieback demarcation only just possible in Southern Region due to Dieback map availability, and imminent operations.	Extensive demarcation required quickly. Problem of insufficient staff time and expertise has arisen. Basic surveying skills appear lacking and require training.	Clear definition of priorities required to assign staff to most important work. Upgrade all Dieback training both inside and outside Forests Department.		
		Increase interpreter capacity, together with supervisory and support staff.		see 1.3 above
- logging plan is prepared for 4 year term to cover J and K Sawlog and Chip. Nominal consideration given to Dieback logging technique - capacity to stockpile is neither favoured nor disfavoured - boundary locations mostly low in topography.	Manual preparation of logging plan is tedious (to say the least) and monopolises time away from other planning tasks. Late preparation of plan has caused late awareness of demarcation task. Albeit, dieback interpretation is the limiting factor.	Review priorities within Systems Analysis section to upgrade operational facilities before new developments i.e. streamline planning. Reduce level of J logging to reduce the mapping task and free up Dieback staff as an alternative to increased staffing.	Develop planning and simulation techniques for operations. Investigate socio-economic impact of seasonal logging	Provide sufficient staff to develop planning and simulation techniques for operations.
Minimal alternatives considered.	Simulation of alternative plans required to optimise needs.	See Above	See Above	See Above
- Burning is closely integrated with logging plans & is being progressively confined to predetermined buffers. 3 year old fuels required before Karri logging. Advance burning required befor Jarrah logging. 3 year old fuel required for dieback identification.	Past burning limits logging options. In jarrah, Dieback demarcation must be completed 2 years ahead of logging to allow time for advance burn and roading. Therefore, interpretation 3 years ahead and photography 4 years ahead.	Reduce the burning requirement by adopting a buffer system instead of broadacre.	Investigate alternative protection strategies.	Redirect staff from fire protection to dieback protection.

Current State of the Art	Existing Needs & Problem Areas	Required Policy Direction	Research Needs	Staff Needs
- Roading is beginning to be planned to the topography rather than the coupe.	Roads low in profile and on perimeters, causing winter logging difficulties and increased snigging distances.	Define safe road conditions.	See seasonal logging above.	
2.2 Mid Term Planning				
- G.W.P. nominates total resource and PI on 5 year basis.	Inadequate consideration given to availability of resource, as determined by burning constraints and interpretation/ demarcation limitations. Logging plans need to be extended to at least 10 years.	Determine levels of cut to match availability rather than to simply satisfy demand.	Identify effects of various reductions on industry specifically, and community in general. See 2.1 logging plan.	Appropriately trained staff.
- Rotational Burning Plans for the term of the rotation, 3 - 9 years.	Often inadequate consideration given to "no burn" period before dieback mapping.	Nominate priorities to resolve logging/burning/photography conflicts.		
- Photography and interpretation programme determined for 5 year period.	Need to integrate logging, burning and photography over at least 5 year period.	See Above.		
2.3 Long Term Planning				
- Sawlog yield determinations completed for Karri over rotation length.	~~The~~ No yield determination exists for Jarrah.	Determine yield for Jarrah and determine cutting levels which in turn determines Dieback mapping task.	See 2.1 logging plan.	
- Strategic burning buffers defined for the next 15-20 year period.	Need to re-determine the effect of these buffers on resource availability and set cutting levels to match, or alternatively adjust protection strategy.	Provide facility to quantify the long term effect of the strategic buffers on logging and dieback mapping.	See 2.1 logging plan.	
- Photography and interpretation programs not developed in long term.	Need to identify deferred Dieback mapping (viz. QT burning buffer that may not be mapped for 20 years.)	Acknowledge deferred mapping.	Identify policy/ legislative implications.	

4. ADMINISTRATION

D. Spriggins (Chairman)

J. Bradshaw

E. Jenkins

1. CURRENT SITUATION

1.1. Departmental Expenditure on dieback management 81/82.

	A/C No.	$
	11-220-	33,458
	11-230-	47,338
Q/T signs	17-511-01A-	3,137
	17-906-01-	10,514
	17-906-02-	5,296
		26,756
API 70mm	18-207-02-	38,292
Equipment	" " -03	4,373
Motorola	" " -04	30,591
Cameras	" " -05	3,346
Transponda's	" " -06	8,408
Light tubes	" " -07	430
Lab materials	" " -08	2,999
Interpretation	" " -09	3,955
		$218,893

1.2. No. of Presecutions and warning letters since quarantine began

Year	Prosecutions	Warning letters
1975/76	-	7
76/77	1	197
77/78	2	72
78/79	5	37
79/80	11	16
80/81	9	12
81/82	6	13
	34	354

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1.3. Divisional Staff time spent on hygiene and quarantine patrols (Estimates)

Region	Hygiene (Man days/year	Total Q/T patrols (Man days/year)
Northern	* 75	* 210
Central	1200	110
Southern	1600	89

* Excluding Darwin figures

1.4. Specialist staff time (man days/year)

	Protection staff	
Northern Region	140	
Central "	94	
Southern "	-	

2. EXISTING NEEDS AND PROBLEMS WITH CURRENT POLICY

2.1. General Comments

Agreed by group that before questions such as future staff needs, overtime, prosecutions etc. can be properly answered, two major areas need to be resolved.

(1) What should the objectives of future disease management be?

(2) Agreement within the Department on the techniques and standards to be applied in implementation of disease management.

1. Future objectives of disease management

Considered by many officers that the main thrust of management should be concentrated on preventing spread into worthwhile areas of upland forest capable of long term protection. Others feel that this was a somewhat negative approach and that maximum protection should be given to all the jarrah forest. The latter group considered there were many areas containing only some infections, where the danger period had probably passed and a useful forest could still be maintained. Such areas should not be "written off".

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There is thus a need to decide which of these two policies to pursue.

If the first policy is favoured it is recommended that each forest Block, whether inside quarantine or not be avaluated by an expert team. Data to be examined to include known dieback infections, past cutting history, quarantine entry records, road and powerline construction in relation to position in the landscape etc.

From the above examination it may already be possible to decide that some roads passing through the Block have been so exposed to sources of infection or are so likely to become infected in the future that some dieback management activities, eg. hygiene grading would be of questionable value. Other areas may be identified where, even though they may not have been quarantined or mapped, significant areas of apparently protectable upslope forest exist. Until better information is available, these areas should be given top priority in disease management by actions such as positive road closure and relocation split-phase logging and destruction of old upland drainage systems which seriously affect downslope forest.

2. Agreement on Standards

Although it is appreciated that information on dieback is incomplete and constantly changing, there is concern at the variation in dieback knowledge and application of hygiene techniques within the Department.

The lack of an up to date section of the Foresters Manual is a problem which should be rectified. Apparently conflicting statements have been given by different sections within the Department. There is a need for a co-ordinating group to oversee, update and circulate new information so that everyone receives the same advice at the same time. A group similar to that set up for Fire Control was suggested i.e. Supt. Protection (liaising with Research) and the R/L Operations from each of the three regions.

2.2. ADMINISTRATION ITEMS IN 1973 D.T.F.R. & RECOMMENDATIONS WHICH ARE STILL RELEVANT AND SHOULD BE IMPLEMENTED

1. re Term of Reference 2

"Report on existing (1973) hygiene measures and the suitability or otherwise of these"

P.15. Para 4 - "To make hygiene more effective, necessary to define control procedures more clearly and to appoint persons responsible for standards of quarantine and hygiene as a full time committment.

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P.15 Para 5 - "The less than adequate control of hygiene standards have limited the success of the hygiene measures to date. Necessary to re-write the hygiene measures laid down in the Foresters Manual.

Comment: As at 1982, none of the regional protection officers have a full time committment to dieback eg. Styles 100% fire, Quicke 40% fire, 60% dieback, Cowcher 40% fire, 60% dieback.

Comment: Hygiene measures in the Foresters Manual have not been re-written. Need now greater than in 1973. Need to have information which is readily graphed and easy to implement in the field.

2. re Term of Reference No. 3

re Para 2 - Need to take more positive steps with road closure and to select the minimum basic network of roads and tracks for fire protection. Road closure by merely falling a tree over the road entrance is often ineffective. Ripping up roads and planting would be more effective. Some officers have cautioned on over reacting on closure until alternative access for fire protection has been actually provided.

3. re Term of reference No. 4

P.20. re Planning & Control

Comment: Question whether planning has or "should be" designed to subordinate all activities to the need for protecting what is left of the jarrah forest" Many officers felt that this was a negative outlook, and less of the jarrah forest may be doomed than previously thought.

Comment: We consider that effort should be directed into managing large compact sections of forest likely to be kept free of dieback in the long term. The minimum area to be protected needs defining. Rehabilitation of affected areas to be given a high priority also.

Comment: Planning for cutting should not now be given top priority to salvaging the wasting resource if the operation is likely to threaten more forest as a result.

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Comment: Implementation of H.O.C.S. system has not been entirely successful. Cutting and regeneration aspects used well in the Southern Region. H.O.C.S. needs a greater staff input into it to maintain and update information. Also needs an inspection service to see it is used. Some officers feel the system needs streamlining to suit the end user. Needs to be recognised that a large staff input is required to get a H.O.C.S. system established.

P.21. - Better definition of when the "unsafe" period is, is still required. Currently a grey area. Some officers question if there really is a safe period at all. Considered that it is almost impossible to classify any access route as "safe". May be better to accept that all roads will become infected in the long term and concentrate effort and staff time into saving upland slopes.

Terms of reference No. 5

P.26. - Provision of contour maps needs to be speeded up. Suggested by some officers that maps of both 1:25,000 and 1:12,500 scale be made available.

Task force recommendations:

Item 4 - Roads and Engineering Works

Comment: Some officers consider that there is a need for a simpler plan for sale to the public, listing only the basic road networks. Roads deliberately closed or gated, not to be shown. Generally though this simpler plan was not favoured as it would tend to only keep the dishonest out. It was thought that if tracks are there they will be used.

Comment: A need for information notice boards to be located at areas where forest visitors congregate and have time to read material. Need to stress need to visitors to remain on forest roads only. Some officers questioned the value of these boards at all. Others thought more basic information should be transmitted to the public by short T.V. advertisements.

Comment: Manning of key entry points not warranted but weekend presence of staff in the forest is considered essential. In N.S.W. under the provision of the A.W.U. award agreement with the N.S.W. Forests Commission, wages staff can be rostered for weekend work and an equivalent two days taken

off during the normal working week. Such a system is worth examination for W.A. Some officers favoured an incentive scheme to make weekend patrol work attractive to existing officers.

Item 15 Control measures

Control of access under Regulation 115 of the Forests Act needs to be put to the test. If this regulation is effective, control of access into areas of forest outside quarantine should be attempted using this approach.

2.3. QUARANTINE ENTRY RECORDS

Issues:
- The time and effort involved in collecting and recording information is considerable; are all the records worth keeping? Several officers had doubts on their value.
- Considerable variation between Divisions on permit issue, use procedures and records of use (legal and illegal). F.D. entry and activity inside quarantine has sometimes been very questionable.

Discussion points:

- No set overall procedure laid down to cover the "how", "why" and "when" of quarantine entry permit issue and record keeping. A great variety of systems used and interpretation of standards exists.
- Records can serve two functions:
  1. Permits - Authorize entry and give Division some control over when/where legal entry can/cannot take place.
  2. Illegal entry records
     (a) Give some measure of when and where unauthorised entry has taken place so that Divisions can take preventative action, plan patrols etc.
     (b) Can give I & P interpreters a record of where and when illegal entries have taken place. Could be a useful aid in dieback risk plan or management plan preparation.

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- Recognized that Divisons are unlikely to locate and record all illegal entries and usually have no record of where the illegal travel occurred once inside quarantine.

- Pigs appear to have been a vector in disease spread yet a broadscale effort to eliminate them is not taking place. Use of approved hunters was suggested.

- Not possible to say whether dieback has stopped spreading in quarantine areas because of lack of information on disease spread since 1976. Was roading and unhygienic logging the main vectors of disease spread and quarantine entries since then of insignificant consequence?

- I & P interpreters have so far not used the illegal entry record data collected by Divisions for use in dieback free mapping. They considered the information an incomplete record and difficult to extract. Use of information made in selecting Dwellingup logging trial area.

- I & P interpreters come across numerous instances of illegal entries during field mapping of a cell. These are not formally recorded but need to be for dieback management plan preparation in the future and for passing on to Divisions.

- Decisions on whether permits can be used is sometimes left to one officer only in a Division. This can annoy the permit holder.

Recommendations:

1. Permit issue and entry recording (legal and illegal) to continue until a disease management plan is produced. Thereafter a completely new appraisal required.

2. Until disease management plans are available, a critical review required in each Division with quarantine to decide whether recording legal use of all routes is necessary eg. a frequently used road leading to a farm just inside quarantine. Protection Branch, Region, Division and an expert in dieback knowledge to be involved in the appraisal.

3. Effort be put into more positive road closure of tracks and roads leading off well used permit routes traversing quarantine. Fire suppression access not to be overlooked in the process.

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4. Information be shown on signs where people enter quarantine, stressing the reason and the need not to venture off the main approved route.

5. A composite Departmental instruction be prepared (for later inclusion in the Foresters Manual) to cover standards for quarantine entry permit issue and record keeping. These standards to be maintained throughout the Department and monitored by Protection Branch.

6. To minimise inconvenience to the public, the Divisional Forest Assistant to be in the position to decide whether entry under an already issued permit is permissible. Guidelines to be laid down by the D.F.O. and Protection Officer.

7. Dieback mapping group to be asked to comment, as a result of mapping results so far, whether illegal or legal entries appear to have had a significant effect on disease spread.

8. If pigs have been definitely linked with dieback spread a more concerted effort be made to eliminate or reduce their numbers.

9. I & P dieback interpreters to examine Divisional records of illegal entry when preparing dieback plans.

10. I & P dieback mapping group to be asked to formally record cases of illegal entry they discover during field mapping so that dieback management plans can be prepared.

11. Computer storage of quarantine entry data (legal and illegal) to be examined to determine if this could make the information more accessible for users. Some officers felt this could be a technical overkill.

12. Only the following current forms used for recording quarantine entry to be used in future. Other records to be held until inspected by Protection Branch.

    FD 626 - Permit to enter quarantine area
    FD 638 - Extension of quarantine permit.
    FD 640 - Daily ground report of quarantine area.
    FD 641 - Report on illegal entry
    FD 678 - Quarantine useage record by Permit Holders.
    FD (Not yet allocated) - Progressive quarantine monthly report.

    It was suggested that if these forms are retained that N.C.R. forms be printed to ease the burden of "form filling".

Apart from the monthly progressive report which summarizes the basic information on quarantine entry, all the other forms to remain in the Division.

One person in each Division, preferably the Forest Assistant to be responsible to the Divisional Protection Officer for recording permit use data and other records.

A wall map to be kept in each Division to show for quarantine areas:

(a) Major approved routes normally suitable for all year round access which have been approved by D.F.O.

(b) Minor routes suitable for dry soil condition access only, approved by D.F.O.

(c) Illegal entries

To be shown by means of an attached sticker showing:

1. Progressive No. of illegal entries at that point.
2. Location and map reference of entry.
3. Date of last illegal entry.

Also any information on where the illegal vehicle travelled once inside quarantine.

Protection Branch to regularly monitor the upkeeping of this plan. We do not recommend that a duplicate copy be held elsewhere.

Some officers queried whether illegal entries should continue to be recorded at a particular point, once a set number of illegal entries had occurred, eg. > 10.

There was also a request for a simpler system to be devised to cover the entry of a large number of vehicles into quarantine over an extended period, eg. Worsley Conveyor Line.

2.4. QUARANTINE PATROLS, APPREHENSION & PROSECUTION

Issues: - How effective are they, would time and effort be better spent on improving hygiene observation by large earth movers.

- Should they attempt to cover the entire quarantine perimeter?

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- How frequently should they be carried out on a routine basis?

- Is there sufficient staff, to carry out patrols adequately?

- When and how should a special patrol be carried out to apprehend suspected illegal entry?

- Are sufficient prosecutions carried out?

- Are fines commensurate with the offence?

Discussion Points:

- Some Divisions have an extensive quarantine perimeter difficult to cover on a weekly basis.

- Northern Region Divisions normally patrol their entire quarantine perimeter each Friday and Monday. Other regions do not patrol anywhere near this frequency. General feeling is more time should be spent on patrols.

- Except by using aircraft, illegal entries very difficult to detect in dry summer months and probably not very serious, conversely entries in wet periods could be very damaging.

- Northern region have made effective use of partially fit but knowledgeable older employees to carry out routine patrols.

- Most of the illegal entries occur over the weekend when foresters are normally not present in the forest.

- Many officers not keen or skilled in interviewing offenders.

- Fines imposed have only been in the $20 - $80 ranges.

- Some recommended prosecutions failed because of slowness in handling paper work and lack of training of officers in interviewing procedures.

- Special weekend patrols involving aeroplane and ground crews to detect illegal offenders have had varying success. Some Divisions felt they were very worthwhile, others were costly and discovered little.

Recommendations:

Recommendations:

1. Each Division to be critically examined with respect to extent of illegal entries and suspected impact of these on the forest. Quarantine patrol levels to be reviewed as a result of this approach; to be carried out by Protection staff, Region, Division and someone with expert dieback knowledge.

2. Concentrate patrols in areas of forest suffering the greatest impact from illegal entry and at times of the year when spread is likely.

3. Examine the use of older, partially fit but experienced wages employees to carry out routine patrols. It was suggested that their legal powers to apprehend be examined.

4. Examine the probability of using retired foresters, policemen M.W.S. rangers etc. to carry out weekend patrols, and arranging their legal ability to apprehend offenders. Most officers prefer to see this work tackled by our own staff as a first option.

5. Give training to staff likely to be involved in apprehension of how to interview etc.

6. Carry out combined aerial and ground patrols to apprehend offenders only where illegal entries are high and likely damage to good forest is occurring.

7. Offenders who dont respond to warning letters to be prosecuted. General feeling was that Department has taken too soft a line with people who although it may have been their first offence were well aware of the seriousness of breaching disease regulations.

2.5. STAFF NEEDS FOR DIEBACK MANAGEMENT

Issues:- Difficult to obtain "extra" staff to carry out specialist work such as dieback interpretation. Normally some other activity suffers in the process.

- Is all work currently being tackled (or thought to be necessary) really effective. Could some aspects be reduced in extent or should more time and effort be given to dieback.

Discussion Points:

- Divisional staff consider they are not putting as much time into dieback management as they should be.

- Unlikely to be able to obtain more staff for dieback management. Failure to provide adequate staff has been a major factor in

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non-achievement of some departmental goals in the past, eg. safety program did not really proceed till a full time safety officer was appointed. Important to direct effort into areas where it will be most effective.

- Standard to apply in activities such as permit issue and control, dieback line demarcation, hygiene techniques etc, are unclear. If carried out fastidiously the staff time involved can be considerable eg. leading apiarists into their apiary sites in quarantine.

- Confusion sometimes results when new research information is made available on an informal basis to an individual officer.

- Because standards to apply are not always clear and dieback management is much more complex than fire protection, there is a tendency for Regional and Divisional protection officers to put their effort into fire protection rather than dieback management.

Recommendations:

1. Attempt to define a more uniform appoach to dieback management throughout the Department. "New" information to be screened by Protection Branch and the R/L operations of each of the 3 regions before release.

2. Concentrate effort and staff time on areas of dieback management which will yield the best return. eg. prevention of spread into large compact areas of protectable high quality forest. At the same time be careful not to "write off" large areas which although partly diseased may survive quite well with sound management.

3. Appoint regional officers with full-time commitment to dieback control matters. Some officers disagree and favour integration with other duties.

4. Examine source of staff outside Divisions for aspects of dieback management eg. patrols, M.W.S. officers, research staff.

2.6. CO-OPERATION OF OTHER AUTHORITIES AND AGENCIES IN DIEBACK MANAGEMENT

Issues: - Some agencies do not advise of intended construction work in State Forest until just before commencement.

- Some agencies have complained about a

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variation in hygiene requirements between Divisions and individual officers.

- Feeling that senior management in most outside organizations have been adequately briefed on dieback but this information has not been passed down the line very well to operator level.

