

WESTERN AUSTRALIA

DISEASES (2007)

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Plantations

Pinus radiata

Diseases

No major problems reported.

Eucalyptus globulus

Diseases

No major problems reported. Research at Universities continues on *Mycosphaerella* leaf blights in *Eucalyptus globulus* plantations, 13 species have now been found associated with *E. globulus* (see Research and Development). One species, *kirramcyes epicoccoides*, not previously known in WA has been found on young *E. diversicolor* near Manjimup and young *E. rudis* near Perth. Research has also commenced on the potential risks posed by MLB and associated pathogens in plantations to native remnants.

Neofusicoccum eucalypti was found for the first time associated with severe cankers on a plantation near Albany. This pathogen has not been found before in WA, even during extensive surveys of plantations, it is endemic to eastern Australia and is highly pathogenic.

Managed natural forests

Jarrah forest (*Eucalyptus marginata*)

Diseases

No new major pathological problems reported, but severe frost damage was reported at several locations (see Urban and Rural). Management and survey of *Phytophthora* root disease in jarrah (*Eucalyptus marginata*) forests continues to command attention (see Forest Health Surveillance and Diagnosis, and Research and Development).

Karri forest (*Eucalyptus diversicolor*)

Diseases

No new major pathological problems reported. Management of *Armillaria* root disease in karri (*Eucalyptus diversicolor*) continues to command attention.

Nurseries

No major problems have been reported in either hardwood or conifer seedlings in nurseries.

Native plant communities

Diseases

Aerial application of phosphite at sites of biodiversity significance infected with *Phytophthora cinnamomi* within the Stirling Range National Park (230 ha), Albany Coastal (73 ha), Bell Track in the Fitzgerald River National Park (377 ha), Cape Le Grand National Park, Esperance (31ha), Mt Lindesay National Park (15 ha) and the Busselton Ironstone Threatened Ecological Community (TEC) has been completed. Targets included a number of associations of Montane-mallee-heath and Montane-mallee-thicket TEC and the critically endangered *Banksia brownii*, *Dryandra montana*, *Dryandra anatona*, *Lambertia fairellii* and *Andersonia axilliflora* in the Stirling Ranges and *Lambertia echinata* subsp. *echinata* in Esperance. New target sites are currently being considered for inclusion into the 2008 Phosphite Spraying Program. Monitoring of occurrences and survivorship of individual species and rate of spread of *Phytophthora* Dieback at target sites has continued. Sampling to confirm disease status and species susceptibility within sites also continues (N. Moore, DEC).



*Dryandra anaton*a communities on sites infested with *P. cinnamomi* in the Stirling Range National Park. Dead plants on an unsprayed site (*left*) and healthy plants on a site sprayed with phosphite (*right*) (photos in Feb 2007 by S. Barrett and N. Moore, DEC).

DEC Phytophthora Research Project

Funded through the State Government's Biodiversity Conservation Initiative a research project was commenced in late 2006 into the epidemiology and control of *Phytophthora cinnamomi* on the south coast of WA. The project is investigating the seasonal disease dynamics of *P. cinnamomi* including the mechanisms to disease centre extension and survival. Further the project is also investigating the use of phosphite basal stem application to prevent disease centre expansion and its effect on the epidemiology of the pathogen (C. Dunne, DEC).

