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Participatory mapping to identify indigenous community use zones: Implications for conservation planning in southern Suriname

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ABSTRACT

Large-scale development projects often overlap forest areas that support the livelihoods of indigenous peoples, threatening in situ conservation strategies for the protection of biological and cultural diversity. To address this problem, there is a need to integrate spatially-explicit information on ecosystem services into conservation planning. We present an approach for identifying conservation areas necessary to safeguard the provision of important ecosystem services for indigenous communities. "Community use zones" (CUZs) were generated using participatory mapping methods that identify place values indicating significant hotspots for ecosystem services. Using principles from landscape ecology, these areas are buffered to provide connectivity and to delineate ecosystem service delivery areas. We demonstrate the use of CUZs for five villages in southern Suriname ($n = 191$ participants) to inform the South Suriname Conservation Corridor project. The mapped data reveal overlapping hotspots for different ecosystem services depicting multifunctional landscapes that provide an empirical foundation for delineating CUZs. In the absence of legal and traditional land rights for indigenous people, CUZs based on the provision of ecosystem services provide a defensible, spatially explicit approach for integrating indigenous needs into regional conservation plans in southern Suriname. We discuss the utility of CUZ maps for promoting land tenure and security and as a basis for collaborative governance in indigenous and community-conserved areas (ICCAs).

1. Introduction

The livelihood and wellbeing of 60 million indigenous people globally depend entirely on forest ecosystem services (Chao, 2012) such as food, water, building materials, non-timber forest products and less tangible ones, often classified as cultural services, such as sense of place and cultural identity (Millennium Ecosystem Assessment, 2005). Because of their interdependency with forests, indigenous people see security of tenure over the forest territories that sustain their lives as a factor determining their existence (Larson, Barry, Ram Dahal, 2010). Incomes derived from ecosystem goods, such as wild foods (e.g., fruits, nuts, fish, game) and raw materials (fibers, resins, timber, and non-timber forest products) play a critical role in wellbeing by enabling vulnerable forest-dependent people to obtain food and other important goods and services (Fisher et al., 2014; Poppy et al., 2014; Poppy, Jepson, Pickett, & Birkett, 2014). Likewise, areas representing cultural values (e.g., sacred places, areas important for recreation) play a less tangible but important role because they are often safeguarded by local resource management strategies that simultaneously safeguard the supply of other ecosystem services (ES) such as pollination, fodder, and biodiversity (Berkes, 2012; Fabricius, Folke, Cundill, & Schultz, 2007).

Community management of forests in the tropics can provide for long-term maintenance of forest cover (Porter-Bolland et al., 2012) while local participation in forest governance institutions is strongly associated with positive forest outcomes (Persha, Agrawal, & Chhatre, 2011). Specifically, the role of indigenous communities in conservation has been acknowledged by international fora such as the UN Convention on Biological Diversity (CBD) (Kothari et al., 2014). Yet, a critical issue in the sustainable management of forest resources in the tropics is the status of land tenure and property

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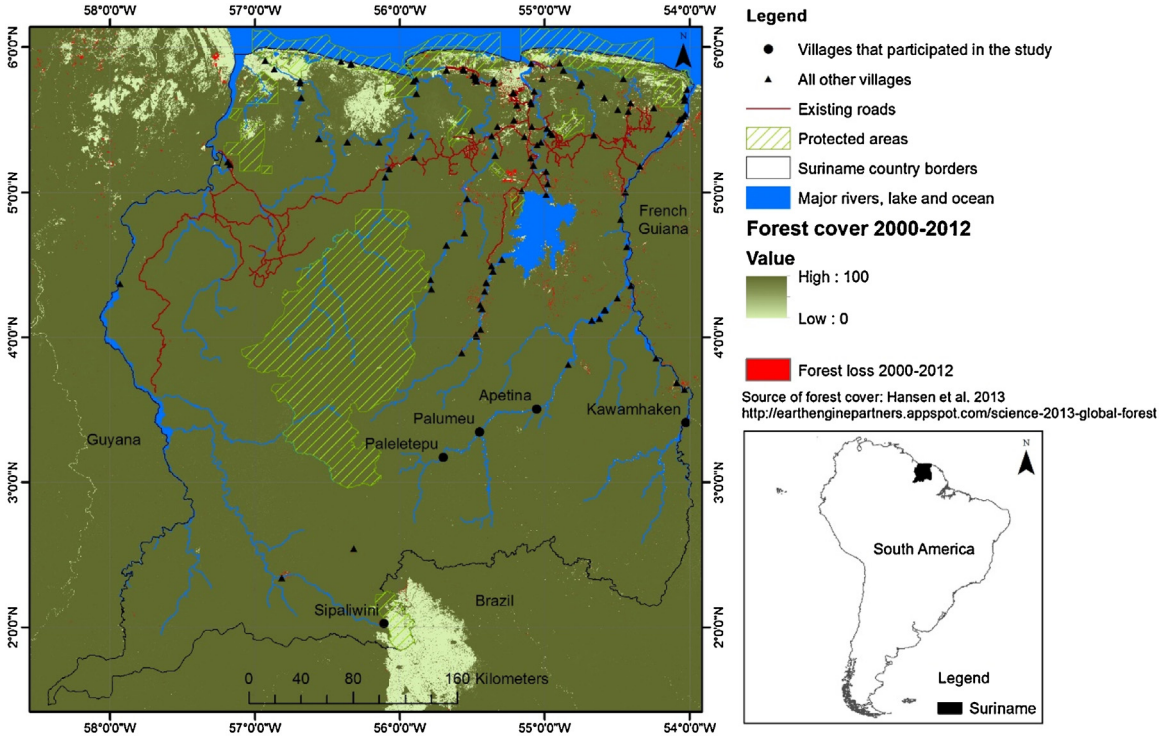

