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POTSDAM INSTITUTE FOR CLIMATE IMPACT RESEARCH

# Agriculture is the Main Tropical Deforestation Driver, Responsible for Carbon Emissions and Ecosystem Service Losses

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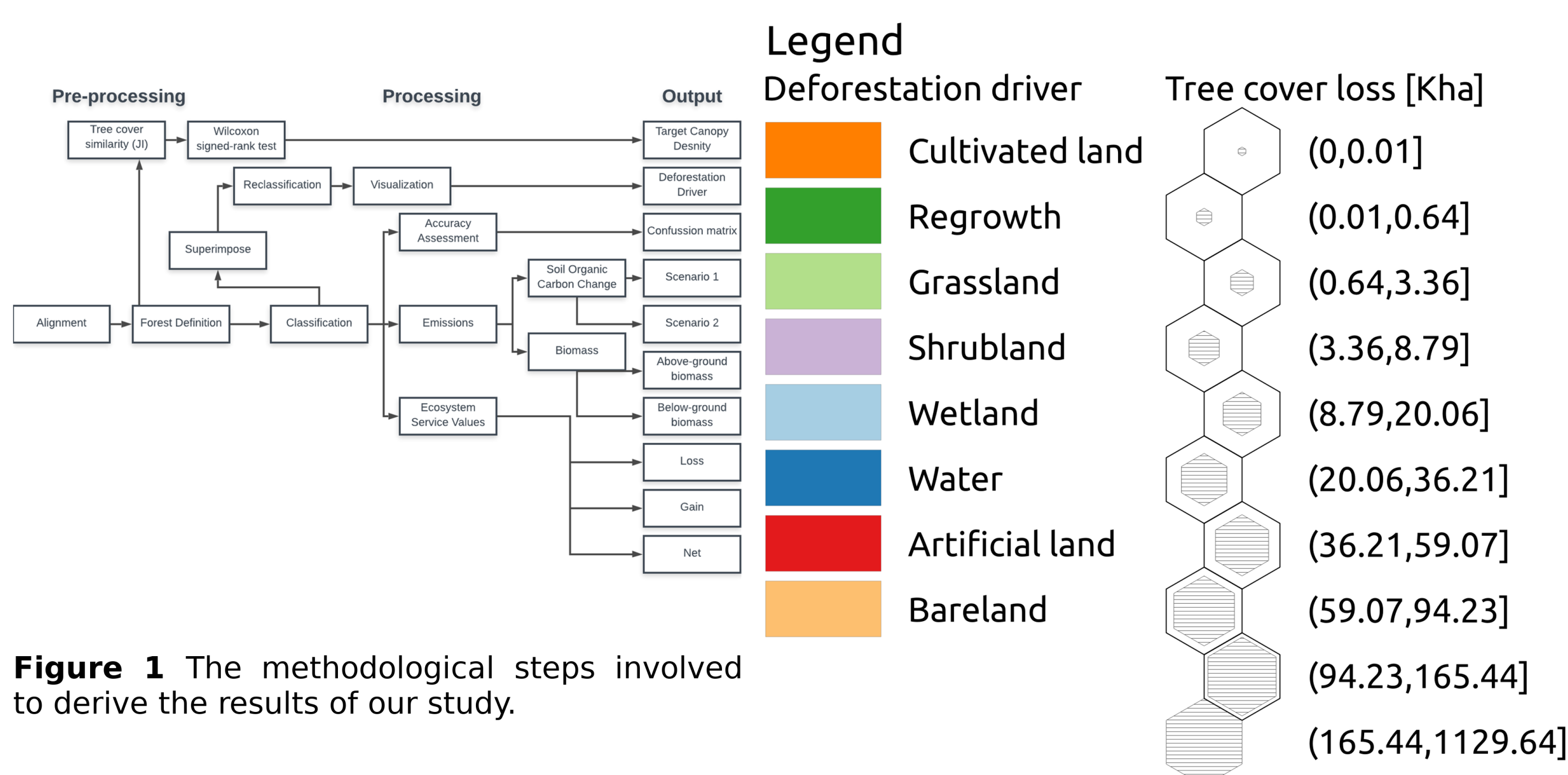
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## Introduction

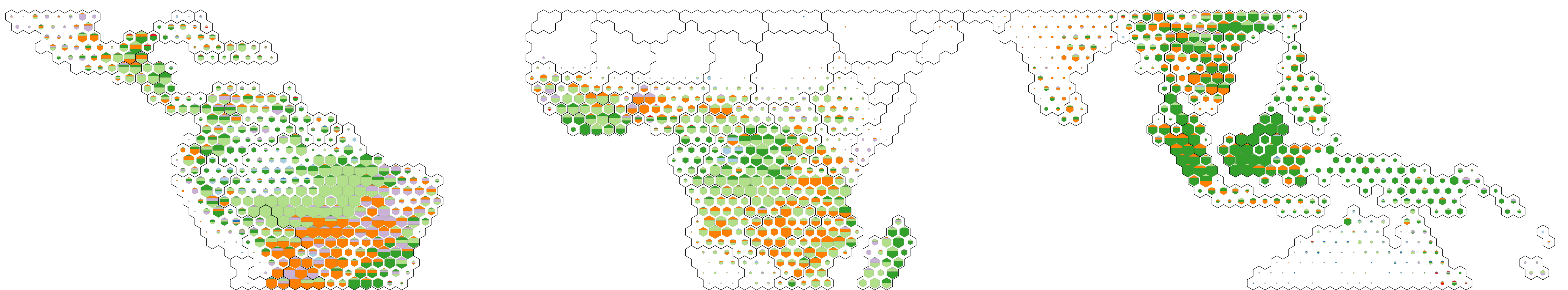
- Deforestation is the dominant land cover change in tropical regions, contributing substantially to climate change by greenhouse gas emissions.
- We analyze for 2001-2010 (1) main causes for deforestation, (2) related carbon loss resulting from the removal of biomass and change in soil organic carbon (SOC), and (3) ecosystem service value (ESV) change due to tropical deforestation.

