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Project *brief*

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Provision of multiple ecosystem services in the tropical lowland forests of Ecuador

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- **Provisioning services, regulating services and tree diversity show synergetic relations indicating compatibility between mitigation and conservation potential, and thus challenging sustainable forest management systems.**
- **Unsustainable logging practices can be critical for ecosystem service multifunctionality reaching values only slightly higher than in successional forests.**
- **Above-ground carbon stocks can serve as "umbrella service" for the conservation of other ecosystem services.**

Background, aims and methods

In the tropics, deforestation and forest degradation result in different land use transition phases (one example is shown in Figure 1) that directly influence ecosystem services. This study assesses the ecosystem service multifunctionality of different land use transition phases, providing quantitative evidence on how human-induced alterations on ecological systems can impact ecosystem services.

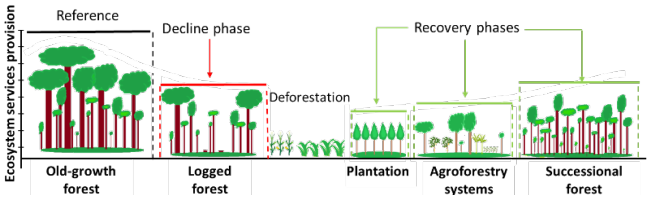

Figure 1: Land use transition phases and their effects on the decline and recovery of ecosystem services. Source: Eguiguren et al. 2020.

We installed 156 inventory plots (40x40m) across different land use transition phases in the Ecuadorian Amazon and Chocó (Figure 1). The decline phase was evaluated in logged forests; whereas for the recovery phases we considered successional forest, plantations, and agroforestry systems. Seven indicators for provisioning (TVP: timber volume potential, NTFP: non-timber forest products), regulating (AGC: above-ground carbon stocks, SOC: soil carbon stocks), and supporting services (N: nitrogen, P: phosphorus, K: potassium) were selected. Two indicators for biodiversity (D: plant diversity, E: plant endemism) were also calculated. Besides, we estimated the ecosystem service multifunctionality based on the multifunctional average approach.

Key findings

- Bundles of ecosystem services with positive relations were found for provisioning (TVP and NTFP), regulating services (AGC), biodiversity (D and E), and ecosystem service multifunctionality.
- AGC can be used as an "umbrella service" for the conservation of provisioning, regulating services, and biodiversity. However, for soil-related services, other indicators are needed.
- Unsustainable logging practices can cause a significant decline in the ecosystem service multifunctionality. TVP and AGC are highly affected, whereas, soil-related services show less decline.
- From the recovery phases, the successional forest achieves the highest levels of ecosystem service multifunctionality and is a suitable option to recover the ecosystem´s functionality. However, in practice, their timber potential is still limited.

Conclusions

In the tropics, landscape approaches are needed to balance the supply of multiple ecosystem services of different forest types and thus the fulfillment of societal demands. It is important to preserve the old-growth forests, but also during logging activities reduced impact logging measures should be applied, to avoid ecosystem services degradation. Restoration actions like successional forest, can be a good option to recover the ecosystem service multifunctionality. However, since more provisioning services are needed by the local population, it is also important to integrate options such as agroforestry systems and plantations.

Further Information

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