WANDERLEY JORGE DA SILVEIRA JUNIOR

ANÁLISE DOS CONFLITOS DA CONSERVAÇÃO EM ÁREAS PROTEGIDAS NO BRASIL

LAVRAS -MG
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Tese apresentada à Universidade Federal de Lavras, como parte das exigências do Programa de Pós-Graduação em Engenharia Florestal, área de concentração em Ciências Florestais, para obtenção do título de Doutor.

Orientador:

Dr. Marco Aurélio Leite Fontes

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“Gerir o meio ambiente é gerir conflitos de uso, não é uma imposição do homem em relação a natureza, mas são consensos que podem ser formados por diversos grupos sociais em relação à conservação” (Antonio Carlos Santana Diegues)

RESUMO GERAL

A criação e a gestão de Áreas Protegidas (AP) são as ferramentas utilizadas para a conservação da biodiversidade mais difundidas em todo mundo. Atualmente, seus objetivos são mais abrangentes e incluem a manutenção dos serviços ecossistêmicos e a análise sobre a cultura e os modos de vida das populações locais ou tradicionais. No entanto, esta estratégia gera conflitos, os quais surgem devido, entre outros fatores, à diversidade de atores envolvidos e suas diferentes demandas. As AP possuem distintos objetivos de manejo e níveis de restrição, portanto, consideramos fundamental para a gestão destas áreas, a compreensão sobre a dinâmica dos conflitos em cada categoria. Diante deste contexto, o objetivo desta tese foi analisar os Conflitos da Conservação (CC) em AP por meio de três pesquisas. A primeira consiste em um estudo de caso envolvendo AP estabelecidas pelo poder público do estado de Minas Gerais, onde buscou-se analisar se o nível de restritividade influencia na ocorrência e importância dos CC, e como suas causas estão relacionadas a estes. Além disso, foram analisadas quais estratégias são utilizadas na gestão dos CC. Para tal, foram enviados questionários semiestruturados aos gestores de 76 AP do estado, os quais foram utilizados na construção de uma Matriz de Hierarquização de Conflitos da Conservação (MHCC). Nossos resultados mostraram que a restritividade estabelecida nos objetivos dos grupos de AP não foi um fator que influenciou a ocorrência dos CC nas AP de Uso Sustentável e Proteção Integral, porém influenciou na importância dos CC. Além disso, constatamos que as causas dos principais conflitos variam de acordo com a restritividade, e que a principal estratégia apontada pelos gestores para o enfrentamento dos conflitos foi a educação ambiental. A segunda pesquisa teve como foco avaliar se a redelimitação de uma AP, realizada com a participação dos atores sociais envolvidos nos conflitos, pode contribuir para gestão dos CC de forma eficiente. Nesta pesquisa, foi realizado um estudo de caso em um Parque estadual de Minas Gerais, na qual também foi utilizada a MHCC, porém construída com a participação dos atores sociais envolvidos nos CC. Os resultados demonstraram que a redelimitação se constitui de estratégia eficiente, pois além de atenuar os CC, aumenta os limites da AP, fator que diminui os custos para regularização fundiária e ainda aproxima os moradores da AP, trazendo maior confiança para a relação entre o Parque e os moradores locais. A terceira pesquisa analisou se o instrumento de mercado denominado Pagamento por Serviços Ambientais (PSA), poderia amenizar os conflitos *Parks vs. People*. Para isso, foram examinados cinco estudos de caso no mundo, nos quais PSA foi utilizado para promover o desenvolvimento de comunidades inseridas no entorno ou no interior de AP. Os resultados mostraram que o PSA pode contribuir para a amenizar CC, embora não seja o seu objetivo principal. No entanto, as experiências diferiram entre os casos devido a atributos locais como: as condições ambientais, as atividades socioeconômicas e a capacidade de envolvimento da população e do governo local.

Palavras Chave: Conservação da natureza. Conflito Socioambiental. Gestão de Área Protegida.

GENERAL ABSTRACT

The creation and management of Protected Areas (PA) are the most widely used tools for the conservation of biodiversity worldwide. Currently, its objectives are more comprehensive and include maintaining ecosystem services and analyzing the culture and lifestyle of local or traditional populations. However, this strategy generates conflicts, which arise due, among other factors, to the diversity of actors involved and their different demands. The PAs have different management objectives and levels of restriction, therefore, we consider fundamental to the management of these areas, the understanding of the dynamics of conflicts in each group. Given this context, the objective of this thesis was to analyze the Conservation Conflicts (CC) in PA through three surveys. The first consists of a case study involving a PA established by the public authorities of the state of Minas Gerais, where it was sought to analyze whether the level of restrictiveness influences in the occurrence and the importance of the CC, and how their causes are related to them. In addition, we analyzed which strategies are used in the management of the CC. To this purpose, semi-structured questionnaires were sent to managers of 76 PAs in the state, which were used in the construction of a Conservation Conflict Hierarchization Matrix (CCHM). Our results showed that the restrictiveness established in the objectives of the PA categories was not a factor that influenced the occurrence of the CC in the PAs for Sustainable Use and Integral Protection, but it did influence in the importance of the CC. In addition, we found that the causes of the main conflicts vary according to the restrictiveness, and that the main strategy pointed out by the managers for confronting the conflicts was the environmental education. The second research focused on evaluating whether the redefinition of a PA, carried out with the participation of the social actors involved in the conflicts, can contribute to the management of the CC in an efficient manner. In this research, a case study was carried out in a State Park of Minas Gerais, in which the MHCC was also used, but built with the participation of the social actors involved in the CCs. The results showed that the redefinition constitutes an efficient strategy, because in addition to mitigating the CC, it increases the limits of the PA, a factor that reduces the costs for land tenure regularization, and besides that, links the residents of the PA closer together, bringing greater confidence to the relationship among the park and the locals. The third survey examined whether the market instrument called Payment for Environmental Services (PES) could alleviate Parks vs. People conflicts. For this, five case studies, in which PSA was used to promote the development of communities inserted in or around some AP in the world were examined. The results showed that PSA can contribute to soften the CC, although it is not its main objective. However, experiences differed between cases due to local attributes such as: environmental conditions, socioeconomic activities and the capacity for involvement of the population and the local government.

Keywords: Nature conservation. Socio-environmental conflicts. Protected Areas Management

Sumário

PRIMEIRA PARTE

1 INTRODUÇÃO

A estratégia de conservar a biodiversidade no lugar em que ela ocorre é denominada *in situ*, sendo a sua principal ferramenta o estabelecimento e gestão de Áreas Protegidas (AP), instituídas legalmente pelo poder público ou não, com o intuito de preservar áreas naturais com nenhuma ou com pouca alteração, sob a intenção de garantir a manutenção não apenas a biodiversidade, mas dos serviços ecossitêmicos e dos modos de vidas das populações tradicionais, além de promover o uso sustentável dos recursos naturais. No entanto, o estabelecimento e gestão de ANP não se resume a fazer a gestão da natureza dentro destes limites territoriais. O processo envolve diferentes atores sociais, que estão ligados direta ou indiretamente com as terras em questão, o que faz com que estes se relacionem de diferentes formas com o processo. As distintas maneiras como os sujeitos envolvidos neste processo percebem as ANP refletem diretamente na forma como farão o uso e gestão destes espaços, o que resulta invariavelmente em "conflitos socioambientais", como comumente são denominados os conflitos relacionados às questões ambientais. Contudo, como o intuito desta tese é pensar, discutir e propor estratégias para gestão de conflitos relacionados à conservação, e por acreditarmos que estes conflitos possuem características inerentes e específicas, além de um corpo teórico e metodológico que requerem muita atenção no momento, utilizaremos o termo "conflitos da conservação" (CC).

Os CC vêm sendo exaustivamente estudados em todo mundo por diferentes áreas do conhecimento, porém, o enfoque quase sempre recai sobre os conflitos em si, fazendo com que causas e origens sejam negligenciadas. Outro fator que marca estes conflitos, é que quase sempre, tanto na prática (no campo onde os conflitos ocorrem), quanto em âmbito acadêmico, estes ainda são compreendidos como ocorrências negativas que precisam ser exterminadas. As ciências sociais, em destaque a antropologia e a sociologia, são campos de estudo nos quais pesquisadores têm se esforçado com vigor na compreensão de conflitos como fenômenos inerentes à sociedade, reforçando a importância de seu carater político, sobretudo, devido às desigualdades sociais e jurídicas existentes entre os atores sociais envolvidos nestes processos. Não nego, nem ignoro a importância e o esforço destes estudos, ao contrário, por entender e acreditar na politização dos CC, busco, nesta tese, olhar com mais atenção para suas causas, compreendendo estes conflitos como inerentes e positivos para a conservação *in situ*, pois podem possibilitar a aproximação e a cooperação entre os atores sociais envolvidos nos CC da natureza. Assim, meu empenho foi identificar e criar instrumentos para que os gestores das AP possam fazer a gestão dos CC de forma mais pragmática, sem, no entanto, perder a compreensão

mais abrangente destes fenômenos sociais.

O programa de Pós-graduação em Engenharia Florestal do Departamento de Ciências Florestais (DCF) da Universidade Federal de Lavras (UFLA), ao longo do seus 24 anos, vêm realizando diversos estudos em AP, a saber: "Análise da composição florística das florestas nebulares do Parque Estadual do Ibitipoca, Minas Gerais" (FONTES, 1997); "Participação social no planejamento do uso público no parque estadual de Ibitipoca, Minas Gerais" (CARVALHO *et al* 2014); "Potencialidades ecoturísticas dos parques estaduais de Minas Gerais" (VIEIRA-JUNIOR *et al*., 2014); "Efetividade de Gestão do Parque Estadual do Ibitipoca, Minas Gerais" (JEANNOT *et al*., 2016); "*The Role and the Precariousness of Volunteer Work in Brazilian Protected Areas*" (SILVEIRA-JUNIOR *et al*., 2019); "Áreas Protegidas, pobreza e desigualdade social: avaliação utilizando indicadores socioeconômicos em Minas Gerais, Brasil" (SALVIO *et al*., 2016); "Desenvolvimento de indicadores de percepção ambiental como suporte à valoração do serviço de regulação do fluxo hidrológico prestado por Unidades de Conservação" (SILVA *et al*., 2020). As pesquisas aqui apresentadas, entre outras que foram desenvolvidas sobre AP, tiveram como objetivo contribuir para a conservação da natureza no Brasil, trazendo subsídios para gestores, chefes ou responsáveis pela gestão destas áreas.

Todavia, os conflitos estabelecidos nos processos de criação e gestão das AP ainda não haviam sido estudados, sendo o primeiro passo dado na realização da dissertação de mestrado, no ano de 2016, do autor desta tese e, publicada como artigo no ano de 2020 no periódico GEOUERJ, sob o título: "Conflitos entre usos e proteção de espécies vegetais nas Unidades de Conservação da Serra de São José, Minas Gerais". A referida pesquisa buscou, por meio de um levantamento etnobotânico, analisar o conhecimento tradicional de raizeiros e os conflitos que surgem entre o uso e a conservação de espécies vegetais. Nesta ocasião, foi possível verificar que as Unidades de Conservação (UC) de proteção integral, categorias de AP brasileiras, protegem não só a biodiversidade, mas também possibilitam a manutenção do conhecimento tradicional, pois ao se proteger espécies vegetais utilizadas pelas populações locais, vigora a possibilidade de seu extrativismo e uso de maneira mais sustentável, além da consequente manutenção de saberes e práticas sobre a manipulação consciente das mesmas. Identificamos ainda que os conflitos que surgem podem ser amenizados com o diálogo e arranjos que atendam às demandas das partes envolvidas. Para tanto, foi sugerida uma revisão das políticas públicas brasileiras destinadas à conservação. Concluiu-se que os conflitos da conservação podem contribuir com a gestão das AP brasileiras, especificamente nas Unidades de Conservação

(UC), onde os conflitos são mais evidentes, e porque a aproximação e o diálogo entre os envolvidos permitiriam enxergar pontos cegos na legislação.

A realização da referida pesquisa de mestrado permitiu verificar que além dos objetivos estabelecidos, o estudo de conflitos relacionados à conservação da natureza, especificamente aqueles envolvendo as UC brasileiras, não recebem a devida atenção, ou seja, configuram uma lacuna a ser preenchida. Verificou-se ainda a ausência de estudos que buscam identificar as causas dos conflitos relativos à conservação. Desta forma, o estudo mais aprofundado sobre os CC, suas causas, estratégias e ferramentas utilizadas como forma de enfrentamento aos conflitos utilizadas em outros países, nos permitiu identificar as principais características deste fenômeno social. Ainda, considerando que a gestão das UC no Brasil dispõe de limitados recursos financeiros e humanos para se investir na gestão de conflitos, verifica-se que os resultados alcançados consistem em importantes instrumentos a serem utilizados pelos gestores das UC brasileiras. Assim, estabelecemos algumas questões que nortearam esta tese e contribuíram para a sua realização: os objetivos das diferentes categorias de manejo influenciam para a existência de conflitos? É possível realizar estratégias de gestão de conflitos mais eficientes a partir do estabelecimento de um Matriz de Hierarquização de Conflitos da Conservação (MHCC) que considere a relação entre a ocorrência e importância dos conflitos com suas causas? É possível amenizar os conflitos que ocorrem em Áreas Protegidas utilizando instrumentos de mercado, como o Pagamento por Serviços Ambientais?

Para responder a estas questões, foram realizadas três pesquisas que compõem a segunda parte desta tese, que está organizada da seguinte forma: a primeira, resultou no artigo intitulado *"Conservation Conflicts and Their Causes in Protected Areas: a Case Study in Brazil"*. Neste estudo analisamos os padrões dos CC em UC com diferentes níveis de restrição, identificando suas causas e as principais estratégias para a resolução desses CC. Para tanto, construímos uma Matriz de Hierarquização de Conflitos da Conservação (MHCC) a partir de informações fornecidas por gestores de 76 UC de Minas gerais, das quais analisamos a ocorrência e importância de CC em UC de diferentes categorias de manejo, e, portanto, com diferentes níveis de restrição.

A segunda pesquisa deu origem ao artigo nomeado "Redelimitação participativa de Áreas Protegidas como estratégia na gestão de conflitos da conservação: um estudo de caso em um ecótono Floresta Atlântica-Cerrado. Nesta pesquisa, analisamos como a redelimitação de AP, quando construída de forma participativa, pode contribuir para a gestão de CC. Para tanto, construímos uma MHCC, como apresentada no capítulo 1, com a participação dos membros do

conselho gestor, na qual estão listados os principais conflitos e suas causas que ocorrem no Parque Estadual da Serra de Boa Esperança (PESBE) - Minas Gerais. Nesta pesquisa também recorremos ao uso de técnicas de sensoriamento remoto, que nos permitiu à avaliação detalhada do uso e cobertura do solo do PESBE e do seu entorno, servindo de base para a determinação dos novos limites do Parque e para a quantificação dos valores financeiros necessários para a indenização de pessoas desapropriadas durante o processo de regularização fundiária da UC.

A terceira pesquisa analisou se o instrumento de mercado Pagamento por serviços Ambientais (PSA) pode contribuir para amenizar os conflitos entre as pessoas e as Áreas Protegidas. O resultado da pesquisa foi publicado no volume 32, número 1, do periódico *Journal of Tropical Forest Science*, no ano de 2020, com o título "*Payment for Environmental Services: Alleviating the Conflict of Parks versus People"*. Nesta pesquisa, analisamos cinco estudos de caso em quatro continentes, nos quais o PSA foi utilizado como estratégia para envolver grupos humanos inseridos em Áreas Protegidas ou em seu entorno na conservação da natureza. Neste sentido, avaliamos quais fatores foram preponderantes para o sucesso ou fracasso das iniciativas, utilizando como referência os principais aspectos do PSA. Concluímos que, embora mitigar o conflito entre AP e pessoas não seja o principal objetivo das iniciativas de PSA, este instrumento vem produzindo bons resultados, sobretudo quando as iniciativas buscam a integração das populações envolvidas nos CC com as AP.

2 REFERENCIAL TEÓRICO

Existe um consenso entre pesquisadores de todo mundo de que o estabelecimento de Áreas Protegidas (AP) é a estratégia mais utilizada para a conservação da biodiversidade (MITTERMEIER *et al*., 2003; MYERS *et al*., 2006). Sabe-se que os benefícios também se aplicam aos serviços ecossistêmicos (ZENG *et al*., 2020); ao sequestro de carbono, à redução da fragmentação florestal (MA et al., 2020), e aos de demais impactos causados pelas atividades humanas (ANDERSON; MAMMIDES, 2019; WATSON *et al*., 2014). Nos aspectos socioeconômicos, propiciam a proteção dos meios de subsistência e a cultura das populações locais (NAUGHTON-TREVES; HOLLAND; BRANDON, 2005; STOLTON; DUDLEY, 2010); e influenciam positivamente na redução da pobreza, no aumento da renda familiar e na geração de emprego (MA *et al*., 2020).

Por outro lado, estudos apontam que os processos de criação e gestão de AP são os principais responsáveis pelos conflitos socioambientais denominados "*parks vs. people"*, pois impactam os meios de subsistência e as atividades socioeconômicas de populações locais (DE POURCQ *et al*., 2015; DE POURCQ *et al*., 2017; BROCKINGTON; SCHMIDT-SOLTAU, 2004; BROCKINGTON *et al*., 2006). Conflitos se constituem como um fenômeno global que afetam os países desenvolvidos e em desenvolvimento (SOLIKU; SCHRAML, 2018), entretanto, nos países em desenvolvimento, os principais fatores que geram conflitos são: a exclusão das populações locais dos seus territórios e a restrição das mesmas ao acesso aos recursos naturais (VEDELD *et al*., 2012; LELE *et al*., 2010), ou exclusão destas nos processos decisórios (D`POURC, 2015). Como consequência, estas podem reagir provocando represálias, incêndios (HAMILTON *et al*., 2000) ou outras ações que ameaçam os objetivos da conservação (ANDRADE; RHODES, 2012; BAUR, 2003; OGRA, 2009; ALLENDORF *et al*., 2006).

