Conservation and social outcomes of private protected areas

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Abstract: Government administered protected areas (PAs) have dominated conservation strategies, discourse, and research, yet private actors are increasingly managing land for conservation. Little is known about the social and environmental outcomes of these privately protected areas (PPAs). We searched the global literature in English on PPAs and their environmental and social outcomes and identified 412 articles suitable for inclusion. Research on PPAs was geographically skewed; more studies occurred in the United States. Environmental outcomes of PPAs were mostly positive (89%), but social outcomes of PPAs were reported less (12% of all studies), and these outcomes were more mixed (65% positive). Private protected areas increased the number or extent of ecosystems, ecoregions, or species covered by PAs (representativeness) and PA network connectivity and effectively reduced deforestation and restored degraded lands. Few PPA owners reported negative social outcomes, experienced improved social capital, increased property value, or a reduction in taxes. Local communities benefited from increased employment, training, and community-wide development (e.g., building of schools), but they reported reduced social capital and no significant difference to household income. The causal mechanisms through which PPAs influence social and environmental outcomes remain unclear, as does how political, economic, and social contexts shape these mechanisms. Future research should widen the geographical scope and diversify the types of PPAs studied and focus on determining the casual mechanisms through which PPA outcomes occur in different contexts. We propose an assessment framework that could be adopted to facilitate this process.

Keywords: conservation easements, ecotourism reserves, neoliberal conservation, private game reserves, privately protected areas, protected area governance, protected area impacts, RPPNS

Conservación y Consecuencias Sociales de las Áreas Protegidas Privadas

Resumen: Las áreas protegidas administradas por el gobierno (APs) han dominado las estrategias, el discurso y las investigaciones de la conservación a pesar de que los actores privados cada vez están administrando más tierras para la conservación. Se conoce muy poco sobre las consecuencias ambientales y sociales de estas áreas protegidas privadamente (APPs). Realizamos una búsqueda en la literatura en inglés sobre las APPs y sus consecuencias ambientales y sociales e identificamos 412 artículos apropiados para la inclusión. La investigación sobre las APPs presentó un sesgo geográfico pues la mayoría de los estudios se realizaron dentro de los Estados Unidos. Las consecuencias ambientales de las APPs fueron principalmente positivas (89%); mientras que las consecuencias sociales estuvieron menos reportadas (12% de todos los estudios) y estas resultaron generalmente mixtas (65% positivas). Las áreas protegidas privadas incrementaron el número o la extensión de los ecosistemas, las ecoregiones o las especies cubiertas por las APs (representatividad) así como la conectividad entre redes de AP y redujeron efectivamente la deforestación y restauraron los suelos degradados. Fueron pocos los dueños de una APP que reportaron consecuencias sociales negativas, experimentaron un incremento en el capital social, aumentaron el valor de su propiedad o redujeron sus impuestos. Las comunidades locales se beneficiaron con el incremento en los empleos, el entrenamiento y el desarrollo a nivel comunitario (p. ej.: la construcción de escuelas), aunque también reportaron una reducción en el capital social y ninguna diferencia importante en el ingreso doméstico. Los mecanismos causales mediante los cuales las APPs influyen sobre las consecuencias sociales y ambientales todavía no están claros, así como la manera en la que el contexto político, económico o social moldea estos
mechanisms. Las siguientes investigaciones deberían ampliar el enfoque geográfico y diversificar los tipos de APPs estudiados, así como enfocarse en determinar los mecanismos causales mediante los cuales las consecuencias de las APPs ocurren en diferentes contextos. Proponemos un marco de trabajo de análisis que podría adoptarse para facilitar este proceso.

Palabras Clave: áreas protegidas privadamente, conservación neoliberal, gestión de las áreas protegidas, impactos de las áreas protegidas, relación de la conservación, reservas ecoturísticas, reservas privadas de caza, RPPNS

Introduction

Biodiversity is in crisis, with extinction rates 1000 times higher than expected background rates (Diaz et al. 2019). In response, the international community has explicitly included biodiversity protection and the expansion of protected areas (PAs) in multiple international agendas, including the Aichi Biodiversity Targets and Sustainable Development Goals. Government administered PAs have dominated conservation strategies, discourses, and research for decades (Adams 2004; Watson et al. 2014). However, a variety of private actors, including individuals, nongovernmental organizations (NGOs), and businesses, are increasingly purchasing and managing significant tracts of land for conservation. These areas are collectively known as privately protected areas (PPAs) and are highly diverse in their form, ownership, size, and location. There are numerous definitions for PPA s (Holmes 2013), but Stolton et al. (2014) provide a comprehensive and widely accepted definition that we use in this review: “a protected area, as defined by IUCN, under private governance (i.e. individuals and groups of individuals; non-governmental organizations; corporations – both existing commercial companies and sometimes corporations set up by groups of private owners to manage groups of PPA s; for-profit owners; research entities (e.g. universities, field stations) or religious entities).”

