Balancing the plural voices at play

Approaches of researchers to advancing an inclusive understanding of people-nature relationships

Milena Groß

LEUPHANA
UNIVERSITÄT LÜNEBURG

LEUPHANA
UNIVERSITÄT LÜNEBURG

Balancing the plural voices at play – approaches of researchers to advancing an inclusive understanding of people-nature relationships

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Milena Groß
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Committee
Doctoral advisor and first reviewer: Prof Dr Berta Martín-López, Leuphana University, Lüneburg, Germany

Second reviewer: Prof Dr Tuyeni Heita Mwampamba, The Nature Conservancy, Arusha, Tanzania, National Autonomous University of Mexico, Morelia, Mexico

Third reviewer: Prof Dr Mario Torralba Viorreta, Vrije Universiteit Amsterdam, Netherlands

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The song entitled 'Uhai ni mazingera asili' (hereafter merely NCP song; English translation in Appendix 1) presented on the next page (III) is based on 'Jambo Bwana', which the Kenyan band Them Mushrooms first released in 1982. Its lyrics were adapted to reflect the experience of hiking Mount Kilimanjaro. Tour crews often sing this song with their clients to motivate them on their journey to Uhuru Peak, the mountain's highest point at 5895 meters above sea level. The NCP song was created in early 2023 during a knowledge exchange tour at Mount Kilimanjaro facilitated by the research team the author belongs to (Appendix 3). Whitey (Julius John White) and Malaika (Steven David Lema) spontaneously crafted the song, contributing significantly to the success of the research presented in this thesis. Both artists feel that this version of the song expresses an appreciation for Mount Kilimanjaro's nature, its importance to people, and the genuine connections between locals and visitors. Multiple recordings of the NCP song feature their vocal contributions and are included to illustrate the essence of the five thesis chapters (see Box 4 A creative means of dissemination: Acoustic illustrations capture the essence of this thesis and Table 6 for the QR codes).

[1] This publication differs from the version submitted as Ph.D. thesis; the manuscript was marked as 'in revision with minor revisions'.

UHAI NI MAZINGERA ASILI

Jambo, jambo bwana
Habari gani, nzuri sana
Wageni, mwakaribishwa
Tanzania, hakuna matata

Tembea pole pole, hakuna matata
Tutunze mazingira, hakuna matata
Dawa nazo tupate, hakuna matata
Kujifunza ni muhimu, hakuna matata
Kufurahia mandhari, hakuna matata

Jambo, jambo bwana
Habari gani, nzuri sana
Wageni, mwakaribishwa
Kilimanjaro, hakuna matata

Miti iko bomba, hakuna matata
Majani yako sawa, hakuna matata
Mazingira mazuri, hakuna matata
Wageni ni wazuri, hakuna matata
Wenyeji wako poa, hakuna matata

Jambo, jambo bwana
Habari gani, nzuri sana
Wageni, mwakaribishwa
Kwa mama Tembo, hakuna matata

Mazingira bomba, hakuna matata
Na watu poa, hakuna matata
Chakula ni upendo, hakuna matata
Na maji ni uhai, hakuna matata
Chakula ni upendo, hakuna matata

Jambo, jambo bwana
Habari gani, nzuri sana
Wageni, mwakaribishwa
Maisha halisi, hakuna matata

Whitey (Julius John White) and Malaika (Steven David Lema)

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Author's address:
Leuphana University Lüneburg
School of Sustainability
Universitätsallee 1
21335 Lüneburg
Germany
milena.gross@posteo.de

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Acknowledgments

“What is more important,” asked the Big Panda, “the journey or the destination?”
“The company,” said Tiny Dragon.

James Norbury

As I near the completion of my Ph.D. journey, I am deeply grateful to the incredible people who have accompanied me along the way, each contributing uniquely to this thesis. The nature and scope of these contributions varied, but every companion whether close by or far away was invaluable to me, and I wish to express my sincere appreciation to all of them. From the bottom of my heart, I thank everyone who has been part of this journey, and especially my Tanzanian companions: Nashukuru sana! I would now like to share some personal thanks to a few special companions.

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I acknowledge my non-academic training in the studies of the Pantarei Approach (2018-2019) and Tension Releasing Exercises (TRE®) (2018-2020). These experiences profoundly shaped me, also how I have conducted and reflected on (my) research. I deliberately chose the term 'approaches of researchers' in the title of this Ph.D. thesis, drawing inspiration from the Pantarei 'Approach.' By opting for the term 'approach' instead of 'method,' the co-founders Claudia and Vered highlight the diversity of people and honor their unique ways of navigating life – an ethos that Pantarei practitioners must adhere to in alignment with their code of ethics. This perspective, hence, rejects the notion of a fixed or universally applicable toolbox for addressing and solving client problems. Similarly, my perspective on research underscores that researchers are not a homogenous group, treating them as such risks stereotyping; their individuality inevitably navigates how they investigate and interpret people-nature relationships. Rather than defaulting to widely applied approaches, acknowledging the diversity among researchers and their particular ways of conducting research, while remaining sensitive to the uniqueness of the places and people being part of their research, can help bring plural voices to the forefront in a balanced way.

I want to thank my family and friends, companions near and far, as well as yoga, dance, and group fit 'facilitators', who have supported me with heart-felt warmth, grounding, groove, and passion throughout this Ph.D. and life in general. Last but not least, I am grateful for the many moments I could spend in and with nature in Germany, Tanzania, and elsewhere, whether walking, running, biking, or simply lying in the hammock. Nature has always been a source of energy, peace, and connection for me. Thank you for being a constant companion throughout this journey.

Abstract

Amidst the intertwined challenges of biodiversity loss and declining human well-being, people's perspectives on nature vary widely based on how they relate to it. Therefore, it is important that conservation policies recognize how nature contributes to human well-being and the diverse values people ascribe to it. Yet, policies often focus narrowly on economic values, neglecting the diversity of people-nature relationships and the varied groups of people who experience them.

In contrast, a growing body of scientific research has demonstrated the importance of accounting for diverse perspectives to address the above mentioned intertwined challenges. To support this, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) introduced two frameworks: Nature's Contributions to People (NCP), reflecting what nature supports to well-being, and the plural valuation framework, which captures the varied reasons nature matters, i.e., their values.

Yet, scientific evidence itself remains biased toward monetary valuation, thereby overlooking critical non-monetary perspectives. The disregard for non-monetary perspectives becomes evident when socio-cultural methods, which can uncover these, are applied. The methods employed for data collection and analysis, i.e., *how* the diversity of people-nature relationships is studied, condition our understanding of people-nature relationships and shape the resulting evidence. Two additional methodological choices also affect scientific outcomes, namely the phenomenon and framework chosen (*what* dimension of people-nature relationships to study and through which framework) and the selection of research participants (*who* participates).

This thesis seeks to advance an inclusive understanding of people-nature relationships by examining how methodological choices shape this understanding, with the ultimate goal of informing inclusive conservation policies and practices. It is based on a study of four relevant social actor groups in Mount Kilimanjaro's social-ecological system in Tanzania, conducted as part of the Kilimanjaro Social-Ecological System (Kili-SES) Research Unit.

The thesis consists of five chapters, with Chapter I framing Chapters II–V. Chapter II synthesizes how research has approached capturing tourists' values ascribed to nature in protected areas so far. Chapters III-V use socio-cultural approaches to yield empirical evidence on NCP and value perspectives of diverse actors in Kilimanjaro.

Chapter II highlights the role of valuation frameworks and methods in shaping scientific outcomes. The frequent application of monetary methods can explain the persistent bias toward monetary values. Further, the results also show that most studies focused on tourists solely, thereby not accounting for potentially differing value perspectives of other (local) social actors.

To confront these imbalances, Chapters III–V apply socio-cultural and diverse-actor approaches. Additionally, this requires closely examining the three methodological choices mentioned above. Chapters III–V are based on data on context-specific NCP expression (Chapter III), preferences for these context-specific NCP (Chapters IV and V), and expression of diverse values tailored to the Kilimanjaro context (Chapter V). This was achieved through the analysis of 130 semi-structured interviews and 623 surveys conducted with farmers, nature conservationists, tour guides, and tourists.

On a methodological level, this thesis demonstrates how researchers can deliberately make decisions throughout the research process to advance a more inclusive understanding of people-nature relationships. It (1) offers an approach that uses different question-framings within a single

method to capture diverse perspectives. Even without changing the method, these question-framings can broaden interviewees' access to their diverse perspectives and thereby, this approach reduces the risk of knowledge omission (Chapter III); (2) reflects on two analysis approaches to avoid the risk of stereotyping social actors, ensuring inclusivity throughout the research process (Chapters IV and V); and (3) shows that combining the two IPBES frameworks can better account for the multidimensionality of people-nature relationships (Chapter V). Thereby, this thesis demonstrates the influential role of researchers' decisions in shaping scientific outcomes. This is an important empirical contribution of the thesis, given the dearth of studies on people-nature relationships that incorporate a critical methodological assessment and reflection.

This thesis has important implications for conservation policy and practice (Chapter V). To account for distinct preferences for context-specific NCP and nurture value pluralism, conservation strategies must not only focus on bending the curve of biodiversity loss but need also to be diversified to simultaneously foster the well-being of all people.

Zusammenfassung

Angesichts der miteinander verknüpften Herausforderungen des Biodiversitätsverlusts und des Rückgangs menschlichen Wohlbefindens variieren die Perspektiven der Menschen auf die Natur, je nachdem, wie sie mit ihr in Beziehung stehen. Daher ist es wichtig, dass die Naturschutzpolitik anerkennt, wie die Natur zum menschlichen Wohlbefinden beiträgt und welche unterschiedlichen Werte Menschen ihr beimessen. Dennoch konzentriert sich die Politik oft auf wirtschaftliche Werte und vernachlässigt dabei die Vielfalt der Mensch-Natur-Beziehungen und die verschiedenen Gruppen von Menschen, die diese Beziehungen unterschiedlich erleben.

Immer mehr wissenschaftliche Studien zeigen jedoch, wie wichtig es ist, verschiedene Perspektiven einzubeziehen, um die eingangs erwähnten miteinander verknüpften Herausforderungen anzugehen. Zu diesem Zweck hat der Weltbiodiversitätsrat IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) zwei komplementäre Frameworks geschaffen, die zum einen die Beiträge der Natur zum menschlichen Wohlergehen (Beiträge; im Original: Nature's Contributions to People (NCP)) und zum anderen die vielfältigen Gründe, warum die Natur für den Menschen wichtig ist, widerspiegeln (Werte).

Dennoch weisen auch wissenschaftliche Studien nach wie vor ein Bias auf, indem sie eine monetäre Bewertung der Natur bevorzugen und wichtige nicht-monetäre Perspektiven vernachlässigen. Das Übersehen von nicht-monetären Perspektiven wird deutlich, wenn soziokulturelle Methoden angewandt werden, die diese sichtbar machen können. Die Methoden der Datenerhebung und -analyse, d.h. die Art und Weise, *wie* die Vielfalt der Mensch-Natur-Beziehungen untersucht wird, beeinflussen unser Verständnis von diesen Beziehungen und prägen die daraus resultierenden Forschungserkenntnisse. Zwei weitere methodische Entscheidungen beeinflussen diese ebenfalls: das untersuchte Phänomen und das Framework (*was*, genauer: welcher Aspekt der Mensch-Natur-Beziehungen wird untersucht und mit welchem Rahmen) sowie die Auswahl der an der Forschung Beteiligten (*wer* nimmt teil).

Die vorliegende Dissertation zielt darauf ab, ein inklusiveres Verständnis der Mensch-Natur-Beziehungen zu entwickeln, indem untersucht wird, wie methodologische Entscheidungen dieses Verständnis prägen. Damit soll ein Beitrag zu einer inklusiven Naturschutzpolitik und -praxis geleistet werden. Die Dissertation basiert auf einer Untersuchung von vier relevanten gesellschaftlichen Akteursgruppen im sozial-ökologischen System des Kilimanjaro in Tansania, die im Rahmen des Kilimanjaro Social-Ecological System (Kili-SES) Research Units durchgeführt wurde.

Die Dissertation besteht aus fünf Kapiteln, wobei Kapitel I den Rahmen für die Kapitel II-V bildet. Kapitel II fasst zusammen, wie die bisherige Forschung die Werte von Tourist*innen in Bezug auf die Natur in Schutzgebieten untersucht hat. Die Kapitel III-V wenden soziokulturelle Ansätze an, um empirische Erkenntnisse über die Perspektiven unterschiedlicher Akteur*innen am Kilimanjaro hinsichtlich der Beiträge und Werte von Natur zu gewinnen.

Kapitel II zeigt, wie die Wahl des Frameworks und der Methode wissenschaftliche Ergebnisse beeinflusst. Die häufige Anwendung monetärer Methoden kann die Überrepräsentation monetärer Werte erklären. Darüber hinaus zeigen die Ergebnisse, dass sich die meisten Studien ausschließlich auf Tourist*innen konzentrieren und damit möglicherweise abweichende Wertperspektiven anderer (lokaler) Akteur*innen außer Acht lassen.

Um diese Einseitigkeiten zu adressieren, werden in den Kapiteln III-V soziokulturelle Ansätze unter Berücksichtig diverser Akteursgruppen angewandt. Dies erfordert zudem eine genaue Untersuchung der oben genannten drei methodischen Entscheidungen. Die Kapitel III-V basieren auf Daten, welche die kontextspezifischen Beiträge der Natur (Kapitel III), die Präferenzen für diese kontextspezifischen Beiträge (Kapitel IV und V) und die Existenz vielfältiger kontextspezifischer Werte am Kilimanjaro (Kapitel V) umfassen. Diese Daten wurden durch 130 semistrukturierte Interviews und 623 Umfragen mit Landwirt*innen, Naturschützer*innen, Reiseleiter*innen und Tourist*innen erhoben.

Auf methodologischer Ebene zeigt diese Dissertation, wie Forschende während des gesamten Forschungsprozesses bewusst Entscheidungen treffen können, um ein inklusiveres Verständnis der Mensch-Natur-Beziehungen zu entwickeln. Insbesondere (1) schlägt sie einen Ansatz vor, der durch vielfältige Fragestellungen innerhalb einer Methode unterschiedliche Perspektiven erfasst. Ohne einen Wechsel der Methode wird durch vielfältige Fragestellungen ein breiterer Zugang für die interviewte Person zu ihren unterschiedlichen Perspektiven angestrebt und somit, das Risiko von Wissenslücken reduziert; (2) reflektiert sie über zwei analytische Ansätze, um Stereotypisierungen von Akteursgruppen zu vermeiden und so Inklusion über den gesamten Forschungsprozess hinweg zu gewährleisten (Kapitel IV und V); und (3) zeigt sie, dass durch die Kombination der beiden IPBES-Frameworks die Multidimensionalität der Mensch-Natur-Beziehungen besser erfasst werden kann (Kapitel V). Damit zeigt die Dissertation, welchen Einfluss die Entscheidungen der Forschenden auf wissenschaftliche Ergebnisse haben. Dies ist ein wichtiger empirischer Beitrag der Dissertation, da sich bisher nur wenige Studien im Forschungsbereich Mensch-Natur-Beziehungen einer kritischen Untersuchung und Reflektion methodischer Fragen gewidmet haben.

Die Dissertation hat wichtige Implikationen für Naturschutzpolitik und -praxis. Um unterschiedlichen Präferenzen für kontextspezifische Beiträge der Natur Rechnung zu tragen und Wertepluralismus zu fördern, müssen Naturschutzstrategien nicht nur darauf abzielen, den Verlust an Biodiversität zu verhindern, sondern gleichzeitig auch das menschliche Wohlergehen aller Menschen fördern.

Muhtasari

Kutokana na changamoto zilizofungamana za kutoweka kwa viumbe anuai na kushuka kwa ustawi wa watu, mitazamo ya watu kuhusu mazingira asili hutofautiana sana kulingana na jinsi wanavyohusiana nayo. Kwa hivyo, ni muhimu kwamba sera za uhifadhi zitambue jinsi mazingira asili yanavyochangia ustawi wa watu na thamani mbalimbali ambazo watu wanazihusisha na mazingira asili. Hata hivyo, mara nyingi sera zimezingatia thamani zenye mlengo wa kiuchumi pekee, na kupuuzia mbali tofauti mbalimbali za mahusiano baina ya watu na mazingira asili pamoja na makundi tofauti ya watu wanaonufaishwa na mazingira asili.

Kwa upande mwingine, tafiti nyingi za kisayansi zimedhihirisha umuhimu wa kuthamini mitazamo tofauti ili kukabiliana na changamoto zilizofungamana kama zilizotajwa hapo juu. Katika kusaidia hili, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) ilianzisha mifumo miwili: *Michango ya Mazingira Asili kwa Watu* (*MMAW*), unayoakisi namna mazingira asili yanachangia katika ustawi, na mfumo wa tathmini anuai, ambao unaojumuisha sababu tofauti za umuhimu wa mazingira asili - yaani thamani yake.

