Threatened at home but naturalized elsewhere: conservation conflict or opportunity?

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Threatened species Numerous plant species are declining and threatened in their native range.

Naturalized species The intentional (e.g. because of economic uses) or unintentional introduction of plants promote naturalization (i.e. the build-up of self-sustaining populations) outside their native ranges.

Most of the naturalized species are also common in their native ranges, but some of them may actually face threats in their native range. The cases of species threatened at home butnaturalized elsewhere could pose conservation conflicts or opportunities. In the novel regions, they could threaten native species, but naturalization can also provide them with opportunities asan accidental type of ex-situ conservation.

Coffea arabica Endangered

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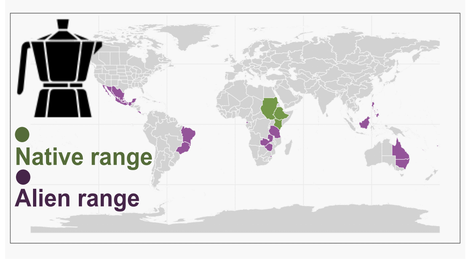
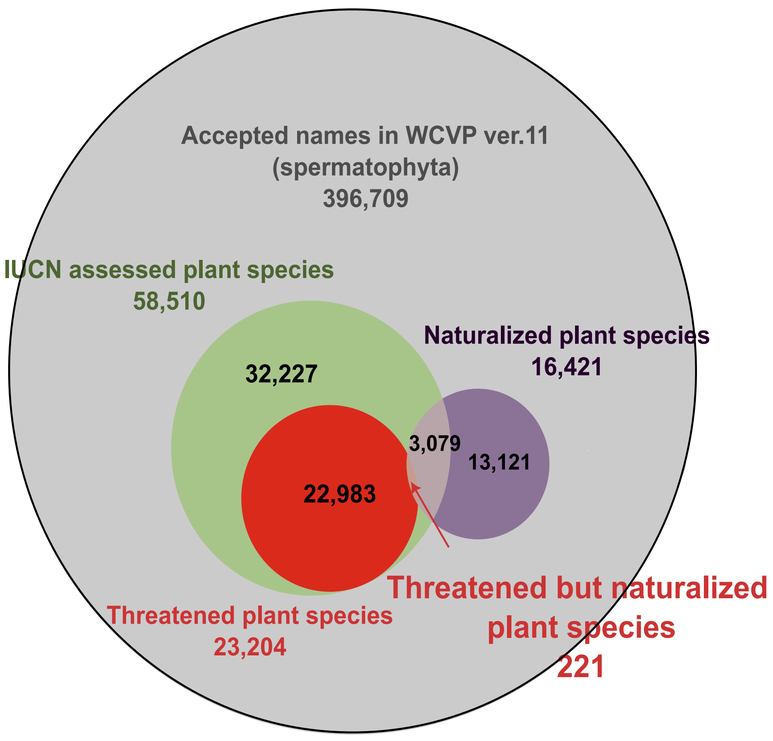


By combining several global databases, we quantifed the number of threatened but naturalized species, characterized their features, and explored the geographic patterns.

Threatened but naturalized species

How many?

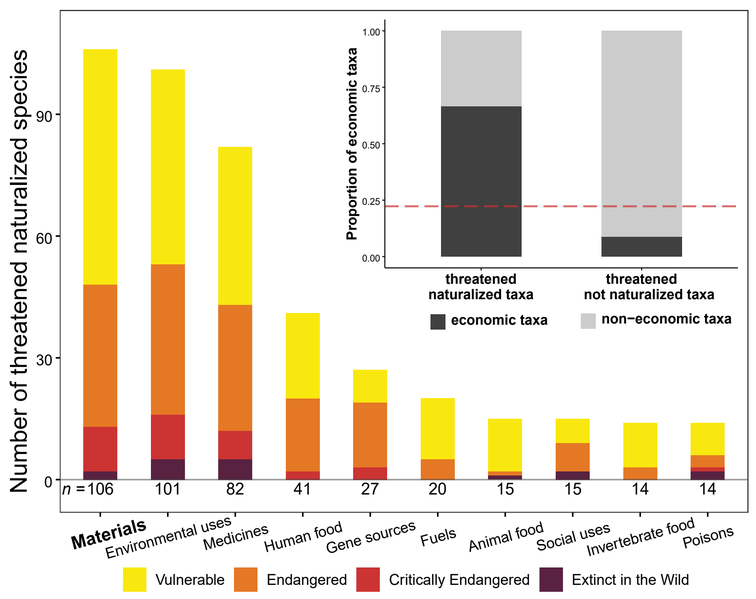
221 threatened species successfully naturalized elsewhere



