Marathon weed management: How can we effectively connect weed research with policy planning and on-ground action for long-term NRM results?

Keith B. Ferdinands[1], Samantha A. Setterfield[2] and Jonathan Vea[3]
[1] Research Institute for Environment and Livelihoods, Charles Darwin University, Northern Territory 0909, Australia
[2] School of Earth and Environment, University of Western Australia (M004), Perth, Western Australia 6009 Australia
[3] Northern Territory Department of Sport and Recreation, GPO Box 1448, Darwin, Northern Territory 0801, Australia
(keith.ferdinands@nt.gov.au)

Summary It has long been recognised that weed management issues require long-term, strategic investment and well-coordinated efforts. In sport this would be talked about as something like running a marathon. In contrast, there appears too few examples of long-term investment in weed management and where investment occurs it is often seeking to achieve short-term results. We reviewed an example of natural resource management in Litchfield National Park, Northern Territory. In this Park, biodiversity conservation and weed management efforts are designed using high levels of collaboration and seek to improve the balance of short-term and long-term weed management results. Based on these examples, we suggest that in many cases in the Northern Territory (NT), we have the policies, plans, tools, systems and experts to do (and/or continue) marathon-like weed management efforts. The big challenge is not how to do long-term strategic management of priority weeds, it is convincing decision makers and funding bodies that there are a variety of benefits to be gained from doing so.

Keywords National Parks, environmental weeds, policy and planning, WoNS, EPBC.

INTRODUCTION

With short funding cycles and changing priorities, natural resource management actions, of which weed management remains a key element, are often, in sporting terms, a 'sprint', with the emphasis on quick results via short-term projects. In contrast, most weed management priorities require long-term, marathon-like responses to achieve or maintain successful weed management outcomes. Typically, long-term, evidence-based and adaptive weed management policies and plans are needed and strategic partnerships formed to design and implement them. Where, to use a sporting analogy, this sprint versus marathon mismatch occurs, it becomes difficult for planners, land managers, scientists and Park Rangers to find ways to design implement or maintain effective NRM plans.

Litchfield National Park in the Top End of the Northern Territory provides an excellent example of the challenges to protect nationally and internationally significant park values from a number of threats, of which weeds are a high priority. In Litchfield, managing the threats posed by weeds, particularly invasive grasses, continues to be a management priority.

In this paper, we argue that the planning and management approaches used in Litchfield offers the greatest likelihood of long-term NRM outcomes, including weed management. This is because the approach used has the following key elements:

(a) Policy, planning, management, research and on-ground actions are developed and implemented in a coordinated and collaborative fashion.
(b) Weed management is linked to conservation values (biodiversity, cultural, social) and threats (fire, feral animals).
(c) Imperfections and knowledge gaps are accepted and adaptive management strategies included.
(d) Outcomes and success or failure are reviewed over both short-term and long-term time frames.

We outline how weed management and weed management research has been incorporated into the management of Litchfield National Park. We will also outline how weed research has contributed to an Integrated Conservation Strategy (ICS).

MATERIALS AND METHODS

NT National Parks and weed management Litchfield National Park is managed by the Parks and Wildlife Commission NT (PWCNT) who classify Litchfield as a Class 1 Biodiversity Park. Situated 120 km south of Darwin, Litchfield is an iconic Northern Territory attraction with more than 300,000 visitors in 2014. For all NT, Class 1 Biodiversity Parks, an ICS and an Annual Action Plan is developed and reviewed annually (PWCNT 2015). The planning and management process is directed by the Conservation Action Planning (CAP) process developed by the Nature

Conservancy (TNC 2007), resulting in an ICS. This approach is widely used nationally and internationally. The PWCNT planning process is being applied to several NT parks, and was recently completed for Litchfield National Park. We therefore use the development process for the Litchfield Park ICS to illustrate how protecting conservation values, threat management and weed management can be linked.

RESULTS

The elements of the NRM approach employed by Litchfield National Park are summarised in Table 1.

Project teams comprising planners, park rangers, relevant experts, traditional owners, key stakeholders and researchers were involved in all of these elements. This was done to ensure that evidence based, adaptive management approach, subject to implementation reality checks (e.g. resources) occurs.

Identifying and prioritising threats to key conservation values in Litchfield National Park The initial steps of the ICS process (Table 1) identified the key conservation values (Table 2), then ranked and prioritised the threats to these values (Tables 3).

Table 1. Planning and management elements.

