

Perspectives on Fire Management in North-Eastern Australia

Peter Stanton¹, David Kington², Michael Blackman³, Eleanor Collins⁴,
Leasie Felderhof⁵, Diana Virkki⁶ and Paul Williams^{4,7}

Abstract

Observations of fire regimes and vegetation dynamics across living memory are critical for Australia's conservation management. Fire frequency has reduced across Queensland over the last 60 years, causing woody thickening and loss of native grass cover. Increased regular burning, every few years with good soil moisture, is recommended for eucalypt forests and woodlands of north-eastern Australia, including South East Queensland. This paper captures perspectives derived from a conversation about fire management in Queensland, which occurred in Cairns on 26 February 2024, amongst three fire statesmen: Peter Stanton, Dave Kington and Mick Blackman; with combined fire ecology and implementation experience of around 150 years. Contributors to the discussion were fire ecologists Eleanor Collins, Leasie Felderhof, Diana Virkki and Paul Williams. Outcomes of the discussion captured in this paper are based on decades of observations in different ecosystem types. The importance of frequent, low-intensity burning is highlighted as a continuous land management practice for healthy ecosystems in Queensland and north-eastern New South Wales.

Keywords: burning, fire ecology, historical observations, vegetation dynamics, woody thickening

¹ Australian Wildlife Conservancy, Cairns, QLD 4870, Australia (psec@ Cairns.net.au)

² Vegetation Management Science, Mt Nebo, QLD 4520, Australia (darlobolpal@gmail.com)

³ Friendly Fire Ecological Consultants, Mareeba, QLD 4880, Australia (mick@ffec.au)

⁴ Vegetation Management Science, Malanda, QLD 4885, Australia (Eleanor_paul@internode.on.net)

⁵ Firescape Science, Atherton, QLD 4883, Australia (leasie@firescape.com.au)

⁶ Queensland Fire and Biodiversity Consortium, Healthy Land and Water, Brisbane, QLD 4000, Australia (diana.v@hlw.org.au)

⁷ Corresponding author (paul@vegetationscience.com.au)

The authors declare no conflicts of interest.

Stanton, P., Kington, D., Blackman, M., Collins, E., Felderhof, L., Virkki, D., & Williams, P. (2025). Perspectives on Fire Management in North-Eastern Australia. *Proceedings of The Royal Society of Queensland*, 133, 123–129. <https://doi.org/10.53060/PRSQ.24.8>

Introduction

Perspectives and implementation of fire in Queensland have changed over time. Fire frequency has reduced across Queensland and northern New South Wales (NSW) (the authors' pers. obs., 2024; Earl & Simmonds, 2017; Mariani et al., 2022), causing woody thickening and loss of native grass cover in grasslands (Butler et al., 2014), tall eucalypt forests (Harrington & Sanderson, 1994; Baker et al., 2020;

Stone et al., 2022) and dry eucalypt forests (Bowman & Fensham, 1991; Russell-Smith et al., 2004; Williams et al., 2020). In some ecosystems, this has led to infrequent, severe wildfires, such as on North Stradbroke Island (Williams et al., 2020). To capture long-term observations of fire regimes and vegetation dynamics, a conversation was recorded with three renowned Queensland fire statesmen: Peter Stanton, Dave Kington and Mick Blackman.

This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International Licence. Individual articles may be copied or downloaded for private, scholarly and not-for-profit use. Quotations may be extracted provided that the author and The Royal Society of Queensland are acknowledged. Queries regarding republication of papers, or parts of papers such as figures and photographs, should be addressed to the Secretary of The Royal Society of Queensland (rsocqld@gmail.com).

Combined, the three long-term fire practitioners have around 150 years of fire ecology and implementation experience through various state departments and private industry. Enhancing the discussion were fire ecologists Eleanor Collins, Leasia Felderhof, Diana Virkki and Paul Williams. The following sections outline the summary of observational perspectives within different ecosystems and recommendations for fire management for the state of Queensland, which has relevance to northern NSW.

