Conservation Biology

Using the capabilities approach to achieve people-centered conservation

Journal:	*Conservation Biology*
Manuscript ID	24-676.R2
Wiley - Manuscript type:	Review
Keywords:	sustainable development, freedom, Brazilian semi-arid, people-centered conservation, social theory

Abstract:

Top-down interventions by state and non-state institutions to conserve biodiversity and improve the lives of forest-proximate people (FPP) in the Global South tend to reflect economistic understandings of human wellbeing. More progressive people-centered conservation projects are rightly guided by normative visions of how the world should be, yet social dimensions of project design, planning and evaluation often remain focused on quantifiable aspects of wellbeing. Conversely, we demonstrate here how thinking about human wellbeing in qualitative terms of freedom and dignity can help achieve rights-based, people-centered conservation. We apply the capabilities approach, a social theory that emphasizes marginalized people's freedom to live a life they have reason to value. First, we systematically reviewed global English-language literature to assess how the capabilities approach has been used conceptually and empirically to examine the wellbeing of FPP. Based on 31 core, methodologically-diverse studies from 16 countries we found: (1) equitable access to forest resources is essential for the flourishing of FPP because access constraints are barriers to realizing development as freedom; (2) creating capabilities for FPP requires strong, local, social institutions; (3) forest-dwellers' agency (someone's power to act of their own volition) to pursue valued capabilities is often deeply embedded in collective structures. Accordingly, we present a framework to guide how people-centered conservation actions can promote the flourishing of FPP. We apply this framework to the Brazilian Caatinga dry forest, characterized by diverse usage of forest resources and deep social inequities, finding diverse examples of conservation practices and their mixed influences on the lives of people in this biome. In conclusion, adopting the capabilities approach can help ensure that people-centered conservation initiatives uphold forest-dwellers' rights and prioritize their subjective wellbeing, whilst striving for sustainability.

Using the capabilities approach to achieve people-centered conservation

Abstract

Top-down interventions by state and non-state institutions to conserve biodiversity and improve the lives of forest-proximate people (FPP) in the Global South tend to reflect economistic understandings of human wellbeing. More progressive people-centered conservation projects are rightly guided by normative visions of how the world should be, yet social dimensions of project design, planning and evaluation often remain focused on quantifiable aspects of wellbeing. Conversely, we demonstrate here how thinking about human wellbeing in qualitative terms of freedom and dignity can help achieve rights-based, people-centered conservation. We apply the capabilities approach, a social theory that emphasizes marginalized people's freedom to live a life they have reason to value. First, we systematically reviewed global English-language literature to assess how the capabilities approach has been used conceptually and empirically to examine the wellbeing of FPP. Based on 31 core, methodologically-diverse studies from 16 countries we found: (1) equitable access to forest resources is essential for the flourishing of FPP because access constraints are barriers to realizing development as freedom; (2) creating capabilities for FPP requires strong, local, social institutions; (3) forest-dwellers' agency (someone's power to act of their own volition) to pursue valued capabilities is often deeply embedded in collective structures. Accordingly, we present a framework to guide how people-centered conservation actions can promote the flourishing of FPP. We apply this framework to the Brazilian Caatinga dry forest, characterized by diverse usage of forest resources and deep social inequities, finding diverse examples of conservation practices and their mixed influences on the lives of people in this biome. In conclusion, adopting the capabilities approach can help ensure that people-centered conservation initiatives uphold forest-dwellers' rights and prioritize their subjective wellbeing, whilst striving for sustainability.

INTRODUCTION

1.1. HUMAN WELL-BEING AND CONSERVATION

The relationship between human wellbeing and nature is a perennial debate in conservation thinking, policy, and practice. Choosing how to conceptualize wellbeing is an important precursor to achieving Newing et al.'s (2023) laudable proposal for people-centered, rights-based conservation. In common with previous turning-points in conservation (e.g. Minteer & Miller 2011's New Conservation Debate), refocusing efforts on people-centered conservation – including scrutinizing ways in which contemporary conservation is *not* sufficiently people-centered – requires engagement with political and moral-ethical dimensions. We concur with Fisher et al.'s (2022) assertion that addressing sustainability challenges and achieving transformational change demands not only empirical evidence, but appropriate theoretical foundations.

Conservation research has developed to incorporate ideas and methods from across the social sciences and humanities yet environmental economics continues to dominate the ways in which conservationists comprehend wellbeing. Neoclassical economic methods have been used to assign monetary value to ecosystem processes which support wellbeing, incorporating 'nature's benefits' to people into economic decision-making. Environmental-economic models are intended to guide scientists, policy-makers, and practitioners in order to 'optimize' relationships with nature, simultaneously maximizing conservation benefits and human welfare outcomes ('win-wins'; but see McShane et al. 2011). Environmental economics makes positivist scientific claims that separate facts from values (i.e. when attempting to distinguish positive 'value free' economics from normative 'value laden' ways of understanding the world; Spash 2012), hence wellbeing becomes equated with monetary income or other readily-quantifiable aspects of people's lives.

Conservation science is broadly criticized for the so-called measure-value dichotomy, in which researchers and practitioners try to separate their subjective, value-laden mission from what is seen as objective, fact-based biodiversity measurement (Baumgaertner and Holthuijzen 2017). This separation is both artificial and misleading given that values are embedded in how biodiversity is defined, prioritized, and measured. Moreover, an economic or bio-economic model cannot elucidate the circumstances in which it may ever be acceptable to curtail human wellbeing in order to protect threatened biodiversity. How can and should the quantifiable environmental benefits of a conservation project be balanced against equitable distribution of social costs and benefits? It is

equally problematic to limit human wellbeing, conceptually, to aspects of lives that are amenable to quantification (Sen 1977). While environmental economics provided valuable quantitative tools, its assumptions often overshadowed non-market moral economies (Granovetter & Swedberg 2011). The capabilities approach (hereafter CA) emerged as a vital ethical counterweight to economistic framings (Sen 1999; Martin 2017), shifting the focus toward human freedom and dignity.

Forest livelihoods researchers historically approached wellbeing through measuring people's dependence on natural resources in order to fulfill basic needs (Newton et al. 2016). This perspective is rooted in forestry management and environment/agricultural economics, and tends to equate a 'good life' with economic success (e.g., Braga et al. 2023). The needs-based, utilitarian framing of wellbeing appealed to natural scientists because it is factual and objective, yet problematic because it ignores diverse values and other non-material aspects of wellbeing (Miller et al. 2021; Razafindratsima et al. 2021). Encouragingly, researchers in this field increasingly agree that conservation must improve forest-dwellers' lives in ways that extend beyond the assumptions and measures of economic cost-benefit analysis and utility maximization (Nerfa et al. 2020; Jagger et al. 2022). This conceptual opening-up reflects the influence of *ecological* economics which, unlike environmental economics, emphasizes social equity and inclusive environmental governance (Røpke 2005). Ecological economics is normative in its goals and often analyzes institutions more than individuals (Vatn 2005). Research by political ecologists is also normative and attempts to understand and improve the lives of marginalized forest-dwellers, examining power dynamics and how conflicts and policies shape access to natural resources (e.g. Ribot & Pelusso's [2003] Theory of Access).

In this article, we argue that the CA which conceives of human wellbeing in terms of freedom and dignity could help achieve people-centered conservation in Brazil (see Chiaravalloti et al. 2025) and elsewhere. Compared to other bottom-up conservation frameworks, the CA provides a theory of agency (Gangas 2016) that can bridge the structural critiques of Marxian frameworks such as political ecology and convivial conservation (Büscher & Fletcher 2020) with liberal justice perspectives, at once emancipatory in its vision of human flourishing yet compatible with policy. The CA then moves beyond the economistic framings of the sustainable livelihoods approach (Arce 2003) and reinforces participatory research's radical Latin American roots (Rappaport 2020; Cooke & Kothari 2001), offering a robust framework for transformative, community-based

conservation. CA has long transformed debates in diverse areas of scholarship and policy, including health (e.g. Coast et al. 2008) and conservation (e.g. Martin et al. 2016). Notions of a good life, and whether they are context-specific or universal, have been debated by societies and political philosophers for millennia yet this knowledge does not sit easily with economic analysis. In rural and peri-urban contexts in Amazonia, a 'good life' and greater subjective wellbeing seems to rest not on material wealth, but instead on strong social relationships, new forms of political engagement and cooperation, autonomy, and living in dignity (Macdonald & Winklerprins 2014; Garrett et al. 2017; Piva da Silva et al. 2022).

1.2. THE CAPABILITIES APPROACH AND PEOPLE-CENTERED CONSERVATION

The CA is a concept based on what people are able to *be* and to *do* and has been paradigm-shifting in the social sciences. Amartya Sen emphasized that in order to flourish, people must have realistic opportunities (termed, *capabilities*) to achieve things (called *functionings*) which they, subjectively, have reason to value (Sen 1993, 1999). Wellbeing is therefore deeply linked to an individual's subjective values, personal sense of self-realization, ethics, and autonomy (Huta 2017). The CA offers a fresh perspective on how the overlapping but distinct concepts of agency and empowerment relate to wellbeing (Claassen, 2016; Drydyk, 2013; Gangas, 2016). Following Drydyk (2013), agency is understood as autonomous personal involvement in actions—focused on the process, not the outcomes. In contrast, empowerment involves both the expansion of power and a process of change, encompassing both 'doings' and 'beings'. Defined as the *'*expansion of the scope of agency*'*, empowerment links changes in a person's capacity to act to enhance their wellbeing in ways agency alone does not. From this perspective, wellbeing (a state of being) lies outside agency (which concerns only action) but is integral to empowerment, which bridges agency and wellbeing. The CA is multifaceted, serving as both a social theory – in the sense of an idea, analytical framework, or thought-experiment – and a normative critique of the prevailing social order and related injustices (Robeyns 2005a). The CA is a political counter theory because it can help identify barriers to people's opportunities to live the life they may wish to, and it has also been used to critique hierarchies of power (see Smith & Steward 2009). Hence, the CA is intended to guide socially-progressive, egalitarian societal change by influencing institutional and individual actions and behaviors, and has influenced scholarship, policy, and practice in research areas

including education (Lozano et al. 2012), health (Venkatapuram 2013), housing policy (Kimhur 2020), human rights (Vizard et al. 2011), and development studies (Holden et al. 2018).

The CA's unique contribution towards people-centered conservation lies in its role as an analytical heuristic that provides an agency-oriented theory of justice (*sensu* Drydyk 2013, Gangas 2016), in ways that existing conservation social science frameworks do not. For instance, while Martin's (2017) "just conservation" and Woodhouse et al.'s (2017) multidimensional wellbeing framework advanced conservation social thinking at the time, the CA foregrounds agency and empowerment to a much greater degree. Rather than focusing solely on the presence of rights or resources, the CA identifies the specific conversion factors that determine whether these actually translate into lived freedoms. The CA therefore provides a diagnostic depth that explains why forest-proximate people may still face capability deprivations and be unable to achieve a dignified life, even when formal rights or material resources are present.

Noteworthy limitations of the CA include assertions that it is overly individualistic, meaning it ostensibly regards individuals as isolated moral units whose choices and opportunities are considered independently of their social embeddedness. However, as Robeyns (2017, section 4.6) explains, this criticism misattributes methodological or ontological individualism to the approach. While the CA is normatively individualistic (individuals are the units of moral concern), it explicitly recognizes social norms, institutions, group identities, and structural constraints as essential conversion factors shaping how capabilities are realized. Also, the CA is critiqued for its emphasis on agency rather than structures. Piva da Silva et al. (2021) addressed this limitation in their analysis of wellbeing in metropolitan Manaus, highlighting the role of individual agency and freedom in relation to economic, political and social structures.

We adopt a conceptually broad, pluralistic framing of the CA based on Sen's seminal writings, with additional insights from political philosophers Martha Nussbaum and Ingrid Robeyns. Sen (1993) defined wellbeing through the dimensions of capabilities, agency and functionings. Capabilities, then, are realistic opportunities to *be* and *do* something one has reason to value; agency is someone's capacity (or power) to act of their own volition to choose to pursue valued opportunities; and functionings represent the conversion of capabilities into achievements (Sen 1993). Sen maintained a reflexive and open position on the CA, encouraging researchers to adapt and extend the approach for practical or ethical purposes. Robeyns also advocated pluralistic

research on the CA and her influential work highlighted the importance of factors which influence how diverse kinds of resources generate opportunities for people's lives (see Robeyns 2017). Notably, Robeyns' (2005b) added a new wellbeing dimension – conversion factors – which influence the conversion between having a resource and having a capability. Robeyns separated conversion factors into personal abilities (e.g., mental and physical characteristics), social characteristics (based on norms, institutions and behavior), and environmental context (place-based features). Nussbaum (2011) insisted that nation states must ensure the conditions for individual flourishing by guaranteeing minimal opportunities (above certain thresholds) for all people to achieve ten universal capabilities. Examples include bodily and mental health, being able to exercise political participation, and establish goals and desires about one's life (Appendix S1). Universal capabilities are not exhaustive, and Nussbaum proposed these be supplemented by capabilities specific to cultures and traditions of a particular country (see Deneulin and Shahani (2009) for examples). While we remain committed to Sen's principle of *value pluralism*, recognizing that forest-proximate populations must define their own priorities, we utilize Nussbaum's (2011) ten universal capabilities as a cross-cultural evaluative framework to ensure that minimal constituents of wellbeing and human dignity (*sensu* Woodhouse et al. 2015) are not overlooked.

The conceptualization of freedom inherent in the CA is relevant for people-centered conservation because it provides a foundation for pursuing egalitarian human development (*sensu* Alkire 2002) and can help link universal human rights (Vizard et al. 2011) with conservation-related agendas such as the UN Sustainable Development Goals (Perdomo et al. 2021). Human rights constitute entitlements to particular capabilities (see Hansen et al. 2015). Leach and colleagues (1999) pioneered the use of capabilities as a conceptual lens to examine people-environment relations, aiming to improve community-based natural resource management (CBNRM): a political-ecology inspired, participatory approach which emphasizes empowerment, equity and sustainable use. CA-analysis can highlight the material and social dimensions of rights, and the need for government action to uphold these rights. Conversely, the language of rights strengthens discussions of capabilities by clarifying that ensuring people's capabilities is urgent and non-negotiable – it cannot be ignored or sacrificed for other goals (Nussbaum 2011).

There is growing use of the CA in human-environment research, albeit largely outside of mainstream conservation literature: in political sciences (Holland 2008), ecological economics

(Fleischman & Solorzano 2018), and urban sustainability (Pineda-Pinto et al. 2025). The CA offers novel insights into human-environment relationships, including how forest-dwellers' well-being is affected by conservation interventions such as creating protected areas (e.g., Ballet et al. 2020), or enforcing regulations to limit resource-use (Lienert & Burger 2015). The CA can improve how conservation framings conceptualize wellbeing, e.g. how ecosystem services contribute to people's freedom to live a life they have reason to value (Polishchuk & Rauschmayer 2012). Pelenc and Ballet (2015) propose that the CA's normative focus on improving people's capabilities (and hence, wellbeing) can play a role in achieving 'strong sustainability'. Watene (2016) contends that although the CA encourages cross-cultural dialogue and accommodates diverse perspectives on valuing nature, this approach mainly focuses on benefits to people, potentially overlooking nature's intrinsic value and related obligations to protect it. The CA contributes a more nuanced theory of agency (Gangas 2016) to people-centered conservation, enabling community-based efforts to move beyond economistic views of humans through a richer understanding of wellbeing.

