Why Australia needs an Ecosystem Restoration Strategy

LUCY E. COMMANDER[1,2]*, AMELIA J. MARTYN YENSON[1,3], DAVID J. COATES[1,2], KEITH BRADBY[4], BOB MAKINSON[1], CATHERINE A. OFFORD[3], LINDA BROADHURST[1], TONY AULD[1] AND PAUL GIBSON-ROY[5]

[1]Australian Network for Plant Conservation.
[2]The University of Western Australia, Crawley WA 6009.
[3]The Australian PlantBank, Australian Institute of Botanical Science, Australian Botanic Garden, Mount Annan NSW 2567, Australia.
[4]Gondwana Link, Albany WA 6332.
[5]Western Sydney University.
*Corresponding author: drlucycommander@gmail.com

Australia needs a national strategy for ecosystem restoration.

2021 marks the beginning of the United Nations Decade on Ecosystem Restoration[1] which aims to prevent, halt and reverse the degradation of ecosystems globally. In Australia, land use practices and invasive species are two of the most pervasive threats that have caused land degradation. We owe it to future generations of Australians to halt and repair as much of this environmental damage as we can, especially given the new and acute stresses that climate change is now imposing. Currently, degraded Australian ecosystems are being restored by organisations and individuals at local and regional scales, but with limited co-ordination and prioritisation at a national level, and a continuation (outside of reserves) of the same systemic settings of weakly restricted land-use regulation that allowed the damage to occur. Given the 'global rallying cry' to heal the planet, and to match efforts that will emerge in 2022 in the final agreed post-2020 Global Biodiversity Framework, now is the time to develop a national ecosystem restoration strategy for Australia.

Existing projects restoring ecosystems at the landscape scale provide examples that could be expanded or applied elsewhere. For instance, Gondwana Link[2], Great Eastern Ranges Initiative[3], Victorian Northern Plains Grasslands Protected Area Network, the Tasmanian Midlands Restoration Project[4], and projects by members of Australian Land Conservation Alliance[5].

Biodiversity conservation in Australia[6] has focused on both threatened species and ecological communities (*i.e.,* species and systems considered to be most at risk of extinction), along with conservation towards a representative set of ecosystems in the reserve network and mitigating threatening processes. In contrast, ecological restoration (the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed; Gann 2019) is largely focused on ecosystems and landscapes under the assumption that habitat loss and land degradation are recoverable. Given the rising number of threatened species and threatened ecological communities, and the limitations of the reserve network, Australia also needs coordinated restoration that is integrated with conservation that includes all stakeholders to overcome any disconnect between those doing 'conservation' and those doing 'restoration'. A similar gap also exists between research and practice, with the Australian Network for Plant Conservation (ANPC) working hard to facilitate communication between all of these groups.

Like the disconnect between conservation and restoration, plants and animals may also be focused on separately rather than together. For instance, many plant biologists complain about 'plant blindness' (Balding and Williams 2016) – that is, the tendency of people to focus on threatened animals, particularly charismatic fauna (*e.g.,* koalas, bilbies, whales, black cockatoos). Whereas restoration programs often concentrate on establishing/returning a basic suite of plant species or removing a threatening process (*e.g.,* invasive plant control), animal biologists bemoan the fact that fauna is routinely left out of restoration projects (Woinarski 2021; Cross *et al.* 2020). By considering ecosystems and landscapes as a whole, we have the opportunity to both conserve threatened species (flora and fauna), as well as restore the ecological communities and processes (such as pollination) on which they depend.

