Post-fire Regeneration Mechanisms of Rainforest and Wet Sclerophyll Flora in South East Queensland

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Report Context

Large components of the Gondwana Rainforests World Heritage Area in South East Queensland were severely affected by high intensity fires in late 2019, damaging rainforest and wet sclerophyll communities, opening-up forest canopies, and allowing weeds to become established in canopy gaps. These areas provide habitat for many State and Nationally listed flora species, and EPBC listed communities, such as critically endangered lowland subtropical rainforest. Post-fire, there was significant evidence of natural regeneration – both resprouting (basal, stem and root) and germination from seed (from established soil seed banks).

These regeneration strategies raise some interesting questions about the capacity of rainforest and wet sclerophyll flora to deal with fire events of varying intensity.

These questions include:
1. Which rainforest and wet sclerophyll flora are regenerating post fire?
2. What are the mechanisms used by rainforest and wet sclerophyll flora to regenerate post fire (resprouting, by seed, both)?
3. Will most regenerating species fall into the Pioneer or Early Secondary categories (see Kooyman 1996)?
4. How does fire intensity affect the capacity of rainforest and wet sclerophyll flora to regenerate post fire?
5. As a result of assessing questions 1-4, are there strategies that need to be considered (such as supplementary planting of select species) when restoring fire-affected rainforest and wet sclerophyll vegetation communities?

Re-sprouting and germinating native species need to be protected from weed growth that could overwhelm and inhibit natural regrowth. So called transformer weeds – such as moth vine, white passionflower, lantana, palm grass, and devils fig – threaten the habitat quality and ecological integrity of rainforest and wet sclerophyll communities. Funding provided by the Australian Government through the DAWE-led Bushfire Recovery Program has enabled HLW to coordinate restoration activities in bushfire affected areas. Field based rehabilitation work has provided the opportunity to collect imagery of regenerating rainforest and wet sclerophyll flora.

It is the intention of this report to capture (with species specific images) and describe the regeneration strategies used by rainforest and wet sclerophyll flora in bushfire affected areas of Lamington National Park (predominantly Upper and Lower Illinbah, Caves Circuit, Lower Bellbird Circuit, and Tabletop Mountain). Where known, the successional status of these species (Pioneer, Early Secondary, Later Secondary or Mature Phase as per Kooyman 1997) and their conservation status (in brackets) is recorded. Concluding remarks are also offered in response to the questions posed above.

Contents

Image Above
Fire scorched buttress roots of a giant fig at Lower Illinbah, Lamington National Park.

Front Cover Image
Cissus hypoglauca resprouting post-fire in Lamington National Park.

Back Cover Image
Lamington National Park Rangers and HLW Staff at the base of a giant fig (same as above) in gallery rainforest damaged by fire.

Acknowledgements

Healthy Land and Water (HLW) acknowledges that the place we now live in has been nurtured Australia's First Peoples for tens of thousands of years. We believe the spiritual, cultural and physical consciousness gained through this custodianship is vital to maintaining the future of our region.

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For further information about Healthy Land and Water, please email info@hlw.org.au or telephone (07) 3177 9100.