Critiques and limitations of the CA notwithstanding, such a freedom-oriented approach to conservation could offer a radical alternative to the *status quo* in many forested contexts in the Global South. Many forest conservation policies remain imbued with the logic of financial rewards and punishment (Gebara & Agrawal 2017), instead of working with forest-dwellers to foster sustainability alongside living a life they have reason to value. Conservation science has evolved to become more participatory but 'fortress conservation' still prevails (Qin et al. 2023). In many countries, people-centered conservation remains an aspiration, and long-standing conflicts between government-imposed conservation measures and rural communities' rights and sovereignty are far from being resolved.

1.3. AIMS AND STRUCTURE OF THE PAPER

Our aim is to enhance the usage of the CA in conservation scholarship, policy and practice. This article draws on a systematic review of the English-language literature on the CA (Appendix S2), identifying studies which have applied this conceptual lens to the lives of forest-proximate people (FPP), a term coined by Newton et al. (2020) to describe the diverse groups of people living in or nearby forests. Instead of reporting trends, we will draw out some key insights from the literature, including research which highlights how conservation actions can positively affect forest peoples'

freedom and foster subjective wellbeing. Recognizing that improving human wellbeing is a key objective of people-centered conservation in the Global South (Bakarr 2023), we then present a CA-inspired conceptual framework, designed to promote the flourishing of FPP. Finally, we apply our framework to scrutinize people-centered conservation in the Caatinga, one of the most biologically diverse and populated tropical dry forests on earth (Silva et al. 2017a). To do-so, we draw on the literature (in Brazilian Portuguese and English) into forest resource use by, and conservation-related barriers constraining the well-being of, rural *Caatingueiros* (the Portuguese term for its traditional inhabitants).

2. METHODS

2.1. SYSTEMATIC REVIEW PROCESS

We conducted a systematic review to answer the question: 'How has the capabilities approach been used conceptually and empirically to examine the wellbeing of forest-proximate people?'. To the best of our knowledge, there have been no previous reviews on this topic. Although the core principles of the CA are universal, we focus specifically on FPP in order to examine how subjective wellbeing may be shaped by issues that characterize many forested landscapes (e.g. sociopolitical struggles for forest tenure, precarious access to non-timber resources and markets, agricultural frontier advance and deforestation, remoteness from political and economic centers, area-based conservation interventions). We conducted the systematic review of English-language published articles following *Guidelines and Standards for Evidence Synthesis in Environmental Management* (Collaboration for Environmental Evidence 2022; Appendix S2), and the widely-used PICO framework (Pullin & Stewart 2006). The PICO approach typically structures a systematic review by defining four key elements (Population, Intervention, Comparison, and Outcome) to help formulate precise, answerable research questions and guide the article search strategy and inclusion criteria. We used only Population and Outcome as guides, since our initial searches using Interventions and Comparisons excluded numerous important articles known to us. Our study population was forest-proximate people (FPP), and the outcome was the CA. Defining whether a population in each article constituted FPP would require precise distance of settlements from forests (following Newton et al. 2020). Because many papers lacked coordinates of the study location(s) we chose to consider participants as FPP if the text

clarified this population was in a rural area, and there was a clear link between forests and their wellbeing.

We extended the aforementioned *Guidelines* using Grames et al.'s (2019) frequency-based method which uses an initial set of 'naive' search terms guided by our Population and Outcome approach to search for papers. Keywords are then selected based on the most frequent terms found in papers from the naive search (Appendix S2). Frequent keywords (from 5+ papers) are then used to search in the 'true', full systematic review. We conducted the naive search and the frequency-based keyword selection between April and June 2022 using *Scopus* (Appendix S2). The true, comprehensive search was carried out between June and October 2022 utilizing *Scopus* and *Web of Science* producing 613 candidate articles.

2.2. ARTICLE FILTERING AND DATA EXTRACTION

First, we examined titles and abstracts to exclude articles which were either unrelated to rural populations that could be considered FPP, did not investigate wellbeing using the CA, were opinion articles, or lacked titles or abstracts due to metadata issues. This left 207 articles for further review. Second, we read the remaining articles to include only those which: i) explicitly drew on ideas from the CA (e.g., agency, capacity, functionings, freedom, social justice); ii) had a clear connection to human wellbeing; iii) applied the CA either conceptually (e.g. in terms of social processes or livelihoods) or for assessing wellbeing; iv) were focused on FPP. This process resulted in 80 papers from which we extracted additional information, entered into a spreadsheet. From each, we collected qualitative data about the focal human population, and engagement with the CA. Information about the focal population included the main social identity characteristic of interest to the researchers on (e.g. intersecting categorizations including women, rural people, farmers); whether the categories of forest-proximate people or forest-dependent people were implicit or explicit; and geographic context (e.g. remote rural). We attempted to establish which theoretical lineage or perspective of the CA was used (i.e., whether the theoretical arguments were based on Sen, Nussbaum, Robeyns, or a combination); which specific or universal capabilities, if any, were used to interrogate wellbeing; and (if recorded) the subjective meanings of these capabilities to the research participants.

From the 80 relevant articles (Appendix S3) we identified 23 core papers which we analyzed qualitatively to draw out key themes (Section 3.1) and develop our CA-inspired framework (Section 3.2). Core articles presented insightful conceptual arguments or empirical findings which either help understand how conservation actions can act as barriers to wellbeing (in terms of freedom and dignity) or demonstrate how progressive conservation actions can do the opposite, fostering capabilities. We included eight additional articles as core articles which were relevant but initially missed due to being published after the cutoff date, or search term limitations.

2.3. CONSERVATION AND INJUSTICE IN THE CAATINGA

The Caatinga biome is the largest dry forest in the Americas, yet one of the least studied social-ecological tropical systems (Figure 1, Figure 2). The entire Caatinga is home to approximately 27 million urban and rural people (IBGE 2022a), of which 9.2 million are considered forest-proximate (Alencar 2023). Persistent injustice is manifested in multidimensional poverty in the Caatinga. More broadly, extreme income poverty and illiteracy rates in Northeast Brazil are two- and five-times higher, respectively, than in the Southeast (IBGE 2022b; 2023). To-date, researchers have mainly examined natural resource use in the Caatinga through economistic lenses, such as the relationship between forest dependence and monetary poverty (Specht et al. 2019). Alencar et al. (2022) identified potential synergies and trade-offs between *Caatingueiros*' usage of forest resources and conservation goals. Two studies show how forest resources are linked to food security via grazing areas for domesticated animals (Alencar et al. 2023) and building materials including fence poles (Gonçalves et al. 2021). Both activities cause forest degradation. This research focus is unsurprising given that non-material, non-visible aspects of peoples' inner worlds, including identities and ancestry, are under-studied by conservationists (Ives et al. 2020).

Current preservationist discourse in the Caatinga – advanced by some state institutions and NGOs – incorporates the idea that the traditional use is part of the anthropogenic disturbance driving land use change and biodiversity loss (Silva & Barbosa 2017; Antongiovanni et al. 2020). Anthropogenic disturbances such as fuelwood consumption, grazing of free-range goats and slash-and-burn agriculture cause continuous, widespread but low-intensity impacts on Caatinga vegetation, and are – ecologically-speaking – preferable to the drastic land use changes involving deforestation and large scale land use changes (Melo 2017; Araujo et al. 2023). However, there

are socio-political implications of describing traditional land uses in terms of environmental degradation (see Fraser et al. 2024), and we caution against describing small-scale disturbances as a primary driver of Caatinga degradation and overexploitation of natural resources, as Ramos et al. (2023) do. The small-scale disturbances attributable to the Caatinga's rural poor are shaped by inequalities in access to land and natural resources (Melo et al. 2023).

Tabarelli et al.'s (2024) theoretical model suggests a negative feedback loop between poverty and anthropogenic disturbance in the region, which they take as evidence that fuelwood, goat-raising and traditional agriculture reduce land productivity and perpetuate poverty. Although ecologically reasonable, this fails to recognize that these land-use practices have existed for hundreds if not thousands of years in this biome and, to date, there is no evidence of any dramatic environmental impact derived from traditional land uses. Conserving the Caatinga's unique vegetation must be done in ways that maintain forest-dependent livelihoods *and* promote human wellbeing (similar to the situations in other tropical dry forests; e.g., Vallejos et al. 2022) which we attempt to address using a conceptual framework derived from the CA.

The role of unjust institutional arrangements and other structures in perpetuating poverty in the Caatinga is sometimes overlooked by conservationists, who instead highlight environmental determinants. For instance, researchers have tended to describe poverty in the Caatinga in relation to marginal agricultural conditions in this semi-arid, drought-prone environment (e.g. Leal et al. 2005), overlooking the on-going marginalization of smallholders and imbalances in the distribution of socio-political power, land and other resources. A negative feedback between poverty and environmental conditions in the Caatinga is also labeled as the primary cause of rural out-migration (Ab'Saber 1999; Silva et al. 2017b). The misconception that Caatinga habitats are poor in biodiversity and provide few ecosystem services to its inhabitants partly explains the low coverage of state-sponsored protected areas (Manhães et al. 2016). The mismatch of different actors' needs and interests is a significant barrier to achieving people-centered conservation in this biome (see Faggin et al. 2017).

3. RESULTS

3.1. SYSTEMATIC REVIEW INTO CA AND FOREST-PROXIMATE PEOPLE

We identified 80 studies in our review, including eight more after the review conclusion. These 88 articles applied the CA to conservation-related problems or situations, and examined the wellbeing of forest-proximate people in diverse geographic and cultural contexts. We concentrated on the most pertinent of these – 31 core studies including the eight added post-review (Table 1) – to draw out three key emergent themes and then elaborate our proposed framework. The other studies (n=57) generally had more superficial engagement with the CA. Core studies all used variants of the CA as their theoretical framing, sometimes paired with another concept. Fifteen papers had a primarily social focus (e.g. analyzing governance), followed by an environmental primary focus (6 papers, e.g. relating capabilities to ecosystem services), health (4 papers, e.g. youth wellbeing and food security), economic (3 papers, e.g. energy demands and capabilities), and mixed social-environmental (3 papers, e.g. wellbeing at a deforestation frontier). Qualitative methods – often in combination with each other – were used in 21 core studies, including interviews (n=16 studies), focus groups (n=9), participant observation (n=8), workshops (n=3), documental analysis (n=1). - Nine core studies used quantitative methods based on a questionnaire, of which five combined questionnaires with qualitative methods. Five were either entirely conceptual or included relatively zoomed-out use of case studies.

African research featured strongly, with 10 core studies from eight countries. Asian research (n=7 core studies) was from four countries but predominantly India (n=4). Latin American research was entirely in Mexico (n=4 studies) and Brazil (n=4). The latter examined REDD+ projects across Brazilian Amazonia (Gebara & Agrawal 2017); agro-extractivist communities in Maranhão State (Vicari 2014); colonists at a farm-forest frontier in Amazonas State (Piva da Silva et al. 2022); and *caiçara* coastal communities in the Atlantic Forest (Bockstael & Berkes 2017).The CA has not been previously applied to analyzing human wellbeing in the Brazilian Caatinga, motivating our analysis of conservation actions and wellbeing in this biome using this lens (Section 3.3). Other core studies came only from Australia (n=4) and USA (n=1).

3.1.1. Theme 1: Equitable access to forest resources and quality public services is essential for human flourishing

Four studies demonstrate that egalitarian access to forests is essential in order for forest-dwellers to have realistic opportunities to convert natural resources into achieved functionings. Kusel's

(2001) seminal study proposed that forest-dwellers' wellbeing should be conceptualized and assessed in relation to three kinds of 'community capacities' (physical, social, and human capital) and sense of place. Dawson & Martin (2015) found that most people in Rwandan farm-forest landscapes depend on precarious access to government-owned or private forests for collecting firewood, highlighting the role of power imbalances. Cleaver and de Koning (2015) offered an important theoretical advance by exploring how people navigate and reshape the formal and informal rules that govern their access to natural resources through a flexible, creative process they called institutional bricolage. Addison and colleagues (2019) used workshops and documental analysis to examine natural resource management structures in Australia, drawing on a hybrid theoretical framing of Sen's work on CA ('development as freedom') and Ribot and Peluso's (2003) theory of access to natural resources. For the latter, access is determined by dimensions including property rights, physical access, and access to capital, markets, technology or knowledge. We consider that these forms of access to forest resources represent forest-dwellers' 'power to act' (see Ahlborg & Nightingale's 2018 paper on theorizing power).

Four studies affirm the importance of geographical context and forest access, showing how these factors can either restrict or facilitate access to forest resources, and shape the capability to utilize forests and meet basic needs. Takahashi et al. (2022) conducted a rural and urban questionnaire-based study in Japan, finding that engagement with forest-related activities (functionings) was related to higher subjective well-being. Sangha et al. (2015) showed that for indigenous Australians, access to their homeland is vital for maintaining traditional practices and intergenerational knowledge. A quantitative study in rural Nigeria also showed that geographical characteristics such as physical proximity to urban centers can influence forest-dwellers' opportunities to utilize public services such as education and healthcare (Ayoola Oni & Adenike Adepoju 2014). J.A. Silva et al. (2018) studied three neighboring communities near Limpopo National Park in Mozambique and found that lower levels of non-monetary wellbeing in one community was associated with rapid conversion of forest to farmland, interpreted by the authors as a land-use trap. Overall, rural peoples' access to both forests and quality public services seems essential in order to create capabilities from forest resources, and subsequently overcome barriers to wellbeing.

388 *3.1.2. Theme 2: Creating capabilities in and around forests through institutions*

389 The literature synthesized here demonstrates that for forest-proximate populations, the realization
390 of capabilities is contingent upon the strength of local social institutions, including customary rules
391 and collective organizational practices, which serve as essential conversion factors for maintaining
392 lives they have reason to value. In Nigeria and India, rural livelihoods and wellbeing rely on having
393 realistic opportunities to reliably acquire sufficient resources from forests including nutritious food,
394 clean water, fuelwood and construction materials (Ayoola Oni & Adenike Adepoju 2014; Schmidt et
395 al. 2022). Indeed, Balasubramanian & Sangha (2021) link the CA and ecosystem services, through
396 a case study with indigenous forest-dwellers in India's Western Ghats. This is coherent with Lienert
397 and Burger's (2015) conclusion that, in Nepal, forest resources are central to achieving
398 Nussbaum's universal capabilities. Their community-based research demonstrated that people
399 recognize biological resources as important for achieving capabilities including bodily health, bodily
400 integrity, interaction with other species, and social affiliation.

401 In indigenous communities in Namibia, parents felt that government prohibition of traditional
402 hunting practices means that succeeding in formal education is now their children's only way of
403 gaining freedom in later life (Matengu et al. 2019). The authors interpret this replacement of
404 indigenous lifestyles, values, and practices in terms of the lingering effects of colonization and
405 marginalization. Velasco-Herrejon and Bauwens' (2020) research in Southern Mexico shows how
406 ensuring that development projects (e.g. around energy-generation) promote justice and create
407 valued capabilities (e.g. around employment, identities, and health) requires inclusion of
408 indigenous and traditional communities' voices and knowledge. Summarizing, ensuring positive
409 connections between forests and human flourishing can be achieved by creating the conditions in
410 which capabilities can arise, through policy interventions and fostering grassroots social
411 movements.

