

# Citizen science tools available for ecological research in South Africa

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Citizen science is a term for scientific research conducted by non-scientists. Ordinary citizens can participate in research from their home computer, in their own gardens, or in the great outdoors – without any expertise in the field. Many citizen science projects and opportunities exist in South Africa – ranging from monitoring bird migrations to identifying and mapping distributions of fungi. In this article, three citizen science tools available to researchers in South Africa are discussed and three interesting plant-focused research projects which currently utilise these tools are introduced. Incorporating citizen science tools into ecological research provides many benefits. The use of citizen science tools increases sampling distributions, both temporally and spatially<sup>1</sup>, and engagement of local citizens in research provides ‘many scientific eyes’<sup>2</sup>, which is especially useful for geographical studies, such as monitoring invasive species or mapping populations of rare species over large spatial scales. Not only does the research benefit from multiple volunteer observers, but also from greater access to private lands.<sup>3</sup> Thus, incorporating citizen science tools ultimately increases the feasibility of many research projects through the culmination of these benefits. Each of the tools discussed below may already be in use by large numbers of citizens who are actively contributing to projects which will be available for future research endeavours. However, citizen science is recognised as an inherent avenue for outreach,<sup>3</sup> and should only be pursued through projects for which there is a commitment and interest in improving scientific literacy by engaging a greater population. Citizen science is not only recognised as a tool for research, but also as a tool for scientific education. Citizen science projects provide ample outside-of-the-classroom learning opportunities for participants. They also provide educational benefits such as skills for accurate data collection, critical thinking and scientifically informed decision-making<sup>2</sup> – which ultimately increases scientific capacity, better informs decisions and improves social capital in South Africa.

## Citizen science tools

Three not-for-profit tools available for ecological research projects in South Africa are discussed below. Each tool is briefly summarised and the method of application in research is introduced. Reviewing the qualities and limitations of each tool is not in the scope of this article. All three tools are web-based platforms on which citizens can register, upload images and locations, and share observations.

### *Ispot*

[www.ispotnature.org](http://www.ispotnature.org)

Ispot is an international platform with a South African based initiative sponsored by the South African National Biodiversity Institute (SANBI). The project launched in South Africa in June 2012, and has contributed to the nearly 400 000 international observations of 30 000 different species reported by mid-2014.<sup>4</sup> The project strives to connect citizens to experts in the field through a social network, who can work together to identify organisms and learn about ecology. Researchers can create ‘projects’ on Ispot for which they can collect observations using a tag system. For example, the tag ‘dyingfynbos’ is used to filter and organise observations for a research project about plant disease in fynbos vegetation. Complexity can also be added to projects on Ispot by adding species interactions to observations (i.e. experts and citizens can work together to identify, from a single image, both the bee species and the flower species being pollinated).<sup>5</sup>

### *WhatSpecies*

[www.whatspecies.com](http://www.whatspecies.com)

WhatSpecies is a citizen science tool that was developed in South Africa. A parent who wanted to help her children identify insects and plants launched the platform to aid people to ‘live out their passion and learn about identifying nature’ (Cruywagen M 2015, personal communication, November 6). The data on the platform are openly accessible and the layout of the website caters well to a young audience. A second version of WhatSpecies is expected to launch in late March 2016. The platform strives to engage youth through other forms of social media such as Facebook and blogging and is committed to protecting the ownership of uploaded images. In contrast to Ispot, researchers organise projects by creating groups that citizens can join to upload observations.

### *Virtual Museum*

<http://vmus.adu.org.za>

Virtual Museum is a South African based platform hosted and organised by the Animal Demography Unit at the University of Cape Town. The platform is project oriented and is currently hosting 17 different geographical projects for mapping distributions of organisms that range from fungi and orchids to dung beetles and birds, with each comprising many genera. Using this tool, researchers create a project and citizens share observations by uploading images and selecting locations specifically for that project. Growth in the platform has been exceptional, with more than a million records of bird distributions added since the beginning of the Southern African Bird Atlas Project (SABAP2) in 2007.<sup>6</sup> The data are stored under a Creative Commons licence and registered users can request static maps and species lists.