1 https://www.decadeonrestoration.org/
2 https://gondwanalink.org/
3 https://ger.org.au/
4 https://www.bushheritage.org.au/places-we-protect/tasmania/midlands
5 https://alca.org.au/members/
6 https://www.awe.gov.au/environment/epbc/what-is-protected/biodiversity-conservation

While government funding at all levels has been one of the key drivers, restoration has also been funded by private entities (*e.g.,* for carbon credits), the resource industry undertaking restoration as part of conditions set by government, and NGOs. However, some funding programs look at each individual project on its merits, devoid of wider context. Many programs do not consider the continent as a whole and fail to prioritise ecosystems and/or landscapes where the need is greatest, or where interventions could make the most difference. Historically, restoration funding has overwhelmingly favoured simplistic tree and shrub plantings (*e.g.,* 20 million trees), rather than returning the structure, function and diversity unique to each ecosystem. They also ignore the potential of other approaches such as natural or assisted regeneration (which includes the management of invasive plants and feral animals; Figure 1). Perhaps it is because inputs (*e.g.,* number of trees in the ground) are easier to measure in the project time frame than outputs (*e.g.,* long term survival and improved ecosystem function)? Despite calls for large-scale restoration in highly degraded landscapes (Mappin *et al.* 2021) a further and more serious consequence of this long-term focus on low diversity restoration is that the restoration sector itself has very poor capacity to undertake these works (Gibson Roy *et al.* 2021b).

What do we need?

1. A prioritisation of where and how to restore.

Prioritisation tools to determine where and how to restore could focus on a variety of parameters, including (but not limited to):

- Identifying which ecosystems are most stressed.
- Establishing essential linkages in highly fragmented landscapes (so long as the linkages do not accelerate the movement of threats).
- Providing habitat for threatened species.
- Providing conservation benefits for survival and persistence of different ecosystems and species.
- Identifying places where there are the biggest opportunities.
- Improving ecosystem services (*e.g.,* combatting salinity, improving clean water, carbon sequestration, urban heat mitigation, microbiome, human health benefits (mental and physical), flood mitigation, sediment trapping, increasing aquifer recharge, increasing pollination, increasing rainfall through increased evapotranspiration etc.).

Another priority is to better understand where in Australia restoration is being done well, and determine firstly what success factors are to do with bio-physical advantages, and what are the results of better practice – and then to generalise the latter to other areas if possible. This needs to be balanced with investigation of lower-success regions or approaches to determine the reasons, recognising that all areas need some investment. Also, 'failures' can be a result of innovation, and if well documented, can lead to adaptive management.

To inform planning, knowledge about the combination of restoration approaches (*e.g.,* seeding, planting, threat mitigation, replacing natural disturbance regimes; Figure 1) that are most effective for particular species and contexts is required to improve the likelihood that funding will be cost-effective and produce successful outcomes. Certainly, one lesson coming from current approaches is that any prioritisation at scale needs to include a degree of 'discretionary opportunism' – where support, or lack of opposition, from local communities is a factor, along with availability of various funding streams, and where property acquisition is a mechanism, market conditions and the relative priority of other land uses.

Planning and prioritisation requires the compilation of baseline ecological data at a variety of scales using multiple methods, to augment existing information collated by the State of the Environment Report[7], Atlas of Living Australia[8], TERN[9], NSW Bionet[10], and others.

2. Connect efforts to conserve threatened species, mitigate threats and restore ecosystems.

While there has been the view that restoration ecology is a discipline in its own right with philosophical and operational differences from conservation biology (Young 2000), it is becoming increasingly clear that an integrated approach is needed to maintain and restore biodiversity. Plant and animal species are often threatened due to habitat loss. Working in collaboration to both restore habitat and increase the number of individuals of threatened species would provide significant benefits. For instance, where feasible, threatened plant species can be included in ecological restoration projects (as seed or as tubestock). Recovery teams, government agencies and NGO groups undertaking threatened species translocations or seeking to improve habitat condition for threatened species could connect with organisations undertaking ecological restoration, including threat mitigation. Single and multi-species recovery plans, conservation advices, threat abatement plans, translocation plans and planting schemes could all be interconnected at a regional level. These connections would create cost-sharing opportunities during both implementation and monitoring, as well as improving the species mix and create local information-sharing hubs of staff, volunteers and community members.

