Science for Saving Species

Research findings factsheet

Project 6.5

Threatened Species Recovery Hub

National Environmental Science Programme

Estimating the spatial coverage of citizen science for monitoring threatened species

In brief

Citizen science has the potential to complement or even redress gaps in data derived from professional monitoring for threatened species. Monitoring is essential for guiding and evaluating conservation actions, and when it is inadequate our capacity to act to protect species and prioritise research can be seriously impeded.

In this study, we generated a spatial database of 133 citizen science projects from across Australia with the potential to contribute to threatened species monitoring and recovery. Our findings uncover patterns in the relationship between the spatial coverage of citizen science projects, the locations of known threatened species and human population centres across the continent.

The findings provide specific details that can guide development of new citizen science projects or the expansion of existing projects aimed at collecting data on threatened species populations or biodiversity in general. By identifying areas with high threatened species richness and low citizen science density, we point to opportunities for citizen science projects to address present shortfalls in monitoring, thereby optimising impact for threatened species.

Background

Numerous native Australian species have either become extinct or threatened since European arrival. While key causes for this include habitat loss and degradation, introduced feral predators, and altered fire regimes, the effects of these threats have been exacerbated by limited funding for conservation and sheer size of the Australian landscape.

Very few Australian threatened species are monitored adequately. Monitoring is vital for the effective conservation of threatened species, and when it is inadequate it results in a diminished capacity to identify species declines and their causes, prioritise research, make informed management decisions and evaluate their effectiveness, and to adhere to international policy agreements such as the Convention on Biological Diversity.

Citizen science, defined as public involvement in scientific research that may or may not be coupled with direct conservation actions, can fill information gaps where professionally derived monitoring data is not available or offer guidance about where further surveying may be needed. Using citizen science to supplement professionally led monitoring may also allow for more effective and strategic use of scarce conservation funding. However, the spatial coverage of citizen science projects and focal species is not well understood.

This research therefore has relevance and utility for all of Australia's threatened species, both marine and terrestrial. By identifying gaps in coverage by citizen science for monitoring threatened species, we provide guidance for new citizen science projects interested in maximising the ability of citizen science to help with the monitoring and recovery of threatened species at a relatively fine spatial scale. We do this by illustrating the opportunities for specific regions and locations where citizen science could yield the greatest benefits for increasing our understanding of the population trajectories of threatened species and the status of threatening processes.

To the best of our knowledge, this is the first attempt to estimate the spatial coverage of citizen science for threatened species monitoring in an Australian or global context. Previous studies indicate bias toward areas with high human population density and/or provide information about the abundance of threatened

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Background (continued)

species in Australian urban centres. With many threatened species persisting near centres of human activity, there lies an efficient opportunity for citizen science to contribute to the recovery of at-risk species. Our study may thus open up opportunities for citizen science data to contribute to scientific research into threatened species in Australia, both in and near urban centres and elsewhere across the country.

Research aims

We aimed to identify gaps in the current spatial extent of citizen science for monitoring threatened species and highlight opportunities for citizen science projects in threatened species recovery and monitoring.

We also sought to determine where citizen science may not be feasible, and professional monitoring efforts will therefore continue to be necessary to monitoring programs. The overarching aim in identifying these knowledge gaps is to help prioritise engagement efforts for citizen science projects as well as future investments ensuring that limited resources are used efficiently, maximising our ability to track changes in threatened species populations and distributions.

What we did

The project team undertook desktop data collection in 2017 and followed it with analyses, interpretation and development in 2018–19. We generated a spatial database of 133 citizen science projects from across Australia with potential to contribute to threatened species monitoring and recovery.

The criteria for including a citizen science project were: (1) a focus on one or more nationally listed threatened species; (2) spatial overlap with the distribution of one or more threatened species; or (3) inclusion of actions within the distribution of one or more threatened species with the potential to improve understanding of a threatening process or reduce its impact.

We then compared these data about the coverage of citizen science projects with threatened species distributions to map the density of citizen science projects relative to the numbers of threatened species within Australian terrestrial and marine environments.

A spreadsheet of all 133 citizen science projects included in this study, including their geographical locations and other details is available here: https://ars.els-cdn.com/content/image/1-s2.0-S2351989419307218-mmc1.xlsx

A lists of the 1715 Australian threatened species considered in this study is available in this spreadsheet: https://ars.els-cdn.com/content/image/1-s2.0-S2351989419307218-mmc2.xlsx

Key findings

Our research uncovered patterns in the geographic distribution and density of citizen science projects and their relationship to threatened species and human populations.

