Detecting Land Attractiveness for Informal Settlement Growth: Integrating Remote Sensing and Gap Detection for Spatial Equity

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SUMMARY

South Africa's informal settlements continue to expand, often in areas that place residents at heightened socio-economic and environmental risk. These growth patterns reveal persistent inequities in land access and spatial governance, underscoring the need for anticipatory spatial information systems to support more equitable development. This paper presents an integrated geospatial framework for identifying and monitoring land types that attract informal settlement growth, leveraging remote sensing technologies within strengthened spatial data infrastructures.

The research brings together several spatial data sources to understand settlement changes and patterns. It combines Sentinel-based change detection with high-resolution drone mapping to capture both broad and local changes. These are integrated with cadastral, service delivery, and zoning datasets, along with national datasets such as the CSIR's Settlement Footprint MesoZone layer and the GreenBook's accessibility and vulnerability indicators.

Results indicate that informal settlement expansion frequently follows rational patterns of opportunity: proximity to mobility networks, employment nodes, community infrastructure, and topographically accessible land. At the same time, systemic spatial injustices remain visible, as low-income households continue to settle near ecological hazards and under-serviced areas. This duality highlights both the potential of spatial intelligence and the persistence of structural exclusion.

These datasets enable alignment with risk-sensitive planning policy and standardized land governance practices. Through advanced spatial gap detection, the study reveals divergences between policy intent and settlement behaviour, offering clear signals of where regulatory systems underperform or overlook vulnerable communities. The analytics culminate in a settlement

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attractiveness index that classifies high-pressure land typologies, providing dashboard-ready decision layers for proactive planning interventions.

The study concludes that integrating Earth observation with modernized geospatial data governance advances real-time, accountable, and equity-focused planning. The proposed framework supports the Sustainable Development Goals through more transparent and coordinated land management, while elevating geospatial technologies as instruments for fairer, data-driven settlement futures. This study recommends that FIG further support efforts to prioritize spatial information management and refine the policy and standards guiding national spatial data infrastructures.

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