# From killing lists to healthy country:

# Aboriginal approaches to weed control in the Kimberley, Western Australia

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**Abstract**

The Australian Government's funding of land management by Aboriginal communities aims to enable them to manage natural and cultural resources according to their values and aspirations. But this approach is countered in the case of weed management, where the emphasis is on killing plants that are identified on invasive alien species lists prepared by government agencies. Based on field research with Bardi-Jawi, Bunuba, Ngurrara, Nyikina Mangala and Wunggurr land managers in the Kimberley region of Western Australia, we observed that 27 of 35 weed control projects followed the government agency weed lists for species-led control. Of these 27 projects, only two were considered successful in meeting Aboriginal cultural aspirations. In most of the other cases, the list-based approach generated frustration among Aboriginal rangers who felt they were engaged in purposeless killing. In contrast, we found that elders and rangers preferred site-based approaches that considered landscape and vegetation management from their culturally specific and highly contextual geographies of 'healthy country'. We outline instances where ranger groups have adopted site-based management that has been informed by geographies of healthy country and argue that such an approach offers a better alternative to current list-based weed control and produces positive outcomes for Aboriginal communities.

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## 1. Introduction

Indigenous people across the world are becoming increasingly involved in land management. Much of this intercultural management intends to reflect Indigenous people's priorities and use their ecological knowledge to direct practice (Howitt, 2001). Such initiatives are representative of a global trend toward the decentralisation of land management rights and responsibilities, which has intended to empower local communities to gain greater control over how resources – and threats to those resources including invasive alien species – are managed (Dressler et al., 2010).

As a part of this movement, Aboriginal Australians have played a key role in the nation's efforts to control invasive alien plants (commonly termed 'environmental weeds', or simply 'weeds' in Australian land management), which are changing ecological communities at a dramatic scale (Low, 2002). Although originally enlisted in the 1970s as a labour force fighting 'the war on weeds' under the command of government agencies, Aboriginal land manager (ranger) involvement has evolved to be increasingly guided by culturally-based aspirations (Altman and Kerins, 2012). At least this has been the objective of the agencies that promote Aboriginal natural and cultural resource management (NCRM), through which most Aboriginal weed control takes place. These 'ranger' programs are structured to support Aboriginal groups to manage traditional lands according to their knowledge and priorities, and have produced various positive outcomes for conservation, Aboriginal employment, cultural re-invigoration, and recognition of the value of Indigenous ecological knowledge (Smyth, 2011).

Despite ostensibly gaining greater autonomy over their work, Aboriginal rangers continue to control environmental weeds according to mainstream norms (Bach, 2015; Smith, 2013). In Australia, the mainstream approach to weed control is characterised by killing plants that have been identified as alien invasive species by government agencies and placed on weed lists (Downey and Sheppard, 2006). Studies have persistently shown that although Aboriginal people view invasive species and environmental weeds differently from mainstream land management agencies, their perspectives are rarely reflected in how rangers control them, (Bach and Larson, 2017; Smith, 2000, 2013). The list-based approach not only contradicts the principles of NCRM initiatives by undermining the cultural significance of the work, but also ignores potential insights and opportunities provided by Aboriginal conceptualisations of invasive species to pursue weed control differently

Our research contributes to a growing body of literature that looks at indigenous, tribal and local perceptions of invasive alien species. This research demonstrates the various ways in which local and indigenous people perceive, consider, use and manage invasive alien species and how these differ from Western perspectives (Robinson et al., 2005; Vaarzon-Morel and Edwards, 2012). It argues for the inclusion of these perspectives in discourse and highlights the contextual nature of managing invasive species in social-ecological systems (Bhattacharyya and Larson, 2014; Head et al., 2015).

In this paper, we explore the perspectives of Indigenous rangers and elders regarding environmental weeds, how they should be controlled and how these ideas match up with current invasive alien species discourse. We outline the current list-based conventions that dominate weed management and the critiques that have questioned these methods. After setting out our methodology, we describe how Aboriginal rangers control weeds following the list-based approach and compare this to their perspectives of how weeds ought to be considered and managed. The Aboriginal ranger critiques invoke their traditional concept of 'healthy country' as the guiding principle for site-based

management, which directly connects weed work with enhancing cultural landscape values. We argue that aligning rangers' weed control with Aboriginal aspirations to look after 'healthy country' can achieve the positive outcomes intended by Indigenous land management programs and provide opportunities to pursue alternative ways of viewing and controlling weeds.

## 2. Weed lists and species-based control in Australia

A first abstraction of Australia's approach to environmental weed management is via listing and categorization of species. It is impossible to find a government document outlining a weed strategy or policy that does not, at the very least, refer to a weed list. Indeed, most new strategies and policies from the local to national level, involve producing new weed lists as one of their outcomes. Lists identify, categorise and prioritise species, dictating if and how species can be imported, sold, transported, grown and controlled. In certain cases, lists are enforced by legislation and defiance is punishable. Although Australia is the focus of this research, this list-making tradition also dominates invasive alien species and biosecurity control measures in North America, the UK and Europe (McGeoch et al., 2012).

The most influential weeds list in Australia are the Weeds of National Significance (WoNS), which set the priorities for weed control across all land tenures (Thorp and Lynch, 2000). This is complemented by the National Environmental Alert List, which includes species that specifically threaten environmental values. A third national list of "Sleeper Weeds" identifies species that might become a threat in the future (Department of the Environment, 2012).

The national list-based tradition is mirrored by the states, which have their own lists. Western Australia's (where this research is focused) initial response to environmental weeds was the Environmental Weed Strategy for Western Australia (1999), which listed 1350 environmental weeds (CALM, 1999; Passeretto and Powell, 2012). This was considered too general and of little practical benefit and was replaced by the Invasive Plant Prioritisation Process (IPPP) in 2008, which streamlined the original list, producing smaller, prioritised and localised weed lists for each of Western Australia's nine bioregions (Bettnik and Keighery, 2008; Passeretto and Powell, 2012).

The development of each list considers various criteria (Table 1). These criteria can be organised into three broad categories: origins, (is the plant outside its 'native' range?); behaviours (could the plant spread rapidly in certain ecological conditions?) and effects (does the plant affect the ecosystem into which it spreads?). This 'origins-behaviours-effects triad' has been identified and explored elsewhere as the main elements behind competing definitions of invasive species (Bach, 2015; Boonman-Berson et al., 2014; Kull and Rangan, 2015). Analysis of the national and state weed lists (Table 1) shows that if a plant possesses two or more of these characteristics – not necessarily the same two – it will be listed as a weed.

