ABSTRACT

The Stirling Range National Park (SRNP), Western Australia, is a place of international importance with regard to its extremely high degree of biodiversity and endemism. However, the plant pathogen *Phytophthora cinnamomi* is having a devastating impact on the flora and plant communities of the SRNP. The inappropriate use of fire has also been considered in driving species declines in some communities in the SRNP. This present study examines for the first time, the role of these two threats together, on different plant communities of the SRNP.

Five survey sites located across four plant communities containing forty vegetation survey quadrats were chosen to compare the effects of fire on *P. cinnamomi* in the SRNP. Vegetation survey sites were paired between recently burnt (< 6 years) and longer-unburnt (>16 years) sites. A mosaic of disease-free and infested vegetation was present at all sites, while the incidence of disease was consistently higher in recently burnt sites. Four families were the focus of the study, Proteaceae, Papilionaceae, Epacridaceae and Myrtaceae. However, species from *Acacia*, *Hibbertia* and *Patersonia* and the susceptible *Xanthorrhoea platyphylla* were also included. One hundred and fifty-two species were identified, of which 62 %, 26.6 %, 2.6 % and 7.8 % were obligate seeder species, resprouter species, facultative sprouter-seeder species, and of unknown fire response strategy, respectively.

Declines in species richness and abundance in recently burnt sites were identified across all plant communities surveyed. The incidence of disease declined with time since last burnt. Increased severity of disease in recently burnt and infested sites was particularly pronounced for *X. platyphylla*. The dominant proteaceous component of the plant communities was the most impacted by the presence of *P. cinnamomi* in recently burnt sites. Fire promoted recruitment of some members of the Epacridaceae and Papilionaceae and especially the Myrtaceae family. However, numerous species of Epacridaceae and Papilionaceae also suffered serious declines in recently burnt *P. cinnamomi* infested sites. An increase in species richness and abundance from the Myrtaceae was documented in most recently burnt sites irrespective of *P. cinnamomi* impact.

Leaf litter measurements including percentage cover, weight (g/m^2) and depth (mm) increased with time since last fire, while percent bare ground decreased with time since last fire. The presence of *P. cinnamomi* increased the incidence of percentage bare ground within quadrats. Leaf litter accumulation was also influenced by plant community type and the incidence of *P. cinnamomi* varied between sites and within sites. Leaf litter was considered to have important roles for reducing the incidence and severity of *P. cinnamomi* and in reducing conditions favourable to the pathogen. Leaf litter on steeper slopes appears to help control erosion/runoff in periods of heavy rainfall and assist in seedling establishment.

Soil temperature between 100 – 200 mm depths were monitored from March 2005 to January 2006, it was identified that soil temperatures in recently burnt sites were up to 9.6 °C warmer than soil beneath leaf litter and canopy cover (long-unburnt sites). Soil moisture contents at the Bluff Knoll Road (BKR) 2000 site, at depths below 200 mm, were significantly greater in spring than at the paired but longer-unburnt BKR 1991 site. At the recently burnt Chester Pass Road (CPR) 2004 site, soil moisture in the top 100 mm was significantly greater in spring than at the longer-unburnt CPR 1996 site.

Sporangial production was significantly higher in soil extract collected from a 7-day-old fire (Saint James Track SJT) when compared to soil collected from the long-unburnt (30^+) site. Sporangial lysis was greatest in the long-unburnt (30^+) soil extract in both seasons but was greatest in spring. Sporangial production was significantly greater in spring than autumn. The SRNP *P. cinnamomi* isolate MP05-1 produced significantly more sporangia in both seasons than the DP55 isolate from the southcoast. Soil microbial activity was significantly reduced in the SJT soil when compared to the comparable long-unburnt soil of CPR (30^+). Fire significantly increased the concentrations of potassium, sulphur, organic carbon and the electrical conductivity and pH of the SJT soil. Soil type was found to have a strong influence on the nutrient composition of sites. Even though some of the findings regarding changes to soil microclimates are preliminary they do undoubtedly provide important directions for future research into the role of fire in *P. cinnamomi* infested communities.

This study has shown that fire in *P. cinnamomi* infested communities has the potential to increase both the severity and extent of disease in native plant communities, and impinge on the regeneration capabilities of susceptible species. The findings have

important implications for *P. cinnamomi* and fire management within the SRNP, and have established a foundation from which future research and monitoring of the plant communities and further soil investigations can be based. With careful consideration of the benefits of regeneration from fire in some plant communities and the evidence that fire can increase the severity of disease in infested sites, management may be able to meet these conflicting disturbances.