11 Defending nature

Animals and militarised landscapes in Australia

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Introduction

Warfare is one of the most intense and far-reaching of human activities in its ecological and geographical impacts over time and space. The legacies of war for the environment and animals are publicly well understood and, indeed, are well documented in more specific cases. White phosphorous used in grenades has been linked to the deaths of thousands of waterfowls in Alaska; cadmium, lead, mercury, and uranium from bombing ranges in Puerto Rico have entered the food chain of the island; flame retardants at air force bases in the United States have proven toxic to fish; herbicides, such as the infamous Agent Orange, defoliated vast swathes of Southeast Asian forest cover during military operations in the 1960s, and to this day, high levels of dioxins are still found in the food chain, particularly in ducks and fish.[1] As Charles E. Closmann summarised it, 'Military conflict is often a cause and consequence of environmental decline . . . military operations (and occupations) can have devastating effects on natural resources, making the study of the relationship between war and the environment vitally important'.[2]

To help us to understand some of the impacts of conflict, ecologists Gary Machlis and Thor Hanson put forward a taxonomy of warfare that includes preparations for war, war itself, and post-war activities. All stages of warfare produce ecological impacts of various intensities and scales. Among post-war activities are long-term alterations to land use and settlement patterns, continued contamination and health risks, groundwater pollution, and socioeconomic disruption leading to loss of resource management programmes.[3] It would seem that, given the nature of war and the military, the question of impacts on animals and their habitats appears settled: war is destructive of animal life. Emerging from the relationship between war and the environment, however, is something of a paradox: some war-related activities may benefit animal habitats, especially if we move beyond the battlefield. Military training areas in particular cover at least 50 million hectares of land globally, an area approximating the size of France. Due to the frequently opaque and uneven nature of information regarding military assets, this is likely a significant underestimate.[4] Among conservationists and ecologists, it is increasingly understood that these training sites and defence

bases often have significant conservation values, and – with the correct policy settings – can play a critical complementary role in international biodiversity conservation.[5] This chapter uses the Puckapunyal Military Training Area in central Victoria, Australia, case study as a springboard for exploring the history of environmental policy in the Australian armed forces and the broader implications for animal populations in militarised landscapes. It reveals the evolution of military environmental discourses and practices that have developed along highly contingent, path-dependent lines, and highlights the complicated, multifarious nature of military training sites and the relationships between their human and non-human occupants. The question of animals in militarised landscapes is far from settled and significantly more complex than a relationship of domination at the hands of destructive forces.

Geographer Rachel Woodward has dismissed the assertion of military lands assisting with conservation as a discursive strategy emanating from the defence establishment to legitimise militarised environments and military control of land, describing the attempts to connect biological diversity with defence estates as 'a sort of military creationism'.[6] This extends on the central critique of the political consequences of military-owned lands, which is that 'militarism and military activities in nonconflict situations exert [discursive and material] control over space in ways and through means which frequently render this control invisible'.[7] Both positions can be accepted, however, with a recognition that military environmentalist discourses have a political function – to assert control over military lands – while also acknowledging that the ecological diversity of defence estates remains a material reality. As Chris Pearson argues, 'the relationships between war, militarization and the environment are more nuanced and complex than the pro-/anti-military dichotomy suggests', although, of course, we must always subject politically charged military discourses around the environment to critical analysis.[8]

Indeed, the picture emerging from ecological studies of military training areas is that cycles of disturbance from shelling or heavy armour, for example, combine with a lack of intensive land use (agriculture, forestry, and mining) and public exclusion to create heterogeneous conditions which provide rich opportunities for biological diversity.[9] Patrick Wright has written of 'crater as habitat' in reference to landscapes, shaped by military activity, which favour some species that otherwise struggle in 'civilian landscapes'.[10] In fact, the withdrawal of military activities, and thus disruption of such ecological dynamics, from some sites has been accompanied by concerns over the future of threatened species that previously found sanctuary at these active military sites.[11] As Pearson notes, 'the relationship between war, militarization, and landscape is more complex than one characterised by military domination and destruction of the environment'.[12]

Furthermore, the subject of conservation at military training areas has implications beyond military geographies. The increasing awareness of the ecological and conservation value of military training sites worldwide and, in recent decades, a shift of policy discourse towards the language of sustainability and

environmental responsibility, highlights the subjective, contested nature of land and wildlife conservation measures more generally.