412

413 3.1.3. *Theme 3: Bottom-up agency and collective forest capabilities*

414 Within the CA framework, agency is the freedom to pursue valued capabilities, yet for forest-
415 proximate people this agency is deeply embedded in collective structures. Hence, people-centered
416 conservation requires moving beyond top-down restrictions to support the social and institutional
417 frameworks that enable bottom-up agency. Cleaver's (2007) pioneering conceptual work

established that collective management of natural resources requires balancing individual agency with community management, customary rules and conservation legal restrictions. Hence, agency is not simply a matter of individual choice or empowerment: it is embedded in and shaped by broader social relationships and institutional structures. Leach et al.'s (1999) seminal work into environmental entitlements emphasized the interaction of structures and agency. They argued that both intended and unintended practices and actions can lead to shifting structures, rules and norms. Likewise, these structures can influence people's actions, and therefore constrain or enable conservation initiatives. Gutiérrez-Zamora et al. (2023) demonstrated how collective capabilities are dependent on forest and non-forest resources, underscoring the plurality of values related with forest usage for communities in Oaxaca, Mexico. In rural South Africa, young people who perceive strong collective action, social cohesion and inclusion within their communities also tend to be more food secure (Owen & Goldin 2015). These empirical findings reinforce how collective forest resource use demands a level of agreement between individuals on how forest resources can generate opportunities. Freitas et al. (2020) argue that focusing environmental management on culturally important species (e.g., Arapaima fish, and Amazonian river turtles) helps foster community engagement (hence, increases agency) and improves collective management of natural resources, benefiting nature and human wellbeing.

Where individual agency is supported by diverse institutions, and the management of resources is collective, conservation practices such as community-based management can promote human wellbeing (see Huber et al.'s [2023] systematic review of 52 empirical case studies). Conversely, in situations where conservation actions constrain individual agency, as seen with strictly protected areas and exclusion of forest-dwellers, many people perceive conservation as a barrier to pursuing valued life opportunities (e.g., see J.A. Silva et al.'s [2018] mixed-methods study into the aspirations of people living around Limpopo, Mozambique). In India, a failure to develop community capabilities for engaging in decision-making processes within so-called participatory forestry has limited the success of these initiatives (Fleischman & Solorzano 2018).

O'Sullivan's (2016) conceptual study on indigenous rights and health inequities, and Téllez Cabrera's (2022) work with P'urhépecha indigenous people in Mexico, teach us that in order to promote human freedom, conservation scientists and government environmental institutions should respect, and seek sustainable use through appreciating traditional practices (e.g. the

harvest and use of traditional medicines). This resonates with Strong and Silva's (2020) CA-informed analysis of conservation-oriented hunting bans in Southern Africa. They found that strict enforcement of protected areas can negatively impact material resources, decreasing the acquisition and sale of bushmeat – an important source of food and rural income. Communities objected to officials using excessive violence and punishment practices against hunters, and denying permission to kill 'problematic' animals posing a threat to villagers' safety. There, many local people felt that regulations were humanizing wild animals and dehumanizing people.

3.2. CONCEPTUAL FRAMEWORK

We present a framework for people-centered conservation to promote the flourishing of forest-proximate people (Figure 3), based on three core elements of the CA (capabilities, agency, functionings; from Sen), Robeyns' notion of conversion factors, Nussbaum's assertion of political obligations to ensure universal capabilities for all people, and the role of social institutions. We have added two additional conservation-specific elements: forest resources and people-centered conservation actions. The framework incorporates the main findings from our systematic review; (i) that equitable access to forest resources is essential for the flourishing of FPP because access constraints are barriers to realizing development as freedom (Addison et al. 2019): (ii) creating capabilities for those living in and around forests requires strong, local, social institutions; (iii) forest-dwellers' agency (i.e. someone's power to act of their own volition) to pursue valued capabilities is often deeply embedded in collective structures. Equity of access, and ecological sustainability of resource-use – which is clearly important if we are to promote wellbeing *and* achieve conservation goals – can be supported and improved through people-centered conservation actions and, in turn, create capabilities (i.e. realistic opportunities for forest-dwellers to be and do something they have reason to value). Wellbeing is conceptualized through the means (i.e. the process) not the ends of conservation actions, and is defined as someone living a life that they have reason to choose, and to value. Wellbeing comes through the process of people converting valued capabilities into achievements, having the freedom to pursue valued opportunities.

Institutions crosscut all our main findings, including addressing needs and values differentiated between people and diverse institutions including State organizations, NGOs and other non-state organizations. Our framework emphasizes the importance of institutional strategies for managing natural resources in order to ensure just and sustainable access—and support fair processes of learning and empowerment—by embracing what Cleaver and de Koning (2015) term institutional bricolage: recognizing and working with the complex mix of formal rules, informal norms, local practices, and power relations through which people actually engage with institutions in everyday life. Rather than relying on top-down designs or rigid participation frameworks, this approach emphasizes the importance of locally embedded knowledge, unequal power relations, and historical practices in shaping access and agency. By enabling more inclusive and socially

embedded forms of governance, such strategies foster meaningful empowerment, collective learning, and accountability, and can achieve more equitable people-centered conservation.

To operationalize our framework, conservation actions should empower marginalized forest-proximate peoples and their social institutions to enhance agency and, ultimately, translate resources into lived freedoms: (a) ensure equity in resource-access (e.g. show sensitivity to actual or potential social gradients in access which may be mediated by factors including gender, age, social status and wealth, formal property rights, and ethnicity) and institutional partnerships (e.g. in project-design, agenda-setting and management); (b) build the autonomy of forest communities and support or strengthen local leadership; (c) be based around grass-roots social and political mobilization rather than the imposition of external agendas and priorities; (d) be sensitive to power imbalances and give voice to under-represented groups; (e) build-in participatory management of natural resources, ideally ensuring that forest-dwellers are involved and in-charge in all stages, from prioritizing species and areas, setting quotas, designing and conducting environmental monitoring methods, harvesting, transport and market sale. (f) finally, related to but not limited to environmental monitoring, any research component in a conservation action should involve co-production of knowledge (in the sense of recognizing diverse contributions and perspectives of local and outside stakeholders, and attempt to promote mutual learning, inclusivity and a focus on locally-relevant research goals).

Our framework could serve as a critical guide – as a way of understanding successes, and obstacles to wellbeing – with the overall aim of ensuring forest peoples' freedom to achieve subjective wellbeing. Importantly, ecological sustainability alone is insufficient. In summary, actions to promote sustainable resource use should also attempt to change lives and communities for the better (as defined by forest-dwellers) by promoting autonomy, creating capabilities, and enhancing people's agency and freedom to pursue valued opportunities.

3.3. ACHIEVING PEOPLE-CENTERED CONSERVATION IN THE CAATINGA

So-called conservation actions have undermined the capabilities and agency of marginalized peoples by disguising and legitimizing land concentration for local elites. We found three cases in the literature showing how access to land and livelihoods in the Caatinga can become more precarious following the creation of protected areas, limiting the already marginalized inhabitants'

517 opportunities to pursue things they value. Within these protected areas, there are widespread
518 conflicts and negative impacts for local people. The example of the Catimbau National Park,
519 created in 2002, on top of traditional farmland and smallholdings (Figure 1), is instructive in
520 revealing negative impacts for local people and conflicts with state institutions. Residents refused
521 to leave, were never compensated, and remain trapped in material poverty with their wellbeing
522 dependent on (what is now) illegal harvest of natural resources (Specht et al. 2019). The Tatu-Bola
523 Wildlife Refuge, a strictly protected area created in 2015, still lacks a management plan (Figure 1),
524 and hence long-standing livelihoods and natural resource uses have been criminalized.
525 Contrasting with these on-the-ground realities, Brazilian law (Nº. 9.985, 18 July 2000) stipulates
526 that such management plans must be co-developed by government agencies and local
527 communities to foster community empowerment and social inclusion. The continued absence of
528 the plan in *Tatu-Bola* has deepened communities' fears and insecurities around land access,
529 fuelling resentment of the park (Bernard & Melo 2019), limiting human flourishing. Finally, some
530 *private* protected areas in the Caatinga were created – through official channels – in order to deny
531 access to landless small farmers in areas where they work as casual contractless laborers, without
532 necessarily having a real conservation motivation (Silva 2017).

533 Ensuring people-centered conservation in the Caatinga requires not only equitable land
534 access but also substantial improvements in basic services in order to support wellbeing and
535 enable *Caatingueiros* to convert valued capabilities into functionings. Renewable energy projects
536 have reduced land-access for *Caatingueiros,* affecting the very lifestyle that characterizes their
537 identities. The expansion of solar and wind farms has involved green-grabbing of land belonging to
538 the state and smallholders (Klingler et al. 2024). The conflicting interests of local people, state and
539 municipal governments, and the renewable energy sector hinder area-based conservation (Neri et
540 al. 2019). Living in dignity in the Caatinga also requires local access to quality public services.
541 Despite progress in recent decades, relative to most other Brazilians, people in the Northeast are
542 more likely to experience income poverty (IBGE 2022b), receive less formal education (IBGE
543 2023), and lack electricity (Thives et al. 2022), clean water and sanitation (IBGE 2020).
544 Consequences of poor access to basic services include limited resilience to environmental shocks
545 (Niemeyer & Vale 2022), and ongoing reliance on forests to meet basic material needs (Alencar et
546 al. 2022). Land concentration in the Caatinga amplifies risks by denying traditional communities

access to farming and grazing areas, constraining livelihoods (Melo et al. 2023). Consequently, state support for people-centered conservation should come in tandem with land reform and improved public services.

Conservation actions can support subjective wellbeing by fostering regional identities, sense of belonging, and livelihoods. Social identities and territorial relationships are frequently mentioned in historical accounts of the Caatinga (Cunha 2018) and in *Caatingueiro* oral histories (Santana 2016; Cruz & Guimarães 2021) and are intrinsically related with how people manage their local environments. For instance, in Santana's (2016) study in Pernambuco, territoriality and ancestral history were important factors which strengthened people's sense of place and their commitment to traditional land management practices such as farm-fallow agriculture. Traditional land uses undoubtedly influence Caatinga habitats but are also integral to people's sense of self and history (Santana, 2016), and support non-material dimensions of wellbeing. Clarifying the extent to which traditional land-uses and associated chronic disturbances can be tolerated within people-centered conservation requires a contextual understanding of the ways in which conservation actions intersect with people's agency and valued life opportunities, or lack thereof. The traditional free-ranging goat raising practiced by *Caatingueiros* preferentially happens in non-forested areas and is unrelated to forest degradation (Jamelli et al. 2021). It is inaccurate and unjust to blame traditional *Caatingueiro* livelihoods for all degradation, which is better-explained by historic economic cycles of cattle and cotton that also deepened land concentration and social inequities (Ab'Saber 1999; Araujo et al. 2023).

Promisingly, several organizations are promoting *Caatingueiro* autonomy and participation in environmental management, attempting to balance improved wellbeing and ecological sustainability. This includes government-led initiatives to enhance capabilities through sustainable forest management and dissemination of effective land management techniques. For example, the *National Semi-Arid Institute* (INSA; https://www.gov.br/insa/pt-br) publishes techniques and promotes courses in managing plant species. However, the outcomes of sustainable forest management in the Caatinga are shaped by how local actors adapt, integrate, or reject formal rules through institutional bricolage (Faggin and Behagel 2018). Widespread rejection occurs when regulations overly centered on biomass and energy supply come into conflict with local livelihood

576 needs, leading communities to maintain informal practices such as the illegal use and trade of
577 forest resources.

578 Through emphasizing local knowledge and participation, various initiatives in the Caatinga
579 demonstrate that empowerment is integral to effective, equitable, and culturally relevant
580 conservation with the potential to improve human wellbeing. A non-governmental organization, the
581 *Articulation of the Semi-Arid* (ASA; https://www.asabrasil.org.br/) network, attempts to make visible
582 *Caatingueiro* lives, histories and values through a strong and consistent media presence,
583 community workshops, and scientific conferences. Beyond sharing how *Caatingueiros* perceive
584 their environment and relate to the land and dry forest, ASA also invests in water cisterns and
585 habitat management, and serves as a central hub for disseminating information and support. Other
586 successful examples include *Recaatingamento*, an inspiring project in Bahia State from an NGO,
587 the *Regional Institute of Appropriate Small-scale Agriculture*; (IRPAA; https://irpaa.org/) which is
588 supporting people's autonomy and agency through conservation actions related to ecological
589 restoration and climate change adaptation (Bartaburu & Martins 2023).

590 Research has also documented positive feedbacks between *Caatingueiro* wellbeing and
591 conservation success, coherent with the positive feedbacks highlighted in our conceptual
592 framework. For instance, Dias et al. (2015) found that strengthening farming practices helped
593 improve creole seed quality and food production for a rural community in Rio Grande do Norte
594 state. Finally, Sena et al. (2021) developed a list of native species culturally valued for use in
595 restoration actions in the Caatinga. By prioritizing species that are culturally significant and
596 multifunctional, they argue that restoration efforts can better meet the needs of forest-dependent
597 communities, improving their well-being. The recent creation of the *Network for Restoration of the*
598 *Caatinga* (https://recaa.org/) was founded on the notion that "*Restauração é feita de gente*"
599 (restoration is made of people) highlighting human-environment relations as key to restoring this
600 biome. Finally, Dawson et al. (2023) demonstrate that local customary institutions in the Caatinga,
601 such as community rules for resource use and shared land-care practices, are vital for sustaining
602 ecosystems. However, these institutions are often undermined or ignored by formal conservation
603 governance. Their analysis shows that the exclusion of local actors from protected area
604 management erodes trust, compromises justice, and weakens local stewardship, despite the
605 crucial role that community-level institutions play in promoting equitable and effective conservation.

