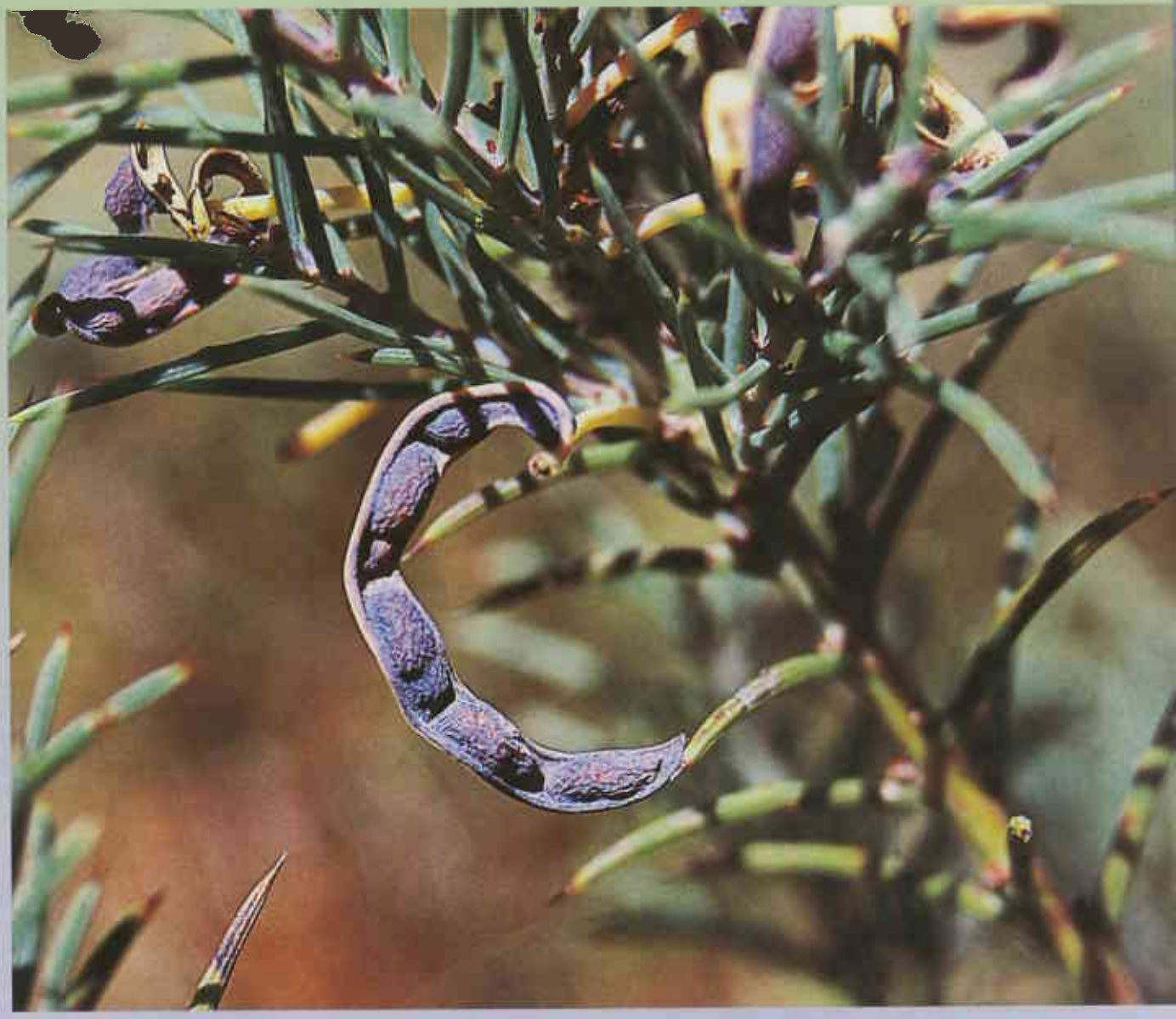
Seed bank pays dividends



Western Australia's South West has been identified as one of the world's 25 hotspots of biodiversity, in part because of its amazing floral diversity. Much of this area is under threat from a range of environmental processes. Thanks to various State, national and international initiatives, seeds of many species are being collected and 'banked' for future conservation dividends.

