Science for Saving Species

Research findings factsheet

Project 7.5

Threatened Species Recovery Hub

National Environmental Science Programme

The extent and adequacy of monitoring for Australian threatened plant species

In brief

Plants make up three-quarters of Australia's threatened species. Without adequate monitoring threatened species could slip to extinction without anyone noticing or having sufficient time to act. Monitoring is also important to indicate if the recovery actions are working.

We examined whether, and how well, over 800 threatened plants on the Australian Government's threatened species list are being monitored. The data were provided by state government environment agencies in Queensland, New South Wales, Victoria, South Australia, the Northern Territory and the Australian Capital Territory.

We found that only 37% of threatened plants are monitored, half the rate for threatened vertebrate animals. Although there were some excellent monitoring programs for some threatened plants, in general for those threatened plants that were monitored, monitoring quality was low.

Plants with more imperilled conservation status were more likely to be monitored, as were plants with recovery plans, and plants most recently listed under threatened species legislation.

Climate change will amplify the need for better monitoring of threatened plants, especially for population resilience to the many existing threats, including changed fire regimes, grazing, altered hydrology and land clearing.

More monitoring is needed for Australian threatened plants, and this monitoring should be designed and conducted in a manner that is likely to best inform management requirements, improve population trajectories and measure management effectiveness.

*Monitoring of the small purple pea (*Swainsona recta*) by the ACT Government has led to better management of its habitat within reserves, informed weed and rabbit control timing and placement, ecological burn plans and seed banking. Image: Emma Cook*

Australian National University · ACT Government · NSW Office of Environment & Heritage · NSW Planning, Industry & Environment · Government of South Australia Department of Environment, Water and Natural Resources · Queensland Government · Northern Territory Government · Victoria State Government Environment, Land, Water and Planning · Australian Government Parks Australia · The University of Melbourne · Charles Darwin University Australia

Background

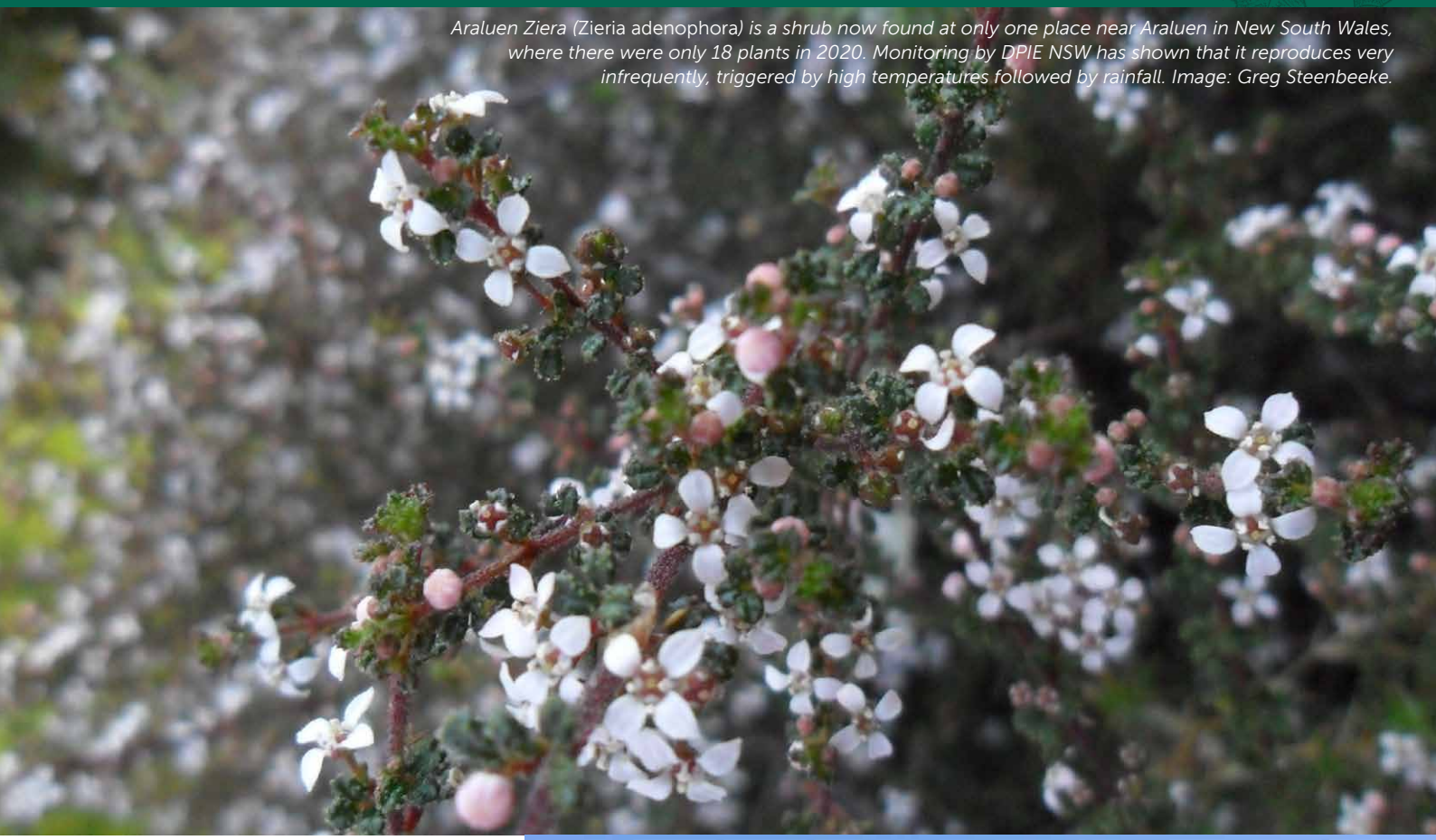
Monitoring of threatened species is critical to understand population trajectories and threatening processes, including the incidence and impact of new threats. Data on population trends are a fundamental requirement for making and evaluating the case for listing species as threatened, and for categorising the conservation status of species, including uplisting or downlisting that status. Monitoring also helps evaluate the effectiveness of conservation actions, and hence provides a measure of return on investment for conservation managers, and monitoring results can help to continually improve management. It also provides evidence for prioritising conservation effort across species.

