



A native at home and abroad: the history, politics, ethics and aesthetics of acacias

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ABSTRACT

Aim Anthropogenic introductions of Australian *Acacia* spp. that become classed as alien invasive species have consequences besides the physical, spatial and ecological: there are also cultural, ethical and political considerations that demand attention from scholars in the humanities and social sciences. As practitioners in these disciplines, our aim is to reflect upon some of the social and conceptual ideas and attitudes relating to the spread of Australian *Acacia* spp. around the world. We therefore provide a longer-term historical and philosophical perspective using South Africa as a key example. We explain some of the cultural aspects of Australian acacias, relating them to history, philosophy and societal ideas that were once, or indeed remain, important, either regarding their exportation from Australia or their importation into other countries. Focussing principally on South Africa and Australia but including brief references to other locations, we augment the literature by making connections between acacia introductions and environmental ethics and aesthetics, national and environmental history and symbolic and other discourses. We evaluate a number of the cultural and philosophical dimensions of invasion biology as a societal response and explicate the interesting contradiction of Australian acacia introductions as simultaneously economically valuable and environmentally transformative in South Africa.

Location South Africa, Australia, with references to other parts of the world.

Methods This paper has been written by an interdisciplinary team (two historians, two geographers, a philosopher and an ecologist) and is conceptual and historical, conforming in language and structure to the humanities style. It relies on published and unpublished literature from this disciplinary domain and the critical evaluation of these sources.

Results Many *Acacia* spp. from Australia have been introduced around the world, generally guided in different eras by a variety of overarching mindsets, including the colonial ethos of ‘improvement’ (1800s to mid 1900s), an economically driven mindset of ‘national development’ (1900s), by a people-centred frame combining concerns of environment and livelihood in ‘sustainable development’ (1980s onwards), and an aesthetic ethos of ornamental planting that surfaces in all periods. The newest ethos of controlling or managing alien invasive species, a normative attitude deriving from the burgeoning of invasion biology, has more recently shaped the ideology of these plant exchanges and sharpened the focus on species that may be simultaneously both weeds and commercially valuable crops. Our perspective from the humanities and social sciences calls for a more transparent approach that clearly acknowledges such contradictions.

Main conclusions We conclude that the global experiment of human-mediated Australian acacia introductions raises a number of issues that reflect changing societal concerns and demand attention from scholars in disciplines apart from

the natural sciences. Here we highlight the impact of historical context in plant exchanges, the history and philosophy of science as it relates to invasion biology, and changing – sometimes divisive – societal priorities in terms of aesthetic, economic and conservation values. In particular, the case of *Acacia* spp. in South Africa highlights the contradictory aspects of introductions in that some species are both commercially important and environment-altering invasive plants. We argue that the contribution of disciplines beyond ecology to the debates about the invasive status of acacias enlarges our understanding and provides useful insights for botanists, foresters, managers and policy makers.

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INTRODUCTION

The ethics and politics surrounding those introduced non-native species that have both valuable and detrimental attributes evolve over time with alterations in human understanding, circumstances and value systems. In this regard, Australian acacias (commonly termed wattles and hereafter taken to refer to the 1012 species of *Acacia* subgenus *Phylodineae* native to Australia; see Miller *et al.*, 2011; Richardson *et al.*, 2011a) in South Africa provide a useful case study of changing ideas and practices, including the evolution of a somewhat polarized situation between those communities that consider wattles to be very valuable, and those who regard them as dangerous weeds. We unpack some of the interesting historical and ethical dimensions to this phenomenon, and examine how many attitudes and socio-political and economic priorities have shifted over time. There is a rich literature on many scientific aspects of plant transfers, exchanges and invasions (see, for example, the large body of work by a wide variety of authors in this special issue of *Diversity and Distributions*), while considerable scholarly attention has also been devoted to environmentalism and ecological consciousness in this regard. Case studies of specific plant genera or species in environments to which they have been introduced are also common, some of which explore the political and social implications and effects. The scholarship of these different disciplinary fields is, however, not often integrated or synthetic (some exceptions include Schroeder, 2000; Staples, 2001; Robbins, 2004; Davis, 2009).

This paper attempts to bring together some of the ideas that emerge from the broader literature about Australian acacias in the fields of history, philosophy and public policy. In some sections that follow, we highlight the importance of analyzing discourse, in terms of the vocabulary that illuminates the mindsets that have been applied to wattle introductions. Thus, ‘discourse’ is used to refer to a way of thinking manifested in language. As Michel Foucault expounded, it is almost impossible to avoid discourse because

it is the vocabulary that delivers and communicates issues around power relationships (Foucault, 1970). Because so many Australian acacias have been introduced over the past two centuries for specific reasons into many other parts of the world – and have spread vigorously in their new homes – they provide a useful lens through which to explore a number of questions relating to scientific, political and popular attitudes towards specific exotic or non-local plant species. We explain some of the cultural aspects of Australian acacias, focussing primarily on South Africa and Australia, and we augment the literature by making connections between acacia introductions and environmental ethics and aesthetics, national and environmental history and public policy. We examine in broad outline how these mutating ideas on wattles have played out.

