

A Review: Potential of Earth Observation (EO) for Mapping Small-Scale Agriculture and Cropping Systems in West Africa

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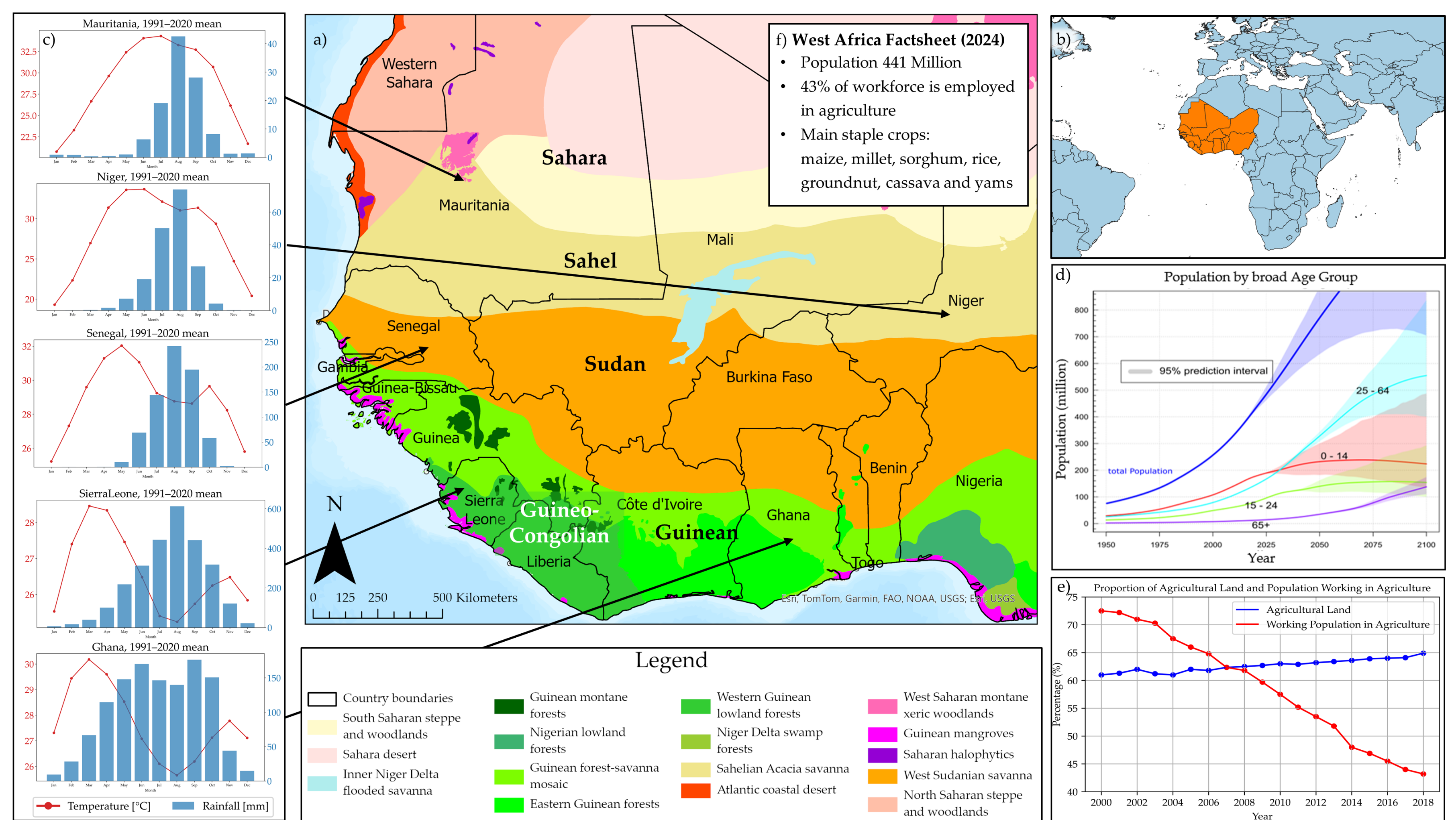
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BACKGROUND

