



Research article

Protected area coverage of threatened vertebrates and ecoregions in Peru: Comparison of communal, private and state reserves



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ABSTRACT

Protected areas (PAs) are a conservation mainstay and arguably the most effective conservation strategy for species protection. As a 'megadiverse' country, Peru is a priority for conservation actions. Peruvian legislation allows for the creation of state PAs and private/communal PAs. Using publicly available species distribution and protected area data sets we evaluated the coverage of Threatened terrestrial vertebrate species distributions and ecoregions provided by both kinds of PA in Peru. Peru's state PA system covers 217,879 km² and private/communal PAs cover 16,588 km². Of the 462 species of Threatened and Data Deficient species we evaluated, 75% had distributions that overlapped with at least one PA but only 53% had $\geq 10\%$ of their distributions within PAs, with inclusion much reduced at higher coverage targets. Of the species we evaluated, 118 species are only found in national PAs and 29 species only found in private/communal PAs. Of the 17 terrestrial ecoregions found in Peru all are represented in PAs; the national PA system included coverage of 16 and private/communal PAs protect 13. One ecoregion is only protected in private/communal PAs, whereas four are only covered in national PAs. Our results show the important role private/communal PAs can play in the protection of ecological diversity.

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1. Introduction

The current global extinction crisis is predicted to increase in severity in the coming decades (Ceballos et al., 2015; Lewis, 2006; Purvis et al., 2000; Scheffers et al., 2016). Caused largely by anthropogenic activities (Asner et al., 2009; Estrada et al., 2017; Godfrey and Irwin, 2007; Moran and Kanemoto, 2017), current trends suggest that the world's tropical regions, home to the majority of terrestrial biodiversity (Dirzo and Raven, 2003; Myers et al., 2000), will be severely affected. A large loss of tropical vertebrate species diversity could have severe consequences for general ecosystem health (Hooper et al., 2005; Petchey, 2000). Other immediate consequences will be those effecting local human populations, including the loss of traditional natural resources, culturally important species and development opportunities from

tourism and other forms of exploitation (Chapin Iii et al., 2000; Gascon et al., 2015).

Peru is considered one of the world's 'megadiverse' countries (McNeely et al., 1990; Noss, 1990). Its high level of species diversity is a result of the diversity of its ecosystems which are distributed between 19 terrestrial ecoregions (Fig. 1) (Olson and Dinerstein, 1998; Olson et al., 2001). The vast majority of Peru's vertebrate species are found in the Amazonian lowlands and Andean montane and pre-montane cloud forests (Pacheco et al., 2009). The remaining species are found distributed between its coastal deserts, dry forests, Andean Puna, and other habitats (ONERN, 1976; Rodríguez and Young, 2000).

Protected areas (PAs) have been a conservation mainstay for decades and are arguably the most effective conservation strategy for species protection (Gray et al., 2016; Hoffmann et al., 2010; Tognelli et al., 2008; Waldron et al., 2013). The locations of PAs are often chosen to protect representative ecosystems (Watson et al., 2010) or are based on socio-political criteria. This has often