Lists play a major role in shaping weed control in Australia. Lists identify plant species that are required to be eradicated or controlled by weed management programs. From the national to local levels, species-led control has become the dominant approach for weed management strategy (CALM, 1999; NRMMC, 2007). Downey and Sheppard (2006) review of Australian weed control highlighted a "species-based foundation to contemporary weed management practice in Australia" (265), which they attributed to the influence of weed lists. Our research reinforces their observation. As this article will show, the link between weed lists and species-led control is obvious on the ground, as non-Indigenous and Indigenous weed managers alike rely on lists to prioritise species-led control.

Table 1: Outlines the major national and Western Australia weed lists. Definitions for the national weed lists were sourced from the National Weed Lists Website (2018). The Western Australia weed lists definitions were

sourced from Environmental Weed Strategy for Western Australia (1998) and the Department of Parks and Wildlife website. The 'Emphasis' column denotes the elements of the origins-behaviours-effects classification triad that are mentioned in the definition.

| SCALE | LIST | DEFINITION | EMPHASIS |
|---|---|---|---|
| NATIONAL | Weeds of National Significance (32 species) | "identified by Australian government based on their invasiveness, potential for spread and environmental, social and economic impacts." | Behaviours, effects |
| | Environmental Alert List (28 species) | "identifies 28 non-native weeds that have established naturalised populations in the wild… and have the potential to become a significant threat to biodiversity if they are not managed." | Origins, behaviours, effects |
| | Sleeper weeds (17 species) | "plants from overseas that have currently established only small wild populations but have the potential to spread widely and affect agricultural or natural environments. Huge environmental damage and control costs can be prevented if these weeds are eradicated before they become widespread" | Origins, behaviours, effects |
| STATE | Environmental Weeds of Western Australia (1350 species) | "environmental weeds are plants that establish themselves in natural ecosystems and proceed to modify natural processes, usually adversely, resulting in the decline of the communities they invade." | Origins, effects |
| | Nine individual bio-regional lists | "prioritise weeds in each region, based on their: invasiveness, ecological impact, potential and current distribution, feasibility of control." | Behaviours, effect |

### *2.1. Destabilising the lists*

Despite their enthusiastic uptake, the effectiveness of lists as mechanisms for guiding invasive alien species and biosecurity control has been under scrutiny for a while (Adams and Setterfield, 2016; Burgman, 2004; McGeoch et al., 2012; Williams and West, 2000). In addition to internal criticism, there is increasing attention on how authoritative information, classifications, and lists from the science of invasion ecology can obscure normative biases, values, and scientific inconsistencies (Downey and Sheppard, 2006; Davis, 2009; Rotherham and Lambert, 2011; Kull and Rangan, 2015; c.f. Richardson and Ricciardi, 2013). We briefly review some of these critiques below - addressing, in turn the 'origins-behaviours-effects triad' that dominates the classification and listing of weeds in Australia.

First, in many definitions, species must have non-native origins to be a weed. This focus on origins has been criticised as 'theoretically weak and internally inconsistent' because of its contingency on the spatial and temporal scale at which the 'introduction' of a species is considered (Chew and Hamilton, 2011:36). Sometimes, nativeness was judged not with respect to biomes and ecosystems but relative to human boundaries of space and time – such as political borders, or the date of arrival of European settlers (Head, 2012). At the extremes, negative evaluations of non-native species have been called a form of biotic xenophobia, rather than anything reflecting inherent or objective qualities of the plants or animals (Sagoff, 1999; McNeeley, 2011). Such critiques, although contested by several invasion ecologists (see Simberloff, 2003; Richardson and Ricciardi, 2013), have promoted more nuance in the language, categories, and distinctions made by the discipline.

Second, many definitions also evoke the behaviour, or 'invasiveness' of the plant or animal being discussed. This has been criticised as an ambiguous and imprecise concept which 'can confuse

ideological debates and undermine management efforts' (Colautti and MacIsaac, 2004:135). Variables such as the speed of spread or the level of dominance achieved need to be spatially and temporally contextualized, and – importantly – depend upon the qualities of the terrain being invaded (Abulizi et al., 2015; Richardson and Pyšek, 2006). Furthermore, the term 'invasion' itself has been criticized as an emotive military metaphor, undermining objective scientific communication in order to emphasise the urgency of the 'problem', attract larger research and management budgets, and intensify control (Sagoff, 1999; Larson, 2007).

Finally, effects or impacts figure in many definitions of invasive species, and are frequently framed in ecological or anthropocentric terms. The challenge in terms of effects is that normative values inevitably influence the effects reported and that effects perceived as negative are more likely to be reported (Tassin and Kull, 2015). Taking a step back, the argument can be expanded to state that ecological change is often conflated with environmental harm, which automatically prioritises ecological stability over dynamism (Robbins, 2004; Davis, 2009).

These critiques emerged in tandem with a variety of proposals for ecology to engage more fully and positively with novel, emergent, and invasive or anthropogenic ecosystems (e.g. Hobbs et al., 2006, 2014). Common to such new ecological understandings are that species movements and new ecological assemblages are unavoidable, and that the broader contexts of invasive species need to be brought into focus if we are to understand and manage them effectively. From this, three points regarding invasive alien species and their management have become clear: 1) ecological change is occurring and is seen by many as unavoidable, 2) this change will always be interpreted through socio-cultural values, and 3) ecosystem management will reflect these values.

While certainly not challenging scientific interest in invasive species and their ecological and social effects, these points reinforce that issues of invasive species occur in social-ecological systems that are highly complex, contextual, political, and culturally relative. The weed lists produced out of this logic are therefore reflective of human preferences about how 'plants ought to be' in nature, rather than a supposedly value-free subset of environmentally unfavourable plants (Peretti, 1998; Warren, 2007; Davis, 2009; Chew and Hamilton 2011). This makes weed lists and species-led control just one way of seeing and managing plants in place, which creates space for other ways of viewing and managing plants.

## 3. Aboriginal rangers and weeds

Much of the land handed back to Australian Aboriginal people during the 1970s and 80s was affected by widespread weeds (Storrs et al., 1999). Traditional owners recognised the threat weeds posed and sought help to control them. Assisted by regional Aboriginal representative bodies, Aboriginal landholders partnered with government agencies and environmental groups to develop community ranger teams to control weeds. Many such teams expanded to become the multifaceted NCRM (ranger) programs that exist today (Altman and Kerins, 2012; Storrs et al., 1999; Young et al., 2001).

