



A barrier to global plant invasion ecology: gaps in trait availability for alien species

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Introduction

Non-native species have strong negative effects on ecosystems, like *Reynoutria japonica*. Functional ecology can help understand them using functional traits. However, the extent to which alien species are described by global trait databases is not known.

We assessed the trait coverage of global alien species using global trait databases.



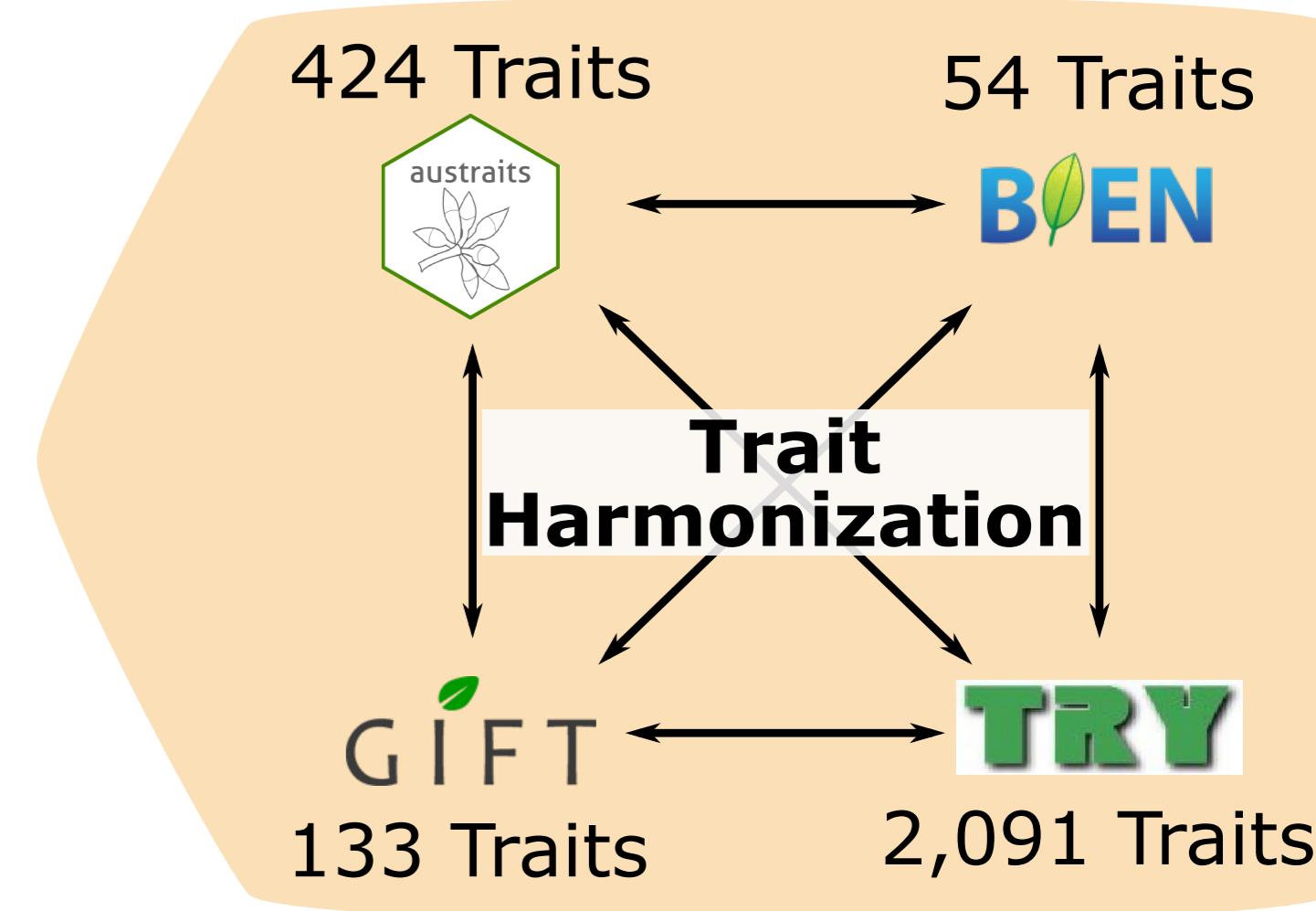
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Boring Affiliations

Methods

We assembled the largest trait dataset for alien plant species using global trait databases (AusTraits, BIEN, GIFT, TRY) and manually curated trait correspondence tables, combining them with the GloNAF database of alien species status and distributions.

We performed taxonomic harmonization for all the involved databases to unify the different taxonomies using the TNRS. In total we obtained distribution and alien status for 16,538 species and observed 2,216 different traits.



Because ecologists are seldom interested in isolated trait, we focused on 3 specific combinations of trait. These represent commonly used combinations for comparative ecology.