Hata hivyo, ushahidi wa kisayansi wenyewe bado umeegemea zaidi kwenye uthaminishaji wa kifedha, hali isiyotilia maanani mitazamo muhimu isiyo ya kifedha. Kupuuzia mitazamo isiyo ya kifedha kunadhihirika wazi pale mbinu za kijamii na kitamaduni zinapotumika zinaweza kufichua mitazamo hii isiyo ya kifedha. Kwa hiyo, mbinu za utafiti zinazotumiwa kukusanya na kuchanganua data, yaani namna tofauti za mahusiano ya watu na mazingira asili unavyochunguzwa, huathiri uelewa wetu kuhusu mahusiano hayo na kuathiri matokeo yenye ushahidi. Chaguzi mbili za mbinu za utafiti za ziada huathiri pia matokeo ya kisayansi, yaani, jambo linalochunguzwa na mfumo ulichaguliwa (mwelekeo upi wa mahusiano ya watu na mazingira asili unaochunguzwa pamoja na kwa kutumia mfumo upi) na uchaguzi wa washiriki katika utafiti (nani anahusika).

Tasnifu hii inalenga kuongeza uelewa jumuishi wa mahusiano ya watu na mazingira asili kwa kuchunguza jinsi uchaguzi wa kimbinu unavyoathiri uelewa huu, kwa lengo muhimu la kuarifu sera za uhifadhi jumuishi na utekelezaji. Tasnifu inatokana na utafiti wa makundi manne muhimu ya wahusika wa kijamii katika mfumo wa kijamii na kiikolojia wa Mlima Kilimanjaro nchini Tanzania, ukiwa ni sehemu ya Kitengo cha Utafiti cha Mfumo wa Kijamii na KiiIkolojia wa Kilimanjaro (*Kili-SES*).

Tasnifu hii ina sura tano, ambapo Sura ya I inaweka msingi wa Sura ya II–V. Sura ya II inaunganisha namna ambayo utafiti huu unaangalia jinsi watalii wanathaminisha mazingira asili katika maendeo yaliohifadhiwa. Sura ya III–V zimetumia mbinu za kijamii na kitamaduni kutoa ushahidi jarabati kuhusu MMAW na mitazamo ya thamani kutoka kwa wahusika tofauti ndani ya Kilimanjaro.

Sura ya II inasisitiza dhima ya mifumo na mbinu za tathmini katika kuathiri matokeo ya kisayansi. Ama kwa uhakika, matumizi ya mara kwa mara ya mbinu za kifedha yanaweza kuelezea uegemeo wa thamani ya kifedha. Aidha, matokeo pia yanaonyesha kuwa tafiti nyingi zililenga watalii pekee, hivyo kuwa na uwezekano wa kutothamini mitazamo ya wahusika wengine (wa mahala husika) wa kijamii.

Ili kukabiliana na upendeleo huu, Sura ya III – V zinatumia mbinu za kijamii na kiutamaduni na mbinu za wahusika mbalimbali. Zaidi ya hayo, jambo hili linahitaji kuchunguza kwa kina chaguo tatu za mbinu za utafiti zilizotajwa hapo juu. Sura ya III–V zinategemea data kuhusu kudhihirishwa

kwa MMAW kwa muktadha maalumu (Sura ya III), upendeleo wa MMAW kwa muktadha maalumu (Sura ya IV na V), na kudhihirisha thamani anuai zinazofaa kwa muktadha wa eneo la Kilimanjaro (Sura ya V). Taarifa hizi zilipatikana kupitia uchambuzi wa mahojiano ya kwa watu 130, na dodoso la ana-kwa-ana kwa watu 623 lililowahusisha wakulima, wahifadhi, waongoza watalii, na watalii.

Katika usawa wa mbinu za utafiti, tasnifu hii inaonesha jinsi watafiti wanavyoweza kufanya maamuzi makusudi wakati wa mchakato wa utafiti ili kuongeza uelewa jumuishi wa mahusiano ya watu na mazingira asili. Tasnifu hii; (1) inatoa mbinu inayotumia tungo tofauti za maswali ndani ya mbinu moja ili kunasa mitazamo tofauti. Hata bila ya kubadili mbinu za kiutafiti, tungo za maswali zinaweza kuwaongezea wahojiwa kutoa mitazamo yao tofauti na hivyo kupunguza hatari ya upungufu wa maarifa (Sura ya III); (2) inaakisi mbinu mbili za kiuchambuzi ili kuepuka hatari ya kutengeneza mitazamo ya kibaguzi kuhusu wahusika wa kijamii, kuhakikisha ujumuishwaji wa kijamii wakati wote wa mchakato wa utafiti (Sura ya IV na V); na (3) inaonesha kwamba kuunganisha mifumo miwili ya IPBES unaweza kuzingatia vyema viwango mbalimbali vya mahusiano ya watu na mazingira asili (Sura ya V). Hivyo basi, tasnifu hii inaonesha dhima ya ushawishi ya maamuzi ya watafiti katika upatikanaji matokeo ya kisayansi. Huu ni mchango muhimu wa utafiti kwa tasnifu, ikizingatiwa ukosefu wa tafiti za mahusiano ya watu na mazingira asili zinazojumuisha tathmini muhimu ya mbinu za utafiti na tafakari.

Tasnifu hii ina athari muhimu kwa sera za uhifadhi na utekelezaji (Sura ya V). Ili kuzingatia machaguo tofauti ya MMAW ya kimuktadha maalumu na kukuza thamani anuai, mikakati ya uhifadhi haipaswi tu kuzingatia kupunguza kutoweka wa viumbe anuai, bali pia inahitajika wakati huo huo kuwa mseto ili kukuza ustawi wa watu wote.

Preface

This Ph.D. thesis, which is composed of a series of five chapter, investigates how research can advance an inclusive understanding of people-nature relationships. Chapter I frames Chapters II–V by presenting the research background and objectives, describing the research approaches and case study, summarizing the key results and contributions, and discussing these to reach overall conclusions. Chapter II examines how empirical research has approached tourists' values of nature in protected areas. Chapter III identifies context-specific NCP expressed by diverse social actors in response to differently worded interview questions. Chapter IV analyzes preferences for these context-specific NCP between different social actors as well as within these groups. Chapter V explores the plural values associated with clustered preferences for context-specific NCP which were initially expressed by diverse social actors.

All chapters, except for Chapter I (the framing chapter), are independent articles. Chapter II is published in an international, peer-reviewed scientific journal, while Chapters III–V have been submitted for publication in international, peer-reviewed scientific journals. Please note that due to the specific requirements of the respective journals, there may be stylistic and formatting variations, including references and appendices, between the chapters. The content of the published chapter remains identical to the corresponding published article and is presented in its original journal format. On the title page of each published or submitted chapter, a list of co-authors and a unique reference to the published articles (if published) or the publication status and the relevant journal (if submitted) are provided.

The appendix to this thesis contains the appendix for each chapter, an overview table highlighting my contributions to each of these papers, and a declaration of independence for my work on this thesis. Please note that ChatGPT-4 was used for the initial translation of the English abstract into Swahili and German, and a preliminary text revision to check English language usage and grammar. The additional publications I have contributed to as a co-author are not attached to this thesis but listed on page XVII.

List of publications

The subsequent list comprises the four research publications that make up the content of this Ph.D. thesis, referred to as Chapters II-V. Chapter I serves as the framing chapter for this Ph.D. thesis and is not part of this list.

Chapter II
Gross M, Pearson J, Arbieu U, Riechers M, Thomsen S, Martín-López B (2023) Tourists' valuation of nature in protected areas: A systematic review. Ambio 52:1065–1084. https://doi.org/10.1007/s13280-023-01845-0

Chapter III
Gross M, Shepeleva D, Vogel F, Mwampamba TH, Arbieu U, Pearson J, Sesabo JK, Hofmann J, Codalli F, Martín-López B (accepted for publication in 2025[2] with Sustainability Science) The questions we ask matter: insights from place-based research on nature's contributions to people

Chapter IV
Gross M, Mwampamba TH, Sanya J, Pearson J, Sesabo JK, Martin-Lopez B (resubmitted after major revisions with People and Nature) Understanding variations in social actor demand for nature's contributions to people: the case of Mount Kilimanjaro, Tanzania

Chapter V
Gross M, Von Wehrden H, Mwampamba TH, Sanya J, Pearson J, Sesabo JK, Riechers M, Arbieu U, Böhning-Gaese K, Martín-López B (resubmitted after major revisions with Conservation Letters) Broadening the arguments for inclusive conservation: values associated with nature's contributions to people

[2] This publication differs from the version submitted as Ph.D. thesis; the manuscript was marked as 'in revision with minor revisions'.

List of additional publications

Caniglia G, Luederitz C, **Gross M**, Muhr M, John B, Withycombe Keeler L, Von Wehrden H, Laubichler M, Wiek A, Lang D (2017) Transnational collaboration for sustainability in higher education: Lessons from a systematic review. Journal of Cleaner Production 168:764–779. https://doi.org/10.1016/j.jclepro.2017.07.256

Kinabo NR, Martin DA, Koggani KD, Martín-López B, **Gross M**, Schleyer C, Hackmann V, Thiel, A, Böhning-Gaese K, & Manning P (submitted to People and Nature). Combining ecological, sociological, and economic approaches allows for the identification of viable and sustainable farming options.

Pearson J, **Gross M**, Hofmann, J (2024). Non-material contributions of nature expressed by former tourists of Mount Kilimanjaro, Tanzania. People and Nature pan3.10575. https://doi.org/10.1002/pan3.10575

Sanya, J, **Gross M**, Mwampamba TH, Pearson J, Sesabo JK, Riechers M, Kinabo NR, Krail V, Martín-López B (resubmitted after major revision with Ecology & Society). Heterogeneity of demands for Nature's Contributions to People and nature's values by farmers: Insights from the Kilimanjaro social-ecological system

Vizuete B, **Gross M**, García-Llorente M, Oteros-Rozas E, Martín-López B (resubmitted after minor revisions with People and Nature). More than food production: Assemblages of values underpinning women in agroecological initiatives.

Lists

List of abbreviations

DFG	German Research Foundation
ILK	Indigenous and local knowledge
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPBES Values Assessment	The methodological assessment report on the diverse values and valuation of nature by IPBES
Kilimanjaro	The social-ecological system of Mount Kilimanjaro
KINAPA	Kilimanjaro National Park
KINAPA Authority	Kilimanjaro National Park Authority
TANAPA	Tanzania National Parks
masl	meters above sea level
NCP	Nature's Contributions to People
NCP song	The song entitled 'Uhai ni mazingera asili'
TEEB	The Economics of Ecosystems and Biodiversity
TEV	Total Economic Value

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Chapter I Balancing the plural voices at play – framing chapter

1 Introduction

In the times of the intertwined challenges of global biodiversity loss and injustices, people have differing conservation perspectives and priorities depending on their relationship with nature at stake (Chan et al. 2018; IPBES 2022; Menzies et al. 2023; Pascual et al. 2017, 2021, 2023). To achieve positive, long-term outcomes for both biodiversity and people, evidence-based conservation strategies are widely recognized as pivotal (IPBES 2022). Despite this, conservation efforts have so far largely failed to reverse the global decline in biodiversity and to improve people's quality of life (Chaplin-Kramer et al. 2019; Díaz et al. 2019). These shortcomings are frequently linked to prevailing environmental and development policies that prioritize a narrow spectrum of primarily market-oriented values (IPBES 2022; Jax et al. 2018; Stålhammar 2021; Pascual et al. 2023). Recently, scholars argued that the conservation crisis is fundamentally a value crisis, stemming from a lack of recognizing the diverse ways in which people benefit from and value nature (Pascual et al. 2023).

1.1 Recognizing the diversity of people-nature relationships in research

A growing body of literature highlights the need to consider diverse perspectives on how people relate to nature in conservation policies and practices to tackle these intertwined challenges effectively (IPBES 2022; Pascual et al. 2021; Salomon et al. 2023). To address the evident neglect in policy and practice, scientific evidence can play a key role in demonstrating its importance. In turn, such research itself must acknowledge the diverse ways in which people benefit from and value nature (Pascual et al. 2021, 2023; Salomon et al. 2023; Tallis and Lubchenco 2014; Zafra-Calvo et al. 2020). It is equally important to account for the diversity of (groups of) people[3] along with their unique perspectives on their relationships with nature in research to support conservation that can (then) be considered as 'inclusive' (hereafter merely inclusive conservation) (Tallis & Lubchenco 2014). To advance an inclusive understanding of people-nature relationships, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) developed two comprehensive frameworks, i.e., the Nature's Contributions to People (NCP) framework (Díaz et al. 2015, 2018) and the plural valuation framework (Pascual et al. 2017, 2023), arguing that no framework alone can fully capture the multidimensionality of people-nature relationships.

[3] The terminology for 'diversity of (groups of) people' reflects an effort to acknowledge a potential diversity within social actor groups. While grouping people based on a single characteristic, e.g., gender, cultures, and livelihood strategies, helps diversify the sample and consider, for example, marginalized groups in research, it risks oversimplifying their members as homogeneous. In the research presented in this thesis, research participants were selected based on social actor groups to diversify the sample by nature-based livelihood and leisure time activity, respectively, profiles, recognizing that members vary in other characteristics. To simplify language, 'social actor (group)' was also used in this thesis while being mindful that such categorization risks stereotyping and does not capture the full complexity of individual identities.

The NCP framework encompasses ‘all the contributions, both positive and negative, of living nature [...] to people’s quality of life’ (Díaz et al. 2018, p. 270). Yet, shaped by distinct worldviews and knowledge systems, these contributions are inherently place-specific and may not always align with a standardized analytical framework such as ecosystem services or the 18 generalizing NCP categories proposed by the NCP framework (Díaz et al. 2015, 2018; Kadykalo et al. 2019; Millenium Ecosystem Assessment 2005). To address this, Díaz et al. (2018) introduced a context-specific perspective aimed at ensuring that scientific outcomes into nature’s benefits and resulting implications for inclusive conservation policy and practice are contextually rooted and sensitive to the unique characteristics of the place. Nevertheless, by linking the context-specific to the generalizing NCP perspective through an interwoven NCP approach, global NCP trends can be examined within specific contexts, while remaining attentive to the place-specific worldviews and knowledge systems (Hill et al. 2021). The diversity of NCP can be categorized into three overlapping NCP groups: Regulating NCP refer to ‘functional and structural aspects of organisms and ecosystems that modify environmental conditions experienced by people and/or regulate the generation of material and nonmaterial contributions’ (Díaz et al. 2018, 271), e.g., pollination and regulation of freshwater quantity. Material NCP comprise ‘substances, objects, or other material elements from nature that directly sustain people’s physical existence and material assets’ (Díaz et al. 2018, p. 271), e.g., food and medicine. Non-material NCP include ‘nature’s effects on subjective or psychological aspects underpinning people’s quality of life, both individually and collectively’ (Díaz et al. 2018, p. 271), e.g., aesthetic enjoyment and cultural identity.

The plural valuation framework embraces specific values (hereafter merely values) which refer to the importance, worth, and usefulness ascribed to nature, including NCP (Pascual et al. 2023). Following the IPBES classification, these values can be categorized into intrinsic, instrumental, and relational value domains (Pascual et al. 2017, 2023). Intrinsic values refer to the importance ascribed to nature regardless of human use (Arias-Arévalo et al. 2017) or experience (Pascual et al. 2017). Instrumental values refer to the importance of nature as a substitutable means to an end (Arias-Arévalo et al. 2017). Relational values refer to the meaningfulness of non-substitutable and context-sensitive people-nature relationships and social relationships mediated by nature. Emerging from these relationships, relational values can reflect responsibility and stewardship toward nature, comprising motivations that potentially facilitate conservation efforts (Chan et al. 2016; Jax et al. 2018).

The NCP and plural valuation frameworks complement each other in informing inclusive conservation. While NCP provide specific insights into *what* [aspects of] nature contribute to people’s quality of life, values reflect the multiple reasons *why* nature is important to people. If conservation is understood as the ‘just, sustainable use and cohabitation of people with nature, in a way that maintains biodiversity and ecosystem functions’ (Cumming et al. 2023, p. 4), it is

crucial to embrace the plurality of values in the context of inclusive conservation, rather than focusing a narrow set of such (Mace 2014; Murali et al. 2024; Pascual et al. 2021).

1.2 The bias toward monetary valuation in research on people-nature relationships

Despite the calls to embrace the diversity of people-nature relationships in research, recent literature shows that these relationships are more frequently captured through monetary than socio-cultural methods (Gross et al. 2023; IPBES 2022) (State-of-the-art in Table 1). Hence, monetary values do not only remain dominant in shaping the scientific understanding of people-nature relationships but are also still widely used as scientific evidence to inform conservation policy and practice. Further, such a research bias toward monetary valuation, however, should not be equated with being the most appropriate and inclusive approach to represent the diversity of people-nature relationships (Jacobs et al. 2016, 2020; McIntyre et al. 2023; Pascual et al. 2017, 2023; Turnhout 2024). The critique here is not a dismissal of monetary values as inherently flawed but rather a recognition of their incompleteness, as monetary valuation fails to capture the broad range of values (Gross et al. 2023; Jacobs et al. 2016, 2018; Martín-López et al. 2014). Scientific evidence derived solely from monetary valuation risk perpetuating the conclusion that people mainly express a narrow set of monetary values toward nature, reinforcing a reductionist view of nature's worth (IPBES 2022; Mace 2014; West and Schill 2022). This becomes particularly evident when socio-cultural methods, which can elicit values beyond monetary measures, are applied. This highlights the need for research to capture diverse perspectives on people-nature relationships using both monetary and non-monetary measures. The concept of research pluralism and particularly its element of methodological pluralism can be useful here (Holden et al. 2024; IPBES 2022; Montana 2018; Popa and Guillermin 2017). Methodological pluralism suggests that research methods, particularly those from different paradigms, approach the phenomenon under study, i.e., people-nature relationships in the case of this thesis, from different angles and hence, capture different aspects of such (Mingers 2001). Therefore, drawing on multiple methods can provide a more comprehensive and inclusive understanding of people-nature relationships. Beyond the importance of advancing scientific understanding, it is essential to embrace methodological pluralism. This is particularly true if empirical evidence is to be relevant for conservation, especially when the places of implementation are understood as complex systems(Popa and Guillermin 2017). Such are not just highly dynamic and uncertain but people are also likely to diverge in their conservation perspectives and priorities, underscoring the need for methodological pluralism.