Since their advent, ranger programs have increasingly foregrounded Aboriginal knowledge and priorities (Altman and Kerins, 2012). The arrival of the Federal Government's Indigenous Protected Areas (IPA) program in 1998, followed by Working on Country (WoC) in 2008, intended to unshackle ranger groups from government-based conservation priorities that were characteristic of early government fee-for-service contracts. Both programs are deliberately structured to enable rangers to pursue culturally-grounded environmental stewardship by basing work on Aboriginal knowledge, which can be supported by Western science and land management (Smyth, 2011).

However, cross-cultural land management arenas are highly political spaces that are persistently dominated by Western science and mainstream conservation norms (Howitt and Suchet-Pearson,

2006; Nadasdy, 1999; Rolls, 2007). Despite producing various social, economic, cultural and environmental benefits, IPAs and WoC have been criticised for such a tendency (Altman and Kerins, 2012; Muller, 2014). This issue has also been recognised around the world, where the fundamentally different perceptions of the environment held by Indigenous and non-Indigenous stakeholders often imply vastly different and sometimes conflicting land management approaches (Bhattacharyya and Slocombe, 2017). Examinations of the epistemological politics of cross cultural management have emphasised the tendency of mainstream science to abstract, marginalise and co-opt Indigenous knowledge and aspirations, particularly when they do not accord with scientific conservation priorities (Nadasdy, 1999; Simpson, 1999; Ellen et al., 2000; Rolls, 2007). Muller (2012:133) notes that such "invisible ontological domination in natural resource management" persists despite formal frameworks for shared governance such as 'co-management' and informal strategies such as 'two-way management' for knowledge integration (Bradley, 2011; Holmes and Jampijinpa, 2013).

The 'invisible ontological domination' also occurs in the context of Aboriginal weed control. Research shows that Australian Aboriginal people hold unique perspectives about plants classified by mainstream science as environmental weeds, but these perspectives are not represented in land management (Smith, 2000, 2013; Vaarzon-Morel and Edwards, 2012; Duff, 2012; Bach, 2015). Although many of these studies emphasise the need to base Aboriginal weed management on Aboriginal perspectives and priorities, few offer suggestions on how these might be translated into alternative land management approaches.

The following sections draw on field research with Aboriginal rangers and elders to show their perspectives in relation to the current weed control paradigm and demonstrate alternative management strategies that reflect particular Indigenous cultural values and aspirations for their community and country.

## 4. Methodology

We used qualitative methods to develop a rich, multi-cited ethnographic picture of Aboriginal weed management in the west and central Kimberley region of Western Australia (Fig. 1). Research participants included Aboriginal Traditional Owners (referred to henceforth as elders) and rangers belonging to Bardi-Jawi, Bunuba, Nyikina Mangala, Ngurrara and Wanjina-Wunggurr-Wilinggin country (Fig. 1), and the staff of Kimberley-based government weed agencies (Western Australia Department of Parks and Wildlife, and Rangelands NRM Western Australia). Aboriginal participants involved in the project were selected by the Kimberley Aboriginal Land Council (KLC), which is the representative Aboriginal organisation for research. Ethics and consent procedures for working with participants were coordinated through the KLC's Research Ethics and Access Committee, which is designed to ensure that researchers meet correct cultural protocols while conducting field research on Aboriginal land in the Kimberley.

Participant observation occurred over a three-year period by the lead author and involved spending time with Aboriginal ranger groups while they planned, conducted and reviewed weed work. Much of this time also involved accompanying ranger groups as they undertook several non-weed related activities. This time provided formal and informal opportunities to develop an in-depth understanding of how weed work is undertaken and how it fits with other activities (Geertz, 1994; Schensul and LeCompte, 2012).

Semi-structured interviews were conducted with government weed managers, rangers and elders to identify attitudes towards weeds and weed work, as well as explore themes that arose out of participant observation (Robinson, 1998). Interviews with individual government weed managers (n = 12) focussed on how they classify weeds and how they prioritise and conduct work. Interviews with individual rangers (n = 44) explored how they classified weeds, the role of Aboriginal knowledge

