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Programa de Pós-Graduação em Diversidade Biológica e Conservação nos
Trópicos

FELIPE ALEXANDRE SANTOS VIEIRA

RELACIONANDO SERVIÇOS ECOSSISTÊMICOS CULTURAIS E PRÁTICAS
GERADORAS DE VALOR EM ÁREAS PROTEGIDAS

MACEIÓ - ALAGOAS
Abril/2023

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GERADORAS DE VALOR EM ÁREAS PROTEGIDAS**

Dissertação/Tese apresentada ao Programa de Pós-Graduação em Diversidade Biológica e Conservação nos Trópicos, Instituto de Ciências Biológicas e da Saúde. Universidade Federal de Alagoas, como requisito para obtenção do título de Doutor em CIÊNCIAS BIOLÓGICAS, área de concentração em Conservação da Biodiversidade Tropical.

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RESUMO

Áreas protegidas são reconhecidas como essenciais para a conservação da natureza no século XXI. Apesar da grande importância destas áreas no Brasil, sua existência a longo-prazo tem sido ameaçada por setores da sociedade que as vêem como custos de oportunidade frente a outros usos do solo. Assim, para assegurar sua existência a longo-prazo, é necessário que demonstremos todas as formas de valor que elas geram, além do tradicional valor de conservação da biodiversidade. Aqui, utilizamos abordagens tradicionais e inovadoras para quantificar o fornecimento de Serviços e Desserviços Ecosistêmicos Culturais e Práticas Geradoras de Valor, respectivamente, por áreas protegidas brasileiras. No capítulo 1 desta tese, utilizamos questionários presenciais para identificar diferenças na percepção de serviços e desserviços culturais entre moradores de dentro e de fora de áreas protegidas na Amazônia, além de explorar fatores socioeconômicos associados a estas diferenças. Foi observado que moradores de áreas protegidas mencionaram mais *recreação social* e *herança cultural* se comparados a moradores de fora destas áreas. Além disso, as comunidades de dentro das áreas protegidas apresentam maior escolaridade e equidade de gênero. Argumentamos que tais diferenças devem estar associadas ao envolvimento destas comunidades com o projeto de manejo do pirarucu, que tem sido apontado como responsável por outros inúmeros benefícios sociais e ecológicos. No capítulo 2, foi possível identificar quais são as práticas geradoras de valor mais relevantes para visitantes domésticos e internacionais nas áreas protegidas costeiras a partir do número de páginas na internet mencionando estas atividades. Como esperado, foi observado que *recreação social* é mais relevante para visitantes internacionais enquanto *uso de recursos naturais* é mais importante para visitantes domésticos. De forma geral, todas as categorias de práticas geradoras de valor foram mais salientes em parques nacionais, se comparados com parques estaduais ou municipais. Finalmente, conclui-se que nossos resultados na Amazônia (capítulo 1) podem servir como uma importante linha de base para avaliações de serviços e desserviços ecosistêmicos no futuro.

Recomendamos também a criação de bases de dados integradas que possam ser rapidamente analisadas em conjunto para auxiliar as tomadas de decisão nas áreas protegidas deste icônico bioma. Ainda, a utilização do índice de saliência cultural baseado na quantidade de páginas da internet contendo termos-chave se demonstrou adequada para mensurar práticas geradoras de valor em áreas protegidas (capítulo 2). Esperamos que a utilização desta abordagem possa ser replicada para a avaliação da importância de *ativos* em áreas protegidas, como espécies icônicas/ameaçadas e atrativos turísticos. No futuro, é esperado que a maior capacidade de processamento dos computadores e o desenvolvimento de novas ferramentas para coletar e analisar os dados provenientes da internet possibilitem a geração de informações que auxiliem tomadas de decisão em áreas protegidas em tempo real.

Palavras-chave: Áreas Protegidas; Serviços Ecossistêmicos Culturais; Desserviços Ecossistêmicos culturais; Práticas Geradoras de Valor; Amazônia

ABSTRACT

Protected areas are recognized as essential for nature conservation in the 21st century. Despite the great importance of these areas in Brazil, their long-term existence has been threatened by sectors of society that see them as opportunity costs compared to other land uses. Thus, to ensure their long-term existence, it is necessary that we demonstrate all forms of value they generate, in addition to their obvious value for biodiversity conservation. Here, we use both traditional and innovative approaches to quantify the provision of Cultural Ecosystem (Dis)Services and Value Generating Practices, respectively, by Brazilian protected areas. In chapter 1 of this thesis, we used face-to-face questionnaires to identify differences in the perception of cultural services and disservices among residents inside and outside protected areas in the Amazon, in addition to exploring socioeconomic factors associated with these differences. It was observed that residents of protected areas mentioned more social recreation and cultural heritage when compared to residents outside these areas. In addition, we observed that communities within protected areas have higher education and gender equity. We argue that such differences must be associated with the involvement of these communities with the *Arapaima* management project, which has been pointed out as responsible for countless other social and ecological benefits. In chapter 2, it was possible to identify which are the most relevant value-generating practices for domestic and international visitors in coastal protected areas. As expected, it was observed that social recreation is more relevant for international visitors while natural resource use is more important for domestic visitors. In general, all categories of value-creating practices were more prominent in national parks, when compared to state or municipal parks. Finally, we conclude that our Amazonian results can serve as an important baseline for assessments of ecosystem services and disservices in the future. We also recommend the creation of integrated databases that can be quickly analyzed together to help decision-making in the protected areas of this iconic biome. Also, the use of the cultural salience index based on the number of internet pages containing key terms

proved to be adequate for the evaluation of value-generating practices in protected areas. We hope that the use of this approach can be replicated for assessing the importance of assets in protected areas, such as iconic/threatened species and tourist attractions. In the future, it is expected that the greater processing capacity of computers and the development of new tools to collect and analyze data from the internet will enable the generation of information that will help decision-making in protected areas in real time.

Keywords: Protected Areas; Cultural Ecosystem (Dis)Services; Value Generating Practices; Amazon

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1 APRESENTAÇÃO

Áreas Protegidas (APs) se tornaram espaços fundamentais para a conservação da natureza no último século (Watson, 2014). Atualmente, APs estão distribuídas por todo o planeta e protegem uma grande parcela das áreas terrestres, águas interiores, áreas costeiras e oceanos (UNEP-WCMC and IUCN, 2020). No entanto, para que estas áreas atinjam todo o seu potencial, ainda é necessário que haja um aumento no reconhecimento das contribuições que elas dão para a sociedade (Watson, 2014).

O Brasil é um país com uma mega biodiversidade que fornece benefícios para todo o mundo (p.ex. sequestro de carbono). No final do século passado, o governo federal fez enormes investimentos na criação e no fortalecimento de sua rede de Áreas Protegidas, principalmente entre as décadas de 1970 e 1990 (Mittermeier, 2005). Isto resultou em um sistema abrangente de unidades de conservação (conhecido como Sistema Nacional de Unidades de Conservação - SNUC; Brasil, Lei 9.985/2000), o que elevou o Brasil a uma posição de referência na conservação da natureza internacionalmente (Loyola, 2015).

Apesar disso, recorrentes decisões parlamentares para reclassificar, diminuir ou até extinguir APs (PADDD; Mascia and Pailler, 2011; Bernard et al., 2014; Pack et al., 2016; Symes et al., 2016) têm ameaçado o status de liderança alcançado pelo país. Os argumentos a favor destas decisões assumem frequentemente que APs competem com outros usos da terra gerando custos de oportunidade (Dobrovsky et al., 2011; Metzger, 2010; Myers et al., 2000). Tais retóricas frequentemente desconsideram os inúmeros benefícios (materiais e imateriais) advindos da preservação e do uso sustentável de recursos em áreas naturais.

Para demonstrar toda a gama de valores de APs brasileiras frente às pressões de setores que ameaçam sua existência a longo prazo (como o da agricultura intensiva), é necessário entendermos a importância econômica e ecológica destas áreas, mas

também seu papel no bem-estar humano (Hirons et al., 2016). Tais avaliações geralmente são baseadas em modelos clássicos de necessidades humanas como o de Maslow (1947). No âmbito das áreas naturais, estes benefícios sobre o bem-estar têm sido denominados *serviços ecossistêmicos* ou *contribuições da natureza para as pessoas* (Díaz et al., 2018; Haines-Young and Potschin, 2018; Millenium Ecosystem Assessment, 2005; Pascual et al., 2017; TEEB, 2010).

Serviços Ecossistêmicos Culturais (SECs) representam uma das categorias de *serviços ecossistêmicos* e podem ser definidos como os “*benefícios não-materiais que as pessoas obtêm dos ecossistemas através de enriquecimento espiritual, desenvolvimento cognitivo, reflexão, recreação e experiências estéticas*” (Millenium Ecosystem Assessment, 2005^b; Leyshon, 2014). A avaliação de tais serviços tem se mostrado desafiadora em comparação a outras categorias de *serviços ecossistêmicos* mais palpáveis, o que fez com que os SECs fossem historicamente negligenciados (Hirons et al., 2016).

Tais desafios experienciados por pesquisadores que avaliam serviços culturais a partir de métodos tradicionais (p.ex. questionários) dizem respeito ao tamanho da área de estudo (geralmente limitados à escala local), o tempo para a coleta dos dados e o emprego de recursos humanos e financeiros. Apesar disso, questionários presenciais geram informações altamente relevantes para a gestão de áreas naturais na escala local e podem identificar detalhadamente os locais e atributos biofísicos que estão associados a cada categoria de SEC (p.ex. recreação, valor espiritual, valor histórico).

Recentemente, o desenvolvimento de ferramentas computacionais (p.ex. análises automatizadas de textos e imagens) voltadas à exploração do grande volume de dados gerados por usuários da internet (p.ex. redes sociais e páginas da web) tem representado uma alternativa rápida e de baixo custo para a avaliação de SECs

(Cardoso et al., 2020; Johnson et al., 2019; Richards and Friess, 2015; Richards and Tunçer, 2017; Vieira, 2021; Zhang et al., 2020).

Práticas Geradoras de Valor (VGPs), por sua vez, é um conceito desenvolvido no âmbito do *assets framework* (Jepson et al., 2017) e, assim como SECs, está associado aos elementos biofísicos de uma Área Protegida e aos valores gerados para os usuários destas áreas. A identificação destas práticas pode ser especialmente útil para orientar ações de gestão na escala local que criem ou potencializem diversas formas de valor (para diversos grupos de usuários) nas APs.

Nesta tese, foram utilizados métodos tradicionais (questionários presenciais; capítulo 1) e inovadores (quantidade de websites contendo termos-chave; capítulo 2) para avaliar serviços ecossistêmicos culturais e práticas geradoras de valor, respectivamente, em áreas protegidas. Nossos resultados têm grande potencial para auxiliar a tomada de decisões e para demonstrar as diversas formas de valor que as APs geram (além do tradicional valor de conservação da natureza), contribuindo para ampliar o leque de argumentos necessários para justificar a manutenção destas áreas no presente e no futuro.

2 REVISÃO DA LITERATURA

2.1 Áreas Protegidas

Áreas Protegidas (APs) se tornaram a pedra fundamental da conservação da biodiversidade e dos ecossistemas. Desde a criação do primeiro parque nacional, em 1872, nos Estados Unidos (Parque Nacional de Yellowstone), APs têm sido estabelecidas com os mais diversos propósitos em praticamente todos os países do mundo. No entanto, o modelo ‘no-take’ (onde nenhuma atividade extrativista é permitida) adotado pelas primeiras APs representam apenas uma fração destas áreas hoje em dia. Conceitualizadas pela União Internacional para a Conservação da Natureza (IUCN), a principal “organização internacional para a proteção dos ecossistemas, promoção do uso sustentável das paisagens e para o avanço da justiça social e equidade na conservação” (IUCN, 2023), estas áreas tiveram seus propósitos diversificados e agora estão organizadas em categorias de gestão que almejam, além da preservação estrita da biodiversidade, a integração do uso da terra por populações extrativistas tradicionais ou a preservação de sítios naturais com grande beleza cênica ou de relevância cultural (Palomo, 2014).

Atualmente, as APs estão distribuídas por todo o planeta (Watson, 2014). No último relatório das Nações Unidas, foi observado que 16.64% das áreas terrestres e águas interiores e, aproximadamente, 8% das águas costeiras e do oceano estão situados em áreas protegidas (UNEP-WCMC and IUCN, 2020). Apesar destes números representarem um avanço significativo desde a última versão deste relatório (UNEP-WCMC and IUCN, 2020), ainda é necessário que haja um aumento no financiamento, no planejamento, na implementação e no reconhecimento das contribuições destas

áreas para a sociedade, possibilitando que estas atinjam todo o seu potencial (Watson, 2014).

2.2 Áreas Protegidas no Brasil

No Brasil, as APs são regulamentadas pelo Sistema Nacional de Unidades de Conservação (SNUC; Brasil, Lei 9.985/2000) que, diferindo ligeiramente da IUCN, criou seu próprio sistema de classificação, onde observa-se uma tipificação abrangente de 12 classes de APs divididas em dois grandes grupos: Unidades de Conservação de Proteção Integral e Unidades de Conservação de Uso Sustentável. No primeiro grupo, incluem-se áreas destinadas à preservação da natureza, sendo admitida apenas a utilização indireta de seus recursos naturais (por exemplo, parques nacionais e reservas ecológicas). O segundo grupo, por sua vez, é destinado a compatibilizar a conservação da natureza com o uso sustentável de parte de seus recursos naturais (por exemplo, áreas de proteção ambiental e reservas extrativistas).

