

Weedy fire regimes: incorporating weed issues into fire programs

Paul Williams

Queensland Parks and Wildlife Service and School of Tropical Biology, James Cook University,
PO Box 5597, Townsville, Queensland 4810, Australia
Email: paul.williams@epa.qld.gov.au, paul.williams@jcu.edu.au

Summary Fire is a major element of land management across Australia. Weeds are a significant issue affecting fire regimes. A weed plan that ignores the effects of fire regime misses a crucial land management tool. A fire plan incorporating only native fauna and flora information, may inadvertently prescribe burning programs that cause the decline of that habitat through weed expansion. Clearly integration of weed and fire management programs is needed.

By increasing fuel loads, affecting natural curing rates or smothering out native grass layers, weeds can alter the characteristics of a fire regime. Fire can affect the abundance of weed populations by killing a proportion of plants, or by promoting seed germination. Fire can be part of an integrated weed control program, by enhancing herbicide programs. Incorporating weed management into fire programs involves identifying the weeds in an area and their priority for control; determining the fire response of those weeds; and determining strategies to use fire in the management of weeds with differing fire responses.

Keywords Fire regime, lantana, rubbervine, exotic grasses.

INTRODUCTION

Weed invasion and inappropriate fire regimes are two processes that are key threats to the long term survival of rare species and the healthy condition of ecosystems. Appropriate fire regimes are a valuable land management tool that should be a part of integrated weed management programs. Weeds affect fire regimes by altering the frequency and intensity of fires through changes in fuel characteristics. Resources are increasingly allocated to produce strategic plans to direct weed and fire work programs. Yet, these two strongly interacting issues are often planned for and dealt with separately.

Weeds can alter all the characteristics of a fire regime Fire intensity is increased by high biomass grass weeds, such as gamba grass (*Andropogon gayanus* Kunth.), para grass (*Urochloa mutica* (Forssk.) T.Q.Nguyen) and guinea grass (*Megathyrsus maximus* (Jacq.) B.K.Simon & S.W.L.Jacobs). This has caused the death of trees that survive fires fuelled by a natural understorey.

The frequency of fires can be affected by weeds. Fire frequency can increase with high biomass grasses or decrease where natural grass layers are smothered by woody weeds.

Even the timing (i.e. season) of burning can be affected by weeds. This is especially the case where a dominating weed cures earlier or later than the natural vegetation, or where woody weeds such as *Lantana camara* L. inhibit the implementation of early burns by shading out the natural grass layer, reducing the scope for prescribed fires under mild conditions. This can reduce the land manager's ability to implement small burns under mild conditions to broaden the width of fire breaks, therefore reducing the ability to protect properties from intense wildfires later in the dry season.

Fire can affect the abundance of weed populations

Some weeds are killed by a specific fire regime. For example, a series of fires can reduce the population of *Lantana camara*, by killing a proportion of mature plants and seedlings. Molasses grass (*Melinis minutiflora* Beauv.) is a perennial grass that can be managed by very short fire intervals. An initial fire can kill a high proportion of mature plants and a follow up fire can kill subsequent seedlings before they produce seeds.

Fires in seasonal wetlands dominated by Para grass can kill a proportion of para grass plants and remove layers of thatch produced by the accumulation of stolons, therefore re-opening water channels.

Some weeds are promoted by a specific fire regime. Annuals and other short lived weeds with the capacity to produce dense seed germination after disturbance, are often fire-promoted. Lion's tail (*Leonotis nepetifolia* R.Br.), snake weed (*Stachytarpheta jamaicensis* (L.) Vahl) and grader grass (*Themeda quadrivalvis* (L.) Kuntze) are examples. Perennial weeds that re-shoot after fire, and have abundant seed germination, can be promoted by fire, e.g. guinea grass and thatch grass (*Hyparrhenia rufa* (Nees) Stapf).

Fire as an aspect of an integrated weed control program

Fire can be useful in the control of Siam weed (*Chromolaena odorata* (L.) R.M.King & H.Rob.), by killing a high proportion of plants <1 m tall, and

causing larger plants to sucker back from the base, assisting in herbicide control (Williams *et al.* 2004).

The promotion of dense weed seedlings can be used to the weed manager's advantage. For species with dense post-fire germination, such as lion's tail, burning triggers the emergence of a high proportion of the store seed bank and subsequent herbicide treatments implemented before those seedlings produce seed will remove a high proportion of stored seed reserves (Greig 2008).