7 https://www.awe.gov.au/science-research/soe
8 https://www.ala.org.au/
9 https://www.tern.org.au/
10 https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/nsw-bionet

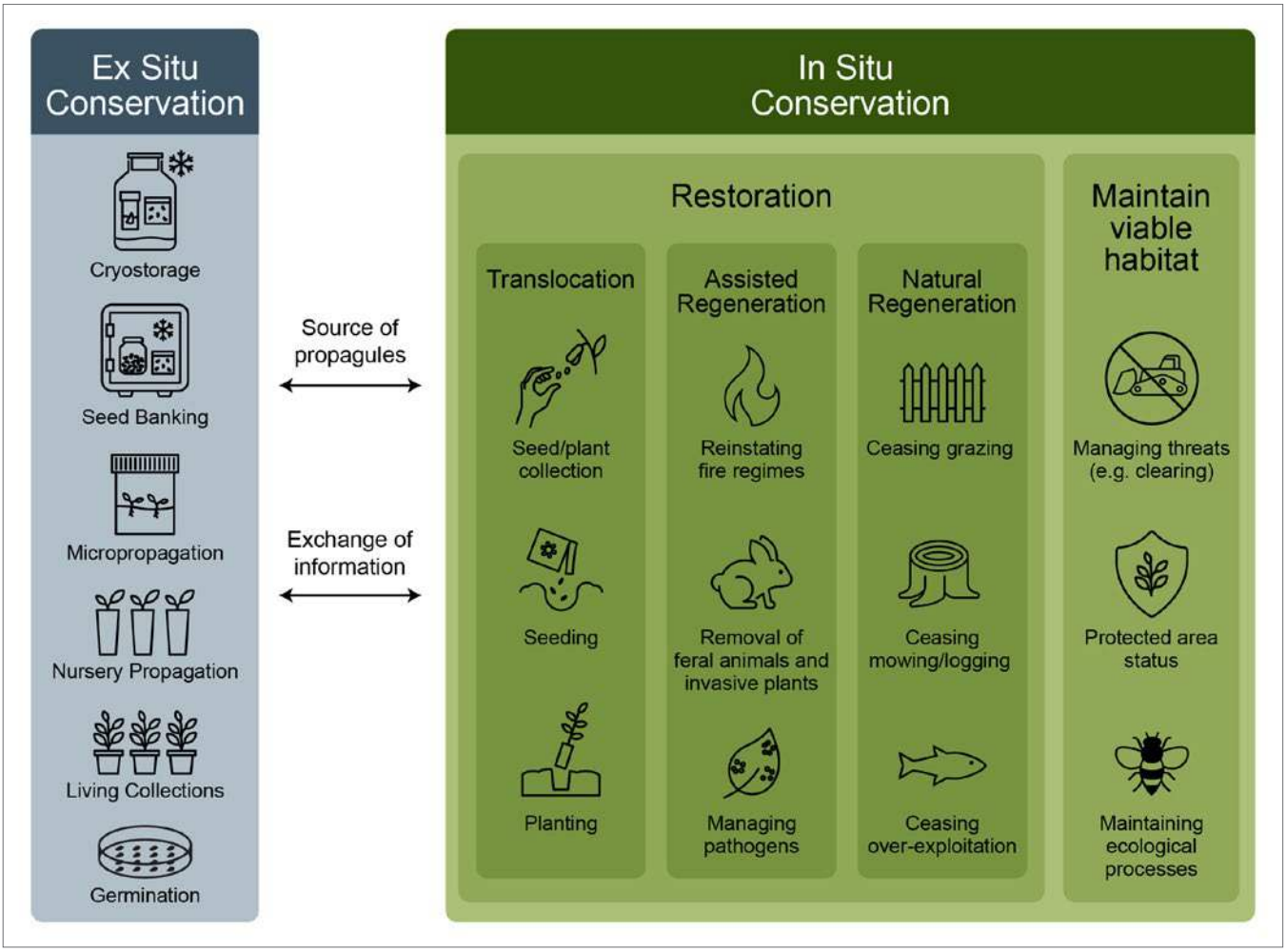

Figure 1. Is there really a difference between conservation and restoration? Is restoration an action within conservation? Or vice-versa? These sectors could be better connected. Image: Commander 2021a; Martyn Yenson *et al.* 2021; CAM graphics

The interconnected elements of both conservation and restoration are recognised in the recent editions of the Germplasm Guidelines (Martyn Yenson *et al.* 2021), Florabank Guidelines (Commander 2021a) and Translocation Guidelines (Commander *et al.* 2018) (Figure 1).

