

Characterization of Agroforestry Systems in Burkina Faso Using an Earth Observation Data Cube

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Abstract : Africa will become the most populated continent by the end of the century, with around 4 billion inhabitants. Food security and climate changes will become continental issues since agricultural practices depend on climate but also contribute to global emissions and land degradation. Agroforestry has been identified as a cost-efficient and reliable strategy to address these two issues. It is defined as the integrated management of trees and crops/animals in the same land unit. Agroforestry provides benefits in terms of goods (fruits, medicine, wood, etc.) and services (windbreaks, fertility, etc.), and is acknowledged to have a great potential for carbon sequestration; therefore it can be integrated into reduction mechanisms of carbon emissions. Particularly in sub-Saharan Africa, the constraint stands in the lack of information about both areas under agroforestry and the characterization (composition, structure, and management) of each agroforestry system at the country level. This study describes and quantifies “what is where?”, earliest to the quantification of carbon stock in different systems. Remote sensing (RS) is the most efficient approach to map such a dynamic technology as agroforestry since it gives relatively adequate and consistent information over a large area at nearly no cost. RS data fulfill the good practice guidelines of the Intergovernmental Panel On Climate Change (IPCC) that is to be used in carbon estimation. Satellite data are getting more and more accessible, and the archives are growing exponentially. To retrieve useful information to support decision-making out of this large amount of data, satellite data needs to be organized so to ensure fast processing, quick accessibility, and ease of use. A new solution is a data cube, which can be understood as a multi-dimensional stack (space, time, data type) of spatially aligned pixels and used for efficient access and analysis. A data cube for Burkina Faso has been set up from the cooperation project between the international service provider WASCAL and Germany, which provides an accessible exploitation architecture of multi-temporal satellite data. The aim of this study is to map and characterize agroforestry systems using the Burkina Faso earth observation data cube. The approach in its initial stage is based on an unsupervised image classification of a normalized difference vegetation index (NDVI) time series from 2010 to 2018, to stratify the country based on the vegetation. Fifteen strata were identified, and four samples per location were randomly assigned to define the sampling units. For safety reasons, the northern part will not be part of the fieldwork. A total of 52 locations will be visited by the end of the dry season in February-March 2020. The field campaigns will consist of identifying and describing different agroforestry systems and qualitative interviews. A multi-temporal supervised image classification will be done with a random forest algorithm, and the field data will be used for both training the algorithm and accuracy assessment. The expected outputs are (i) map(s) of agroforestry dynamics, (ii) characteristics of different systems (main species, management, area, etc.); (iii) assessment report of Burkina Faso data cube.

Keywords : agroforestry systems, Burkina Faso, earth observation data cube, multi-temporal image classification

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