HARNESSING EARTH OBSERVATION TO COMBAT DEFORESTATION: WFP'S INSIGHTS FROM SIERRA LEONE

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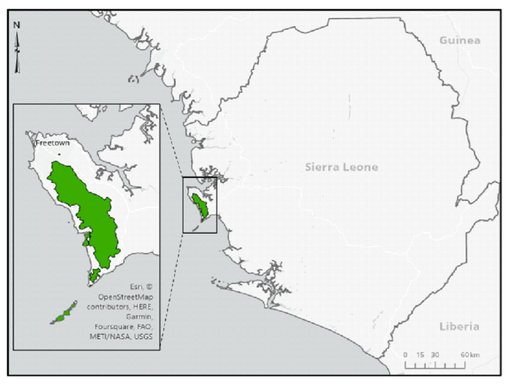
UN WORLD FOOD PROGRAMME

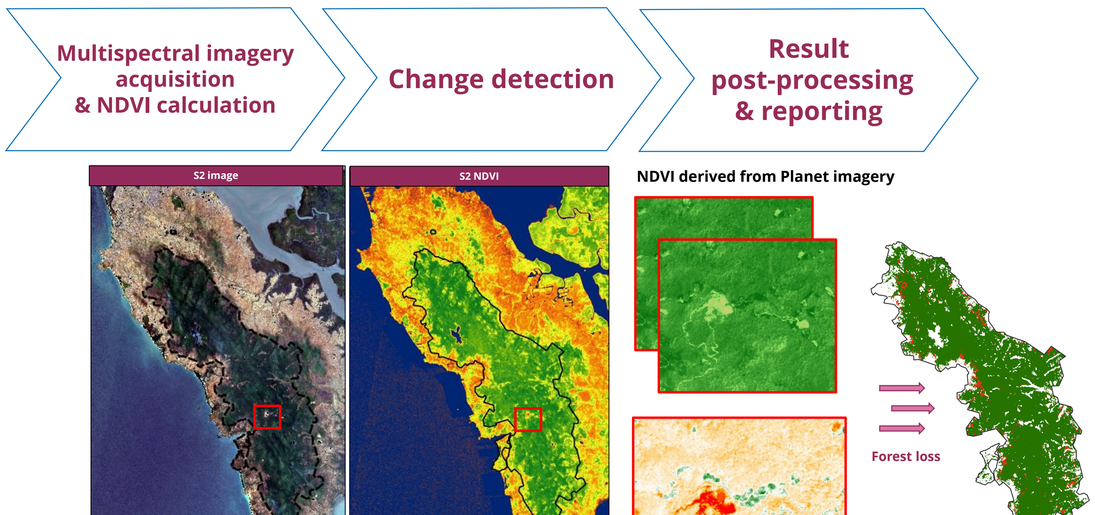
1. INTRODUCTION

Deforestation poses a significant threat to food security, resilience, and disaster risk reduction efforts. By disrupting vital ecosystem services like clean water provision, fertile soil maintenance, and climate regulation, it heightens the susceptibility of ecosystems to natural hazards such as floods, landslides, and droughts, thereby jeopardizing the well-being of affected populations. Sierra Leone's **Western Area Peninsula National Park (WAPNP)** is a good example of these challenges, despite its legal protection since 2012. The uptake of digital technology in conservation efforts exacerbates inefficiencies and compromises the effectiveness of protected area management. Moreover, the loss of forest area threatens the habitat of western chimpanzees, among its several endangered species, and is critical for biodiversity and the ecosystem's ability to withstand environmental stressors. **Illegal land appropriation, quarrying, marijuana cultivation, and charcoal production are the primary drivers of environmental degradation**, escalating disaster risks and culminating in catastrophes, as witnessed in the devastating 2017 landslide. Recognizing the urgency of the situation, WFP with various organizations, have mobilized efforts to address deforestation in the WAPNP. **The Asset Impact Monitoring from Space (AIMS) service**, housed at WFP´s headquarters and specialized in the use of geospatial technology, is collaborating with the **Sierra Leone WFP's Country Office**, and other environmental protection entities, to **monitor deforestation within the protected area**.



