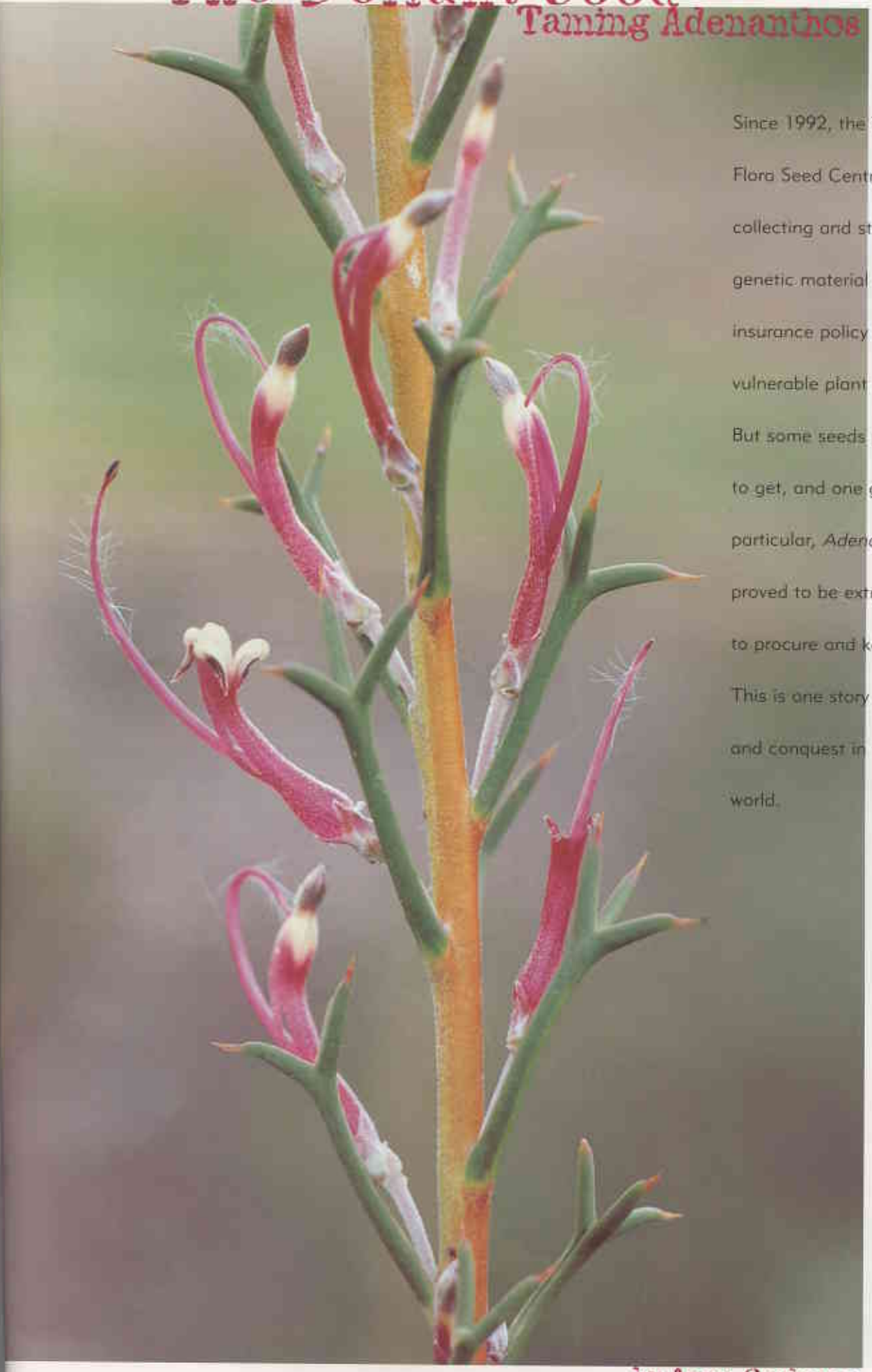
The Defiant Seed

Taming Adenanthos



Since 1992, the Threatened Flora Seed Centre has been collecting and storing genetic material as a life insurance policy for rare and vulnerable plant species. But some seeds play hard to get, and one genus in particular, *Adenanthos*, has proved to be extremely tricky to procure and keep. This is one story of pursuit and conquest in the plant world.

by Anne Cochrane

For hour after hour, a repetitive motorised growl was emanating from an on-site van at a south coast caravan park on a Spring day in 1993. Hobby fishers and other holiday campers were no doubt wondering what on earth was happening on the other side of the caravan walls. It was a seed biologist working for the Department of Conservation and Land Management (CALM), putting her old sewing machine through its last paces as she stitched 50 metres of fibreglass flyscreen wire into place to complete a set of 'seed traps'—contraptions that would, ironically, go on to be huge labour-saving devices in a long-term rescue effort for a rare plant, spiky adenanthos (*Adenanthos pungens* subsp. *pungens*). The sewing machine did not survive, but because of it, the plants might.

