

PROJECT PHOENIX



BUSHFIRE IMPACTS WHERE WILL THE SEED COME FROM?

JUNE 2021

First published 2021
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ISBN: xxx-x-xxxxxx-xx-x (Book)
xxx-x-xxxxxx-xx-x (epub)

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Title: Bushfire impacts — Where will the seed come from?
Notes: Includes bibliographical references

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Cover by Kerry O’Flaherty, Design Consultant
Internal design by Puddingburn Publishing Services
Proofread by Puddingburn Publishing Services

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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

I would like to acknowledge the work of Dr Melinda Pickup and her team, and the review and feedback of Patricia Verden and Dr Melinda Pickup.

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.

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1 KEY TERMS

ABBREVIATION	EXPLANATION
ESRMHT	Eastern Stirling Range Montane Heath and Thicket
LGWSEC	Lowland Grassy Woodland in the South East Corner Bioregion
LROSA	Lowland Rainforest of Subtropical Australia
SLPS	Silurian Limestone Pomaderris Shrubland of the South East Corner and Australian Alps Bioregions
TEC	Threatened Ecological Community
SPA	Seed Production Area
Propagule	Plant parts able to be used for reproduction or propagation, such as cuttings or pups.
Recalcitrant seed	Seed unable to tolerate drying and freezing, limiting long-term storage options.

2 INTRODUCTION

2.1 Project Phoenix

Project Phoenix is a Wildlife and Habitat Recovery package funded by the Commonwealth Government. Following on from the Australian Network for Plant Conservation’s survey and analysis of Australia’s native seed sector,¹ Project Phoenix aims to improve native seed and plant supply in preparation for targeted restoration of areas impacted by the 2019–20 Black Summer bushfires, as well as build native seed sector capacity through the development of a ten-year Strategy.¹

This report details the investigation into the capacity of suppliers to provide seed or seedlings of species associated with Threatened Ecological Communities (TEC) impacted by the Black Summer bushfires. It also provides context to the many factors affecting supply, including:

- variations in market focus of suppliers
- constraints surrounding market stability and reliability
- environmental factors affecting seed availability
- challenges in locating, harvesting, processing, storing and propagating
- best practice surrounding seed quality and environmental sustainability.

¹ This report contributes to the evidence base for a ten-year strategy to guide the native seed and landscape sector. The document, which is untitled until endorsement in September 2021, is referred to as the Strategy in all Project Phoenix publications.

3 CONTEXT

3.1 The Black Summer bushfires

Thousands of years of traditional burning as part of land management methods employed by Australia’s Indigenous peoples has resulted in many of the country’s ecosystems and the species within them being fire adapted.^{2,3} Fire dependant or resistant species rely on fires occurring within certain regimes; at particular seasonality, frequency and intensity. When fires occur outside these regimes, fire adapted species or communities may face death or disruption, which is amplified for species or communities considered fire sensitive.⁴⁻⁶



During Black Summer (2019–20), the high intensity uncontrolled wildfires which burned more than 10 million hectares, had an unprecedented impact on the environment, increasing pressure on species and ecosystems already threatened by extinction, decline or transition, and placing new species and ecosystems at risk.⁷⁻¹¹

In the aftermath of Black Summer, studies have been undertaken to identify species and vegetation communities most impacted to inform recovery actions and funding priorities,^{8,12,13} and state and federal governments have identified focal communities and species for proposed management actions. These actions are based largely on protecting and supporting natural regeneration, such as refugia protection, feral animal and weed management, herbivory control, etc. However, targeted revegetation may be needed to reinstate species or strata unable to recover naturally, or full ecosystem reconstruction may be needed in the absence of natural regenerative capacity.¹⁴

Any revegetation works implemented will be reliant on the availability of native seed or seedlings.

While the quantity of seed or seedlings needed for such revegetation works is unknown, and can only be accurately determined by conducting on-site assessments, indicative figures estimated in the Project Phoenix report *Bushfire impacts — How much seed will I need?* (2021) for plantings associated with Lowland Rainforest of Subtropical Australia (LROSA), suggest for one Threatened Ecological Community (TEC) alone, seedling needs could equate to 77 to 617 seedlings per hectare to reinstate fire sensitive tree species (2–20% of trees across the fire impacted area), and 300 to 3,300 seedlings per hectare to reinstate fire sensitive herbaceous species (3–33% of herbaceous species within the impacted area).¹⁵

3.2 Australia's native seed sector

The native revegetation industry in Australia is well established in some regions, but subject to much variation depending on the parties involved, methods used, scales of operation, ecosystems established, etc.¹⁶ Underpinning this is the native seed industry, which supplies native plant nurseries, mining restoration projects, community Landcare projects (and other community groups), restoration organisations, agricultural and forestry sectors, bush foods, and the landscaping sector, to name a few.



Demand for seed by these industries, organisations, projects or programs is subject to fluctuation. This factor, in addition to variations in seed availability impacted by seasonal conditions, natural plant cycles, flood, fires, drought, herbivory or seed predation, land clearing, pollinator absence/decline, and disease, result in a highly unpredictable and inconsistent market.^{1,17,18}

This market volatility in turn impacts the sustainability of the industry for collectors and suppliers, and the monetary value of native seed is not necessarily reflective of the challenges faced in collecting and processing seed, nor the niche skills and specialised knowledge involved locating suitable populations to harvest, or knowing when and how to harvest, process, clean and store the seed of Australia's highly diverse range of species.^{1,19,20}



The Australian Native Seed Survey Report,¹ in which the sector is described as an ad hoc assembly of individuals, agencies, businesses and enterprises, found a high number of these were sole traders or small businesses with <5 staff, which are especially vulnerable to market fluctuations.

In addition, as an industry at the mercy of environmental conditions, and dominated by small business, the seed sector is extremely vulnerable to environmental disasters.^{17,18,21,22}

3.3 Best practice

For native seed used in ecological restoration works, be this targeted reintroduction of a missing species or strata, or complete reconstruction of an entire ecosystem, obtaining seed from specific provenance with appropriate levels of genetic diversity is a priority. Provenance requirements may involve obtaining seed within a specified distance from the intended planting location to ensure local adaption (known as local provenance), or from other selected locations based on strategies to improve climate adaptation.



In addition to provenance sourcing, best practice requires seed or propagules to be obtained from an adequate number of well-spaced healthy individuals (for forbs and woody species) existing within suitably-sized and connected natural populations to ensure the best chances of genetically diverse seed.^{23,24}

Moreover, best practice also aims to mitigate or reduce risks to the plant, population and community by:

- limiting the amount of seed harvested from any individual
- minimising damage to vegetation
- avoiding unnecessary disturbance of wildlife habitats
- not introducing or spreading pests or pathogens and
- observing state and federal laws regarding the harvest of seed or plant parts of threatened species or species at risk from excess harvest pressure.²⁵



Some best practice guidelines and standards include those developed by FloraBank,^{19,20,23-28} or those produced by the Revegetation Industry of Western Australia (RIAWA).²⁹⁻³¹

3.4 Sustainable harvest and seed production areas (SPAs)

Due to the many challenges and constraints mentioned, revegetation projects/programs often face difficulties in obtaining seed from the range of species desired, or sufficient quantities of seed from the species that are available, and it has been recognised that wild harvests alone are not capable of supplying the increasing demands of the restoration industry.^{1,32} Seed production areas (SPAs), in which native species are cultivated specifically for seed, are advocated as a solution for increasing native seed availability.³³⁻³⁶



In Australia, native grasses and forbs are reported to be the most commonly grown, which is thought to be due to the faster rate of return on investment and lower space requirements. However, generally speaking, all plant forms may be cultivated (trees, shrubs, grasses and forbs).¹

