Author/s:
Jellinek, S;Wilson, KA;Hagger, V;Mumaw, L;Cooke, B;Guerrero, AM;Erickson, TE;Zamin, T;Waryszak, P;Standish, RJ

Title:
Integrating diverse social and ecological motivations to achieve landscape restoration

Date:
2019-01-01

Citation:
Jellinek, S., Wilson, K. A., Hagger, V., Mumaw, L., Cooke, B., Guerrero, A. M., Erickson, T. E., Zamin, T., Waryszak, P. & Standish, R. J. (2019). Integrating diverse social and ecological motivations to achieve landscape restoration. Journal of Applied Ecology, 56 (1), pp.246-252. https://doi.org/10.1111/1365-2664.13248.

Persistent Link:
https://hdl.handle.net/11343/285127

DR SACHA JELLINEK (Orcid ID : 0000-0002-6779-8948)
MR PAWEL WARYSZAK (Orcid ID : 0000-0002-4245-3150)
DR RACHEL STANDISH (Orcid ID : 0000-0001-8118-1904)

Article type : Commentary
Editor : Tien Ming Lee

Integrating diverse social and ecological motivations to achieve landscape restoration

Jellinek S[a, b], Wilson KA[c], Hagger V[c], Mumaw L[d], Cooke B[d], Guerrero AM[c], Erickson TE[e, f], Zamin T[g], Waryszak P[h], Standish RJ[h]

[a] Greening Australia, Melbourne, Victoria 3083, Australia
[b] LaTrobe University, Department of Ecology, Environment & Evolution, Bundoora, Victoria 3083, Australia
[c] The University of Queensland, School of Biological Sciences, Australian Research Council Centre of Excellence for Environmental Decisions, Brisbane, Queensland 4072, Australia.
[d] RMIT University, School of Global, Urban and Social Studies, Centre for Urban Research, Melbourne, Victoria 3010, Australia
[e] Kings Park Science, Department of Biodiversity, Conservation and Attractions, Kings Park, Western Australia 6005, Australia
[f] The University of Western Australia, School of Biological Sciences, Crawley, Western Australia 6009, Australia
[g] Monash University, School of Biological Sciences, Clayton, Victoria, Australia 3800
[h] Murdoch University, School of Veterinary and Life Sciences, 90 South Street, Murdoch, Western Australia 6150, Australia

Corresponding Author: Sacha Jellinek, sacha.jellinek@gmail.com, +61 410 917 123

Running title: Integrating social motivations in restoration

Word Count: Summary - 150, Main Text - 2,801, Acknowledgements - 52, References - 1,510

Figure: 0

Tables: 0

References: 54

Abstract

1. Landscape-scale restoration requires stakeholder collaboration and recognition of diverse social and ecological motivations to achieve multiple benefits. Yet few landscape restoration projects have set and achieved shared social and ecological goals.

2. Mechanisms to integrate social and ecological motivations will differ in different landscapes. We provide examples from urban, agricultural and mined landscapes to highlight how integration can achieve multiple benefits and help incentivise restoration.

3. Better communication of ecological and especially social benefits of restoration could increase motivation. Social and economic incentives from carbon markets are evident in agricultural landscapes, biodiversity offset schemes are unlikely to motivate restoration without proof-of-concept, and framing restoration in terms of ecosystem services shows promise.

4. *Synthesis and applications*. When setting restoration goals, it is important to recognise the diverse motivations that influence them. In doing so, and by evaluating both social and ecological benefits, we can better-achieve desired restoration outcomes. Customising incentives to cater for diverse stakeholder motivations could therefore encourage restoration projects.

Keywords:

Old-field restoration, biodiversity offset scheme, ecosystem services, restoration incentives, mine restoration, stakeholder engagement, urban restoration, socio-ecological.