ACACIA TRANSFERS: OVERVIEW

Trans-continental and trans-regional plant transfers have an extremely long history, and they include most of the world’s food and other useful species (Crosby, 1972; Beinart & Middleton, 2004). Chew (2009: 235) emphasizes that the ‘re-dispersal of biota is a hallmark of civilization’, while Staples (2001) has asserted that the ability to move species from place to place is a defining element of human culture and consciousness.

Documented transfers of Australian acacias to other continents began in the late 1700s with British and French exploration of the Australian coast. Australian plants, novelties to Western knowledge, were sought after by botanists and gardeners alike. Yellow-blooming acacias graced the greenhouses of Empress Josephine, and grew outdoors in gardens on the Côte d’Azur (Hamilton & Bruce, 1998).

The subsequent transfers of the mid-1800s occurred at a far greater scale. These exchanges of plant material were encouraged by a growing international network of botanic gardens, colonial enterprises, acclimatization societies and private enthusiasts. The reasons were various, and included scientific

study, landscape improvement, economic and commercial ventures, and gardening interests. The long-term effects of plant and animal introductions were not known (or perhaps ignored or considered unimportant) during these periods of colonization and modernization. More recently, however, the science of invasion biology has come to dominate understanding of acacia transfers and generating contradictory perspectives between those who regard wattles as weedy and those who see it as commercially valuable. These perspectives are particularly sharply displayed in South Africa.

Early transfers of acacia are inconsistently documented. Estimated dates for the introduction of Australian acacias to southern Africa and elsewhere vary widely and often lack contextual information about the specific importer and the scale of the introduction. For example, the dates of arrival of some Australian acacias in South Africa are known, but the source of origin may be uncertain. As Stirton (1978) suggests, as early as 1827 Kew Gardens' collector James Bowie introduced *Acacia longifolia* to the Cape. In addition to there being no record as to whether this was a seedling or a seed, it is also highly likely that this specimen came to Cape Town via the Royal Botanic Gardens at Kew, rather than directly from Australia. Moreover, evidence is slim on what might have been later, larger and more frequent introductions, sponsored by departments of forestry or other organs of government (e.g. roads) or private large-scale growers. It is these that could bear the responsibility for generating sufficient propagule pressure to create an invasion (see Le Roux *et al.*, 2011 for further discussion).

Despite the widespread natural distribution of genus *Acacia* (*sensu lato*) around the world, hundreds of individual species have been transported to new locations (Richardson *et al.*, 2011a,b). Historical studies of these transfers have tended to see colonial naturalists, botanic gardens and foresters as key protagonists. This has diverted attention from the non-specialist people involved in everyday cultivation and spread of a plant after its arrival, the knowledge or technology bundled with a plant, and the biological and social factors that allow a plant to succeed (Kull & Rangan, 2008). These elements are important because they highlight distinctive combinations of material, discursive and aesthetic interests of societies – what might be referred to as a social ethos or set of attitudes and mindsets – that are reflected in plant diffusions at different times. We review a number of different guiding beliefs under which Australian acacias have been introduced around the world, bearing in mind that these are not discrete historical periods that play out in the same way everywhere in the world. We also point to contradictory attitudes depending on whether the plant is being exported or imported. In addition, we explore a number of guiding beliefs stemming from the emergence of invasion biology itself that have been, or could be, used in decision-making about the land management options available to countries that struggle with the contradictions of human-initiated *Acacia* spp. introductions, some of which are highlighted in the discussion of Australian acacias as weed and crop within the South African context.

Colonial ethos

The colonial period, extending from the 1800s through to the early and mid-1900s (depending on the locality), was characterized overall by a philosophy of 'improvement': establishing productive lands, rehabilitating poor soils, and creating landscapes reflecting the economic interests and aesthetic sensibilities of the colonists and the colonizing power (Beinart, 2003; Crosby, 2004). From the 1820s onwards, many British colonies (eastern Africa, the Cape and Natal, southern India, Ceylon) were planted with cool climate acacias to provide fuelwood and timber and reduce pressure on native forests (for South Africa see Sherry, 1971; Witt, 2005). Other species, most notably *A. cyclops* and *A. saligna*, were introduced for soil conservation and dune stabilization in Mediterranean climate areas such as the Cape Colony (Shaughnessy, 1986) and British-mandate Palestine (El-Eini, 2006). This was encouraged by colonial botanists. Ferdinand von Mueller, Government Botanist of Victoria (1853–1896) and leading member of the Acclimatisation Society of Victoria, for example, tirelessly promoted Australian plants internationally, believing that it was his duty to spread useful plants around the world (Maroske, 2006).