Cabe-se ressaltar, ainda, a existência de um terceiro grupo que não está tipificado no SNUC mas que é representado por áreas de extrema importância para a conservação da biodiversidade e de complementariedade às Unidades de Conservação: os Territórios Indígenas (ou reservas indígenas; Brasil, Lei 6.001/1973; Brasil, decreto 1.775/1996). Estas áreas são territórios sob jurisdição federal geridos através da Fundação Nacional do Índio (FUNAI). Apesar da existente discussão sobre o enquadramento destas áreas como áreas protegidas, é evidente que as práticas de extrativismo e os meios de vida dos povos indígenas são compatíveis com a conservação da natureza a longo prazo e o desenvolvimento sustentável, havendo evidências de que estes territórios apresentam taxas de desmatamento e intensidade do uso do solo menores do que áreas não protegidas na Amazônia (Ferreira et al., 2005; Sze et al., 2022; Sze et al., 2022^b).

Historicamente, o Sistema Nacional de Unidades de Conservação representou um grande avanço no que diz respeito a facilitação de criação e implementação de diversas APs no território nacional, alavancando grandes investimentos do governo federal entre as décadas de 1970 e 1990. Tais despendimentos contemplaram APs nos mais diversos níveis administrativos (federais, estaduais, municipais e privadas), ultrapassando os investimentos realizados por qualquer outro país tropical na época e comparável aos de países desenvolvidos (Mittermeier et al., 2005). A criação desta complexa rede de APs elevou o Brasil a uma posição de prestígio internacional com relação à preservação ambiental (Loyola, 2014) e resultou no sedimento de conferências internacionais para a elaboração de metas para a conservação da natureza global. Dentre estas, destacam-se a Rio + 20, em 2012, e a ECO-92, uma conferência das Nações Unidas que produziu um dos mais importantes tratados internacionais relacionados ao meio ambiente, assinado por mais de 160 países: a Convenção sobre a Diversidade Biológica (CBD).

Apesar da fundamental importância desta posição de liderança e da rede de APs para a conservação da biodiversidade brasileira, políticas nacionais com relação às unidades de conservação e à preservação da natureza como um todo desfizeram o prestígio internacional conquistado pelo país nas últimas décadas (Escobar, 2019). Estas políticas incluem frequentes decisões parlamentares para reclassificar APs para categorias mais permissivas à exploração, diminuir sua área ou até extingui-las completamente (Mascia and Pailler, 2011; Bernard et al., 2014; Pack et al., 2016; Symes et al., 2016), afetando negativamente a conservação nos diversos biomas brasileiros.

Uma outra medida controversa tomada pelo parlamento brasileiro foi a reformulação do código florestal, que é considerado a principal legislação sobre a preservação da natureza em propriedades privadas. O novo código florestal foi aprovado em 2012

(Brasil, 2012) e tem sido, desde então, fortemente criticado por conservacionistas, uma vez que concedeu uma anistia para os donos de áreas desmatadas ilegalmente antes de 2008. De acordo com o antigo código, estas áreas deveriam ser reflorestadas com recursos de seus proprietários. Sob o novo código florestal, cerca de 90% das propriedades rurais do Brasil se qualificaram para esta anistia e pesquisadores sugerem que isto permitirá a ocorrência ainda maior de desmatamentos, especialmente no Cerrado e na Caatinga (Soares-Filho et al., 2014).

Os principais argumentos dos parlamentares que endossam tais medidas contrárias à preservação de áreas naturais e à manutenção de APs no longo-prazo sugerem que a proteção destes espaços gera custos de oportunidade, uma vez que compete com outros usos da terra, principalmente a agricultura e a pecuária (Dobrovsky et al., 2011; Metzger, 2010; Myers et al., 2000). Tal desarranjo no sistema de áreas protegidas nacional culminou, recentemente, na interrupção de importantes investimentos internacionais, como o ‘fundo amazônia’ (Escobar, 2019^b; Marcovitch, 2014; Pelicice, 2021), uma contribuição financeira internacional para a conservação da floresta amazônica. A partir de 2023, este apoio foi reestabelecido após a reaproximação do governo brasileiro com as autoridades alemãs e norueguesas, principais responsáveis pelo fundo.

2.3 Bem-estar humano

Atualmente, existem diversas tipologias e definições de bem-estar humano descritas na literatura científica. Estas definições provêm das mais diversas áreas, incluindo as ciências sociais, filosofia, economia, sociologia e a psicologia (Hulme, 2013). Apesar desta área de pesquisa contar com inúmeras contribuições científicas hoje em dia, ainda não há uma definição consensual para ‘bem-estar humano’ e as que existem

frequentemente se contrapõem (Clarke and McGillivray, 2007), refletindo as dificuldades para a mensuração deste fenômeno.

A Teoria das Motivações Humanas de Maslow (1943) talvez seja, ainda hoje, o estudo sobre necessidades humanas com impacto mais duradouro entre acadêmicos e a sociedade em geral (Abulof, 2017). Na primeira (e mais difundida) versão deste estudo, o psicólogo americano apresenta um esquema hierárquico que vai desde necessidades básicas (requerimentos fisiológicos e de segurança básicos para a sobrevivência) até necessidades psicológicas (relações interpessoais, amizades e prestígio) e necessidades de autorrealização (atingir todo o seu potencial, incluindo atividades criativas), nesta ordem. A ideia central desta teoria é que os seres humanos precisam suprir as necessidades de nível mais baixo antes de progredir para as necessidades de nível mais alto na hierarquia (Figura 1) e alcançar seu desenvolvimento pleno.

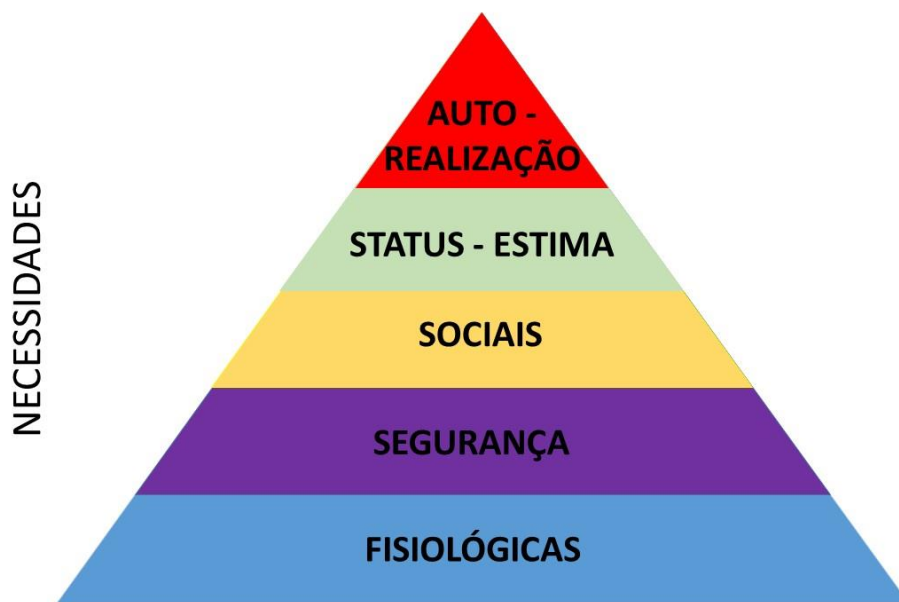


Figura 1: Pirâmide de necessidades de Maslow. Figura adaptada de Maslow (1943).

A teoria de Maslow (1943) tem sido a base para diversas avaliações de bem-estar humano desde então, apesar de alguns autores apresentarem ressalvas sobre a não consideração das diferenças pessoais de cada indivíduo e sobre o ordenamento das necessidades apresentadas por Maslow (Henwood et al., 2015), além da ‘rigidez’ da ideia de que as necessidades de nível mais baixo precisam ser cumpridas antes das demais (McLeod, 2018). Posteriormente, Maslow admite que esta ideia poder passar “a falsa impressão de que uma necessidade precise ser 100% satisfeita antes da próxima necessidade surgir” (Maslow, 1987).

Um dos maiores desafios na organização da literatura científica sobre *bem-estar* emerge a partir do emprego de diversos termos que se confundem e, por vezes, são utilizados com significados semelhantes, como: *qualidade de vida*, *desenvolvimento humano*, *felicidade*, *satisfação pessoal*, entre outros. Frequentemente, quando existe a utilização de um determinado termo, não há o aprofundamento ou discussão sobre como este se distingue das demais nomenclaturas existentes (Clarke and McGillivray, 2007).

Além da não existência de um consenso sobre a terminologia para representar bem-estar, existem diversas outras categorizações que podem confundir a identificação do tópico sobre o qual um determinado estudo discorre. Por exemplo, a comum diferenciação entre bem-estar hedônico, que se refere ao bem-estar subjetivo (p.ex. emoções positivas; Diener (1984), e bem-estar eudaimônico, que se refere ao bem-estar psicológico (p.ex. satisfação com a vida; Ryff (1989), tem auxiliado na descrição e no direcionamento de pesquisas sobre o tema. No entanto, sua utilidade tem sido questionada por diversos autores (Coyne 2013, Kashdan et al., 2008), uma vez que esta separação pode causar a impressão da existência de mais de um tipo de bem-estar (Disabato et al., 2016).

Um indicador simples e amplamente utilizado como proxy para bem-estar humano é a *renda* (do inglês 'income') (D'Ambrosio et al., 2020; Howarth and Kennedy, 2016; Macchia et al., 2020; Sarracino and Piekalkiewicz, 2021), onde pesquisadores frequentemente utilizam o argumento de que esta aumenta o *consumo* (McKenzie, 1983; Slesnick, 1998). No entanto, ainda existe muito debate sobre como o *consumo* pode representar bem-estar diretamente (Clarke and Islam, 2004) e sobre as debilidades desta associação quando não há distinção de gênero ou quando utilizada em diferentes contextos socioeconômicos. Por exemplo, ocupação profissional e aderência aos papéis tradicionais de gênero na sociedade têm sido apontados como relevantes fatores psicológicos com grande influência no bem-estar de homens e mulheres (Matud, et al., 2004). Apesar disso, Haring e colaboradores (1984) constataram que *gênero* nunca transcende *classe social* como fator determinante de bem-estar subjetivo na literatura científica e Hueting (1980) argumenta que *renda* é uma boa métrica para bem-estar principalmente em áreas de extrema pobreza.

Nas últimas décadas, a literatura científica mudou de direção, no sentido de se reconhecer a importância dos aspectos não-econômicos nas avaliações de bem-estar humano. Este movimento ressalta a ideia de que o bem-estar proveniente do sistema econômico está associado a sistemas sociais e biofísicos mais amplos (aspecto que a economia clássica tem ignorado historicamente). Estas novas correntes de pensamento deram origem a grandes áreas na ciência como a ecologia econômica (Dodds, 1997) e resgataram aspectos da psicologia (p.ex. as necessidades levantadas por Maslow (1943)) que são utilizados em avaliações mais holísticas sobre bem-estar.

2.4 Contribuições de áreas naturais para o bem-estar

A criação, o estabelecimento e a boa gestão de APs têm sido apontados como fundamentais para o desenvolvimento sustentável e a proteção dos recursos naturais e

culturais para proteger, além da biodiversidade, a saúde e o bem-estar humano nas próximas gerações (IUCN, 2023). Atualmente, existem inúmeras evidências de que a interação homem-natureza é benéfica tanto para a saúde física quanto mental (Pretty, 2004; Russel et al., 2013). Pretty e colaboradores (2004) descrevem três níveis de interação com ambientes naturais: o primeiro nível se refere à observação da natureza através de uma janela, uma pintura, livro ou televisão. O segundo corresponde a estar na presença da natureza ao realizar outra atividade, como caminhar em um parque enquanto vai ao trabalho ou se reunir com amigos em uma área natural. O terceiro nível se refere ao engajamento ativo de uma pessoa com o ambiente natural, como a prática de jardinagem, agricultura ou eco-esportes.

O primeiro nível apontado por Pretty e seus colaboradores (interação indireta com a natureza) já foi objeto de diversos estudos, com implicações diretas para o ramo da saúde. Em sua pesquisa, Ulrich (1984) faz uma importante contribuição para a área da saúde hospitalar ao observar que pacientes em período pós-operatório tiveram uma recuperação mais rápida quando instalados em quartos com vista para ambientes naturais, em comparação com pacientes em quartos sem janelas.

O contato direto com a natureza, por sua vez, tem sido nomeado por diversos autores como *serviços ecossistêmicos* (Haines-Young and Potschin, 2018; Millenium Ecosystem Assessment, 2005; TEEB, 2010) ou, mais recentemente, *contribuições da natureza para as pessoas* (Díaz et al., 2018; Pascual et al., 2017). A interação com jardins terapêuticos ('healing gardens') em hospitais, por exemplo, foi apontada como um importante redutor de estresse em pacientes com doenças crônicas (Setyani and Theresia, 2020). Outros estudos têm sido mais específicos, identificando uma relação positiva entre os níveis de biodiversidade em ambientes naturais e a saúde das pessoas que interagem com esses ambientes (Russel et al., 2013; Carrus et al., 2015).

