

PROJECT PHOENIX



PSST... EVERYTHING YOU WANTED TO KNOW ABOUT NATIVE SEED LICENSING

JUNE 2021

First published 2021
Project Phoenix
Greening Australia (National Office)
Level 3, 349 Collins Street
Melbourne VIC 3000
Tel: 1300 886 589
Email: phoenix@greeningaustralia.org.au
Website: www.greeningaustralia.org.au

ISBN: xxx-x-xxxxxx-xx-x (Book)
xxx-x-xxxxxx-xx-x (epub)

Author: Zoe Birnie, Technical Lead, Greening Australia
Title: Psst... Everything you wanted to know about native seed licensing
Notes: Includes bibliographical references

Copyright © Project Phoenix 2021
Cover by Kerry O'Flaherty, Design Consultant
Internal design by Puddingburn Publishing Services
Proofread by Puddingburn Publishing Services

This report is copyright. Except for private study, research, criticism or reviews, as permitted under the *Copyright Act 1968* (Cth), no part of this report may be reproduced, stored in a retrieval system or transmitted in any form or by any means without prior written permission. Enquiries should be made to phoenix@greeningaustralia.org.au.

Project Phoenix is supported by the Australian *Government's Wildlife and Habitat Bushfire Recovery program* and co-ordinated by Greening Australia.



Australian Government



Across all of our Project Phoenix activities and actions we pay respect to the Traditional Owners and Custodians of the lands and waters on which we work. We honour the resilience and continuing connection to country, culture and community of all Aboriginal and Torres Strait Islander people across Australia. We recognise the decisions we make today will impact the lives of generations to come.

ACKNOWLEDGEMENTS

This paper would not have been possible without the guidance and support of Samantha Craigie. This research was supported by interviews with on-ground seed collection practitioners and state Department professionals and I am very grateful for their contribution. The expertise of all contributors improved this paper in many ways, and saved me from many errors. This paper was written to the best of my ability with the resources available, but I recognise errors may still exist and I welcome feedback on those.

Greening Australia would like to acknowledge the hard work and dedication of the Project Phoenix Management Team: Samantha Craigie, Patricia Verden, Brian Ramsay, Irene Walker, Courtney Sullivan, Rowan Wood, Paul Della Libera, Kim Philliponi and Ella Campen.

CONTENTS

Executive summary	5
Introduction	6
Objectives	10
Method.....	10
Literature review	10
Interview of key seed sector individuals	10
Results	13
Legislative frameworks.....	18
Compliance.....	34
Other considerations.....	40
Recommendations: Pathway to a system fit for purchase	43
Summary	46
References.....	47

EXECUTIVE SUMMARY

Globally, almost all ecosystems are in decline and are becoming increasingly fragmented (Tulloch et al. 2016; Lindenmayer, 2007). Australia's biodiversity is also in decline with 1,300 flora species and more than 80 ecological communities listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*. Australia has one of the highest land clearing rates in the world, with approximately 44 per cent of forests and woodlands cleared since European settlement (Metcalf & Bui, 2016) which has contributed significantly to the degradation of the landscape and fragmentation of remnant vegetation. The overall decline in Australia's environment has coincided with a marked increase in restoration activities, however, the environmental pressures continue to outweigh investment in conservation (Hancock et al. 2020 as cited in Cresswell and Murphy 2017 & Metcalfe and Bui 2017).

Climate change is adding extra pressure to the system in various ways: increased intensity and frequency of bushfire seasons; reduced water availability; and rising air and soil temperatures (Broadhurst et al. 2016). For example, the recent 2019–20 'Black Summer' bushfires burned more than 19 million hectares and the intensity of these fires has raised concerns over the ability of vegetation to recover (CSIRO, 2020). This is because seed stored either in the canopy, soil seed bank or epicormic buds may have been killed by the extreme temperatures of the fires, therefore preventing reproductive events.

In Australia, the majority of seed used for restoration projects is harvested from wild populations (Broadhurst et al. 2015). However, there is a growing consensus that harvesting from wild populations will not satisfy the growing demand for seed as restoration activities scale up across the country. This research was aimed at understanding the intersection of licensing systems and harvesting native seed from wild populations. This review is the first of its kind to take a deep dive into the licensing systems across Australia and provides some useful insights into the future needs of the native seed industry.



Seed licensing systems vary across the different states and territories in Australia, but all systems are inherently complex. Native flora is managed at the state/territory level and therefore falls under relevant state/territory legislation. There is an intersection with federal legislation for matters of 'national significance' (i.e. species listed as threatened under the *EPBC Act*).

The licensing systems in general are built around three key factors: (i) threatened species; (ii) commercial or non-commercial activity; and (iii) land tenure. It is generally prohibited to collect seed from threatened species without a licence, however there are slight discrepancies. For example, Queensland's licensing system has an exemption for 'species of least concern'. It was understood that licences are required to harvest seed for sale or commercial activity. There is some confusion over how the restoration sector fits into this category, with some

licensing systems including restoration as a commercial activity and others not. This highlights a disjunction between historical small-scale, community restoration projects and large-scale landscape restoration projects. Furthermore, it is usual to be required to acquire a state/territory licence in addition to local council permits (public land), landholder permission (private land) as well as other permits (e.g. Local Land Services, Forestry, National Parks). Land access was considered too complex for this study and should be further explored in a second body of work.

Insights from our industry interviews again highlight the complexity of the licensing systems, and a consensus was drawn that the systems may be fit for purpose for small-scale restoration but are not conducive to scaling up restoration projects or providing high quality seed for those projects. This report provides several recommendations on creating a system that is fit for purpose including: technology and agile data management systems; development of a simplified system with a single licence that is supported by industry standards and a Code of Conduct; and increased cross-sector collaboration through the establishment of a native seed committee.

INTRODUCTION

Large-scale landscape clearing for urban development and agriculture are two drivers of biodiversity loss and habitat fragmentation which have been widespread across the world (Breed et al. 2012). Over recent decades, there has been a global shift towards restoring degraded landscapes for both positive biodiversity outcomes and carbon offset programs. The rapid growth in biodiversity and carbon credit markets has been a significant driver for the increased demand for revegetation projects (Breed et al. 2012).

Australia has more than 21,000 species of plants, with a large proportion of those species protected and managed under state/territory legislation as well as federal legislation for matters of 'national significance' (Broadhurst & Coates, 2017).



Globally, almost all ecosystems are declining in total extent and are becoming increasingly fragmented (Tulloch et al. 2016; Lindenmayer, 2007). Australia's biodiversity is in decline, with over 1,300 flora species and more than 80 ecological communities listed as threatened under the *EPBC Act* (Department of Agriculture, Water and Environment, 2020).

Australia has one of the highest land clearing rates in the world, with approximately 44 per cent of forests and woodlands cleared since European settlement (Metcalf & Bui, 2016). Deforestation rates decreased over the last two decades; however, between 2010 and 2015, around 1 million hectares of land was cleared, representing a significant loss of vegetation and habitat fragmentation (Metcalf & Bui, 2016), with some areas affected by both high loss and high fragmentation (Tulloch et al. 2016). Vegetation fragmentation and a decrease in patch size can reduce genetic diversity and increase the chances of inbreeding depression and

bottleneck effects (Broadhurst et al. 2017). Additionally, for most species, flowering, seed production and seed release varies year to year. Therefore, reliance on wild seed may have implications for the area and diversity of species able to be used for revegetation (Broadhurst et al. 2017).

Although, Australia's rate of ecological restoration has also increased significantly over this time, the scale of environmental pressures continues to outweigh investment in conservation (Hancock et al. 2020 as cited in Cresswell and Murphy 2017 & Metcalfe and Bui 2017). That being said, the marked increase in landscape-scale conservation and biologically diverse restoration is heavily reliant on native seed.

Unfortunately, the Australian native seed sector which comprises individuals, businesses and government faces several challenges in collecting and meeting the increased demand for native seed including a lack of policy that accurately reflects the needs of the seed sector.



In comparison to other countries such as the US who has 'The American Seed Trade Association' and Europe with the 'European Native Seed Producers Association', Australia lacks a national governance body for native seed. The exception to this is the Revegetation Industry Association Western Australia (RIAWA), which is an independent governance body for the state's native seed sector (Hancock et al. 2020).

Additionally, the *FloraBank Guidelines* were developed as a collaborative effort between Greening Australia, the Australian Government, and the Commonwealth Scientific and Industrial Research Organisation (CSIRO). Since the ten guidelines were developed, they have remained the benchmark for best practice for collection, treatment and storage of native seed in Australia. These guidelines include but are not limited to:

- Native Seed Storage for Revegetation (1)
- Keeping Records on Native Seed (4)
- Native Seed Collection Methods (6) and
- the Model Code of Practice.

The Model Code of Practice was designed for community-based collectors and the localised supply of native seed, which are voluntary and self-regulatory in nature (Mortlock et al, 1999). Whilst the *FloraBank Guidelines* and this Code of Practice have been pivotal in the native seed industry for the last 20 years, a gap exists for large-scale and commercial operations of revegetation and a lack of governing legislation for enforcement of the Guidelines' 'best practice'. This is not to say that the Guidelines are inept, but rather highlights how the native seed industry has evolved over the last decade. Thus, it requires more robust legislative instruments to ensure sustainable access and supply of native seed that is conducive to delivering the ecological outcomes in a meaningful time frame. It is important to note that at the time of writing this paper, the *FloraBank Guidelines* are being updated.

With demand for native seed projected to increase over the coming years, it is key that we understand the constraints on accessing seed and supplying seed in the quantities required to deliver large-scale restoration.

Native seed banks have been operating since the mid-1960s in Australia, and are important in supporting research, and long- and short-term conservation efforts (North, 2009). In response to the Black Summer bushfires, the Council of Heads of Australian Botanic Gardens Inc (CHABG) curated a response to aid in the restoration of impacted ecosystems (CHABG, 2020). However, in order to respond to loss of native vegetation due to unforeseen natural disasters in a timely way, we need to have seed at the ready. Therefore, two key questions remain:

1. How can we access the right seed?
2. How can we collect enough seed to conduct an adequate bushfire restoration response?

Seed Production Areas (SPAs) are areas designated to cultivate species for seed production. SPAs are an industry response to meeting the growing demand for seed. This system is most advanced for agricultural purposes but also supports the production of native seed for restoration, particularly for grass species. SPAs were first developed in America, and Greening Australia started SPAs in Australia in the late 1990s. SPAs help to mitigate the risks of over-collecting from wild, remnant populations and increase our capacity to restore landscapes affected by extreme weather events such as bushfires and floods.

As highlighted in the Australian Native Seed Survey Report, climate change has the potential to alter population sizes and ranges which may affect the amount of seed that can be ‘ethically’ sourced (Hancock et al. 2020) during a time that landscape-scale restoration will be increasingly important.



In Australia, we have four SPAs in New South Wales and one in the Australian Capital Territory. For example, the Regent Honeyeater Project Seed Orchard in Victoria was established to support restoration of Regent Honeyeater habitat (Thomas, 2016). Similarly, in the Murray region, there are currently 12 active SPAs which collectively provided 80% of the 240kg of the seed harvested in the region for 2019–20 (Logie, 2020).

In addition to anthropogenic land-use change, the fire regime plays a significant role in the ecology of native vegetation and biodiversity (Hayward et al. 2016). In Australia, many plant species including numerous *Eucalypts* are adapted to regenerate post-fire through lignotubers and epicormic shoots, as well as smoke-triggered germination. The intensity and frequency of fire is extremely important. For example, the recent 2019–20 Black Summer bushfires burnt more than 19 million hectares and the intensity of these fires has raised concerns over the ability of vegetation to recover (CSIRO, 2020). For example, remnant rainforest which typically does not burn and is not adapted to fire, may never recover (Commonwealth of Australia, 2019).

Climate change has increased the number of extreme fire weather days as well as expanding the length of the fire season, with some fires in 2019 starting during winter. 2019 was Australia's warmest and driest year on record, with a mean average temperature 1.52°C above the 1961–1990 average and a nationally averaged rainfall 40% lower than the 1961–1990 average (Bureau of Meteorology, 2020). In line with climate warming projections, bushfire weather is predicted to increase in frequency and intensity, and the length of the bushfire season is also projected to increase (Lucas et al. 2007).

The implication of these projected changes to bushfire patterns in Australia is the inability for plant species to recover, mature and produce seed to facilitate survival and recruitment. This implication may be exacerbated by years of low flowering and seed set, as well as a lull in seed production for surviving individuals for 3 to 5 years following a bushfire (Fagg et al. 2013). For example, areas of mountain ash (*E. regnans*) and alpine ash (*E. delegatensis*) in Victoria's Central Highlands were burnt in 2003, 2006–07 and 2009 (Fagg et al. 2013). These species are killed quite easily by fire due to their thin bark which kills epicormic shoots, therefore regeneration post-fire relies on aerial seed stored in the canopy. Additionally, these ash species need to reach 15–20 years old to produce effective seed crops.

