Policy Brief

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Côte d'Ivoire in danger – Forests on borrowed time, future in peril, who will stop the bleeding?

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1. Introduction

Côte d'Ivoire is on the brink of a silent ecological collapse. In the space of a century, the country has lost almost 90% of its forest cover, from 16 million hectares to 2.7 million (IFFN, 2021). This massive deforestation is not just a local issue, it's a global warning. It increases greenhouse gas emissions, weakens ecosystems and undermines our ability to withstand climate shocks. In the face of this urgency, continuing to rely on outdated and ineffective environmental monitoring tools is tantamount to managing a crisis blindfolded (IPCC, 2006; World Bank 2021).

For several decades, Côte d'Ivoire has relied on carbon and biodiversity monitoring methods that today contribute more to the crisis than to its resolution. These techniques, essentially based on one-off field inventories, are slow, costly and incapable of capturing the rapid, diffuse dynamics of modern deforestation (FAO, 2021; Word Bank, 2021). By remaining prisoners of these tools, decision-makers have often found themselves blind to the silent but profound transformations of the Ivorian forest landscape. These methods have made it possible to observe, but never to anticipate. They have limited reaction, prevented prevention, and delayed the transition to evidence-based policies. Worse still, their ineffectiveness has served as a justification for inaction, consolidating a form of institutional habit in the face of progressive ecosystem loss. By failing to evolve, these practices have indirectly fuelled the degradation of Ivorian forests, amplifying the vulnerability of rural communities and compromising the country's environmental sovereignty (Kouakou, 2025).

Refusing to abandon these obsolete approaches means continuing to navigate without map or compass in an increasingly violent climatic storm. In the face of rising stakes and the availability of modern tools, this refusal to change becomes a risky and costly political choice. It's time to break this cycle of inefficiency. Developed as part of a new initiative, this innovative approach designed by the author marks a strategic departure from conventional forest monitoring. It integrates satellite imagery, ground surveys and artificial intelligence into a unified, predictive system. Unlike traditional methods, which offer only static, fragmented views, this model provides continuous, forward-looking information on forest carbon dynamics, enabling a shift from reactive to proactive decision-making. In other words, we no longer simply estimate the present: we trace the history of carbon sequestration back to earlier years, document its current state with precision, and model its future evolution up to 2100.

Thanks to this approach, it becomes possible to map carbon losses and gains over time, identify critical or regenerating areas, and project evolution scenarios under different hypotheses (conservation, exploitation, status quo). It's an ecological management capability that most countries in the South lack, and one that gives Côte d'Ivoire a strategic edge in its environmental diplomacy and climate projects. This methodological innovation is a game-changer: it transforms forests into systems that can be observed, governed and valued, notably on carbon markets or in REDD+ programs. It also provides governments and their partners with the tools to base environmental policies on solid, scalable data that can be used on a large scale.

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2. Methodology

The method developed in this study represents a significant advance on traditional approaches, which are often limited to static, one-off observations that are difficult to use for planning purposes. It is based on a coherent combination of three components: analysis of satellite images (optical and radar), field data and prospective modelling using artificial intelligence algorithms. To demonstrate its robustness in a variety of contexts, the method was initially applied to two pilot sites with distinct ecological characteristics: the Lamto Science Reserve, located in the forest-savannah transition zone (also known as pre-forest), and the Lokoli Eco-Farm, located in the sub-Sudanese ecological zone (predominantly savannah environment). This application enables fine spatiotemporal analysis of carbon stocks. It enables a fine spatiotemporal analysis of carbon stocks from 1990 to 2100, by combining satellite data (optical and radar), field surveys and modelling based on artificial intelligence algorithms.

The study was based on an analysis of six time milestones: 1990, 2002, 2012, 2022, 2060 and 2100. This approach made it possible to retrace the evolution of carbon stocks in the past, to establish a current diagnosis in 2022, and to project their future evolution according to different management scenarios (conservation, exploitation, status quo). This approach traces their past evolution since 1990, establishes a precise diagnosis for the year 2022, and projects their future dynamics up to 2100 (via the milestones 1990, 2002, 2012, 2022, 2060 and 2100). It also includes the evaluation of different management scenarios (conservation, exploitation, status quo) to inform future choices.