Leaf-Height-Seed Mass



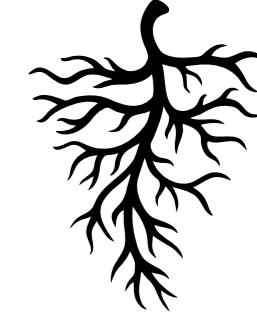
3 traits - Westoby et al. 1998

Aboveground Traits



6 traits - Díaz et al. 2016

Root Traits

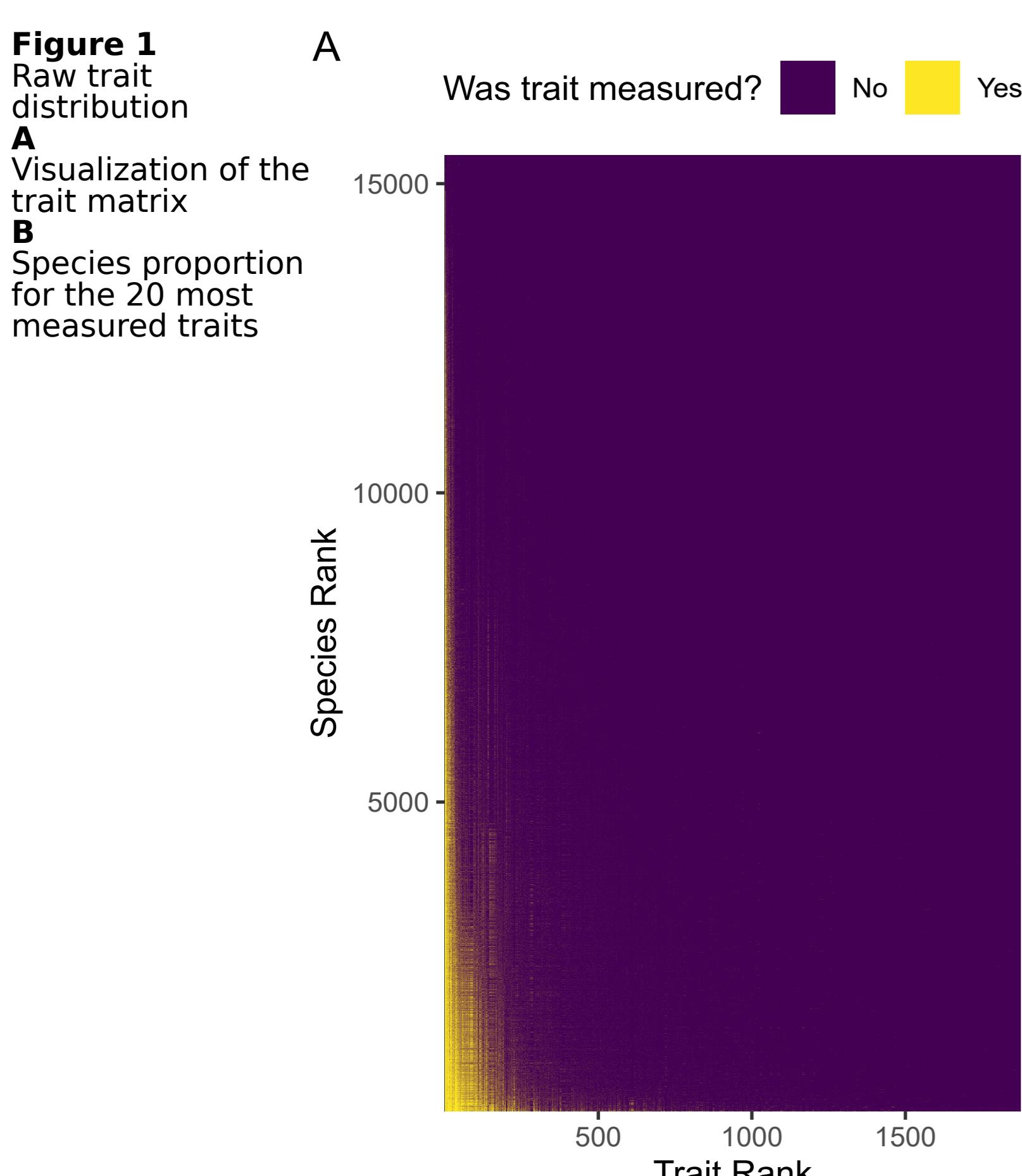


4 traits - Bergmann et al. 2020

Results

We found that the species-by-trait matrix (16,538 species x 2,216 traits) was empty at 98% (Figure 1A). 1,717 species (~10%) had >100 different traits measured, while 50% of the species have >20 traits measured.

