



NATIVE SEED IN AUSTRALIA

SUMMARY FINDINGS AND
DRAFT RECOMMENDATIONS

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BASED ON A SURVEY OF
COLLECTION, STORAGE AND DISTRIBUTION OF
NATIVE SEED FOR REVEGETATION AND
CONSERVATION PURPOSES

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Note:

The word 'states' in this document generally refers to both states and territories.

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Introduction

The FloraBank project seeks to improve the availability and quality of native seed and plant material for revegetation and conservation purposes in Australia. It provides support, advice and assistance to collectors, seedbank managers and distributors of native seed and plant material. FloraBank seeks to enhance existing networks between seedbanks and plant collections. The project will assist with training and provide guidelines for the collection, storage and handling of seed to local, regional and community-based seedbanks and groups. FloraBank encourages practices that protect Australia's biodiversity.

This document summarises the findings of a national survey of seed collection and storage in Australia and proposes draft recommendations to address issues and needs arising from the survey. The survey looked broadly at seed collection and storage but the focus was on the needs and issues of the community seed sector: that is, the seed collection and storage operations of community groups and landholders involved in landcare and revegetation initiatives.

Your comments are a valuable part of developing recommendations that are useful to the community. All comments received will be considered in developing final recommendations by FloraBank to Environment Australia in February 1999. These recommendations are also of wider relevance to the Commonwealth, to state and territory governments, local government and many other organisations, groups and interested parties.

Comment is invited on this draft by 29 January 1999 and should be forwarded to:

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Copies of this document and a fact sheet about the FloraBank project may

also be obtained from the above address or, alternatively, may be viewed or downloaded from the FloraBank web site (www.florabank.org.au).

The findings of the national survey are presented in full in the report *Native Seed in Australia: A survey of collection, storage and distribution of native seed for revegetation and conservation purposes*. Copies of the report are also available from the above sources. The national survey was undertaken to determine the status of seed collection and storage operations in the community. It was conducted from March to September 1998 and comprised three parts:

- a national tour involving visits to seedbanks, and discussion forums
- a questionnaire distributed nationally to collectors, seedbank operators and seed users
- a literature review.

Forty-nine seedbank operations were visited and structured discussions were held with operators and managers. A further 20 major structured consultations were held during the tour involving key seed users and those with a good knowledge of revegetation initiatives at regional and state levels. Eleven forums were organised for informed discussion of needs and issues between key people involved with native seed.

About 1,500 questionnaires were distributed to stakeholders in each state. The national response to the questionnaire was good, with 325 returned – a response rate of 20%. The questionnaire provided a sample of stakeholders at the national and state levels, according to broad groupings of respondents.

A brief review of recent literature was undertaken. The review concentrated on previous surveys and description of seed collection and storage practices in Australia, of which there are few. Current initiatives in this area were also reviewed and contact made with their principals where possible.



Main seed users

Nationally, indications are that the mining sector uses as much as 70% to 80% of all seed collected for mine site rehabilitation. Almost all the seed they use is either collected or supplied by commercial operators. The next largest users of seed are the revegetation projects of community groups and landholders (including some state government involvement) which consume perhaps 10% to 20% of all seed collected. A large part of this seed is supplied by community collection and storage operations.

Lesser seed users are roadside and reserve revegetation, and forestry and bush food operations, which are also supplied by commercial operators.

At the state level, this ranking of users also occurs in Queensland, New South Wales, Victoria and Western Australia. These are all states in which there are regions (Central Queensland, Hunter Valley, Gippsland, Pilbara and south-west Western Australia respectively) where the mining industry uses native seed extensively. In South Australia and the Northern Territory there is comparatively little mining activity and the community seed sector and bush food operations are the major users. In Tasmania, forestry and the community seed sector are the big users of native seed.

In revegetation, most seed is planted by mining companies using direct seeding methods. However, the area covered is small compared to that covered by revegetation through landcare which, for the most part, still relies heavily on planting seedlings (tubestock). Comparatively little seed but a much larger range of species is typically used by nurseries to produce tubestock. Direct seeding typically uses a limited number of species (usually less than 25) selected for their site worthiness, availability and ease of establishment.

One implication is that most of the seed collected across Australia represents only a tiny proportion of the total flora and its

biodiversity. Another implication is that most seed is consumed in revegetating a small part (mine sites) of the total area revegetated each year. This raises questions about the efficiency of use of an often scarce resource and whether direct seeding and mine site rehabilitation may be affecting the availability of seed. Commercial suppliers commented that seed available on the commercial market is frequently left over from contracts with mining rehabilitation and other large commercial projects.