Introduction

The transformative and widespread impact of human activity on the Earth's ecosystems requires landscape-scale restoration approaches to support and promote biodiversity conservation (Menz, Dixon & Hobbs 2013). Here we define ecological restoration as the 'process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed' (SERA 2016). In principle, ecological restoration can achieve best practice outcomes for both people and nature in degraded landscapes (Martin *et al.* 2014; Guerrero, Mcallister & Wilson 2015). Indeed, the 2030 Agenda for Sustainability highlights the need for social motivations to be incorporated into restoration objectives (UN 2015). The *International Standards for the Practice of Ecological Restoration* (McDonald *et al.* 2016) suggest how social values can be incorporated in setting restoration goals and objectives, but the social outcomes do not feature among the proposed indicators of restoration success in this guiding document or its predecessor, the *Australian Standards for Ecological Restoration* (SERA 2016). More generally, references to social attributes, aspects, outcomes or benefits are often mentioned in the literature (Hobbs 2018), but they are usually poorly addressed or defined, and used interchangeably, making it unclear how restoration outcomes impact society.

While there is agreement that shared goals for social and ecological outcomes are prerequisites for restoration, there are few examples of shared outcomes being achieved in practice. Landscape-scale restoration requires the involvement of diverse stakeholders invested in restoration planning, activities and outcomes (Gold *et al.* 2006). Motivation to engage in restoration can be influenced by political context, cultural values, personal attributes and social identities (Fielding & Hornsey 2016). As motivations ultimately define intended outcomes in restoration, differences in motivations between stakeholder groups and the nature of the governance arrangements can lead to tensions and divergent outcomes, particularly if socio-political conflict exists between groups (Fielding & Hornsey 2016).

A comprehensive understanding of the socio-ecological context of landscape restoration could help to set and achieve shared restoration goals (Budiharta *et al.* 2016). In particular, shared restoration goals could be achieved by understanding and promoting the expression of multiple and inter-linked motivations (Hagger, Dwyer & Wilson 2017). Whether motivations for ecological restoration are biotic, heuristic, technocratic, idealistic or pragmatic (Clewell & Aronson 2006), being explicit about the diversity and inter-relatedness of motivations, and their potential to change over time, could help identify trade-offs and improve on-ground outcomes (Iftekhar *et al.* 2016).

Here we argue that social motivations could be better integrated into ecological restoration, because integration may provide: a) greater shared ecological and social benefits; b) greater involvement of, and collaboration among stakeholder groups and; c) better governance of restoration projects. We identify social and economic incentives that can promote integrated ecological restoration projects into the future. We use examples from Australia to support our arguments, but many ideas will be applicable to restoration projects elsewhere in the world.

Benefits of socio-ecological approaches to restoration

Below we outline examples of how social motivations have been integrated into ecological restoration, and some of the benefits achieved. We begin with examples from three different settings where landscape-scale restoration activities are prevalent. These landscapes offer a rich diversity of lessons owing to differences among socio-political and ecological contexts. We then discuss incentives for restoration and their potential application in these landscapes, some of the challenges with their current use, and opportunities for potential future use.

Agricultural landscapes

In agricultural landscapes, restoration efforts can increase farm productivity and native biodiversity on properties (Fischer *et al.* 2010). For example, in south-eastern Australia, landholders tended to undertake restoration activities if they believed these activities were likely to benefit their farm as well as the natural environment (Jellinek *et al.* 2013). In South Australia, community organisations, government agencies and Indigenous groups collaborated to undertake landscape-scale restoration around a Ramsar wetland (Jellinek *et al.* 2016). In this program, all stakeholders were involved in every step of the planning process, and new knowledge was shared among project stakeholders. Motivations of individual farmers to contribute towards landscape-scale restoration in such programs will be tempered by farm productivity, which determines the amount of farmland set aside for conservation (Polyakov & Pannell 2016). Productivity losses resulting from land set-aside for restoration, and the potential for greater financial benefits over the short-term through traditional farming methods, are trade-offs that may limit the uptake of restoration activities (Crosthwaite *et al.* 2008). Improved knowledge and communication of the social and ecological benefits arising from restoration is therefore important for enhancing uptake of these activities (Alexander *et al.* 2016).

