PRG.

Mistletoes and their effect on native vegetation.

Discussion paper for SIMC.

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Mistletoes in WA.

Australian Mistletoes belong to two families, the Viscaceae and the Loranthaceae.

Viscaceae. This family probably originated in the northern hemisphere. It is poorly represented in WA where two species of *Viscum* are recorded in the Kimberley and one species, *Korthalsella leucothrix*, in the south west. They are all stem-hyperparasites. These *Viscum* species usually grow on loranthaceous mistletoes. In WA, *K. leucothrix* is known only from the type locality, Wanarra Rock and Lake Monger (both in the Midwest Region). It occurs on *Acacia* species.

Loranthaceae. Most Australian mistletoes belong to this family, which probably has a Gondwanan origin. However *Nuytsia floribunda*, the Western Australian Christmas tree, is probably the only Western Australian species which has descended from stock that was on the Australian plate when it separated from Gondwana. Most Australian mistletoes are probably derived from stock that was on the African and, more commonly, the Indian plates. Their ancestors reached Australia via the Indonesian archipelago. Within Australia, these immigrants spread across tropical latitudes and down the mesic, east coast. The family has been fairly successful at spreading into the arid zone and there are a few species in southern WA that have entered the State from south eastern Australia.

In Western Australia, the greatest diversity occurs in the Kimberley where Barlow (1984; *Flora of Australia* Volume 22) recorded 20 species in 5 genera. In the Pilbara, I am aware of 14 species (including four undescribed ones) in 3 genera, while in the south west there are only six species in two genera (excluding *Nuytsia*) and all but one are widespread on the continent. This analysis is grossly simplified but it serves to paint a picture of mistletoe biogeography in WA.

Conservation status of Mistletoes in WA.

No mistletoes are listed as threatened but two are listed Priority 1. They are:

- *Korthalsella leucothrix* (Viscaceae)
- *Amyema* sp. Fortescue (M Trudgen 5358) (Loranthaceae)

K. leucothrix also occurs in South Australia. It is a small, cryptic species that may be more abundant than collections suggest. I have not seen it.

I have collected the *Amyema* at five locations, including Karijini NP. At some locations it was locally common. It was always growing on *Acacia xiphophylla* which tends to grow on soils that do not support *Triodia* and it is thus reasonable fire-safe. (All my records are from the Ashburton drainage except one at the base Exmouth Gulf).

Fire is the biggest threat to most mistletoes. Fires that scorch canopies kill most mistletoe species. After fire, they have to recolonise from outside the burn area. Where hosts are killed (eg many *Acacia* species carry mistletoes), recolonisation can not commence until the hosts have regenerated. The huge fires that nowadays affect hummock grasslands have all but eliminated mistletoes from vast areas. Nevertheless I am not aware of any taxa that may be threatened with extinction because there are many populations in relatively fire-safe situations. Perhaps *Amyema melaleucae* should be "watched". It is host-specific to *Melaleuca* spp. in coastal scrub on the south coast (and Garden Island). Fire-caused local extinctions and its limited ability to recolonise after fire could eventually eliminate it. I suspect this will occur west of Esperance. However it seems to be reasonably common from Eucla into South Australia.

Mistletoes as pests in WA.

Most of the literature on mistletoes as pests concerns a genus that infests conifer plantations in America. That genus is absent from Australia. In the literature, there is some mention of mistletoes as pests in the eastern States but there is very little pertaining to WA. Nevertheless there are people who have expressed concern in areas of the wheatbelt. Thus, a couple of years ago Pat Ryan (CALM, Geraldton) asked me to meet with farmers and councillors from various shires in the Mullewa, Geraldton, Northampton area. I spent three days visiting these people and looking at the problem with Pat. From that trip and, particularly from my own observations through much of the State, the following table summarises situations where mistletoes are perceived as pests.

Table 1. Occurrence of mistletoes in situations where they may be regarded as pests.

Mistletoe	Affected hosts	Location (CALM Region)	Situation
Amyema miquelii	*Eucalyptus wandoo*	Western wheatbelt, York to Mt Barker (Wheatbelt)	Patchy. Usually road verges and paddocks
A. miquelii	*Corymbia calophylla*	Gosnells/Martin (Swan)	Paddocks and remnant vegetation
A. miquelii	*Eucalyptus todtiana*	Geraldton Sandplain south from Eneabba (Midwest)	Patchy in kwongan, including many conservation reserves
A. preissii	*Acacia acuminata*	Northern and western wheatbelt, notably Toodyay-York and Mullewa-Northampton areas, (Midwest)	Patchy. Usually road verges and remnant vegetation
A. preissii	Eastern States Acacias	Perth, notably the hills and adjacent suburbs) (Swan)	Gardens and "escapes"
A. fitzgeraldii	Various Acacias notably *A. acuminata*	Wheatbelt north from Mullewa/Northampton (Midwest)	Patchy. Usually road verges and remnant vegetation

Natural Balance. All our mistletoes are indigenous flora. No doubt, before European settlement they would have occurred in a balanced relationship with their hosts. This is still the case over much of the State.

It has changed
(a) where fire appears to have eliminated them from huge areas of hummock grasslands (and perhaps tropical savannas) and
(b) in the south west where clearing has eliminated them from large areas. In this case, remnant populations persist in remnant vegetation along roads, rivers, in paddocks and some uncleared sites, including small and large conservation reserves.

Mistletoes are only perceived as a problem/pest in the south west. In all the cases cited in Table 1 (except *A. miquelii* on *E. todtiana* in kwongan, see below) the problem occurs in highly disturbed sites where natural processes have been curtailed, typically, road verges, paddocks, and remnant vegetation. These sites also tend to be highly visible, often giving casual observers the impression that the problem is more widespread than it really is.