An example of SPAs for woody species cultivation is Big Scrub Landcare’s ‘Science Saving Rainforest’ program which involves creating SPA’s of 23 important structural rainforest species through tissue culture derived from specimens of highest quality genetic diversity located through genome sampling programs of 180 trees across 30 locations.^{37,38}

3.5 Seed storage and alternatives

For high volumes of quality seed to be procured, adequate facilities are required to dry, process, clean, and store it, matched with requisite skills, knowledge, and equipment; lack of one or more of these factors places limitations on supply capacity. Adequate storage facilities are especially important for seed longevity if planning multi-season harvests.^{19,27,28}

Other challenges surround species with seed unable to tolerate drying or freezing, known as seed recalcitrance, which places limitations on seed storage options. Many of Australia’s fleshy-fruited native rainforest species bear recalcitrant seed, and for these species ‘storage’ in seedling form is considered a viable option.³⁹ Propagation via cuttings or tissue culture has also been used for ex situ conservation of species with low seed production or viability. This method, integrated with domestication, has been famously used as part of the conservation strategy of the highly charismatic ‘dinosaur plant’ the Wollemi Pine (*Wollemi nobilis*).^{40,41} The production of recalcitrant seed, or seed with limited storage life, or species with low to no seed production makes native plant nurseries an essential element of native revegetation works.

4 AIMS

The aim of this study is to conduct a spatial and sector engagement analysis of the ability of the current seed sector to respond to restoration priorities and management scenarios (identified in *Bushfire impacts — How much seed will I need?*), and clarify seed and plant resources availability in bushfire-affected areas.

Bushfire impacts — How much seed will I need? identified a total of 1,260 species across 568 genera associated with 19 TECs which had been burnt across >10% of their range. The species identified were obtained from TEC species lists, and from the ‘wildlife and threatened species bushfire recovery expert panel list of plants requiring urgent management intervention’.¹² The availability of a subset of these species relating to five nominated TEC were assessed.

The name of each community, reference code, community type, and state location may be seen in **Table 1**.

TABLE 1. NOMINATED PRIORITY LOCATIONS FOR ECOLOGICAL RESTORATION WORKS

THREATENED ECOLOGICAL COMMUNITY (TEC)	CODE	COMMUNITY TYPE	STATE
Lowland Rainforest of Subtropical Australia ⁴²	LROSA	Rainforest	QLD/NSW
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion ⁴³	UBEFS	Wet Sclerophyll	NSW
Lowland Grassy Woodland in the South East Corner Bioregion ⁴⁴	LGWSEC	Grassy Woodland	NSW
Silurian Limestone Pomaderris Shrubland of the South East Corner and Australian Alps Bioregions ⁴⁵	SLPS	Shrubland	VIC
Eastern Stirling Range Montane Heath and Thicket ⁴⁶	ESRMHT	Heathland	WA

5 METHODOLOGY

In order to evaluate the capacity of the native seed industry to supply species needed for priority restoration works, we searched publicly available seed and seedling catalogues for listings of 296 species across 180 genera, associated with the five nominated TECs impacted by the 2019–20 Black Summer bushfires.

A list of suppliers for each TEC was obtained through Greening Australia’s existing industry contacts and web searches, prioritising suppliers within or closest to the TEC based on physical distance between place of business and TEC location, measured using Google Earth.⁴⁷

The list of suppliers was then prioritised for assessment based on availability of web catalogues or online inventory search portals, supplier type, and distance from TEC, generating a list of seven seed suppliers and three seedling suppliers for each region, totalling ten suppliers.

Catalogue or web portal searches were then conducted, recording the presence or absence of 296 priority species (ranging from 20–86 species per community), supplier details including name, location, approximate number of native species in catalogue, supplier type, market focus, and subjective/qualitative observations. The collected data was analysed in Excel, and charts and tables generated. The percentage of species available within the supply sector and number of suppliers assessed have been reported.

6 FINDINGS

6.1 Number of suppliers

The number of suppliers initially identified through Greening Australia’s industry contacts and web searches, located within broad geographic range of the target TEC’s, includes 77 seed suppliers and 25 nurseries. Please refer to **Table 2** for the number of suppliers identified per state. *Please note, this does not represent the actual total number of suppliers operating in each state, only in focus regions.* Of these 102 suppliers identified, the websites of 25 seed suppliers and 14 seedling suppliers were assessed (39 total).

TABLE 2. TOTAL NUMBER OF SUPPLIERS IDENTIFIED (WITHIN BROAD GEOGRAPHIC REGION OF TEC’S) THROUGH INDUSTRY CONTACTS AND WEB SEARCHES, COMPARED TO NUMBER OF SUPPLIERS ASSESSED

STATE		QLD	NSW	VIC	SA	WA	TOTAL
Seed suppliers	Identified	7	31	14	2	23	77
	Assessed	4	7	7	1	6	25
Nurseries	Identified	1	8	5	0	11	25
	Assessed	1	7	3	0	3	14

6.2 Market focus and supplier type of those assessed

The stated focus of seed merchants targeting wholesale markets included rehabilitation (mining and Landcare), forestry, nurseries and landscaping, in addition to less often stated focus of international markets, salinity control, erosion control, and horse pasture improvement. Seed suppliers with a retail focus (\pm wholesale focus) usually catered to the home gardener and Landcare.

Community seed banks provided a higher focus on speciality species, such as local endemic species of defined catchments/regions aimed at supplying rural landholders/Landcare. Seedling suppliers (community or commercial) had an increased focus on speciality species, such as local endemic species of defined catchments/regions, ecosystem-based focus (e.g. rainforest, coastal heath, etc.) or novelty value (bushfoods, wildflowers etc.). A breakdown of supplier type and market focus can be seen in **Table 3**.

TABLE 3. MARKET FOCUS AND SUPPLIER TYPE

MARKET FOCUS	SUPPLIER TYPE			
	SEED		SEEDLING	
	Commercial	Community	Commercial	Community
Wholesale & Retail	13	0	7	1
Wholesale only	6	0	1	0
Retail only	1	5	2	3
Native and Exotic	5	0	2	0
Native only	15	5	8	4
Total # of suppliers	20	*5	10	4

* Includes one state run conservation seed bank facility

6.3 Percentage of species available

From the 315 species searches (296 species, with 18 species searched more than once) across 39 seed/seedling suppliers, an average of 37% of species were listed in catalogues or web search portals. Between the TECs, the highest percentage of species listed was for Grassy Woodland (LGWSEC) at 50%, and the lowest was for Heathland (ESRMHT) at 22%.



Seed suppliers offered a higher percentage of species listed for Wet Sclerophyll (UBEFS) and Heathland (ESRMHT) communities, while seedling suppliers offered a higher percentage of listings for the remaining three communities.

Refer to **Table 4** for details regarding total number of species assessed per TEC, percentage of species listed per seed or seedling suppliers, and the total percentage of species listed across all suppliers assessed.