Summary of Observational Perspectives Within Different Ecosystems and Recommendations for Fire Management

A Change of Fire Management Practices Over the Decades Has Resulted in Thickening of Eucalypt Forests with Infrequent Burning

Our recollections are that fires were an annual part of the South East Queensland landscape in the 1950s and 1960s. Burning around Brisbane, Dayboro and Samford was sufficiently frequent to maintain relatively low fuel loads so that fires simply burnt themselves out. A small number of South East Queensland graziers were lighting fires right up until the early 2000s, with an even smaller number continuing active burning today. For example, ongoing, intergenerational burning by the Hardgrave family on the Queensland side of the NSW border has maintained healthy eucalypt forests and protected them from damage in the 2019 wildfires (Williams et al., 2022).

The regularly burnt Brisbane eucalypt forests of the 1950s and 1960s had an open structure with a dense native grass understorey, typically dominated by kangaroo grass (*Themeda triandra*). These open, healthy eucalypt forests included Boondall, White's Hill and Venman's Reserve, where Jack Venman implemented regular burning into the early 1980s. These forests have undergone considerable vegetation change following the loss of regular burning, including reduced native grass cover and significant mid-strata thickening of wattles, eucalypt saplings and casuarinas. What was open bush around Brisbane in the 1950s and 1960s is now forest with a dense mid layer and limited grass cover. This woody thickening was recently substantiated for a well-studied area on North Stradbroke Island (Williams et al., 2020).

While regular burning was implemented by

many private land managers in the 1950s and 1960s, government organisations had a fire exclusion philosophy. The Queensland Forestry Department's approach in the early 1960s was geared for fire exclusion, which produced a eucalypt forest lacking canopy tree regeneration and smothered by lantana (*Lantana camara*). This contrasted with adjacent grazing lands, where regular fire produced a healthy, open forest lacking lantana thickets.

Regular Burning for Maintaining a Healthy Grass Layer and Reducing Woody Thickening

The Queensland Forestry Department's Forest Inventory Survey plot data, and observations by a range of foresters, led to a change in fire philosophy, with burning trials instigated in the late 1960s and early 1970s (Department of Forestry, 1974). These Forestry fire trials built a picture supporting a more calculated way of burning. Once Queensland Forestry staff started reintroducing regular burning in the early 1970s, the vegetation responded with good outcomes, such as reducing woody thickening.

Woody thickening is a progressive increase in shrubs, saplings and trees at the expense of the grass layer. It is a symptom of poor fire management; i.e., fires during dry conditions and long fire intervals (Burgess et al., 2014; Partridge et al., 2024). Landscape descriptions by early explorers, such as Giles and Mitchell, indicate the country was more open at a time when Aboriginal Peoples were constantly burning the landscape. For example, Giles wrote: "The natives were about, burning, burning, ever burning; one would think they were of the fabled salamander race, and lived on fire instead of water" (Giles, 1889).

Fire management to maintain grassy eucalypt forests and reduce woody thickening is uncomplicated if burning can be undertaken in the same location, preferably every two years but at a maximum of every three years. This is necessary to ensure woody regrowth is either killed or scorched to ground level, and few saplings escape the scorching influence of fire. The two- to three-year fire cycle arises from the observation that under average rainfall conditions in the humid areas of tropical and subtropical Queensland, a burnt area will not burn again in the following year, at the same time of year, because there is no old, cured grass foliage from the previous year. It is ready to

burn after two years, but every year neglected after that runs the risk of fires being difficult to control and causing some canopy scorch. Native grass abundance starts to decline in the absence of fire for more than three years (Williams et al., 2003).

Cattle Management in Burnt Areas

Managing fire in the presence of cattle requires some expertise. To avoid woody thickening in the presence of managed herds, it is essential to avoid overstocking and to have the ability to move cattle around to ensure the development of ground cover for at least two years before burning.

With feral cattle herds, early dry-season patch burning will concentrate grazing, weakening or removing the ground cover at a time of year when, because of drying ground and cooling temperature, the competitive balance is changed in favour of shrubs and small trees. This can only be changed by wider-scale burning when soil moisture conditions are sufficient to allow vigorous growth of ground cover to the disadvantage of trees and shrubs.