Commercial seed

Native plant seed of many species is readily available on the commercial market. Commercial seed suppliers have the potential to collect and supply seed from anywhere to anyone. It must be logistically possible and profitable to do so, and there must be adequate prior notice for collectors to find and harvest seed.

The physical quality of seed available commercially (but not necessarily genetic quality and known provenance) is generally good and the prices generally low, considering the cost of collection and storage. There is currently no native seed certification system operating in Australia to regulate or standardise seed quality.

Community operations

Many people in the community collect native seed. The survey indicated that, of these seed collectors:

- most also clean and store seed
- of those who store seed, the primary purpose for storage is either for use in specific replanting projects or to distribute (non-profit) for revegetation
- community operators are much more likely to distribute seed for free than sell it
- community operators distribute seed (in order of importance) to community groups, farmers and landholders, direct seeders and community nurseries

- most are also involved in the use of native seed and raise seedlings for replanting, which most carry out themselves
- about half are also involved in direct seeding and a little more than half in managing natural regeneration.

Where landcare and community revegetation projects continue to create demand, it is very likely that the trend for increased seed collection in the community will also continue unabated. Wherever there is increased effort in revegetation, or a switch from tubestock to direct seeding, increased community seed collection capacity will be required unless commercial operators are willing to supply locally collected seed back to that area.

Indigenous seed

Seed that is indigenous to the local area of the user, however, can be much more difficult to obtain commercially. Seed users are increasingly unwilling to use seed of unknown or far-off origins and there is a strong trend in the community to specify local indigenous seed for revegetation. This trend is commendable and should be supported. Indigenous plants are often better adapted to perform in the local environment and it is better practice for conserving biodiversity.

There is frustration among community seed users at the difficulty in obtaining sufficient information about the origins of seed available commercially. This is particularly true of respondents to the questionnaire in Queensland and New South Wales but less so for respondents from Tasmania, South Australia, Northern Territory and Western Australia.

Seed users must trust that the seed purchased from their supplier comes from the locality claimed, for there is no other practical way of determining seed origins.

Commercial suppliers have been quick to respond to tender specifications that increasingly call for indigenous seed collection and supply for projects,

for example, roadworks, mining rehabilitation and major infrastructure projects. Commercial suppliers, however, have been slow to respond to the increasing demand for local indigenous seed by community groups and landholders for their revegetation projects. It is very likely to be uneconomic for commercial collectors to collect a range of local indigenous seed for all regions of a state. The logistical and environmental difficulties involved in collecting seed across vast areas are formidable. In addition, the demand in terms of volume of seed may be small and profit margins may be non-existent.

Most commercial suppliers consider that better planning in community projects to provide a longer lead-time for seed collection is essential to improving the commercial availability of local seed. However, this is likely to make a difference only where demand is sufficient to interest commercial collectors in the first place.

Regional availability

Consequently, many community seed users are unable to source any local indigenous seed for revegetation projects (especially small projects). Others have difficulty obtaining a reasonable range of species in the quantities required. The survey indicated that South Australia is the easiest state in which to source local seed (from any source) and the Northern Territory and Queensland are the most difficult.

In most states, indications are that the availability of seed varies from region to region. Indigenous seed is generally available for some regions but not others, and within all regions there are local areas for which little or no local indigenous seed is available. The nearer you are to the collection areas of commercial suppliers, the easier it will be to obtain local indigenous seed commercially. There are still many areas where commercial suppliers simply do not operate or do not supply indigenous seed.

Even where commercial suppliers are willing to collect local indigenous seed, there may be collection difficulties, such as:

- lack of vegetation
- seasonal scarcity of seed
- logistical, climatic and environmental difficulties in seed collection
- the need for constant surveillance of seed set
- the need for good timing for collection when seed is mature.

All these factors may vary greatly between regions and contribute greatly to regional scarcity. Determining exactly which regions experience scarcity of local indigenous seed is a considerable undertaking. While there are some indicators, a definitive assessment of regional scarcity was not undertaken during the survey.

Seed resource

The seed resource available in the bush is poor over large areas of Australia, though good in other areas. There is a lack of remnant vegetation and small numbers of plants left to collect from in many areas. In many remnants the seed resource is all but gone or is inadequate from a genetic viewpoint. This is largely a consequence of the combined effects of human presence, our land use and land management, and general decline of the vegetation, especially the understorey.

We need to better understand the genetic resources of remnant vegetation. As a priority, access to seed should be improved in areas where seed is scarce in the bush, rather than in well-vegetated regions where seed is more abundant. Restricted access to highly diverse bushland reserves and national parks also causes concern to questionnaire respondents, especially where these may be the only sources of seed available in a region.