TABLE 4. COMPARISON OF SPECIES AVAILABILITY BETWEEN SEED AND SEEDLING SUPPLIERS ACROSS TECs

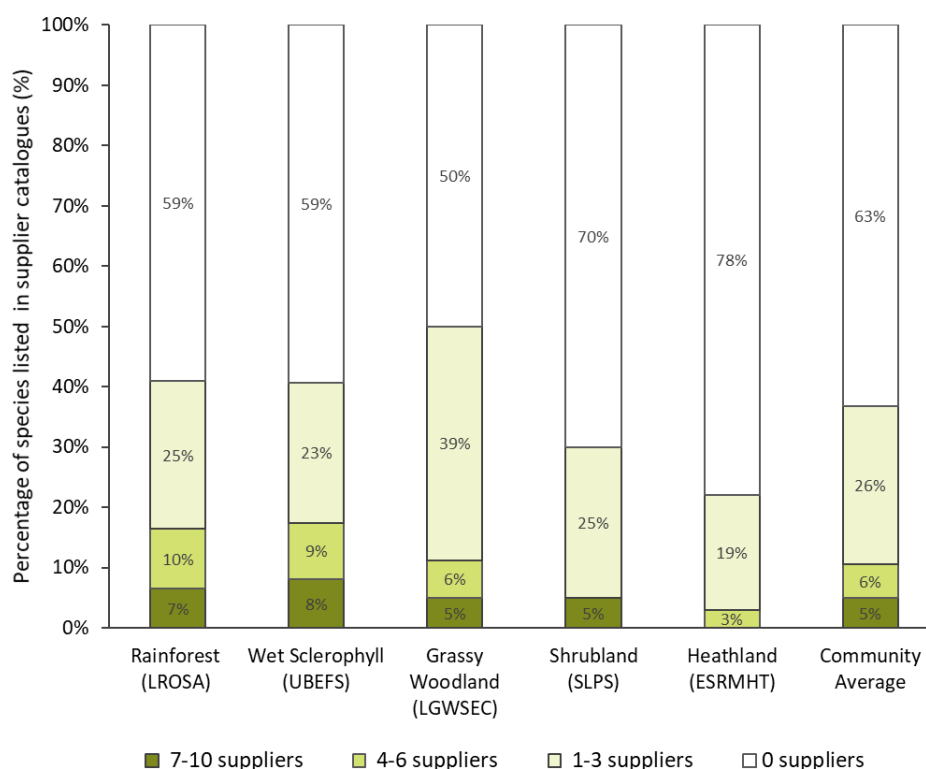
TEC SPECIES LIST	# SPECIES ASSESSED PER TEC	% SEED LISTED FROM 7 SUPPLIERS	% SEEDLING LISTED FROM 3 SUPPLIERS	% COMBINED SPECIES LISTED FROM 10 SUPPLIERS
LROSA	61	26%	33%	41%
UBEFS	86	34%	23%	41%
LGWSEC	80	25%	38%	50%
SLPS	20	15%	25%	30%
ESRMHT	68	15%	10%	22%
Total	296*	25%	26%	37%

*18 Species were included in two or more searches. 315 searches in total.

6.4 Number of suppliers (out of 10) with a species listed

The highest percentage of species listed by ≥ 4 suppliers were found in assessments of suppliers for Rainforest (LROSA, 16%), and Wet Sclerophyll (UBEFS, 17%). For all communities most species listed in supplier catalogues were offered by ≤ 3 suppliers, which was largely confined to species listed by one supplier only. Refer to **Figure 1** following for comparison of the percentage of species listed for each TEC, compared to the number of suppliers with each species listed. Species searched and number of suppliers with any species listed may also be found in **Tables 6–10** of [Appendix A](#).

FIGURE 1. STACKED COLUMN CHART SHOWING THE PERCENTAGE OF SPECIES AVAILABLE FOR EACH TEC SEARCH AND NUMBER OF SUPPLIERS (OUT OF 10) WITH EACH TARGET SPECIES LISTED IN THEIR CATALOGUES



6.5 Distance from Threatened Ecological Community (TEC)

Efforts were made to identify suppliers <100km from each TEC. While no single community had a total of ten suppliers operating within this range, four of five community had at least one seed supplier, and three of five had at least one seedling supplier.



Rainforest (LROSA) had the highest number of suppliers at close range, all <200km away. Suppliers for Wet Sclerophyll (UBEFS) were <500km away, with majority <200; suppliers assessed for Grassy Woodland (LGWSEC) were mostly between 400–600km away; suppliers for Shrubland (SLPS) ranged from <100–500km away; and suppliers for Heathland (ESRMHT) ranged from <50–>1,500km away.

Refer to **Table 5** for list of suppliers assessed, approximate distance from community, approximate number species present in catalogues, and number of target species listed per supplier/community. Please note, only information available from websites and freely available in the public domain has been reported.

6.6 Subjective and qualitative observations

Suppliers located in similar biogeographic regions to that of the target community often stocked seed or seedlings of the same genus, if not the target species themselves, while suppliers located in different biogeographic regions/climatic zones had a much lower chance of stocking the same genus.



The seed banks assessed usually provided provenance and quantity details of the seed stored, whereas this information was not ordinarily included in catalogues or search portals by commercial suppliers (wholesale or retail).

Many seed merchants/retail suppliers indicated they supply targeted collections services, and some suppliers specialising in native grass referenced use of Seed Production Areas to obtain seed.

TABLE 5. SUPPLIERS ASSESSED FOR EACH TEC, SHOWING APPROXIMATE NUMBER OF SPECIES AVAILABLE IN CATALOGUES, SUPPLIER LOCATION AND APPROXIMATE DISTANCE FROM TEC AND NUMBER OF TARGET SPECIES LISTED BY SUPPLIER

SUPPLIERS	APPROXIMATE # SPECIES ORDINARILY SUPPLIED	LOCATION	STATE	LROSA		UBEFS		LGWSEC		SLPS		ESRMHT	
				# target spp. listed	distance (km)	# target spp. listed	distance (km)	# target spp. listed	distance (km)	# target spp. listed	distance (km)		
SEED SUPPLIERS													
Austrahort ⁴⁸	800	Cleveland	QLD	8	<50								
Bay Horticultural Seeds ⁴⁹	600	Redland Bay, QLD	QLD	8	<100								
Native Seeds & Land Repair ⁵⁰	290	Maleny	QLD	7	<50								
QLD Native Seeds ⁵¹	330	South Burnett	QLD	7	100–200								
ABCeeds ⁵²	100	Ballina	NSW			2	400–500						
Alessi Native Seeds ⁵³	150	Goulburn	NSW			11	<100						
Australian Seed Company (aka Ausseed) ⁵⁴	1000	Hazelbrook	NSW	9	100–200	23	<50						
Diversity Native Seeds ⁵⁵	450	Coonabarabran	NSW	4	100–200	13	100–200						
Harvest Seeds & Native Plants ⁵⁶	580	Terrey Hills	NSW			19	100–200	16	100–200				
Royston Petrie Seeds (Aka RPS) ⁵⁷	850	Mudgee	NSW			15	<100						
Seed World ⁵⁸	260	Nowra	NSW	3	100–200	12	<50						

SUPPLIERS	APPROXIMATE # SPECIES ORDINARILY SUPPLIED	LOCATION	STATE	LROSA		UBEFS		LGWSEC		SLPS		ESRMHT	
				# target spp. listed	distance (km)	# target spp. listed	distance (km)	# target spp. listed	distance (km)	# target spp. listed	distance (km)		
Ballarat Region Seed bank (Seeding Victoria Inc) ⁵⁹	360	Creswick	VIC					9	500–600	1	300–400		
Murray Mallee Seed bank (Seeding Victoria Inc) ⁵⁹	120	Nyah	VIC					2	500–600	0	400–500		
Native Seeds Pty Ltd ⁶⁰	21	Eurobin	VIC					0	200–300	0	<100		
Flora Victoria ⁶¹	10	not indicated	VIC							0	?		
Goulburn Broken Catchment Seed Bank ⁶²	140	Euroa	VIC					10	400–500	2	200–300		
South Gippsland Seed bank ⁶³	150	Leongatha	VIC					6	400–500	1	200–300		
Yarram Landcare Seed bank ⁶⁴	170	Yarram, Gippsland	VIC					9	400–500	1	100–200		
Seeds of South Australia ⁶⁵	1251	Adelaide	SA									1	>1500
Australian Seed ⁶⁶	>40	not indicated	WA									3	?
GHEMS Holdings ⁶⁷	500	Bassendean	WA									1	300–400
Nindethana Seed Service ⁶⁸	>2000	Albany	WA									4	<100
Red Dirt Seeds ⁶⁹	280	Porongurup	WA									0	<50
Seed Shed ⁷⁰	>1000	Donnybrook	WA									2	200–300
Seed West ⁷¹	650	Wanneroo	WA									9	300–400