French colonies introduced Australian acacias with the goal of acclimatization, seeking to improve agriculture through the introduction and domestication of exotic animals and plants. In colonial Algeria, more than twenty botanic gardens were involved in acclimatizing exotic plants (Osborne, 2000). Acacias and eucalypts were planted in barren areas to provide fuelwood and timber (Tyrrell, 1999). In Madagascar from 1900 onwards, the colonial government promoted *A. dealbata* in the cool, treeless highlands for soil conservation, railway fuel and firewood. Then, the revival of economic protectionism during the 1920s led the French government to encourage companies to establish commercial *A. mearnsii* plantations (Kull *et al.*, 2007).

The purpose and dates of some introductions of Australian acacias to southern Africa have been recorded. Stirton (1978: 31–32) stated that Port Jackson (*A. saligna*) was introduced in 1833, rooikrans (*A. cyclops*) in 1835, blackwood (*A. melanoxylon*) in 1848, black wattle (*A. mearnsii*) in 1858, golden wattle (*A. pycnantha*) in 1892, their function being to ornament, to stabilize dunes, to protect roads from sand-storms, and to provide timber and firewood – for which purposes some were more successful than others (Brown, 2001). Even as they were introduced, not all botanically minded people were enthusiastic. Botanist Peter MacOwan—who corresponded with Mueller and sent South African plant specimens to him (S. Maroske pers. comm. 6 October 2010; Stirton, 1978: 35)—was not keen on these plant transfers, recommending against planting more long-leaved wattle (*A. longifolia*) in 1894. Forester David Hutchins declared that *A. saligna* and *A. cyclops* were 'useless plants' (Stirton, 1978: 35). And in the Transvaal Colony in the early years of the 20th century, forestry officer Charles Lane Poole resigned in protest against a directive to plant Australian trees in the Woodbush district

(Dargavel, 2008) because he believed that doing so would destroy the indigenous forest vegetation.

Despite some contrary opinions on the matter, in scanning the documents in the National Archives of South Africa on wattle, it is clear that the propagation of Australian acacias was energetically pursued as state policy in the early 20th century for a variety of purposes from firewood, tannin, timber and dune stabilization, to local uses for Africans, particularly where natural timber was scarce or where indigenous trees required conservation. Towards the end of the 1800s, greater emphasis was placed on increasing production of raw materials that would aid self-sufficiency. South Africa's mining boom in the late 19th and early 20th century created an enormous demand for timber (Hillis, 1989; Witt, 2005). Farmers in Natal were given incentives to plant trees to supply the mines (Witt, 2002), and also established an export tanbark industry based on *A. mearnsii*. By 1902, there were more than 14,000 ha of wattle in Natal (Witt, 2005: 92).

While these plantations were regarded as beneficial for the South African economy, some Australians believed that their country's economy was adversely affected by the transfers. For example, William Ey wrote to the *Adelaide Register* (1911): 'We have lost a great lot of the commercial value of our beloved wattle tree by selling them [i.e. South Africans] seed'.

The colonial ethos of improvement also produced a discourse that blamed native people for degrading land and forests, whether in South Africa (Tropp, 2003), Palestine (El-Eini, 2006) or Madagascar (Kull *et al.*, 2007). This discourse was used as the basis for imposing restrictions on local communities in areas reserved for planting exotic trees to reverse environmental degradation (Maddox, 2002).

National development ethos

Like the colonial ethos, ideas around national development in countries newly independent were also focussed on the creation of productive landscapes. However, the scale differed: the trees were seen to contribute to *national* environments and independent economies, and the interventions tend towards *larger-scale* industrial plantations. Institutions like the semi-decadal British Empire (later Commonwealth) Forestry Conferences bridged the transition between the attitudes of the different eras, facilitating idea-sharing between the colonies, later nations (Richards, 2003).

An early example is Portugal, where widespread planting of Australian acacias from the late 1800s through the mid-1900s was couched in the rhetoric of modern nation-building (Fernandes, 2008). Foresters and private entrepreneurs collaborated to establish plantations to supply raw materials for industrial modernization as well as re-green the landscape. Similarly, in Brazil, the desire to end dependence on raw material exports drove governments from the 1930s onwards to promote local industries, including leather. From the 1940s, large areas in Rio Grande do Sul were planted with *A. mearnsii* to supply tanbark (Oliveira, 1960).

In South Africa, following Union in 1910, national interests of self-sufficiency in wood products dominated the concerns of the new government. National forestry companies were set up to establish large plantations and farmers given seeds and grants to take up large-scale tree cultivation (Hillis, 1989; Witt, 2005). By the 1950s, South Africa had the world's largest plantations of *A. mearnsii* and wattle forestry products formed a major portion of the national economy (Sherry, 1971). In India, *A. mearnsii* plantations were expanded after 1948 when the Indian government ceased trade relationships with apartheid South Africa, also with the aim of achieving national self-sufficiency and promoting industrial development (Rangan *et al.*, 2010).

