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CONTROL OF CROWN DIEBACK DISORDERS IN EUCALYPT FORESTS

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CONTENTS

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1. Introduction

Jarrah dieback (Podger, 1972) and phasmatid defoliations of alpine ash (Readshaw, 1965) have emphasised to foresters in Australia the fact that disease is and can be a major problem in native eucalypt forests. Concern at the gradual accumulation of a series of eucalypt crown disorders (Hopkins, 1973) led to the convening of the current seminar to assess the ways in which these disorders may influence general forest management.

Up to the early 1960's professional training in Australia was noticeably deficient in accent on eucalypt pathology or the conditioning of future managers to meet major eucalypt forest disease problems. This situation, with one noticeable exception, was largely the result of lack of precedent in the field to warrant detailed attention. Generally, native eucalypt forests were considered to be remarkably free from major diseases and in balance with natural agencies.

The noticeable exception to the above generality is fire damage. Fire has been the greatest controllable agent which impaired values within indigenous eucalypt formations. Control of fire was essential before sound management could be envisaged. Fire protection was also the necessary prerequisite before any other disorders in the forest could be afforded sufficient economic weight to warrant detailed attention from control viewpoints.

Research, operational techniques and available manpower are now adequate within most States to control wildfires in forest (under responsible management) to a satisfactory level. This situation is assumed in the review and further omission to consider fire control is based on the facts that -

(a) it is still regarded as the paramount aspect of control required to decrease value loss by eucalypt crown dieback and

(b) all seminar participants should be more than just aware of this situation.

Fire warrants, and is receiving separate consideration through working groups, committees, seminars and special research teams.

This review does not detail control requirements for particular types of eucalypt crown dieback. The object is to consider the requirements for control and to outline approaches which may be applicable in general instances of forest disease in Australia.

2. Economic Significance

Before control procedures can be applied to a eucalypt crown disorder it is essential to demonstrate current or future economic significance. Loss of forest values due to the disorder must justify some flow of finance and manpower to alleviate the condition. This has been demonstrated for jarrah dieback (Hopkins, 1972; Shea and Hopkins, 1973), phasmatid damage to alpine ash (Readshaw and Mazanec, 1969), high altitude dieback in Tasmania (Ellis, 1964) and currently appears to be implied for disorders in east Victoria (Marks et al, 1972) and potential damage to regrowth in Tasmania (Felton, 1972). A preliminary evaluation for gully dieback in Tasmania (Felton and Bird, 1972) suggests that at present, expenditure on control may be unwarranted.

It is essential, however, for managers to have flexible attitudes to economics of control. Realization by the public that areas of indigenous forest are finite and increased demands for amenity values of forests have placed new relevance on the requirements for control of dieback disorders. Wood production is no longer the sole criterion and aesthetics and reserve values (Weste and Taylor, 1971; Weste and Law, 1973) must be considered.

3. Causal Agencies

Decisions as to whether control procedures are warranted do not lie purely with the value of benefits lost or threatened by the disorder. It is essential to know of the process and possible course of the disease. This requires a knowledge of the causal agencies and their potential within the environment to continue activity. Such a situation refers to regrowth dieback in southern Tasmania (Felton, 1972) and dieback of E. saligna at Ourimbah in N.S.W. (Hartigan, 1969). Before control measures can be contemplated it is essential to ensure that the problem is adequately researched. Successful control cannot be contemplated without a full appreciation of the critical aspects of the disease process.

Control of a disorder requires knowledge of some basic process or "weak links" within the disease process which can be modified by practical procedures.

4. Control Objectives

Most eucalypt crown disorders appear to result from physical disturbance by man. This may be direct as in the case of the introduction of Phytophthora cinnamomi to Western Australia (Podger et al, 1965) or Victoria (Marks et al, 1972) or indirect as in the disturbance of the sequence of burning (Ellis, 1964). In the case of crown deterioration in the jarrah forest (Wallace and Hatch, 1953) and regrowth dieback (Felton, 1972) the conditions may have to be accepted, as the forest formations involved possibly cannot withstand disturbance due to logging without some expression of crown deterioration.

It is essential when considering control of eucalypt crown diebacks to determine the values or end point to which the control effort is directed. Preservation of high amenity values may require reservation of unlogged wilderness areas. Jarrah dieback control aims to decrease damage in currently

healthy stands but cannot restore the original forest values to areas that are diseased (Hopkins, 1972; Batini and Hopkins, 1972). Control here applies to management alternatives and not necessarily to the process of devastation of original values on diseased areas. For much of the coastal east Gippsland forest threatened by P. cinnamomi (Marks et al, 1972) a practical approach may be to remove the derelict native type by chipwood operations and replace with a high proportion of resistant species such as P. radiata and E. globulus. Such decisions cannot be made without a thorough knowledge of the disease process, the ecology of the type and the land use alternatives involved.

5. Control Procedures

A range of established control procedures can be considered for eucalypt crown dieback situations.

5.1. Quarantine and Hygiene - The association of dieback disease with human vectors which are susceptible to control by quarantine and hygiene, has been amply demonstrated by Podger (1972), Weste and Taylor (1971), and Weste and Law (1973).