Methodological pluralism implies that monetary methods are an important but not the only approach to capture the diversity of people-nature relationships. How the evident dominance of monetary methods shapes the scientific evidence on people-nature relationships can be illustrated by drawing on a music-inspired metaphor, originally proposed by McIntyre et al. (2023).

Imagine a choir, where plural voices represent the diverse perspectives on people-nature relationships, perceived by and through the diversity in (groups of) people considered in research. For diverse perspectives to be simultaneously and fully audible, all voices must align. However, the augmented application of monetary methods amplifies particular voices, overshadowing others that cannot be captured by these methods but nonetheless exist. Likewise, overlooking the diversity in (groups of) people can reinforce this imbalance because research does not capture their perspectives. To comprehensively and inclusively account for the diversity of people-nature relationships, it is essential to lower the volume of the most dominant voices to allow the overlapping but less audible voices to be simultaneously heard. This calls for the continued, albeit reduced, use of monetary methods alongside a remarkable increase in applying socio-cultural methods. Achieving such a balance of voices requires operationalizing methodological pluralism in research, ensuring that all perspectives are made simultaneously audible and thereby, contributing to a more nuanced and inclusive understanding of people-nature relationships.

1.3 The role of researchers in shaping research on people-nature relationships

Like a composer writing music to thoughtfully orchestrate the voices of a choir, researchers determine which voices take center stage. They effectively shape the (im-)balance of perspectives by amplifying or toning down certain voices. Methodological literature questions the notion that research methods are ‘neutral tools that researchers can pick up and use to learn about a reality ‘out there’’ (West and Schill 2022, p. 1). Rather than just observing, they shape the reality that exists (Law and Urry 2004; Moon et al. 2019; West and Schill 2022), as scholars discuss this concretely in the context of nature valuation (Gross et al. 2023; Martín-López et al. 2014; Vatn 2009). Through methodological choices researchers condition scientific outcomes and consequently, scientific evidence (Moon and Blackmann 2014). Thus, these choices can be understood as vectors that intentionally include but also omit knowledge, which is ultimately reflected in the comprehensiveness of scientific outcomes (Balaine et al. 2024; Kaljonen et al. 2023; Moon et al. 2019; Saltelli et al. 2020; Schwartz-Shea and Yanow 2011).

Methodological choices that researchers make are, in turn, influenced by contextual and internal factors (Böhme et al. 2024; Fay 1996; Moon et al. 2019; Pérez-Hämmerle et al. 2024; Tashakkori et al. 2021; Vatn 2009; West and Schill 2022). These might be analytically separable but drive methodological decisions inextricably. In the context of nature valuation, the concept of ‘value-articulating institutions’ emphasize the role of the institutions in which the research is embedded in shaping their methodological choices (Vatn 2009). Specifically, institutional rules shape the rationalities based on which researchers decide on which, who, and whose values should be studied. In that sense, methods ‘are meaningful rule structures facilitating value articulation’ (Vatn 2009, p. 2008). In addition to contextual factors, methodological choices are also affected by researchers’ internal factors such their philosophical assumptions, e.g., ontology and

epistemology, and personal values (Böhme et al. 2024; Fay 1996; Moon et al. 2019; Pérez-Hämmerle et al. 2024; Tashakkori et al. 2021; West and Schill 2022). Given that onto-epistemological pluralism underpins methodological pluralism, researchers' internal factors play an influential role on how researchers perceive and investigate the diversity of people-nature relationships (Pérez-Hämmerle et al. 2024; Popa and Guillermin 2017). For example, an investigation into the epistemic worldviews of experts contributing to 'IPBES Methodological Assessment regarding the Diverse Conceptualization of Multiple Values of Nature and its Benefits' revealed an imbalance of epistemic worldviews that could lead to an underrepresentation of relational values in the assessment (Hakkarainen et al. 2020). In the research context, variations in contextual and internal factors lead to distinct differences in methodological choices (Holden et al. 2024; Moon and Blackmann 2014; Pascual et al. 2021; Vatn 2009) about:

***What is* studied** (phenomenon under study): which dimension/s of people-nature relationships (embedded in its particular framework) is/are investigated.

***How* it is studied** (methods of data collection and analysis): how are data on people-nature relationships gathered and analyzed.

***Who* participates** (research participants): which (groups of) people, specifically whose perspectives on their relationships with nature, are considered in the study.

Considering how researchers can influence scientific outcomes and consequently, the empirical evidence produced challenges the long-held notion of scientific objectivity. Hence, research, particularly in the context of conservation and nature valuation, is unavoidably value-laden and normative bounded to the contextual and internal factors (Salomon et al. 2023; West and Schill 2022; Vatn 2009; Zafra-Calvo et al. 2020). This positions researchers as composers, with their methodological decisions functioning as volume regulators that amplify or tone down the plural voices that get to be represented in and by research. By orchestrating these voices, researchers influence their relative prominence and, ultimately, the (im)balance of diverse perspectives on people-nature relationships conveyed. Against this backdrop, I outline how I relate to and shaped the research presented in this thesis (see Box 1 Balancing plural voices: A reflection on the approaches shaping my Ph.D. research).

Box 1 Balancing plural voices: A reflection on the approaches shaping my Ph.D. research.

Reflecting on my Ph.D. research, which began in March 2020, I have come to recognize that scientific knowledge creation is far from objective: It is co-created, it is inherently value-laden and political, as feminist scholarship has long argued (Haraway 1988; Rose 1997; Staffa et al. 2022). The research presented in this thesis has been deeply shaped by my philosophical assumptions about ways of being and knowing, core personal values (accountability, care, courage, humility, and good and committed relations with and between places and people), lived experiences, my close engagement with the people and place of Kilimanjaro (Box 2 Relating to Kilimanjaro: How

place and people shaped the research of this thesis), my normative stance that researchers bear responsibility (Jacobs et al. 2023). Operationalizing the normative stance of making research serve the greater good must be guided by normative principles such as justice and sustainability (e.g., Caniglia et al. 2023; Turnhout 2024; Zafra-Calvo et al. 2020).

The terms nature and inclusive conservation are central to this thesis. I adopt an inclusive framing of nature, acknowledging the plurality of perspectives shaped by diverse worldviews and knowledge systems (Coscieme et al. 2020; Díaz et al. 2015, 2018; Reed et al. 2024a). However, I recognize that my personal understanding of nature has been influenced by a perspective that does not fully separate people from nature (mechanistic perspectives) but recognizes their interconnectedness rather from a perspective of complex coupled system than a relational one (West et al. 2020). Feeling a sense of belonging to the sustainability science community, my framing of conservation has never been limited to preserving 'biodiversity and ecosystem functioning' alone. Instead, I advocate for integrating different dimensions of people-nature relationships as experienced and expressed by a diversity of (underrepresented and overlooked groups of) people, i.e., diverse voices as referred to by Tallis and Lubchenco (2014) (Cumming et al. 2023; Salomon et al. 2023). Embracing this diversity, I believe, is essential for achieving meaningful and lasting conservation success to bend the curve of biodiversity loss and improve human well-being. My perspective on inclusive conservation has undoubtedly influenced the research presented in this thesis. While reflexive and more in-depth positionality statements accompany Chapters III–V in their respective appendices, Chapter II does not include such a statement. This is because I only came to fully appreciate the importance of positionality and reflexivity during the Ph.D. research process and the need to transparently convey them to readers. Not least, for Chapter II, I developed extensive Supplementary Material to ensure transparency regarding – not the authors' assumptions but – how the decisions of the authoring team influenced the literature review process and its outcomes.

I co-evolved alongside my research, mainly influenced by the nine months I spent living, experiencing, and conducting research at Kilimanjaro; the stories and perspectives shared in formal and informal conversations and public talks; engaging with different and partially opposing strands of literature; and ultimately (self-)reflections. Internal reflections and discussions with members of the author teams and the Kili-SES research unit as well as our research assistants and others enriched not only this thesis but also my contributions to the working group Equity, initiated by members of the Kili-SES research unit. Against this background, I was prompted to critically reflect on the (German) colonial and post-colonial imprints on people, nature, their relationships, and conservation approaches employed worldwide, particularly in Kilimanjaro National Park. I was confronted with questions such as my role as a White early-career, female researcher in a rural and post-colonial setting (German colonizers declared Tanganyika, nowadays Tanzania, a protectorate as part of German East Africa in 1891). This led, among other things, to a radical shift in my understanding of the conservation-tourism nexus as well as a strong

methodological focus in this thesis (funded to conduct basic research) on creating scientific knowledge that integrates researcher reflexivity and responsibility (Box 3 Shifting perspectives: Inquiry, emotion, and experience matter). I would describe this co-evolution as a relational dance between inner and outer transformation (Ives et al. 2023), which is reflected in how I conducted, analyzed, and framed the research presented in this thesis, particularly in Chapters III–V.

Finally, embarking on a knowledge exchange tour in Kilimanjaro (Appendix 3) was not merely a supplementary activity that diverted resources I could have used to maintain the high pace demanded for (alleged) academic success. Rather, it was a deliberate choice to pursue an alternative (more sustainable) approach (Care et al. 2021; Fischer et al. 2012; Paasche and Österblom 2019). Indeed, this tour was an integral component of my Ph.D. work, embodying an ethos of care and commitment to adhering to my core personal values in my research (Caniglia et al. 2023; Care et al. 2024; CLEAR 2021; Staffa et al. 2022). The knowledge exchange tour enabled the Kili-SES subproject 3 research team, including myself, to share initial findings in formats accessible to research partners and non-academic partners (Figure A3.1), such as posters featuring quotes, visual illustrations, photos, and layperson-friendly language (Figure A3.2–5). Similarly, in this thesis, I want to complement traditional communication formats presented as text, numbers, and figures in Chapters I–V by proposing acoustic illustrations (Böhme et al. 2024) (Box 4 A creative means of dissemination: Acoustic illustrations capture the essence of this thesis). These illustrations represent the (methodological) essence of each chapter, brought together in this framing chapter, to promote balancing the plural voices at play.

1.4 The nexus of conservation and nature-based tourism: a case to illustrate how researcher shape and potentially bias research?

To reveal how researchers have shaped scientific evidence on a specific research topic and hence, potential research biases, systematic literature reviews provide the means for researchers to achieve this. To investigate this through a specific case given the focus on people-nature relationships in this thesis, the nexus of conservation and nature-based tourism in protected areas seems suitable. Nature-based tourism in protected areas has globally become one of the most rapidly growing economic sectors (Balmford et al. 2015; Buckley 2009; Buckley et al. 2019; Davenport et al. 2002), contributing funding for conservation in protected areas and thereby, providing economic arguments to justify their existence (Balmford et al. 2002; Bruner et al. 2004; McCarthy et al. 2012; Waldron et al. 2013). To to highlight the importance of tourism in funding conservation scientific evidence, empirical studies have estimated the monetary value of nature-based tourism through, for example, travel costs analysis (Martín-López et al. 2009) as well as tourists' willingness to pay to protect species (Estifanos et al. 2021) or to watch wildlife (Saymann and Saymann 2014). However, monetary valuation fails to reveal that tourists are likely to assign value to nature in protected areas in more ways than only in monetary terms, for example, aesthetic and recreational values (Harmon 2004).

Further, while exploring the potential of tourism in funding conservation, monetary valuation is likely to disregard other (groups of) people who live and work adjacent to and in protected areas. Market-based conservation strategies frequently prioritize tourists' needs and interests in nature, while overlooking the needs and interests of other (groups of) people (e.g., Brockington 2008; Honey 2008; Nelson 2012; Holroyd 2016). If a research bias toward monetary valuation proves true in this nexus, then it is likely that studies mainly consider tourists only, i.e., a single actor group. Yet, how the existing body of empirical studies has approached tourists' values of nature in protected areas and hence, has shaped the empirical evidence produced has not been systematically studied yet (Gap I in Table 1). This thesis seeks to address this research gap by systematically reviewing empirical studies, synthesizing the valuation methods applied, identifying the association of valuation frameworks as well as valuation methods with value types, and, eliciting the social actor/s groups considered. Intentionally anticipated, as it is relevant to the research as part of the thesis that follows, this systematic literature review will confirm the hypothesized bias toward monetary valuation and provide insights that support the use of socio-cultural method, diverse-actor approaches, and the exploration of diverse values in the subsequent research of this thesis.

1.5 Socio-cultural approaches as counterweight?

In addressing the evident research bias toward eliciting people-nature relationships in monetary metrics, the researchers play a crucial role given that they have some degree of freedom in their methodological choices. If accompanied by informed and conscious decisions, researchers might choose socio-cultural approaches to uncover scientific outcomes beyond monetary measures (Jacobs et al. 2018; Massarella et al. 2021). In the context of research on people-nature relationships, previous studies have employed socio-cultural approaches to explore, for example, which NCP people express (e.g., Kockelkoren et al. 2023; Nicolás-Ruiz et al. 2023; Totino et al. 2023), which NCP they prefer (e.g., Bidegain et al. 2019; Castillo-Eguskitza et al. 2018; Iniesta-Arandia et al. 2014), and how they rate values ascribed to nature (e.g., Arias-Arevalo et al. 2017, 2018; Brück et al. 2024). To enhance the comprehensiveness of scientific outcomes on people-nature relationships, the application of socio-cultural methods has been diversified across various frameworks (e.g., Kacheler et al. 2024; Topp et al. 2022), methods (e.g., Holden et al. 2024; Maestre-Andrés et al. 2016) and social actors (e.g., Kockelkoren et al. 2023; Nícolas-Ruiz et al. 2023) in empirical research. Yet, few empirical studies on people-nature relationships critically assess and reflect on how their methodological choices have influenced the empirical outcomes (but see, Totino et al. 2023). To address this overarching gap, this thesis aims to advance an inclusive understanding of people-nature relationships, with a particular focus on how methodological decisions shape the outcomes and hence, the empirical evidence produced. To this end, three methodological approaches were identified in the literature that can help further an inclusive understanding of people-nature relationships within socio-cultural research (Table 1):

Approach A: Applying plural methods (*how* it is studied) to reduce the risk of knowledge omission and hence, maximize the comprehensiveness of the scientific evidence (addressed by Chapter III).

Approach B: Considering multiple social actor groups (*who* participates) to ensure inclusivity (addressed by Chapter IV).

Approach C: Applying a comprehensive framework on people-nature relationships (*what* is studied) to suggest implications for inclusive conservation (addressed by Chapter V).

By reflecting on Approaches A–C, three research gaps were, in turn, identified (Gaps II–IV in Table 1). These reflections emphasize critical methodological and empirical research gaps, offering complementary ways forward for social-cultural research to gain a more comprehensive and inclusive understanding of the diversity of people-nature relationships.

*Approach A: Applying plural methods (*how *it is studied) to reduce the risk of knowledge omission (addressed by Chapter III).*

The methodological choice of *how* data are gathered plays a critical role in minimizing the risk of omitting knowledge. To maximize the comprehensives of scientific outcomes, the literature emphasizes the importance of employing plural methods, particularly if the study intends to capture the diversity and context-specificity of people-nature relationships (see Approach A in Table 1) (Jacobs et al. 2018, 2020; Termansen et al. 2022; Totino et al. 2023). Totino et al.'s (2023) study underscores this argument by applying five socio-cultural methods to elicit nature's benefits specific to the Dry Chaco eco-region in Argentina, which were expressed by local peasant communities. Their findings revealed that no single method captured the most comprehensive record of benefits, highlighting the importance of combining complementary methods to reduce the risk of omitting NCP.

Yet, while method pluralism offers clear advantages, it requires skills and resources that may not always be accessible to researchers and interdisciplinary research collaborations. To address this, an alternative to method pluralism can be to explore how a single method can independently produce the most comprehensive record of context-specific NCP. Given that methods condition the outcomes, this thesis makes the case that developing strategies to mitigate the risk of omitting NCP by using a single method becomes essential. This thesis suggests that such a strategy can be operationalized, for example, by using differently worded questions in interviews. The reason is that different question-framings can provide multiple opportunities for interviewees to reflect on how nature contributes to their well-being. This might allow them to express a broader range of NCP, ultimately improving the comprehensiveness of the NCP record uncovered.

