Int J Appl Earth Obs Geoinformation 66 (2018) 37–45

Contents lists available at ScienceDirect

Int J Appl Earth Obs Geoinformation

journal homepage: www.elsevier.com/locate/jag

Research Paper

GlobeLand30 shows little cropland area loss but greater fragmentation in China

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ARTICLE INFO

Keywords:
Land use change
Fragmentation
Characterization
Gross change
Cropland protection
GlobeLand30

ABSTRACT

Understanding of cropland dynamics in a large geographical extent is mostly based on observations of area change, while the changes in landscape pattern are hardly assessed. The total amount of cropland in China has remained relatively stable in recent years, which might suggest there was little change. In this analysis, we combine the number of cropland patches (NP) with the total cropland area (TA) for a more comprehensive characterization of cropland change in China. We use GlobeLand30–a global land cover dataset with a 30 m resolution for the years 2000 and 2010–and characterize changes in TA and NP for each county as increase, stable, or decrease. This characterization shows that 703 out of 2420 counties experienced both cropland loss and increased fragmentation. The predominant cropland loss in these areas, especially in the North China Plain, is converted to artificial land. Another 212 are characterized by the opposite developments: an increase in cropland and decreased fragmentation. These counties, are mainly characterized by a conversion of forest areas and grassland areas. It suggests that the cropland conservation policy in China effectively protected the total cropland area in overall, but the consequences in terms of fragmentation might be underestimated. Counties with no obvious change in both indicators, measuring 279 counties, are mainly located in the Southeast. Our results are further compared with local level case studies: the fair consistency indicates alternatives of applying GlobeLand30 for analyzing landscape changes across scales and for cross-site comparisons.

1. Introduction

Cropland is vital for human as a producer of food, fuel, fibers, and many other ecosystem services. It is the largest use of land on the planet and it is one of the most important land cover types for society (Foley et al., 2011). Cropland is also an essential research topic for land system studies (Verburg et al., 2013) and landscape studies (Merriam, 1988), where the spatial-temporal characteristics of cropland has been assessed from local level to global level. Land system science mainly focuses on the area of cropland cover, and the existing analyses include area expansion and conversion (Döös, 2002; Tyler et al., 2015), abandonment (Schierhorn et al., 2013), displacement (Meyfroidt et al., 2010; van Vliet et al., 2017), and potential availability (Lambin et al., 2013; Eitelberg et al., 2015). Recently, more attention is given to the spatial structure of croplands in terms of farm size (Samberg et al., 2016), field size (Fritz et al., 2015) or the level of fragmentation of cropland area with other land use types (van der Zanden et al., 2013). Usually, cropland area change is often considered in the context of climate change, food security, and sustainability at a macro level (Verburg et al., 2015), while fragmentation is frequently connected with detailed placed-based ecological and social processes at a micro level, e.g. distribution, movement, and persistence of species (Forman and Godron, 1986; Turner, 1989).

In China, the spatial-temporal characteristics of cropland and their consequences, among other land cover types, have gained much attention from scientists and policy-makers. This is because Chinese cropland plays an essential role as the “rice bowl” for the country, which currently feeds 22% of the world population with only 7% of the planet's cropland resources (Ryan and Flavin, 1995). Especially since the late 1990s, the challenge to provide national food security has been amplified along with China’s unprecedented economy growth. A national level land cover mapping work suggests a net cropland loss of

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https://doi.org/10.1016/j.jag.2017.11.002
Received 14 July 2017; Received in revised form 25 October 2017; Accepted 11 November 2017