Urban landscapes

In urban landscapes, the importance of collaboration to achieve ecological and social benefits is also evident. For example, a partnership between a municipal council and local community group in Melbourne, Australia, engages urban residents to become involved in restoration on their land, retaining remnant vegetation and adding vegetative structure and habitat features. A study of this program found residents had strong connections to the environment, and viewed their property-scale restoration activities as contributions to landscape-scale conservation efforts as well as to their local community (Mumaw 2017). Council and community members were the key factors promoting and supporting their participation (Mumaw & Bekessy 2017). Residents were also motivated by their personal wellbeing, including learning new skills and sharing experiences and knowledge (Mumaw, Maller & Bekessy 2017). Similarly, a survey of people involved in vegetation restoration projects across Australia showed social motivations to be important, particularly in urban areas (Hagger, Dwyer & Wilson 2017).

In another study, landholders in Melbourne's semi-rural areas had attempted to return private land to a pre-colonial condition (Cooke & Lane 2015). The ecological success of these plantings differed; shifting participant motives for restoration from a desire to return historical ecological communities, to a desire to establish novel ecological communities that could persist in heavily modified landscapes. This study showed that considerations of restoration motivations are not static, and that past experience can shape subsequent restoration efforts. Similar to agricultural landscapes, urban residents can be engaged to work collaboratively towards restoration beyond the boundaries of their land if these activities result in broader social and ecological benefits.

Mined landscapes

In mined landscapes there are social, ecological and regulatory pressures that affect restoration approaches and outcomes (Carrick *et al.* 2015). In Western Australia, mining companies undertaking restoration near to the capital city and its water catchment have been influenced by social pressures and regulations. As a result, companies have invested in research and restoration practice has developed to consistently restore forest ecosystems, minimising impacts on water supplies, benefiting people and the environment (Koch 2007). In contrast, the remote mining region of the Pilbara, Western Australia, has limited visibility to large human populations and restoration has been less successful (Shackelford, Miller & Erickson 2017). However, these restoration activities can provide social benefits for remote indigenous communities, through employment opportunities and connection to country, if these groups are engaged in setting restoration objectives. Moreover, social licence to operate is becoming increasingly important for the mining industry, even in remote regions (Mercer-Mapstone *et al.* 2018).

Incentives for restoration

Depending on stakeholder needs and their motivations for restoration, incentives can foster and promote restoration activities. While incentives are often framed in terms of direct payments, payments for ecosystem services are only one approach amongst a range of policy options for incentivising action (Muradian *et al.* 2013). Critically, payments for ecosystem services can outcompete the more intrinsic motivations such as heuristic and idealistic motivations (Muradian *et al*. 2013). However, covering direct costs of interventions are also common. For example, in agricultural and urban landscapes, pragmatic incentives such as funds to support fencing and weed control can increase landholders' ability to implement conservation activities (Nielsen-Pincus, Ribe & Johnson 2015).

Many incentive programs currently operate in different countries to promote restoration and conservation activities on private and public land. In Australia, the Environmental Stewardships Programme and the 20 Million Trees Program promote conservation and restoration respectively, in the United States the Conservation Reserve Program has operated since 1985, and in Europe there is the Common Agricultural Policy. In developing countries, the United Nations REDD+ (Reducing Emissions from Deforestation and Forest Degradation) programme aims to reduce land-use related emissions, and globally there is the Bonn Challenge to achieve forest landscape restoration (e.g., 150 million hectares by 2020). In addition to these specialised programs, there are universal incentives for restoration that might underpin or complement these programs. These incentives are seldom well aligned to people's motivations to undertake restoration activities (Clewell & Aronson 2006), so we provide examples of how motivations can be better integrated into restoration incentive payments, and ways to inform future policies and programs.

Carbon markets

Carbon markets have been developed to address global greenhouse gas emissions and have the potential to pay landholders for the restoration activities that they undertake, predominantly in agricultural landscapes (Bryan *et al.* 2016). Evans *et al.* (2015) showed there were economic returns and biodiversity benefits for undertaking assisted natural regeneration in Queensland, Australia, and that carbon farming was a viable land-use on up to 34 % of the land in a catchment, depending on the carbon price. However, achieving ecological restoration in practice will likely require additional regulation or incentive payments to compete with other land uses, such as payments for ecosystem services or accounting that considers the cost of environmental degradation (Maraseni & Cockfield 2015). Furthermore, the carbon sequestration potential of biodiverse carbon plantings needs to be emphasised to offset both the perception that monocultures sequester more carbon, and the more complicated carbon accounting for mixed-species plantings (Hulvey *et al.* 2013). Carbon projects that retire agricultural land may also cause a trade-off with food security, highlighting the importance of considering the social implications of carbon farming initiatives (Evans *et al.* 2015).