Os conflitos que ocorrem nos processo de estabelecimento e gestão das AP são denominados Conflitos da Conservação (CC) (YOUNG *et al*., 2010), e ocorrem quando os atores sociais percebem os prejuízos (*impairments*) ou impactos causados pelas ações de conservação, ou quando os agentes da conservação percebem os prejuízos causados pelos impactos das atividades de outros atores sociais (DE POURCQ *et al*., 2017; DE POURCQ *et al*., 2015). Estudos verificaram quatro características principais dos CC: i) se caracterizam por serem constantemente confundidos com impactos, quando na verdade, tem sua origem neles (YOUNG *et al*., 2010; DE POURCQ *et al*., 2017), ii) são inerentes ao processo de conservação (AYLING; KELLY, 1997); iii) não são estáticos, podem variar no tempo e espaço (YASMI;

SCHANZ; SALIM, 2006); iv) são propulsores de mudanças positivas, seja por meio da utilização de instrumentos financeiros, introduzidos pela economia neoliberal (SILVEIRA-JUNIOR *et al.*, 2020), seja pela possibilidade de diálogo e confiança que se estabelece a partir da evidência dos conflitos (YOUNG *et al*., 2010,YOUNG *et al*., 2016).

No Brasil, o estudo de Diegues (2011) sobre conflitos em Unidades de Conservação (UC), AP brasileiras que correspondem às categorias elencadas pela União Internacional para Conservação da Natureza (PELIZARO *et al*., 2015), apontou os seguintes conflitos: queimadas; problemas com animais domésticos; caça/pesca; desmatamento; vandalismo; disposição irregular de resíduos sólidos; problemas com fiscalização; pouca participação popular nas decisões; invasões e posseiros; uso de pesticida; mudança nos cursos dos rios; grilagem / expulsões; uso de transgênico; extração de areia e cascalho; e as seguintes causas: legislação restritiva; regularização fundiária; expansão urbana; industrialização; especulação imobiliária; turismo; agricultura; pecuária; mineração e garimpo.

Uma característica que marca os estudos sobre os CC é o seu enfoque quase sempre sobre os confrontos, em detrimento de suas causas, o que influencia na escolha sobre qual estratégia utilizar nos processos conflitantes (DE POURCQ *et al*., 2017). Duas estratégias se destacam no enfrentamento aos conflitos: gerenciamento e resolução. No primeiro caso, os esforços podem ocorrer antes, durante e após os conflitos, e se concentram em reduzir os impactos negativos, e na segunda, os esforços para acabar com os conflitos acontecem logo após a ocorrência dos mesmos (REDPATH *et al*., 2013).

Nas AP dos países em desenvolvimento, a educação ambiental foi identificada como principal ferramenta na gestão de CC, utilizada com o intuito de aproximar as partes envolvidas nos conflitos e criar confiança entre elas (SOLIKU; SCHRAML, 2018). Nestes processos de gestão de CC o estabelecimento da confiança é apontado como caminho para construção pacífica e participativa da co-gestão das AP (DAVENPORT *et al*., 2007; De POURCQ *et al*., 2015).

O uso de técnicas de sensoriamento remoto é um instrumento que pode contribuir para gestão de conflitos, pois permite uma análise detalhada do uso e cobertura do solo das AP, seu entorno e suas dinâmicas temporais (PAYÉS *et al*., 2013). A disponibilidade de imagens de satélite e *softwares* de geoprocessamento gratuitos torna o uso das ferramentas de sensoriamento remoto acessível para os gestores de AP de países desenvolvidos e em desenvolvimento (BAILEY *et al*., 2015).

Instrumentos de mercado também vêm sendo utilizados como estratégias para amenizar

conflitos *"parks versus people"* (MILLER *et al*., 2011), como eram classificados os CC estabelecidos entre a gestão das AP e as populações locais ou tradicionais (SCHMIDT-SOLTAU, 2004; WEST *et al*., 2006). Nesta seara, a efetivação de Pagamento por Serviços Ambientais (PSA) vem apresentando resultados promissores, capazes de amenizar conflitos entre as partes envolvidas (MILLER *et al*., 2011; SALAFSKY, 2011). De um lado, as AP conseguem alcançar seus objetivos conservacionistas, e do outro, as populações tradicionais e locais conseguem manter os seus meios de subsistência e seus modos de vida (ASQUITHA *et al*., 2008; NELSON *et al*. 2010; BAUR *et al*., 2012; LEEUW *et al*., 2014; TUANMU *et al*., 2016).

Os benefícios aos grupos sociais envolvidos no processo conservacionista podem ir além, e contribuir para reduzir a pobreza (CLEMENTS; MILNER-GULLAND, 2015). O PSA é uma transação voluntária entre um comprador de serviço ecossistêmico e seu provedor, e somente se concretiza quando o segundo garante sua prestação (WUNDER, 2008; 2015). Desta forma, para que os projetos de PSA sejam eficientes, alguns aspectos devem ser considerados, a saber: deve ser evitado o foco exagerado na eficiência econômica (PASCUAL *et al*., 2014), as características dos compradores e a fonte dos recursos utilizados na compra, pois é imprescindível que os contratos estabelecidos sejam cumpridos um vez que, caso contrário, pode haver desconfiança quanto aos fornecedores dos serviços e a consequente desmobilização durante o processo (ENGEL *et al*., 2008); os valores pagos e os custos de oportunidade devem ser suficientes para motivar a participação dos provedores de serviços ecossitêmicos e a valorização do conhecimento das comunidades envolvidas sobre o serviço ecossistêmico prestado (CHAN *et al*., 2017).

3 CONSIDERAÇÕES GERAIS

A realização desta tese permitiu confirmar que os Conflitos da Conservação (CC) em Áreas Protegidas (AP) são inerentes a esta estratégia de conservação *in situ*, independente dos seus objetivos de manejo. Assim, tanto as categorias de Uso Sustentável, na qual também se incluem as reservas particulares, quanto as de Proteção Integral, precisam fazer a gestão de seus conflitos. Os resultados apresentaram instrumentos que podem contribuir para tal. A Matriz de Hierarquização de Conflitos da Conservação (MHCC), desenvolvida e aplicada nos dois estudos de caso, permite identificar as causas dos conflitos e o valor de importância que os atores sociais envolvidos percebem, bem como as estratégias de gestão que devem ser utilizadas para administrar os conflitos.

Mas sobretudo, esta tese demosntra a importância dos processo democráticos para a conservação da natureza, na qual a participação social no conselho gestor é fundamental, afinal, como diria o Professor Diegues, "gerir o meio ambiente é gerir conflitos de uso, não é uma imposição do homem em relação a natureza, mas são consensos que podem ser formados por diversos grupos sociais em relação à conservação".

Essa tese, demonstrou a importância da participação dos gestores das AP nas pesquisas realizadas, não só como entrevistados ou informantes, o que também foi fundamental para o desenvolvimento desta, mas também como pesquisadores, como aconteceu no estudo de caso realizado no Parque Estadual da Serra de Boa Esperança. A atuação do gestor foi fundamental, pois o seu conhecimento sobre as específicidades e dinâmicas locais, favoreceu a utilização da matriz de hierarquização de conflitos, e consequentemente todo processo de modificação dos limites do parque.

Ainda que os conflitos configuram-se como campos de lutas, na qual grupos sociais são motivados pelas suas formas de apropriação e significação do mundo material, esta tese também permitiu a confirmação do conflito como um processo positivo, ao contrário de ser comumente percebido como negativo, e portanto, precisa ser eliminado. Acreditamos que a estratégia de evidenciar os conflitos e seus fatores causais, possibilita alcançar mudanças positivas a partir do diálogo e da aproximação das partes envolvidas, como amenizar os conflitos causados pela regularização fundiária, um dos principais gargalos das AP no Brasil.

Ao desenvolver esta tese encontrou-se um resultado que merece atenção em pesquisas futuras, pois configura-se como uma lacuna em estudos sobre CC em AP, e diz respeito ao fato da educação ambiental ser eleita pelos gestores como a principal estratégia para gerir os conflitos das AP de Minas Gerais. Baseado no fato que existem mútiplas formas de se realizar

educação ambiental, as quais são guiadas por diferentes correntes epistemológicas que determinam como as ações, projetos e programas serão desenvolvidos e quais práticas e atividades serão realizadas, verificar como a educação ambiental é utilizada pelos gestores das AP na gestão de conflitos da conservação é uma lacuna que precisa ser preenchida. Os resultados poderão contribuir para maior compreensão sobre a educação ambiental em AP como campo de estudo, mas podem ir além das lacunas acadêmicas, mostrando aos gestores das AP e demais envolvidos em CC possíveis caminhos da educação ambiental na prática.

E por fim, espera-se que as pesquisas que compõem esta tese possam contribuir enriquecendo a área de estudos sobre CC em AP fornecendo subsídios para futuras pesquisas sobre o tema e para gestão de AP no Brasil e no mundo.

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SEGUNDA PARTE-ARTIGOS

ARTIGO 1- Conservation Conflicts and Their Causes in Protected Areas: a Case Study in Brazil

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Abstract

The restriction of access to natural resources by human populations as a result of the creation and management of protected areas (PAs) can spark conservation conflicts (CCs) and undermine PA objectives. PAs have different management objectives and levels of restrictions; therefore, understanding the causes, occurrence, and importance of CCs in different groups of PAs is essential for conflict management. Here, we built a conservation conflict hierarchical matrix (CCHM) using the information provided by the managers of 76 PAs in Brazil. We found that PA restrictiveness influenced the importance of CCs but not CC occurrence in sustainable use and full protection PAs. We also found that the causes of the main conflicts depend on PA restrictiveness and that managers refer to environmental education as the main strategy to mitigate the conflicts. We concluded that different levels of restriction in PAs promote different patterns of CCs and their respective causes. Finally, given the different contexts and CCs experienced in different PAs, our results suggest that a collaborative approach between stakeholders using the CCHM approach can be beneficial to the management of local conservation conflicts.

Key-words Nature conservation. Conflict management. Conflict matrix. Social participation. South america. Brazil.

Introduction

Protected areas (PAs) integrate a strategy for the conservation of biodiversity (Mittermeier et al. 2003) and maintenance of ecosystem services (Dudley and Stolton 2010; Zeng et al. 2020). These areas play an essential role in mitigating human impacts on natural remnants all over the world (Anderson and Mammides 2020), especially in regions with rising population density (Ellis and Ramankutty 2008). PAs also protect cultural and spiritual values and socioeconomic aspects of local populations (Jenkins and Joppa 2009; Dudley and Stolton 2010).

Despite the breadth of PA objectives, the results of their establishment are not always positive: for example, when PAs are created but lack human resources, financial resources, and sufficient infrastructure for their management – "Parks of Paper" (Di Minin and Toivonen 2015; Pieraccini et al. 2016) – and when they disregard the existence of local and traditional populations and their lifestyles (Diegues and Arruda 2001; Anaya and Espirito-Santo 2018). Although conservation conflicts (CCs) are a global phenomenon, they predominate in developing countries (Soliku and Schraml, 2018). CCs often emerge when local populations are expelled from their territories to give way to the creation of PAs that do not admit local residents ("Fortress Conservation", Brockington 2002), which in many cases results in the phenomenon of "*conservation refugees*" (Dowie 2011). CCs also emerge when these residents remain in or around the PA and are prevented to access their means of subsistence (Diegues and Arruda 2001; Lele et al. 2010; Vedeld et al. 2012) or when they are denied the right to participate in PA management (De Pourcq et al. 2015). As a response, these populations may retaliate and cause negative impacts to PAs (Hamilton et al. 2000; Bauer 2003; Ogra 2009; Allendorf, et al. 2006), enhancing the conflicts and threatening the conservation objectives of these areas (Andrade and Rhodes 2012).

There is a vast literature on CCs and their management (Young et al. 2010; 2016;

Redpath et al. 2013; 2015; Baynham-Herd et al. 2018; Rechciński, et al. 2019; Cusack et al. 2021). However, few studies have evaluated CCs and their determining causes (Marfo and Schanz 2009; De Pourcq et al. 2017). CCs are often confounded with the impacts themselves when, in reality, they originate from these impacts (Young et al. 2010). These conflicts emerge when social actors perceive losses (impairments) resulting from the impacts of the actions of other social actors (De Pourcq et al. 2017). CCs also bear three distinctive characteristics: (i) cannot be solved by a definitive solution, (ii) occur in different levels in all PAs (Ayling and Kelly 1997), and (iii) can vary over space and time (Yasmi et al. 2006).

Considering the characteristics inherent to CCs, some strategies towards their mitigation include conflict resolution (whereby efforts aim to end conflicts after their onset) and conflict management (whereby strategies are devised before, during and after conflict onset, aiming to reduce their negative impacts) (Redpath et al. 2013; Soliku and Schraml, 2018). Studies suggest that the social participation in CC management actions of stakeholders involved in conflicts improve the relationships between them (Young et al. 2010).

The direct participation of local populations in the co-management of PAs also shows positive results in conflict mitigation (Fedreheim and Blanco 2017). This approach favors the establishment of trust and transparency between the involved parties, which is key for conflict management in PAs (Hovik and Hongslo 2017). For this, these populations need to be effectively included and provided with all necessary conditions for their participation (D Pourcq et al. 2015). Participation goes beyond sharing the responsibility for PAs with local administrations. For instance, in many cases, management by local or traditional communities achieve equal or better results than management by the public power in terms of the maintenance of vegetation cover (Porter-Bolland et al. 2012; Vergara-Asenjo and Potvin 2014).

Local populations can also be encouraged to participate in PA management through financial instruments that focus on local economic development (Salafsky 2011). For example,

Payment for Environmental Services (PES) can be an effective strategy to alleviate conservation conflicts. To this end, local knowledge should be included in biodiversity and ecosystem services management initiatives (Chan et al. 2017; Silveira-Junior et al. 2020).

Brazil is among the most biodiverse countries on the planet, hosting important natural areas for the maintenance of ecosystem services, such as global climate regulation and maintenance of the hydrological cycle (Strassburg et al. 2017; Strand et al. 2018). Brazil is also home to vast cultural diversity (Diegues and Arruda, 2001). However, current changes in the Brazilian environmental legislation have weakened the protection of natural areas (Alarcon et al. 2015; Fearnside 2016; Vieira et al. 2018) and directly contributed to rising deforestation rates and wildfires (Strassburg et al. 2017; Brando et al. 2020; Barlow et al. 2020; Schmidt et al. 2020), all of which mainly affect PAs (Fidelis et al. 2018).

Considering the need to expand conservation conflict (CC) management tools in protected areas (PAs), here we aim to analyze the CCs in PAs of different management categories in the state of Minas Gerais, Brazil. For this, we develop a conservation conflict hierarchical matrix (CCHM) based on the information provided by PA managers seeking to answer the following questions: i) How does CC occurrence vary according to the management objectives of each group, and what factors influence CC occurrence? ii) What is the importance of each CC in the total pool of PAs, in different PA management categories, and what factors are related to CC importance? iii) What are the main causes of CCs in general and in the different management categories, and how are they related to conflicts? and iv) What are the main strategies used and suggested by PA managers to alleviate conflicts and how can they contribute to the management of CCs?

Material and methods

Study area

The state of Minas Gerais (southeastern Brazil), with a land area of 586,513.993 km²

(IBGE 2020), contains great biological diversity and different ecosystem types. The state is covered by three biogeographic regions with different territorial extensions: Cerrado (predominance of savannas) with 57% of the land cover, Atlantic Forest (predominance of forests) with 41%, and Caatinga (predominance of forests) with 2% (Terra et al. 2017). Both the Cerrado and the Atlantic Forest are global biodiversity hotspots (Myers et al., 2000) (Figure 1). The state of Minas Gerais has a diversified economy, but its exports are concentrated in primary products, mainly iron ore (43.15%), coffee (11.29%), ferroalloys (5.86%), and gold (5.15 %) (BCB 2013). With the third-largest cattle herd in Brazil, Minas Gerais has 22 million head of cattle and is the country's largest producer of milk, holding 27% of the national production. Minas Gerais is also the largest coffee producer in Brazil, concentrating 61.2% of the national production (BCB 2013; IBGE 2018).

Data collection

First, we requested authorization for data collection from the governmental institution responsible for the management of public PAs in the state of Minas Gerais (*Instituto Estadual de Florestas do Estado de Minas Gerais* - IEF). Then, we sent out a structured questionnaire with questions involving CCs (S1) to managers of public PAs and Private Natural Heritage Reserves (PNHRs, which are owner-managed PAs) in the state of Minas Gerais. From 130 PA managers to which we sent the questionnaires, 76 replied, providing information that covered an area of 1,462,438.42 km². From this pool, 35 PAs are in the full protection (FP) group (where only indirect use of natural resources is allowed), 7 PAs are in the sustainable use (SU) group (where the sustainable use of natural resources is allowed) (Brasil, 2000), and 34 PAs are private natural heritage reserves (PNHRs or "private reserves", hereafter; Figure 1; Table S3). Only 29 PAs among the 76 assessed (38.17%) had a management plan when the managers answered the questionnaire.

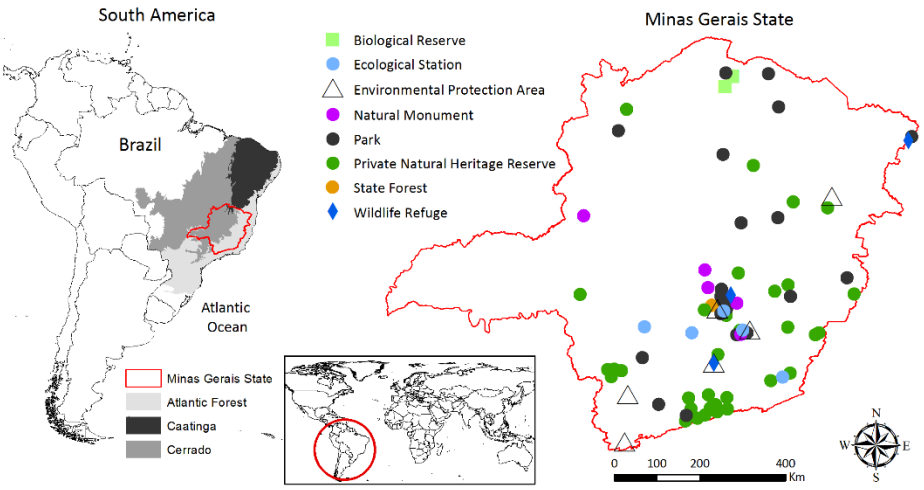

Figure 1. Location of the study area, the state of Minas Gerais, in South America and Brazil, and location of the protected areas assessed in the state of Minas Gerais.