Resprouters

Acacia melanoxylon
Pioneer

Acmena ingens
Mature Phase

Adiantum hispidulum* var. *hispidulum
Unspecified

Ailanthus triphysa
Later Secondary

Akania bidwillii
Mature Phase

Alchornea ilicifolia
Unspecified

Alocasia brisbanensis
Unspecified

Alphitonia excelsa
Early Secondary

Alphitonia petriei
Early Secondary

Alpinia caerulea
Unspecified

Araucaria cunninghamii
Later Secondary

Archidendron grandiflorum
Mature Phase

Argophyllum nullumense
Unspecified

Argyrodendron actinophyllum
Mature Phase

Austrosteenisia blackii* var. *blackii
Unspecified

Beilschmiedia obtusifolia
Mature Phase

Blechnum cartilagineum
Unspecified

Boehmeria virgata* var. *austroqueenslandica
Unspecified

Bosistoa pentacocca
Unspecified

Brachychiton acerifolius
Later Secondary

Breynia oblongifolia
Unspecified

Calamus muelleri
Unspecified

Callicoma serratifolia
Unspecified

Carissa ovata
Unspecified

Carronia multisepalea
Unspecified

***Cassia marksiana* (Vulnerable)**
Unspecified

Castanospermum australe
Mature Phase

Causonis clematidea
Unspecified

Cissus antarctica
Unspecified

Cissus hypoglauca
Unspecified

Clerodendrum tomentosum
Pioneer

Commelina diffusa
Unspecified

***Cordyline* sp.**
Unspecified

Croton verreauxii
Unspecified

Cryptocarya laevigata
Mature Phase

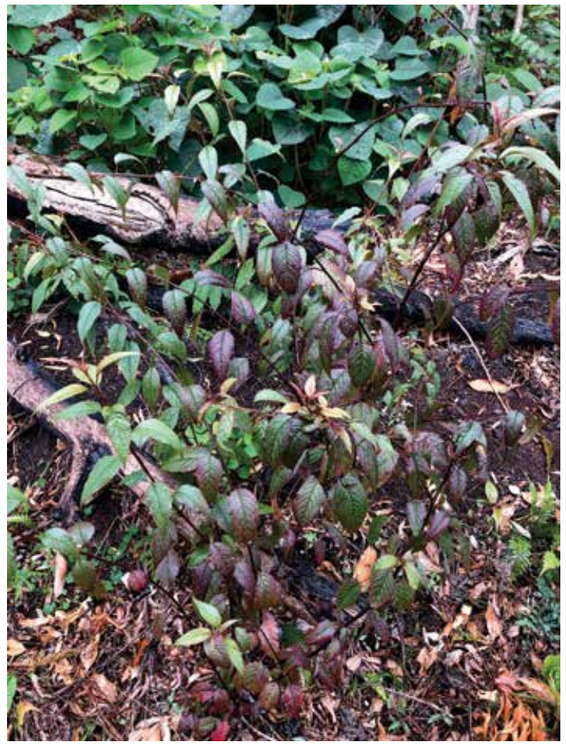
Cryptocarya microneura
Later Secondary

***Cupaniopsis newmanii* (Near Threatened)**
Mature Phase

Cupaniopsis parvifolia
Later Secondary

Dendrocnide photinophylla
Early Secondary

Denhamia bilocularis
Unspecified



Deeringia amaranthoides
Unspecified

Dendrocnide excelsa
Early Secondary

Denhamia silvestris
Unspecified

Dioscorea transversa
Unspecified

Diploglottis australis
Early Secondary

Dysoxylum fraserianum
Mature Phase

Ehretia acuminata
Later Secondary

Elaeocarpus obovatus
Later Secondary

Elaeocarpus reticulatus
Early Secondary

Eupomatia laurina
Mature Phase

Euroschinus falcatus
Early Secondary

Ficus coronata
Pioneer

***Ficus* sp.**
Mature Phase

Flindersia australis
Mature Phase

Glochidion sumatranum
Pioneer

Guioa semiglauca
Early Secondary

Jagera pseudorhus
Early Secondary

Karrabina benthamii
Mature Phase

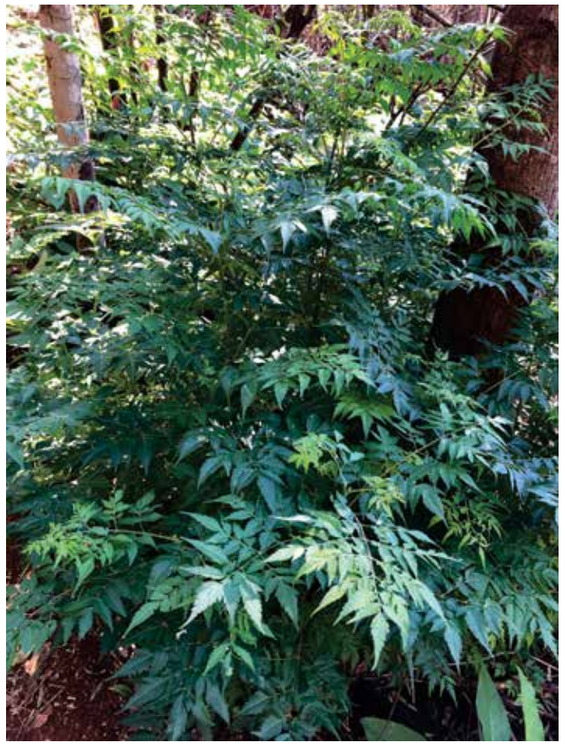
Legnephora moorei
Unspecified

Lophostemon confertus
Unspecified

Maclura cochinchinensis
Unspecified

Mallotus claoxyloides
Unspecified

Mallotus philippensis
Pioneer



Melia azedarach
Early Secondary

Melicope elleryana
Early Secondary

Mezoneuron scortechinii
Unspecified

Mischocarpus anodontus
Mature Phase

Myrsine variabilis
Unspecified

Neolitsea dealbata
Unspecified

Palmeria scandens
Unspecified

Pararchidendron pruinosum
Unspecified

Pilidiostigma glabrum
Unspecified

Polyscias elegans
Pioneer

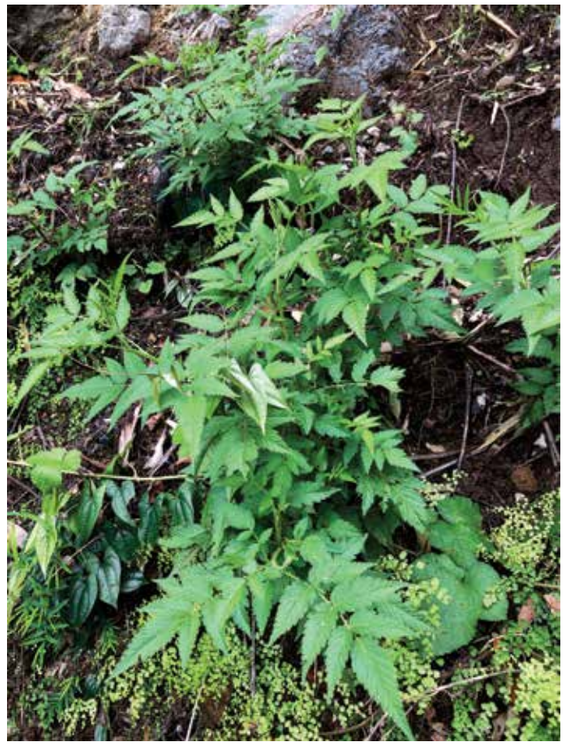
Psychotria daphnoides
Unspecified

Psychotria loniceroides
Mature Phase

