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TREE COVER PATTERNS AND CHANGES IN THE WEST SUDANIAN SAVANNA AND OBSERVED SOCIO-ECONOMIC IMPACTS

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ABSTRACT:

Savannas cover approximately one fifth of the global land surface. In this biome, the proportion of trees and their spatial distribution are of major relevance for ecosystem functioning and for the provision of ecosystem services. For example, trees are a source of food, timber, and firewood in savannas, they provide fodder for animals, and impact soil stability, infiltration, and biodiversity. Furthermore, they act as long-term carbon storage and thus have a regulating impact on climate. While earth observation based mapping of the forest biome is well established, mapping the tree component in savannas is still a challenge.
In this study, tree cover and tree cover changes during the last 15 years are mapped at a spatial resolution of 30 m for a study region of approximately 240.000 km^2 in the West African Sudanian Savanna. The mapping procedure is based on multi-temporal Landsat TM, ETM+ and OLI imagery, and reference data derived from very high resolution earth observation data (IKONOS, QuickBird, and WorldView). Landsat data are preprocessed to consistent multi-temporal, cloud-free mosaics based on atmospheric correction and image normalization. In order to account for the typical gradual transitions between areas of open and closed tree cover in savannas, information on trees is derived as sub-pixel proportions at the 30 m Landsat resolution by using random forest regression trees.
The presented results reflect different types of tree cover change pathways in the West Sudanian Savanna during the past one and a half decades. Relationships between the observed patterns of tree cover change and different potential socio-economic drivers such as population density and growth, developments of infrastructure and settlements, as well as land use and management practices are investigated and discussed. The analyses show a major human impact on tree vegetation in the West Sudanian Savanna, a region where high population growth rates are likely to accelerate changes in future years.

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