



Economic benefit and ecological cost of enlarging tea cultivation in subtropical China: Characterizing the trade-off for policy implications



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ABSTRACT

Cash crop expansion has become a global land use issue in recent decades. While the enlarging cash crop cultivation brings promising profitability, it can impair the delivery of various ecosystem services, with a risk of threat to sustainability and human well being. In order to make well-informed land use policy decisions, it requires elaborate efforts to characterize the trade-off between the benefit and cost of cash crop cultivation. This paper focuses on the enlarging tea cultivation in subtropical China, using a case of Anji County. We first monitor tea expansion from 1985 to 2016 based on time-series Landsat imageries, and then analyze the subsequent changes of water conservation service through an in-field survey of soil loss. Monetary approach is finally employed to evaluate the trade-off between economic benefit and ecological cost associated with the growing age of tea plantations. Results show that tea plantations expanded rapidly from 1985 to 2016 in Anji County. Delivery of water conservation service has been significantly impaired by the conversion from natural forests to tea plantations, but it can be gradually improved during the long rotational life cycles of tea plantations. For a given plot (1 ha at moderate slope), in theory, the economic benefit and ecological cost exhibit opposite trend associated the growing age of tea plantations, and an equilibrium point is approximately achieved at the 12-year growing age. In reality, ecological cost exceeds the economic benefit throughout the study period in Anji County. More specifically, the net difference increases from 11575 Yuan in 1985–1469167 Yuan in 2016. It denotes that economic benefit fails to compromise the ecological cost of the enlarging tea cultivation in Anji County. Conflicting land use policies (ecological conservation vs cash cropping promotion) and ‘household contract responsibility’ system should account for the unbalanced relationship between economic benefit and ecological conservation. We finally propose four major options towards the win-win possibilities between economic gain and ecological conservation associated with tea cultivation.

1. Introduction

1.1. Cash crop expansion: a global land use issue

Recent decades have saw a boom in demand of cash crops, and global cash crop markets subsequently have emerged and proliferated quickly (Delpeuch and Leblois, 2014). This has led to local and landscape-level conversion of natural or semi-natural land into perennial or annual cash crop plantations in many places around the world (Ahrends et al., 2015; Brown, 2012; Vongvisouk et al., 2016; Ziegler et al., 2009). Cash crop cultivation, including the rubber, commercial fruit, coffee, oil palm, tea, and nursery, has become an expanding global

phenomenon (Abram et al., 2017; Carlson et al., 2012; Castiblanco et al., 2013, 2015; Gatto et al., 2015; Godone et al., 2014; Qiu, 2009; Xiao et al., 2015; Zhang et al., 2015). This is especially the case in Latin American, Asian, and African countries, including China, Columbia, Cuba, Indonesia, Laos, Malaysia, Myanmar, Peru, Thailand, and Vietnam (Fig. 1; data Source: FAO, 2013). In particular, the oil palm and rubber are the most rapidly expanding cash crops in the tropics (Phalan et al., 2009), while commercial fruits and tea gain increasing dominance in the subtropics (Su et al., 2015). The total plantation area of oil palm is estimated to reach over 15 million ha and increase by 200% within 25 years. Statistics report a net growth of 50% for rubber production since 2000 in Southeast Asia (FAO, 2013). The coming

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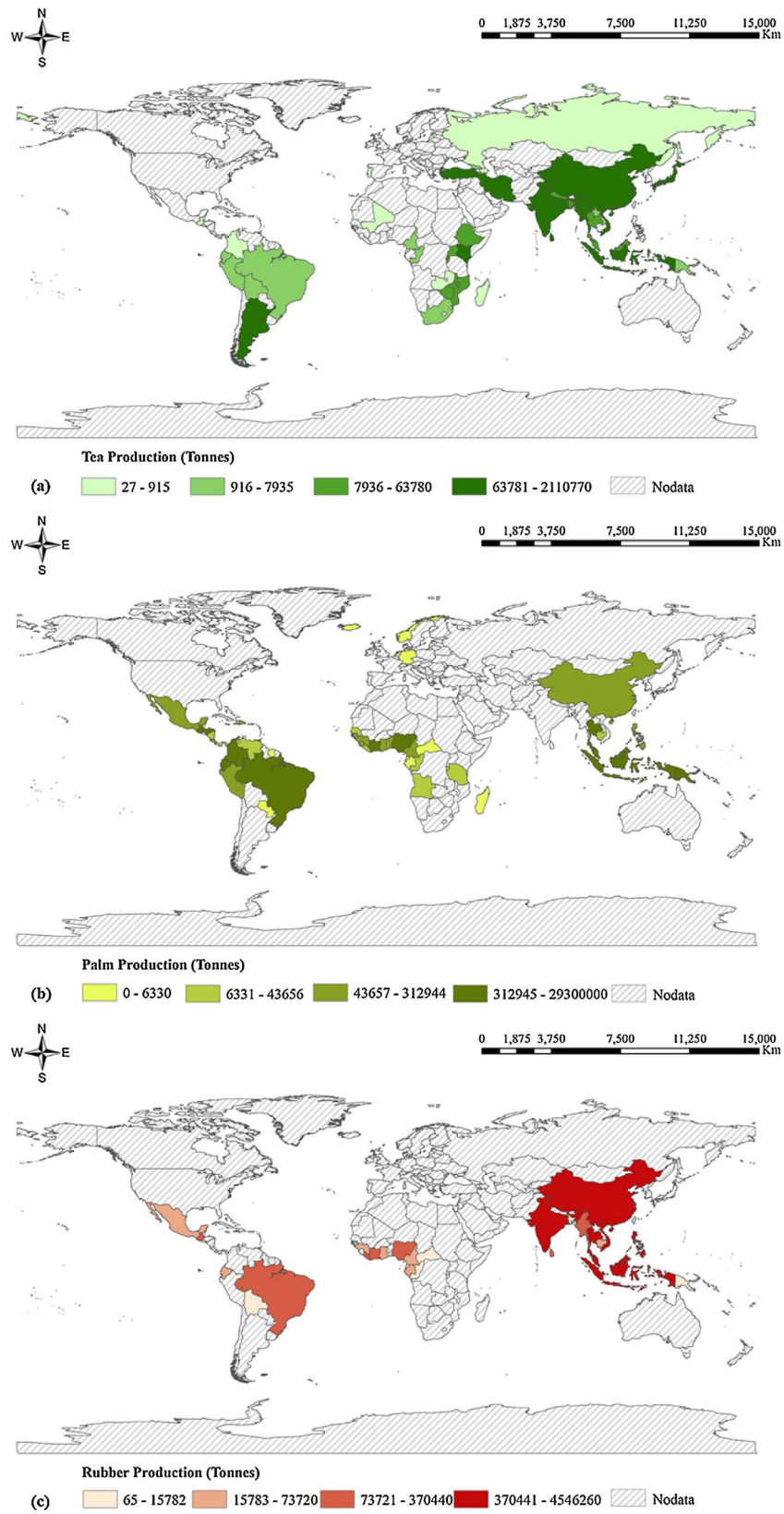


Fig. 1. Production of tea (a), palm (b), and rubber (c) around the world.

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