An Early Warning Earth Observation System to Detect and Map Forest Disturbances

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SUMMARY

Traditional approaches to detecting illegal forest activities, such as foot patrols, are time-consuming, expensive, dangerous, and often ineffective. Monitoring forest reserves and their immediate surroundings with earth observation data, such as satellite and drone imagery, helps differentiate between natural and anthropogenic drivers of forest degradation and deforestation. Increased availability of open-source geospatial data, such as optical and Synthetic Aperture Radar (SAR) satellite imagery and affordable UAV technologies, have fostered the development of near-real-time forest and land monitoring applications.

Through a demonstration project sponsored by the European Space Agency, a customised remote sensing service – GalamWatch - was developed and piloted in Ghana. Deploying Machine Learning methods and time series analysis, the service was designed to monitor and map artisanal and small-scale mining (ASM) activities and abnormal land cover changes associated with deforestation. Comparing high spatial resolution satellite data such as Cosmo-SkyMed (SAR, 3 m spatial resolution) to relatively low spatial resolution satellite data such as Sentinel-1 (SAR, 20 m spatial resolution), Sentinel-2 (optical, 10 m spatial resolution), and Landsat-8 (optical, 30 m spatial resolution), it was observed that open-source satellite data with spatial resolution ranging from 10 – 30 m and temporal resolution spanning 10 – 16 days were adequate for monitoring purposes. In contrast, high-resolution satellite and UAV data with a spatial resolution of 5 m or better are suitable for mapping purposes. Cloud computing technologies enabled a continuous analysis of large volumes of data.

Full implementation of the customised remote sensing service will play a valuable role in identifying which forest reserves are under pressure and require prioritisation and subsequent resource allocation for law enforcement and conservation.