Social barriers to carbon farming include uncertainty regarding policy and compliance schemes, variable carbon pricing and requirements for long-term management of carbon stocks (Mitchell, Harper & Keenan 2012). There is also potential for financial incentives of emerging carbon markets to fail to capture all the environmental and social benefits that could result from carbon projects (Standish & Hulvey 2014). For example, projects can deliver co-benefits such as honey production which can be highly valued in surrounding local communities (Funk *et al.* 2014). Ensuring carbon markets achieve high level environmental and social outcomes will require research that aligns incentives to motivations, and for these elements to be incorporated into policy frameworks (Standish & Hulvey 2014).

Biodiversity offsets

Biodiversity offsets are measurable outcomes for biodiversity conservation that are meant to compensate in full for biodiversity impacts or losses associated with economic development. They are increasingly being delivered in global restoration projects, driven by economic and legislative incentives (Bull *et al.* 2013). Biodiversity offsets are created on the assumption that restoration can recreate ecosystems containing equivalent biodiversity to those lost to development, i.e. that there is 'no net loss' or 'net gain' in biodiversity, which often may not be achievable or feasible (Maron *et al.* 2015).

The blending of biodiversity outcomes and legislative incentives has created inevitable tensions and potential for unintended outcomes. For example, the choice of baseline against which the offset is measured can lock in biodiversity loss if it assumes a business-as-usual scenario of ongoing biodiversity decline (Maron *et al.* 2015). Also, if policy makers have an interest in promoting development, there can be a perverse incentive to have steeper crediting baselines (Pattanayak, Wunder & Ferraro 2010). Bull *et al.* (2015) outlines ways in which social considerations, conservation targets and other drivers can be included in offset policies, and Maron *et al.* (2016) has described the most contentious social issues related to offsets. While biodiversity offsets have the potential to deliver social and ecological benefits, this is heavily dependent on a range of interrelated issues including restoration feasibility, implementation frameworks, social equity, ethical considerations and compliance (Bull *et al.* 2013).

Ecosystem services

Framing restoration in terms of restoring or maintaining ecosystem services provides a clear approach to integrating ecological and social motivations and benefits. A meta-analysis by Benayas *et al.* (2009) showed that global restoration projects increased biodiversity by 44 % and ecosystem services by 25 % compared with (un-restored) degraded sites. In agricultural landscapes, restoration efforts can increase crop pollination and decrease pest invertebrates (Klein *et al.* 2007), whereas in urban areas they can improve air quality, reduce urban noise and increase peoples opportunities to engage with nature (Standish, Hobbs & Miller 2013). Provision of these sorts of ecosystem services can be an important incentive for restoration activities, especially when linked to improved markets and payment schemes for ecosystem services (Barral *et al.* 2015).

The benefits of restoration in providing these ecosystem services are increasingly being recognised (Guerrero, Mcallister & Wilson 2015), although the economic and social outcomes of these services are seldom measured (Salzman *et al.* 2018). Similarly, ecosystem disservices such as competition on crops or gardens from native plant species, increased pest animals (von Döhren & Haase 2015) and groundwater drawdown are rarely evaluated. Yet, obtaining these measures and understanding their financial or intrinsic value or cost is important for determining their social value. Managing or enhancing ecosystem services are already a stated incentive for restoration activities (Hagger, Dwyer & Wilson 2017), although their social and economic benefits may be greater if these benefits could be adequately quantified.