Recommendations:

1. Each region to arrange to contact each organization in their area at least once a year on a systematic basis to collect and document.

   (a) Advance plans of any future activity in State Forest.
   (b) Training needs of the organization down to operator level.

   Arrange top level discussions where advance information is not being made available eg. S.E.C. rural landholder lines.

2. A departmental decision be made as to what the message to outside organizations needs to be. Need to define the areas we really need to concentrate on and gain co-operation on rather than attempt to apply hygiene in every situation.

3. Need for a "Nifty Numbat" type publication aimed at operator level. This publication to carry the endorsement of the agency involved so as to carry more weight to the message.

4. Hold training sessions for operators in field and pitch the session to their level.

5. Region to co-ordinate a follow up system to check that briefing on dieback hygiene requirements is always given before the start of any new project and to new operators as they arrive.

6. Adequate time to be devoted to monitoring of field operations by outside agencies to ensure they are complying with instructions.

2.7. INCORPORATION OF DIEBACK HYGIENE IN DEPARTMENTAL DOCUMENTS, LEASES ETC.

Issue: - Although some dieback management requirements have appeared in leases, licences etc over the last few years there are cases eg. contracts, where dieback is not always mentioned or there is a variation in the conditions.

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Recommendation:

Once it has been agreed as to the dieback management standards to be applied in the future, a list of standard conditions to be drafted for inclusion where appropriate in all documents where dieback management is needed.

5. PLANTATIONS

D. Keene (Chairman)

D. Lejeune

K. Kelers

J. Gilchrist

DIEBACK POLICY REVIEW - PLANTATION PRACTISES

PREAMBLE

1. The Committee decided that there were three plantation types to be considered :

   (a) Hills - generally loamy soils well drained;

   (b) Coastal - generally sandy soils well drained;

   (c) Sunkland - generally infertile soils with poor drainage.

2. Some variations in practise between the Plantation types were identified. The condition to each type has been recorded separately.

3. The land use classification applying to each plantation was considered. The present land use classifications applying to plantations do not preclude their use for production forestry, nor do present production forestry activities impair the primary land use, where it is not for production.

4. In the context of dieback control, there was considered to be little difference in the type of work activity, as all were intensive in nature and most involve the disturbance of soil, e.g., ploughing, planting, roading, harvesting etc.

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5. The results of the forest damage assessments recently carried out by Superintendent Peet, as they related to dieback were considered. The issues recognised in the assessment are attached.

A. HILLS PLANTATIONS

A1 *CURRENT PRACTISE*

A1.1 Some plantations (i.e., Mundaring) are in quarantine.

A1.2 Where quarantine is near plantations, a buffer (400 - 800m) of hardwood bush outside quarantine, generally adjoins the plantations.

A1.3 Plantations are generally planted on loams thought to be resistant or where the impact of the disease is low.

A1.4 In the northern region plantations have been established on badly dieback affected areas, as a rehabilitation measure. The soils are different and symptoms of the initial infections are still visible. Points made in regard to Hills Plantations generally should be read with this in mind. e.g. Plantations adjacent to Albany Highway.

A1.5 *Topography in Relation to Dieback*

The areas are generally well drained and undulating ranging to steep. Most areas are below the peneplain on soils derived from igenous rock with drainage directly into major valleys and water courses.

A1.6 Under these conditions, if dieback exists, the natural spread into hardwood forest would be low.

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A1.7 If the disease exists or could be transmitted, there is no hygiene practised within the plantation (except in quarantine) and establishments, maintenance and harvesting operations would allow spread through the plantations.

A1.8 Movement in and out of plantations is not restricted or hygiene practised (except in quarantine). i.e., no washing down of equipment used. However, particularly in the logging phase, specialised equipment not used elsewhere is employed. Road permits issued for log trucks restrict the access to and from each plantation to a single specified route. If the route is not bitumen, dieback could be spread along the road. It is more likely the disease spread from roadside infections than from inside the plantation.

At Mundaring all access into plantations is limited to dry soil conditions.

A1.9 Generally the establishment phase is complete, though in second rotation areas no particular hygiene measures are practised.

A1.10 Despite no precautions being taken and intensive operations involving soil movement and disturbance occurring for 50 years, there is no visual evidence of the disease within plantations.

A1.11 Deaths of pines noticed have not been attributed to dieback after research soil testing.

A2 *EXISTING NEEDS AND PROBLEM AREAS WITH CURRENT POLICY*

A2.1 Before any changes to present policy are recommended proof is required that Phytophthora is present or can be sustained in the red loams. This should be ascertained.

A2.2 The current policy of not allowing any gravel supplies to be obtained from quarantine areas in Central Region has increased the cost of logging roads. There is a need to release areas from quarantine or give permits to obtain gravel from existing pits in safe periods.

Gravel has been obtained from quarantine in the Northern Region with special hygiene precautions.

A2.3 It is understood that the Mundaring Plantations were placed in quarantine for ease of management. For consistency with hardwood logging trials in quarantine operations at Mundaring Plantations have had similar constraints. Further consideration could be given as to whether the constraints are really justified.

i.e., If this logic was carried to conclusion we would then carry out hygiene measures in all plantations without further justification.

A3 *REQUIRED FUTURE POLICY DIRECTIONS*

A3.1 Review the policy of access into presently quarantined plantations.

A3.2 Direction of research into proving the presence and impact of the disease in hills plantations.

A3.3 A re-inforcement of current policy on operations in plantation areas unless research information proves otherwise.

A3.4 Should policy appear to need review, consider the economic impact of any proposed change.

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A4 *RESEARCH NEEDS*

A4.1 Confirmation of the presence or level of impact of the disease in hills plantations and the effects on pine and indigenous species, if any.

A5 *STAFF*

A5.1 A priority of research staff was recognised to ascertain whether a problem exists. The Committee could not find such evidence.

A5.2 Reinforce research findings with staff training programmes.

B. COASTAL PLANTATIONS

B1 *CURRENT PRACTISE*

B1.1 There is no quarantine in or near plantations.

B1.2 A dieback problem has been recognised in the Hardwood forest adjoining plantations.

B1.3 Some hygiene measures are taken in plantation areas, but this is not general or standardised.

B1.4 Outside plantation boundaries, where there is evidence of dieback, hygiene is practised.. e.g., Wanneroo - gas pipeline.

B1.5 South of Perth to Busselton protectability of the hardwood forest (excluding Tuart) has been considered doubtful.

B1.6 Deaths of pine have not been attributed to dieback. Drought has been considered the major problem.

B2 *EXISTING NEEDS AND PROBLEM AREAS WITH CURRENT POLICY*

B2.1 There appears to be an unclear definition of the dieback problem on the coastal plain.

B2.2 Clear directions are required as to the need for standardised dieback hygiene measures.

B2.3 Are limestones areas susceptible? No?

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B3 *REQUIRED POLICY DIRECTIONS FOR THE FUTURE*

B3.1 Reinforce current operations unless new research information shows need for change, then consider economic impact of such change.

B4 *RESEARCH NEEDS*

B4.1 Ascertain impact of dieback on coastal sands, on pine and indigenous species.

B5 *STAFF*

B5.1 A priority of research staff was recognised to acertain whether a problem exists.

B5.2 Reinforce research findings with staff training programmes.

C. SUNKLANDS PLANTATIONS

C1 *CURRENT PRACTISE*

C1.1 Within plantable areas there is no hygiene practised, from dozer demarcation operation onwards.

C1.2 Outside plantations normal hygiene is practised in the native forest.

C1.3 It is recognised that dieback is widely spread throughout the Sunklands.

C1.4 There are scattered pine deaths attributed to Phytophthora cinnamomi. At this stage thought not to be significant as resistant strains of Radiata have been identified and are to be used in future as the seed source base.

C1.5 There is no quarantine of hardwood forest areas. Proposals have been submitted, but not implemented.

C1.6 Generally the Sunkland is considered susceptible, having soils with poor nutrient status, compounded by poor drainage in some areas.

C1.7 Protectability of surrounding forest is considered difficult because of large amounts of dieback and the level of activity.

C2 *EXISTING NEEDS AND PROBLEM AREAS WITH CURRENT POLICY*

C2.1 Current dieback information is inadequate and based on old photography and no quarantine. Need to define protectable forest areas worthy of increased management control.

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C2.2 Is the sequence of plantation development correct, based on present information that most heavily infected areas be planted first? Some conflict of opinion was recognised.

C2.3 Further knowledge of dieback effects on P. radiata may be required. The effect of current silviculture and clover establishment on the impact of the disease should be closely monitored.

C2.4 Hasten the use of resistant strains of P. radiata in the Sunklands

C3 *REQUIRED FUTURE POLICY DIRECTIONS*

C3.1 Reinforce policy as provided in the statement of intent to plant suitable soils within any compartment, dieback infected or not. i.e., Dieback is not the reason for the Sunklands project.

C3.2 Provide improved dieback information to allow improved hygiene in unplanted uninfected areas.

C3.3 Review policy on unplantable jarrah forests enclaves within plantations. i.e., Should active rehabilitation work be carried out?

C3.4 Ascertain the impact of dieback on P. radiata. Should most heavily infected areas be planted first as a greater risk to pines may occur.

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C4 *RESEARCH NEEDS*

C4.1 Determine the impact of dieback on radiata and silvicultural practices.

C4.2 Monitor the impact of dieback on resistant strains of P. radiata.

C5 *STAFF*

C5.1 Additional or redirection of staff is required to provide up-to-date mapping of dieback, so effective hygiene can be implemented.

C5.2 Reinforce research findings with staff training programmes.

EXTRACT FROM FOREST DAMAGE REVIEW MAY - JUNE 1982

SPREAD OF DIEBACK DISEASE AND OTHER DISEASES

PERATION	ISSUE	SUGGESTED ACTION	DIVISIONS RECORDING THE ISSUE
ANTATION TABLISHMENT D SOFTWOOD GGING	Probable spread of dieback within plantations by logging operations. Impact is not known because of lack of indicator or susceptible species. Difficult to specify sensible hygiene measures under these conditions.	Need for further research to assess the impact on future land use and possible spread of dieback from the plantations into surrounding forest. Action: List for Dept. review.	MUNDARING HARVEY NANNUP KIRUP COLLIE
	Need to improve hygiene (wash-down) when dozers move from cleared compartments through hardwood ridge tops to next job.	Divisional staff to tighten control procedures. O.I.C. to arrange further training of F.D. and contractors in hygiene requirements. Action: O.I.C.	BUSSELTON
	What are the effects of current plantation practices on dieback spread in coastal soils? Inadequate information available on which to base a sensible hygiene programme.	Map areas to be cleared and assess possible damage to likely environmentally susceptible areas, e.g. M.P.A.s. Action: Division and Region.	WANNEROO

6. NURSERIES

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DIEBACK REVIEW 1982 : SUBMISSION ON FORESTS DEPARTMENT NURSERIES

August, 1982

R.J. Edmiston

INTRODUCTION

Nurseries can be a major source of distribution of *Phytophthora cinnamomi* when hygiene standards are absent or low. Even when maximum economic hygiene conditions are implemented it is impossible to declare a nursery totally clean. The best that can be achieved is to cover all possible sources of contamination in the most efficient manner to guarantee the highest level of protection.

The Forests Department has seven nurseries under its control sited at Manjimup, Hamel, Narrogin, Nannup, Gnangara, Karratha and Broome. Because of the difference in climate and soil types and production methods, it is necessary, for this report, to discuss each nursery separately.

MANJIMUP NURSERY

Current Techniques

Soil Treatment, Sowing & Hygiene

Due to the high and comparatively recent priority of the large scale raising of trees for replanting in the karri forest, Manjimup is fortuitous in being able to develop its nursery in a modern hygienic manner. The jiffy pot production area is in a large shed. The soil is mixed in a separate room, the pots filled, and then placed in a steam-air steriliser for 30 minutes at 60°C. This temperature eliminates plant pathogens but leaves most beneficial fungi and bacteria (Baker, 1957). Following sterilisation, the treated trays are moved to a separate section where a partially manual and automated system carries out the sowing procedure. The trays are placed on pallets and removed to an open area for growing on. The growing on areas are covered with an 8cm layer of blue metal to provide drainage and exclude soil splash. The plants are further protected with the pallets supporting the trays 25cm above ground level. Strict nursery hygiene precautions (O. Goss & D. Harrison, 1979) are taken with regular sterilisation of working, storage and despatch areas.

Open-rooted Stock

The open-rooted seedling areas are planted on a rotation system. All machinery used is washed down prior to entering clean areas and Ridomil at 0.5 gms/sq. metre (N. Malajczuk, pers. comm.) is applied immediately after sowing and again in early autumn to control Pythium and Phytophthora species.

Nursery Baiting for P. cinnamomi

A baiting programme of 50-60 random samples is taken during each of the spring and autumn periods which are the most susceptible periods for Phytophthora cinnamomi spread.

Watering

The catchment area for the dam used to supply water to the nursery traverses dieback areas. To eliminate the chances of infection from this source, the water is chlorinated, using gas, to a level of 1 p.p.m. residual chlorine.

Transport

Delivery trucks are confined to special plant despatch areas and are not allowed to enter the production site.

Existing Needs and Problem Areas

(1) The level of chlorine treatment to the dam water is questionable as to its full effectiveness. A level of 2 p.p.m. (Pauline M. Smith, 1979) is considered to be the safest treatment rate. Although it is possible that the 1 p.p.m. could be effective, an increase to 2 p.p.m., providing there are no phytotoxic effects, would be an additional safeguard. The higher application rate has not damaged plants at Hamel nursery.

(2) Most systemic insecticides and more recently fungicides, tend to become less effective with repeated use due to the development of resistant pathogen strains (Ian D. Geard, 1974). Ridomil is a systemic fungicide and its repeated use could build up resistant strains of pathogens in areas which are producing open-rooted stock on a continual or rotational basis.

HAMEL NURSERY

Current Techniques

Hamel nursery raises both jiffy pot plants and plants in 70mm plastic pots. No open-rooted plants are propagated.

Soil Treatment, Sowing & Hygiene

The potting medium is mixed outside the hygiene area and loaded into either a bulk bin or, in the case of jiffy pot stock, into pots in trays which are then transferred into a bin equipped with racks. The system is an air-steam injection method coupled to the bins. It is not as efficient in heat conductivity as the Manjimup plant and requires a longer period of treatment to ensure that 30 minutes at the desired temperature is obtained. The sterilisation temperature at the Hamel nursery is 78°C. The sowing procedure is performed manually under stringent hygiene conditions (Goss & Harrison, 1979). On the completion of sowing the pots are moved to the shadehouse area. Within the shadehouse a programme is in operation to raise benches approximately waist height both for hygiene and safety purposes and to facilitate thinning and handling of stock. At the present moment approximately one-third of the programme is completed. The floor of the shade-house is covered with a washed gravel base approximately 15cm deep and plants not on raised benches are placed on this medium. The whole shadehouse area is treated at the beginning of each season with Biogram to eradicate any pathogens present. Bitumen areas are sprayed weekly and footmats at the entrance to hygiene areas are impregnated daily with Biogram.

Nursery Baiting for P. cinnamomi

At the beginning of each season baiting of each medium that constitutes the soil mix is carried out. During the season the nursery is baited on a monthly programme using 30 random samples and the water is baited fortnightly.

Watering

The water for the Hamel nursery is drawn from a stream that traverses dieback country. The water is treated automatically with sodium hypochlorite at the rate of 2 p.p.m. (Pauline M. Smith, 1979), using an injection method. Until the end of the 1982 season the injection method was direct into the flow system without any holding period.

Transport

All customers are confined to a parking area outside the hygiene limits. Forests Department trucks entering the hygiene area for bulk loading are inspected and washed down at the nursery prior to admittance with copper sulphate.

Existing Needs and Problem Areas

(1) The main problem area was the direct injection of the sodium hypochlorite into the water without a holding period. No automatic system is infallible and the danger of contaminated water reaching the plants cannot be overlooked. There have been localised outbreaks of P. cinnamomi in 1981 and P. citricola in 1982; whether this was due to water contamination or some other means is difficult to say. Another tank has been obtained and sufficient storage is now available so that the water can be held overnight to ensure complete treatment.

(2) The efficiency of the soil bin and tray bin is suspect. Thermometer insertion holes at selected points need to be made so that there are no small pockets of soil not receiving the optimum treatment.

(3) The completion of the raised bench programme.

Research Monitoring

To ensure maximum efficiency with soil sterilisation, at present being undertaken by Engineering Branch.

The ongoing programme of baiting nursery soils and water by Research Branch at Dwellingup.

NARROGIN NURSERY

Soil Treatment, Sowing & Hygiene

Narrogin nursery supplies plants in the 70mm container only. The soil mixture is derived from local sources and is sterilised before use. To date sterilisation has been by the "Acre" machine which is a heat treatment of moist soil passing along a conveyor belt. To ensure total sterilisation, a temperature of 80^{o}C in the soil stack, after passing over the flame, is maintained. The sowing procedure is manual and similar to that used at Hamel nursery and is likewise

carried out under stringent hygiene conditions. The stock is then transported to the shadehouse and placed on concrete beds. These beds are treated with Biogram at the beginning of each season.

This year a stringent hygiene programme has been implemented, footbaths have been established and vehicles are excluded from the hygiene area. Mainly due to the problem of P. citricola, raised benches are being introduced into the nursery to prevent contamination from splash or soil contact, and the shadehouse will be treated with Biogram. The Acre soil steriliser is to be replaced with an air-steam system similar to the one at Hamel and drainage plus blue metal between the existing concrete beds in the shadehouse will further improve hygiene.

Plants are not transported between Narrogin and Hamel as in previous years.

Nursery Baiting for P. cinnamomi

Normally no baiting programme has been carried out. In 1981 Phytophthora citricola was introduced into the nursery shadehouse and, following treatment, a baiting programme was initiated during 1982 when the same problem evolved. During this baiting programme no Phytophthora cinnamomi was discovered.

Watering

Water for the nursery is available from two sources, the Wellington Dam supply and a dam on an adjoining poultry farm. The former is treated water and P.c. contamination through this source presents no problem. However, in periods of low rainfall the salt content can reach levels that are damaging to young plants and at this time the untreated dam water from the farm is used.

Transport

Delivery trucks are not allowed within the hygiene areas and are loaded with a roller system.

Existing Needs and Problem Areas with Current Policy

(1) Although no apparent infection has come through the poultry farm dam water supply to date, it does not rule out the possibility of this occurring. The problem could be overcome

by a sodium hypochlorite injection technique as used at Hamel. Since there is no contract guarantying the Department continuing use of the dam water, it is proposed that a desalination plant be installed in 1983 to use scheme water. With this proposal in mind it appears reasonable to defer any water treatment this year.

(2) The completion of the raised bench programme.

Research Monitoring

The current programme of testing for presence of P. citricola will ensure the detection of P. cinnamomi if present. This will be phased out on completion of the raised benches.

NANNUP NURSERY

Current Techniques

Soil Treatment and Hygiene

Nannup nursery raises only open-rooted pine predominantly for planting in forestry projects, although some private sales are made. Preparation of the nursery soil is by machinery contained within the nursery hygiene area. If machinery is brought in from outside, it is washed down first according to the hygiene standards in force. Following sowing, Ridomil 25kg/ha and Thiram 80kg/ha are applied for the control of pathogens. Once Thiram stocks are completed it is intended to use Ridomil only. A second application is applied two weeks after emergence. Lifted pines are packed in bags which are washed thoroughly in copper sulphate solution prior to use. Cardboard cartons or plastic containers are being considered as a more desirable alternative.

Nursery Baiting

Assessment of P.c. disease risk was conducted by Research (Trevor Boughton & C.E. Crane) at the Nannup nursery in 1980. Only 300 trees were tested of a total of 3 million and the results were negative. The more intensive the sampling the more likelihood there is of gaining a positive result. However, even with large scale baiting, it only reduces the likelihood of the pathogen being present unless there is a positive result.

Watering

Water for the Nannup nursery is drawn from an untreated dam supply. The vehicle parking is sited above the dam and drainage from this area reaches the dam.

Transport

All vehicles are confined to the parking area which is excluded from the nursery.

