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Land cover changes and natural vegetation dynamics under remote and hostile conditions of northern Niger (1955-2023)

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Abstract

Past and current knowledge about natural vegetation and land cover dynamics in the mountains of the Saharan Desert is largely limited, although these regions provide habitat for diverse taxa and livelihood options for humans and are considered stepping stones between northern and central African ecosystems. This study will focus on the Air Mountains of northern Niger as largely pristine socio-ecological systems. The region is inhabited by Touareg people, nowadays practicing irrigated oasis agriculture combined with sheep and goat pastoralism on sparse pasture land. Population pressure, accompanied by increasing livestock stocking rates and recurring drought conditions, affect vegetation patterns and biomass production in the region. Moreover, telecoupled urban demand of sprawling West African cities has led to an expansion of irrigated agriculture for cash-crop production. This has resulted in extensive land clearing and falling groundwater tables, potentially causing negative effects on pastures, wild plants, local varieties, and overall biodiversity.

Through GIS-based mapping of agriculture and natural vegetation based on aerial photographs, Sentinel and Landsat images as well as drone-based surveys, this study aims at quantifying land cover changes from 1955 to 2023 in Timia, Mont Bagzam and their surroundings. Normalized Difference Vegetation Index (NDVI) analyses were carried out and matched with manual and supervised land use and land cover (LULC) classifications of shrubs/trees, agricultural land, natural grassland and barren land. Seasonal herding activities were recorded with GPS logger for 2021 to 2023 to identify possible influences on land cover changes. Records over the past 10 years of sheep and goat sales to the biggest nearby marketplace of Agadez were analysed for changes in production amounts.

Unmonitored changes in vegetation and land cover, combined with unpredictable weather events such as droughts and heavy rains, pose threats not only to livestock keeping and local genetic resources, but also to the provision of ecosystem services and the livelihoods of the local population in the long-run.

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