Provenance

There is a trend in the revegetation sector to specify a desired provenance of seed. Almost always this is simply specified as seed indigenous to the local area. This is especially evident among some of the big seed users in mining, landcare and government. The definition of 'local' varies but is expressed most often as a distance (for example, a 15-kilometre radius) from the planting site, or in terms of catchment, land system, bioregion or even local and state government boundaries. This sort of approach is a 'best guess' and almost never based on understanding of the actual genetics of plant communities. Another motivation is to collect seed locally for use locally and so that biodiversity may be protected and enhanced.

It is of great importance that more is done to improve understanding and reduce doubt and uncertainty about the provenance boundaries of common plants used in revegetation. How local should 'local' be? A workable system for describing broad provenance areas and promoting it in the community is needed. Such a system may reduce over-zealous or too tight a provenance specification for seed used in revegetation. It may also ensure that adequate provenance specification is used. There are numerous vegetation classifications and existing information on which the development of a rudimentary provenance system could be based. There is also a system of 62 forest provenances developed by Forestry Tasmania and used in Tasmania that may provide a basis for development.

Imported native seed

There were reports of native seed being imported into Australia for revegetation at very low prices from overseas suppliers. While the cost may indeed be lower, there is widespread concern and condemnation in the community and among commercial and government suppliers about this practice. Overseas seed is reported to be inferior and often poorly identified and labelled, or in

seedlots where species are intermixed and contaminated with other seed. There are concerns about the genetic origins and hybridisation of such seed, and the possible effects of such introductions on biodiversity and the introduction of plant pathogens as yet unknown. Revegetation seed needs should and can be met from within Australia, with an increasing emphasis on matching known provenance to the area of use.

Seed storage

In general, we store seed to maintain it in a viable condition from the time of collection until the time of sowing. Storage time varies according to the purpose for which you store seed. In revegetation work, for example, seed is generally collected with the aim of sowing it as soon as possible in the next growing season. A storage period of 2 or 3 years is typical, with a maximum storage time of perhaps 5 years. In comparison, the conservation of a species through storage of seed may involve periods in excess of 25 years, over which viability must be maintained. Commonly in Australia, the length of time in storage is classified as short term (up to 5 years), medium term (5 to 25 years) and long term (more than 25 years). Remember that the longer you need to store seed, the more expensive it becomes.

What's difficult about collecting and storing seed?

Anyone can readily collect a few cupfuls of seed from a eucalypt or acacia in their backyard in a matter of minutes and use it to propagate thousands of seedlings. It sounds easy and it is. But to do this on any scale, do it in every season, for a wide range of local plants, and ensure the best quality possible is demanding and not an endeavour to be taken lightly. To do it cost-effectively adds an extra element of difficulty. You can spend a lifetime learning to do it in one region, and only a handful of people can do it for the plants of their whole state or for Australia.

Newcomers must overcome considerable hurdles, such as:

- accurately identifying flora in the field
- understanding seed biology and ecology
- learning when and where to collect seed
- learning the secrets of germination and viability testing.

Seed drying, extraction, cleaning and storage are technical disciplines in the wider agricultural seed industry in which technicians may spend a lifetime at work. These disciplines are much less well understood for native seed than for agricultural seed. In some cases this knowledge is hard won and closely guarded by commercial seed collectors, merchants and native plant nurseries.

Collecting seed for long-term conservation purposes adds to this complexity still further, with the requirement for scientific rigour in the way that genetic parentage is understood and documented, seed is handled, treated and stored, and viability is monitored. It is generally only the major academic and research facilities in Australia that are capable of operating long-term low-temperature and cryogenic storage.

Regulations

Frequent concerns were raised at discussion forums and by questionnaire respondents about the problems of regulation, royalty and permit systems and their significant impediment to seed collection. Many expressed concern at the generally counter-productive trend to 'lock up' seed resources and increasingly restrict access to them. There is a recent trend for local authorities to also introduce restrictive seed collection policies on collectors, regardless of their reasons for collection or technical competence.

Considerable differences in regulatory approaches are apparent between the states. Seed collection may fall under the jurisdictions of land management and flora protection legislation, forest production

royalty systems, and interstate export and import regulations, requiring that a collector be conversant with many requirements in each state. There are often considerable fees attached to approvals and permits, and anecdotal evidence that these may be restricting collection practice.

Royalty systems were criticised for unfairly grouping seed collection with wildflower harvesting and other forest production, resulting in royalties set at too high a level.

Regulatory authorities and some others in the native seed sector increasingly promote certification for native seed collectors.