Cape York Peninsula Fire Management, Especially of Grasslands

Aerial photography demonstrates a large and progressive loss of the grasslands of Cape York Peninsula. This has involved an expansion of broad-leaved tea tree (*Melaleuca viridiflora*) woodlands into grasslands (Neldner et al., 1997). This has occurred through episodic periods of well-above-average rainfall, creating saturated soils and long-standing surface water, weakening the ground cover. At such times there has been massive seedling recruitment of *M. viridiflora* within grasslands, which grow towards woodlands in the absence of fire for several years, at which stage the process cannot be reversed by fire.

The remaining grasslands should be burnt whenever they will support fire, with the emphasis on fire late in the year when the ground is moist (i.e. storm burning). At such a time, grasses will rebound quickly and *M. viridiflora* recruitment is retarded.

Tall Eucalypt Forest Fire Management

Tall eucalypt forests in high-rainfall areas of eastern Queensland are a multi-cohort forest of resprouting eucalypts (Bradford, 2018). Canopy trees in Queensland's tall forests only successfully recruit seedlings

with regular fire, which also maintains dense grass cover necessary to fuel regular burning (Stanton et al., 2014a). Following reductions in fire frequency, most of these forests have been invaded by dense understoreys of rainforest species and lantana, and are in progression to eventual rainforest capture (Stanton et al., 2014b). The loss of a previously dense kangaroo grass ground layer is widespread in tall eucalypt forests of the Wet Tropics and southern Queensland.

In grassy, tall forests, rainforest germination (i.e. rainforest invasion) does not occur evenly between fires but is concentrated in the first year or two after fire, with much less recruitment in subsequent years because dense grass cover inhibits rainforest germination (Williams, 2000). Fires in dry conditions can trigger dense rainforest seed germination (Williams et al., 2012), similar to abundant wattle recruitment (Partridge et al., 2024). In the absence of fire, a dense rainforest subcanopy develops that shades out grasses. At this point, rainforest recruitment becomes continuous (Williams et al., 2012).

Rainforest invasion of tall eucalypt forest was thought to occur by expansion from the rainforest-eucalypt forest ecotone (e.g. Unwin, 1989). This is only true for those restricted areas bordered by regularly burnt grazing country. Rainforest invasion of tall eucalypt forest usually occurs by an irruption of rainforest seedlings scattered across the landscape (Russell-Smith et al., 2004). Most of these seedlings rapidly develop the capacity to basally resprout after fire, and regular burning is required to keep these saplings small amongst the grass layer (Williams et al., 2012).

The survival of tall eucalypt forests, many with an 'Of Concern' *Queensland Vegetation Management Act 1999* status, now depends on the long-term management of the few 'legacy areas': forests with healthy ground cover subject to regular (every two to three years) fire, and those areas that can be reclaimed by appropriate use of fire. Successful rehabilitation of a forest in early-stage rainforest thickening depends on re-establishment of a healthy ground cover. A fire that scorches the understorey reducing it to ground level is an essential first step but will achieve little if it is followed by a quick rebound of the woody understorey. A burning strategy must increase grass cover within and on the edge of a forest. Rehabilitation requires a very long-term commitment and will not work if

an initial fire is not followed by regular fire as soon as the forest will burn, returning every one to two years or so, and repeated ad nauseum. If you do get a fire through tall eucalypt forest on the cusp of permanent rainforest conversion, another fire is needed within a year or two, otherwise the rainforest invasion process is accelerated via fire-promoted seed germination, basal coppicing and root suckering.

Prescriptive fire intervals should not govern tall eucalypt forest management. As long as fuel in neighbouring country has been adequately reduced by early burning, advantage should be taken of any conditions in which a fire will carry in tall open forest, and at any time of year. Some of the most successful burns have taken place during rain-free intervals within the wet season, which leave a soil-protecting litter layer and protect against loss of hollow trees.

Coastal Vegetation

The coastal lowlands of the Wet Tropics from Townsville to Cairns contain a succession of beach ridges of eucalypts, with paperbarks in the swale, which have diminished through reduced fire frequency. Most lowlands are now non-burnable rainforest thickened country. Continued regular burning has maintained some open coastal lowlands, such as the First Nations-owned Yarrabah country south of Cairns, the Department of Defence's Cowley Beach south of Innisfail, and sections of national parks between Cardwell and Townsville.