In response to the Black Summer bushfire crisis, the Australian Federal Government announced initial \$5 million funding for Greening Australia to build a strategic program to secure native seed and plant supply for landscape restoration, recovery and resilience in bushfire affected areas and other vulnerable landscapes. This led to the development of Project Phoenix. This research paper contributes to the overall objectives of Project Phoenix by exploring seed collection licensing and regulation across Australia.

This paper is intended to summarise key aspects of the licensing systems within Australia that pertain to seed collection and highlight areas that could be improved to increase the access and supply of native seed for large-scale restoration.



In the spirit of learning together, improving effectiveness and enhancing innovation and opportunities within the seed sector, this report should not be portrayed as negating the current systems, or giving the impression that we have the answers to current challenges, but rather that we want to think bigger and understand what the best system could look like and provide recommendations on how we could get there. We would like to highlight that this paper is not exhaustive, and that we welcome feedback and comments.

Objectives

The aim of this research is to support future work under Project Phoenix and provide a foundational understanding of seed collection licensing across Australia, and how these licences are governed at a state and federal level. The specific objectives of this research are:

- to understand the legislative framework constraints to scaling associated with wild seed collection
- to understand the legislative framework constraints to the establishment of SPAs
- to compare and contrast state-based systems and the intersection with federal systems, to allow recommendations to be drawn and
- to identify legal frameworks for land access across multiple tenures.
- to understand the legislative purpose of the system, and how effective the current licensing systems are in achieving that purpose

METHOD

This research was carried out in two phases. The first phase was conducted primarily as an in-house desktop literature review and the second phase engaged several key individuals within the seed sector including Greening Australia's internal staff members and key external players.

Literature review

This literature review utilised state and Federal Government policy and legislation documents as well as private organisations' data to gather information on seed collection permits and licensing. In addition, a review of the scientific literature was conducted using the ScienceDirect, Web of Science and Google Scholar databases. The search included Australian and international sources. Most sources included in the literature review were published between 2010–2020, however there were a couple of exceptions.

A total of 26 peer reviewed sources and 35 secondary literature sources were utilised for the review, and each source was assessed for inclusion using a traffic light system, where green, orange, and red represented good, moderate and poor-quality sources respectively. The inclusion/exclusion criteria used was primarily relevance (e.g. Australian-based studies, year published) and quality (peer reviewed, level of detail etc).

Interview of key seed sector individuals

The second phase of this research consisted of a series of interviews with Greening Australia internal staff and key external personnel within the seed field. These groups and number of responses are summarised below. These interviews were aimed at gathering insights and perspective on seed collection licensing and regulation across all states within Australia. Specifically, we wanted to understand individuals' experience and perspectives on the licensing system for their state or territory and how the system as a whole services the

demand for seed through restoration. **Table 1** provides an outline of the general questions that were used as a starting point for these interviews. However, these interviews were not structured strictly around these questions, but they acted as starting points to trigger discussion. All interviewees had different experiences in the seed industry and therefore some questions were not applicable.

In addition, we were interested to understand licensing from perspectives of non-Greening Australia staff to avoid potential biases in the results. We interviewed external seed collectors and state Department representatives. Due to several factors including increased workloads during COVID-19, several surveys were sent to each respondent, completed, and returned to us rather than conducting an interview over the phone or face-to-face. Upon completing a first draft, we did not receive responses from a few intended interviewees, therefore creating a gap in our data. We were not able to conduct any interviews for the Northern Territory.

GROUP	SAMPLE
Internal Greening Australia staff	7
External seed collectors	6
State/territory Department representative	4

Across all sets of interviews, it was made clear to respondents that the answers to these questions would be used in the analysis of this research paper and that the responses would be treated confidentially.



The purpose of including interviews as part of this research was to understand seed licensing from the respondents' perspective.

Our method to analyse the qualitative data obtained through interviews/questionnaires was firstly to identify common themes and messages within the groups included (Greening Australia employees, external seed collectors, state/territory Departments), and secondly to highlight new thinking and bold ideas to accelerate the native seed sector. These themes and ideas were then considered against several criteria from the work of Tracy (2010) including worthy topic, rich rigor, significant contribution and meaningful coherence.

To ensure the validity of this data and therefore the research outcomes of this paper, the data was assessed according to three key criteria (Department of Education, 2020):

- Credibility: are the results credible or believable?
- Transferability: has the researcher adequately described the research context?
- Confirmability: Has the researcher acknowledged their own position in the research? Have the findings been triangulated with other data to strengthen findings?

TABLE 1. DISCUSSION QUESTIONS USED WHEN INTERVIEWING KEY INDIVIDUALS WORKING IN THE SEED SECTOR (SEED COLLECTION PRACTITIONERS), EITHER CURRENTLY OR IN THE PAST

QUESTION	ANSWER CONTEXT
Do you currently, or have you previously held a licence to collect wild seed?	Yes/No
Have you collected seeds in multiple states? Was there any differences?	Yes/No + qualitative response
Do you have experience in moving seed across state borders? Was this process easy/hard?	Yes/No + qualitative response
How easy did you find the process to understand (a) if you needed a licence, and (b) which licence you needed?	Qualitative response
How/where did you find this information?	State government website, state government representative, colleague, other — please specify
What constraints have you experienced when applying for a licence or collecting seed?	Qualitative response
What compliance factors are there for collecting seed in your state?	Qualitative response
How easy is it to comply with these reporting requirements?	Qualitative response

TABLE 2. DISCUSSION QUESTIONS USED AS A TEMPLATE WHEN INTERVIEWING KEY STATE- AND TERRITORY-BASED GOVERNMENT STAFF WORKING IN SEED LICENSING

QUESTION	ANSWER CONTEXT
What is the purpose of the seed licensing system from your Government's perspective?	Qualitative response
Does the current system meet that purpose?	Qualitative response
What are the current limitations of the system (if any)?	Qualitative response
How is the data collected used?	Qualitative response
Are you able to quantify the total volume of native seed collected? (e.g. in a financial year or calendar year)	Qualitative response
If so, how much native seed has been collected in the last financial/calendar year?	
Are you able to map the data collected geographically?	Qualitative response
If no, Is there a capacity to do this?	

RESULTS

This research took a multi-layered approach to understand native seed licensing systems and regulation across Australia to further understand:

- how we can access high quality native seed and
- how we can collect the volumes of native seed needed to supply large-scale restoration projects in the future.

This research provides key insights into seed collection licensing and regulation in Australia. Specifically, this research highlighted that there are large differences in seed collection licensing between the states and territories. These differences ranged from the language used within the licences, the type of licences (e.g. scientific or commercial), land access, and the application and reporting requirements. Furthermore, some similarities were also identified across the licensing systems including the need to obtain landholder permission when collecting seed on private land, the need to obtain appropriate permissions from local councils in addition to obtaining a licence from the state/territory Department and restrictions on harvesting from threatened species.

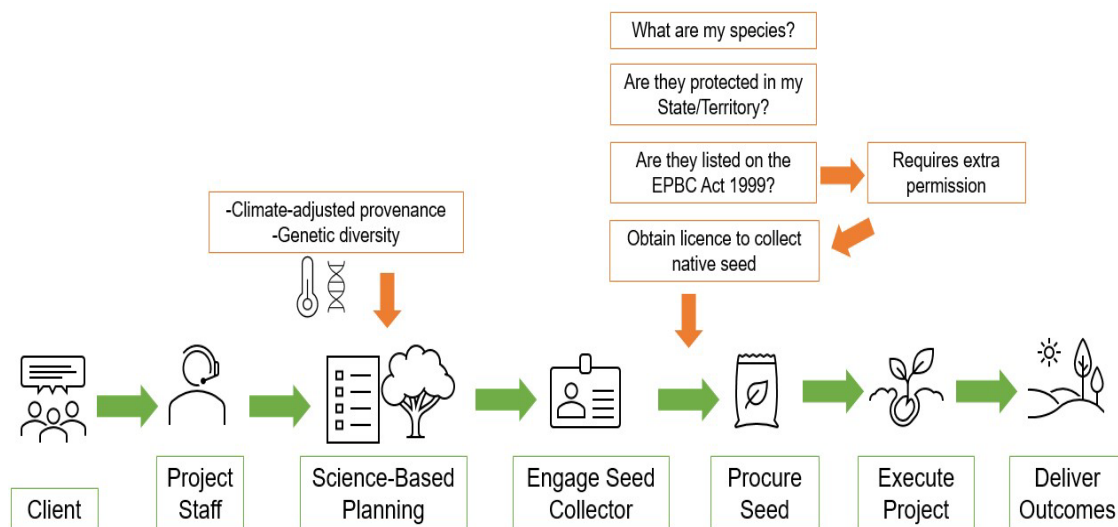


The literature provides a solid consensus that we need to collect seed in large volumes to meet the demand for large-scale landscape restoration, and the need to implement best practice in seed collection to ensure that genetic diversity and climate-adjusted provenance are properly accounted for (Broadhurst et al. 2015; Broadhurst et al. 2017).

However, interestingly, there was little to no peer reviewed literature regarding governance structures for licensing or the seed supply chain for restoration projects. This information was also largely absent in detail from secondary literature documents including state/territory and federal legislation as well as sustainability and biodiversity strategies. This exposes a large gap between what we need to do to restore Australia's landscape, and how we achieve those restoration outcomes. This report is the first of its kind to take a deep dive into understanding the licensing that governs native seed collection within Australia's states and territories and to make recommendations on ways the system could be changed to facilitate the massive scaling up of native restoration in Australia.

Figure 1 below simplifies the native seed supply chain and highlights the key stakeholders and steps involved in a restoration project. Note this captures the supply chain at a high level and should not be interpreted as exhaustive. However, it clearly outlines the role of licensing in the supply chain as a requirement to collect species within a specified location. In subsequent sections, this research will provide detailed discussion on these requirements and how they impact seed supply for restoration projects.

FIGURE 1. DIAGRAM OF NATIVE SEED COLLECTION SUPPLY CHAIN*



* Based on information gathered from the literature and pers obsvs.

In addition to the learnings from examining the legislation on licensing systems across Australia, there are valuable takeaways from the interview process of this research. Summarised in Tables 3, 4 and 5 below are the various key themes that emerged from these interviews categorised by survey group.

Many respondents in Groups 1 and 2 noted that they had worked in the seed industry for many years. This became a factor for various questions. For example, after a few years of experience, it becomes easier to understand the licensing requirements and processes. Having good working relationships with the appropriate government Department was a common theme that was noted across various questions for Groups 1 and 2 as increasing the ease at which to apply for a licence and report on collections.

Some common constraints that were recognised for Group 1 and 2 were the long turnaround times to get a licence approved. On most licences, it is noted to allowed between 2–4 weeks for a response, however respondent 1a noted it has sometimes taken months for a licence to be approved. This ties in with another key theme that emerged from Group 3 — staffing and resource limitations. Research supports this by suggesting that these Departments are often underfunded. However, there were exceptions to this point, with no respondents from Group 2 highlighting this as a constraint, except for respondent 2e who noted that smaller, rural councils can take a long time to approve permits.

Continuing from this point, a common constraint raised by Group 2 was needing multiple levels of permission to collect seed, for example, requiring a state licence as well as a local council permit. Respondent 2c noted that local councils can be harder to deal with and may incur a charge for a permit. It was detailed that on top of paying for a state licence, you could pay upwards of \$150 for a council permit, and in some cases you are required to have a permit to operate on a roadside which could cost around \$800.

Furthermore, this interview process led to some very passionate conversations and big ideas on how we could accelerate the native seed sector and meet the future demand for seed in large-scale restoration projects. This included:

- Developing a national framework to facilitate dialogue between industry stakeholders to ensure decision-making reflects the needs of the industry
- Development of a national Code of Conduct for the native seed sector
- A complete remodel of the licensing system, to one that is simple and consists of:
 - formal training
 - acquiring of a licence through testing
 - signing on to a Code of Conduct
 - detailed annual reporting and
 - auditing
- A licensing system that eliminates the need to acquire several permits in addition to a state/territory Department licence
- Tailoring a licence specifically for seed collection that helps native seed supply meet demand
- Increased support for the establishment of SPAs to help native seed supply meet demand and concurrently ease pressure on natural systems
- A nation-wide, open source database that all collectors could access. This would require data logging standards and species ID training.