In addition to *how* data are gathered, literature highlights that the choice of *who* participates significantly influences the empirical evidence on NCP expression, with notable differences in how

social actors articulate NCP (Kockelkoren et al. 2023; Nicolás-Ruiz et al. 2023). Studies suggest that the expression of specific NCP is closely tied to the ways social actors interact with nature, including nature-based livelihood strategies (Felipe-Lucia et al. 2015; Ramos et al. 2018). This implies that diversifying social actors across nature-based profiles can help mitigate the risk of overlooking certain NCP.

Against this backdrop, it remains unclear whether different framings of interview questions can uncover a more comprehensive record of context-specific NCP expressed by different social actors (Gap II in Table 1). This thesis aims to address this gap empirically by conducting interviews with three social actors involved in the conservation-tourism nexus. These actors, distinct in their nature-based livelihood and leisure time activity, respectively, profiles, are selected to enhance the likelihood of capturing a broad spectrum of NCP. The study employs four distinct question-framings to explore how variations in the wording of questions (hereafter merely question-wording) influence the expression of NCP. The analysis will examine how one of the three factors, i.e., question-framing, the social actors, or both combined, condition the comprehensiveness of the NCP record uncovered and, particularly, whether these different interview framings can reduce the risk of NCP omission.

*Approach B: Considering multiple social actor groups (*who *participates) to ensure inclusivity (addressed by Chapter IV)*

People have diverse needs and interests in nature, which can be explored through their preferences for specific NCP (Bidegain et al. 2019; Ebner et al. 2022; Iniesta-Arandia et al. 2014). An inclusive approach to studying NCP preferences requires moving beyond single-actor approaches to recognizing social actors who are differ in their needs and interests in nature to capture the diversity of NCP preferences in a given place (see Approach B in Table 1) (Díaz et al. 2018; Jacobs et al. 2016; Klain et al. 2014). Diverse-actor approaches are essential for mitigating potential conflicts among social actors and enhancing the success of conservation efforts in protected areas (García-Llorente et al. 2018; Kovács et al. 2015; Riechers et al. 2018).

Various factors can shape NCP preferences, including socio-demographic attributes like formal education (Martín-López et al. 2012) and connectedness with and experiences with nature usually operationalized via proxies like the rural-urban gradient (Martín-López et al. 2012; Zoderer et al. 2019). Bashan et al. (2021) argue for direct measures, such as perceived closeness to or time spent in nature, over proxies. To study NCP preferences across social actors and the factors that drives their preferences, the conservation-tourism nexus serves as a great platform. Despite the simultaneous presence of nature conservationists, tour guides, and tourists in the nexus, their NCP preferences have not been simultaneously studied. Independently, studies found, for example, that nature conservationists often prioritize regulating NCP (e.g., Bidegain et al. 2019), while tourists tend to favor non-material NCP (e.g., Felipe-Lucia et al. 2015a).

Although literature has recognized the need for inclusivity by applying multi-actor approaches (Díaz et al. 2018; Jacobs et al. 2016; Klain et al. 2014), they still bear the risk to treat the group members as homogeneous, if they overlook a potential variation within the groups. Evidence of internal heterogeneity is generally scarce (e.g., Tauro et al. 2018), but it is absent for social actors who represent the conservation-tourism nexus.

Given this gap, how preferences for context-specific NCP compare both between and within social actors remains underexplored, but worthwhile exploring to avoid stereotyping and oversimplification social actors based on their NCP preferences (Gap III in Table 1). This thesis seeks to address this gap by empirically investigating NCP preferences of nature conservationists, tour guides, and tourists. Preferences between and within three distinct social actors will be statistically analyzed, also to explore how socio-demographic attributes and interaction patterns with nature might drive NCP preferences.

*Approach C: Applying a comprehensive framework on people-nature relationships (*what *is studied) to draw implications for inclusive conservation (addressed by Chapter V).*

A framing of inclusive conservation necessitates research to explore people-nature relationships by accounting for the diversity of (groups of) people (Cumming et al. 2023; Tallis & Lubchenco 2014). While conceptual literature links values to NCP (Díaz et al. 2015; Pascual et al. 2017), and empirical studies demonstrate that people value nature for multiple reasons (e.g., Brück et al. 2024), most empirical studies focus on NCP preferences (e.g., Ebner et al. 2022; Zoderer et al. 2019), on diverse values (e.g., Arias-Arévalo et al. 2017; Chapman and Deplazes-Zemp 2023) or the association of values with NCP (Brück et al. 2024; Kachler et al. 2024; Topp et al. 2022) independently (Approach C in Table 1) (but see, Bidegain et al. 2019 for associating values with NCP preferences). This thesis was based on the hypothesis that combining the plural valuation framework (Pascual et al. 2017; 2023) with the NCP framework (Díaz et al. 2018) might offer complementary insights into multidimensionality of people-nature relationships that neither framework alone can capture, i.e., the broad range of nature's benefits to people and the various reasons of why people value nature (Chan et al. 2016; Jax et al. 2018).

Overlooking people's value pluralism, i.e., the diverse values people ascribe to nature, has also been identified as a root cause of failures in existing conservation strategies (Chan et al. 2016; Jax et al. 2018; Kenter 2018; Pascual et al. 2023). Also, research can improve to make relational values more visible in empirical evidence compared to the representation of intrinsic and instrumental values (Himes et al. 2024). To address this shortcoming, valuation studies intended to inform inclusive conservation policies and practices must encompass the plurality of values people hold. Despite this recognition, the empirical elicitation of diverse values in conservation contexts remains insufficiently explored (but see, e.g., Ghijselinck et al. 2023).

Against this background, there is a need to empirically investigate the underexplored association between diverse values and NCP preferences expressed by diverse social actors (Gap IV in Table 1). Addressing this gap is crucial for informing inclusive conservation policy and practice. in the context of this thesis, diverse social actors, including farmers, nature conservationists, tour guides, and tourists, were surveyed to elicit both their NCP preferences and the diverse values they ascribe to nature. To ensure contextual rootedness and relevance in implications for inclusive conservation, preferences for context-specific NCP and values contextualized to nature in the place of study were investigated. To avoid oversimplifying social actors' relationships with nature, as the results of Chapter IV reveal, the empirical data were used to identify groups of people with similar NCP preferences, referred to as NCP clusters (Schmidt et al. 2017). These clusters, rather than predefined social actor categories, provide the foundation for analyzing the association between NCP preferences and values.

2 Research approach

Against the backdrop of the state of research and the gaps identified, this thesis aims to advance an inclusive understanding of people-nature relationships, with a particular focus on how methodological decisions shape the outcomes and hence, the empirical evidence produced, by fulfilling the following three objectives (Table 1):

Theory-related objective: Advance the understanding of NCP and diverse values through a context-specific perspective.

Methods-related objective: Reflect on and identify methodological choices as institutions that articulate scientific knowledge in order to advance an inclusive understanding of people-nature relationships.

Policy-and-practice-related objective: Evaluate and provide insights into people-nature relationships to promote inclusive conservation.

Specifically, this thesis seeks to address the following research questions (RQ I–IV in Table 1) that correspond with the four research gaps that I identified in the literature (see 1 Introduction):

RQ I: How did empirical studies approach tourists’ valuation of nature in protected areas over time?

RQ II: How do differently worded open-ended interview questions affect social actors’ expression of broad spectrum of NCP?

RQ III: How do NCP preferences differ between and within social actors?

RQ IV: How are diverse values associated with groups of people similar in their NCP preferences, i.e., NCP clusters?

Table 1 gives an overview of research questions on which each chapter focuses, and the results linked to respective objectives they fulfill. However, as the braid in the background of the table

shows, these objectives are inherently interwoven. I disentangled the objectives of each chapter solely for analytical purposes, shown as artificially distinct categories in Table 1. Further, while each chapter has a certain focus, the results of Chapters II–IV also contribute to all subsequent chapters to a strong degree, illustrated by the braid running through the chapters.

Table 1 Overview of the research gaps, research questions, key results linked to the objectives, and the interwovenness between Chapters II–V indicated by the braid running through the chapters. The theory-related (T), methods-related (M), and policy-practice-related (P) objectives of this thesis are inherently interwoven in the research presented in Chapters II–V, as the braid in the background shows. Each color indicates one of the three objectives. *NCP* Nature's Contributions to People; *RQ* Research question. Braid design credit and gratitude to Anna Mayer.

Chapter	**Chapter II** Tourists' valuation of nature in protected areas – a systematic review	**Chapter III** The questions we ask matter: insights from place-based research on nature's contributions to people	**Chapter IV** Understanding variations in social actor preferences for nature's contributions to people for inclusive conservation: the case of Mount Kilimanjaro, Tanzania	**Chapter V** Broadening the arguments for inclusive conservation: values associated with Nature's Contributions to People
Approach	**State-of-the-art** The frequent use of monetary valuation has shaped the understanding of people-nature relationships toward a narrow spectrum of values.	**Approach A** Using plural methods to identify NCP expressed by social actors contributes to advancing a more inclusive understanding of people-nature relationships.	**Approach B** Acknowledging NCP preferences of diverse social actors contributes to advancing an inclusive understanding of people-nature relationships.	**Approach C** Applying a comprehensive framework such as the NCP or plural valuation framework contributes to advancing a more inclusive understanding of people-nature relationships.
Gap	**Gap I** Unknown how empirical studies investigated tourists' values of nature in protected areas	**Gap II** Unknown whether different framings of interview questions can capture a comprehensive record of NCP	**Gap III** Underexplored how NCP preferences compare between and within social actors	**Gap IV**: Underexplored how diverse values are associated with NCP preferences
Question	**RQ I** How did empirical studies approach tourists' valuation of nature in protected areas over time up to now?	**RQ II** How do differently worded open-ended interview questions affect the broad spectrum of NCP that social actors express?	**RQ III** How do NCP preferences differ between and within social actors?	**RQ IV** How are diverse values associated with groups of people who are similar in their NCP preferences, i.e., NCP clusters?
Key results	- 71% of the studies used economic valuation and 72% reported values in monetary metrics only. - 30% of the studies investigated the values of tourists and other actors. - The chosen valuation framework and method conditioned the value types elicited, suggesting that they are value-articulating institutions. (M) - Conservation implications may be biased toward evidence from monetary valuation and values expressed by a single actor. (P) - Applying socio-cultural approaches that consider non-monetary values can reduce the risk of overlooking values that cannot be expressed in monetary measures. (M) - Empirical evidence for inclusive conservation policy and practice demands an uptake of empirical studies that apply complementary methods as well as to account for value pluralism and diverse social actors (M+P)	- 27 context-specific NCP were expressed, with all but one NCP (*new and unique experiences*) linkable to the generalizing NCP perspective. (T) - The question-framing, social actor or a combination of both conditioned the expression of ten NCP. - Methods to identify NCP are NCP-articulating institutions. (M) - Using different question-framings in interviews with diverse social actors increased the comprehensiveness of the NCP record. - Complementary to a plural method approach, a so-called 'within-method pluralizing' approach can reduce the risk of NCP omission. (M)	- Social actors differed and were internally heterogeneous in their NCP preferences. - NCP preferences across and within social actors were driven by the level of formal education and interaction with nature. - Investigating between-actor NCP preferences solely risks yielding an less comprehensive understanding of people-nature relationships because it can overlook a potential internal heterogeneity. - Acknowledging between- and within-actor NCP preferences reduces the risk of stereotyping and oversimplifying social actors concerning their NCP preferences. (M) - Inclusive conservation needs to account for between- and within-social actor variations of NCP preferences. (P)	- Five NCP clusters were identified. - NCP clusters were relatable to social actors, but also socially heterogeneous. - Conservation strategies may not be centered on social actors solely but rather on clusters of people united by common stakes in nature. - Not just instrumental values but a comparatively high expression of intrinsic, instrumental, and relational values, i.e., a prominent value pluralism, was associated with preferences for material NCP. (P) - Neither framework alone could fully capture the different dimensions of people-nature relationships. - Combining the NCP and plural valuation frameworks suggests that conservation strategies need to be diversified to account for distinct NCP preferences and diverse values, to ultimately be socially inclusive. (T+P)

This thesis includes a systematic literature review on tourists' valuation of nature in protected areas (Chapter II) and three empirical studies on social actors' perspectives of NCP and values of nature, conducted within the Kilimanjaro social-ecological system using a sequential research design (Chapters III–V) (Table 2). In the following subsections, I describe the research approaches for both the literature review and the empirical studies.

2.1 State-of-the-art: Research approaches to tourists' valuation of nature in protected areas

Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al. 2009; Page et al. 2021) and the empirically validated review protocol by Luederitz et al. (2016), we[4] systematically reviewed 152 peer-reviewed scientific articles (Chapter II) that reported on empirical research approaches to tourists' valuation of nature in protected areas to address Research Question I (RQ I in Table 1). We characterized articles based on their methodological choices on framework, methods to gather and analyze data, value types investigated, and the social actors considered. We analyzed the research trend over time and examined the proportion of articles employing monetary and socio-cultural valuation in relation to the release of three prominent valuation frameworks. The Total Economic Value (TEV) framework emphasizes a utilitarian understanding of nature through use, non-use, and option values (Krutilla 1967; Pearce and Turner 1990). The Economics of Ecosystems and Biodiversity (TEEB) framework expands on this utilitarian understanding by also recognizing non-utilitarian values and hence, proposes instrumental and socio-cultural values (TEEB 2010). Finally, the IPBES plural valuation framework broadens the value spectrum by recognizing plural values, encompassing intrinsic, instrumental, and particularly relational values (Chan et al. 2016; Pascual et al. 2017, 2023), as described in the Introduction section. To explore how valuation frameworks and methods function as value-articulating institutions, and thus, as vectors that include but also omit certain value types, we conducted a qualitative content analysis linking the value types identified in the reviewed literature with those embedded in the valuation frameworks. Finally, we performed a correspondence analysis to examine the relationships between valuation methods and value types identified in the literature.

[4] I intentionally use the first-person plural throughout this thesis when referring to the contributions of the co-authors in Chapters II–V, as a way to acknowledge their efforts.

Table 2 Overview of the methodological decisions taken and the sample size of each social actor group, shown for Chapters II–V. *IPBES* Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services; *Kilimanjaro* the social-ecological system of Mount Kilimanjaro, Tanzania; *NCP* Nature's Contributions to People. Icon design credit and gratitude to Jelke Meyer.

Decision | Chapter	***What* is studied**		***How* it is studied**		***Who* participates**			
	Nature's Contributions to People	Values ascribed to nature	Methods used to gather data	Methods used to analyze data	Farmers	Conserva-tionists	Tour guides	Tourists
II	–	Review of tourists' values independent from the valuation framework	Systematic literature review - Systematic review of 152 empirical articles	- Qualitative content analysis - Descriptive statistics - Correspondence analysis	–	–	–	Focus
III	NCP derived from applying the context-specific perspective of the NCP framework (Díaz et al. 2018) - Expression of NCP	–	Empirical case study - Semi-structured interviews (n=86) with differently worded questions	- Qualitative content analysis - Descriptive statistics	–	26	20	38
IV	NCP derived from applying the context-specific perspective of the NCP framework (Díaz et al. 2018) - Preferences for NCP	–	Empirical case study - NCP preference assessment - Survey (n=261) content contextualized based on interviews (n=130) with all four social actors -	- Descriptive statistics - Canonical correspondence analysis with partial least square extension	–	50	55	156
V	NCP derived from applying the context-specific perspective of the NCP framework (Díaz et al. 2018) - Preferences for NCP	Diverse values *sensu* the IPBES plural valuation framework (Pascual et al. 2017, 2023) - Expression of values	Empirical case study - NCP preference assessment - Value rating - Survey (n=623) content contextualized based on interviews (n=130) with all four social actors	- Descriptive statistics - Wards cluster analysis - Indicator analysis - Chi-Square test	362	50	55	156

2.2 Kilimanjaro and its associated social actors as a case to advance an inclusive understanding of people-nature relationships

The empirical research presented in Chapters III–V was part of the Kili-SES research unit, which examines the role of nature in supporting human well-being within the Kilimanjaro social-ecological system (hereafter merely Kilimanjaro) by applying basic research (https://kili-ses.senckenberg.de/en), funded by the German Research Foundation (DFG). While the preceding research unit and other studies have primarily focused on Kilimanjaro's biodiversity and the supply of associated NCP (e.g., Hemp 2006; Hemp et al. 2018; Misana et al. 2012; Peters et al. 2016, 2019; Said et al. 2019), empirical evidence on people's perceptions of their relationship with nature in Kilimanjaro remains limited (but see, e.g., Kijazi and Kant 2010; Masao et al. 2022; Pearson et al. 2024). This research was conducted as part of subproject 3, which aimed to investigate preferences for regulating, material, and non-material NCP, as well as the diverse values of nature expressed by relevant social actors in Kilimanjaro. The case description presented in this subsection as well as the research process outlined in Subsection 2.3 have been influenced by personal experiences in Kilimanjaro (Box 2 Relating to Kilimanjaro: How place and people shaped the research of this thesis).

Box 2 Relating to Kilimanjaro: How place and people shaped the research of this thesis.