Cultural ecosystem services are worthy of special consideration because of their direct influence on people's motivation towards restoration and stewardship activities (Masterson *et al.* 2017). Cultural ecosystem services include those services that underpin people's quality of life, such as learning, inspiration, and identity support (Díaz *et al.* 2018). Indeed, ecosystem services as a whole have recently been re-categorised by key intergovernmental bodies to recognise that: 1) culture, place, and people mediate how all these services are perceived and experienced, and 2) the different forms of services and motivations to secure them are intertwined (Díaz *et al.* 2018). Importantly, in landscape-scale projects, developing collaborative governance can be an important step in capturing these diverse motivations, and building authentic engagement through relationships of trust (Jedd & Bixler 2015). From a restoration standpoint, cooperation will fail if benefits to individuals and groups are in conflict, or when socio-ecological systems have problem-causing and problem-enhancing feedbacks (Cumming 2018).

A Way Forward

In urban landscapes, understanding the motivations of urban dwellers, and how these can be integrated with a biodiversity conservation ethic and practice, are research priorities. In rural settings, there is a long history of farmer-driven restoration of agricultural landscapes and some understanding of the motivations for this activity. However, a better understanding of the dynamic social context of restoration in these landscapes is required. In mined landscapes, restoration has been largely driven by mine closure legislation but there is scope to more proactively involve local communities, particularly in remote regions to facilitate higher-level ecological and social outcomes for local residents and indigenous communities. Better dialogue between mining companies and communities may also foster social acceptance of mining (Mercer-Mapstone *et al.* 2018).

Mechanisms such as biodiversity offsets and carbon markets can provide economic incentives not to clear habitats, removing the need for restoration in the first place. Improving our ability to predict carbon sequestration resulting from restoration, advancing landscape-scale restoration, and increasing restoration success under a changing climate can greatly enhance the ecological benefits of carbon-funded restoration in degraded landscapes. Similarly, offsets will become more meaningful through advancing best-practice restoration, reducing uncertainty, and increasing the feasibility of restoration. While not covered here specifically, the efficacy of incentives for restoration may hinge on how land tenure and ownership is understood. Where land tenure is uncertain, contested or does not conform to western notions of individual property ownership, financial incentives may prove unsuitable (Kolinjivadi & Sunderland 2012). Finally, assessing the economic and social value of ecosystem services arising from restoration activities, while simultaneously improving the ecological value of restoration activities through best-practice, would greatly increase our ability to generate and evaluate the socio-ecological benefits of restoration projects (Chazdon *et al.* 2017).

Enabling researchers and practitioners to undertake long-term social and ecological monitoring of restored landscapes, and collaborate with indigenous groups and local communities, may deliver greater benefits from future restoration projects. Monitoring should capture ecological and social benefits and engage the local community to ensure ongoing support for long-term management (Guerrero *et al.* 2017). Socio-ecological researchers should collaborate with landowners, land managers and practitioner to innovate and develop restoration best practice.

Identifying both social and ecological restoration goals, seeking to understand how they are interconnected, and incorporating them into restoration decisions would improve shared ecological and social benefits. Collaborative governance can provide a mechanism by which different social and ecological motivations can be captured and integrated into restoration. The scale of restoration and stakeholder heterogeneity are key areas for further research in collaborative governance (Cumming 2018). Continuing to promote research across disciplines for progressing the field of restoration ecology - or possibly better termed - restoration socio-ecology, would greatly increase research outcomes.

Authors' contributions:

SJ and RS conceived the ideas and outlined the contents of the manuscript; KW, VH, BC, LM, SJ, RS, PW, TZ, AG and TE provided examples and wrote sections of the document; SJ, RS, KW, VH, BC and LM reviewed the manuscript. All authors contributed critically to the drafts and gave final approval for publication.

Acknowledgements

Thanks to the local communities and companies who were the basis of these case studies. Some of the research was conducted by the Australian Research Council (CE11001000104) and Linkage project (LP140100176). KAW was supported by an Future Fellowship (FT100100413). Ms Nooshin Torabi and Dr Tein McDonald provided valuable comments on this manuscript.

Data accessibility

Data have not been archived because this article does not use data.

References:

Alexander, S., Aronson, J., Whaley, O. & Lamb, D. (2016) The relationship between ecological restoration and the ecosystem services concept. *Ecology and Society,* **21**.