1	Identify, group by function, define practical indicators and prioritise key conservation values. Develop agreed standards to categorise the health of the grouped conservation values based on defined indicators. Develop conservation targets to determine management success based on agreed standards.
2	Identify and prioritise threats to values to define management objectives.
3	Evaluate strategic options by aligning priority conservation targets and prioritised threat objectives.
4	Define management programs based on the strategic priorities to reach conservation targets and threat objectives.
5	Design and implement monitoring and reporting program based on the defined health indicators.
6	Determine and implement simple annual action plans to meet priority conservation targets and prioritised threat objectives.
8	Establish a governance body to review annual results, refine further conservation strategies (5 years) and frame a consistent adaptive management response over successive years.

Conservation values, threats and health: invasive grass The highest priority threats to Litchfield Park are fire and invasive grasses. Fire is a frequent occurrence in the savanna region (Scott *et al.* 2012). There is high awareness in northern Australia about the threat of invasive grasses, particularly gamba grass (*Andropogon gayanus* Kunth.) to the conservation, cultural and visitor values of the region. The evidence is the result of decades of research demonstrating impacts on ecosystem structure and function, particularly by altering fire regimes (Flores *et al.* 2005, Brooks *et al.* 2010, Setterfield *et al.* 2013, Adams and Setterfield 2016). In addition, the NT's weed risk assessment process (Setterfield *et al.* 2010, Setterfield *et al.* 2015) underpinned evidence of the very high risk posed by gamba grass and other invasive grasses. The interaction between gamba grass, other invasive grasses and their ability to alter fire regimes (Rossiter *et al.* 2003,

Table 2. Key values in Litchfield Park identified through the ICS process.

	Key value
1	Visitor safety, visitor, cultural and heritage assets
2	Sandstone plateaus
3	Monsoon rainforest and swamps
4	Melaleuca woodlands
5	Lowlands and alluvial plains

Table 3. The top fourteen priority threats to Litchfield identified through the ICS process.

Priority	Threat to Litchfield	Threat ranking
1	Wildfire	Extreme
2	Gamba grass	Extreme
3	Inappropriate fire regimes	Very high
4	Arson	Very high
5	Mission grass	High
6	Mimosa	Medium
7	Humidicola	Medium
8	Pigs	Low
9	Buffalo	Low
10	Cattle	Low
11	Olive hymenachne	Low
12	Other weeds	Low
13	Cane toads	Low
14	Cats	Very high

Setterfield *et al.* 2013) and increase risk to the Park's visitor values and conservation goals was therefore reflected in the high priorities for these threats in Table 2.

Realistic, evidence based management targets Guided by the conservation values and threats identified through the ICS, the management actions required to protect or maintain these values were identified. Park Rangers had a lead role in identifying the appropriate actions because they have the knowledge and skills in on-ground management as well as knowledge of what is a realistic approach. For NT parks, 5-year realistic management action targets are set. For gamba grass, outcomes of research projects on the current distribution and predicted spread of gamba grass (Adams and Setterfield 2016) directly informed the Litchfield ICS management goals (NERP 2015).

Realistic, evidence based outcomes Because the values being managed and the management methods are sometimes imperfectly understood, monitoring and evaluation is very important. Annual reporting of management actions occurs for Class 1 NT Parks. State of the Park reports are produced to evaluate and report on the state of health of conservation values (PWCNT 2015).

DISCUSSION

Litchfield National Park, like many protected areas in the region, has ongoing weed management problems. With the exception of the rare scenario of a very high-risk weed that is (a) has a high feasibility of eradication, partly due to being identified early and with a short maintenance of a propagule-bank and (b) triggers a rapid and successful response, we have to apply long term (marathon-like) weed management programs. While the value and logic of strategic long-term management responses is not debated, it does not always occur.

This paper outlined the process being used by NT Parks for planning long-term management of all risks to park values – development of an ICS using a CAP approach. The planning and management process in Litchfield, developed using a combination of existing policies and related planning tools, research publications and other survey and monitoring data and reports, along with expert knowledge throughout the process achieved a lot with limited resources.

The CAP process and resulting ICS provides a template for the development, implementation, review and refinement of a planning approach very well suited to both short and long term weed management challenges. Collaborative research aligned with policy and planning requirements continues to play an important role in improving all the elements of the CAP/ICS. In theory, done well and maintained for the long term, park planners, weed managers and researchers can all use the planning process to try and achieve a variety of NRM outcomes.

While the CAP process and linked ICS's may have been under-utilised in weed management in Australia, the underlying principles outlined here are not new. Existing examples of many of these principles include: the Weeds of National Significance (WONS) program (Thorp and Lynch 2000, DoE 2007), the CRC for Australian Weed Management (2001–2008) and the National Land and Water Resource Audit documents (e.g. NLWRA 2002) provide examples of these principles and also highlight the challenge of maintaining well designed, coordinated long-term efforts to manage weeds.