Urban and rural

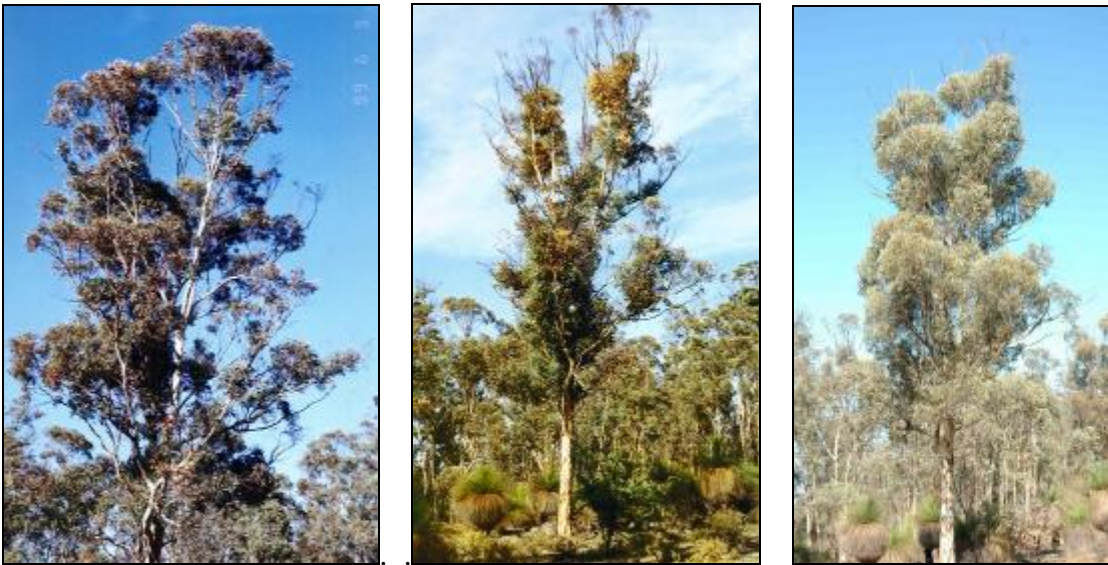
A Woodland Decline Symposium was held at Mandurah in November 2006. About 260 delegates from government, industry and community groups attended. Results of recent research on Tuart (*Eucalyptus gomphocephala*), Wandoo (*E. wandoo*), rudis (*E. rudis*) and marri (*Corymbia calophylla*) were presented as well as presentations and commentary on future directions and management implications.

Diseases

Mundulla Yellows: Monitoring of the occurrence and symptom development of Mundulla Yellows (MY) in WA has continued. Symptomatic eucalypts (both planted trees and remnant native trees) have been observed in several additional locations. Spread of symptoms within affected sites appears generally to be slow. The observed distribution of MY symptoms in the south of the state is from north of Geraldton to Esperance, and it occurs on alkaline coastal sands as well as on acid soils including laterites. As in South Australia, MY in WA is only seen in vegetation in disturbed sites or modified landscapes such as road verges and medians, parks and gardens, and in parkland or paddock remnant stands where it can be several hundred metres from, and sometimes upslope from, any road. Symptoms have not been observed within undisturbed native forest or woodland stands in WA. DEC was an Industry Partner in a three-year ARC Linkage project at The University of Adelaide, “A comparative study of the distribution and spread of potential molecular markers for Mundulla Yellows disease”, which was completed in March 2007. (M.Stukely, DEC).

Tuart Decline: In recent years, tuart (*Eucalyptus gomphocephala*) woodland within Yalgorup National Park, south of Mandurah has suffered a severe decline in health. Research carried out by The Tuart Health Research Group (THRG) has shown from surveys of tuart across the range, that the major decline syndrome is confined to Yalgorup N.P. These sites show a high correlation with higher rainfall, finer and shallower soils, higher groundwater alkalinity and salinity, and a greater rate of groundwater salinity increase (T. Edwards - Edith Cowan University). Critical water potentials for loss of xylem function were rarely breached in any size class or location within YNP over the past 20 months (P. Drake - Edith Cowan University). A *Phytophthora citricola*-like sp. has been recently isolated from a number of declining sites with the Yalgorup region. Further work is being conducted to determine the pathogenicity of these isolates and to characterise them (P. Scott, Murdoch University). There have been fewer mycorrhizal pads associated with fine roots of declining trees c.f. healthy trees and foliar analysis has shown that tuart within Yalgorup NP have low levels of trace elements such as Zinc (H. Eslick - Murdoch University). Studies on the role of fire and competition indicate tuart seedlings growing on ashbeds exhibit greater rates of survival and growth compared to those grown off ashbeds. Canopy health of the majority of tuart has increased following a controlled burn within Yalgorup NP (R. Archibald, Murdoch University). Trunk injections of a complete nutrient formula, zinc and phosphite either alone or in combination have shown promising results in a two trials established within the Yalgorup region and monitored over the previous 24 months (P. Barber, Murdoch University).