Protected areas, such as national parks, have been established to protect ecosystems and species, but their ability to do so optimally is contingent on the historical conservation, as well as political and economic, contexts in which they were established. The oldest reserves protect areas that are aesthetically pleasing, geologically and topographically unique, or, frequently, areas that were then unsuited to agricultural, pastoral, or extractive industries and development. It is only more recently that protected areas have been established to safeguard biological diversity and ecological processes and to encourage ecosystem and species restoration. This historical gap in protected area types is filled to an extent, however, by a range of typically human-affected landscapes, including military training sites, which often overlap otherwise historically underprotected ecosystems and species but which encompass significantly different ecological disturbance regimes than, for instance, agriculture.[13]

As this chapter observes, however, the protection of ecological diversity at these sites is often, but not always, subject to and limited by the requirements of maintaining defence capabilities. Woodward rightly notes that a metaphor of balance between environmental protectionism and the needs of military training is central to military environmental discourse. As in the United Kingdom and North America, the boundaries of conservationism on Australian military training areas have been set by normative understandings of national defence requirements.[14] Furthermore, although the maintenance of landscapes has obvious benefits for the utility of training sites – to avoid soil erosion, for instance – the presence of various animal populations pose more complicated sets of issues that intersect with competing political interests and with evolving cultural attitudes towards both defence activities and environmental protection.

The restoration and revegetation of Puckapunyal, 1971–85[15]

In 1975, a technical memorandum from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) observed that 'As well as deferring to a growing public awareness of ecological values and concern for the environment it is advantageous for the Defence Forces to conserve areas under their control and to maintain them in a condition suitable for the purposes for which they were acquired'.[16] The language of deferment to public environmental concern highlights the shaping of a new military environmentalist discourse in Australia that, much like similar strategies in the United Kingdom and North America, emphasised military environmental stewardship. Indeed, the CSIRO researchers continued:

> The Army may derive satisfaction in giving a lead in the conservation of land used by Governments – ecological studies and revegetation works began on Army Training Areas before the Australian Government established a Department of Environment and Conservation.[17]

As an outcome of discussions between the Australian Army and the CSIRO in 1969, the latter organisation agreed to begin ecological studies of military training areas, with a focus on land management and environmental conservation. The initial sites designated for CSIRO studies throughout 1970 included army training areas at Puckapunyal in Victoria in addition to four Queensland bases at High Range, Shoalwater Bay, Canungra, and Tully. By the middle of the 1970s, the research programme had been extended, and studies were completed at training sites across Australia: Enoggera and Mount Stuart in Queensland; Bindoon, Lancelin, and Swanbourne in Western Australia; Murray Bridge, Cultana, and Lincoln Park in South Australia; Holsworthy in New South Wales; Queenscliff and Portsea in Victoria; and Buckland in Tasmania.[18]

This research was to provide information on the sites that would 'permit their continued use for military training purposes and as far as is consistent with their use for such purposes permit their management for the conservation of vegetation, soil, wildlife, and related matters'. Furthermore, the CSIRO was to 'advise the Army on remedial measures necessary to halt degeneration on new training areas and to regenerate and re-establish vegetation on areas which have been degraded by military operations'.[19] Conservation was permissible but within limits: environmental programmes and policies were to be subject to and limited by the requirements of maintaining defence capabilities.