Overview of the study area. (a) Displays the terrestrial ecosystems by Olson et al. and the bioclimatic zones, (b) is the localization map of the study area based on USGS, (c) climate graphs of Mauritania, Niger, Senegal, Sierra Leone, and Ghana averaged from 1991 to 2020 and over the area of each country, based on WorldBank Climate Change Knowledge Portal, (d) total population and population by age group based on UN World Population Prospects, (e) shares of agricultural land and population working in agriculture based on FAO STAT, and (f) fact sheet on West Africa based on UN World Population Prospects and FAO STAT.

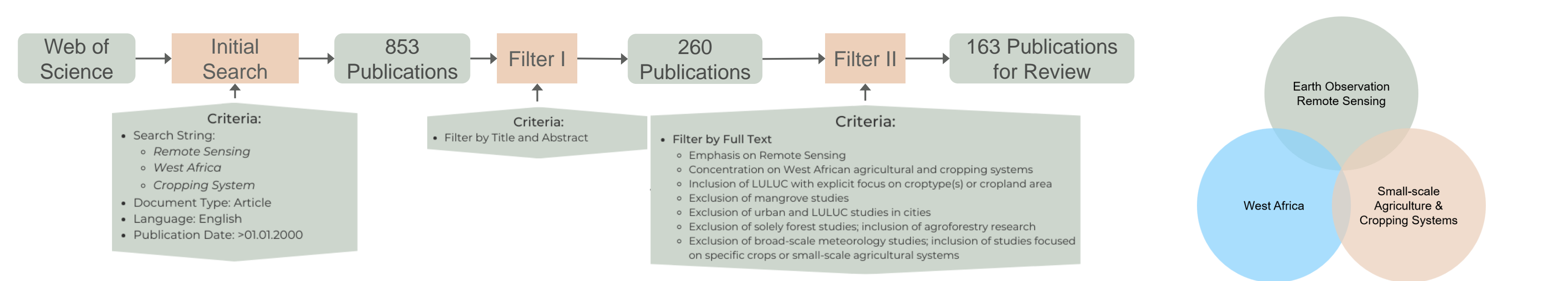
West Africa faces a complex range of challenges arising from climatic, social, economic, and ecological factors, which pose significant risks. The rapidly growing population, coupled with persistently low agricultural yield, further exacerbates these risks.

A state-of-the-art monitoring and data derivation of agricultural systems are crucial for improving livelihoods and enhancing food security. Despite smallholder farming systems accounting for 80% of cultivated cropland area and providing about 42% of the total employment in West Africa, there exists a lack of a comprehensive overview of Remote Sensing (RS) products and studies specifically tailored to smallholder farming systems.