Impressions. There are places where the problem is real and serious. However there is a psychological element too. "They are parasites (like tape-worms or fleas and therefor inherently bad!) and must be eliminated." This is the message conveyed in 'Men of the Trees" displays at Garden Week and other shows (I'm giving them a talk on mistletoes in January!). It was also the motive for a boy-scout project to eliminate *A. miquelii* from marri trees in the Perth suburb of Martin. They got good coverage in the local newspaper too!

At Pat's request I visited one farmer who had a kilometre or more of the Greenough River, lined by river gums, running through his paddocks. All the trees were degenerating. Less than 10% carried mistletoes and <1% were heavily infested. Nevertheless he firmly believed that mistletoes were wiping out the trees. The real problem was salt and other disease organisms like borers and wood rot were doing more damage to the already unhealthy trees than the mistletoes.

While such perceptions may be a little off the mark, they are very real to those conservation-minded people who hold them. We need to encourage people to care for remnant bush. Therefor we need to provide education and solutions. Neither is easy.

The real problems in remnant bush. Mistletoe occurrence at pest levels is usually patchy. Eg in a wandoo-lined road reserve there may be sections of a few hundred meters every few kilometres in which infestations are excessive. Even within these sections, some trees will be so heavily infested that their health is affected or, in extreme cases, they die while neighbours are 'clean'. This phenomenon can be seen on the Albany and Brookton Highways.

It seems probable that mistletoes can be the ultimate cause of death for some hosts. Eastern States Acacias eg *A. baileyana* and *A. podalyrifolia* are very susceptible to excessive infestations by *Amyema preissii* in WA. This may not be a bad thing as both have the potential to become weeds. However, there seem to be two indigenous

hosts that experience problems more frequently than most. They are jam wattle, *Acacia acuminata*, and wandoo, *Eucalyptus wandoo*.

Jam wattle. Like many other acacias, jam is a relatively short lived tree. Old stands can become senescent and eventually collapse. Fire is probably important for regeneration. Heavy mistletoe infestations occur on jam growing in road reserves and other remnant vegetation. No doubt the mistletoes hasten the demise of some of them. However two pertinent factors contribute to the problem.

(a) Many of the trees are already old, senescent or in poor health because of their situation.
(b) The fire regimes that would have played a part in jam regeneration and mistletoe control have changed.

The mistletoes are not the underlying problem. The jam will die from one cause or another and a lot of it is dying from other causes. Unless it is regenerated, it will disappear from those remnant communities, with or without mistletoes. Removing the mistletoes will not solve the problem of jam disappearing from the road verges or other remnants.

If CALMScience is to address this problem, we need to tackle it by seeking methods to regenerate and manage jam in remnant vegetation, particularly road verges. The judicious use of fire may be the most effective tool to develop because fire probably did the job before we altered things. A difficult problem will be managing the dense, exotic grasses that usually dominate the under-story now. I suspect they are a factor in suppressing jam regeneration.

Wandoo. Wandoo differs from jam in that it lives longer, survives hot fires by producing epicormic shoots, and is less/not reliant on seed germination after fire for regeneration. I've never seen sites where many trees carry debilitating mistletoe loads in substantial areas of woodland where fire scars suggest fires occasionally scorch the canopy. Lack of hot fires once in a while is probably the reason why excessive infestations can build up along road reserves and in remnant vegetation. Nevertheless, even at those sites some trees are clean and healthy. I suspect that the mistletoes are exploiting trees that are less healthy for other reasons.

It may now be difficult to introduce fire that is sufficiently hot to scorch eucalypt canopies in narrow road reserves except on days when the adjacent farmers would NOT want anyone lighting up ! However it may be possible to remove the mistletoes with tree pruning equipment. *A. miquelii* has a simple haustorium that terminates its host branch. Cutting off the mistletoe kills it.

Prickly bark. In Table 1 I have listed *Amyema miquelii* as a serious pest of prickly bark, *Eucalyptus todtiana*, in kwongan communities north of Perth. In many of the National Parks and Nature Reserves south from Eneabba, prickly bark occurs as a sparse over-story to the kwongan (heathlands) and it is often heavily infested by the mistletoes to a debilitating level. I have observed dead trees with many mistletoe scars that suggest the mistletoes killed them. Fire is often rare in these communities. However I have observed areas that have been burned. The fires have killed all the mistletoes (their haustorial scars are obvious) and the trees all regenerate canopies

from epicormic shoots. The new canopies are dense and healthy in strong contrast to those that were not burned and still have mistletoes.

It appears that, through fire exclusion, mistletoes could more or less eliminate this tree from the community. In any case, one could generate a testable hypothesis and establish an experiment involving fire, physical pruning and a no-treatment control to examine it. The experiment would shed light on fire frequency and appropriate fire management in kwongan. As far as I know, CALM's approach to fire in kwongan is exclusion. While the mistletoe/prickly bark experiment would be quick and easy to set up, it would be a pity not to use the opportunity to examine other fire effects in these heathlands. This could be a nice student project provided the Midwest Region staff come to the party with the burning. I'd be happy to be involved.

Other possibilities. I have emphasised the role of fire in the problems and solutions because I think it is probably the most important single factor. However there are many other processes that may have contributed. For example, mistletoes are palatable.

Brush-tailed possums have exterminated one New Zealand mistletoe and threaten others. The loss of possums in remnant vegetation may have removed another mistletoe control agent.

It has also been suggested that mistletoe birds, when confined to corridors such as road verges, contribute to the problem. It may be a contributory factor but I doubt that it is a prime cause because it does not explain the patchy nature of excessive infestations or the selection of only some trees in a population by mistletoes.