Existing Needs and Problem Areas

(1) The water supply for the Nannup nursery could be a possible source of infection for Phytophthora cinnamomi. P. cryptogea has been recovered within the catchment area and the treatment of the water with sodium hypochlorite would eleminate the danger of infection.
(2) The carpark area is also sited within the catchment of the dam and could be a further source of contamination. A drainage system to channel water away from the catchment is advisable.
(3) Vehicles coming to the nursery to pick up plants should be washed down at Nannup division prior to entering the parking area at the nursery.
(4) Footbaths should be located at the nursery entrance to offset the risk of infection from contaminated footwear.
(5) The effect of pathogen resistance with the continued use of Ridomil as discussed for Manjimup. This problem could be overcome by alternating the range of effective fungicides.

GNANGARA NURSERY

Gnangara nursery produces Pinus pinaster seedlings for planting in the northern pine plantation. Public demand for pines has increased and sizable orders are being received for planting on farms, mainly for windbreaks, but with a view to some commercial utilisation in the future. Pinus radiata and P. halepensis are also being raised at the nursery for private sales.

Possibly because of Pinus pinaster's resistance to Phytophthora cinnamomi and since initially there was no private sale demand, the nursery has functioned without hygiene safeguards. It is important that this situation should be rectified and hygiene measures undertaken.

Existing Needs and Problem Areas with Current Policy

Water for irrigation is obtained from a bore which would eliminate the chances of infection from this source.

Proposed needs are:

(1) Bait nursery area for presence of P.c.

(2) Exclude vehicles from nursery area.

(3) Nursery tractor to remain at nursery or to be washed down prior to entering nursery, if used elsewhere.

(4) Construction of suitable washdown facilities.

(5) Heavy duties at present fill up from standpipe in nursery. Other arrangements to be made outside nursery area.

(6) All bags to be washed in copper sulphate or sodium hypochlorite solution.

(7) As the nursery area is not fenced, nursery to be effectively signposted and access roads closed.

Research Monitoring

Baiting programme for nursery.

KARRATHA AND BROOME NURSERIES

These two nurseries have just been acquired by the Forests Department. There has been some input into the Karratha nursery during the Department of Regional Administration and North West management period. This has resulted in soil sterilisation and a list of hygiene requirements being implemented which are close to being completed. Broome nursery has had no Forests Department input and requires a complete hygiene and soil sterilisation programme. Since these two nurseries are in their formative years and production rates low, it is essential to assess their viability, particularly that of the Broome nursery, for at least twelve months before embarking on costly hygiene programmes.

RESEARCH NEEDS FOR ALL NURSERIES

(1) The effective Ridomil dosage rates for the control of Phytophthora species in containers and the open ground for nursery situations and the levels at which phytotoxicity occurs.

(2) Literature research on Ridomil and other fungicides as to their effective control on Phytophthora species.

(3) The use of ectomychorrhizal inoculation, both with open-rooted and container stock, to boost vigour both in the nursery and field situation and to improve the plant's resistance to P.c.

PUBLICATION REQUIREMENTS

A manual covering all aspects of nursery hygiene relevant to the situations that occur in all Forests Department nurseries.

REFERENCES

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Selection of Fungi for Ectomycorrhizal Inoculation in Nurseries. James M. Trappe, Ann. Rev. Phytopathol 1977, 15; 203-222.

7. PROTECTION (FIRE)

P. Jones (Chairman)

D. Grace

G. Styles

HO 299/82
PROT DB 11

THE INTERACTION OF FIRE AND DIEBACK

Apart from the physical aspects of vehicle and human movement associated with fire management practices, fire has a number of potential biological interactions which are summarised below.

1. REMOVAL OF THE LITTER LAYER

It is possible that in removing the litter layer in prescribed burning, the site's susceptibility to *Phytophthora cinnamomi* is increased. This is because soil temperatures will rise, thus increasing the period of time when soil temperature and soil moisture are at an optimum for sporangial production and development. It is also possible that a reduction in organic material entering the soil will increase site susceptibility, as increased organic levels have been associated with disease amelioration in avocado orchards.

2. UNDERSTOREY COMPOSITION

Mild fires in spring favour the domination of the understorey by proteaceous species (principally *Banksia grandis*) which is undesirable from a disease viewpoint because they provide a highly susceptible food source and reservoir of inoculum. Conversely, moderate intensity fires in summer promote a leguminous understorey which is potentially a more anti-disease environment because:

(i) Phytophthora has great difficulty invading the roots of legumes, hence inoculum level is lowered.

(ii) Dense understories of legumes intercept rainfall and shade the soil, thus reducing the period when soil temperature/moisture relationship is suitable for sporangial development.

(iii) Soil microbiological activity under legume stands is potentially less suitable to *P. cinnamomi* than under proteaceous stands.

(iv) Promotion of leguminous stands may improve forest fertility by increasing soil nitrogen, which will increase disease resistance in the stand.

These potential interactions have not as yet been translated into any management practice, save for a number of research trials.

The next stage of the submission deals with interactions between current dieback management and fire control. Within that, however, are included current conflicts of the same nature as would occur if fire control practices were altered to accommodate the potential interactions listed above.

FUEL ACCUMULATION

Current State of the Art

Policy (W.P. No. 87, page 56) states that fuel reduction will be undertaken to enable wildfire suppression to be effective under normal summer conditions. This has been more specifically stated to be an accumulation of not more than 8t/ha in jarrah and 19t/ha in karri (Foresters Manual, 9.042).

Problem Areas with Current Policy

In many areas of State Forest the stated policy is not being achieved because of conflicts with dieback management, namely the aerial photography programme. This has arisen because of:

(i) The need for an area to be at least 3 years since a burn for effective symptom expression for photographic purposes.

(ii) The need for an area to be held unburnt for ground truth verification, whilst film of it is being interpreted.

(iii) The inability of interpreters to keep pace with the photography programme because of a mismatch of production rates of the two teams and rapidly changing priorities.

In the initial stages of the photography programme an acceptance of the need to extend rotation lengths in some areas was accepted, however because of (iii) above, this has reached unacceptable levels (see attached plan of Kirup area).

It has also led to a waste of resources where areas photographed but not interpreted have been burnt because fuel accumulation had reached excessive levels in areas of strategic importance, thus incurring a loss of up to $5/ha for photography.

Required Policy Direction for the Future

No change of policy is required, merely implementation of current policy as stated. I believe, with accurate forward planning, the photography programme can be incorporated into current fuel accumulation policy.

Research and Staff Needs

If long-range planning is not possible so that current interpretation resources can keep pace with the photography programme, there needs to be a pool of available interpreters who can be brought into the task to cover the emergency situation and ensure no backlog develops.

ACCESS

Current State of the Art

There is no defined policy on access, however it is inherent in our strategies for implementation of current fire control policy that access to all areas of State Forest is very good.

Existing Needs and Problem Areas with Current Policy

The existing need of fire control policy implementation is good access and this conflicts with desired dieback management which has worked to restrict access by closing roads, limiting access to some roads and minimising maintenance of open roads. This has caused problems for fire control through:

1. Ground Fire Suppression

   Limiting access will delay initial attack, resulting in larger fires. Larger fires will result in greater forest damage from increased area and intensity, plus cause a likely escalation from hand tool to machine suppression operation. This is undesirable from a fire and a disease viewpoint.

2. Hazard Reduction Planning

   Whilst wherever possible burn boundaries are placed on major access roads, it is necessary and becoming more so as other constraints divide burns up, to use lower quality roads. This causes control problems and increases the risk of further disease spread.

   Access into burn areas for fuel sampling, water supplies, fire behaviour observation, quality control and post-burn inspection is difficult and sometimes impossible. This lessens control and lowers the efficiency and standard of the total job.

3. Safety

   Unmaintained roads present a safety hazard for vehicles due to overhanging scrub, loss of visibility and damaged culverts and bridges. This also introduces elements of personal danger through vehicle incidents involving the above and the blocking of potential escape routes in a fire emergency.

4. Detection and Investigation

   Unmaintained roads affect detection by -

   (i) Restricting ground patrol ability to locate and investigate smoke sightings

   (ii) Overhanging vegetation obscuring tracks, making aerial plotting more difficult.

Required Policy Directions for the Future

There is a need for a policy defining a basic network of roads suitable for all forest users. This network would then be opened and regularly maintained, which for low class roads would only entail log removal, scrub slashing and drainage. From a fire control point of view such a network should divide the area into cells of not greater than 2000 ha.

Research and Staff Needs

No additional staff inputs for planning as the existing branches staff could complete this task. It would however, increase Divisional works programmes, resulting in increased employee levels or a rearrangement of priorities.

OPERATIONS

Current Policy

To conduct all field operations to limit the spread of dieback disease.

Problems with Current Policy

There are a number of problems which restrict an individual's ability to implement this policy in fire control; they are:

(i) Lack of accurate information on pathogen presence. Quality maps produced by the dieback mapping group are of limited availability. Most operations are based on the 1976 Dieback 80s, which are completely inadequate for a job which requires instant decision making.

(ii) An ability to translate the map information to a boundary on the ground. This requires careful time-consuming work, not conducive to a fire suppression situation, especially at night.

(iii) An ability to recognise dieback symptoms on the ground. This complex task results in many different interpretations from individuals viewing the same set of symptoms.

(iv) Plant Availability and Type

From a dieback point of view, hand tool attack is superior to machine use. When machines are required, rubber tyred is superior to tracked machines. In many cases however, machine availability will dictate what is used rather than the most suitable from a dieback point of view, all other things being equal.

Burn preparation will also require the use of machines to clear tracks. Machines may be used merely because they are available and not because they are suitable. This also applies to wash-down equipment.

(v) Lack of Uniform Hygiene Standards

Confusion as to what is the correct procedure will lead to an inadequate or inappropriate decision on hygiene measures being taken. In the extreme case this may result in no hygiene being done.

(vi) Suppression Strategy Impact Analysis

When suppressing a fire, a controller will consider hand attack initially, then direct attack with machines, or indirect attack. From a dieback spread viewpoint, indirect attack is most desirable because if involves least earth movement, however few controller are in a position to make this decision immediately because it requires quantitative analysis of:

(a) The potential for dieback spread by use of a machine on a fireline.

(b) The impact on the forest from the potential spread of dieback.

(c) Values threatened by the fire.

(d) The damage to forest values by increasing the size of the fire.

(e) The likelihood of success of the backfire, which is dependent on fuels, both within the burn and adjacent, weather, technique used and control forces available.

All other things being equal, controllers in a majority of cases will opt for direct attack because of either constraints on time to work through the established procedure or a lack of quantitative data to use in the evaluation.

Required Policy Directions for the Future

Current policy is correct, however greater support is required to ensure it is implemented. From an operational viewpoint this will mean:

- Greater effort in producing dieback-free plans.
- Training for staff in map interpretation, symptom recognition, strategy evaluation, wash-down procedures, use of fungicides and biology of the pathogen.
- The production of uniform reference manuals on the above.
- Development of computer-based decision models for evaluating alternative strategies (this would be an extension of the suppression computer system in that it would assess dieback spread and impact).
- Development of more appropriate machines for track maintenance, fire suppression etc.

Research Staff and Needs

Research is required into spread probabilities and impact analysis for dieback under different conditions and land forms. Once this is known to a certain stage, it can be built into models for evaluating operations. This would appear to be a complex task requiring substantial input.

Research into fungicide use, effectiveness and potential environmental impact.

Research into plant requirements for fire control could I believe, be handled by our current Engineering and Protection services. An immediate start could be made on designing and building suitable slashing and sweeping machines, rubber tyred log removal, drainage maintenance machines and appropriate wash-down equipment, provided finance was made available.

An increased training requirement for Protection Branch would, of necessity, mean the appointment of a full time training officer to develop manuals, design schools etc.

FIRE REGIMES

State of the Art

Current policy calls for low intensity hazard reduction burns on an approximate 5-7 year cycle. It also states that fire intensities and frequencies must facilitate achievement of the major land use (G.W.P. No. 87, page 56).

Problems with Current Policy

It can be said that except for isolated instances the amelioration of the impact of dieback disease is compatible with all land use, consequently fire regimes should be aimed at achieving this. The general belief on the interaction of fire and dieback is detailed at the beginning of this report, however lack of adequate confirmation has prevented translation into policies on fire regimes.

Current policy also provides for the continuation of research into fire and its relationship to land use, consequently there should be a gradual implementation of fire regimes appropriate to dieback management as research knowledge becomes available.

Policy Directions for the Future

Current policy is adequate for the future until research findings determine what fire regimes are appropriate for dieback management. It will then be important to see how the new regimes affect the current fire protection policy on fuel accumulation. Very careful consideration will have to be given to any change in current regimes because the Department's whole fire protection system is based on the limitation of fuel accumulation. Any changes to this will have a significant effect on the type of suppression force required, access required, prescribed burning capability etc. This will bring associated cost increases in staff and equipment for it is considered that the current fire protection system is operating at an optimum efficiency for protection and that any changes will increase rather than decrease costs.

Changes in fire regime policy, which lead to increased fuel build-up will bring an associated rise in the risk of damaging escapes. This must affect the Department's chances of being sued, hence its public liability premiums.

LIAISON

State of the Art

Current policy calls for effective liaison with all neighbours on fire protection responsibilities.

Problems with Current Policy

Current policy is adequate and necessary, however its implementation is being affected by dieback management practices, which have restricted local contact and created apprehension in adjoining P.P. by controverting our policy on fuel accumulation.

This has arisen because of:

(i) Quarantine limiting contact between neighbours and Forests Department.

(ii) Heavy fuel accumulation alongside P.P. as a result of conflicts with dieback photography.

(iii) The limitations of landholders' ability to investigate potential threats from fires in the area.

Required Policy Direction for the Future

Policy is adequate; it is its implementation which is a problem. To improve implementation there are three things which could be considered:

(a) Move the quarantine boundary back off the fence line to the inside of the boundary track where it does not compromise hygiene or security. This will improve perimeter access, which will assist contact and aid investigation by landholders.

(b) Rearrange priorities to allow staff to spend more time in contacting neighbours.

(c) Increase staff number. Effective liaison takes time and the workloads currently being carried by Divisional staff makes them reluctant to dedicate the necessary time to talk with neighbours. Effective liaison may require a full time officer within each Division.

Centralisation of Divisional offices has lead to a centralisation of liaison such as interdepartmental committees, shire advisory committees etc. Whilst this is necessary, to be really effective liaison must also be strong at the brigade level, i.e. over the boundary fence.

ADMINISTRATION

Current State of the Art

This requires:

1. Permits for entry into quarantine.
2. Checklists for hygiene measures.

Problems with Current Policy

Current entry permits for quarantine are cumbersome to use for fire suppression. In an emergency they may hold up initial attack, or conversely not be attended to, with the associated dieback spread risk from use of the wrong access or unclean vehicles.

The requirement for permit entry also restricts the ability of neighbours to take the initiative and enter quarantined State Forest to investigate or instigate attack on a fire before F.D. forces arrive.

Required Policy Direction

Consideration be given to a more rapid permit issuing procedure for fire suppression needs. This may go so far as to allow a Bush Fire Brigade under the direction of an F.L.O. to enter quarantine under certain circumstances without first seeking local office approval.

Current hygiene standards and checklists require reviewing and issuing as formal documents. Training would then be required for effective implementation.

P M JONES
CHAIRMAN

For H.G. Styles and D.E. Grace.

PMJ:vgh

ATTACH

8. PROTECTION (ENVIRONMENTAL)

R. Sneeuwjagt (Chairman)

G. Peet

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DRAFT

DIEBACK REVIEW 1982

DIEBACK - ENVIRONMENTAL PROTECTION

(Committee: Sneeuwjagt, Peet, Batini)

PART A: THE STATE OF THE ART

Four main aspects will be discussed:

a. direct impacts of dieback causing environmental damage.
b. interactions between dieback and other causes of environmental damage e.g. insects.
c. operational practices for dieback control which may cause environmental damage e.g. roads low in the profile resulting in erosion.
d. operational practices for environmental control which may cause spread or ~~of~~ intensification of dieback disease e.g. containment bunds for erosion control altering soil moisture regimes.

a. Direct impacts of dieback causing environmental damage.

The main impact of dieback is through its effects on reducing forest cover. This change can then impact on other aspects of the environment e.g. water (quality and quantity), soil erosion, flora and fauna (dealt with by Mr. Havel), aesthetics and landscape (dealt with by Mr. Schmidt) as well as other factors such as weeds, insects, other fungi, feral animals, changes in soil temperature etc. The degree of impact will depend on the severity of the disease expression. This in turn depends on the site and the vegetative type.

Reduction in forest cover by dieback has increased water yield substantially in higher rainfall areas. Increases of between 50 and 100 percent have been reported. Data is less well documented for drier areas when the disease is less prevalent and where the potential for transpiration is greater. In areas exceeding 1200mm no increases in weighted average salinity have occurred e.g. Wungong brook. However, in areas of lower rainfall, increases in baseflow salinity and obvious salt problems have resulted e.g. Helena, Cameron dam, Mt. Cook, upper Canning basin. Replanting with tolerant species could assist.

As dieback often occurs close to streamlines, there is potential for soil erosion and turbidity problems. These are generally not widespread since areas are seldom left entirely bare. In addition, the dense stream vegetation is largely tolerant and plays a very important

role in reducing turbidity. Also slopes are gradual, soils are not easily eroded and colonisation occurs. Wind erosion is not normally a problem within the forest.

Direct increases in soil temperatures have been quantified. The more open forest may also be more suited to weed and feral animals. We are not aware of data which quantify these aspects.

b. Interactions between dieback and other causes of environmental damage.

The interaction between dieback and other causes of damage is not well understood, because the relationship will be complex. Effects may either be direct (synergism) or through the changes resulting from dieback (higher soil temperatures, more sunlight, less competition etc.) No evidence of a direct interaction between dieback and leaf miner has been noted (CSIRO), though insect attack is more common in open stands. Insect damage could predispose jarrah to fungal attack or retard its recovery.

Interactions between Phytiums and Phytophthora have been reported in the U.S.A. Pythiums and Phytophthora spp have been isolated from Departmental nurseries and the Sunklands. There are also possible relationships between dieback disease and twig and branch cankers, Armillaria and/or phorocantha borers, either by assisting entry through wounds or by stumps acting as a substrate for new infections, or by debilitating the tree.

The effects of dieback on other factors through its indirect effects (such as temperature, moisture, availability of litter, altered species composition) on aspects such as the plant environment, soil microflora, (eg. mycorrhizoe) and fauna may be considerable. These relationships are complex, little understood and there are few workers in this field in W.A. These effects may predispose or accentuate the effects of the disease on the host.

These effects reinforce the complexity of the forest ecosystem and the wide range of possible side effects that a disease such as dieback can have on this ecosystem.

Recreation generally relies on healthy forest conditions and areas affected by dieback disease do not provide this. However, open spaces are occasionally beneficial for forest recreation and areas affected by dieback disease may be used for this.

c. Operational practises for dieback control which may causes environmental damage.

Some of the dieback control measures adopted by Divisions can cause both short and long term changes to other environmental values.

These measures include practices to minimize dieback infection or spread in roadworks, forest tending and rehabilitation (FIRS) of diseased and mined areas, and promotion of native legumes through dry summer burns.

(i) Roading

The construction, maintenance and usage of forest roads remains one of the principle sources of dieback spread in the forest. A number of guidelines have been developed over the years to minimize the risk of disease spread. The current 'state of the art' approach is best summarized in 'Jarrah 81'. (Page 10 - 13)

The implementation of these guidelines appear to have helped reduce the spread of dieback during road works. However, their implementation can cause conflict in the conservation of other environmental values. These conflicts are listed under each of the principle roading guidelines adopted.

Instruction

Use as few roads as possible, and define unwanted roads for closure.
Conflict - Restriction of access may hamper control of wildfire with possible increase in area and extent of forest damage by wildfire.

Benefit - Less disturbance to bulk of forest ecology by forest users.

Instruction
Avoid new roading
No Conflicts. Benefits as above.

Instruction

Select roads as low in profile as possible
Conflicts - Increase risk of stream siltation from roads that closely parallel water courses.