Of the IUCN-assessed vascular flora (n = 58,510), 23,204 are threatened with extinction, and **3300** are naturalized elsewhere. Among the threatened species, **221** have successfully built up stable populations outside their native range.

Specific features?

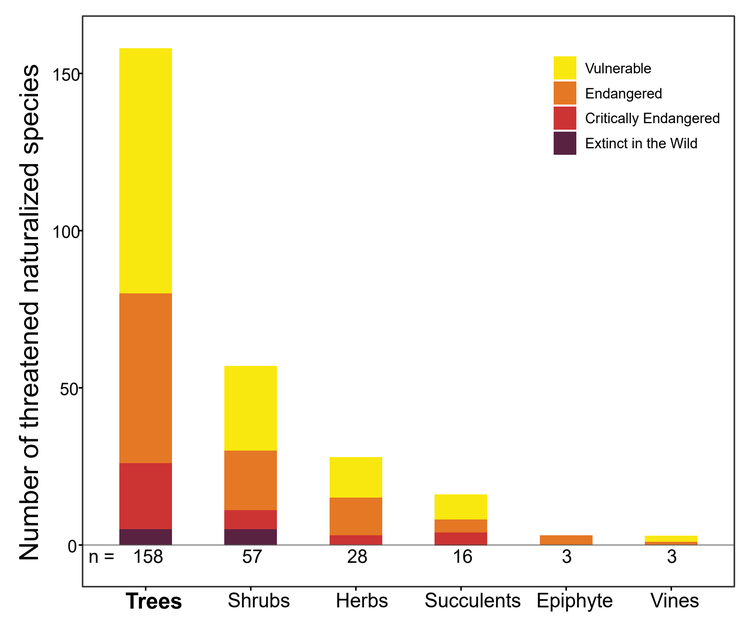
Economic use promotes naturalization of threatened species



Main usages: Materials (e.g., wood products), environmental uses (e.g., ornamental species) and medicines (both for humans and veterinary).

Relatively high proportion of threatened naturalized species have an economic-use **(66.52%; 147 out of 221)**.

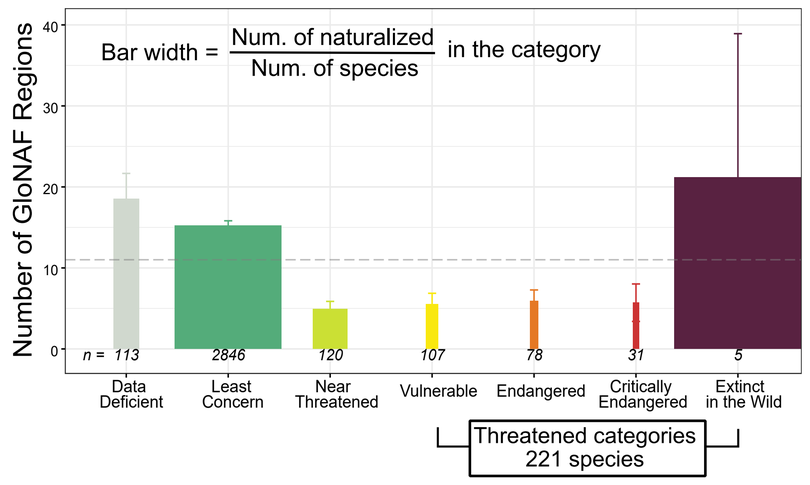
Link between woodiness and naturalization probability