by Anne Cochrane

In spring and summer, when the weather warms and wildflowers bloom, it is easy to believe that more than 12,500 species grow (many of them nowhere else) in Western Australia's South West. The South West has a seasonally dry, Mediterranean climate and, for part of the year, is prone to fire. Many of the species that contribute to the area's spectacular floral display are threatened by the effects of weed invasion, land clearing, salinity and dieback—a disease caused by the introduced plant pathogen *Phytophthora cinnamomi*—among other things.

Various government and conservation organisations have long worked hard to conserve and manage the State's plant biodiversity. In the past decade, they have stepped up their commitment to conserve and manage the area's floral biodiversity through the National Strategy for the Conservation of Australia's Biological Diversity (1996), the Western Australia State Salinity Strategy (2000) and the Global Strategy for Plant Conservation (2002).

Collecting and storing seeds in a 'bank' is one way to protect the species. 'Seedbanking' supports management of

populations in the wild and ensures seed material and information is not lost if the species becomes extinct.

Insuring natural assets

Since the early 1960s, Kings Park and Botanic Garden has collected and stored seeds of important species, mostly for display, education and research purposes.

Realising the need for a storage facility for conservation, the Department of Conservation and Land Management (CALM) established its own long-term seed storage facility in 1992 to store the seeds of rare, threatened and poorly-known local plant species (see 'Banking for the future', *LANDSCOPE*, Winter 1996). Its early focus was on species threatened by dieback, and species requiring immediate or future recovery programs. This initiative was recognised by the National Threat Abatement Plan for Dieback Caused by the Root-rot Fungus (*Phytophthora cinnamomi*), 2001, as an important measure to protect species threatened by the disease.

Global initiative

In 1999, the UK's Seed Conservation Department at the Royal Botanic Gardens in Kew developed the Millennium Seed Bank—the world's largest seed bank and associated research facility—specifically for the conservation of wild species. Its focus was to collect and store seed samples, primarily from the world's arid and semi-arid regions, so as to develop and implement flora conservation programs. The aim is to store seed from 10 per cent of the world's dryland flora (about 24,000 species) by 2010.

To achieve these objectives, the Millennium Seed Bank set out to forge a series of collaborative partnerships with various organisations in countries around the world, including North America, South Africa, Madagascar, Namibia, Botswana, Kenya, Saudi Arabia, Chile, Mexico and, lately, China.

Project development

In 2001, the WA government began a nine-year partnership with the Millennium Seed Bank Project (see

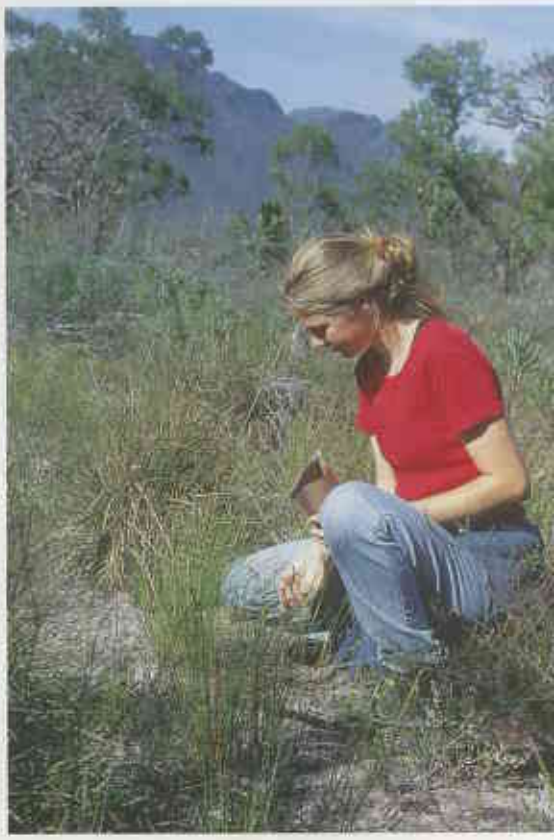
Previous page
Main Fruits of the rare Chapman's southern wattle (*Acacia chapmanii* subsp. *australis*).