Além das contribuições para as ciências da saúde, muitos são os esforços de operacionalização do conceito de *serviços ecossistêmicos* para que este seja útil na gestão de áreas naturais, beneficiando ambos: natureza e sociedade. De Groot e colaboradores (2002) destacam a importância da integração de diversos conceitos como i) *estrutura dos ecossistemas*, ii) *funções ecossistêmicas*, iii) *serviços ecossistêmicos*, iv) e *valor* (ecológico, econômico e social). Idealmente, estes sistemas socioecológicos devem ser entendidos como um todo, uma vez que as práticas culturais dos seres humanos modificam a estrutura dos ecossistemas, o que afeta suas funções (que são, segundo os autores: as *‘capacidade dos processos e componentes naturais de fornecer bens e serviços para satisfazerem as necessidades humanas, direta ou indiretamente’*) e sua capacidade de fornecer serviços ecossistêmicos. Por fim, o *valor* que é fornecido para a sociedade nas suas diversas formas é considerado um produto indireto deste sistema (Figura 2).

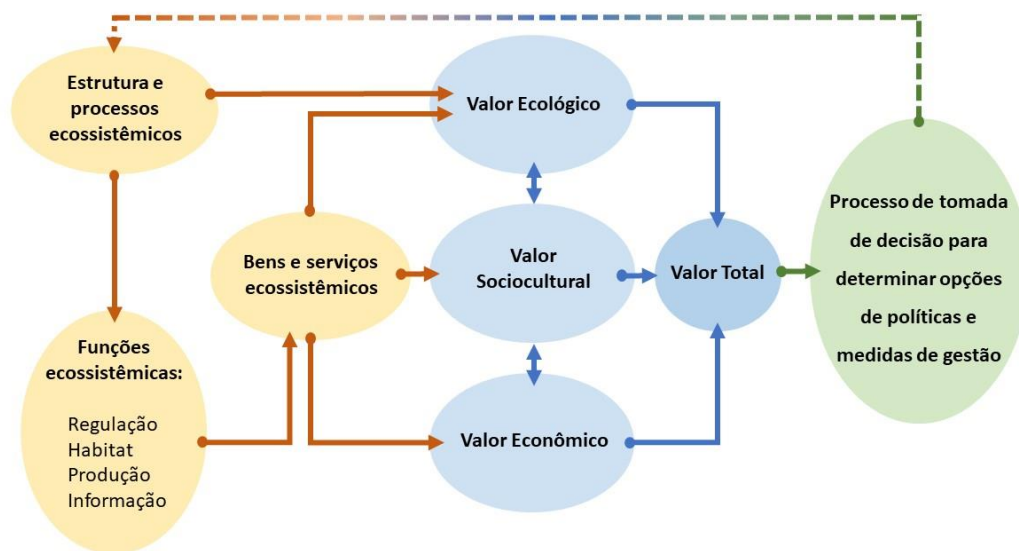


Figura 2: Sistema socioecológico relacionando estruturas e processos ecossistêmicos, funções ecossistêmicas, serviços ecossistêmicos e valor. Figura adaptada de De Groot e colaboradores (2002).

2.5 Serviços Ecossistêmicos Culturais

Serviços Ecossistêmicos Culturais (SECs) representam uma das 4 categorias tradicionais de Serviços Ecossistêmicos (Figura 3) identificadas pela Avaliação Ecosistêmica do Milênio (Millenium Ecosystem Assessment, 2005). SECs podem ser definidos como “os benefícios não-materiais que as pessoas obtêm dos ecossistemas através de enriquecimento espiritual, desenvolvimento cognitivo, reflexão, recreação e experiências estéticas”. Diversos estudos têm apontado a influência positiva destes benefícios imaterias fornecidos pela natureza sobre o bem-estar humano (Millenium Ecosystem Assessment, 2005^b; Leyshon, 2014).

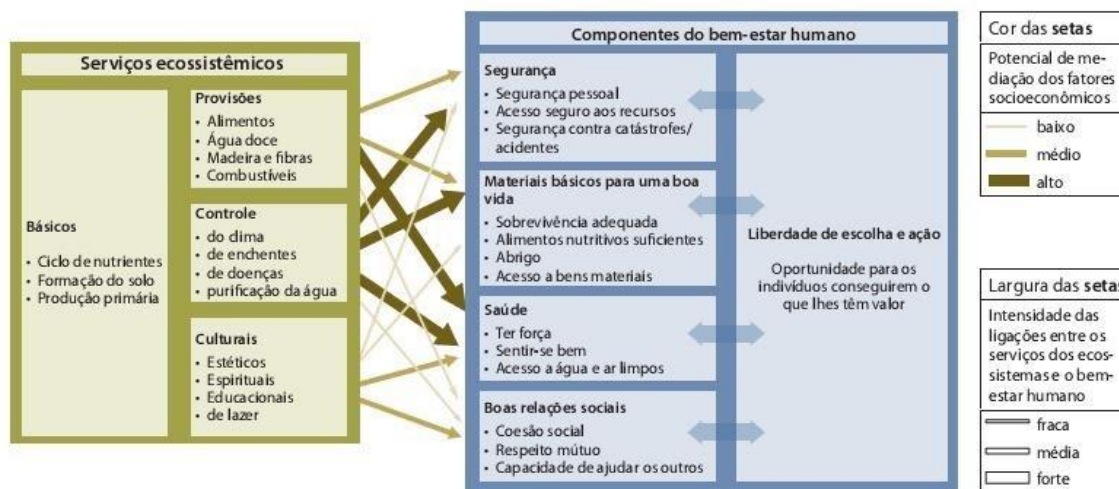


Figura 3: Ilustração das relações entre serviços ecossistêmicos e os constituintes do bem-estar. Figura adaptada de Millenium Ecosystem Assessment (2005).

Uma vez que estes serviços não podem ser diretamente observados (Satz et al., 2013) e provêm de uma complexa interação entre a estrutura dos ecossistemas, práticas culturais e valores relacionais, sua mensuração tem sido apontada como especialmente

desafiadora (Small, 2017). Por isso, SECs têm recebido, historicamente, uma menor atenção na literatura científica do que outras classes de serviços ecossistêmicos (Hirons et al., 2016).

Apesar dos desafios para sua mensuração, pode-se encontrar alguns estudos recentes no contexto brasileiro sobre o fornecimento de SECs com enfoques diversos como, por exemplo, ecossistemas costeiros (Vieira et al., 2021), manguezais (Queiroz et al., 2017), pantanal (Chiaravalloti, 2022), áreas protegidas (Retka et al., 2019; Ribeiro and Ribeiro, 2016) e floresta Amazônica (Vieira et al., 2023, *in prep*). Recentemente, Azevedo e colaboradores (2022) sugeriram que SECs podem ser utilizados como indicadores de qualidade ambiental ao constatarem mudanças no fornecimento destes serviços após um grande derramamento de óleo no litoral, apontado como um dos maiores desastres ambientais na história do Brasil.

Tradicionalmente, questionários têm sido utilizados para a avaliação de SECs, onde o pesquisador pergunta para os utilizadores de um determinado espaço onde eles recebem estes serviços, na escala local (Brown, 2004; Brown et al., 2014; Gould et al., 2015). Nestes levantamentos, os respondentes geralmente podem escolher entre uma gama de valores apresentado pelo pesquisador e associá-los a locais específicos da paisagem (Plieninger et al., 2013; Vieira et al., 2018). Estes valores podem incluir: beleza cênica, valor de inspiração, valor espiritual, valor cultural, valor de recreação, valor histórico, entre outros.

Mais recentemente, novos bancos de dados têm sido utilizados para a avaliação indireta de SECs como, por exemplo, as grandes quantidade de dados gerados pela utilização das redes sociais. Geralmente, estes dados são acessados a partir das Interfaces de Programação de Aplicativos (API), onde pesquisadores podem obter, rapidamente, informações sobre as atividades que os usuários estão realizando em extensas áreas geográficas. Estas abordagens inovadoras para a avaliação de SECs

têm sido realizadas, principalmente, a partir da análise de textos (*análise de sentimentos* e de frequência de palavras-chave) e fotos (análise computadorizada do conteúdo de imagens) publicadas na internet (Cardoso et al., 2020; Johnson et al., 2019; Richards and Friess, 2015; Richards and Tunçer, 2017; Vieira, 2021; Zhang et al., 2020). As principais vantagens deste tipo de abordagem é sua rapidez, baixo custo e maior independência com relação ao tamanho da área amostral quando comparada aos tradicionais questionários presenciais. Entre os pontos negativos, pode-se destacar que tais dados, oriundos de redes sociais, representam apenas a parcela da sociedade que tem acesso a smartphones/computadores e que utiliza estas ferramentas.

A interação homem-natureza pode, por vezes, trazer mais prejuízos do que benefícios aos seres humanos e serem percebidas como negativas. Um exemplo disso são as doenças causadas por vetores patogênicos em ambientes naturais ou danos causados por aves a plantações (Echeverri et al., 2020). Assim, tais interações 'danosas' aos seres humanos têm sido chamadas de 'desserviços ecossistêmicos'. Embora não seja um conceito amplamente explorado (como os serviços ecossistêmicos), os poucos estudos científicos existentes avaliaram desserviços ecossistêmicos associados a plantações de videiras (Brambilla and Ronchi, 2020), abutres (Carucchi et al., 2022) e aves em geral (na visão de observadores de aves; Echeverri et al., 2019).

2.6 Práticas Geradoras de Valor em Áreas Protegidas

Para que as Áreas Protegidas sejam resilientes e suportem as diversas pressões que sofrem atualmente e que podem vir a sofrer no futuro, é preciso que os conservacionistas demonstrem as diversas formas de valor que elas geram para as sociedades. Diferentes formas de valoração ambiental têm sido empregadas em áreas naturais (Primack and Rodrigues, 2001, Buckley et al., 2019) e, a depender do método escolhido, os investigadores podem fazer uma estimativa do valor destas áreas e

utilizá-la para a tomada de decisões que sejam embasadas nas preferências dos usuários.

No entanto, um grande desafio para a valoração completa de uma determinada área natural diz respeito à consideração de todas as formas de valor existentes, seus custos e benefícios, e a identificação dos grupos sociais para os quais os atributos da área gera valor (Gómez-Baggethun, 2013; Primack and Rodrigues, 2001; Vieira et al., 2018). Recentemente, alguns autores têm sugerido que existe uma simplificação histórica no uso do conceito *valor* em estudos de valoração, uma vez que este é *relacional* e deveria ser entendido como processos compostos *por relações espaciais e históricas [...] que conectam pessoas a seus ambientes e ecossistemas* (Chan et al., 2016; Tadaki et al., 2017).

Como apontado por Jepson e colaboradores (2017), uma maneira de valorar as Áreas Protegidas de forma abrangente é encará-las, individualmente, como um conjunto de *ativos* (do inglês ‘assets’). De acordo com os autores, estes ativos podem ser investidos para aumentar (ou criar) seu valor (econômico, social e ecológico) para a sociedade, e estão divididos em cinco grandes categorias: ativos biofísicos, humanos, infraestruturais, institucionais e culturais.

Para que o valor exista, no entanto, é preciso que o usuário de uma área protegida interaja com esta de alguma forma. Assim, Práticas Geradoras de Valor podem ser entendidas amplamente, incluindo qualquer atividade que possa gerar valor para os diversos grupos de usuários de uma AP (p.ex. comunidades locais, turistas, pesquisadores, gestores). Estas práticas podem incluir, desde atividades de recreação na natureza, até medidas de gestão que aumentem o valor da AP de alguma forma (Figura 4). Por exemplo, a prática de esportes em uma AP pode gerar valor em forma de aumento da saúde corporal e bem-estar (Godbey et al., 2010) para o praticante (p.ex. turista), enquanto também gera valor para comunidades locais em forma de maior

atividade econômica e/ou fortalecimento da identidade local e do *senso de pertencimento* (Amsden et al., 2011; Lessa et al., 2021; Liu and Cheung, 2016). Por outro lado, o investimento em trilhas que levam a um determinado monumento natural (p.ex. cachoeira) também gera valor para diversos grupos de usuários ao possibilitar/potencializar a visitação neste local.

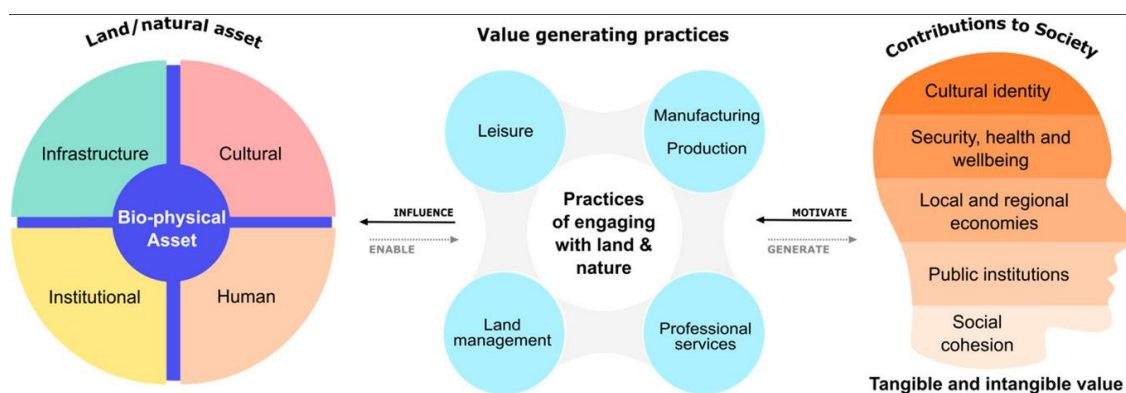


Figura 4: Associações entre assets, Práticas Geradoras de Valor e valor (contribuições para a sociedade). Figura extraída de Lessa e colaboradores (2021).