Perhaps the most significant of such projects at the time – 'one of the largest single landscape revegetation operations yet attempted in Australia and perhaps anywhere', suggested the CSIRO – took place at the Puckapunyal Military Training Area in central Victoria, which had been used for military purposes since the First World War.[20] Today, Puckapunyal is home to 44,000 hectares of box-ironbark ecosystem, of which over three quarters has been cleared elsewhere in the state. There are 12 endangered or vulnerable vegetation communities, 481 indigenous and 225 introduced plant species, and 170 species of lichens, mosses, and fungi. It is a rich site of biodiversity and holds high conservation value, now forming an extensive wildlife corridor with neighbouring state parks. It is registered as a Land for Wildlife property, has been placed on the Register of the National Estate, and is listed as a Commonwealth Heritage Site on the grounds of its biological significance.[21] The area forms integral habitat for a range of animals. Puckapunyal today supports 185 native bird species, 17 indigenous and 15 introduced mammals, 12 kinds of bat, 18 species of reptile, and 12 species of amphibian, 7 native and 4 introduced kinds of fish, and over 140 species of invertebrates.[22]

At the same time, Puckapunyal is one of the Department of Defence's most intensively used training areas, and it is a significant element in the maintenance of Australia's defence capabilities (see Figure 11.1). Between 60,000 and 70,000 training days, involving 12,000 vehicles and 1,000 live-firing exercises, are undertaken at Puckapunyal every year, and up to 3,500 people are present at the site on any given day.[23] Its restoration and conservation since the 1970s has been driven by both environmental protectionism and militarism, and it represents a

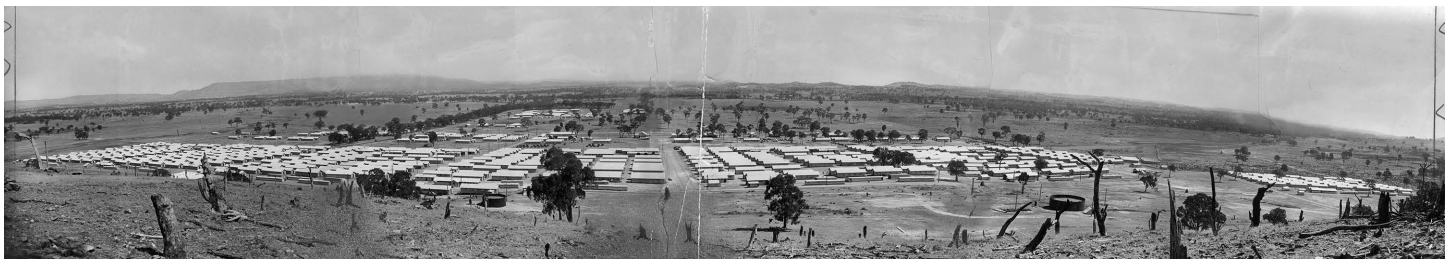

Figure 11.1 The Puckapunyal military training area, circa 1940, showing the initial degradation of the environment.
Source: *Argus* Newspaper Collection of Photographs, State Library of Victoria.

useful case study of how militaries – and other organisations – have attempted to establish a balance of these two interests.

In the aftermath of European colonisation in the mid-nineteenth century, the land around Puckapunyal – traditionally belonging to the Taungurung people – was utilised for intensive sheep and cattle grazing, later followed by gold mining and logging for timber and firewood in the area's box and ironbark forests. Land degradation and accelerated soil erosion was severe in most of the area by the early twentieth century – the soils at Puckapunyal were and are particularly susceptible to erosion after disturbance – and caused siltation of the nearby creek systems that formed tributaries of the Goulburn River.[24] Military training commenced at Puckapunyal during the First World War, and the Department of Defence formally purchased the site from pastoral landowners during 1939. It was one of the largest infantry training sites in Australia, becoming home to the 1st Infantry Brigade, the 3rd National Service Training Brigade, the Royal Australian Army Service Corps Centre, and even school cadets. During the Second World War, the US 41st Infantry Division trained there, and from 1949, Puckapunyal was home to the 1st Armoured Regiment.[25]

Historical land use impacts and heavy military usage, with little attention paid to land management or maintenance, eventually left the area barren and denuded. One newspaper described it in 1953 as the 'most desolate and barren military camp in Victoria'.[26] Some early attempts to improve the area were made, although it is unclear whether this was for environmental remediation or for purely aesthetic reasons; certainly, animals were not a core concern at this point. In the early 1950s, the Australian Army in consultation with the Commonwealth Arboculturalist and the Department of Works and Housing 'embarked upon a programme of reafforestation at Puckapunyal in an attempt to remedy the damage caused to the camp by the endless tramping of hundreds of thousands of soldiers'. *The Age* reported:

> Seventy trees have already been planted on the camp by ex-servicemen who trained at Puckapunyal. . . . All associations of former wartime units which trained at Puckapunyal will be asked to help in the reafforestation plan. Every national service trainee who enters the camp to do his 98 days' service is now obliged to plant a tree.[27]

The enlistment of defence personnel would presage later attempts at restoration. By the 1960s, however, half of the range area was impassable in winter because of waterlogging and severe erosion. For the tanks of the armoured division, these areas were unsafe and unusable. By 1969, the army was faced with two alternatives: '(1) to rehabilitate the area, or (2) to abandon it with consequent loss of facilities and the certainty of having to face similar problems elsewhere in the future'.[28] The former option was taken, but it presented numerous challenges: the soils were of low fertility, made worse by widespread erosion; and the climate was not amenable to standard practices in revegetation works. Furthermore, as one report acknowledged ten years after the commencement of the project, 'Cost

and time considerations rule out the use of normal farm techniques of ploughing and harrowing to prepare seedbeds. Unexploded bombs and shells (UXOs) posed serious hazards to ploughing and deep ripping'.[29]

Despite these unique challenges, the Puckapunyal Restoration and Conservation Project began work in 1971. Officially operating under the auspices of defence, the research and scientific support for the project was provided by the CSIRO, while the Victorian Soil Conservation Authority managed operations and provided its expertise in soil erosion and land restoration. By 1985, the extensive program of earthworks, soil and water erosion control, and revegetation had been completed on 20,000 hectares of land. Some 5,000 hectares of barren and denuded landscape was repaired, and 16,000 hectares of improved pasture had been established. At the completion of the project, land management and scientific officers were appointed to continually monitor and research the Puckapunyal site. A rest and restore program was implemented, creating 'no-go' areas where the land was overused, where new vegetation was establishing itself or was otherwise sensitive to environmental changes, or where research was being conducted.[30] Up to this point, the focus had been on restoring a landscape, not on a habitat for animals. The question of animal populations inevitably arose, however, as the ecology of Puckapunyal was re-established, and they would be shaped in large part by emerging public and political concern about biological diversity in Australia.

Conservation and controversy: animals at Puckapunyal since the 1980s

The evolution of land management and wildlife conservation at Puckapunyal since the large-scale restoration projects of the 1970s and 1980s has occurred in the context of a similarly evolving state and national policy framework. The recognition of the need for a national approach to conservation and biodiversity brought about the Commonwealth Endangered Species Advisory Committee in 1988, a national Endangered Species Program in 1989, and the creation of an Endangered Species Unit as part of the federal environment agency in the same year. Building on the United States' Endangered Species Act of 1974 and the Victorian Flora and Fauna Guarantee Act of 1988, a federal Endangered Species Protection Act was passed in 1992; Australia ratified the Convention on Biological Diversity in 1993.[31]

The prominence of environmental awareness and concern in the Australian community from the 1980s onwards therefore found expression in various state and Commonwealth policies and laws, and it was in this milieu of change that the Australian defence forces started to consider their environmental impact in a more systematic and serious way. It was in the wake of the Endangered Species Protection Act that Australia's Department of Defence began to consider further country-wide environmental management and protection programmes.

In March 1995, the facilities division of the Department of Defence and the chief executive officer of the Australian Nature Conservation Agency signed a

new Memorandum of Understanding. It broadly described how Australia's armed forces would go about meeting their obligations under the new Endangered Species Protection Act with regard to the 'lands and waters under control of the Department of Defence'. The department agreed to 'commence a review in 1994/95 of existing biological information for Defence land, to prepare a preliminary inventory of the presence and abundance of listed species and to identify priorities for further inventory work as well as recovery action'. It agreed to prepare and implement recovery plans for listed species on the lands it owned, develop threat abatement strategies, and incorporate this work into existing environmental management plans for its military sites. In return, the Nature Conservation Agency would 'provide educational materials on endangered species issues and the ESP Act . . . for distribution to Local Commanders and Environmental Advisory Committees'.[32] Importantly, the text of the memorandum does not equivocate on the priority of adhering to the Endangered Species Protection Act, distinguishing it from earlier agreements – such as that between the army and the CSIRO in 1969.