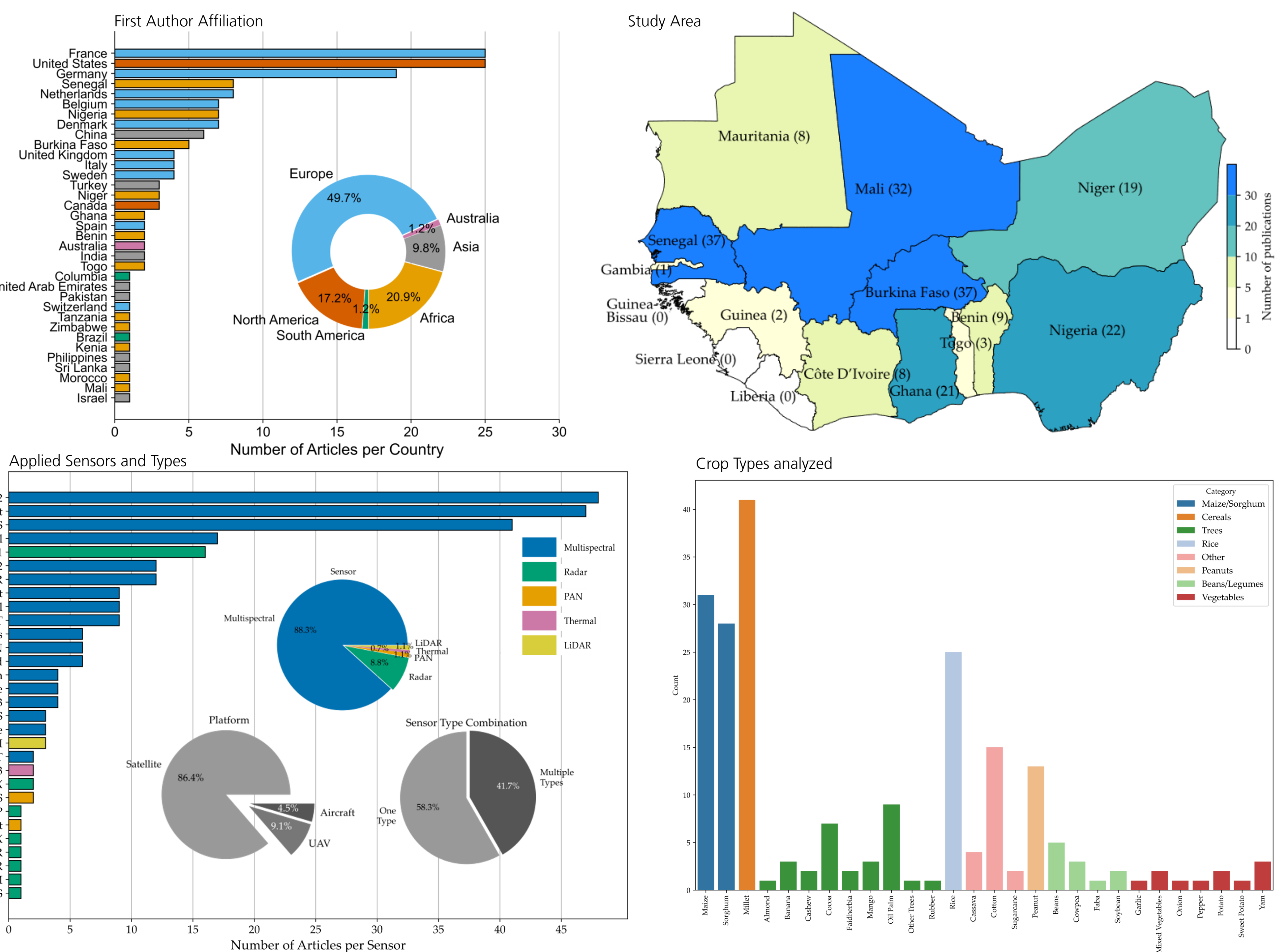
METHOD

A structured literature search comprising 163 SCI papers on the potential of EO for mapping small-scale agriculture and cropping systems in West Africa has been conducted using the Web of Science (WoS) platform (last accessed 1 May 2024). Filtering by title and abstract (Filter I), followed by a full-text review (Filter II), we analyze the RS sensors, spatiotemporal distribution, temporal scales, the crop types examined, and thematic foci employed in existing research.



KEY RESULTS

Our findings underscore the predominance of high to very high-resolution multispectral sensors as the primary data source. The growing variety of sensors and datasets, combined with increasing computing capacities, has substantially shaped the field in recent years. By consolidating existing knowledge, this study highlights the potential of remote sensing (RS) and identifies key research gaps. Europe leads in both first author affiliations (49.7%) and funding origins (54%). RS holds strong potential to support sustainable smallholder agriculture in West Africa through practices like sustainable intensification and integrated soil fertility management. However, its effectiveness is influenced by evolving socio-economic and climate conditions, diverse farming systems, and information asymmetries—factors that demand RS be integrated with other strategies for impactful agricultural development.



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