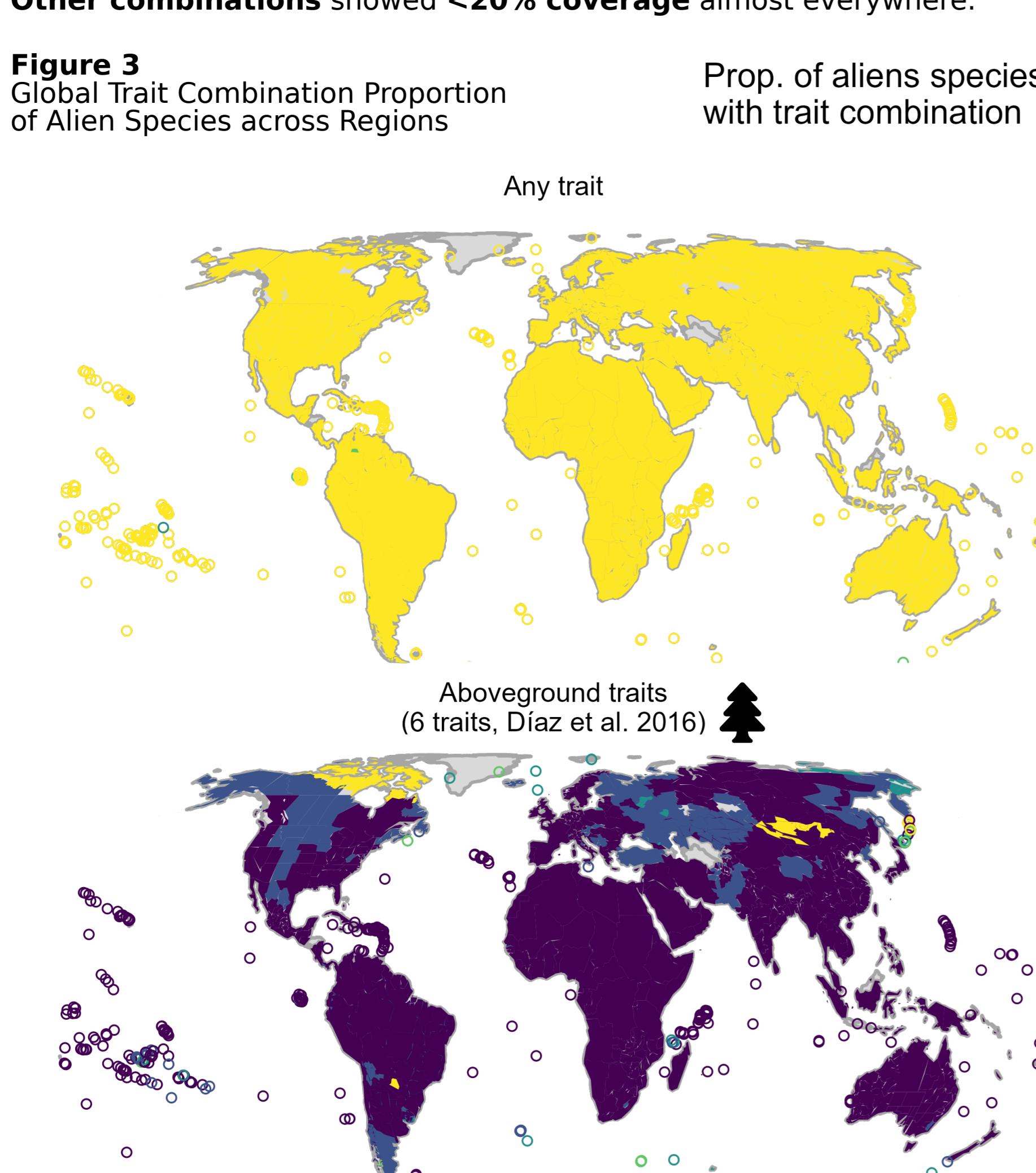
We also looked at the 20 most frequently measured traits (Figure 1B). Most of them were categorical. Plant height and seed mass were the most available continuous traits at respectively 68% and 51% of the species. There were only 8 traits available for over 50% of the species.



We mapped the proportion of alien species in each region with target trait combinations (Figure 3). All regions of the world showed >80% coverage with >0 trait.