Commercial rather than community collectors appear to be the main target of such moves. Community collectors and seedbank operators can do much to deliver real improvements in standards of practice and quality control other than through a certification scheme.

Information sharing and awareness

There is little sharing of information in the native seed sector, despite great need.

Individual user groups such as gardeners, mining companies, nursery operators, and regenerators share information to some extent within their groups, but seldom between groups. These user groups have considerable technical expertise that is often not written down and there is much to be gained from greater information sharing.

There is a great need for networking among community practitioners about native seed to avoid the prospect of waste and duplication, and to increase cost-effectiveness.

Better promotion and awareness of the value of native seed as a resource and raw material is needed. Much seed is wasted during vegetation clearance operations. Private landholders, local authorities and state governments need to be more aware of their seed resource and allow access to collectors.

The seed people in the community are broadly aware of the issues regarding local provenance and the consequences of using plants from outside local gene pools. However, all face the practical difficulties imposed by strict adherence to provenance and in identifying how far afield one should consider 'local' to be.



Community seed sector

Community seedbanks

Community seedbanks are facilities established and operated by the community for collecting, storing or distributing native plant seed. A distinction is made between a community 'seedbank' and a 'seedstore'. The distinction draws attention to fundamental and important differences in the scale and purpose of operations.

A seedbank is intended as a more permanent facility with some commitment to meeting ongoing seed needs – revegetation projects or otherwise – in a region. However, the seedbank role includes services in addition to supply of seed, including extension, advice, training, information and assistance to the community on seed collection, storage and use. A community seedbank usually contributes to revegetation projects and initiatives, generally in the region in which it is located.

A seedstore is a small-scale temporary facility with a primary role as a short-term storage of native seed. In most cases, a seedstore services the needs of one or more specific revegetation projects while these projects are in progress. Few resources are required, and storage infrastructure and methods are basic and low cost.

Community seedbanks collect by far the majority of seed collected and stored by the community seed sector. The size and scale of a seedbank operation quickly increases in direct proportion to the involvement in direct seeding in a particular region. However, the capacity of community seedbanks is small compared to those in the commercial sector. Only nine seedbanks of 23 that responded to the questionnaire currently store in excess of 50 kilograms of seed. It is estimated that there are less than 50 community seedbanks (storing in excess of 20 kilograms of seed) in total in Australia.

Seedbank roles

Despite their name, community seedbanks often do more than just supply seed. Almost all provide extension, education and training in the community to encourage and develop local capacity for wider use of native seed. They provide assistance, training, coordination and facilitation for seedstore operators and staff or volunteers of local projects that have a seed use component.

Seedbanks perform the vital role of storing seed that may be used during drought or unfavourable seasons when seed is scarce in the bush. This carry-over role allows revegetation initiatives to continue where they otherwise could not.

Seedbank establishment and location

Community seedbanks are typically established through community initiative to take a regional focus for seed supply, extension, seed storage and multi-project service roles. Often the motivations are that the range of species (and provenances) in demand is not available commercially. A seedbank may rely on a mix of sponsorship, host organisation, volunteers and funding (especially government funding) for resources and to meet operating and major project costs.

Community groups, landcare and catchment management groups, community nurseries and non-government organisations operate seedbanks.

Indications were that many are operated under community partnerships rather than by single groups. There are also seedbanks operated by government, primarily in support of community revegetation initiatives. Such seedbanks tend to be managed by steering committees, with representation from many groups, organisations, agencies and businesses in the community.

Some community seedbanks follow a centralised model for storage where seed is contributed from projects, collectors, landholders and others for storage in a central location in the region. Another

seedbank operating model is the decentralised model or regional seedbank network. Here a protocol is established for exchanging information about seed holdings of otherwise autonomous seedbanks and seedstores. All members have access to advice, training, extension and other support programs. Members also trade seed for their needs within the region.

Communities will likely choose one or the other model, though both have advantages and disadvantages and may perform equally well.

Seedbank location

Seedbanks operate regionally rather than locally, though what constitutes a 'region' varies. There is not a system of regions recognised or in operation across all seedbanks, and boundaries are often flexible. Most regions do not have a community seedbank and the demand for seed is already sufficient for many more community seedbanks to be established. Currently the density of seedbanks is such that they do not overlap in jurisdiction and do not duplicate resources. Indeed, even were geographic overlap to occur, the functional roles (and specialisation) of seedbanks may not overlap or duplicate resources. In some regions a number of community seedbanks will almost certainly be required to meet demand.

More than one seedbank may also be required where, for example:

- seedbanks specialise in vegetation types (wetland, forest, grasses), volumes of seed (direct seeding supply), or distribution on a non-profit or profit basis
- geographic isolation or community structure suggests sub-regional coverage.