Next, with the answers to the questionnaire, we built a conservation conflict hierarchical matrix (CCHM). For this, we offered to each respondent a table containing 17 CCs extracted from Diegues et al. (2011): “burnings”; “presence, breeding or abandonment of domestic animals”; “hunting/fishing”; “deforestation”; “vandalism”; “improper disposal of solid waste”; “problems with enforcement”; “little popular participation in decision-making; “invasions and squatters”; “pesticide use”; “change in river courses”; “land grabbing/expulsions”; “use of transgenics”; “extraction of sand and gravel”; “wastewater emission”; “public supply”; and “energy generation”. Respondents were asked to rank the CCs in order of importance from 1 to 17 (different CCs could occupy the same hierarchical position in the rank order). The importance of each CC was scored according to its position in the rank: the most important CCs received a higher score and the less important CCs, a lower score.

We also asked the managers to list the causes of each CC drawing from a list of 12 causes extracted from Diegues et al. (2011). These 12 causes were classified according to

Rechciński et al. (2019), as follows: institutional ("restrictive legislation" and "land tenure regularization"); economic ("urban expansion", "industrialization", "real estate speculation", "tourism", "agriculture"; "livestock", "mining" and "illegal mining"); and sociocultural ("cultural manifestations and traditions", "disinterest of the population"). Managers were allowed to add other causes to the list and their respective conflicts. We then assigned the scores of each CC to its respective causes, which led us to a value of importance for each cause. Therefore, the importance of each cause was the sum of scores of each CC associated with it.

The PAs that we evaluated belong to eight different categories according to the Brazilian legislation (Law 9,985 / 2000 - National System of Nature Conservation Units – SNUC), mainly distinguished from one another by the degree of restrictiveness (Brasil 2000) (Table 1). We highlight that the PA category environmental protection area (EPA; sustainable use) may overlap with PAs of the full protection and sustainable use categories. We analyzed private reserves (PNHRs) separately because their management objectives may vary broadly depending on the holder's intention. For instance, some private reserves allow activities related to scientific research, recreation, education, and tourism, while others forbid any kind of public use.

Table 1: Number of protected areas (PAs) assessed in the state of Minas Gerais (Brazil) and their categories and management regimes (restrictiveness) according to the Brazilian National System of Nature Conservation Units (SNUC) (Brasil 2000) and the International Union for Conservation of Nature (IUCN) (Pellizzaro et al. 2015).

SNUC Groups	SNUC - Categories	Management Regimes	IUCN-Categories	Total of PAs
Sustainable Use	Environmental Protection Area	Extensive areas consisting of public and private lands aiming to protect biological diversity and regulate human occupation and sustainable use of natural resources.	V	6
	State Forest	Conserving and promoting the sustainable use of forest resources and scientific research. Traditional populations are allowed to remain.	VI	1

	Private Natural Heritage Reserve	Private area aiming to conserve biological diversity. With the consent of the owner, scientific research, tourism, recreational and educational visits are allowed.	VI	34
Full Protection	Ecological Station	Nature preservation and scientific research. Visitation is allowed for educational purposes only.	Ia	5
	Natural Monument	Preservation of rare scenic beauty with visitations allowed. May consist of private areas, as long as they are compatible with the objectives of the PA.	III	5
	Parks	Preservation of natural ecosystems and scenic beauty sites. Allows recreational, educational, environmental interpretation, and scientific research activities.	II	20
	Biological Reserve	Preservation of biological diversity. Allows visitation for educational purposes and recovery of altered ecosystems.	Ia	2
	Wildlife Refuge	Protection of natural environments to ensure suitable conditions for the maintenance or reproduction of flora and fauna species or communities. Residents are allowed to remain and to visit.	II	3

Analysis

First, we evaluated the relevance of CCs in each group of conservation units (full protection, sustainable use, and private reserves) by calculating the ratio between the number of CCs observed and the total number of CCs proposed to the managers in the questionnaire (17 CCs; Table S2). For this, we used generalized linear models (GLMs) with relevance as a response variable and restrictiveness category as a discrete explanatory variable. We used *Lsmeans* for pairwise comparisons at a 5% significance level (Length 2018). We used *Gaussian* residuals distribution with *identity* link function, ensuring homoscedasticity, normality of residuals, and absence of spatial dependence.

To assess how CC occurrence varied among the general pool of protected areas (PAs), we divided the PAs into five classes of CC importance: 0 to 20%, very weak; 20.1 to 40% weak; 40.1 to 60% medium; 60.1 to 80% strong; and 80.1 to 100% very strong. Then, we calculated the importance of each CC separately for each PA category, as follows: for each PA, we divided the importance score of each CC by the maximum possible score of 17 (simulating a scenario

where the given conflict is ranked as the most important); then, we summed the relative importance of each CC in each of the PA categories (35 full protection, 34 private reserves, and 7 sustainable use). For example, the scores of the hunting/fishing conflict in the 35 full protection PAs added up to a total of 310. Divided by the maximum possible value of 595 (= 35 PAs x maximum score of 17), hunting/fishing had 52.1% of importance in full protection PAs. The same logic was applied to calculate the relative importance of CCs considering the entire pool of PAs. We chose this approach because the importance of a given conflict in a given PA is relative to the other conflicts that occur in the same area.

We also scored the importance of the causes of CCs as reported by the PA managers. This was done by assigning to each cause the values attributed to the conflicts related to it (hereinafter, "importance value"). This importance value for each cause of conflict was calculated both in the general approach (for the total pool of PAs) and separately by PA category. For the general approach, the average importance value of a given cause was calculated as the sum of all conflicts related to it divided by the total number of PAs. For the PA groups approach, the average importance value of a given cause was calculated as the sum of CCs related to it in a given group (full protection, sustainable use, or private reserve) and then, divided by the number of PAs in that group. We stress that, because the same cause could be associated with various conflicts, its score could exceed 17 (which is the total number of conflicts). The causes were also organized according to their origin: institutional ("restrictive legislation"; "land tenure regularization"), economic ("urban expansion", "industrialization", "real estate speculation", "tourism", "agriculture", "livestock", "mining" and "illegal mining"), and sociocultural ("cultural manifestations and traditions" and "disinterest of the population"). Finally, we compared the strategies suggested by the PA managers for mitigating socioenvironmental conflicts by quantifying the proportion of mentions received by each strategy.

Finally, we analyzed three factors that potentially contribute to conflict occurrence and conflict importance as attributed by the PA managers: (i) population density of the municipalities that comprise the PAs, (ii) land extension of the PAs (Table S3), and (iii) PA management objectives (Table 1).

Results

The occurrence of conservation conflicts (CCs) varied among the protected areas (PAs), ranging from 0 to 16, out of the 17 proposed CCs (0 to 94.1% of the total). In most PAs assessed, CC occurrence was either strong (~ 39% of the PAs) or very weak (~ 22% of PAs) (Figure 2 - A). The importance values of CCs varied significantly depending on PA group ($p < 0.001$ between categories; AICc = 702 and $p < 0.01$ compared to the chi-square test null model): 60.5% of CC importance value in full protection PAs, 68.9% in sustainable use PAs and 32.2% in private reserves (PNHRs) (Figure 2 - B). Considering the entire pool of PAs, the importance of CCs ranged from 0.3% to 57.4%. The five most important CCs in this approach were: “burning”, “presence, breeding or abandonment of domestic animals”, “hunting/fishing”, “deforestation” and “vandalism” (Table 2). The importance of these CCs varied among the three PA categories: it was overall higher in full protection and sustainable use PAs and lower in private reserves (Table 2). The position of these five CCs varied in the importance rank depending on PA group. For example, while “burning” ranked as the most important CC in full protection PAs and private reserves, it ranked as second in sustainable use PAs, where vandalism ranked as the top conflict (Table 2).

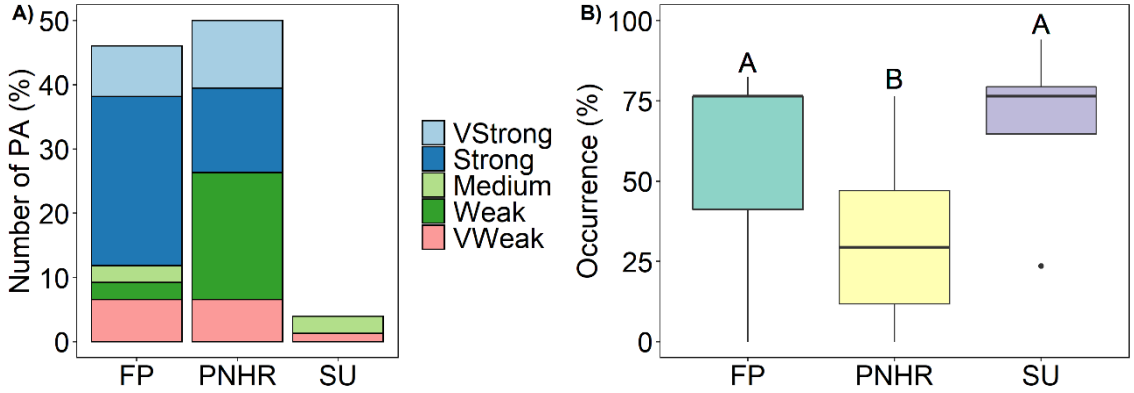

Figure 2. (A) Distribution of the number of different protected area (PA) categories in the state of Minas Gerais (Brazil) in classes of conservation conflict (CC) importance; and (B) Boxplots of CC importance values (%) in the three PA management categories. **Note:** In figure A, the importance classes were determined as follows: very weak (VWeak; 0% to 20%), weak (20.1% to 40%), medium (40.1% to 60%), strong (60.1% to 80%) and very strong (VStrong; 80.1% to 100%). FP: full protection; PNHRs: private natural heritage reserves (or private reserves); and SU: sustainable use.

Table 2. Importance values of the conservation conflicts (%) in general ("Total") and in three protected area categories: full protection (FP); private natural heritage reserve (PNHR or private reserves); sustainable use (SU).

Conservation Conflicts	FP	PNHR	SU	Total
Burnings	63.2	50	64.7	57.4
Presence, breeding, or abandonment of domestic animals	62.9	41.7	58.8	53
Hunting/fishing	52.1	47.2	58	50.5
Deforestation	54.6	36.3	51.3	46.1
Vandalism	56.5	29.2	70.6	45.6
Improper disposal of solid waste	48.7	24.7	42.9	37.5
Problems with enforcement	45.7	28	38.7	37.2
Little popular participation in decision-making	48.6	20.9	37.8	35.2
Invasions and squatters	42.4	24.9	31.9	33.6
Pesticide use	29.7	28.2	49.6	30.9
Change in river courses	24.5	14.5	39.5	21.4
Land grabbing/expulsions	21.3	19.2	16	19.9
Use of transgenics	10.8	13.8	41.2	14.9
Extraction of sand and gravel	2.9	0	12.6	2.5
Wastewater emission	2.5	0	12.6	2.3
Public supply	0	0	9.2	0.9
Energy generation	0	0	3.4	0.3

In total, the main causes of CCs according to PA managers were "land tenure

regularization", "agriculture", "livestock", "urban expansion", and "real estate speculation". These causes presented the highest average importance values when the entire pool of PAs was considered (not discriminated by group). They were also the most important causes in each group assessed, but with varying positions in the importance rank and varying coexisting causes (Table 3). "Land tenure regularization" (an institutional cause) was, in general, the most important cause of CCs in the full protection group, but did not feature among the top five causes in private reserves and sustainable use PAs. The main causes of CCs in private reserves were "agriculture", "livestock" and "urban expansion", all related to socioeconomic activities; "lack of institutional support" and "illegal mining" were also important. The main causes of CCs in sustainable use PAs were, in decreasing order of importance: "urban expansion", "agriculture", "livestock", "real estate speculation", and "restrictive legislation" (Table 3).

Some causes were often more important in the full protection (FP) and sustainable use (SU) categories than in private reserves, indicating that they were related to a higher number of conflicts with higher importance scores in these categories (FP and SU) than those observed in private reserves (Table 3). The most important causes (in each of the three PA categories and also considering the entire pool) were generally of economic origin and less frequently of institutional origin (Figure 3). Aligned with our results presented in Table 3, we found that the importance of the origins of the conflict causes was generally higher in full protection and sustainable use PAs than in private reserves (Figure 3).

Table 3. Average importance values of the causes of conservation conflicts (CCs) in different protected area (PA) categories in Minas Gerais state (Brazil). These values were obtained from the importance scores of the conflicts associated with them. Because the maximum score allowed to each CC was 17, causes with values higher than 17 are necessarily associated with more than one conflict. **Note**: FP: full protection; PNHR: private natural heritage reserve or

private reserve; SU: sustainable use.

Causes of Conservation Conflicts	FP	PNHR	SU	Total
Land tenure regularization (*Institutional*)	26.3	0.9	13.6	13.7
Agriculture (*economic*)	14.3	8.0	17.1	11.7
Livestock (*economic)*	16.2	6.0	16.3	11.6
Urban expansion (*economic*)	15.3	4.9	25.6	11.6
Real estate speculation (*economic*)	13.6	3.4	14.3	9.1
Restrictive legislation (*Institutional*)	9.9	1.6	14.0	6.6
Tourism (*economic*)	11.7	1.7	2.6	6.4
Illegal mining (*economic*)	3.4	3.0	4.0	3.3
Mining (*economic*)	4.3	1.0	3.6	2.8
Industrialization (*economic*)	3.0	0.0	3.3	1.7
Lack of institutional support (*Institutional*)	0.0	3.0	0.0	1.3
Lack of infrastructure (*Institutional*)	1.3	0.0	0.0	0.6
Fishing (*economic*)	0.0	1.1	0.0	0.5
Legislation without regulation (*Institutional*)	0.5	0.0	0.0	0.2
Cultural manifestations and traditions (*sociocultural*)	0.0	0.5	0.0	0.2
Disinterest of the population (*sociocultural*)	0.4	0.0	0.0	0.2

Our results showed that the eight main causes of the five main conflicts in the entire pool of PAs were related to the following economic activities: “real estate speculation”, “agriculture”, “urban expansion” and “livestock”. In sustainable use PAs, the main conflict (“burning”) was mostly associated with “real estate speculation” (Figure 3). These five causes (along with the institutional cause “restrictive legislation”) were also the most associated with the second most important conflict in sustainable use PAs, “deforestation”. “Urban expansion” was the main cause associated with the conflict “presence, breeding or abandonment of domestic animals” in the three categories. “Urban expansion”, “tourism” and “real estate speculation” were the most important causes for the “vandalism” conflict, also in the three categories. Importantly, “urban expansion” was the only cause that influenced the five main CCs in the three categories.

“Fishing” was also identified as a cause of CCs according to PA managers. It was associated, although with low importance, with the conflicts “burning”, “vandalism”, “presence, breeding or abandonment of domestic animals” and “improper disposal of solid

waste". However, when grouped with hunting and regarded as a conservation conflict rather than a cause, "fishing/hunting" was strongly associated with the causes "agriculture" (in full protection PAs) and "tourism" (in private reserves). Although generally less associated with the five main conflicts than socioeconomic causes, institutional causes were associated with the conflicts "burning", "vandalism" and "presence, breeding or abandonment of domestic animals". Finally, according to PA managers, "land tenure regularization" was the most important general cause of conflicts when the entire pool of PAs was considered. In full protection PAs, it was associated with the five most frequent conflicts and in sustainable use PAs, with "burning", "vandalism" and "deforestation/plant extraction".

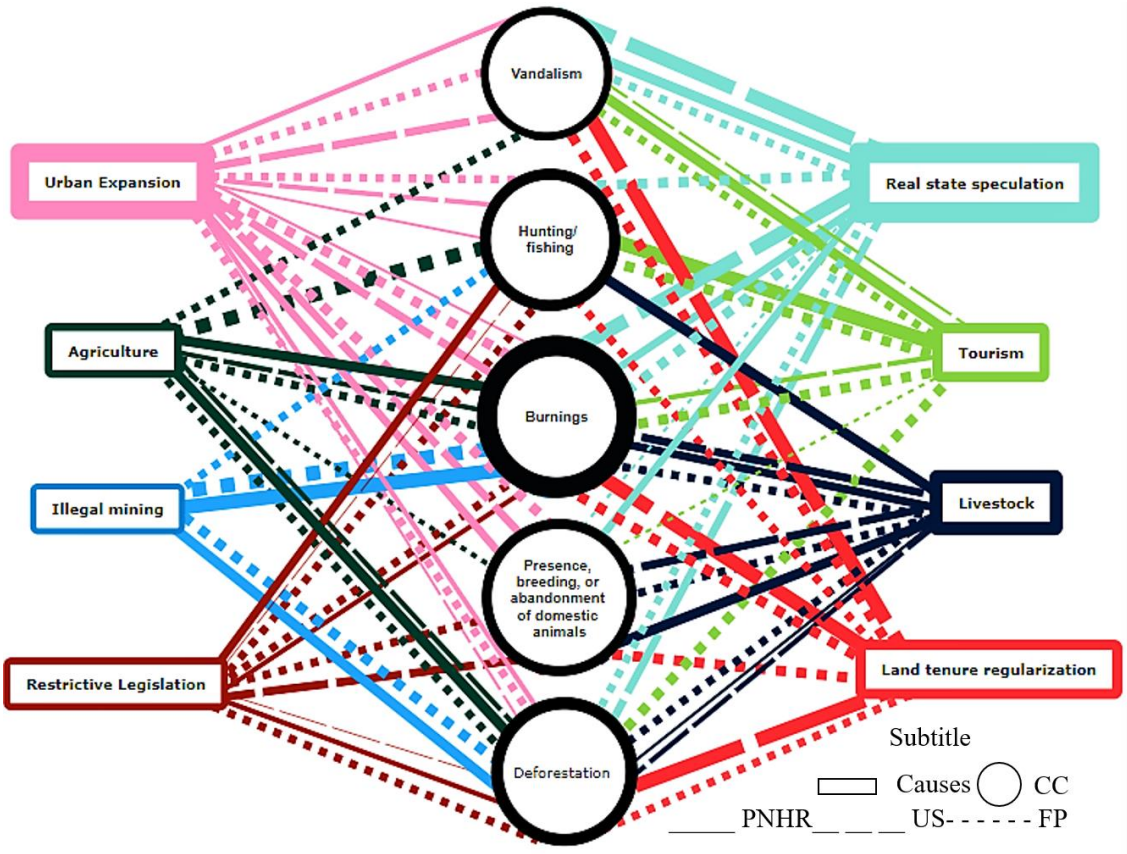

Figure 3: Relationships between the five most important conservation conflicts (CCs; in the circles) and their main eight causes (economic and institutional origins; in the rectangles) in protected areas of sustainable use, full protection, and private reserves in Minas Gerais state, Brazil. Contour-line thickness is proportional to the strength of the relationships between CCs

and causes.

