Carbon, deforestation, and livelihoods in the Loma Mountains National Park

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- This policy brief presents the findings of a research project aimed at accurately assessing carbon stocks in Loma Mountain National Park, Sierra Leone, and understanding deforestation drivers and community attitudes toward conservation.
- Combining field data with traditional remote sensing methods can yield more accurate measures of carbon loss arising from deforestation. Using this methodology, carbon loss in the Loma Mountains National Park (LMNP) is likely to be higher than estimates relying solely on remote sensing suggest.
- Surveys in thirteen communities in the 4km fringe around the LMNP show how livelihood activities drive deforestation. Despite relying on the utilisation of forest resources for livelihoods, respondents recognised the importance of sustainable management.
- To both account for the economic needs of communities around the park and effectively reduce high levels of carbon loss in Sierra Leone, this brief recommends forest governance through the REDD+ framework.

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Overview of the research

The Loma Mountain National Park (LMNP) spans 28,731 hectares of North-Eastern Sierra Leone, comprising the western portion of the Upper Guinean Forest Block – one of the most biodiverse forests on the planet. Alongside this, the LMNP is thought to play a significant role as a store of carbon in Sierra Leone. However, as is the case for forests across sub-Saharan Africa, deforestation is a major concern. Though the LMNP is legally protected from deforestation under Sierra Leonean law, enforcement is weak – partly due to uncertainty around the boundaries of the forest.

Changes in forest biomass are estimated to quantify the carbon loss from deforestation. However, since the most recent National Forest Inventory in Sierra Leone occurred nearly fifty years ago, there is a lack of accurate data on forest biomass. Such data is commonly collected via remote sensing using satellite imagery, although multiple sources exist, and their estimates vary.

As such, to accurately assess carbon stocks in the LMNP and gauge how they have changed over time, field data for biomass were collected and combined with remote sensing of tree coverage. Forest biomass was estimated by manually calculating tree volumes – a function of tree height, diameter, and species – in fourteen plots of the LMNP.

These data suggest that carbon stocks in the LMNP are likely to be greater than existing remotely sensed estimates, and carbon loss to be more acute than previously thought. Carbon loss from the LMNP alone accounts for 0.5% of Sierra Leone's total atmospheric carbon emissions between 2011-2021 (Harris et al., 2021). Forest loss was concentrated around the unclearly delineated 4km "buffer zone" surrounding the LMNP.

To understand the drivers of these higher-than-expected levels of forest carbon loss, a study was carried out in 13 communities in this 4km buffer zone. Household surveys, administered to 12 households in each community, included questions about assets, income sources, non-timber forest product collection (NTFP), agricultural activities, and attitudes towards conservation. Village chief surveys gauged village demography and governance. An exercise was also conducted with community members to test their willingness to invest in forest conservation in a hypothetical REDD+ benefit-sharing project.

Findings from these surveys suggested that:

a) livelihood activities such as agriculture are common, with 96% of households engaged in farming
b) agricultural plot size and fishing activity were correlated with deforestation in the LMNP buffer zone

c) despite this, community members recognise the value of sustainable forest management and are eager to contribute to the park, given alternative livelihoods

d) willingness to contribute to forest conservation increased with oversight by traditional authorities and park rangers

TABLE 1: Research questions and key findings

Research question	Key findings
1. How can forest carbon loss be accurately determined via remote sensing?	Remote sensing is a widespread method used to estimate rates of deforestation. However, efforts to remotely estimate biomass, and therefore carbon stocks, vary significantly by dataset. Combining remotely sensed estimates of deforested area with field data – through the assessment of tree characteristics in randomly selected forest plots – provides a more accurate picture of forest biomass and carbon loss. In the case of the LMNP, this methodology found that forest carbon loss was greater than expected.
2. Where are the forest carbon loss hotspots in the LMNP?	Forest carbon loss was concentrated around the 4km buffer zone, an area of the park's fringe commonly not perceived locally as belonging to the park. Enforcement in this area is weak, and uncertainty around the boundaries of the park can encourage encroachment.
3. What livelihood strategies are employed in communities around the LMNP?	Surveys in 13 communities within this buffer zone found that agriculture was the primary livelihood activity, with 96% of respondents engaged. Non-tree forest product (NTFP) collection, such as fruit picking or fishing, was another significant livelihood strategy – engaging 76% and 71% of households, respectively.
4. How do livelihoods contribute to higher-than-anticipated forest carbon loss levels?	Farm size and intensity of fishing activity were positively associated with deforestation rates, suggesting these livelihood strategies may drive carbon loss in the LMNP.
5. What are the attitudes of community members around the LMNP?	The exercises conducted with community members suggested broad pro-conservation attitudes as well as a willingness to contribute to conservation, increased through oversight by traditional authorities and park rangers.

Policy relevance and recommendations

Combine locally collected field data with remote sensing to obtain accurate estimates of forest carbon loss

The uncertainty of the existing remotely sensed estimates makes it important to integrate local contextual information into models of forest biomass. This would enable an accurate picture of forest carbon and loss arising from deforestation to be obtained, allowing forest management policies to be better informed - especially with respect to UNFCCC obligations. It also allows for accurate indications of the conservation value of forested areas, improving the accuracy of carbon compensation through REDD+. This is important for projects in the LMNP, but also elsewhere in sub-Saharan Africa, where up-to-date field information may be lacking.

Focus conservation policy on carbon loss hotspots

Accurate information about forest carbon loss also enables conservation policies to be focused on carbon loss hotspots. The findings that carbon loss was most prevalent in the fringes of the LMNP, where the park's boundaries are unclear, suggest that governance and enforcement must be strengthened in these locations to reduce carbon loss. Identifying and targeting areas that are particularly affected by carbon loss would allow projects to be more effective and efficient.

Community engagement and benefit-sharing in REDD+ projects

Findings from surveying local community members show a high incidence of livelihood strategies that potentially incur forest loss, particularly agriculture. This means that deforestation management projects, such as a potential REDD+ project, must focus on compensating potential reductions in livelihood activities while supporting diversification towards the use of NFTPs.

In addition, the willingness of community members to conserve the LMNP – as well as evidence that the involvement of local stakeholders such as park staff and traditional authorities improves the efficacy of conservation projects – shows that forest governance efforts must take a participatory approach, working within local structures to achieve greater reductions in deforestation.

References

Harris, N. L., Gibbs, D. A., Baccini, A., Birdsey, R.A., De Bruin, S., Farina, M., Fatoyinbo, L., Hansen, M.C., Herold, M., & Houghton, R.A. (2021). Global maps of twenty-first century forest carbon fluxes. *Nature Climate Change*, *11*(3), 234–240. doi: 10.1038/s41558-020-00976-6