606 We suggest that creating capabilities requires area-based conservation actions such as
607 sustainable use protected areas created through bottom-up mobilization and then having
608 participatory management (Parry et al. 2025). These reserves are mainly associated with
609 extractivist livelihoods in the Amazon and are poorly represented in other Brazilian biomes
610 (Pacheco & Meyer 2022).
611
612 **4. CONCLUDING DISCUSSION**
613 Thinking about human wellbeing in terms of freedom and dignity could help achieve people-
614 centered conservation in Brazil, and beyond. Adopting the CA can help ensure that people-
615 centered conservation initiatives recognize forest-dwellers' rights and create realistic opportunities
616 to lead a life they have reason to value, whilst striving for sustainability. The urgent need for
617 people-centered conservation is clear – conservation challenges are enmeshed with people's lives
618 in complex ways (Mushonga 2023) – yet our systematic review reinforced that many of these
619 linkages or aspects of human wellbeing cannot be readily quantified. We found significant evidence
620 of top-down conservation actions impinging on forest-dwellers' subjective wellbeing (Strong & Silva
621 2020; Ballet et al. 2020).
622 Our conceptual framework emphasizes how the CA connects freedom, dignity, and human
623 well-being. It shows that people's freedom to live lives they value depends on access to forests
624 and other kinds of resources, enabling social and political institutions, and respect for human
625 dignity as the moral foundation. Drawing on our systematic review and conceptual framework
626 (Figure 3), we conclude that conservation actions in Brazil's understudied Caatinga dry forest can
627 help improve subjective wellbeing when they engage with local institutions, because sidelining
628 community rules and practices undermines trust, justice, and ecosystem stewardship. Interventions
629 should also: safeguard or improve equitable access to land and resources, avoiding exclusionary
630 protected areas; create capabilities (i.e. realistic, valued opportunities) including through socially-
631 inclusive sustainable resource management; and enhance the agency of marginalized
632 *Caatingueiros* and empower them through respect for autonomy, identities, and sense of place.
633 Overall, we have argued that the CA offers an insightful practical-analytical lens which can
634 help (re)focus conservation actions in order to support forest-dwellers' wellbeing. Structural
635 limitations of the CA mean that our analysis is better-suited to examining wellbeing at local scales

636 in a given time and place, and less-suited to analyzing the root causes of inequities in Brazil, which
637 would require a historical analysis of colonialism and capitalism (Souza 2017). Nonetheless, as a
638 normative theory focused on human flourishing, the CA can help bring ethical dilemmas and the
639 life goals of forest-dwellers into the planning, and scrutiny, of conservation policies and actions.
640 We found strong, multidisciplinary evidence that the capabilities of forest-dwellers can be
641 created, amplified and converted into achievements through purposeful people-centered
642 conservation interventions that promote socially just and ecologically sustainable use of forest
643 resources. Conservation actions can promote local autonomy and empowerment related with
644 forest usage, and appreciate *Caatingueiro* values and histories. We believe the CA can help
645 enable conservation science to become people-centered via a careful examination of how
646 conservation actions may affect forest-dwellers' ability to reproduce their cultural values and
647 identities; both are necessary for having a meaningful life (Lienert & Burger 2015; Pelenc & Ballet
648 2015). Conservation efforts in the Caatinga should focus on reconciling rural people's livelihoods,
649 agency and forest usage. Future work there could draw on research elsewhere exploring ways in
650 which indigenous peoples' interactions and dependencies on forests go beyond livelihoods to
651 include cultural and spiritual relationships with landscapes and other species (Sangha et al. 2024).
652 The ultimate goal is to improve ecological sustainability and human wellbeing by fostering
653 individual and community empowerment, identities, autonomy and self-realization.

654 **Supporting Information**

655 Additional supporting information may be found in the online version of the article at the publisher's
656 website.

657

References

Ab'Sáber AN. 1999. Sertões e sertanejos: uma geografia humana sofrida. *Estudos Avançados* **13**:7–59.

Addison J, Stoeckl N, Larson S, Jarvis D, Bidan Corporation Aboriginal, Bunuba Dawangarri Aboriginal Corporation RNTBC, Ewamian Aboriginal Corporation RNTBC, Gooniyandi Aboriginal Corporation RNTBC, Yanunijarra Ngurrara Aboriginal Corporation RNTBC, Esparon M. 2019. The ability of community based natural resource management to contribute to development as freedom and the role of access. *World Development* **120**:91–104.

Ahlborg H, Nightingale AJ. 2018. Theorizing power in political ecology: the "where" of power in resource governance projects. *Journal of Political Ecology* **25**. University of Arizona Libraries.

Alencar L, Baldauf C, Manhães AP, Melo FPL. 2023. Tradeoffs and synergies between food security and forest cover in Brazilian drylands. *Land Degradation & Development* **34**:5343–5354.

Alencar L de FCS. 2023. *Dinâmica da cobertura florestal e sustentabilidade na Caatinga*. PhD thesis. Universidade Federal de Pernambuco - UFPE, Recife, PE.

Alencar L de FCS, Rodrigues AA de B, Parry L, Melo FPL. 2022. *Forest security as a fourth dimension of the water-energy-food nexus: empirical evidence from the Brazilian Caatinga*. Pages 161–181 in Moreira F de A, Fontana MD, Malheiros TF, Di Giulio GM, editors. The Water-energy-food nexus: what the Brazilian research has to say. Universidade de São Paulo. Faculdade de Saúde Pública.

Alkire S. 2002. Dimensions of Human Development. *World Development* **30**:181–205.

Antongiovanni M, Venticinque EM, Matsumoto M, Fonseca CR. 2020. Chronic anthropogenic disturbance on Caatinga dry forest fragments. *Journal of Applied Ecology*, **57**:2064–2074.

Araujo HFP, Canassa NF, Machado CCC, Tabarelli M. 2023. Human disturbance is the major driver of vegetation changes in the Caatinga dry forest region. *Nature Scientific Reports* **13**:18440.

Arce, A. 2003. Value contestations in development interventions: community development and sustainable livelihoods approaches. *Community Development Journal*, **38**:199-212.

Ayoola Oni O, Adenike Adepoju T. 2014. Analysis of rural households' wellbeing in Nigeria: a capability approach. *International Journal of Social Economics* **41**:760–779.

Bakarr MI. 2023. Reimagining protected and conserved areas in Africa: Perspectives from the first Africa Protected Areas Congress. *Conservation Letters* **16**:e12944.

Balasubramanian M, Sangha KK. 2021. Integrating Capabilities and Ecosystem Services Approaches to evaluate Indigenous connections with nature in a global biodiversity hotspot of Western Ghats, India. *Global Ecology and Conservation* **27**:e01546.

Ballet J, Bazin DJA, Komena BK. 2020. Unequal capabilities and natural resource management: The case of Côte d'Ivoire. *World Development* **134**:105016.

Bartaburu, X, & Martins, R. 2023. December 11. A community-led strategy to save Brazil's dry forests from desertification. *Mongabay*. Retrieved from https://news.mongabay.com/2023/12/a-community-led-strategy-to-save-brazils-dry-forests-from-desertification/

Baumgaertner, B and Holthuijzen, W, 2017. On nonepistemic values in conservation biology. *Conservation Biology*, **31**, pp.48-55.

Bernard E, Melo FPL. 2019. Fuleco revisited: Football, conservation and lessons learned from the 2014 FIFA World Cup. *Biotropica* **51**:473–476.

Bockstael E, Berkes F. 2017. Using the capability approach to analyze contemporary environmental governance challenges in coastal Brazil. *International Journal of the Commons* **11**:799–822.

Braga DPP, Pokorny B, Porro R, Vidal E. 2023. Good life in the Amazon? A critical reflection on the standard of living of cocoa and cattle-based smallholders in Pará, Brazil. *World Development Perspectives* **31**:100520.

Büscher, B and Fletcher, R. 2020. *The Conservation Revolution: Radical Ideas for Saving Nature Beyond the Anthropocene*. Verso, New York.

Chiaravalloti, RM, Scarano, FR, Valladares-Padua, C, & Morcatty, TQ. 2025. Evolution of people-centered conservation in Brazil. *Conservation Biology*, *39*(3), e70041.

Claassen, R, 2016. An agency-based capability theory of justice. *European Journal of Philosophy*,

716 **25**(4):1279-1304.
717 Cleaver F. 2007. Understanding Agency in Collective Action. *Journal of Human Development*
718 **8**:223–244.
719 Cleaver, FD and De Koning, J, 2015. Furthering critical institutionalism. *International Journal of the*
720 *Commons*, **9**(1).
721 Coast J, Smith R, Lorgelly P. 2008. Should the capability approach be applied in Health
722 Economics? *Health Economics* **17**:667–670.
723 Collaboration for Environmental Evidence. 2022. *Guidelines and Standards for Evidence synthesis*
724 *in Environmental Management*. Version 5.1. (AS Pullin, GK Frampton, B Livoreil & G
725 Petrokofsky, Eds).
726 Cooke, B. & Kothari, U. 2001. *Participation: The new tyranny?* Zed books, London.
727 Cruz F de S, Guimarães CS. 2021. Um assentamento na Caatinga: lugar, representações e
728 identidades. *Diversitas Journal* **5**:1411–1427.
729 Cunha, da E. 2018. *Os sertões: edição crítica comemorativa*. Ubu Editora LTDA-ME.
730 Dawson N, Martin A. 2015. Assessing the contribution of ecosystem services to human wellbeing:
731 A disaggregated study in western Rwanda. *Ecological Economics* **117**:62–72.
732 Dawson N, Carvalho WD, Bezerra JS, Todeschini F, Tabarelli M, Mustin K. 2023. Protected areas
733 and the neglected contribution of Indigenous Peoples and local communities: Struggles for
734 environmental justice in the Caatinga dry forest. *People and Nature* **5**:1739–1755.
735 Deneulin, S, and L Shahani, eds. 2009. *An introduction to the human development and capability*
736 *approach: Freedom and agency*. Earthscan.
737 Dias MCC, Portela JC, Silva SYAM da, Filho TJ de O, Diniz AA. 2015. Os conflitos de terra na
738 Chapada de Apodi e a transição agroecológica no Projeto de Assentamento Santa
739 Agostinha. *Cadernos de Agroecologia* [Volumes 1 (2006) a 12 (2017)] **10**.
740 Drydyk, J. 2013. Empowerment, agency, and power. *Journal of Global Ethics*, **9**(3):249–262.
741 Faggin JM, Behagel JH. 2018. Institutional bricolage of Sustainable Forest Management
742 implementation in rural settlements in Caatinga biome, Brazil. *International Journal of the*
743 *Commons*, **12**(2):275-299.
744 Faggin JM, Behagel JH, Arts B. 2017. Sustainable Forest Management and Social-Ecological
745 Systems: An Institutional Analysis of Caatinga, Brazil. *Forests* **8**:454. Multidisciplinary
746 Digital Publishing Institute.
747 Fisher E, Brondizio E, Boyd E. 2022. Critical social science perspectives on transformations to
748 sustainability. *Current Opinion in Environmental Sustainability* **55**:101160.
749 Fleischman F, Solorzano CR. 2018. Institutional supply, public demand, and citizen capabilities to
750 participate in environmental programs in Mexico and India. *International Journal of the*
751 *Commons* **12**:162.
752 Fraser JA, Cosiaux A, Walters G, Asiyanbi A, Osei-Wusu Adjei P, Addo-Fordjour P, Fairhead J,
753 Kialo P, Laurier Engone Obiang N, Oslisly R. 2024. Defining the Anthropocene tropical
754 forest: Moving beyond ‘disturbance’ and ‘landscape domestication’ with concepts from
755 African worldviews. *The Anthropocene Review*. **0**(0).
756 Freitas CT, Lopes PFM, Campos-Silva JV, Noble MM, Dyball R, Peres CA. 2020. Co-management
757 of culturally important species: A tool to promote biodiversity conservation and human well-
758 being. *People and Nature* **2**:61–81.
759 Gangas, S. 2016. From Agency to Capabilities: Sen and Sociological Theory. *Current Sociology* **64**
760 (1): 22–40.
761 Garrett RD, Gardner TA, Morello TF, Marchand S, Barlow J, de Blas DE, Ferreira J, Lees AC,
762 Parry L. 2017. Explaining the persistence of low income and environmentally degrading
763 land uses in the Brazilian Amazon. *Ecology and Society* **22**.
764 Gebara MF, Agrawal A. 2017. Beyond Rewards and Punishments in the Brazilian Amazon:
765 Practical Implications of the REDD+ Discourse. *Forests* **8**:66.
766 Gonçalves PHS, Medeiros PMD, Albuquerque UP. 2021. Effects of domestic wood collection on
767 tree community structure in a human-dominated seasonally dry tropical forest. *Journal of*
768 *Arid Environments* **193**:104554.
769 Grames EM, Stillman AN, Tingley MW, Elphick CS. 2019. An automated approach to identifying
770 search terms for systematic reviews using keyword co-occurrence networks. *Methods in*
771 *Ecology and Evolution* **10**:1645–1654.
772 Granovetter MS, Swedberg R, editors. 2011. *The sociology of economic life*. 3rd ed. Westview
773 Press, Boulder, CO.
774 Greco G, Skordis-Worrall J, Mkandawire B, Mills A. 2015. What is a good life? Selecting

capabilities to assess women's quality of life in rural Malawi. *Social Science & Medicine* **130**:69–78.
Gutiérrez-Zamora V, Mustalahti I, García-Osorio D. 2023. Plural values of forests and the formation of collective capabilities: learnings from Mexico's community forestry. *Environmental Sociology* **9**:117–135.
Hansen M, Faran T, O'Byrne D. 2015. The Best Laid Plans: Using the Capability Approach to Assess Neoliberal Conservation in South Africa—The Case of the iSimangaliso Wetland Park. *Journal of Environment & Development* **24**:395–417.
Holden E, Linnerud K, Banister D, Schwanitz VJ, Wierling A. 2018. *The imperatives of sustainable development: needs, justice, limits*. Routledge, Taylor & Francis Group, London ; New York.
Holland B. 2008. Justice and the Environment in Nussbaum's "Capabilities Approach": Why Sustainable Ecological Capacity Is a Meta-Capability. *Political Research Quarterly* **61**:319–332.
Hoque AM, Haque M. 2013. River Erosion: Vulnerability & Its Social Consequences on the Life of Women: A Study at Chondonbaisha & Kutubpur in Sariakandi, Bogra. *Review of European Studies* **5**:p99.
Huber JM, Newig J, Loos J. 2023. Participation in protected area governance: A systematic case survey of the evidence on ecological and social outcomes. *Journal of Environmental Management* **336**:117593.
Huta V. 2017. An overview of hedonic and eudaimonic well-being concepts. Pages 14–33 *The Routledge handbook of media use and well-being: International perspectives on theory and research on positive media effects*. Routledge/Taylor & Francis Group, New York, NY, US.
IBGE (Instituto Brasileiro de Geografia e Estatística). 2020. *Pesquisa nacional de saneamento básico : 2017 : abastecimento de água e esgotamento sanitário*. IBGE, Coordenação de População e Indicadores Sociais. IBGE, Rio de Janeiro.
IBGE (Instituto Brasileiro de Geografia e Estatística). 2022a. *População residente, por sexo, idade e forma de declaração da idade*. IBGE, Rio de Janeiro.
IBGE (Instituto Brasileiro de Geografia e Estatística). 2022b. *Síntese de indicadores sociais: uma análise das condições de vida da população brasileira : 2022*. Coordenação de População e Indicadores Sociais, Rio de Janeiro.
IBGE (Instituto Brasileiro de Geografia e Estatística). 2023. *Educação 2022*. IBGE, Coordenação de Trabalho e Rendimento. IBGE, Rio de Janeiro.
Ives CD, Freeth R, Fischer J. 2020. Inside-out sustainability: The neglect of inner worlds. *Ambio* **49**:208–217.
Jagger P, Cheek JZ, Miller D, Ryan C, Shyamsundar P, Sills E. 2022. The Role of Forests and Trees in Poverty Dynamics. *Forest Policy and Economics* **140**:102750.
Jamelli D, Bernard E, Melo FPL. 2021. Habitat use and feeding behavior of domestic free-ranging goats in a seasonal tropical dry forest. *Journal of Arid Environments* **190**:104532.
Kimhur B. 2020. How to Apply the Capability Approach to Housing Policy? Concepts, Theories and Challenges. Housing, *Theory and Society* **37**:257–277. Routledge.
Klingler M, Ameli N, Rickman J, Schmidt J. 2024. Large-scale green grabbing for wind and solar photovoltaic development in Brazil. *Nature Sustainability* **7**:747–757.
Kusel J. 2001. Assessing Well-Being in Forest Dependent Communities. *Journal of Sustainable Forestry* **13**:359–384.
Leach M, Mearns R, Scoones I. 1999. Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management. *World Development* **27**:225–247.
Leal, I. R., DA Silva, J. M. C., Tabarelli, M., & Lacher, T. E. 2005. Changing the Course of Biodiversity Conservation in the Caatinga of Northeastern Brazil. *Conservation Biology*, **19**(3), 701–706.
Lienert J, Burger P. 2015. Merging capabilities and livelihoods: analyzing the use of biological resources to improve well-being. *Ecology and Society* **20**.
Lozano JF, Boni A, Peris J, Hueso A. 2012. Competencies in Higher Education: A Critical Analysis from the Capabilities Approach. *Journal of Philosophy of Education* **46**:132–147.
Macdonald T, Winklerprins AMGA. 2014. Searching for a Better Life: Peri-Urban Migration in Western Para State, Brazil. *Geographical Review* **104**:294–309.
Manhães AP, Mazzochini GG, Oliveira-Filho AT, Ganade G, Carvalho AR. 2016. Spatial associations of ecosystem services and biodiversity as a baseline for systematic conservation planning. *Diversity and Distributions* **22**:932–943.
Martin A, Coolsaet B, Corbera E, Dawson NM, Fraser JA, Lehmann I, Rodriguez I. 2016. Justice