A PLANT WITH A PEDIGREE

The biologist was working for CALM's Threatened Flora Seed Centre (TFSC), on an expedition to collect seed from a colony of a rare species of the genus *Adenanthos*, which is endemic in southern temperate Australia. Of the 33 described *Adenanthos* species, 31 occur in the south-west of Western Australia. They are shrubs or small trees belonging to the protea family (Proteaceae), which includes some of our best-known plants—including *Banksia*, *Dryandra*, *Grevillea*, *Isopogon* (coneflowers), *Petrophile*, *Persoonia* (snottygobble) and *Conospermum* (smokebush, made famous as a potential medicine). The best-known among the *Adenanthos* species is probably the Albany woolly bush (*A. sericeus*).

Adenanthos are found in many different vegetation communities including open woodlands, forests and heathlands. Some have lignotubers that allow them to regenerate after fire; others are killed by fire and regenerate from seed. Many species are popular as garden species, propagated from cuttings and highly prized for their pretty pink or red flowers, their interesting foliage, or their suitability as dense mat ground covers.

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The erect habit, spiky leaves and hairy styles of spiky adenanthos (*Adenanthos pungens* subsp. *pungens*).
Photo – Andrew Davoll/Lochman Transparencies

Above: Yellow-flowered woollybush (*Adenanthos flavidiflorus*), one of the many soft-leaved woolly bushes found in the south-west of Western Australia.
Photo – Marie Lochman

Left: Mature seed of yellow jugflower (*Adenanthos detmoldii*) showing healthy white endosperm.

Below left: Spiky adenanthos seed trap at Hamilla Hills in the Stirling Range National Park.

Below: Retrieving seed from spiky adenanthos at Lake Chinocup.
Photos – Anne Cochrane/CALM

Endemic to the southern Wheatbelt of Western Australia, spiky adenanthos has been classified as vulnerable according to World Conservation Union criteria, and could indeed become extinct within the next decade due to rising salinity and other environmental impacts. Therefore, collecting seed samples for off-site conservation has become a matter of urgency.

A TOUGH NUT TO CRACK

The problem with collecting *Adenanthos* seed is that it is set within fruits that are hidden within bracts, which in turn are hidden in the tips of whorled branchlets. Collecting this sort of seed had in the past proven to be an extremely labour-intensive, low-yield task, further complicated by the fact that the plants occur in hard-to-reach places, always a long journey away. Once collectors reached the site, they had to work for hours at a time over a period of several days or weeks to find the fruits in the foliage. The result of this back-breaking effort might be a handful of fruits, many of which would not contain seed.

The seed traps sewn in the caravan park that day proved to be the answer. Ten traps were installed in the Stirling Range National Park at one of two known sites for the species. The traps consisted of aluminium fence droppers inserted into the ground around the outside of individual plants. These were joined by light fencing wire that served as a frame from which hammocks of fly-wire could be suspended to capture falling seed. Enough seed was blown outside the catchment area of the fly-wire or escaped through a gap around the stem of the plant to the ground to ensure that natural regeneration could still occur. The traps could be left unattended and periodically cleared, dramatically increasing the volume of seed that could be collected, with much less effort.

The Stirling Range traps were left in place for four years, with local farming families employed to clear them regularly. The operation was so successful that, in 1997, funding was granted by the World Wide Fund for Nature for members of the Australian Trust for Conservation Volunteers to construct an additional 20 traps at a second spiky adenanthos collection site at Lake Chinocup. The effort finally yielded enough material for germination trials and long-term storage and monitoring.

Like many species of *Adenanthos*, the common basket flower (*Adenanthos obovatus*), has a lignotuber and can resprout after fire.
Photo – Marie Lochman

WEIGHING THE EVIDENCE

Having overcome the difficulty with collection, TFSC scientists then faced the problem of identifying which fruits contained actual seed. The fruits are small, measuring approximately five millimetres by two millimetres. The seed consists of an embryo surrounded by a nourishing white pulpy endosperm. A large proportion of the fruits produced by the plants do not have fully developed endosperm or embryo. The only way of being absolutely certain of a fruit's contents is to cut it open under a microscope, a procedure that risks damaging the precious seed.

After weighing and cutting open a range of seeds, TFSC scientists determined that fruits above a weight of 0.015 grams were most likely to contain viable endosperm and embryos. All

Above: Erecting seed traps for *Adenanthos labillardierei* in the Fitzgerald River National Park.
Photo – Anne Cochrane/CALM

Left: The attractive *Adenanthos oreophilus,* confined to the area between the Fitzgerald River National Park and Mt Ragged north-east of Esperance.
Photo – Greg Harold

Below: The hairy jug flower, (*Adenanthos barbigerus*) glistening with early morning dew.
Photo – Andrew Davoll/Lochman Transparencies

fruits above this weight were then presumed to contain viable seeds and were moved into storage and germination trials. Fruits weighing under 0.015 grams were cut open to confirm the lack of healthy endosperm. Of the 4,624 fruits collected at Lake Chinocup, only 84 per cent were filled.

