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Review

Brave new green world – Consequences of a carbon economy for the conservation of Australian biodiversity

Corey J.A. Bradshaw [a,b,*], David M.J.S. Bowman [c], Nick R. Bond [d], Brett P. Murphy [e,c], Andrew D. Moore [f], Damien A. Fordham [a], Richard Thackway [g], Michael J. Lawes [h], Hamish McCallum [i], Stephen D. Gregory [a], Ram C. Dalal [j], Matthias M. Boer [k], A. Jasmyn J. Lynch [l], Ross A. Bradstock [m], Barry W. Brook [a], Beverley K. Henry [n], Leigh P. Hunt [o], Diana O. Fisher [p], David Hunter [q], Christopher N. Johnson [r], David A. Keith [q], Edward C. Lefroy [s], Trent D. Penman [m], Wayne S. Meyer [a], James R. Thomson [t], Craig M. Thornton [u], Jeremy VanDerWal [v], Richard J. Williams [o], Lucy Keniger [p], Alison Specht [w]

[a] The Environment Institute and School of Earth and Environmental Sciences, The University of Adelaide, Adelaide, South Australia 5005, Australia
[b] South Australian Research and Development Institute, P.O. Box 120, Henley Beach, South Australia 5022, Australia
[c] School of Plant Science, University of Tasmania, Private Bag 55, Hobart, Tasmania 7001, Australia
[d] Australian Rivers Institute, Griffith University, Nathan, Queensland 4111, Australia
[e] School of Botany, The University of Melbourne, Victoria 3010, Australia
[f] CSIRO Sustainable Agriculture National Research Flagship & Plant Industry, GPO Box 1600, Canberra, Australian Capital Territory 2601, Australia
[g] School of Geography, Planning and Environmental Management, The University of Queensland, Brisbane, Queensland 4072, Australia
[h] Research Institute for the Environment and Livelihoods, Charles Darwin University, Darwin, Northern Territory 0909, Australia
[i] School of Environment, Griffith University, Nathan Campus, 170 Kessels Road, Nathan 4111, Queensland, Australia
[j] Queensland Department of Science, Information Technology, Innovation and the Arts, Block B, Level 3 East, 41 Boggo Road, Dutton Park, Queensland 4102, Australia
[k] Hawkesbury Institute for the Environment, University of Western Sydney, Locked Bag 1797, Penrith, New South Wales 2751, Australia
[l] Institute for Applied Ecology, Faculty of Applied Science, University of Canberra, Canberra, Australian Capital Territory 2601, Australia
[m] Centre for Environmental Risk Management of Bushfires, School of Biological Sciences, University of Wollongong, New South Wales 2522, Australia
[n] Institute for Sustainable Resources, Queensland University of Technology, Room 318, Level 3, D Block, Gardens Point Campus, 2 George Street, Brisbane, Queensland 4000, Australia
[o] CSIRO Sustainable Agriculture National Research Flagship & Ecosystem Sciences, Tropical Ecosystems Research Centre, PMB 44 Winnellie, Northern Territory 0822, Australia
[p] The University of Queensland, School of Biological Sciences, Goddard Building (8), St Lucia 4072, Queensland, Australia
[q] New South Wales Department of Environment, Climate Change and Water, PO Box 1967, Hurstville, New South Wales 2220, Australia
[r] School of Zoology, University of Tasmania, Private Bag 55, Hobart, Tasmania 7001, Australia
[s] Centre for Environment, University of Tasmania, Private Bag 141, Hobart, Tasmania 7001, Australia
[t] School of Biological Sciences and Australian Centre for Biodiversity, Monash University, Melbourne, Victoria, Australia
[u] Natural Resources and Mines, PO Box 1762, Rockhampton, Queensland 4700, Australia
[v] Centre for Tropical Biodiversity and Climate Change, James Cook University, Townsville, Queensland 4811, Australia
[w] Australian Centre for Ecological Analysis and Synthesis, Terrestrial Ecosystem Research Network, The University of Queensland, Queensland 4072, Australia