In contrast to other forms of PAs, PPAs have received relatively little scholarly attention (Capano et al. 2019). This despite their being an old conservation approach; some countries (e.g., United Kingdom) established PPAs decades before state-governed PAs (Hodge & Adams 2012). Private protected areas deserve greater attention because they may be increasing in number due to rising trends in neoliberal conservation approaches that facilitate a role for private actors (Büscher & Whande 2007) and because there is a pressing need for conservation on private land to help achieve global conservation goals (Kamal et al. 2015). The World Database on Protected Areas (WDPA) reports 13,103 privately governed PAs (UNEP-WCMC 2020). Yet, this may be a substantial underestimate because only a small proportion of countries report PPAs to the WDPA and these may also report only a subset of existing PPAs (Fitzsimons 2015; Bingham et al. 2017).

Private protected areas can potentially make significant contributions to conservation in some countries (Holmes 2013) and may operate differently from other forms of PAs due to different owner motivations and incentives, access to financial resources, and levels of accountability (Langholz & Lassoie 2001). Existing global reviews of PPAs have focused on PPA typologies (Langholz & Lassoie 2001; Carter et al. 2008; Kamal et al. 2015), their differences relative to other effective conservation measures (Mitchell et al. 2018), their geographical distribution (Stolton et al. 2014; Bingham et al. 2017), and PPA reporting (Clements et al. 2019) and management guidelines (Pasquini et al. 2011; Mitchell et al. 2018). Recent studies focusing specifically on outcomes have been region specific and explore the outcomes of private land acquisitions for forest conservation in the United States (Nolte 2018), contributions of PPAs to the regional persistence of large- and medium-sized
mammals in South Africa (Clements et al. 2019) and Brazil (Laurindo et al. 2017), how PPAs contribute to ecosystem representativeness in Victoria, Australia (Fitzsimons & Wescott 2001), and the outcomes of conservation concessions in South America (Schleicher 2018).

However, a global understanding of PPA outcomes for people and nature is lacking. We address this gap by synthesizing the published literature on PPAs to describe the geographic distribution of peer-reviewed PPA literature, summarize PPA environmental and social outcomes and how these have been measured, whether outcomes are positive or negative and for whom or what, and examine the challenges of measuring PPA outcomes and future research needs. We assessed ecological outcomes to see to what extent PPAs contribute to global biodiversity conservation goals. We assessed social outcomes of PPAs because it is now accepted that PAs should do no harm to local communities. Social outcomes of PAs can determine their legitimacy and the level of support they receive from local communities and therefore their long-term persistence and effectiveness in achieving the biodiversity conservation goals they were meant to achieve. Social outcomes for owners are also important for the longevity and number of PPAs.

Compiling the Literature

We used the PRISMA method (Moher et al. 2009) to conduct extensive literature searches in Web of Science, SCOPUS, and the first 500 articles from Google Scholar in October 2019. We focused on PPAs in peer-reviewed journals in English. We assessed the gray literature on PPAs but decided to exclude it because of its limited scope. We assessed the gray literature through searches on Google Scholar, snowballing, and searching NGO and land trust websites (e.g., The Nature Conservancy and World Land Trust). Much of this literature in English focuses on defining PPAs (e.g., Stolton et al. 2014), how they should be managed (e.g., Mitchell et al. 2018), and where they can be found (e.g., American Bird Conservancy 2013). Few reports focus on environmental outcomes (n = 2), and social outcomes center on changes in land value following the establishment of conservation easements (n = 7). The gray literature was also difficult to systematically collate and posed challenges related to research quality and potential duplication of information (Oldekop et al. 2016; Hajjar et al. 2016). Although we excluded gray literature from our review, we believe our results, nonetheless, reflect important PPA trends and gaps and the key issues are currently covered in the peer-reviewed literature. Using the comprehensive International Union for Conservation of Nature (IUCN) report The Future of Privately Protected Areas (Stolton et al. 2014), we compiled search terms to cover the diversity of forms of PPAs, which are widely reported and accepted (see Appendix S1 for our complete search string).

We screened all results in a 3-stage process based on title, abstract, and full text, according to our study inclusion criteria. To be included, studies needed to first meet our definition of PPA. Confusion still exists as to what exactly classifies as a PPA, and the boundaries between what constitutes a PPA versus PAs under other forms of governance or other effective conservation measures can be ambiguous. We based our definition on that of the IUCN (Stolton et al 2014) and define PPAs as areas under private forms of governance; primarily used for biodiversity conservation; designated based on long-term intent; and that afford legal or other effective means of biodiversity protection. Like Capano et al. (2019), we discarded articles reporting ecological surveys inside PPAs that did not relate the results to PPA management or governance (n = 15). We coded PPAs by landowner type, governance entity, and protection mechanism. We coded environmental and social outcomes according to the primary research question asked in the literature. We further categorized social outcomes based on the 5 livelihoods assets in the sustainable livelihoods framework (DFID 2000). We coded outcomes as an increase, decrease, or no discernible effect in the identified outcome and based on to whom the outcome accrued.

Our initial search returned 1325 articles, which we reduced to 373 following title and abstract screening. We selected a further 39 articles from reference lists, resulting in a final sample of 412 articles. A full overview of our methods and all reviewed articles is available as Supplementary Information.