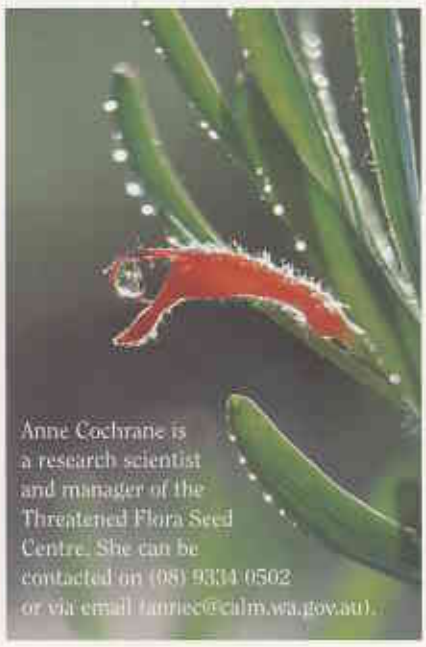
ACCELERATING NATURE: GERMINATION

Little is known about how spiky adenanthos grows. Perhaps the most important undertaking of the TFSC with this species has been to determine which combination out of a range of possible factors is most likely to trigger the seeds to germinate. The relatively large volume of seed made available through the seed traps has allowed a complex program of germination trials to take place.

Initial experiments using controlled light, temperatures, moisture and growth hormones yielded only an eight per cent germination rate. Later trials, conducted one year after the seeds had been frozen, introduced other factors such as exposure to smoked water to simulate the effects of fire. Eventually, it was determined that the key to overcoming dormancy in the seed was to completely remove the seed coat. Replicate trials are still being conducted, but systematic testing of treatments by the TFSC has increased the germination rate of the stored seeds from eight per cent to 71 per cent, and reduced germination time from 35 days to 15 days.

CONCLUSION

We are finally coming to terms with how some rare and threatened native plant species regenerate. What is amply evident is that it is seldom a straightforward process. Fortunately, not all native plant species are as difficult to understand or as hard to collect as *Adenanthos*. But the tale of the spiky adenanthos shows how much there is yet to learn about our native plants. It also shows how much in the way of time and resources is required to conserve our rare species for future generations. The knowledge gained through this persistent effort can be applied to other species in the same genus, streamlining the learning process. Nevertheless, the essential qualities for the conservation endeavour will always be patience, determination and human ingenuity, along with quantities of seed—the foundation of plant life.



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Winner of the 1998 Alex Harris Medal for excellence in science and environment reporting.

LANDSCOPE

VOLUME FIFTEEN NUMBER 2, SUMMER 1999–2000

How many seals or sea lions are there around WA's coasts? See 'A Tale of Two Seals' on page 42.

"What I wasn't prepared for was the magic of the experience." See 'Desert Impressions' on page 35 for the story of a LANDSCOPE *Expedition.*

The malleefowl has declined to 46 per cent of its former range. Read about the combined effort to save it on page 17.

Enjoy the WA environment—and don't get hurt! See 'Balancing Act' on page 23.

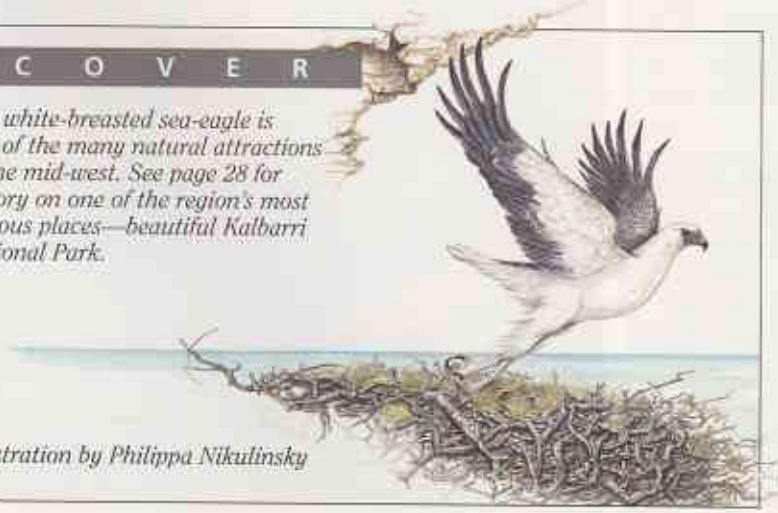
Traditional owners are working with CALM and other agencies to manage the land. See page 10.

FEATURES

REGULARS

COVER

The white-breasted sea-eagle is one of the many natural attractions of the mid-west. See page 28 for a story on one of the region's most famous places—beautiful Kalbarri National Park.



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Colour Separation by Colourbox Digital
Printed in Western Australia by Lamb Print

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Published by
Department of Conservation and Land Management,
Dick Perry Avenue, Kensington, Western Australia