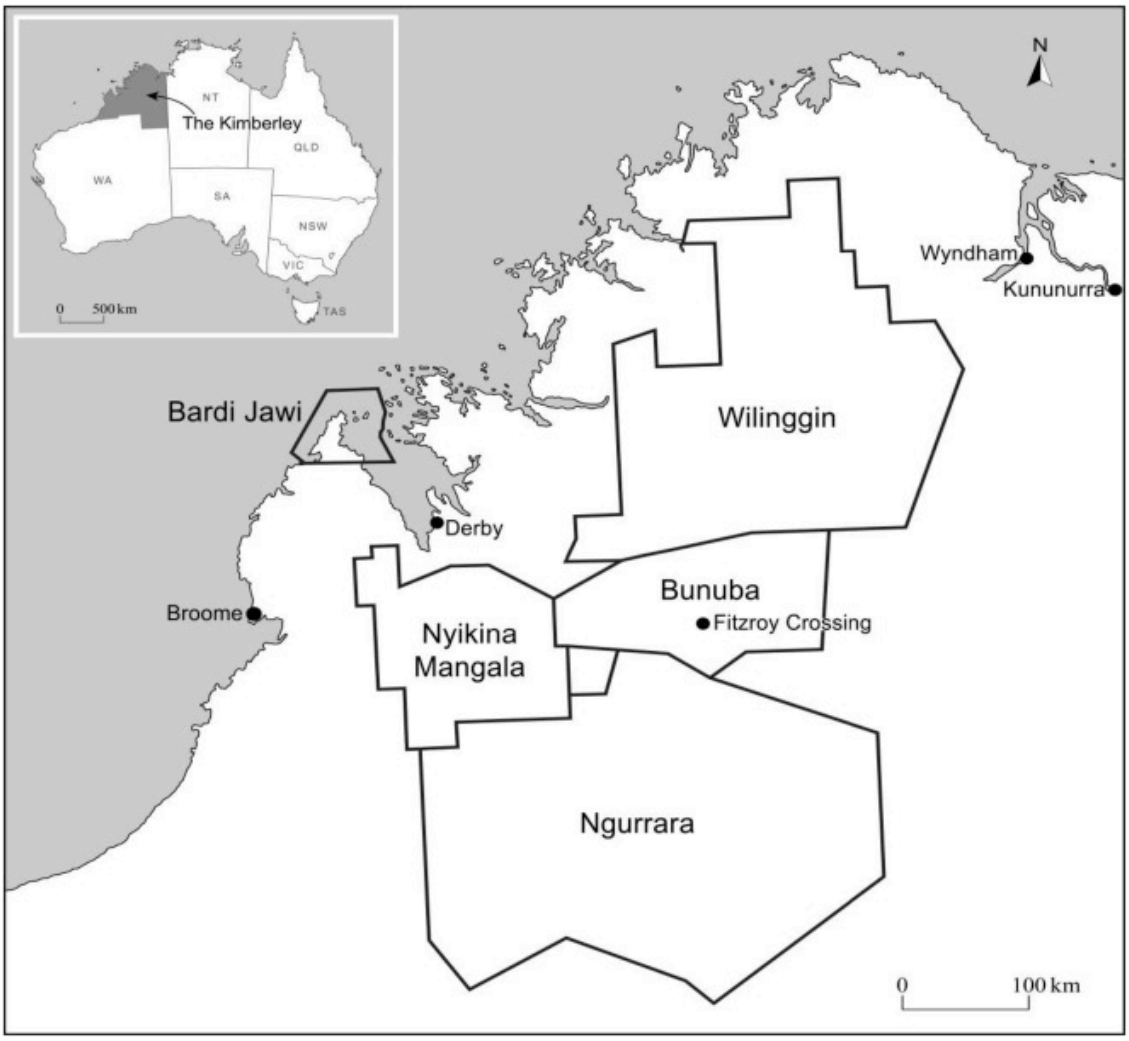


Fig. 1. The Kimberley region of Western Australia.

in weed work, attitudes towards weed work (with reference to specific examples), and reflections on other parts of their work. Interviews with elders (n = 38) were conducted in groups of two to five. Elder participants were selected by the rangers according to who held knowledge about weeds and had cultural authority to speak about them. All interviews with elders were attended by a ranger who ensured correct cultural protocol and who shared the findings of the interview directly back to the ranger group. Elders were invited to share their thoughts about definitions of weeds, listed weeds, the weed work done by their ranger groups, and how they would like to see weed work done on country.

Comprehensive notes were taken during participant observation and interviews (which were not recorded, in line with ethics and access considerations). These notes constituted the raw data for the project and were manually coded to identify recurrent themes within and across participant groups (mainstream weed managers, rangers and elders). Once themes were identified, the notes were sorted to identify incidents, quotes and interview segments that corresponded to each of these themes, which allowed a clearer picture of perceptions and attitudes across each of the groups.

Towards the end of fieldwork, the lead author was asked by three groups to facilitate weed work reviews, which involved focus groups in which rangers evaluated work processes and outcomes and suggested improvements. At the end of the research project, all results and findings were presented back to participants through a detailed report accompanied by an oral presentation.

## 5. Aboriginal weed work in the Kimberley

The Kimberley region is located in northwest Australia and is part of the state of Western Australia (Fig. 1). It is remote and has experienced relatively less human-induced landscape change compared to the southern and eastern coastal regions of Australia. Consequently, it is seen as a region of high environmental and cultural significance and value for biodiversity conservation.

Despite its remoteness and sparse population, the Kimberley region has experienced a significant expansion of environmental weeds over several decades. A large proportion of these weeds entered along with the introduction of large-scale pastoralism in the early 1900s and further growth after the 1950s and 1960s. Some plants that were favourable for livestock were introduced to ensure the viability of the pastoral industry, while others were spread by the livestock in pastures and along cattle droving routes. Today, many of these plants are considered environmental weeds and as threats to the biodiversity and cultural heritage of the region. The marketing of the Kimberley as an outback and wilderness tourist destination over the past three or more decades has also contributed to the rapid spread of weeds into ecologically-sensitive areas by vehicles traversing the region. This saw the direct introduction favourable pastoral plants and the indirect transport of other introduced plants through contact with livestock – many of which are now considered environmental weeds (ibid). Together, the advent of pastoralism and spread of invasives have caused large-scale, dramatic changes to regional ecologies that are without analogue.

Weed control has thus become a key concern for Kimberley land managers and receives a large allocation in their annual operating budgets for natural and cultural resource management. NCRM in the Kimberley is chiefly undertaken by Aboriginal ranger groups operating on behalf of their Native Title (land-holding) corporations. Most ranger groups are coordinated through the Kimberley Aboriginal Land Council's Land and Sea Management Unit and funded by the WoC program. Some also have IPAs for which they undertake an extra weed work component.

Rangers need training and accreditation from the local technical college before they are permitted to carry out weed control activities. This training teaches rangers weed identification and safe control techniques using chemicals and machinery in accordance with mainstream norms, which has heavily influenced how ranger coordinators and rangers manage weeds on country.

Weed work by Aboriginal rangers is, therefore, focussed on killing plants that are on national, state or regional weed lists. Of the 35 Aboriginal weed work projects observed during field research, 27 were justified according to the target species being listed. As one Bardi-Jawi ranger stated, “if it's on the list, we kill it”. Work prioritisation mirrored the institutional hierarchies of mainstream weed lists – species on the WoNS list were killed first, weeds categorised as ‘high risk’ by the IPPP killed second, followed by weeds featuring in other local lists. In contrast, site-based and asset-based weed work was far less common, constituting only 8 of the 35 projects (Table 2).

Table 2: Instances of weed work observed during fieldwork.

| RANGER GROUP | SPECIES TARGETED | SPECIES VS SITE-BASED | JUSTIFICATION MADE BY RANGER GROUP | SECONDARY JUSTIFICATION | SUCCESSFUL |
|---|---|---|---|---|---|
| BARDI-JAWI | Coffee bush | Species-based | Declared by IPPP | Near town | No |
| | Coffee bush | Species-based | Declared by IPPP | Could be used as a site to do chainsaw | No |