Barral, M.P., Rey Benayas, J.M., Meli, P. & Maceira, N.O. (2015) Quantifying the impacts of ecological restoration on biodiversity and ecosystem services in agroecosystems: A global meta-analysis. *Agriculture, Ecosystems & Environment,* **202,** 223-231.

Benayas, J.M.R., Newton, A.C., Diaz, A. & Bullock, J.M. (2009) Enhancement of biodiversity and ecosystem services by ecological restoration: a meta-analysis. *Science*.

Bryan, B.A., Runting, R.K., Capon, T., Perring, M.P., Cunningham, S.C., Kragt, M.E., Nolan, M., Law, E.A., Renwick, A.R., Eber, S., Christian, R. & Wilson, K.A. (2016) Designer policy for carbon and biodiversity co-benefits under global change. *Nature Clim. Change,* **6,** 301-305.

Budiharta, S., Meijaard, E., Wells, J.A., Abram, N.K. & Wilson, K.A. (2016) Enhancing feasibility: Incorporating a socio-ecological systems framework into restoration planning. *Environmental Science & Policy,* **64,** 83-92.

Bull, J., Singh, N., Suttle, K., Bykova, E. & Milner-Gulland, E.J. (2015) Creating a frame of reference for conservation interventions. *Land Use Policy,* **49,** 273-286.

Bull, J.W., Suttle, K.B., Gordon, A., Singh, N.J. & Milner-Gulland, E.J. (2013) Biodiversity offsets in theory and practice. *Oryx,* **47,** 369-380.

Carrick, P.J., Erickson, T.E., Becker, C.H., Mayence, C.E. & Bourne, A.R. (2015) Comparing ecological restoration in South Africa and Western Australia: the benefits of a 'travelling workshop'. *Ecological Management & Restoration,* **16,** 86-94.

Chazdon, R.L., Brancalion, P.H., Lamb, D., Laestadius, L., Calmon, M. & Kumar, C. (2017) A Policy-Driven Knowledge Agenda for Global Forest and Landscape Restoration. *Conservation Letters,* **10,** 125-132.

Clewell, A.F. & Aronson, J. (2006) Motivations for the restoration of ecosystems. *Conservation Biology,* **20,** 420–428.

Cooke, B. & Lane, R. (2015) Re-thinking rural-amenity ecologies for environmental management in the Anthropocene. *Geoforum,* **65,** 232-242.

Crosthwaite, J., Malcolm, B., Moll, J. & Dorrough, J. (2008) Future investment in landscape change in southern Australia. *Landscape Research,* **33,** 225-239.

Cumming, G.S. (2018) A Review of Social Dilemmas and Social-Ecological Traps in Conservation and Natural Resource Management. *Conservation Letters,* **11,** e12376.

Díaz, S., Pascual, U., Stenseke, M., Martín-López, B., Watson, R.T., Molnár, Z., Hill, R., Chan, K.M.A., Baste, I.A., Brauman, K.A., Polasky, S., Church, A., Lonsdale, M., Larigauderie, A., Leadley, P.W., van Oudenhoven, A.P.E., van der Plaat, F., Schröter, M., Lavorel, S., Aumeeruddy-Thomas, Y., Bukvareva, E., Davies, K., Demissew, S., Erpul, G., Failler, P., Guerra, C.A., Hewitt, C.L., Keune, H., Lindley, S. & Shirayama, Y. (2018) Assessing nature's contributions to people. *Science,* **359,** 270-272.

Evans, M.C., Carwardine, J., Fensham, R.J., Butler, D.W., Wilson, K.A., Possingham, H.P. & Martin, T.G. (2015) Carbon farming via assisted natural regeneration as a cost-effective mechanism for restoring biodiversity in agricultural landscapes. *Environmental Science & Policy,* **50,** 114-129.

Fielding, K.S. & Hornsey, M.J. (2016) A Social Identity Analysis of Climate Change and Environmental Attitudes and Behaviors: Insights and Opportunities. *Frontiers in Psychology,* **7,** 121.

Fischer, J., Zerger, A., Gibbons, P., Stott, J. & Law, B.S. (2010) Tree decline and the future of Australian farmland biodiversity. *Proceedings of the National Academy of Sciences of the United States of America,* **107,** 19597-19602.