It can be used to generate dynamic maps pinpointing areas of loss, gain or potential regeneration. Its strategic interest is twofold: on the one hand, it strengthens national capacities for long-term ecological monitoring; on the other, it provides a robust scientific basis for environmental planning, in support of public restoration and land-use planning policies and climate financing mechanisms such as REDD+. Conventional approaches to estimating carbon stocks, which are limited in time and space, are currently insufficient to meet the challenges of climate change and sustainable land management. They do not allow us to look back into the past, nor to project the long-term evolution of landscapes, leaving decision-makers without reliable tools for anticipation or planning. What's more, these methods are often costly, time-consuming and limited to small-scale analyses, which limits their usefulness for public policy at national or regional level. By providing an operational, reproducible and scalable tool, this method enables governments and their partners to base their decisions on accurate, up-to-date data that can be used directly at national level.

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3. Results

Conventional approaches to estimating carbon stocks, which are limited in time and space, are currently insufficient to meet the challenges of climate change and sustainable land management. They do not allow us to look back into the past, nor to project the long-term evolution of landscapes, leaving decision-makers without reliable tools for anticipation or planning. The integrated approach we have developed breaks with traditional static methods. It was tested for the first time in two contrasting ecological zones: the Lamto Scientific Reserve, located in the centre of Côte d'Ivoire in the forest-savannah transition zone (or pre-forest zone), and the Lokoli Eco-Farm, located in the north of the country, in the heart of the sub-Sudanese zone, characterised by savannah formations. This method enables a detailed spatiotemporal analysis of changes in carbon stocks between 1990 and 2100, by combining satellite data, modelling and prospective scenarios.

The results obtained are clear:

- **Between 1990 and the early 2000s**, carbon stocks fell sharply, as a result of intense deforestation. Gallery forests and dense semi-deciduous formations have regressed, reducing the sequestration capacity of ecosystems **(Figure 1).**
- **From 2012 onwards**, a dynamic of natural afforestation emerged. This is expressed by the gradual densification of the savannahs into trees, especially in the transitional formations (open forests, wooded savannahs), where forest cover is gradually regaining in scope.
- **In 2022**, the gallery forests/dense semi-deciduous forests of Lamto show stocks of more than **100 tC/ha**, compared to barely **5 tC/ha** for the shrub savannahs, i.e. **a ratio of more than 20**. This strong spatial heterogeneity constitutes a strategic lever for targeting restoration efforts (**Figure 1).**

Projections to 2100, based on contrasting scenarios, reveal two possible trajectories:

- **Optimistic scenario**: the strengthening of conservation policies would allow a continuous increase in carbon stocks, reaching up to **150 tC/ha** in some forest areas **(Figures 2 and 3).**
- **Pessimistic scenario**: in the absence of targeted interventions, woody formations could regress again, causing stocks to fall below **50 tC/ha (Figures 2 and 3)**.

These results show that the adoption of this innovative method is essential to guide public policies on climate, biodiversity and land management. Not only can we measure past and present impacts, but we can also anticipate future trajectories, which is essential if we are to take effective action. These results are not simply ecological indicators: they are decision-making tools. They enable us to anticipate, plan and optimise investments in reforestation, ecosystem protection and carbon recovery. In short, our approach doesn't just measure what has been lost or gained; it sheds light on what can still be saved.