A inclusão da perspectiva de diferentes grupos de usuários para informar a gestão de APs pode garantir um maior respaldo da sociedade e diminuir conflitos, garantindo uma maior resiliência destas áreas a longo prazo (Gamarra et al., 2019; Lessa et al., 2021; Stoll-kleemann, 2001). Desta forma, a identificação das diversas atividades que são realizadas em Áreas Protegidas podem ter uma grande importância para informar os gestores de diversas formas, desde o monitoramento de impactos ambientais até a elaboração de planos de gestão (Marion et al., 2016).

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3 OBJETIVOS

Avaliar a influência de áreas protegidas no bem-estar humano através de abordagens tradicionais (questionários presenciais) e inovadoras (análise de dados da internet).

3.1 OBJETIVOS ESPECÍFICOS

- 1) Identificar características socioeconômicas associadas à percepção de Serviços e Desserviços Ecosystemáticos Culturais;
- 2) Mensurar a influência de Áreas Protegidas de uso sustentável na percepção de moradores sobre Serviços e Desserviços Ecosystemáticos Culturais;
- 3) Identificar Práticas Geradoras de Valor relevantes para visitantes domésticos e internacionais em áreas protegidas costeiras;
- 4) Quantificar a saliência cultural de Práticas Geradoras de Valor em áreas protegidas.

4 CAPÍTULO 1

PERCEPTION OF CULTURAL ECOSYSTEM SERVICES AND DISSERVICES IN AMAZON PROTECTED AREAS¹

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ABSTRACT

Cultural ecosystem services and disservices emerge from human-nature interactions and have significant impacts on human well-being. However, ecosystem services assessments frequently limit cultural (dis)services to their most tangible categories (i.e. recreational activities) while not contributing to tackle the scientific gap about how intangible values affect different social groups. Here, we sought to undertake an holistic evaluation of cultural ecosystem (dis)services perception in two protected areas (PA) of the western Brazilian Amazon rainforest and how they relate to socioeconomic characteristics. For this, we conducted semi-structured questionnaires in 17 communities inside protected areas and 13 communities outside them (N = 125). The questionnaire allowed people to associate cultural ecosystem services and disservices to events or places in their communities. We found that people living inside protected areas perceived more *social recreation* and *cultural heritage* compared with people outside them, while sense of place was more mentioned by PA outsiders. Respondents living outside PAs also associated significantly more events/places with *discomfort*. Furthermore, our data indicates that communities in protected areas have higher schooling levels and greater gender equity than those in unprotected areas. To our knowledge, this is the first assessment of both cultural ecosystem services and disservices in the Amazon rainforest and clearly demonstrates the influence protected areas on increasing gender equity and CES/CED perception. We hope that it may serve as a baseline for studies in the future while represents a strong argument in favour of protected areas in the present.

Keywords: Cultural ecosystem services, socioeconomic indicators, protected areas

4.1 INTRODUCTION

Cultural ecosystem services (CES) are broadly regarded as “the nonmaterial benefits that people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences” (Reid *et al.*, 2005). CES arise from human-nature interactions and contribute diverse benefits to individuals and societies, such as increasing physical and mental health and providing security against natural and human-made disasters by strengthening social networks within society (Millennium Ecosystem Assessment, 2005). Ecosystem services assessments often provide important information to environmental managers, allowing the generation of long-term benefits for biodiversity, cultural diversity and human wellbeing while simultaneously meeting conservation goals (Comberti *et al.*, 2015).

The most important scientific initiatives for the classification and assessment of ecosystem services have so far focused on measuring how ecosystem change affect human well-being or its economic impacts (i.e. Millennium Ecosystem Assessment (2005), the Common International Classification of Ecosystem Services (Haines-Young and Potschin, 2018) and The Economics of Ecosystems and Biodiversity (TEEB, 2010)). Traditionally, such assessments measure ecosystems’ values as from the benefits they provide to humans, while the negative effects of ecosystems are often disregarded. Recently, a part of the ecosystem services scientific community started to contribute to fill this gap by exploring the negative influence of nature on human endeavors, often framing it as *ecosystem disservices*: ecosystem services that are harmful to human well-being (Blanco *et al.*, 2019; Dunn, 2010; Echeverri *et al.*, 2020, 2019). Likewise, the nature’s contributions to people (NCP) framework (created by the Intergovernmental Panel on Biodiversity and Ecosystem Services) has recently broadened the framing of the ‘stock-and-flow’ of ecosystem services to include both beneficial *and detrimental*

contributions of living nature, highlighting historically under-represented social sciences and indigenous people's perspectives (Díaz et al., 2018). While the need for a conceptual shift has been widely debated (cf. Braat, 2018; Faith, 2018; Kadykalo et al., 2019; Maes et al., 2018), the ecosystem disservices concept is becoming an important part of contemporary conservation discourse. Indeed, the recent coronavirus pandemic provides a dramatic example of how nature can generate enormous disservices to humanity, directly and indirectly decreasing human well-being and impacting economies across the world (Arthi and Parman, 2021; Dawel et al., 2020).

The balance between ecosystem services and disservices is particularly important for communities living within or adjacent to protected areas (PAs). In the Brazilian Amazon, for example, sustainable-use PAs (where local communities are allowed to extract natural resources) may generate a wide range of cultural and economic benefits whilst contributing to the recovery of endangered animal populations (Campos-Silva and Peres, 2016) and yet they are often threatened by politicians that consider them as opportunity costs in the way of economic development (Keles et al., 2020; Pack et al., 2016). Thus, arguments to justify increasing public investment in Amazonian PAs should foresee counter arguments ("push-back") from landowners and associated stakeholders. The land-holder and agricultural lobby has a huge influence on Brazilian politics and decision making, and their support is arguably critical for the successful implementation of pro-environmental policies in the Amazon (Garret et al. 2021). In this sense, environmental evaluations should ideally weigh benefits *and* costs that ecosystems generate to local people as a first step towards strengthening arguments in favour of conservation in Brazil.

Here, we aim to assess the influence of protected areas on the perception of CES and CED by local residents. Additionally, we sought to respond to the following questions: do people living inside and outside protected areas perceive CES and CED differently? Do socioeconomic characteristics influence the perception of CES and CED

inside and outside protected areas? For this, we conducted surveys with 125 individuals from 30 communities inside and outside two sustainable use Amazonian Protected Areas. Our study was undertaken in the Medio Jurua Extractive Reserve and the Uacari Sustainable Development Reserve; two well-established PAs in the Amazon Rainforest that are often described as successful examples of community-based management of natural resources with clear positive outcomes to both people and nature (Campos-Silva and Peres, 2016; Campos-Silva et al., 2021, 2018).

4.2 METHODS

4.2.1 Study Area

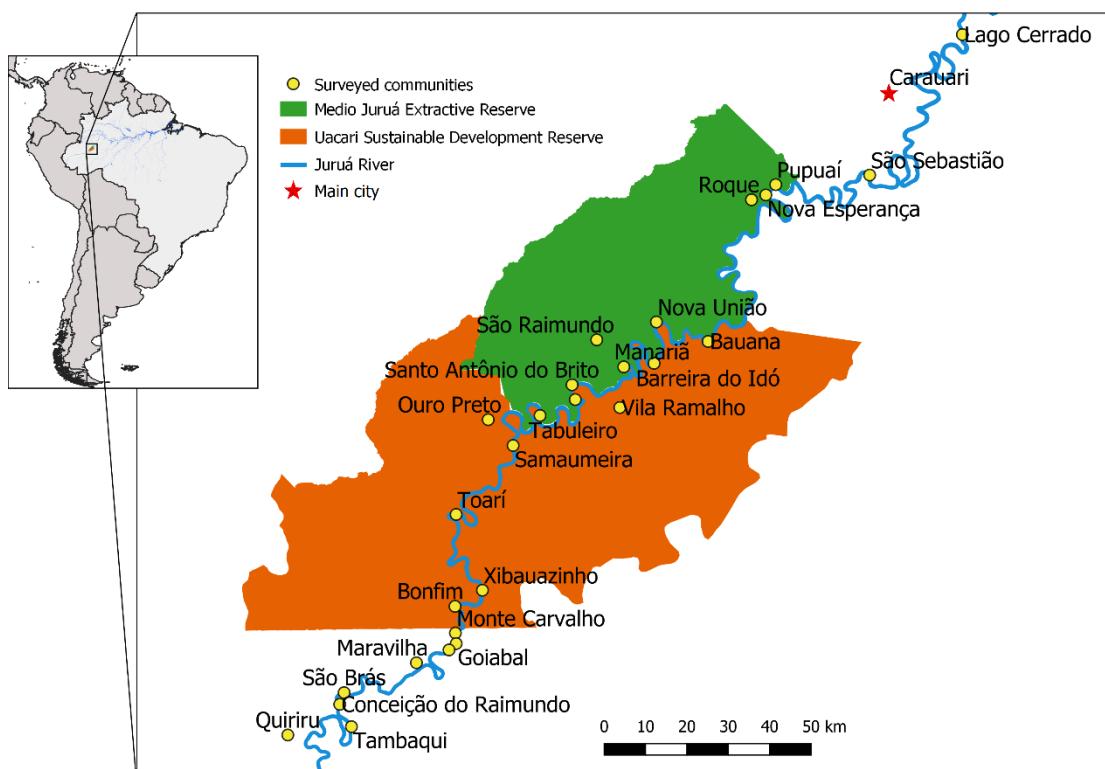


Figure 1: Map of the study area representing the two protected areas and the surveyed communities along the Juruá River in the western Brazilian Amazon Rainforest.

4.2.2 Data collection

We applied semi-structured questionnaires to 125 individuals of 30 Amazonian communities (17 inside and 13 outside protected areas; Figure 1) during November and December 2018. The communities studied are spread across ~600km of a major river of the western Brazilian Amazon Rainforest, the Juruá River.

Our questionnaire was designed to allow the identification of natural events or places that provide cultural ecosystem services (CES) and disservices (CED) in the surveyed communities. The set of CES/CED categories used in this study was constructed based on previous typologies (Table 1) and their evaluation was made by asking the respondents about *places or events* related to each CES/CED category. This design permitted the association of CES/CED categories with the places where they are occurring or being captured while also allowed the expression of elements that are not attached to a specific spatial feature (i.e. a species, an animal behavior, local myths or beliefs). Each question was preceded by the following statement: “Is there any place or event in your community...”. This standard statement was rigorously repeated before all questions to make sure that the respondents’ answers were related to events or places of their own communities and not from somewhere else. In order to give respondents a better understanding about the desired type of response, a supporting statement was also provided after the main questions of each CES/CED category, when needed (Table 1). Also, after each response given by a respondent, the interviewers asked if there was “*any other place or event*” that they would like to include, and when three responses were associated with each CES/CED category, the researchers stopped writing and only counted how many more answers were provided. This was to ensure that no

questionnaire would be excessively time consuming while also resulting in an exhaustive list of the perceived elements related to each CES/CED category by each respondent.

Cultural Ecosystem Services/Disservices categories	Description of what is being assessed	Asked question (<i>Is there any event or place in your community...</i>)	Supporting statement	Bibliographic references
Aesthetic appreciation	Events and places which are visually pleasant	...that is very beautiful?	...related to nature, animals, plants and landscapes.	Millennium Ecosystem Assessment, 2005
Education	Events and places that contribute to formal and informal education	...where you go to learn?	...with friends, teachers, yourself or with the nature.	Millennium Ecosystem Assessment, 2005
Cultural heritage	Culturally important events, places and species	...that represents the local culture?	...for example, artisans, musicians, dance groups, natural assets.	Millennium Ecosystem Assessment, 2005
Historic value	Historically important events, places and species	...that represents the local history?	...that makes you remember the old times.	Retka et al., 2019
Inspiration	Events and places that contribute to creative processes	...that inspires you?	...that stimulates new ideas and thoughts.	Millennium Ecosystem Assessment,

	and mental stimulus to do or feel something			2005; Coscieme, 2015
Social recreation	Events and places that contribute to social relations among individuals	...where you can spend some time with friends?	...where you can meet other community residents to chat.	Millennium Ecosystem Assessment, 2005
Sense of Place	The sense of attachment and belonging to a place	...that makes you feel like home?	...a place in which you feel comfortable or that you like to think when you are away from home.	Millennium Ecosystem Assessment, 2005
Spiritual values	Religious and sacred values attached to ecosystems and their components	...that is sacred to you?	...that you think is blessed or protected by god.	Millennium Ecosystem Assessment, 2005; Hernández- morcillo et al., 2013
Sports recreation	Events and places that contribute with opportunities to practice sports and enhance physical health	...where you can practice sports?	...where you can play football, dance or practice any other physical exercises.	Retka et al., 2019; Vieira et al., 2021
Aesthetic unpleasantness	Visually unpleasant events and places	...that is ugly?	(free interpretation)	Authors

Noysiness	Noisy events and places	...that is too noisy? (free interpretation)	Echeverri et al., 2020
Illness	Events and places associated with diseases	...where you risk being sick/getting a disease?	...where you can get yellow fever, dengue, malaria, foot bugs, etc Dunn, 2010
Discomfort	Uncomfortable events and places	...that makes you feel uncomfortable? (free interpretation)	Authors
Sadness	Events and places associated with the feeling of sadness	...that makes you feel sad? (free interpretation)	Authors
Angriness	Events and places associated with the feeling of angriness	...that makes you feel angry? (free interpretation)	Authors

Table 1: Cultural Ecosystem Services and Disservices assessed in the study, their description, the asked question, a supporting statement (used when respondents needed a better explanation about the type of answer required) and previous studies citing each category.