We will discuss these big ideas in more detail as we take a deep dive into the licensing systems throughout this paper.

It is important to note that there were fewer responses from Group 3 than Groups 1 and 2. It is understood that some respondents may have been reluctant to participate due to a perceived risk of negative repercussions within their workplace. Therefore, there may be gaps in our data and a limitation to ascertain that our data is confirmable.



However, an insight that can be drawn from the interview process for Group 3 was the difficulty in engaging with appropriate personnel and potentially ties in with the themes of resourcing and staffing limitations. However, this is presumptive and should be further understood.

The data collected was assessed against three criteria: credibility, transferability, and confirmability. There were no pre-existing relationships between the researcher and respondents when conducting the interviews for this research.

Additionally, although it was not specifically requested, respondents provided firsthand accounts of their experiences which increases the credibility of the data because there was no expectation of the provision this information and therefore negligible motive to lie. These spontaneous statements are also more likely to have been said irrespective of a researcher being present.

At the beginning of each interview, the researcher's role and broader context of the research was explained to respondents. In some cases, (Group 2 and 3 in particular) rather than an interactive interview being conducted, the questions were provided to respondents as a questionnaire which included details of the research context. This ensures the data meets the transferability criterion.

Prior to this research, there has been little research of this kind on native seed licensing specifically, therefore it will be difficult to triangulate all aspects of our results. However, some data can be confirmed by triangulating with data from the Australian Native Seed Survey (Hancock et al. 2020), and where possible, the construct of the licensing systems themselves. Confirmability of our data could be increased by including a larger sample size in future studies.



It should be noted that there are inherent limitations when interpreting and assessing qualitative data. However, for the purpose of this research it was a useful tool to understand the perspectives of key groups working in or operating under seed licensing systems as it allows for flexible and context-specific data collection. Future studies would benefit from a larger sample size of respondents due to spatial differences in seed collection activities (e.g. regional and city areas).

TABLE 3. SUMMARY OF QUESTIONS AND COMMON THEMES OF RESPONSES FOR GROUP 1 AND 2

QUESTION	COMMON THEMES (GROUP 1)	COMMON THEMES (GROUP 2)
Do you currently, or have you previously held a licence to collect wild seed?	More than half of respondents either currently or previously held a licence to collect seed	Yes, some holding multiple licences
Have you collected seed in multiple states? If yes, was there any difference?	Only one respondent had a licence in more than one state, and the systems were acknowledged as being quite different	Most respondents had only collected within their current state/territory
Do you have experience in moving seed across borders? And is this process easy/hard?	It was common to send seed interstate via the post Process is generally easy, but it was noted that it is more difficult to send to Western Australia and South Australia due to quarantine regulations	Most respondents had posted seed interstate Process was considered easy except for Western Australia and South Australia
How easy did you find the process to understand (a) if you need a licence, and (b) which licence you need?	An easy process once you have done it a few times It is more complicated when wanting to collect threatened species More complicated in states with multiple but specific licences	Once you have worked in the sector and held a licence for many years the process is easy to understand and follow An acknowledgement that in the beginning it can be tricky to understand Even after many years it can be difficult to find the right information
How, and where do you find this information?	Once you have been working in the sector for many years, you don't need to look up information often Government website	Government website Often need to call Department and speak to a licensing officer
What constraints have you experienced when applying for a licence to collect seed?	Long turn-around times to get a licence approved Licences that are valid for short time periods (<2 years) Often have to collect from fragmented vegetation Requiring multiple levels of permission Having a good relationship with licensing department is extremely beneficial to the process	Needing various levels of permission (state licence, local council etc) Seed collection is lumped in with other flora activities and this can make the system clunky Easier once you have a relationship with the Department
What compliance factors are there for collecting seed in your state/territory?	Reporting is the main compliance factor Collecting within the allowed land tenure Carrying licence with you when collecting	Reporting is the main compliance factor Collection limits and land access
How easy is it to comply with reporting requirements?	Easy The more regular reporting was considered more onerous (quarterly in WA) Collectors would prefer to be out collecting than doing paperwork	Easy Helps to have a good relationship with Department
What do you think needs to change to achieve a national approach that supports the future demand for seed?	Being able to apply for longer licences Current system works fine for small-scale restoration but won't support a large scaling up of restoration	Current systems are 'city-centric' and often don't reflect regional areas Need to accelerate SPA development on a much larger scale Improved communication and coordination within Government and between industry and regulators

TABLE 4. SUMMARY OF QUESTIONS AND COMMON THEMES OF RESPONSES FOR GROUP 3

QUESTION	COMMON THEMES (GROUP 3)
What is the purpose of the seed licensing system from your Governments perspective?	<ul style="list-style-type: none"> To provide a legal process to apply for permission to collect native plant material in a way that doesn't negatively impact natural values
Does the current system meet that purpose?	<ul style="list-style-type: none"> Current systems meet the intended purpose It is likely that some illegal collections still occur
What are the current limitations of the system (if any)?	<ul style="list-style-type: none"> All systems have their limitations Staff and resourcing limitations restrict capacity to follow-up on non-compliance Limitations are negligible
How is the data that is collected used?	<ul style="list-style-type: none"> Data is assessed to ensure seed is not over collected in a given location Data is entered into a public database (e.g. Natural Values Atlas) Data is not collated to a single source
Are you able to quantify the total volume of native seed collected? (e.g. in a financial or calendar year?). (i) If so, how much native seed has been collected in the last financial/calendar year?	<ul style="list-style-type: none"> Not everybody complies with reporting, or there are large gaps in data which makes it hard to accurately analyse It would be possible to quantify the number of permits approved and the quantity of seed approved for collection from application data
Are you able to map the data collected geographically? (i) Is there capacity to do this?	<ul style="list-style-type: none"> If data was reported correctly, it would be possible to map geographically In states where reporting is not mandatory, it would only be possible to map the locations approved for collection

Legislative frameworks

There is now a strong consensus on the importance of landscape-scale restoration, and this is increasingly reflected in governmental policy across the world. In Australia however, ecological restoration policy has largely been ad hoc and has often reflected environmental conditions such as major drought (Campbell, Alexandra & Curtis, 2017). Additionally, frequent restructuring and agency cut-backs have meant that policies, programs and science are rarely aligned for long-enough to instil the importance of sustained large-scale restoration over time. This helps to understand a key finding of this research, that overall, the licensing systems for native seed collection are not fit for purpose to enable a large scaling up in restoration over the next decade. These findings will be discussed further in the following sections.

Wild seed collection, threatened species and SPA establishment

Most of Australia's land environment is managed at the state/territory-level, with these sectors largely responsible for public land across various tenures (Broadhurst & Coates, 2017). Likewise, the collection of native seed is also predominately managed at the state/territory level. However, for matters of 'national significance', collection of native seed requires additional permissions from the federal Minister for the Environment. A matter of 'national

significance' may be for example, the act of regularly harvesting seed having a significant impact on a species listed on the *EPBA 1999* (Department of Environment, 2013). It was consistent across all states and territories that collection of native seed fell under legislation that more broadly governs nature, biodiversity or parks and wildlife. The legislation is focused on protecting threatened species from harvest, clearing and impacts on future survival and reproduction. **Table 5** below provides a summary of the various legislation within each state and territory.

It was found that the sections that related to native seed collection were predominantly written from a high-level and focused on outlining the penalties for failing to comply with the legislation. Information relating to SPAs was absent from the legislation. This is interesting in the context that harvesting seed for the purpose of developing a SPA would, in theory, help to reduce harvesting impacts on wild populations. However, harvesting seed is not viewed as a restorative practice in the legislation but rather a 'taking' or 'clearing' action. In fact, in NSW, it is considered 'clearing' to collect wild seed (*pers obs.* Birnie). From this perspective, we can identify that there is a gap between the legislation, science and on ground delivery of restoration. For instance, the literature suggests that future demands for seed will be difficult to meet from wild harvest (Hancock et al. 2020). Concurrently, a key theme that emerged in the context of developing a national approach that supports the demand for native seed, was the need to rapidly scale up the development of SPAs.



If we use a standard scenario that it takes 1kg of seed to revegetate 1.5ha, and use the example of needing to restore the area that was recently burned over the 2019–20 Black Summer bushfires (19 million hectares), we would need 12,000 tonnes of seed to revegetate that burned area.

There is little data available to determine the amount of native seed collected annually, however the Australian Native Seed Survey found that most seed is collected and traded in small amounts (less than 5kg) annually (Hancock et al. 2020). This scenario was raised by respondent 2e and is sobering to consider.

In Victoria, protected flora are listed and protected under the *Flora and Fauna Guarantee Act 1988 (FFG Act)*. This list does not only include threatened species, but species that require protection for other reasons, for example, because they are highly sought after, and therefore harvesting must be controlled (DELWP, 2020). Collection of any species listed on the *FFG Act* requires a licence. There are exceptions to this, for example, you can collect species listed on the *FFG Act* on private land without a licence if the person is a landholder, or is given permission by the landholder and the material was not collected for the purpose of sale.

Additionally, in Victoria, all native vegetation is protected under planning permits and these apply to all land tenures, but albeit are more relaxed for private land. This means that in addition to requiring a licence to collect seed in Victoria, you are also required to have a council planning permit. There are some exemptions to this system, and it is recommended to contact your local council regarding your project (DELWPb, 2019).

Interestingly, the New South Wales, the *Biodiversity Conservation Act 2016* does not contain the word ‘seed’ at all in the document, but instead refers more broadly to ‘plants’ and ‘plant parts’ (New South Wales Government, 2020). This provides an opportunity to recommend more clear language in legislation that is consistent with the language used on native seed licences. Additionally, this ties in with one of the themes from Group 2 that seed from the perspective of licensing and legislation is grouped together with all flora-related activities which can make the system clunky. This relates back to an earlier argument that the legislation is not conducive with the purpose of harvesting seed for restoration, which in theory will generate new resources to supply native seed in the future.

In addition to key pieces of legislation, most states and territories were found to have policies that also had some governance over wild seed collection. For instance, the Australian Capital Territory has the *ACT Nature Conservation Strategy 2013–2023* which includes the establishment of seed banks and SPAs as an action area (Australian Capital Territory Government, 2013). What is important about this action is that it relates to landscape restoration, and therefore recognises the range of species typically included in restoration projects. Similarly, earlier this year, New South Wales released its *Wildlife and Conservation Bushfire Recovery: Immediate Response Plan* in response to the Black Summer bushfires. Included within this policy is the response actions to collect native seed and cuttings from endangered rainforest plants and high-risk habitats for nursery propagation of those species and therefore use in habitat restoration (NSW Government, 2020).

Furthermore, in Tasmania, the *Natural Heritage Strategy for Tasmania 2013–2030* acknowledges the need for seed collection and storage in situations where in situ conservation measures are likely not enough to protect biodiversity, and includes the maintenance of ex situ collections of priority plants and animals including genetic diversity as a long-term action to support climate change adaptation and mitigation (DPIPWE, 2013).



Whilst it is acknowledged that no single piece of policy can be exhaustive, it does appear that in general policy for biodiversity conservation fails to recognise the importance of native seed and restoration in response to biodiversity loss and land degradation.

Furthermore, not all states included actions or priorities that related native seed collection to habitat restoration or bushfire response. For example, Victoria’s *Protecting Victoria’s Environment — Biodiversity 2037* only mentions seed three times, once in the context of maintaining seeds in ‘intensively controlled settings’ (e.g. botanic gardens), and twice in the context of working with Traditional Owners and Aboriginal Victorians to identify seed funding and business opportunities (The State of Victoria, 2017).

Whilst the latter ties in very well with observations from Group 1 and 2 on the need to support training and provide funding opportunities to underpin a healthy seed industry, there remains a disconnect about how this will be achieved, for example, through \$1 million in funding to support such training opportunities or through the development of two new SPAs. In the past,

there has been government funding to support the development of SPAs, either from a localised level or national approach. For instance, in 2017 the Commonwealth Government provided \$10 million in funding to help develop the Cumberland Seed Production Hub (Greening Australia, 2017).