and conservation: The need to incorporate recognition. *Biological Conservation* **197**:254–261.
Martin, A., 2017. *Just conservation: Biodiversity, wellbeing and sustainability*. Routledge.
Matengu M, Korkeamäki R-L, Cleghorn A. 2019. Conceptualizing meaningful education: The voices of indigenous parents of young children. *Learning, Culture and Social Interaction* **22**:100242.
McShane TO et al. 2011. Hard choices: Making trade-offs between biodiversity conservation and human well-being. *Biological Conservation* **144**:966–972.
Melo FPL. 2017. The Socio-Ecology of the Caatinga: Understanding How Natural Resource Use Shapes an Ecosystem. Pages 369–382 in Silva JMC da, Leal IR, Tabarelli M, editors. *Caatinga: The Largest Tropical Dry Forest Region in South America*. Springer International Publishing, Cham.
Melo FPL, Mazzochini GG, Guidotti V, Manhães AP. 2023. Using land inequality to inform restoration strategies for the Brazilian dry forest. *Landscape and Urban Planning* **239**:104844.
Miller DC et al. 2021. Forests, trees and poverty alleviation: Policy implications of current knowledge. *Forest Policy and Economics* **131**:102566.
Minteer BA, Miller TR. 2011. The New Conservation Debate: Ethical foundations, strategic trade-offs, and policy opportunities. *Biological Conservation* **144**:945–947.
Mushonga T. 2023. Constitutional Environmental Rights and State Violence: Implications for Environmental Justice in Protected Forests. *Environmental Justice* **16**:194–202.
Nerfa L, Rhemtulla JM, Zerriffi H. 2020. Forest dependence is more than forest income: Development of a new index of forest product collection and livelihood resources. *World Development* **125**:104689.
Neri M, Jameli D, Bernard E, Melo FPL. 2019. Green versus green? Adverting potential conflicts between wind power generation and biodiversity conservation in Brazil. *Perspectives in Ecology and Conservation* **17**:131–135.
Newing H, Fisher M, Brittain S, Kenrick J, Milner-Gulland EJ. 2023. How can we advance equitable, rights-based conservation? *Oryx* **57**:273–274.
Newton P, Kinzer AT, Miller DC, Oldekop JA, Agrawal A. 2020. The Number and Spatial Distribution of Forest-Proximate People Globally. *One Earth* **3**:363–370.
Newton P, Miller DC, Byenkya MAA, Agrawal A. 2016. Who are forest-dependent people? A taxonomy to aid livelihood and land use decision-making in forested regions. *Land Use Policy* **57**:388–395.
Niemeyer J, Vale MM. 2022. Obstacles and opportunities for implementing a policy-mix for ecosystem-based adaptation to climate change in Brazil's Caatinga. *Land Use Policy* **122**:106385.
Nussbaum MC. 2011. *Creating capabilities: the human development approach*. Belknap Press of Harvard University Press, Cambridge, Mass.
O'Sullivan D. 2016. Indigenous health: Capabilities and freedom. *Ethnicities* **16**:733–751.
Owen G, Goldin J. 2015. Assessing the relationship between youth capabilities and food security: a case study of a rainwater harvesting project in South Africa. *Water SA* **41**:541–548.
Pacheco A, Meyer C. 2022. Land tenure drives Brazil's deforestation rates across socio-environmental contexts. *Nature Communications* **13**:5759.
Parry L, Morello TF, Fraser JA, Guerrero N, Lotta GS, Martins RC, Newton P, Cardoso JC, Souza Santos AA, Torres M. 2025. Forest citizens and people-centered conservation in the Brazilian Amazon. *Conservation Biology*. e70031.
Pelenc J, Ballet J. 2015. Strong sustainability, critical natural capital and the capability approach. *Ecological Economics* **112**:36–44.
Perdomo J, Phélan Casanova M, Levy-Carciente S. 2021. Sustainable Wellbeing Operationalization and Measurement Based on the Capabilities Approach: The Case of Latin America. *Sustainability* **13**:12202.
Pineda-Pinto, M., Lennon, M., Kennedy, C. et al. 2025. Realizing multispecies justice through a capability approach to promote nature-based solutions. *Urban Sustainability* **5**:31.
Piva da Silva, M., Fraser, J. A., Parry, L. 2021. Capability failures and corrosive disadvantage in a violent rainforest metropolis. *Geographical Review*, **113**(1), 91–111.
Piva da Silva M, Fraser JA, Parry L. 2022. From 'prison' to 'paradise'? Seeking freedom at the rainforest frontier through urban–rural migration. *World Development* **160**:106077.
Polishchuk Y, Rauschmayer F. 2012. Beyond "benefits"? Looking at ecosystem services through

893 the capability approach. *Ecological Economics* **81**:103–111.
894 Pullin AS, Stewart GB. 2006. Guidelines for Systematic Review in Conservation and Environmental
895 Management. *Conservation Biology* **20**:1647–1656.
896 Qin Y, Xiao X, Liu F, de Sa e Silva F, Shimabukuro Y, Arai E, Fearnside PM. 2023. Forest
897 conservation in Indigenous territories and protected areas in the Brazilian Amazon. *Nature*
898 *Sustainability* **6**:295–305.
899 Ramos MB, Maciel MGR, Cunha SSD, De Souza SM, Pedrosa KM, De Souza JJLL, González EJ,
900 Meave JA, Lopes SDF. 2023. The role of chronic anthropogenic disturbances in plant
901 community assembly along a water availability gradient in Brazil's semiarid Caatinga
902 region. *Forest Ecology and Management* **538**:120980.
903 Rappaport, J. 2020. *Cowards Don't Make History: Orlando Fals Borda and the Origins of*
904 *Participatory Action Research*. Duke University Press.
905 Razafindratsima OH et al. 2021. Reviewing the evidence on the roles of forests and tree-based
906 systems in poverty dynamics. *Forest Policy and Economics* **131**:102576.
907 Ribot JC, Peluso NL. 2003. A Theory of Access. *Rural Sociology* **68**:153–181.
908 Robeyns I. 2005a. The Capability Approach: a theoretical survey. *Journal of Human Development*
909 **6**:93–117.
910 Robeyns I. 2005b. Assessing Global Poverty and Inequality: Income, Resources, and Capabilities.
911 *Metaphilosophy* **36**:30–49.
912 Robeyns I. 2017. *Wellbeing, Freedom and Social Justice: The Capability Approach Re-Examined*.
913 Open Book Publishers, Cambridge, UK.
914 Røpke I. 2005. Trends in the development of ecological economics from the late 1980s to the early
915 2000s. *Ecological Economics* **55**:262–290.
916 Sangha KK, Le Brocque A, Costanza R, Cadet-James Y. 2015. Ecosystems and indigenous well-
917 being: An integrated framework. *Global Ecology and Conservation* **4**:197–206.
918 Sangha, K.K., Madegowda, C. and Balasubramanian, M., 2024. Reshaping conservation
919 incorporating Indigenous perspectives. *Global Ecology and Conservation,* 54, p.e03197.
920 Santana OA. 2016. Resistência social na Caatinga árida: a narrativa de quem ficou no colapso
921 ambiental. *Desenvolvimento e Meio Ambiente* **38**:419–438.
922 Schmidt M, Strotmann H, Volkert J. 2022. Female and Male Community-Level Empowerment:
923 Capability Approach-Based Findings for Rural India. *The European Journal of Development*
924 *Research* **34**:754–784.
925 Sen A. 1993. *Capability and well-being*. Pages 30–53 The Quality of Life. Oxford University Press.
926 Sen A. 1999. *Development as Freedom*. Oxford University Press.
927 Sen A. 1977. Rational Fools: A Critique of the Behavioral Foundations of Economic Theory.
928 *Philosophy & Public Affairs* **6**:317–344.
929 Sena PHA, Gonçalves-Souza T, Gonçalves PHS, Ferreira PSM, Gusmão RAF, Melo FPL. 2021.
930 Biocultural restoration improves delivery of ecosystem services in social-ecological
931 landscapes. *Restoration Ecology* **30**: e13599.
932 Silva JA, Loboda T, Strong M. 2018. Examining aspiration's imprint on the landscape: Lessons
933 from Mozambique's Limpopo National Park. *Global Environmental Change* **51**:43–53.
934 Silva JIAO. 2017. Desenvolvimento e meio ambiente no semiárido: contradições do modelo de
935 conservação das Reservas Particulares do Patrimônio Natural (RPPNs) na Caatinga.
936 *Sociedade e Estado* **32**:313–344.
937 Silva JMCD, Barbosa LCF. 2017. Impact of Human Activities on the Caatinga. Pages 359–368 in
938 Silva JMCD, Leal IR, Tabarelli M, editors. *Caatinga*. Springer International Publishing,
939 Cham.
940 Silva JMCD, Barbosa LCF, Leal IR, Tabarelli M. 2017a. The Caatinga: Understanding the
941 Challenges. Pages 3–19 in Silva JMCD, Leal IR, Tabarelli M, editors. *Caatinga*. Springer
942 International Publishing, Cham.
943 Silva JMCD, Barbosa LCF, De Souza Pinto LP, Chennault CM. 2017b. Sustainable Development
944 in the Caatinga. Pages 445–458 in Silva JMCD, Leal IR, Tabarelli M, editors. *Caatinga*.
945 Springer International Publishing, Cham.
946 Smith ML, Steward C. 2009. The Relational Ontology of Amartya Sen's Capability Approach:
947 Incorporating Social and Individual Causes. *Journal of Human Development and*
948 *Capabilities* **10**:213–235.
949 Souza, J. 2017. *A elite do atraso: da escravidão à Lava Jato*. Leya.
950 Spash CL. 2012. New foundations for ecological economics. *Ecological Economics* **77**:36–47.
951 Specht MJ, Santos BA, Marshall N, Melo FPL, Leal IR, Tabarelli M, Baldauf C. 2019.

952 Socioeconomic differences among resident, users and neighbour populations of a
953 protected area in the Brazilian dry forest. *Journal of Environmental Management* **232**:607–
954 614.
955 Strong M, Silva JA. 2020. Impacts of hunting prohibitions on multidimensional well-being.
956 *Biological Conservation* **243**:108451.
957 Tabarelli M, Filgueiras BKC, Ribeiro EMS, Lopes AV, Leal IR. 2024. Tropical Dry Forests. Pages
958 294–312 in Scheiner SM, editor. *Encyclopedia of Biodiversity* (Third Edition). Academic
959 Press, Oxford.
960 Takahashi T, Asano S, Uchida Y, Takemura K, Fukushima S, Matsushita K, Okuda N. 2022.
961 Effects of forests and forest-related activities on the subjective well-being of residents in a
962 Japanese watershed: An econometric analysis through the capability approach. *Forest*
963 *Policy and Economics* **139**:102723.
964 Téllez Cabrera MR. 2022. Health resource allocation among indigenous peoples from the right to
965 health and health capability approaches: The case of P'urhépecha people. *Global Public*
966 *Health* **17**:986–1001.
967 Thives LP, Ghisi E, Thives Júnior JJ. 2022. Regional inequalities in electricity access versus
968 quality of life in Brazil. *Ambiente Construído* **22**:47–65.
969 Vaughan D. 2011. The importance of capabilities in the sustainability of information and
970 communications technology programs: the case of remote Indigenous Australian
971 communities. *Ethics and Information Technology* **13**:131–150.
972 Vallejos M, Faingerch M, Blum D, Mastrángelo M. 2022. 'Winners' and 'losers' of the agricultural
973 expansion in the Argentine Dry Chaco. *Landscape Research* **47**:723–734. Routledge.
974 Vatn A. 2005. Rationality, institutions and environmental policy. *Ecological Economics* **55**:203–217.
975 Velasco-Herrejon P, Bauwens T. 2020. Energy justice from the bottom up: A capability approach to
976 community acceptance of wind energy in Mexico. *Energy Research & Social Science*
977 **70**:101711.
978 Venkatapuram S. 2013. *Health Justice: An Argument from the Capabilities Approach*. John Wiley &
979 Sons.
980 Vicari S. 2014. The Co-Operative as Institution for Human Development: The Case Study of
981 Coppalj, a Primary Co-Operative in Brazil. *Journal of International Development* **26**:683–
982 700.
983 Vizard P, Fukuda-Parr S, Elson D. 2011. Introduction: The Capability Approach and Human Rights.
984 *Journal of Human Development and Capabilities* **12**:1–22.
985 Wang X, Day R, Murrant D, Marín AD, Botello DC, González FL, Radcliffe J. 2021. A Capabilities-
986 Led Approach to Assessing Technological Solutions for a Rural Community. *Energies*
987 **14**:1398.
988 Watene K. 2016. Valuing nature: Māori philosophy and the capability approach. *Oxford*
989 *Development Studies* **44**:287–296.
990 Woodhouse, E., Homewood, K.M., Beauchamp, E., Clements, T., McCabe, J.T., Wilkie, D. and
991 Milner-Gulland, E.J., 2015. Guiding principles for evaluating the impacts of conservation
992 interventions on human well-being. *Philosophical Transactions of the Royal Society B:*
993 *Biological Sciences*, **370**(1681).
994 Woodhouse E, Homewood KM, Beauchamp E, Clements T, McCabe JT, Wilkie D, Milner-Gulland
995 EJ. 2017. Understanding Human Well-being for Conservation: A Locally Driven, Mixed
996 Methods Approach. In *Decision-Making in Conservation and Natural Resource*
997 *Management: Models for Interdisciplinary Approaches*. Cambridge University Press.
998

Tables and Figures

Table 1. Core studies drawing on the capabilities approach (CA) to examine the wellbeing of forest-dwellers worldwide, identified through our systematic review. Primary focus is indicative and these are not definitive classifications, and many studies span multiple focal areas. Social refers not only to interpersonal and community relationships but also the political structures, cultural values, economic practices, and institutional arrangements that influence livelihoods, conservation initiatives and wellbeing.