3. Re-think funding models.

Short-term grant rounds may be considered a necessity due to established budget cycles or allocated resources, but providing funding that must be spent within 1-3 yrs (as is typical with both private and government funding) is not ecologically sound or practical at an on-ground level. For instance, if land managers want to control weeds, a 5-7 year commitment may be required to deplete the seed bank. If land managers don't expect ongoing funding, they are unlikely to start a weed management program, because just doing one year will likely be a waste of funds.

Projects that involve seeding and planting require long timeframes (Dillon *et al.* 2018; Commander 2021a), and can take at least one year to plan, and then several more to implement. Consistent advice from the seed industry is that to economically achieve a broad range of species for restoration plantings at large scale can take several years. Both collecting from the wild and developing seed production areas (SPAs) require long term planning. SPAs can help meet seed needs in large-scale restoration (Gibson-Roy *et al.* 2021a) but developing SPAs and establishing crops to full production can take up to five years. Collected seeds from either the wild or SPAs then need to be cleaned, and it can take six months or more to propagate seedlings if restoration is done by planting. Typical funding models are also often out of sync with Australia's seasonal changes. For instance, funding for WA's Community Stewardship Grants[11] (small grants are for just 18 months, larger grants are up to 3 years) are announced in October/November for projects commencing on or after 1 January, which is too late for people to order seed and/or seedlings for propagation and planting in July of that year (typical planting season in south-west WA).

11 https://www.wa.gov.au/service/community-services/grants-and-subsidies/apply-community-stewardship-grant

Nor does single year funding allow for the prior planning and resourcing of projects that may be needed to prepare for stochastic events such as bushfires, where it is prudent to have seed in storage, and have the ability to rapidly act to control post-fire weeds. In addition, not all species produce seeds each year, due to species-specific or climatic factors, hence single year funding may not allow for the anticipatory collection of these species when they are available and store them under conditions that maintain viability until they are required.

Most funding timelines do not allow for follow up maintenance and monitoring, and this needs to be included for a number of years after planting. Annual grant applications and the low likelihood of success in many of these is debilitating for the organisations and individuals involved. We suggest simplified EOI processes and robust final rounds would be an improvement to current processes, along with longer grant time frames and sensible reporting intervals to give practitioners more time for planning, implementing and following up on-ground activities and reduce the burden of office time seeking funds. Grant recipients should have up to a minimum of 5 years to spend these funds so that they can adequately plan and undertake activities to ensure success.

The scale of restoration needed across Australia requires an effort that stimulates greater expenditure from both public and private funding streams. A national strategy would need to address the issue of resourcing the scale of restoration needed.

4. Spend money on capacity building to improve practices and outcomes

Much restoration is done by landcare, coastcare, bush regeneration and community groups in urban bushland, who may be landowners or volunteers. Equally, restoration is also done by those in areas such as the mining industry, NRM sector, consultants and Main Roads Departments. These people may or may not have a background in restoration ecology, may not be trained in seed procurement, or understand the concepts of natural regeneration. We need to make sure that all these people and groups have access to the best knowledge and resources available.

We need to provide better resources for capacity building, at a national, state and regional level. Capacity building in relation to knowledge may be in the form of technical guidelines, fact sheets, face to face workshops, upskilling trainers or funding a knowledge broker who can connect people to publications or knowledge-holders then answer follow-up questions. However, the sector needs much more than improved information flow. To move beyond low diversity restoration, increased investment in infrastructure and restoration technologies is required to enable the sector to develop the capacity to undertake landscape-scale restoration. Stronger markets for restoration would also mean practitioners are better paid for their work and we are more able to retain a skilled and motivated work force.