The PA managers cited 11 strategies to mitigate CCs and their causes. “Environmental education” was cited in over half of the suggestions, followed by “monitoring and enforcement” (~ 11% of suggestions) and “fire prevention plans” (~ 6 % of citations). Other strategies appeared in less than 5.6% of the suggestions (Figure 4).

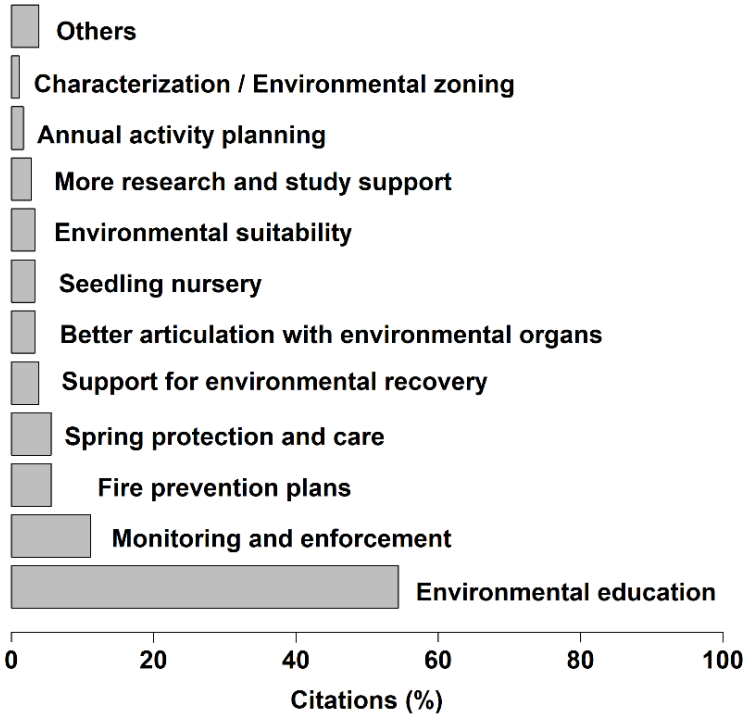

Figure 4. Proportion of times a strategy was mentioned by managers as a potential solution to socio-environmental conflicts in protected areas of Minas Gerais state, Brazil.

Discussion

Our results revealed (i) the vision of protected area (PA) managers on conservation conflicts (CCs), (ii) the importance rank of CCs in different categories of PAs, and (iii) what causes are related to CCs. To assess the factors that influenced our results, we considered human population density, territorial extension, and management objectives of the PA categories. High population density likely implies a high number of impacts on natural areas (Ellis and

Ramankutty 2008). Although impacts are not exactly conflicts, they are likely to entail conflicts (Young et al. 2010); that is, impacts may cause losses that may or may not be perceived by the third parties (De'pourcq et al. 2017). Therefore, PAs located in areas with high population density may present a higher number of CCs. To account for this factor, here we considered the population density of the municipalities that comprise each PA. We found that density is 45% higher in sustainable use PAs in comparison with integral protection PAs (IBGE 2017). In terms of PA territorial extension, we found that sustainable use PAs are on average three times larger than integral protection PAs, and 200 times larger than private reserves. We also found that PA management comprises not only natural areas, but also urban, peri-urban, and anthropized areas where different economic activities take place.

We highlight that the PA category "environmental protection area" (from the sustainable use group), composed of public and/or private land, aims to protect a large territorial extension (BRASIL 2000) and, therefore, covers a larger area than the other PAs evaluated. Importantly, environmental protection areas can overlap with integral protection PAs and private reserves. Therefore, CC occurrence in environmental protection areas and the values attributed to them can also be related to CC occurrence in integral protection PAs and private reserves. Also, the management objectives in integral protection PAs (which correspond to IUCN categories Ia, Ib, II, 1994) are more restrictive about the direct use of natural resources and, therefore, have a greater potential to spark conflicts.

"Burning" was rated as the most important conflict among all. It ranked as the top CC in full protection PAs and private reserves and as the second most important CC in sustainable use PAs. This may be related to the use of fire in the management of pastures and open areas, a common agricultural practice in Brazil. In Minas Gerais, this is particularly related to the need for extensive pastures to maintain the state's large dairy herd (the second largest in Brazil; IBGE 2018; BCB 2013). Moreover, 57% of the state's land extension belongs to the Cerrado

biogeographic region, where savannas (fire-related ecosystems historically managed by human populations; Mistry et al., 2019) predominate (Terra et al., 2017). These facts corroborate our other results, which showed that “agriculture” and “livestock” are among the main causes of fire-related conservation conflicts in full protection PAs and private reserves. These two causes (“agriculture” and “livestock”) were also the top-ranked causes of the conflict “deforestation”.

Because CCs are dynamic and may change over time (Yasmi et al. 2006), we suggest two factors that are likely to influence the conflicts related to fire use. The first factor, with countrywide effects, is agriculture and animal husbandry expansion, which have been stimulated by the recent relaxation of Brazilian environmental laws, driven by the political temperature in Brazil (Alarcon et al. 2015; Fearnside 2016; Vieira et al. 2018). This tendency has been unfolding since 2012 when Law No. 4,771/65 was replaced by Law No. 12,651/2012, a shift that granted amnesty to around 90% of Landowners who were previously supposed to restore deforested land and allowed another 86 million hectares of land to be legally deforested (Soares-Filho et al. 2014). Since 2019, deforestation and fire records have seen unprecedented growth, especially in areas where agriculture has been expanding into natural areas and threatening the maintenance of indigenous lands and other PAs (Brando et al. 2020; Barlow et al. 2020; Schmidt et al. 2020). The second factor that likely influences fire-related conflicts in PAs is the use of fire by the local populations as a form of retaliation (Hamilton et al. 2000; Bauer 2003; Ogra 2009; Allendorf, et al. 2006). In this context, fires are set into the protected areas as an act of “quiet everyday resistance” by local residents in response to the restrictions and impositions promoted by the management of PAs (Holmes 2007).

The main conservation conflict in sustainable use PAs, “vandalism”, showed a weak relationship with “agriculture” and “livestock” (economic causes); that is, the source of conflicts in sustainable use PAs is likely unrelated to the rural producers established within them. In all three PA categories (full protection, sustainable use, and private reserves),

"vandalism" showed a strong relationship with "real estate speculation", "urban expansion" and "tourism". While "real estate speculation" and "urban expansion" characterize the process of urbanization, "tourism" presents itself as a dynamic activity for the local economy (Segi 2014). PAs have attracted increasing numbers of tourists around the world (Newsome et al. 2002). However, no consensus has yet been reached about the consequences of this growing search (Brandt and Buckley, 2018). While some argue that tourism may contribute to the management of PAs (Xu et al. 2009; Snymana, Brickerb 2019), others argue that its negative impacts would predominate (Leung & Marion 2000; Buckley 2004), exemplified by improper disposal of solid waste (a form of vandalism) (Bhati and Pearce 2016). Beyond their influence in natural ecosystems, these impacts also affect the local economy, in the sense that public authorities need to allocate funds to deal with them (e.g., vandalized structures).

Our results showed that the most important CCs were associated with economic activities. We discussed whether the main CC mitigation strategies mentioned by PA managers could contribute to CC management in PAs. "Environmental education" was the main strategy suggested by the PA managers, which agrees with the findings by Soliku and Schraml (2018). According to them, environmental education is the main strategy to mitigate CCs in developing countries: aiming to improve relationships and increase trust between the parties involved in the conflicts, it raises awareness about biodiversity conservation and increases the participation of the local population in PA conservation. Trust between social actors is essential for conflict resolution, especially when traditional knowledge by local residents is recognized by PA managers (Davenport et al. 2007).

Conservation conflicts should be recognized as an inherent component of biodiversity conservation plans, which could be constructed collaboratively between the interested parties by fostering trust between them (Young et al. 2010, Young et al. 2016, Hovik and Hongslo 2017). In this sense, the co-management of PAs, a strategy that combines the effective

participation of local communities in partnership with environmental agencies, has contributed to alleviating conservation conflicts, especially when these local communities hold ecological knowledge about the ecosystems at hand (Berkes et al. 2000; Berkes 2004; Young et al. 2016). For this to be achieved, all conditions needed to ensure the effective participation of local communities should be guaranteed (D pourcq et al. 2015). We highlight, however, that in our study none of the PA managers considered co-management as a strategy to mitigate conflicts.

A positive outcome of conservation conflicts is that, when they become evident, they promote a broader debate about their causes (Young et al. 2010; Pourcq et al. 2017). This debate favors the establishment of public policies for conservation in which the rights of traditional or local populations and their livelihoods are respected. A successful example in Brazil is the creation of extractive reserves (Diegues and Arruda, 2001; Mittermeier et al. 2005), which are sustainable use PAs managed by legally responsible traditional populations by way of contract with the government (Brasil 2000). The management of PAs by local or traditional populations has shown promising results, demonstrating a capacity to manage biodiversity and ecosystem services that is equal to or greater than that of the public authorities and with a lower incidence of CCs (Porter-Bolland et al. 2012; Vergara-Asenjo and Potvin 2014).

The second most mentioned strategy by PA managers for conflict resolution was "monitoring and enforcement", which was itself also a conflict recognized by the managers of our case study, ranking as the seventh most relevant CC. Although not exclusive to developing countries, enforcement conflicts are more frequent in them. They usually stem from the creation of PAs that restrict the access of local populations to the natural resources (Diegues and Arruda 2001) on which their livelihoods rely (e.g., hunting, fishing, logging, and extraction of medicinal plants) (Soliku and Schraml 2018). Although enforcement may reduce some impacts by inhibiting illegal activities inside PAs, they can also lead to reprisals against PA managers and, consequently, may intensify the conflicts (Soliku and Schraml 2018; Oldekop et al. 2015).

As verified by Andrade and Rhodes (2012) and Hamilton et al. (2000), prohibitions and control through ostensive surveillance against the use of natural resources by local populations can cause retaliation (e.g., fires) and exacerbate other existing CCs.

The third most cited strategy by PA managers for resolving CCs was “fire prevention plans”. This suggestion is justified by the cultural use of fire in the study region, where farmers and ranchers make use of fire to prepare new plantation areas and to manage pasture. However, fire suppression policies in and out of PAs have historically restrained this practice, which increases the risk of uncontrolled fires in natural areas with the buildup of vegetation fuel (Fidelis et al. 2018; Durigan 2020). As we showed, in the three PA groups, the main causes related to the “burning” conflict were “agriculture” and “livestock”, revealing the importance of the cultural context and fire-related policies to conflict occurrence.

However, although still incipient in the study region (Batista et al. 2018), in the last decades a change of paradigm on fire management in protected areas around the world has been sought (Mistry et al. 2018; Moura et al. 2019). Strategies such as “fire prevention plans” can contribute to the regulation of fire use together with communities in and around PAs, either in the establishment of firebreaks and/or in the execution of prescribed fires (Mistry et al. 2018). Fire management plans that previously only focused on fire suppression and combat, now also involve fire prevention and acknowledgment of its ecological and socio-cultural roles (Myers, 20006). In some locations, managers perform prescribed burning when the practice is ecologically feasible and recommended, especially in fire-dependent and fire-adapted ecosystems (Moura et al. 2019). These practices may integrate more participatory processes between conservation agencies and local communities, such as integrated fire management (Schmidt et al. 2020) and intercultural fire management (Eloy et al. 2019). These have shown important results in reducing forest fires (Schmidt et al. 2018; Mistry et al. 2019), reducing conservation conflicts (Rodríguez et al. 2013; Eloy et al. 2019), and enabling the

acknowledgment and safeguarding of traditional fire knowledge (Mistry et al. 2019).

Despite the importance of strengthening the three main strategies proposed by PA managers to alleviate conservation conflicts ("environmental education", "monitoring and enforcement" and "fire prevention plans"), they must take advantage of new conflict mitigation strategies related to causes with which local populations are directly involved, e.g., "agriculture", "livestock", "illegal mining" and "fishing". In this case, the use of financial incentives for local development can be a suitable strategy, especially when the livelihoods of local populations depend on these activities (Salafsk 2011). In this case, the payments for environmental services provided in PAs can contribute to softening CCs, providing financial incentives to local populations (Silveira-Junior et al. 2020). In some cases, PES can be used to promote the conservation of surrounding natural areas (Nelson et al. 2010) and to stimulate the removal of farm fences of surrounding private properties (Leeuw et al. 2014) in favor of the movement and conservation of wild fauna. Payment for environmental services could also be used to guide the rules for sport hunting based on traditional ecological knowledge (Baur et al. 2012), to inhibit deforestation and at the same time to stimulate local populations to monitor the protected areas (Tuanmu et al. 2016).

Despite limitations, (1. only PA managers and not all stakeholders involved in CCs were interviewed; 2. general conflicts were assessed without considering local specificities), we believe that our study brings an important contribution to the management of conservation conflicts in protected areas. The use of a conservation conflict hierarchical matrix (CCHM) allows the conflicts, causes, and stakeholders involved to be identified. Consequently, it aids the development of conflict management strategies that respect local specificities. Finally, we propose CC management be continuous and participatory, involving all interested parties, and that CCHMs be periodically employed to follow potential variations in the occurrence and importance of conservation conflicts over time.

Conclusions

We conclude that irrespective of management group, conservation conflicts are inevitable and involve multiple social actors and their demands. However, different levels of restriction in protected areas promote different conservation conflicts associated with different causes. The importance of these conflicts and causes is influenced by human population density and territorial extension of protected areas. Most conflicts are related to economic activities and the main strategy proposed by managers to tackle them is environmental education. Co-management of protected areas was not considered by them.

We acknowledge that our results only explored the protected area managers' point of view on a range of management categories with different local contexts and, therefore, different conflicts and related causes. We emphasize that the conservation conflict hierarchical matrix that we proposed should be reviewed periodically, given the potentially fluctuating relationships between conservation conflicts and their causes over time.

Due to the great variety of social and environmental conditions in our study region (Minas Gerais state, Brazil), we suggest that the conflicts and their causes in the protected areas assessed here are likely to occur in other regions of the world, especially in developing countries. Therefore, our results should encourage future research to focus on the causes of conservation conflicts, identifying the threats and pressures that precede impacts and conflicts, which are detrimental to both the local populations and the protected areas.

Conflict of interest

The authors declare that they have no conflict of interest.

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S1-Questionnaire for the characterization of socio-environmental conflicts in the Protected Areas of Minas Gerais, Brazil

e-mail: _____ Phone:_____

Protected area data

Name: _____

Size (km²):_____

Biome:_____

Geographic coordinates:_____

Has a Management Plan?

yes ( ) Not ( )

In general, what strategies have been used to achieve the PA goals in the face of the local socio-environmental conflicts?

_____

_____

_____

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Table Conflicts in order of importance

Check in order of importance (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17), the main socio-environmental conflicts that occur in its Protected Area. Check all that are present in the PA and, if necessary, add others. Note: conflicts can be of the same order of importance, if you considered them similar; the closer to 1, or 1, the more important the conflict will be. 1 = 17 points; 2 = 16; 3 = 15; 4 = 14; 5 = 13; 6 = 12; 7 = 11; 8 = 10; 9 = 9; 10 = 8; 11 = 7; 12 = 6; 13 = 5; 14 = 4; 15 = 3 16 = 2; 17 = 1.

Conflitos	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Use of transgenics																	
2. Pesticide use																	
3. Hunting/fishing																	
4. Deforestation																	
5. Burnings																	
6. Vandalism																	
7. Presence, breeding, or abandonment of domestic animals																	
8. Improper disposal of solid waste																	
9. River courses changes																	
10. Invasions and squatter																	
11. Land grabbing/expulsions																	
12. Problems with enforcement																	
13. Little popular participation in decision-making																	
14. Extraction of sand and gravel																	
15. Wastewater emission																	
16. Public supply																	
17. Energy generation																	
other conflicts																	

Conflitos	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
20																	
21																	
22																	

Table of causes: relate the causes to the corresponding conflicts by placing in column B the numbering of the conflicts in table 1. Note: several conflicts may correspond to the same cause.

A	B
Causes	**Corresponding conflict (s|)**
Restrictive legislation	
Land tenure regularization	
Urban expansion	
Industrialization	
Real estate speculation	
Tourism	
Agriculture	
Livestock	
Mining	
Illegal mining	
Lack of institutional support	
Lack of infrastructure	
Fishing	
Legislation without regulation	
Cultural manifestations and traditions	
Disinterest of the population	
Other Causes	

Table S2: Conservation conflicts Matrix (CCM) with the conflict to be score (Importance column) and to be related to any of the 10 causes presented. In the Importance column the manager of PA may score with a number between 1 (high importance) and 17 (low importance), while the columns of causes may be filled with X (cause related to the conflict).

Conservation Conflicts	Importance (1-17)	Causes of conflicts (fill with X)									
		Restrictive legislation	Land regularization	Urban expansion	Industrialization	Real estate speculation	Tourism	Agriculture	Livestock	Mining	Illegal mining
Burnings											
Change in river courses											
Deforestation/plant extractivism											
Energy generation											
Extraction of sand and gravel											
Hunting/fishing											
Invasions and squatters											
Irregular disposal of solid waste											
Land grabbing/expulsions											
Little popular participation in decisions											
Pesticide use											
Problems with domestic animals											
Problems with enforcement											
Public supply											
Transgenic use											
Vandalism											
Wastewater emission											

Table S3. List of the 76 Protected Areas used in this study with the correspondent categories according to the National System of conservation Units (SNUC), categories of use and International Union for Conservation of Nature (IUCN) categories and Brazilian biomes. Note that in the name of PA the category is in Portuguese, since is part of the PA name, but in the second column the name was translated to English.