Funk, J.M., Field, C.B., Kerr, S. & Daigneault, A. (2014) Modeling the impact of carbon farming on land use in a New Zealand landscape. *Environmental Science & Policy,* **37,** 1-10.

Gold, W., Ewing, K., Banks, J., Groom, M., Hinckley, T., Secord, D. & Shebitz, D. (2006) Collaborative ecological restoration. *SCIENCE-NEW YORK THEN WASHINGTON-,* **312,** 1880.

Guerrero, A.M., Mcallister, R.R. & Wilson, K.A. (2015) Achieving cross-scale collaboration for large scale conservation initiatives. *Conservation Letters,* **8,** 107-117.

Guerrero, A.M., Shoo, L., Lacona, G., Standish, R.J., Catterall, C.P., Rumpff, L., de Bie, K., White, Z., Matzek, V. & Wilson, K.A. (2017) Using structured decision making to set restoration objectives when multiple values and preferences exist. *Restoration Ecology,* **25,** 853-865.

Hagger, V., Dwyer, J. & Wilson, K. (2017) What motivates ecological restoration? *Restoration Ecology,* **25,** 832-843.

Hobbs, R. (2018) Where to from here? Challenges for restoration and revegetation in a fast-changing world. *The Rangeland Journal,* **39,** 563-566.

Hulvey, K.B., Hobbs, R.J., Standish, R.J., Lindenmayer, D.B., Lach, L. & Perring, M.P. (2013) Benefits of tree mixes in carbon plantings. *Nature Clim. Change,* **3,** 869-874.

Iftekhar, M.S., Polyakov, M., Ansell, D., Gibson, F. & Kay, G. (2016) How economics can further the success of ecological restoration. *Conservation Biology*.

Jedd, T. & Bixler, R.P. (2015) Accountability in Networked Governance: Learning from a case of landscape-scale forest conservation. *Environmental Policy and Governance,* **25,** 172-187.

Jellinek, S., Parris, K.P., Driscoll, D.A. & Dwyer, P.D. (2013) Are incentive programs working? Landowner attitudes to ecological restoration of agricultural landscapes. *Journal of Environmental Management,* **127,** 69-76.

Jellinek, S., Te, T., Gehrig, S., Stewart, H. & Nicol, J. (2016) Facilitating the restoration of aquatic plant communities in a Ramsar wetland. *Restoration Ecology,* **24,** 528–537.

Klein, A.-M., Vaissière, B.E., Cane, J.H., Steffan-Dewenter, I., Cunningham, S.A., Kremen, C. & Tscharntke, T. (2007) Importance of pollinators in changing landscapes for world crops. *Proceedings of the Royal Society of London B: Biological Sciences,* **274,** 303-313.

Koch, J.M. (2007) Alcoa's mining and restoration process in south Western Australia. *Restoration Ecology,* **15.**

Kolinjivadi, V. & Sunderland, T. (2012) A review of two payment schemes for watershed services from China and Vietnam: the interface of government control and PES theory. *Ecology and Society,* **17.**

Maraseni, T.N. & Cockfield, G. (2015) The financial implications of converting farmland to state-supported environmental plantings in the Darling Downs region, Queensland. *Agricultural Systems,* **135,** 57-65.

Maron, M., Bull, J.W., Evans, M.C. & Gordon, A. (2015) Locking in loss: Baselines of decline in Australian biodiversity offset policies. *Biological Conservation,* **192,** 504-512.

Maron, M., Ives, C.D., Kujala, H., Bull, J.W., Maseyk, F.J.F., Bekessy, S., Gordon, A., Watson, J.E.M., Lentini, P.E., Gibbons, P., Possingham, H.P., Hobbs, R.J., Keith, D.A., Wintle, B.A. & Evans, M.C. (2016) Taming a Wicked Problem: Resolving Controversies in Biodiversity Offsetting. *BioScience,* **66,** 489-498.