TABLE 5. A SUMMARY TABLE OF KEY STATE AND TERRITORY LEGISLATION DESIGNED TO CONSERVE AND MANAGE FLORA AND FAUNA*

STATE/ TERRITORY	LEGISLATION	INCLUDES PROVISIONS RELATING TO THREATENED SPECIES	INCLUDES PROVISIONS RELATING TO WILD SEED COLLECTION	INCLUDES PROVISIONS RELATING TO SPAS
ACT	<i>Nature Conservation Act 2014</i>	✓	✓	X
QLD	<i>Nature Conservation Act 1992</i>	✓	✓	X
NSW	<i>NSW Biodiversity Conservation Act 2016</i>	✓	X	X
NT	<i>Territory Parks and Wildlife Conservation Act 2006</i>	✓	X	X
SA	<i>National Parks and Wildlife Act 1972</i>	✓	X	X
Are you able to map the data collected geographically? If no, Is there a capacity to do this?	<i>Native Vegetation Act 1991</i>	✓	X	X
VIC	<i>Flora and Fauna Guarantee Act 1988</i>	✓	X	X
WA	<i>Biodiversity Conservation Act 2016</i>	✓	✓	X
TAS	<i>Threatened Species Protection Act 1995</i>	✓	X	X

* Including outline of whether it includes information relating to native seed collection and SPA development in Australia



KEY MESSAGES

- Native seed is under-represented in state/territory legislation and there is a mismatch between legislation, science and on ground delivery of restoration projects.
- SPAs have proved to be very useful in supplying seed in a sustainable way for revegetation projects, and are recognised in the literature as important to delivering landscape scale restoration, but remain under-represented in government policy and legislation.
- Wild seed will not be enough to service the future demand for native seed restoration and will require a large scale-up of SPAs.

How native seed collection is governed by federal legislation

Although seed collection is predominantly managed at the state/territory-level, the *EPBC Act* plays a governing role from a national perspective. The *EPBC Act* is responsible for managing matters of national significance such as protecting species that are recognised as threatened on a national level. The purpose of this section is to identify how the *EPBC Act* relates to the access and supply of native seed for restoration projects and to identify opportunities to scale up restoration efforts in the coming years.

The primary role of the *EPBC Act* is to limit access to wild seed from native species classified as threatened on a national level. Exceptions to this rule can be made by obtaining permission from the Minister to collect from that species, however this would need to be a special circumstance. The *EPBC Act* can sometimes be misaligned to state/territory-level management due to differences in species classification (Broadhurst & Coates, 2017). For instance, a species may be unequally distributed across multiple states and territories, and in a state where there is a larger population, the species may be classified lower compared to a state which has a lower number of individuals. This highlights the importance of cooperation between state, territory and federal agencies in dealing with seed licensing.

In 2010, the Federal Government released the *National Biodiversity Conservation Strategy 2010–2030*, which has since been revised and was released in 2019 as *Australia's Strategy for Nature 2019–2030: Australia's biodiversity conservation strategy and action plan* (Commonwealth of Australia, 2019). This strategy is aligned to the Aichi Targets and Sustainable Development Goals. Importantly, this national strategy does reference the requirement of 'viable seed supplies' to support restoration and maximise genetic diversity, and the need for 'seed banks' to support conservation efforts, as well as improving cross-boundary and cross-border collaboration. However, the national strategy fails to establish goals or meaningful action around seed collection and the establishment of SPAs to support future demand for seed in restoration and conservation programs.

In addition, Australia is signatory to several international agreements including the Ramsar Convention on Wetlands, UN Convention to Combat Desertification and the 17 Sustainable Development Goals for the 2030 Agenda for Sustainable Development — specifically goal 15 ‘Life on Land’ which includes specific goals to restore degraded land by 2030 (United Nations, 2020). Additionally, the Convention on Biological Diversity’s Strategic Plan ‘Living in Harmony with Nature’ 2050 stipulates a mission to restore and conserve biodiversity and key ecosystem services to ensure an equitable and healthy life for all (UNEP, 2010).



KEY MESSAGES

- The *EPBC Act* is the key piece of legislation that governs the collection of wild native seed in Australia. Any species listed on the *EPBC Act* is prohibited from harvesting, without permission from the Minister.
- There is an opportunity to reduce impacts on remnant populations by allowing seed collection to establish SPAs.
- Federal legislation fails to establish meaningful and actionable goals to support the future demand for seed in restoration projects.

Seed licensing systems

Overall, seed licensing systems can be described as built on three key factors:

1. species status e.g. threatened or non-threatened
2. commercial or non-commercial purposes and
3. land tenure.

After conducting an initial sweep of the literature, land access was considered to be quite complex and is therefore recommended that a deep dive into land access be addressed in a follow-up body of work to this research. Therefore, this paper will only discuss relevant land tenures as a high-level initial assessment.

Our research highlighted some key similarities and differences between seed licensing systems in different states and territories. These have been summarised in **Table 6** below. It should be noted that this table does not include all of the available licences but includes where possible a licence for commercial collection.

In almost all states and territories, seed collection licences fell under the umbrella of flora licensing, and in the case of the Northern Territory, seed collection licensing comes under wildlife permits more broadly. This means that there is a generalised permit application for plant harvesting, crocodile egg harvesting, observing nesting marine turtles, pet trade collection and removal of problem animals in the Northern Territory. Similarly, in the Australian Capital Territory and New South Wales, seed collection comes under the umbrella of a ‘scientific licence’. Both of these matters spark concern over the ability of the system to

meet the specific needs of the native seed industry and ties in with a common theme from our data analysis that generalising all flora licences makes the process clunky. Respondent 2f proposed that tailoring a licence specifically to seed harvesting would be helpful in streamlining the licence process.

As discussed in the previous section, plant species are protected under state-based legislation and in some cases the *EPBC Act*. In all states and territories, a licence is required to collect seed from threatened species. However, there are exceptions to this rule. For instance, in Queensland, all native plant species are protected, but you only require a licence when collecting from species listed as threatened or special least concern under the *Nature Conservation Act 1992*. The remaining least concern plants are exempt from this licensing framework, and therefore native seed from these species can be collected without a licence (Queensland Government, 2019).

Similarly, to collect seed for commercial purposes on public land, Crown land or private land a permit is required. Permission from landowners is required for collecting seed on private land. As far as this research could ascertain, Western Australia is the only state to have a 'Private Land Suppliers Licence'. This licence covers the collection and possession of seed for the purpose of supply (DPAW, 2020) from private land. In addition to this licence, it is still required to obtain permission from the landholder.



Interestingly, it was uncommon for licences to directly relate to restoration activities. From a research perspective, this made it at times difficult to ascertain which licences are applicable to collecting seed for restoration projects. In some cases, revegetation was considered to be part of 'commercial' activities (e.g. South Australia) and in others it was considered a 'non-commercial' activity (e.g. Victoria).

The Australian Native Seed Survey (Hancock et al. 2020) found that most seed was collected from private property, public reserves and roadsides. This is consistent with what you would expect in relation to seed licensing systems across Australia, which typically do not allow collection from National Parks or reserves. National Parks and state reserves are typically off limits for seed collection, however in some circumstances, for example if native seed is not available anywhere else, collection in these areas may be allowed but requires extra permission and occasionally additional permits.

There is strong anecdotal evidence that having good relationships with local collectors and agencies has made this process easier over the years through communication and coordination. For example, in the past, Parks Victoria has assisted with seed collection in these reserve areas for use in local projects. Likewise, in regional South Australia good relationships have allowed collections to occur from revegetation sites in conservation reserves.

- An exception to this is the Australian Capital Territory, which is the only region in Australia where you are not allowed to collect on private property. This largely pertains to the fact within the Australian Capital Territory, private land is leased and is therefore still owned by the government. Even though it is unlikely they would ask for this land back, it is a possibility. Additionally, collection within nature reserves is typically allowed within the Australian Capital Territory (with a few exceptions) and only requires you let the local ranger know.
- In Victoria, these are various levels of permissions and additional permits may be required to collect on different land tenures. From the discussions above, we know that to collect species listed on the *FFG Act*, on public land, a seed collection licence is required. Additional permits are required to collect from State Forests and permission is required to collect from Parks Victoria land, rail reserves (e.g. Metro or Freight Australia) and roadsides (VicRoads and Local Government Authority) (Hadden, Bramwells & Macdonald, 2004). This Landcare Notes resource contained a clear and concise outline of licensing requirements in Victoria, however it was written in 2004 and is therefore quite out of date. It would be useful for state and territory governments to release updated fact sheets that are consistent with source, in the sense that it was very clear and easy to understand.
- In New South Wales, if you collect outside of the NPWS reserve system and are not collecting from threatened species then you do not need a seed collection licence (Wildlife Licensing and Management Unit, 2012). However, to collect on private land you will still require permission from a landholder.

Respondent 2d recounted an experience of wanting to collect seed from a native grass species along a roadside in New South Wales. As a courtesy, the respondent contacted the Local Land Services (who are responsible for travelling stock routes) to alert them of their collection and were delivered an immediate cease and desist order. In an attempt to understand why this order had been given, four different bodies were contacted who all believed the roadside belonged to them. By the time the matter could be resolved, and it was determined the respondent did indeed have the correct licence and permission to collect from the roadside location, the opportunity to collect had passed.

- In Tasmania, for areas covered by a Forest Practices Plan a separate permit may be required to collect seed from threatened species (Lawrence, 2003).
- In Queensland, you don't need the seed collection licence aforementioned to collect from a State Park/Reserve, but rather need a different licence that allows you to take from a State Reserve which you would typically be required to pay royalties on.
- Upon reading through state and territory policy documents, it was observed that land-tenure and land-access was largely not recognised in relation to landscape scale restoration. An exception to this was in Tasmania's *Natural Heritage Strategy for Tasmania 2013–2030* which acknowledges that a 'good landscape conservation approach' 'integrates conservation management across land-tenure and land-uses' (DPIPWE, 2013).

- In Western Australia, you are required to have a licence to collect from Crown land and private land. You are also required to obtain local area endorsement from the area you wish to collect seed in. This is because local authorities may not want people to collect. In addition, to collect from State and Conservation reserves, you are required to obtain a Regulation for Authority. Likewise with Victoria, it is difficult to obtain this authority. WA also has a 'Private Land Suppliers Licence'. This licence covers the collection and possession of seed for the purpose of supply (DPAW, 2020) from private land.

TABLE 6. SUMMARY OF STATE AND TERRITORY SEED COLLECTION LICENCES/PERMITS

	WA	SA	VIC	TAS	NSW	ACT	QLD	NT
	Flora taking Crown land licence (commercial)	DENR Permit to Collect Native Plant Material — Commercial (Class A)	Permit to Take Protected Flora	Taking of Native Flora Permit	Seed harvester licence	Licence to take plants from unleased land for commercial purposes	Protected Plant Harvesting Licence	Permit to take or interfere with wildlife
Permission required to take from private land	✓	✓	✓	✓	✓	✓	✓	✓
Allows collection of wild seed on public land	✓	✓	X	✓	✓	✓	✓	✓*
Allows collection within National Parks	X	X	X	X	X	X**	X	X
Allows collection of threatened species	✓	✓	✓	✓***	X	✓	✓	✓
Allows seed collection for SPA	Not specified							
Governed by state based legislation	✓	✓	✓	✓	✓	✓	✓	✓
Governed by Federal legislation	EPBC Act 1999							

*Even with a permit, you are required to obtain permission from the landowner (private, public, Aboriginal)

**Seed may be harvested from state forests under a seed harvester licence

***You do not need a permit if your species is endangered, rare or vulnerable under the *Threatened Species Protection Act 1995* if the area and species have been addressed under a certified Forest Practices Plan



KEY MESSAGES

- Seed collection typically comes under more broad ‘flora’ licences and in the Northern Territory comes under the even more broad ‘wildlife’ licence.
- Seed licensing systems are highly varied across Australian states and territories.
- Key overarching factors in the seed licensing system are: (1) species status (threatened or non-threatened); (2) commercial or non-commercial; and (3) land tenure (predominantly public or private land). You cannot collect from threatened species without a licence in most jurisdictions.
- Land access for seed collection varies across the states and territories. It was found to be common for additional permits or permissions to be required to collect from State Parks and Reserves.
- To collect seed from a protected species or commercial activity requires a licence.
- Public and private land are typically covered under the same licence, but additional landholder permission is required. An exception to this is Western Australia, where you need to obtain a ‘Private Land Suppliers licence’ if you intend to collect seed for the purpose of supply.

Application processes

It was observed that the application and reporting processes for obtaining a seed collection permit differed across the states and territories. These have been summarised in **Table 7** and **Table 8** below.

Across all states and territories, it was found to be common practice for a seed licence application to require: a list of species to be collected from and the quantity; the names of additional persons who will be collecting under the permit; the purpose of the collection and; the area planned for collection. There were subtle differences across the states and territory licensing systems. For example, South Australia’s application also asks that you specify the council you will be collecting within. South Australia’s application only requires species botanical name whilst Queensland’s licence requires the scientific and common name. Further, Queensland’s licence application asks you to list the ‘wildlife status’ (live, dead, parts/products) and a description of the parts/products.

