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Biogeophysical and biogeochemical feedbacks of West African land use change: A systematic review

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Abstract

Land use change plays a major role in shaping climate dynamics, particularly in West Africa, where environmental and socioeconomic changes are occurring rapidly. Although research on this topic has expanded in recent years, there remains a lack of targeted synthesis on land use–climate interactions that can directly inform Sustainable Land Management (SLM) strategies and decision-making. This study presents a systematic review of 74 peer-reviewed articles published in English and French between 2010 and 2025, following the ROSES (RepOrting standards for Systematic Evidence Syntheses) protocol. Only studies explicitly addressing land use–climate interactions are considered. The review examines commonly used approaches for analysing these interactions, synthesizes existing evidence, and identifies key research gaps. Implications for SLM are inferred from the collective findings to support policy and practice. The literature is largely dominated by biogeophysical processes and climate extremes, while biogeochemical aspects remain less explored (18 % of studies). The findings indicate a clear shift toward landscapes increasingly shaped by human activity. On average, built-up areas have expanded by about 155 %, while cropland has increased by around 40 %, especially at the expense of natural vegetation. Overall, land cover dynamics influence surface temperatures, with a mean coefficient of determination (R^2) of approximately 0.5, as well as precipitation patterns, with values reaching up to 0.8, particularly when linked to vegetation changes. Extreme events, such as floods, are often more associated with poor land management than with change in climate alone. Business-as-usual scenarios project a significant decline in the region’s carbon storage capacity. However, restoring natural vegetation under SLM presents important trade-offs, balancing climate regulation benefits against land competition and the effect of large-scale atmospheric processes. The review highlights several key gaps for future research. In addition to the limited attention given to future projections (26 % of studies), there is a scarcity of long-term ground-based data, persistent scale mismatches, and insufficient integration of socioeconomic factors. Most studies adopt one-way approaches, with fewer than 14 % explicitly addressing two-way feedback mechanisms between land use and climate.

Keywords: Climate, interactions, sustainable land management, West Africa

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