the state Opposition, when interest was expressed by Mark Birrell when in opposition) informed.

This information, of course, is all particular to Friends of the Elms, but I would encourage anyone who wants to mobilize support for the elms in his or her area to employ some or all of these techniques. They've worked for us, so they should do so again.

Generally speaking I believe councils with elm trees in their care need to educate their staff. Staff should be able to recognize the symptoms of elm leaf beetle attack, and of Dutch elm disease if it strikes (the New Zealand outbreak was spotted by an alert council worker). They need to be competent enough to call for expert help where this is warranted, and they need to realize that local residents are inclined to feel possessive about old trees. Here I quote from a newspaper article written last May after the Shire of Kyneton began felling a stand of 74 elm trees in Malmsbury:

"A council spokesman said (Kyneton Shire Council) now realized it should have talked to the residents before deciding about the trees. It has agreed to call in a tree surgeon to inspect them before taking any further action. He said council officers had believed the trees were in poor condition".

Once the contingency report for Dutch elm disease which I referred to earlier is published, all affected councils need to be familiar with its provisions because prompt action is vital if the disease breaks out. Councils also need to know what is happening with the elm leaf beetle research project and – this is most important – they should have a management strategy in existence in case the beetle begins to feed on elm trees in their municipality.

But where are the elm trees? To locate each elm tree on public and private land in all municipalities is a logistic nightmare, but one with which the community can help. To raise general awareness, local newspapers should be used regularly for news and feature stories. These could be as general as a historic or human interest story about a fine old tree, or as specific as the news of a new outbreak of elm leaf beetle and the way the council is treating it. Illustrated leaflets about identification and control of the beetle could be put in letterboxes. Journalists who have written previous stories or who show an interest in the subject should be cultivated. Phone them up, keep them regularly informed. Journalists are always anxious to expand their contacts or be first to a good story.

In summary, members of the community must be encouraged to feel some sense of responsibility for the elms that are such a feature of Victoria (and some other parts of Australia). They must recognize that many of these beautiful trees are very old, and susceptible to pests and disease. Ideally they should keep an eye on them and report outbreaks of disease. Today people "out there" cannot expect the authorities to do everything; a joint effort is much better for all concerned. For our part, Friends of the Elms would like to see more response to our own efforts from municipal councils right across Victoria. After all, a few dollars annually is a small price to pay for information which may help you in your area to preserve or enhance some of the trees that help create its character.

Dutch elm disease – contingency plan

Peter Jenkins, 2/2A Tyrrell Street, Box Hill North, Victoria 3129, Australia. (Formerly Director of Plant Research Institute, Department of Agriculture)

Introduction

Dutch elm disease was first described in the Netherlands in 1920. Since then, it has spread through Europe and North America. More recently it has been detected in New Zealand. It has killed several million trees, mainly in the course of two epidemics, the first prior to the 1960s and the second beginning in the late 1960s. The latter epidemic has been responsible for the greater number of deaths. The disease is caused by a fungus, commonly known as *Ceratocystis ulmi*. Recently, however, it has been renamed *Ophiostoma ulmi*. The fungus associated with the second (current) epidemic was considered to be a particularly aggressive strain of *O. ulmi*; research in England has shown that it is, in fact, a different species, named *O. novo-ulmi*.

The fungus spreads from tree to tree by various bark beetles. The main vector is the smaller European elm bark beetle, which feeds and breeds in elm and in so doing, emerges from infected elm trees contaminated with spores of the fungus which are then carried to healthy elms. This beetle is widely distributed in Australia, having been introduced, but without the fungus, in the 1970s.

A second means of spread, particularly in close plantings such as in avenues and in wild situations, is by root grafts. There are no other direct means of spread such as in air, by wind or in rainsplash, as occurs with many other fungi. Spread is greatly facilitated by man, within and between countries. Beetles have obtained free rides in containers on ships, planes and on cars. The fungus has been spread in timber and firewood. In addition, man has greatly influenced the way epidemics have developed, by his management and distribution of the host population. Hence in Australia, the elm population has low genetic variability, having been propogated from only a few imported plants. Avenue plantations probably comprise only a few clones and are almost genetically identical. The elms in Australia are highly susceptible to Dutch elm disease, and should the disease arrive, it will spread very rapidly.

Control of Dutch elm disease

There are four chronologically distinct phases to minimizing the impact of Dutch elm disease:

1. exclusion of the fungus,
2. pre-introduction,
3. eradication and
4. containment.

