Use of Target Species in Citizen Science Fungi Recording Schemes

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Abstract

Observational records of fungi by citizen scientists have mushroomed over the last three decades, especially those submitted via on-line platforms, increasingly accompanied by images. For example, Research Grade observations of Fungi in iNaturalist have increased from just over 5,000 for 2010 to more than 400,000 for 2020, with annual rates of increase of more than 60% in recent years.

A feature of fungi records on platforms such as iNaturalist and Mushroom Observer is that the identification of numerous images remains unconfirmed. Of the more than 4 million observations of fungi in iNaturalist, more than 70% are not confirmed as Research Grade, either because the identification is not to species, or because the minimum number of confirming identifications has not been reached.

Images are unidentified due to several factors, including that characters necessary for identification are not visible. This aside, many field images are of species of fungi whose identification is challenging, due to subtle macroscopic distinguishing features or because microscopic or DNA characters are required for accurate identification. Even among identified records, misidentifications are common among both observational and herbarium records, due to misapplication of names from one geographic area to another and numerous undescribed species (coupled with the tendency for naive observers to over-identify their observations).

One strategy to deal with high under- or mis-identification rates is the use of target species, which are species selected and presented as readily identifiable. Given that citizen science platforms have wide appeal, and many users do not have expert knowledge of fungi, target species make initial engagement more satisfying by facilitating the identification of at least some observations, by both the observer and subsequent identifiers.

Target species selection can be based on a range of factors. From the observer point of view, species that are common and widespread provide the advantage that the observer has a reasonable chance of encountering some species on any excursion. Selection of

species can be further stratified by habits, hosts and substrates. Diversity of morphological and trophic groups among targets serves to introduce recorders to major groups and educates about the way fungi interact with their environment and other organisms.

The most important aspect of target species is identifiability. Expert knowledge of species that could be encountered must be used to select species. Monographs of fungi tend to focus on differentiation from taxonomically related species, often using microscopic characters. In providing information on target species, it is vital to provide comparisons to look-a-like (macroscopically similar) species, whether related or not and whether formally described or not.

In Australia, Fungimap commenced in 1995 as a fungi mapping scheme. Initially eight target species were selected, growing to 200 species. Key elements in the success of the scheme included: (1) a regular *Fungimap Newsletter*, (2) an illustrated guide to the first 100 target species (Fungi Down Under, published in 2005) in which inclusion of maps for all species was a spur for observers to fill and extend distributions, which at that stage were often patchy, (3) a small team of identifiers, who checked incoming records, and (4) training opportunities via workshops and forays.

Fungimap records were initially handled in-house in a purpose-built database that lacked a web interface, but could handle input from spreadhseets. Records are regularly supplied to the Atlas of Living Australia and thence to the Global Biodiversity Information Facility. Observers are now encouraged to use the Fungimap Australia project in iNaturalist.

Use of target species significantly increased the number and geographic spread of records. For example, prior to 1990, the highly distinctive Pixie's Parasol (*Mycena interrupta*) was known from few specimens (17 unique databased specimens). Inclusion as a target species has yielded more than 2,300 observation records, specifically contributed to Fungimap. There are more than 3,400 observations of the species, of which 99% were contributed since 1990. These data allow presentation of mature distribution maps in contexts such as the Australian State of the Environment report for 2016.

In relation to conservation threat assessments, data on target species can support apparent rarity by comparison of records of rare species against those of more common species that are in the same list. The assessment of Tea-tree Fingers (*Hypocreopsis amplectens*) as Critically Endangered on the IUCN Red List of Threatened Species was supported by the fact that this species had been a Fungimap target since 1999, but at the time of the assessment in 2019 was known only from four sites.

Challenges in the use of target species include: (1) adjusting lists to incorporate new taxonomies without confusing recorders, (2) dealing with species that are not formally described, such as those with "field" names, (3) communicating with recorders not engaged with local networks that species belong to target sets, and (4) growing target

species lists to maintain engagement. Nevertheless, target species are useful for observers and identifiers, and expert categorisation of the “identifiability” of species could be a useful feature to add to aggregated data sets, for use as a potential filter.

Keywords

biodiversity, distribution, identification, mushrooms, naturalists

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Conflicts of interest