Results

We found an increasing trend in the number of peer-reviewed articles in English focusing on PPAs, but the overall number of articles remained small (n = 412, Fig. 1) relative to the current number of PPAs (n = 13,103). The environmental and social outcomes of PPAs only recently received scholarly attention (Fig. 1). The literature was substantially skewed in geographic focus (perhaps due to a sampling bias of conducting the literature search only in English) (Fig. 2); the types of PPAs studied (Table 1); the types of questions asked about PPAs (Table 2); and the spatial scale at which research was conducted. Most studies were (SSG, tense) conducted at a subnational (n = 261) or national scale (n = 78). In contrast, landscape-level studies were uncommon (n = 21). Most studies were conducted in only 5 countries (United States 226, Brazil 31, Australia 31, South Africa 30, and Chile 19), and studies on conservation easements in the United States dominated the literature (Fig. 2 and Table 1). There was marked overlap between country and PPA type studied (e.g., conservation...
Figure 1. Cumulative number of peer-reviewed articles on private protected areas.

Table 1. Types of private protected areas (PPAs) included in a synthesis of the published literature on PPAs.

| PPA characteristic                      | No. of articles (total 412) |
|-----------------------------------------|----------------------------|
| Landowner type                          |                            |
| individual                              | 254                        |
| multiple undefined\(^a\)                | 89                         |
| nongovernmental organization (NGO)      | 38                         |
| unspecified\(^b\)                        | 18                         |
| corporate                               | 8                          |
| informal community group                | 5                          |
| Governance entity                       |                            |
| convenant (unspecified)                 | 130                        |
| multiple undefined\(^c\)                | 93                         |
| individual-NGO partnership (e.g., landowner and The Nature Conservancy) | 54 |
| NGO                                     | 29                         |
| individual-state partnership            | 28                         |
| unspecified                              | 17                         |
| corporate                               | 8                          |
| informal community group                | 2                          |
| Protection mechanism                    |                            |
| conservation easement or convenant      | 250                        |
| multiple undefined\(^d\)                | 56                         |
| landholder agreement in perpetuity      | 44                         |
| (e.g., RPPN in Brazil)                  |                            |
| unspecified                              | 29                         |
| NGO freehold                            | 26                         |
| long-term landholder agreement          | 8                          |

\(^a\) Studies in which PPAs were reviewed or generalizations were made across PPAs but certain specific characteristics were not given.

\(^b\) Studies in which a case study was undertaken on a certain subset of PPAs in a specific region (e.g., conservation easements in Wyoming), but specific details were not provided.

Environmental outcomes were considered in 79 studies and focused mainly on species coverage (\(n = 37\)) and ecosystem representativeness (\(n = 20\)). Social outcomes were discussed in 48 studies, the majority of which focused on financial outcomes (\(n = 36\)).

Results of studies on ecological outcomes of PPAs showed many positive outcomes, particularly for species conservation (increase \(n = 35\), decrease or no effect \(n = 2\)) (Table 3). Social outcomes of PPAs were far less reported and more mixed. Studies that researched social outcomes of PPAs showed local communities benefitted from skills training (\(n = 6\)), infrastructure development in the local area (\(n = 4\)), improvements to the regional economy (\(n = 5\)), and increased employment opportunities (increase \(n = 9\), decrease or no effect \(n = 3\)). However, there was little improvement in household income (\(n = 2\), decrease or no effect \(n = 5\)). Some local communities reported feeling a loss of power and cultural identity (\(n = 9\)).

Due to the bias in articles focusing on individual landowners (Table 1), results also showed that the general public lost tax revenue (\(n = 4\)) and access to open space (\(n = 4\)) and that landownership increased (\(n = 3\)). In contrast, landowners benefitted from increased land value (\(n = 8\)), reduction in tax payments (\(n = 4\)), and strengthened community involvement, relations, and networking (\(n = 6\)). In our study, few PPA owners reported any negative impacts (\(n = 6\)).

Discussion

Characterizing the Literature on PPAs

Research on PPAs is geographically and ecologically limited, reflecting global skews in conservation research (Oldekop et al. 2016; Capano et al. 2019). We found a marked overlap between the country and PPA type studied, perhaps because certain types of PPA management may be unique to, or more dominant in, specific countries (e.g., Private Natural Heritage Reserves [Reservas Particulares do Patrimônio Natural] [RPPNs] in Brazil). The bulk of the PPA literature focused on conservation easements in the United States (\(n = 216\), 52% of all studies), perhaps due to their prominence and large numbers (Nolte 2018; UNEP-WCMC 2020). Conservation easements and covenants are contractually binding agreements between landowners and a third party (e.g., land trusts or governments) that dictate how properties...
Figure 2. Geographical distribution of articles on private protected areas.