Authors	Methods	Context	Main Contribution
Primary focus - Social (15 studies)			
Addison et al. (2019)	Workshops, document analysis	Indigenous communities. Australia	Reframes development through indigenous values
Ballet et al. (2020)	Questionnaire	Communities near protected area. Côte d'Ivoire	Historical analysis of governance using the CA
Bockstael & Berkes (2017)	Observation, interviews, workshop	Caiçara community. Brazil	Wellbeing in relation to environmental governance
Cleaver (2007)	Conceptual	Collective resource users.	Conceptually links agency, social relationships, and institutions
Cleaver & de Koning (2015)	Conceptual	Rural communities reliant on natural resources (implied).	Agency shaped by institutional complexity
Fleischman & Solorzano (2018)	Structured and semi-structured interviews	Diverse contexts and stakeholders. Mexico & India	Scrutinizes participatory governance programs
Gebara & Agrawal (2017)	Interviews, observation, focus groups	6 REDD+ project areas. Brazil.	Community heterogeneity, governance and capacity
Greco et al. (2015)	Focus groups	Rural women. Malawi.	Wellbeing and quality of life from women's perspective
Hoque & Haque (2013)	Interviews	Rural women. Bangladesh	Examines capability deprivation and lack of agency
Kusel (2001)	Conceptual	Rural forest communities. USA	Reconceptualized wellbeing using community capacity
Matengu et al. (2019)	Focus groups	San indigenous community. Namibia	Parents' evaluations of children's education, using CA
Silva et al. (2018)	Semi-structured interviews	3 communities near protected area. Mozambique	Explored aspirations and CA
Vaughan (2011)	Observations, interviews	Indigenous communities. Australia	Community-defined wellbeing and functionings

Vicari (2014)	Focus groups, interviews, questionnaires	6 agroextractivist communities. Brazil	Impact of cooperatives on agency and wellbeing
Schmidt et al. (2022)	Household surveys	4 communities in Karnataka. India	Analyzed gender dimensions of empowerment
Primary focus - Environment (6 studies)			
Balasubramanian & Sangha (2021)	Semi-structured interviews	Soliga & Kattunayaka indigenous communities. India	Framework linking CA to indigenous knowledges and ecosystem services
Dawson & Martin (2015)	Focus groups, interviews	Communities near forests and parks. Rwanda	Relates ecosystem services to capabilities
Gutiérrez-Zamora et al. (2023)	Participant observation, interviews	Community San Simón. Mexico	Deliberation and social accountability as capabilities, in forestry context
Hansen et al. (2015)	Interviews, focus groups, narrative walks	Communities near protected area. South Africa	Analyzed assets, agency, and freedoms
Strong & Silva (2020)	Interviews	Communities in/near protected areas. Mozambique and Namibia	Effects of hunting bans on agency and functionings
Takahashi et al. (2022)	Questionnaires	Rural & urban households. Japan	Linked natural capital to subjective wellbeing
Primary focus - Health (4 studies)			
Ayoola Oni & Adenike Adepoju (2014)	Core Welfare Indicators Survey	Rural households. Nigeria	Developed CA-inspired wellbeing metrics
O'Sullivan (2016)	Conceptual	Indigenous people. Australia	Health inequities and CA
Owen & Goldin (2015)	Focus groups, questionnaires	2 communities. South Africa.	Youth wellbeing and food security
Téllez Cabrera (2022)	Health & census data, interviews, observations	P'urhépecha indigenous people. Mexico	Conceptualizes inequities and indigenous health
Primary focus - Economic (3 studies)			
Leach et al. (1999)	Mainly conceptual	Forestry and watershed communities. India, South Africa, Ghana	Environmental entitlements framework
Lienert & Burger (2015)	Questionnaire, interviews	3 remote communities. Nepal	Combines CA with sustainable livelihoods
Wang et al. (2021)	Site visits, focus groups	Tlamacazapa communities, Mexico	Energy demands and capabilities
Mixed Social - Environmental Focus (3 studies)			
Piva da Silva et al. (2022)	Observation, interviews, focus groups	3 Amazonian communities, Brazil	Examines wellbeing in frontier settings
Sangha et al. (2015)	Review of 3 case studies	Indigenous peoples, Australia	CA and indigenous perspectives on wellbeing

Velasco-Herrejon & Bauwens (2020)	Interviews, questionnaires, workshops	Indigenous & rural people. Mexico	Scrutinizes wind farm impacts on agency

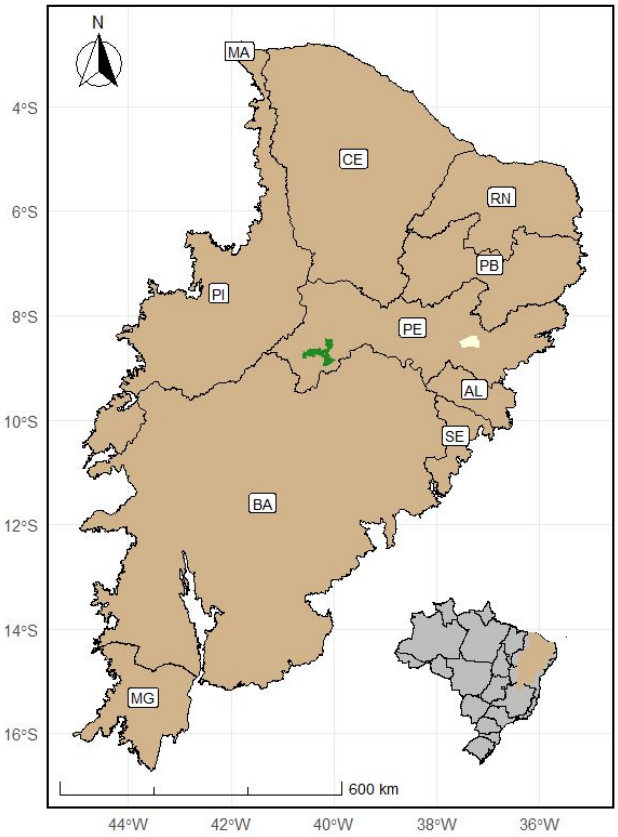

Figure 1. Map of the Brazilian Caatinga dry forest. The Caatinga biome is highlighted in brown-yellow, along with the Brazilian states it encompasses. The state acronyms refer to: Alagoas (AL); Bahia (BA); Ceará (CE); Maranhão (MA); Minas Gerais (MG); Paraíba (PB); Pernambuco (PE); Piauí (PI); Rio Grande do Norte (RN); Sergipe (SE). The protected area Refúgio de Vida Silvestre [Wildlife Refuge] Tatu-Bola is shown in green. The Parque Nacional do Vale do Catimbau, another protected area mentioned in the text, is shown in light yellow.

1054

1055 **Figure 2.** Selected images of the Brazilian Caatinga dry forest. Photos by the authors in
1056 Pernambuco State. A) An example of a rural community in the Caatinga. B) An historical road
1057 called *estrada do gado*. C) *Pega de boi no mato* cultural event involving racing after angry bulls
1058 into the forest on horseback.

1059

1060

1061

1062

1063

1064

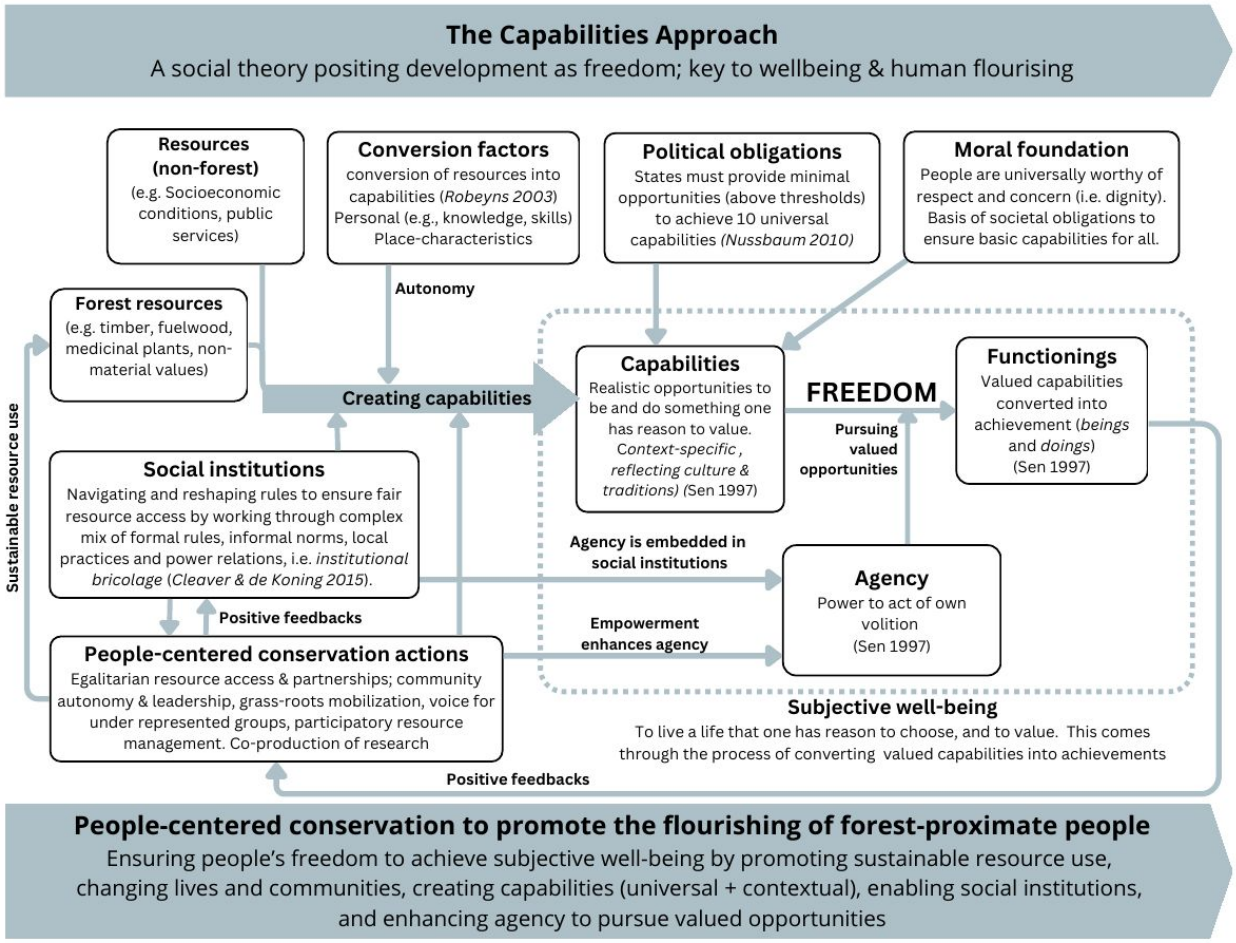

Figure 3. Conceptual framework drawing on the capabilities approach (CA) and people-centered conservation in order to promote the flourishing of forest-proximate people (FPP). Our framework demonstrates the role of forest resources and conservation actions in promoting specific and universal capabilities, and then, people's valued achievements (known in the CA as functionings). The elements within the dotted line together constitute subjective wellbeing. Social institutions are enduring patterns of social practice, organized by rules and resources, that extend across time and space and shape human behavior. The framework provides a normative vision of how the world ought to be but can also be used for critiquing injustices in the present day through identifying barriers to achieving wellbeing.

Systematic Review Checklist

Systematic Review Checklist	#	Item	Reported on page #
COVER LETTER	1	Identify the review as a systematic review, meta-analysis, or both. **yes**	p1
ABSTRACT			
	2	a. Summarize aims and scope of review. **yes** b. Describe the data set. **no - our paper is doing quite a few things (beyond the Review) hence lacking space** c. Summarize primary results. **yes** d. State conclusions. **yes** e. State limitations. **no (although we mention we only searched English-language literature)**	p1 N/A p1 p1 p1
INTRODUCTION			
Rationale	3	a. Describe aims and scope of the review in the context of what is known. **see Section 1.2, and:** b. Reference previous reviews or meta-analyses on the topic. **no previous reviews on this topic (p7)** c. State why the review is needed and how it contributes to conservation. **see Section 1.2** d. State the role of stakeholders in the process based on a broad definition of *stakeholder* (e.g., researchers, funders, other decision makers).	p6, p7 p4, p5, p6 App. S2 p1
Objectives	4	a. State primary and secondary (usually related to effect modifiers) questions addressed. **Open-frame question** b. Summarize key elements of questions (e.g., populations, interventions, outcomes). **yes (see also Appendix S2)**	p7 p7
METHODS			
Protocol and registration	5	a. Indicate whether a registered protocol exists. If so, where can it be accessed. **No** b. State type of synthesis used (narrative only, narrative and quantitative, **narrative and qualitative**, narrative, qualitative and quantitative, narrative and mixed methods). **Yes**	N/A p8, 10, 11
Information sources	6	State what sources of information were sought (e.g., published articles, gray literature). **Yes, published articles**	p7
Search	7	a. Describe type of search (e.g., comprehensive, representative sample). **Yes. comprehensive** b. Name the databases searched and provide the exact search strings, keyword combinations, Boolean operators, and time span covered. **Yes (databases on p8, search details and strings etc are fully described in App S2)** c. Describe efforts to source gray literature and other sources of evidence (e.g., calls for submission of evidence by stakeholders). **No - not part of our search strategy** d. Provide enough information so the search is repeatable (e.g., languages searched, platform for which the search string was formatted [e.g. Web of Science format]). **Yes**	p8 p8, App. S2 N/A App. S2
Study screening and inclusion	8	a. Describe how studies were screened for eligibility (e.g., use of decision trees, screening software). **Yes. + App. S2** b. Describe process for checking consistency of decisions, including levels at which consistency checking was undertaken and proportion of studies screened and checked for consistency by two or more	p8

