



# Forest cover, development, and sustainability in Costa Rica: Can one policy fit all?



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## ABSTRACT

Forest Transition Theory offers the hope that global economic development can continue in tandem with forest recovery. Costa Rica has been lauded for its successful forest transition—once the fastest deforesting country in Central America, forests began to regrow in the 1980s and have had a steady trajectory of recovery since. This forest regrowth can be linked temporally to Costa Rican policies that have promoted tourism and discouraged small-scale agriculture. We use a case study from the Bellbird Biological Corridor (Corredor Biológico Pájaro Campana; CBPC), Costa Rica, combining remote sensing analysis with interviews and ethnography, to unravel the relationship between national policy, forest regrowth, and social-ecological sustainability. The forest cover change analysis between 1986 and 2014 indicates that, at the parcel-level, national policy has served to promote farm abandonment in favor of tourism and that this change has been critical to forest regrowth. However, these changes have occurred within a development framework that has created new social-ecological challenges that threaten future forest and economic sustainability. Examining the parcel-level impacts of the driving forces of landscape change highlights that forest cover is an insufficient proxy for conservation success, and conservation policy focused primarily on forest recovery may create new sustainability challenges.

## 1. Introduction

Sustainable development goals propose to improve socioeconomic conditions while sustaining environmental well-being across generations (Bruntland, 1987). Under this paradigm, socioeconomic conditions are often reduced to income, and environmental well-being is reduced to forest cover. Declining forest cover is frequently used as the primary indicator of a litany of global environmental concerns: biodiversity loss, climate change, and the decreased provision of ecosystem services for human well-being (Kalnay and Cai, 2003; Turner et al., 2007; Vitousek et al., 1997). Global environmental policy, spearheaded by the United Nations (UN) redirects funds from categorized “developed” countries to “less-developed” countries under the explicit goal of creating markets and incentives for forest retention to spur sustainable development (Angelsen and Rudel, 2013). It is not clear, however, that coupling forest cover with economic growth will lead to environmental sustainability and increased well-being among populations in the regions that are targeted by these policies.

This paper explores the relationship among land use policy, forest cover, development, and social-ecological sustainability by examining evidence from a nation frequently praised for its forest recovery—Costa

Rica. In doing so, we seek to provide a nuanced perspective on the connection between forest regrowth and sustainable development policies as observed by the Forest Transition Theory (FTT) literature. We begin by briefly describing the relationship between land cover change and development outlined in the Forest Transition Theory and related Environmental Kuznet's Curve (EKC) literature and describe how it can, possibly unintentionally, support the types of sustainable development policies that Costa Rica has undertaken in the past 30 years. We then describe our case study, which combines ethnographic and survey data with a land cover change analysis from 1986 to 2014. We focus on the parcel-level to examine the relationship between land use decisions, forest regrowth, and multiple indicators of sustainability. By doing so, we demonstrate that the forest transition in Costa Rica is accompanied by new environmental and economic challenges in Costa Rica that fall short of sustainable development goals.

## 2. Background

### 2.1. FTT and EKC—empirical evidence for sustainable development

Key academic evidence supporting sustainable development policies

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has come from the Forest Transition Theory (FTT). FTT posits that over time forest cover in a nation declines up to an inflection point, after which net regeneration begins (Grainger, 1995; Mather, 1992; Mather and Needle, 1998). Though FTT is based on historical trend data, research has focused on empirical drivers of this transition. Rudel et al. (2005) propose two main forest transition pathways—either forest scarcity drives demand for forest regrowth, or economic development diverts labor from rural agricultural landscapes. Angelsen and Rudel expand on this (2007), taking a von Thünen approach to understanding land values as a function of distance from a market center (Von Thünen, 1966). Angelsen (2007) postulates that during the early development phase of a country, deforestation happens on all lands that are being pioneered, whereas during the forest transition phase marginal agricultural land returns to forest. Still other researchers have found that a nexus of economic and political factors, under the broader process of globalization, ultimately drives forest regeneration in developing countries (Geist and Lambin, 2002; Kull et al., 2007; Lambin et al., 2001).

The connection between the FTT and economic growth draws on another core theory of sustainable development—the Environmental Kuznet's Curve (EKC). The Kuznet's Curve describes an inverted U-shaped relationship between economic growth and income inequality (Kuznets, 1955), while the EKC describes a similar relationship between economic growth and the environment. Its interpretation is that as a nation develops environmental degradation occurs up to a point of inflection, after which environmental improvements begin (Grossman and Krueger, 1994). To date, some of the best empirical evidence for the EKC comes from forest cover data, linking the EKC and FTT (Chowdhury and Moran, 2012). The relationship between the EKC and the FTT suggests that financial incentives for forest cover can be successfully tied to economic development policies, resulting in a win-win for both conservation and development (Culas, 2012). However, empirical evidence supporting the EKC for multiple environmental factors is lacking, and any robust conclusions about the relationship between economic development and environmental degradation need to consider the complex tradeoffs associated with economic development, human well-being, and environmental integrity at a global scale (Dietz et al., 2012; Stern, 2004; Stern et al., 1996).