- High potential for increasing spread of disease within water course reserve from road works. This is often the most sensitive portion of forest ecosystems from a point of view of fauna habitat, stream salinity and turbidity and variety of understorey vegetation.
- The high incidence of dieback within low forest profile places a high risk of infection by roads crossing from diseased forest to dieback-free category.
- Greater requirement for gravel to service low profile roads which:

  (a) normally are longer than most existing roads located along ridge lines.
  (b) need deeper sub-base to avoid collapse during wet conditions.
  (c) normally require more cut-and-fills than conventional roads.

  The higher demand for gravel allied with requirement to confine gravel pits to within single dieback categories, or single coupes may result in creation of numerous small gravel pits and permanent forest clearings.

- Increase in forest clearing to accommodate longer, indirect low profile roads and larger number of small gravel pits. This may be further aggravated with requirement to complete "profile falling" of trees leaning over roads in order to avoid later hygiene difficulties.

- Road surface remains wet and slushy for longer periods, thereby increasing period of high disease risk and reducing "Spatially Safe" period.

- Low profile roads often unsuited for location of winter landings as these can bog-out more readily in wet weather. Uphill spur roads leading from low profile haul road to sub-coupe landings are normally directed at right angles to contours to minimize potential dieback spread. Steep spur roads can cause significant soil erosion and siltation as water rushes straight down hill along roadsides.

- Washdown of machinery on low profile roads can have higher risk of introduction of harmful fungicide directly into streams.

Benefit - Apart from reducing the area at risk to dieback spread, low profile roads normally follow a winding course and are therefore of high scenic and aesthetic value.

Instruction
Avoid crossing dieback categories
Roads relocated to avoid crossing dieback categories are usually longer, requiring more road clearing and more gravel.

Instruction
Winter Roads to have rapid drainage to nearest water course.
Conflict - Increase risk of soil erosion along table drains with associated increase in stream turbidity and sedimentation.

Instruction
Winter Roads to be stabilized in specified situations
Conflicts - Where sump oil used for stabilization, danger of spillage and run off into streams may affect aquatic ecology.

- Increased demand for gravel for stabilization can result in extra clearing for gravel excavation.

(ii) Forest Improvement and Rehabilitation Scheme - F.I.R.S.

These operations are to be discussed by the Operations committee. However, it is worth noting here that the current F.I.R.S. prescriptions can have some short-term and long term detrimental side-effects on environmental values. For example, the banksia push down and follow up burn can lead to fire damage and even death to retained crop trees and can also result in short-term reduction in aesthetic values. The use of herbicides for banksia control (e.g. Roundup) needs to be evaluated for its effects on environmental values.

Also, rehabilitation of advanced dieback areas using cultivation, planting or seeding, and fertilising can lead to deterioration and even deaths of remaining mature trees. The exact reasons have not been determined.

(iii) Moderate Intensity, summer burns

The promotion of hot, dry soil burns to promote native legumes has several detrimental aspects. The proliferation of dense acacia thickets can lead to future fire control problems and wildfire damage. The hot burns also result in some death and deterioration of standing trees, whilst the widespread crown scorch detracts from the visual qualities for some 1 to 2 years after the burn.

(iv) Washdown of Machinery

The dangers of chemical pollution of streams from fungicides used to washdown soiled vehicles and heavy plant has not been assessed, although these are not likely to be high, provided the prescribed concentrations are adhered to.

d. Environmental control operations which may cause spread or intensification of dieback disease.

The impacts of most environmental control practices on dieback have not been closely studied and documented. One practice that is being closely monitored is on effects of mild intensity spring hazard-reduction burning on dieback. This aspect will be covered by the Fire Protection and Research Committees. The following comments are based on observations and comments by field staff.

(i) Containment bunds constructed for erosion control in rehabilitated mine sites or on snig tracks and fire control tracks , modify soil drainage patterns such that they often provide localized moist conditions favourable for fungal sporulation and zoospore survival. This situation can also occur near siltation ponds on major access roads with bauxite mining areas and major chip roads in the Southern Region.

(ii) Deep ripping for rehabilitation of gravel pits, landings, snig tracks and mined sites often results in soil puddling and modification of soil drainage

patterns, thereby providing ideal opportunities for the dieback fungus to proliferate and spread. In addition, the ripping operations are often done during autumn and spring conditions that favour fungal sporulation.

In many cases (eg. cleared pasture areas in Wellington Catchment) the ripping is done in absence of indicator and therefore without adequate knowledge on the extent and location of dieback.

(iii) Blackberry eradication operations involve construction of access close to streams where bushes proliferate. The track construction can lead to spread of dieback disease especially if this is done in absence of indicator species (eg. karri forest) or without proper hygiene precautions.

Similarly, operations for other weed control and poisoning of feral animals often demand creation and use of access roads which can cause spread of dieback.

PART B: POLICY NEEDS

The General Working Plan No. 87 does not contain a consolidated statement on the Department's policy towards environmental protection, although many of the major environmental values are considered separately within the management objectives.

A consolidated statement will assist managers to decide the appropriate course of action needed to minimize environmental damage whenever these conflict on the one area. eg. blackberry eradication versus spread of dieback.
The strategy for environmental protection must include consideration of the impacts of each management alternative on all major environmental values, leading to the selection of the management practice with least detrimental impact for the greatest long-term social and economic benefit.

It is suggested that the environmental protection strategy include the following steps.

(i) Identify environmental values requiring protection.
(ii) Assess risk of loss (or deterioration) of these values for each alternative management strategy.
(iii) Choose management alternative - preferably with low risk of loss for all major values.
(iv) Review and reconsider management alternatives regularly.

These guidelines are along the lines adopted in suppression of wildfires in dieback - affected forest (Controller's Fire Suppression Guide FD613)

PART C: RESEARCH NEEDS

Although considerable research has been carried out in the past, some gaps in knowledge still exist. Areas where data is still considered to be less than adequate are:

(a) impact of P. cinnamomi by forest types and by species.

(b) extent and susceptibility of jarrah forest by Havel's site types.

(c) effects of dieback disease on salinity.

(d) interactions between P. cinnamomi and other host-environment factors e.g. weeds, feral animals, insects, soil environment, changed water relations, site factors, other fungi.

(e) quantifying the effects of changing site factors (e.g. fertilisation, water relationships by roading and mining) on both the fungus and the host.

(f) effectiveness of current control methods for feral pigs, weeds and blackberries.

PART D: STAFF NEEDS

Additional staff allocation to environmental protection is required to fully implement recommendations.

1. Research Requirements

   (a) Two professional research officers to develop programmes outlined under research needs.

   (b) Two to four technical assistants to assist in development of these programmes.

2. Operations Requirements

   (a) Allocation of specific environmental protection responsibility to a Regional Group officer and Divisional Protection officer (0.5 - 1 officer/group, depending on complexity of problems).

   (b) One L4 Professional Officer attached to Protection Branch to develop programme, set standards and provide services and supply functions, e.g. training.

   (c) Two senior field staff (Forester and above) to assist L4 with implementation. These officers to be attached to Protection Branch, but working within Regional Group, as for S.F. Fire Control.

9. RESEARCH

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S. Shea

B. Shearer

J. Havel

CURRENT KNOWLEDGE OF THE BIOLOGY OF *Phytophthora cinnamomi*

Phytophthora cinnamomi is an introduced, soil-borne pathogen that mainly attacks living plant tissue, but can also survive for a time living on dead plant material.

Its principal method of attacking plants is through infection of their roots by zoospores; small spores which are able to move toward plant roots when soil-moisture levels are high.

Extension of the disease through the soil, by the growth of fungal mycelium, is very slow and can be ignored for all practical purposes. An infection expands by downslope movement of spores at a rate which varies with soil type, steepness of slope, soil moisture conditions and presence of highly susceptible hosts. At present we have no way of preventing this. Upslope and lateral extension of an infection is very slow and appears to be via mycelial growth through the roots of infected plants.

During extended dry periods, few zoospores survive in the soil under Western Australian conditions, but fungal mycelium persists in the roots of infected plants. The infected host may be alive or dead.

The zoospores are produced by fruiting structures called sporangia. Sporangia can be very rapidly produced, but only under suitable conditions, that is, in warm, wet soil and when soil temperatures are in the range 15-27^{o}C and when certain stimulating factors are present in the soil. The interaction of these physical and biotic factors is very important but little understood.

There is marked variation in the behaviour of the disease on different forest sites. On moisture-gaining sites, that is lowland areas and valley floors, soil moisture conditions are suitable for zoospore production and survival for long periods in spring and early summer. On freely-drained upland sites, which constitute

about 75% of the jarrah forest, conditions are suitable for zoospore production for a much shorter period of one to six weeks each year, depending on rainfall patterns. In certain soil types, such as the red loams found along major river valleys, the disease appears to be suppressed and susceptible plants are apparently unaffected.

There is a wide variation in the susceptibility of various species to the disease. Highly susceptible plants include *Banksia grandis* and *Persoonia longifolia*. These die rapidly after infection by the disease on any site.

At the other end of the scale are tolerant plants such as marri, which does not succumb to the disease, although the pathogen may survive in its roots for many years and the host plant may decline in general health.

Jarrah is essentially a mildly susceptible host, only being killed on sites where conditions are highly favourable to the disease. In relation to jarrah, three broad site susceptibility categories can be distinguished:

A. Lowland moisture-gaining sites, as noted above.

B. Upland sites with a layer of concreted sheet laterite at shallow depth. These have recently been shown to be highly conducive of *P. cinnamomi* spread and intensification.

C. Upland sites with deep soil, where conditions are inimical to pathogen activity.

Apart from site type A, suitable conditions for zoospore production are found primarily during spring and autumn, although unusual summer rains, such as those of January 1982 are also conducive to sporulation. The length of the suitable period varies from year to year with seasonal weather patterns. Although spring is generally the main period of zoospore production, the

build up of fungal inoculum can be significant in autumn, depending on the nature of early seasonal rainfall.

Where there has been a buildup of inoculum in autumn, it may go into a resting stage with the onset of cold weather. The inoculum then becomes active as soon as soil temperatures rise sufficiently in the following spring.

New infections of the disease occur through the transport of soil or plant material from an infected site to an uninfected site. Once a new infection is initiated, it takes from three months to three years before the presence of the disease is indicated by the death or decline of susceptible plants, which is the only external indication of disease presence.

Zoospores can survive for extended periods in water and can be found in water running off infected areas in late spring and summer. It is possible for the pathogen to be spread, e.g. in nurseries, by the use of contaminated water supply systems.

It is impractical to use a fungicide to destroy the pathogen in the forest because (a) the inoculum is protected deep in infected root material, (b) no fungicide could reach all the inoculum, and (c) the very rapid build up of inoculum when conditions are suitable for it would override any effect of the fungicide. There are also ecological objections to the use of fungicides on a wide scale in a natural ecosystem.

Recent work has shown that *P. cinnamomi* propagules can occur at very high density at depths of up to 75 cm. Where there is a concreted lateritic layer at this depth the zoospores are laterally transmitted in water running over the surface of this layer. These features mean that the sinker roots passing through the laterite layer are very vulnerable to pathogen attack and probably accounts for the high susceptibility of the forest on these sites. A similar process is likely to operate on lowland sites with either a

lateritic layer like this or a marked transition to a clay subsoil. It appears that this site characteristic is a pre-requisite to rapid intensification of the disease syndrome on undisturbed upland sites.

Excavations of the root systems of trees growing on upland sites which do not have this concreted lateritic layer present in the surface soil horizons and which have been exposed to *Phytophthora cinnamomi* for several years indicate that jarrah on these sites is relatively resistant to the fungus. The fungus has been detected in the horizontal roots, but its occurrence is low and the infections have often been found to be arrested or "compartmentalized" by a host tree reaction.

Jarrah appears to have the ability to form a periderm layer which can arrest extension of a lesion which has formed on a root. Lesion extension in jarrah secondary tissue is markedly seasonal with maximum rates of extension in summer. Site and tree vigour do not appear to affect the rate of lesion extension in any one year, however it is possible vigour may influence the ability of a tree to contain the fungus in subsequent years.

The death of jarrah results from destruction of the vertical root system and/or the extensive invasion of horizontal root systems and stump by *P. cinnamomi*. This prevents uptake of water from depth in the soil and death results from dehydration. Clearly, on sites with shallow caprock, destruction of the vertical root system is facilitated and the tree is much more vulnerable to their loss on such sites, compared with sites with deep soils.

Results continue to indicate that some legume species have a suppressive effect on the fungus in the soil. Silvicultural techniques which favour maintenance of legumes in the understorey will therefore make the site less favourable for disease intensification.

The presence of *Banksia grandis* has been shown to be highly undesirable as it aids intensification of the disease and acts as a reservoir of infection. Silvicultural techniques which maintain the Banksia population at low levels are a pre-requisite to successful disease management.

It is also clear that any site disturbance which results in ponding of water, or concentration of water in any way, is highly conducive to sporulation and therefore disease intensification.

Given that the forest on most of the highly susceptible sites has already been severely affected by the disease, we now believe that *P. cinnamomi* will have little impact on freely drained sites, provided disturbance is kept to a minimum, hygiene is very efficient and we adopt forest management practices which reduce Banksia and promote leguminous species. The jarrah forest is not doomed!

ADDITIONAL INPUT ON THE RESEARCH ASPECTS OF THE DIEBACK REVIEW

1. The key question raised by the Research findings is - Can the susceptible parts of the landscape be defined accurately and rapidly?

2. There is danger, if mapping of susceptible parts of the landscape is undertaken too soon before the research knowledge is sufficiently consolidated, that useless maps will be produced.

3. For the full implementation of the dieback findings, it will be necessary to tie together information on fungal physiology and geomorphology via ecological studies and review of the drilling data.

4. The initial stages of the mapping need to be a Research project and not a routine Inventory and Planning activity.

5. As forest hygiene measures cannot keep the dieback out of the forest indefinitely, it is possible that too much effort is going into detailed mapping and enforcement of hygiene measures.

6. It is necessary to put the hygiene measures in proper perspective. Their importance depends on the general susceptibility of the landscape where they are being applied. In an area where susceptible sites are already dead, hygiene may be of little consequence.

7. In order to finalise the research in a reasonable time, say two years, it is highly desirable to reallocate priorities in terms of funding and personnel and to remove some of the constraints in finance and logistics.

8. The additional research may be the means of getting us off the quarantine /aerial photography / photo interpretation hook-up. In the light of our new findings, lower precision impact maps may be adequate.

9. Logging trials in quarantine cannot be multiplied indefinitely. It is preferable to develop an alternative rational land use policy that will ensure that the forest can be managed in perpetuity.

10. In the light of our present knowledge, the likelihood of dieback intensification following logging may be greatly reduced by such prophylactic treatments as the removal of banksias a year or two beforehand.

11. In order to complete the current research as early as possible and therefore make it available for management, it may be desirable to assign some of the newly-trained photo interpreters to research.

10. MANAGEMENT INFORMATION

E. Hopkins (Chairman)

H. Campbell

B. Ashley

MANAGEMENT INFORMATION REQUIREMENTS FOR DIEBACK SYSTEMS

INTRODUCTION

The objectives of the group are to review, at policy level, the information requirements to achieve the goals of management in dieback influenced forest, as set out in General Working Plan 87 of 1982.

Management information concerns the data, its processing as information and its presentation as the knowledge required to make enlightened decisions on dieback management. It does not directly concern standard procedural information or prescriptions used in defined administrative roles; (i.e. how to implement a decision once it is made). These should be included in the Foresters Manual.

Management information may be written or verbal or in the form of charts, maps or mathematical models. Policy needs to formulate what information is required and why and how it is required.

SCORE

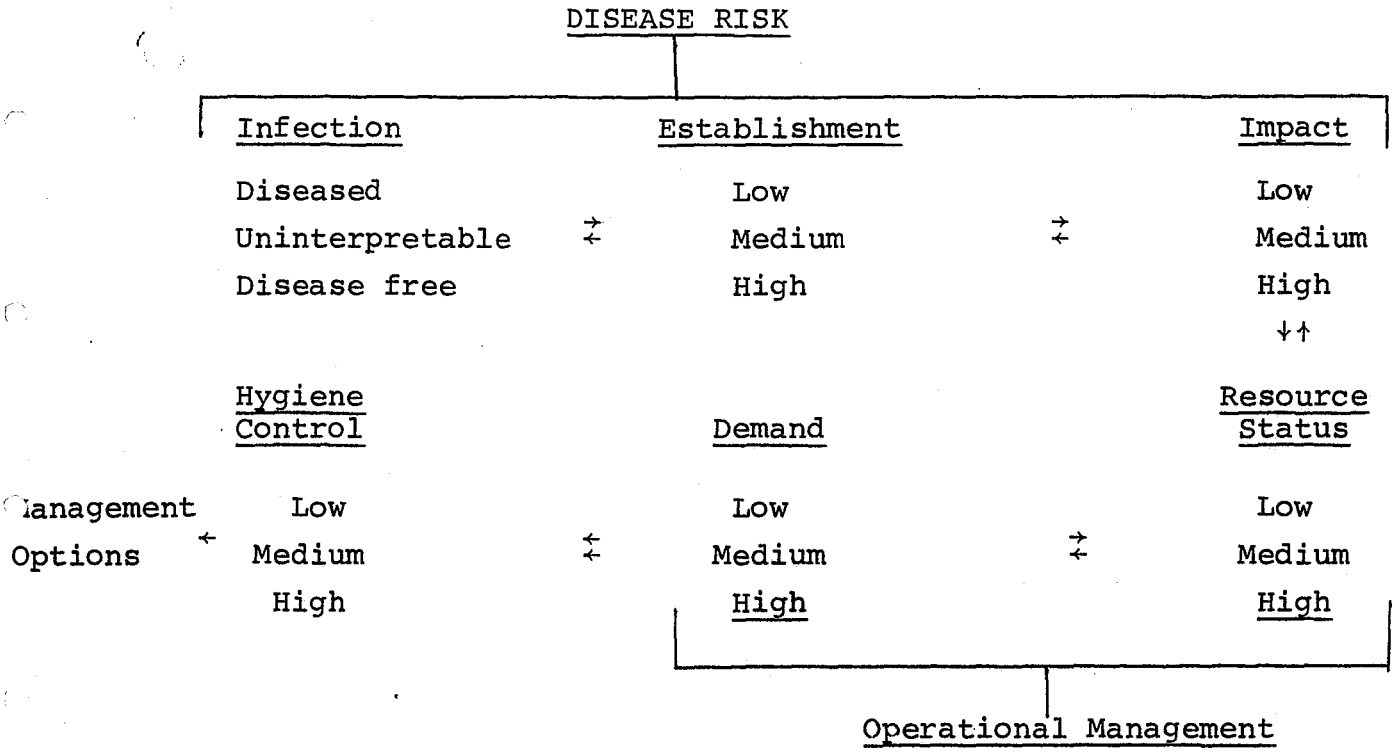
Effective management decisions for resource use in the presence of the influence of Phytophthora cinnamomi (as an introduced pathogen) require the integration of disease management strategies with operational forest management. Integrated disease management brings together knowledge to meet the protection needs of resource management. American studies have shown that inventory data, collected for a wide variety of purposes, can be interpreted and applied in an operational setting to reduce pest loss with minimal effort at low cost.

Integrated management for jarrah dieback is seen as a product or interaction of information in the following subject fields:

1. Infection Occurrence
2. Infection Establishment
3. Disease Impact
4. Resource Status
5. User Demand
6. Hygienic (access) Control

The first three of these subject fields concern the disease impact or disease risk. Items 4 and 5 of the areas constitute operational forest management. Item 6 is related to both disease risk and operational management, but is separated as it may be artificially manipulated to influence disease risk, operational management or the product of both.

Within each of the above interest areas, the situation may vary in degree from high to low. Grouping of the assessed gradings may provide a matrix from which the manager can view and systematize the numerous values and options concerned, i.e.:



Such a simple model as above could generate 3^6 options. Most options would however, be based on similar data and many would become redundant to any specific decision issue.

The initial problem is seen as the assembling and ordering of the numerous data areas that are available and their mixing in a systematic way acceptable to managers.

The information requirement is more obvious on considering components of the above six interest areas.

1. Infection Occurrence

This is currently expressed on a dieback free map showing:

(i) Areas of diseased (infected) forest.

(ii) Areas of disease free forest.

(iii) Non interpretable forest (due to lack of indicators, burning history, logging, etc.).