From the 1980s onwards, the growing use of chemical tannins reduced demand for *A. mearnsii*. But technological developments enabled the use of wattle pulp and chips (Bennett, 2011). The more recent surges in plantations of tropical wattles (e.g. *A. mangium*) in Southeast Asia are direct responses to national government incentives to supply raw materials for both domestic and export demand for wood pulp (Griffin *et al.*, 2011).

Economically oriented planting of Australian acacias, both past and present, has been successful because of investments in research and development by national governments, including South Africa, Brazil, Vietnam and others. The Australian government has also researched and promoted its native trees, in particular through the CSIRO and the Australian Centre for International Agricultural Research (ACIAR). Both agencies are heavily involved in the collection, testing and promotion of various species (Griffin *et al.*, 2011), including *Acacia* spp., many of which are valuable commercially or horticulturally both within Australia and for sale abroad.

Together with the mindset that introductions of Australian acacias would benefit a national economy, nationalism also provided justification for eradicating these species. As appreciation of local indigenous flora developed, some non-native species became regarded as 'weeds'. Around the beginning of the 20th century, Cape Town's middle-class settler population came to value the Cape flora and to prefer it, aesthetically and botanically, to introduced species (Pooley, 2010). By the 1930s, publications were appearing on 'Weeds: the "new" Cape flora', indicating growing unease about the proliferation of Australian *Acacia* spp. (Moran & Moran, 1982). Moran & Moran's (1982) bibliography demonstrates an exponential explosion in the acacia/wattle-as-weed literature in the 1960s, 1970s and 1980s, alongside literature on Australian acacias as commercially valuable. The discourse of the 'danger' of introduced invasive species in South Africa gained momentum in the late 1950s and early 1960s with reports such as 'The green cancers in South Africa: the menace of alien vegetation' (Control of Alien Vegetation Committee, Kirstenbosch, 1959). Charles Stirton's (1978) *Plant invaders: beautiful, but dangerous* brought the topic to further public notice.

While evidence of economic nationalism relating to Australian acacia exports and imports and the visual impact of non-native species on a local landscape is clear, nationalism is

also displayed through the power of botanical symbolism, demonstrated in coats-of-arms and other formal regalia. A case in point relates to Australian acacias in Australia and in South Africa. In Australia, wattle was promoted as a symbol for Australia (federated in 1901) because of its ubiquity in the landscape in every state. It also represented equality in the new classless nation: 'people of all classes and creeds and political parties' could wear it (Robin, 2007: 13).

One of the first public, international, uses of an *Acacia* species as a national symbol concerns the matter of human-mediated transfers, and in 1911 this was displayed in arrangements for the coronation regalia of King George V. On such occasions, it was customary for the botanical symbols of all the British colonies to be embroidered on the coronation stole. The Union of South Africa, established on 31 May 1910, had not yet decided on its national flower. Nonetheless, someone took the decision to embroider the branch of a tree with pom-pom yellow flowers and small leaves. There were no thorns: this was clearly an imported (Australian) wattle, not an African *Acacia* species, as had, presumably, been the intention. There was a heated diplomatic exchange, and the solution to the symbolic confusion was to add thorns (Brownell, 1993; Carruthers & Robin, 2010). But after an initial burst of enthusiasm around federation at the beginning of the 20th century, not all Australians regarded their wattles with affection. The most frequent objection was that the flowers caused hayfever. Systematic opposition to wattle as national symbol came from the Australian Forest League in the 1930s. Richard Baker, for example, objected that wattles also grew 'in other countries in the world' (unlike waratah, *Telopea* spp., which he advocated instead). He noted that wattles harboured 'wood borers and gall insects' (Baker, 1933) which spoiled its value for the decorative arts and furniture making. It was only in 1988 that *A. pycnantha* was formally adopted as Australia's national flower.

Although many of these nationalist attitudes have become outdated in a globalized world, elements of the importance of botanical symbolism to the national endeavour and to national pride continue into the present. This has been demonstrated in recent international scientific politics. On 23 July 2005, at a plenary session of the meeting of the International Botanical Congress (IBC), a vote was taken on whether to uphold the decision of the Nomenclature Section to alter the type specimen of the genus *Acacia* from *A. nilotica* (an African species) to *A. penninervis* (an Australian species; Orchard & Maslin, 2003). This has created an international furore and sparked a heated, even emotional, exchange in the scientific literature either supporting or opposing the decision on the basis that Australia 'owns' this botanical brand or that it has 'poached' it from the rest of the world. Arguments for and against what should be a taxonomic decision made by botanists for scientific reasons, range from the procedural and legal, to the economic, to the historical and also to whether the 'developing world' is – once again – being exploited by the 'developed world'. What has been demonstrated since 2005 is that scientific integrity and taxonomy itself can be obfuscated

by matters of convenience, national pride and history (Orchard & Maslin, 2005), publicity and commerce, all of which relate in particular to the genus *Acacia* because of its almost worldwide natural and human-mediated distribution. What was also been demonstrated is the power of discourse and the non-neutrality of science. The details of the matter have been dissected elsewhere (Brummitt, 2005; Luckow *et al.*, 2005; Moll, 2005; Maslin & Orchard, 2006; G.F. Smith *et al.*, 2006; Moore, 2007, 2008; Glazewski & Rumble, 2009; Carruthers & Robin, 2010; Smith *et al.*, 2010; Orchard & Maslin, n.d.; Van Rijckevorsel, 2006) and will not be repeated here. The debate continued in the lead up to the 18th Congress of the IBC (Melbourne in July 2011) (Moore *et al.*, 2010; Thiele *et al.*, 2011).