Equally, investing in training people seeking restoration qualifications from certificate to degree level makes good sense, equipping the next generation with the skills and knowledge they need to undertake restoration in a changing climate. Well-meaning 'environmental green jobs' programs of recent decades didn't really do this, they largely created short-term on-ground positions for unemployed or socially disadvantaged people. This short-term benefit often meant private practitioners were excluded from work (with many forced to leave the sector). Stable restoration markets would also create stable career paths so the sector could take on and retain a suitably trained, skilled and motivated workforce (rather than the current aging and poorly trained one).

Indigenous ranger programs and indigenous seed collection enterprises are opportunities for employment and the continuation of generations of caring for Country. A national restoration strategy should recognise and celebrate traditional ecological knowledge, provide local employment, and empower and build capacity in communities.

Who should do the capacity building? Providing separate grant programs for training so they are not competing with on ground works would be beneficial. In fact, capacity building and coordination is often ineligible for funding. Perhaps a national restoration training network with representatives from each state and sector (university, TAFE, government at all levels, landcare, NGOs, zoos, botanic gardens, mining, land development, carbon capture projects). A network could be responsible for collating information for on-ground needs, and connecting with experts who can deliver training to meet those needs. This would improve communication flow and knowledge-transfer. Also, synergising efforts to get the most out of a small workforce: those providing training can use restoration areas to train people (for instance, teaching staff at Murdoch University in Western Australia take students to a local restoration site[12] to teach them how to do surveys – it's a win-win situation as students receive practical training and the land managers receive the survey information).

Over the last 30 years, the Australian Network for Plant Conservation has played a role in capacity building through publications, workshops and conferences. Furthermore, the ANPC's Australian Native Seed Survey Report (Hancock *et al.* 2020) provides recommendations for building capacity across the sector.

12 https://rehabilitatingroe8.org/wp-content/uploads/2019/07/Murdoch-University-Vegetation-monitoring-of-Roe-8-.pdf

5. Develop regional restoration guidelines for planning, monitoring and ongoing management

Planning guidelines and templates that include checklists would assist practitioners to ensure that each restoration project consider and address all elements required for restoration, as well as the timeframe for each element. This would make it easier for funding bodies to assess the plan, though caution will be needed to ensure this can proceed over lengthy timeframes. There are templates for translocation proposals (Nally *et al.* 2018), so a suite of similar documents could be developed for restoration. Projects can follow the same decision-making process and proforma irrespective of the restoration approach (natural or assisted regeneration, planting or seeding) though timelines may be adjusted. Guidelines will then facilitate a process to determine the most appropriate approach, and if that approach is natural or assisted regeneration (which includes threat mitigation), then funds need not be spent on planting.

Regional Restoration Standards could follow the National and International Standards for Ecological Restoration (Standards Reference Group SERA 2021; Gann *et al.* 2019) and the Australian Translocation Guidelines (Commander *et al.* 2018), with the Florabank Guidelines (Commander 2021a) and Germplasm Guidelines (Martyn Yenson 2021) as supporting documents for sourcing seed and other plant material. Hence, with regional level strategising and synchronising of restoration needs, each region and restoration program could develop its own restoration planning document. These 'How To' guides could include specific advice on the local reference ecosystems, threatening processes, and how to implement various restoration approaches.

Do related strategies already exist?

Various national strategies and plans exist. There is Australia's Strategy for Nature[13], Threatened Species Strategy[14], Threatened Species Action Plan Consultation Paper, Threat Abatement Plans[15], National Vegetation Framework[16], and the draft Strategy for the Australian Seed Sector[17], but these could be better linked and supported by an overarching document outlining the direction for restoration. In addition, various legislation protects species and ecosystems, such as the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and a range of legislation for each State and Territory (see Florabank Guidelines Module 3 (Cuneo *et al.* 2021) for list of state and territory legislation). Additionally, a number of private organisations have developed strategic approaches across priority areas (such as Gondwana Link and Great Eastern Ranges) or to match specific funding opportunities (such as for large scale carbon sequestration).