The approach to and framing of the framing chapter as well as the empirical Chapters III–V have been profoundly shaped by the meaningful relationships I developed with both the people and the place of Kilimanjaro. As a White woman, a German citizen, and a researcher based at a German university in an academic system rooted in dominant worldviews, I positioned myself as an outsider in relation to Kilimanjaro and its people, including the four social actor groups representing the research participants. Prior to this Ph.D. research, I had neither visited Kilimanjaro nor Tanzania, and my initial knowledge of Kilimanjaro was limited to the Kili-SES research proposal, which provided little context-specific information. However, I quickly came to understand that people-nature relationships cannot be comprehended in isolation but must be situated within their broader social, cultural, and ecological contexts that have evolved over time (e.g., discussions with Tuyeni Heita Mwampamba, the second supervisor of this thesis, and Jennifer Kasanda Sesabo, affiliated researcher with subproject 3; Eyster et al. 2023; Hertz et al. 2020; Yuliani et al. 2023).

The DFG, which funded the Kili-SES research unit, also supported a research station close to the border of Kilimanjaro National Park throughout the funding period. This resource enabled prolonged stays, allowing for deeper engagement and avoiding the pitfalls of short-term, in-and-out 'parachute science' practices, given one was motivated, committed, and willing to immerse oneself (Beaty et al. 2024; Carmenta et al. 2023; Paasche and Österblom 2019; Yuliani et al.

2023). Over the course of my Ph.D. research, I spent a total of nine months in Kilimanjaro across four research stays. These extended periods not only facilitated interviews and surveys but also enabled me to immerse myself in the place and empathize with the lived experiences of my research participants.

During my time in Kilimanjaro, I engaged in a wide range of activities that deepened my connection to the place and its people (Figure 3). I participated in both formal and informal conversations, absorbed the sensory and emotional experiences of being there, joined in colleagues' fieldwork, and read literature. I deliberately stepped out of ‘catered and safe spaces’ typically created for Westerners, choosing instead to use public transportation, shop at local markets, stay in homestays within villages, and attend community events such as church services and weddings. I also tried to familiarize myself with basic Swahili terms. In addition, I participated in initiatives led by nature conservationists, such as tree-planting activities, and visited community-driven projects like the Kweme (*Telfairia pedata*) project, Bees and Trees, and the Tanzania Elephant Foundation. To gain insights into the work of tour guides and the experiences of tourists, I climbed Mount Kilimanjaro, joined day hikes within the national park, and participated in other nature-based activities, including waterfall hikes below the national park’s boundary. These experiences became part of my research process; while shaping me, they also shaped my research and implications for inclusive conservation (Eyster et al. 2023).

These immersive experiences and interactions helped me cultivate what I perceive as trust-based relationships with the (groups of) people key to my Ph.D. research, including tour operators, KINAPA (Kilimanjaro National Park Authority) officers, as well as informal gatekeepers. What began as research-related relationships evolved into a deep and meaningful engagement with both the place and its people. This profound connection significantly challenged and influenced my perspectives on life, research, and academia.

The Kilimanjaro social-ecological system encompasses both the biophysical landscape of Mount Kilimanjaro and its associated social actors. Mount Kilimanjaro is situated approximately 300 km south of the equator in northeastern Tanzania (Figure 1) and is ecologically located within the Eastern Afromontane, one of the world’s 36 biodiversity hotspots (Hrdina and Romportl 2017). The mountain’s altitudinal gradient, as the highest free-standing peak in the world (5895 meters above sea level (masl)), supports a range of global climatic zones and includes seven distinct vegetation zones, with the lower two zones (800–2000 masl) heavily modified by human activities (Ensslin et al. 2015; Hemp and Hemp 2018; Hemp et al. 2018; Newmark and IUCN Tropical Forest Programme 1991; Rutten et al. 2015) (Figure 2). The protected area, designated as Kilimanjaro National Park (KINAPA), spans elevations from approximately 1600–2350 masl (depending on the location on the mountain) up to the summit at 5895 masl (Hemp et al. 2017).

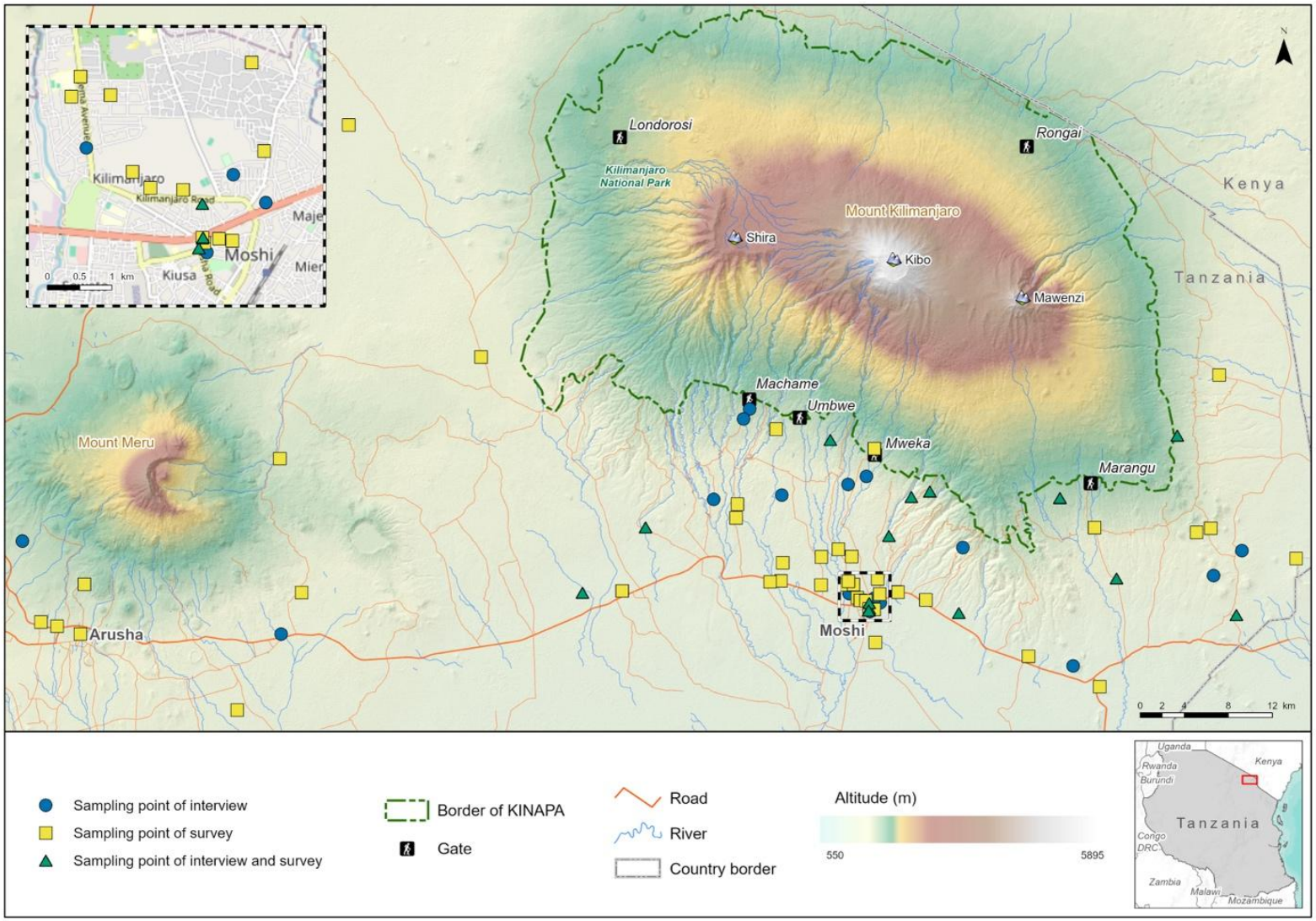

Figure 1 Map showing the geographical location of Mount Kilimanjaro and the sampling points of interviews collected *in situ* relevant for Chapters III–V and surveys relevant for Chapters IV and V (Environmental Systems Research Institute 2020). *KINAPA* Kilimanjaro National Park. Map design credit ad gratitude to Fabia Codalli.

Figure 2 Overview of selected ecosystems of Mount Kilimanjaro along its altitudinal gradient. (**a**) View from the cultivated lowlands (800 meters above sea level (masl)) on Mount Kilimanjaro with its three peaks (Shira, Kibo, and Mawenzi from left to right); (**b**) View from a Chagga home garden (1600 masl) on Kibo; (**c**) Middle montane Ocotea forest (ca. 2650masl); (**d**) Subalpine Erica bushland and forest (ca. 3500masl); (**e**) Subalpine bushland with iconic giant groundsels (*Dendrosenecio kilimanjari*) (ca. 3900 masl) in the foreground and alpine Helichrysum vegetation in the background; (**f**) A glacier close to Uhuru Peak, the highest point of Mount Kilimanjaro (5896masl). Photo credit and gratitude to (a)–(d) author's own; (e) and (f) Berta Martín-López.

Social actors and their relationships with nature in Kilimanjaro

We investigated four groups of social actors who either reside in, work in, or visit Kilimanjaro, i.e., smallholding farmers, nature conservationists, tour guides, and tourists. These groups offer a robust foundation for advancing an inclusive understanding of people-nature relationships. First, these actors vary significantly in the time they have spent in Kilimanjaro over their lifetimes, leading to differences in their scope of experience and attachment to Kilimanjaro's nature. Local residents, both from the area and other parts of the country, as well as international residents and visitors, are likely to express and have distinct preferences for NCP (Masao et al. 2022; Pearson et al. 2024) as well as diverse reasons for valuing Kilimanjaro's nature. Furthermore, even within the local population, the ways nature supports livelihoods and employment opportunities are diverse (Felipe-Lucia et al. 2015b; Ramos et al. 2018). For some locals, nature functions as an 'employer', an 'office', or a 'service provider'. In contrast, tourists engage with Kilimanjaro mainly through a variety of nature-based recreational activities. Additionally, Kilimanjaro's unique altitudinal gradient offers a range of nature-based experiences suited to different social actors. This diversity enriches the spectrum of NCP and values that can be realized and fostered through time spent in this globally significant biodiversity hotspot (Tanzania National Parks 2023).

Kilimanjaro's altitudinal gradient supports a rich variety of regulating, material, and non-material NCP, meetings to the diverse needs and interests in nature of various social actors. For instance, the montane forest belt plays a critical role in regulating freshwater quantity and quality, supporting the livelihoods of those living on the mountain slopes and downstream, including hydropower generation (Agrawala et al. 2003; Hemp et al. 2018; Sébastien 2010). Below the national park boundaries, the mountain's northern and western slopes have been designated as forest reserves to provide material NCP, such as building materials and energy through tree plantations (Hemp et al. 2017; Mariki 2013). In contrast, the more fertile southern and eastern slopes are densely populated and have been transformed into large-scale croplands and small-scale Chagga home gardens (Fernandes et al. 1985; Hemp et al. 2017). Cash crops like coffee and maize are cultivated in monocultures, mainly supplying food (Misana et al. 2003; Soini 2005).

Distinctively, the biodiverse Chagga home gardens managed by smallholding farmers, one of the social actor groups considered in this thesis, are coffee-banana agroforestry systems with a multi-layered vegetation structure resembling a humid tropical forest (Hemp 2006) (Figure 3). 'Chagga' refers to the largest ethnic group on the mountain's southern and eastern slopes (Mariki 2013). These home gardens, integral to traditional Chagga livelihoods over generations (Hemp and Hemp 2008), provide a variety of material NCP such as food, feed, energy, and medicine, alongside regulating NCP like soil fertility, and non-material NCP including cultural heritage and identity (Fernandes et al. 1985; Hemp 2006; Sébastien 2010).

Moreover, certain locations on the mountain hold cultural significance for the Chagga, such as Kifunika Hill, a ritual site within the national park at 3125 masl (Frömming 2009). Kilimanjaro's supply of non-material NCP extends from its foothills to Uhuru Peak, offering recreational and aesthetic experiences (Pearson et al. 2024). Indeed, this iconic mountain is a premier destination for nature-based tourism in Tanzania, with recreational hiking within the national park being the most popular activity (Tanzania National Parks 2023).

Figure 3 Exemplary illustrations of the four social actor groups, farmers, nature conservationists, tour guides, and tourists. (**a**) A Chagga woman presenting her harvest of two avocados; (**b**) The Beehive Fence Project run by Tanzanian Elephant Foundation: bees deter elephants from destroying crops; the farming stewards of the beehive fence gain economic benefits from selling the honey; (**c**) A mountain resident demonstrating an oyster nut (*Telfairia pedata*); the vine grows on old trees in Chagga home gardens to protect against logging; farmers benefit from the nutritious and medicinal seeds used for their consumption or sale. (**d**) A tourist participates in a local coffee ceremony; the coffee plants grow in Chagga home gardens; (**e**) Tourists accompanied by a tour guide hiking Mount Kilimanjaro (ca. 3900 meters above sea level); (**f**) A tourist watching wildlife on the slopes of Mount Kilimanjaro. Photo credit and gratitude to: (a)–(b) and (d)–(f) author's own; (c) Erik Swai.

The nexus of nature conservation and nature-based tourism in Kilimanjaro

Established in 1973, Kilimanjaro National Park laid the groundwork for achieving the dual goals of nature conservation and nature-based tourism in the region. The Kilimanjaro National Park Authority (KINAPA Authority), under the mandate of Tanzania National Parks (TANAPA), has prioritized NCP conversation and recreational tourism in its management objectives (Durrant 2004; Holroyd 2016; Tanzania National Parks n.d.). This established a nexus connecting nature conservation and nature-based tourism in Kilimanjaro, involving the key social actors: nature conservationists, tour guides, and tourists – three of the four groups examined in the empirical research of this thesis (Figure 3).

However, despite Tanzania gaining independence from colonial rule in 1961, the park's management has been criticized for perpetuating colonial-era practices and modern worldviews that maintain a separation between people and nature, creating 'tourism (…) enclaves that exclude local communities' (Holroyd 2016, p. 254; Sébastien 2010). Given the high volume of tourism, KINAPA's revenue significantly supports both the national and local economies (United Republic of Tanzania 2022; Tanzania National Parks 2023). Kilimanjaro National Park generates the second-highest revenue among Tanzanian national parks, following Serengeti National Park (Tanzania National Parks 2023). Hiking within the park requires professional guiding, thereby supporting the livelihoods of tourism-related actors, including tour guides.

Although the national park serves as the primary attraction for tourism, tour guides also facilitate nature-based activities in Kilimanjaro's non-protected areas, such as hikes to waterfall hikes (Tanzania National Parks 2023). Conservation efforts extend beyond the boundaries of the national park as well, involving government officials, community-based organizations, and non-governmental organizations operating on the lower slopes (as noted in discussions with a natural resource officer at the Moshi district office and interviews with conservationists conducted as part of this research). Some of these initiatives are connected to nature-based tourism (according to interviews with conservationists and tour guides conducted in this research), indicating that the conservation-tourism nexus spans both within and beyond Kilimanjaro National Park.

2.3 Empirical research approaches to advancing an inclusive understanding of people-nature relationships

In the empirical Chapters III–V, we employed a sequential research design, beginning with interviews followed by surveys (e.g., Ebner et al. 2022) (Table 2 and Figure 4).

Figure 4 Selected experiences of researching in Kilimanjaro. (**a**) Training session for the survey takers to facilitate the interactive survey section on preferences for Nature's Contributions to People (NCP); (**b**) Group photo of the whole Kili SES survey team; (**c**) A challenging fieldwork experience in Kilimanjaro; (**d**) Reading the theory of the research, i.e., the summary of the IPBES Values Assessment (IPBES 2022), while climbing the mountain (3995 meters above sea level (masl)); (**e**) Recruiting a potential survey respondent belonging to the social actor group of tour guides at Uhuru Peak (5985 masl); (**f**) Explaining the interactive survey section on NCP preferences to a survey respondent. Photo credit and gratitude to (a) and (c) author's own; (b) Isaack Kinawa; (d) and (e) Berta Martín-López; (f) Rosemary Joseph Mgumya.

Interviewing social actors to identify NCP and values through a context-specific perspective

We conducted 130 semi-structured interviews with farmers (n=44), nature conservationists (n=28), tour guides (n=20), and tourists (n=38) to identify context-specific NCP and values ascribed to nature in Kilimanjaro (for descriptions of the social actors see Appendix 6). The interview guide began with general questions about the interviewees' experiences with Mount Kilimanjaro, followed by deliberate questions on NCP and values, and concluded with questions on socio-demographics (for the interview guides see Appendix 6). The interviews served two main purposes:

Sequential study design: We identified NCP and values in the transcripts of all social actors. As part of the sequential design, they were used to inform the survey sections, which aimed to assess NCP preferences (Chapters IV and V) and value expression (Chapter V).

Testing a methodological approach to reduce the risk of knowledge omission: Chapter III analyzes how differently worded interview questions affected the NCP expression of diverse social actors (nature conservationists, tour guides, and tourists).

These interviews were conducted by two research assistants, two Ph.D. students (including the author), and a postdoctoral researcher.