(iv) Areas of suspect dieback.

This information is normally provided from photography and/or ground truth data following quarantine. As such, (ii) is assumed to have no infection, or to be resistant. A second type of information for non-quarantine areas does not necessarily assume (ii) is free of infection, but can be applied to the whole forest area.

This information allows hygiene to be implemented in certain operations and shows that some stands have a higher risk of damage from disease than others.

2. Infection Establishment (Intensification)

This interest area concerns the pattern and rate of the disease establishment in the stand once it is known to be infected with spores. Disease may develop as a point source, a peppering of point sources, several clusters of expressions, or a general massive deterioration of the understorey. Here we are largely concerned with understorey rather than overstorey which is rated as impact due to its direct relationship with resource values.

The area of disease expression in the field has been sadly neglected and a priority is required to follow up the excellent early pattern expressions reported by the 70 mm photo interpretators. Much useful information on disease pattern and extent of development is contained in the worksheets used to prepare the dieback free maps. Currently we know little of the intensification process, except to assume from the history of infection whether disease spread is rapid, slow, general or localised.

Available data which could be relevant to this area are

(i) Pattern of infection (70 mm)
(ii) Slope
(iii) Density and type of understorey
(iv) Stand health at time of infection
(v) Disturbance history (logging, fire damage, etc.)
(vi) Position relative to infections outside area.

The objective is to provide a model of this infection process which, with that of impact, will predict rate of spread and extent of damage within resource values.

3. Disease Impact

Impact is defined as the observable or potential response of the dominant stand to disease infection. It varies from resistant (low impact), to high impact, as in early expressions in the gully heads and parts of Park Block and Alco Block.

Impact is either a potential condition for stands which are about to be diseased or have been recently diseased, or real for stands with a history of infection. Impact also must be assessed with respect to human disturbance of the stand. Stand dynamics and application of management treatments require periodic updating of impact.

Impact is a new positive information requirement for effective jarrah forest management and concerns the following data:

(i) Species composition of stands (dominant and understorey)
(ii) Stand structure
(iii) Stand age
(iv) Stand vigour - site index
(v) Rainfall zone
(vi) Aspect

(vii) Slope class

(viii) Topographic position

(ix) Soil type

(x) Soil depth and drainage type

(xi) Degree of disturbance (fire history, logging, etc.)

It is believed that all of this data is available in adequate detail, at least in the area covered by System 6. It can be sorted and displayed to a large extent by the current FMIS system. Relation of the various factor scores of (i) to (xi) to Impact requires field grading in a similar manner to that used for bark beetle susceptibility in the U.S.A. (Lorio et al, 1982).

Knowledge of 1, 2 and 3 could ultimately allow modelling to assess rate of disease spread and stand damage within forest areas. This is seen as essential knowledge for total management. In the meantime, a zoning of risk categories as currently attainable could greatly assist management decision making.

4. Resource Status

Resource status concerns the resource values of stands as provided by total inventory. It shows areas of high quality bush and low quality bush, high pole numbers, few pole numbers, virgin sawlog areas, depleted sawlog areas. It also shows high or low recreational value, water values, fauna values, flora values, i.e. LUMP values. It is an extension of the data base required in items 2 and 3 to that available in special (ML1) inventories.

Inventory data requires constant upgrading, but it must work towards the total ecologic inventory essential also to items 1, 2 and 3 above.

Resource status indicates the natural resource potential, the priority class set by management and its utilizable stage, i.e. sapling, pole or mature forest.

5. User Demand

User demand considers 4, but with special constraints or advantages of interest to the market, i.e. proximity to a mill, proximity to a town, road location, the special value of the product desired (apiary sites). A blending of 4 or 5 with 1, 2 and 3 is desirable to determine for instance whether quality forest areas of high impact, with a high disease risk are available for sawlog operations.

Often user demand will initiate the probe into management information to assess how such a demand can be met while minimizing disease spread.

6. Hygiene (Access) Control

This interest area is seen as the one where the manager can markedly influence the resource use and disease risk options. If the product is required only in dry periods in areas with good sealed roads, much may be achieved. Vehicle washing on entering non-interpretable forest from dieback areas and on

leaving such areas for dieback free areas can favour activity in such uncertain types.

Hygiene planning and decisions require all the information in 1, 2, 3, 4 and 5, plus good maps showing road type, washing down points, and natural catchment areas (micro and macro).

THE MODEL AND SYSTEM

Research and development is required in all 6 areas of interest considered. This work however, is seen as reasonably straight forward, except for the disease pattern modelling which may require special expertise.

Most of the data required are available in some form or another, and are common to several of the interest areas. The FMIS system could make this available to managers to allow grading or field calibration of classes. The information can be presented by the system as a range of maps of any scale and varying sophistication. Updating is required, but this is also a high priority for normal resource management.

The information system presented is by no means complete or fully workable. Access to available data and its overlaying will however, greatly improve management. The hesitancy of operations and management to date in facing the continuing operations issue and the regularly voiced requirement for special maps, special photography and special research indicate the need to put the available data at the manager's fingertips. This is the initial challenge.

RECOMMENDATIONS

1. Dieback Mapping

Information on the distribution of dieback is required for planning and for the organisation of hygienic operations.

The 70mm technique provides maps of a high degree of precision. Maps of this quality are certainly necessary for short-term planning and for the organisation of operations. However, high precision is not essential for longer term planning. The 70 mm technique is too expensive and above all, too slow, for resource level mapping.

Mr. Heberle has compared maps prepared by 70 mm interpretation with earlier maps derived from conventional photography. The comparisons suggest that the earlier maps are sufficient for planning purposes. It is recommended that:

(a) Mr. Heberle's work should be re-examined to confirm that existing maps augmented by further interpretation of conventional photographs can satisfy our needs for planning information.

(b) The 70 mm technique should be restricted to areas where detailed management information is required.

2. Disease Spread

The Fire Suppression System uses an algorithm which models the pattern of spread of a wildfire and predicts the future shape and extent of the fire. The model relies on the FMIS data base to provide the site factors which determine pattern of spread. The FMIS pixel structure is the basis for the model and permits the graphic representation of the burnt area at any point in time.

The analogy with disease spread is immediately obvious. Some work along these lines has already been done (ESRI has developed a computer programme which models disease spread using slope data organised in the FMIS pixel format).

It is recommended that:

(a) A project team be set up, to develop this work further.

(b) As current topographic information is probably inadequate for the above purpose and for other purposes related to dieback management, the means to acquire maps showing 5 m contours should be investigated.

3. Intensification and Impact

(a) Current

The dieback infected zone shown on our Dieback Free Maps encompasses a wide range of stand conditions. The lack of discrimination may be appropriate for the Dieback Free Map, but is not appropriate for a management map. It is recommended that management maps should display a range of categories within the infected zone. The categories should distinguish between patterns of infection within the understorey and degrees of impact on the overstorey.

(b) Potential

In 197[illegible], Mr. Batini established formally the relationships between dieback distribution and various site factors and disturbance factors. He used an early version of FMIS as a research tool in this enterprise.

The approach is applicable to the identification of the site factors influencing disease impact. It is recommended that a project team be set up to investigate this possibility.

4. Management Modelling

The management of diseased forest requires integration of information in the following areas:

(a) Infection occurrence
(b) Infection establishment
(c) Disease impact
(d) Resource status
(e) User demand
(f) Hygienic control (or access control)

It is proposed that inforation in the first 3 areas above should be integrated in a manner which assigns Disease Risk Ratings to distinct forest zones. The Risk Rating serves to establish priorities for silvicultural operations, removal of banksias, logging and mining operations, etc. Information in the latter 3 areas, together with the Risk Rating, determine prescription.

It is recommended that additional overlay options (weighted overlaying) be developed for FMIS. Weighted overlaying will facilitate modelling of the kind discussed above.

P.L.Lorio Jr, G.N. Mason and G.L. Autry (1982) Stand Risk Rating for the Southern Pine Beetle: Integrating Pest Management with Forest Management. Journal of Forestry. April 1982 p 212 - 214.

E.R.HOPKINS

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August 16, 1982

11. DISEASE DETECTION, AERIAL PHOTO AND INTERPRETATION

J. Williamson (Chairman)

K. Veer

D. Hilder

G. Butcher

DIEBACK REVIEW TASK FORCE

Expert group: Disease Detection

(This expert group was formerly known as aerial photo).

The members of the group are : Williamson (chairman), Hilder, Vear, G. Butcher.

1. Current state of the art

1.1 Disease detection based on 70mm photography.

After several years of development and trials a technique for disease detection has been established, based on the use of 70mm air photos. It is unique in world forestry and won several productivity awards for team members.

It involves the recognition of individual indicator species in the understorey, such as Banksia grandis. Computerised navigation equipment is used in a twin engined aircraft to ensure that photos are taken in parallel strips flown 180m apart. Flying at 450m above the forest ensures complete cover at a scale of 1:4 000. Cloud cover is necessary during photography so that tree crown shadows do not obscure the indicator species close to the ground.

Photography achieved so far:

YEAR	TARGET (HA)	ACHIEVED (HA)
1978/79	120 000	60 000
1980	84 500	81 000
1981	79 500	54 500
1982	53 000	43 000
Total	337 000	238 500
Average/year	84 000	60 000

The photography team consists of 2 crews each with a pilot, navigator, and cameraman. They work alternate weeks of 7 working days to take full advantage of suitable photography weather. Normal hours are worked during the other weeks.

Interpretation is carried out by two man teams with each member trained to recognise indicator species on the air photos, check boundaries in the field, and take samples of indicator species to be analysed in the laboratory for the presence of Phytophthora cinnamomi.

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The ratio of field days to office days is about 4:1. A productivity rate of 10 000 ha - 12 000 ha/year has been achieved for each 2 man interpretation team.

Interpretation achieved so far:

1978/79	27 000 ha	3 interpreters
1980	34 000 ha	4 "
1981	34 000 ha	6 "
1982	52 000 ha (projected)	10 "

Costs are approximately:

Aerial photography	$5/ha	*1
Interpretation	$3/ha	*2

*1 Includes salaries and overheads.
*2 Includes salaries, overheads, vehicle costs, laboratory processing of samples.

1.2 Disease detection based on divisional ground surveys

The following information is based on experience from Jarrahdale division.

Strips are 60m apart.

The two man team consists of interpreter and chainman. About 60 ha/day can be covered. Field samples are taken for laboratory testing. Adjustments are made to the disease location map as laboratory results become available. Cost is approximately $2.50/ha.

1.3 Disease detection by Alcoa

Colour air photos have been used for two areas, both outside quarantine, one near Mt. William, one near Huntly. Field checking by the Forests Department indicated that Alcoa's approach can only be used for broadscale planning, and is not satisfactory for hygiene management.

2. Problem areas associated with disease detection using 70mm photography

2.1 Annual photography program.

Careful integration of each year's photography program is needed with regard to :

* prescribed burning (A prescribed burn masks indicator species symptoms for approximately 3 years. Dieback photography is therefore of no use unless it is at least 3 years after a prescribed burn)

* logging (both sawlogs and poles)

* mining

* any other potential use of the forest

* the amount of interpretation that can be achieved.

A departmental committee with members representing these functions and headed by the C.O.D. Operations is needed to co-ordinate each year's photography program and to allocate priorities. It should meet by September of the preceding year.

Many users of the forest are not aware of the time needed for disease symptoms to appear (approximately 3 years) nor the additional time needed to photograph, interpret and map an area (approximately 2 years). A standard letter should be prepared advising forest users and potential users of the minimum 5 year lead time needed to prepare diebackfree maps.

2.2 Policy

Policy statements are needed to clarify:

(1) The use of 70mm photography outside quarantine.

(2) The role of the Air Photo and Interpretation (AP and I) section.

(3) The staff needed to allow the AP and I section to carry out its role.

2.3 Headquarters

The photography group should relocate its headquarters in Bunbury for the 1983 season. This is central to all operations in State forest and will reduce the need for overnight stays for the group members, with a resulting improvement in morale as well as reduction in costs.

2.4 Staff

Additional staff needed in the short term for the AP and I section are a "T/01 Interpretation" to co-ordinate interpretation standards and training, and a navigator who can be either a T/A or a F/G. A T/A is needed in Radio Communications branch to service and maintain the Motorola navigation equipment used by the photography group. In the long term an ADFO will be needed and the OIC should be a DFO or SDFO.

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2.5 Maintenance of navigation equipment

Adequate maintenance of the computerised navigation equipment is essential to ensure that each year's photography target is achieved. 6 months work by a T/A from Radio Communication branch is needed to do this. Radio Communication branch is understaffed and a new T/A must be added to their numbers to cope with this workload, as indicated in section 2.4 on staff.

2.6 Camera

The existing Vinten camera equipment is expected to last another 3 years. As Vintens are no longer being made, research is needed to find a suitable replacement camera.

2.7 Aircraft

The hire aircraft used, a Britten Norman Islander, is the only one fitted with specialized equipment for our use. We must ensure that it continues to be available to us each year.

3. Problem areas associated with interpretation of 70mm photography for dieback disease detection

3.1 Objective

A statement of the objective, policies and strategies associated with dieback interpretation is needed. The policies should indicate the standards to be aimed at as this markedly affects the work load and speed of interpretation. Areas inside quarantine could well have different standards to those outside quarantine. The annual photography and interpretation targets should also be stated as this controls the staff, equipment and finance needed to achieve the policies. The inefficiency of changing priorities in mid program of either photography or interpretation targets must be recognised.

3.2 Staff

The five interpretation teams are under the control of each regional Inventory and Planning office so that their work priorities are in accordance with regional needs.

Some of the interpreters are career interpreters. However, others are seconded from divisions as part of their operational training. This has the advantage of training operational staff in the latest dieback interpretation skills. When they return to divisional work it would seem sensible to have these former interpreters responsible for some key aspect of their division's dieback disease management program. Two things are necessary to make this part of the interpretation program work - adequate training

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of officers joining an interpretation team, and maintenance of standards once training is finished. A "T/O grade 1 Interpreter" position in the AP and I section is needed to be responsible for these two important functions.

3.3 Extension

Those who have worked as interpreters are aware of the latest approaches to dieback interpretation and management. Many others in the department and outside it will require information and advice as new developments are made. This can be provided once a position of "T/O grade 1 Interpreter" is filled. This officer would also be responsible for producing publications such as a manual of interpretation procedures, and other information of use to divisions and those outside the department.

3.4 Field sampling

This is the most time consuming stage of dieback interpretation. The time taken between sending a sample for laboratory analysis and receipt of a positive or negative result is also discouraging divisional staff from using the service. The most helpful contribution that research branch could make in this area would be to provide a faster test for the presence of Phytophthora cinnamomi (Pc). Until then there is a need for a laboratory for processing field samples to be situated at Manjimup as well as Dwellingup.

3.5 Maps

A clear statement must be made indicating what maps are to be produced (location, risk, operational, others?) and who is responsible for providing the information in them. The title of each kind of map, and the terminology of its legend must be standardized. The distribution of each type of map must also be clearly understood. If there is some time between the preparation of a Pc location map and its use as the basis for a field operation, the location map should be updated. This will involve both checking for new infections and remapping areas where existing disease has spread.

3.6 Terminology

There is a strong need for a glossary of terms associated with dieback disease management. Formal communication inside and outisde the department must be clear, concise, correct and consistent. Informal communication using slang or non standard terms should only occur when the meaning is quite clear.

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3.7 Other diseases

Pc is the obvious major disease threat to the forest. However, all field staff and the interpreters in particular should always be alert to the dangers from other diseases and disorders such as those caused by the fungus Armillaria, leaf miner attack, and Sirex wood wasp.

12. MAPPING

D. Johnson (Chairman)

D. Muir

B. Rowlands

MAPPING FOR DIEBACK

1. PRESENT SYSTEM

1.1 1:50,000 DIEBACK MAPS

The Dieback maps at this scale are each an enlargement of an east or west portion of a standard 80 chain scale map. The information relating to dieback is an accumulation of successive interpretations of 1:40,000 aerial photographs up to and including 1976. The categories shown are:

1.1.1 Dieback mapped by photo interpretation, (field checks extrapolation).
1.1.2 Clear cut for Dieback by sawmills.
1.1.3 Phytopthera probably present but no obvious symptoms.

See appendix 1.

Note that information from an early interpretation into categories 1 - 4 is not included.

The Dieback maps at 1:50,000 are not a good presentation. There is little demand for copies. It should be noted that further interpretation for dieback in 1977 and 1978 produced information which so far has only been shown on 1:63,360 maps.

1.2 1:25,000 FLIGHT LINE INDEX TO 70mm PHOTOGRAPHY

Needed as a pre-requisite to interpretation of 70mm photography, the flight line indexes can be of two types. The first and more usual type is based on API Planimetric or Topo maps. The second type which is to be preferred and which will become more prevalent as the Mapping Branch's new mapping programme

.../2

progresses, is based on the new 1:25,000 Topographical Series maps on the Australian Map Grid (AMG).

Production of a flight line index involves external reprographic services, use of the plot sheet (Mylar) from the Motorola equipment, the post print data and the aerial film for random checking. The accuracy with which exposure positions are placed on the map base is critical.

Flight line indexes are normally produced within 2 weeks of the receipt of the required data.

See Appendix 2.

1.3 1:25,000 DIEBACKFREE MAP (Appendix 3)

The Diebackfree map is produced as a result of interpretation of the 70mm photography. The base map for the interpreted data is a new 1:25,000 Topographical Series map which is actually a cadastral/topographical combination. See Appendix 4. Production of the base map utilises existing data on AMG from the Dept. of Lands and Surveys and the Australian Army Survey Corps to which our own information is added. Contour intervals may be at 10 or 20 metres.

The requirement for these base maps is the greatest inhibitor to the production of Diebackfree maps. Accordingly, the work programme for the base maps conforms to 70mm dieback mapping priorities.

To produce a Diebackfree map, interpreted dieback information is drawn as overlays and screen printed to produce a colour map. The following legend applies to the interpreted area.

.../3

White DIEBACKFREE: Forest apparently free of dieback.
Red DIEBACK: Forest in which dieback symptoms are present.
Blue SUSPECT: Forest in which the evidence for dieback presence or absence is inconclusive.
Purple UNINTERPRETABLE FOR DIEBACK: Forest in which susceptible plants are absent or too few to enable interpretation for dieback presence or absence.

At present the agreed production is 20 copies of each Diebackfree map. Automatic distribution is -

1 set to the Regional Leader Planning,
1 set to the A.D.F.O., AP&I Section,
2 sets to the OIC Division.
The remainder are held in Mapping Branch until required.

N.B.: Protection Branch utilises the maps on a borrow and return basis.

The quantity of these maps produced must be reviewed in the light of -

a) their being the only map showing the results of 70mm photo interpretation or

b) whether an additional (Hygiene, Risk or Operational) map is produced thus reducing the requirement.

Production of a 1:25,000 Topographical Series base map averages 15 man days: preparation of dieback category overlays involves some 6 man days, and screen printing turn around time (private contractor) can vary from a few days to 2 weeks.

In 1981-82 the branch's production was 28, 1:25,000 Topographical Series maps. Thirteen of these were

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developed to Diebackfree maps. The current Diebackfree mapping programme (dated July 19th) calls for the production of 19 maps by August 1983.

It is estimated that with the current manpower commitment, the annual production of Topographical Series maps should be between 30 and 35 maps. The production surplus to Diebackfree map requirements can be directed to future dieback cells or areas where logging is being planned. See Section 2.2

2. PROPOSED CHANGES

Several changes have already been proposed to dieback mapping operations through consultation with the Superintendent of the Northern Region and the O.I.C.s of the Northern Division.

2.1 1:50,000 DIEBACK MAPS - See appendix 5.

It is proposed that the maps be redrafted to allow for easier interpretation of the 1976 dieback information. They will be produced on the new 1:50,000 AMG map bases with contours. On each map, references will also be made to areas where 70mm photo interpretation has been completed as well as to other (e.g. ground) surveys for dieback. In this way it is hoped that the early information will be more useable and that the maps will also become an index to other maps containing better dieback information.

The dieback categories shown are:

DIEBACK: Forest in which dieback symptoms are present.
SUSPECT: Forest in which the evidence for dieback presence or absence is inconclusive.