It was particularly difficult to find information on the licensing system for native seed collection in the Northern Territory. However, it is understood that you cannot collect seed from species listed as under the *Parks and Wildlife Conservation Act 2006*. In addition, you are required to obtain permission from landowners (private, public, or Aboriginal) and in many community's permission from local Traditional Owners is also required because some plants have cultural significance.

For Tasmania and the Northern Territory, it was difficult to ascertain the length and cost of a permit to collect seed within the respective jurisdiction. This relates to a common theme arising throughout this research, that the information required by practitioners is not clear or easily accessible. It would be appropriate for this information to be either listed on the webpage alongside the application, or directly on the application.

A number of key themes emerged from our data analysis of Group 1 and 2.



Firstly, it was highlighted that there is often a long turn-around to get a licence/permit approved once an application has been submitted and this was considered to be a significant challenge when working under tight project deadlines.

Respondent 1a recalled instances where it had taken up to two months to get a permit re-issued. Plants typically have a naturally short collection window, and detailed planning in advance (generally at least 12 months) is considered best practice, however sometimes projects come along with a tight deadline that requires a much quicker turn-around.



Secondly, it was observed that the short length for some permits was perceived as negative by Groups 1 and 2, particularly when accounting for the long time it can take for an application to get approved.

On all permit application forms, it is noted in various languages to allow sufficient time for the application to be processed; typically this was stated as at least four (4) weeks. There was a strong emphasis on the importance of having good relationships with other agencies in your local area. In effect, this can make the process of applying for and renewing a licence much easier. For example, respondent 2c recalled they are not required to list species (except for endangered species) or locations as they are trusted by the Department, and this makes the process more efficient.

In addition, respondents 2c, 2d and 2e highlighted that a lot of seed collection is opportunistic in accordance with species that set seed irregularly (e.g. saltbush), or climatic conditions which cause variation in seed availability (e.g. drought). This can make it difficult to know exactly what you will harvest from and where when applying for a licence. This aligns with the literature that asserts sourcing seed from wild populations is inherently difficult due to variation in flowering, pollination and seed crop (Broadhurst et al. 2015; Hay and Probert, 2013; Broadhurst et al. 2016).

When we build in the added risks of climate change to this scenario, it becomes more obvious and imminent that we need a more reliable system to harvest native seed. In this scenario, streamlining the application process of the licence system may help to allow more opportunistic harvesting, however as noted by respondent's 2e and 2f and supported by the literature, even the most efficient licensing system can only go so far in supporting seed supply and that the way forward is to support and facilitate the establishment of SPAs (Nevill et al. 2016).

TABLE 7. SUMMARY OF THE APPLICATION PROCESS SEED COLLECTION LICENCES ACROSS AUSTRALIAN STATES AND TERRITORIES

STATE	LICENCE LENGTH	FEE	APPLICATION PROCESS	GPS COORDINATES	SPECIES	TYPE OF MATERIAL	QUANTITY
WA	One or three years	\$145 or \$255	Send completed application form Wildlife Licensing Section, DBCA	X*	✓	✓	✓
SA	One year	\$100	Send completed application form to DENR office	✓**	✓	✓	✓
VIC	Three years	No fee. Royalties may apply	Send completed form to DELWP as a hard copy via post or email	X	✓	✓	✓
TAS			Send completed application form to the Natural and Cultural Heritage Division of DPIWWE	X***	✓	✓	✓
NSW	Three years	\$175	Send completed form to the Department of Planning, Industry and Environment	✓	✓	X	
ACT	One year	\$289.50	Complete online form	X****	✓	X	✓
QLD	Five years	\$1,233	Send completed application form to DES	✓			
NT			Submit completed application to the Parks and Wildlife permits and concessions office	X***			

*Requires that you provide the location according to the grid map provided on the licensing web page

**Required to provide a map or GPS coordinates

*** Requires that you attach a map and/or describe in detail the location(s) to be collected from. If the destruction of Threatened Species is proposed, an exact location is required

**** The online application uses google maps and requires you to add a marker where you intend to collect from and subsequently provide a description of the location

This information pertains to the licences/permits outlined in the previous table (**Table 6**).



KEY MESSAGES

- The application process varies across the states and territories with the most common process being to download an application form, complete and return to the relevant Department. The ACT and NSW are the only systems to have an online application portal, but there is some confusion with the latter and this may only be used for scientific licences.
- There are different costs associated with respective licences, varying from \$100 to over \$1,233.
- Licence applications require specific information regarding species to be harvested from, the type of material (i.e. seed) and the quantity. Groups 1 and 2 noted that it can be difficult to know this information when applying for a licence.
- Location data (of varies type) of where harvest was intended to occur was required on all licence applications. Respondent 2d highlighted this can also be difficult, because a lot of seed collection is opportunistic.

Reporting processes

Reporting requirements varied significantly between the states and territories. In some states and territories, such as Western Australia, the reporting requirements are outlined clearly with specific data sheets provided in the same location as the permit application forms. However, this was inconsistent. For instance, in Victoria, the reporting requirements were considerably hard to find on the DELWP website. Respondent 1d stated that they generally do not report and has never been questioned by the Department. This again speaks to possible resource and staffing limitations.



There was consensus among Groups 1 and 2 that reporting is the main compliance factor for seed licensing but that it is also easy to comply with once you get used to it, although notably more difficult in Western Australia where you are required to provide more frequent (quarterly) returns data.

Having a good relationship with the state/territory Department was identified as a key factor in reporting being perceived as easy. Interestingly, respondent 2c referred to the reporting process as an 'honesty system'. This ties in with a theme that emerged throughout the interview process that individuals working in the seed sector have a strong moral code, and 'do the right thing'. Additionally, in Queensland, it is not a requirement to provide returns data for seed collections. The various reporting requirements have been summarised in **Table 8** below.

Together this data leads us to beg the question, 'Why do we need this complicated system, if it is relying on the honesty of its users?'. Respondent 2d holds a similar view, positing that the native seed industry needs a new, simple system that follows a 'driver's licence' model. This system would be built on a strong foundation of formalised training with testing to obtain a 'licence'. Licenced individuals would be required to sign on to a legally binding Code of Conduct to enable them to harvest and sell native seed within the industry, and would be required to keep detailed harvesting records that satisfy minimum requirements (species, quantity, location, vegetation condition etc). Yearly reporting to a national, open source data system would be required. This system would include randomised auditing, with non-compliance leading to licence suspension or cancellation and financial penalty.

This hypothetical and simplified system addresses several of the key constraints previously identified within the current licensing systems. The various types of licences and levels of permission required to access different land tenures makes it difficult to harvest opportunistically, needing multiple levels of permissions/permits is expensive. This system will not support a large scale-up in restoration.

It was difficult to determine the reporting requirements for the Northern Territory's 'permit to take or interfere with wildlife', and in the absence of being able to contact the appropriate Department this remains a gap in this research.

TABLE 8. SUMMARY OF THE REPORTING REQUIREMENTS FOR SEED COLLECTION LICENCES ACROSS AUSTRALIAN STATES AND TERRITORIES

STATE	PROVIDING RETURNS DATA	GPS COORDINATE	TYPE OF MATERIAL	QUANTITY	METHOD OF REPORTING
WA	Collectors are required to submit quarterly returns reports District officers are encourages to submit annual reports One month prior to licence expiry a report is generated of the collectors total harvest	X*	✓	✓	Three monthly return data sheet
SA	Annual return report to DENR within 14 days of permit expiry.	GPS coordinates or map	✓	✓	Data entered into annual data return form
VIC	Returns data reports must be provided with 30 days of permit expiry date or on request	✓			Data entered into the Victorian Biodiversity Atlas (VBA)
TAS	As specified on permit	✓	X	X	Data entered into the Natural Values Atlas **
NSW	Annual report	✓			Must complete a harvest site condition sheet and harvest return sheet
ACT	Annual (must be returned at the end of a project or licence expiry/renewal)	✓	X	X	Data entered into a ACT Rare Plants Records spreadsheet
QLD	When requested (audited)	X	✓	✓	Data entered into a Protected plant trade record spreadsheet
NT	Once permit has expired				Send data to biodiversity@nt.gov.au

*Must specify 'Locality Grid No.' as per the map on the return data sheet

**Data reporting requirements are specified by the Natural Values Atlas with the minimum reporting requirements being the completion of fields marked mandatory. DPIPWE also requires that any publication arising from the collection of plant material within the Tasmanian reserves and crown lands managed by DPIPWE be provided to DPIPWE when it becomes available

This information pertains to the licences/permits outlined in the previous table (**Table 6**).



KEY MESSAGES

- You need to complete and submit an application for the appropriate licence before you can collect native seed (in areas requiring a licence). These applications differ slightly across the states and territories, with some having seemingly more progressed and updated application systems. Application and reporting requirements differed slightly across the different jurisdictions.
- In general survey respondents noted that the long turnaround times to getting a licence approved was problematic. There were some differences in survey respondent's perception of the licence reporting systems. Some believed it was easy, whilst others found it more onerous.
- In terms of increasing access and supply of seed for future restoration needs, the current licensing systems may create challenges by being restricted to specific land (i.e. public land, Crown land, or private land). Additionally, presuming a marked increase in the volume of seed being collected to support the rising demand of landscape restoration as it scales up, this will increase the amount of data being reported and will require more sophisticated data management systems to ensure compliance.

What are the carbon regulations for native seed collection?

In Australia, we have a Federal Government scheme known as the Carbon Farming Initiative (CFI) that allows landowners to earn Australian Carbon Credit Units (ACCUs) by sequestering and storing greenhouse gas emissions. ACCUs can be sold on to businesses to offset their emissions footprint. CFI projects must meet a range of criteria including the permanence of carbon storage in vegetation biomass for at least 100 years, attaining a crown cover of at least 20 per cent and a height of at least two metres when mature amongst others.

The Carbon Credits (Carbon Farming Initiative) Regulations 2011 defines a *permanent planting* as a planting that:

- is not harvested other than
 - for thinning for ecological purposes
 - to remove debris for fire management
 - to remove firewood, fruits, nuts, seeds, or material used for fencing or as craft materials

if those things are not removed for sale, in accordance with traditional indigenous practices or native title rights and

- that is not a landscape planting.

A *landscape planting* is defined as a planting in an urban centre or locality in a residential place, on the grounds of a sporting facility, factory or other commercial facility, on the grounds of a hospital, school or other institution or in a car park or cemetery.

Under the *Carbon Credits (Carbon Farming Initiative) Act 2011* seed cannot be collected from carbon project sites for commercial activities (i.e. seed that is collected, cannot be sold on). Currently in Australia, this legislation is the key governing legislation regulating seed collection and carbon regulations and there are no state/territory level pieces of legislation of the like.



KEY MESSAGES

- Currently, the most important intersection between carbon regulations and collection of native seed is the prohibition to collect seed from sites revegetated to deliver carbon offsets for commercial purposes. This falls under the *Carbon Credits Act 2011*.

Compliance

The previous section highlighted the types of data required when applying for a seed collection licence and the reporting requirements for these licences. This section aims to discuss the enforcement of compliance for the licensing systems across Australia's state and territories, and the intersection with federal legislation compliance. In addition, this section will discuss how these factors influence seed collection for future projects and explore biosecurity constraints across jurisdictional borders.

State and territory compliance

Across all states and territories, penalties are written into the relevant legislation for various failures to meet the terms and conditions of the respective flora licence. It was not deemed necessary for the purpose of this research report to list all these penalties. But rather, that it was important to understand what systems are in place to track compliance and whether these systems are enforced on the ground. However, as an example, under the *FFG Act* Section 56 'Offence of not complying with terms and limitations of licence or permit' the penalty is 240 penalty units or imprisonment for two years or both (person); or 1200 penalty units (body corporate). Similarly, under the BC Act, the maximum penalty for picking or selling plants that are threatened species in New South Wales is \$330,000 for individuals and \$1,650,000 for companies and/or imprisonment for two years (Office of Environment and Heritage, 2017).



With the exception of Western Australia, where seed collection licensing is comparatively onerous and strict following the introduction of a new system in 2019, in other states compliance is relatively low. It was considered uncommon by Groups 1 and 2 to be questioned regarding compliance with seed collection and reporting requirements.

There is a known case of non-compliance currently in court in New South Wales for illegal collection of seed within a National Park (*pers obs.* Driver). When considering the complexity of the licensing system and inherent confusion over land access, it is not surprising that enforcement of compliance is low, and it is expected that you would have to be operating illegally under the nose of an authorised body in order to be caught (e.g. in a National Park). However, when non-compliance is enforced, the penalties appear disproportionate in severity.