Coding NCP and values

We conducted a content analysis of the interview transcripts to code context-specific beneficial NCP and values ascribed to nature in Kilimanjaro. For NCP, we developed the coding scheme through an inductive-deductive process. We focused on capturing the contextual nuances of people-nature relationships (inductive) while being guided by the general NCP perspective and value domains and categories described in the literature (e.g., Arias-Arévalo et al. 2017; Chan et al. 2016; Riechers et al. 2022; see Appendix 7 for additional literature consulted) (deductive). The coding process was a collaborative effort among several authors. We trained together to ensure consistent identification of NCP and values and developed inter-coder agreement. We described each NCP by following Díaz et al. (2018) and Pearson et al. (2024), incorporating terms used by the interviewees to maintain the integrity of their language. Here, our goal was to preserve the contextual meaning of each NCP while reflecting on the interviewees' perspectives. Where possible, we also applied an interwoven approach (Hill et al. 2021) to link the context-specific NCP with the general perspective of the NCP framework outlined by Díaz et al. (2018) (Table 3).

Table 3 Overview of the context-specific Nature's Contributions to People (NCP) identified in interviews with farmers, nature conservationists, tour guides, and tourists; NCP descriptions based on the interviews (e.g., Pearson et al. 2024) and Díaz et al. (2018); and NCP linked with the generalizing NCP category (Díaz et al. 2018), using an interwoven approach (Hill et al. 2021). Please note, that *materials for domestic use* was not identified by the research as part of Chapter III, *challenging experiences* and *spiritual experiences* were not considered in the survey (Chapters IV and V). Icon design credit and gratitude to Jelke Meyer.

NCP		Description	Generalizing NCP category
Regulating NCP			
	Habitat creation and maintenance	Nature's processes and conditions to form and continue providing a place for human and non-human organisms to live and thrive.	1. Habitat creation and maintenance
	Pollination	Animals' contribution of distributing pollen among flowers.	2. Pollination and dispersal of seeds and other propagules
	Dispersal of seeds	Animals' contribution to moving seeds such birds and elephants as seed dispersers.	
	Regulation of air quality	Nature's processes of purifying air to improve its quality for people.	3. Regulation of air quality
	Regulation of climate	Nature's regulation of atmospheric conditions, including effects on greenhouse gases and temperature, carbon sequestration and storage, and pleasant weather conditions.	4. Regulation of climate
	Regulation of freshwater quantity	Nature's hydrological processes to regulate the water flow and function as a source of water for various people-related purposes, e.g., irrigation and water for domestic use.	6. Regulation of freshwater quantity, location, and timing
	Regulation of freshwater quality	Nature's processes of purifying water to improve its quality for people.	7. Regulation of freshwater and coastal water quality
	Regulation of soil fertility and protection of soils	Nature's processes occurring in the top layer of the Earth's crust to sustain plant growth and to prevent the in/organic surface materials from erosion.	8. Formation, protection and decontamination of soils and sediments
	Regulation of hazards and extreme events	Nature's processes to prevent or reduce damage to people and their infrastructure caused by natural disasters and events such as strong floods, winds, and storms.	9. Regulation of hazards and extreme events
	Regulation of detrimental species	Controlling effects derived from organisms and abiotic conditions on organisms that are pests or transmit diseases, e.g., the temperature limits the spatial coverage of anopheles mosquitos which can transmit Malaria disease.	10. Regulation of detrimental organisms and biological processes
Material NCP			
	Energy	Production of timber-based fuels such as firewood and hydropower.	11. Energy
	Food	Production of eatables and beverages derived from wild, managed, or domesticated organisms for human consumption, e.g., maize, banana, coffee, milk, and meat.	12. Food and feed

	Feed	Production of forage and fodder for domesticated animals such as grasses.	
	Building materials	Producing materials derived from nature to construct buildings such as timber.	13. Materials, companionship, and labor
	Materials for domestic use	Producing materials derived from nature to make furniture, everyday objects, tools, aids, and accessories.	
	Medicine	Collection and production of materials derived from non-human organisms used for salutary purposes such as insects and herbs.	14. Medicinal, biochemical, and genetic resources
Non-material NCP			
	Learning	Different levels of acquiring knowledges and gaining insights that can be experienced by and through nature, from education on different species to cultural exchange and new profound perspectives, which can influence one´s outlook on life.	15. Learning and inspiration
	Aesthetic enjoyment	Pure pleasure of the appealing appearance and beauty of nature.	16. Physical and psychological experiences
	Recreation	Provision of opportunities for physical activities in nature such as hiking and animal watching.	
	Challenging experiences	Provision by nature of opportunities for people to seek challenges, which test their mental and physical capabilities, often resulting in a sense of achievement.	
	Therapeutic and restorative benefits	Nature's opportunities for improving physical and psychological well-being through for example a break from technology and modern life.	
	New and unique experiences	Provision by nature of novel and special opportunities for people to encounter.	*Context-specific NCP that cannot be linked*[5]
	Connectedness with nature	Opportunities for people to develop or strengthen relationships with nature, a feeling of being part of nature, and feeling emotionally, physically, and spiritually connected to nature.	17. Supporting identities[6]
	Cultural heritage and identity	Nature's opportunities for maintaining culture through ongoing cultural practices, ancestral ties, sacred places, and/or the historical significance of nature that represents collective human identities and heritage.	
	Social cohesion and bonding	Basis of nature for people to develop new connections or nurture their existing relationships with other people.	
	Spiritual experiences	Basis of nature for nurturing one´s religion or inner spirit by connecting to self or a higher entity.	

[5] This publication differs from the version submitted as Ph.D. thesis; *New and unique experiences* was marked as '16. Physical and psychological experiences'.

[6] This publication differs from the version submitted as Ph.D. thesis; *Connectedness with nature* was marked as 'Context-specific NCP that cannot be linked'.

Cross-cutting NCP			
	Intergenerational benefits	Maintaining the existence of nature for future generations to experience.	18. Maintenance of options

Analyzing the NCP expressed in response to different interview question-framings (Chapter III)

To address how differently worded open-ended interview questions influenced the diversity of NCP expressed by social actors (RQ II in Table 1) in Chapter III, we relied on NCP identified in response to four NCP-targeting open-ended questions. Each question was framed differently to elicit responses about how interviewees perceive nature's contribution to their own and others' quality of life. In version 1 of the question-framing, we used the term 'appreciate' (hereafter merely Appreciation); in version 2, we used 'benefits' (hereafter merely Benefits); in version 3, we referred to 'contributing to well-being/quality of life' (hereafter merely Well-being); and in version 4, we used 'importance of nature' (hereafter merely Importance) (see Chapter III for the specific question-framings). These questions addressed both the interviewees themselves and others who live, work, or visit Kilimanjaro. Finally, we determined the overall number of NCP expressed by each social actor in response to each question-framing and identified for each NCP how one of the three factors, i.e., question-framing, social actor, or their combination, conditioned its expression.

Surveying social actors to elicit NCP preferences and value expression

We conducted 623 surveys with farmers (n=362), nature conservationists (n=50), tour guides (n=55), and tourists (n=156) to elicit NCP preferences and values expression. The survey questionnaire entailed an interactive section to assess NCP preferences, a rating of value statements to identify value expression, and questions on respondents' interactions with nature as well as socio-demographics.

We used an interactive format to assess NCP preferences in three steps (for a detailed description, see Chapters IV and V and Appendices 6 and 7). Step 1: Respondents were provided with a list of 25 NCP identified in the interviews. To facilitate understanding, we included examples from the interviews and two illustrative pictures for each NCP (Martín-López et al. 2012; Iniesta-Arandia et al. 2014; Oteros-Rozas et al. 2014; Maestre-Andrés et al. 2016). Respondents were asked to select up to five NCP from this list that were most important to them and their lives (Scholte et al. 2016; Zoderer et al. 2019), with binary NCP data used to determine NCP preferences in Chapter V. Step 2: Respondents ranked the five NCP they had selected. Step 3: Respondents quantified their preference for each by allocating points between 1 and 100 to the NCP ranked first, with progressively fewer points for the lower-ranked NCP. These point allocations were used to determine NCP preferences in Chapter IV.

To investigate respondents' value expression, we formulated 20 value statements (Table 4) to capture the nuances of different values within three key value domains and their respective categories (for details, see Appendix 7). These statements were contextualized to Kilimanjaro through an extensive literature review and relevant interview quotes. Respondents were asked to indicate their level of (dis-)agreement with each statement using a four-point Likert scale: (1) strongly disagree, (2) disagree, (3) agree, and (4) strongly agree. An additional option, 'I don't know', was also provided.

Table 4 Overview of values ascribed to nature and value statements used to reveal value expression, adapted from Sanya et al. (submitted).

Value	Value statement
Intrinsic value	
Right to existence and conservation	I value each species at Kilimanjaro because it has its reason for its existence and is therefore worthy of conservation.
Right to existence and prosperity	I value nature at Kilimanjaro because it has its own right to exist and prosper.
Instrumental value	
Basic needs	I value nature at Kilimanjaro because it contributes to meeting my/our basic needs such as clean air and water.
Economic benefits	I value nature at Kilimanjaro because I/we economically benefit from it.
Relational value	
Cultural identity	I value nature at Kilimanjaro because it connects me/us with who we are as a culture/ethnic group/community.
Individual identity	I value nature at Kilimanjaro because our/my relationship with it is an important part of my/our culture.
Cultural heritage	I value nature at Kilimanjaro because it is relevant to the heritage and history of myself/our people/the nation.
Tradition	I value nature at Kilimanjaro because it connects me/us with my/ our traditions and the way of life of my/our ancestors [former family members].
Social cohesion	I value nature at Kilimanjaro because it enables a sense of community.
Social relations	I value nature at Kilimanjaro because being in nature at Kilimanjaro gives me the opportunity to enjoy and deepen relationships with friends, family, and other people.
Kinship	I value nature at Kilimanjaro because it is like family/friend/community to me/us.
Individual connectedness	I value nature at Kilimanjaro because I/we feel part of it.
Wisdom and knowledge	I value nature at Kilimanjaro because it is relevant for wisdom and knowledge of myself/our people.
Learning	I value nature at Kilimanjaro because I/we learn from and with it.
Stewardship	My/our care for nature at Kilimanjaro helps me/us to lead a good and fulfilling life.
Responsibility	I value being responsible for nature and caring for it at Mount Kilimanjaro.
Aesthetic	I value nature at Kilimanjaro because I/we enjoy the beauty of its sights/sounds/smells.

Inspiration	I value nature at Kilimanjaro because it inspires me/us with new ideas and creativity.
Uniqueness	I value nature at Kilimanjaro because its uniqueness fulfills me/us.
New/special experiences	I value nature at Kilimanjaro because it fulfills me/us with new/special experiences that I have not experienced elsewhere.

Additionally, we collected data on respondents' interactions with nature, using the Inclusion of Nature in Self (INS) scale (Schultz 2022) as well as information on the time spent in nature during the week and on the weekend. Socio-demographic information, including age, gender, level of formal education, nationality, and parental residency in Kilimanjaro, was also gathered. The survey was conducted by using ArcGIS Survey 123 (Version 3.15.165). A team of twelve research assistants, seven Ph.D. students (including the author), and a postdoctoral researcher coordinated and administered the survey (see Appendix 6 for details on the training).

Analyzing NCP preferences between and within social actors (Chapter IV)

To investigate whether NCP preferences differ between social actors (RQ III in Table 1), we conducted a non-parametric Kruskal-Wallis test for each NCP, as the Shapiro-Wilk normality tests indicated a non-normal distribution of the data. When the Kruskal-Wallis tests reached 95% significance, we followed up with Dunn's pairwise comparison tests, using Bonferroni adjustment, to detect differences in NCP preferences between the social actors.

To explore variations in between- and within-actor NCP preferences (RQ III in Table 1), we performed predictive canonical correspondence analyses with partial least squares extension on the entire sample and on each social actor group. In doing so, we assessed the strength of associations between socio-demographic attributes, nature interaction variables, and NCP preferences, both between social actors and within each social actor group. For this analysis, we used the NCP points data.

Analyzing the values associated with NCP clusters (Chapter V)

To address Research Question IV on how diverse values are associated with NCP clusters (RQ IV in Table 1) in Chapter V, we performed Ward's cluster analysis to identify groups of respondents based on their similarity in their preferences for the five most important NCP, i.e., NCP clusters. Then, we conducted an indicator analysis to determine which NCP were associated with each cluster. Due to missing data on farmers' NCP points, the NCP data used in Chapter IV, we used binary NCP data for analysis in Chapter V. Next, we ran a Chi-Square test to explore the relation between the social actors and NCP clusters and identified the social actors with the highest share in each cluster. Additionally, we descriptively analyzed the value expression for each NCP cluster and performed Chi-Square tests to determine if respondents' value expressions differed between

NCP clusters. To conduct the Chi-Square tests, we reduced the four-point Likert scale to a two-point scale by merging ‘strongly disagree’ and ‘disagree’ as well as ‘agree’ and ‘strongly agree’.

2.4 Ethical considerations

To ensure ethical standards were met in the empirical research presented in Chapters III–V, we submitted detailed information about our research intentions, interview guidelines, and survey questionnaires for approval. These were reviewed by the Ethics Committee at Leuphana University Lüneburg (EB-Antrag 202104-07-MartinLopez_KiliSES, EB-Antrag-202109-12-Martin-Lopez_KiliSES-02, EB-Antrag_202111-17-Martin-Lopez_KiliSES-03, and EB-Antrag_202206-11-Martin-Lopez_KiliSES-02; approval letters are included in Appendices 2.1-4). Additionally, we obtained the necessary research permits from the Tanzania Commission for Science and Technology (COSTECH; 2021-225-NA-2021-09 and 2022-308-NA-2021-09; research permits available in Appendices 2.5-6), the Tanzanian Wildlife Research Institute (TAWIRI), and the Tanzania National Parks Authority (TANAPA). In compliance with Tanzanian research protocols, we also secured written or oral permissions from regional, district, and village authorities, as well as from tour guides, tour operators, and tour agents.

Research participants were fully informed about the research objectives, their rights, participation requirements, confidentiality, pseudo-anonymity, and how their data would be used and managed (for detailed information, see Chapters III and IV and Appendix 7). We only collected and saved participant responses after obtaining their oral or written consent. At the end of the study, farmer interviewees were compensated with 20,000 TSH (approximately €7.70 or US$8.70 as of January 2022), and farmer respondents as well as village and district officials and their support teams were compensated with 10,000 TSH (approximately €4.35 or US$4.35 as of September 2022) for their assistance with the survey process.

In early 2023, we conducted a knowledge exchange tour where we shared our initial research findings with research participants from Kilimanjaro and others involved in or interested in the research. Research participants who expressed interest received outreach materials via email (for details of the knowledge exchange tour, see Appendix 3). We will continue to share the results of our research with research participants who expressed interest, once the findings are published in peer-reviewed journals.

3 Key results and contributions

In this section, I summarize the key results of Chapters II–V (Table 1) along with their key contributions to research on people-nature relationships and to this Ph.D. research (Table 5); like the thesis objectives (see 2 Research Approach), the theoretical, methodological, and empirical contributions are interwoven (Table 5). Drawing on the key results, I address the research gaps

(see 1 Introduction; Table 1) and respond to the four research questions (see 2 Research Approach; Table 1) to advance an inclusive understanding of people-nature relationships.

Chapter II *Tourists' valuation of nature in protected areas – a systematic review*

To explore how empirical studies approached tourists' valuation of nature in protected areas over time (RQ I, Table 1), we conducted a systematic literature review. Reviewing 152 articles revealed that economic valuation (71%) was the most frequently used approach, followed by socio-cultural valuation (24%) and a mixed approach (5%). We observed a notable increase in empirical research on tourists' valuation of nature in protected areas from 1977 to 2021, with a significant rise in socio-cultural approaches following the release of the TEEB valuation framework in 2010 and the IPBES valuation framework in 2015. Despite this, the field remains heavily biased toward economic valuation and quantitative value types measured in monetary terms. 72% of the studies reported values in monetary metrics only. These findings suggest a risk that the scientific literature may have overemphasized a narrow spectrum of values, potentially overlooking co-existing non-monetary values that are usually captured by socio-cultural valuation. Around 30% of the articles incorporated a diverse-actor approach, considering social groups beyond tourists.

Furthermore, this chapter contributes to a deeper understanding of valuation frameworks and methods as value-articulating institutions (Vatn 2009). A qualitative content analysis revealed that, for example, the TEV valuation framework would overlook three of the 24 value types identified in the reviewed articles. This suggests the limited suitability of TEV for capturing the full range of identified value types, in contrast to the more comprehensive TEEB and IPBES valuation frameworks which could capture all. A correspondence analysis further highlighted a clear distinction between economic and socio-cultural valuation methods and the corresponding value types they elicit. These analyses demonstrate that the choice of valuation framework and method condition the value types empirical study can uncover, implying that both do not simply elicit but pre-determine values, i.e., function as value-articulating institutions.

Given that the reviewed studies rarely stated the valuation frameworks which they used and given that we were unable to directly identify them used in the reviewed studies, we encourage future research to be transparent about their framework choices. To further advance empirical insights for inclusive understanding of people-nature relationships to provide research-informed contributions for inclusive conservation, we emphasize the importance of studies that apply socio-cultural, and ideally complementary, valuation approaches while accounting for value pluralism and are inclusive to the perspectives of diverse social actors. Chapter II provides mainly methodological and empirical contributions, alongside implications for conservation practice and policy, to research on people-nature relationships (Table 5).