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ABSTRACT

Pricing greenhouse gas emissions is a burgeoning and possibly lucrative financial means for climate change mitigation. Emissions pricing is being used to fund emissions-abatement technologies and to modify land management to improve carbon sequestration and retention. Here we discuss the principal land-management options under existing and realistic future emissions-price legislation in Australia, and examine them with respect to their anticipated direct and indirect effects on biodiversity. The main ways in which emissions price-driven changes to land management can affect biodiversity are through policies and practices for (1) environmental plantings for carbon sequestration, (2) native regrowth, (3) fire management, (4) forestry, (5) agricultural practices (including cropping and grazing), and (6) feral animal control. While most land-management options available to reduce net greenhouse gas emissions offer clear advantages to increase the viability of native biodiversity, we describe several caveats regarding potentially negative outcomes, and outline components that need to be considered if biodiversity is also to benefit from the new carbon economy. Carbon plantings will only have real biodiversity value if they comprise appropriate native tree species and provide suitable habitats and resources for valued fauna. Such plantings also risk severely altering local hydrology and reducing water availability. Management

* Corresponding author at: The Environment Institute and School of Earth and Environmental Sciences, The University of Adelaide, Adelaide, South Australia 5005, Australia. Tel.: +61 8 8313 5842; fax: +61 8 8313 4347.
E-mail address: corey.bradshaw@adelaide.edu.au (C.J.A. Bradshaw).

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Forestry
Greenhouse gases
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Regrowth
Stocking

of regrowth post-agricultural abandonment requires setting appropriate baselines and allowing for thinning in certain circumstances, and improvements to forestry rotation lengths would likely increase carbon-retention capacity and biodiversity value. Prescribed burning to reduce the frequency of high-intensity wildfires in northern Australia is being used as a tool to increase carbon retention. Fire management in southern Australia is not readily amenable for maximising carbon storage potential, but will become increasingly important for biodiversity conservation as the climate warms. Carbon price-based modifications to agriculture that would benefit biodiversity include reductions in tillage frequency and livestock densities, reductions in fertiliser use, and retention and regeneration of native shrubs; however, anticipated shifts to exotic perennial grass species such as buffel grass and kikuyu could have net negative implications for native biodiversity. Finally, it is unlikely that major reductions in greenhouse gas emissions arising from feral animal control are possible, even though reduced densities of feral herbivores will benefit Australian biodiversity greatly.

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1. Introduction

As world greenhouse gas emissions (see glossary: Table 1) continue to track worst-case projections (Intergovernmental Panel on Climate Change, 2007), humanity is beginning to implement workable financial mechanisms to abate them. The basic rationale for such mechanisms is to provide industry with incentives via a financial penalty ('carbon pricing') or offset scheme ('carbon credits'), thereby promoting investment practices that reduce emissions, produce 'clean' energy, or increase energy efficiency. A key inclusion within such programs is the recognition for the potential to sequester carbon in soils and vegetation.

Deforestation, particularly the destruction of biodiverse tropical rainforests, is thought to have contributed between 10 and 20% of the anthropogenic CO_2 emissions since the Industrial Revolution (van der Werf et al., 2009). Thus, there should be a good fit between conservation of biodiversity outcomes and carbon storage given that forests are the most carbon-dense ecosystems on Earth (Luyssaert et al., 2008). Indeed, this is the underlying logic of schemes such as Reduced Emissions from Forest Deforestation and Degradation (REDD) in tropical forests (Phelps et al., 2010), which hold well over 60% of the world's species (Bradshaw et al., 2009). However, schemes such as REDD (and its variants, including REDD+; van Oosterzee et al., 2012) are extremely complex to manage and in some geo-political settings, are vulnerable to perverse outcomes, such as clearing of high-diversity native forests to establish forestry plantations (Venter et al., 2010).