People-centred development ethos

In the 1980s, a new ethos emerged, generating a discourse that combined environmental and livelihood concerns through popular terms such as 'sustainable development', the 'woodfuel crisis' and 'agro-forestry' development (Kull *et al.*, 2011). Its impact can be seen in the ways in which plantings of Australian acacias have been rearticulated in terms of people-centred development. South Africa's Department of Water Affairs and Forestry is promoting small-scale woodlots as a means for black economic empowerment (Aitken *et al.*, 2009), Vietnam's national push for afforestation specifically involves large numbers of small-scale (< 20 ha) growers (Fisher & Gordon, 2007), and NGO promotion of acacia woodlots in the Dominican Republic sought in part to secure smallholder land tenure rights (Rocheleau *et al.*, 2001).

A different example of this ethos can be found in West Africa where the French *Centre de Techniques Forestier Tropical* planted dry zone Australian acacias in the Sahel during the 1970s and 1980s, when global concern about desertification was at its peak. The fast-growing, drought-tolerant trees were planted to provide fuelwood, fodder and create windbreaks against sandstorms (Cossalter, 1986). In recent years, Australian development agencies have followed in promoting these acacias for additional agro-forestry purposes such as harvesting seeds for food (Rinaudo & Cunningham, 2008; Kull *et al.*, 2011).

Comaroff & Comaroff (2001: 236) have shown how language and attitudes denigrating alien vegetation escalate once the introduced plant takes on an invasive tendency. Richardson, Pyšek, Simberloff and others are aware of the need to invent more careful and nuanced terminology (Simberloff, 2003; Richardson *et al.*, 2011b). Social and natural scientists are also increasingly careful about phrases such as 'alien invasive species', 'natural indigenous vegetation', as though they had a single meaning, comprehensible to all (Richardson *et al.*, 2008; Davis, 2009: 169). A factor that might change attitudes is greater knowledge and appreciation of how local communities make constructive use of introduced species and may have a different philosophical and conceptual approach to them.

In post-Apartheid South Africa, the 'Working for Water' programme aimed to control alien trees that were water-thirsty

at the same time as alleviating poverty through employment and training programmes (Van Wilgen *et al.*, 2011b). This people-centred ethos is particularly strong in the Western Cape Province where ‘alien’ vegetation is considered a fire hazard, but Working for Water is also active in other provinces as a means of creating jobs, developing skills and clearing water-courses that have been adversely affected by invasions of dense riverine vegetation. The Working for Water initiative is an interesting sociobiological programme because it combines politics, society and ecology with reference to the South African Constitution. It has generated funding for scientific study (invasion biology) through the state’s poverty relief budget rather than via the usual channels for scientific research. It has also brought community development and scientists together, involving them jointly in invasive species control and encouraging a form of nationalism that resonates with conserving an indigenous biodiversity and promoting sustainable development and resilient ecosystems (Robbins, 2004; Neely, 2010), an attitude that Pauly (1996) refers to as national ‘ecological independence’.

Ornamental and aesthetic ethos

While in some form or another economic development and environmental goals underpin the three frames of reference discussed earlier, aesthetic concerns have played an important role in the diffusion of Australian acacias in all eras. Although ornamental plantings affect less land area, they frequently involve a more diverse array of species. In France, the government-run Jardin Thuret tests a large number of wattles each year for introduction as street trees and ornamentals, while private nurseries continue to introduce and breed other acacia varieties. Towns in southern France promote winter tourism through mimosa routes and festivals (mimosa is the French common name for Australian acacias). Yellow-blossomed Australian acacias are also popular ornamental additions in home gardens across Mediterranean Europe, Chile, California and elsewhere.

The European aesthetic norm of a pleasantly vegetated landscape led Cape colonial botanist John Croumbie Brown in the mid 19th century to urge the public to cultivate any tree that would survive in the region, particularly recommending blackwood and Port Jackson and distributing seeds of both species (Stirton, 1978: 33–34). In his work, Witt explains how during the early settler years, the landscape of KwaZulu-Natal was regarded as visually unappealing because it was devoid of trees. Introducing Australian acacias ‘clothed the bare hills’ attractively, at least to Western eyes (Witt, 2002, 2005; Starfinger *et al.*, 2003).