Several recent reviews have evaluated the extent and adequacy of monitoring for a diversity of threatened species in Australia; however, those reviews did not include threatened plants. About three-quarters of Australia's national list of threatened species are plants, with about 1350 plant species and subspecies listed as Vulnerable, Endangered or Critically Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Little information is available on population trends for most of these species, making it difficult to evaluate the relative urgency of conservation needs for different species or the effectiveness of efforts to protect and recover them.

Plants have some characteristics that may make them easier to monitor than many animal species, such as being immobile, which means that known populations can be reliably monitored relatively quickly and cheaply, depending on variables such as site accessibility and ruggedness. However, some plant species fluctuate greatly in numbers in response to rainfall or disturbances such as fire, which can make it harder to identify longer-term trends. Other plants are annual or ephemeral and may 'disappear' from the above ground flora for periods of time.

Australia has a poor record of preventing species declines and extinctions of plants and 37 are listed as extinct.

Each year populations of the metallic sun-orchid (Thelymitra epipactoides) *alongside the Great Ocean Road in Victoria are monitored. These data are helping inform land management decisions, in particular ecological burning. Monitoring is coordinated by Parks Victoria and DELWP and most years involves many local volunteers. Images: Laura Prentice / DELWP*



*Araluen Ziera (*Zieria adenophora*) is a shrub now found at only one place near Araluen in New South Wales, where there were only 18 plants in 2020. Monitoring by DPIE NSW has shown that it reproduces very infrequently, triggered by high temperatures followed by rainfall. Image: Greg Steenbeeke.*

Research aims

The main aim of this research was to evaluate the extent of monitoring, and its adequacy, for Australian threatened plant species.

We also aimed to identify potential factors that are associated with higher quality monitoring. This will provide opportunity for improving the extent and standard of monitoring for threatened plant species.

Monitoring Fragrant Pepperbush in NSW. Image: Luke Foster / DPIE

What we did

This is the first ever assessment of the extent and adequacy of monitoring for Australia's threatened plant species.

We collected data on monitoring adequacy for 839 threatened plant species and subspecies (from 111 plant families), representing more than 60% of plants listed on the EPBC Act. We compiled this monitoring information in collaboration with government agencies in Queensland, New South Wales, Victoria, South Australia, the Northern Territory and Australian Capital Territory. Comparable information was not contributed by Tasmanian and Western Australian agencies, so the dataset has some notable gaps.

For each species, monitoring status was scored against a set of nine criteria previously used to evaluate the adequacy of monitoring for Australian vertebrate species. (Table 1.)