Each map will also carry the following note as well as a schedule to record map amendments.

.../5

CAUTION

1. THE DATE OF THIS PRINT IS
2. THIS MAP SHOWS OR REFERS TO THE MOST RECENT DIEBACK INFORMATION AVAILABLE TO THE MAPPING BRANCH. BASIC DATA WAS DERIVED FROM PHOTO INTERPRETATION AND IS DATED 1976.
3. ADDITIONS TO THE 1976 DIEBACK CATEGORIES ON THIS MAP ARE LISTED IN THE AMENDMENTS SCHEDULE.
4. UNSYMBOLISED AREAS REPRESENT FOREST WHERE THE EXISTENCE OR NON EXISTENCE OF DIEBACK HAS NOT BEEN PROVEN.
5. HOWEVER, ALL OF THE FOREST WITHIN THE BOUNDARIES OF 70MM PHOTO INTERPRETATION HAS BEEN CATEGORISED. REFER TO 1:25,000 DIEBACKFREE MAPS FOR THIS ADDITIONAL DETAIL.
6. ALL OF THE FOREST WITHIN THE BOUNDARIES OF RECENT GROUND SURVEY AND/OR INTERPRETATION FROM 230MM x 230MM PHOTOS HAS BEEN CATEGORISED. REFER TO 1:25,000 DIEBACK MAPS FOR THIS ADDITIONAL DETAIL.

Approximately 10 man days are required to redraft each 1:50,000 Dieback map.

2.2 1:25,000 DIEBACK MAPS - See Appendix 6.

It is understood that logging operations outside quarantine should conform to the Jarrah 81 prescription and that before operations commence there must be a new dieback survey. Contoured topographical maps at 1:25,000 showing dieback categories are desirable for planning these operations. They are also readily enlarged to make 1:12,500 Coupe Maps.

The 1:25,000 Dieback map is produced and separately identified because of the above reasons and also because it is considered to be carrying dieback information of a different reliability to either the 1:50,000 maps or Diebackfree maps.

The demand for these maps already exists and in most cases is being satisfied by extra (wasted) effort to match contours (only available on the AMG) with our existing Bonne projection Planimetric or Topo maps.

The surplus production capacity of about 10 Topographical Series maps mentioned in section 1.3 can be channelled to meet this requirement. However, indications are that an annual logging programme for all regions is so scattered as to make timely satisfaction of all needs an impossibility.

To satisfy the 1983 logging programme for Northern and Central Regions would require the production of 27, 1:25,000 Topographical Series maps. Southern Region's requirement is so extensive and scattered that a further 27 new maps are needed almost immediately. That is beyond Mapping Branch's capacity. However, it is reasonable to extend our production to 45 - 50 base maps per year, to give a surplus from the present level of production of Diebackfree maps of some 30 maps. No doubt these could be assigned to agreed priorities in the logging programme.

Given a base map, production time for a 1:25,000 Dieback map should average about 3 man days. Therefore, there are approximately 90 man days of additional work required to produce the 30 Dieback maps.

The information for the 1:25,000 Dieback map has so far been derived from field surveys where the area concerned is traversed at 50 metre intervals and simple ties made to connect the survey to mapped data. A test is to be conducted to determine if interpretation of dieback can be satisfactorily completed to the same standard from conventional high contrast black and white aerial photography at 1:25,000 scale. If it is successful, dieback information will also be contributed to the 1:25,000 Dieback map from this source.

As planned so far this map will have a legend of the categories -

Diebackfree
Dieback
Suspect.

.../7

It will be produced as a black and white map so that it can be quickly printed on demand in the Mapping Branch. Black and white also facilitates enlargement to 1:12,500 for a Coupe map.

Appendix 6 is not a proper sample of the proposed map. However it is visually similar.

The Dieback mapping system as proposed therefore comprises:

1. 1:50,000 Dieback maps - recording the comprehensive early interpretations and acting as an index to more detailed Dieback information;

2. 1:25,000 Diebackfree maps - recording the results of interpretation from 70mm photographs and

3. 1:25,000 Dieback maps - recording intensive field surveys and perhaps interpretation from specially flown black and white photography.

Appendix 7 is a flow chart of these proposals.

3. FUTURE POSSIBILITIES

3.1 1:25,000 FLIGHT LINE INDEX MAPS TO 70mm PHOTOGRAPHY

There is a proposal to investigate decoding of the Motorola output tape so that a principal point plot can be completed on a more sophisticated plotter (XYNETICS or CALCOMP). The aim is to produce a drawing of the principal points at a standard which will eliminate hand drawing. The map base and computer plot will be processed together to produce a composite flight line index. If successful the procedure will eliminate many man days of tedious drafting.

3.2 PROPOSED HYGIENE, RISK OR OPERATIONAL MAP

Much has been said about the need for a map to follow

the Diebackfree map. Such a map would presumably reduce the need for specialist interpretation as is required with a Diebackfree map and therefore simplify the categories to be shown. Mapping Branch would prefer such a map to be a black and white production to enable it to be simply reproduced on demand in whatever quantities are necessary. The same map would then provide Coupe maps from direct enlargement.

A decision to produce this map may significantly vary the Mapping Branch's work programme. Implications will have to be investigated.

3.3 EXTENSION OF 70mm PHOTOGRAPHY PROGRAMME

If a decision is made to increase the 70mm programme to include operational areas outside quarantine, Mapping Branch should be able to readily adapt for a production of 30 - 35 Diebackfree maps annually. Fifty would be difficult. Presumably such a programme would replace the production of 1:25,000 Dieback maps. As is the case with the present programme, the critical thing will be the lead time to produce 1:25,000 A.M.G. base maps.

3.4 DIGITIZED DATA FOR FMIS AND THE DIGITAL FIRE SYSTEM

The department's future needs clearly require dieback information in digital form.

The accompanying flow chart (appendix 7) shows the recently proposed Dieback mapping system. It is to be noted that all maps are on the Australian Map Grid and it may be seen that dieback information is ideally digitised soon after the completion of each map or each map amendment.

Eventually, Mapping Branch will have the equipment to digitise the maps and information at the ideal time by the polygon method. It would then be readily available

to both the Fire System and F.M.I.S. Although this is some time away it will be possible in the interim to run a trial project. At that stage consideration can also be given to the desirability of distinguishing between the various accuracies of the dieback information.

CHIEF DRAFTSMAN

August 10 1982

13. RECREATION AND LANDSCAPE

W. Schmidt (Chairman)

D. Allen

R. Burrows

P. Kimber

DIEBACK REVIEW 1982 : SUBMISSION ON RECREATION & LANDSCAPE MANAGEMENT

AUGUST, 1982.

1.0 INTRODUCTION

The following submission briefly examines the effect(s) that dieback has and is likely to have on the use and management of State forest for recreation. As part of this review, the impact of both the disease and current rehabilitation practices on forest landscape values is also considered.

The report has been divided into 2 major sections. The first is concerned with the existing effect that disease and disease management controls are having on recreational use, while the latter identifies and discusses future options and research needs.

2.0 EFFECTS OF DIEBACK AND DISEASE MANAGEMENT ON FOREST RECREATION USE AND LANDSCAPE VALUES.

The presence and spread of dieback in State forest has affected recreational use in several ways. On the one hand, the disease has resulted in the physical and visual degradation of the forest landscape and this would seem on first examination to have contributed to the loss of scenic and recreational appeal of many forest areas. Another obvious impact is associated with the introduction of disease management controls such as quarantine which have to some extent resulted in restricted public access to extensive areas of forest. The likely effect of such factors is now considered in greater detail.

2.1 Effect of Dieback Disease on Landscape Values and Recreational Use

There appears to be a common belief that dieback infected forest has a reduced recreational value due to a loss of scenic quality. However, apart from a survey carried out in the Mundaring and Jarrahdale areas of State forest in 1970 (Spriggins, Research Paper 16), and a study conducted by D F O Beatty at Bunbury in 1977, there is little factual evidence presently available to support or contradict this view.(1)

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(1) Observational fied data obtained during the 1978 forest-wide visitor survey are currently being analysed to determine what relationships, if any, exist between the type, location and extent of recreational activity and various environmental factors including the presence and severity of dieback infection.

In this latter study, a group of 13-15 year old Bunbury students were surveyed to determine their reaction to dieback following a talk and tour conducted by a department officer. The tour took the students to each of 3 forest areas - an area of extensive dieback infection, healthy forest and a small pocket of dieback surrounded by healthy forest. Although the majority of students indicated an aversion to the idea of recreating in the "graveyard site", the other 2 areas appeared to have equal appeal.

This finding and that of the earlier Mundaring-Jarrahdale survey tend to suggest that many forest users are not averse to recreating in areas of infected forest. This could be due to a low degree of environmental awareness on the part of some recreationists or the fact that infected areas which are more open hold greater attraction (i.e. a parkland setting) for certain users.

Thus the level of recreational activity may remain relatively unchanged in areas of dieback infected forest, although the type of use to which such sites are put may well alter. Graveyard sites, for example, may prove particularly attractive to family picnic groups who wish to gather firewood or to owners of trail/trial bikes or other off-road vehicles. As outlined in Section 3.5, more research is required to objectively assess the actual effect dieback has on the level and type of recreational activity. Mere conjecture is inappropriate as a basis for guiding future recreation planning, management and rehabilitation programmes in dieback affected forest.

2.2 Effect of Dieback Hygiene and Quarantine Regulations on Recreational Use

The introduction of hygiene requirements appears to have had relatively little effect on most types of recreational activity in State forest. The one notable exception is organised motor sport events (i.e. car and motorcyle rallies) such as those sponsored by CAMS, where rallies are directed into areas of forest where the spread of disease is minimal.

Other travel oriented activities including the non-organised use of motorcycles and 4-wheel drive vehicles as well as

horse-riding no doubt have resulted in the spread of dieback in certain areas, particularly where such activities occur on poorly formed tracks or in off-road situations. However, hygiene considerations have had little effect on this group of recreationists, primarily due to the obvious difficulties of attempting to contact and control such users. That is, it is simply not feasible without a massive increase in staff patrols and widespread provision of washdown facilities to ensure hygiene prescriptions are implemented. Fortunately, it appears that the large majority of forest visitors restrict their movement to better quality roads and/or to environments such as major river valleys where conditions are less amenable to dieback infection and spread.

With respect to organised motor vehicle rallies, most club events are arranged with the Division concerned. The features of the current approach are as follows:

* Rallies are directed to areas where spread of disease is less likely. As far as possible rally routes are confined to infected or uninfected forest. Lack of accurate dieback maps often make the planning of a rally route that minimises dieback spread difficult.
* Rally routes may be directed to low profile roads. From the motor sport viewpoint this is probably not desirable as rallies require a wide variety of terrain to be traversed.
* Where the rally passes from infected to predominantly dieback free areas, vehicles may be required to "wash down" before proceeding. A vehicle wash-down service probably has to be supplied by the Department, though it should be at the rally organisers' expense. Provision of wash-down facilities requires considerable planning by the Department and organisers.
* Hygiene measures can be implemented for organised vehicle-based recreation, provided the Department is involved in planning the route to be used.

The introduction of quarantine regulations has, to some extent, restricted public access to extensive areas of State forest. As quarantine prohibits vehicle access and horse riding activity (except on designated roads), these travel-oriented activities have been most affected. In contrast, destination-oriented activities such as picnicking and vehicle-oriented camping have not been greatly constrained as the most frequently visited sites (e.g. river valleys) are largely outside of quarantine. With one or two exceptions, the public have not been excluded from any developed recreation areas within State forest.

Other activities dependent on foot access such as bushwalking, backpack camping, nature study and the desire for solitude have, if anything, benefited from quarantine. Quarantine areas represent an extensive resource available for those recreationists who don't require vehicles and who wish to be isolated from other forest users. Thus viewed in an overall context, quarantine has been beneficial in helping to separate or zone various uses (refer to Section 3.1).

3.0 DISEASE MANAGEMENT - FUTURE OPTIONS AND RESEARCH NEEDS

Changes to existing dieback disease regulations and rehabilitation practices could have a number of effects on the future use and management of State forest for recreation. Some of the more important implications and options available are briefly discussed under 5 headings as follows: planning, landscape management and rehabilitation, education, enforcement and research.

3.1 Planning

Land use planning offers the single most effective way of ensuring that the future spread of dieback as a result of recreation use is minimised.

This fact has been recognised in developing the latest recreation framework plan for the Northern Jarrah Forest. The general thrust of this plan, in which the concept of resource capability is utilised, is to allocate various recreational activities to areas of forest which have the capacity to attract and support such use without causing severe or irreversible long term damage to the environment.

With respect to dieback, the approach has been to assess such factors as disease presence/absence and likelihood of spread within various parts of the forest. At the same time, the physical resource requirements of various activities have also been evaluated to assist in matching user needs with available resource characteristics. Activities can then be directed via techniques such as zoning (e.g. control of access, signposting, etc.) into areas of forest where user needs are met while at the same time safeguarding forest values. Thus, for example, activities likely to result in the spread of dieback are excluded from areas of susceptible forest where disease incidence is low.

As indicated previously, the mitigation of public access currently provided by quarantine has the benefit of indirectly controlling recreational usage over much of State forest. This is to be viewed as a positive development when one considers the largely uncontrolled, unregulated nature of forest recreation within W.A. forests. Thus, current disease regulations are fortuitous in that they have helped preserve some of our river valleys, monadnocks, etc., from recreational (vehicular) usage/access. However, the current recreational benefits now provided by quarantine will only be maintained if we are able to plan for orderly recreational development in these areas now and establish the commitment for such plans by providing the necessary finance for their implementation.

Therefore, as a matter of course, future recreation plans will need to considered such factors as .....

(1) provision of motorised activities, particularly if/where quarantine restrictions are removed.

(2) impact of improving road access (as a technique for curbing dieback spread) on the use of particular recreation areas or sites within State forest. If sites which can withstand additional use are redeveloped accordingly, then the upgrading of roads, particularly those low in the landscape, can provide a means of channelling use to desirable areas.

3.2 Landscape Management and Rehabilitation

Several programmes and/or prescriptions for the rehabilitation of dieback infected forest as well as other degraded areas, such as minesites and gravel pits, exist. These include the FIRS and Rehab. 81 prescriptions now in use in the Northern Jarrah Forest.

Rehab '81 - the former Rehab '80 prescription was reviewed and revised during 1981 in order to develop specific guidelines covering rehabilitation practices in recreation M.P.A.s. To date, implementation of these prescriptions has only just commenced; as the outcome of these new rehabilitation practices becomes known, further revision and updating will be carried out as required.

FIRS - the main impact of the current FIRS programme on recreational potential and use of the jarrah forest is largely an aesthetic one as outlined in the following observations:

1) General forest areas

(a) the typical 2-tiered tree structure of the western jarrah uplands is gradually being altered over large tracts of forest as a result of the banksia eradication programme. This results in a simplified and more open forest structure which may or may not be appealing to certain categories of forest users.

(b) the broadcast sowing of leguminous species modified the generally complex association of understorey species found in the jarrah forest. Selection of understorey species should also be based on landscape aesthetics and not guided solely by dieback and nutritional criteria.

(c) the FIRS prescription should allow for variability in plant spacing to accentuate such things as prominent vistas, or to conceal certain scars on the landscape. The directive to 'not plant trees' in areas with low potential for timber production may also be inappropriate in a number of cases.

(d) the choice of species available for areas of high timber production potential, may also be inappropriate where they are in direct conflict with the surrounding landscape character.

(e) protection from fire for 8-10 years in areas with high timber production potential could prove to be a safety risk for recreationists, especially as these areas would be broadcast sown with leguminous species.

2) Recreation area influence zones

(a) the criterion for 'major or tourist road' as presently exists should be extended to incorporate all roads except 4 x 4 tracks, as these roads have the potential to be used by large numbers of visitors.

(b) hazard reduction burns adjacent to recreation sites will

need to be programmed so as to minimise aesthetic impact.

(c) the existing FIRS guidelines for landscape and rehabilitation plans are not as yet comprehensive. As with the Rehab '81 prescription, the Department's landscape architects should be requested to periodically review and provide input into the formulation of new guidelines as the FIRS programme evolves.

3.3 Education

The campaign designed to inform the public and more particularly the forest user about dieback and the restrictions its management places upon him, appears to have been largely effective. While there have and will continue to be violations of quarantine regulations for example, these do not seem to be excessive in number considering the extent of forest involved.

One of the more positive aspects of this educational campaign relates to the system of quarantine information signs now in use. The large map signs in particular have proven effective and appear to be the least vandalised of all signs presently in use. The reason for this can be attributed to the positive manner in which restrictions on public access are presented and explained. As suggested in Section 3.4, the avoidance of negative commands has worked to our advantage.

Despite the general public awareness and co-operation with dieback management regulations, there is however still some confusion about the meaning and purpose of current quarantine regulations. Many forest users including some who should be aware of the meaning and intent of quarantine look upon the disease regulations in a medical sense. That is, there is a general misconception that it is the areas of most extensive disease infection that are quarantined rather than vice versa. Although this confusion exists, it probably has not created any significant problems as far as the actual implementation of quarantine goes.

Looking to the future, if large tracts of forest are to remain in quarantine, then the Department should consider developing a more comprehensive educational programme consisting of .....

1) T.V./radio advertisements
2) School and teacher training sessions
3) Newspaper articles
4) Field education

The first three of these aspects will no doubt be discussed in the publicity and extension submission. The fourth, field education, could incorporate the following:

1) Signs - the type of information signs currently in use could be incorporated as part of a comprehensive network of roadside information bays as outlined in the Northern Region Recreation Framework Plan (Draft 2).

2) Brochures and directories which explain the nature of the disease, the reason for management regulations, and the areas of forest affected by such regulations.

3) Demonstration tours which enable the forest visitor to view at first hand the impact that dieback has had on the forest ecosystem and what management procedures the Department is using to overcome its spread.

3.4 Enforcement

To date the enforcement role of the Department has been concerned with limited quarantine boundary patrols in association with Forests Department aerial surveillance (fire spotters) and the Metropolitan Water Authority (catchment patrols). The outcome of these patrols in terms of cost/benefits is unknown. What is known is that quarantine regulations have been violated, largely by marroners in gazetted water catchments and perhaps, pig shooters.

It is suggested that the fortress mentality displayed by the M.W.A. with their storm trooper patrols and ubiquitous negative signs has done little to prevent access or educate people about their ultimate goal of catchment protection. Rather than follow this route it is our recommendation that the Forests Department continue with a low key system of signage aimed at educating the public as to the reasons for quarantine and its successful implementation.

This can be done by increasing the explanative/educative content of signage and avoiding wherever possible the use of negative

words or connotations. The sign should convey a request for co-operation rather than dictate rules and regulations/penalties. Patrols should only be undertaken in conjunction with fire detection work or during periods of intensive use, e.g. Easter period. Here again, confrontations between the public and the Forests Department should be positive, stressing educative explanation as to why quarantine is necessary and the long term benefits thereof. This is essential if we are to create a responsible and respectable image as multiple use forest managers.

3.5 Research

Research can be undertaken in a planning sense (refer Northern Regional Recreation Framework Plan) e.g. the trial or experimental zoning of gazetted water catchments according to levels of recreational usage. Research can also establish the level of degradation or recovery by 'before and after' type studies of recreation areas, e.g. sites currently in quarantine which will be developed for recreation, sites currently degraded which can be closed and monitored.

Another area of research is concerned with obtaining information regarding the public's perceptions of quarantine restrictions and benefits. Is the public seriously restrained in its pursuit of recreational experience by the imposition of quarantine regulations or is it largely oblivious of the existence of such regulations? What will be the long term effects of continual usage of currently established camping, picnic, trail facilities on the environment and public attitudes towards forest management if quarantine is continued, altered, abandoned? Are there environments and associated experiences contained within quarantine areas which should be open to the public, e.g. a monadnock walk trail? Preference studies would establish this and other aspects of forest user behaviour related to quarantine. A follow-up of the forest-wide visitor survey designed so as to obtain such perceptual and preference information would provide answers to the above questions as well as supplying data on the increase/decrease of recreational activity and its containment by quarantine.