Fig. 1. Location and geographic context of the communities that participated in this study.

rights that enable access to livelihood resources and provide security from outside threats (Bennett & Sierra, 2014; Fisher et al., 2014; Chapin et al., 2010). In the absence of land tenure security, an effective system of stewardship in indigenous peoples' regions can be undermined by both development and conservation efforts (Arnot, Luckert, Boxall, 2011; Schwartzman & Zimmerman, 2005).

But long-term conservation outcomes cannot be guaranteed through property rights, community-based conservation, or the establishment of protected areas (Andrade & Rhodes, 2012) alone. In practical terms, conservation has a spatial outcome, and without spatially-explicit boundaries, conservation becomes meaningless because there is no baseline to assess the impact of anthropogenic influences or to measure success or failure (Cumming, 2011; Daily et al., 2009). Especially in remote and data scarce regions where indigenous territories are not clearly defined or demarcated, and where there is no spatially-explicit information about the importance of areas to indigenous communities, investment plans for infrastructure, mining, and other extractive activities may conflict and undermine indigenous peoples' well-being. In the absence of adequate information regarding land use needs, nature conservation plans may inadvertently limit access for indigenous peoples to locations with cultural, symbolic, and livelihood value (Willemen, Drakou, Dunbar, Mayaux, & Egoh, 2013; Lele, Wilshusen, Brockington, Seidler, & Bawa, 2010; Daily et al., 2009; Cowling et al., 2008; Chan, Shaw, Cameron, Underwood, & Daily, 2006). New information is required to estimate the shape and size of areas necessary to maintain the livelihoods of indigenous peoples, but the demarcation and zoning of these areas is hindered by gaps in spatial layers of socio-ecological information (Bernard, Barbosa, & Carvalho, 2011; McLain et al., 2013).

The growing dependence on visualization tools for managing the impacts of land use on ecosystem services (Pagella & Sinclair, 2014) has created the need for maps that communicate conservation and management needs more effectively (De Groot, Alkemade, Braat, Hein, & Willemen, 2010; Egoh et al., 2007). And there is demand for visual tools that better integrate stakeholder perceptions and values into resource and environmental planning processes (Brown & Fagerholm, 2014; McLain et al., 2013; Schägner, Brander, Maes, & Hartje, 2013; Bryan, Raymond, Crossman, & Macdonald, 2010; Nassauer & Opdam, 2008). The integration of ES into spatial landscape planning (Crossman et al., 2013; De Groot et al., 2010) is important to safeguard ES flows (Ban et al., 2013; Reyers et al., 2013; Carpenter et al., 2009; Cowling et al., 2008) and should include areas where ES are generated, delivered to users, and areas that connect ES sources with users (Villa, Voigt, Erickson, 2014; Syrbe & Walz, 2012; Fisher, Turner, & Morling, 2009).

Participatory mapping appears suitable for identifying provisioning and cultural ecosystem services (Brown, Weber, Zanon, & de Bie, 2012) that are operationalized through the mapping of place values. The early typologies of place values developed for participatory mapping were called *landscape values* (Brown & Reed, 2000) and subsequently relabeled as *social values for ecosystem services* (Sherrouse, Clement, & Semmens, 2011) because the values represent end-products of ecosystem services at their interface with human well-being. The supporting rationale for linking place values with ecosystem services derive from interpreting place values as part of a 'structure–function–value chain' (Termorshuizen & Opdam, 2009) where ecosystem functions become services when their benefits are valued by humans (Brown, 2013). As an alternative to the concept of ecosystem services, Fagerholm, Käyhkö, Ndumbaro, & Khamis (2012) used the term *landscape services*, arguing it has more relevance to the way that local stakeholders act and perceive their environment. The terms *ecosystem* services and *landscape* services appear largely interchangeable and for the purposes of this study, we adopt the more widely used term ecosystem services as the end-product identified by the mapping of place values.

In this article, we apply participatory geographic information systems (PGIS) to identify hotspots of place values to inform systematic conservation planning. We apply the concept of service provision hotspots (SPH) developed by Palomo, Martín-López, Potschin, Haines-Young, & Montes (2013) to indicate areas highly valued for their multi-functional character in providing social and