In South East Queensland, coastal eucalypt forests with old, large cypress and eucalypt trees have been greatly reduced by an absence of regular burning, allowing wildfires. Where old, large eucalypt and cypress trees are killed by wildfire, the healthy structure of the forest was lost. Saplings of cypress and eucalypts may regenerate, but the forest structure and whole range of plants that exist only within that structure are lost.

Old-growth Trees

One of the arguments that gets used against very regular burning is: "You are destroying your old-habitat trees." Of course, some may burn down

because they had been damaged in a previous wildfire, with the base burnt out; but if burns are implemented when there is moisture on the ground, even hollow trees will still stand. For example, flames will roar up paperbark trees (*Melaleuca quinquenervia*) during a late dry-season fire, and paperbark embers will float for miles. After a shower of rain, the trees suck up the water and no longer carry flames up the trunk.

Conclusion

While our observations emanate from Queensland, our perspectives on fire management have relevance across Australia. We suggest fire management needs to be seen primarily as an ongoing land management activity, rather than as an emergency response. We must not return to a fire-suppression focus, or decadal-scale fire intervals, but concentrate on active, regular burning every few years to reduce wildfire risk and maintain healthy vegetation. In eucalypt forests and woodlands, burn where you can whenever you can, as long as there remains some soil moisture, low fuel load containment boundaries are in place and a permit to burn has been obtained. In practice, this means taking every opportunity to implement good fire under moist conditions, especially targeting forests and woodlands that are still in a healthy grassy condition. Areas that were burnt in the last year or two will not carry a fire very far under mild conditions, creating a natural mosaic. Move away from prescriptions of rotational burning of specific intervals or for specific individual species management because a healthy ecosystem will retain these species.

As a community, we need to appreciate the difficult job of fire managers and allow them flexibility and understanding. Fires will be smoky. Some fires will burn beyond their intended borders, and some will flare up hotter than anticipated, perhaps even killing a few individuals of a threatened species. We must look at the broader landscape picture of maintaining healthy habitats and sustainable populations.

Acknowledgements

We are grateful for assistance in refining this manuscript provided by Editor Ross Hynes and Reviewer Patricia Dale.