Other countries have national or regional strategy documents (Commander 2021b), such as the USA's National Seed Strategy for Rehabilitation and Restoration 2015–2020 (Plant Conservation Alliance 2015), EU Biodiversity Strategy to 2020[18], Finland's Saving Nature for People[19], and Biodiversity 2020: A strategy for England's wildlife and ecosystem services[20].

However, there is no national strategy in Australia to provide the support needed for co-ordinated and prioritised restoration of degraded ecosystems across the country which is integrated with conservation of species and places.

Summary

So, what do we need in the National Restoration Strategy?

- Where – a prioritisation of where we need to restore ecosystems, as well as a comprehensive list of all places in need of restoration, rather than an ad-hoc approach to restoration.
- What – baseline data on the current state of the ecosystems and information on reference communities so goals and targets can be established for individual restoration projects. A focus on restoring biodiverse ecological communities, rather than just single species replacement or simplistic, low diversity plantings.
- How – recognition and funding of different yet complementary approaches for restoration – natural regeneration, assisted regeneration, translocation, and complementary actions such as *ex situ* conservation, and identification of the appropriate approach(es) for each context. Publication of guidelines for these approaches, as well as guidelines for scaling up approaches, *e.g.,* large scale direct seeding. Some of these guidelines exist, however, regional guides with location-specific information and knowledge brokers are likely to be required. Investment and capacity building to enable landscape-scale restoration.
- Who – both a ground up and top down approach. We need to identify all of the actors including those on ground, those involved in education and training, policy and governance, large networks and associations. We need experts in conservation prioritisation, environmental economics,

13 https://www.awe.gov.au/environment/biodiversity/conservation/strategy
14 https://www.awe.gov.au/environment/biodiversity/threatened/publications/threatened-species-strategy-2021-2031
15 https://www.awe.gov.au/environment/biodiversity/threatened/threat-abatement-plans
16 https://www.awe.gov.au/agriculture-land/land/publications/australias-native-vegetation-framework
17 https://www.greeningaustralia.org.au/wp-content/uploads/2021/08/3.01.pdf
18 https://ec.europa.eu/environment/nature/biodiversity/strategy_2020/index_en.htm
19 https://ym.fi/en/national-biodiversity-policy
20 https://www.gov.uk/government/publications/biodiversity-2020-a-strategy-for-england-s-wildlife-and-ecosystem-services

landscape-scale restoration, threatened species and communities, volunteer management, baseline assessment of ecosystems, restoration practitioners, and *ex situ* conservation. Using this collective expertise, and a co-ordinated approach, we could develop and enact a comprehensive plan if funding is available.

- Why – identify and communicate all the benefits of restoration: decreasing extinction risk, improving ecosystem services, providing economic benefits (*e.g.,* 'forest products' and employment) and contributing to fulfilling international obligations such as the UN Convention on Biological Diversity's (CBD) Post-2020 Global Biodiversity Framework and Global Strategy for Plant Conservation; and the Paris Agreement.
- When – now, but also a long-term plan (10 years and beyond) to capitalise on the UN Decade on Ecosystem Restoration and the CBD 2050 Vision for Biodiversity. Individual restoration projects require sufficient time for adequate planning, preparation, implementation, monitoring, adaptive management and reporting.

Australia needs a national strategy for ecosystem restoration. With 30 years of the Australian Network for Plant Conservation, let's develop a national strategy to restore our ecosystems over the next decade, so in the 40th anniversary edition, we can reflect on our positive, collaborative contribution.

References

Balding, M. and Williams, K.J. (2016). Plant blindness and the implications for plant conservation. *Conservation Biology* **30**(6): 1192-1199.

Commander, L.E. (Ed.) (2021a). *Florabank Guidelines (2nd edn)*. Florabank Consortium, Australia.

