Computers and Electronics in Agriculture 122 (2016) 41–54

Contents lists available at ScienceDirect

Computers and Electronics in Agriculture

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

Original papers

Land use patterns for driving environmental management of tea agricultural croplands

Ali Erdem Ozcelik [a,*], Recep Nisanci [b]

[a] Recep Tayyip Erdogan University, Department of Geomatics Engineering, 53100 Rize, Turkey
[b] Karadeniz Technical University, Department of Geomatics Engineering, 61080 Trabzon, Turkey

ARTICLE INFO

Article history:
Received 9 November 2015
Received in revised form 19 December 2015
Accepted 9 January 2016
Available online 25 January 2016

Keywords:
Tea agriculture
Tea agricultural cropland
Tea agricultural parcel
Land administration
Geo-spatial data
Land certification

ABSTRACT

Today, there is no integrated land administration system within cadastre and land registry for land use and management of tea agricultural croplands. So, it is needed to a comprehensive development agenda for enabling land management driven land use policy reforms integrated geo-spatial data with cadastre through parcel-based registration and recording system on tea agricultural croplands. A wide range of uses of spatial data and geo-information in these reforms brings real ability to enable achieving global initiatives on sustainable and interoperable tea agricultural systems. To support sustainable tea agriculture for current and future agricultural trends, an application-oriented modeling for monitoring, mapping and registration system is needed to shape and management of tea agricultural croplands and cropping facilities. Having said this firstly registration and recording of recognized property rights are crucial especially for land certification process. So improved property rights (rights, restrictions and responsibilities (RRR)) on certificated croplands are the basis for the building of management system. This system is coming to the fore also to make sound creating standards at global level in the well-designed and long-term initiative supports for sustainable tea agricultural cropping management. Reflecting this, it is also essential to enable modeling of production to consumption process to draw attention through increasing tea agricultural productivity with recording of tea agricultural outputs. So in this paper it is revealed what the initiatives are for support to spatial design and planning of tea agricultural croplands integrated global tea agricultural development by comparison current tea agricultural system. In order to accomplish a broad range of applications as especially registration, recording and monitoring system the spatio-temporal changes based on Geographical Information System (GIS) and Remote Sensing (RS) would be chosen. Our results show that it is coming to the fore together with growing concerns in global agricultural world by lack of a comprehensive integration of cadastre and land administration system for management of tea agricultural croplands having uneven geographic distribution. It has been also found evidence of the certification type of current tea agricultural cropland that is required to register with a certificate integrated land registry and cadastre to enable tea agricultural farming facilities on it by tea parties. They are having been led to mapping by using unique certification types, namely as "certificated cropland". So, for the future work, it is showed that intended to building a National Tea Agricultural System for environmentally-related tea agricultural croplands development practise in all concerned countries.

1. Introduction

Tea plant is one of the most economically important crops in global agricultural world (Yang et al., 2015). The tea plant is native to Southeast Asia but is currently cultivated in more than 30 countries around the world (Xiong et al., 2015). Tea crop is the most popular beverage in the world. Global tea production has been increased in the last decade. According to Food and Agriculture Organization of the United Nations world production reached 4.1 million tonnes in 2010 (Garcia Londoño et al., 2015). Tea agricultural cropping has an important role in global agriculture market (Dutta, 2013). It is a leading cash crop in world agriculture. With the increasing world population, the tea market is expected to grow further (Dutta et al., 2011). And also it is curial for socio-economic development of a great number of country as well

* Corresponding author at: Recep Tayyip Erdogan University, Faculty of Engineering, Department of Geomatics Engineering, 53100 Rize, Turkey. Tel.: +90 4642237518/1222; fax: +90 4642237514.
E-mail address: alierdem.ozcelik@erdogan.edu.tr (A.E. Ozcelik).

http://dx.doi.org/10.1016/j.compag.2016.01.013
0168-1699/

(Owuor et al., 2011). Due to fact that tea agriculture and tea agricultural cropping facilities are a source of livelihood and income as financial support mechanisms in some part of the global agricultural world, it is needed to enable economical growth toward the development of the tea industry in related countries (Ganewatta and Edwards, 2000). Tea agricultural cropping and production is also ensuring initiative supports for agricultural employment to a growth number of people as a broad range of revenue (Gupta and Dey, 2010). Highlight the fact that tea is the second most frequently consumed drink after water in today world since it is known for thousands of years being famous plant as a hot beverage (MBG, 2010). Having said this it is emphasized that in per year approximately millions tones of tea worth millions of dollars is consumed all around the countries where people daily drink billions cups of tea (Kumar et al., 2013). One of these countries is Turkey. With a total tea volume Turkey has the second largest tea market in the world and as tea is a consumer staple the industry is regulated by the government with under state-owned company (Euromonitor International, 2010). According to the FAO statistics, Turkey ranks fifth in world production of tea after China, India, Kenya and Sri Lanka (Republic of Turkey – Ministry of Economy, 2014). In Turkey, for the management of agricultural subsidies, information on farmers and croplands are registered in the National Registry of Farmers (NRF) system. It is noted that further developed version of this system (currently called Agricultural Information System) includes only cadastral land parcels as spatial data. The NRF system is based on declarations by farmers, which depend on the land registry and related land use rights (title, land use contract, consent from first order relatives or notary statement) as proof of right for agricultural activity (Inan et al., 2011).

