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Editorial: Conserving cultural ecosystems: the biodiversity and ecosystem service provision of semi-natural anthropogenic ecosystems versus natural ecosystems

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Editorial on the Research Topic

[Conserving cultural ecosystems: the biodiversity and ecosystem service provision of semi-natural anthropogenic ecosystems versus natural ecosystems](#)

Many ecosystems across the world are cultural ecosystems that have been shaped by human activities, traditions and practices through millennia of farming and resource extraction. This has resulted in a range of plagioclimax habitats that have long been recognized as of high ecological conservation value (Green, 1972). These include the mountain pastures, meadows, heathlands and wood pastures that together comprise many of the habitats designated as the most valuable and threatened in Europe within the [Habitats Directive \(92/43/EEC\)](#). Through the papers presented in this Research Topic, we highlight the value of these cultural ecosystems and discuss the threats they face, as well as potential conservation solutions. The major threat they all face is change in rural land use so we draw comparisons with alternative land covers including the more natural later successional forest ecosystems that arise following abandonment of traditional cultural practices across Europe.

Changes to agroforests, one of the most ancient and previously widespread cultural ecosystems across Europe, are explored by [González Díaz et al.](#) in a case study that demonstrates a major reduction in area and increase in fragmentation of hay meadows and grazed pastures since the mid 20th century following the abandonment of farming and the rural exodus to urban and industrial areas. The meadows and pastures have been succeeded by dense shrublands and forests. This expansion of forests due to ecological succession of

cultural ecosystems may be potentially beneficial considering that tree planting is widely used to enhance carbon sequestration (Domke et al., 2020). However, Hermoso et al. (2021) caution against reliance on forest restoration for climate regulation due to the increase in fire risks, particularly in areas that are becoming drier and hotter. Instead, these authors join recent calls recommending the restoration and conservation of intact ecosystems, including wetlands, mountain grasslands, peatlands and other natural carbon sinks as better ways to mitigate climate change impacts (Martin & Watson, 2016; Rockström et al., 2021). Ioannidou et al. show poignantly the value of temporary salt lakes for carbon storage by demonstrating how their replacement by a soil-sealed airport resulted in a 37% loss of carbon storage. This was in addition to major losses of food provisioning services and avifauna habitats.

Important ecosystem services and biodiversity conservation are also provided by alpine semi-natural grasslands. Fernández-Guisuraga et al. demonstrate the role that low-intensity grazing practices linked to millennial sheep transhumance has in promoting plant diversity, forage provision and soil fertility in mountain areas. These multifunctional ecosystem values declined when grazing was excluded for long periods and biodiversity-rich grasslands were replaced by more homogeneous woody vegetation. The knock-on impact on insect diversity from the loss of grassland diversity has been shown across central Europe (Markl et al., 2022).

Heathlands were once abundant and interconnected across Northern Europe (Ombashi and Løvschal, 2022). Remaining heathlands face threats including loss of traditional management and increased atmospheric nitrogen deposition. Walmsley et al. provide a framework for deciding which conservation management measures might best mitigate these threats and support the ecosystem services and functions of heathlands. They explore trade-offs between ecosystem services, ecosystem function, and the costs of each management intervention. In addition to these considerations, a detailed study by Vogels et al. elucidates how restoration interventions impact other trophic levels such as herbivorous invertebrates. So, while the framework provided by Walmsley et al. identifies removal of above-ground vegetation and O soil horizon (chopping) or also the A soil horizon (sod cutting) as the most effective techniques for mitigating excess nitrogen, Vogels et al. show that because sod cutting also removes phosphorus, the resulting high nitrogen:phosphorus ratio has high fitness costs for herbivorous invertebrates such as field crickets *Gryllus campestris* (L.). Other stoichiometric effects of restoration treatments on nutrient availability for plants and animals are also discussed by Vogels et al.

The conservation of cultural ecosystems may be less challenging than their restoration but requires conservation of the cultural practices that created these systems and for them to be valued by current local human communities. In recent decades, the phenomenon of counter-urbanization has created newcomer rural populations, which might offer opportunities to reverse rural abandonment (Herrero-Jáuregui and Concepción, 2023). Understanding this potential requires an interdisciplinary approach to future research. To exemplify this, Sansilvestri et al. combine historical, geographical and forestry literature to evaluate

the changing nature of the human relationships with the pollarded oak dehesa forest in Spain. They assess local perceptions of the landscapes and people's views of community resilience given the associated socio-economic and governance contexts. They highlight the dichotomy of thinking among conservation managers between a return to more "pristine" natural ecosystems versus finding ways to maintain more traditional management practices as key to biodiversity preservation. Engagement in reviving these more traditional practices is identified as a factor that reinforces community resilience, but which needs stronger governance and financing support.

This Research Topic emphasises how the conservation and restoration of cultural ecosystems, along with the biodiversity and ecosystem services they offer, rests on addressing common challenges of ensuring appropriate management practices in a rapidly changing world. Ultimately, the preservation of a large proportion of European biodiversity and ecosystem service provision will depend on societies finding new ways of appreciating hence preserving the cultural practices that created these valuable landscapes.

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