Commander, L.E. (2021b). *Successful international restoration systems.* Greening Australia, Melbourne. Available at: https://www.greeningaustralia.org.au/wp-content/uploads/2021/07/2.15.pdf

Cross, S.L., Bateman, P.W. and Cross, A.T. (2020). Restoration goals: Why are fauna still overlooked in the process of recovering functioning ecosystems and what can be done about it? *Ecological Management and Restoration* **21**(1): 4-8.

Cuneo, P., Grose, D., Neilly, B. and Sutton, T. (2021). Florabank Guidelines Module 3 – Approvals, Principles and Standards for Seed Collection. In: Commander, L.E. (Ed.) *Florabank Guidelines* (2nd edn). Florabank Consortium: Australia.

Dillon, R., Benwell, A., Emery, N., Monks, L. and Offord, C.A. (2018). Pre-translocation preparation. In: Commander, L.E., Coates D.J., Broadhurst, L., Offord, C.A., Makinson, R.O. and Matthes, M. (Eds.) *Guidelines for the Translocation of Threatened Plants in Australia* (3rd edn). Australian Network for Plant Conservation, Canberra.

Gann, G.D., McDonald, T., Walder, B., Aronson, J., Nelson, C.R., *et al.* (2019). International principles and standards for the practice of ecological restoration (2nd edn). *Restoration Ecology* **27**(S1): S1-S47.

Gibson-Roy, P., Breed, M., Driver, M., Harrison, P., Logie, S., Zwiersen, T. and Berryman, T. (2021a). Florabank Guidelines Module 7 - Seed Production. In: Commander, L.E. (Ed.) *Florabank Guidelines*. Florabank Consortium, Australia.

Gibson-Roy, P., Hancock, N., Broadhurst, L. and Driver, M. (2021). Australian native seed sector practice and behavior could limit ecological restoration success: further insights from the Australian Native Seed Report. *Restoration Ecology* **29**(7): e13429.

Hancock, N., Gibson-Roy, P., Driver, M., Broadhurst, L. (2020). *The Australian Native Seed Sector Survey Report*. Australian Network for Plant Conservation, Canberra. Available at: https://www.anpc.asn.au/wp-content/uploads/2020/03/ANPC_NativeSeedSurveyReport_WEB.pdf

Martyn Yenson, A., Offord, C.A., Meagher, P.F., Auld, T., Bush, D., Coates, D.J., Commander, L.E., Guja, L.K., Norton, S.L., Makinson, R.O., Stanley, R., Walsh, N., Wrigley, D. and Broadhurst, L. (Eds) (2021). *Plant Germplasm Conservation in Australia - strategies and guidelines for developing, managing and utilising ex situ collections* (3rd edn). Australian Network for Plant Conservation Inc, Canberra.

Nally, S., Greeshaw, F., Bickerton, D., Reiter, N. and van Leeuwen, S. (2018). Policy, approvals and translocation proposals. In: Commander, L.E., Coates D.J., Broadhurst, L., Offord, C.A., Makinson, R.O. and Matthes, M. (Eds.) *Guidelines for the Translocation of Threatened Plants in Australia* (3rd edn). Australian Network for Plant Conservation, Canberra.

Plant Conservation Alliance (2015). *National Seed Strategy for Rehabilitation and Restoration 2015–2020*. US Department of the Interior, Bureau of Land Management, Washington (DC).

Standards Reference Group SERA (2021). *National Standards for the Practice of Ecological Restoration in Australia.* Edition 2.2. Society for Ecological Restoration Australasia. Available at: www.seraustralasia.org.

Woinarski, J. (2021). *The challenge, opportunity and benefits of fauna restoration in Australia*. Society for Ecological Restoration Australasia conference presentation. Available at: https://www.youtube.com/watch?v=o4hbXMvLXgA

Young, T.P. (2000). Restoration ecology and conservation biology. *Biological Conservation* **92**: 73-83.

Editor's note: this article was submitted in 2021, hence some information may be out of date by the time of publication. The author would like to thank the input of several reviewers.