We investigated whether presence or absence of monitoring for all plants was associated with: (1) family; (2) taxonomic rank (species, subspecies or variety); (3) plant life form (forb, orchid, shrub, tree, and "other"); (4) conservation status (Critically Endangered, Endangered or Vulnerable); (5) whether or not a species/subspecies/variety had been included in a recovery plan; and (6) time since EPBC Act listing (in years).

We then examined variables that influence monitoring adequacy.

Table 1. *The nine criteria used to evaluate the quality of threatened species monitoring adopted from (Woinarski, 2018).*

Criterion	Description	Rationale
1. Fit-for-purpose	The use of monitoring methods suited to detect the target species.	To provide robust information, species-specific methods that consider the ecology and detectability of the target species are needed.
2. Coverage	The spatial extent of monitoring efforts across the target species' distribution.	A species' abundance and threats can vary markedly across its distribution. Therefore, monitoring across a species distribution is needed to provide representative information on the species' trajectory.
3. Periodicity	Frequency of monitoring.	Timely information on a species' trajectory is needed. Monitoring should be undertaken frequently enough to be able to detect rapid changes and inform management.
4. Longevity	Longevity of monitoring.	Monitoring needs to be undertaken over sufficient timeframes to detect longer-term trends despite shorter-term fluctuations which can be caused by periods of drought etc..
5. Design quality	The design of monitoring to collect enough of the right kinds of data to be able to confidently detect trends.	It is important to have enough data in order for monitoring to have enough 'statistical power' to be able to reliably detect population trends in the target species. The amount of data needed is influenced by factors like the level of variability.
6. Coordination	The coordination of monitoring efforts among relevant jurisdictions and stakeholders.	When a species occurs across multiple areas, for example in more than one state, it is important for survey methods, analysis and reporting to be co-ordinated in order to reflect the whole picture.
7. Data availability and reporting	The availability and reporting of monitoring information.	For the value of monitoring data to be maximized, it must be readily accessible and well organised, with adequate metadata and secure long-term storage.
8. Management linkage	Integration of monitoring and management actions.	Monitoring should inform the design and implementation of management, as well as be able to evaluate effectiveness.
9. Demographic parameters	The inclusion of demographic parameters in monitoring efforts.	In most cases, monitoring should involve assessment of critical demographic parameters, such as if a plant is a seedling or adult, rather than just abundance. Information on life-history parameters can provide important ecological insights and help refine management.

Key findings

Our results provide the first overview of the extent and adequacy of monitoring for a near continent-scale set of threatened plant species. Our key finding was that, overall, the extent of monitoring for threatened plants was low, with only 37% of the species and subspecies examined having some form of monitoring.

Extent of monitoring

The likelihood of a threatened plant species being monitored varied according to which of the 111 families it belonged to. For most families, less than half of threatened species received some form of monitoring.

The factors which most influenced if a species was being monitored are conservation status, recovery plan status, and number of years listed on the EPBC Act. (Figure 1)

- Critically Endangered and Endangered plant species were more likely to be monitored than Vulnerable species.
- Plant species that have or have had a recovery plan were more likely to be monitored than those that did not.
- Plants that were more recently listed as threatened were more likely to be monitored than species that have been listed longer.

Monitoring adequacy

Plants with a more imperilled conservation status, such as Critically Endangered, were more likely to be monitored and tended to have higher quality monitoring.

Plant type also influenced whether monitoring was fit-for-purpose and had extensive coverage. Orchids, shrubs and trees generally had better monitoring than herbs, ferns and other plant types.

Of 784 plants with a recovery plan 361 (46%) received no monitoring at all. However, plants with a recovery plan that are monitored were more likely to have been monitored for longer. One unexpected finding was that monitoring was less likely to be integrated with management actions for plants with a recovery plan than for those species without a recovery plan.

Comparing plants and vertebrates

Similar assessments for threatened vertebrate animals - mammals, birds, frogs, fish and reptiles found that 74% had been monitored. This means vertebrate animals are about twice as likely to be monitored as threatened plant species (37%). Animal monitoring programs have generally also been operating longer.

However, where monitoring of threatened plants had occurred the coverage, data availability, integration with management actions and collection of demographic information (such as maturity) were better for plant monitoring than for vertebrate animals.