Today, it is a renewed interest in whether land reforms can contribute to development of agricultural land market within an approach to land registration and land certification of land property and land tenure rights (Holden et al., 2011). Land registration is a process of locating, measuring and registering farm plots, whereas the certification covers the attributes and geo-information on these plots. Land certification is based on the maintenance and updating of land registration. Land registration and certification involve technically advanced spatial data based surveying, recording and monitoring technologies for enabling how they will be integrated. For this, land related laws and land titling systems integrated with land administrations is essential tools through the building land registration and land certification (Bezu and Holden, 2014). The land certification process is designed to especially enhance land tenure security of farmers integrated policy related variables with social and economic outcomes (Bezabih et al., 2011). In case of the land certification can enhance tenure security that reduces conflicts over lands, it may enhance the investment within the positive effects on land productivity (Holden et al., 2009) through the agricultural croplands as well. The uneven geographic distribution of all certification types of croplands remains one viable option that is for being enabled building of management systems of these croplands (Lewis and Davis, 2015) through the land registration system integrated with land administration.

Thus, firstly, there is an increasing need and growing interest through providing insights in underlying drivers for tea agriculture with all facilities and actions. One of these drivers is to enable management framework of tea agricultural croplands and cropping assessment. Secondly, to determination and registration of land use rights, restrictions and responsibilities (RRR) on these croplands in a legal framework, the spatial data or spatial data management collaboration with land administration domains is required as a major tool for enabling both sustainable land management and spatial data infrastructure to enable spatial land use planning for tea agricultural crop-lands. At the last, it is also sounded as development the production to consumption management schema for tea agricultural cropping with all applications and practices (Ozcelik and Nisanci, 2015). So highlights the fact that, for enabling improved cropping and production facilities, the tea agriculture and croplands are having a specialty agricultural aided under by leading state-owned tea industry. Thus, to allow being aided yearly and regularly in NRF system, it needs to have a range of requirements/components as mainly (1) integration to land registry system (2) having cadastral records and (3) being certificated (tea farming license) for enable tea agricultural farming, cropping and production facilities in legally. Underline the fact that these are the core elements for sustainable tea agricultural cropland management integrated with land administration system through the land use monitoring and mapping of tea agricultural croplands as required. As there is no an integrated system within cadastre and land administration system for the both land use planning and management of tea agricultural croplands in NRF, it is needed to comprehensive development agenda for environmentally adapted tea agricultural croplands, land use and land use rights reforms integrated with spatially referenced data. A wide range of uses of spatial referenced data in these reforms also brings real ability to enable achieving global initiatives on tea agricultural development integrated agri-environmental impacts. To identify ways with a number of core components and measures to support sustainable tea agriculture for current and future agricultural trends, an application-oriented modeling for monitoring, mapping and registration system is needed to shape and management of tea agricultural croplands and cropping facilities. Having said this firstly recognized and registration of property rights are crucial for tea agricultural land use. So improved property rights (rights, restrictions and responsibilities (RRR)) on tea agricultural croplands are the basis for the building of monitoring, mapping and registration system. These systems also fundamental to make sound creating standards at global level in the well-designed and long-term initiative supports for sustainable tea agricultural cropping management as a key to enable accurate recording of tea agricultural outputs. Recalls that take the view to sound building these systems for tea agricultural cropping process modeling are also needed to draws attention to innovative technologies for increasing tea agricultural productivity. In order to accomplish a broad range of applications such as especially registration and recording system and monitoring system the spatio-temporal changes based on Geographical Information System (GIS) and Remote Sensing (RS) would be essential.

2. Tea agricultural production in global world

Because of tea cropping has an important role in especially global agricultural market tea farmland are planted broad range of arable land throughout the world. Designed with the agricultural initiatives to meet socio-economic requirements, it is emphasized that tea croplands are intensively needed to manage agricultural ecosystems to support the sustainable of crop plantation management (Li et al., 2011). And also, it is one of the cash crops in field farm, local, regional, national level since millions of farmer's livelihoods are directly or indirectly based on tea agriculture as well (Baruah and Bhagat, 2012). Recall that the tea cropping is "originally native to mainland China, South and Southeast Asia, today the plant is cultivated across the world in tropical and subtropical regions" (Fig. 1) (Groosman, 2011).

Tea is one of the functionalities agricultural crops supported with agricultural industry (Musai et al., 2013). The tea agricultural industry creates considerable socio-economic long-term benefit schemes toward the current and future trends to employing a wide range of labor force (Bian, 2013). Further it provides opportunities for helping people to meet the needs living in both rural and urban