SUPPLIERS	APPROXIMATE # SPECIES ORDINARILY SUPPLIED	LOCATION	STATE	LROSA		UBEFS		LGWSEC		SLPS		ESRMHT	
				# target spp. listed	distance (km)	# target spp. listed	distance (km)	# target spp. listed	distance (km)	# target spp. listed	distance (km)	# target spp. listed	distance (km)
SEEDLING SUPPLIERS													
Burung Landcare ⁷²	228	North Maleny	QLD	6	<50								
Burringbar Rainforest Nursery ⁷³	>500	Upper Burringbar	NSW	17	<50								
Fire Wheel Rainforest Nursery ⁷⁴	227	Corndale	NSW	13	<50								
Indigrow ⁷⁵	200	La Perouse	NSW			6	<100						
Muru Mittigar ⁷⁶	170	Llandilo	NSW			17	<50						
South Coast Native Flora ⁷⁷	60	Narooma	NSW					3	<50				
Sydney Wildflower Nursery ⁷⁸	1000	Heathcote	NSW			17	<50						
Wariapendi Nursery ⁷⁹	150	Colo Vale	NSW					6	<100				
Goldfields Revegetation ⁸⁰	2760	Mandurang	VIC					30	500–600	3	300–400		
Kuranga Native Nursery ⁸¹	>360	Mount Evelyn	VIC							5	200–300		
Sandy Creek Trees ⁸²	200	Allans Flat	VIC							3	100–200		
Native Plants WA ⁸³	280	Cooloongup	WA									0	300–400
Plantrite ⁸⁴	500	Bullsbrook	WA									3	300–400
Wildflower society of WA ⁷⁸	1000	Darch	WA									5	300–400

7 DISCUSSION

7.1 Analysis of findings

7.1.1 Seed suppliers

Averaged across the study, the number of seed suppliers with no web presence, identified via Greening Australia’s industry contacts, compared to those suppliers with online websites was 67%, suggesting two-thirds of the seed supply industry in the focus areas are small businesses, hobbyists, sole traders, etc, illustrating the Australian Native Seed Sector report’s findings,¹ that sole traders or businesses of <5 staff are dominant in the industry. The low level of ‘visibility’ of these operators (i.e. no web presence) poses challenges to seed buyers wishing to trade.

7.1.2 Species availability

The number of species listed within a supplier’s catalogue doesn’t indicate whether a species is currently stocked, only that it might be, has been, or may be again. Based on this, key information that can be gleaned from catalogue searches is whether a species ordinarily features in supply chains, and some indication as to the likelihood of obtaining it, inferred by the number of suppliers listing it.



A low frequency of listing suggests the species is not widely used, and therefore is mainly of local importance (e.g. local catchment or region), or has novel value (e.g. bush tucker, wildflowers, etc.), while a high frequency of listing suggests high level of use in focus markets (rehabilitation, forestry, etc.) and a higher likelihood of seed being available/in stock.

Based on this, it might be hazarded that species listed with ≤ 3 out of 10 suppliers have a low likelihood of being available, but capacity to obtain through targeted collections may exist. Species listed with 4–6 out of 10 suppliers have improved likelihood of obtaining through targeted collections, and species with ≥ 7 out of 10 supplier listing have a good chance of being obtained from existing stock or secured through targeted collection.



Species not ordinarily featured in the market (63% on average) will need research to discover the most reliable and sustainable method of obtaining them, be it wild harvest, SPAs and germ culture/cloning.

7.1.3 Market focus

Community seed banks, in addition to native seedling nurseries, had a higher number of species not commonly listed by industry focused seed merchants (and therefore assumed to be less commonly used in the wider rehabilitation industry) due to a higher levels of focus on local ecosystems or catchments, or novelty value such as bushfoods and wildflowers. For seed suppliers, this variation seems indicative of the dynamic that commercial entities need to maximise sales by supplying reasonable quantities of high demand species (insuring inventories keep turning over), versus the community-based organisations willingness to stock species of niche value or interest at lower volumes.



For seedling suppliers, the variation between commercial and community-based entities was not evident, and it seems more likely that seedling suppliers have a higher focus on local markets (wholesale, retail, etc.) due to challenges and costs involved in effectively transporting seedlings long distances, and therefore a higher occurrence of supplying species of mainly local value/interest. This division in focus may be useful to consider when sourcing seed/seedlings.

Comparisons between the capacity of seed and seedling suppliers could not be considered reliable, as insufficient assessments of nurseries were made. However, it was interesting to note that in some regions, the seedling sector was able to offer a greater range of species (Rainforest (LROSA), Grassy Woodland (LGWSEC), and Shrubland (SLPS)). While seedling suppliers may be considered seed buyers/end users of the seed market, anecdotally many seedling suppliers also engage in seed collection. In addition, for species more readily stored as seedlings, such as recalcitrant rainforest species, or species in which cuttings or tissue culture provide the most effective means of conservation and proliferation, seedling suppliers might also be considered as an aspect of the seed supply industry.

7.1.4 Distance between supplier and Threatened Ecological Community (TEC)

Assessment of suppliers were prioritised for each TEC based on physical distance between place of business and TEC location, on the assumption that the likelihood of stocking target species would increase with increased proximity to the TEC. In reality, a higher number of 'local' suppliers didn't result in a higher total number of species listed, but did result in increased consistency, with a higher number of species listed across multiple suppliers (up to 17% of species in Rainforest (LROSA) and Wet Sclerophyll (UBEFS)).

There were increased challenges identifying suppliers within close range of TECs that had limited geographical distribution and were located at greater distances from major population centres (Shrubland (SLPS) and Heathland (ESRMHT)), which did translate to a low amount of species for these communities being listed, and low consistency of listing.

It was also challenging to find suppliers within close range of Grassy Woodland (LGWSEC), even though this community has a reasonable distribution and is within range of many medium sized population centres on the NSW south coast. Most suppliers were 400–600km away, which didn't translate to less species listed (Grassy Woodland (LGWSEC) had highest listing rates at 50%), however 39% were listed with ≤ 3 suppliers (mostly one supplier), suggesting low reliability of sourcing these.

All in all, it appears that increased number of suppliers operating in proximity to a TEC increases the likelihood of reliably obtaining a few species (up to 18%) from existing markets but doesn't translate directly to increased total number of species.



Obtaining seed for most priority species assessed will require targeted collections, or establishment of SPAs.

7.1.5 Provenance

In the context of provenance, the distance between suppliers' place of business and the TEC may loosely suggest the region that the seed is obtained from, however many suppliers collect from broad areas, or on-sell seed from other suppliers, so direct parallels would be unreliable. Further study is required to determine provenance sourcing options for those few target species that are regularly featured in supply chains, to determine if seed may be purchased 'off the shelf' or if targeted collections will also be required.

7.1.6 Further research is needed

It must also be noted that these results do not illustrate how supply chains may have been impacted by the Black Summer bushfires, nor answer the question entirely as to the seed/seedling industry's capacity to respond to Black Summer restoration priorities. It would be expected that in fire affected regions seed supply would be variable, dependant on the fire response of each species, and the levels of plant fatality due to the intensity and frequency of said fires. Further research is needed to investigate what kinds of quantities are available for commonly traded species, and the chances of obtaining seed from target provenance. For species not featured within existing markets research on a whole range of topics will need to be addressed.