Systematic Review Checklist

		reviewers (e.g., percentage of titles , abstracts, and full text checked). **Yes** c. Describe inclusion criteria used to assess relevance of identified studies broken down into the question key elements (e.g., populations, interventions, outcomes, study design) and other restrictions (e.g., date ranges or languages). **Yes** d. Provide list of studies excluded at full text and reasons for exclusion. **No, but this is available upon reasonable request to the authors** e. Report number of people involved in selection and how they contributed (e.g., independent parallel screening). **yes**	App. S2 p8 + App S2 N/A App S2 p1
Data collection process	9	a. Describe where data were collected from (e.g., text, figures, tables), how they were extracted (e.g., digitizing software, external data sources), and coding for studies (consider providing data sheets and list of variables extracted as meta-data and those that were coded). **No quantitative data were extracted** b. Describe method for extraction of qualitative and quantitative study findings (consider providing data sheets). **Manual extraction of qualitative information, entered into a LibreOffice spreadsheet.** c. Describe how repeatability of data extraction process was tested. **Yes** d. List and define all variables for which data were sought and assumptions and simplifications made. **Yes** e. Describe moderator variables constructed from collected data (e.g., number of generations calculated). **No** f. Report how missing or ambiguous information was dealt with (e.g., authors contacted) and justify decisions made to deal with missing data. **Yes** g. State number of extractions checked for accuracy. **Yes**	N/A p8 App S2 p6 p8 & App S2 N/A App. S2 p6 App S2 p1
Critical appraisal of studies	10	a. Describe method used to assess the validity of studies included (e.g., blinded data collection, experimental versus observational), including assessment of individual studies and evidence base as a whole. **No** b. State how validity information was incorporated in analyses (e.g., sensitivity analyses). **No** c. Describe how repeatability of critical appraisal of study validity was tested. **No**	N/A N/A N/A
Analyses	11	Effect size **No, for all of these questions** a. State whether effects sizes were derived from experimental or observational comparisons or both. b. Describe calculation of effect sizes, methods for handling complex data, statistical methods for combining data from individual studies, and exploration of heterogeneity (e.g., sensitivity analysis, subgroup analysis and meta-regression). c. Provide a reference to the equation of each calculated effect size (e.g., standardized mean difference, log response ratio) and (if applicable) its sampling variance. If no reference exists, derive equations for each effect size and state assumed sampling distributions. d. Describe models used for synthesis of effect sizes and provide justification for choice. e. Provide a list of and justification for the effect modifiers or reasons for heterogeneity considered and details of how the list was compiled. Qualitative and other syntheses a. Describe synthesis of qualitative data and justify methodological choice. Describe analyses of subsets of data. **Yes** b. Describe other approaches used to synthesize data or combine qualitative and quantitative synthesis (e.g., mixed	 N/A N/A N/A N/A N/A N/A N/A N/A p10-14

Systematic Review Checklist

		methods) and justify methodological choice. **No**	N/A
Software	13	a. Describe statistical platform used, packages and function used to run models, and report version numbers. **Yes but not this refers only to the search. We did not conduct any statistical analysis.** b. Describe arguments that differed from default settings. **Yes, in relation to word frequency cut-offs**	App. S2 App. S2
Meta-regression and model selection	14	a. Provide rationale for inclusion of covariates evaluated in meta-regression models. **No** b. Justify number of parameters estimated in models in relation to number of effect sizes and studies (e.g., interaction terms were not included due to insufficient sample sizes). **No** c. Describe other analyses of robustness of results. **No**	N/A N/A N/A

	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies, avoided bias related to reviewing and assessing author's own work) and describe steps taken to examine biases. **Bias would be a greater issue if we had asked "How useful is the capabilities approach..". Because authors who use this lens in their work are probably already enthusiastic about it. However, instead we were interested in the ways in which this lens has been applied, and were open to different theoretical interpretations (e.g. from Sen, Nussbaum, Robeyns), which reduces the potential bias from excluding particular kinds of interpretations.**	
Additional analyses	16	a. Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done. Indicate which were prespecified. **No** b. Describe methods used to identify knowledge gaps (unrepresented or underrepresented subtopics that warrant further primary research) and knowledge clusters (well-represented subtopics that are amenable to full synthesis via systematic review). **No**	N/A N/A
RESULTS			
Studies selected	17	Give numbers of studies screened, assessed for eligibility, and included in review and reasons for exclusions at each stage. **Yes**	p8
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, follow-up period) and provide citations. **Not relevant, although we describe methodological and geographic plurality (p10)**	N/A
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, outcome-level assessment. **No**	N/A
Results of individual studies	20	a. For all outcomes considered, present, for each study, simple summary data for each intervention group and effect sizes and confidence intervals. **No** b. Summarize characteristics related to individual study quality. **No, not relevant to our study aims**	N/A N/A
Synthesis of results	21	Report indicators of heterogeneity in the estimated effect (e.g. *I*2, tau2, and other variance components). **No**	N/A
Meta-regression	22	a. Provide estimates of meta-regression slopes (i.e., regression coefficients) and confidence or credible intervals. **No** b. Include estimates and confidence or credible intervals for all moderator variables assessed. **No**	N/A N/A

Systematic Review Checklist

		c. Report interactions, if included. **No** d. Describe outcomes from model selection, if done (e.g., R^2 and AIC). **No**	N/A N/A
Risk of bias across studies	23	Present results of assessment of risk of bias across studies. **No**	N/A
Additional analysis	24	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression. **No**	N/A
DISCUSSION			
Summary of evidence	25	a. Summarize main findings, including magnitude and precision of effect heterogeneity. **No** b. Consider relevance of findings to key groups (e.g., conservation practitioners, planners, and policy makers). **Yes**	N/A p15
Limitations	26	Discuss limitations at study and outcome level (e.g., risk of bias) and at review level (e.g., incomplete retrieval of identified research, reporting bias, gaps in evidence). **Many risks of potential bias do not apply to our study, given it was not a meta-analysis. We clearly explain the English-language focus in several places. Limitations of the capabilities approach are elaborated on in the Introduction and Conclusions.**	
Conclusions	27	Provide a general interpretation of the results in the context of other evidence and implications for future research. **Yes**	p21-22
REFERENCES			
	28	Provide a reference list of all studies included in the systematic review or meta-analysis. **Yes (80 studies)**	App. S3

Adapted from Moher D., Liberati A., Tetzlaff J., Altman D.G., The PRISMA Group. 2009. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Medicine 6(7): e1000097. doi:10.1371/journal.pmed1000097; PRISMA-ECOEVo Checklist https://doi.org/10.1111/brv.12721; and Haddaway N.R., Macura, B., and Pullin, A.S. 2018. ROSES Reporting standards for systematic evidence syntheses: *pro forma*, flow-diagram and descriptive summary of the plan and conduct of environmental systematic reviews and systematic maps**.** Environmental Evidence: https://doi.org/10.1186/s13750-018-0121-7.

March 2023

Response letter: Using the capabilities approach to achieve people-centered conservation

09-Mar-2026 EDITOR COMMENTS: Thank you for further revising your manuscript "Using the capabilities approach to achieve people-centered conservation" (24-676.R1) for Conservation Biology. I have received two thorough, constructive reviews and the comments and recommendation of the handling editor, Dr. Rafael Chiaravalloti and the South America Regional Editor, Prof. Christopher Anderson. The full set of comments is pasted below. The reviewers and editors appreciate the effort you have taken to revise. However, they have remaining concerns regarding the framing of the study and some of its underlying assumptions. Your attention to these will further enhance its clarity and impact. On the basis of the reviews and recommendation, I invite you to respond to the comments and submit a revised manuscript for potential publication in Conservation Biology.
Response: Thanks for your invitation to submit a revised manuscript. We are very grateful to the editorial team and all the Reviewers (since original submission onwards) for your feedback, which has helped to substantially improve our paper. In this round, one Reviewer (#3) had already looked at an earlier submission and one Reviewer (#6) was new. Reviewer 3 was strongly supportive, feeling it's now "suitable for publication". Reviewer 6 raises valid points, especially from the perspective of someone new to the paper. Whilst we have tried hard to incorporate these additional suggestions, we feel some of their comments reflect inevitable differences in how a particular area of social theory is understood/utilized by different scholars. Implementing all their suggestions would mean going 'backwards' in the sense of un-doing important changes we have already made in relation to substantial Reviewer comments from the first two rounds (Reviewers 1 and 2 in round one, Reviewers 3, 4, 5 in round two). We have tried to strike a balance between attending to Reviewer 6's points whilst still trying to retain a coherent argument that adequately incorporates the input and expertise contributed from the other five Reviewers.

REGIONAL EDITOR'S COMMENTS: The handling editor and the two reviewers appreciate this revised version and feel that it has merit, novelty and impact. However, there are still various concerns raised in the review, which the HE feels can and should be addressed. Therefore, I ask you to consider them for a final decision based on how they are addressed, overcome or refuted.
Response: Ok, thanks. Please see our reply to the Editor's comment, above.

HANDLING EDITOR'S COMMENTS: Thank you very much indeed for submitting a new version of the paper. I have received two reviewers on the paper. The second reviewer is a new reviewer, and looked at the paper for the first time. They suggested a major review in the paper. Although I understand that the paper has been under review for a while, I do agree with the points raised. I invite you to address them point by point. I believe the paper would benefit a lot should the questions raised by the reviewer were answered. Best Wishes, Rafael Chiaravalloti
Response: Thanks for your continued input and support with our manuscript. As we outlined above (response to Editor) we feel many of the points raised by Reviewer 6 reflect inevitable (and acceptable) differences in how a social theory is used or understood by different scholars. You didn't mention which of the Reviewer's #6's eleven comments you agree with, leaving open the possibility you agree with all of them. If so, we respectfully disagree with the suggestion that it would be possible or helpful if we incorporated all eleven points. We have had to strike a balance between making changes based on Reviewer 6's points with

maintaining the integrity of our argument, which has already been shaped through the expertise of the five previous Reviewers.

Reviewer 3 Comments to the Author

Comment #1: The authors have conducted a substantial revision to the manuscript. These changes have strengthened the conclusions and positioned the Caatinga as an important case study for understanding the value of CA in conservation. Though the authors did not adopt all my suggestions for improvement, their response indicates they soundly considered each suggestion and have made a logical, rational decision for not accepting the suggestion. I can respect this approach. Therefore, I believe this manuscript is suitable for publication. I look forward to seeing it in print.
Response: We are really pleased that this Reviewer recognized all of our hard work and are happy that they recommended acceptance. However, we are disappointed with the incongruence of this recommendation in relation to Review 6, below. It appears that Reviewer 6 has not been made aware of the history and development of this paper and has probably not seen or read the previous two thorough revisions of the paper and our detailed replies to earlier Reviewer comments. In our experience as authors, reviewers and editors, we believe a clear editorial position is needed here to resolve very contradictory reviews such as those between Reviewer 3 ("accept") and Reviewer 6 ("major review"). Not doing so leaves us as authors in a situation where we are potentially expected to continue major rewrites in a possibly endless cycle, depending on the somewhat stochastic nature of which Reviewer(s) are drawn upon in a particular round. We don't think this is fair, nor serves the interest of producing a high-quality piece of work.

Reviewer 6 Comments to the Author

Comment #1: I'm generally supportive of papers in the conservation literature that focus on issues of social justice and bring in social theory to conservation thinking – so the intention here is good! The paper puts forward the Capabilities Approach (CA) as an important normative and analytical tool for conservation policy. It incorporates a systematic review of CA application in "forest proximate contexts", a synthesised conceptual framework designed to guide equitable conservation practice and an application of the framework to the Brazilian Caatinga.
Response: We are glad that Reviewer 6 welcomes our theoretically-informed paper as useful for conservation research.

Comment #2: I appreciated the argument that CA provides an ethical counterweight to reductionist economic conservation framings although this needed to be backed up with citations (and was a little overstated).
Response: We are pleased that the Reviewer appreciated our argument. We respectfully disagree that the critique of economistic conservation framings was not supported by citations given we cited five papers in those two paragraphs they are referring to, plus half a dozen economic-oriented citations in the following paragraph on forest livelihoods research. Nonetheless, we take Reviewer 6's point and have now changed the text to avoid overstating this critique:

> PREVIOUS: Ironically, when conservationists were embracing the reductionist allure of environmental economics…L62-63
>
> UPDATED: While environmental economics provided valuable quantitative tools, its assumptions often overshadowed non-market moral economies (Granovetter & Swedberg 2011). The Capabilities Approach (CA) emerged as a vital ethical counterweight to economistic framings (Sen 1999; Martin 2017), shifting the focus toward human freedom and dignity. L62-65

Comment #3: However, a key problem with the paper is that it lacks a clear articulation of how the CA uniquely contributes beyond existing wellbeing, justice and human rights centred frameworks some of which already incorporate the idea of capabilities. The paper fails to engage with, for example, Adrian Martin (2017) and others work on justice in conservation (Martin et al. 2016 is mentioned as transforming debates in conservation but there is nothing further about justice), and Woodhouse et al's (2015; 2017) conceptualisation of wellbeing for conservation which draws upon Gough and McGregor's (2009) three dimensional approach, which is explicitly based in capabilities thinking. What exactly is your framework adding?
Response: Thanks. As we explain below, we only partially agree with the Reviewer's point. Firstly, we point out that our paper already made explicit comparisons with numerous other relevant conservation approaches, including ecological economics framings. Their comment gives the impression that the only valid/relevant social science ideas are those which have already been filtered through mainstream conservation literature. And then they go on to imply our paper suffers from a lack of novelty. This does not feel reasonable.

Our previous revision stated:

> …Compared to other bottom-up conservation frameworks, the CA provides a theory of agency (Gangas 2016) that can bridge the structural critiques of Marxian frameworks such as political ecology and convivial conservation (Büscher & Fletcher 2020) with liberal justice perspectives, at once emancipatory in its vision of human flourishing yet compatible with policy. The CA then moves beyond the economistic framings of the sustainable livelihoods approach (Arce 2003) and reinforces participatory research's radical Latin American roots (Rappaport 2020; Cooke & Kothari 2001), the CA offers a robust framework for transformative, community-based conservation…L86-93

We also feel that the previous manuscript's text on the emergence of the CA in the conservation/ environment literature already speaks to their desire to see discussion of "existing wellbeing, justice and **human rights** centred frameworks":

> The conceptualization of freedom inherent in the CA is relevant for people-centered conservation because it provides a foundation for pursuing egalitarian human development (*sensu* Alkire 2002) and can help link universal human rights (Vizard et al. 2011) with conservation-related agendas such as the UN Sustainable Development Goals (Perdomo et al. 2021). Human rights constitute entitlements to particular capabilities (see Hansen et al. 2015). Leach and colleagues (1999) pioneered the use of capabilities as a conceptual lens to examine people-environment relations, aiming to improve community-based natural resource management (CBNRM): a political-ecology inspired, participatory approach which emphasizes empowerment, equity and sustainable use. CA-analysis can highlight the material and social dimensions of rights, and the need for government action to uphold these rights. Conversely, the

> language of rights strengthens discussions of capabilities by clarifying that ensuring people's capabilities is urgent and non-negotiable – it cannot be ignored or sacrificed for other goals (Nussbaum 2011). L158-169

We are surprised that Reviewer 6 is so emphatic about the relevance to our paper of the additional works they mention by Martin (beyond his 2016 co-authored paper which we had already cited), and Woodhouse and colleagues. Martin mobilizes capabilities as one-third of his Just Conservation theoretical framework (see Figure 4.1 in his book) but for our purposes we feel this conceptualization is too broad and, critically, agency and empowerment become somewhat overlooked. For instance, agency is mentioned just four times in several hundred pages, and empowerment has only a single mention. The Reviewer contends that Woodhouse et al's arguments are based on *another author's explicit capabilities thinking*. This is third-hand use of social theory, and Reviewer 6's point would be more persuasive if they had drawn on the original sources, instead. We are not convinced about their strong relevance or overlap with our paper. For instance, the centrality of agency and empowerment to capabilities thinking has been widely written about (e.g. Drydyk 2013 in *Journal of Global Ethics*, and Gangas 2016 in *Current Sociology*, both already cited) yet these concepts are virtually absent in the two Woodhouse et al pieces. Woodhouse et al.'s 2015 paper doesn't seem to mention agency at all, mentions empowerment twice and omits justice entirely. In their 2017 book chapter, agency is included in their conceptual figure (5.1) yet is only mentioned once in the text. Although Woodhouse et al (2017) mention empowerment in the book chapter, it is not linked to agency in any meaningful sense.