***Rhodamnia rubescens* (Endangered)**
Mature Phase

Rhodosphaera rhodanthema
Mature Phase

Rubus moorei
Unspecified



Rubus rosifolius
Unspecified

***Rubus* sp.**
Unspecified

Sarcopteryx stipata
Early Secondary

Smilax australis
Unspecified

Solanum aviculare
Pioneer

Stenocarpus sinuatus
Mature Phase

Stephania japonica
Unspecified

Synoum glandulosum
Late Secondary

Syzygium australe
Mature Phase

Toona ciliata
Late Secondary

Trema tomentosa
Pioneer

Trichosanthes subvelutina
Unspecified

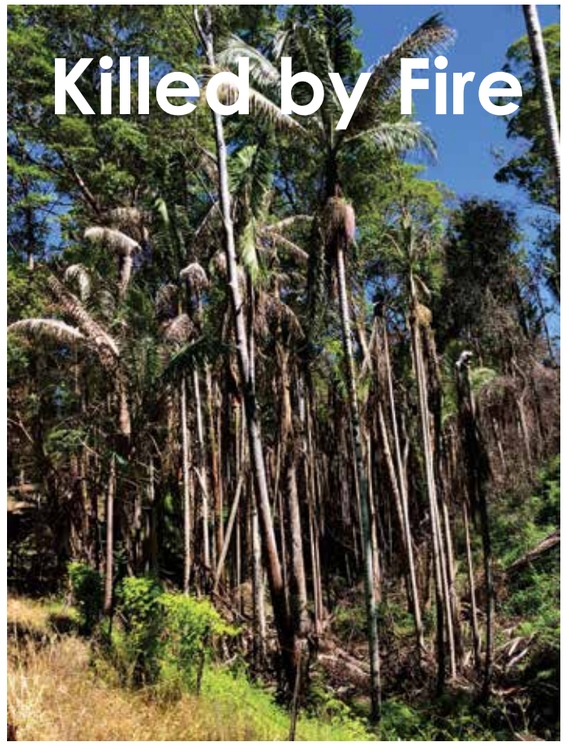
Trochocarpa laurina
Unspecified

Wilkiea huegeliana
Mature Phase

Zehneria cunninghamii
Unspecified

Burn scars on *Ficus* buttress roots

Killed by Fire

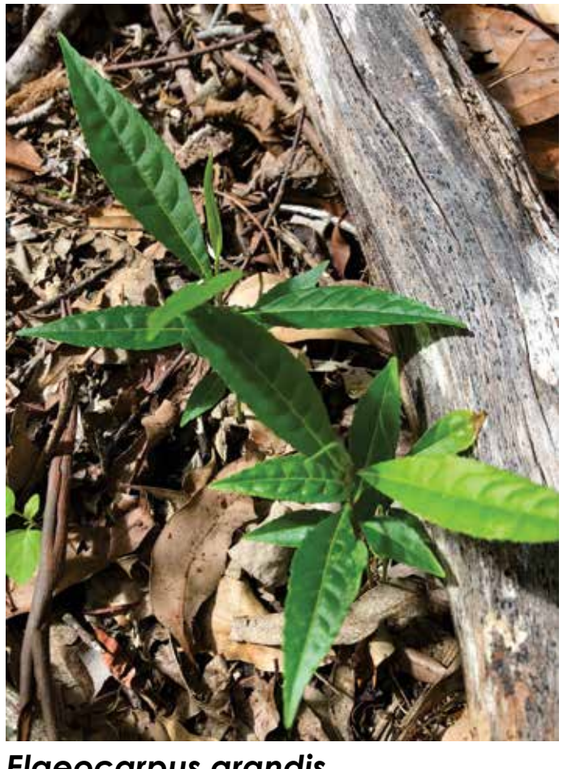


Archontophoenix cunninghamiana
Later Secondary

Linospadix monostachyos
Unspecified

Seeders

Dendrocnide excelsa
Early Secondary



Elaeocarpus grandis
Later Secondary

Grevillea robusta
Early Secondary

Hibiscus heterophyllus
Unspecified (but considered a Pioneer)

Homalanthus populifolius
Pioneer

Melia azedarach
Early Secondary

Toona ciliata
Later Secondary

***Toona ciliata* seed casings**

Melicope elleryana
Early Secondary

***Senna* sp.**
Unspecified

Natural regeneration at Upper Caves Circuit in Lamington NP

Discussion

Of the 100 rainforest and wet sclerophyll species with a documented response strategy to fire covered in this report 93% (93) resprouted, 5% (5) regenerated exclusively from seed, 4 species were able to both and 2% (2) were killed outright.

Of these 100 species, 51 have a described successional status (Kooyman 1996). Of these 47 species, 91.5% (43) resprouted, 8.5% (4) regenerated from seed, and 8.5% (4) species were able to do both. Amongst resprouters (43 species), 18.6% (8) are Pioneers, 20.9% (9) are Early Secondary species, 16.3% (7) are Later Secondary species and 44.2% (19) are Mature Phase species. Amongst seeders (4 species), 50% (2) are Pioneers, 25% (1) are Early Secondary species, 25% (1) are Later Secondary species and 0% (0) are Mature Phase species

Very few species showed neither capacity to regenerate from seed or resprout and were killed outright by fire, with Bangalow (*Archontophoenix cunninghamiana*) and Walking Stick Palms (*Linospadix monostachyos*) the most notable of these, though the former can survive a trickle fire running through forest litter in the rainforest understorey. Note that in some fire grounds, especially Lower Illinbah at Lamington National Park, fire intensity was sufficient to kill large standing rainforest trees. This gave rise to three waves of treefall – an initial wave during the fire event itself, a second protracted wave as trees with fire damaged root systems slowly succumbed to persistent underground fire (see image to the right), and a third wave when the root systems of damaged trees gave way under heavy rain. The latter continues until this day and provides further disturbance to recovering rainforest canopies.