## Results

- Approx. 77 million ha of the tropical forest has been lost between 2001 and 2010, while the expansion of agricultural land causes approx. 90% of the deforestation (**figure 2**).
- Grassland expansion accounts for 37.5% of the deforestation, followed by regrowth (29.9%) and cultivated land (22.8%).
- The primary source for biomass carbon loss is the expansion of grassland, accounting for approx. 40% (**figure 3**).
- Transitions of forests to cultivated land cause 30% to 40% of the SOC loss.
- Transitions of forest to grassland contribute the most to the ESV loss (about 155 billion dollars), while the largest net gain can be observed for transitions to cultivated land (approx. 3 billion dollars) (**figure 4**).



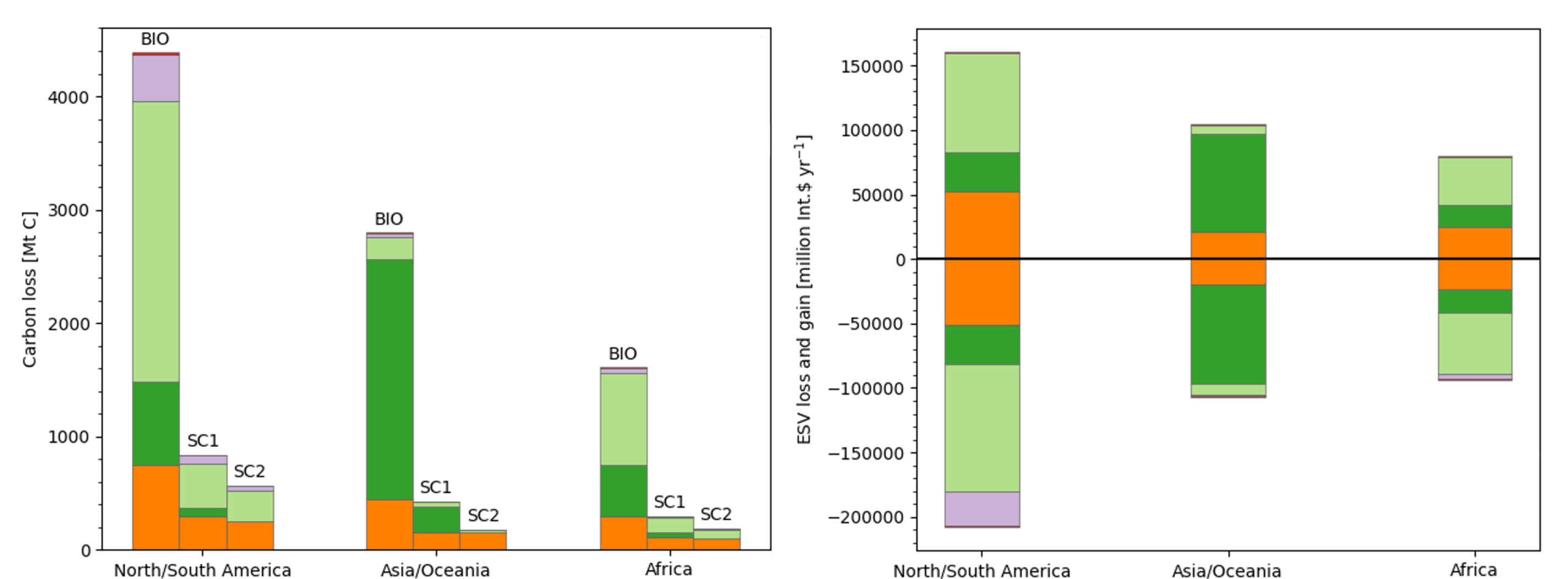
**Figure 1** The methodological steps involved to derive the results of our study.



**Figure 2** Area of deforestation and its drivers vary across the continents: North and South America, Africa, and Asia/Oceania. Each hexagon's interior shows the share of the most dominant deforestation driver sorted from bottom to top. Each grid cell covers an area of approximately 4.9 million ha at the equator. The hexagons' size corresponds to the forest loss by deforestation within the region.

## Methods

- By harmonizing and combining the global land cover products Global Forest Change and GlobeLand30, we evaluated deforestation drivers at a spatial resolution of 30m x 30m between 2001-2010 (**figure 1**).
- Using our results for the deforestation drivers and a biomass density map, we calculated the carbon loss through deforestation per disaggregated deforestation driver.
- The GSOCmap, map of Intact Forest Landscapes, and unified SOC change rates provided the data basis to calculate SOC change per deforestation driver for two different scenarios (SC1) changes occur only within primary forest and (SC2) changes occur within primary and secondary forest.
- We use the global ecosystem service unit values in 2007 Int.\$/yr to scrutinize the ESV loss and gain per driver.



**Figure 3** Carbon loss through removal of above- and below-ground biomass (BIO) and soil organic carbon change (under scenario SC1 and SC2) on the continental scale per disaggregated deforestation driver. In scenario SC1, all land cover changes occurred in the primary forest. We distinguished between land cover change in primary and secondary forest in scenario SC2.

**Figure 4** Ecosystem service value (ESV) loss and gain in Int.\$ yr<sup>-1</sup> per continent and deforestation driver. Bars with negative values show ESV loss, while bars with positive values represent the gain.

## Conclusion

- Distribution and magnitude of deforestation drivers vary across regions.
- Agriculture is the most relevant deforestation driver causing carbon loss and ecosystem service degradation.

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