Table 2. Focus of articles on private protected areas (PPAs).

| Focus                                                      | No. of articles (total 412) |
|------------------------------------------------------------|------------------------------|
| Ownership characteristics, incentives, or motivations      | 84                           |
| Coverage (e.g., spatial distribution, representativeness, and connectivity) | 70                           |
| Opportunities, challenges, and constraints                  | 5                            |
| Defining PPAs (e.g., typologies, classifications, and history) | 42                           |
| Management actions                                         | 38                           |
| Ecological effectiveness and impacts (e.g., reduce deforestation or prevent development) | 31                           |
| Permanence                                                 | 26                           |
| Financial analysis (e.g., how establishment affect land prices) | 25                           |
| Governance (e.g., participation of local communities and collaborative governance) | 17                           |
| Social impacts                                             | 16                           |
| Political economy (e.g., neoliberalism, land grabbing, and resource nationalism) | 11                           |

should be managed alongside conservation goals (Merrill et al. 2004).

Mexico, Canada, Colombia, Namibia, Spain, and Finland have growing PPA networks (Stolton et al. 2014) and receive limited scholarly attention. Studies commissioned by NGOs in these countries were not published in the peer review literature. Countries with a large number of PPAs reported to the WDPA received greater scholarly attention than countries with few reported PPAs. The United Kingdom was an exception. It has a large number of PPAs managed by NGOs (Stolton et al. 2014) reported to the WDPA ($n = 690$), but they were little discussed in the peer-reviewed literature ($n = 2$).

Limited questions have been asked about PPAs; 38% of articles ($n = 155$) investigated the location of PPAs or ownership characteristics, incentives, and motivations for PPA establishment (Table 2). These research questions reflect an exploratory research agenda and demonstrate a trend of research heavily dominated by factors shaping PPA establishment and aims (inputs), rather than results (outputs) (Tables 3 and 4).

Environmental Outcomes of PPAs

We found that PPAs made unique and significant spatial contributions to achieving some global conservation
Table 3. Assessments of the environmental outcomes of private protected areas (PPAs)∗.

| Study focus | No. of articles | Method | Increase (+), decrease (-), or no discernible effect (∼) | Study |
|-------------|----------------|--------|----------------------------------------------------------|-------|
| Species conservation | 37            | biodiversity survey | + | Burgi et al. 2011; Higgins et al. 1999; Tapp et al. 2015; Benson et al. 2018; Herzog & Vaughan 1998; Pegas & Castley 2016; Child et al. 2013 |
| Species abundance   | 8              | biodiversity survey | + | Burgi et al. 2011; Higgins et al. 1999; Tapp et al. 2015; Benson et al. 2018; Herzog & Vaughan 1998; Pegas & Castley 2016; Child et al. 2013 |
|                       | spatial analysis | + | Olmstead et al. 2013 |
| Projected estimates of PPAs to conserve species in future scenarios | 19            | analysis of secondary data or modeling | + | Cox & Engstrom 2001; Stralberg et al. 2011; Copeland et al. 2013; Smith et al. 2016; Lewis et al. 2019 |
|                       | biodiversity survey | + | Cabral et al. 2017; Dos Santos & Da Costa 2008; Falcão et al. 2012; Gatti et al. 2017; Laurindo et al. 2017; Porfirio et al. 2014; Posso et al. 2013; Ruiz-Esparza et al. 2016; Sánchez-Lalinde et al. 2019; Talamoni et al. 2014; Zortéa et al. 2008; Jones & Jiménez-Saa 2017; Clements et al. 2019 |
|                       | spatial analysis | ∼ | Sandker et al. 2011 |
| Compliment species protection in other PAs | 9              | biodiversity survey | + | Rambaldi et al. 2005; Colletta et al. 2016; Negroes et al. 2011; Shane et al. 2017; Lovett-Doust & Kuntz 2001 |
|                       | spatial analysis | + | Pegas & Castley 2010; Munks et al. 2004; Alarcón & Cavieres 2015; Maslo et al. 2015 |
| Protect species of conservation concern | 1              | biodiversity survey | + | Ortiz-Lozada et al. 2017 |
| Ecosystem representativeness | 20 | analysis of ecoregions, plant species diversity, or ecosystems in PPA boundaries compared with other PA types | + | Squeo et al. 2011; Martínez-Tilleria et al. 2017; Pliscoff & Fuentes-Castillo 2011; Lemcanger et al. 2014; Baldwin et al. 2015; Gallo et al. 2009; Von Hase et al. 2010; Shane et al. 2017; Graves et al. 2019; De Vos & Cumming 2019; Yuan-Farrell et al. 2005; Fitzsimons & Wescott 2001 |
|                       | analysis of ecoregions, plant species diversity, or ecosystems in PPA boundaries compared with other PA types | ∼ | Jackson & Gaston 2008; Larrea-Alcazar et al. 2010; Schutz 2017; Yuan et al. 2015; Lacher et al. 2019 |
|                       | analysis of ecosystems protected in future PPA scenarios | + | Chomitz et al. 2006 |
| Protect or restore conservation priorities and human values | 2              | spatial analysis of overlap of ecosystems protected and desirable human values | + | Fisher et al. 2012; Cronan et al. 2010 |
| Connectivity and adjacency | 15            | spatial analysis of PPA locations assessing contiguity and connectivity of PAs | + | Crouzeilles et al. 2013; Chomitz et al. 2006; Gatti et al. 2017 Langholz and Lassoie 2001; Rissman and Merenlender 2008; Meyer et al. 2015; Graves et al. 2019; Tack et al. 2019; Lawley et al. 2015; De Vos and Cumming 2019; Lovett-Doust & Kuntz 2001; Pegas & Castley 2016 |
|                       | as above | ∼ | Rissman 2013; Cronan et al. 2010; Lacher et al. 2019 |

