Assess seasonal patterns in crop rotation with Google Earth Engine

Crop rotation is a common practice to improve soil properties and optimize resources. Crop rotation implies planting different crops on the same plot along the time. In Mediterranean areas where the lack of water affect soil productivity or crop yield , fallowing practices are commonly applied. For example Spain counts with more than three million hectares of fallow lands per year that represents 30% of non-irrigated farmlands and the 6% of the national surface. Monitoring fallow lands is vital to achieve a sustainable agriculture, however, fallowing practices are not consider as a class in most of the land use classification systems. The main goal of this assessment is to map different crop rotation practices using time series analysis tools.

At the end of this exercise you will be able to:

- Understand and calculate the autocorrelation function at pixel level
- Describe different crop rotations based on the phenological cycle amplitude
- Discriminate different crop rotation practices using autocorrelation values and the phenological cycle amplitude

This assessment is divided in two phases. In the first phase the student will describe and discriminate different crop rotation practices within non-irrigated crops in Castilla La-Mancha (Spain). In the second phase the student will select an agricultural area in Bangladesh and repeat the same study.

Within the course material there is a GEE repository with useful scripts for this assessment.

The steps to follow are the followings:

- Define the study area (use the shapefile provided to define the study area of Castilla La-Mancha)
- Add the time series: The script provided uses MODIS data but the student can adapt the script to Landsat data if the agricultural plots are very small
- Estimate the spectral metric used as ecological indicator: The script provided estimates the vegetation index NDVI but the student can consider other metric based on their knowledge of the study area.
- Estimate the trend and evaluate if it is necessary to detrend the time series (add a map of the trend in the report indicating maximum, minimum and mean values)
- Define the harmonic function.
- Estimate the amplitude of the phenological cycle (add a map of the amplitude in the report indicating maximum, minimum and mean values)
- Estimate the autocorrelation function. Select the most appropriate lag to be considered. (Add the maps of the autocorrelation values at the selected lag)
- Combine the different seasonal metrics to identify and map different crop rotations.
- Display a map with the result and some examples of time series of the different classes.
- Repeat the same step choosing an agricultural area in Bangladesh.
- Describe the different crop rotation systems found and the differences between study areas.
- Include the script(s) used in the assessment report.