4.2.3 Data Analysis

For analytical purposes, we divided the communities in two groups: i) Protected (those communities inside the limits of the Medio Juruá Extractive Reserve or the Uacari Sustainable Development Reserve) and ii) Unprotected communities. For this, we used the georeferenced limits of the protected areas provided in the Brazilian Ministry of Environment Website (<https://antigo.mma.gov.br/areas-protegidas>) and the communities' geographic coordinates. We hypothesized that the establishment of the two sustainable use protected areas with clear socioeconomic benefits in those areas

would lead to differences in the perception of CES and CED by its residents. A recent study indicate that a significant percentage of communities inside the two sustainable use Protected Areas surveyed in this study has more key services and commodities in comparison with communities from outside them, these include: increased accessibility to educational centers, more capability to export extractive and horticultural products, sanitation, health care infrastructure, shops to purchase food and basic equipment, communication and electricity infrastructure, among others (Campos-Silva et al., 2021).

The data analysis was conducted in two main steps. First, we analyzed the personal characteristics of respondents (age, gender, schooling and religion), the individuals' dwelling time and leadership status within their communities. Further, we quantified the assets that individual participants associated to each of the 9 CES and 7 CED categories assessed. Additionally, we performed independent T tests to check if there were significant differences in the average counts for each CES/CED category for male/female and community-leader/non-leader respondents inside and outside the protected areas. Maps were produced with QGIS (version 3.8.2) and statistical tests and graphs were made with R software (R Core Team, 2022) and Microsoft Excel 2016.

4.3 RESULTS

The group of people interviewed was composed mainly by men (54%) aged 37 years on average (SD = 15.32). Their individual average dwelling time in the communities where they lived when the survey was conducted was 22.4 years (SD = 15.8) and the majority of them declared themselves to be religious (94%) with 78% being catholic. Respondents living inside Protected Areas had generally higher schooling levels, with 32% of them having reached at least high school education compared to 13% of the rest of the population. Both educational level and number of people

considering themselves as leaders in their communities have clear gender bias (Table 2).

Characteristics	Sustainable use protected areas		Unprotected areas		Total
	Female (N = 32)	Male (N = 31)	Female (N = 25)	Male (N = 37)	125
Average age in years	34.45 ($\pm$ 17.28)	39.83 ($\pm$ 13.46)	32.24 ($\pm$ 15.01)	40.43 ($\pm$ 14.78)	37.13 ($\pm$ 15.38)
Are leaders in their communities	29% (9)	30% (9)	4,1% (1)	35% (13)	50% (63)
Schooling		19%			
Illiterate	19%	35%	20%	22%	20%
Incomplete Elementary	34%	19%	48%	35%	38%
Complete Elementary	9%	16%	24%	24%	19%
Incomplete high school	16%	10%	0%	5%	10%
Complete high school	16%	0%	8%	14%	12%
Higher education	3%	0%	0%	0%	1%
Non-declared	3%		0%	0%	1%

Average CES mentions	13.18 (±5.85)	13.80 (±5.29)	13.76 (±6.75)	13.73 (±5.08)	13.61 (±5.63)
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Average CED mentions	6.93 (±3.48)	5.06 (±3.21)	6 (±4.42)	6 (±3.97)	6 (±3.78)
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Table 2: Socioeconomic characteristics of the surveyed population. One respondent did not declare religion, age, schooling or dwelling time in the community. Three respondents did not declare their leadership status.

In general, respondents associated a total of 1,702 assets to CES and 751 to CED categories. The quantity of assets associated with CES was similar between people living in protected areas (with an average of 13.49 (±5.49) mentions) and those living in unprotected areas (average 13.74 (±5.75; $p=0.4$) mentions; Figure 2). Individual categories of CES had similar counts of assets for both groups, except for *social recreation* and *cultural heritage*, for which independent t tests revealed significantly higher counts inside PAs, with an average 1.79 (±0.89) and 1.08 (±1.17) counts per respondent. This contrasts with the average 1.52 (±0.88; $p= 0.04$) and 0.76 (±0.86; $p= 0.04$) counts outside protected areas, respectively. Interestingly, *sense of place* had significantly higher counts outside protected areas (average 1.82 (±1.01)) than inside (average 1.49 (±0.79; $p= 0.02$)).

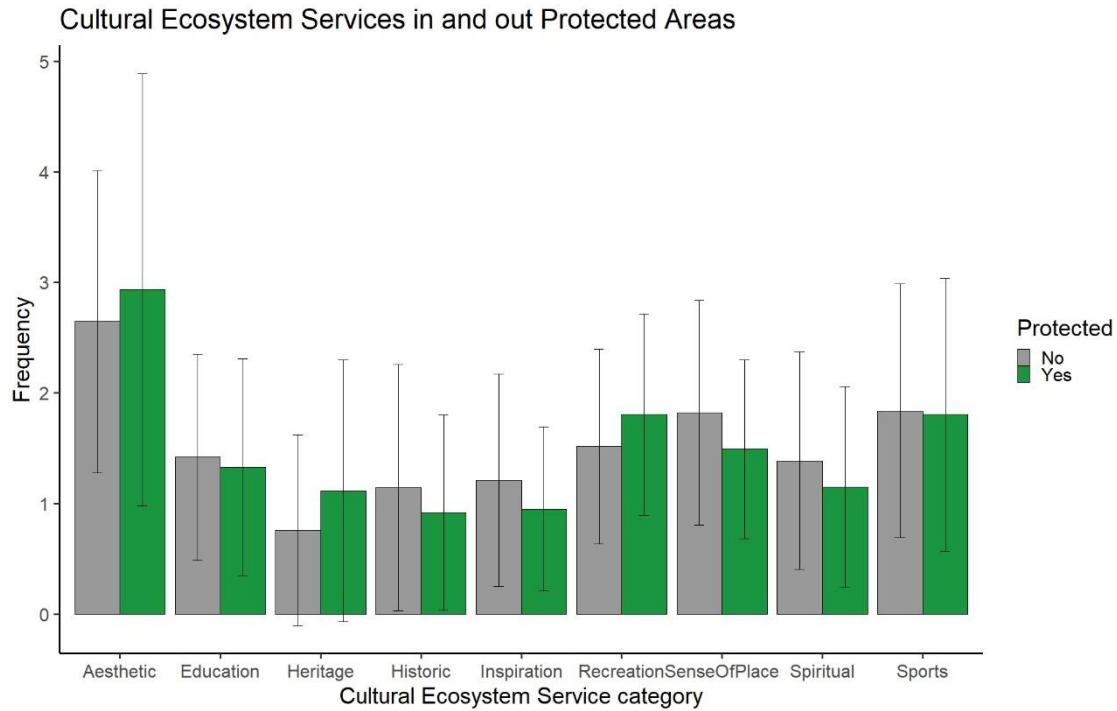


Figure 2: Average Cultural Ecosystem Services mentions by interviewees from communities inside and outside Sustainable Use Protected Areas

Similarly, the interviewees reported a similar number of assets related to CED with an average of 6,01 (± 3.45) and 6 (± 4) mentions per respondent from inside and outside protected areas, respectively ($p=0.49$). We found that *discomfort* had significantly more counts outside protected areas (average 0.47 (± 0.67)) than inside (average 0.29 (± 0.52 ; $p= 0.04$)). None of the other categories of CED differed significantly between the two groups. The distributions of CES and CED by community can be seen in figure 4.

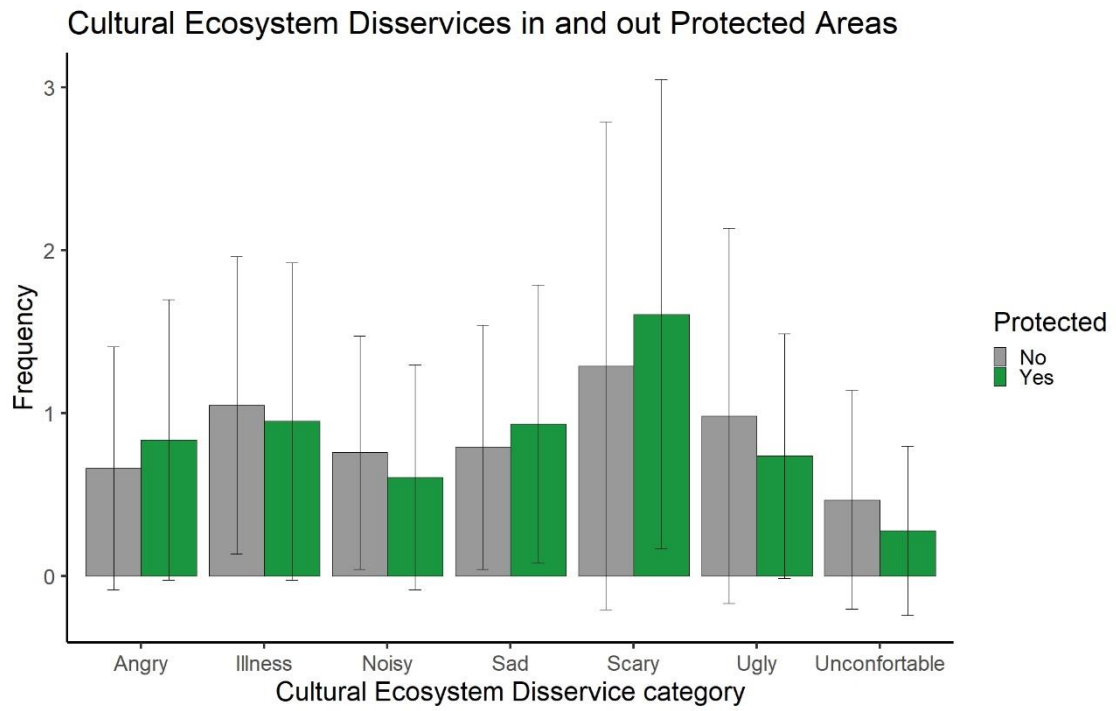


Figure 3: Average Cultural Ecosystem Disservices mentions by interviewees from communities inside and outside Sustainable Use Protected Areas

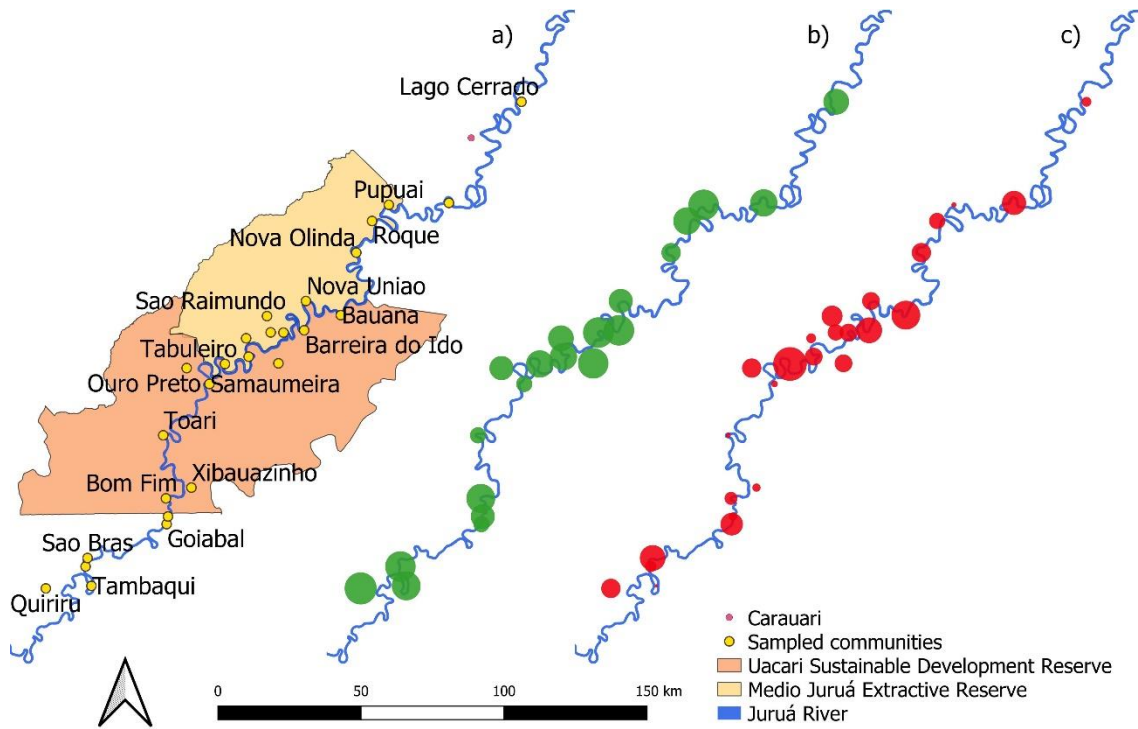


Figure 4: Distribution of Cultural Ecosystem Services (green circles) and Cultural Ecosystem Disservices (red circles) in the study area. Circles' sizes are proportional to the total CES or CED mentions in a given community.