CONCLUSIONS

The CAP process and related integrated conservation strategies, provide another way to strategically pick which weed marathons to run, as well as engage in the occasional sprint. In theory a win-win for the doers and the funders! Incorporating these new tools, while reconsidering the existing tools and methods, may assist weed managers and policy makers to review the need for a long-term, cross-tenure strategic weed management approach.

ACKNOWLEDGMENTS

This paper, like the management plans and conservation strategies referred to, are only possible because the combined long-term efforts and expertise of policy makers, planners, land managers and Park Rangers, traditional owners and researchers. Many thanks to the staff of the Flora and Fauna Division for the flora and fauna survey data and advice that is a key element of ICS's. Special thanks to the Rangers of Litchfield National Parks whose local knowledge and on ground management and monitoring skills and efforts underpin the success of the park management described.

REFERENCES

Adams, V.M. and Setterfield, S.A. (2013). Estimating the financial risks of *Andropogon gayanus* to greenhouse gas abatement projects in northern Australia. *Environmental Research Letters* 8. doi: 10.1016/j.biocon.2012.01.064.

Adams, V.M. and Setterfield, S.A. (2016). Approaches to strategic risk analysis and management of invasive plants: lessons learned from managing gamba grass in northern Australia. *Pacific Conservation Biology* 22, 189-200. doi:10.1071/PC15041

Anon. (2006). 'HB 294-2006 National Post-Border Weed Risk Management Protocol'. (Standards Australia International Ltd., Sydney, Standards New Zealand, Auckland and CRC Australian Weed Management, Adelaide).

Australian Government Department of the Environment (2007). Australian Weeds Strategy – A national strategy for weed management in Australia. Natural Resource Management Ministerial Council Australian Government Department of the Environment and Water Resources, Canberra ACT.

Brooks, K.J., Setterfield, S.A. and Douglas, M.M. (2010). Exotic grass invasions: applying a conceptual framework to the dynamics of degradation and restoration in Australia's tropical savannas. *Restoration Ecology* 18, 188-97.

Flores, T.A., Setterfield, S.A. and Douglas, M.M. (2005). Seedling recruitment of the exotic grass *Andropogon gayanus* (Poaceae) in northern Australia. *Australian Journal of Botany* 53(3), 243-9.

Land and Water Resources Audit (2002). Australia's Natural Resources: 1997–2002 and beyond.

NERP (2015). Northern Australia Resources Program. 'Video. Research helps tackle Gamba Grass in Litchfield National Park'. https://vimeo.com/137781537?lite=1. (Northern Australia National Environmental Research Programme, Darwin).

PWCNT (2014). 'Litchfield National Park Report Card 2014'. https://parksandwildlife.nt.gov.au/__data/assets/pdf_file/0009/249390/Litchfield_22-May-2015.pdf. (PWCNT, Darwin).

PWCNT (2015). 'Litchfield National Park Draft Plan of Management' (PWCNT, Darwin). https://parksandwildlife.nt.gov.au/__data/assets/pdf_file/0007/249082/Litchfield-National-Park-draft.pdf

Rossiter, N.A., Setterfield, S.A., Douglas, M.M. and Hutley, L.B. (2003). Testing the grass-fire cycle: alien grass invasion in the tropical savannas of northern Australia. *Diversity and Distributions* 9, 169-76.

Scott, K., Setterfield, S.A., Douglas, M., Parr, C.L., Schatz, J. and Andersen, A. (2012). Does long-term fire exclusion in an Australian tropical savanna result in biome shift? A test using the re-introduction of fire. *Austral Ecology* 37, 693-711.

Setterfield, S.A, Ferdinands, K., Rossiter-Rachor, N., and Douglas, M. (2010). The Northern Territory's Weed Risk Management System: an application of the national post-border WRM Protocol. *Plant Protection Quarterly* 25(2), 86-8.

Setterfield, S.A., Rossiter-Rachor, N.A., Douglas, M.M., Wainger, L., Petty, A.M., Barrow, P., Shepherd, I.J. and Ferdinands, K.B. (2013). Adding fuel to the fire: the impacts of non-native grass invasion on fire management at a regional scale. PLoS ONE 8, e59144.

Setterfield, S.A., Ferdinands, K., Rossiter-Rachor, N.A. and Elliott, L. (2015). 'Northern Territory Weed Risk Management System User Guide.' (Department of Land Resource Management, Darwin)

Thorp, J.R. and Lynch, R. (2000). Determination of Weeds of National Significance. (National Weeds Strategy Executive Committee, Launceston).

TNC (2007). 'Conservation Action Planning Handbook: Developing strategies, taking action and measuring success at any scale'. (The Nature Conservancy, Arlington, VA).