Wandoo Decline: In recent years the health of Wandoo (*Eucalyptus wandoo*) woodlands has been affected by crown decline, sometimes resulting in the death of declining trees. The Wandoo Recovery Group was established in 2003 and a Wandoo Strategy and Action Plan was developed, which included aims to support research, distribute information in the community and develop partnerships with stakeholders. Research strategy aims to increase the understanding of the relationships between climate, tree physiology and putative pests and pathogens associated with the decline. A number of projects, funded by The Australian Research Council, DEC, the Cooperative Research Centre for Plant-based Management of Dryland Salinity and UWA, focus on mapping canopy condition, tree physiology and ecology and pathology. Recent findings indicate that (1) wandoo decline occurs throughout most of its range and is not explained by a single factor, (2) wandoo trees continue to transpire when soils dry out, but other species such as jarrah and marri reduce transpiration rates under the same conditions, (3) tolerance levels to drought and salinity vary among wandoo populations from different locations, (4) wood boring insects and fungal pathogens are constantly associated with branch death and (5) crown assessment surveys suggest April to May is the peak time for decline symptoms. Future research will address links between environmental stress and susceptibility to pests and diseases (Wandoo Recovery Group Bulletin No. 4, March 2007).



Wandoo tree showing symptoms of crown decline and recovery photographed in June 1999 (*left*), May 2001 (*centre*) and May 2007 (*right*) (photos by A. Wills, DEC).

Rudis decline: Rudis (*E. rudis*) has shown varying degrees of symptoms of crown decline throughout its range for many years. Collaborative research between Murdoch University, Serpentine-Jarrahdale Local Council and ALCOA has been initiated to investigate the efficacy of trunk injections to reverse canopy decline. Trials include treatments of phosphite, complete nutrient and also an insecticide. A trial established in

spring 2005 at Pinjarra is currently in progress. Assessments of crown health are focusing at the crown, branch and leaf scale and the incidence and severity of a range of insect and fungal pests. Results indicate that stem injection with phosphite or a systemic insecticide induce an increase in crown health when compared to control and nutrient treatments (P. Barber, Murdoch University).

Forest health surveillance and diagnosis

Dieback mapping and management

To assist the planning of roading and harvesting operations undertaken by the FPC on DEC managed lands, a total area of 21,233 ha was mapped by accredited DEC interpreters for the presence of symptoms of dieback disease, caused by *Phytophthora cinnamomi*. This included 6,710 ha of previous mapping that was rechecked for further spread. Mapping and hygiene planning was also undertaken on a further 4,462 ha for the Parks and Visitor Services, Nature Conservation and Sustainable Forest Management Services, and 2,615 ha for external requests. Mapping for external clients included assistance to review the current extent and model predicted future spread of dieback from point infestations in the Fitzgerald River National Park (Bell Track Project), and in the implementation of phosphite application trials. New projects including engineering solutions were initiated to attempt to control the spread and immanent spilling of the infection into the next larger catchment (G. Strelein, DEC).

A major project to undertake dieback threat assessment and risk analyses for vegetation on the South West was extended with the South Coast Natural Resource Management group. This work has included the collation of biological assets, strategic disease mapping, predictive modelling of future disease spread, and estimation of threat and risk categories within a target area of approximately 0.6 million ha, and commenced in the Northern Agricultural Catchment Council and South West Catchment Council NRM zones. (G. Strelein, DEC).