For animals at Puckapunyal, the practical impacts of these policy shifts have been evident in the results of monitoring programmes. Bush stone-curlew, tuan, common dunnart, powerful owl, barking owl, and lace monitor, among many others, are regularly recorded today.[33] In the 1990s, however, all these species were otherwise considered threatened in Victoria.[34] The tuan, for example, was thought rare in Victoria in the early to mid-1990s; assessments at Puckapunyal since 1995, however, have recorded a 65% increase in juveniles. Reports of the common dunnart increased from 13 sites at Puckapunyal in 1995–96 to 67 sites in the mid-2000s. Similarly, the bush stone-curlew, although believed to inhabit parts of Puckapunyal in the 1950s, was rare by the time of environmental assessments in 1995; numbers increased from 3 breeding pairs and 9 individual birds, at that time, to 14 pairs and 31 birds in the mid-2000s. Two pairs of powerful owls were known to live at the base in the 1970s, and by 2006, 11 breeding pairs and 3 single birds were recorded.[35]

Although conservation programmes emphasised utility for defence requirements, the restoration project of the 1970s and 1980s had, in reality, reimagined Puckapunyal as both a military training area *and* a natural landscape for vegetation and habitat for animals. This is evident in the re-emergence of native fauna at the site but also in the treatment of 'pest' species. Since the late 1980s, the site has been managed under various range standing orders, land management plans, and environmental management plans and systems that focus on the management of land, water, fire, and pollution. A key component of these plans since the mid-1990s has also been the management of rabbits, red foxes, and feral cats through baiting, shooting, trapping, and habitat control. The first baiting treatments in 1994 reduced the red fox population, for example, from 84 to 34 individuals (at selected monitoring sites); between 1995 and 2006, 121 cats have been shot or trapped, and in the 2000s, only 4 to 10 cats have been observed on the range – some of these are roaming domestic pets.[36] In any case, the management of these animals has likely been a significant factor in the flourishing of native faunal species.

The management of animals at Puckapunyal, however, has also been subject to controversy, thus further reflecting the intersection of defence environmental policy with changing attitudes to land management and conservation in the public sphere. Since the 1980s, a significant issue at Puckapunyal had been an increasing population of eastern grey kangaroos. A major drought in 2002–03 pushed kangaroo populations south from the northern areas of Victoria; population monitoring undertaken since 1983 put the number of kangaroos at Puckapunyal by the drought years at 80,000; the site, it was claimed, was unable to support a population this size. A plan to hire contractors to kill 15,000 kangaroos was met with protest from animal activists – one group referred to the cull as the Puckapunyal Military Massacre – although the RSPCA provided inspectors to ensure the cull was conducted humanely.[37] A second cull in 2003 was met with more objection, this time from the RSPCA itself.[38] More culls in 2013 and 2016 sparked further protest from animal rights groups.[39]

Broadly, however, the restoration project appears to have been a net benefit to native animal populations, providing habitat and sanctuary for various species that are endemic to the grassy woodlands that have otherwise not been well protected under traditional conservation models. The overall effect of the Endangered Species Protection Act on defence environmental policy was to provide impetus for creating a broader framework for wildlife and land conservation at military sites across Australia. Furthermore, it opened up possibilities for the Department of Defence to respond to increasing public and community interest in environmental and conservation issues. As it was during the emergence of early environmental policy in the military forces, Puckapunyal provided a testing ground for defence approaches to animal conservation that continue to develop to this day.[40]

