

## Spectral measurements for detecting *Phytophthora*-related stress in *Corymbia calophylla* (marri)

Louise Croeser<sup>2</sup>, Treena Burgess<sup>1</sup>, Giles Hardy<sup>1,2</sup>, Trudy Paap<sup>1</sup>, Margaret Andrew<sup>3</sup>

1) Centre for *Phytophthora* Science and Management, Murdoch University, Perth, Western Australia.

2) Centre of Excellence for Climate Change, Woodland and Forest Health, Murdoch University, Perth, Western Australia.

3) School of Veterinary and Life Sciences, Murdoch University, Perth, Western Australia  
l.croeser@murdoch.edu.au

*Corymbia calophylla* (marri) is a keystone species in the forests and woodlands of south-west Western Australia. Since the 1970's widespread marri mortality has been reported and various factors have been cited as the cause of this decline. In this study we investigated the pathogenic effect of *Phytophthora* root infection to evaluate its potential role in marri decline.

Field surveys were conducted to determine the extent of *Phytophthora* infection on marri. Soil and root samples from the rhizosphere of declining marri, from both remnant and natural sites, were collected and baited to recover *Phytophthora* species. The recovered *Phytophthora* species were used in pathogenicity trials. Hyperspectral remote sensing measurements, sensitive to leaf chemical and functional traits (especially related to foliar pigment and water content), and stomatal conductance measurements of plant function, in addition to estimates of above- and below-ground biomass, were taken during the trials to develop indicators of *Phytophthora*-related stress in marri.

Five *Phytophthora* species were isolated from marri, *P. cinnamomi*, *P. cryptogea*, *P. elongata*, *P. multivora* and *P. calophyllaphila* prov. nom. These varied in their pathogenicity to marri. *P. cinnamomi* was the most pathogenic species whilst some isolates of *P. multivora* stimulated root and shoot growth on marri compared to the control plants. Stomatal conductance measurements correlated with the results of the pathogenicity trials, as did a number of spectral indices. The Normalised Difference Vegetation Index (NDVI) and Simple Ratio Index (SRI), general indicators of "greenness" and vegetation condition, and the Vogelmann Red Edge Index 3 (VOG3), indicator of auxiliary pigment content were closely related to marri response to *Phytophthora* infection. Conductance and greenness measurements were decreased and pigment content was increased by the *P. cinnamomi* infection. Non-destructive spectral measurements taken regularly throughout the trial reveal time-courses of marri decline and may provide early-warnings of infection. More experimental work is underway, including dual inoculation with *Phytophthora* and *Quambalaria coyrecup*, the cause of marri canker disease.