4.4 DISCUSSION

The Juruá River has several communities along its banks, most of which are led by one or a few individuals who tend to be older than the average age of the inhabitants (42 years on average in our sample). Leaders of these communities possess a great knowledge of the natural resources and history of the area, and are frequently involved in the decision-making process of their community, such as agreements with the government regarding trading goods. Our socio demographic data uncovered differences in the composition of the leadership groups between protected and

unprotected communities, indicating a greater gender equity in communities inside protected areas (Table 2).

Also, this study has revealed that the implementation of protected areas in rural communities has had a positive effect on female leadership representation. Though our study does not assess the influence of protected areas implementation directly, informal interviews with locals have indicated that women have been more active in household financial decisions, as a result of their involvement in the arapaima management and the trade of rural products with the support of local NGOs (i.e. Associação dos Produtores Rurais de Carauari). This finding is an important indication of the potential for gender equity in rural Amazonian PAs, as it demonstrates that women can take on more responsibility and autonomy within their households, thus challenging the historic pattern of men having sole control over family income. The involvement of woman in community decision-making process has been previously described as an important driver of gender equity in protected areas with positive outcomes for both nature conservation and socioeconomic conditions (Mistry et al., 2023; Di Ciommo and Schiavetti, 2012).

Though we had similar responses inside and outside PAs, some insights can be drawn on specific services. Mainly, *social recreation* and *cultural heritage* are more mentioned in the communities inside PAs. This may be related to enhanced opportunities of recreation and sense of heritage associated with the arapaima management (Gamarra et al., 2022), but further explorations considering socioeconomic factors (such as familiar income) are needed. Similarly, the higher mentions to *sense of place* and *discomfort* in unprotected sites found in this study can serve as a baseline for future studies in the rural Amazon. In this sense, multi-disciplinary research groups composed by natural and social scientists are needed to fully assess the range of (ecological, economic and social) factors that may influence such differences in cultural (dis)services perception.

To date, there is a lack of official databases providing detailed socioeconomic characteristics of the communities inside both the Médio Juruá Extractive Reserve and the Uacari Sustainable Development Reserve (i.e. in their management plans). Nevertheless, valuable information can be found in documents produced by NGO's which develop important studies in the region (i.e. the Operation Native Amazon Rainforest (OPAN) and the Carauari Rural Producers Association (ASPROC)). Initiatives to gather the existing social information together may spare resources of future investigations aiming to assess how the implementation of those PAs are affecting societies in the local scale. Such detailed studies will be fundamental to broaden the arguments in favour of the continued public investments that are needed for the maintenance of such successful PAs (Campos-Silva and Peres, 2016) in the long term.

4.5 CONCLUSION

The results presented here may serve as a baseline for future studies aiming to compare how CES/CED perceptions change in time and can be used to improve impact assessment studies for decision-making in Protected Areas. In our study area, this is especially relevant if we consider the several restrictions on natural resources' use that need to be carefully justified in order to raise community compliance with conservation rules. This means demonstrating the whole variety of contributions that nature may give to people in these areas. More broadly, integrated ecosystem services/disservices frameworks will enhance our comprehension towards social-ecological ecosystems and provide valuable insights for more equitable and effective policy making (Blanco et al., 2019).

In our view, environmental evaluations including perspectives on both ecosystem services and disservices will enhance our power to argue in favour of Protected Areas in a scenario of increasing pressure against nature conservation in Brazil. We recommend

that future environmental studies should ideally consider the multiple contributions of natural systems to people in order to construct a clear baseline for the evaluation of the impact that sustainable-use protected areas in the rural communities in the Amazonian rainforest have on local communities, given that they are usually inserted in complex social ecological ecosystems. This may be facilitated by the creation of official information databases about local communities in the surroundings of protected areas and by encouraging the creation of multi-disciplinary research groups to assess ecological, economic and social factors involved in ecosystem services and disservices perception.

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5 CAPÍTULO 2

QUANTIFYING THE CULTURAL SALIENCE OF VALUE GENERATING PRACTICES IN BRAZILIAN COASTAL PARKS²

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ABSTRACT

Brazil is one of the most biodiverse countries in the world, but its environmental leadership and protected areas (PAs) network have been undermined by controversial political decisions. In order to secure PAs maintenance in the long-term, there is a need to clarify the set of values they provide to society, beyond the traditional biodiversity value. Here, we employed an automatized approach to evaluate Value Generating Practices (VGPs) in the 26 Brazilian coastal parks. For this, we used the most popular World Wide Web searcher to quantify web pages that mention VGPs in our targeted protected areas. Our 3,355 searches returned 11M+ web pages mentioning VGPs in Brazilian coastal parks. The majority of web pages mentioned VGPs in *state* parks, but the average cultural salience indicate that *national parks* are more relevant for both Portuguese and English content. Generally, VGPs related to *social recreation* were the most salient, followed by *use of natural resources*, *commercial activity* and *recreation in nature*. Though some limitations can be identified, we argue that the World Wide Web is a suitable index to measure VGPs in protected areas. Finally, the advance of technological devices and analytical tools in the following years may improve the automation of VGPs identification and provide a promising tool to uncover hidden values in protected areas, increasing the set of arguments that society need to justify these areas as important spaces for both people and nature.

Keywords: Culturomics, protected areas, Value Generating Practices

5.1 INTRODUCTION

Brazil is a mega biodiverse country with an extensive network of Protected Areas (PAs). However, recent changes in Brazilian environmental laws are undermining this network, leading to an increase in downgrading, downsizing and degazettement (PADDD) events, and weakened governance and management (Bernard, 2014; Escobar, 2019; Mascia, 2011; Ruaro *et al.*, 2022). This increasing level of threat is largely driven by a perception among many Brazilian politicians and policy-makers that PAs represent opportunity costs (Keles *et al.* 2020); that forgoing farming, logging and mining in the name of biodiversity protection is a poor deal for society. It follows that one of the best ways to strengthen PAs in face of such attitudes is to reveal the many forms of value, intrinsic and instrumental, that they provide to individuals, communities and society at large (Bernard *et al.* 2014; Guedes-Santos *et al.* 2021).

Measuring the cultural value of nature is not straightforward, and there are many different frameworks and metrics available to researchers. Value in conservation is typically dichotomized as: i) intrinsic or non-anthropocentric value, generally referring to species, habitats and nature having value independent of human needs (Vucetich *et al.*, 2015), or; ii) instrumental or anthropocentric values, referring to the benefits that nature provides to people and societies. Some recent studies (e.g. Jepson *et al.* 2012; Pascual *et al.*, 2017; Eyster *et al.*, 2022; West *et al.*, 2018) have attempted to go beyond such value dichotomies by adopting a more relational approach that considers value as an emergent property of interactions between entities and systems. Within this context value is an assessment of worth, usefulness or importance which critically depends on context. Relational approaches explicitly consider value to be composed of 'spatially and historically contingent relationships' (Tadaki *et al.*, 2017 p7) that connect people, society and nature (Chan *et al.*, 2016; Díaz *et al.*, 2015). Critically, in addition to economic

value, relational approaches include values that contribute to psychological and social well-being (Deci and Ryan, 2008).

Relational forms of value can be attributed to interactions with biophysical features of protected areas (e.g. a waterfall), but are always contextually dependent on locality, culture and the identity and agendas of those interacting with the feature. As Jepson *et al.* (2017) state, “value is a relational attribute arising from practices of engaging with nature (and PAs)” (p.186).

The levels of protection in protected areas in Brazil vary, depending on the specific area. For example, national parks are strictly protected, while biological reserves are managed for conservation and research purposes. Other protected areas may have different levels of protection, depending on their objectives. Generally speaking, the levels of protection in Brazil's protected areas range from strict protection to multiple-use management. The Protected Areas' Assets Framework (PAAF - Jepson *et al.*, 2017) proposes that PAs can be interpreted as a set of assets which can be invested in to generate value to the society, including strengthening citizenship, increasing/enhancing individual and public health and rescuing Traditional Ecological Knowledge (Lessa *et al.*, 2021). The rationale behind the PAAF is that PAs users' activities (Value Generating Practices - VGPs) are always associated with one or more categories of *assets* and can create or enhance the value of a Protected Area. For example, VGPs such as birdwatching, hiking or camping can generate various forms of value to local communities (i.e. economic value or strengthening local identity) and tourists (increasing mental health and well-being; Godbey, 2010). In this sense, characterizing the visitors' practices in Protected Areas may provide crucial information for a range of conservation aims, from evaluating ecological impacts to designing recreational plans (Marion *et al.*, 2016) but, it may also help administrators to plan and manage PAs in a way that

enhances their potential to generate value to a number of user groups (Gamarra *et al.*, 2019; Lessa *et al.*, 2021) and, ultimately, increases public support.

In the last decades, the ever increasing number of internet users and content creators established new data sources for assessing peoples' preferences about an area or a topic. The analysis of such data (i.e. natural language processing, sentiment analysis) has been increasingly applied to nature conservation (Sutherland *et al.*, 2018) and most frequently draws on *conservation culturomics* methods (Ladle *et al.*, 2016; Correia *et al.*, 2021). One widely used data source on conservation culturomics is the World Wide Web, which can be accessed through search engines (with the most famous being Google's and Yahoo's) and comprises millions of web pages that are focused on a variety of content (text, images, video, etc.). Such search tools allow the count and content analysis of web pages with targeted content, which generates information often used to measure the cultural salience of birds (Correia *et al.*, 2017; Schuetz *et al.*, 2015; Zmihorski *et al.*, 2013), insects (Wang *et al.*, 2021) and broader biological groups (Jaric *et al.* 2020; Mittermeier *et al.*, 2019) or to investigate relevant conservation issues (Do *et al.*, 2015; Kulkarni and Di Minin, 2021; Phillips *et al.*, 2022; Vieira *et al.*, 2021).

Here, we sought to measure the cultural salience of Value Generating Practices in Brazilian coastal protected parks. Our main hypothesis is that national parks has a higher salience of VGPs since they comprise highly popular destinations for both domestic and international visitors, in comparison with state and municipal parks. Also, we expect *sports recreation* and *social recreation* related VGPs to be more salient in national parks since their objectives include promoting sustainable tourism. *Use of natural resources* is also expected to be more valued in state/municipal parks, since they may promote closer relationships between local users and natural resources. In order to test such hypothesis, we used the number of web pages containing textual representations of visitors practices (VGPs) as indicators of their cultural salience for a given Brazilian coastal park. We discuss VGPs' cultural saliences under the light of

Protected Areas administrative level (national, state or municipal), web pages' language and parks characteristics. We also explored methodological limitations and provide recommendations for future studies on the topic.

5.2 METHODS

5.2.1 Study Area

Our study area corresponds to the 26 parks in the Brazilian coastal environment (Figure 1). The parks differ in level of administration (national, state and municipal), size (from 330 m² to 3,222 km²), year of establishment (older was created in 1961 and the most recent in 2018) and distance to urban centers (from 3,6 km to 120 km). Some of these parks are very well known destinations receiving thousands of tourists every year (e.g. Jericoacoara National Park) while others are mostly known locally.



Figure 1: The study area comprises all protected parks of the Brazilian coast (N = 26). Numbers correspond to parks as follows: 1) Xixová-Japuí State Park, 2) Dunas Da Lagoa Da Conceição Municipal Natural Park, 3) Lençóis Maranhenses National Park, 4) Forte De Tamandaré Municipal Natural Park, 5) Serra Do Mar State Park, 6) Lagoa Do Jacaré Das Dunas Do Santinho Municipal Natural Park, 7) Superagui National Park, 8) Jericoacoara National Park, 9) Serra Da Bocaina National Park, 10) Monte Pascoal National Park, 11) Cocó State Park, 12) Ilha Do Mel State Park, 13) Lagoa Do Peixe National Park, 14) Serra Do Tabuleiro State Park, 15) Itaúnas State Park, 16) Costa Do Sol State Park, 17) Corais De Armação Dos Búzios Municipal Natural Park, 18) Acaraí State Park, 19) Prainha Municipal Natural Park, 20) Penhasco Dois Irmãos - Arquiteto Sérgio Bernardes Municipal Natural Park, 21) Paisagem Carioca Municipal Natural Park, 22) Grumari Municipal Natural Park, 23) Lagoinha Do Leste Municipal Natural Park, 24) Serra Da Tiririca State Park, 25) Niterói Municipal Natural Park, 26) Restinga Do Barreto Municipal Natural Park.

5.2.2 Value Generating Practices typology

The authors of this study used an adapted version of the list of Protected Areas' contributions to the society developed by Lessa *et al.* (2021) for a local project in

Northeastern Brazil. Our final list included 64 Value Generating Practices (subcategories) relevant for coastal environments, organized into seven broader categories: commercial activity (3), education (7), protected area management (3), sports recreation (9), social recreation (19), recreation in nature (10) and use of natural resources (13). For organizational issues, two authors of this study independently translated the 64 VGPs from Portuguese to English and then agreed on a final list of VGPs in both languages (Supplementary Material).