7.2 Industry sustainability

The high number of small businesses in the sector coupled with the increased level of vulnerability that small businesses face relating to environmental disaster, not to mention the high level of volatility in the market ordinarily, suggest that many operators in bushfire-affected regions may be struggling or no longer operational.

As a result of climate change, environmental pressures on the sector are likely to increase (flood, fires, droughts, pollinator decline, etc.), at the same time the need for restoration work increases (disaster response, carbon capture, etc.), highlighting the importance of planning and support to build the sector's resilience and capacity.

Key items for consideration in capacity building programs include:

- adequate equipment and infrastructure
- improving market visibility and bargaining power of small suppliers
- a need for research and innovation
- supporting and promoting the establishment of SPAs.

In addition, other factors important for a maturing and stable industry include standardised guidelines for seed quality, and improving provenance information sharing.

7.2.1 Equipment and infrastructure

Many suppliers are resource limited due to the high cost of specialist cleaning and harvesting equipment, and the variety of equipment needed to harvest or process seed of Australia's diverse flora. The ability to scale up production is limited by access to these resources, as well as the facilities to store seed effectively.

To increase volume and stability of native seed supply, access to the right equipment and infrastructure is essential. One means that this may be achieved is through supporting adaptation of innovations from the grain industry, such as:

- shared centralised/regional storage and processing locations
- development of mobile processing plant capacity and
- innovations from the sharing-economy such as 'tool libraries'.

A variety of models may be explored, which could consist of establishing or strengthening these capacities for cooperatives or community seed banks, or supplier networks.

7.2.2 Networks, cooperatives and community seed banks

In addition to increasing opportunities for knowledge sharing, another benefit that may result from networks, cooperatives or seed bank models is an increased market visibility of small operators, which in turn improves opportunities to increase both consistency of trading and collective bargaining power, stabilising seed pricing and improving opportunities to receive fair rates of pay.



A variety of models and factors would need to be considered, based on the scale of seed demand for each region, existing industry and infrastructure, the aims and motivations of the suppliers involved, levels of industry competition or collaboration, and insurance and liability implications.

7.2.3 Supporting research and innovation

Research will be needed to discover suitable wild populations for harvest, in addition to the trial and error of discovering how and when to collect, process, and store or propagate each species. Species with limited or threatened populations, or other harvest restrictions or challenges, may require the development of dedicated SPAs. Many seed suppliers create their own harvesting, cleaning and processing equipment, due to a lack of existing devices or prohibitive expenses of those devices available on the market. As most priority species are unlikely to be available within existing markets, innovation will be needed to develop or adapt equipment to harvest or process said species.

7.2.4 Seed production Areas (SPAs)

SPAs have the capacity to dramatically boost seed availability of species already featured in the seed market and will be needed for many species unavailable from wild harvest. However, the industry within Australia is still in its infancy. Recognition of native seed markets in the agricultural sector is low, and upfront costs with a lag on returns can be prohibitive of those who are aware and willing.



To develop Australia's SPA capacity, we need increase market awareness coupled with research and innovation to develop this practice for a range of species, plus assistance with up-front investment.

7.2.5 Quality

To build market reliability, ensuring seed quality in the market is essential, however at present there is no legislation governing supply. Guidelines need to be set surrounding seed viability and germination rates, allowable levels of contamination, and labelling requirements. For SPA, guidelines surrounding the sourcing and use of 'founder' seed (used to establish or replenish SPA crops)³⁶ are needed to ensure best genetic outcomes.

7.2.6 Provenance information sharing

Generating, supporting or expanding capacity to share provenance information for seed banks, cooperatives and willing commercial suppliers would help improve market transparency and enable more effective provenance planning and sourcing. The seed inventory search programs found on seed bank websites, such as Seeding Victoria,⁵⁹ which allows inventory search by location or species across multiple networked seed banks, is a good example of this.

7.3 Environmental sustainability

Species or plant communities with limited or highly fragmented distributions (through impacts of severe wildfire, limited natural range, or reduced range through land clearing and other anthropogenic causes) may be put at further risk through harvest pressure caused by unsustainable harvest quantities, damage to plants, or the introduction of pests or pathogens during harvesting activities. Harvesting of threatened species and/or in TECs needs to be done by adequately trained/skilled professionals, working according to industry best practice and legislated requirements.

7.3.1 *Best practice, training and accreditation*

While best practice guidelines and standards exist (FloraBank/RIAWA), there are no mechanisms to ensure adherence to these in most states or territories. The voluntary online accreditation scheme delivered by RIAWA provides at minimum a means for seed sector practitioners to demonstrate awareness of and commitment to best practice, and in an ideal scenario, a means of ensuring practitioners are suitably educated on relevant matters. RIAWA’s program is a great first step, and introduction of similar programs to all states and territories is needed, which may be facilitated through FloraBank.

Combining training and accreditation with state harvest licensing schemes may also provide a means of improving greater regulation of quality and environmental safety within the sector, however any measure introduced should be mindful of the economic limitations of many in the industry.

7.3.2 *Environmental risk assessments*

For permitted/licensed collection of threatened species, or species within TECs, risk assessments should be conducted, evaluating environmental risks and hazards of collecting activities, weighing desired benefits versus potential detriments. If collection is considered safe to proceed, environmental risk mitigation strategies should be developed, implemented and reviewed through the harvest process.

7.3.3 *Industry support by government*

It has been recognised that the native seed sector in Australia is highly reliant on government spending, and therefore highly vulnerable to the boom and bust of funding cycles. While major government support is needed to increase capacity, thought must be given as to how this may achieve the long-term goals of a sector less dependent and more resilient to these fluctuating cycles, and how funding cycles may be regulated to build industry confidence.



It is crucial to ensure any government funding supports and strengthens existing resources or infrastructure (human, academic, technological, and built), builds networks and encourages collaboration to maximise knowledge, resource-sharing or gain across the sector, and specifically targets regions where long-term sector development is needed.

The rural nature of the industry provides opportunities to link support of seed enterprises with regional jobs creation and small business support, and opportunities to develop these causes, in line with national employment narratives, should be investigated further.

7.4 Ex situ conservation and domestication of novel species

Harvesting and/or propagation of threatened species for targeted in situ revegetation may present additional opportunities for ex situ conservation programs. As was famously and successfully done with the Wollemi Pine, ex situ conservation programs involving the propagation and commercial domestication of a species may offer an opportunity for economic return on conservation investment, as well as opportunities to raise community awareness of selected species, which might include those with attractive or unusual flowers, foliage, or form, or with a pleasant aroma.

Likely to be of particular interest to the seedling supply sector, any consideration of this must be subject to economic and environmental risk, cost and benefit analysis for any species considered, in addition to consideration of licensing arrangements.

7.5 Timing

Ideally, any targeted revegetation works delivered according to the Strategy² would allow at minimum five years of after-care and maintenance, meaning securing of seed or seedling resources needs to be established by year five of the ten-year program. Timely assessments will need to be made determining whether wild harvests or SPAs are the most effective option to secure seed for each priority species in each priority region, followed by the development of harvest or production strategies.



Sustainable wild harvest may involve successive harvests over multiple years, and harvests from SPAs may require multiple years in lead time, dependant on time taken for a species to reach maturity in addition to the SPAs' production capacity.

In addition, the challenges of harvesting, processing, storing and propagating species not ordinarily within the supply chain will present a vast range of challenges and opportunities for learnings.

² See note 1.