We agree, however, that a clearer explanation of the CA's unique contribution (especially the ways in which it foregrounds agency) would strengthen our paper and we thank the Reviewer for this suggestion. We have inserted this paragraph:

> ADDED: The CA's unique contribution towards people-centered conservation lies in its role as an analytical heuristic that provides an agency-oriented theory of justice (*sensu* Drydyk 2013, Gangas 2016), in ways that existing conservation social science frameworks do not. For instance, while Martin's (2017) "just conservation" and Woodhouse et al.'s (2017) multidimensional wellbeing framework advanced conservation social thinking at the time, the CA foregrounds agency and empowerment to a much greater degree. Rather than focusing solely on the presence of rights or resources, the CA identifies the specific conversion factors that determine whether these actually translate into lived freedoms. The CA therefore provides a diagnostic depth that explains why forest-proximate people may still face capability deprivations and be unable to achieve a dignified life, even when formal rights or material resources are present. L123-132

It's important to clarify that our aim in this paper is not to develop a novel theory, nor do we claim this to be the case. We refer Reviewer 6 to our October 2025 reply to Reviewer 3:

> COMMENT: How is your approach novel? Others have conducted systematic literature reviews.
>
> RESPONSE: We agree that conducting a systematic literature review is not novel and hence we have removed 'novel' from this sentence. Nonetheless, we do feel that our overall approach is novel because: (1) our reading of the CA literature is then, (2) paired with the findings of a systematic literature review and, (3) boiled down into a modified

conceptual framework, which is then (4) applied to a case study. Normally, systematic reviews don't yield conceptual frameworks. Conversely, conceptual frameworks used to analyse case studies are generally not backed up with systematic literature reviews.

Also relevant here is our October 2025 response to a comment from Reviewer 5:

Comment #5: The authors talk about the framework is novel which to me can be a simple applicable framework, even if it's not novel and hence suggest authors to adjust/update the framework but the value will be in applying it to their case study.
Response: We note that Reviewer 3 was unhappy with our description of a "novel" systematic review in section "1.3. Aims and structure of the paper". In response to that we deleted the descriptor of 'novel'. Likewise, we understand Reviewer 5's point about the novelty (or not) of the framework given the ideas/concepts on which our framework is derived are well-established. Consequently, we have removed 'novel' in the text and also in the caption for the conceptual framework figure.

Comment #3: It would be good to more clearly outline how you see capabilities in relation to justice and rights, for instance Martin views capabilities as the ends of justice, but does put forward some normative content such as material needs and social needs in order to have the opportunities to lead a valued life. It's not clear if you are completely committed to value pluralism (like Amartya Sen) or if you want to put forward any ideas about what constitutes human needs and rights (e.g. adequate nutrition? Or like Martha Nussbaum's 10 central capabilities which feature in your framework). Woodhouse et al. use the five components from the Voices of the Poor research (Narayan et al) as minimal constituents of wellbeing and human dignity.
Response: Thanks for this comment. In the development studies literature, and beyond, capabilities is a well-established way of conceptualizing justice and rights in relation to well-being, agency and empowerment. Given space limitations and because we already point the reader towards relevant books and papers in this field (Holden et al. 2018; Perdomo et al. 2021; Vizard et al. 2011; Addison et al. 2019), we don't feel it is necessary or realistic to include any more discussion of the kind the Reviewer is requesting here. Nonetheless, we have added this sentence to improve clarity:

> While we remain committed to Sen's principle of *value pluralism*, recognizing that forest-proximate populations must define their own priorities, we utilize Nussbaum's (2011) ten universal capabilities as a cross-cultural evaluative framework to ensure that minimal constituents of wellbeing and human dignity (*sensu* Woodhouse et al. 2015) are not overlooked. L163-166

Comment #4: The introduction focuses on the ideas of agency and empowerment. The conceptual discussion in the introduction starts to get a bit confusing where structure is brought in with the idea of recognition (an aspect of justice), which therefore seems to be vital to empowerment (?).
Response: We use capabilities theory here and not recognition, which is a separate essential debate in political anthropology, political philosophy and political science. This is not what our paper is about. For clarity, we have now removed all three mentions of recognition in the paper (and 'recognize' in the Abstract), and reworded the relevant sentences.

Comment #5: The second section aims to provide insights from a synthesis of the literature. First, I wasn't sure why the review focused specifically on forest proximate people and if your framework would be any different if you included say pastoralists and fishers?
Response: Thanks for pointing this out. We have added this sentence to the Methods:

> Although the core principles of the CA are universal, we focus specifically on FPP in order to examine how subjective wellbeing may be shaped by issues that characterize many forested landscapes (e.g. sociopolitical struggles for forest tenure, precarious access to non-timber resources and markets, agricultural frontier advance and deforestation, remoteness from political and economic centers, area-based conservation interventions). L224-229

We drafted a sentence for the Discussion explaining how future research could adapt this framework to other social-ecological systems but decided not to insert it given we are already at the word limit. Nonetheless, we feel the framework we present could be adapted to pastoralist or small-scale fishery contexts (and others) by identifying context-specific conversion factors, like the *mobile agency* required for grazing rights or the *fluid commons* of aquatic resources, that can determine whether conservation actions in those spaces promote genuine human flourishing.

Comment #6: Second, the way in which the papers are reviewed is not very synthetic and rather lists publications and their key messages under loose categories. Sometimes its not clear how the description of the category fits the description of the papers reviewed. For example "Theme 1: equitable access to forest resources and quality public services" does not refer to public services in the text (underlined here for emphasis).
Response: We were confused by this example because public services *are* referred to in this text: "A quantitative study in rural Nigeria also showed that geographical characteristics such as physical proximity to urban centers can influence forest-dwellers' opportunities to utilize public services such as education and healthcare (Ayoola Oni & Adenike Adepoju 2014)." L367-370

Comment #7. It would be better here to synthesise what you learnt about what 'equitable' means in this context and if access to forest (as theorised as by Ribot and Peluso) constitutes a key capability? It's not clear how Theme 2 differs from Theme 1. The link to recognition and procedural justice comes in here strongly without comment.
Response: To reiterate, our paper is about the capabilities approach and not about environmental justice, of which procedural justice is one of its tripartite elements. Hence it is hardly surprising that we don't mention recognition or procedural justice in that bit of text. We also feel that in this comment and in Comment #6 the Reviewer is conflating themes (which by definition are deliberately broad and "loose" - as they put it) and categories. We use themes in the main text and not categories (such as the Social, Health, Environment labels we refer to in Table 1) because of course the papers cross-cut different rigid categories.

However, based on this comment we have carefully gone through the theme titles and made some changes in order to ensure coherence between the theme titles and the text in each of these sub-sections:

Changed the title of Theme 2 (new text underlined):
3.1.2. Theme 2: Creating capabilities in and around forests through institutions

Changed the first sentence in the Theme 2 sub-section:

> PREVIOUS: The studies we identified show how forest-proximate populations need access to forests to realize capabilities and maintain social institutions such as community rules and customary ways of organizing daily life.
>
> REVISED: The literature synthesized here demonstrates that for forest-proximate populations, the realization of capabilities is contingent upon the strength of local social institutions, including customary rules and collective organizational practices, which serve as essential conversion factors for maintaining lives they have reason to value. L389-392

Based on these revised titles and topical sentences, we have also updated two of the three main findings from the Review, which we present in the Conceptual Framework section (please note the third finding was updated based on our response to Comment #8, below):

> The framework incorporates the main findings from our systematic review;..
> PREVIOUS: (ii) to create capabilities for those living in and around forests we must learn from past failures and successes; (iii) conservation initiatives can, done right, empower forest-dwellers and enhance agency (i.e. someone's power to act of their own volition).
>
> **REVISED:** (ii) creating capabilities for those living in and around forests requires strong, local, social institutions; (iii) forest-dwellers' agency (i.e. someone's power to act of their own volition) to pursue valued capabilities is often deeply embedded in collective structures. L465-468

We have also revised two sentences in the Abstract, which directly repeat these key findings.

Please note that a previous version of our paper drew on Ribot and Peluso more explicitly in terms of how our conceptual framework emphasized equitable resource access. However, in response to Reviewer comments (e.g. Reviewer 3 felt that using access theory had 'muddied the water' and detracted from the CA) we removed this from the Conceptual Framework text and diagram. And, in response to other Reviewer comments, we developed a stronger and clearer emphasis on social institutions, which also helps analyze resource access. For example, the social institutions box in our diagram refers to "Navigating and reshaping rules to ensure fair resource access by working through complex mix of formal rules, informal norms, local practices and power relations, i.e. institutional bricolage (Cleaver & de Koning 2015)". Hence we don't feel any more emphasis on Ribot and Peluso is necessary.

Comment #8. Theme 3 brings up the interesting question of how conservation can promote both individual and collective capabilities, but there is not a clear point made here and the points about structure vs agency seem to get lost in the rest of the paper. Perhaps this is where procedural justice in decision-making is important?
Response: On reflection, we agree with the Reviewer about the lack of clarity, especially in relation to the coherence between the Theme title and the proceeding text. We feel the main

novel finding here is about collective capabilities and have made two key changes in order to emphasize this:

(1) Changed the theme title:

PREVIOUS: Theme 3: Empowerment to bridge agency and wellbeing

REVISED: Theme 3: Bottom-up agency and collective forest capabilities

(2) Rewritten the first, topical sentence in this section to emphasize the main point being made, more clearly:

PREVIOUS: Agency is an important conceptual element of the CA, representing an individual's freedom of choice to pursue valued capabilities, and we found clear evidence that empowering forest-dwellers and enhancing their agency can help achieve people-centered conservation.

REVISED: Within the CA framework, agency is the freedom to pursue valued capabilities, yet for forest-proximate people this agency is deeply embedded in collective structures. Hence, people-centered conservation requires moving beyond top-down restrictions to support the social and institutional frameworks that enable bottom-up agency. L414-417

The Reviewer also says here "*Perhaps this is where procedural justice in decision-making is important?*". Again (see our response to Comment #7, above) our paper is not about environmental justice and hence we disagree that we could or should refer to procedural justice in this bit of text.

Comment #9: The framework (Figure 3) links together key aspects of the capabilities approach. It feels a bit like everything has been thrown in here. States are tasked with ensuring Nussbaum's universal capabilities, whereas its not quite clear what the value of conversion factors are from a conservation perspective. The role of conservation in all of this is included and outlined in lines 476-489. These are all very important considerations but they broadly reflect good governance principles and dimensions of equity/justice in conservation so again the importance of your conceptualisation of capabilities and the literature review is unclear. The point about coproduction of knowledge does not appear in the review at all I don't think.

Response: Yes, we agree that our diagram links together key aspects of the capabilities approach, and yes it is broad. This is deliberate and reflects our conceptually broad, pluralistic framing of the CA. To be frank we feel the Reviewer is being a bit unreasonable by on the one hand encouraging us to use even broader well-being and justice frameworks (e.g. Martin, Woodhouse) yet on the other hand criticizing our framework (which we feel is more coherent) for having "*everything … thrown in*".

The Reviewer is also inferring (regarding their mention of value to conservation) that our framework is intended to achieve particular biocentric conservation outcomes, perhaps reflecting a misreading of our paper. Our conceptual framework (Figure 3) is fairly explicit in showing that our normative goals revolve around promoting the freedom of forest-proximate people to achieve subjective well-being. Hence we position conversion factors in relation to the creation of capabilities (to promote freedoms) not in relation to conventional (often measurable) conservation outcomes. Furthermore, our conceptual framework has already been modified (and improved) significantly in relation to comments from five other Reviewers, including approval from Reviewer 3.

We agree that the guiding principles we outlined were insufficiently linked back to capabilities. We have added new text to that paragraph:

> NEW: To operationalize our framework, conservation actions should empower marginalized forest-proximate peoples and their social institutions to enhance agency and, ultimately, translate resources into lived freedoms. L489-491

We feel our mention of co-production is justified given that our literature review already asserted that creating capabilities "requires inclusive community engagement and recognition of indigenous voices and knowledge" in the October 2025 version.
This has been revised to "…requires inclusion of indigenous and traditional communities' voices and knowledge." in response to their Comment #4, above.

Comment #10: The section on Caatinga could provide an opportunity to bring home the value of the framework to a specific case in a holistic way but it needs to be applied systematically with the links between your points made more clearly perhaps with a table. Perhaps you could trace a pathway through your framework with an example?
Response: We appreciate that Reviewer 6 was not involved in the earlier rounds (and sympathize with them arriving to this late on!) but we would like to point out that we have already re-written this section twice in relation to very helpful reviewer feedback. This includes detailed input (and changes/responses from us) from Reviewer 3, who is now satisfied with this section of text and feels it positions the, "*...Caatinga as an important case study for understanding the value of CA in conservation*". We thank Reviewer 6 for their suggestion to trace through a specific example, perhaps using a Table. Actually, our earlier manuscript did include a Caatinga-specific Table with examples but we removed it in response to Revision feedback. We're therefore reluctant to re-insert such a Table, including because it would require many additional words in the main text in order to adequately explain the example(s) in relation to the capabilities approach and the case study context. We hope and anticipate that future empirical research in the Caatinga can apply our conceptual framework in greater detail.

Comment #11: Overall I think the paper needs to be a much stronger novel argument for the specific value of the CA, a clearer synthetic argument made from the literature, and a tighter integration between the case study and the framework to demonstrate its analytical value. I think a way forward could be to take a more critical approach to the literature review, to identify how CA has been employed, gaps and assumptions etc (and how it links to rights and justice), and then draw out more specific tensions, learning points and normative principles – to apply to future research and conservation approaches with forest communities.
Response: Our reading here is that this is not raising a new point but instead summarizing the points they have made, above. We believe we have carefully addressed each of their specific points and made quite a few changes to the text as a result. Nonetheless, it does feel a bit like the Reviewer's final sentence here is suggesting that we rewrite the paper. This is not something we are willing to do, nor do we consider this would produce a 'better' piece of research because any further substantial changes would almost certainly cause the paper to move against some of the directions that previous Reviewers have encouraged us to

move in. Nonetheless, we are grateful to Reviewer 6 for their careful reading of our manuscript for their suggestions for improvements.

Additional sources mentioned by Reviewer 6 which we have cited in the revised paper:

Martin, A., 2017. Just conservation: Biodiversity, wellbeing and sustainability. Routledge.

Woodhouse, E., Homewood, K.M., Beauchamp, E., Clements, T., McCabe, J.T., Wilkie, D. and Milner-Gulland, E.J., 2015. Guiding principles for evaluating the impacts of conservation interventions on human well-being. Philosophical Transactions of the Royal Society B: Biological Sciences, 370(1681).

Woodhouse E, Homewood KM, Beauchamp E, Clements T, McCabe JT, Wilkie D, Milner-Gulland EJ. 2017. Understanding Human Well-being for Conservation: A Locally Driven, Mixed Methods Approach. In Decision-Making in Conservation and Natural Resource Management: Models for Interdisciplinary Approaches. Cambridge University Press.