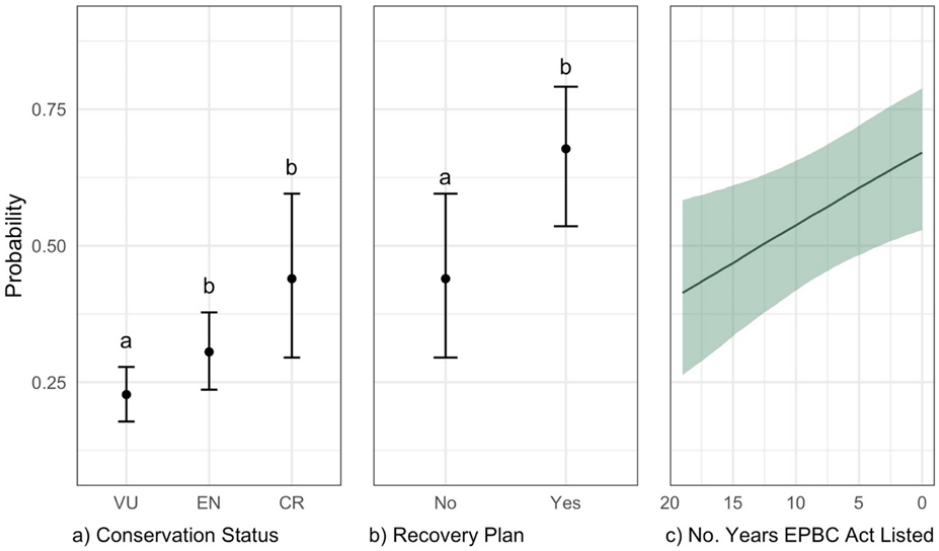


Figure 1. *Probability of a species being monitored for threatened plants by: (a) conservation status; (b) recovery plan status; and (c) years on EPBC Act list. Example explanation of probability scores: the probability of a Vulnerable plant being monitored is approximately 0.25 when values for the other two variables included in the model are averaged (Recovery Plan and No. Years EPBC Act Listed).*

*RIGHT: The Canberra Spider Orchid (*Caladenia actensis*) has not had a monitoring program in place but the ACT Government plans to start one soon. Image: Emma Cook*

*RIGHT: The button wrinklewort (*Rutidosis leptorrhynchoides*) has been monitored in New South Wales and Victoria for over 30 years. It once occurred over a much larger area, but habitat loss has left the species in many small and fragmented populations, which can then suffer inbreeding issues or be wiped out by a single event. Monitoring has detected when populations are in trouble, such as at a site which declined to only one plant – flower heads were brought from another site to pollinate it. The monitoring data has also provided valuable insights into the life history and recruitment patterns of the species and has also contributed to genetic studies which are very important for this species due to the small and fragmented populations. Shown here, John Hick from Trust for Nature monitoring a button wrinklewort population at Truganina Cemetery, west of Melbourne. Image: Steve Sinclair / Arthur Rylah Institute*

Button Wrinkle Wort.
Image: Steve Sinclair / Arthur Rylah Institute

Implications and recommendations

The lack of monitoring for 63% of the threatened plant species assessed in this study is of major concern.

The consequences of lack of monitoring, or of inadequate monitoring, are that population declines will not be detected, or will be detected too late to allow for effective response. There is also a lot we don't know about how to best manage many species, and monitoring tells us if management strategies are working, or need to be adjusted.

This concern is heightened because recent evidence suggests an ongoing deterioration in the status of many of Australia's threatened plants. Based on monitoring data for 112 threatened and near-threatened plant species from almost 600 sites nationally the Threatened Species Index found that in just over two decades (1995–2017) the population sizes of these plants had decreased by almost three-quarters (72%) on average.

The longevity of many plant monitoring programs assessed was poor. Monitoring longevity is especially critical for Australian species, where highly variable climatic patterns and alternating periods of drought and high rainfall can obscure actual population trajectories, and where irregular episodes of catastrophic fire events can lead to sudden changes in population sizes and conservation statuses.

Climate change will amplify the need for improved and intensified threatened plant monitoring in the coming decades, as it may lower population resilience to the many existing threats, including changed fire regimes, grazing, altered hydrology, weed invasion and land clearing.

More monitoring is needed for Australian threatened plants, and this monitoring should be designed and conducted in a manner that is likely to best inform management requirements, improve population trajectories and measure management effectiveness.