Seedstore and seedbank roles in any region are generally complementary and may establish independently. Seedbanks do not replace or make redundant the seedstores already located in a region. Nor do they

necessarily duplicate resources or create overlap of effort with seedstores.

Community seed collection

The survey indicated that most community seedbanks, community groups and landholders collect most of their seed in the local area or, to a much lesser extent, from within their region. Almost none of their seed comes from outside of Australia. A large proportion of seed comes from natural bush and a much smaller proportion from plantings or plantations. Very little seed comes from uncertain origins or areas established specifically to supply native seed (seed production areas).

The survey indicated that a wide variety of vegetation types are collected, though most operators collect relatively more trees and tall shrubs than low shrubs. The least collected are native grasses and wetland plants.

The survey indicated that community operators, apart from collecting seed themselves, are more likely to acquire seed at no cost from other collectors than to buy seed from commercial seed merchants or collectors. Typically, one to three collectors are used who may be paid people, volunteers, recently trained or part-time collectors or full-time commercial collectors.

The seed needs of a community seedbank may be satisfied through collection by seedbank staff, community group members and volunteers, or through contract collectors and seed merchants. Typically, seedbanks use one to three collectors (not necessarily non-profit), which sets a limit to the amount of seed that may be collected in any season without employing collectors. The involvement of volunteers is an important part of extension programs, but may make it more difficult to maintain quality standards.

The survey indicated that most seed is collected and very little seed is actually purchased, even by seedbanks. Less than half the community operators actually buy seed and those that do buy very little – on average less than 10% of their total requirements.

Many of those consulted in the community only buy seed when they are unable to collect all the seed they need themselves. Some find that the seed they want to use (local indigenous seed) is not available commercially, or not in the quantity needed. In at least one case in north-central Victoria, where local seed is not available, community projects have been postponed rather than buy seed, especially seed not local to the area.

Community collection needs

Indications were that community operators are less confident of their collection practices and have fewer needs than for storage practices. Obtaining viable seed on any regular basis is hampered by the combination of natural factors such as:

- lack of rain and poor seasons
- unpredictable seed maturation and sporadic seed set
- high levels of seed predation by insects before seed is mature
- height of seed in trees
- naturally poor seed viability.

Logistical difficulties were often cited by collectors in the community, including:

- timing collection when seed is mature
- having a naturally short window of opportunity to collect seed
- having insufficient people and resources when it is time to collect
- collecting in sometimes inaccessible, difficult or distant locations
- monitoring seed set in remote areas or for difficult populations or species
- gaining access to mechanical or other harvesting equipment.

These difficulties vary a little between the states but are consistent across community, government and commercial sectors, suggesting the strong influence of logistical and environmental factors.

Consistent themes in the difficulties experienced by community groups and landholders were lack of knowledge and lack of skills and expertise. Many commented that they do not have enough knowledge for correct plant identification, collection timing, understanding what to collect, where and how. There are problems caused by changing and uncertain taxonomy for some species.

The information available to community operators on seed collection and storage is generally inadequate. There has been little research on the collection and storage of the flora, despite recent advances through applied research conducted by mining companies. There are some technical and scientific publications on seed collection and storage. The community generally does not have access to this information and there are only very basic leaflet materials written for community use.

Consequently, the community and, to some extent, commercial collectors experience a lack of species-specific information on key aspects of collection, such as the:

- approximate time of flowering and seed set for even common species across broad climatic zones
- appropriate propagation methods for a species
- reasonable (and broadly accepted) provenance boundaries for species.

There are major bottlenecks in the chain of supply of local indigenous seed, significantly due to these information gaps. Seed users are often unaware of the seed holdings of many collectors and suppliers. It can be a time-consuming task to search for seed of a certain species. A central clearing house or network for accessing local seed from all sources may be of considerable value to seed users and improve the efficiency of seed use. FloraBank has initiated a seedbank directory and catalogue as part of its web site to address this issue.

Training

Seedbank operators and landcare extension staff currently conduct basic (introductory) training programs in seed collection and use. These programs are almost entirely pitched at community groups and landholders. Training modules have been developed and are currently offered in most states. These modules provide a foundation for delivery anywhere in Australia, although some modifications would be necessary to reflect regional vegetation composition and community needs.

Community seed production areas

There was a lot of discussion about seed production areas among those consulted. Much of the discussion was based on a growing recognition in the community that, if carefully established, seed production areas could be used to supply local indigenous seed to community group and landholder revegetation projects.

The survey demonstrated that very few in the community sector (slightly more in the commercial sector) currently collect seed from seed production areas.