Continued
targets and overwhelmingly had positive ecological outcomes (89%, \( n = 70 \)). Globally, state PAs account for 82% of total PA coverage, whereas PPAs account for approximately 7% (UNEP-WCMC 2020). The PPAs added little to the total protected land area (additionality), and extent of PPA coverage was much smaller than that of state PAs. However, 72% of articles \( (n = 13) \) discussing ecosystem representativeness suggest that PPAs add complementarity to the PA matrix by existing in ecoregions not represented or underrepresented by state PAs or by existing in less remote areas that are more suitable for agricultural or urban development (Pegas & Castley 2016; De Vos & Cumming 2019). Private protected areas have been reported to protect species not recorded in state PAs (Shanee et al. 2017). Eighty percent \( (n = 12) \) discussing connectivity showed PPAs increase the contiguity and connectivity of PAs by being adjacent to other PAs (Rissman & Merenlender 2008) or by forming parts of wildlife corridors increasing connectivity between PAs of other governance types (De Vos & Cumming 2019).

The remaining 20% \( (n = 3) \) exclusively studied conservation easements in the United States and showed they add little to PA network connectivity because they are often small and do not border other PAs (Graves et al. 2019).

Overall, different countries had unique spatial configurations of PPAs that lead to varied conservation outcomes, potentially because in each country, PPAs establishment is shaped by different factors (Nolte 2018).

Few studies monitored or evaluated the ecological effectiveness of PPAs. Those that did defined effectiveness as the degree to which a PPA achieves a successful outcome for biodiversity conservation as defined by their own unique study criteria. Eighty percent \( (n = 5) \) of articles in which deforestation rates were analyzed showed that PPAs are more effective at reducing deforestation and degradation than PAs under other governance types (Schleicher et al. 2017; Nolte et al. 2019). Sixty-six percent of studies examining landcover change \( (n = 2) \) showed PPAs effectively reduced landcover.

| Study focus                  | No. of articles | Method                                                                 | Increase (+), decrease (-), or no discernible effect (∼) | Study                                                                 |
|------------------------------|-----------------|------------------------------------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------|
| Land restoration             | 8               | field surveys to determine reduction in pollutants, increases in ecosystem function | +                                                         | Benson et al. 2018; Burgi et al. 2011; Forshay et al. 2005; Bunnell-Young et al. 2017; Sonnier et al. 2018; Tang et al. 2016; Tapp et al. 2018 |
|                              |                 | spatial analysis of reforested area                                      | +                                                         | Zambrano et al. 2008                                                |
| Deforestation and degradation| 5               | biodiversity surveys                                                    | +                                                         | Turyahabwe & Tweheyo 2010                                           |
|                              |                 | matched similar areas under different PA governance types to determine deforestation rates | +                                                         | Scheicher et al. 2017; Vuohelainen et al. 2012; Song et al. 2014     |
|                              |                 | as above                                                                | ∼                                                         | Noone et al. 2012                                                  |
|                              |                 | matched similar areas under different PA governance types to determine land cover change | +                                                         | Braza 2017; Wu 2000                                                |
| Land-cover change            | 3               | spatial analysis                                                         | ∼                                                         | Gonzalez-Roglich et al. 2012                                       |
| (nonforests)                 |                 | modeled projection of development with or without PPAs                 | ∼                                                         | Byrd et al. 2009                                                   |
|                              |                 | analysis of degree of naturalness of protected land under different governance types | +                                                         | Smith et al. 2016                                                  |
|                              |                 | inside PPA and outside PPA comparison of road densities                 | ∼                                                         | Fouch et al. 2019                                                  |

Full references are available within the supplementary information.
Table 4. Assessment of the social outcomes of private protected areas (PPAs)∗.