With the rise of invasion biology over the last 30 years (discussed below), aesthetic considerations over ‘alien invasives’ have also been prioritized. Aesthetic grounds are often advanced in support of action against invasive species: for some, invasions are also a perceived threat to the beauty, wonder and fascination that we humans experience in wild nature or historic landscapes (Pauly, 1996). For some cultures,

undisturbed nature is ‘a source of experience for poets and artists, of materials and pleasure for the naturalist and scientist ... [and] of recreation’ (Elton, 1958: 144), and should therefore not be sullied by non-indigenous invasive species. If one asks why the aesthetic dimension of such landscapes is so important, the answer is often given that it has inspirational and instructional significance that plays a role in the formation of personal, cultural or national identity – which is the case in comparing the botanical symbolism of Australian and African acacias, and, somewhat ironically, in the aesthetic ethos that has driven some plant and animal invasions.

The ethos of invasion biology

Because Australian acacias are so widespread and invasive, it is appropriate to consider the discourse about their invasiveness from within the discipline of invasion biology, not least of all because this field of study has become a significant ethos of our era. Invasion biology does not advocate an ethos of introduction but rather one of understanding those introductions, controlling or eradicating spread and appropriate management. It is also explicitly an ethos of ‘science’ and, as will be explained below, has assumed a discourse of powerful ‘objectivity’ that could not have been applied to some of the mindsets identified above. There have been many factors at play in introducing Australian acacias to other parts of the world that link directly to society in terms of human needs and desires, some rational, some emotional. In many cases, these trees have become ‘invasive’ (Richardson & Rejmanek, 2011) and have thus become the object of study in invasion biology that, like other mindsets described above, also resonates directly with a society in a particular historical context. Invasion biology is the formalized study of the movement of species out of their natural ranges and the results thereof, and is thus distinct from agro-forestry, botany and other plant and animal sciences (Richardson, 2011). The discipline is integral to modern Western scientific knowledge that has cultural underpinnings that are not necessarily shared by communities with different intellectual roots. Currently, a major focus of invasion biology is the effect of invasive species on ‘biodiversity’, which itself has a cultural context and institutions supported by Western science (Granjou, *in press*).

Acacias have had different human and environmental impacts in different places, so their invasive status requires more than just a scientific and management response. The fundamentals of invasion biology as a scientific enterprise demand that actions be sensitive to ecological and social context. Like all sciences, invasion biology incorporates certain value choices that are grounded in aesthetic sensibilities, feelings of national identity, ethical ideas, and deeply seated cultural or philosophical assumptions that, to a large extent, are subjective and historically and ecologically contingent. Because of the contradictory values ascribed to Australian acacias that emanate from the past, it is particularly important that such assumptions should be recognized. As Larson (2005, 2007a) has summarized: if we do not acknowledge and

critically scrutinize the values present in and promoted by the practice of invasion biology, we expose ourselves to the risk of perpetuating blindly accepted stereotypes and prejudices circulating in society, or embarking on courses of action without informed and rigorous debate about the basis and intentions of that action (see also R.G. Smith *et al.*, 2006; Davis, 2009: 156).

Others have discussed the ethical dimensions of invasion biology, illuminating both its subtleties and the challenges of definition (Woods & Moriarty, 2001; Lodge & Shrader-Frechette, 2003; Haider & Jax, 2007). If invasion biology is considered as a normative science, with one of its aims being to serve a modern conservation agenda, then some of its values become explicit by first conceptualizing the conservation target that it sets, and second the justifications that are offered in pursuing that goal. In other words, and applied to our case study, we need to consider what are we conserving by removing Australian invasive acacias and why are we doing so. The word target (widely used in invasion biology) has a history of its own, deriving from a set of military metaphors that mobilize public and institutional support for conservation efforts. Such language has been widely criticized (cf. Schroeder, 2000; Larson, 2005, 2007a; Colautti & Richardson, 2009; Davis, 2009: 3, 192). Moreover, the target can either refer to a particular non-native invasive species that becomes the focal point 'of control and management efforts' (Davis, 2009: 5), or it can refer to the goal, or end state that is to be achieved through control and management efforts.

Davis (2009: 5), for instance, points out that the target of invasion biology is generally the *invader*, but he suggests that focussing on *invasiveness*, that is, the behaviour of a certain species under the right conditions to invade (or spread rapidly and produce undesirable effects), might be preferable. Introduced Australian acacias have been studied by invasion biologists both as an invader plant and in terms of their invasiveness – which, Davis argues, cannot be 'simply described' in neutral, value-free language – acknowledging that there could be different kinds of undesirable impacts, ranging from health to economic to ecological impacts (see Davis, 2009: 101–131), and that individuals may differ on what constitutes harm or undesirable effects. What Davis suggests is that the category of invasiveness itself includes a human perspective in terms of assessing spread and impact. It also allows specific reference to the ecological context of the invasion, unlike the universal 'invader', where the capacity to invade is an intrinsic property of the plant.