Lack of compliance could be attributed to limitations of staffing resources, and a lack of time to follow up on reports as highlighted by Group 3. In other cases, it appeared as though the way the licensing system has been set up makes it hard to implement compliance measures. For example, if a licensing system has broad reporting requirements (in terms of mandatory data to be disclosed), then it would be increasingly difficult to assess non-compliance. As highlighted in **Table 9** the following jurisdictions were found to have little supporting policy, regulation or plans in relation to conduct and compliance:

- For the Northern Territory licensing system, the only piece of supporting policy referenced on the webpage with the application was the Northern Territory Parks and Wildlife Commission's marine turtle watch policy. In addition to this is an outline of penalties for wildlife offences, which includes non-compliance with permit (Northern Territory Government of Australia, 2019).
- Similarly, Victoria lacks policy and legislative frameworks that relate specifically to seed collection with the only supporting documents listed alongside the protected flora permit being the Victorian Tree-fern Management Plan (DELWP, 2020).
- No supporting policy documents, standards or plans were available in the same location as the application for a licence to take plants in the Australian Capital Territory.

This is emerging as a common theme and highlights a significant gap in the licensing systems. Without the appropriate, clear systems in place, it becomes increasingly hard and complex to detect and enforce non-compliance. Additionally, the complexity of the legislative documents available would make it difficult and time-consuming for practitioners to understand their legal rights and obligations. As was highlighted by a survey respondent, you are often required to call licensing departments to access this information. At this point, you could infer that what was originally a burden for the practitioner is now a burden to both parties, particularly when you consider that government respondents stating that resources are stretched. Therefore, it would be mutually beneficial to improve online platforms so that they provide clear and easy to understand documents and reflect the needs of their users, which is predominantly practitioners.

In theory, compliance could be monitored, audited, and reported on using the returns data provided according to the requirements of each state/territories licence reporting terms. The database could be interrogated to ascertain harvest levels and trends within a geographic context by state/territory Department staff. However, our data analysis found that resourcing and staff limitations are a barrier to updating and/or developing these systems to allow this data to be adequately tracked and analysed. Additionally, the way some systems are set-up

inherently restricts this approach to compliance. For instance, the Queensland licence system does not mandate reporting, and therefore it would not be possible to firstly ascertain what seed was collected and therefore determine compliance. However, Queensland is considered to have the most sophisticated compliance system as highlighted below.

Case study: Queensland

The Queensland licensing system provides the highest quantity of resources in relation to compliance for seed collection. These include; ‘*Code of Practice for the Harvest and use of Protected Plants*’, ‘*Protected Plants Assessment Guidelines*’ and ‘*Draft Wildlife Trade Management Plan — Queensland Protected Plants 2019–2024*’. This Plan outlines that the Department of Environment and Science (DES) will keep records of: (i) the number of protected plant licences issued, (ii) the locations, species and quantities specified on licence applications, (iii) the number of official tags issued and (iv) sustainable harvest plans (State of Queensland, 2019). The plan stipulates that this data will be analysed “as required to monitor harvesting trends” and that a portion of these will be routinely audited.

These documents are designed to be read in conjunction to the broader Wildlife Management Regulations. What is notable about this system is the transparency facilitated by the ‘*Protected Plants Assessment Guidelines*’ which clearly outlines the assessment process for permit applications by Department officers. This essentially provides a checklist that practitioners could use to ensure they are meeting.

TABLE 9. SUMMARY OF SUPPORTING DOCUMENTS THAT EITHER OUTLINE OR REGULATE COMPLIANCE FOR NATIVE SEED COLLECTION*

STATE/ TERRITORY	POLICY	REGULATORY FRAMEWORK/ GUIDELINE OR STANDARD	CODE OF CONDUCT	MANAGEMENT PLAN
WA		✓		✓
SA	✓	✓		
VIC				✓**
TAS		✓		
NSW	✓			✓
ACT				
QLD		✓	✓	✓
NT		✓	✓	✓

* It should be noted, that in the states/territories where it is been marked as not available (indicated by ‘X’), this does not suggest these documents do not exist, but rather, highlights that it is not readily accessible.

**Refers only to the Victorian Tree-fern Management Plan

Federal level compliance factors

Typically, compliance relating to seed collection licences is managed at the state/territory level. The only compliance factors from a federal level would typically relate to matters of national significance, meaning that the plant or ecological community being collected from is listed on the *EPBC Act 1999*.

The *EPBC Act* is an environmental protection framework and has a range of detection and enforcement mechanisms for non-compliance. This includes civil or criminal penalties, remediation orders and enforceable undertakings. Compliance is managed by the Office of Compliance for the Commonwealth Department of the Environment and Energy.



There are three key pieces of documentation that govern compliance: ‘The Department of the Environment and Energy Regulatory Framework, Commonwealth of Australia 2017’, the ‘Compliance Policy, Commonwealth of Australia 2019’ and the ‘Compliance Plan 2019–23, Commonwealth of Australia 2019’.

The recent interim report for the review of the *EPBC Act* highlights the key deficiencies of this piece of legislation which are in parallel to some of the key findings of this research. In essence, this review has found that the *EPBC Act* is ineffective and is not fit to address future environmental challenges and that a significant reform of national environmental law is needed (Samuel, 2020).

Considering the consensus that Australia’s environment is in an overall state of decline, it is clear that large scale restoration is required to ensure future development can be performed sustainably. Here we need to be very clear, that in order to facilitate restoration projects, we need seed, and lots of it. However, the current licensing systems are not set up in a way that reflects this, or the urgency in which we need to access and supply seed.

Furthermore, the review highlights the need for new, legally enforceable National Environmental Standards that are measurable. This points to the need to underpin new standards with robust data and information. These proposed standards would be highly beneficial to state and territory licensing systems. However, it should be recommended that a national standard that is specific to seed collection be developed with regards to servicing restoration projects.

The Regulatory Framework

The Regulatory Framework outlines the process of developing and administering regulation within the Department of Environment and Energy. This regulation pertains to climate change, environment, biodiversity, atmosphere, cultural and natural heritage, waste, chemicals and energy. The many drivers and pressures within these various sectors makes the regulatory system complex and dynamic. In line with this the framework places strong emphasis on engagement, education, transparency and continuous improvement.

For an in depth look into the Regulatory Framework visit:

<https://www.environment.gov.au/system/files/resources/f992a66c-ff2f-4698-b816-c578f4511954/files/dept-environment-energy-regulatory-framework.pdf>

Compliance policy

The Compliance Policy works alongside the Regulatory Framework by outlining the Office of Compliance's approach to compliance. The Office of Compliance uses a risk-based approach, and collects information (e.g. allegations, risk assessments, preliminary enquiries, monitoring) to prioritise resources. This means that low risk activities are handled by maintaining awareness and rewarding good compliance, whilst high risk activities require penalties to be applied and the highest risk behaviours require the full force of the law.

For an in-depth look into the Compliance Policy visit:

<https://www.environment.gov.au/system/files/resources/7bc85eb4-6cf6-4b9a-ab9f-6a23718d5f2c/files/compliance-policy.pdf>

Compliance Plan 2019–23

The Compliance Plan 2019–23 has been designed to be read in conjunction with the Regulatory Framework and Compliance Policy mentioned above and outlines the Office of Compliance’s priority compliance outcomes. The key aspect of this document that relates to seed collection is compliance outcome to ‘increase compliance with the *EPBC Act*’ which outlines the following priorities:

- support landowners to consider environmental laws
- monitor compliance with approval conditions and take required action
- detect and disrupt illegal trade of wildlife.

For an in depth look into the Compliance Plan 2019–23 visit:

<https://www.environment.gov.au/system/files/resources/0e313c68-fa7c-4c20-8e17-201f791a5344/files/compliance-plan-2019-23.pdf>

Biosecurity constraints

Invasive species, weeds and disease represent a significant threat to the Australian environment (Metcalf & Bui, 2016a). Strong biosecurity processes are required to prevent pests and diseases entering Australia in the first place and to manage the spread of pests and diseases if they do enter. For example, the pathogenic fungus Myrtle rust infects a range of Myrtaceous plant species including common *Eucalypts* and tea trees. Regional extinction has been observed for the rainforest species *Rhodomyrtus psidioides* and severe dieback across its species range in Queensland (Pegg et al, 2014).

With Myrtle rust widespread in Queensland and New South Wales and present in Victoria and Tasmania, it is now important to manage the risk of spread through appropriate biosecurity measures. For instance, over 940 seeds are currently prohibited from entering Western Australia, with a further 127 species banned to stop the spread of Myrtle rust disease (Department of Primary Industries and Regional Development, 2019).



Biosecurity policy in general differs between states and territories across Australia. Therefore, it is no surprise that there would be differences in biosecurity and quarantine procedures when it comes to seed. Further to this, each state has different native flora, therefore a species that is native to one state or territory may pose a threat of becoming a weed in a different location.

Movement of plants and plant products may therefore be prohibited or subject to conditions such as quarantine. Movement within a state or territory may also be restricted if pests or diseases establish in a particular area. Key themes that emerged from Groups 2 and 3 are that

it is difficult to send seed to South Australia, Western Australia and Tasmania, but easy to send seed to Victoria and New South Wales. This aligns to the respective quarantine systems in place and the lower occurrence of diseases such as Myrtle rust in these regions.

Seeds do not require an export permit under the *EPBC Act*, but are instead subject to the controls from the state or territory being exported from (Department Biodiversity, Conservation and Attractions, 2013).



KEY MESSAGES

- Compliance is managed at the state and territory level in the first instance. In matters of national significance, this may change and be escalated.
- Compliance across the states and territories were similar from a high level, in that penalties for non-compliance are contained in the key environmental legislation for the jurisdiction.
- In addition to the key environmental legislation, there were minimal supporting documents such as policy, code of conduct, regulatory frameworks or management plans in place that were specific to seed collection or sustainable harvesting.
- This highlights a key gap in policy and may also make it difficult and time-consuming for practitioners to understand their legal rights and obligations.
- Lack of enforcement of non-compliance was a key theme among respondent Groups 1 and 2. This can be partly attributed to staffing and resource limitations.

Other considerations

Collection of vegetative material

Under all the licensing systems reviewed as part of this research, it was found that in most cases all vegetative plant materials fall under the same licensing system (e.g. leaves, flowers, fruits, seeds, bulbs etc). A respondent to our questionnaire from Western Australia pointed out that having all flora aspects lumped together under the licensing has at times created barriers to collecting seed. For instance, the following situation has arisen whereby the respondent could not collect seed because limited licence holders can access certain areas, and a licence holder who wanted to collect flowers had applied to collect without that same earlier prior to the respondent. In the context of large-scale restoration and bushfire recovery, this presents as a complex issue of how to prioritise these wild resources, being seeds and other vegetative materials.

Licences for scientific collection

All states and territories have licences for scientific research that are separate from seed collection licences. The reasons for collecting under these licences may include collection of specimens for a herbarium, species identification and genetic analysis. These licences for scientific research are typically governed by the same pieces of legislation pertaining to collecting from threatened species and land access. An exception to this is in New South Wales whereby the permit to collect seed falls under a scientific licence and is usually used in conjunction with a bush regeneration licence, which also falls under the scientific licensing system.

It is common across all states and territories to provide details of the project you require the scientific licence for as well as the species you will be collecting from. This is not dissimilar from the details required when applying for licences for commercial purposes as discussed previously.

Comparative to the commercial licences discussed previously, it was common for there to be no fee attached to scientific licences and often the cost of renewal is cheaper than when applying for the licence the first time.

Victoria has not been included in **Table 10** below, as a scientific research licence could not be found for taking wild flora. Scientific research permits are required for wildlife and to conduct scientific research in National Parks, but there is little information on the permits required to take plant parts.