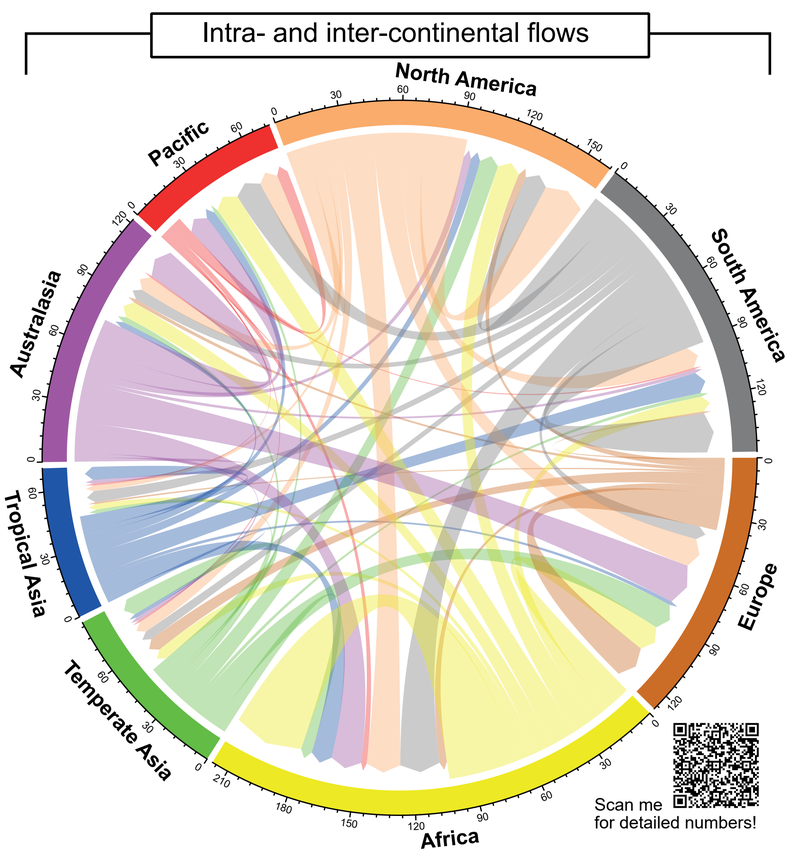
71.5% (158 out of 221) threatened naturalized species are woody species (trees or shrubs).

Geographic patterns?

Africa and Europe received most species, both intra- and inter-continentally



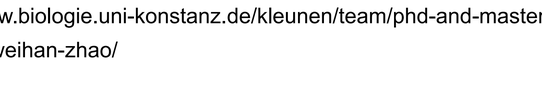
Threatened species are naturalized in fewer GloNAF regions than taxa categorized as Least Concern.



- Africa is the largest donor and recipient continent.
- Europe has the highest proportion of intracontinental naturalization.
- Africa and Europe also harbor most threatened naturalized species from other continents.
- The Pacific Islands are the smallest donor of threatened naturalized species but are overrepresented as recipient.

Methods

- Two main datasets: IUCN Red List[1], GloNAF (Global Naturalized Alien Flora)[2]
- Major taxa studied: vascular plant species



- Standardization of the taxa names and native distribution: 'rWCVP' package[3], against WCVP v.11 (World Checklist of Vascular Plants version 11)[4]
- Species economic usage: WCUP (World Checklist of Useful Plant Species)[5]
- Venn and Chord diagrams: 'eulerr' package[6], 'circlize' package[7]

Discussion

Economic use likely promoted naturalization of threatened species. Naturalization might have a positive role in conserving threatened plant species (e.g., managed relocation, assisted migration, ex-situ conservation). Islands appear to be a larger than expected recipient of thereatened naturalized species. Further investigating the overlap of the ecological characteristics of threatened and naturalized plant species might provide insights into the factors influencing species persistence and distribution patterns.

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https://www.biologie.uni-konstanz.de/kleunen/team/phd-and-master-students/weihan-zhao/

[1]iucnredlist.org

[2]van Kleunen M., et al. (2019) The Global Naturalized Alien Flora (GloNAF) database. Ecology

[3]Brown M.J.M., et al. (2023) rWCVP: a companion R package for the World Checklist of Vascular Plants. New Phytologist

[4]Govaerts R., et al. (2021) The World Checklist of Vascular Plants, a continuously updated resource for exploring global plant diversity. Scientific Data

[5]Diazgranados M., et al. (2020) World Checklist of Useful Plant Species.

[6]Larsson J. (2018) "eulerr" package

[7]Gu Z., et al. (2014) "Circlize" package