Perhaps the most unlikely of report findings was the high number of Mature Phase species that resprouted post fire. Although slow growing, and without the lateral branching structure evident in Pioneer species, their presence provides valuable assurance that large numbers of particular rainforest species were not lost to fire. Indeed, that some 20 Mature Phase species described in this Report are clearly resprouting – and probably a gross underestimate of the total number that were – provides compelling evidence of both rainforest recovery and resilience in the face of wildfire.

Several key questions remain:
While a relatively high number of Mature Phase species did indeed resprout, their contribution to canopy formation (percentage cover) over time is unknown. Field observations to date suggest that the rapid growth and lateral branching architecture that characterise Pioneer and most Early Secondary species will see this suite of plants contribute most to restoring canopies damaged by wildfire, regardless of their documented regeneration response to fire. In some regenerating areas, dense Pioneer monocultures can be found (notably *Hibiscus heterophyllus* and *Solanum aviculare*), effectively overwhelming any other species. These areas should follow the successional process, and the retention of Later Secondary and Mature Phase species post fire is encouraging for future species richness.

In high fire severity areas, little mass regeneration from seed was observed. Large amounts of regeneration from seed from Pioneer species is often observed post disturbance events such as treefall, but in this case, it may be that Pioneer seed retained in soil seed banks was consumed by fire. It seems likely that there is a correlation between high fire severity, damaged rainforest canopies and loss of soil seed banks. Further investigations to investigate this relation would help advance our understanding of rainforest recovery after wildfire.

In summary, this report allowed many hours of field-based observations to be captured into a single document. For the present, and in the absence of subsequent equally intense and severe wildfire, it appears that additional restoration strategies, such as supplementary planting of select species, are not yet required to repair fire-affected rainforest and wet sclerophyll vegetation communities in places such as Lamington National Park.

Image Above
All that remains of a rainforest tree destroyed by fire in Illinbah in Lamingtion National Park. While not clearly visible, a large void exists below the stump; evidence of a slow burning root-mass fire.

References

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