Mapping Mining Expansion in the Aprampama Forest Reserve with Low-Shot Learning and Satellite Embeddings

Richmond Akwasi Nsiah, Prosper Basommi Laari (Ghana) and Qingfeng Guan (China, PR)

Key words: Remote sensing; Keywmining; forest reserve; land cover; classification; embedding

SUMMARY

The rapid expansion of artisanal and small-scale mining (ASM) within ecologically sensitive forest reserves in Ghana has contributed significantly to land use and land cover (LULC) changes. Monitoring these dynamics remains challenging due to cloud interference, spectral confusion, and the absence of high-quality labelled data. This study applies a machine learning classification approach using the AlphaEarth Foundations (AEF) satellite embedding dataset to map and assess mining activity in the Apamprama Forest Reserve from 2017 to 2024. Sentinel-2 median composites were used to generate ground control points (GCPs), while AEF embeddings enabled low-shot classification into mining, vegetation, and water classes. A Random Forest classifier was trained annually and evaluated using both internal validation and post-classification assessments with independent ground truth data from Google Earth Pro. Results show a progressive expansion of mining from 0.1 km² in 2017 to over 12 km² in 2024, accompanied by a significant decline in vegetation. Classification accuracy exceeded 90% across most years, although some misclassifications occurred due to sedimentation and regrowth in abandoned pits. The findings provide spatial insights into the spiralling of mining activities within a protected ecosystem and underscore the effectiveness of pre-trained geospatial embeddings for environmental monitoring. This research can support timely detection and informed policy intervention in tropical regions.

Mapping Mining Expansion in the Aprampama Forest Reserve with Low-Shot Learning and Satellite Embeddings (13647)
Richmond Akwasi Nsiah, Prosper Basommi Laari (Ghana) and Qingfeng Guan (China, PR)

FIG Congress 2026
The Future We Want - The SDGs and Beyond
Cape Town, South Africa, 24–29 May 2026