| | | | | | |
|---|---|---|---|---|---|
| | | | | training | |
| | Parkinsonia | Species-based | WoNS | | Yes |
| | Passionfruit Vine | Species-based | Declared by IPPP | Near town | No |
| | Siratro and Passionfruit vine | Species-based | Declared by IPPP | Near town | No |
| | Neem trees and Buffel Grass | Site-based | Inhibiting the growth of bush foods in vine thickets which are important cultural sites | | Yes |
| | Caltrop | Site-based | Stopping people from using beaches, which are important meeting points and cultural sites | | Yes |
| BUNUBA | Calotropis | Species-based | Declared by IPPP | Easy access | No |
| | Calotropis | Species-based | Declared by IPPP | Easy access | No |
| | Passionfriut vine | Species-based | Declared by IPPP | Easy access | No |
| | Parkinsonia | Species-based | WoNS | | No |
| | Bellyache Bush | Species-based | WoNS | | No |
| | Parkinsonia | Site-based | Stopping people from visiting an important camp site on country | | Yes |
| | Gallon's Curse | Site-based | Important walking tracks, stopping people from accessing country | | Yes |
| NYIKINA MANGALA | Calotropis | Species-based | Needed to fill item on work plan | Declared by IPPP | No |
| | Calotropis | Species-based | Declared by IPPP | On the side of the road | |
| | Rubber vine | Species-based | WoNS | | Undecided |
| | Parkinsonia | Species-based | WoNS | Near to a community | No |
| | Bellyache bush | Species-based | WoNS | | No |
| | Buffel Grass | Site-based | Growing near a significant group of trees, which could promote fire and harm the trees | | Yes |
| NGURRARA | Calotropis | Species-based | Declared by IPPP | On the side of the road | No |
| | Parkinsonia | Species-based | WoNS | On the side of the road | No |
| | Buffel grass | Site-based | Encroaching too close to an important waterhole | | Yes |
| | Bulrush | Site-based | Choking a water hole | | Undecided |
| WUNGURR | Calotropis | Species-based | Declared by IPPP | On the side of the road | No |
| | Calotropis | Species-based | Declared by IPPP | | No |
| | Chinee apple | Species-based | Needed to fill item on work plan | Declared by IPPP | Yes |
| | Rosella | Species-based | Declared by IPPP | Near town | Yes |
| | Coffee bush | Species-based | Declared by IPPP | On the side of the road | No |
| | Bellyache bush | Species-based | WoNS | | No |
| | Taro | Species-based | Declared by IPPP | | No |
| | Gamba Grass | Species-based | WoNS | | No |
| | Gamba Grass | Species-based | WoNS | | Yes |

### *5.1. Aboriginal reflections on weed work*

While Aboriginal rangers and elders recognised the importance of weed work for managing their country, they were generally critical of doing this based on weed lists. Rangers expressed their frustration by highlighting the ineffectiveness of their weed control efforts and the lack of cultural connection between their work and managing country. Their critical observations also questioned mainstream views about invasive species – particularly the origins-behaviours-effects triad – and recognised the need for alternative approaches to weed work on country (Table 3).

#### *5.1.1. A sense of failure*

Most of the Aboriginal ranger groups we interviewed believed that their weed work yielded minimal outcomes - only 10 of the 35 weed work projects they carried out were considered beneficial or successful. Rangers often described their weed work as 'frustrating' and 'pointless', and was set up to fail, given the number of weeds on the lists and the expansive landscapes across which they needed to be controlled.

Table 3: Quotes from rangers regarding weed work

| Ranger group | Comments |
|---|---|
| Bardi-Jawi | "We keep going to the same places and killing the same weeds…it's bullshit …doesn't mean much, doesn't get much done." |
| | "Weed work doesn't get anywhere." |
| | "If we're going to do something, we might as well get something done." |
| Bunuba | "It was a failure, a waste of time." |
| | "It doesn't look like we've done anything here, strange for us to even bother again." |
| Nyikina Mangala | "It even seems like there are more weeds here than when we started." |
| | "All of the weeds are going to grow back, just like the last times." |
| | "We go back and it seems like we haven't got anywhere. Probably because we haven't!" |
| Wunggurr | "It doesn't seem to be getting anything done." |
| | "We are going to have to keep coming back for this weed. What's the point?" |

*5.1.2. Lack of cultural connection and motivation*

Unlike their other activities, rangers felt that weed work was not connected to their cultural ways of managing their landscapes. Only four of the 44 rangers responded that weed work had cultural significance. Most others responded that they control weeds because "it's on our work plan", and "because that's our job". In contrast, for other activities such as fire management, cultural site maintenance, and taking people back to country, rangers offered culturally-based reasons that highlighted their role in 'looking after country'.

The lack of effectiveness of their weed control efforts contributed to a lack of motivation for doing such work, particularly in comparison with other culturally relevant activities. As a Wunggurr ranger mentioned, "Weed work doesn't mean as much, which makes it hard to get motivated." Many rangers emphasised that the inability to see positive results of their work undermined their spirit and reinforced feelings of frustration and pointlessness.

*5.1.3. Only one way to control weeds*

All but four rangers believed that there was only one correct way to classify and control weeds, and that this conformed to the origins-behaviours-effect triad. Only twice during initial interviews did rangers connect the concept of a weed to an unwanted plant. A Nyikina-Mangala ranger that made this connection defended his group for aligning with mainstream orthodoxy, "we don't know any other way for weeds – we are only taught this one way". To most rangers, it was implausible that our research would ask about Aboriginal conceptualisations of weeds, because "weeds are weeds, they are on the list!"

However, as fieldwork progressed, our conversations with rangers created opportunities for them to question their conventional ways of thinking about weeds and weed control. Some rangers found it liberating to consider other ways of doing weed management. A Bardi-Jawi ranger asked his fellow workers, "how would we do weed work if we could do it the way we like? There is a different way, our way." While this reflection was to some extent influenced by our ongoing discussions during field research, we were aware that this idea was implicit in the way the rangers contrasted weed work with other culturally relevant practices of fire management and taking people out on country.

*5.2. Challenging mainstream norms*

Rangers and elders began to reflect more openly about the problems with weed lists and the origins-behaviours-effects triad. The most overt challenge came from some elders who parodied the hypocrisy of mainstream weed classification by likening non-Indigenous Australians to environmental weeds – both are introduced, invasive and have caused significant upheaval to their Aboriginal ancestral landscapes. Through this analogy, elders humorously pointed out that if the logic of the 'triad' was extended to humans, it would mean the eradication of all non-Indigenous Australians from the Kimberley.

Referring to 'origins', several elders pointed out that non-native species can be good, that native species can be bad, and that animals and plants frequently come to 'belong' in country over time. As one Bardi-Jawi elder noted, "the plants have been here our whole lives, they belong". Edible introduced plants such as Passionfruit Vine and Chinee Apple were frequently considered positively because of the food they provide for people and animals. Bardi-Jawi rangers pointed out that native birds, including the charismatic Gouldian Finch (Erythrura gouldiae), nest in introduced vines. Elders that had worked on pastoral stations several decades ago had fond memories of cattle grazing on Kapok Bush and Buffel Grass and suggested that these plants 'belonged' as much as cattle to the country.