8 CONCLUSION

Results of catalogue searches for 296 species associated with five nominated TEC suggest on average:

- only 11% of species needed for targeted revegetation works might be reliably sourced
- an additional 26% of species are infrequently featured in the supply chain, showing capacity to harvest does exist and will need to be boosted
- the remaining 63% of species assessed were unavailable, indicating research will be needed to learn where, when and how to harvest, process, store and grow them.

Whether these species should be obtained from wild harvests, SPAs, or both, needs to be determined early on, as successive harvests over multiple years is likely needed for wild harvests, and SPAs require multiple years to establish and become productive. Any targeted revegetation program should have at minimum five years after-care/maintenance, so adequate seed or seedlings should be established by year five of the Strategy.

To ensure the sector can deliver what's needed for Black Summer restoration priorities, and ensure long-term stability and capacity, support and investment will be needed to boost equipment and infrastructure, research and innovation, market access/visibility of small suppliers, and to support/promote the establishment of SPAs.

In addition, other factors important for a maturing and stable industry include standardised guidelines for seed quality, accredited best-practice training, and improving provenance information sharing.

9 RECOMMENDATIONS

9.1 Seed/seedling research and harvest/production timing

Prompt actions are needed to generate seed, propagule or seedling supplies within the first five years of the ten-year program, including:

1. Further studies into priority species readily available in the market.

Investigating available provenances and quantities.

2. Species already featured in supply chains but not available from existing stocks will need targeted collections.

Early arrangements will allow for sustainable harvest over multiple seasons, subject to seasonal variation, and seed storability or staged usage.

3. Assessments must be made for priority species unavailable in the supply chains.

Whether they may be sustainably harvested from wild populations (who, when, where, how, and over what period), or are suitable candidates for SPAs (or both).

4. Research into species not ordinarily featured in the seed/seedling supply chain.

To develop skill and knowledge as to where these species may be sustainably sourced, how and when to harvest, how to process and preserve, germinate and/or propagate.

5. Early establishment/development of SPAs for suitable species will maximise harvest potential.

This must include identifying, supporting and/or expanding SPAs already producing priority species, and the development or expansion of SPAs to produce priority species not yet in cultivation.

6. SPA research.

Investigating horticultural methods to maximise seed production of a diverse range of species (including pollinator research), and developing best practice for genetic quality.

7. Support innovation to develop cheap/cost effective harvesting or collecting plant/equipment.

9.2 Industry capacity building measures

All recommendations are subject to regional and community suitability or need, and to the benefit of the local sector, not just a single supplier.

1. Develop and implement models for economically viable and resilient community seed banks, cooperatives or networks (or increase capability of existing ones), subject to regional and community suitability or need.
2. Improve access to shared equipment and facilities through the creation of regional storage and processing locations through seed banks, cooperatives or supplier networks.
3. Create or support access to mobile processing equipment, and/or implement innovations from the sharing-economy such as ‘tool libraries’.
4. Supporting networking initiatives between seed banks or cooperatives, which enables improved provenance searching capacity (such as Seeding Victoria’s ‘map search’ function).⁵⁹

9.2.1 *Environmental sustainability and quality*

1. Develop and implement training and accreditation programs, delivered through FloraBank, instructing best practice native seed harvesting, processing, record keeping and storage methods.
2. Development of an environmental risk assessment process for permitted/licensed collection of threatened species, or species within TECs.

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APPENDIX A

TABLE 6. SPECIES LIST: LOWLAND RAINFOREST OF SUBTROPICAL AUSTRALIA (LROSA)

SCIENTIFIC NAME	NUMBER OF SUPPLIERS WITH SPECIES LISTED		
	SEED	SEEDLING	TOTAL
<i>Acacia beadleana</i>			
<i>Acacia cangaensis</i>			
<i>Acacia irrorata</i>	5		5
<i>Acacia melanoxylon</i>	7	2	9
<i>Acacia tessellata</i>			
<i>Acacia trachyphloia</i>	1		1
<i>Alphitonia petrei</i>	5	2	7
<i>Archontophoenix cunninghamiana</i>	4	3	7
<i>Asplenium australasicum</i>		1	1
<i>Astrotricha</i> sp. Mount Boss (P.Gilmour 7907)			
<i>Bertya</i> sp. Clouds Creek (M.Fatemi 4)			
<i>Breynia oblongifolia</i>	3	1	4
<i>Caldcluvia paniculosa</i>			
<i>Cestichis reflexa</i>			
<i>Chiloglottis anaticeps</i>			
<i>Cinnamomum oliveri</i>		2	2
<i>Cissus hypoglauca</i>			
<i>Citronella moorei</i>		1	1
<i>Cryptocarya williwilliana</i>		1	1
<i>Dendrocnide excelsa</i>			
<i>Deyeuxia reflexa</i>			
<i>Ehretia acuminata</i>	1	2	3
<i>Elaeodendron australe</i> (Aka: <i>Cassine australis</i>)	1	3	4
<i>Eucalyptus olida</i>	2		2
<i>Eucalyptus rudderi</i>	1		1
<i>Eucalyptus scias</i> subsp. <i>apoda</i>			
<i>Eucalyptus stellulata</i>	1		1
<i>Grevillea acanthifolia</i> subsp. <i>paludosa</i>			
<i>Grevillea rhizomatosa</i>			
<i>Hibbertia villosa</i>			
<i>Kardomia prominens</i> (aka <i>Babingtonia prominens</i>)			
<i>Leptospermum benwellii</i>			
<i>Lepyrodia oligocolea</i>			
<i>Liparis reflexa</i> var. <i>parviflora</i>			

SCIENTIFIC NAME	NUMBER OF SUPPLIERS WITH SPECIES LISTED		
	SEED	SEEDLING	TOTAL
<i>Litsea reticulata</i>			
<i>Macrozamia johnsonii</i>			
<i>Macrozamia montana</i>			
<i>Mallotus philippensis</i>	2	3	5
<i>Melia azedarach</i>	5	3	8
<i>Omаланthus populifolius</i>			
<i>Pandorea pandorana</i>	4	1	5
<i>Persoonia rufa</i>			
<i>Philothea obovatifolia</i>			
<i>Podolobium aestivum</i>			
<i>Polyscias elegans</i>	1	2	3
<i>Pomaderris ligustrina subsp. latifolia</i>			
<i>Prostanthera saxicola var. major</i>			
<i>Pultenaea tarik</i>			
<i>Sarcomelicope simplicifolia</i>		1	1
<i>Senecio scabrellus</i>			
<i>Sloanea australis</i>		2	2
<i>Sloanea woollsii</i>		1	1
<i>Solanum curvicauspe</i>			
<i>Streblus brunonianus</i>		1	1
<i>Telopea aspera</i>			
<i>Trema aspera (Aka Trema tomentosa var. viridis)</i>	3	2	5
<i>Triplarina imbricata</i>			
<i>Wilkiea huegeliana</i>		2	2
<i>Xerochrysum sp. Mt Merino (S.T.Blake 22869)</i>			
<i>Zieria floydii</i>			
<i>Zieria lasiocaulis</i>			
Total number of species listed from 61 spp. searched:	11	10	15

TABLE 7. SPECIES LIST: UPLAND BASALT EUCALYPT FORESTS OF THE SYDNEY BASIN BIOREGION (UBEFS)