In the year to 30th June 2007, a total of 1,693 samples were tested for the presence of *Phytophthora* by DEC's Vegetation Health Service (VHS). These samples were associated with verification of dieback mapping for the above projects, as well as external requests. DNA sequencing has been carried out at the Centre for *Phytophthora* Science and Management (CPSM), Murdoch University, on various recent and historical isolates of unidentified *Phytophthora* in the DEC culture collection, from a range of WA locations and ecosystems. This has led to the identification of *Phytophthora inundata* which was associated with dying *Banksia littoralis* in 1984 and with a dead *Xanthorrhoea preissii* in the Southern Jarrah Forest in 2005. *Phytophthora gonapodyides* has also been identified. At least seven new and undescribed *Phytophthora* taxa have been distinguished, based on their ITS rDNA sequences. Several of them are indistinguishable, on morphological characters, from known locally-occurring species such as *P. citricola*, *P. cryptogea*, or *P. megasperma*. A PhD project commenced in April 2007 at Murdoch University to further investigate and describe these new *Phytophthoras*, and to test their pathogenicity. A small number of other tree health and nursery problems were investigated (M. Stukely, DEC).

Plantations

Eucalyptus globulus

Forest health surveillance

Several projects at Murdoch University are focusing on eucalypt plantation health and risks to biodiversity of native forests in Australia. In the past 3 years, surveys have been conducted in collaboration with State departments and private forestry companies in eucalypt plantations in QLD and NT. The surveys provide a framework for a database on disease already present in Australia. Several new fungal species have been found causing leaf diseases and these are currently being described. A database of exotic eucalypt diseases and their proximity to Australia and the risk they pose to Australia's forests and industry is being compiled. A number of diseases are of particular interest, *Kirramyces destructans*, *Kirramyces zuluensis* and *Chrysosporthe cubensis*. Molecular markers have been developed for *K. destructans* and are already in existence for *K. zuluensis* and *C. cubensis* (through collaboration with the Forestry and Agriculture Biotechnology institute in South Africa). These markers will be used to determine the origin, diversity and movement of potentially destructive eucalypt diseases. The population of *K. destructans* in Asia was found to be genetically uniform providing evidence for a founder effect in Asia. Australia was thought to be the most likely origin and surveys in northern Australia have now found *K. destructans* in two locations, Derby Western Australia and Melville Island in the Northern Territory. A project has been funded to test the susceptibility (in trials in Asia) of several tropical and sub-tropical eucalypt species to *K. destructans* and *K. zuluensis*. These trials have been established in Thailand, Vietnam and China and will be rated by the end of 2007. A matching trial will be established on Melville Island in 2008 (T. Burgess, Murdoch University)

Study on the exchange of pathogens between native forests and bluegum plantations in Western Australia continued at Murdoch University and the new forestry CRC is studying the movement of *Mycosphaerella* spp. into WA and between forests and plantations. The focus of this project will be the two main pathogens, *M. nubilosa* and *M. cryptica* (student Kate Taylor). Kate is currently designing molecular markers for *M. cryptica*. The number of *Mycosphaerella* spp. associated with bluegum plantations has increased from 4 species in 1995 to 13 in 2006 (Sarah Jackson).

Several *Neofusicoccum* spp. (*N. australe*, *N. macroclavatum*), endemic to WA, have moved into the plantations and *N. eucalyptorum*, endemic to eastern Australia has recently been found in a plantation (T. Burgess, Murdoch University).

Kate Taylor (MU) completed an honours thesis on *Botryosphaeria* spp. associated with trees in healthy and declining tuart stands; identification, pathogenicity and potential role in decline. She found that *N. australe* was widespread and very pathogenic on most

hosts. Several new endophytic species were also found and these are currently being described (T. Burgess, Murdoch University).

Diseases

Work under the following grants is in progress at Murdoch University (MU).