Of all taxonomically focused programs the largest proportion are focused on birds (45%), followed by mammals (35%). Despite 74% of all Australian threatened species being plants, only 1 program is focused on plants. Three percent of all threatened species are invertebrates, but there are no monitoring programs specifically focused on invertebrates. See table 1.

Table 1. The numbers and relative proportions of taxonomically focused citizen science programs by taxonomic group, and the number and relative proportions of threatened species by taxonomic group.

Taxonomic group	Number of relevant programs	% of all taxonomically focused programs	Number of threatened species	Relative proportion of all threatened species
Birds	43	45%	133	8%
Mammals	33	35%	108	6%
Fish	9	9%	55	3%
Frogs	5	5%	29	2%
Reptiles	5	5%	61	4%
Plants	1	1%	1271	74%
Invertebrates	0	0	60	3%

LEFT: Citizen scientists contributing to threatened species monitoring. Image: Idelies Govett

RIGHT: Citizen scientists assisting with field based monitoring of threatened species and ecological communities. Image: Ayesha Tulloch.

Our key finding is that for many terrestrial environments with relatively high human population density that also harbour many threatened species, citizen science has great potential to contribute to present shortfalls in threatened species monitoring.

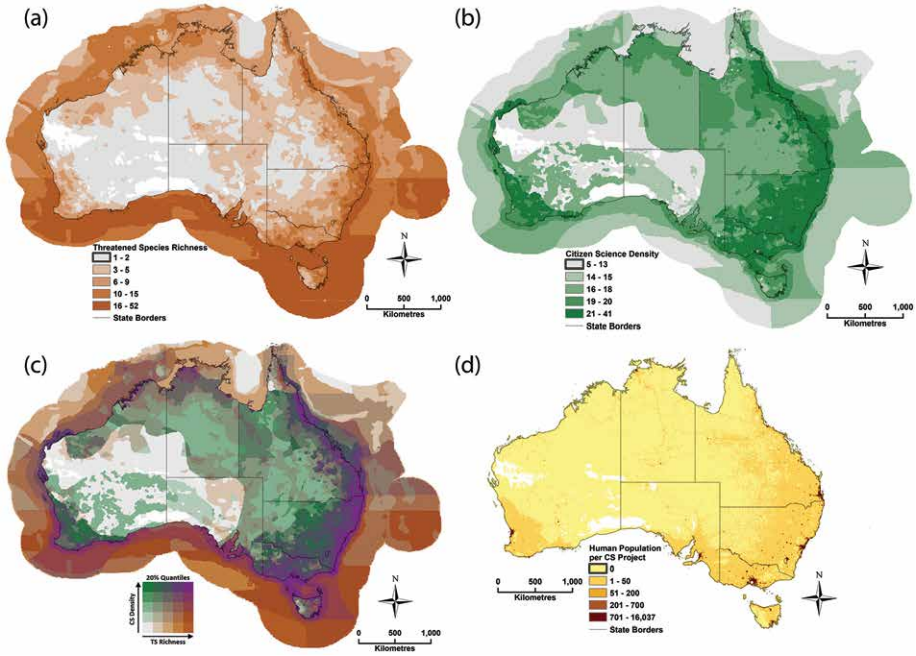

Figure 1. (a) threatened species richness per 10 × 10 km grid cell, (b) citizen science project density per 10 × 10 km grid cell, (c) citizen science (CS) density combined with threatened species (TS) richness per 10 × 10 km grid cell, and (d) human population density per citizen science (CS) project per 10 × 10 km grid cell, within the contiguous Australian Exclusive Economic Zone.