We suggest that state and national agencies pay careful attention to the mix of species that are monitored to ensure that the overall portfolio of monitoring programs delivers the greatest possible benefits. Prioritisation tools that consider multi-species benefits across habitats and jurisdictions are available and could be used to evaluate the effects and benefits of different monitoring programs.

RIGHT: Fleurieu Peninsula Guinea-flower (Hibbertia tenuis). *Image: South Australian Seed Conservation Centre*

Case-study: Monitoring making a difference on the Fleurieu Peninsula in South Australia

Effective monitoring programs have been essential to the survival and recovery of three highly threatened plants in South Australia.

Monitoring identified when numbers of the Critically Endangered Fleurieu Peninsula guinea-flower (*Hibbertia tenuis*) dropped to only 20 and has provided feedback on the effectiveness of management actions, such as prescribed burning, thereby helping to improve recovery efforts. There are now almost 700 individual plants!

Monitoring also identified when the number of Critically Endangered Fleurieu leek orchids (*Prasophyllum murfetii*) dropped to only 1 at one of two known populations, and has been critical to evaluating the success of different habitat manipulation trials such as canopy clearance and understorey slashing, as well as kangaroo proof exclosures. That site has now grown to 146 flowering plants and there are 280 at the second site.

The Endangered yellow-lip spider-orchid (*Caladenia xanthochila*) was presumed extinct in South Australia and was rediscovered in 2019 during monitoring surveys. On-going monitoring will track the population and how it responds to management approaches.

Monitoring and management of the Fleurieu Peninsula Guinea-flower, Fleurieu leek orchid and yellow-lip spider-orchid were undertaken as part of the Hills and Fleurieu Landscape Boards Back from the Brink project, through funding from the Australian Government's National Landcare Program.

Image: Jeremiah Smith / Hills and Fleurieu Landscape Board

Denzel Murfet, volunteer botanist and the person after whom Prasophyllum murfetii was named, Dan Duval and Dr Jenny Guerin, all from the South Australian Seed Conservation Centre monitoring a Fleurieu leek orchid population. Image: South Australian Seed Conservation Centre

Image: Jeremiah Smith / Hills and Fleurieu Landscape Board

Dr Jenny Guerin and Dan Duval from the South Australian Seed Conservation Centre and Kieran Brewer from South Australian Indigenous Flora during a survey for yellow-lip spider-orchids.

Yellow-lip spider-orchid (Caladenia xanthochila). *Image: Jeremiah Smith / Hills and Fleurieu Landscape Board.*

Fleurieu leek orchid (Prasophyllum murfetii) *Image: South Australian Seed Conservation Centre*

Volunteer botanist Denzel Murfet (left) and Dan Duval from the South Australian Seed Conservation Centre monitoring a population of Fleurieu Peninsula guinea-flowers after a prescribed burn at a site near Yundi South Australia.

Image: Jeremiah Smith / Hills and Fleurieu Landscape Board

*BELOW: The Tarengo Leek Orchid (*Prasophyllum petilum*) has a good monitoring program in place by ACT Government. The findings from monitoring have led to better management of the bush cemetery where it grows in the ACT including guiding mowing methods, timing and restrictions throughout the year; grave digging approaches; woodland tree management; and seed banking. Image: Emma Cook*