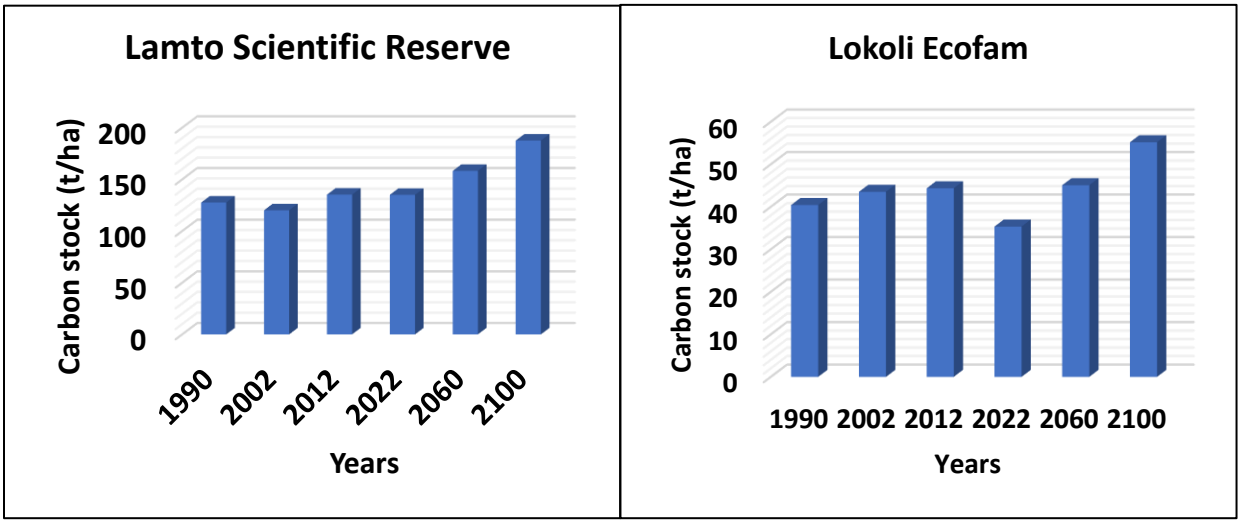

Figure 1: Variations in the carbon stock of the Lamto Scientific Reserve and the Lokoli Ecofarm from 1990 to 2100

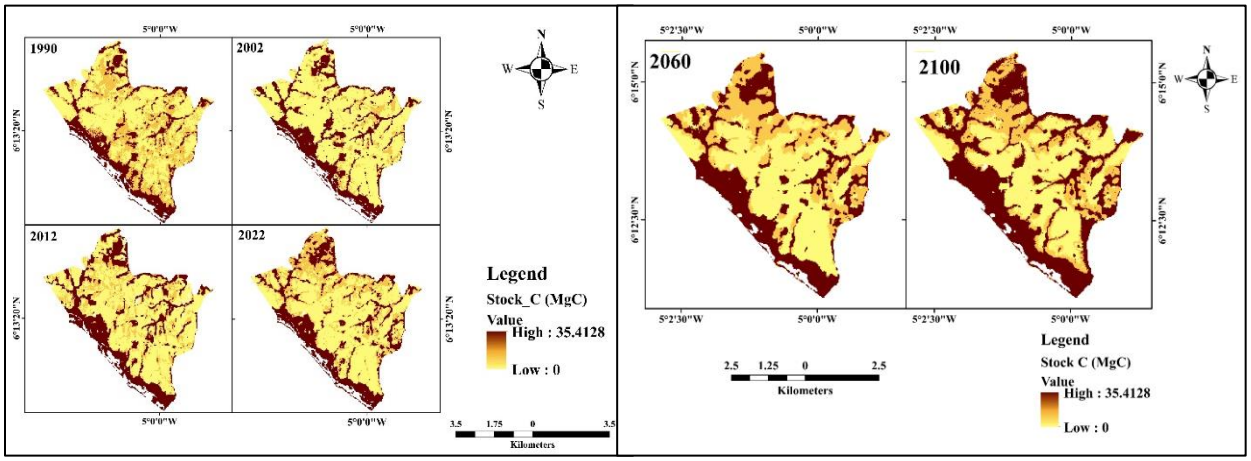

Figure 2: Spatiotemporal dynamic of carbon stock of the different land use/land cover at the Lamto Scientific Reserve