There is great potential for seed production areas, for example:

- where certain local species are in high demand locally
- where genetic rejuvenation of remnant vegetation in an area is needed
- where established as part of wider revegetation or rehabilitation initiatives.

Long-term land tenure, access and management and good quality local seed (genetic quality) are prerequisites for establishing seed production areas. Such areas may be established and maintained locally by local and state government, landcare groups and landholders. However, there is very little practical guidance or information available on what to do, where and how. This is to be addressed in the current FloraBank project.

Community seed storage

Seedbanks hold most of the seed stored by the community, although most community questionnaire respondents who collect seed also store some seed. Community seedbanks typically store seed for the short (up to 5 years) or medium term (5 to 25 years), although few have been operating for more than 10 years. A small proportion of seed (less than 40%) but a relatively large range of species is stored for more than 5 years.

Seed drying, cleaning and storage practices vary in accordance with size of operation and the length of time that seed is stored. The methods used are, however, usually basic and not conducive to viable long-term storage.

Seed storage is greatly affected by broad climatic differences across Australia and, in particular, is reduced by high heat and high humidity. Much seed can be stored in the short term at room temperature and humidity (or in air-conditioned environments), provided that seed is well dried and sealed in airtight containers. Current community storage practices do not, however, universally achieve this standard of storage. Average ambient seed storage space in community seedbanks is about 20 cubic metres. Where seedbanks have refrigerated storage space they will store the majority of their seed in it. Very few seedbanks have access to more than one or two (ordinary domestic) fridges and few if any surveyed rent storage space in air-conditioned or refrigerated premises.

Seed is typically air-dried and cleaned by hand before storage. Many community operators do not clean seed at all, though all seedbanks surveyed do. Over half of all community seed operations do not use any pest control. Many store seed in a mixture of containers – most of which are not airtight.

It is good collection practice to record basic information about seed collected (species, location, date and collector). Such information is essential to label seed of a certain locality or provenance. It is also important when undertaking subsequent

collections, in making accurate species identification, and in understanding the local seed resources. Yet many community sector operators who responded to the questionnaire do not record such basic information for seed collected. Most seedbanks do record basic collection information but do so by hand rather than using a computer. A point may be reached in the development of a seedbank (perhaps 20 to 50 kilograms of seed or 50 to 100 seedlots turnover per annum) where the scale of operation justifies the use of a computer in seedbank operation and management.

Community storage needs

Generally, needs were more clearly expressed for collection than for storage, perhaps because many community operators simply do not store much seed for long. These operators are typically involved in revegetation and perhaps not overly concerned at difficulties they experience with storage, whereas difficulties in collection may directly restrict revegetation effort.

Many community questionnaire respondents listed difficulties with storage, including, in order of frequency:

- attack by vermin, insects and fungal agents
- the loss of seed viability and the short shelf life of many species in storage
- lack of available storage space and equipment, poor equipment and equipment failures
- understanding technical aspects of storage and overcoming problems with temperature and humidity.

While these difficulties confront all those who store seed, overcoming them depends greatly on the knowledge of the operator and the resources at their disposal. Seedstore operators have fewer resources but not necessarily less knowledge than do seedbank operators.

Technical advice, training courses and, to a lesser extent, information on storage were

considered inadequate by over half of respondents. The only other needs listed by respondents were advice on data handling on computers and access to seed storage facilities.

The community experiences a lack of species-specific information on key aspects of storage, including:

- approximate natural viability of species
- best-bet storage regimes for species
- approximate expected shelf life of species under major storage regimes
- expected viability of species after storage
- seed cleaning techniques for species.

Community seedbanks are typically ill-equipped and lack essential resources and support services. Respondents indicated a need for all forms of equipment except computers. Most do not have adequate drying, fumigation and bagging equipment, such as electronic balances, heat sealing equipment and better seed drying facilities. In particular, there is a need for temperature and humidity control and monitoring equipment, air-conditioning and refrigeration in many seedbanks.

There are a number of services to the horticultural and agricultural seed industries that are not universally used or available to community seedbanks. Such services include contract:

- seed drying and extraction
- seed cleaning
- seed moisture content determinations
- seed viability and germination testing.

That community seedbanks do not all use such services may in part be due to the as yet limited exposure of service providers to community seedbanks, and vice versa. Not all such services are provided in every region, however, most are available on a state basis. These services use equipment and cover areas of expertise that may be beyond many (but not all) community seedbanks and their operators. Greater

access to commercially available services at market rates may be a better short-term strategy than investing in high levels of training and equipment for community seedbanks to be self-sufficient in these respects.