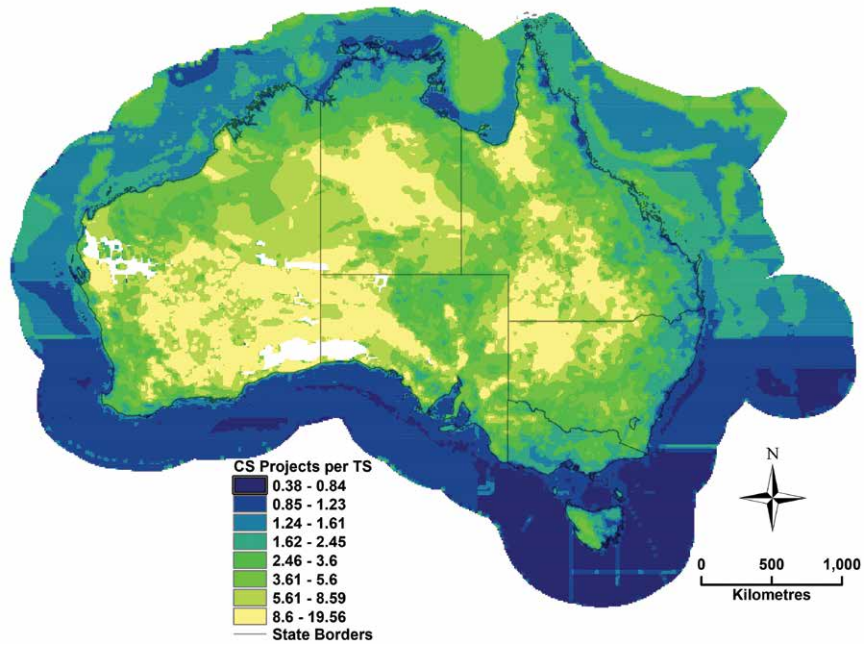

Figure 2. Citizen Science Programs per Threatened Species. The number of citizen science projects per threatened species per 10 x 10km grid cell. White areas represent areas with no threatened species. The darkest blue areas have the least citizen science programs operating per threatened species in that area (0.38 – 0.84 programs per threatened species) while yellow areas have the highest number of programs per threatened species (8.6-19.56 programs per threatened species)

Most of these areas were on the densely populated eastern, south-eastern and south-western coastal areas of Australia, near population centres and extending into several marine coastal environments. The potential coverage of citizen science aligns relatively well generally with threatened species richness in terrestrial ecosystems.

Our findings also reinforce previous studies that have found that human population density can be a strong predictor of the occurrence of citizen science efforts across terrestrial species. By comparison, however, marine environments had no pattern of high citizen science project density despite high population densities in adjacent terrestrial regions.

While the density of citizen science projects was lower in marine ecosystems, coastal waters were generally well-represented, particularly along the eastern coasts of Australia and south-western Western Australia. Good representation was found for the Ningaloo Reef area of central Western Australia, the Great Barrier Reef region of eastern Queensland and the New South Wales southern coast. The coasts of far northern Australia were poorly represented, despite having relatively higher numbers of threatened species. The greatest deficit in marine science project coverages relative to the richness of threatened species, however, was in southern Australian waters, particularly those off Victoria and Tasmania.

We also identified several areas with presently low density of citizen science projects but high numbers of threatened species that may benefit from an expansion of

Key findings (continued)

citizen science projects –north-eastern far north Queensland, along the northern coastlines of the Northern Territory and in eastern Tasmania. Albeit, some areas may lack the human population density to be able to make substantial contributions to the paucity of available data.

Further, we found that citizen science is unlikely to replace professional monitoring in some places, such as offshore marine environments and the arid interior. This finding was made possible by including data on human population density; citizen science may not be readily expanded in some of these areas due to resourcing and logistical shortfalls. Providing extensive resources and training may not be cost-effective for the most threatened of species in such environments.

Cited material

Lloyd, T. J., Fuller, R. A., Oliver, J. L., Tulloch, A. I., Barnes, M., Steven, R. 2020. Estimating the spatial coverage of citizen science for monitoring threatened species. *Global Ecology and Conservation* 23. doi.org/10.1016/j.gecco.2020.e01048

Further Information

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Implications and recommendations

The widespread overlap of citizen science projects with many areas with high numbers of threatened species in Australia, especially in terrestrial and marine coastal environments, demonstrates the great potential for citizen science as a tool to support conservation action for threatened species. Considering the high threat of extinction to numerous native Australian species, the uneven distribution of the human population across the continent and the related inadequacy of threatened species monitoring in Australia, new methods of gathering information, such as those offered by citizen science, can help address these shortcomings.

Our findings will be most relevant to conservation practitioners coordinating citizen science programs involved in the collection of data about biodiversity or threatened species, as well as to research scientists working in the citizen science and biodiversity sphere. Policy-makers and funding bodies working to improve the capacity of threatened species monitoring in Australia will also be able to make use of our findings. Monitoring Australian threatened species efficiently in time and space to predict and mitigate biodiversity loss cannot be achieved by professionals and institutions alone. Organisations and agencies considering offering new citizen science projects or expanding existing projects could base their decisions on where gaps in potential citizen science coverage are, where the threatened species are, which locations are likely to be visited by the public, and which locations might be unattractive or inaccessible to the public.

Nature-based tourism could potentially provide a steady supply of participants in citizen science projects and monitoring for threatened species in the areas identified as fruitful for such expansion, where there is also a real need for more information about local threatened species – namely, the northern coasts of the Northern Territory, the north-east of far north Queensland, eastern Tasmania and coastal marine environments neighbouring areas with high human occupancy.

Finally, a more exact picture of where citizen science is directly contributing to threatened species conservation could be made possible by citizen science programs being encouraged to regularly contribute their data, including basic metadata about observations, to online databases. This in turn could vastly improve the utility of this data to conservation managers and researchers.

Australian Government

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