Above The narrow mountain bell (*Darwinia hypericifolia*), which is confined to Stirling Range National Park.
Photos – Anne Cochrane

Left The Welcome Trust Building in Kew, UK, which houses the Millennium Seed Bank.
Photo – Courtesy of the Millennium Seed Bank Project

Above Jingymia mallee (*Eucalyptus synandra*) buds and flowers.

Right Volunteer Rebecca Coates collecting seed in the Stirling Range National Park.
Photos – Anne Cochrane



'Our Frozen Future', *LANDSCOPE*, Winter 2001). CALM and Kings Park and Botanic Garden were the two organisations committed to this partnership. During the first three-year phase of the collaboration, the partnership has proved to be beneficial to both Western Australian parties.

The Millennium Seed Bank Project agreed to store duplicate collections long-term, from CALM and Kings Park and Botanic Garden, providing their collections with additional insurance. CALM's Threatened Flora Seed Centre, and Kings Park and Botanic Garden's WA Seed Technology Centre and orchid researchers also received funds that enabled them to employ seed collectors to boost collecting programs that were already underway.

Existing conservation programs included developing recovery plans for threatened plant species, particularly in the Wheatbelt agricultural zone. The 2001–2004 targets were for CALM to collect 300 rare and poorly-known priority flora species, and for Kings Park and Botanic Garden to collect 360 species that were common but considered 'at risk' and 66 threatened and priority orchid species.

Achievements

By the end of Phase 1, in September 2004, both WA organisations had exceeded their collecting goals. More than 80 per cent of the collections—along with voucher specimens and specific information about the collections—were safely banked in WA and the UK. The remaining 20 per cent is currently being processed.

Most species collected during Phase 1 grew only in WA and provided new specimens for the Millennium Seed Bank and WA conservation organisations. The collections represent 49 families and 145 genera, of which about half are rare, threatened or poorly known. Collections range in size from just more than 100 seeds from one of the more difficult to collect species of the spiderflower (*Grevillea* species) to more than a million seeds of an orchid (*Caladenia* species).

Species were collected from the Kimberley region in the north to the State's southern coast and as far east as the Goldfields and Great Australian Bight, but the primary focus was on the South West. About 110,000 kilometres were travelled during more than 650 people days in the field.

The actual seed collecting accounted for about a third of each year's work. The remaining time was spent processing the seed and information about collections, among other activities. A number of joint collecting trips between the two WA organisations helped strengthen agency ties, ensured minimal duplication of effort and allowed collectors to learn from each other. A member of the Millennium Seed Bank Project's seed curation team took part in one collection, and a further collection trip was done with all three partners in 2003.

Equipment and training

The project enabled the purchase of specialised equipment to support collection and conservation work in WA. An instrument to measure seed moisture, to increase the accuracy of the drying process before storage, and a blower, to separate mature seed from empty, poorly-developed seed and other material, were purchased to help ensure that stored seed was of good quality.

