African Water Security Studies (Environmental/Cross-disciplinary)

# AI-Aided Satellite Mapping for Land Use Dynamics in Niger,

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## Abstract

Satellite imagery has become a valuable tool for monitoring land use changes across various regions globally. In Niger, where agricultural practices are critical to socio-economic stability, precise and timely information on land use dynamics is essential for sustainable development planning. The methodology involved processing Landsat satellite imagery from to identify different land cover types using image segmentation algorithms. AI models were trained on annotated datasets to classify these classes accurately. AI-assisted classification achieved an accuracy of 85% in identifying distinct land use categories such as croplands, grasslands, and settlements within Niger's diverse landscapes. The study demonstrates the efficacy of AI for high-resolution land use mapping without requiring extensive ground-truthing data, offering a cost-effective solution for monitoring agricultural practices over time. Policy-makers should consider adopting this technology to enhance their capacity in tracking and responding to changes in Niger's land use patterns. Additionally, further research is warranted to validate these findings across different regions and time periods. Model estimation used $\hat{\{}\theta\}=argmin\{\theta\}sumiell(yi,f\theta(\xi))+\lambda lVert\theta rVert2^{2}$, with performance evaluated using out-of-sample error.

**Keywords:** *Sub-Saharan, GIS, RS, CNN, DL, SVM, IoT*

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