Name	SNUC category	Snuc Group	IUCN category	Biome
APA da Bacia Hidrográfica do Rio Machado	EPA	SU	V	Atlantic / Cerrado
APA do Alto do Mucuri	EPA	SU	V	Atlantic
APA Estadual Parque Fernão Dias	EPA	SU	V	Atlantic / Cerrado
APA Fernão Dias	EPA	SU	V	Atlantic
APA Seminário Menor de Mariana	EPA	SU	V	Atlantic
APA Serra São José	EPA	SU	V	Atlantic
EE Água Limpa	ES	FP	Ia	Atlantic
EE Cercadinho	ES	FP	Ia	Atlantic / Cerrado
EE Corumbá	ES	FP	Ia	Cerrado
EE Mata do Cedro	ES	FP	Ia	Atlantic
EE Tripuí	ES	FP	Ia	Atlantic
Floresta Estadual São Judas Tadeu	SF	SU	VI	Atlantic / Cerrado
MN Estadual Gruta Rei do Mato	MN	FP	III	Cerrado
MN Peter Lund	MN	FP	III	Caatinga / Cerrado
MN Serra da Piedade	MN	FP	III	Atlantic / Cerrado
MN de Itatiaia	MN	FP	III	Atlantic
MN Lapa Nova de Vazante	MN	FP	III	Cerrado
PE Alto Cariri	Park	FP	II	Atlantic
PE Baleia (jardim botânico 1932)	Park	FP	II	Atlantic
PE Biribiri	Park	FP	II	Cerrado
PE Caminho das Gerais	Park	FP	II	Caatinga / Cerrado
PE da Cerca Grande	Park	FP	II	Cerrado
PE da Lapa Grande	Park	FP	II	Caatinga / Cerrado
PE Itacolomi	Park	FP	II	Atlantic / Cerrado
PE Lagoa do Cajueiro	Park	FP	II	Caatinga
PE Nova baden (REBIO 1974)	Park	FP	II	Atlantic
PE Rio Doce	Park	FP	II	Atlantic
PE Sagarana (EE Sagarana 08/03)	Park	FP	II	Cerrado
PE Serra da Boa Esperança	Park	FP	II	Atlantic / Cerrado
PE Serra do Ouro Branco	Park	FP	II	Atlantic / Cerrado
PE Serra do Papagaio	Park	FP	II	Atlantic
PE serra do Rola_Moça	Park	FP	II	Atlantic / Cerrado
PE Serra do Sobrado	Park	FP	II	Atlantic / Cerrado
PE Serra Negra	Park	FP	II	Atlantic / Cerrado
PE Serra Nova e Talhada	Park	FP	II	Atlantic / Cerrado
PE Serra Verde	Park	FP	II	Atlantic / Cerrado
PE Sete Salões	Park	FP	II	Atlantic
REBIO Jaíba	BIORE	FP	Ib	Caatinga
REBIO Serra Azul	BIORE	FP	Ib	Caatinga
RPPN Doutor Norberto Custódio Ferreira	PNHR	PNHR	None	Atlantic
RPPN EcoCerrado Brasil	PNHR	PNHR	None	Cerrado

Name	SNUC category	Snuc Group	IUCN category	Biome
RPPN Fazenda Nascer	PNHR	PNHR	None	Atlantic
RPPN Fazenda Sucupira	PNHR	PNHR	None	Cerrado
RPPN Fragalha	PNHR	PNHR	None	Atlantic
RPPN Instituto Olho D'Água	PNHR	PNHR	None	Atlantic
RPPN Mato Limpo	PNHR	PNHR	None	Atlantic
RPPN Ovidio Pires 3	PNHR	PNHR	None	Atlantic
RPPN Ovidio Pires 2	PNHR	PNHR	None	Atlantic
RPPN Ovidio Pires 4	PNHR	PNHR	None	Atlantic
RPPN Ovidio Pires 5	PNHR	PNHR	None	Atlantic
RPPN Sítio Dois Irmãos	PNHR	PNHR	None	Atlantic
RPPN Alto da Boa Vista	PNHR	PNHR	None	Atlantic
RPPN Ave Lavrinha	PNHR	PNHR	None	Atlantic
RPPN Brumas do Espinhaço e RPPN Ermo das Gerais	PNHR	PNHR	None	Cerrado
RPPN Cachoeira das Pedras	PNHR	PNHR	None	Atlantic
RPPN Cachoeira do Curiango	PNHR	PNHR	None	Cerrado
RPPN Ecovive	PNHR	PNHR	None	Atlantic / Cerrado
RPPN Fartura	PNHR	PNHR	None	Atlantic
RPPN Fazenda Bulcão	PNHR	PNHR	None	Atlantic
RPPN Fazenda Lagoa	PNHR	PNHR	None	Atlantic
RPPN Guilman Amorim	PNHR	PNHR	None	Atlantic
RPPN Josepha Mendes Ferrão	PNHR	PNHR	None	Atlantic
RPPN Morro do Elefante	PNHR	PNHR	None	Atlantic
RPPN Nascentes do Aiuruoca I e II	PNHR	PNHR	None	Atlantic
RPPN Olga Coelho Ullmann	PNHR	PNHR	None	Cerrado
RPPN Quintas do Cedro	PNHR	PNHR	None	Atlantic
RPPN Refúgio dos Sauás Resgate III	PNHR	PNHR	None	Atlantic
RPPN Resgate I	PNHR	PNHR	None	Atlantic
RPPN São Francisco de Assis	PNHR	PNHR	None	Atlantic
RPPN São Francisco de Assis - Lagoa Dourada	PNHR	PNHR	None	Atlantic
RPPN sitio do Zaca	PNHR	PNHR	None	Atlantic
RPPN Vale dos Cristais	PNHR	PNHR	None	Atlantic / Cerrado
RRPN Fazenda Serra Negra	PNHR	PNHR	None	Atlantic
RVS Libélulas da Serra de São José	WR	FP	IV	Atlantic
RVS Macaúbas	WR	FP	IV	Cerrado
RVS Mata dos Muriquis	WR	FP	IV	Atlantic / Cerrado

Table S3: Basic data from the Protected areas categories used in the study.

Categories	Nº of PA	Area (ha)	Population density (habitants/km²)	Population (habitants)
SU	7	1,154,556.88	8719.2	2,117,400.33
IP	35	302,231.21	5992.9	1,368,167
RPPN	34	5,650.33	931.99	967,604

ARTIGO 2- Redelimitação participativa de áreas protegidas como estratégia na gestão de conflitos da conservação: um estudo de caso em um ecótono Floresta Atlântica-Cerrado

Wanderley Jorge da Silveira Junior, Raissa, Ravi Fernandes, Mariano, Leandro Leite, Alan de Vilhena Ayres, Fabio Freire Diniz, Marco Aurélio Leite Fontes

RESUMO

É incontestável o relevante papel que as áreas protegidas cumprem em todo mundo, como também são inevitáveis os conflitos da conservação, que ocorrem devido aos diferentes interesses dos atores sociais envolvidos nos processos de criação e gestão destas áreas. Diante do contexto exposto, esta pesquisa teve como objetivo analisar se a redefinição participativa dos limites de uma área protegida poderia se configurar como uma estratégia eficiente na gestão de conflitos da conservação. E se sim, analisar quais instrumentos utilizados contribuíram para o resultado. Para tanto, realizamos um estudo de caso em uma área protegida situada em um ecótono Floresta Atlântica-Cerrado: o Parque Estadual da Serra de Boa Esperança, no qual os gestores já apontavam a modificação dos limites como opção para atenuar os conflitos existentes com os moradores, que foram desapropriados e não receberam as devidas indenizações, e os quais possuem terras produtivas dentro do parque e áreas de vegetação nativa fora dos limites da área protegida. A metodologia se dividiu em duas partes, que consistiram em construir uma matriz de conflitos com a participação dos membros do conselho consultivo do parque, o que confirmou que a modificação dos limites poderia atenuar vários conflitos, e a utilização de sensoriamento remoto que definiu os limites possíveis para modificação, juntamente com participação dos moradores diretamente relacionados aos conflitos. Os resultados demonstraram que a redefinição dos limites constitui uma estratégia eficiente, pois além de atenuar os conflitos relacionados aos problemas com as delimitações do parque, aumenta seu território e diminui os custos de indenização nos processos de regularização fundiária, e ainda aproxima os moradores da área protegida, trazendo maior confiança para relação entre o parque e os moradores locais.

Palavras-chave: Conservação da Natureza. Conflitos Socioambientais. Regularização Fundiária. Protagonismo Social.

INTRODUÇÃO

A criação de Áreas Protegidas (AP) é uma importante estratégia para a conservação da biodiversidade (MITTERMEIER *et al*, 2003), dos serviços ecossistêmicos (ZENG *et al*., 2020) e dos meios de subsistência das populações locais (STOLTON; DUDLEY, 2010). As AP podem ser mais ou menos restritivas em relação aos seus objetivos de manejo, o que contribui para a existência de conflitos (SOLIKU; SCHRAML, 2018), que em maior ou menor grau são inerentes a todas AP (AYLING; KELLY 1997). Os conflitos que envolvem as AP são denominados conflitos da conservação (CC) e surgem quando as posições das partes que representam os interesses de conservação são ameaçadas pelas posições daqueles que têm outras visões, ou quando os interesses da conservação ameaçam atividades socioeconômicas desenvolvidas no local (REDPATH *et al*., 2013; YOUNG *et al*., 2010). Estes conflitos podem corresponder também às causas institucionais, ligadas a falhas na execução de políticas públicas conservacionistas, como por exemplo a regularização fundiária incompleta de áreas desapropriadas pelo poder público (SILVEIRA-JUNIOR *et al*., Artigo 1 desta tese).

Para melhor compreender e promover ações que atenuem os CC, estudos como De Pourcq *et al*. (2015; 2017) entendem que estes ocorrem quando uma das partes interessadas sentem o impacto ou sofrem prejuízos decorrentes das ações de outra parte. Estes ainda apontam ser fundamental identificar os fatores causais dos conflitos.

Os CC não resultam apenas em impactos negativos para a conservação: determinadas ações são capazes de produzir mudanças favoráveis. A gestão dos CC é uma estratégia que pode proporcionar resultados positivos, pois ao ser implementada, contribui para evitar conflitos e, caso ocorram, pode atenuar seus impactos negativos. A gestão aproxima as partes envolvidas nos conflitos em busca de soluções, o que favorece a construção de uma relação de confiança entre elas (YOUNG *et al*., 2010; 2016; REDPATH *et al*.,2013; SOLIKU; SCHRAML, 2018); ademais, a utilização de instrumentos financeiros, como os Pagamentos dos Serviços Ambientais, além contribuir para atenuar os conflitos entre as populações locais e as AP, promove a inclusão social das pessoas, aproximando-as aos objetivos da conservação (SILVEIRA-JUNIOR *et al*., 2020).

Como os CC são dinâmicos, variam no tempo e espaço (YASMI, SCHANZ, SALIM, 2006). Portanto, para efetivação da sua gestão, torna-se fundamental identificar suas ocorrências, suas importâncias e as causas para os envolvidos, dados que permitem compreender quais conflitos precisam ser atenuados e quais as suas causas, fator que contribui

para uma gestão mais eficiente. Neste sentido, é fundamental garantir a participação de todos os atores sociais envolvidos desde o diagnóstico até a implementação das estratégias de gestão dos CC (SILVEIRA-JUNIOR *et al*., artigo1 desta Tese).

A ausência de regularização fundiária no Brasil é um dos principais fatores causadores de conflitos em AP no país (SILVEIRA JUNIOR *et al*., artigo 1 desta Tese) e é a causa que mais contribui para o desmatamento dentro de seus limites (NOLTE *et al*., 2013). Até o ano de 2005, 50% das Unidades de Conservação federais necessitavam de algum tipo de regularização fundiária. Muitos proprietários anteriores à criação destas UC ainda não foram compensados financeiramente e aproximadamente 25% aguardam indenização financeira (SILVA, 2005). A situação dos Parques Nacionais é ainda mais grave, pois até 2008, nenhuma das 52 Unidades de Conservação desta categoria estavam totalmente regularizadas (ROCHA *et al*., 2010). A regularização fundiária, em muitos casos, é solucionada modificando os limites das AP, seguindo a tendência de diminuir o tamanho das mesmas em detrimento de atividades socioeconômicas conflitantes com as AP (ARAÚJO; BARRETO, 2010).

Considerando o contexto apresentado, no qual a falta de regularização fundiária se configura com uma das principais causas de CC, duas questões emergem: (i) A modificação dos limites de uma AP pode ser uma estratégia eficiente para gestão dos CC causados pela falta de regularização fundiária? (ii) Se sim, quais elementos são fundamentais para que a modificação dos limites de uma AP seja eficiente?

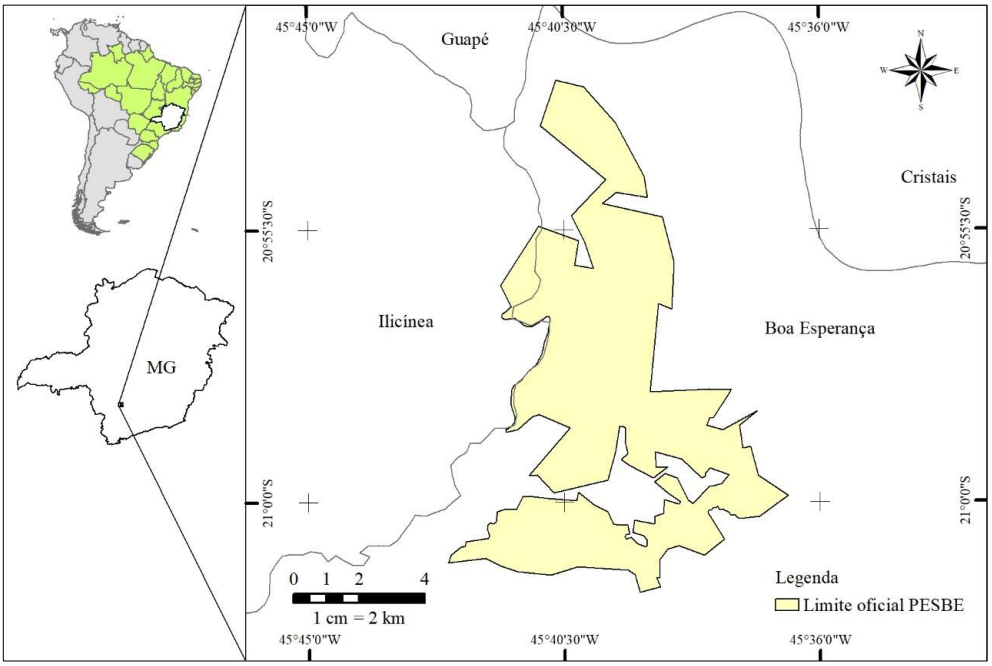
Para responder estas questões, o objetivo deste estudo foi analisar se a "modificação dos limites de uma AP" seria eficiente na gestão de conflitos da conservação. Para tal, buscamos identificar quais elementos são imprescindíveis para este êxito. Assim, nós realizamos um estudo de caso em uma Área Protegida do Brasil, situada em um ecótono Floresta Atlântica-Cerrado, chamada Parque Estadual da Serra de Boa Esperança.

Materiais e métodos

O Parque Estadual da Serra da Boa Esperança (PESBE) foi escolhido como estudo de caso, pois seus gestores apresentaram na pesquisa de Silveira-Junior (Artigo 1 desta Tese) a falta de regularização fundiária como uma das principais causas de Conflitos da Conservação (CC) e a modificação dos limites como uma estratégia a ser implementada. O PESBE possui área de 5.878,26 hectares (IDE-SISEMA, 2021), está inserido majoritariamente no município de Boa Esperança (97%) e possui uma parcela territorial no município de Ilicínea (3%), ambos

localizados na região Sul/Sudoeste de Minas Gerais, entre as latitudes de 20° 53' 2,261" S e 21° 1' 30,048" S; e longitudes 45° 36' 32,411" W e 45° 42' 31,203" W (Figura 1). O Parque está inserido em uma região ecotonal entre dois *hotspots* de conservação, os domínios do Cerrado e da Mata Atlântica (MYERS *et al*. 2000). Ele abriga tipos de vegetação campestres e arbóreas desses dois domínios e também plantios de *Coffea arabica*, *Eucalyptus* e *Brachiaria*. O PESBE possui um relevo diverso, variando de 800 m de altitude a 1.400 m (BRASIL, 2008). A região apresenta clima do tipo Cwb, subtropical úmido com inverno seco e verão temperado, de acordo com a classificação de Koppen (ALVARES *et al*., 2013).

Figura 1- Localização do Parque Estadual da Serra da Boa Esperança no Brasil e América do Sul.



Fonte: do autor (2021)

Coleta de dados

A pesquisa se dividiu em duas fases distintas. A primeira consistiu em realizar um diagnóstico participativo para aferir se a falta de regularização fundiária no PESBE consistia como causa dos Conflitos da Conservação (CC) e se estas eram de alta importância. Buscou-se ainda identificar qual estratégia seria mais adequada para a gestão dos conflitos relacionados a esta causa. Para isso, foi construída uma Matriz de Hierarquização de Conflitos da Conservação (MHCC) com a participação dos membros do conselho consultivo do PESBE. Como o resultado desta primeira etapa confirmou-se que a falta de regularização fundiária era causa de CC de alta

importância e a “modificação dos limites do PESBE” surgiu como principal estratégia a ser realizada para gerenciar os conflitos. Na segunda fase buscou-se desenhar os novos limites em duas etapas. A primeira consistiu no mapeamento do uso e cobertura do solo no interior da AP e em uma área exterior correspondente a 500 metros além dos limites legais da AP. A segunda etapa da pesquisa consistiu de consultas aos 56 produtores rurais que desenvolvem suas atividades socioeconômicas nas áreas exteriores à AP, dentro dos limites de 500 metros de *buffer* estabelecidos, e que também desenvolvem essas atividades no interior da AP, em áreas que foram desapropriadas pelo governo, mas em que não houve o pagamento de indenizações aos produtores rurais. Durante as consultas, foi verificada a possibilidade de troca entre os produtores e o poder público, na qual as áreas produtivas situadas no interior da AP e, portanto, irregulares, seriam trocadas por áreas de vegetação nativa dos mesmos produtores rurais situadas fora da AP.