Regarding the 'behaviour' of weeds, elders from all groups observed that just because a particular plant spreads rapidly does not automatically make the species threatening. Many cited the examples of the edible weeds mentioned above and pointed out that their rapid spread was favourable because they provided more food for people and animals. Some Wilinggin and Ngurrara elders pointed to the benefits of "tough" weeds, such as Prickly Acacia and Rubber Bush that covered degraded landscapes. Looking across the road towards a pastoral property, a Bunuba ranger commented, "without those weeds, there would be nothing [on road verges and overgrazed pasture]". Bardi-Jawi elders, who encounter high numbers of tourists during the dry season, pointed out that in most cases it is humans looking for off-road adventure in their four-wheel drives that contribute to the spread of weeds through landscape disturbance and physical transport of seeds.

When discussing impacts, many elders pointed out that it would be wrong to think of change as always causing harm. Elders of each group told stories about the substantial cultural, ecological and economic changes they had witnessed since their childhood and used this broader context as the backdrop to reflect on the ecological effects of weeds. As a Wilinggin elder commented "Everything has changed since we were young - the plants are one of those things". Another elder suggested that "Country takes its course and changes, maybe for the better, maybe not. Places are changing, that's how it is". For these elders, conflating change and harm and constantly working against change disregards the agency of country to change itself. They pointed out that harm can and does happen when things change, but that one should consider the change before calling it harm.

When they talked about weed control, some elders and rangers mentioned that the emphasis for ranger work was always on killing plants rather than doing something positive with them. A few rangers observed independently, without any suggestion from our side, that they felt they were permanently at 'war' with weeds, and that there was no time or room to think about doing something different with weeds. A Bardi-Jawi ranger commented, "We always seem to be taking something with weeds. We need to make something instead. You know, create."

These reflections, like the findings of Robinson et al. (2005), show that Aboriginal perspectives of invasive alien species do not accord with mainstream norms. Rather, most elders and rangers felt it was important to do weed work in ways that enhanced their communities' knowledge of country and their cultural priorities for continued connections to country. They referred to this as 'healthy country'.

## 6. Geographies of healthy country

'Country' is a well-known and widely used Aboriginal term and concept that describes all living, non-living and spiritual parts of the world, as well as the interactions between them (Rose, 1996). Wherever and whenever these interactions occur according to Aboriginal Law, country is considered to be 'healthy' (Moorcroft et al. 2012). People are responsible for maintaining the health of country by 'caring for' it according to cultural obligations.

Over the past 15 years, the concept of 'health' in terms of the relationship between people and country has become a popular focus for anthropologists and geographers doing research with Australian Aboriginal communities. These studies have highlighted the close correlation between personal and community well-being and their environmental condition (Burgess et al., 2005). They argue that this correlation is as much about people having the opportunity and capacity to look after country as it is about the environmental condition itself (Garnett et al., 2009). The act of looking after country represents the act of looking after themselves, their culture and their community, which in turn provides feelings of personal and collective empowerment and leads to better human health (Green and Martin, 2017). Such connections are captured by the phrase 'healthy country-healthy people', now widely used in Aboriginal land management and Aboriginal health circles and has been influential in supporting Aboriginal NCRM programs.

The concept of 'caring for healthy country' has been taken up by Aboriginal NCRM programs and is now a popular guiding principle for ranger work (Moorcroft, 2012a). It has become formalised in official and bureaucratic terms, as 'Healthy Country Plans', which are required to establish and document Aboriginal priorities for IPAs (ibid). The increasing uptake of Healthy Country Plans has been attributed by Moorcroft (2012b) to their ability to provide rangers a culturally meaningful framework for identifying Aboriginal priorities and values that can direct their work for and on country

While healthy country provides a broad conceptual understanding of Aboriginal priorities for land management, it needs a finer grained analysis to be translated into weed work. Healthy country has several constituent parts that come together in different places and across different scales to form what we call geographies of healthy country. Geographies of healthy country encompass activities, places, and values that overlap in ways that provide a clear cultural sense for rangers to carry out their weed work. These relate to people's mobility, sustenance, commemoration, cleansing, and maintaining continuous connection with country. The following sections describe how elders and rangers explained the constituent parts of healthy country and related them to weeds and weed control.

### *6.1. Mobility: people on country*

The ability of people to visit, gain access to, and engage with their ancestral sites and landscapes is regarded as the most important aspect of healthy country. People are a part of country. Country cannot function without people, let alone be healthy. Summed up by several elders, "Country needs people, people need country".

Engagement with country relies on the ability to access it. However, in certain places, weeds inhibit such mobility. Vines (Passionfruit Vine, Siratro and Hairy Merremia) on Bardi-Jawi and Bunuba country have overgrown walking tracks, which makes it impossible to walk country and access important sites. On Wilinggin country, long grasses (Mission Grass, and Speargrass) have obscured the access points to important fishing, swimming and rock art sites, which means people can no longer find or visit them. Ground layer, prickly plants such as Caltrop around beaches on Bardi-Jawi

country, and Gallon's curse at fishing spots on Bunuba country, were blamed for hindering the community's ability to visit these places.

### *6.2. Sustenance: bush foods*

The harvest and consumption of bush foods is considered important for the health of Aboriginal people, culture and country. As a Wilinggin elder explained, "Healthy country means lots of bush food…Lots of food means that people are looking after country". Bush foods require traditional methods of harvesting such as hunting and manual collection, and commonly have important medicinal qualities. This harvest is central to people's connection to their country: hunting on Ngurrara country, fishing on Bunuba country and bush fruit collection on Bardi-Jawi country are all communal activities that involve practicing culture and transferring knowledge. Wilinggin, Ngurrara and Bunuba elders and rangers, whose communities mainly live in towns, suggested that their people needed to eat more bush foods and decrease reliance on fast-food and packaged food from town shops.

Weeds directly and indirectly affect the availability and harvesting of bush foods. Some plants, such as Neem, smother food-bearing vine thickets. Grass species such as Buffel and Gamba grass create a large fuel load that can promote fire and reduce the amount of bush foods in large areas. Although Passionfruit Vine and Chinee Apple are popular for their edible fruit, they can grow densely in areas where Aboriginal communities hunt and fish. Plants like Gallon's Curse and Speargrass also crowd along water bodies and prevent access for hunting and fishing.