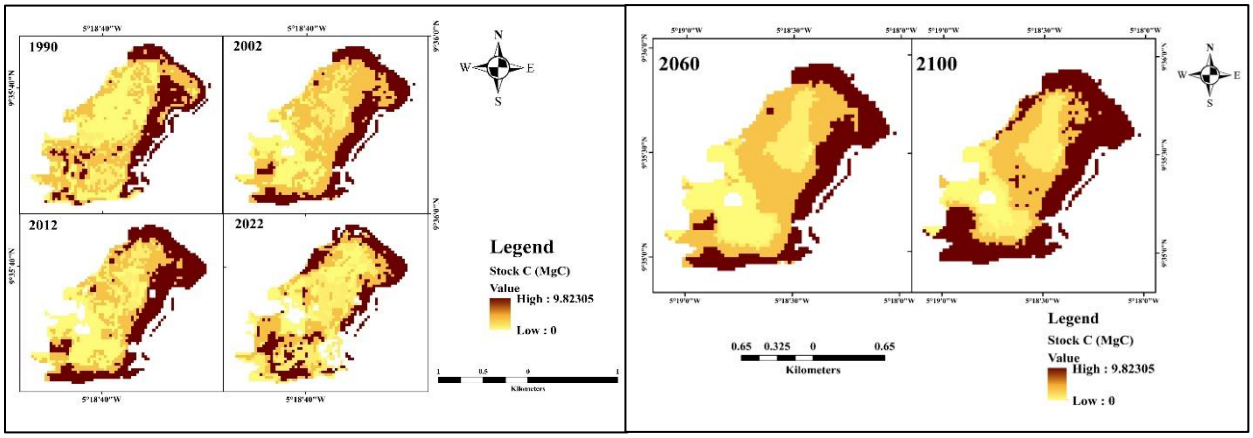

Figure 3: Spatiotemporal dynamic of carbon stock of the different land use/land cover at the Lokoli Ecofarm

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4. Policy implications for public policy

Adopting this approach provides decision-makers with a reliable tool for guiding environmental action on the basis of solid, up-to-date science. It is also a gateway to international climate financing, by demonstrating the national capacity to measure, monitor and project the impacts of restoration policies. It makes it possible to add value to conservation efforts in carbon offsetting mechanisms by making local actions measurable and verifiable. Finally, it is a lever for strengthening Côte d'Ivoire's position in international negotiations, based on credible data and long-term projections. It is no longer a question of reacting to ecological emergencies, but of strategic planning.

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5. Recommendations

1. Institutionalise integrated carbon monitoring: Create a dynamic national ecological monitoring platform, with dedicated resources, a clear mandate and multi-stakeholder governance.

2. Strengthen local capacities: Train technicians on a massive scale, equip universities and decentralise monitoring tools. Know-how must be shared and anchored locally.

3. Extend geographical coverage: Don't limit yourself to Lamto and Lokoli. Apply this method to other critical areas, in particular dense rainforests of high ecological value and all protected areas in Côte d'Ivoire.

4. Integrate science and decision-making: Use scientific results as a basis for planning. Each land-use plan must include a carbon and biodiversity component, based on up-to-date data.

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5. Conclusion

Failure to act means accepting the programmed disappearance of Côte d'Ivoire's forests. It means losing a major lever in the fight against climate change and the preservation of biodiversity. Conversely, adopting a national strategy based on technology and data means regaining control. It means anticipating rather than repairing. There's no time to lose. We need to modernise forest monitoring now, or risk seeing one of West Africa's greatest natural heritages disappear forever.

Contact & collaboration: This document aims to promote synergies between researchers, decision-makers, technical and financial partners. For any further information or partnership, please contact the coordination team.

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6. References

World Bank,. 2021. Assessment of Innovative Technologies and Their Readiness for Remote Sensing-Based Estimation of Forest Carbon Stocks and Dynamics. © World Bank. 40p.

IPCC. (2007). Climate Change Review 2007: Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [103 p.]. Geneva, Switzerland: IPCC.

IFFN, 2021. Inventaire Forestier et Faunique de Côte d'Ivoire.

Kouakou A.A.M., 2025. Modelling above-ground carbon stock in Lamto Scientific Reserve and Lokoli Ecofram, Ivory Coast. Thesis. WASCAL Graduate School in Climate Change and Land Use. College of Engineering. Department of Civil Engineering. Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. 350p