Chapter III *The questions we ask matter: insights from place-based research on nature's contributions to people*

We proposed and tested a methodological approach aimed at reducing the risk of NCP omission to reveal a comprehensive NCP record. To this end, we investigated how different question-framings affected social actors' expression of NCP and, ultimately, conditioned the NCP record we uncovered (RQ II, Table 1). Through a qualitative content analysis, we identified 27 context-specific NCP (Table 3). We then linked the context-specific NCP back to the NCP of the generalizing perspective using an interwoven NCP approach (Hill et al. 2021). We found that all but one NCP (*new and unique experiences*) were relatable to an NCP of the generalized perspective (Díaz et al. 2018). The diversity of social actors contributed to enriching the record of NCP. Nature conservationists expressed all 27 NCP, tour guides 25 NCP, and tourists 19 NCP, respectively. We detected that the NCP expressed in response to the four different wordings, i.e., Appreciation, Benefits, Well-being, and Importance, varied between the social actors. For all social actors, however, the four different framings proved complementary and hence, essential to capture the NCP record expressed by each group. Next, we investigated at the individual NCP level how the factors of question-framing, the social actor, or their combination affected NCP expression. We found that the expressions of ten NCP were conditioned to one of the three factors. For example, *intergenerational benefits* was expressed by all social actors but only in response to the question-framing of Importance. This example shows that the question-framing but not the social actor conditioned the identification of this NCP. Moreover, nature conservationists and tour guides (but not tourists) expressed *feed* and *building materials* as NCP. The second example indicates that the identification of these two NCP was independent of the question-framings but conditioned by the social actor considered. Finally, *regulation of hazards and extreme events* was expressed by nature conservationists only in response to the question-framings of Appreciation and Well-being. The final example demonstrates that a combination of particular question-framing and a specific social actor also conditioned NCP identification.

These results underscore how decisions on *how* data on NCP are gathered and *who* participates can affect whether NCP are included but also omitted, ultimately conditioning the NCP record uncovered by the study. We argue that methods used to identify NCP function as 'NCP-articulating institutions', an understanding similar to how valuation methods act as value-articulating institutions (Vatn 2009), as explained in Chapter II.

Building on previous calls to explore the diverse ways people relate to nature using plural methods (e.g., Jacobs et al. 2018, 2020; Termansen et al. 2022; Totino et al. 2023), we propose a 'within-method pluralizing' approach. This approach employs diverse question-framings within a single method to enhance the expression of NCP across social actors. It serves as a complement to plural method approaches by highlighting that the use of multiple methods alone does not

guarantee a comprehensive understanding of people-nature relationships. This is particularly true when plural methods fail to enable research participants to articulate a broad spectrum of NCP. Chapter III provides key methodological and empirical contributions to research on people-nature relationships, with the methodological advancements serving as a foundation for the empirical findings (Table 5).

Chapter IV *Understanding variations in social actor preferences for nature's contributions to people for inclusive conservation: the case of Mount Kilimanjaro, Tanzania*

Drawing on surveys with nature conservationists, tour guides, and tourists, we aimed to understand how NCP preferences differ between and within social actor groups (RQ III, Table 1). The Kruskal-Wallis tests revealed significant differences between the social actor groups, i.e., between-group variation in NCP preferences. The group of nature conservationists tended to prefer regulating and material NCP, while the group of tourists favored non-material NCP. The group of tour guides exhibited NCP preferences spanning across all NCP groups. They were more diverse than the other groups, with some NCP preferences overlap with those of conservationists and tourists. Next, the canonical correspondence analyses with partial least squares extension further revealed differences between the social actor groups and that the members of each social actor group were internally heterogeneous in their NCP preferences, i.e., between- and within-group variation in NCP preferences. Respondents' interaction with nature and their level of formal education were key drivers of variation in NCP preferences; this applied to all three groups. For example, those nature conservationists who spent much time in nature during the week were associated with preferences for *pollination*, *regulation of air quality*, *medicine*, *learning*, and *intergenerational benefits*. In contrast, those conservationists with graduate degrees or higher who are in nature on the weekend expressed higher preferences for *habitat creation and maintenance*, *regulation of climate*, *freshwater quantity*, *learning*, and *cultural heritage and identity*.

Our results suggest that focusing solely on between-actor differences in NCP preferences, as done in the literature (e.g., Ebner et al. 2022; Zoderer et al. 2019), risks providing an incomplete understanding of people-nature relationships, as it may overlook internal heterogeneity within each social actor group. By considering both between- and within-actor NCP preferences, the risk of stereotyping or oversimplifying social actors' NCP preferences can be minimized. Therefore, we argue that research aiming to advance inclusive conservation must account for both between- and within-social actor variations in NCP preferences. Chapter IV provides key methodological and empirical contributions to research on people-nature relationships, with the methodological advancements serving as a foundation for the empirical findings (Table 5). Additionally, conservation practice and policy can also benefit from research conducted as part of Chapter IV.

Chapter V *Broadening the arguments for inclusive conservation: values associated with Nature's Contributions to People*

To investigate how diverse values are associated with NCP clusters (RQ IV in Table 1), we elicited NCP preferences and value expression from farmers, nature conservationists, tour guides, and tourists. The Wards cluster analysis revealed five clusters of people similar in their NCP preferences. Following the indicator analysis these five NCP clusters can be characterized as follows: (1) 'Intangible benefits', (2) 'Tangible benefits', (3) 'Health-related benefits', (4) 'Resilience-related benefits', and (5) 'Regulating benefits' (Figure 5). The result of the Chi-Square test showed that the relation between NCP clusters and social actors was significant. For example, tourists were relatable to 'Intangible benefits' and farmers to 'Tangible benefits' and 'Health-related benefits'. Although all clusters were socially heterogeneous, a noticeable mix of all social actors assembled in 'Resilience-related benefits' and 'Regulating benefits'. Further, the results of the second set of Chi-Square tests showed that respondents across all NCP clusters expressed intrinsic, instrumental, and relational values, with variations in the strength of the value pluralism observed between the clusters. A prominent value pluralism was associated with preferences for material benefits, comprising the NCP clusters 'Tangible benefits' and 'Health-related benefits' (Figure 5). In contrast, the 'Intangible benefits' cluster showed the least prominent value pluralism. We suggest that research seeking to advance an inclusive understanding of people-nature relationships, particularly in the context of inclusive conservation, undermines ways forward for inclusive conservation by solely studying either NCP preferences or (plural) values. Instead, ways forward for inclusive conservation should draw on the complementarity of these frameworks that they offer, i.e., *what* [aspect of] nature contributes to people's quality of life (NCP) and the multiple reasons *why* nature is important to people (values). For conservation policy and practice, our results imply that the design of conservation strategies need to account that social actors are not homogenous but diverse in NCP preferences. These results imply that conservation strategies should move beyond focusing solely on social actors, i.e. a grouping of people based on based nature-based livelihood strategies and leisure time activity, respectively, profiles, and instead center on clusters of people united by shared stakes in nature. Further, conservation strategies need to account for the distinct NCP preferences and nurture value pluralism. Ultimately, this means that they need to be diversified to avoid overlooking the needs and interests of particular (groups of) people. Chapter V provides a key empirical contribution to research on people-nature relationships as well as policy and practice (Table 5) .

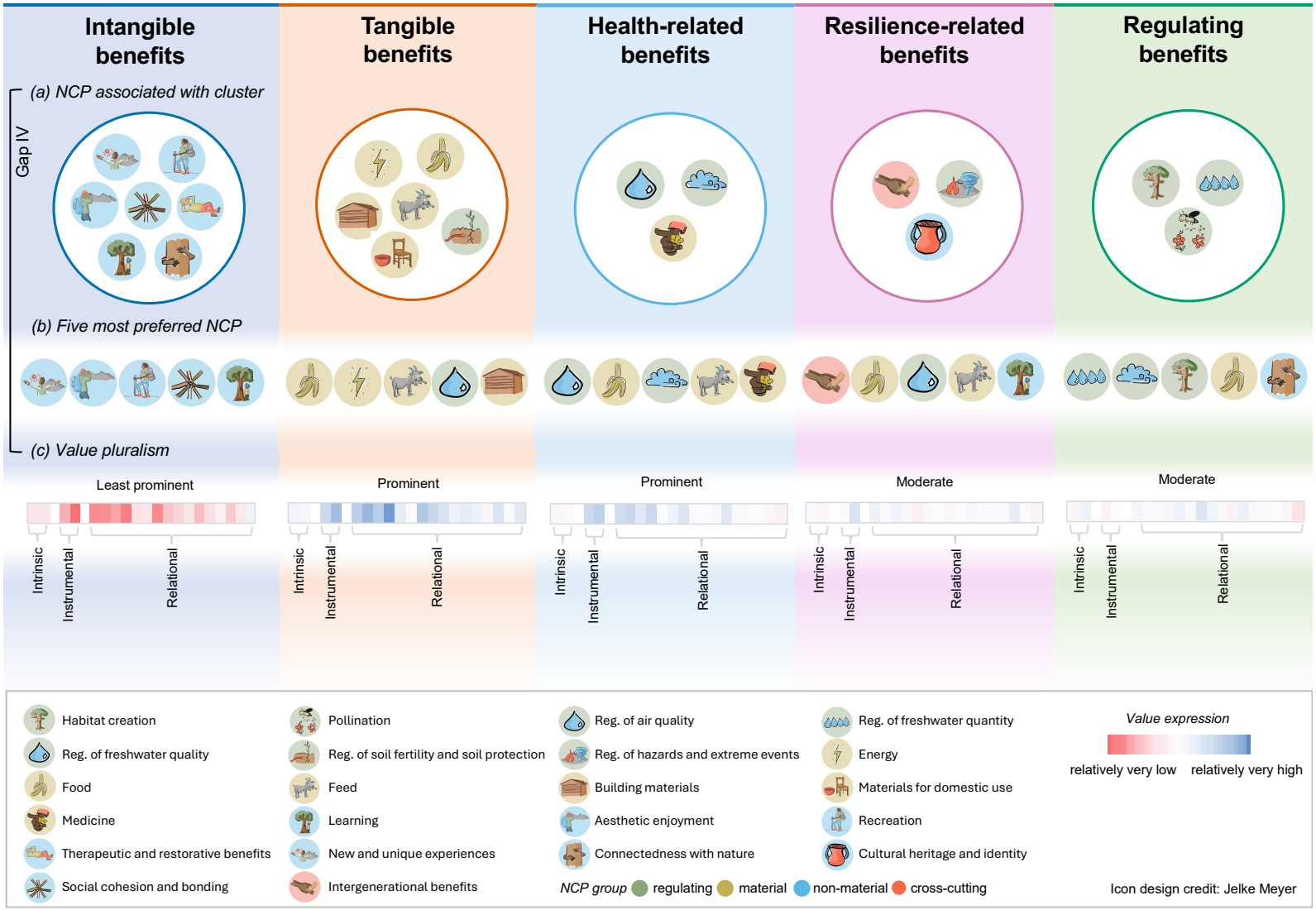

Figure 5 Key results of Chapter V, building on contributions from Chapters III and IV, on (**a**) Nature's Contributions to People (NCP) associated with clusters; (**b**) the five most preferred NCP; and (**c**) Expression of intrinsic values (intrinsic), instrumental values (instrumental), and relational values (relational) used to derive implications for inclusive conservation policy and practice. For details on value expression, see Figure 2 in Chapter V. *Reg.* Regulation.

Table 5 Overview of the key contributions to research on people-nature relationships and to this Ph.D. research, shown for Chapters II–V.

Chapter | Key contribution	**Chapter II** Tourists' valuation of nature in protected areas – a systematic review	**Chapter III** The questions we ask matter: insights from place-based research on nature's contributions to people	**Chapter IV** Understanding variations in social actor preferences for nature's contributions to people for inclusive conservation: the case of Mount Kilimanjaro, Tanzania	**Chapter V** Broadening the arguments for inclusive conservation: values associated with Nature's Contributions to People
Methodological key contribution	Advancing the understanding of valuation frameworks and methods as institutions of scientific knowledge articulation, specifically value-articulating institutions.	Advancing the understanding of methods to identify context-specific NCP as institutions of scientific knowledge articulation and proposing a methodological approach to reduce the risk of knowledge omission.	Reflecting on a methodological approach to mitigate the risk of stereotyping and oversimplifying social actors based on their NCP preferences	–
Empirical key contribution, contributing to theoretical understanding, if indicated	Advancing the understanding of how research approached tourists' values of nature in protected areas by a systematic synthesis of empirical studies.	Identifying context-specific NCP expressed by social actors, contributing to the theoretical understanding of the context-specific NCP perspective through empirical evidence, particularly through the identification of one context-specific NCP that cannot be linked to an NCP of the generalizing perspective.	Better understanding of which NCP are preferred by social actors, as well as the variations in NCP preferences both across and within different social actor groups.	Advancing the understanding of the association of diverse values with NCP preferences, thereby contributing to the theoretical understanding of value pluralism and of combining the NCP and plural valuation frameworks through empirical evidence.
Key contribution to policy and practice	Signaling that scientific evidence and linked conservation implications may be biased toward insights from monetary valuation and values expressed by a single actor.	–	Being attentive to potential differences in NCP preferences between and within social actors.	Centering conservation strategies on clusters of people united by shared NCP preferences rather than focusing on social actors soley. Diversifying conservation strategies to account for the varying NCP preferences and diverse values, ultimately ensuring inclusivity for the diversity of (groups of) people.
Contribution to the research conducted in the subsequent chapter/s	Justifying the use of socio-cultural and diverse-actor approaches in Chapters III–V, particularly the investigation of value pluralism in Chapter V, to advance an inclusive understanding of people-nature relationships.	Providing context-specific NCP, thereby contributing to the survey content tailored to the Kilimanjaro context for Chapters IV and V.	Justifying the use of a hierarchical cluster analysis applied in Chapter V to identify NCP clusters. A cluster analysis approach helps avoid the risks of stereotyping and oversimplifying the NCP preferences of social actors because it identifies groups of respondents based on emergent NCP preferences, regardless of the social actor group to which the respondents originally belong.	–

4 Discussion

This thesis advanced an inclusive understanding of people-nature relationships, with a particular focus on how methodological decisions shape the outcomes and hence, the empirical evidence produced, to fill the dearth of empirical studies on people-nature relationships that incorporate such a critical methodological assessment and reflection. This section takes the key results under the theory-related, methods-related, and policy-and-practice-related objectives and discusses their implications in a wider context. In subsection 4.1, I discuss how researchers influence scientific outcomes and, against this backdrop, I look at obstacles and enablers within research to capture and represent the diversity of perspectives on people-nature relations. In subsection 4.2, I go beyond a strict discussion of the key results and reflect on the transfer of the empirical evidence revealed in Chapter V into conservation policies and practices through the lens of value-articulating institutions. Finally, I outline two ways forward for research to further progress toward an inclusive understanding of people-nature relationships in subsection 4.3.

4.1 Reflect: How researchers shape the diversity of people-nature relationships

Scientific outcomes are not direct representations of 'reality out there' (West and Schill 2022, p. 1); they are conditioned by the researchers that produce them. This thesis adds to prior methodological discussions (e.g., Moon and Blackman 2014; Moon et al. 2019; Law and Ury 2011; Pérez-Hämmerle et al. 2024; Vatn 2009; West and Schill 2022) and empirical studies in this regard within the broader context of research on people-nature relationships (e.g., Balaine et al. 2024; Martín-López et al. 2014; Saltelli et al. 2020; Totino et al. 2023). In particular, the results of this thesis demonstrate the influential role of researchers' methodological decisions in shaping scientific outcomes and consequently, scientific evidence produced (for a discussion on understanding methods to identify NCP as NCP-articulating institutions and how the within-method pluralizing approach functions as a strategy to reduce the risk of knowledge omission, refer to Chapter III). Methodological decisions shape the scientific evidence which can either reinforce or counteract undesirable and even harmful patterns and behavior in the real world (Beaty et al. 2024; Böhme et al. 2024; Kaljonen et al. 2023; Law and Urry 2004; Turnhout 2024). As such, methodological decisions can be understood as conscious and even political choices (Jacobs et al. 2023; West and Schill 2022). Political choices are often discussed in terms of how policymakers and practitioners might use or disregard scientific evidence (Newing 2010; West and Schill 2022). However, these choices are rarely integrated into the research itself as a deliberate and reflective component of the research process (Turnhout 2024). Being aware of and open to addressing the implications of decisions, in turn, is linked to the willingness and the responsibility that researchers hold to ensure their research serves the greater good (Jacobs et al. 2020, 2023; Turnhout 2024; Salomon et al. 2023; West and Schill 2022). For researchers, such a normative call necessitates

a continuous commitment to asking the question: 'Which voice(s) is my research (not) amplifying?' (To understand how reflecting on this question influenced the framing of the empirical chapters of this thesis in a specific case, see Box 3 Shifting perspectives: Inquiry, emotion, and experience matter).

Box 3 Shifting perspectives: Inquiry, emotion, and experience matter.

Researching the social actors such as nature conservationists, tour guides, and tourists, as outlined in the Kili-SES research proposal, prompted me to critically reflect on how I would conceptualize the relationships among these actors and justify their combined focus in my thesis. This intellectual and personal inquiry unfolded as part of a broader journey, marked by self-reflection and moments of emotional intensity.