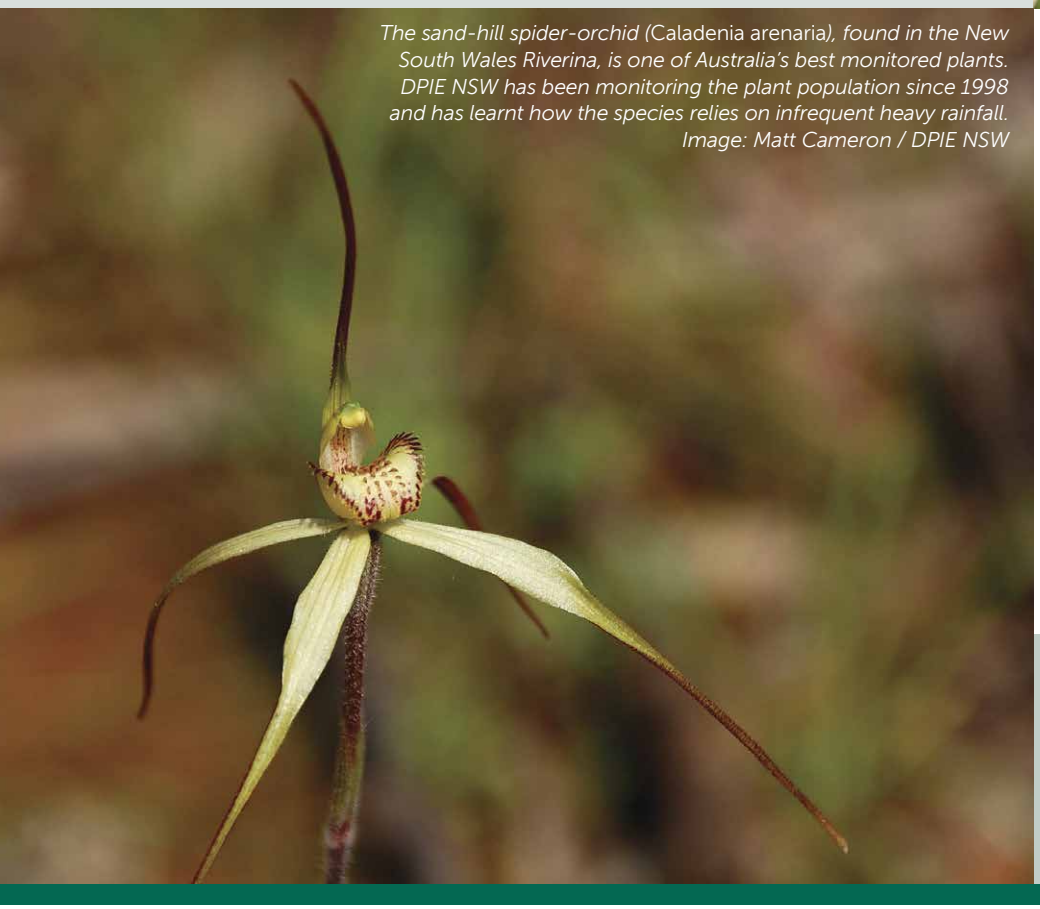
Further reading

Lavery, T., Blanchard, W., Cook, E., Carey, A., Copley, P., Lindenmayer, D., MacGregor, N., Melzer, R., Nano, C., Prentice, L., Scheele, B.C., Sinclair, S., Southwell, D., Stuart, S., Woinarski, J., 2021. Counting plants: The extent and adequacy of monitoring for a continental-scale list of threatened plant species. *Biological Conservation* 260, 109193.

Broadhurst, L., Coates, D., 2017. Plant conservation in Australia: Current directions and future challenges. *Plant Diversity* 39, 348–356.

Scheele, B.C., Legge, S., Blanchard, W., Garnett, S.T., Geyle, H.M., Gillespie, G.R., Harrison, P.L., Lindenmayer, D.B., Lintermans, M., Robinson, N.M., Woinarski, J.C.Z., 2019. Continental-scale assessment reveals inadequate monitoring for threatened vertebrates in a megadiverse country. *Biological Conservation* 235, 273–278.

Woinarski, J.C.Z., 2018. A framework for evaluating the adequacy of monitoring programs for threatened species, In *Monitoring threatened species and ecological communities*. Eds: S. Legge, D.B. Lindenmayer, N.M. Robinson, B.C. Scheele, D.M. Southwell, B.A. Wintle, pp. 13–20. CSIRO Publishing, Melbourne.



*The sand-hill spider-orchid (*Caladenia arenaria*), found in the New South Wales Riverina, is one of Australia's best monitored plants. DPIE NSW has been monitoring the plant population since 1998 and has learnt how the species relies on infrequent heavy rainfall. Image: Matt Cameron / DPIE NSW*

Acknowledgements

Thank you to Wade Blanchard, Emma Cook, Alex Carey, Peter Copley, David Lindenmayer, Nick MacGregor, Rhonda Melzer, Catherine Nano, Laura Prentice, Ben C. Scheele, Steve Sinclair, Darren Southwell, Stephanie Stuart, John Woinarski, for the detailed work and knowledge that underpins this fact sheet.

Further Information

Tyrone Lavery
tyrone.lavery@anu.edu.au

Threatened Species Recovery Hub
National Environmental Science Programme

Cite this publication as NESP Threatened Species Recovery Hub. 2021. The extent and adequacy of monitoring for Australian threatened plant species, Project 7.5 research findings factsheet.

This project is supported through funding from the Australian Government's National Environmental Science Program.