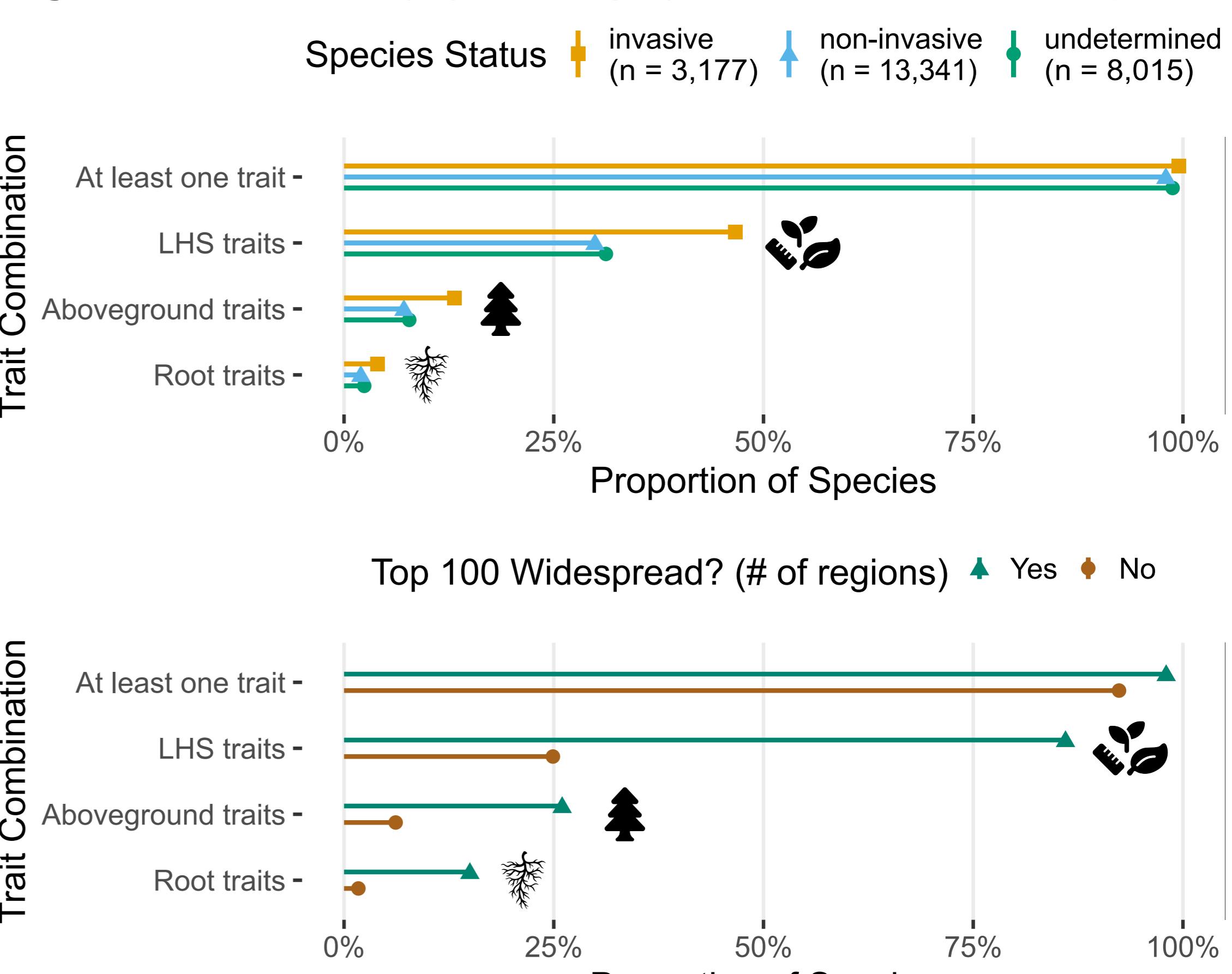
However, for other trait combinations, the proportion dropped. The median was <60% for LHS. The Tropics showed vast regions with <40% coverage.

Other combinations showed <20% coverage almost everywhere.



We measured the proportion of species with a given trait combination in function of their alien status as well as their widespreadness. We found that invasive and widespread species had a consistently higher proportion of known trait combinations than non-invasive and non widespread species. This result hold whatever the considered trait combination.

Figure 2 Trait combination proportions (top) by alien status (bottom) and range size

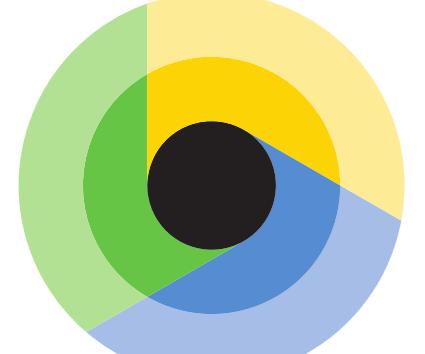


Take-Home Messages

- Global trait databases show overall low coverage of alien species.
- Many traits are measured (over 1,875 have been measured at least once) but as soon as we combine them the coverage drops dramatically.
- We're currently building a model to quantify the factors that explain trait knowledge per species (invasiveness, range size, GDP across range size, etc.).
- This doesn't mean the data do not exist, rather that they are not deposited in global databases. We should increase the awareness about data consolidation.
- We would need a global coordinated effort to increase the trait coverage at global scale: data mobilization from the community, literature search, or targeted field campaign.

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