Martin, L.J., Quinn, J.E., Ellis, E.C., Shaw, M.R., Dorning, M.A., Hallett, L.M., Heller, N.E., Hobbs, R.J., Kraft, C.E., Law, E., Michel, N.L., Perring, M.P., Shirey, P.D. & Wiederholt, R. (2014) Conservation opportunities across the world's anthromes. *Diversity and Distributions,* **20,** 745-755.

Masterson, V.A., Stedman, R.C., Enqvist, J., Tengö, M., Giusti, M., Wahl, D. & Svedin, U. (2017) The contribution of sense of place to social-ecological systems research: a review and research agenda. *Ecology and Society,* **22.**

McDonald, T., Gann, G.D., Jonson, J. & Dixon, K.W. (2016) *International standards for the practice of ecological restoration - including principles and key concepts*. Society for Ecological Restoration, Washington DC.

Menz, M.H., Dixon, K.W. & Hobbs, R.J. (2013) Hurdles and opportunities for landscape-scale restoration. *Science,* **339,** 526-527.

Mercer-Mapstone, L., Rifkin, W., Louis, W.R. & Moffat, K. (2018) Company-community dialogue builds relationships, fairness, and trust leading to social acceptance of Australian mining developments. *Journal of Cleaner Production,* **184,** 671-677.

Mitchell, C.D., Harper, R.J. & Keenan, R.J. (2012) Current status and future prospects for carbon forestry in Australia. *Australian Forestry,* **75,** 200-212.

Mumaw, L. (2017) Transforming urban gardeners into land stewards. *Journal of Environmental Psychology,* **52,** 92-103.

Mumaw, L. & Bekessy, S. (2017) Wildlife gardening for collaborative public–private biodiversity conservation. *Australasian Journal of Environmental Management,* **24,** 242-260.

Mumaw, L., Maller, C. & Bekessy, S. (2017) Strengthening wellbeing in urban communities through wildlife gardening. *Cities and the Environment,* **10**.

Muradian, R., Arsel, M., Pellegrini, L., Adaman, F., Aguilar, B., Agarwal, B., Corbera, E., Ezzine de Blas, D., Farley, J. & Froger, G. (2013) Payments for ecosystem services and the fatal attraction of win-win solutions. *Conservation Letters,* **6,** 274-279.

Nielsen-Pincus, M., Ribe, R.G. & Johnson, B.R. (2015) Spatially and socially segmenting private landowner motivations, properties, and management: A typology for the wildland urban interface. *Landscape and Urban Planning,* **137,** 1-12.

Pattanayak, S.K., Wunder, S. & Ferraro, P.J. (2010) Show Me the Money: Do Payments Supply Environmental Services in Developing Countries? *Review of Environmental Economics and Policy,* **4,** 254-274.

Polyakov, M. & Pannell, D.J. (2016) Accounting for private benefits in ecological restoration planning. *Learning from agri-environment schemes in Australia. Investing in biodiversity and other ecosystem services on farms* (eds D. Ansell, F. Gibson & D. Salt). ANU Press, Canberra, Australia.

Salzman, J., Bennett, G., Carroll, N., Goldstein, A. & Jenkins, M. (2018) The global status and trends of Payments for Ecosystem Services. *Nature Sustainability,* **1,** 136-144.

SERA (2016) National standards for the practice of ecological restoration in Australia. Society for Ecological Restoration Australasia, Australia.

Shackelford, N., Miller, B.P. & Erickson, T.E. (2017) Restoration of open-cut mining in semi-arid systems: A synthesis of long-term monitoring data and implications for management. *Land Degradation & Development,* **25,** 605-617.

Standish, R.J., Hobbs, R.J. & Miller, J.R. (2013) Improving city life: options for ecological restoration in urban landscapes and how these might influence interactions between people and nature. *Landscape Ecology,* **28,** 1213-1221.

Standish, R.J. & Hulvey, K.B. (2014) Co-benefits of planting species mixes in carbon projects. *Ecological Management & Restoration,* **15,** 26-29.

UN (2015) Transforming our World: The 2030 Agenda for Sustainable Development. (ed. U. Nations). New York City, USA.

von Döhren, P. & Haase, D. (2015) Ecosystem disservices research: a review of the state of the art with a focus on cities. *Ecological Indicators,* **52,** 490-497.