Animals and militarised landscapes in an international perspective

The Puckapunyal case, and the broad discussion around the management of animals on defence estate in Australia, draws attention to some far wider, global considerations. As we have seen, the place of animals at Puckapunyal has been determined in part by the emergence of military environmental policy and practice and in part by the evolution of environmentalist discourse in the Australian community. This reflects the development of policies for outlining and establishing the environmental responsibilities of militaries internationally, which can also be attributed to the broader growth of environmentalism in the 1960s. This is true, at least, for the United Kingdom, where a Defence Lands Committee, chaired by Lord Nugent, was established in 1973 in response to growing public and political concerns about the environmental impacts of non-conflict military activities. An important and immediate outcome was the establishment of conservation officers at major military training areas in the United Kingdom. The Nugent inquiry set the tone for future military environmental policymaking: environmental and military needs could be balanced, although with priority given to the latter, with the correct managerial practices and policy settings. One

critique of the framework established, however, is that little regard was given to remediating already-existing environmental damage at military training sites.[41] At the centre of military environmentalist discourses in the United Kingdom during the 1970s was the humble fairy shrimp, which found sanctuary at the Salisbury Plain tank training grounds, where it inhabits the ditches and ruts created by tank activity; the Salisbury Plain fairy shrimp became, in the wake of the Nugent inquiry, a 'weapon in the battle for hearts and minds of those who opposed military land ownership'.[42]

A key point, in any case, is that conservation at training areas has been limited by military requirements and that defence departments have tended to set the terms of environmental protection. In 1987, for example, the United Kingdom Ministry of Defence affirmed, 'In managing land which it owns or uses within the national parks, the MoD declares that it will endeavour to promote the objectives of the park authorities wherever these are compatible with the needs of national defence'.[43] In Australia, the origins of the relationship between environmental protectionism and militarism have been similar, with the distinct exception that defence environmental policy did not ignore the importance of remedying existing damage but rather emerged from remediation and restoration projects themselves.

Similar concerns have arisen in the United States, which has increased its defence training estate by around 1,200 hectares per year in recent times. Indeed, lands under the mandate of the United States National Parks Service only slightly exceed Department of Defence holdings in terms of their representation of ecological diversity.[44] As elsewhere, military landscapes in the United States have provided unexpected benefits for some species. Preble's meadow jumping mouse, for example, was endemic to streamside meadows in Colorado and south-east Wyoming, but its numbers have declined as 90% of its habitat has been occupied by agriculture, commerce, and residential developments since the 1960s. The Front Range base in Colorado has provided sanctuary for this threatened animal.[45] Elsewhere in Colorado, at the Rocky Mountain Arsenal and Rocky Flats military areas, militarisation led to 're-wilding' after the cessation of intensive cattle grazing. From the 1970s, prairie grasses began to re-establish themselves and created habitats for native herbivores, such a mule deer, and their predators. Outside the protection of this militarised area, the same animal populations have otherwise dwindled.[46]

The extent of conservation practice at such sites is bounded, as we have seen, by the needs and priorities of defence capability. How the defence forces approach issues of habitat and wildlife conservation has, however, moved in concert with broader public concerns about ecological and biological diversity. The question of animal populations has emerged as a significant feature of wider considerations of how an equilibrium might be established by the sometimes competing, sometimes complementary demands of militarism and environmentalism. In the twenty-first century, this question has become increasingly complicated as the social, political, and technological contexts of warfare have evolved. Of particular concern to conservationist and environmentalists will be the privatisation of

military activity. Although this chapter focused on the ability of governments to determine military environmental policy and outcomes for animal populations, the growth of private military and security firms has raised a host of issues around transparency and accountability for misconduct that will, no doubt, intersect with concerns touched upon here.[47]

The place of animals and their habitants in militarised landscapes should remain a significant issue as preparations for war use up to 50 million hectares of land across the Earth and make up 6% of global raw material consumption. Wars and military activities account for perhaps 10% of annual global carbon emissions. Over 80% of major armed conflicts between 1950 and 2000 occurred within recognised global biodiversity hotspots, areas that harbour over 40% of terrestrial vertebrate species and at least half of all plant species but which cover less than 2.5% of the Earth's land surface.[48] It is essential, therefore, to continue to seek an understanding of the complex relationships between animals and the militarised landscapes they inhabit, in times of war and peace, and on both battlefields and homefronts.