Training

Some structured training at a more advanced level suitable for seedbank operators is available, but not in every state. There are a variety of horticultural courses that include seed collection, storage and use offered by TAFE campuses throughout Australia. The Australian Network for Plant Conservation and the Threatened Flora Seed Centre (Department of Conservation and Land Management in Western Australia) run germplasm conservation training programs on a national basis approximately annually. There is a great lack of suitably qualified people to conduct advanced training.

Information and networking solutions may be more effective than advanced training programs in improving seed collection among seedbank operators. These issues are to be addressed in the current and proposed FloraBank project.

Community involvement in flora conservation

The large range of indigenous species collected makes the holdings of community seedbanks of considerable interest to conservation. This is especially true of seedbanks in highly biodiverse regions or where the flora is disappearing or under threat. Community seedbanks may be viewed as a collection network for local indigenous species from a region. Reference collections from each seedbank may be cleaned, dried and stored at a high standard by government-operated seedbanks in each state. To a small degree this already occurs in some states.

There appears to be growing awareness of genetic quality issues and interest in flora conservation in the community. However, this level of awareness could be improved.

Some community seedbank operators do wish to contribute more to conservation than their revegetation focus currently allows. Many seedbanks could store seed for longer periods were they to have better resources, adopt better practices or make use of rented storage options. Some seedbanks are looking for longer term storage options for reference collections and for species conservation purposes. A surprisingly large number (24%) indicated that species conservation was the primary purpose (or one of the primary purposes) for storage.

Seed production areas could also contribute to flora conservation if carefully established and maintained.



Recommendations

The following recommendations are made by FloraBank to Environment Australia.

General

1. Commonwealth, state, territory and local governments should support the strong trend in the community to use local indigenous seed for landcare and revegetation projects.
2. The Commonwealth Government should ensure that, where possible, the local indigenous seed needs of funded projects (especially landcare and revegetation projects under Bushcare and the Natural Heritage Trust) are sourced through commercial suppliers. However, it is recognised that in many regions this is not possible or may only partly satisfy requirements.
3. Commonwealth, state and territory governments should support community seed collection operations (seedstores and seedbanks) where adequate supply of local indigenous seed is not available commercially. Adequacy of supply should be determined by community consensus at the regional level, taking into account demand, quantity, quality and provenance considerations over the long term.
4. Commonwealth, state and territory governments should improve the advance planning for seed collection needs inherent in funded programs and projects.
5. The Commonwealth Government should develop and promote an agreed national system of hierarchical provenance boundaries for indigenous flora.
6. The Commonwealth Government should (through FloraBank) establish and trial a central clearing house where seed users may locate seed available commercially or otherwise for their needs. The FloraBank web site has such a mechanism in development which should be tested for at least 18 months to evaluate the role and prospects for such a service to the community.
7. The Commonwealth Government should (through FloraBank) produce guidelines on maintaining the genetic quality of seed collected for revegetation purposes.
8. Commonwealth, state and territory governments should foster the participation of community seedbanks in long-term flora conservation through involvement in in-situ conservation programs, species recovery programs, and the identification and collection of representative local indigenous flora.
9. Commonwealth, state and territory governments should establish and promote a system of germplasm storage facilities across all states and territories, based on existing facilities, to provide long-term seed storage services for the reference collections of community seedbanks. The service should include refrigerated and sub-zero temperature storage (and perhaps limited cryogenic storage).
10. The Commonwealth Government should (through FloraBank) investigate and recommend on the need for and implementation of mechanisms (for example, a national forum) to promote greater exchange and awareness of information on seed storage regimes, storage life, germination and viability of a much broader range of native species.

11. Commonwealth, state, territory and local governments should review regulations relevant to native seed to:
 - provide greater conformity in regulatory approaches within and between levels of government
 - introduce performance-based controls rather than restrictions on collection.
12. Commonwealth, state, territory and local governments should be more aware of the role that reserves, crown lands and, in particular, national parks could have as gene banks for revegetation programs. Governments should look at ways of facilitating greater access to these genetic resources (seed) for revegetation.
13. The Commonwealth Government should (through FloraBank) investigate and recommend on national certification schemes for:
 - competence in seed collection and storage
 - seed distributed by seedbanks.
14. Commonwealth, state and territory governments should introduce restrictions on the importation of native seed for revegetation purposes. Restrictions should not apply to seed imported for research, horticulture, floriculture, plant breeding or silvicultural purposes.
15. The Commonwealth Government should (through FloraBank) produce general guidelines on better valuing the seed resource and making provision for its collection and use – directed at state government agencies, gas, water, electricity and other utilities, local government, road maintenance and construction operations, and landscape architects.
16. The Commonwealth Government should (through FloraBank) investigate ways of determining the regions in which seed is least available (commercially and through community seedbanks) coincident with higher demand in the community for landcare and revegetation.
17. The Commonwealth Government should (through the FloraBank network) extend existing training modules in seed collection for the community to regions and seedbanks where such training is not at present available.