| Study focus                        | No. of articles | Method                                    | Increase (+; decrease (−); and no discernible effect (∼)) | Assessment recipient | Study                                    |
|------------------------------------|-----------------|-------------------------------------------|-----------------------------------------------------------|----------------------|------------------------------------------|
| Financial                          | 36              | questionnaires and interviews              | + local community                                         | Hora 2017; Hora 2018; Zambrano et al. 2010; Sims-Castley et al. 2005; Langholz 1996 |
| Employment opportunities           | 12              | questionnaires and interviews              | + local community                                         | Serenari et al. 2017 |
|                                    |                 | case study                                 | + local community                                         | Louder & Bosak 2019  |
|                                    |                 | quasi-experimental design                  | - local community                                         | Dodds 2012           |
| Household income                   | 10              | questionnaires and interviews              | + local community                                         | Hora 2017; Sims-Castley et al. 2005 |
|                                    |                 | case study                                 | + PPA owners                                              | Maynard et al. 1998; Rissman & Sayre 2011 |
|                                    |                 | financial analysis                         | + PPA owners                                              | Ulisses Saraiva Farinha et al. 2019 |
|                                    |                 | Modeling                                   | - local community                                         | Sandker et al. 2011  |
|                                    |                 | quasi-experimental design                  | ∼ local community                                         | Sims et al. 2019     |
| Land or property value             | 12              | questionnaires and interviews              | + local community                                         | Hora 2018            |
|                                    |                 | modeling using secondary data              | + landowners of PPAs                                       | Ulisses Saraiva Farinha et al. 2019 |
|                                    |                 | financial analysis                         | + PPA owners                                              | Schilling et al. 2013 |
|                                    |                 |                                          | + land owners surrounding PPAs                             | Zhang et al. 2018; Reeves et al. 2018; Yoo & Ready 2016; Chamblee et al. 2012; Armsworth et al. 2006; Farja 2017 |
|                                    |                 |                                          | ∼ PPA owners                                              | Lawley et al. 2014; Anderson & Weinhold 2008 |
|                                    |                 |                                          | ∼ nonland owners (renters)                                 | Farja 2017           |
| Tax payments                       | 4               | financial analysis                         | + PPA owners                                              | Sandre-Drake 1999; Crompton 2009; Jurinski & Goveia 2000; Forshay et al. 2005 |
| Tax revenue                        | 4               | financial analysis                         | ∼ local government                                         | King & Anderson 2004 |
| Regional economy                   | 5               | interviews and questionnaires              | + local community                                         | Vercammen 2017; Crompton 2009; Anderson & King 2004 |
| Ability to access grants or funding| 1               | Interviews                                 | +/- local community                                        | Zambrano et al. 2010; Child et al. 2013; Sims-Castley et al. 2005; |
| Physical capital development in the| 5               | interviews and questionnaires              | + local community                                         | Hora 2017; Zambrano et al. 2017; |
| area (e.g., road improvements and building schools) |                | case study                                 | Hora 2018                                                  |
| Social capital                     | 12              |                                           |                                                           |

Continued
Table 4. (Continued).

| Study focus                                      | No. of articles | Method                        | Increase (+; decrease (-), and no discernible effect (∼)) | Assessment recipient | Study                                                                 |
|--------------------------------------------------|-----------------|-------------------------------|-----------------------------------------------------------|----------------------|----------------------------------------------------------------------|
| Strength community involvement, relations, and networking | 7               | interviews and questionnaires  | ∼                                                         | local community      | Hora 2018; Rissman & Sayre 2011; Horton et al. 2017                  |
|                                                  |                 | case study                    | +                                                         | PPA owners           | Rissman & Sayre 2011; Hora 2018; Horton et al. 2017                  |
|                                                  |                 | questionnaires                | +/−                                                       | Maciejewski et al. 2016; Selinske et al. 2015; Pasquini et al. 2010 |
|                                                  |                 | Interviews                    | +/∼                                                       | Harrington et al. 2006 |
| Strengthen or maintain cultural identify         | 3               | interviews and questionnaires  | +                                                         | local community      | Hora 2018                                                             |
|                                                  |                 |                               | −                                                         | PPA owners           | Louder & Bosak 2019                                                  |
|                                                  |                 |                               | +                                                         | local community      | Louder & Bosak 1988; Serenari et al. 2017                            |
| Strengthen power relations or ability to make decisions | 3               | Interviews                    | +/−                                                       | PPA owners           | Horton et al. 2017                                                   |
|                                                  |                 |                               | −                                                         | local community      | Serenari et al. 2017                                                 |
| Land-ownership equality                          | 3               | interviews                    | +/−                                                       | PPA owners           | Serenari et al. 2017                                                 |
| Human capital                                    | 5               | case study                    | −                                                         | local community      | Quintana & Morse 2007                                                |
| Improve environmental education                  | 4               | questionnaires and interviews  | ∼                                                         | local community      | Hora 2018                                                             |
| New skills (e.g., diving, tour guiding, baking, and cooking) | 3               | case study                    | +                                                         | local community      | Dodds 2012                                                           |
|                                                  |                 | Inteviews                     | +                                                         | local community      | Serenari et al. 2016; Serenari et al. 2017                          |
|                                                  |                 |                               | −                                                         | local community      | Serenari et al. 2017                                                 |
| Natural capital                                  | 9               |                               |                                                           | general public       | Crompton 2009; Owley 2015; Rissman & Merenlender 2008; Lieberknecht 2009 |
| Access to open space, cultural heritage, or recreation (cultural services) | 7               | interviews and questionnaires  | −                                                         | general public       | Crompton 2009; Owley 2015; Rissman & Merenlender 2008; Lieberknecht 2009 |
|                                                  |                 |                               | +                                                         | PPA visitors         | Clements and Cumming 2017; Langholz 1996                             |
| Regulating services (e.g., erosion control and surface water regulation) | 1               | modeling                      | +                                                         | PPA visitors         | Nahuelhual et al. 2013                                               |
| Access to forest resources (provisioning services) | 1               | Interviews                    | −                                                         | local community      | Villamagna et al. 2017; Serenari et al. 2017                         |