Quarantine and hygiene can be specific to prevent harmful agents (such as P. cinnamomi) from entering healthy, susceptible stands (Hopkins, 1972). Shea has shown that soil conditions are unfavourable to P. cinnamomi in the prime jarrah forest and quarantine and hygiene procedures may effectively restrict dieback in these situations (Shea and Hopkins, 1973). Batini (1973) has demonstrated that the simple process of washing down vehicles moving from diseased areas can be effective.

The major problems associated with quarantine and hygiene procedures in forest situations are to see that they are enforced satisfactorily and to monitor their effectiveness. In Western Australia quarantine and hygiene to control jarrah dieback are in practice

within State Forest boundaries (Batini and Hopkins, 1972). There is however, no control in national parks or in other diseased areas outside the authority of the Forests Department. Demands for road gravel from diseased shires outside the State Forest areas hence involve the possibility of private, infected vehicles entering the forest and gravel pits to obtain the material. There is no authority to insist that private vehicles must be cleaned and if there was, the enforcement of this activity would place severe demands on Departmental staff. It would, for instance, require careful and regular mapping of all diseased areas outside of the State Forest. The answer, to refuse to supply gravel, is not necessarily acceptable, with gravel representing a third or less the cost of alternative material available to the shires for road construction.

Quarantine and hygiene can also only slow the rate of spread of the disease, not completely eliminate it. Logic shows that this control must appreciably reduce spread of the fungus (Hopkins, 1972) but no satisfactory monitoring system to demonstrate this reduction has yet been devised. Without such evidence of beneficial effect it is often difficult for a divisional forest officer to keep faith with control policy. He is still dismayed by the extent that the disease continues to spread within his management division.

Quarantine and hygiene measures need to be complete for full effect. It is however, rarely possible to achieve this degree of control.

5.2. Chemical Procedures - Chemical treatment may be effective in the case of insect damage such as for the phasmatid defoliation in southern N.S.W. and northern Victoria. Weste and Law (1973) also report some possibilities for chemical use in localised

control of P. cinnamomi. Generally however, chemicals have restricted application in the control of eucalypt crown diebacks. The crop value is of such a low unit cost to prohibit widespread use; if a suitable control chemical is available. The disadvantage of further environmental pollution from the chemicals is also relevant. Generally it is felt that chemicals can only have applications in high value situations such as nurseries or plantations (Hopkins, 1972).

5.3. Cultural Procedures - Canopy maintenance, host reduction and fertiliser addition may offer appropriate control procedures for specific circumstances of eucalypt crown dieback. Shea and Hopkins (1973) have shown that the maintenance of low soil temperatures by canopy and litter manipulation has significant effects on reducing damage by P. cinnamomi in the jarrah forest. Ellis (1972) suggests that for the alpine ash dieback, understorey removal to increase soil temperatures at these high altitudes will effectively control ash dieback. Controlled drainage to restrict waterlogging is also important to disorders associated with waterlogging and P. cinnamomi (Hopkins, 1972).

Within the sphere of cultural control must be considered the use that can be made of natural species resistance (Podger and Batini, 1971; Marks et al, 1973; Weste and Law, 1973). Regeneration treatments for diseased or threatened forest should be aimed to increase the proportion of resistant species where this is practicable.

Biological control procedures are also important. As most eucalypt crown dieback disorders appear to result from interference from man, the reservation of certain forest types as true "wilderness" to preserve ecosystems intact for biological study deserves attention. This is the simplest form of biological control.

7. Conclusion

Much greater knowledge of the natural processes, interactions and balances within both natural and cut over eucalypt ecosystems is required before the control function in any one eucalypt crown dieback condition can be satisfactorily explained. The areas of forest involved and value per unit hectare make it unreasonable to rely on empirical or other approaches founded mainly on good ideas and optimism. These same limitations, and experience, restrict optimism concerning chemical controls or new forms of biological control. At the same time, the rate of spread of many of the disorders and the time span for the forest crop allow that even partial control procedures can be of importance.

Control of disease situations in native forest is a relatively new concept for foresters to digest. Limited experience would suggest an initial requirement to forget the "flick gun" approach - one simple technique once discovered will solve the problem. Forests are large and complex organisms which must be relatively effectively buffered against disease to survive. Many of the crown diebacks considered in this seminar reflect an imbalance which is probably uncontrollable; if restoration to some semblance of the natural ecosystem is the objective sought.

A case in point is the northern jarrah forest in Western Australia which has been heavily exploited by past cutting and fires and is now ravaged in parts by P. cinnamomi. Consideration has been given to rehabilitating the refractory soils of the heavily diseased areas by sowing or planting resistant species i.e. a future timber function was envisaged. It is far more economical and efficient to meet this future wood function by growing P. radiata or P. pinaster in alternative areas. Following salvage and some cleaning up, the park-like stands which remain after heavy disease development are satisfactory for recreation and water catchment purposes. These are the most desirable and obvious forest values to be developed in the area and are now major considerations in control and management policy.

Control procedures must often be regarded as making the best out of a bad situation. Once faced with the alternatives however, the manager will often find from a full analysis of land use resources and the disease situation that useful and publicly acceptable procedures are available.

It is suggested that disease control in eucalypt forests should be viewed initially from the viewpoint of management alternatives rather than as a panacea to the preservationist, research worker or timber miller.

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