Considerando que um dos entraves para regularização fundiária são os custos financeiros, nós entendemos que a modificação dos limites deveria considerar a máxima redução dos valores gastos por hectare pelo governo, o que foi utilizado como premissa para a modificação dos limites do PESBE. Como base para isso, foi utilizado o mapa de uso e cobertura do solo e os valores da terra sob diferentes usos e coberturas disponibilizados pelo governo do estado de Minas Gerais (EMATER-MG, 2019) (Tabela 1).

Tabela 1. Valores médios da terra (R$/ha) em 2019 no município de Boa Esperança sob diferentes usos e coberturas de acordo com a Empresa de Assistência Técnica e Extensão Rural do Estado de Minas Gerais-EMATER.

Valores Médios (R$/ha)					
Lavoura Aptidão Boa	Lavoura Aptidão Regular	Lavoura Aptidão Restrita	Pastagem Plantada	Silvicultura ou Pastagem Natural	Áreas de Preservação da Fauna ou Flora
27.000,00	22.000,00	13.000,00	10.000,00	6.000,00	3.000,00

Primeira fase- Construção da Matriz de conflitos

Para aferir juntamente aos atores sociais envolvidos se a regularização fundiária era uma causa relevante de CC, nós desenvolvemos uma matriz de conflitos utilizada por Silveira-Junior et al., (cap I). A partir de um diagnóstico participativo, identificamos os conflitos, suas ocorrências, importâncias, e as causas relacionadas, bem como estratégias para gerenciamento

dos conflitos. Os dados foram coletados através de uma reunião composta por 14 membros do conselho consultivo do PESBE, que representam a sociedade local: Organizações Não Governamentais; poder público local; associações de produtores rurais e comerciantes; instituições de ensino; moradores do entorno da AP, e a gerência da UC. Nesta reunião, os participantes receberam um formulário no qual foram apresentadas doze possíveis causas de conflitos relacionadas à conservação da natureza, extraídos de Silveira-Junior *et al*. (Artigo 1 desta Tese). Todavia, os participantes poderiam acrescentar outras causas caso fosse necessário. Posteriormente, para identificarmos os conflitos e suas relações com as causas, foi solicitado que os participantes apontassem os conflitos que entendiam ocorrer no PESBE relacionando-os às causas apresentadas, e, para permitir comparações, deveriam pontuar com nota de um a nove cada conflito, sendo os mais intensos valorados com nota nove e os menos intensos com nota um.

Para identificar a intensidade de cada conflito, calculamos a relação entre o somatório das notas dadas pelos atores sociais e a nota máxima que cada conflito poderia obter (100% = 126 pontos), sendo mais intensos os conflitos mais próximos a 100% (126 pontos). Para identificar a relação entre causas e conflitos e a estratégia de gestão de conflitos a ser adotada, foi construído um fluxograma de relação e decisão, baseado na importância de cada conflito apontada pelos membros do conselho do PESBE.

Segunda fase -Modificação dos limites do Parque Estadual da Serra da Boa Esperança

Como o resultado da primeira fase apontou a "modificação dos limites do PESBE" como a estratégia mais importante de gestão de conflitos, buscou-se elaborar uma proposta para tal modificação realizada em duas etapas. Na primeira etapa, foi elaborado um mapa de uso e cobertura do solo da área do parque considerando uma área do entorno correspondendo a 500 metros de distância da borda dos limites atuais para inclusão de vegetação nativa adjacente e exclusão de áreas produtivas no interior da unidade. Esse valor (500 m) foi utilizado por ser considerado suficiente para a visualização das áreas de vegetação nativa que poderiam ser inseridas nos limites da AP. Para elaboração do mapa, nós utilizamos imagens do sensor Rapideye (cenas 2329411 e 2329412), com resolução espacial de 5x5 m. A classificação do uso e cobertura do solo da AP, feita de forma manual, assim como o desenho dos limites propostos, foram realizados através do *software* ArcGis 10.5 (ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE, 2016), utilizando-se o *Datum* Sirgas 2000 e o sistema de projeção

Universal Transversa de Mercator (UTM). Para dar suporte à classificação, foram realizadas idas a campo para conferência dos usos e coberturas do solo na AP e em seu entorno.

Na segunda etapa considerou-se as partes envolvidas diretamente nos conflitos, que são os 56 proprietários rurais que estão parcial ou totalmente inseridos na área abrangida pelo PESBE. Para tanto, foram consultados sobre a possibilidade de aceitarem trocar as partes de vegetação nativa presentes em suas propriedades por suas áreas produtivas que estão dentro do Parque, as quais foram desapropriadas e não foram devidamente indenizadas. Destes, 95% (53) aceitaram. Para ambas propostas, utilizamos para calcular a alteração de área, os limites oficiais disponibilizados pelo Governo do Estado de Minas Gerais através do sítio eletrônico <http://idesisema.meioambiente.mg.gov.br/>.

RESULTADOS

Primeira fase- Matriz de hierarquização de conflitos e decisão

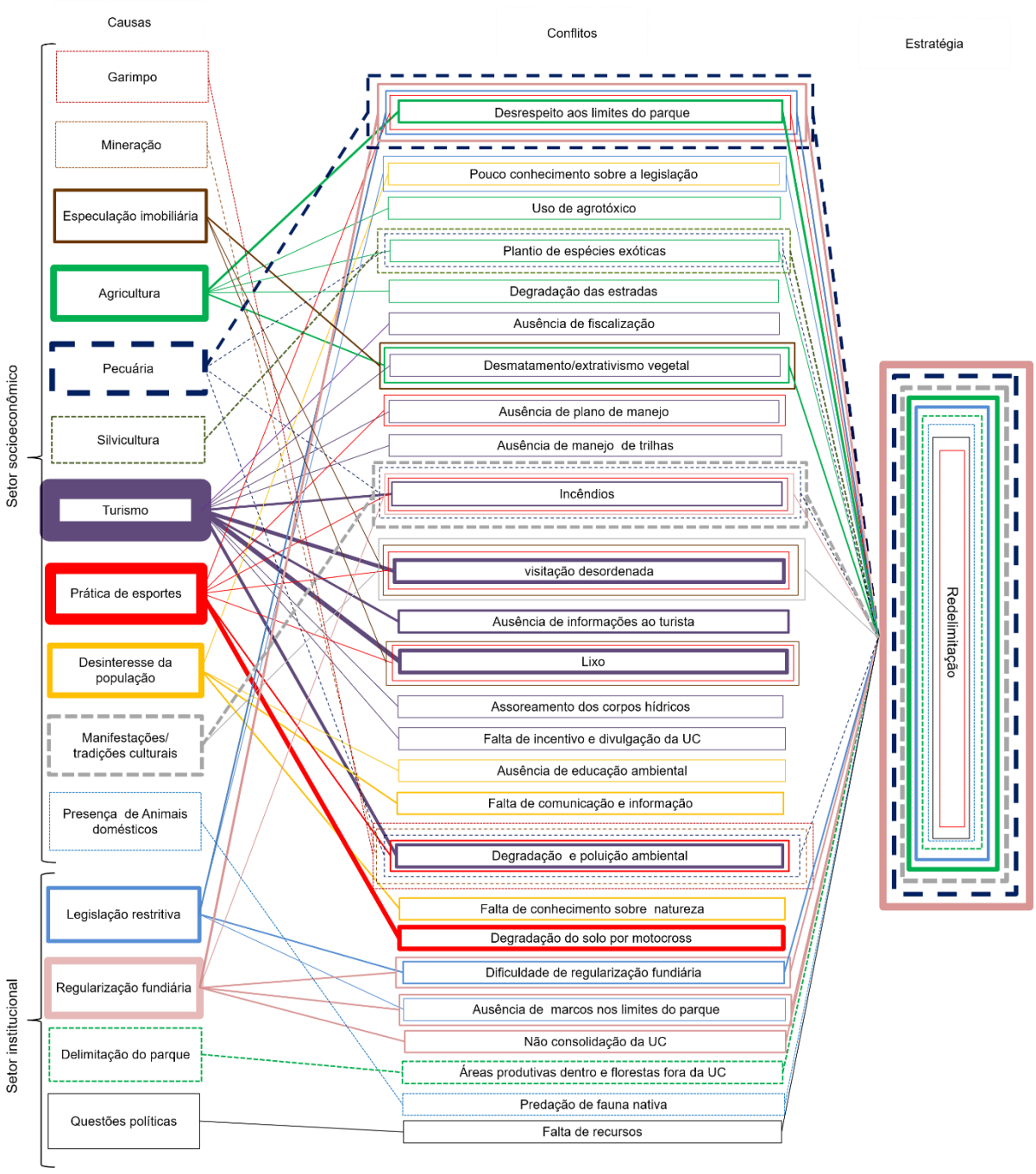
Foram levantados 27 conflitos da conservação, sendo os três importantes: desrespeito aos limites do parque; incêndios florestais; degradação e poluição ambiental. Em ordem de importância, as cinco causas de conflito foram: “Regularização fundiária”; “Pecuária”; “Manifestação e tradições culturais”; “Agricultura”; e “Legislação restritiva” (Tabela 2).

Tabela 2- Principais conflitos apontados pelos membros do conselho consultivo do Parque Estadual da Serra de Boa Esperança, dos quais “S” são originados de atividades socioeconômicas e “I” institucionais.

Principais conflitos	Total de pontos	%
Desrespeito aos limites do parque (S)	86	68,25
Incêndios (S)	63	50
Degradação e poluição ambiental (S)	62	49,20
Lixo (S)	40	31,74
Degradação das trilhas por moto (S)	35	27,77
Visitação desordenada (S)	30	23,8
Desmatamento e extrativismo vegetal (S)	28	22,22
Falta de conhecimento sobre a legislação e o parque (I)	26	20,63
Dificuldade de regularização fundiária (I)	26	20,63

As principais estratégias definidas foram: “modificação dos limites do Parque”; “construção e efetivação do Plano de Manejo”; e “educação ambiental”. Todavia, a primeira foi apontada como a que deveria ser implementada, devido a sua forte relação com nove causas que estão relacionadas a 22 CC, sendo o conflito “desrespeito aos limites do parque” ligado a mais causas (1/3 do total) e que envolve os dois setores: socioeconômico e institucional (Figura 2).

Figura 2 - Fluxograma de relação entre causas e conflitos da conservação e decisão sobre a estratégia de gestão de conflitos relacionados do Parque Estadual da Serra de Boa Esperança.

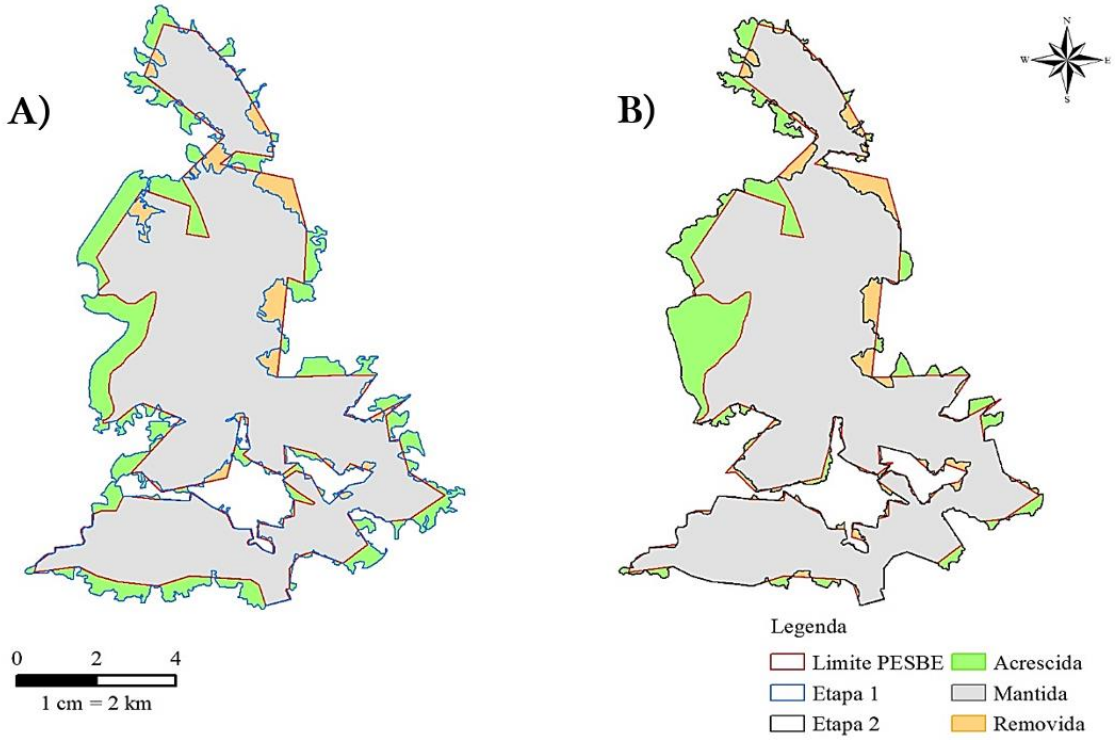


Fonte: do autor (2021)

Segunda fase – Proposta de alterações nos limites do PESBE

Na primeira etapa dessa fase, foi sugerido um aumento em relação à extensão original do PESBE (de 5.878,26 ha para 6.942,99 ha), totalizando acréscimo de 1064,73 ha. As mudanças realizadas incluiriam 74 áreas, totalizando 1429,18 ha, e removeriam 77, total de 364,46 ha (Figura 3a). Na segunda etapa, foi sugerido um aumento da área para 6.485,35 ha, perfazendo acréscimo de 607,09 ha. Dessa forma seriam acrescidas 94 áreas, totalizando 930,37 ha, e as remoções corresponderiam a 94 áreas, totalizando 323,28 ha (figura 3b).

Figura 3- Proposta de alterações dos limites do PESBE, demonstrando as áreas removidas, mantidas e adicionadas nas duas etapas. A- Utilizando o *buffer* de 500 para inclusão de áreas de vegetação nativas adjacentes aos limites atuais, e B - limites propostos após consulta aos proprietários rurais inseridos no entorno imediato.



Fonte: do autor (2021)

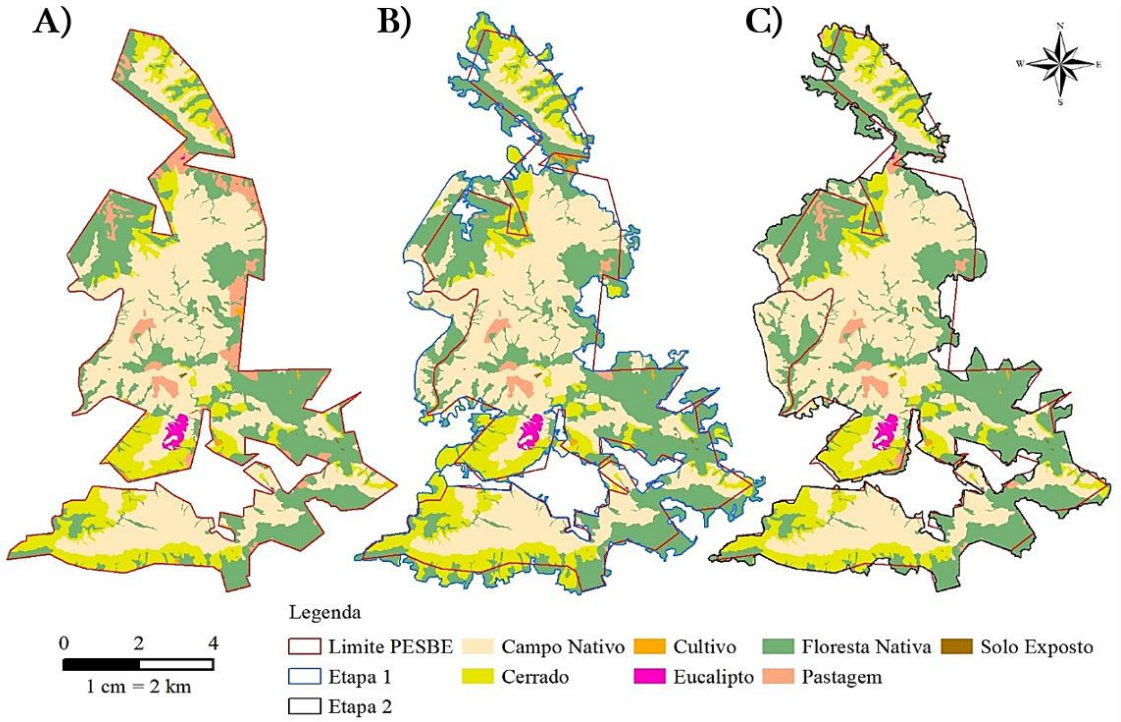
Proposta de alterações no uso e ocupação do solo

No levantamento de uso e ocupação das áreas inseridas no PESBE, assim como no seu entorno, identificou-se sete feições, divididas em dois grupos: naturais e antrópicas. As feições naturais são compostas por Floresta Atlântica, Cerrado e Campo Nativo, com esta última ocupando a fração mais representativa em extensão territorial. As feições antrópicas são compostas por Cultivo de café, Eucalipto, Pastagem e Solo exposto (Figura 4). As alterações

nos limites do PESBE implicam, inevitavelmente, na alteração da extensão das fisionomias que ocorrem na AP. Dessa forma, em ambas as propostas, a expansão da área do PESBE é resultado da remoção de áreas caracterizadas pelo desenvolvimento de atividades antrópicas, que ocorrem em sua maioria nas bordas, bem como pela inclusão de fragmentos de vegetação naturais adjacentes ao limite oficial da área (Tabela 3). Nesse sentido, as feições que tiveram suas áreas expandidas foram, em ordem decrescente: Floresta, Campo Nativo e Cerrado; por outro lado, as feições antrópicas tiveram suas áreas retraídas.