Community seedbanks

18. Commonwealth, state and territory governments should establish community seedbanks across Australia over the next 5 years to supply local indigenous seed to community and landholder landcare and revegetation projects and initiatives.
19. Three important criteria for establishment of a community seedbank in a region are that:
 - there is demonstrated demand for seed in greater quantity or for a greater range of local indigenous species
 - current or predicted demand for local indigenous seed is unlikely to be met by commercial suppliers
 - commercial suppliers operating in the area have been consulted regarding the establishment of the seedbank.

20. The rationale for location of seedbanks should include:
 - providing effective service to community landcare and revegetation initiatives
 - implementing revegetation programs in line with regional strategic priorities
 - providing opportunity for cooperation and links between community, government and funding programs
 - promoting better land management practice and revegetation.
21. Community seedbanks should, wherever possible, co-locate at landcare or catchment management centres, or facilities administered by state or territory government agencies or local government.
22. Community consensus at a strategic regional level should establish the coverage and density of community seedbanks in any region, rather than seedbanks conforming to any imposed system of environmental or administrative regional boundaries.

Seedbank roles

23. The roles of community seedbanks should include the following as a minimum.
 - Provide awareness, education and basic training to the community to encourage and develop local capacity for wider and more efficient use of local indigenous seed in landcare and revegetation.
 - Provide extension, training, coordination and facilitation for seedstore operators and staff or volunteers of local projects that have a seed use component – especially in the collection, storage and use of a greater range of local indigenous species.
 - Supply seed to a wide range of users for propagating plants in nursery situations, or direct seeding for specific revegetation projects – including supply to seedstores.
 - Coordinate the collection of seed in the community to meet strategic requirements on a regional basis.
24. Centralised and decentralised (or network) models for community seedbanks are recognised and supported. Seedbanks should not be required to adopt a certain model but rather be supported in adopting or developing the most appropriate model(s) for effective operation in a region.

Seedbank funding and support

25. Commonwealth, state and territory governments should ensure that community seedbanks are adequately funded and supported. Seedbank equipment should include basic air-conditioning, refrigeration equipment, temperature and humidity meters and heat sealing equipment so that a basic standard of storage practice may be achieved.
26. Commonwealth, state and territory governments should ensure that a dedicated full-time seedbank manager operates all community seedbanks.

27. The Commonwealth Government should (through FloraBank) provide for community seedbank operators:
 - information on all aspects of seed collection and storage
 - guidelines on best management practice for seedbank operation
 - a code of practice for community seedbanks
 - training in seedbank establishment and operation and basic practices for operators.
28. The Commonwealth Government should ensure that all community seedbanks (especially projects under Bushcare and the Natural Heritage Trust):
 - maintain a basic standard of record-keeping for seed collected and stored
 - supply reference collections of local indigenous species to state, territory or nationally based long-term storage facilities: see Recommendation 9.
29. The Commonwealth Government should (through FloraBank) investigate and recommend to community seedbanks on the availability of contract seed services or facilities in each state or territory.
30. Commonwealth, state and territory governments should encourage and provide more advanced training in seed storage and handling (but less so for seed collection) for community seedbank operators. There are prospects for using TAFE horticulture courses and the germplasm conservation training programs operated by the Australian Network for Plant Conservation and the Department of Conservation and Land Management in Western Australia. There is a role for training in seedbank establishment and best practice operation for revegetation purposes to be developed and introduced (through FloraBank).

Community seed production areas

31. Commonwealth, state and territory governments should establish community seed production areas across Australia over the next 5 years, on a trial basis, as a means of supplying local indigenous seed to community seedbanks, community groups and landholder revegetation projects.
32. In order to achieve long-term revegetation and conservation objectives, seed production areas need to conform to minimum establishment and management guidelines that ensure genetic quality in seed produced.
33. Community seed production areas should, where possible, be managed under the auspices of a community seedbank, landcare or catchment management centre where one exists, a local authority, or combination of community groups.
34. Community seed production area establishment should, as a priority:
 - be part of wider revegetation initiatives
 - target areas of limited seed availability
 - target high-priority vegetation communities
 - complement regional land management strategies.
35. Important criteria for establishment of community seed production areas are the same as those listed in Recommendation 19 applying to community seedbanks.



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