Literature Cited

- Baker, A. G., Catterall, C., Benkendorff, K., & Fensham, R. J. (2020). Rainforest expansion reduces understorey plant diversity and density in open forest of eastern Australia. *Austral Ecology*, *45*, 557–571. <https://doi.org/10.1111/aec.12871>
- Bowman, D. M. J. S., & Fensham, R. J. (1991). Response of a monsoon forest–savanna boundary to fire protection, Weipa, northern Australia. *Australian Journal of Ecology*, *16*, 111–118. <https://doi.org/10.1111/j.1442-9993.1991.tb01486.x>
- Bradford, M. (2018). *Eucalyptus grandis* (Rose Gum) in northern Queensland: a species under fire. *North Queensland Naturalist*, *48*, 30–38. https://www.nqnat.org/_files/ugd/003377_377edef4d7bd415b93c2fcf08cde9d7c.pdf
- Burgess, E. E., Moss, P., Haseler, M., & Maron, M. (2014). The influence of a variable fire regime on woodland structure and composition. *International Journal of Wildland Fire*, *24*, 59–69. <https://doi.org/10.1071/WF14052>
- Burrows, W. H., Henry, B. K., Back, P. V., Hoffmann, M. B., Tait, L. J., Anderson, E. R., Menke, N., Danaher, T., Carter, J. O., & McKeon, G. M. (2002). Growth and carbon stock change in eucalypt woodlands in northeast Australia: ecological and greenhouse sink implications. *Global Change Biology*, *8*(8), 769–784. <https://doi.org/10.1046/j.1365-2486.2002.00515.x>
- Butler, D. W., Fensham, R. J., Murphy, B. P., Haberle, S. G., Bury, S. J., & Bowman, D. M. (2014). Aborigine-managed forest, savanna and grassland: biome switching in montane eastern Australia. *Journal of Biogeography*, *41*, 1492–1505. <https://doi.org/10.1111/jbi.12306>
- Department of Forestry. (1974). *Annual Report for the Department of Forestry for the Year 1973–74*, Queensland Government. https://era.dpi.qld.gov.au/id/eprint/10511/1/Dept%20Forestry%20annual%20report_1973-1974.pdf
- Earl, N., & Simmonds, I. (2017). Variability, trends, and drivers of regional fluctuations in Australian fire activity. *Journal of Geophysical Research: Atmospheres*, *122*(14), 7445–7460. <https://doi.org/10.1002/2016JD026312>
- Giles, E. (1889). *Australia twice traversed: The Romance of Exploration, being a narrative compiled from the journals of five exploring expeditions into and through central south Australia, and Western Australia, from 1872 to 1876*. Hesperian Press.
- Harrington, G. N., & Sanderson, K. (1994). Recent contraction of wet sclerophyll forest in the wet tropics of Queensland due to invasion by rainforest. *Pacific Conservation Biology*, *1*(4), 319–327. <https://doi.org/10.1071/PC940319>
- Mariani, M., Connor, S. E., Theuerkauf, M., Herbert, A., Kuneš, P., Bowman, D., Fletcher, M.-S., Head, L., Kershaw, A. P., Haberle, S. G., Stevenson, J., Adeleye, M., Cadd, H., Hopf, F., & Briles, C. (2022). Disruption of cultural burning promotes shrub encroachment and unprecedented wildfires. *Frontiers in Ecology and the Environment*, *20*, 292–300. <https://doi.org/10.1002/fee.2395>
- Neldner, V. J., Fensham, R. J., Clarkson, J. R., & Stanton, J. P. (1997). The natural grasslands of Cape York Peninsula, Australia. Description, distribution and conservation status. *Biological Conservation*, *81*, 121–136. [https://doi.org/10.1016/S0006-3207\(96\)00162-0](https://doi.org/10.1016/S0006-3207(96)00162-0)
- Partridge, D., Kington, D., Williams, P., & Burns, D. (2024). Blackout Burning in Dry Conditions Increases Long-Term Fire Severity Risk. *International Journal of Wildland Fire*, *33*, WF23180. <https://doi.org/10.1071/WF23180>
- Russell-Smith, J., Stanton, J. P., Whitehead, P. J., & Edwards, A. (2004). Rain forest invasion of eucalypt-dominated woodland savanna, Iron Range, north-eastern Australia: 1. Successional processes. *Journal of Biogeography*, *31*, 1293–1303. <https://doi.org/10.1111/j.1365-2699.2004.01069.x>
- Stanton, J. P., Parsons, M., Stanton, D., & Stott, M. (2014a). Fire exclusion and the changing landscape of Queensland's Wet Tropics Bioregion 2. The dynamics of transition forests and implications for management. *Australian Forestry*, *77*, 58–68. <https://doi.org/10.1080/00049158.2014.882217>

