

Recent changes in crop phenology and their relationship to climate in West Africa

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The climate of West Africa is expected to become more arid due to increased temperature and uncertain rainfall regimes, while its population is expected to grow faster than the rest of the world. As such, increased demand for food will likely coincide with declines in agricultural production in a region where severe undernutrition already occurs. The evaluation of changes in crop phenology is important for agricultural monitoring and could provide useful data to crop models. Moreover, assessing the relationship between climate and crop growth is needed to elaborate localized adaptation measures towards improved food security. In this study, we attempt to discriminate between the impacts of climate and anthropogenic factors on crop production across West Africa.

First we identify trends in climate (temperature and precipitation) and land surface phenology at 250m using the following metrics: start of season (SOS), length of season (LOS) and integrated NDVI (iNDVI) over the crop growing period between 2000 and 2015. Second, we establish the relationship between crop productivity and climate through pixel-wise partial linear regression. Finally, we use residual trend (RESTREND) analysis to discriminate between climate and anthropogenic impacts on crop productivity.

We find that across the region, trends in SOS, LOS and iNDVI are consistent with each other except in some areas of Nigeria, Burkina Faso, Senegal and Mali. We identify increases in crop productivity along the Sahel, Liberia and coastal Ivory Coast and Ghana, while decreases are observed in Senegal, Burkina Faso and Nigeria. We also find that climate has a stronger influence on NDVI in the arid and semi-arid areas rather than the sub-humid and humid zones. However, anthropogenic impacts are observed throughout the entire study area. The aggregation of these trends and their drivers are presented at second-level administrative boundary and adaptation and trade policy implications are discussed.