Quarantine also offers an opportunity to implement Forest Landscape Management Guidelines (FLMG) as a basis for forest management when the current areas/boundaries are reviewed. The effects of FLMG could be readily tested and contrasted in quarantined areas which are subsequently reverted to unregulated State forest.(1) Here, as with recreation planning, the opportunity exists to implement forest management according to the best planning/management information that we have. In fact, reclassification of quarantine areas should only be undertaken after detailed management prescriptions (including the above) are ready for implementation.

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(1) Landscape management guidelines currently being formulated will eventually classify the whole of State forest into Landscape Management Zones based largely on their visual quality and sensitivity to disturbance. Areas within quarantine will be similarly classified but will not foreseeably be developed or extensively utilised.

14. CONSERVATION

J. Havel (Chairman)

B. White

O. Loneragan

299/82

SUBMISSION TO THE DIEBACK REVIEW COMMITTEE ON CONSERVATION

In the light of the nomenclature adopted by the Forests Department, conservation in its proper sense is the wise use of natural resource, as defined in the World Conservation Strategy. In this sense, all aspects of departmental activity hopefully fall into this category. What this group is therefore presumably charged with is the review of preservation of natural ecosystems as it affects, and is affected by, the dieback disease and its management. It is therefore primarily concerned with the Management Priority Areas for the Conservation of Flora, Fauna and the Landscape, and unless specifically stated otherwise, the term MPA is used in this narrow sense.

As requested, the submission is organised under the headings of current state of art, existing needs and problems, future policy directions and research needs. Staff needs are not specified, as it is not envisaged that a special conservation or preservation section will be created, but rather that the management and protection of such areas will be undertaken by individual decisions operating within overall guidelines.

1. The Current State of the Art

a) Most MPAs are located in locations free of, or with low occurrence of dieback.

b) In delineating boundaries, the aim was to encompass a catchment or a monadnock and its surround, so that the dieback would not be introduced from the outside, downslope, into the core of the MPA. However, for administration ease, the nearest road was normally used as the best practical approximation to this ideal.

c) In our submission to System 6 the core was described as being under permanent quarantine against all mechanised activities which could introduce dieback. Even access on foot is not encouraged in order to reduce the risk of dieback introduction.

d) The primary purpose of the buffer is to minimise risk to the core of the MPA. The introduction of dieback is looked upon as the most serious risk, as its impact is, with current knowledge, irreversible.

e) As one of the management prescriptions for the MPAs, closure of roads not essential to protection was recommended. Another alternative was the relocation of roads which enter and leave a catchment, so that the entire road would be outside the MPA.

f) In the current discussions with Alcoa, dieback has been identified as one of the major points affecting the future of the MPAs. The risk of introducing dieback through mining activity is one of the main arguments used by us for excluding mining. The presence of dieback is used as an argument for allowing mining by Alcoa.

2. Existing Needs and Problems Arising out of the Current Policy

a) In some MPAs there is unavoidable occurrence of dieback, even up to the graveyard stage. It would have been impossible to exclude them without grossly distorting boundaries.

b) Investigations by Supt. Peet indicate that uncontrolled travel in 4-wheel drive vehicles is occurring in MPAs, even such highly vulnerable ones as Gunapin.

c) Although active recreation involving soil and vegetation disturbance is to be excluded from core areas, the implementation of this in the field has been handicapped by inadequate patrolling on the weekends, when recreation activities are at peak.

d) The Divisional administrators have been requested to treat the core as an area under quarantine, but not all MPAs have been gazetted under the Forest Diseases Act.

e) Pigs are now identified as a serious source of dieback introduction and ironically the build-up in their numbers may be the result of imposing quarantine restrictions on pig hunters. They represent a random factor difficult to control, especially within the core of an MPA.

f) Despite 15 years of study by CSIRO on the impact of dieback on the forest vegetation, we still have no published quantitative information. We do have some qualitative information, through observations by our own staff.

g) Biological surveys of MPAs, which would give indication of their condition with respect to such factors as the spread of dieback, are occurring in the Southern Region, but not in the Central or Northern Regions. Even in the Southern Region, occurrence of dieback is not the primary observation made on such surveys.

h) The new mining legislation, in particular points covering exploration, have a major bearing on the security of MPAs, but its detailed implications have as yet not been worked out.

i) Current negotiation with Alcoa over the future of the MPAs have developed into a Catch 22 situation. Alcoa claims that they require further information on ore bodies only obtainable through additional drilling. Yet in the past drilling has been shown as one of the most free-ranging sources of infection.

3. REQUIRED POLICY DIRECTIONS FOR THE FUTURE

As this is obviously the main objective of the review, it warrants most detailed discussion.

(a) Operations

(i) Within the MPAs it is important to keep dieback even out of the more resistant types, as the more vulnerable understorey species are still important from the preservation viewpoint, even though the overstorey may survive intact.

(ii) No logging should take place within the core, or any part of the buffer sloping towards the core, so as to minimise the risk of introducing Phytophthora. Logging in buffer areas sloping away from the core should be conservative and only take place in safe, dry, mid-summer season.

(iii) Where major roads exist through MPAs, road maintenance, especially road drainage, needs to be improved.

(iv) Where dieback areas within the MPAs have already been rehabilitated by planting exotics, they should be given minimal treatment, such as no fertilisation or tending, but not necessarily elimination of the exotic species unless they show a tendency to spread.

(v) Dieback rehabilitation in MPAs should be kept to a minimum, and all exotic species should be excluded from new plantings.

(b) Plantations

(i) Plantation establishment should not take place hard up against the boundaries of MPAs because of high risk of introducing Phytophthora and creating hydrological changes which favour the intensification of the disease.

(c) Planning

(i) Forest operations should be planned so as to minimise entry into MPAs because of the associated risk of spreading or intensifying dieback.

(ii) Regional planners should make themselves aware of conditions necessary for long term survival of MPAs so that they give them adequate consideration in planning forestry operations.

(iii) MPAs need to be shown clearly on our management plans so that they are adequately considered in planning and execution of forestry operations.

(d) Administration

(i) Apiary sites should not be located in MPAs as access cannot be adequately policed because of irregular and dispersed nature of this industry, and there is consequently a high risk of introducing dieback.

(ii) Provision should be made for a certain amount of overtime to enable policing of quarantine restrictions over weekend in such critical areas as MPAs.

(e) Regional Superintendents

No specific recommendation, but all other recommendations relevant.

(f) Research

(i) There is a need for fundamental ecological research, especially at the soil and litter interface.

(ii) Fire ecology research should be aimed at maintaining or improving the health of the forest.

(iii) Further consideration should be given to treatment of small initial infections in core areas of MPAs, such as poisoning of banksias and the use of Ridomyl.

(iv) Research should be continued into the control of feral animals with potential to spread Phytophthora, especially pigs.

(g) Protection-fire

(i) Fire protection operations should be planned with the risk of spreading Phytophthora in mind.

(ii) Prescribed burning within MPAs should only be done from the air, or from roads in the buffer. Formation of new firebreaks and grading of established firebreaks should be avoided.

(iii) Wherever possible let-burn policy is preferable to suppression involving heavy machinery. This is particularly so in the core.

(h) Protection - environmental

(i) Guidelines developed for assessment of environmental damage should be followed, to serve as a data basis for prescribing appropriate control measures.

(i) Legislation

(i) If quarantine is to be lifted as a broad measure for the eastern jarrah region, there will be need to impose quarantine on all the MPAs within it. Any active management measure relevant to MPAs, e.g. medium intensity fires, should be first tested outside, or at least in the buffer, before they are applied to the core.

(ii) Legislative backing for control of activities in the MPAs is needed, particularly if quarantine constraints become untenable.

(iii) MPAs should be included in the national estate, to give them protection from federal organisations such as the Army and Telecom.

(iv) In responding to legislative changes with respect to exploration and prospecting, which would involve access into MPAs, we should use dieback as a major argument.

(v) MPAs need protection from mining by means of written agreements with the holders of special leases for the mining of bauxite, which would ensure the purpose of management.

(vi) In the event of an MPA, or a portion of it, losing its value through spread or intensification of the dieback disease, there should be provision for its reversion to the original holder of the mineral lease.

(j) Management information

(i) It may be desirable to develop the FMIS system so that it can be used to predict the spread of disease from existing infections, or from proposed mechanised incursions into the MPAs, e.g. new roads, mining.

(ii) Research currently being done by the Dwellingup Group on site variation in the impact of dieback may help to determine whether a particular dieback occurrence in an MPA will have only a minor impact, or be a major disaster.

(iii) If dieback-prone vegetation types can be identified, this would help greatly in prediction of long term viability of MPAs. It may be possible to do this from the large scale photos, on the basis of geomorphology.

(k) Mapping

(i) In order to be able to defend the MPAs against Alcoa and other mining companies, we need relevant information in map form such as dieback occurrence, vegetation type, topography, roads and ore bodies.

(l) Recreation

(i) There is need for legislation to control recreational access, both by vehicles and on foot, into MPAs.

(ii) Recreational planning should deflect people away from key preservation areas or Phytophthora susceptible sites.

(iii) Zoning of recreation should aim for having the recreational intensity inversely proportional to the preservation value of an area and its vulnerability to dieback, e.g. the more valuable and the more vulnerable an area is, the less recreational activity should reach into it.

(iv) Where public access is unavoidable, it should be via all-weather roads for vehicles and then by foot, because recreation occurs on weekends and is therefore hard to control. Vehicle-based recreation should be actively discouraged by blocking roads leading into the core, or putting gates on them where access is needed for scientific purposes.

(v) Where high dieback risk is involved, picnic areas should be relocated outside of MPAs.

(vi) Camping should be kept outside of MPAs, particularly where it involves entry by vehicles. This may necessitate provision of camping areas adjacent to all-weather roads.

(m) Conservation

All topics discussed so far are relevant, but no specific recommendations will be made.

(n) Publicity - extension

(i) In our public outreach we need to stress that in terms of the World Conservation Strategy, conservation refers to the bulk of our activities. Within the MPAs for flora, fauna and landscape, we are speaking about preservation.

(ii) Where it is necessary to deny access into an MPA, there is need to explain, either by literature lodged at the gate, or by notice board, why it has been necessary to impose the constraints. The aim of this should be to get the people to recognise that we do not wish to risk our best preserved forest to be infected.

(o) Training

(i) All induction courses for new staff should include a session on MPAs as a special case of forest management, and what is involved in maintaining them in the long term.

(ii) New officers, especially those involved in administration, should be briefed on the location of MPAs in their respective Divisions, and should be made aware of the complications that dieback generates in their management.

4. Research Needs and

5. Staff Needs

have been discussed in the preceding notes, under a number of appropriate topics, e.g. 3d, 3o and 3f.

15. PUBLICITY AND EXTENSION

P. Hewett (Chairman)

C. Winfield

P. Kimber

DIEBACK REVIEW

TOPIC: PUBLICITY AND EXTENSION

GROUP: HEWETT, KIMBER, WINFIELD

1. EXISTING PUBLICITY

1.1 Information Sheets .....

No. 4	Jarrah Dieback, A threat to W.A.'s unique jarrah forest	1978
No. 35	Quarantine in Native Forests	1977
No. 37	Plants resistant to Phytophthora cinnamomi	1977
No. 39	Some questions and answers about jarrah dieback.	1979

1.2 Forest Focus .....

No. 14	Jarrah Dieback (1975)	1978
No. 16	Sunklands includes refer to dieback	1975
No. 21	Dieback hygiene	1979

1.3 Slide Sets - now widely dispersed.

- In 1976 one set of dieback slides a projector (Kodak Carousel) and lecture notes was supplied to each region, as an aid for talks. There has been no feedback on their use.

1.4 Movie/Video - a proposed dieback film, to be funded by Alcoa, has lapsed due to problems with the narrative and choice of narrator.

- A movie, produced about 1968 called 'Research in Forestry' contains a small segment on dieback research, and is considered to be seriously out of date.

2. TECHNICAL PUBLICATIONS

2.1 Research Papers: No. 3, 14, 21, 25, 39, 40 and 65 are relevant to dieback.

2.2 Bulletins: No. 84, 85, 88 are also relevant.

2.3 Externally Published: in various journals and proceedings 14 scientific articles written or presented in recent years.

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3. EXTENSION ACTIVITY

This occurs in two main areas, enquiries about plant deaths, and request for talks to clubs etc.

3.1 Plant Death Enquiries: There was a spate of these, mainly from the Metro area, and from Avocado orchardists from 1976 to 1980. Enquiries related to two sources, our own dieback publicity on the one hand, and a habit of nurseries to use dieback as the "scape-goat" on the other.

3.2 Talks to Clubs, Industry: Alot of these, especially in 1975-1977, were solicited by us, in order to extend the knowledge of our quarantine proposals. Since 1977 the demand has dropped quickly but had a minor increase in 1980/81 in response to a circular from the IFA to all Rotary Clubs.

4. EFFECTIVENESS OF PAST PUBLICITY

The group consider that publicity about the disease, and about control of access to Disease Risk Areas, has been remarkably successful, due to a combination of attempted 'saturation' during the 1975 run-up to proclamation of disease regulations in 1976, and the steady follow-up cover from a generally sympathetic media.

One of the most pleasing indications of success is with the recreational users of the forest who have voiced very few complaints. It may also be significant that although the "Road Closed" and other similar signs have been vandalised, the much larger signs with a map and explanations, placed at recreation sites, have generally been un-marked after 6 years.

5. PROPOSALS FOR THE FUTURE

It has been assumed by the Group, that the latest findings of research could produce a less restrictive attitude to entry into the forest by vehicles (including horses) and that we may have to admit to a degree of over-kill in hygiene. Given this scenario, the following proposals are made.

5.1 Public Information

5.1.1 Forest Education Series: the Extension Branch is phasing out some of the old Information sheets, and replacing them with several new series e.g. Tree Care Series; The next group in preparation is the "Forests Education Series" which will be aimed at Senior Primary School students, age 10 to 12 years. Two dieback titles are proposed:-

a) What is jarrah dieback?
b) Helping to control jarrah dieback.

5.1.2 Forest Focus: it is suggested that new information and new procedures for dieback be included as part of successive issues of Forest Focus. We strongly appose any suggestion that there be a Special

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Focus on Dieback since we consider the changes need maximum penetration of the market, and this will not be achieved at $2.00 per copy.

5.1.3 Press Coverage: the options, apart from Ministerial releases, are suggested as either, a paid quarter-page advertisement in the city and rural press, or, a couple of feature activities by a reliable journalist in the West Australian.

5.1.4 A second edition of Nifty Numbat Talks to Dieback!

5.1.5 External Pamphlets/Maps: In liaison with the organisations that produce maps, directories or tourist brochures over the forest estate, a review will be needed to ensure that there is a close correlation with the manner of presentation of data. Such organisations include:

Dept. of Youth, Sport & Recreation	:	Picnic area guide
	:	Campsites booklet
	:	Youth Camp material
Dept. of Tourism	:	Maps
	:	Brochures
	:	Information
Lands Department	:	Tourists maps
Royal Automobile Club	:	Tourist maps
	:	District maps
National Parks Authority	:	Tourist brochures
Dept. of Fisheries & Wildlife	:	Handbook for inland fishing

5.1.6 New annotated slide set to each R HQ for local use

5.2 Internal Publicity (Training?)

5.2.1 Briefing sessions as soon as possible for all Departmental staff including State Headquarters staff.

5.2.2 Briefing talks for timber industry, and mining organisations that operate on State forest.

5.2.3 A thorough review of job prescriptions, forester's manual and circulars to remove dieback or hygiene comments that become redundant.

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6. GENERAL

An explanation of the role of other species of Phytophthora, such as P. citricola, may also need to be included in all of the above, but the Group is of the opinion that unless this can be done very simply, it may serve only to confuse both the staff and the public.

P.N. HEWETT
CHIEF OF DIVISION

27th July, 1982

PNH:DR

16. TRAINING

A. Hill (Chairman)

N. Ashcroft

B. Brody

HISTORY OF DISEASE TRAINING

Professional Cadets

No formal training provided until commencement with the Department as Assistant Divisional Forest Officers. Knowledge of dieback disease obtained through vacational work and pathology lectures at A.N.U.

Field Staff

Field Staff - Operations

Three levels of training have been undertaken.

a) Protection Branch Courses

Five courses of approximately 25 participants each were held over the years 1980 and 1981. These numbers included a small number of people from other organizations who operated in the forest.

These courses were directed at Operational staff and their perceived needs at the time. Training was carried out on basic biology of the disease; nomenclature, identification and mapping; hygiene measures for logging and earthworks, recreation planning; liaison with public utilities and other organizations. A major part of each course was the syndicate exercise consisting of the development of a logging project using advanced dieback hygiene knowledge and available planning aids.

Training staff for these courses were drawn from Protection Branch, Regions, Extension Branch, Dwellingup Research Station and Inventory & planning Branch.

b) Divisional/Regional Courses

From time to time Divisions and Regions have run smaller and less formalised hygiene training sessions as the need arose. These included such things as marking down disease identification, demarcation for logging, silvicultural operations (e.g. FIRS), grading roads etc.

c) Disease Identification & Mapping

A series of field courses were run by the Dieback Photography Group on the use of dieback map and disease indentification. They were run in conjunction with the production of dieback-free maps and concentrated on how these maps were produced and their use in the field situation.

They have been held in the Division being mapped at the time, (i.e. Dwellingup, Jarrahdale, Harvey, Nannup and Pemberton Divisions). Local staff, regional staff and occasionally representatives from other Divisions attended.

Field Staff - Technical

Technical staff working on dieback research, identification or mapping have been able to keep informed by virtue of their work. Formal training for other technical staff has been very limited.

Field Staff - Promotional Exams

Promotional exams provide a training mechanism in addition to satisfying on industrial requirement. There is a benefit for staff up to the LF7 exam only.

Professional Staff

Professional staff from Regional Offices and Divisions have been included in formal training courses for field staff.

There has been no comprehensive training carried out for senior professional staff.

State Headquarters Clerical Staff

There has been no formal training carried out for clerical staff from State Headquarters. In 1982 a series of one day field visits has given a selected number of Clerical staff an insight into various aspects of forestry adjacent to the Metropolitan area, including disease management.

Other Organizations

Two formal approaches have taken place.

(i) Timber Industry Training

Semi-formal training in disease management has been given at Regional level to some timber industry staff through the liaison and working committees.

Consultative Committee on Forestry & Timber.
Joint F.P.A./F.D. Study Group.

Informal on-the-job training of mill managers and bush crew is generally a continuous exercise.

(ii) General Forest Users

The five formal Dieback Management Courses held in 1980 and 1981 were attended by a selected number of representatives from organizations which operate over State Forest, or in areas where dieback disease is a potential threat. Organisations represented were sawmilling companys (Whittakers, Bunnings and Millars), bauxite mining companies (Alcoa, Worsley, Alumina) State Energy Commission, Bush Fires Board

Disease Training Requirements

1. Professional Cadets

These students are the Departments representativ on the A.N.U. course.

They require basic knowledge on biology of disease and disease management techniques and should receive formal training in vacation periods prior to going to Canberra.

2. Field Staff - Operations

General training requirements are disease, biology, identification and mapping, hygiene techniques, patrolling.

Depending on location and programme, specific requirements may also include rehabilitation and methods of altering forest resistance.

3. Field Staff - Technical

All need to be versed on disease identification and general hygiene requirements. Otherwise, unless specifically required for their work, general knowledge of other aspects of disease management will suffice.

4. Professional Staff

Regional and Divisional staff require in depth knowledge on all aspects of disease management. In addition they require an in-depth understanding of Departmental policy objective to policies.

Senior professional staff require a broad understanding of disease management.

Wages Employees

Require an in-depth knowledge on disease identification and hygiene measures. Otherwise a general awareness of other matters of disease management will suffice.

State Headquarters Clerical Staff

General awareness of the disease and disease management techniques required, particularly for those who interface with the public on behalf of the Department.

Other Organizations

There is a great and continual need to update dieback knowledge for organizations operating on State Forest.

In most instances the prime requirement would be identification and hygiene techniques.

An on-going programme will be required to offset staff changes in other organizations. The great need is to keep the planners and the front line supervisors aware of disease management requirements.

17. LEGISLATION

L. Hammond (Chairman)

B. Cowcher

J. Adams

INPUT DEFERRED UNTIL SUBMISSIONS
BY OTHER GROUPS ARE AVAILABLE.