TABLE 10. LICENSING REQUIREMENTS TO UNDERTAKE SEED COLLECTION OF NATIVE SPECIES FOR SCIENTIFIC RESEARCH ACROSS AUSTRALIAN STATES AND TERRITORIES

STATE/ TERRITORY	SEED COLLECTION LICENCE	DESCRIPTION	\$COST
WA	Flora taking (biological assessment) licence or	Refers to taking biological material for inventory and identification purposes. Typically referring to environmental consulting services	\$150 for one year, or \$260 for 3 years
	Flora taking (other purposes) Crown land licence	Taking biological material for non-commercial purposes such as research, education, hobby etc	\$45-\$90 for one year, or \$75-\$160 for 3 years
SA	Scientific research permit	Application to undertake scientific research, plant or animal.	No fee
TAS	Scientific permits	A permit is required for scientific research purposes (e.g. collecting for herbarium or genetic analysis).	No fee
NSW	Scientific Licence	This licence can cover a range of activities including research, ecological surveys, bush regeneration and seed collection (non-commercial activities).	\$50 and issued on a project by project basis
ACT	Licence for non-commercial and scientific purposes	Refers to taking plant parts for scientific research or education including ecological surveys.	No fee
QLD	Scientific research and educational purposes permit	A permit is needed to 'take, use or interfere' with native flora in protected areas. In state forests you also need a Scientific Purposes Permit and a Permit to Collect	No fee
NT	Permit to undertake scientific research on wildlife	This permit covers the collection of biological resources for scientific research (i.e. bioprospecting). Need to enter into a benefit sharing agreement before you can apply for this permit.	No fee



KEY MESSAGES

- There are separate licences to collect seed and other plant materials if the purpose is to undertake scientific research.
- Compared to licences for commercial collect, scientific licences are either cheaper or free to obtain.
- There are situations where collection of different plant parts may make it difficult to collect seed and this presents a complex issue of how to prioritise wild resources.

Recommendations: Pathway to a system fit for purchase

This research has covered a lot of material, which at times was complex and difficult to summarise and compare between states and territories. This is largely because the systems within each state and territory are designed and managed according to the specific context of each jurisdiction. This goes beyond the licensing systems which therefore makes it difficult to determine whether one system is superior to another, because they are operating in different contexts. Despite this however, if we look at the bigger picture and think about these licensing systems in the context of enabling the access and supply of seed required to meet the future demand for large-scale restoration, we can think about how to create the best system.



A system is only as strong as its weakest link and there are several aspects of the current licensing systems which make it difficult to service the growing need for landscape scale restoration.

These issues come back to the inherently complex nature of the licensing systems, which require multiple levels of permissions (in some cases, state Department, local council, and landholder) and are restrictive to an industry that in many cases requires opportunistic collection of seed.

This section of the report aims to highlight areas of licensing which need reform, improvement and where new elements would benefit the system and enable access and supply of seed to meet the future demands for seed, but in a sustainable way. It is important to emphasise some key points that arose from our data analysis, that: (i) adding to the existing structure is likely to complicate the system further, and that a simplified system is required; and (ii) even the most efficient licensing system would not go far enough to support the supply of native seed for the future demand.

Technology

Over the last decade, we have seen huge technological advancements and an increase in information and services available online. We are now considered to be in the 'digital age' where it is increasingly important to deliver high quality products and services for customers online. A study by Brown et al. (2020) shows that the top drivers for 'agile ways of working' are customer centricity, productivity and employee engagement. This disruption and 'agile ways of working' are lagging in the public sector and native seed industry. This becomes obvious when you consider the simple act of searching for licence information online, completing an application or reporting on returns data, which are clunky and disjointed.

Online application systems

At this point in time it seems almost archaic to complete an application offline. Currently, the Australian Capital Territory and New South Wales have the only licensing systems in Australia that allow you to apply for a permit online. All other states and territories require a form to be downloaded, completed and either emailed, posted or delivered in person to the appropriate Government Department. While this may not come at an inconvenience to users, it does limit

the opportunity for optimised electronic data management. It also increases the lead time for an application to be received if were sent via post and requires additional effort by Department officers to manage the data received. When considering the key theme derived from Group 3 that staffing and resources are a limitation to the current licence systems, an increase in innovative and optimised operating systems would in theory alleviate workload but would require upfront investment. This may be a barrier as these Departments are generally underfunded (respondent 1c).

Data management and transparent reporting

Data management is another area that is experiencing ‘agile’ digital transformation (Brocchi et al. 2016). The public and private sector both face huge gaps in the benefits of data migration and management to deliver analytics updated in real-time to stakeholders.

It was identified through this research that various organisations or sole traders have chosen to develop their own sophisticated record keeping and data management systems for their own benefit, but for the benefit of guaranteeing high quality seed enters the market (respondent 1b, 2a, 2d). For instance, respondent 2d recalled keeping meticulous records down to soil condition so that the seed can enter the market with a ‘birth certificate’. This level of record keeping would help to overcome to large issue of poor-quality seed entering the market, and in turn would improve the ecological outcomes of restoration projects.

Because seed testing is not mandatory or governed across Australia, there is little data on the quality of seed entering the market. However, anecdotal evidence suggests that a combination of collecting from fragmented vegetation, collecting immature seed and inappropriate storage leads to a high percentage of seed being sold into the market with low viability rates. Respondent 2d recalled instances where seed viability where they had tested seed that had already been purchased that returned results of 0% viability. This may not be a common occurrence, however without oversight and mandated testing it is impossible to know the overall quality of native seed entering the market.

When we consider the data management of seed collection data within the state and territory Departments across Australia, it seems to be quite siloed. From an external perspective, there is little transparency on where the data goes or how it is used. Investing in transforming data infrastructure and processes would have cross-sector benefits.



A comprehensive online database would not only help to improve resources efficiencies, for example, by reducing the manual labour involved for Department officers to input data sent in from licenced practitioners, but would help to generate smart data, quickly. This has flow-on effects including an increased ability to detect and manage non-compliance.

By increasingly moving licensing systems online and integrating more sophisticated data systems, it would be possible to develop a user portal whereby a user could log on, see their previous applications, view their estimated collection quantities, and report on their actual

collection data. Furthermore, the seed sector needs more transparency and reporting on sustainable collection. There are standards that dictate how to collect seed sustainably, but it is unclear to external organisations if the actual amounts of seed collected meet these standards. This ties into the following point – licensing systems must be conducive to facilitating ecological outcomes.

Licensing systems must be conducive to facilitating positive ecological outcomes

‘Sustainable harvesting’ is referenced in all licensing systems that were considered for the purposes of this study. However, when we look at these systems through the lens of providing positive ecological outcomes (e.g. through restoration projects) these systems start to appear quite siloed and not conducive to enabling these outcomes.

Firstly, as previously discussed, wild seed is often sourced from already fragmented vegetation (e.g. from degraded roadsides) because of the complex issue of land access under current licensing systems. Thus, we need high quality seed that has been tested and assured entering the market. Secondly, there needs to be a shift away from the perception that harvesting seed is a ‘clearing’ or ‘taking’ action if it is harvested for restoration purposes. Restoration is inherently aimed at returning life to degraded landscapes, and over time will create new seed resources. This is particularly true if seed is harvested for the purposes of developing SPAs.

Standards — Quality over quantity

As highlighted earlier in this research, the amount of resources such as standards, code of conduct, regulatory frameworks, and policy that support seed licensing systems varies across the different state and territories. Western Australia is the only state to have an independent accreditation body – RIAWA – which acts as an independent governance body for the state’s native seed sector (Hancock et al. 2020). RIAWA was formed in 2003, as a cross-sector approach to provide a code of practice for the revegetation industry.



Nationally, standards are limited to the Australian Seed Federations’ Code of Practice for Seed Labelling and Marketing and National Code of Practice for the Use of Seed Treatments. These accreditations assist members to follow best practice pertaining to seed treatment, labelling, and marketing of seed.

Therefore, a significant gap appears for standards relating to the access and supply of seed. We do have the *FloraBank Guidelines*, which have been benchmarked as best practice for seed collection and use. Respondent 1d made key comments that we must be careful not to duplicate efforts of other stakeholders whilst respondent 2d posited that we need a new system, and that the new system should not in any way be built off the old system. Considering these points, in addition to the inherent complexities of land access, various licences and seed quality that have been previously discussed, it is suggested to explore opportunities to build a National Standard and Code of Conduct service for native seed off the existing *FloraBank Guidelines* or SERA Standards. This suggestion is supported by the fact that the RIAWA Native Seed Accreditation System and Seed Standards were developed from the *FloraBank Guidelines*.

Cross-sector collaboration to inform adaptive management

An interesting outcome from the interview component of this research was in the first instance, the willingness or lack thereof, of some Government Departments to engage in our research. This may also have been influenced by increased workload due to COVID-19 and more general staffing constraints. In addition, a common theme that emerged was that there is misalignment between the government systems, science and on-ground delivery. There is a consensus from the perspective of scientists and practitioners that the current systems are not fit for purpose when considering the large scaling up of seed supply that is needed to meet future demands for restoration. These perspectives need to be aligned to decision making for the native seed sector and could be facilitated through the development of a native seed committee that reports directly to decision makers.

SUMMARY

Common themes that emerged from surveying seed collectors and practitioners where that the licensing itself typically was not viewed as a barrier to collecting the seed that is needed to fulfil project. Rather, key issues pertained to the small workforce of seed collectors, the need for seed collection training, the need for more consistent demand, the long turn-around times in getting a licence approved and the difficulty in contacting government licensing staff.

Further, it was identified that there is a significant disparity between the true cost of collecting seed and what people are willing to pay for seed. For example, ensuring high quality seed is collected with good genetic diversity may require a seed collector to visit several sites to collect seed which often isn't reflected in the price people are willing to pay for that seed. A potential negative consequence of this is lower quality seed entering the market. One respondent said they have overcome this issue by paying seed collectors by the hour, instead of by weight to ensure collectors have the time to visit multiple sites and collect high quality seed. Largely, this type of information is missing from current seed collection licensing and regulation. This paper does not suggest that new regulations are the answer for this issue, however it certainly warrants discussion for future support tools for the industry.

Responses from Government Departments was varied across the states and territories, but overall, respondents felt that the current licensing systems are fit for purpose. Staff limitations and resourcing were identified as barriers to follow up on non-compliance and updating and improving aspects of licensing. In addition, it became apparent that there is a lot of data collected and analysed internally, but that data is rarely collated and made public. This highlights a gap in dialogue between key stakeholders within the seed industry, as this data may be useful for practitioners and restoration organisations.

REFERENCES

- ACT Government. (2013) ACT Nature Conservation Strategy 2013–2023. *ACT Government, Environment and Sustainable Development*, Canberra. Viewed 9 July 2020. https://www.environment.act.gov.au/_data/assets/pdf_file/0004/576184/ACT-Nature-Conservation-Strategy_web.pdf
- Booth, T.H. (2016) Identifying particular areas for potential seed collections for restoration plantings under climate change. *Ecological Management and Restoration*, 17(3). Doi: 10.1111/emr.12219
- Breed, M.F., Stead, M.G., Ottewell, K.M., Gardner, M.G., Lowe, A.J. (2012) Which provenance and where? Seed sourcing strategies for revegetation in a changing environment. *Conservation Genetics*, 14, pp 1–10. Doi: 10.1007/s10592-012-0425-z
- Broadhurst, L.M., Jones, T.A., Smith, F.S., North, T., Guja, L. (2016) Maximising seed resources for restoration in an uncertain future. *BioScience*, 66(1), pp 73–79
- Broadhurst, L. and Coates, D. (2017) Plant conservation in Australia: Current directions and future challenges. *Plant Diversity*, 39, pp 348–356
- Broadhurst, L., Hopley, T., Li, L., Begley, J. (2017) A genetic assessment of seed production areas (SPAs) for restoration. *Conservation Genetics*, 18, pp 1257–1266. Doi: 10.1007/s10592-017-0977-z
- Brocchi, C., Brown, B., Machado, J., Neiman, M. (2016) Using agile to accelerate your data transformation. *McKinsey & Company*. Viewed 7 August 2020. <https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/using-agile-to-accelerate-your-data-transformation>
- Brown, J.S., Kaur, K., Khan, N. (2020) Government agencies are under pressure to deliver more and better services to their stakeholders. Agile ways of working can be transformative. *McKinsey & Company*. Viewed 7 August 2020. <https://www.mckinsey.com/industries/public-and-social-sector/our-insights/implementing-agile-ways-of-working-in-it-to-improve-citizen-experience>
- Bureau of Meteorology. (2020) Annual climate statement 2019. Viewed 28 May 2020. <http://www.bom.gov.au/climate/current/annual/aus/>
- Campbell, A., Alexandra, J., Curtis, D. (2017) Reflections on four decades of land restoration in Australia. *The Rangeland Journal*, 39, pp 405–416. Doi: 10.1071/RJ17056
- CHABG. (2020). Australia’s major botanic gardens united to assist ecosystem restoration in response to recent bushfires. Viewed 7 July 2020. <https://www.seedpartnership.org.au/wp-content/uploads/2020/02/CHABG-statement-bushfire-recovery-capability.pdf>
- Commonwealth of Australia (2019). Australia’s Strategy for Nature 2019–2030: Australia’s national biodiversity strategy and action plan. *Prepared by the interjurisdictional Biodiversity Working Group convened under the Meeting of the Environment Ministers, Commonwealth of Australia*. https://naturehub.govcms.gov.au/sites/default/files/2019-11/Australia_s_Strategy_for_Nature_20web.pdf
- Compliance Plan 2019–23, Commonwealth of Australia 2019. Viewed 31 July 2020. <https://www.environment.gov.au/system/files/resources/0e313c68-fa7c-4c20-8e17-201f791a5344/files/compliance-plan-2019-23.pdf>

Compliance Policy, Commonwealth of Australia 2019. Viewed 31 July 2020.

