A non-grain production on cropland spatiotemporal change detection method based on Landsat time-series data

WU XIAO[1], Tingting He[1], Suqin Jiang[1], Maoxin Zhang[1], Tie Tang[2], and Heyu Zhang[3]

[1]Zhejiang University Department of Land Management
[2]Hunan Planning Institute of Land and Resources
[3]Guangzhou South China Institute of Natural Resources Science

November 22, 2023

Abstract

Global food security is being threatened by the reduction of high-quality cropland, extreme weather events, and the uncertainty of food supply chains. The globalization of agricultural trade has elevated the diversification of non-grain production (NGP) on cultivated land to a prominent strategy for poverty alleviation in numerous developing nations. Its rapid expansion has engendered a multitude of deleterious consequences on both food security and ecological stability. NGP in China is becoming very common in the process of rapid urbanization, threatening the national food security. To better understand the causal mechanisms and enable governments to balance food security and rural development, it is crucial to have a clear understanding of the spatiotemporal dynamics of NGP using remote sensing. Yet knowledge gaps remain concerning how to use remote sensing to track human-dominated or -induced long-term cultivated land changes. Our study proposed a method for detecting the spatiotemporal evolution of NGP based on Landsat time series data under Google Earth Engine (GEE) platform. This approach was proposed by (1) obtaining the union of cultivated lands from multiple landcover products to minimize the cultivated land omission, (2) constructing multi-index dynamic trend rules for 3 representative types of NGP and obtaining results at the pixel level, while adopting the continuous change detection and classification (CCDC) algorithm to Landsat time series (1986~2022) to determine when the most recent change occurred, (3) minimizing the noise by object-oriented (OO) Land Use–Land Cover (LULC) classification and mode filter approaches, (4) mapping the spatiotemporal distribution of NGP. The proposed methodology was tested in Jiashan, located in Zhejiang province (eastern China), where NGP is widespread. We achieved high overall accuracy of 95.67% for NGP type detection and an overall accuracy of 85.26% for change detection of time. The results indicated a continued increasing pattern of NGP in Jiashan from 1986-2022, with the cumulative percentage of NGP increased from 0.02% to 20.69%. This study highlights the utilization of time-series data to document essential NGP information for evaluating food security in China and the method is well-suited for large-scale mapping due to its automatic manner.

Hosted file

`manuscript.docx` available at https://authorea.com/users/702900/articles/688633-a-non-grain-production-on-cropland-spatiotemporal-change-detection-method-based-on-landsat-time-series-data