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Editorial: Insights in plant conservation

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Editorial on the Research Topic:
Insights in plant conservation

Plants, as primary producers, underpin almost all life on Earth and provide numerous services to humans including food, climate regulation, soil erosion control, soil formation, as well as numerous cultural, spiritual and aesthetic benefits. Of an estimated 417,000 plant species, over 62,000 have been assessed by the IUCN Red List and of these 42% are threatened with extinction (i.e., fall into the categories extinct, extinct in the wild, critically endangered and vulnerable) (IUCN, 2023). Like all biodiversity, plants are primarily threatened by habitat loss, degradation and fragmentation, as well as over-harvesting and climate change (IPBES 2019). Synergies between extinction threats and trophic cascades (e, g., plant-pollinator disruptions) amplify and exacerbate these individual threats. Perhaps it is not surprising, given the current biodiversity crisis, that research on plant conservation has increased by orders of magnitude over the past few decades (Figure 1).

The Kunming Montreal Agreement aims to protect 30% of terrestrial land surface and restore 30% of degraded land by 2030 (Stephens, 2023). Yet, these ambitious frameworks and burgeoning research on plant conservation, have not been matched with allocation of resources. Plant conservation remains underfunded when compared to animals (Molano-Flores et al.; Adamo et al., 2022).

How then is plant conservation to keep pace in a world of rapidly growing threats and over-stretched resources? The papers in this Research Topic illustrate several ways forward.

First, is to make sure that conservation and restoration efforts are resource efficient. This involves targeting species of concern, then ensuring that restoration techniques are as effective as possible. Bialic-Murphy et al. explore how effective different life stages are in the success of restoration projects. While mature individuals had a higher survival rate, stochastic modelling also indicated the need to consider seedling survival when assessing the long-term success of restoration efforts. Their results highlight the need for restoration management to adapt throughout the course of a restoration project.

Second, plant conservation needs to be resource efficient. Molano-Flores et al. show how herbarium specimens can provide a low-cost option for gathering data and conserving rare plants. The information provided on herbarium labels can provide data on precise locality, date of observation, habitat, associated species, and substrate. Digitised herbarium data, lodged in databases such as GBIF, can be used to develop habitat suitability models, which in turn can be used to predict range shifts under climate change. The paper shows how data from herbaria can

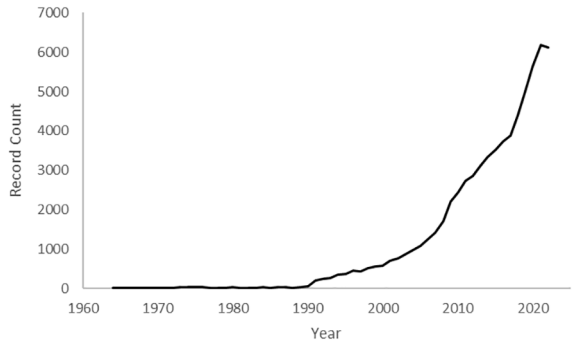

FIGURE 1
Number of publications with "plant " and "conservation" in the title or keywords since 1964, retrieved from Web of Science Core Collection, November 2023.

further knowledge of past, present, and future trends for rare plants, as well as providing additional knowledge on species' biology and ecology. This valuable addition to the conservationists' toolkit can improve decision making and protection of listed species.

In another approach to resource efficiency, Finch et al. explore the success and challenges of citizen science (community science) in plant conservation. This approach uses data and expertise of volunteers to increase data gathering and monitoring power. Emerging several decades ago, the approach was driven by technological advances, public interest and limited funding, while volunteers gain hands-on research experience, scientific knowledge, as well as community and time spent in nature. Digital surveys of project managers and volunteers show that staffing, funding, program size, data management, and volunteer training are all important predictor variables of success of citizen science projects. The authors also state the need for citizen science to become more inclusive and diverse. Their study can help to improve existing projects and inform the establishment of new ones.

Third, plant conservation must be done with environmental and ecological context in mind. Vitt et al. discuss how climate change is affecting seed sourcing strategies in restoration ecology. While the "local is best" paradigm assumes locally sourced genotypes are best adapted to their environment, the rapid changes that are taking place today may outpace such local adaptations. Their study shows how common garden and reciprocal transplant experiments, alongside long-term studies, can help identify seeds that are best adapted to local and future conditions. However, their review also highlights the bias in available information towards commercial tree species rather than species of importance to restoration. They call for more studies on herbaceous and perennial species, which are important in the early stage of restoration. They also highlight the need for greater use of species distribution modelling, identifying dynamic seed transfer zones and regional seed networks, as well as establishing a Restoration Project Clearinghouse where lessons can be shared.

With regard to ecological context, Sandacz et al. studied the effects of a decline in a keystone plant on a plant-pollinator network and ecosystem resilience. *Cirsium pitcheri* is a keystone plant in Lake Michigan dune communities, but is in decline because of habitat loss. Sandacz et al. tracked the effects of this decline in plant-pollinator networks and showed that sensitivity to disturbance increased as the *C. pitcheri* declined, and that species turnover could have detrimental effects on the long-term persistence of the dune community. The work has implications for best conservation and restoration practices in areas vulnerable to disturbance and habitat loss.

This Research Topic has illustrated potential ways forward in these three important areas, showing how plant conservation can become more effective, resource efficient, and adaptable.

Author contributions

LG: Conceptualization, Writing – original draft. DI: Visualization, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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