Questions in FTT literature expand knowledge on the nature of the development/land cover relationship and the policy mechanisms best suited to promote and sustain a net increase in forest cover (Angelsen and Rudel, 2013; Rudel et al., 2002). Researchers have questioned the *quality* of the forest that has recovered, and the ability of satellite imagery to adequately reflect the biodiversity and other ecosystem services produced by those forests (Angelsen and Rudel, 2013; Melo et al., 2013). Researchers also have recognized the importance of scale – leakage may occur as a nation that has undergone the forest transition begins to import necessary goods from other places with net deforestation (Pfaff and Walker, 2010; Walker, 2012). As follow-up, this literature has identified the relationship between key indicators of development and forest cover at local (Daniels, 2010; Schelhas and Sánchez-Azofeifa, 2006), regional (Redo et al., 2012), and global scales (Lambin and Meyfroidt, 2011). Others have questioned the relationship between forest recovery and national food security, suggesting that intensification of agriculture might allow continued forest recovery while meeting food demands (Lambin and Meyfroidt, 2010). In sum, the FTT and related EKC literature has provided scholars and policy makers with an important grounding in the relationship between forest cover and development, but has less frequently questioned whether increased forest cover coupled with increased development is, in fact, a win-win scenario (Meyfroidt and Lambin, 2011).

Some scholars have built upon the FTT and EKC literature, posing difficult questions about the impacts of globalization and development on local communities, and implications for long-term sustainability. For example, Kull et al. (2007) find that forest cover on the Pacific Coast of Costa Rica has occurred in conjunction with globalization and ask

whether globalization is a preferable alternative to the detrimental impacts of deforestation. Hecht (2010, 2005) uses evidence from El Salvador and the Amazon to question the impact of globalization on rural development, and the relationship between tropical forest cover and rural sustainability. Likewise, Dietz et al. (2012) suggest that more research needs to probe multiple indicators of development in order to understand the complex relationship between the biophysical environment and increases in human well-being. We contribute to this literature by offering an analysis of the forest transition in Costa Rica as seen “from above” in remote sensing imagery, and “from below” in ethnographic and survey data. Our analysis intends to build on FTT and related literature by offering further insight into the social-ecological challenges that may accompany forest transitions.

## 2.2. Study area

Our study area is in a section of the Bellbird Biological Corridor (Corredor Biológico Pájaro Campana; CBPC), Costa Rica. The CBPC is part of a network of mixed-use regions targeted for national conservation efforts by the Sistema Nacional de Areas de Conservación (SINAC). According to the CBPC directorate, the conservation objectives for this network are to promote forest connectivity across privately held parcels, linking the private and public reserve systems ([www.cbpc.org](http://www.cbpc.org)). We chose the study area to include the regions between the popular tourism destination of Monteverde, located at the Northern limit of the CBPC, and the Pan American highway. The study area stretches between 77 and 1800 m in elevation, moving from transitional tropical rainforest/dry forest to tropical lower montane rainforest (Holdridge, 1979). The region is mostly composed of small farms (the mean in our sample is 29.3 ha) where landowners partake in cattle and dairy production, coffee farming, tourism, and some subsistence agriculture.

The study area has two “market poles” at the northern and southern extremes: Sardinal, a town near the Pan American Highway, and Monteverde, a district that includes Santa Elena and San Luis (see Fig. 1). Sardinal has off-farm income opportunities in several factories, and it is easily accessible from the capital of the province, the city of Puntarenas. Sardinal is also approximately one hour from the Central Valley, the economic center of the country. Many farms in the immediate Sardinal region are low production cattle ranches, owned by absentee landowners living in the central valley. Monteverde is remotely located, approximately one hour drive from Sardinal along gravel roads. It is an urbanizing region that has transitioned from a farming economy to a tourism economy over the last 30 years. The main tourist attraction in Monteverde is the Monteverde Cloud Forest Preserve, founded in 1972 (Burlingame, 2000). Farms in Monteverde tend to produce either milk, which is typically sold to the Monteverde Cheese Factory, coffee, or they are involved in tourism. Some farms in Monteverde are residences and landowners work off site and complete income with home food production. The central area is the district of Guacimal, which is rural and agrarian. Most farms in this region produce milk and/or beef cattle. Although the road to Monteverde passes through the center of town, there is negligible tourism in the Guacimal district.

Costa Rica has experienced dramatic policy shifts over the course of the last half-century. Prior to the 1980's, the Costa Rican economy primarily rested on the large agricultural exports of coffee, banana, and pineapple, with numerous small scale farms contributing slightly to the net food production of the country (Booth et al., 2010). In the 1980's, Costa Rica, along with many other Latin American countries, defaulted on international debt and, as a result, was coerced to undertake structural reforms that undercut the social welfare state and removed protectionist measures (Capitán, 1997). These policies included the removal of subsidies for agricultural products and the promotion of nature tourism (Edelman, 1999). Costa Rica simultaneously implemented a series of forestry laws that closed the frontier, prohibited

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