



Tropentag, September 14-16, 2022, hybrid conference

“Can agroecological farming feed the world?
Farmers’ and academia’s views”

Detecting cocoa plantations in Côte d’Ivoire and Ghana and their implications on protected areas

ITOHAN-OSA ABU¹, ZOLTAN SZANTOI², ANDREAS BERNHARD BRINK³, MARINE ROBUCHON³,
MICHAEL THIEL¹

¹*University of Würzburg, Dept. of Remote Sensing, Germany*

²*European Space Agency, France*

³*European Commission - Joint Research Center, Italy*

Abstract

Côte d’Ivoire and Ghana are the largest producers of cocoa in the world. In recent decades the cultivation of this crop has led to the loss of vast tracts of forest areas in both countries. Efficient and accurate methods for remotely identifying cocoa plantations are essential to the implementation of sustainable cocoa practices and for the periodic and effective monitoring of forests. In this study, a method for cocoa plantation identification was developed based on a multi-temporal stack of Sentinel⁻¹ and Sentinel⁻² images and a multi-feature Random Forest (RF) algorithm. The Normalized Difference Vegetation Index (NDVI) and second-order texture features were assessed for their importance in the Random Forest classification, and their optimal combination was used as input variables for the RF model to identify cocoa plantations in both countries. The Random Forest model based cocoa map achieved 82.89% producer’s and 62.22% user’s accuracy, detecting 3.69 million hectares (Mha) and 2.15 Mha of cocoa plantations for Côte d’Ivoire and Ghana, respectively. The results demonstrate that a combination of an RF model and multi-feature classification can distinguish cocoa plantations from other land cover/use, effectively reducing feature dimensions and improving classification efficiency. The results also highlight that cocoa farms largely encroach into protected areas (PAs), as 20% of the detected cocoa plantation area is located in PAs and almost 70% of the PAs in the study area house cocoa plantations. These findings highlight the urgent need for governments and buyers to address both the distal and the proximal causes of cocoa-related deforestation.

Keywords: Cash crops, cocoa mapping, encroachment, Protected areas, Sentinel⁻¹, Sentinel⁻², West Africa