In the second meaning of *goal*, invasion biology also investigates the end states that could (or should) be promoted when Australian *Acacia* spp. are managed as invaders of landscapes whether in Australia itself or, as is more usually the case, in other parts of the world. Some, for example, have emphasized human wellbeing as such an end state (e.g., Pyšek & Richardson, 2010), while others have emphasized, as we have pointed out earlier, the natural beauty of a landscape, or the integrity of an ecosystem – to mention but three broad categories of these goals or end states. These goals or end states

appear to function typically as *justifications* for actions taken to address perceived harmful effects of invasions, and as such can be discussed in greater detail.

The most widely accepted reason to curb the negative effects of invasions is the protection of human wellbeing (e.g. Pyšek & Richardson, 2010). Invasions can have impacts on the health and safety of humans, on crops and livestock, and on essential ecosystem services such as clean water and timber, or on broader extinctions (Davis, 2006; Davis, 2009: 101). From this point of view, one relevant to Australian acacias, decisions about action on invasions are based on utilitarian cost-benefit analysis, which favour actions that enhance net wellbeing in society (Le Maitre *et al.*, 2002).

Towards a new ethos?

Another factor that is often invoked to justify action against invasive species is not human-centred, aesthetic or practical, but rather eco- or bio-centric and ethical: it is the so-called right of natural phenomena, ecosystems, species and individual entities to exist without human interference, acknowledging that their value does not depend on human use. Philosophically, this school of thought may grow in the future, not only in the developed world but also in other communities that respect the environment in principle (including non-indigenous plants) for reasons related to religion and culture. In some of its Western articulations (e.g. Taylor, 1986; Rolston, 1994, 1999), this philosophical position articulates a somewhat radical cry for extending the boundaries of moral considerability that in its more extreme formulations (e.g. Naess, 1989; Warren, 1990; Plumwood, 1993) calls for a redefinition of who we are as human beings (urging us to redefine humanity in terms of our relationships with natural entities, instead of seeing humans as separate from the natural world). Note, however, that biocentrism does not necessarily exclude the right of 'invasive' or 'alien' species to exist: they may themselves have an intrinsic worth, but they are often not considered to be 'natural' outside a certain place.

While these justifications for actions against invasive species seem to be mutually exclusive and even conflicting, the radical challenge is to 'think them together', and to bring the implications of such a *rapprochement* right into the science and practice of invasion biology. This has been suggested to some extent by Elton (1958: 145), Larson (2007b, 2010) and Hattingh (2011). If one adopts this viewpoint, and can figure out its implications in the practice of invasion biology, then it is possible that invasion biology might function less as a normative science merely reflecting societal values in pursuit of a conservation agenda. Instead, it might come to serve a transformative function, contributing to a 'modified kind of nature' as well as a 'modified kind of man' (Elton, 1958: 145) that is less dominating, disturbing and altering of nature. This point is strongly taken up by Larson (2007a: 149) who argues that invasion biology, if practised self-critically, i.e. explicating, scrutinizing and continually assessing the value-assumptions and the effects of identifying and fighting invasive species, could

'help us grow in humanity and in wisdom'. By this he means, *inter alia*, the formation of a new human identity that can be articulated in terms of connection with nature, instead of standing apart from and dominating it; acknowledging that humans shape their environment and are part of it; accepting that we have to take responsibility for our actions and their justifications. Accordingly, a critical consideration of the global experiment of human-mediated introductions of Australian acacias has a role to play in this emerging philosophy of invasion biology. Such a critical assessment could, however, also have a significant transformative role to play in modern society.

Invasion biology, and the case of Australian acacias, reflects how thinking in modern society has altered against a backdrop of growing human populations, shrinking resources, increasing understanding and changing values. Early introductions and plantings were driven by the needs of the 19th century for expansion and development, and many benefits were realized. However, misgivings began to arise as acacias spread away from plantings into natural areas. These concerns grew further following the articulation of concerns about the global erosion of biodiversity, and the effects this would have on human wellbeing (Millennium Ecosystem Assessment, 2005), as well as the role that invasive species played as drivers of this phenomenon (Drake, 1989). In addition, South African scientists demonstrated the negative effects of invading tree species on water resources in the mid 1990s (Le Maitre *et al.*, 1996; Van Wilgen *et al.*, 1996), and the consequences that this would have for development in this water-scarce country (Van Wilgen *et al.*, 2008). During the same period, South Africa was experiencing significant political change that was to further influence the course of events. South Africa's relatively peaceful transition to democracy in 1994 undoubtedly provided a powerful catalyst for many of the innovative changes in policy that may not otherwise have been possible (Van Wilgen *et al.*, 2011b). These changes included South Africa's ratification of the Convention on Biodiversity in 1996, which contained clauses that committed the country to taking steps to combat invasive species; the promulgation of new and innovative legislation that allowed growers of acacias (and other species with commercial value) to continue their activities subject to conditions that included an obligation to prevent spread; the combination of control operations with employment creation among the rural poor (Van Wilgen *et al.*, 2011b); and increasing the funding for finding biological control options for invasive acacias, including those with commercial value (Zimmermann *et al.*, 2004). South Africa remains the only country in the world to have a biological control programme against acacias (Impson *et al.*, 2009). This case of biological control illustrates the shift in the balance of opinion against a backdrop of growing understanding that highlighted the impacts, and political change that favoured the rights of the poor over the protection of business interests.