Collaborative Project - Murdoch University and the Tree Pathology Cooperative Program (TPCP - Sth Africa). The project 'New and emerging pathogens threatening the biodiversity of Australia's eucalypts' continues, and concentrates on some of the major eucalypt pathogens worldwide (*Kirramcyes* spp. *Mycosphaerella* spp., *Botryosphaeria* spp. *Cryphonectria* spp.). The aim is to determine their origin, movement and the risk they pose to Australia's eucalypts (T. Burgess, MU and M. Wingfield, TPCP).

PhD Theses in progress at Murdoch University

Francisco (Paco) Tovar: The cause of basal stem rot in second rotation *Eucalyptus globulus* plantations (Supervisors: T. Burgess, G. Hardy, MU and R. Robinson, DEC). 2006-2007 saw the completion of a large-scale survey of 2nd rotation *E. globulus* coppice plantations. The survey was conducted to establish the incidence and likely causal agents of stump rots observed in such plantations. Six main wood decay fungi have been identified as possible causal agents of observed rots on stumps; *Trametes versicolor*, *Stereum hirsutum*, *Sterum illudens*, *Pycnoporus coccineus* and 2 as yet unidentified polypores species termed 'species A' and 'species B'. An inoculation trial on *E.globulus* coppice shoots will be set up this spring 2007 in order to determine the capacity of the above mentioned fungi to move from the stump into the new coppice shoots and cause further rot during the rotation. A stump treatment trial set up in 2005 will end in December 2007. Preliminary data already indicates that none of the anti-fungal preventative treatments were effective. An experiment investigating effect of harvest season on subsequent fungal colonisation was set up in spring 2006 and will continue until summer of 2008. Further surveys of both 1st and 2nd rotation plantations will be conducted in 2007-2008 to ascertain if there is an increase in levels of rot through the rotations (F. Tovar, MU).



Collapsed bluegum coppice (*left*) and *Pycnoporus coccineus* fruiting on a treated stump (*right*) (F Tovar, MU).

Vera Andjic: The movement of *Kirramcyes destructans* throughout Asia, a potential threat to Australia's forests and plantations (Supervisors: T. Burgess and G. Hardy, MU and M. Wingfield, TPCP).

Katherine Taylor: A detailed study of *Mycosphaerella cryptica* and *Mycosphaerella nubilosa* in Western Australia, focusing on the threat to native remnants. (Supervisors: T. Burgess, G. Hardy and P. Barber, MU, C. Mohammad, Forestry CRC and A. Carnegie, SF NSW).

Diseases of Boabs

In collaboration with Mike Winfield in South Africa Murdoch University has conducted a survey of fungi associated with boab (*Adansonia gregorii*) in Western Australia that will have a matching project in South Africa. Monique Sakalidis (PhD, MU) is taking on this work as part of her thesis. Seven new species in the Botryosphaeriaceae have been identified. *Lasiodiplodia* sp. nov, *Dothiorella* sp. nov, *Botryosphaeria* sp. nov and *Pseudofusicoccum* sp. nov (3 species). The most commonly isolates species was *Lasiodiplodia theobromae*. A pathogenicity test has shown that this species is highly pathogenic to boabs.

Managed natural forests

Jarrah forest (*Eucalyptus marginata*)

Diseases

Dieback-resistant jarrah (*Eucalyptus marginata*): Field trials of jarrah clones selected for resistance to *Phytophthora cinnamomi* have been written up. Trials of site preparation procedures for re-establishment of jarrah in dieback “graveyard” sites, especially on the “black gravels”, commenced in 2003 with further trials established in 2004, and very promising levels of survival have been recorded in the critical first and second years. Final planting of a production seed orchard of dieback resistant jarrah clones at the Forests Products Commission’s Plant Propagation Centre near Manjimup has been deferred pending the availability of clones. The first seed crops from the clonal seed orchards established from the late 1990s has been harvested. (M.Stukely, DEC).