5.2.1 Data collection

We accessed the georeferenced information of the Protected Areas in our study area on The World Database on Protected Areas (WDPA) (UNEP-WCMC and IUCN, 2022) and Brazilian coastal cities' population and geolocation was accessed on the official Brazilian statistics office website (Brazilian Institute of Geography and Statistics - IBGE) (IBGE, 2021a; IBGE, 2021b).

We then used the Google Search engine (<https://www.google.com>) to search mentions to each of the 26 Brazilian coastal parks along with terms representing VGPs in websites. Since many of the searched Protected Areas are visited by international tourists, we conducted this process two times: firstly, using terms that represent VGPs in Portuguese and then using the same terms in English. The final search strings can be generally described as follows: “protected area x” AND [“first term representing VGP y” AND/OR “second term representing VGP y”] (See Supplementary Material for the complete list of search strings). In order to allow comparison between languages, search strings' structure was the same for both languages (Supplementary Material). In total, we performed 3,326 searches and recorded the number of web pages on the World

Wide Web matching our search strings. The process was automated using a python code (Supplementary material).

5.2.1 Data analysis

The total number of web pages matching our search strings was used to calculate the cultural salience of each VGP in each PA. This was achieved by log-transforming the absolute numbers of search hits. The cultural salience index based on logarithmic values allows an easier exploration on the relative importance of each topic (VGP + park) compared to the analysis of absolute search hits.

Differences on domestic and international visitors' practices were also explored through the cultural salience of searches in different languages. For this, the average salience of all VGPs subcategories in each PA (Supplementary Material) per language was calculated. Generalized Linear Models (GLMs) were performed in order to assess the influence of Protected Areas' characteristics on cultural saliences. PAs characteristics included: distance to urban centers (cities with 100.000> inhabitants), date of creation and size. A non-parametric test (Kruskal-Wallis followed by Dunn test with adjustment of the p-value by bonferroni; α 0.05) was employed in order to determine significant differences in the cultural salience of VGPs in parks on different administrative levels (national, state or municipal park). The distances of parks to urban centers were calculated using the cities and PAs centroids as geographic reference. A Principal Component Analysis was also conducted in order to evaluate the relation between the parks, their administrative levels and VGPs categories. All statistical procedures were carried out in R software (R Core Team, 2022).

5.3 RESULTS

We found a total of 11,168,437 web pages matching the 3,326 searches for Value Generating Practices in coastal parks (average 3,355 hits per search string). On average, VGPs in *state* parks had a higher number of web pages than *national* or *municipal* parks. Also, *state* parks had the higher variation on the number of web pages mentioning VGPs, indicating that specific search strings may be inflating the search results for specific VGPs (Table 1).

Web Pages (Mean/Standard Deviation)			
PA Administration	English	Portuguese	Total
National	1,490,145 (3,881 ± 10,657)	1,736,282 (4,552 ± 9,388)	3.2M
State	3,443,049 (5,978 ± 33,352)	3,745,417 (6,502 ± 15,695)	7.1M
Municipal	304,462 (432 ± 1,967)	449,082 (638 ± 2,956)	753,544

Table 1: summary statistics of web pages mentioning VGPs in Brazilian coastal parks under different administrative levels.

The confounding effect of such outliers was solved by the calculation of a cultural salience index which allowed a direct comparison of the relative difference of VGPs saliences in each administration level. The cultural salience index also reveals a slight prominence on the number of Portuguese written web pages in comparison with English pages for parks in all administration levels (Figure 2).

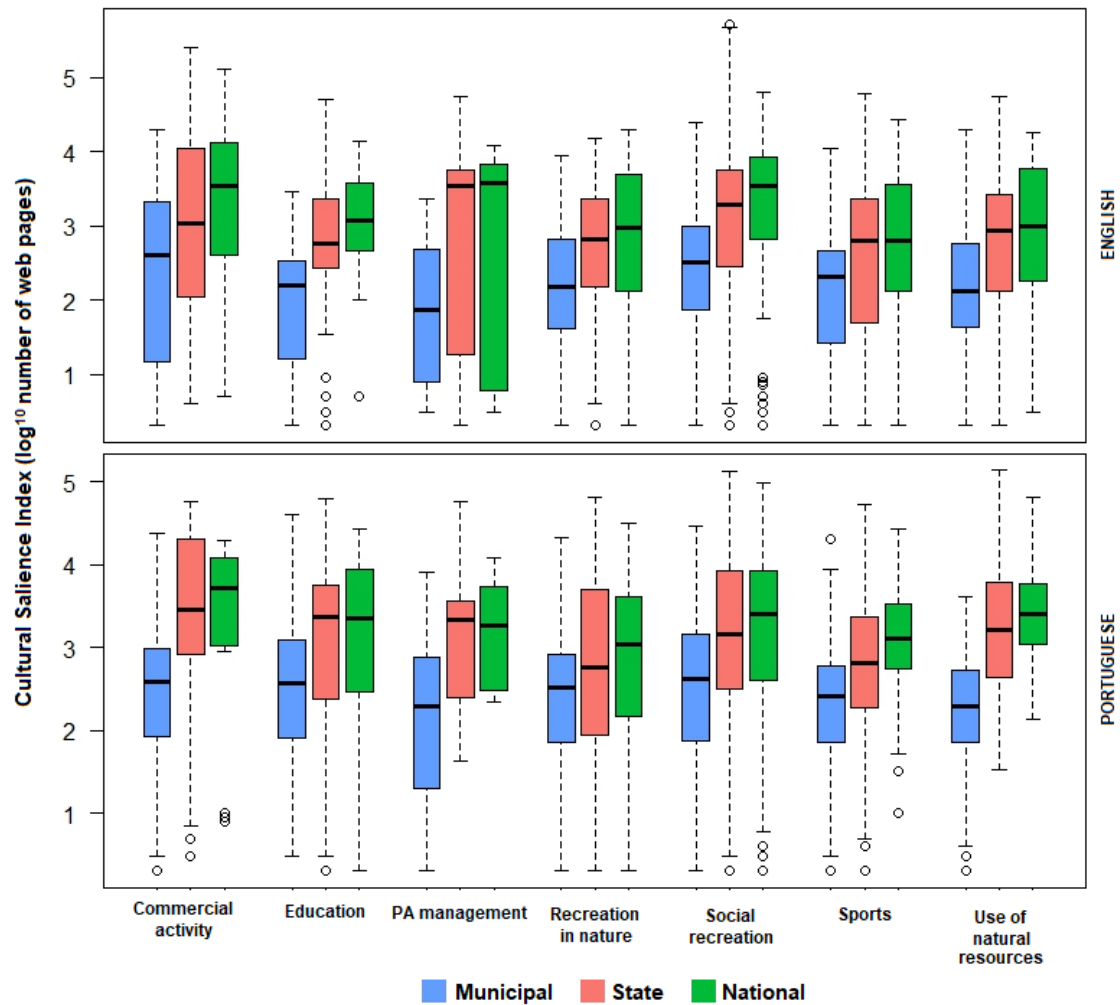


Figure 2: Cultural Salience Index of Value Generating Practices (broad categories) in Brazilian coastal Protected Parks under different administrative levels.

Broadly, *social recreation* was the most salient VGP on the internet, followed by *use of natural resources*, *commercial activity* and *recreation in nature* (Figure 3). More specifically, *Cocó State Park* had the higher number of mentions to VGPs in websites (N = 2,089,380) followed by *Serra do Mar State Park* (N= 2,051,564) and *Ilha do Mel State Park* (N = 1,115,388).

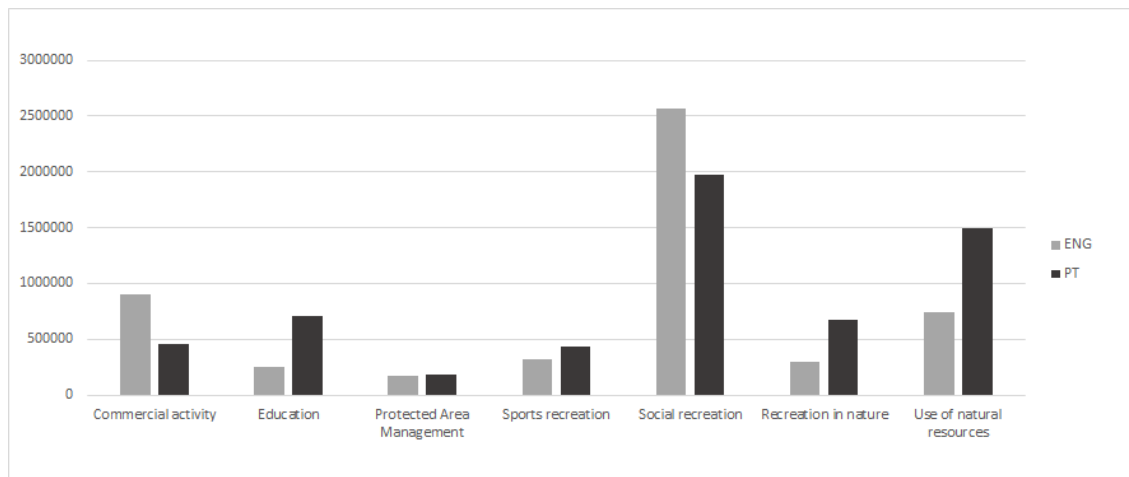


Figure 3: Total number of web pages mentioning each broad category of Value Generating Practices for both Portuguese and English languages. The number of searches was different between VGPs categories but equal between languages.

The VGPs subcategories with higher cultural salience were *field class* and *artisanal fishery*, followed by *zipline* and *sky/stars observation*. In the searches for Portuguese web pages, *tours trade* and *field class* had the higher salience values, while *artisanal fishery* and *sportive tournaments* were the most salient in English written web pages (Figure 4).

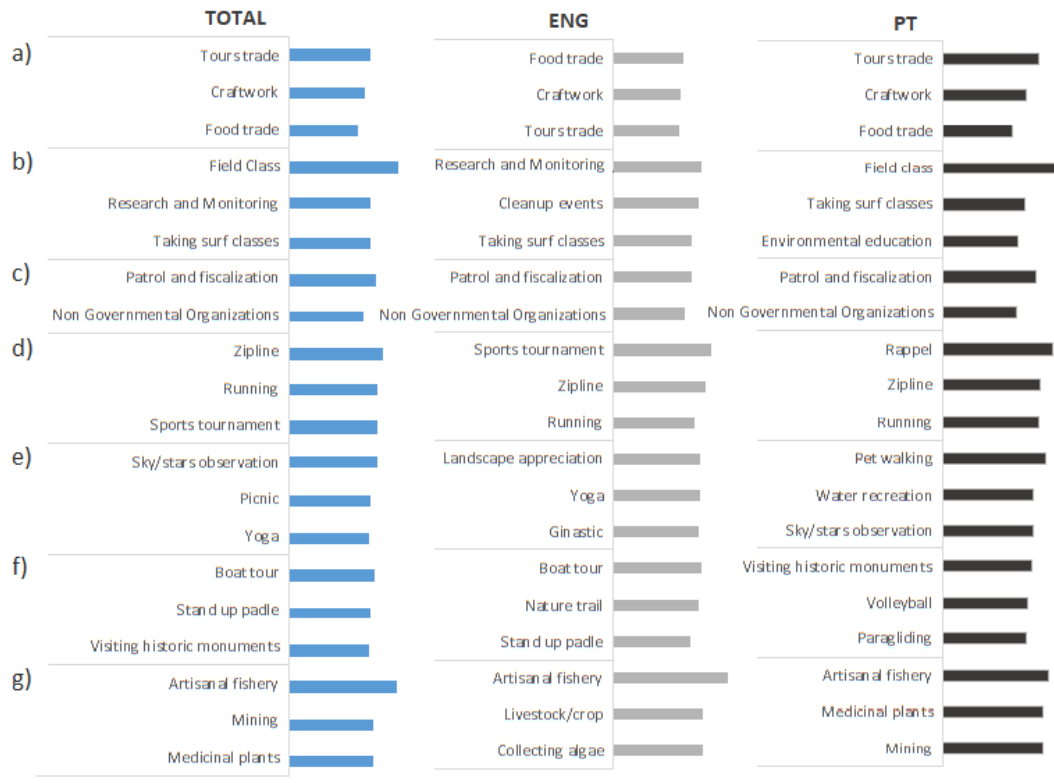


Figure 4: Top 3 Value Generating Practices subcategories for all Brazilian coastal parks. Bars represent VGPs' average Cultural Salience. Lettering corresponds to VGPs broad categories: a) Commercial activity, b) Education, c) Protected Area management, d) Sports recreation, e) Social recreation, f) Recreation in nature and g) Use of natural resources.

The first two components of the principal component analysis were able to explain approximately 88% of the data variation and indicates clear associations between parks' administrative levels and VGPs categories (Figure 5). As expected, *national parks* are more related to *sports* and *nature recreation*, while *municipal parks* seem to form a very specific cluster, opposing to the VGPs eigenvectors. This may be explained by the relatively lower cultural salience of municipal parks.