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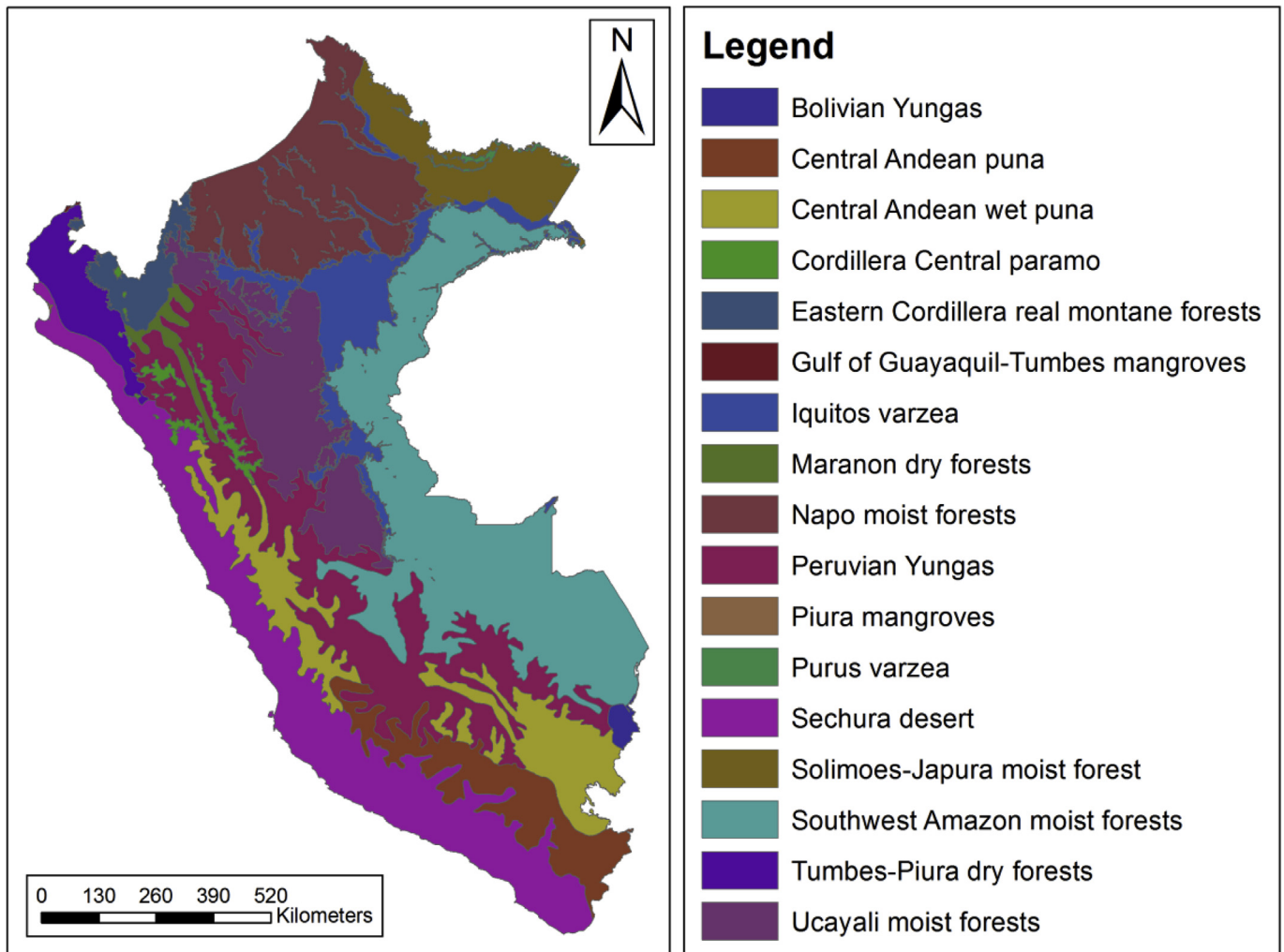


Fig. 1. Peru's major ecoregions, based on Olson and Dinerstein (1998) and Olson et al. (2001).

led to inadequate and unrepresentative coverage of species diversity, and does not prioritize Threatened species (Khan et al., 1997; Tognelli et al., 2008; Watson et al., 2010). Estimates suggest that globally only 15% of Threatened vertebrate species are 'adequately' covered by PAs (Venter et al., 2014). Previous studies in Peru have also reported inadequate coverage for a majority of species evaluated (Fajardo et al., 2014; Swenson et al., 2012; Young et al., 2009).

Conservation initiatives involving PAs in Peru have increased dramatically over the past few decades (Jenkins and Joppa, 2009; SERNANP, 2017). Protected area legislation in Peru began by following the traditional 'fines and fences' approach (Adams, 2004; Brockington, 2002; Hutton et al., 2005) but now also includes more inclusive conservation models, such as community conservation initiatives; those run by local stakeholders (Horwich and Lyon, 2007; Horwich et al., 2015; Kitamura and Clapp, 2013; Shanee et al., 2014), which include private/communal PAs (Hajek et al., 2011; Monteferri and Coll, 2009; Shanee et al., 2014; Stolton et al., 2014). Government PAs are divided between those that are run by the state (National Parks, National Sanctuaries, etc) and those run by regional governments (Regional Conservation Areas) (Monteferri and Coll, 2009). In Peru non-government PAs can be awarded to those with land titles, such as owners of family plots or

on communally held lands, as a Private Conservation Areas (ACP) through application to the Ministry of the Environment (Law No. 26834 of 1997) or through conservation agreements based on the civil code. On un-titled lands with forest cover, individuals and organizations can request non-timber forestry concessions. The two most common are Conservation Concessions (CC) and Ecotourism Concessions (CE) (Law No. 29763 of 2015). There is no limit to the size of a CC, although CEs are limited to areas of $\leq 10,000$ ha and are subject to an annual fee.

The first state PA, the 8214 ha Parque Nacional de Cutervo, was created in 1961. In contrast the first private PA, the 34,412 ha ACP Chaparri, wasn't created until 2001 as legal frameworks for ACPs were not previously available. The first Conservation Concession, the 135,955 ha Los Amigos CC, was also granted in 2001. The first Ecotourism Concessions weren't created until 2004, when four were formalized in the same year.

We use publicly available data to evaluate coverage of the distributions of terrestrial mammal, bird, reptile and amphibian species listed in one of the IUCN Red List Threatened categories or as Data Deficient (IUCN, 2016), and ecoregions (Olson and Dinerstein, 1998; Olson et al., 2001) provided by state and private/communal PAs in Peru. We pay particular attention to species and ecoregions that are found in only one type of PA.

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