Measuring Climate Adaptation In The Senegal River Valley With Deep Learning

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TAPAS AI for Climate Action

Fondúireacht Eolaíochta Éireann sfi Dá bhfuil romhainn

Ollscoil na Gaillimhe University of Galway

1

The Senegal River Valley (SRV) is one of the most intensively cultivated rice growing regions in West Africa through extensive irrigation from the Senegal river as well as rain-fed crops. The region is vulnerable to climate shocks and gradual degradation, exacerbated by desertification encroaching from the north due to the Sahara Desert. Consequently, the region has seen intensified farming efforts and investment aimed at both maximising production and mitigating climate change impacts.

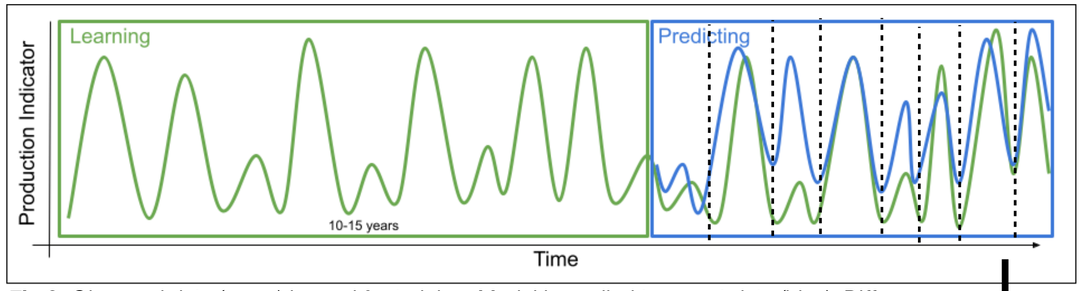

Fig 3: *Observed data (green) is used for training. Model is applied to recent data (blue). Differences between both are considered to be predominantly a divergence from background climate effects.*

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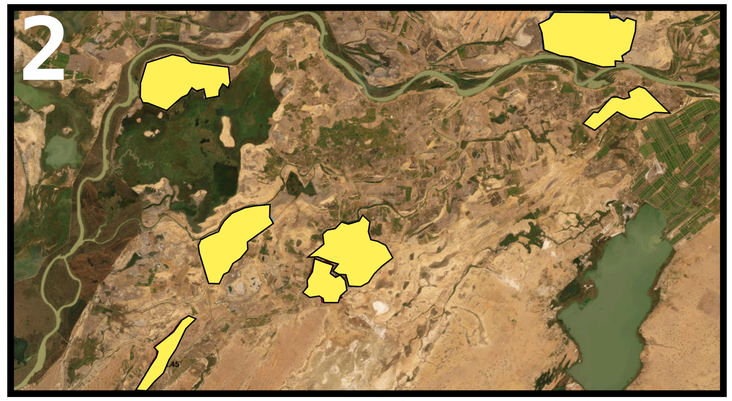


Fig 1: *Map showing SRV and agricultural regions of interest.*

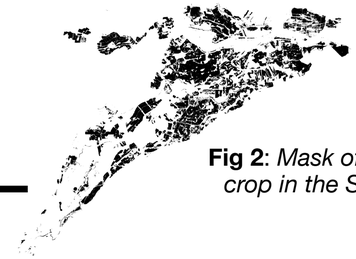
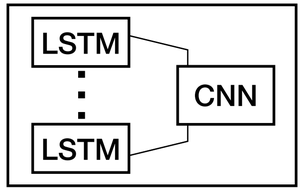
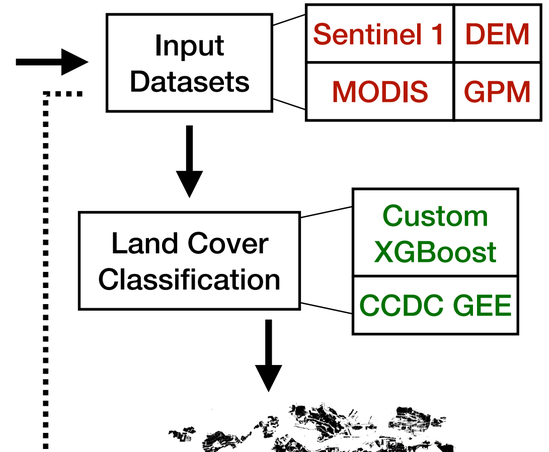


Fig 2: *Mask of rice crop in the SRV*





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By training a machine learning model on data from 2000-2015 it can learn the patterns of historical data. Within this data are the background climate effects on agriculture. Applying this model to more recent data results in discrepancies (difference between green and blue time series above) which we assume are due to a changing climate background.

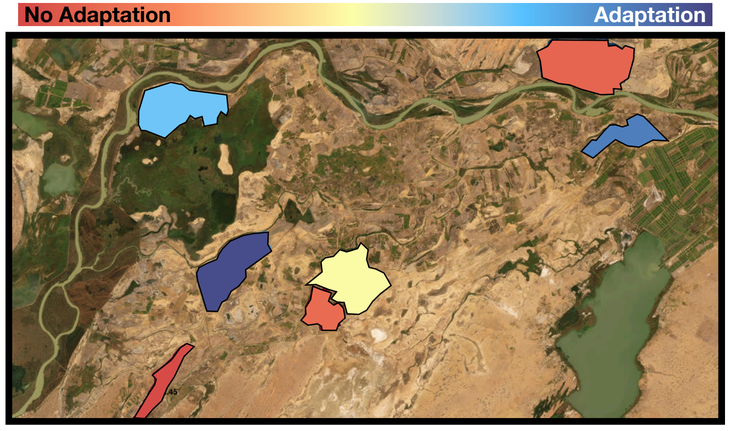

Fig 4: *Mapping the differences between observed and predicted biomass indicators for a recent crop season.*

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By employing time-series deep learning techniques on Sentinel 1, Landsat 8, and MODIS we assess the impact of associated climate change adaptation. These methods can be used by governments, aid agencies, NGOs, or the private sector to assess adaptation to climate change remotely. The goal of this analysis is to reduce cost and increase efficiency in quantifying food production and security. While this analysis focuses on biomass, the algorithm could be adapted to analyse other important agricultural factors such as soil moisture, soil organic carbon, or salinity.