a We define local community as a group of individuals who live in the area immediately surrounding a PPA.
b Outcomes especially for women.
c Outcomes felt most by nonwealthy community members.
Full references are available within the supplementary information.
change in nonforest areas. All studies assessing ecological restoration \((n = 8)\) showed PPAs have positive outcomes for restoring degraded lands. Most of these studies focused on wetlands in the United States and showed PPAs can increase wetland functionality, reduce pollution, increase flora and fauna diversity, and contribute to recovery of species in greatest conservation need (Benson et al. 2018). Half the studies \((n = 2)\) that empirically assessed the impacts of PPAs on development prevention reported reductions in development and the other half reported no discernible changes.

The 95% \((n = 34)\) of articles examining species conservation showed PPAs achieve positive outcomes. Empirical exploration of PPAs’ ability to protect or increase specific species’ populations showed that PPAs can significantly increase numbers of wetland bird species compared with unprotected sites (Tapp et al. 2018) and that they may play a substantial role in the long-term conservation of large- and medium-sized mammals (Laurindo et al. 2017; Clements et al. 2019). Model-based studies to predict future PPA impacts suggested that they may contribute to the conservation of key species (Copeland et al. 2013). Only 1 study explored the spillage effects of PPAs (Wu 2000).

Social Outcomes of PPAs

Social outcomes of PAs take different forms, including economic, livelihood, and cultural outcomes (Oldekop et al. 2016). We found PPA outcomes echoed the common outcomes of other types of PAs; however, private entities may have different levels of accountability than nonprivate equivalents. Moreover, accountability across different PPA types (e.g., private landowner and NGO) may also vary widely.

We found studies on the social outcomes of PPAs focused predominantly on financial outcomes \((n = 35, 73\%)\). Eighty-two of studies \((n = 9)\) discussing employment reported PPAs increase employment opportunities for local communities, and Sims et al. (2019) suggest that PPAs may have greater positive impacts for employment than state PAs. However, only 29% of studies \((n = 2)\) commenting on household income reported that PPAs increase the household income of local communities, and Sims et al. (2019) found no difference in median household income between state and private PA governance types. Moreover, some studies reported that PPAs could increase inequalities in communities because poorer households, those less able to capitalize on tourism opportunities, or those living farther from reserve boundaries benefitted less than others from PPA establishment (Serenari et al. 2016; Hora 2017).

Eight studies (80%) quantifying changes in land value showed landowners benefit from increased land value after designating a PPA. However, Farja (2017) reported this can have detrimental effects for nonlandowners by facilitating a concentration of land ownership and exacerbating inequalities. Last, where PPAs were used in tourism, studies in Costa Rica, Nicaragua, Chile, and South Africa showed that PPAs can have a positive impact for regional economies. However, in the United States (where easements are not used in tourism and more likely to be family ranches), studies showed that PPAs reduce regional tax revenue (Crompton 2009).

The broader social costs and consequences of livelihood shifts linked to PPAs have not been systematically studied (Spierenburg & Brookes 2014). Trade-offs may exist between financial gains and social and cultural costs. Two studies reporting on cultural identity (66%) showed that local communities sense a loss of cultural identity and values and community cohesion. This may be because nonlocals move into the area and introduce new cultures and ideas, and as opportunities for greater financial income increase, it can generate competition within communities (Serenari et al. 2017; Büscher et al. 2018).

PPAs can redistribute political resources, particularly control over land. They have sometimes been perceived as land grabs, illegitimate and harmful land acquisitions by foreign and local elites with negative outcomes for local communities (e.g., Langholz et al. 2000; Serenari et al. 2017; Büscher et al. 2018). All the studies in our review commenting on landownership inequality \((n = 3)\) reported an increase in land ownership inequality and negative outcomes for nonwealthy community members in areas where PPAs were established. In contrast, 6 studies (80%) showed that individuals who own, create, and govern PPAs (e.g., through conservation easements) may obtain greater social benefits (e.g., building social networks) and political empowerment (e.g., being able to have greater influence over development decisions [Rissman & Sayre 2011]) and are able to maintain their cultural identity (Maynard et al. 1998).

Nine studies discussed PPA outcomes on natural capital. Villamagna et al. (2017) reviewed the distribution of ecosystem service benefits from PAs. They found that PAs offer benefits for all, but the benefits disproportionately benefit households with greater income and beneficiaries of ecosystem services from PPAs in particular have a significantly greater household income than all other beneficiaries of ecosystem services from other PA governance types. Crompton (2009) found that public benefits of conservation easements emerge serendipitously to the public and that most benefits accrue to landowners. These findings are important because enhancing the equity of benefit delivery from PPAs will build public and private support for them as a long-term conservation strategy and increase conservation efficacy. We found no empirical studies on the magnitude of impacts that PPAs have on sequestering carbon or improving water quality, although Kreuter et al. (2010) found private nature reserves exhibit some of the critical conditions for
the sustainability of common-pool resources. These studies are needed because PPA creation may be driven by REDD+ incentives that claim to provide ecosystem services, such as carbon sequestration (Schleicher 2018). Due to a bias in articles focusing on individual landowners (Table 1), 100% of studies investigating cultural services showed PPAs have negative impacts for local communities ($n = 5$) (e.g., access to open space and forest resources) (e.g., Serenari et al. 2017), but have positive impacts for paying PPA visitors (Clements & Cumming 2017). It is unclear the extent to which people had access to land before its establishment as a PPA because the land may have been privately owned with limited public access.