- Stanton, J. P., Stanton, D., Stott, M., & Parsons, M. (2014b). Fire exclusion and the changing landscape of Queensland's Wet Tropics Bioregion 1. The extent and pattern of transition. *Australian Forestry*, 77, 51–57. <https://doi.org/10.1080/00049158.2014.881702>
- Stewart, P. L. C., Moss, P. T., & Farrell, R. (2020). Land change analysis of moon point vegetation on Fraser Island, East Coast, Queensland, Australia. *International Journal of Ecology and Environmental Sciences*, 46(1), 25–39. <https://www.nieindia.org/Journal/index.php/ijeec/article/download/2042/558>
- Stone Z. L., Maron M., & Tasker, L. (2022). Reduced fire frequency over three decades hastens loss of the grassy forest habitat of an endangered songbird. *Biological Conservation*, 270, 109570. <https://doi.org/10.1016/j.biocon.2022.109570>
- Unwin, G. L. (1989). Structure and composition of the abrupt rainforest boundary in the Herberton Highland, North Queensland. *Australian Journal of Botany*, 37, 413–428. <https://doi.org/10.1071/BT9890413>
- Williams, P. R. (2000). Fire-stimulated rainforest seedling recruitment and vegetative regeneration in a densely grassed wet sclerophyll forest of north-eastern Australia. *Australian Journal of Botany*, 48, 651–658. <https://doi.org/10.1071/BT99020>
- Williams, P. R., Congdon, R. A., Grice, A. C., & Clarke, P. J. (2003). Effect of fire regime on plant abundance in a tropical eucalypt savanna of north-eastern Australia. *Austral Ecology*, 28, 327–38. <https://doi.org/10.1046/j.1442-9993.2003.01292.x>
- Williams, P. R., Parsons, M., Jensen, R., & Tran, C. (2012). Mechanisms of rainforest persistence and recruitment in frequently burnt wet tropical eucalypt forests. *Austral Ecology*, 37, 268–275. <https://doi.org/10.1111/j.1442-9993.2011.02271.x>
- Williams, P., Kington, D., & Collins, E. (2020). Vegetation change over 50 years in eucalypt forest on north Stradbroke Island. *Proceedings of The Royal Society of Queensland*, 128, 49–58. https://www.royalsocietyqld.org/wp-content/uploads/Proceedings%20128%20v2/05_Williams_et%20al_Web.pdf
- Williams, P., Watson, P., Kington, D., & Collins, E. (2022). Frequently burnt subtropical eucalypt forest is more resilient to wildfire than rarely burnt forest. *Proceedings of The Royal Society of Queensland*, 131, 51–61. <https://doi.org/10.53060/prsq.2022-19>

Author Profiles

Peter Stanton has had 62 years' practical experience of fire management in a wide range of environments across Queensland, covering wet, humid, and sub-humid areas from south-east Queensland to northern Cape York Peninsula, as well as many inland areas of central Queensland and the north-western highlands. This was gained during his years of work for the Queensland Forestry Department and later the National Parks and Wildlife Service and continues today as a land management officer for the Australian Wildlife Conservancy.

David Kington has spent over 50 years working in fire management and land management in southern Queensland, northern New South Wales and central Queensland. Beginning his association with fire in Queensland Forestry Department and continuing this work with National Parks, he has also worked on fire management in local government and consultancies. David penned the original QPWS *Guide for Planned Burning*. For the past 10 years he has worked alongside Indigenous groups from central Queensland to northern New South Wales with a focus on reconnecting people, ecology and fire. This work is ongoing.

Michael J Blackman has worked in the field of fire management for over 35 years, firstly for QPWS and then for private conservation organisations Australian Bush Heritage and Australian Wildlife Conservancy. Since 2009, in his role as Principal Consultant/Director, he has run a successful business implementing complex fire management programs for a variety of government and private-sector organisations and providing advice on fire management issues. As a qualified trainer, he continues to deliver appropriate fire management training to government, private and Indigenous organisations.

Eleanor Collins is an ecologist interested in fauna and flora management, including suitable fire management. She has undertaken ecological surveys and planned and implemented fires for state and local governments and private industry for over two decades.

Dr Lesie Felderhof B.Sc.(Hons), Grad. Dip. Natural Resource Management; PhD (Environmental Sciences) has over 30 years' experience working in north Queensland landscapes as an environmental consultant and landholder. In her professional capacity, she works with Indigenous groups, property owners, businesses, government departments, and communities to provide support and guidance on fire management in terrestrial landscapes. Emphasis is on the conservation of biodiversity within the client's operating environment and using fire as a management tool to meet other objectives landholders may have (e.g. weed control, protection of cultural sites).

Dr Diana Virkki B.Sc. (Hons), PhD (Environmental Sciences) is a fire ecologist with 17 years' experience across Australia in research and applied fire management. Her PhD investigated the effects of fire on fauna, flora and habitats in south-east Queensland. Diana provides technical advice and holistic fire management strategies and capacity building for communities, landholders and stakeholders at the local, state and federal levels.

Paul Williams is a vegetation ecologist with 30 years' experience in government and private business. He has helped plan and implement fires and now monitors plant responses to fire type (intensity, ignition pattern, weather and soil moisture conditions) and frequency on eucalypt forest, woodlands, grasslands and heaths, and has noticed that very regular mild fire promotes healthy ecosystems.