## Selecting a citizen science tool

Each tool discussed above has strengths and weaknesses, which are highly dependent on the scope of the research project itself. Therefore, it is important to try and consider all three when initiating a citizen science component of a research project in South Africa. Alternatively, researchers could choose to create projects in all three tools discussed, merging observations for their own analysis. All three tools are limited to geographical studies, but each could be used to recruit participants for more interactive projects that involve physical sampling. Data quality, target audience, social engagement and user-abundance (e.g. number of active citizen scientists) are important components to consider when selecting a tool. Both Ispot and WhatSpecies use crowd-sourcing to identify observations, but observation identifications on Virtual Museum are at the discretion of the project leaders and a selected 'expert panel' through checking of photographs. All three tools are suitable for mapping distributions supported by images, but each is limited to projects in which organisms can be identified from photographs (e.g. plants, fungi and birds). However, each tool can be used to direct sampling efforts to confirm observations or conduct a more thorough investigation. For example, Cape Citizen Science (discussed below) is a citizen science initiative for a research project to study plant disease throughout the Fynbos Biome. Because microscopic organisms cause plant disease, images showcasing symptoms of disease cannot be used to conclusively identify the microorganism. However, the project is currently using two of the tools discussed above to find sampling locations and potentially identify new hotspots of plant disease emergence.

## South African citizen science projects

There are many citizen science projects ongoing within South Africa. As mentioned previously, there are 17 different projects that citizens can participate in hosted on Virtual Museum alone. One project on Virtual Museum and two projects on Ispot that focus on plant communities are discussed below.

### OrchidMap

<http://orchidmap.adu.org.za>

OrchidMap is a project hosted by Virtual Museum in which citizens can upload images and locations of orchid observations. The purpose of the project is to improve the understanding of the distributions of African orchids. Nearly 3000 geo-referenced records for orchids have been uploaded to Virtual Museum for this project since it was initiated in September 2014.<sup>6</sup> In contrast to Ispot and WhatSpecies, Virtual Museum uses a grid system to share location data for individual observations and does not provide explicit coordinates to avoid potential abuse of the platform. This approach is important in the case of access to distributions of rare and endangered species with economical incentives, such as many orchid species. Ispot and WhatSpecies do allow users to hide location data when sharing observations, but users may be unaware of the risk.

### Cape Citizen Science

<http://citsci.co.za>

The Forestry and Agricultural Biotechnology Institute of the University of Pretoria initiated Cape Citizen Science for a project to survey plant disease in the Fynbos Biome. The research is designed to focus on a

group of microorganisms called *Phytophthora*, which translates from Greek as 'plant destroyers'. As part of the initiative, the researchers have created a project on Ispot in which citizens can contribute observations of dying plants using the tag 'dyingfynbos'. A group also exists to organise observations for this project on WhatSpecies. The reported locations will be used to choose sampling locations and are expected to help researchers and land managers respond more quickly to new invasions and diseases. Since the project was initiated, the researchers have also started collaborating with a group from the Cape Peninsula University of Technology that is studying invasive aboveground fungi in the same system. These research projects will directly benefit from shared observations from citizen scientists and will ultimately contribute positively to the conservation of the biodiversity in the Fynbos Biome.

### Aliens of the Cape Peninsula

<http://www.ispotnature.org/projects/aliens-of-the-cape-peninsula>

Aliens of the Cape Peninsula is a project exclusively on Ispot. The aim of the project is to catch new introductions of alien plants and map the current distributions of known alien species. The project page on Ispot indicates that there are currently over 800 species of alien plants – a third of the total species present – on the Cape Peninsula and provides a long list of species for which to look. The project was initiated in early January 2016 and has already received more than 1000 observations.

## Conclusion

The tools discussed above are freely and readily available for implementation in southern Africa research projects. They are incredible resources that are useful for improving public well-being through educational benefits whilst also providing future societies with basic research. These tools also enable the coupling of science education and hypothesis-driven research, thereby benefitting society and the planet by engaging the public in the scientific process.

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