A small number of articles ($n = 7$) briefly mentioned PPA outcomes on physical and human capital. Some PPAs may encourage infrastructure developments for local communities (e.g., roads and building of schools) (Barany et al. 2010; Serenari et al. 2016), and PPAs involved in tourism may offer training or facilitate access to education for local staff (Hora 2017).

**Current Approaches to Determine PPA Outcomes**

Research approaches varied in the scale and rigor of analysis (Tables 3 and 4). Quasi-experimental designs to measure PPA effects on deforestation and forest degradation reflect broader trends in the use of such methods to assess outcomes of natural resource management and conservation interventions (Ferraro & Hanauer 2014). We are aware of only one study that applied these methods to assess PPA outcomes for land restoration (Sims et al. 2019). In assessments of PPA outcomes for species of conservation interest, researchers either modeled projected future outcomes (e.g., Copeland et al. 2013) or focused on individual case studies based on primary data (e.g., Negroes et al. 2011). Methods to assess the social outcomes of PPAs almost exclusively focused on semistructured interviews and mailed questionnaires. In most studies, a variety of stakeholders (e.g., government officials, PPA owners, and local communities) were interviewed and the number of respondents was large relative to the total population size. Only 3 (Langholz et al. 2000; Hora 2017; Serenari et al. 2017) out of 36 studies combined methods and data sources to triangulate results, raising questions about the strength of many conclusions regarding the social outcomes of PPAs. Only 1 study (Sims et al. 2019) used quasi-experimental techniques to assess the social outcomes of PPAs.

**Challenges to Assessing PPA Outcomes**

The global number of reported PPAs is believed to be a significant underestimation of total number in existence (Stolton et al. 2014; Bingham et al. 2017). Although we acknowledge some countries have good national-level spatial data for PPAs (e.g., South Africa [De Vos & Cumming 2019]), others do not (e.g., Canada [Stolton et al. 2014]) or data may not be publicly available (e.g., Australia [Stolton et al. 2014]). Moreover, the quality of spatial point and polygon data on the location of PPAs is highly variable, depending on the original data source (Milam et al. 2016). For example, there may be mismatches in the reported area and actual area of the PPA or PPA locations may be given as points (with a written area attached) that do not convey the actual shape of the PPA and the area it covers on the ground (Bingham et al. 2017). There are rarely data that would allow a detailed assessment on the contribution of PPAs to landscape-scale conservation, beyond presence or absence of a PPA, making any assessment of their additionality, complementarity, or connectivity a best guess. For example, in some areas, such as South Africa, PPAs are often fenced and thus impermeable to animal movements, limiting their effective contiguity, yet such data are rarely reported (Jakes et al. 2018). Quasi-experimental approaches are increasingly being used to address limitations of before and after and inside versus outside reserve comparison methods to determine PPA environmental and social outcomes (Schleicher 2018). Yet, these studies rely on good quality spatial data, which may be scarce for PPAs in some regions.

**Future Research Needs**

Our study offers a comprehensive review of PPA peer-reviewed literature, but this could be expanded by including non-English and NGO literature, which would help address regional biases and bias toward individual owners in our results. We found that there is a need to measure and report the diverse outcomes of PPAs, as well as examine the underlying factors that make PPAs effective, which is currently absent in the literature. These insights could help maximize potential PPA benefits and minimize negative outcomes. We propose an assessment framework that could be adopted to facilitate this process. The framework should include determining the extent to which PPAs achieve their desired environmental and social outcomes (e.g., extent to which landscape restored or poverty alleviated); how PPAs operate as institutions (e.g., who are PPA stakeholders, what are the distributions of power and agency between different stakeholders, and to whom are the stakeholders accountable); and how the positive outcomes of PPAs (if any) are shared among stakeholders and the local communities surroundings PPAs. We envisage this framework could be used by PPA owners to self-report and by academics and government bodies to objectively assess PPA outcomes. This will require strengthening data collection efforts on the distribution of PPAs and their environmental and social impacts (e.g., deforestation rates with PPAs
boundaries or changes in multidimensional poverty surrounding PPAs) to accompany the rise in quasi-experimental approaches, as well as qualitative research initiatives to assess more intangible social impacts of PPA interventions.

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Supporting Information

Additional information is available online in the Supporting Information section at the end of the online article. The authors are solely responsible for the content and functionality of these materials. Queries (other than absence of the material) should be directed to the corresponding author.

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