Can ecosystem restoration mitigate climate change?

Level: Master
Start: Any time
Project form: Meta-analysis using R
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Background

Ecosystem restoration is the return of degraded land into a natural state, i.e., a complex ecosystem with function, structural diversity, self-organization, and services (Gann et al., 2019). As a multi-purpose strategy, ecosystem restoration can offer several benefits at the same time, such as biodiversity increase (Crouzeilles et al., 2016), climate change adaptation and mitigation (Seddon et al., 2020). As a result, it is expected to play an important role in the transition towards a sustainable society. Restoring degraded land mitigates climate change through the increased sequestration of atmospheric carbon (Ontl & Schulte, 2012), however, estimates of this mitigation potential vary. More specifically, factors such as the type of restored vegetation (Rey Benayas et al., 2009), the land use pre-restoration (e.g., cropland, pasture, minefield) (Shimamoto et al., 2018), and restoration strategy (passive revegetation or human-mediated interventions) (Zanini et al., 2021) can all affect restoration outcomes and, in specific, the amount of carbon sequestered. To achieve maximum climate mitigation potential at sites, it is important to identify for each ecosystem which land uses best to restore and how to best restore them. However, studies generally focus on singular pre-restoration land uses or a restoration strategy, and thus, do not allow to compare different options. Furthermore, most studies are focused on restoring forest ecosystems and on human-mediated restoration strategies, so it is still unclear the effect of restoration on contexts and approaches that are understudied.

Aim & approach

In this internship, you will estimate the change in carbon stored in restored compared to degraded land in a singular ecosystem. Using R programming language, you will perform a meta-analysis, where primary studies are combined using statistical methods to obtain a more accurate estimate. If possible, you will identify which pre-restoration land uses and strategies deliver highest carbon sequestration (Fig.1). This type of information will provide important input to policy makers, especially to the United Nations in their decade on ecosystem restoration (2021 – 2030).

Depending on your own interest, you can choose one of the following ecosystems to focus on:

1. Peatlands
2. Wetlands
3. Mangroves
4. Seagrasses
5. Forest restored through passive revegetation

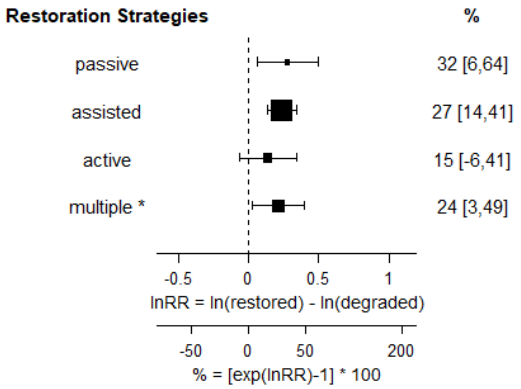

Figure 1: Influence of restoration strategies on Soil Organic Carbon (SOC) change in restored grasslands. The percentages of change are reported with relative 95% CI for the different strategies, listed in the column on the left. The points are the pooled summary effects for a singular strategy and their size represents the weight of the pooled summary effect, higher for larger points. We considered statistically significant the estimates whose CI do not overlap with zero.

References

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