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FORESTCHECK: The response of lichens and bryophytes to silviculture in jarrah forest

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Background

Cryptogams, which include lichens and bryophytes (mosses, liverworts and hornworts), are a significant component of eucalypt forest biodiversity and contribute to healthy ecosystem functioning. They are important in nutrient recycling, are active in the weathering of rock surfaces to create new soil and release nutrients, and enhance water conservation by reducing run-off and evaporation which helps to maintain humidity. Cryptogams also provide a food source, habitat and protection for many invertebrates and nesting material for small mammals and birds. Lichens gain a portion of their nutrition from the atmosphere and many species are sensitive to pollutants, which makes them potential indicators of air quality and ecosystem health. Lichens and bryophytes that form soil crusts play important roles in soil stabilization and prevention of erosion in arid regions of Australia. Many lichens also produce unique secondary metabolites that may be potential pharmaceuticals.

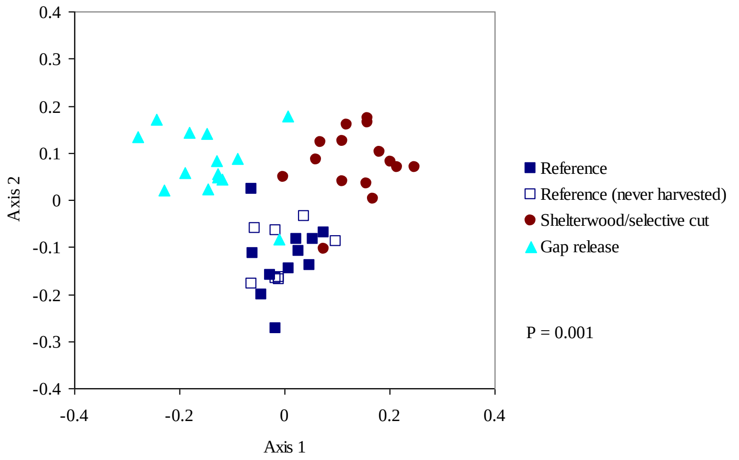
The FORESTCHECK project contributes to adaptive management of Western Australian forests by providing timely and relevant information about the implementation, effectiveness and biodiversity consequences of silvicultural practices in jarrah forest. Monitoring takes place at five locations within four jarrah forest ecosystems at 48 sampling grids. Grids represented examples of reference forest (never harvested or forest that had not been harvested for at least 40 years) and forest subject to either gap release or shelterwood/selective cut silvicultural treatments during the period 1988-2002.

Grids were surveyed over a five-year period with grids at one of the five locations sampled in autumn in each year. At each grid all species of lichens, mosses and liverworts were recorded within a 1 ha plot.

Left: *Usnea inermus* an important nesting material for native birds and small mammals

Findings

- A total of 280 lichens, 27 mosses and 11 liverworts were recorded, of which 72% were identified as known species.
- There were strong regional influences (relating to different forest ecosystem types) observed in the composition of cryptogam communities.
- Silvicultural treatments had a significant impact on the species assemblages of cryptogam communities, and on the species richness of lichens.
- *Sematophyllum subhumile* var. *contiguum* (a moss), *Cephaloziella exilifolia* (a liverwort) and several lichens were more frequent in reference forest than in silvicultural treated forest.
- Total cryptogam species richness was lowest in silvicultural treated grids 1-4 years after treatment, but 10 or more years after treatment it was similar to reference grids prescribed-burnt 10 years or more previously.



Left: CAP ordination based on cryptogam species assemblages recorded in three silvicultural treatments ('never harvested' is subset of the reference forest). The ordination compares species assemblages on each grid and identifies differences, hence grids with similar assemblages group together. The resulting graph shows that grids from the same treatment had similar species assemblages (i.e. they grouped together) but the species assemblages were significantly different between treatments.

- One-half of all the cryptogams recorded utilised coarse woody debris as a substrate and 40% of them depended on it entirely.
- *Pannaparmelia wilsonii*, *Hypogymnia subphysodes* and *Tephromela alectoronica*, two foliose and a crustose lichen associated with mature trees, were also recorded in the gap release treatment, demonstrating the importance of retained habitat trees for species other than native mammals and birds (Cranfield *et al*. 2011).


Above*: Hypogymnia subphysodes* (left) and *Tephromela alectoronica* (right) are associated with mature trees and large diameter logs

Management Implications

Cryptogams (particularly lichens) appear to be sensitive to recent silvicultural treatment and take about 10 years to develop into a similar community in treated areas to that observed in reference forest.

Many cryptogams were strongly associated with coarse woody debris. To provide adequate habitat, silvicultural treatments should aim to have a component of coarse woody debris with a range of diameters and of varying condition. Large logs in advanced stages of decay are likely to be critical for some species.

Current silvicultural guidelines provide for retention of habitat trees as nesting and refuge sites for fauna. This work has shown that habitat trees are also important for a number of lichen species associated with mature trees. These trees eventually fall and contribute to large diameter woody debris on the forest floor.

Reference:
Cranfield, R.J., Robinson, R.M., Williams, M.R. and Tunsell, V.L. (2011) FORESTCHECK: The response of lichen and bryophytes to silviculture in jarrah (*Eucalyptus marginata*) forest. Australian Forestry 74: 303-314.

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