Mapping Change - Integrating Remote Sensing into Botswana's Mining Cadastre for Sustainable Land Management and Climate Action

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SUMMARY

Abstract:

The mining sector plays a pivotal role in Botswana's economic development while presenting growing challenges in the context of climate change and sustainable land management. In recent years, the impacts of unregulated or poorly monitored mining activities, such as land degradation, vegetation loss and altered drainage systems have highlighted the need for more efficient, data-driven monitoring tools. This paper explores how remote sensing and GIS technologies can be integrated into Botswana's Mining Cadastre System to enhance environmental oversight, promote rehabilitation and support national climate action goals.

This study utilizes high-resolution satellite imagery and UAV-based photogrammetry to assess changes in land cover and surface morphology within active and post-mining zones. Spatial analysis techniques such as NDVI classification, change detection and terrain modelling were applied to quantify environmental changes and identify areas requiring restoration. These geospatial outputs were then linked to cadastral datasets to assess the correspondence between mining lease boundaries, actual site footprints and environmental compliance levels.

Results demonstrate that integrating remote sensing into the mining cadastre can significantly improve monitoring accuracy and timeliness, enabling authorities to detect unauthorized expansions, assess reclamation progress, and enforce sustainability regulations more effectively. Additionally, the study underscores the importance of adopting a Fit-for-Purpose Land Administration (FFPLA) approach to accommodate dynamic environmental data within land records, ensuring that cadastral systems support both economic development and ecological

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preservation.

The findings contribute to the ongoing dialogue within the FIG community on how geospatial science supports climate adaptation, mitigation, and resilience planning. Specifically, the research aligns with SDG 13 (Climate Action), SDG 15 (Life on Land), and SDG 9 (Industry, Innovation and Infrastructure) by demonstrating how innovation in geomatics can promote sustainable resource management in developing economies.

In conclusion, the paper advocates for the institutionalization of geospatial monitoring frameworks within Botswana's mining cadastre to strengthen transparency, accountability, and climate-responsive governance. The proposed integration model offers a scalable framework for other resource-dependent countries seeking to modernize their land administration systems while advancing climate resilience and sustainable land use.

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