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# Degraded pasturelands for sustainable biorenewables production: an ecological approach

**Maíra Padgurschi**, Daniele de Souza Henzler, Gabriel Palma Petrielli, and Thayse A. D. Hernandes
Brazilian Center for Research in Energy and Materials, Campinas, Brazil

Worldwide changes in the land use and climate are the main drivers that have triggered a decline in both biological and cultural diversities, and the degradation of ecosystems. In countries like Brazil, deforestation is the main source of greenhouse gas emissions, and it is increased, in some cases, by the degradation. As response to those challenges, degraded areas have emerged as a promising option for cultivating biomass to produce biorenewables, aligning with the concept of a 'green transition'. Brazil stands out as a viable region for new cropland requirement to address the global demand for biorenewables production. Nevertheless, despite the large areas of degraded pastureland in Brazil, identifying those for growing the crops avoiding worsening the principal causes of biodiversity loss is an issue to be addressed. We evaluated the ecological feasibility of degraded pasturelands as potential areas for biomass production. We selected four exclusion criteria based on the Brazilian legal framework and the conventions and agreements to which the country is a signatory. In 2021, Brazil had 98.1 Mha of degraded pasturelands with the largest portion (63.9 Mha) experiencing a moderate level of degradation, mostly in Amazon biome (22.3 Mha). In addition, Brazilian legislation for biofuels production (Renovabio) predicts the exclusion of Amazon and Pantanal (a Brazilian wetland) biomes as eligible areas. Those biomes were the first exclusion criteria, remaining 65.1 Mha after its exclusion. In terms of protected areas, another adopted criterion, the land of traditional populations evaluated contains fewer degraded areas (0.3 Mha), when compared to the other Brazilian conservation categories (1.2 Mha). In the excluded degraded pasturelands (55.8 Mha, in total), the restoration of native vegetation should be prioritized to enhance biodiversity loss and the mitigation of climate change. Restoration efforts may vary by region, but agroforestry systems using native species of the biome could be a positive alternative. In addition to prioritizing the recovery of habitat and biodiversity loss, this approach has the potential to decrease local social vulnerabilities and to promote sustainable biorenewables production. By prioritizing the conservation of biological diversity, Brazil still has 42.3 Mha available for biorenewables, which corresponds to almost the total area currently under soybean cultivation in the country. The greater availability of degraded pastureland areas is within the Brazilian savanna. In addition to be a biodiversity hotspot, the Brazilian savanna is also central to water supply, contributing to important river basins in the country. Future work should consider other criteria such as water scarcity and climate vulnerability since it is necessary to evaluate the whole biorenewables' value chains to assure sustainability.