Research on biological control for Australian acacias was initiated in the early 1970s, following representations from the South African Department of Forestry, conservation bodies and farmers (Van Wilgen, 1987). However, it met with strong resistance from wattle growers who were concerned about the

possible effects of such control on their industry (Stubbings, 1977). Senior officials in the South African Department of Forestry challenged this view (Luckhoff, 1977), leading to investigations into the use of seed-feeding agents that would be less of a threat to the wattle industry as they damage only seeds (Dennill & Donnelly, 1991). Nonetheless, the industry held enough sway to bring about a temporary cessation of research in 1987 (Anonymous, 1987). At this stage, a few agents had been released against non-commercial acacia species. However, continued growing pressure from government conservation agencies, private landowners, and the public led to the release in 1994 of agents against *A. mearnsii*. These were initially only released in the Western Cape, where *A. mearnsii* threatened the unique biodiversity of the local fynbos vegetation, but where it is not grown commercially (Dennill *et al.*, 1999). Following these releases, agreements were negotiated between wattle growers in other provinces for releases to take place. The situation today, with full acceptance of biological control by commercial growers, is a complete turnaround from Stubbings's time, and reflects a substantial shift in the balance of opinion towards commercially important but simultaneously invasive acacia species. These changes were largely possible because of the unique power shift that followed the 1994 democratic elections (Van Wilgen *et al.*, 2011b), which led to the introduction of new legislation as well as release of biological control agents nationally. Such shifts in opinion regarding the usefulness of Australian acacias have not been confined to *A. mearnsii* either. In coastal zones, *A. cyclops* and other species were widely planted by the Department of Forestry to stabilize naturally mobile sand dunes. However, the plantings altered coastal sediment movements (an ecosystem service that replenishes sand on beaches subject to constant marine erosion). This led to massive beach erosion that threatened coastal developments in the Eastern and Western Cape provinces (Lubke, 1985). In a complete turnaround, the Department of Forestry initiated clearing programmes in the early 1980s to once again free the dunes of vegetation (M.E.R. Burns, former District Forest Officer, pers. comm.).

The situation remains dynamic, and doubtless will change again. Despite the expenditure of almost a billion Rand (1 US\$ = ~ 7 South African Rand (ZAR); values adjusted to 2010 ZAR) on mechanical and chemical control, and the introduction of biological control, certain acacia species (mainly *A. mearnsii*) continue to spread (Van Wilgen *et al.*, 2011a). The levels of damage, in the form of lost ecosystem services and biodiversity, probably already far exceed the value of the wattle industry (De Wit *et al.*, 2001; De Lange & Van Wilgen, 2010). Calls are emerging for the response to invasive species such as acacias to be directed at minimising harm, rather than protecting vested interests, if the harm can be shown to exceed the value of benefits (Van Wilgen *et al.*, 2011a). This may represent a new form of the people-centred ethos, where the primary goal would be to protect those ecosystems that deliver services to people, especially the rural poor, who tend to suffer the consequences of erosion of these services through invasion more than others.

CONCLUSIONS

A 'weed' is only a weed in the eye of the beholder. It is a human category and thus subject to scrutiny, criticism and change over time (Coates, 2006: 113). The global acacia experiment signals a shift in thinking and in levels of communication between governments and their constituencies. It affects scientific issues around biological control (and introduced biota to effect that control) and on how changing political dispensations influence both science and management.

Most Australian acacias are generally not undesirable plants in Australia (although some are; Randall, 2007; Richardson *et al.*, 2011a,b), nor are they when grown in plantations elsewhere in the world, but as 'escapees' they can be, with good reason, declared undesirable: at least 23 species are clearly invasive in different parts of the world (Richardson & Rejmanek, 2011), and several species cause very substantial damage to natural ecosystems, especially in Mediterranean climate regions (Gaertner *et al.*, 2009). While Australians celebrate Wattle Day with speeches by politicians, garlands from schoolchildren and tree-planting ceremonies, South African taxpayers pay millions of Rand annually to clear stands of the Australian floral emblem *Acacia pycnantha* from the country. Nine Australian acacias are classified as 'major invaders' and another three are 'emerging invaders' in South Africa (Nel *et al.*, 2004). How this has come about is a socioeconomic, ethical and historical narrative as much as it is a botanical one, framed by particular places and times which this paper has sought to illuminate.

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BIOSKETCH

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