O custo para a regularização do PESBE a partir das etapas 1 e 2 de redefinição de limites aumentou e isso se deve à expansão da área proposta quando comparadas com o limite oficial. Todavia, na etapa 2, ao considerar as especificidades e demandas dos proprietários, apresenta-se uma maior possibilidade de amenizar conflitos. A modificação da extensão das áreas de cada feição reflete, necessariamente, na alteração do custo para a desapropriação dos imóveis inseridos no PESBE. Isso se dá em função da variação do preço da terra, que é calculada tomando como base a aptidão e o uso, e cobertura da terra, assim como suas características locais. Áreas utilizadas para o desenvolvimento de atividades antrópicas apresentam maior valor quando comparadas a áreas ocupadas por feições naturais (Tabela 4). Sendo assim, a remoção de áreas onde são realizadas atividades com finalidade econômica e a inclusão de áreas naturais têm como consequência a redução do custo médio por hectare da AP, o que reduz os valores a serem pagos na desapropriação (Tabela 5).

Figura 4- Mapa de uso e cobertura do PESBE e seu entorno imediato, considerando: o limite atual (A), os limites propostos na etapa utilizando o *buffer* de 500 metros na etapa 1 (B), e na etapa 2 após consultar os proprietário rurais envolvidos nos conflitos (C).



Fonte: do autor (2021)

Tabela 3- Cálculo dos Valores a serem pagos pelo poder público no processo de regularização fundiária de acordo com as fisionomias: campo nativo, floresta, cerrado, pastagem, eucalipto, cultivo, e solo exposto.

Limite oficial				
Fisionomias	Extensão		Custo	
	ha	%	un. (R$/ha)	total (R$)
Campo nativo	2.613,74	44,5	6.000,00	15.682.427,11
Floresta	1.957,91	33,3	3.000,00	5.873.725,44
Cerrado	904,72	15,4	3.000,00	2.714.158,81
Pastagem	326,76	5,6	10.000,00	3.267.585,23
Eucalipto	36,48	0,6	6.000,00	218.60,04
Cultivo	29,71	0,5	20.000,00	594.197,41
Solo exposto	8,95	0,2	13.000,00	116.336,97
Área total (ha)	5.878,26			28.467.291,00
Custo médio (R$/ha)	4.842,81			

Tabela- 4 Cálculo da alteração do uso e ocupação do solo a partir da inclusão e exclusão de áreas após acordo com os proprietários envolvidos nos conflitos. Resultado em hectare e percentual a partir dos limites oficiais nas etapas 1 e 2 nas fisionomias: campo nativo, floresta, cerrado, pastagem, eucalipto, cultivo, e solo exposto

Alteração do uso e ocupação do solo		
Fisionomias	Área do limite (ha)	Diferença

	Oficial	Etapa1	Etapa2	Etapa1 (ha)	Etapa1 (%)	Etapa2 (ha)	Etapa2 (%)
Floresta	1.957,91	2.703,28	2.408,78	745,37	12,68	450,87	7,7
Campo nativo	2.613,74	2.922,57	2.939,86	308,83	5,25	326,12	5,5
Cerrado	904,72	1.162,22	947,27	257,50	4,38	42,55	0,7
Eucalipto	36,48	35,93	36,43	-0,54	-0,01	-0,04	0,0
Solo exposto	8,95	8,54	7,17	-0,41	-0,01	-1,78	0,0
Cultivo	29,71	23,03	5,51	-6,68	-0,11	-24,20	-0,4
Pastagem	326,76	87,42	140,33	-239,34	-4,07	-186,43	-3,2
Total	5.878,26	6.942,99	6.485,35	1.064,73	18,11	607,09	10,3

Tabela- 5 Cálculo da alteração dos limites do PESBE em hectare e percentual a partir dos limites oficiais nas etapas 1 e 2 e valor médio nas fisionomias: campo nativo, floresta, cerrado, pastagem, eucalipto, cultivo, e solo exposto.

Alteração do uso e ocupação do solo							
Fisionomias	Valoração (R$)			Diferença			
	Oficial	E1	E2	E1 (R$)	E1 (%)	E2 (R$)	E2 (%)
Campo nativo	15.682.427,11	17.535.403,54	17.639.167,35	1.852.976,44	6,5	1.956.740,25	6,9
Floresta	5.873.725,44	8.109.833,86	7.226.346,89	2.236.108,42	7,9	1.352.621,44	4,8
Cerrado	2.714.158,81	3.486.666,91	2.841.796,19	772.508,10	2,7	127.637,38	0,4
Eucalipto	218.860,04	874.176,95	218.606,63	655.316,91	2,3	-253,41	0,0
Solo exposto	116.336,97	215.598,98	93.195,77	99.262,01	0,3	-23.141,19	-0,1
Cultivo	594.197,41	460.640,55	110.183,18	-133.556,86	-0,5	-484.014,23	-1,7
Pastagem	3.267.585,23	111.029,77	1.403.285,79	-3.156.555,46	-11,1	-1.864.299,44	-6,5
Total	28.467.291,00	30.793.350,56	29.532.581,80	2.326.059,56	8,2	1.065.290,80	3,7
Custo médio (R$/ha)	4.842,81	4.435,17	4.553,74	-407,64	-8,4	-289,07	-6,0

DISCUSSÃO

Os resultados encontrados a partir da proposta de modificação dos limites do Parque Estadual da Serra de Boa Esperança (PESBE) apontam que a estratégia pode funcionar na gestão dos CC de Áreas Protegidas (AP) nos seguintes aspectos: atenuar os conflitos relacionados, aproximando as populações envolvidas e gerando confiança entre o órgão gestor da AP e as populações locais (YOUNG *et al*. 2016), no caso deste estudo, representado pelo Instituto Estadual de Florestas (IEF). Além disso, essa estratégia pode contribuir com os objetivos da conservação da biodiversidade e dos serviços ecossistêmicos, aumentando a área de vegetação nativa; auxiliando na manutenção sustentável das atividades socioeconômicas (agricultura e pecuárias), e gerando maior facilidade no processo de indenização dos produtores rurais desapropriados por meio da diminuição dos custos financeiros da regularização.

Para tanto, classificamos como imprescindível a utilização de três instrumentos apontados neste estudo: i) a utilização da MHCC aplicadas por Silveira-Junior *et al*. (Artigo 1 desta Tese); ii) a participação efetiva das populações locais diretamente envolvidas nos CC, na construção da MHCC; e iii) a utilização de técnicas de sensoriamento remoto.

Para isso, consideramos que foi indispensável adotar a abordagem sobre conflitos desenvolvida por De Pourcq *et al*. (2017), que se distancia da abordagem clássica do enfrentamento dos CC, pois esta considera fundamental a identificação dos fatores causais quando se pretende amenizá-los, e que para haver o conflito é necessário que uma das partes acuse os impactos (*impairment*) das ações da outra parte. Em adição, como os CC são dinâmicos e podem variar no espaço e no tempo (YASMI, SCHANZ, SALIM, 2006), entendemos que foi fundamental relacionarmos as causas com os conflitos quantificados na MHCC, conforme proposto por Silveira-Junior *et al*. (Artigo 1 desta Tese), uma vez que a associação de dados permitiu verificar que a modificação dos limites do PESBE atenuaria os conflitos que surgem por causa da não regularização fundiária, e, portanto, ratificar a decisão do órgão gestor da AP e seus conselheiros em adotar tal estratégia.

O CC são fenômenos sociais inerentes a todas as AP (AYLING; KELLY, 1997) e a forma ou intensidade como se desenvolvem está relacionado às especificidades locais. No entanto, a pouca ou nenhuma participação de atores sociais nos processos de gestão das AP é um fator causal de CC, o que é comum em AP (SOLIKU; SCHRAML, 2018). Para Young *et al*. (2016), processos participativos favorecem a resolução de CC, pois a cooperação dos envolvidos aumenta a confiança entre as partes conflitantes. Assim, entendemos que a modificação dos limites do PESBE pode ser considerada uma estratégia de gestão de conflitos eficiente, pois constituiu-se de duas ações participativas. A primeira, ao considerar a posição dos membros do conselho consultivo do PESBE, que representam a sociedade local, para a criação da MHCC, e a segunda ao consultar os moradores envolvidos que ainda não foram ressarcidos financeiramente por terem suas terras desapropriadas na criação do PESBE.

A modificação de limites como estratégia para amenizar CC envolvendo os agentes das AP e as pessoas responsáveis pelas atividades socioeconômicas geralmente é utilizada no Brasil ao final de longos trâmites judiciais, e tende a afetar as AP, diminuindo-as de tamanho (ARAÚJO; BARRETO, 2010). Nossos resultados demonstraram que a proposta de modificação dos limites do PESBE seria exitosa nesse sentido, ao inverso do que Araújo e Barreto (2010) demostraram em seus resultados, pois a área do PESBE seria aumentada, assim como as áreas de Cerrado (savanas) e Mata Atlântica, ambos *hotspots* de biodiversidade

(MYERS *et al*., 2000). Ademais, não houve prejuízo para as atividades socioeconômicas dos produtores rurais, pois suas áreas produtivas seriam devolvidas e a indenização dos produtores rurais desapropriados teriam um custo menor ao estado, uma vez que as terras produtivas economicamente inseridas no Parque têm preços mais altos, se comparadas às compostas por vegetação nativa, que estavam fora da AP.

Para tanto, além da participação dos moradores, o uso de técnicas de sensoriamento remoto foi fundamental, pois permitiu a avaliação detalhada do uso e cobertura do solo do PESBE e do seu entorno, que serviu de base para a determinação dos novos limites do Parque e para a quantificação dos valores financeiros necessários à indenização de pessoas cujas terras foram desapropriadas durante o processo de regularização fundiária da AP. Além disso, análises de imagens de satélite permitem a verificação e avaliação de mudanças temporais no uso e cobertura do solo, o que é importante para a gestão de AP (PAYÉS *et al*., 2013), dado que os CC são dinâmicos e podem mudar ao longo do tempo e da localização (YASMI, SCHANZ, SALIM, 2006). Em adição, o monitoramento das paisagens adjacentes também é importante, pois essas áreas influenciam a manutenção e conservação dos ecossistemas do interior das AP (BAILEY *et al*., 2015). A disponibilidade de imagens de satélite e *softwares* de geoprocessamento gratuitos torna o uso das ferramentas de sensoriamento remoto acessível para os gestores de AP tanto em nações desenvolvidas quanto em nações em desenvolvimento.

CONCLUSÃO

A partir do estudo de caso do Parque Estadual da Serra da Boa Esperança, concluímos que a modificação dos limites de uma AP pode ser uma estratégia eficiente para a gestão dos CC causados pela falta de regularização fundiária, ao mesmo tempo que contribui para que ela não sofra redução dos seus limites. Assim, concluímos, que dois instrumentos são fundamentais: a construção da MHCC realizada com a participação dos envolvidos nos conflitos, a qual possibilita a aproximação as partes envolvidas e o estabelecimento de confiança entre elas; e o uso de técnicas de sensoriamento remoto, que permite verificar com maior clareza o uso e ocupação do solo, o que em muitos casos estão relacionados às causas dos conflitos.

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APÊNDICES

1 - Tabela com os conflitos apontados pelos membros do conselho gestor do Parque Estadual da Serra de Boa Esperança (PESBE) e suas respectivas notas

Conflitos	1	2	3	4	5	6	7	8	9

Anexo 2- Tabela com a cauas relacionadas aos conflitos apontadas pelos membros do conselho gestor do PESBE

Causas dos conflitos	**Conflito (s) correspondente (s)**
Legislação restritiva	
Regularização fundiária inexistente ou inadequada	
Expansão urbana.	
Industrialização.	
Especulação imobiliária.	
Turismo	
Agricultura	
Pecuária	
Mineração	
Garimpo	
Desinteresse da população	
Silvicultura	
Manifestação e tradições culturais	
Prática de esportes	
Outras causas	

ARTIGO 3 - PAYMENT FOR ENVIRONMENTAL SERVICES: ALLEVIATING THE CONFLICT OF PARKS VERSUS PEOPLE

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The "parks versus people" conflict is a result of the establishment of protected areas (PAs) that often restrict access to biological resources by the human population, mainly in developing countries. Payment for environmental services (PES) is one of the several strategies that have been developed and implemented in order to mitigate this conflict. This study aimed to evaluate whether PES could smooth the "parks and people" conflict through the analysis of five case studies from different regions and social-environmental contexts. The results have shown that PES may contribute effectively towards conflict resolution, although it was not the main objective. However, the PES results differed between cases due to attributes such as local environmental conditions, local activities and involvement capacity of both the population and local government. Some characteristics must be considered in order to have efficient results, both in biodiversity and environmental services conservation, and in the development of populations involved towards maintaining PES continuity. It is necessary to consider PES joint strategies to improve the process efficiency from diagnoses to decisionmaking.

Keywords: Nature conservation, national park, socio-environmental conflict, protected areas, ecosystem services

INTRODUCTION

The conflict between biodiversity conservation and the indigenous human population wellbeing, known as "parks versus people", is a form of conflict, which began with the Yellowstone National Park, USA creation in 1872. The fortress conservation model was inaugurated by the establishment of protected areas (PAs) through laws and decrees (Brockington 2002, Adams et al. 2004, Mcshane et al. 2011). This conservation strategy restricts population access to the natural resources of the sites that they historically inhabited

through their preservation. This is considered the main cause of conflict that promotes social exclusion, denial of ancestral territorial rights and the consequent population impoverishment (Brockington et al. 2006, Dpourcq et al. 2017).

The constant presence of conflicts in these areas are not be considered negative, since it allows the construction of a unique decision in the face of divergent and opposing positions, and thus may drive important changes (Simmel 1986). Many strategies have been established in order to smooth these conflicts such as: i) the creation of more inclusive PAs, proposed in the World Congress of National Parks held in Bali, Indonesia (1982) and Caracas, Venezuela (1992) (Naughton-Treves 2005), ii) the recognition by the International Union for Conservation of Nature (IUCN) of the different global PAs typologies, organised into six categories related to the level of restriction or possibility in natural resources use (Ia, Ib, II, III, IV, V, VI) (IUCN 1994), and iii) the construction of Integrated Conservation and Development Project (ICDPs) that has as objective to link the local population development to biodiversity conservation (Alpert 1996, Bauch 2014).

The payments for ecosystem or environmental services (PES) are defined as a voluntary transaction between a buyer of the service provided by nature and its provider, which occurs effectively if the ecosystem service provider ensures its provision (Wunder 2015). The PES has been indicated as an effective strategy to smooth the "parks versus people" conflict, since it can contribute towards PES maintenance and at the same time generate benefits to the human population involved, including them in the conservation process and relieving their poverty (Clements & Milner-Gulland 2014).

However, some aspects of the PES requires greater attention because they can influence the design, and consequently result in excessive focus on alleviating the poverty of the provisor population, that may draw attention away from environmental services (Wunder 2008). Overfocusing on economic efficiency can compromise and neglect important issues, such as the procedural fairness and equitable distribution of project outcomes, involvement of national and local public authorities, non-governmental organisations (NGOs), local communities and companies, characteristics of buyers and source of resources used in the purchase of government and private initiatives, amounts paid and opportunity costs, and the valuation of the knowledge of communities on the environmental service provided (Engel et al. 2008, Fisher et al. 2010, Pascual et al. 2014, Chan et al. 2017).

In this study, five empirical studies on PAs in four continents (Asia, Africa, Central and South America) were evaluated in order to verify whether PES can contribute to smoothing the

"parks versus people" conflict, and how the experiences may meet both the demands of environmental services and populations involved. The conflicts were initially identified, and the PES project evaluated the bodies involved, the provided environmental services, the values and their origin, the fauna or flora species that were benefited, the populations involved, the factors that have contributed to PES success or failure, and how these factors are related to other strategies used globally to smooth the "parks versus people" conflict.

MATERIALS AND METHODS

Data collection and analysis

This study consisted of identifying and analysing PES initiatives developed in PAs or in their surrounding areas that presented "parks versus people" conflicts. The study was divided into two distinct stages. In the first, a survey was carried out on the platforms of Google Scholar, Web of Science and Scopus, using the key words, "payments for environmental services", "protected areas" and "social-environmental conflicts". Priority was given to studies in which PAs fit into IUCN categories (Ia, Ib and II) that are associated with frequent conflicts (IUCN 1994). Five cases of PES were selected, directly related to PAs or to their surroundings (Figure 1).

In the second stage, two questions guided the study: i) What factors were preponderant to the success or failure of related PES initiatives? ii) What is the relationship between PES and other strategies that aim to conserve biodiversity and environmental services, and to smooth the conflicts of "parks versus people"? To answer the first question, four aspects were considered: the amounts paid to the populations involved and the opportunity costs to join PES, the valorisation of the knowledge of populations involved, the sociopolitical organisation and the participation experience in local populations, the existence of a promising market related to environmental services, and the resources for PES funding. To answer the second question, how PES can work to compensate the failures of PA policy strategies of the Integrated Conservation and Development Projects (ICDPs), were analysed.

Figure 1 Localisation of the protected areas considered in this study

Case studies

The Wolong National Nature Reserve in China (category Ia-IUCN) was founded in 1963 and expanded in 1975, currently covering about 2,000 km². It houses a great biological diversity, including 10% of the entire wild giant panda population (Ailuropoda melanoleuca) in the world (Schaller et al. 1985). About 9900 residents of 2200 households reside inside the reserve or immediately outside (Tuanmu et al. 2016). Before PES establishment, the agriculture was the main economic activity, and wood was the main domestic energy source, which contributed a strong pressure on the reserve (Liu et al. 2001, He et al. 2009). In 1998, the Natural Forest Conservation Program (NFCP) established PES in China, aiming to increase the quality of the giant panda's habitat. Based on the fact that the Panda's main food source is bamboo, which needs a canopy cover, the PES aimed to reduce deforestation and to increase the reserve's forest cover. In order to achieve it, payments were propoesed to local families as a compensation for switching timber extraction to forest conservation. Both households and the government are responsible for monitoring and reporting illegal logging in protected forest plots (Tuanmu et al. 2016).

