Advancing Land Cover Accuracy Assessment in South Africa: A Statistical Approach to Sample Size Determination

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SUMMARY

Land cover data is essential for achieving the United Nations Sustainable Development Goals (SDGs), providing critical spatial information for monitoring, planning, and evidence-based decision-making across multiple sectors. It supports initiatives related to food security (SDG 2), water resource management (SDG 6), sustainable urban development (SDG 11), climate action (SDG 13), biodiversity conservation (SDG 15), infrastructure planning (SDG 9), and poverty reduction (SDGs 1 and 10). Despite its central role, South Africa currently lacks a statistically grounded framework for determining the optimal number of sample points required for the accuracy assessment of its national land cover products.

This study seeks to establish a scientifically robust approach for determining optimal sample sizes in land cover accuracy validation for the country. Accurate sample size estimation is vital for ensuring statistical reliability, cost-effectiveness, and practical feasibility. An appropriately determined sample size reduces sampling bias, enhances spatial representativeness, and strengthens the credibility and comparability of validation results. Thus, improving the overall trustworthiness of land cover products.

The research critically evaluates existing sampling techniques and their corresponding design methodologies. It investigates suitable sampling approaches and applies statistical formulas to estimate optimal sample sizes. Both simple random and stratified sampling methods are analysed using probability-based strategies to minimise standard errors and unbiased variance estimators.

The anticipated outcomes include establishment of minimum sample size requirements for land cover validation in South Africa. By comparing accuracy estimates derived from literature-based sample sizes with those calculated using statistical formulas across both simple random and

stratified sampling approaches, the study aims to identify the most effective and efficient validation strategies. Ultimately, the findings are expected to contribute to a more rigorous, standardised framework for validating national land cover datasets, thereby enhancing the reliability of spatial information used in sustainable development planning.

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