Technical and research training also played an important role in the exchange of ideas and experiences, the use of new equipment, and the development of new skills in conjunction with other Millennium Seed Bank Project staff. Several Western Australians attended an international seed ecology conference, and staff from Kew visited WA at various times during the past three years. Training programs were also conducted for farming communities, bushland conservation organisations, volunteers and school groups to raise awareness about the project. A poster

Top left CALM Technical Officer Andrew Crawford (left) and Luke Sweedman from Kings Park and Botanic Garden collecting seed in WA.
Photo – Anne Cochrane

Centre left Inside the laboratory of the Threatened Flora Seed Centre.
Photo – Michael James

Left Buds of narrow-leaved bushy yate (*Eucalyptus petila*).
Photo – Anne Cochrane

Above Seed drying under low temperature and low moisture conditions.
Photo – Michael James

Sowing the seeds of rare flora conservation

In December 2000, in the infancy of the Millennium Seed Bank Project, CALM's Threatened Flora Seed Centre collected Chapman's southern wattle (*Acacia chapmanii* subsp. *australis*) seed from the only known population, at Drummond Nature Reserve near Bolgart. At the time, the species was on the priority list (P2) because the population was thought to be at risk of threatening processes. About 5500 seeds of the species were sent to the Millennium Seed Bank in Kew for safekeeping, as part of the first consignment from WA.

During the next three years, the population continued to decline and succumb to the effects of salinity, weed invasion, disease and other threats. As a result, the species was upgraded to Declared Rare Flora. In December 2003, more seeds were collected and staff from CALM's Swan region and Science Division set up 12 monitoring plots at the site to try to identify the factors involved in the species' decline. Some plots were subjected to different events, including fire, and others were protected from possible threatening processes, such as grazing. A small sample of seed was also germinated in the laboratory so seedling characteristics could be more easily and accurately studied in the wild population. Seed is highly germinable (97 per cent) so this phase was extremely successful.

While this *Acacia* is still highly threatened, CALM scientists are hopeful that—with appropriate recovery programs and conservation measures—the species will recover. The initial collection for the Millennium Seed Bank Project in 2000 provided data and banked seeds that were later used to enable species recovery programs to be conducted.

and leaflet were developed, and assistance was provided for a joint publication on Australian seeds.

The cost

During Phase 1, the Millennium Seed Bank Project invested more than $500,000 in WA government agencies to support their work on the project. Of this, about 20 per cent was spent on expenses associated with collecting seed and more than 60 per cent was spent on staffing costs. During the past three years, the WA government also contributed a similar amount to seed conservation through salaries and infrastructure.

The worth of the collection of 700 species stored both in WA and at the Millennium Seed Bank is estimated to be more than $1 million. Based on this figure, it is estimated that each WA species that was collected, duplicated and stored at both locations has cost about $1400.

The returns

Since its inception, the Millennium Seed Bank Project has become an integral part of WA's seed conservation activities. The technological and scientific benefits of the project have strengthened the ability of CALM and Kings Park and Botanic Garden to collect, conserve and describe important endemic species. It has also raised the profile of seed conservation activities. Now, thanks largely to the project, information about important species is available for recovery and restoration programs, and a number of threatened species are being restored through on-ground management.

As an added bonus, thousands of seedlings—produced from germination tests on the stored seed—are available for research projects into major threats, such as dieback disease and the effects of salinity and waterlogging. The results of these studies can then be applied directly to on-ground flora conservation management. The seedlings can also be used to recover threatened communities.

Future prospects

Phase 2 of the Millennium Seed Bank Project will result in even more seed being collected and stored. The WA partners, CALM and Kings Park and Botanic Garden, will plan conservation actions until the end of 2009 to meet the project's collection and storage goals. Hopefully, approximately 60 per cent of WA's threatened flora will have been collected and safely stored by 2010, of which 10 per cent will have been used in recovery and restoration programs. Phase 2 will also aim to expand WA's capacity to store and study seed, in addition to the extensive research that is being done in the UK.

The successes of the project to date, and those destined for the future, have, and will, render better conservation of seed and contribute to better conservation outcomes for WA's remarkable flora.

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Anne wishes to thank other members of the WA partnership in both CALM and Kings Park and Botanic Garden.

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