<https://www.environment.gov.au/system/files/resources/7bc85eb4-6cf6-4b9a-ab9f-6a23718d5f2c/files/compliance-policy.pdf>

Cresswell, I.D. and Murphy, H.T. (2017) Australia state of the environment 2016: biodiversity, independent report to the Australian Government Minister for the Environment and Energy. Australian Government Department of the Environment and Energy, Canberra

CSIRO (2020) The 2019–20 bushfires: a CSIRO explainer. Viewed 28 May 2020.

<https://www.csiro.au/en/Research/Environment/Extreme-Events/Bushfire/preparing-for-climate-change/2019-20-bushfires-explainer>

DELWP (2019a) Protected flora controls. *Department of Environment, Land, Water and Planning*. Viewed 30 July 2020. <https://www.environment.vic.gov.au/conserving-threatened-species/flora-and-fauna-guarantee-act-1988/protected-flora-controls>

DELWP (2019b) Applying for a planning permit. *Department of Environment, Land, Water and Planning*. Viewed 23 July 2020. <https://www.planning.vic.gov.au/permits-and-applications/do-i-need-a-permit/apply-for-a-planning-permit>

DELWP (2020) Protected flora and listed fish. *Department of Environment, Land, Water and Planning, State Government of Victoria*. Viewed 6 August 2020.

<https://www.environment.vic.gov.au/conserving-threatened-species/protected-flora-and-listed-fish>

Department of Agriculture, Water and Environment. (2020) *EPBC Act Lists. Australian Government*. Viewed 27 May 2020. <http://www.environment.gov.au/epbc/about/epbc-act-lists>

Department of Agriculture, Water and Environment. (2020) Wildlife and threatened species bushfire recovery research and resources. Viewed 28 May 2020.

<http://www.environment.gov.au/biodiversity/bushfire-recovery/research-and-resources>

Department Biodiversity, Conservation and Attractions (2013) Management of Commercial Harvesting of Protected Flora in Western Australia, 1 July 2018–30 June 2023, Department of Biodiversity, Conservation and Attractions, Perth. Viewed 31 July 2020.

<https://www.dpaw.wa.gov.au/images/documents/plants-animals/licences-permits/Flora/Management%20of%20commercial%20harvesting%20of%20protected%20flora%20in%20WA%202018%20to%202023.pdf>

Department of Education (2020) Analysing qualitative data. *Department of Education, New South Wales Government*. Viewed 3 September 2020. <https://education.nsw.gov.au/teaching-and-learning/school-excellence-and-accountability/sef-evidence-guide/guidelines-for-using-data/analysing-qual-data>

Department of Environment (2013) Matters of National Environmental Significance: significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999. *Department of Environment, Commonwealth of Australia*, Canberra.

DPAW (2020) Licences and authorities: Flora licences. *Department of Biodiversity, Conservation and Attractions, Parks and Wildlife Service*. Viewed 24 July 2020.

<https://www.dpaw.wa.gov.au/plants-and-animals/licences-and-authorities?showall=&start=1>

Department of Primary Industries and Regional Development (2019) Importing seed to Western Australia. *Department of Primary industries and Regional Development, Government of Western Australia, Perth*. Viewed 7 August 2020. <https://www.agric.wa.gov.au/importing-plant-and-plant-products/importing-seed-western-australia>

DPIPWE (2013) Natural Heritage Strategy for Tasmania (2013–2030): Securing our Natural Advantage. *Department of Primary Industries, Parks, Water and Environment*. Hobart, Tasmania. Viewed 9 July 2020.

<https://dipw.tas.gov.au/Documents/NaturalHeritageStrategy2013.pdf>

Fagg, P., Lutze, M., Slijkerman, C., Ryan, M., Bassett, O. (2013) Sivicultural recovery in ash forests following three recent bushfires in Victoria. *Australian Forestry*, 76(3–4), pp 140–155. Doi: 10.1080/00049158.2013.848610

Greening Australia. (2017) \$10 million of funding to grow Seed Production Area a major boost for diverse Cumberland Plains. Viewed 10 July 2020. <https://www.greeningaustralia.org.au/10-million-of-funding-to-grow-seed-production-area-a-major-boost-for-diverse-cumberland-plains/>

Greet, J. (2016) The potential of soil seed banks of a eucalypt wetland forest to aid restoration. *Wetlands Ecological Management*, 24, pp 565–577

Hadden, S., Bramwells, H., and Macdonald, R. (2004) Landcare Notes: What permit do you need to collect local seed? *State of Victoria, Department of Sustainability and Environment*.

Hancock, N., Gibson-Roy, P., Driver, M., Broadhurst, L. (2020) *The Australian Native Seed Sector Survey Report*. Australian Network for Plant Conservation, Canberra

Hayward, M.W., Ward-Fear, G., L’Hotellier, F., Herman, K., Kabat, A.P., Gibbons, J.P. (2016) Could biodiversity loss have increased Australia’s bushfire threat? *Animal Conservation*. Doi: 10.1111/acv.12269

Hay, F.R., Probert, R.J. (2013) Advances in seed conservation of wild plant species: A review of recent research. *Conservation Physiology* (1), pp 1–11

Lawrence, N. (2003) Guidelines for permit applications for the ‘Taking’ of native flora. *Department of Primary Industries Water and Environment, Nature Conservation Branch*. Viewed 16 July 2020. <https://dipw.tas.gov.au/Documents/Guidelines-for-Permit-Applications-june03revised.pdf>

Lindenmayer, D.B. (2007) On borrowed time: Australia’s environmental crisis and what we must do about it. CSIRO Publishing, Camberwell, Australia.

Logie, S. (2020) Seed production areas help with native seed harvest. *Local Land Services, New South Wales Government*. Viewed 3 September 2020. <https://www.lls.nsw.gov.au/regions/murray/articles,-plans-and-publications/nrm-news-may-2020/seed-production-areas-help-with-native-seed-harvest>

Lucas, C., Hennessy, K., Mills, G., Bathols, J. (2007) Bushfire weather in southeast Australia: recent trends and projected climate change impacts. *Bushfire CRC and Australian Bureau of Meteorology*. Viewed 28 May. http://www.cmar.csiro.au/e-print/open/2007/hennesseykj_c.pdf

Metcalfe, D., Bui, E. (2016) Land: regional and landscape-scale pressures: land clearing. In: Australia state of the environment 2016, Australian Government Department of the Environment and Energy, Canberra, <http://soe.environment.gov.au/theme/land/topid/2016/regional-and-landscape-scale-p pressures-land-clearing>, DOI 10.4226/94/585f94911

- Metcalfe, D., Bui, E. (2016a) Land: regional and landscape-scale pressures: land clearing. In: Australia state of the environment 2016, Australian Government Department of the Environment and Energy, Canberra, <https://soe.environment.gov.au/theme/land/topic/2016/regional-and-landscape-scale-pressures-invasive-species>, DOI 10.4226/94/58b6585f94911
- Metcalfe, D.J. and Bui, E.N. (2017) Australia state of the environment 2016: land, independent report to the Australian Government Minister for the Environment and Energy. Australian Government Department of the Environment and Energy, Canberra
- Mortlock, W., Greening Australia, Australian Tree Seed Centre (1999) Model Code of Practice. *FloraBank*, ACT. Viewed 13 August 2020. https://www.greeningaustralia.org.au/wp-content/uploads/2017/11/FLORABANK-GUIDELINES_Model-code-of-practice.pdf
- New South Wales Government (2020) Biodiversity Conservation Act 2016 No 63. Viewed 3 September 2020. <https://www.legislation.nsw.gov.au/view/html/inforce/current/act-2016-063>
- Northern Territory Government of Australia (2019) Wildlife offences. *Northern Territory Government of Australia*. Viewed 6 August 2020. <https://nt.gov.au/environment/animals/wildlife-permits/wildlife-offences>
- North, T. (2009) Building on AuSCaR: towards an Australian Native Seed Bank Partnership. *Australasian Plant Conservation*, 17(4).
- NSW Government. (2020) Wildlife and Conservation Bushfire Recovery: Immediate Response. *NSW Government, Department of Planning, Industry and Environment*. Viewed 9 July. <https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Parks-reserves-and-protected-areas/Fire/wildlife-and-conservation-bushfire-recovery-immediate-response-january-2020-200027.pdf>
- Office of Environment and Heritage (2017) Whole Plant Sustainable Management Plan 2018–22: For the commercial harvest, salvage and propagation of protected whole plants. *New South Wales Government*, Sydney. Viewed 3 September 2020. <https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Licences-and-permits/whole-plant-sustainable-management-plan-170679.pdf>
- Pegg, G.S., Giblin, F.R., McTaggart, A.R., Guymer, G.P., Taylor, H., Ireland, K.B., Shivas, R.G., Perry, S. (2014). *Puccinia psidii* in Queensland, Australia: disease symptoms, distribution and impact. *Plant Pathology*, 63(5), pp 1005–1021
- Queensland Government (2019) Harvesting protected plants. Viewed 1 July 2020. <https://www.qld.gov.au/environment/plants-animals/plants/protected-plants/harvesting>
- Revegetation Industry Association of Western Australia (2014) About. *Revegetation Industry Association of Western Australia (RIAWA)*. Viewed 13 August 2020. http://riawa.com.au/wordpress/?page_id=5
- Samuel, G. (2020) Independent Review of the *EPBC Act* – Interim Report, Department of Agriculture, Water and the Environment, Canberra, June. CC BY 4.0.
- State of Queensland (2019) Draft wildlife trade management plan – Queensland protected plants (2019–2024). *Wildlife and Threatened Species Operations, Department of Environment and Science*. Viewed 16 July 2020 <https://www.environment.gov.au/system/files/consultations/7cdb6d32-4883-4037-9a42-bd5f9e4765f6/files/draft-mgt-plan-qld-protected-plants-2019-2024.pdf>

The Department of the Environment and Energy Regulatory Framework, Commonwealth of Australia 2017. Viewed 31 July 2020.

<https://www.environment.gov.au/system/files/resources/f992a66c-ff2f-4698-b816-c578f4511954/files/dept-environment-energy-regulatory-framework.pdf>

The State of Victoria. (2017) Protecting Victoria's Environment – Biodiversity 2037. *The State of Victoria, Department of Environment, Land, Water and Planning*. Viewed 9 July 2020.

https://www.environment.vic.gov.au/_data/assets/pdf_file/0022/51259/Protecting-Victorias-Environment-Biodiversity-2037.pdf

Thomas, R. (2016) Update on Regent Honeyeater habitat restoration project (7 years on) – Lurg Hills, Victoria. Viewed 6 July 2020.

<https://site.emrprojectsummaries.org/2016/03/05/update-on-regent-honeyeater-habitat-restoration-project-7-years-on-lurg-hills-victoria/>

Tracy, S.J. (2010) Qualitative quality: eight “big-tent” criteria for excellent qualitative research. *Qualitative Inquiry*, 16(10), pp 837–851. Doi: 10.1177/1077800410383121

Tulloch, A.I.T., Barnes, M.D., Ringma, J., Fuller, R.A., Watson, J.E.M. (2016) Understanding the importance of small patches of habitat for conservation. *Journal of Applied Ecology*, 53, pp 418–429

United Nations. (2020) Sustainable Development Goal 15. *United Nations*. Viewed 29 May 2020. <https://sustainabledevelopment.un.org/sdg15>

UNEP. (2010) Strategic plan for biodiversity 2011–2020: provisional technical rationale, possible indicators and suggested milestones for the Aichi Biodiversity targets. *Convention on Biological Diversity, United Nations Environment Program*. <https://www.cbd.int/doc/meetings/cop/cop-10/official/cop-10-27-add1-en.pdf>

Victorian State of the Environment. (2018) Scientific Assessments Part III Land. Commissioner for Environmental Sustainability Victoria.

https://www.ces.vic.gov.au/sites/default/files/SoE2018ScientificAssessment_L.pdf

Wildlife Licensing and Management Unit (2012) Scientific licensing policy. Office of Environment and Heritage: Wildlife Licensing and Management Unit, Conservation Operations Section, Park Management Division, Parks and Wildlife Group. Viewed 30 July 2020.

<https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Licences-and-permits/scientific-licensing-policy-120942.pdf>