



Declining use of wild resources by indigenous peoples of the Ecuadorian Amazon



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ABSTRACT

Wild product harvesting by forest-dwelling peoples, including hunting, fishing, forest product collection and timber harvesting, is believed to be a major threat to the biodiversity of tropical forests worldwide. Despite this threat, few studies have attempted to quantify these activities across time or across large spatial scales. We use a unique longitudinal household survey ($n = 480$) to describe changes in these activities over time in 32 indigenous communities from five ethnicities in the northern Ecuadorian Amazon. To provide insight into the drivers of these changes, we also estimate multilevel statistical models of these activities as a function of household and community characteristics. These analyses reveal that participation in hunting, fishing, and forest product collection is high but declining across time and across ethnicities, with no evidence for a parallel decline in resource quality. However, participation in timber harvesting did not significantly decline and there is evidence of a decline in resource quality. Multilevel statistical models additionally reveal that household and community characteristics such as ethnicity, demographic characteristics, wealth, livelihood diversification, access to forest, participation in conservation programs and exposure to external markets are significant predictors of wild product harvesting. These characteristics have changed over time but cannot account for declining participation in resource harvesting. This finding suggests that participation is declining due to changes in the regional-scale social and economic context, including urbanization and the expansion of government infrastructure and services. The lesson for conservationists is that macro-scale social and economic conditions can drive reductions in wild product harvesting even in the absence of successful conservation interventions.

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1. Introduction

Harvesting of wild resources by forest-dwelling peoples, via hunting, fishing, timber harvesting and forest product collection, has been identified a major threat to biodiversity in many tropical forest ecosystems (Asner et al., 2005; Peres et al., 2006; Castello et al., 2013). However, these activities are often central to the livelihoods of the poor and isolated populations that live at forest frontiers (Brashares et al., 2011; Wunder et al., 2014). This conflict is particularly salient for indigenous peoples of the Amazon Basin who have harvested wild products for centuries, control large areas of forest, and have populations that are growing rapidly (McSweeney and Arps, 2005; Nepstad et al., 2006; Wunder et al., 2014). The discussion of potential solutions to this conflict has

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generated a large literature (e.g., Redford and Sanderson, 2000; Terborgh, 2000), but this discussion has taken place largely in the absence of landscape-scale evidence on levels and trends of wild resource use (Peres et al., 2006; Wunder et al., 2014). This lacuna is the result of difficulties in conducting large-scale social and biological surveys in this context, the near-invisibility of small-scale wild product harvesting to remote-sensing methods (Peres et al., 2006), as well as enduring barriers between conservation science and the quantitative social sciences (Fox et al., 2006).

Using a unique longitudinal survey dataset, we confirm that indigenous peoples of the Northern Ecuadorian Amazon (NEA) are highly dependent on wild resources, ask whether their harvesting activities have changed over time, and also ask whether household or community-level factors can account for these changes. The NEA is a center of Amazonian biodiversity for many taxa, the home of a large and growing indigenous population, and the site of high-profile conflicts between biodiversity conservation and resource use (Finer et al., 2008; Bremner et al., 2009), making the

region particular interest for these questions. The data capture changes in wild resource use across 480 households, 32 communities, 5 ethnicities, an 11 year time period, and low to moderate connections to external markets. We first use this dataset to characterize various dimensions of wild resource use by this population, including hunting, fishing, timber harvesting and forest product collection. Building on this descriptive analysis, we subsequently use multilevel regression models to investigate the social and economic predictors of wild resource use across time. This effort expands on previous studies which have investigated indigenous resource use via cross-sectional surveys (e.g., Brashares et al., 2011; Wunder et al., 2014) or small longitudinal samples (e.g., Vickers 1991; Gill et al., 2012), and points to significant additional opportunities at the intersection of conservation science and the quantitative social sciences (see Godoy et al., 2010).

2. Methods

2.1. Study area

The NEA is located at the western periphery of the Amazon Basin (Fig. 1) and overlaps the center of Amazonian species richness for amphibians, birds, mammals and vascular plants, marking it a globally important region for biodiversity conservation (Finer et al., 2008). The region has been inhabited for millennia by Amerindian indigenous peoples, but its current large-scale environmental transformation began in the 1970s with the initiation of oil exploration. Road construction by the oil industry enabled large-scale agricultural colonization from outside the region and

was facilitated by government land tenure policies (Bilborrow et al., 2004). These processes have transformed the area between Coca and Lago Agrio (Fig. 1), where soils are productive for agriculture, into an urbanizing agricultural hinterland with only remnant forests, while colonization and oil extraction continue to penetrate into previously remote areas (Holland et al., 2014). Indicative of this ongoing transformation, the urban population of Sucumbíos and Orellana provinces, which overlap the study area, increased from 76 thousand to 129 thousand between 2001 and 2010 (INEC, 2014).