SCIENTIFIC NAME	NUMBER OF SUPPLIERS WITH SPECIES LISTED		
	SEED	SEEDLINGS	TOTAL (OF 10)
<i>Acacia clunies-rossiae</i>			
<i>Acacia elata</i>	4	1	5
<i>Acacia hamiltoniana</i>	1		1
<i>Acacia melanoxylon</i>	6		6
<i>Acaena novae-zelandiae</i>			
<i>Ajuga australis</i>	1	1	2
<i>Austrocynoglossum latifolium</i>			
<i>Baloskion longipes</i>			
<i>Banksia penicillata</i>			
<i>Boronia deanei</i> subsp. <i>deanei</i>			
<i>Boronia subulifolia</i>			
<i>Callistemon subulatus</i>	3		3
<i>Carex breviculmis</i>			
<i>Centella asiatica</i>			
<i>Clematis aristata</i>	3	3	6
<i>Coprosma quadrifida</i>			
<i>Coronidium scorpioides</i>			
<i>Cyathea leichhardtiana</i>			
<i>Cyphanthera scabrella</i>			
<i>Darwinia taxifolia</i> subsp. <i>macrolaena</i>		1	1
<i>Daviesia ulicifolia</i>	4		4
<i>Dianella</i> spp.	6	3	9
<i>Dichelachne inaequiglumis</i>			
<i>Dichondra</i> spp.	4	1	5
<i>Dillwynia stipulifera</i>			
<i>Echinopogon ovatus</i>			
<i>Epacris gnidioides</i>			
<i>Epacris sprengelioides</i>			
<i>Eucalyptus bensonii</i>			
<i>Eucalyptus corticosa</i>			
<i>Eucalyptus cunninghamii</i>			
<i>Eucalyptus elata</i>	6	1	7
<i>Eucalyptus fraxinoides</i>	3		3
<i>Eucalyptus gregsoniana</i>	5	1	6
<i>Eucalyptus oreades</i>	3		3
<i>Eucalyptus smithii</i>	5		5

SCIENTIFIC NAME	NUMBER OF SUPPLIERS WITH SPECIES LISTED		
	SEED	SEEDLINGS	TOTAL (OF 10)
<i>Eucalyptus stellulata</i>	6		6
<i>Eustrephus latifolius</i>	2	1	3
<i>Geranium spp.</i>			
<i>Glycine spp.</i>	1		1
<i>Grevillea asplenifolia</i>		1	1
<i>Grevillea baueri subsp. asperula</i>		1	1
<i>Grevillea evansiana</i>			
<i>Grevillea imberbis</i>			
<i>Grevillea renwickiana</i>	1		1
<i>Hakea constablei</i>	1		1
<i>Hakea dohertyi</i>			
<i>Hardenbergia violacea</i>	7	3	10
<i>Hedycarya angustifolia</i>			
<i>Hibbertia scandens</i>	5	2	7
<i>Indigofera australis</i>	6	2	8
<i>Kunzea aristulata</i>			
<i>Leptospermum macrocarpum</i>	1		1
<i>Leptospermum petraeum</i>			
<i>Leucopogon lanceolatus</i>		1	1
<i>Lomandra longifolia</i>	6	2	8
<i>Luzula flaccida subsp. Long Anther (K.L.Wilson 828 et al.)</i>			
<i>Marsdenia flavescens</i>			
<i>Myrsine howittiana (syn. Rapanea howittiana)</i>			
<i>Persoonia mollis subsp. budawangensis</i>	1	1	2
<i>Philothea scabra subsp. latifolia</i>			
<i>Plantago debilis</i>			
<i>Poa affinis</i>		1	1
<i>Polyscias sambucifolia</i>	1		1
<i>Polystichum proliferum</i>			
<i>Poranthera microphylla</i>	1		1
<i>Prostanthera lasianthos</i>	1	1	2
<i>Prostanthera saxicola var. montana</i>			
<i>Pterostylis crebra</i>			
<i>Pyrrhosia rupestris</i>			
<i>Schoenus evansianus</i>			
<i>Senecio linearifolius</i>			
<i>Sigesbeckia orientalis subsp. orientalis</i>			

SCIENTIFIC NAME	NUMBER OF SUPPLIERS WITH SPECIES LISTED		
	SEED	SEEDLINGS	TOTAL (OF 10)
<i>Stellaria flaccida</i>			
<i>Stellaria pungens</i>			
<i>Telopea mongaensis</i>	1		1
<i>Tetradlea ericifolia</i>			
<i>Trachymene scapigera</i>			
<i>Urtica incisa</i>			
<i>Veronica blakelyi</i>			
<i>Veronica brownii</i>			
<i>Veronica lithophila</i>			
<i>Veronica plebeia</i>			
<i>Viola spp.</i>		2	2
<i>Zieria caducibracteata</i>			
<i>Zieria murphyi</i>			
Total number of species listed from 86 spp. searched:	29	20	35

TABLE 8. SPECIES LIST: LOWLAND GRASSY WOODLAND IN THE SOUTH EAST CORNER BIOREGION (LGWSEC)

SCIENTIFIC NAME	NUMBER OF SUPPLIERS WITH SPECIES LISTED		
	SEED (OF 7)	SEEDLINGS (OF 3)	TOTAL (OF 10)
<i>Acacia implexa</i>	4	3	7
<i>Acacia mearnsii</i>	5	2	7
<i>Acacia trachyphloia</i>	1		1
<i>Ajuga australis</i>		1	1
<i>Allocasuarina littoralis</i>	5	3	8
<i>Boronia subulifolia</i>			
<i>Bossiaea buxifolia</i>		1	1
<i>Brachyscome salkiniae</i>			
<i>Callistemon (or Melaleuca) subulatus</i>	1	2	3
<i>Calotis lappulacea</i>	1		1
<i>Capillipedium parviflorum</i>			
<i>Carex breviculmis</i>		1	1
<i>Cassinia aculeata</i>	4	1	5
<i>Cassinia longifolia</i>	4		4
<i>Cassinia trinerva</i>	1		1
<i>Chenopodium carinatum</i>			
<i>Chrysocephalum apiculatum</i>	2	1	3
<i>Chrysocephalum semipapposum</i>	3	1	4
<i>Clematis glycinoides var. glycinoides</i>	3		3
<i>Convolvulus angustissimus</i>		1	1
<i>Convolvulus erubescens</i>			
<i>Cullen microcephalum</i>		1	1
<i>Cyanthillium cinereum (Aka: Vernonia cinerea)</i>			
<i>Cynoglossum australe</i>	1		1
<i>Cynoglossum suaveolens</i>		1	1
<i>Dichondra spp.</i>	1	1	2
<i>Digitaria brownii</i>			
<i>Dodonaea viscosa subsp. angustifolia</i>	5		5
<i>Dysphania pumilio (Aka: Chenopodium pumilio)</i>			
<i>Echinopogon ovatus</i>			
<i>Einadia hastata</i>		1	1
<i>Einadia nutans</i>		1	1
<i>Einadia trigonos</i>			
<i>Eucalyptus fraxinoides</i>	1		1
<i>Euchiton gymnocephalus</i>			