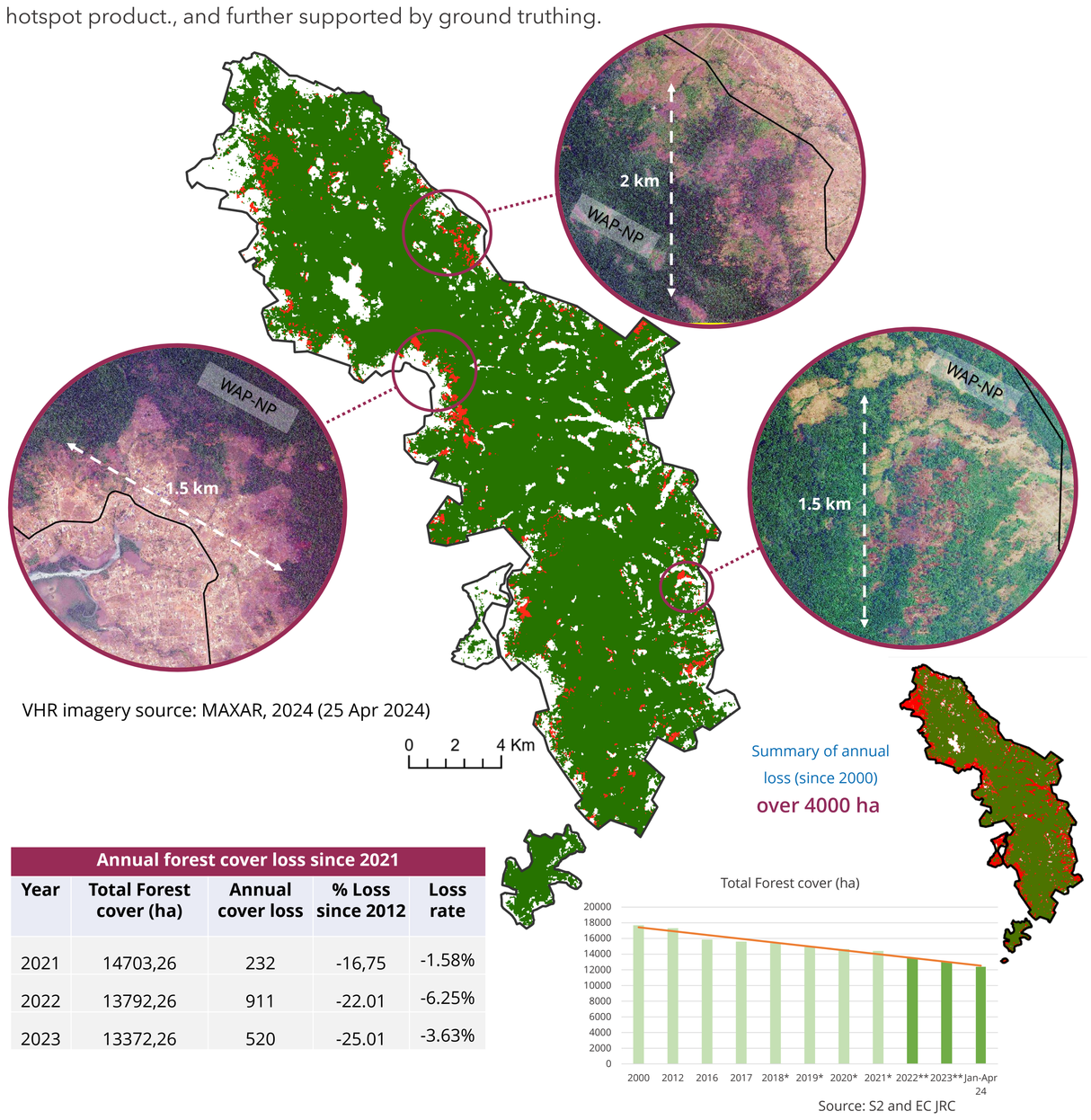
2. OBJECTIVE & METHODS

This study relies on remote sensing to **comprehensively assess the loss in forest cover within the WAPNP, aiming to identify key drivers and patterns for informed ecosystem management**. The workflow relies primarily on **Sentinel-2 imagery** for vegetation condition estimates, supplemented by Very High-Resolution (VHR) imagery (PlanetScope & Maxar) for validation. Particularly, a **change detection** method was applied using the **Normalized Difference Vegetation Index (NDVI).** Google Earth Engine was the primary tool used to process the imagery, products of which were then exported to ArcGIS Pro, where the outputs underwent post-processing for the generation of the results. Ancillary products like the JRC Tropical Moist Forest (Vanctusem, et al. 2021) cover dataset and the VIIRS fire hotspot product (NASA FIRMS) were used to further support the analysis. Additionally, field sampling was conveyed with GPS and drones to validate alterations and drivers, providing a comprehensive understanding of deforestation dynamics and ecosystem health impacts in the WAPNP. The methodology was applied to assess forest cover loss between December 2023 and April 2024 and was later applied for deriving an annual estimation of loss since 2021.



3. RESULTS

A forest cover loss layer for the period between December 2023 and April 2024 was extracted for the WAP-NP area using the JRC TMF 2021 forest cover dataset as a baseline to exclude non-forest cover from the estimates. Approximately **550 hectares of forest cover were lost or significantly degraded** within the national park during this period. Most of these areas were affected by human-induced forest fires, followed by land grabbing for settlement and agricultural land expansion, as well as mining activity. Hotspots were initially validated using PlanetScope and Maxar VHR imagery, along with NASA's FIRMS fire hotspot product., and further supported by ground truthing.



Annual forest cover loss since 2021				
Year	**Total Forest cover (ha)**	**Annual cover loss**	**% Loss since 2012**	**Loss rate**
2021	14703,26	232	-16,75	-1.58%
2022	13792,26	911	-22.01	-6.25%
2023	13372,26	520	-25.01	-3.63%

Source: S2 and EC JRC

Field Validation April 22nd- May 2nd 2024

Drone images (2 May 2024)

4. CONCLUSION & DISCUSSION

Remote sensing, combined with on-site ground data, has revealed that approx. 550 hectares of forest in the Western Area National Park have been lost since December 2023 alone. Since 2021, the total deforested area extends to over 1500 ha. The park's terrain and steep slopes may lead to an underestimation of the actual forest cover loss. The study's findings are compelling and underscore the urgent need to strengthen conservation strategies, develop robust environmental policies, and enhance community engagement. Continued deforestation will lead to irreversible damage to the park's integrity and ecosystem services it provides.

Future research efforts should be directed towards improved accounting for seasonality-influenced changes, establishing forest cover baseline at the local scale, and quantifying the forest loss attributable to each identified pressure–such as illegal crops, mining, urban expansion, logging/charcoal production, and land grabbing. Additionally, future assessments will benefit from integrating additional satellite data sources such as Sentinel-1 (radar) and Landsat (optical) to mitigate temporal and cloud cover limitations.

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