Notes

1 R. Woodward, *Military Geographies* (Malden: Blackwell, 2004), 77–80.
2 C. E. Closmann, 'Landscapes of Peace, Environments of War', in Closmann (ed.), *War and the Environment: Military Destruction in the Modern Age* (College Station: Texas A&M University Press, 2009), 1.
3 G. E. Machlis and T. Hanson, 'Warfare Ecology', *BioScience*, 58 (2008): 729.
4 R. Zentelis and D. Lindenmeyer, 'Bombing for Biodiversity – Enhancing Conservation Values of Military Training Areas', *Conservation Letters*, 8 (2015): 299–305; J. L. Aycrigg et al., 'Bombing for Biodiversity in the United States: Response to Zentelis & Lindenmeyer 2015', *Conservation Letters*, 8 (2015): 306–7.
5 Zentelis and Lindenmeyer, 'Bombing for Biodiversity', 299–305; J. L. Aycrigg et al., 'Response', 306–7.
6 Woodward, *Military Geographies*, 92.
7 Woodward, *Military Geographies*, 3.
8 Chris Pearson, 'Researching Militarized Landscapes: A Literature Review on War and the Militarization of the Environment', *Landscape Research*, 37 (2012), 117.
9 R. A. Hirst et al., 'Assessing Habitat Disturbance Using a Historical Perspective: The Case of the Salisbury Plain Military Training Area', *Journal of Environmental Management*, 60 (2000): 181–93; R. A. Hirst et al., 'Ecological Impacts of Military Vehicles on Chalk Grassland', *Aspects of Applied Biology*, 58 (2000): 293–8; S. D. Warren et al., 'Biodiversity and the Heterogeneous Disturbance Regime on Military Training Lands', *Restoration Ecology*, 15 (2007): 606–12; D. G. Milchanus et al., 'Plant Community Structure in Relation to Long-Term Disturbance by Mechanized Military Manoeuvres in a Semiarid Region', *Environmental Management*, 25 (2000): 525–39; J. W. Rivers et al., 'Long-term Community Dynamics of Small Landbirds with and Without Exposure to Extensive Disturbance from Military Training Activities', *Environmental Management*, 45 (2010): 203–16; S. D. and R. Buttner, 'Active Military Training Areas as Refugia for Disturbance-dependent Endangered Insects', *Journal of Insect Conservation*, 12 (2008): 671–6.
10 P. Coates, T. Cole, M. Dudley and C. Pearson, 'Defending Nation, Defending Nature? Militarized Landscapes and Military Environmentalism in Britain, France, and the United States', *Environmental History*, 16 (2011): 470.