### *6.3. Commemoration: spiritual and sacred sites*

Each Aboriginal group has particular cultural sites and places embodied in landforms and in rock art that are associated with creation stories and for conducting rituals and ceremonies. Strong laws exist about who can visit these sites and how people should use and look after them. When these places are misused or become unhealthy, it can lead to reprisals in the human world and cause people to become sick. Vines such as Passionfruit, Hairy Merremia, and Siratro have spread into several ceremonial sites on Bardi-Jawi country and have made it difficult for communities to use them. Likewise, prickly weeds such as Gallon's Curse and Caltrop have affected Law grounds on Ngurrara and Wilinggin country in the same way.

### *6.4. Cleansing: 'right-way fire'*

Fire is regarded as the most important tool for maintaining and restoring healthy country. There is the 'Right-way fire' which is carried out by Aboriginal people to protect country. Right-way fires reduce fuel loads and prevent uncontrolled hot fires that can occur during the hottest and driest time of year. They help 'clean up' overgrowth and enable clear access to important cultural sites and hunting and fishing areas. The rangers identified Gamba Grass, Buffel Grass, Mission Grass and Passionfruit Vine as the main plants that upset the practice of right-way fire. These introduced plants dry out earlier than native species and increase fuel loads during the dry season, resulting in more intense early season fires that disrupt traditional burning regimes (Head and Atchison, 2015a,b; Rossiter et al., 2003; Setterfield et al., 2011; Trauernicht et al., 2013).

### *6.5. Maintaining connection with country: Keeping Law and culture strong*

Law and culture are embedded in country. Healthy country relies upon adherence to Aboriginal Law and culture, which encompasses knowledge, language, and spirituality. Their practice maintains healthy country, and in turn, healthy country maintains them – they are damaged when country is damaged. Keeping Law and culture strong relies upon people to return regularly to country and transmit these across generations. This requirement poses a significant challenge for all Aboriginal groups in the Kimberley because their families and youth are increasingly growing up in town and far away from their traditional country. Although keeping Law and culture strong may seem peripheral to weed control, elders frequently mentioned it to emphasise the need to maintain access to sacred sites and places so that their people could visit them more often and reinforce their connection to country.

## 7. Managing weeds for healthy country

Three ranger groups provided instances of weed control activities that were aimed at creating geographies of healthy country. We describe their activities and outcomes below.

### *7.1. Bardi-Jawi rangers*

The Bardi-Jawi rangers liked to emphasise the creative outcomes of their weed work rather than simply killing plants. They showed their weed work at sites that harboured culturally significant monsoonal vine thickets. At these 'healthy' vine thicket sites, people can sit comfortably in the shade, harvest fruit, consume bush foods, transfer knowledge about the plants and animals that belong, and conduct their ceremonies.

During fieldwork, we visited some of the vine thicket sites where the rangers were working at weed control. They removed Buffel Grass to prevent 'wrong way fire' and Neem Trees that were outcompeting the vine thickets and bush fruit plants. They combined these activities with bush food revegetation, burning around the thickets to protect them from high intensity fires, and bring children from the community to teach them about ranger work. Towards the end of fieldwork, the Bardi-Jawi rangers were planning an integrated weed project for a vine thicket on the edge of a community. They were enthusiastic about the project because it would showcase ranger work to the larger community and demonstrate to youth the importance of maintaining healthy country.

Another site where the Bardi-Jawi rangers followed a healthy country approach was on their community beaches. These areas were covered by Caltrop, a ground layer prickly weed that is very painful to step on. Although Caltrop is a listed environmental weed in Western Australia, it is lower down in terms of priority than other weeds on the beaches such as Rubber Bush and Coffee Bush. The rangers and elders were concerned that Caltrop had undermined the community's enthusiasm to visit the beaches and spend time keeping culture through gathering food, fishing, visiting and telling stories. The rangers worked intensively for three days to manually remove the major infestations of Caltrop, and subsequently followed this with spot removals during regular visits to the beaches. The rangers and elders regarded this their most successful project because it noticeably changed the way that people engaged with the place and improved the health of country.

### *7.2. Bunuba rangers*

The Fitzroy River is an important cultural feature of Bunuba country. Hence the Bunuba rangers were keen to focus their weed work at sites along the Fitzroy River. They consulted their elders and identified important walking paths and fishing spots along the river, particularly near Darnguu/Geike Gorge, to keep healthy so that people and children from the community could visit regularly and learn

about country and culture. They saw that Gallon's Curse was widespread at these sites and that its prickly burrs made it almost impossible to visit these places. The rangers manually cleared the weed at these sites and put up signs to tell people how to safely get rid of the burrs from the body or clothing. A month later, this combination of manual clearing and chemical spraying of new shoots of Gallon's Curse had a positive impact at the sites along the river, allowing people from the community to return with their children and teach them about country and culture.

Another important community site was 'Sheep Camp', a popular spot on the banks of the Fitzroy River where people camped and fished. The rangers asked elders for advice on managing the site, since several weeds like Calotropis, Parkinsonia, Buffel Grass, and Gallon's Curse were present. The elders attributed the weeds to a lack of human engagement and advised them to remove the weeds so that people would be happy to visit the site more frequently. The rangers then conducted three days of intensive weed pulling and spraying, followed by weekly check-ups to control regrowth. They also requested community members to immediately report any new weeds or regrowth at the site. Rangers considered their strategies in both cases to be successful because they were based on elders' visions of healthy country, the importance of maintaining sites for learning and practicing culture, and regular, targeted management of weeds to prevent regrowth.

### *7.3. Ngurrara rangers*

As a part of their 'Seasonal Calendar Project', the Ngurrara rangers had collected knowledge from their elders about managing healthy country at several significant sites (around water places in the Great Sandy Desert). The rangers used this site-specific healthy country knowledge to guide their work.

Rather than travelling long distances to eradicate one or two listed weeds, the Rangers performed a number of different tasks at culturally important sites for maintaining healthy country. For example, one of their trips to a water hole to clear the Bulrush achieved other outcomes such as taking old and young people to country, performing ceremonies, conducting right-way burning, monitoring a nearby spiritual site and water monitoring. Soon after this trip, they took a group of elders back to country to a jila (freshwater spring) to record their knowledge. While they were there, the rangers also surveyed the area for feral animals, harvested bush foods, checked to see if a weather research installation was working properly, and cleared any unwanted plants growing near the jila. In both cases, weed work did not drive their agenda, but was part of several activities linked to maintaining healthy country and culture.