These processes have radically transformed the regional context for five resident and culturally distinct indigenous groups, the Cofán, Kichwa, Shuar, Secoya and Waorani, via territorial displacement and circumscription as well as increased contact with the outside world (Lu and Bilborrow, 2011). Despite these changes, all five groups, particularly the Waorani and Cofán, have retained a significant degree of spatial, economic and cultural isolation from urban economies and the dominant mestizo culture, and continue to practice traditional livelihood activities such as wild resource use and swidden agriculture in landscapes dominated by forest (Gray et al., 2008; Lu et al., 2010). At the same time, all five groups have also taken advantage of new opportunities created by regional transformation, as evidenced by their participation in wage labor, sales of agricultural products, purchases of manufactured goods, use of government services, and engagement in political activism (Lu, 2007; Suarez et al., 2009; Bremner, 2013). High fertility and access to basic health services have also contributed to rapid population growth, with the indigenous population of Sucumbíos and Orellana increasing from 40 thousand to

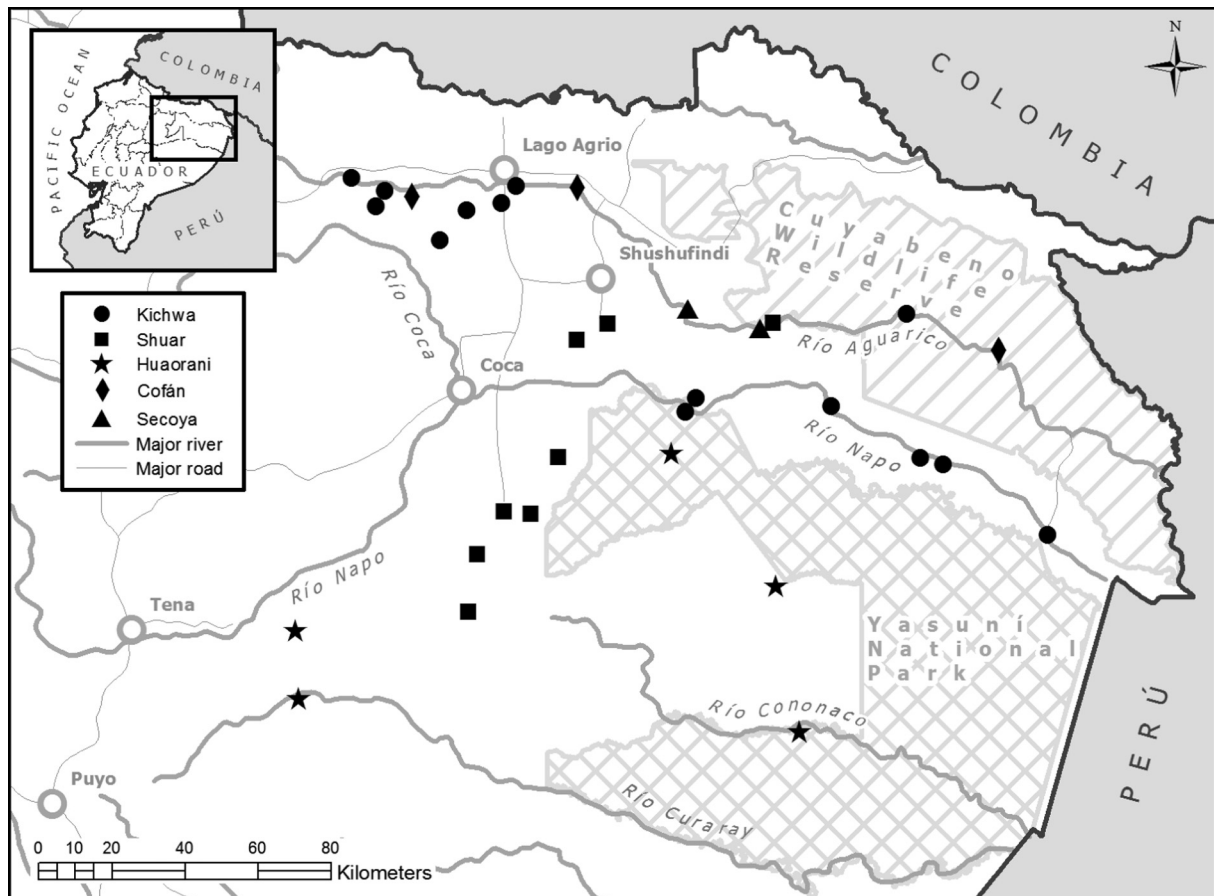


Fig. 1. Map of the study communities.

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