Approximately one-third of the total NFCP monitoring area (approximately 400 of 1,205 km²) was allocated to approximately 250 families in Wolong and Gengda, who received an annual payment of about USD110 (8% of annual family income in the two municipalities in 2001). The families of Sanjiang received half the amount paid to the families of Wolong and Gengda, due to being outside the reserve. The remaining area was monitored by the local

government. As a result, there was an improvement in forest cover, contrary to the trend of habitat loss and degradation observed between the years 1960 and 2001. Thus, the reserve experienced a general improvement in panda habitat, which increased by 3.4% (from 686 to 709 km²) between the years 2001 and 2007. The increased income from PES enabled people to consume electricity, which consequently favored less use of forests wood (Tuanmu et al. 2016).

The Maya Biosphere Reserve in Guatemala (category IV-IUCN) was established in 1990 with an area of 21 602.04 km², consisting of archaeological sites, areas of multiple use occupied by human population with wood extraction as their main source of income, and central areas that shelter more restricted PAs. In multiple-use areas, isolated populations of the endangered Meleagris ocellata bird can be found, with their conservation status directly linked to the pressure of uncontrolled subsistence hunting (Baur et al. 2012). The Guatemala's government, through the National Council of Protected Areas (NCPA,) and in partnership with resident populations, developed a project called "Pavo". The project aims the conservations of these birds, associated to living quality improvement of local human populations. The project is based on a sport hunting model in which rural dwellers, through concessions, are mainly responsible for field operations, such as inspection activities, tourist guide work and annual bird population census. In exchange, the population receives a percentage of the income obtained from the sport hunting activity. The funding for the residents' remuneration is obtained by predefined charges to hunter tourists, i.e., the amount for the first slaughtered bird varies between USD1,250 and 1,450, the second USD700 and the third USD500. The income obtained from protecting the first slaughtered bird is directed to the project, 70% of the second and 100% of the third stay with the residents (Baur et al. 2012).

Within each participating concession, the project designates an area of occurrence of the M. ocellata from 25000 to 30000 ha where the activities are carried out. Such management areas are not physically delimited but are indicated on maps within the hunting management region, in plans provided by NCPA audit body, and in public announcements published within participating communities. The management areas are designated based on two criterias, bird population status and vehicular access. Due to hunting pressure, the population density of M. ocellata is directly correlated to the distance from human settlements, which is smaller where human activities are concentrated, thus the management areas are located far from villages (Baur et al. 2012). PES establishment has dramatically decreased uncontrolled subsistence hunting, and resulted in stabilisation of the species population (Baur et al. 2012). The two main contributing factors were, the project financial viability, favored by the specialised market for

hunting M. ocellata, which contributed towards payment to the residents, equivalent to almost two weeks of wages; and the organisation and search for improvement in the quality of services by local residents, mainly due to extensive experience in working with forest concession systems, and the historical economic dependence on the extraction of non-wood forest products.

The Tarangire National Park in Tanzania (category II-IUCN) was founded in 1970, covering about 2,850 km². The objective of the PES program is to allow wildlife access to the Simanjiro plains located in areas adjacent to the park, and thus encourage tourism and sport hunting that may generate income for tourism companies for the government through collecting fees and taxes, and for the local population through services linked to hunting and tourism. To this aim, the tour operators remunerate members of the Sukuro, Emboreet and Terrat tribes through an annual payment of approximately USD4,500 per tribe, in exchange for the removal of agricultural cultivation and/or the permanent settlements in areas under concession. The agreement also allows for continued seasonal grazing of livestock, as both parties have agreed that this use does not conflict with wildlife conservation objectives. The population is still committed to avoiding activities such as wood burning for coal production and unlicensed hunting in concession areas. In addition, the population also assume responsibility for supervision and custody of the area. The Wildlife Conservation Society contributes by providing wages and equipment to four village members, who act as enforcement agents and receive approximately USD300 in addition to monthly expenses (Nelson et al. 2010).

The Nairobi National Park in Quenia (category II- IUCN) was founded in 1946 and has 114 km² of area. This plain is part of the pastoral ecosystem known as Kitengela, considered very important for the grazing migratory wildlife. However, due to increasing urban expansion and agropastoral development, the fauna that migrates seasonally to the park areas faced barriers by property fences. The program aims to reduce the barriers between the conservationist and the rural producers associated to the park area by removal of fences from rural properties, and thus allowing the seasonal migration of fauna and the maintenance of economic activities in rural properties. For this purpose, it has been proposed a payment of USD10 ha-1 year-1 to landowners (Leeuw et al. 2014).

However, due to the heterogeneity of the region in attributes such as size (small properties and large latifundia) and geographic location (near or far from roads and rivers), characterising them as more fertile and productive, there are different values in the real estate market. For example, the areas closest to the rivers in the ecosystem have a greater value, reaching between USD9,000–12,000 ha-1 in 2008. Therefore, the value offered by the PES was

not enough to attract all the owners in the region. Those who accepted the proposal have glimpsed an opportunity to obtain secure reliable financial resources for investing in their children's education, thus using them to conclude payments for the fees required by schools (Leeuw et al. 2014).

The Amboró National Park in Bolivia (category II-IUCN) was founded in 1984, covering an area of 636 000 ha and located in the region of Codo de los Andes, where the western mountain range oscillates towards the south, providing different climates and physiognomies to the park. The Park also participates significantly in the protection of springs that supply nine downstream municipalities, in which 80% of water use is concentrated for agriculture (irrigation). This use is controlled by dam construction and user fees payments (low or zero). However, there is recurrent shortage in drought periods, which hinders the agricultural vegetables production (2 to 3 harvests year-1). The main conflict is land invasion by migrant populations, trying to expand their properties by forest deforestation. There are two motivating factors for the invasion, i.e., the fact that most landowners have buy-andsell contracts and not government land titles, and the incentives from local political leaders and syndicate leaders (Asquith et al. 2008).

In 2003, in order to protect the Ambóro National Park and its surrounding areas, the Natura Bolivia Foundation developed a PES of hydrographic basins, where the resources were funded by Pampa Grande municipality and US Fish and Wildlife Service. The payments are not made in cash, but in beehives and technical assistance to implement beekeeping activities in the forest areas. The cost is accounted for in the form of USD3 (cost of a beehive) per 10 ha of preserved forest, plus assistance in beekeeping activities (i.e, hired technicians). The farmers reported that they prefer this payment as they have added value to the future, which would not happen if they received money that may not result in benefits if indiscriminately use. Other farmers who do not have aptitude for apiculture may choose to receive fruit tree seedlings or barbed wire (to surround and demarcate their lands) (Asquith et al. 2008).

The observations have shown that many thrive in beekeeping activities. and others that do not have success end up selling their hives. Those who prosper can earn up to USD16.66 ha-1 from this activity. The program provides technical assistance but does not monitor the beekeeping activities. Vegetation preservation of the areas have been protected by PES, i.e. contracted technicians conduct surveys on site and through geoprocessing. The program has established conservation priorities, making larger payments following the order: cloud forests, dry forest and forest impacted by livestock. The initial proposal was that the project could be

financed by downstream agricultural producers who benefit from the good water quality, resulting from forest conservation in higher parts, but they were not willing to pay (Asquitha et al. 2008).

RESULTS AND DISCUSSION

Amounts paid to the populations involved and the opportunity costs

Of the five studied cases, the PES developed in Tarangire National Park, Maya Biosphere Reserve and Wolong National Nature Reserve were clearly more successful. The first positive point in these three initiatives is related to payment amount and opportunity cost. If the offered amount is low and the opportunity cost is high, the abandonment of activities practiced by the populations involved is not encouraged, which could be harmful to environmental services (ES) maintenance (Wunder 2008, Engel et al. 2008). Thus, the PES tend not to be efficient in situations in which the landowners, most valued by the real estate market, are not attracted by the amounts offered, as was the case of the Nairobi National Park. The PES programmes that offer low, undifferentiated and non-targeted payments are likely to fail (Engel et al. 2008).

In the Ambóro National Park PES, the forest cover maintenance is linked to beekeeping success, but not all participants obtained success. In this way, the beehives sale or abandonment may possibly promote the return of invasion and deforestation threats, and consequently conflict continuity. Although some owners opt for fruit tree seedlings or wire fences, it can be understood that PES implementation through incentives that are not financial by socioeconomic practices, can present problems especially when the activities are not part of the local culture, and so require a learning curve. Another PES negative point is the search for efficient resource investment, that may favor some ecologically more interesting areas to the detriment of others. Chan et al. (2017) reported differentiate payments that may have negative consequences, such as the creation of barriers to participation. For example, in the Ambóro Natiional Park case, the properties located in the higher parts (cloud forests) are more valued in payment than those in dry forests, which in turn are more valued than the forests impacted by livestock.

In the Wolong Reserve and Maya Biosphere Reserve, the payment amount and opportunity cost were satisfactory. In the first program, the populations abandoned firewood use and begun to consume electricity. Thus, within seven years of monitoring, it was found that PES was more efficient than reserve establishment in the reduction of deforestation. In the

Maya Biosphere Reserve, the payment amount and opportunity cost were enough for the communities to abandon the uncontrolled subsistence hunting on M. ocellata bird, and it was more advantageous to work on the activities established by the Pavo project PES.

Specifically, the amounts paid in Tarangire were equal for all tribes, and so the opportunity cost was also equal. However, it should be noted that in this program the number of ES suppliers is small and homogeneous, unlike Nairobi, since all the population use the Sirimanjaro plains to graze livestock communally without fences separating the properties. This benefits wildlife during dry season, and consequently the tourism. Another advantage is the existence of a tourism market dependent on ES, and the positive relation of Tarangire tribes with this activity, which does not exist in Nairobi.

Valorisation of knowledge, social organisation and experience of the communities involved in new economic arrangements

In Tarangire and Maya Biosphere Reserve PES, the positive results are a consequence of various factors, such as recognition of the communities' knowledge on ES in question, its political/social organisation and the communities' experience in working with new financial arrangements, which is fundamental to PES effectiveness (Chan et al. 2017). In the Maya Biosphere Reserve, the population participation in forest concession is a long-standing practice, and in the Tarangire National Park the tourism activities have been incorporated into their daily practices, contributing towards effective participation in negotiations, contract and ES supply.

Another positive factor that contributed towards the success of both PES initiatives is a promising market in Maya Biosphere Reserve for *M. ocellata* sport hunting, and tourism and sport hunting in the Tarangire National Park. It is important to emphasise that these markets are favored by ESs, maintained by the knowledge of the populations involved in PAs, due to the existence of buyers that are willing to pay.

A financial view of the future of PES

A very relevant issue about PES is about its capacity to continue if financial resources are withdrawn (Wunder 2008). This problem is fundamental to PES continuity, since environmental services do not follow laws, rules and schedules, but continue to exist due to dependence on them. In this sense, the participation of the funding source is very important for

PES maintenance. Chan et al. (2017) reported that withdrawing financial incentives, after they have been introduced, may have a negative effect, i.e., ES suppliers may stop contributing because they believe they are entitled to receive compensation or because the agreement has not been fulfilled. Thus, the end of PES or non-payment of an agreed amount may increase the pressure on the ESs to a greater condition than it was before the payments were started.

Analysing the five PESs, different realities were found: (a) the resources coming from the Pavo project, conservation of *M. ocellata*, funds all PES of Maya Biosphere Reserve, (b) the tourism operators who profit from the presence of wildlife on the Sirimanjiro plain in Tarangire National Park, finance part of the PES, but the wage payments are subsidised by the Wildlife Conservation Society, (c) The Wolong Reserve PES is fully funded by the Chinese Government through NFCP, (d) in Ambóro National Park, the municipality of Pampa Grande finance the PES, together with US Fish and Wildlife Service, and (e) in Nairobi National Park funding is carried out by the Wildlife Conservation Society.

In terms of funding, it was understood that the Pavo project PES, developed at Maya Biosphere Reserve, is the best perspective, since it does not depend on external funding, and is therefore less subject to global economic instability and local political changes. Financially, it depends on the success of the Pavo project and the continuity of the market for hunting *M. ocellata*.

The PES developed in Tarangire National Park (b) follows the same direction as that applied in the Maya Biosphere Reserve, where the tour operators are the main beneficiaries from the local fauna that they finance. However, monitoring, which is an important part of the PES, is funded by the Wildlife Conservation Society, an external source of subject to global market instability. Thus, the possible withdrawal of its resources could contribute to PES failure, and may lead to increased pressure on humid plains and local fauna, thus jeopardising tourism, its main financier.

The Wolong Reser ve reality (c) can be considered positive in three respects: the China's economic momentum which favors long-term financing of the project, the worldwide appeal for giant panda conservation and the existence of a promising tourist market, mainly due to the presence of these species. However, the fact that the government is the only funder could compromise PES effectiveness long term, since government-funded programs are subject to political mandated durations, which is less likely to occur in user-funded PES programmes (Engel et al. 2008).

In Ambóro National Park (d) the initial proposal was for financing to be carried out by

the agricultural producers, downstream of the river, they being the major beneficiaries of the forests conservation. For Pagiola and Platais (2007), PES programmes in which users are the financers, tend to be more efficient because they have more information about the service value, and are directly involved and observe the delivery of the services, and a possibility of renegotiating the contract if necessary. However, there was no such disposal from rural producers, thus it is financed by the Pampa Grande municipality and US Fish and Wildlife Service. As in Wolong Reserve, political changes could remove the municipality from the project and leave only an external funding source, thus reducing the possibilities of its continuity.

In the Nairobi National Park (e), the PES leasing program on Athi-kputiei plains is fully funded by the Wildlife Conservation Society, and thus may suffer from possible changes in world economy, similar to other initiatives dependant on external resources. The existence of only one financier is another negative factor for consideration, because the program may end if the investment is withdrawn.

The relationship between PES programmes and other strategies for conservation of PAs and "parks versus people" conflicts: PAs and ICDPs

The PES are market instruments while PAs are command and control instruments, established by public policies in order to conserve biodiversity and environmental services. Under the environmental economics view, PES are considered more efficient, since command and control regulation tend to prescribe the same level of activity for all ES suppliers, while marketbased instruments are more flexible (Engel et al. 2008). The Wolong Reserve corroborates with the study, as in seven years of monitoring it was found that PES was more efficient than command and control policies in generating an increase in forest cover (Tuanmu et al. 2016). The African parks analysed in this study are located in Savannas and are not able to protect the flow of migratory fauna solely within their boundaries (Nelson et al. 2010, Leeuw et al. 2014). Thus the PES of the two parks searched for complementary to cover the gap. However, in the initiative developed in Tarangire National Park, it was attempted to involve the populations inhabiting the park surroundings into conservation practices in order to generate income and social inclusion, and thus contribute to the poverty alleviation and conflicts smoothing. The more flexible PA categories, in relation to the biological resources use (categories III, IV, V and VI of IUCN) may fail to maintain forest cover and to conserve endangered species

(Françoso et al. 2015). Thus, the PES programmes can act in a complementary way by filling the gaps left by these PAs, as observed in PES of Maya Biosphere Reserve.

The ICDPs have been implemented to alleviate the poverty of populations affected by the restrictive PAs establishment (categories Ia, Ib and II of IUCN) and to help conservation by reducing both conflicts and pressure on biological resources in interior and buffer zones (Alpert 1996, Bauch 2014). However, experiences in Asia, South America and Africa have shown that ICDPs did not fully achieve their stated goals. When biodiversity conservation and human well-being occurred, they were dissociated or lacked equity in resource distribution among the members of the populations benefitting by the funding resources (Alpert 1996, Kellert et al. 2000) (Figure 2). For example, in Malaysia, in the Ranomafana National Park, new sources of income created by ICDP were incorporated into traditional activities, initially considered harmful to PAs, instead of being replaced (Peters 1998). In five ICDPs studied in African continent, revenue from tourism was included into two initiatives favored by good quality roads and easy megafauna visualisation (Alpert 1996). In the national forest of Tapajós, in Brazilian Amazon, an ICDP that aimed to reduce cattle herds in the vicinity of the PA, to reduce deforestation, have had results only in herd decline (Bauch 2014).

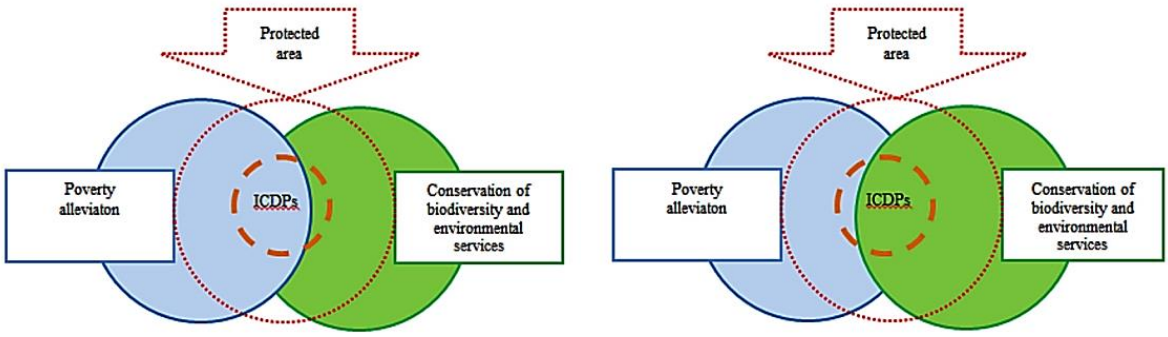

Figure 2 Integrated Conservation and Development Project (ICDP) scheme applied to Protected Area (PA) demonstrating the disassociation between poverty alleviation and conservation of biodiversity and environmental services

These examples show that generating income alone is not sufficient to maintain ESs. It is fundamental to have conditions to deliver the ESs, as required in PES (Wunder 2015). In the ICDP analysis, projects were created with the hope that the activities or behaviors impacting the ES would cease only with the creation of new income sources, without any counterpart, which does not occur in PES projects, since they include the counterpart requirement registered in contract (Engel et al. 2008).

CONCLUSIONS

Although mitigating the “parks versus people” conflict is not the main objective of the PES initiatives developed in PAs, the results of this study have indicated that its a great possibility, when associated with such areas. However, further research is needed for a more detailed analysis. It is also concluded that the use of PES developed in PAs should not divert the focus from ES conservation towards poverty alleviation of populations affected by conservationist restrictions, nor should the opposite be done. It is necessary to search for the integration of populations involved in conflicts with ESs conservation through PESs. In this sense, it is also fundamental to use other biodiversity preservation strategies that may guarantee and encourage the participation of populations involved in the PA management processes, from diagnoses to decision-making stages, thus considering the people’s participation as a premise.

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