18. EXTRACTS FROM DAMAGE REVIEW

G. Peet

FOREST DAMAGE REVIEW MAY-JUNE 1982

During May and June 1982 a review of forest damage from various operations was carried out for all Divisions. The review examined the effectiveness of controls for minimising forest damage from operations such as logging, mining, recreation, plantation establishment, roadwork and fire control.

There were time constraints on the review and only operations of immediate concern to each Division were examined. For each operation 13 damage criteria were assessed in terms of effective prevention and rehabilitation measures. The method of assessment is explained in the explanatory notes accompanying Forest Damage Assessment Sheets.

The attached extracts are summaries from the forest damage assessment sheets for the first damage criterion - spread of dieback disease. The extracts show the operation under review, the issue or cause for concern raised by the Divisional and Regional staff, the suggested remedy and the Divisions recording the issue.

N.B.

It is important to recognise the limitations of this data and it should not be quoted out of context. The data reflects the opinions of the review group, which included senior Divisional staff, Regional staff and representatives from Protection Branch. Their brief was to list all issues of immediate concern for environmental protection, irrespective of whether the issue was of minor importance, a potential problem, or a serious issue.

At this time the issues have not been ranked in order of importance, nor has field checking been undertaken to clarify the seriousness of many issues. Further work is required to separate those of relatively minor importance or potential impact (but nevertheless quite relevant in assessing the effectiveness of controls), from those which are serious and require immediate remedies. These evaluations are progressing through the Superintendents' Functional Group.

Further information on the review is available in reports of each Division's survey and a report on Departmental findings titled Environmental Protection Review May-June 1982, dated 28/7/82.

EXTRACT FROM FOREST DAMAGE REVIEW MAY - JUNE 1982

SPREAD OF DIEBACK DISEASE AND OTHER DISEASES

OPERATION	ISSUE	SUGGESTED ACTION	DIVISIONS RECORDING THE ISSUE
HARDWOOD LOGGING	1. Spread of dieback could be reduced by: 1.1 More effective training for F.D. and industry particularly higher levels of management in industry. 1.2 More accurate dieback maps for demarking logging coupes. Ground surveys produce variable results. 2. Divisional staff require training in identification and control of armillaria.	List for Dept. review. (a) Identify proposed logging areas that have in effect been reasonably well quarantined. (b) Put forward proposal to have these areas photographed by 70 mm. (c) Develop standard training format for dieback hygiene.	Manjimup, Harvey Kirup
	3. Effect of logging on spread of other diseases, e.g. Armillaria, P. citricola is not assessed. 4. Although Divisional training programme in dieback hygiene for logging is adequate, there is a need for a Regional programme to ensure consistency of standards, also industry training programme is required.	3. Research has commenced at Dwellingup. Monitor results. 4. Region, Protection Branch and Dept. training programme.	Dwellingup Collie
	5. Dieback hygienein karri is a lower priority than for jarrah forest but there is a need for research to define sensible operational constraints for hygiene relative to dieback impact on karri. 6. An integrated operation for all timber products is highly desirable if hygiene is to be improved.	List for Dept. review.	Manjimup, Pemberton
	7. Possible spread of dieback in wandoo through logging operations. Impact in eastern forest not adequately assessed.	(1) Ongoing training of Divisional staff in Jarrah 81 and prescriptions. Action: O.I.C. and Region. (2) Review dieback research requirements for eastern forest. Action: List for Dept. review.	Mundaring
	8. Jarrah 81 not fully implemented.	Training required for both F.D. and industry in dieback mapping and demarkation hygiene procedures. Action: Region, Division, Protection.	Jarrahdale
	9. Need to be 2-4 years ahead in planning so that hygiene can be properly implemented. 10. Suggest "Regional facility" for plating dieback samples so results can be obtained with less delay. 11. Information on use of copper sulphate and sodium hypochlorite for wash-down needs clarifying. 12. Revitalize training programmes in dieback for both F.D. and industry once hygiene requirements for S. Region are clearly identified. 13. Clarify whether F.D. or industry is to supply wash-down equipment. The type of equipment used for wash-down needs improving (better design). 14. F.D. have not really come to grips with dieback problem and a uniform approach is needed for implementation of hygiene, e.g. need for a Dept. Jarrah 81. 15. There are considerable difficulties in accurately demarkating dieback in S. jarrah forest because of reduced visibility in dense scrub.	List for Dept. review. " " " " Checked with Research, letter circulated. List for Dept. review. Advice from C.O.D. List for Dept. review. " " " " involves reallocation of photography priorities.	Walpole

EXTRACT FROM FOREST DAMAGE REVIEW MAY - JUNE 1982

SPREAD OF DIEBACK DISEASE AND OTHER DISEASES

OPERATION	ISSUE	SUGGESTED ACTION	DIVISIONS RECORDING THE ISSUE
RECREATION AND PUBLIC USE OF THE FOREST	Dieback hygiene is implemented to a degree for organized car groups, but there is a considerable traffic of 4-wheel drives and motorbokes on weekends not controlled. These activities will spread dieback.	The subject of public education and co-operation in dieback hygiene requirements has arisen in most Divisions. Need for concerted thought to determine how improvements can be achieved. List for Dept. review. More weekend patrols may be appropriate. Effectiveness needs evaluation. Action: Include in Dept. review. Public and vehicle clubs given more talks on dieback hygiene to increase awareness of damage they cause. Action: Include in Dept. review. Locate vehicle recreation areas in low dieback impact areas. Encourage vehicle owners to use these areas by: Signs over designated routes to the areas Weekend patrols to educate offenders Improve quality of access roads so that spread is less likely. Ensure dieback spread is adequately covered in new recreation proposals. Need to review policy and legislation on use of vehicles in State Forest. Action: List for Dept. review.	DWELLINGUP NANNUP HARVEY MUNDARING WANNEROO BUSSELTON
	Dieback continues to be spread by activities of pig hunters, weekend firewood gatherers and off-road vehicles. (No specific information available). Public are inadequately informed on need for quarantine and reasons for restrictions on entry.	Inform public more fully on the damage caused by these activities. Assess suitability and practicability of more weekend patrols by F.D. staff, also signs. Action: Include in Dept. review.	JARRAHDALE KIRUP
	Spread of dieback by motorbikes and car rallies increased by lack of adequate dieback maps.	Question whether these activities are legitimate use of forest susceptible to dieback. Action: List for Dept. review.	MANJIMUP
	Damage to picnic sites from vandalism + overuse from camping at peak holiday periods. Need to review adequate picnic facilities in view of demand and to educate public against vandalism.	Region to discuss with Extension Branch.	COLLIE

EXTRACT FROM FOREST DAMAGE REVIEW MAY - JUNE 1982

SPREAD OF DIEBACK DISEASE AND OTHER DISEASES

OPERATION	ISSUE	SUGGESTED ACTION	DIVISIONS RECORDING THE ISSUE
PLANTATION ESTABLISHMENT AND SOFTWOOD LOGGING	Probable spread of dieback within plantations by logging operations. Impact is not known because of lack of indicator or susceptible species. Difficult to specify sensible hygiene measures under these conditions.	Need for further research to assess the impact on future land use and possible spread of dieback from the plantations into surrounding forest. Action: List for Dept. review.	MUNDARING HARVEY NANNUP KIRUP COLLIE
	Need to improve hygiene (wash-down) when dozers move from cleared compartments through hardwood ridge tops to next job.	Divisional staff to tighten control procedures. O.I.C. to arrange further training of F.D. and contractors in hygiene requirements. Action: O.I.C.	BUSSELTON
	What are the effects of current plantation practices on dieback spread in coastal soils? Inadequate information available on which to base a sensible hygiene programme.	Map areas to be cleared and assess possible damage to likely environmentally susceptible areas, e.g. M.P.A.s. Action: Division and Region.	WANNEROO

EXTRACT FROM FOREST DAMAGE REVIEW MAY - JUNE 1982

SPREAD OF DIEBACK DISEASE AND OTHER DISEASES

OPERATION	ISSUE	SUGGESTED ACTION	DIVISIONS RECORDING THE ISSUE
ROADWORK	Inadequate precautions in shire roading activity. Improved hygiene resisted by Shire because of costs (Kirup).	Division to identify shire roads where dieback is not already established. Liaison with shire required to peg these roads for hygiene grading and upgrading. Action: Division.	NANNUP KIRUP
	Inadequate dieback maps are resulting in risk of spread of disease from infected gravel and inadequate grading procedures.	Training of shire staff in: (i) dieback mapping (ii) sampling techniques (iii) dieback hygiene methods. Action: Division to remedy where possible. Include problem areas in Dept. review.	JARRAHDALE
	Roading prescription requires revising in terms of dieback requirements for South Region. What are the hygiene requirements in forest with few, if any, indicator species and apparently low impact of disease?	Review dieback hygiene requirements for all operations in southern forest where impact is low. What is known about risk of infection, spread and environmental effects? List for Dept. review. As a precaution, ensure road contracts are timed for dry soil conditions.	WALPOLE MANJIMUP
	Spread of dieback during road maintenance.	May be improved by closing more roads high in the profile. Shire requires further training in dieback hygiene. Action: O.I.C. and list for Dept. review.	HARVEY
	The impact of dieback on karri types needs further research so that applicable hygiene can be specified. How can high hygiene costs be justified when impact is apparently minor?	List for Dept. review.	PEMBERTON

EXTRACT FROM FOREST DAMAGE REVIEW MAY - JUNE 1982

SPREAD OF DIEBACK DISEASE AND OTHER DISEASES

OPERATION	ISSUE	SUGGESTED ACTION	DIVISIONS RECORDING THE ISSUE
CLEARING FOR PUBLIC FACILITIES	Although some hygiene is practised in clearing and construction of these facilities, it is not fully effective. There is a need for further training in hygiene requirements for F.D. and outside organizations, including clear specifications of what is required for this area.	Need for further training for organizations such as M.R.D. and S.E.C. to ensure better self-monitoring of dieback hygiene. Action: Region and Division. Also note for Dept. review.	WANNEROO MUNDARING PEMBERTON
	The number of clearings through S.F. for S.E.C. lines etc. needs crititcal review. Does each S.E.C. clearing carry the maximum possible number of lines? Are additional lines cleared when present facilities could be upgraded?	List for Dept. review.	COLLIE

EXTRACT FROM FOREST DAMAGE REVIEW MAY - JUNE 1982

SPREAD OF DIEBACK DISEASE AND OTHER DISEASES

OPERATION	ISSUE	SUGGESTED ACTION	DIVISIONS RECORDING THE ISSUE
MINING	Roading for Worsley (Saddleback) took place during winter which does not conform with best dieback hygiene. What is the priority for production against hygiene? Planning for mining requires a better standard of dieback map than is achievable by ground stripping method. Need for better training of Divisional staff in dieback hygiene for mining operations.	List for Dept. review. Region to consider implementing a dieback-mining training programme with assistance from Protection Branch and other specialist groups.	DWELLINGUP
	No precautions to prevent spread of dieback disease within pits and to surrounding forest once mining commences.	Develop prescription for dieback hygiene covering minesite operations, obtain Alcoa co-operation. Train Alcoa and F.D. staff in requirements. Action: Include in Dept. review.	JARRAHDALE
	Spread of dieback along haul roads and within minesite.	Need for regular "update" session for F.D. staff on dieback hygiene, e.g.: information paper. Check procedures against those for Northern Region.	HARVEY (Willowdale Mine)
	Illegal prospectors have carried out drilling without reference to Divisions.	What control does F.D. have under Forests Act? What can be done to achieve better control under Mines Act?	NANNUP
	Possible spread of dieback along access roads during construction and by inadequate drainage along conveyor line.	Monitor drainage along conveyor this winter. Check for new outbreaks of dieback along access roads. Ensure roads properly gated at quarantine boundaries. Action: O.I.C.	HARVEY (Worsley)
	Illegal mining still goes on in S.F. with obvious implications for dieback spread. The Dept. has very little control over activities of Greenbushes Tin, which may spread dieback.	List for Dept. review.	KIRUP
	Dieback spread from drilling, roading and access due to inadequate dieback plan. Need to clarify what can be protected in the Collie Coal Basin from proposed mining plans. There is a high level of vehicle activity in this highly susceptible area.	Lectures and better understanding of dieback hygiene is required for industries such as coal, S.E.C. and others. Better hygiene requires better dieback plans and forewarning of mining intentions. List for Dept. review.	COLLIE

EXTRACT FROM FOREST DAMAGE REVIEW MAY - JUNE 1982

SPREAD OF DIEBACK DISEASE AND OTHER DISEASES

OPERATION	ISSUE	SUGGESTED ACTION	DIVISIONS RECORDING THE ISSUE
HARDWOOD REGENERATION AND FIRE CONTROL SOUTHERN REGION	Improved hygiene for scrub rolling and preparation of firebreaks for regeneration burns is necessary. Impact requires assessment.	List for Dept. review.	MANJIMUP
	Dieback probably spread along firebreaks and coupe boundaries during construction. Lack of adequate dieback plan and dense scrub hinders proper demarkation and hygiene. There is a high risk of spread during fire suppression without adequate maps.	Need for adequate dieback maps has been recorded for many operations. List for Dept. review.	WALPOLE

EXTRACT FROM FOREST DAMAGE REVIEW MAY - JUNE 1982

SPREAD OF DIEBACK DISEASE AND OTHER DISEASES

OPERATION	ISSUE	SUGGESTED ACTION	DIVISIONS RECORDING THE ISSUE
MINOR FOREST PRODUCE	Probable spread of dieback by public gathering firewood on weekends. Also by weekend firewood sellers.	Possibilities are: Control of illegal sellers through their newspaper advertisements. Impose shorter time limits on current licences. Signpost closed roads. Weekend patrols. Action: List for Dept. review.	MUNDARING

19. INFORMATION REQUIREMENTS FOR POST QUARANTINE MANAGEMENT

H. Campbell

INFORMATION REQUIREMENTS
FOR POST-QUARANTINE MANAGEMENT

OBJECTIVES OF MANAGEMENT

(1) MAJOR OBJECTIVE: to preserve the jarrah forest ecosystem over as wide an area as current technology permits while continuing to manage the forest resources,

(2) SECONDARY OBJECTIVE: applied where the major objective is not feasible; to minimise the wastage of the jarrah timber resource by ensuring its extraction before it is destroyed.

Comments on the Objectives

(i) Confidence in our ability to achieve our major objective is not widespread. Practices in some areas indicate that there may be some tendency to believe that (2) is our only objective. Confidence should be restored before re-entering QT.

(ii) It is interesting to note how the accumulation of information has gradually modified the target area of our major objective. In the early days of hygiene management the target was restricted to protectable forest. New information on biological impact allowed us to extend the target to low-impact, non-protectable forest. The recent research results suggest that we may be able now to apply our major objective over the whole forest except the infected areas where damage to the overstorey has already occurred.

MANAGEMENT STRATEGIES

In areas where we apply the major objective:

(i) containment

(ii) inhibition.

In areas where we apply the secondary objective:

(i) passive rehabilitation - leave it to nature,

(ii) active rehabilitation - plant resistant species possibly in salt sensitive or visually sensitive areas.

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Containment: Developments promoting confidence in the success of the strategy include:

(i) the high quality Dieback Location Maps becoming available for the QT areas,

(ii) the breakthrough in hygiene management philosophy achieved by the Northern Region staff through their intelligent use of natural topographic features to contain dieback.

A problem that remains is the concept of non-protectable forest. That the concept is ambiguous is indicated by the fact that it is often misinterpreted. The definition of non-protectable forest is extremely arbitrary leading to problems in mapping and demarcation on the ground. The dangers inherent in the use of these categories to determine logging priorities are referred to in a subsequent section.

I propose that the concept of protectable and non-protectable forest should be replaced by a concept of secure and insecure land units. The units may be whole sub-catchments or possibly those parts of sub-catchments which are bounded downslope by a creek or creeks and upslope by the watershed. A secure sub-catchment must meet the following conditions:

(i) it contains no upslope infections, though it may contain downslope infections adjacent to a creek,

(ii) it is not traversed high in the topography by a useable road, or by a powerline or by any other potential source of infection.

An insecure sub-catchment is one which does not meet these conditions.

This concept is a logical extension of the Northern Region hygiene philosophy. It provides a sounder basis for management than the arbitrary classification into protectable and non-protectable zones.

Inhibition: Policy statements made in GWP No. 87 indicate a high degree of confidence in the eventual success of this strategy. However, we do not know how to implement it at the operational scale and therefore cannot integrate it into our overall management strategy. What we can do, is to refrain from taking any action which may prejudice its successful application in future. This does not imply any changes in our operational procedures but may imply changes in our management priorities.

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MANAGEMENT PRIORITIES

The priorities for the sequence of logging operations in dieback infected forest are currently: dieback infected, non-protectable, protectable. This sequence does not recognise the significance of the recently reported research results.

A logging operation in infected forest will raise the inoculum potential. If the infection is upslope, the non-protectable zone below it is exposed to a higher level of risk. A subsequent logging operation in the non-protectable zone will increase its vulnerability to the threat. Without a logging operation the rate of intensification in an upslope infection is likely to be slow.

On the other hand, the rate of intensification within a downslope infection is likely to be rapid even without a logging operation, but the rise in inoculum potential resulting from an operation has less serious consequences as the natural rate of spread upslope is negligable.

Our priorities should recognise the difference in status between upslope and downslope infections. They should also recognise the difference in status between low-impact and high-impact forest. I propose the following:

(i) secure Sub-catchments: these areas contain dieback free forest and possibly some downslope infections. These may be logged safely, in the sequence: infected areas followed by dieback free.

(ii) insecure sub-catchments: these areas contain upslope infections (or potential, upslope infections), dieback free forest and possibly downslope infections,

(a) in high-impact forest the downslope infections may be logged safely. The remainder of the sub-catchment should be protected from logging activity until the appropriate conditions can be created in the understorey.

(b) in low-impact forest each upslope infection and potential infection should be enclosed by a buffer strip. The infections and the buffers should be protected from logging activity. The remainder of the sub-catchment may be logged safely in the sequence: down-slope infections followed by dieback free.

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MANAGEMENT INFORMATION:

A map suitable for management purposes should show the distribution of infections and should also indicate how the distribution effects management. Two factors are important:

(i) the topography, in particular the position of the infections relative to the topography and the location of the critical sub-catchments,

(ii) the forest type insofar as it determines the biological impact of the disease.

The first factor determines the organisation of a hygienic operation. The latter influences the strategy to be adopted and the prescriptions to be applied.

Neither the Dieback Location Map nor the Risk Category Map meet the requirement. A Management Map should display the following information:

(i) the distribution of the dieback categories: dieback, suspect and uninterpretable,

(ii) the boundaries of the insecure sub-catchments (or the parts of sub-catchments as described above) and, to ensure containment, the boundaries of a buffer zone extending into the reverse slope of the watershed,

(iii) within the insecure sub-catchments containing low-impact forest: the boundaries of the buffers enclosing upslope infections and potential infections, suspect and uninterpretable zones.

(iv) the boundaries of the low impact forest occurring within downslope infections (i.e. the forests on the red, loamy soils).

The Management Map is the basis for a series of operations maps each specific to a particular type of operation. A key map in the series is the Logging Operations Map which is prepared by superimposing the following information on the Management Map:

(i) the coupe boundaries which should follow sub-catchment boundaries

(ii) the road network to be used during the operation. All other roads are prohibited from use.

(iii) the control points at which wash down facilities will be provided.

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The selection of the road network and the coupes is co-ordinated in a manner which ensures that all useable roads and all permitted entry points into coupes are maintained as low as possible in the profile.

A CONCLUDING REMARK ON TERMINOLOGY

The boundaries of an insecure zone are well defined whereas the boundaries of a non-protectable zone are arbitrarily defined. At first sight, it may seem that this is the only difference and, therefore, that the distinction in terminology is trivial. However, this is not the case. Managers have used the concept of protectability in order to establish logging priorities and for no other purpose. It now appears that the priorities established in this way are unsound. The preceeding sections make it clear that "security" is not so much related to priorities for logging but, rather to priorities for the inhibition treatment. It seems appropriate or even necessary that a change in direction should be accompanied by a change in terminology.