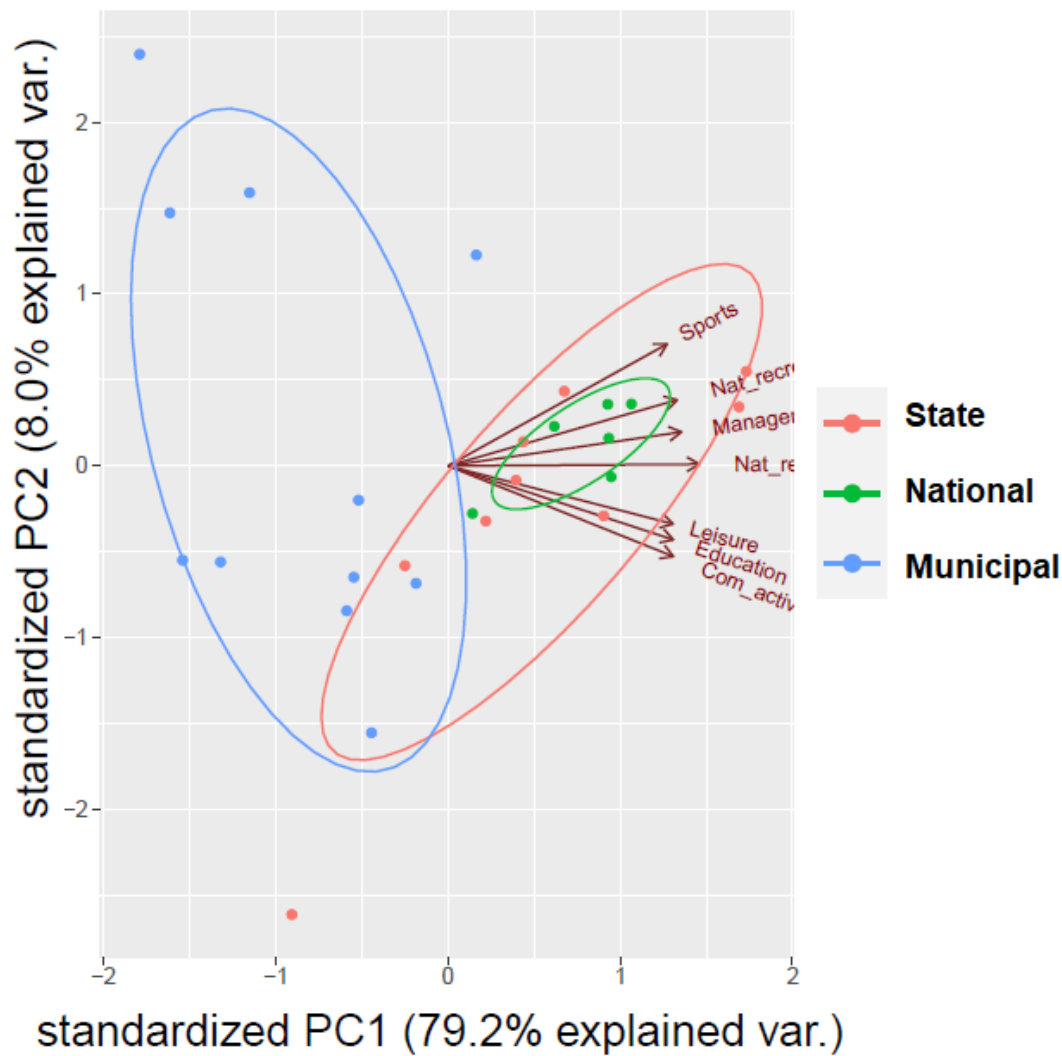


Figure 5: Principal Component Analysis of Value Generating Practices in Parks' on different administrative levels (colors).

We found a significant difference on the cultural salience values of *commercial activity* (Kruskal–Wallis test, $\chi^2 = 11.394$, $df = 2$, p value = 0.003), *education* ($p = 0.004$), *park management* ($p = 0.001$), *sports recreation* ($p = 0.01$), *social leisure* ($p = 0.0006$), *nature recreation* ($p = 0.001$) and *use of natural resources* ($p = 0.0001$) across parks on different administrative levels. Generalized Linear Models (GLM) indicated there is a

weak relationship between the year of creation and the salience index of VGPs in the parks. Distance to urban centers had a negative (though weak) influence on *commercial activity* ($p = 0.09$) and *education* ($p = 0.07$). On the other hand, all seven VGPs categories are strongly influence by *park size*, unsurprisingly revealing that extensive PAs has a general higher cultural salience on the internet (Figure 6).

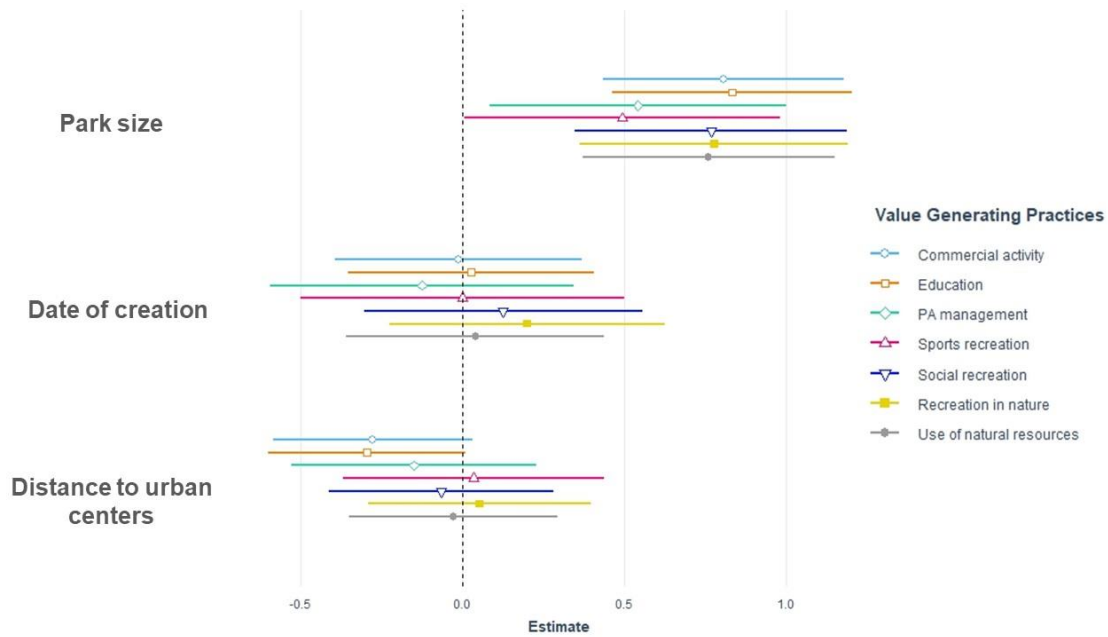


Figure 6: Generalized Linear Models relating the cultural salience of Value Generating Practices' broad categories and parks characteristics. Distance to urban centers represents the distance from a parks' centroid to the nearest city with 100.000+ inhabitants.

5.4 DISCUSSION AND CONCLUSION

In this study, we found that the World Wide Web is a rich data source for evaluating Value Generating Practices in protected parks. With the data collected, we successfully identified the main activities for international and domestic users in Brazilian coastal parks. Our large dataset provides a valuable resource for research on VGPs in particular parks in the future but promptly gives us critical insights into visitors' activities along the Brazilian coast. Firstly, the high cultural salience of *social recreation* in English web

pages clearly highlights the international prestige towards leisure activities in Brazilian coastal parks on the internet. Also, the assumption that domestic visitors may be more likely to *use natural resources* than international users (i.e. artisanal fishery, collect medicinal plants, hunt) was confirmed by the results, where *use of natural resources* had more than twice the number of web pages in Portuguese than in English (Figure 3). The measurement of the cultural salience of VGPs using the number of total search hits provided useful information about their relative importance for international and domestic users, though limitations were identified. Potential bias related to multiple meanings of words should be especially considered when researching web topics (the “-onym” challenge; Correia et al. 2017; Ladle et al., 2016). For instance, the number of hits for a search string containing the word ‘*ranger*’ may include results for park guards and the car model, thus inflating this specific search. The bias arising from words with multiple meanings may require especial attention of researchers dealing with multiple languages.

Another notable limitation on research using internet data sources in Brazil is that a large segment of society is less likely to create digital content due to a lack of access to internet infrastructure, cell phones, or computers. This may lead to an underrepresentation of socioeconomically vulnerable groups and preclude extrapolations of research findings to the broader society.

In our case, some caution is also needed on the comparison of cultural saliences as there can be great differences in how visible parks are. In this sense, the high cultural salience of VGPs in national parks (Figure 2) is not surprising since this category comprises famous international destinations such as Jericoacoara National Park and Lençóis Maranhenses National Park. Similarly, state and municipal parks were unsurprisingly more salient in portuguese web pages (Table 1), indicating that domestic and local visitors are more likely to create content about VGPs occurring in them.

We also selected three parks' characteristics and tested them to explain the cultural saliences of different VGPs. We found that *park size* was positively correlated with high number of VGPs while *date of creation* and *distance to urban centers* had no significant correlation with VGPs. In this regard, there may be a *cause and effect* issue since national parks are usually larger and more visited than state/municipal parks (Canto-Silva, C. R., & da Silva, J. S., 2017; Zhang et al., 2021).

Though the scientific literature describes a range of typologies for ecosystem services or nature's contributions provided by natural spaces to human beings, there is little agreement towards a categorization of the various practices of visitors in natural areas. In this sense, the Value Generating Practices framework may represent a landmark for future research on the topic, which can benefit from a user practices' standardization while reducing dependence from more general typologies (such as *Cultural Ecosystem Services* or *Nature's Contributions to People*; Millenium Ecosystem Assessment, 2005; Díaz et al., 2015) which often include a variety of abstract human-nature interactions.

Despite the limitations our data has the potential to generate valuable insights for the identification of key assets that can be managed in order to create and enhance the value of Protected Areas. We hope that the ever increasing amount of content published on the internet and the advance of devices and big-data analysis tools is likely to allow a more detailed evaluation of Value Generating Practices in Protected Areas in real time in the near future. We suggest that further exploration and combination of our database with other big-data analysis techniques (e.g. natural language processing and sentiment analysis) can provide a more comprehensive view of visitors' preferences in protected areas, as well as a better understanding of the relational values arising from human-nature interactions (Muradian and Pascual, 2018). Finally, we recommend this approach for the Brazilian parks and protected areas as a whole, in order to demonstrate the existing and the potential forms of value that they can provide to society, going beyond

the traditional biodiversity conservation argument, which has proven insufficient to safeguard Brazilian protected areas in the long-term.

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6 CONCLUSÕES GERAIS

Nesta tese, foram utilizadas diferentes abordagens para mensurar a influência de Áreas Protegidas no bem-estar de seus usuários. Isto foi realizado através do emprego de métodos tradicionais (como questionários presenciais) e inovadoras (como a análise de dados da internet) para a mensuração de dois indicadores de bem-estar: *Serviços Ecológicos Culturais* e *Práticas Geradoras de Valor*, respectivamente.

Uma vez que este é, provavelmente, o primeiro estudo sobre o fornecimento de serviços e desseviços culturais por áreas protegidas da Amazônia, esperamos que possa servir como linha de base para futuros estudos, além de auxiliar na avaliação de impactos ambientais no nível comunitário em que foi desenvolvido. A criação de bases de dados oficiais sobre a percepção destes serviços e desserviços é recomendada, uma vez que poderá ser de grande valia para seu monitoramento a longo prazo e para a rápida integração destas informações com outros tipos de dados (p.ex. censos oficiais, dados de pesquisadores de outras áreas da ciência, dados bioclimáticos, etc).

O maior número de menções a determinados serviços, como *recreação* e *herança cultural*, em áreas protegidas em comparação com áreas não protegidas são um claro reflexo do manejo do pirarucu (que está sendo desenvolvido no interior da Amazônia há décadas). O manejo comunitário do pirarucu em comunidades rurais da Amazônia já foi associado a diversos benefícios econômicos e sociais (Campos-silva, 2018; 2021), além de ecológicos (Campos-silva, 2016).

Nossos dados sobre o número de páginas da web que mencionam cada tipo de atividade em Áreas Protegidas costeiras mostra claras diferenças entre visitantes domésticos e internacionais. Como esperado, a alta saliência cultural de *recreação social* em páginas escritas em inglês demonstra o prestígio internacional sobre atividades de recreação na porção protegida da costa brasileira. De forma semelhante,

a alta saliência cultural de *uso de recursos naturais* em páginas escritas em português faz referência à importância desta atividade para visitantes locais.

Mais amplamente, a mensuração da saliência cultural de Práticas Geradoras de Valor através de um índice (representado pelo número de páginas na internet) mostra grande potencial para ser replicada em outras áreas de estudo e em outros campos da ciência. Dentro das ciências ambientais, esperamos que o método para avaliação da saliência cultural de VGPs possa também servir para a avaliação de *assets* em áreas protegidas, como espécies carismáticas/ameaçadas ou atrativos turísticos (locais/eventos), por exemplo. Esperamos ainda que, no futuro, a maior capacidade de processamento dos computadores e o desenvolvimento de novas técnicas para a análise de dados da internet possibilitem análises robustas e em tempo real sobre as preferências dos visitantes em Áreas Protegidas. Tais informações serão cruciais para uma rápida tomada de decisão que considere as percepções de todos os grupos de usuários, além de ser uma poderosa ferramenta para demonstrar os diversos tipos de valor que uma AP pode fornecer para a sociedade.