Incorporating weed management into fire programs More efficient and successful land management programs can be achieved once weed and fire management has been incorporated. There are four key steps for incorporating weed management into fire programs.

1. *Identify the weeds in an area and their priority for control.*

Most areas of bushland contain some significant weeds, so determining the priority of weeds for control on a property is fundamental. This needs to be based on legislation (i.e. declared weeds), impact on primary production and native fauna and flora (including the indirect effects of a weed on fire regime) and current abundance and distribution of a weed on a property (e.g. weeds with restricted distributions can be targeted for eradication). A weed map for the property is extremely valuable for determining and directing control programs.

2. *Determine the fire response of those weeds.*

Does fire kill a proportion of a weed population? If so, does fire kill both seedlings and mature weed plants? Does fire promote germination of weed seedlings?

3. *Determine strategies to use fire in the management of weeds with differing fire responses.*

Fire may be beneficial in controlling the priority weeds in an area. For example, regular burning can dramatically reduce rubbervine (*Cryptostegia grandiflora* (Roxb.) R.Br.) populations (Collins *et al.* 2008). However, often the weeds in an area will have differing fire responses. For example, the coexistence of lantana, guinea grass and grader grass presents differing fire management requirements.

Consideration needs to be given to the relative abundance and therefore priority of those weeds. A program of frequent burning, with intervals of around two years, is likely to thin the lantana while

promoting grader grass and possibly also guinea grass. The post-fire guinea grass regrowth can be controlled by herbicide, where accessible. If there is only a minor, but expanding population of grader grass in the area, the grader grass-invaded area may be excluded from burning or fire could be delayed until grader grass is eradicated from the site.

4. *Consider the implications of altered fire regimes on native species.*

Altering fire regimes to assist in the control weeds may have repercussions for populations of native flora and fauna, and the impacts of changed fire regimes on native species needs to be considered. For example, populations of fire-killed, obligate seeder shrubs may decline when more frequent fire is used to control of woody weeds, such as rubbervine or lantana. Where fire intervals are increased, such as for reducing the abundance of grader grass, consideration needs to be given to short-lived plants that only recruit after fire (Keith 1996).

CONCLUSION

Weeds pose a considerable challenge to the determination, planning and implementation of appropriate fire regimes. Weed and fire plans must be integrated to ensure fire is used as a valuable tool for controlling some weeds and to reduce the potential problems of inadvertently promoting other weeds. Fire regimes that incorporate weeds may differ slightly from a regime suited to a weed-free ecosystem. Care is needed to evaluate the effect of changed fire regimes on native species. Future fire regimes will need to be more flexible to respond to weed and native species interactions. Several fires in a row, linked with herbicide spraying and followed by a longer fire interval may be necessary to address the complex interactions between weeds, native species and fire.

ACKNOWLEDGMENTS

I have learnt much about the combination of fire and weed control from the many dedicated QPWS rangers, who implement burns and herbicide programs across the diverse Queensland landscape. This paper was improved by comments from Dr Tony Grice and Dr Rieks van Klinken.

REFERENCES

Collins, E.M., Contarino A.J., Hasted J. and Williams P.R. (2008). The effect of fire and herbicide on rubber vine (*Cryptostegia grandiflora*) in Bowling Green Bay National Park, Queensland.

- Proceedings of the 16th Australian Weeds Conference, eds R.D. van Klinken, V.A. Osten, F.D. Panetta and J.C. Scanlan, pp. 488-90. (Queensland Weeds Society, Brisbane).
- Greig, C. (2008). Lion's tail control at Boodjamulla National Park. Proceedings of the 16th Australian Weeds Conference, eds R.D. van Klinken, V.A. Osten, F.D. Panetta and J.C. Scanlan, pp. 491-3. (Queensland Weeds Society, Brisbane).
- Keith, D.A. (1996). Fire-driven extinction of plant populations: a synthesis of theory and review of evidence from Australian vegetation. *Proceedings of the Linnean Society of New South Wales* 116, 37-78.
- Williams, P., Douglas, J., Parsons, M. and Roberts, M. (2004). The mortality of Siam weed (*Chromolaena odorata*) caused by fire in the Wet Tropics of northern Australia. *Plant Protection Quarterly* 19, 135-6.