### *7.4. Geographies of healthy country: outcomes and insights*

The Aboriginal concept of healthy country is context specific and varies from place to place, and from one community to another. It links the health and cultural engagement of the communities with the health of country, the importance of people regularly visiting, cleansing, and looking after sacred sites, performing ceremonies and teaching young people traditional knowledge of country, language, law and culture. Weed control is one component among many others for keeping country and its place-centred geographies healthy. By focusing on places and their connections to each other and to peoples' traditions and generational transmission of knowledge of country, the healthy country perspective allows Aboriginal rangers to learn from their elders and combine this with their technical training to protect and enhance the values of each place. Weed lists, with their rigid categorisation of plants that should be killed across all contexts, no longer dominate the rationale for managing country. Instead, the focus on maintaining healthy country ensures that any plant, whether native or alien, that takes over the site and prevents people from visiting it, harvesting bush food, and conducting

ceremonies, is removed and regularly controlled in an appropriate manner. In short, a health country approach regards weeds not as inherently evil invaders, but as plants that reflect the neglect or poor health of places due to various reasons. Hence, such plants need to be removed and controlled to restore and revive the health of these places.

Site-based management concentrates rangers' weed control efforts. Instead of working at sites chosen "because there are [listed] weeds there", they can focus on maintaining healthy country at culturally important sites. Considering that rangers mostly work across immense landscapes with limited personnel and resources, concentrating on such sites adds a crucial pragmatic dimension because it allows them to combine several culturally significant activities with weed control, regular monitoring, and follow-up maintenance in feasible ways.

The healthy country approach, therefore, neither dismisses the relevance of invasion ecology nor the need to identify plants that may be noxious in particular contexts. It takes into account the landscape and vegetation changes that have been wrought by pastoralism, tourism, mining and Aboriginal resettlement in the Kimberley. It recognises the need for lists that identify the most noxious plant species at a landscape level so that land managers and Aboriginal ranger groups can understand their respective spreading behaviour and deploy appropriate methods of control. But it is also clear in recognising that such lists cannot be the main decision-making guides for restoring and maintaining healthy country. As many Aboriginal rangers commented during fieldwork, killing plants because they are in the top categories of weed lists is frustrating and futile. In contrast, concentrating effort on managing and removing unwanted plants at sites of cultural importance enables Aboriginal rangers to recreate and maintain healthy country.

*7.4.1. Synergies with new ecologies of biotic exchange*

There are important synergies between Aboriginal geographies of healthy country and new directions and thinking in invasive species discourse. As we noted earlier, ecological science has begun to come to terms with dynamic, changing, and novel ecosystems, particularly in the context of climate change and the Anthropocene (Head et al., 2015; Hobbs et al., 2006, 2014; Robbins and Moore, 2012). The synergies between the two perspectives are best seen in the way they consider the origins, behaviour, and effects triad that is central to conventional thinking in invasion biology.

The new ecological perspective and healthy country approach are interested in knowing about the origins and 'native range' of a plant, yet this does not become the central, determining factor for deciding landscape vegetation management policy. Many plants in the landscape come from other places and regions, but people's views of individual plants are often produced from a combination of cultural acceptance of these as new biotic elements that provide food or other benefits in their lives.

In terms of behaviour, both perspectives recognise that the geographical spread and dominance of certain plants has more to do with human actions than with their innate character or behaviour. Changes in land use and economic activity, through grazing, burning, clearing, mining, construction or tourism are key factors that facilitate the spread of plants that can survive in such disturbed, 'invadable' landscapes. Aboriginal respondents consistently made this point, "it's about people, not plants", redirecting the blame from so-called invasive plants to larger land use decisions by governments and activities of people

Just as scientists have begun to challenge the static views of nature inherent in mainstream conservation approaches, Aboriginal rangers and elders also challenged the notion of an unchanging landscapes and biodiversity. Elders and rangers spoke of 'change as inevitable'. They pointed out that plants on the weed lists did not have universally negative effects on country; some covered and protected soil in areas made barren by mining or grazing, while others had become part of the bush foods they harvested from country. They observed that changing climate, introduction of new plants and animals due to agriculture, pastoralism, mining or tourism meant that land managers should

'understand change' in country and find new ways to keep it healthy. Their views correspond with the reflections of the Native American botanist, Robin Wall Kimmerer about ecological restoration efforts in the industrially wasted margins of Syracuse, New York. He points out that "We may not be able to restore the Onondaga watershed to its pre-industrial condition …. We might debate the authenticity of the desired reference ecosystem, but she [Nature] will decide. We're not in control. What we are in control of is our relationship to the earth. Nature herself is a moving target … Species composition may change, but relationship endures." (Kimmerer, 2013, page 336). Restoration ecologists have argued for a while now that invasive species may also play an important role in functioning ecosystems and even serve as solutions to problems of degradation (D'Antonio and Meyerson, 2002; Hobbs et al., 2014). When considered in their social and landscape context, and in situations where they have become well-established, it is possible that invasive species are accepted as a resource and used for various purposes (Kannan et al., 2014).

## 8. Conclusion

The inclusion of Indigenous and local peoples' values and perspectives in natural and cultural resource management through programs such as Working on Country in Australia offers innovative ways and spaces for rethinking landscape conservation beyond the mainstream invasive species management paradigm. Such movements do not just provide 'indigenous knowledge' inputs that can be incorporated into mainstream weed control but bring new insights and values to guide the activities for making healthy country. This, in turn, produces management that reflects the fundamentally different relationships that Indigenous people have with the environment.

The geographies of healthy country approach described here not only enables Aboriginal rangers to control weeds according to cultural priorities, but also provides an opportunity for rangers to synergise management of culturally important sites with emerging ecological understandings of plant transfer and environmental change. For this to occur, the healthy country approach requires government and funding agencies to develop and implement alternative metrics for assessing the work of ranger groups. These agencies can work with ranger groups to develop indicators that can assess the activities conducted as part of Working on Country programs. The indicators could include the number of community people being taken back to traditional country, children's learning camps at important cultural sites, weed control for improved access and mobility for people and animals at these sites, changed use patterns, and other monitoring activities integrative to maintaining healthy country.

Implementation of alternative indicators would demonstrate a shift towards recognising the alternative perspectives that Indigenous and local people hold about invasive alien species and their management. In the case of Kimberley Aboriginal rangers, it would release them from subservience to killing targets for listed weeds and allow them instead to combine understanding of climate and land use change, disturbance, plant behaviour, and cultural values to manage landscapes and maintain healthy country. More broadly, it would show a new way for policy makers and land managers to draw on their experiences, voices, and visions to find innovative ways of tackling unwanted plants to recreate and sustain the health of their landscapes.

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