11 J. Reif et al., 'Abandoned Military Training Sites Are an Overlooked Refuge for Threatened Bird Species in a Central European Country', *Biodiversity Conservation*, 20 (2011): 3645–62; A. Jentsch et al., 'Assessing Conservation Action for Substitution of Missing Dynamics on Former Military Training Areas in Central Europe', *Restoration Ecology*, 17 (2009): 107–16.
12 C. Pearson, 'Researching Militarized Landscapes: A Literature Review on War and the Militarization of the Environment', *Landscape Research*, 37 (2012), 117.
13 O. Cizek et al., 'Conservation Potential of Abandoned Military Areas Matches That of Established Reserves: Plants and Butterflies in the Czech Republic', *PLoS One*, 8 (2013), http://doi.org/10.1371/journal.pone.0053124.
14 Woodward, *Military Geographies*, 95–6.
15 This chapter extends on material first presented in B. Wilkie, 'Australian Environments in War and Peace: Toward an Environmental History of Australia's Defence Estate' (Paper Presented at the Australian Historical Association Conference, Ballarat, Australia, 2016) and B. Wilkie, 'Bombs and Biodiversity: A Case Study of Military Environmentalism in Australia', *Arcadia: Explorations in Environmental History*, 15 (2016).
16 R. M. Moore et al., *Ecological Studies and Conservation Projects on Army Training Areas, 1974* (Canberra: CSIRO Division of Land Use Research, 1976) 33.
17 Moore et al., *Ecological Studies*, 33.
18 Moore et al., *Ecological Studies*, 2.
19 Moore et al., *Ecological Studies*, 2.
20 Moore et al., *Ecological Studies*, 3–10.
21 Bob Anderson et al., 'Habitat Management for Tanks and Tuans: Evolving Approaches at Puckapunyal Military Area', *Ecological Management & Restoration*, 8 (2007): 11–13.
22 Anderson et al., 'Habitat Management', 12.
23 Anderson et al., 'Habitat Management', 14.
24 J. F. McDonagh, J. Walker and A. Mitchell, 'Rehabilitation and Management of an Army Training Area', *Landscape Planning*, 6 (1979): 376.
25 'Puckapunyal', in Peter Dennis et al. (eds.), *The Oxford Companion to Australian Military History* (Melbourne: Oxford University Press, 2008), 435.
26 *The Age*, 7 January 1953, 9.
27 *The Age*, 7 January 1953, 9.
28 J. F. McDonagh, J. Walker, and A. Mitchell, 'Rehabilitation and Management', 376.
29 J. F. McDonagh et al., 'Rehabilitation and Management of an Army Training Area', 379.
30 Anderson et al., 'Habitat Management', 14–15.
31 John Woinarksi and Alaric Fisher, 'The Australian Endangered Species Protection Act 1992', *Conservation Biology*, 13 (1999): 959–60.
32 R. Carey and P. Bridgewater, *Memorandum of Understanding between the Department of Defence and the Australian Nature Conservation Agency on the Application of the Endangered Species Protection Act 1992 to Lands and Waters Under the Control of Department of Defence* (Canberra, 1995).
33 Anderson et al., 'Habitat Management', 21.
34 A. Bennett, *Wildlife Extinction in the Box-ironbark Forests* (Melbourne: Department of Natural Resources and Environment 1999).
35 Anderson et al., 'Habitat Management', 21–2.
36 Anderson et al., 'Habitat Management', 20.
37 Anderson et al., 'Habitat Management', 17; *Sydney Morning Herald*, 21 May 2002; 'Puckapunyal Military Massacre', Australian Society for Kangaroos, www.australiansocietyforkangaroos.com/puckapunyal_massacre.html (accessed 14 August 2017).
38 'Kangaroos Starving at Puckapunyal Army Base', *ABC Radio: The World Today*, www.abc.net.au/worldtoday/content/2003/s889035.htm (accessed 14 August 2017).

39 'Puckapunyal Kangaroo Cull "Our Dirty Little Secret": Activists,' *The Age*, www.theage.com.au/victoria/puckapunyal-kangaroo-cull-our-dirty-little-secret-activists-20131221-2zs5c.html (accessed 14 August 2017); '25,000 Roos for Culling in Victoria', *The Weekly Times*, www.weeklytimesnow.com.au/news/politics/25000-roos-for-culling-in-victoria/news-story/033bf63998fc54d9e4115ad08aa4acaa (accessed 14 August 2017).
40 B. Wilkie, 'Defence White Paper Shows Australian Forces Must Safeguard Nature Too,' *The Conversation*, https://theconversation.com/defence-white-paper-shows-australian-forces-must-safeguard-nature-too-55386 (accessed 24 October 2017).
41 Woodward, *Military Geographies*, 85–9.
42 Coates et al., 'Defending Nation, Defending Nature?', 470.
43 Woodward, *Military Geographies*, 86.
44 Zentelis and Lindenmeyer, 'Bombing for Biodiversity', 299–305; J. L. Aycrigg et al., 'Response', 306–7.
45 Coates et al., 'Defending Nation, Defending Nature?', 471–2.
46 Coates et al., 'Defending Nation, Defending Nature?', 473–4.
47 On the legal issues arising between governments and private firms in military and conflict scenarios, see, for example, B. Sheehy, J. Maogoto and Virginia Newell, *Legal Control of the Private Military Corporation* (London: Palgrave Macmillan, 2008).
48 T. Hanson et al., 'Warfare in Biodiversity Hotspots', *Conservation Biology*, 23 (2009): 578–87.