Exclusion

The history of the spread of Dutch elm disease in North America and Europe indicates that unbarked elm logs or timber contaminated with both the fungus and the beetle present the greatest risk of entry of Dutch elm disease into Australia. Unbarked logs infected only with the fungus pose a risk, because the bark can remain suitable for beetle infestation for a considerable time after cutting, by the beetle population already in Australia.

Spores are short lived and beetles may fly up to 10 kilometres in search of elms for feeding and breeding. Hence long distance transmission is unlikely. The geographic isolation of Australia and the short range of natural Dutch elm disease dispersals suggest that Dutch elm disease incursions will be man assisted. In these circumstances, quarantine presents a practicable means of Dutch elm disease exclusion.

Quarantine is a form of hazard management and of acceptable risk, providing a level of security against the entry of unwanted pests and diseases that is considered cost effective and scientifically justifiable.

Risk assessment requires both biological and economic inputs and the bio-economic analysis determines the level and cost of quarantine. Such an analysis for Dutch elm disease is somewhat different from that for, say, fire blight of apples. Because resources for quarantine are limited, it is essential that they be directed for maximum effect.

Existing quarantine regulations prohibit importation of elm without permit and require various testing procedures to gain permits. A major risk lies in dunnage, the low grade timber used for packaging and which will be destroyed at

destination. The effectiveness of the regulation and its policing is one for possible review.

First occurrences of Dutch elm disease have been at ports and hence a systematic survey of elms close to ports could be a greater priority than random examination of elms, to detect first occurrences of Dutch elm disease in Australia.

Other quarantine activities; which could be enhanced include overseas intelligence and community and industry education. The administration of quarantine is a Commonwealth responsibility, through AQIS, a division of the Department of Primary Industries.

Pre-introduction

The objective of pre-introduction measures is to minimize the factors conducive to Dutch elm disease establishment and spread. The longer Dutch elm disease is excluded, the more thoroughly can this objective be addressed, thereby enhancing the possibility of eradication or containment. These measures include survey to determine the location of elms and their significance; removal of unwanted elms; improvement of tree vigour; and removal of unthrifty and dead limbs.

Consideration should be given to the economic removal of unnecessary elms – for timber or chipping – to aim for a population of elms significant to tourism or community enjoyment. Pre-introduction measures should include establishment of administrations and resources for diagnoses, surveys, co-ordination of intra and interstate activities and preparation and distribution of extension literature.

Eradication

If Dutch elm disease occurrence is suspected or proven, technical and financial implications and a decision is made to attempt eradication or not. Eradication will be feasible only if Dutch elm disease is detected very early in the progress of an outbreak. The elements of a Dutch elm disease management programme are detection, isolation, removal, and disposal.

1. Detection is the systematic inspection for Dutch elm disease of every elm in a control zone and the detection of all dead elm wood including cut timber and fire wood.
2. Isolation is the isolation of healthy from infected trees by disruption of root grafts.
3. Removal is the prompt elimination of all dead and dying elm material from the control zone.
4. Disposal is the destruction by burning, burying, chipping, debarking of elm material.

Spraying trees with insecticide may be a necessary complementary measure.

A number of factors detract from Dutch elm disease eradication. These include the difficulty of an initial detection because of the large geographical distribution of elms in SE Australia; the difficulty of mapping the elm population, particularly in private gardens and in wild neglected situations; the genetic uniformity of the elm population, highly susceptible to Dutch elm disease; the prior establishment of the insect vector throughout SE Australia; the unthriftness of a large proportion of the elm population resulting in high beetle populations, the concern in the community about pesticide usage.

It must be appreciated that successful eradication is a rarity; even if successful, new introductions remain possibilities.

Containment

If eradication is not feasible or has failed, a programme of containment will be necessary to keep tree losses to a minimum, to spread the cost of tree removal, and to protect significant trees. Containment includes detection and removal or therapeutic pruning of infected trees, isolation of infected from non-infected trees by mean of root graft disruption and use of fungicide barriers, use of systemic fungicides and possible use of insecticides. It includes the disposal of infected wood and utilization of non-infected wood and trees.

The level of containment might vary from state to state, or within states, from city to city. An ongoing overview committee should monitor containment programmes.

The future

One of the recent research findings in the United Kingdom is that the fungus itself has a disease. Brasier has identified a virus-like agent which spreads from diseased to healthy forms of the fungus. Infected isolates of the fungus are much less vigorous in growth and spore germination is severely impaired. A similar virus-like agent was isolated from the fungus causing chestnut blight and this has been developed into a commercial biological control agent in France.