SCIENTIFIC NAME	NUMBER OF SUPPLIERS WITH SPECIES LISTED		
	SEED (OF 7)	SEEDLINGS (OF 3)	TOTAL (OF 10)
<i>Euchiton japonicus</i>			
<i>Exocarpos cupressiformis</i>		1	1
<i>Galium leiocarpum</i>			
<i>Glycine clandestina</i>	2		2
<i>Grevillea rhyolitica</i> subsp. <i>semivestita</i>		1	1
<i>Hardenbergia violacea</i>	2	2	4
<i>Hydrocotyle laxiflora</i>		1	1
<i>Hypericum gramineum</i>			
<i>Lagenophora stipitata</i> (Aka: <i>Lagenifera stipitata</i>)			
<i>Laxmannia gracilis</i>			
<i>Leucopogon juniperinus</i>			
<i>Lobelia purpurascens</i>			
<i>Lomandra longifolia</i>	5	3	8
<i>Opercularia aspera</i>			
<i>Opercularia varia</i>		1	1
<i>Oxalis perennans</i>			
<i>Ozothamnus argophyllus</i>			
<i>Ozothamnus diosmifolius</i>		1	1
<i>Panicum effusum</i>			
<i>Pimelea curviflora</i> var. <i>gracilis</i>		1	1
<i>Pimelea curviflora</i> var. <i>sericea</i>		1	1
<i>Pittosporum undulatum</i>	1		1
<i>Polygala japonica</i>			
<i>Ranunculus lappaceus</i>		1	1
<i>Rytidosperma pilosum</i> (formerly <i>Austrodanthonia pilosa</i>)			
<i>Scleranthus biflorus</i>			
<i>Scleranthus fasciculatus</i>			
<i>Senecio hispidulus</i> var. <i>hispidulus</i>			
<i>Senecio quadridentatus</i>			
<i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i>			
<i>Solanum prinophyllum</i>			
<i>Solanum pungetium</i>			
<i>Sorghum leiocladum</i>			
<i>Sporobolus creber</i>			
<i>Sporobolus elongatus</i>			
<i>Thesium australe</i>			

SCIENTIFIC NAME	NUMBER OF SUPPLIERS WITH SPECIES LISTED		
	SEED (OF 7)	SEEDLINGS (OF 3)	TOTAL (OF 10)
<i>Tricoryne elatior</i>		1	1
<i>Vernonia cinerea</i> var. <i>cinerea</i>			
<i>Veronica calycina</i>			
<i>Veronica plebeia</i>		1	1
<i>Wahlenbergia communis</i>		1	1
<i>Wahlenbergia gracilis</i>			
<i>Wahlenbergia stricta</i> subsp. <i>stricta</i>		1	1
<i>Zieria caducibracteata</i>			
<i>Zornia dyctiocarpa</i> var. <i>dyctiocarpa</i>			
Total number of species listed from 80 spp. searched:	20	30	40

TABLE 9. SPECIES LIST: SILURIAN LIMESTONE POMADERRIS SHRUBLAND OF THE SOUTH EAST CORNER AND AUSTRALIAN ALPS BIOREGIONS (SLPS)

SCIENTIFIC NAME	NUMBER OF SUPPLIERS WITH SPECIES LISTED		
	SEED (OF 7)	SEEDLINGS (OF 3)	TOTAL (OF 10)
<i>Allocasuarina verticillata</i> (previously <i>A. stricta</i>)	4	3	7
<i>Carex breviculmis</i>		2	2
<i>Dichondra repens</i>		2	2
<i>Olearia astroloba</i>			
<i>Oxalis perennans</i>			
<i>Ozothamnus adnatus</i>			
<i>Poa sieberiana</i>	2	1	3
<i>Wahlenbergia gracilis</i>			
<i>Lomandra confertifolia</i> subsp. <i>leptostachya</i>			
<i>Asplenium trichomanes</i> subsp. <i>quadrivalens</i>			
<i>Ireneparsus magicus</i>			
<i>Isoetopsis graminifolia</i>			
<i>Pimelea flava</i>		1	1
<i>Pimelea flava</i> subsp. <i>dichotoma</i>			
<i>Pimelea pauciflora</i>			
<i>Pomaderris oraria</i> subsp. <i>calcicola</i>	1		1
<i>Senecio quadridentatus</i>			
<i>Vittadinia tenuissima</i>			
<i>Pultenaea densifolia</i>			
<i>Senna aciphylla</i> (syn: <i>Cassia aciphylla</i>)			
Total number of species listed from 20 spp. searched:	3	5	6

TABLE 10. SPECIES LIST: EASTERN STIRLING RANGE MONTANE HEATH AND THICKET (ESRMHT)

SCIENTIFIC NAME	NUMBER OF SUPPLIERS WITH SPECIES LISTED		
	SEED (OF 7)	SEEDLINGS (OF 3)	TOTAL (OF 10)
<i>Acacia drummondii</i> subsp. <i>elegans</i>	5		5
<i>Actinotus rhomboideus</i>			
<i>Adenanthos filifolius</i>			
<i>Andersonia axilliflora</i>			
<i>Andersonia echinocephala</i>			
<i>Aotus genistoides</i>			
<i>Astartea montana</i>			
<i>Banksia brownii</i>	1	1	2
<i>Banksia concinna</i> (aka: <i>Dryandra conicina</i>)	4		4
<i>Banksia formosa</i> (Aka: <i>Dryandra formosa</i>)			
<i>Banksia montana</i> (Previously: <i>Dryandra montana</i>)			
<i>Banksia solandri</i>			
<i>Banksia oreophila</i>			
<i>Beaufortia anisandra</i>		1	1
<i>Beaufortia decussata</i>	1		1
<i>Billardiera drummondii</i>			
<i>Boronia crenulata</i> var. <i>angustifolia</i>		1	1
<i>Boronia spathulata</i>			
<i>Calothamnus montanus</i>			
<i>Cassytha glabella</i>	3		3
<i>Cryptostylis ovata</i>			
<i>Dampiera leptoclada</i>			
<i>Darwinia collina</i>			
<i>Darwinia nubigena</i> (sp. Stirling Range)		1	1
<i>Darwinia squarrosa</i>			
<i>Daviesia obovata</i>			
<i>Desmocladius flexuosus</i>		1	1
<i>Deyeuxia drummondii</i>			
<i>Dielsiodoxa tamariscinus</i>			
<i>Gastrolobium leakeanum</i> (previously: <i>Nemcia</i> sp. Ellen Peak)			
<i>Gompholobium</i> aff. <i>villosum</i>	1		1
<i>Hibbertia argentea</i>			
<i>Hypocalymma myrtifolium</i>			
<i>Isopogon latifolius</i>	1	1	2
<i>Kingia australia</i>	2		2

SCIENTIFIC NAME	NUMBER OF SUPPLIERS WITH SPECIES LISTED		
	SEED (OF 7)	SEEDLINGS (OF 3)	TOTAL (OF 10)
<i>Kunzea montana</i>	1		1
<i>Lambertia fairallii</i>			
<i>Lambertia uniflora</i>			
<i>Latrobea colophona</i>			
<i>Leptomeria squarrulosa</i>			
<i>Leucopogon atherolepis</i>			
<i>Leucopogon gnaphalioides</i>			
<i>Leucopogon interstans</i>			
<i>Levenhookia pusilla</i>	1		1
<i>Lysinema fimbriatum</i>			
<i>Microcorys</i> sp. Stirling Range			
<i>Muiriantha hassellii</i>			
<i>Opercularia nubicola</i> (Previously: <i>Opercularia</i> sp. Stirling Range)			
<i>Persoonia micranthera</i>			
<i>Pimelea angustifolia</i>			
<i>Platysace</i> sp. Stirling Range			
<i>Schoenus efoliatus</i>			
<i>Schoenus</i> sp. Stirling			
<i>Sphenotoma drummondii</i>			
<i>Sphenotoma</i> sp. Stirling Range			
<i>Spyridium montanum</i>			
<i>Stylidium bellum</i>			
<i>Stylidium diversifolium</i>			
<i>Stylidium keigheryi</i>			
<i>Stylidium oreophilum</i>			
<i>Stylidium rosulatum</i>			
<i>Stylidium scandens</i>		1	1
<i>Stylidium</i> sp. Bluff Knoll			
<i>Taxandria floribunda</i>			
<i>Tetralia</i> sp. Jarrah Forest			
<i>Veillea foliosa</i>			
<i>Xanthosia rotundifolia</i> DC			
<i>Xyris exilis</i>			
Total number of species listed from 68 spp. searched:	10	7	15