My starting point to develop a perspective on conservation and nature-based tourism nexus related to a widely established one: coupling tourism with conservation could create a win-win scenario. This perspective suggests that revenues from tourism in protected areas can fund conservation measures, which, in turn, help preserve their biodiversity (e.g., Balmford et al. 2015; Buckley et al. 2009; Dharmaratne et al. 2000). Well-maintained protected areas attract more tourists, creating a reinforcing cycle of mutual benefit. While seemingly straightforward and pragmatic, this perspective aligns with mainstream conservation strategies that often fail to account for the broader social and political implications (e.g., Brockington et al. 2008, 2010; Büscher et al. 2014; Büscher and Fletcher 2019, 2020). Given that I am convinced that conservation can only succeed if people's needs and relationships with nature are accounted for, while this focus should not come at the expense of maintaining biodiversity (e.g., Cumming et al. 2023; Salomon et al. 2023), this initial framing of the nexus did not convince me. It oversimplified the complex dynamics of conservation and tourism, favoring a narrow spectrum of social actors while neglecting critical concerns such as social justice for those living adjacent to protected areas.

This initial perspective did not sit comfortably with me, and I was hesitant to rely on it as the primary justification for my empirical research, particularly for Chapters III and IV, because it gnawed at my sense of commitment to justice (Caniglia et al. 2023). My questioning of this perspective was profoundly shaped by my early research stays in Kilimanjaro and the relationships I developed with its people and places, again emphasizing their significance for my research (Box 2 Relating to Kilimanjaro: How place and people shaped the research of my thesis; Beaty et al. 2024; Eyster et al. 2023). During field trips and in formal and informal conversations, for instance, I learned that many conservation initiatives in Kilimanjaro aim to integrate conservation with local livelihoods: traditional practices like hanging beehives in trees or cultivating the oyster nut (*Telfairia pedata*) serve both conservation and economic purposes, providing benefits for local people in terms of personal consumption or income generation. In contrast, the decoupling of people and nature,

particularly through the expansion of Kilimanjaro National Park and the exclusion of local communities from areas such as the Half-Mile Forest Stripe, has created significant disadvantages for local people. I first learned from a conversation with a Ph.D. student who is not involved in the Kili-SES research unit at the research station that the Half-Mile Forest Strip originally belonged to the Chagga community but was later transferred to other authorities, excluding the Chagga from using this social buffer forest. These exclusions from the social buffer forest have limited opportunities for meeting livelihood needs, highlighting the socio-political dimensions that the mainstream conservation perspective tends to overlook. I subsequently deepened my understanding of this history through literature (e.g., Durrant 2004; Newmark and IUCN Tropical Forest Programme 1991; Sébastien 2010).

For several months, I struggled to find diverse perspectives on this nexus in the literature, which led to considerable frustration and disappointment. A pivotal turning point came during a panel discussion hosted by Tanzania Network e.V. in spring 2023, two years into my Ph.D. research. This discussion illuminated the enduring legacies of dominant conservation strategies in formerly colonized regions and their impacts on local people (e.g., Holroyd 2016; Kiwango and Mabele 2022; Massarella et al. 2021). This panel discussion introduced me to the framework of political ecology, which examines power dynamics, social justice, and the socio-political contexts of, e.g., conservation and tourism (Mostafanezhad et al. 2016; Robbins 2019;). Incorporating the term political ecology into my literature search finally enabled me to uncover sources that critically challenged the dominant conservation narratives and offered more nuanced perspectives.

Discovering these perspectives evoked mixed emotions. I felt a deep sense of discomfort and embarrassment at realizing it had taken me two years to engage with these critical perspectives. Reflecting on this, I recognized how I might have inadvertently perpetuated dominant conservation perspectives and colonial legacies. However, I was also relieved and motivated, as these insights arrived at a crucial time, while I was framing and drafting the empirical Chapters III–V of this thesis, allowing me to integrate an up to then underrepresented perspective into them.

My curiosity, coupled with a normative stance and commitment to challenge dominant perspectives, drove this transformation. Both my analytical drive to explore deeper questions and the emotional discomfort that pushed me to persist shaped this transformative journey. I view this as a demanding but invaluable experience, underscoring the importance of integrating rational inquiry with the engagement of our inner dimensions in academic works (Ives et al. 2020).

I claim that this radical shift in perspective, combined with an introduction to valuation frameworks and the notion of methods as value-articulating institutions (Chapter II; Vatn and Bromley 1994; Vatn 2005, 2009), as well as my core personal values (Box 1 Balancing plural voices: A reflection on the approaches shaping my Ph.D. research), motivated the strong methodological focus of my

thesis. Additionally, I claim that my relational engagement with the place and its people was, in fact, a pivotal factor in avoiding the perpetuation of mainstream conservation perspectives (Box 3 Shifting perspectives: Inquiry, emotion, and experience matter; Beaty et al. 2024; Turnhout 2024). This is not to suggest that my thinking and actions, or the research presented in my thesis, are entirely free from mainstream (conservation) perspectives. I have conducted research with the best intentions while acknowledging the inherent, learned, and uncovered perspectives that influence it. This engagement transformed me from a pragmatic and relatively detached researcher at the start into one who views research as being co-created, value-laden, and political (e.g., Haraway 1988; Rose 1997; Staffa et al. 2022).

Rather than emphasizing the creation of scientific knowledge solely to inform inclusive conservation practices (the policy-and-practice-related objective of this thesis), my framing chapter prioritized the role of the researchers, particularly the normative stance and responsibility (Jacobs et al. 2020) reflected in decisions about *what* is studied, *how* it is studied, and *who* participates, in advancing an inclusive understanding of people-nature relationships. This focus also stemmed from navigating the limitations of the basic research which the third-party funding provider DFG funds only. While action-oriented research in a participatory manner, for example, has proven more suitable for successfully improving equity and sustainability outcomes (Zafra-Calvo et al. 2020), this thesis demonstrates that even within the constraints of basic research, researchers have methodological agency to balance the voices at play. In doing so, this thesis provides methodological contributions beneficial for both basic and other forms of research such as participatory action-research.

Inclusivity beyond merely opting for comprehensive frameworks and diverse research participants – a political choice in a specific case

The results of this thesis may help to illustrate a conscious and political choice through a specific case. Through the lens of methodological choices, this thesis also underscores and reflects on the risk of stereotyping and oversimplifying social actors. Scientific outcomes that stereotype and oversimplify are not inherently incorrect. The risk, however, lies in their potential reinforcement of a narrow understanding of social actors and their relationships with nature. Doing justice to social actors and their diverse perspectives embraces adopting an inclusive framework that acknowledges the context-specificity of people-nature relationships (Díaz et al. 2015, 2018; Hill et al. 2021: Kadykalo et al. 2019), and considering the diversity of social actors (Díaz et al. 2018; Klain et al. 2014; Tallis and Lubchenco 2014; Zafra-Calvo et al. 2020) by, for instance, being sensitive to the language used when referred to them (e.g., Reed et al. 2024b). Inclusivity extends to data analysis, where a lack of its deliberate application can lead to overlooking internal heterogeneity within social actors (Moon and Blackman 2014; Vatn 2009). To minimize the risk of oversimplifying and stereotyping social actors, this thesis proposes two analytical approaches that provide concrete strategies. First, if researchers choose to begin with predefined social actor

groups, they should test for internal variation in the phenomenon under study (*what* is studied), such as NCP preferences, as done in Chapter IV. Second, an alternative to a group-based approach is a data-emergent approach. By grouping people based on emergent similarities in the phenomenon under study (*what* is studied), such as NCP preferences, the study allows for inclusivity grounded in the data itself (Chapter V). Inclusivity, however, must be embedded across the entire research process, not only during the initial conceptualization (Díaz et al. 2015, 2018; Hill et al. 2021: Kadykalo et al. 2019) and participant selection (Díaz et al. 2018; Klain et al. 2014; Tallis and Lubchenco 2014; Zafra-Calvo et al. 2020), but also in the stages of data collection, analysis, and interpretation. This thesis does not claim to dictate what is right or wrong in a given research endeavor. Instead, it invites researchers to critically reflect on, carefully weigh the pros and cons of their methodological decisions, and to be transparent about them, considering their potential to reinforce or challenge stereotypes and oversimplifications of social actors (Böhme et al. 2024; Carmenta et al. 2023; Moon et al. 2019).

Capturing the diversity of people-nature relationships in research – obstacles and enablers

The results of this thesis also show that taking into account the multidimensionality of people-nature relationships and the diversity of perspectives is essential to produce comprehensive and inclusive empirical evidence. This is crucial, particularly given the pluralism of value perspectives and motivations underpinning (inclusive) conservation, which has grown substantially over recent decades, alongside the associated normative stances (Cumming et al. 2023; Mace 2014). Educating conservation students about the many ways people relate to nature and their intentions to conserve it is critical to train next-generation researchers in both recognizing the diversity of perspectives on people-nature relationships and addressing the normative aspects of conservation (Luque-Lora et al. 2022; Saltz et al. 2019; Tallis and Lubchenco 2014). Methodological education and training are equally important for researchers to have the ‘means’ to capture diverse perspectives, specifically gaining skills to practice methodological pluralism (Hakkarainen et al. 2020; Holden et al. 2024; Montana 2018; Montana et al. 2021). This involves applying a broad range of research approaches that can be operationalized and deliberately diversified through methodological decisions.

In addition to knowledge and skills gained through methodological education and training, other factors also drive methodological decisions. These include researchers’ internal factors, e.g., philosophical assumptions (Hakkarainen et al. 2020; Montana et al. 2021; Moon et al. 2019; Pender 2023; Pérez-Hämmerle et al. 2024) and personal values (Horcea-Milcu et al. 2019; Luque-Lora et al. 2022; Salomon et al. 2023). Despite their influence on the methodological setup, scientific outcomes, and implications for policy and practice, they frequently remain implicit, unacknowledged, presumed, and unnoticed (Horcea-Milcu et al. 2019; Ives et al. 2020, 2023; Moon et al. 2019; Salomon et al. 2023). By adding this layer to its scope, however, methodological

education and training in the context of conservation can explicitly address these internal factors (Luque-Lora et al. 2022; Saltz et al. 2019).

Disregarding diverse value perspectives might also be attributed to researchers being unconsciously trapped in research routines, driving them to conduct research in ways they are accustomed to , e.g. defaulting to frameworks and methods to gather and analyze data (Ahmed 2012; Schwartz-Shea and Yanow 2011). While the rapidly evolving pluralism of value perspectives underpinning inclusive conservation makes it challenging to stay up to date (Mace 2014), researchers might simultaneously fail to reflect on habituated methodological decisions, also around how they position themselves and their research in the pluralism of value perspectives, i.e., an anticipated obstacle to value pluralism (Horcea-Milcu et al. 2022). Defaulting to unreflected business-as-usual can be redefined by personal experiences, learning through inter- and transdisciplinary collaborations, and engaging with people who hold different worldviews (Hakkarainen et al. 2023; Horcea-Milcu et al. 2022; Luque-Lora et al. 2022; Mäkinen-Rostedt et al. 2023; Montana 2021). For example, experts involved in the IPBES Values Assessment reflected critically on their assumptions during the four-year inter- and transdisciplinary process, resulting in a deeper recognition of value pluralism (Mäkinen-Rostedt et al. 2023). Capturing the diversity of people-nature relationships requires expanding knowledge about diverse people-nature relationships and the associated methodological skill set, but also onto-epistemological pluralism (Holden et al. 2024; Pérez-Hämmerle et al. 2024). Building onto-epistemological pluralism and developing the flexibility to navigate between different ways of being and knowing is a critical element of research pluralism. Identified as a key competency for researchers, ‘epistemological agility’ (Haider et al. 2018, p. 196) can enable researchers to guide people-nature relationships toward more sustainable and inclusive trajectories, including those associated with conservation (Pérez-Hämmerle et al. 2024; Saltz et al. 2019).

However, while this thesis has mostly examined the methodological decisions of individual researchers, the responsibility to embrace the diversity of perspectives on people-nature relationships in research must also extend to the research community individual researchers belong to and the institutions for which they work. For example, peers and institutions play a key role in determining which research foci are accepted or rejected (Bennet et al. 2016; Luque-Lora et al. 2022; Raymond et al. 2022; Sandbrook et al. 2010). They may reinforce specific conservation perspectives, intentionally or not. Extending the results of this thesis to the community and institutional levels means that acting on this responsibility requires the wider community and institutions to foster a culture that embraces diverse perspectives in conservation. At the community level, this involves discussing and reflecting on research practices, fostering openness toward inter- and transdisciplinary collaboration, and planting seeds to challenge business-as-usual routines, ultimately sparking the courage to transform from within (Care et al. 2021, 2024;

Horcea-Milcu et al. 2022; Staffa et al. 2022). At the institutional level, resources, for example, to support training sessions and inter- and transdisciplinary collaboration can be enablers (Horcea-Milcu et al. 2022).

To ignite enthusiasm for the methodological focus of this thesis and allow the readers to relate to it (Böhme et al. 2024), I have chosen to bring acoustic illustrations center stage. These creative and unconventional tools serve as an alternative way to convey the methodological essence of the research presented here, as well as my interpretation of it (See Table 6 in Box 4: A creative means of dissemination: Acoustic illustrations capture the essence of this thesis). With these, I aim to complement traditional academic communication formats, such as text, numbers, and figures presented in this framing chapter (Böhme et al. 2024). To achieve this, I draw on the choir-inspired metaphor woven throughout this framing chapter, originally introduced by McIntyre et al. (2023).

Box 4 A creative means of dissemination: Acoustic illustrations capture the essence of this thesis.

I invite you to scan the QR codes (Table 6) and listen to the five acoustic illustrations while reading my interpretation for each. I bring acoustic illustrations center stage as a creative, unconventional means of disseminating my research (Böhme et al. 2024). With these, I aim to complement traditional academic communication formats, i.e., text, numbers, and figures presented in this framing chapter, by drawing on the choir-inspired metaphor weaved into this framing chapter, originally used by McIntyre et al. (2023). Each acoustic illustration captures the (methodological) essence of research presented in each chapter of this thesis, offering my interpretation of a researcher's role in composing the relevant voices to advance an inclusive understanding of people-nature relationships.

The acoustic illustrations are based on different versions of the song entitled 'Uhai ni mazingera asili' (hereafter merely NCP song) (see page II for details, page III for lyrics, and Appendix 1 for the English translation). Julius John White, a key praxis partner in Kilimanjaro, and Steven David Lema, a crew member on the hike to Uhuru peak, spontaneously crafted the song during the knowledge exchange tour in Kilimanjaro (Appendix 3). Both artists feel that the song expresses an appreciation for Mount Kilimanjaro's nature, its importance to people, and the genuine connections between locals and visitors. I want to express my gratitude to Isack Charles Shija, Julius John White, Kulwa Onesmo Sianga, McDonald Gregory Mlemwa, Rehema Julius Mwasenga, Steven David Lema who contributed to these acoustic illustrations recorded at Maisha Khalisi, Moshi, Tanzania, in October 2024.

Table 6 Acoustic illustrations as a creative, unconventional means of disseminating the (methodological) essence of the research presented in this thesis and my interpretation of it (Box 4).

Chapter II Tourists' valuation of nature in protected areas – a systematic review

Imbalanced soundscape of plural voices: Although researchers, when viewed through their role as composers, allow multiple voices to play, they tend to amplify one particular voice, making the others barely audible.

Multiple voices sing the lyrics of the NCP song. These voices represent the rich diversity of perspectives on people-nature relationships. Their very existence highlights the breadth and variety of methodological decisions made in the empirical literature that seeks to capture and represent these relationships.

Chapter II's systematic review of tourists' valuations of nature in protected areas highlights the role of valuation frameworks and methods in shaping scientific outcomes. The conclusion is that these methodological choices act as value-articulating institutions, rather than simply instruments for capturing and representing objective realities. Through their choices of frameworks and methods, researchers control the relative prominence of different voices in the soundscape, thereby influencing the diversity of perspectives reflected in the scientific evidence.

Further, the results of this chapter reveal that monetary valuation is by far the most used approach. This may explain the bias toward monetary value perspectives, with one dominant voice overwhelming the soundscape. This voice is amplified by the focus on a single, often distant actor employed in most studies. However, the loudness of this one voice overshadows other, barely audible voices, which represent coexisting and potentially differing non-monetary value perspectives. Socio-cultural approaches, for example, can capture and represent these perspectives, but their volume remains low due to their less frequent application. Additionally, this low volume may result from overlooking the perspectives of other (local) social actors, as most studies focus on a single actor and fail to consider a broader range of perspectives.

Systematically assessing the volume of the plural voices at play, as this state-of-the-art investigation aims to do, is crucial. It reveals how empirical research has approached the study of people-nature relationships. The revealed dominant prominence of monetary value perspectives may lead to the conclusion that tourists primarily value nature in monetary but not in non-monetary terms. This one-sided representation could present an artifact worth exploring by how researchers approached the study topic. This needs to be reflected considering the influential role researchers have in making methodological choices, which ultimately shape scientific outcomes.

Additionally, it has been argued that the most dominant voice may not necessarily be the most appropriate or inclusive one to represent diverse perspectives (Jacobs et al. 2016, 2020; McIntyre et al. 2023; Pascual et al. 2017, 2023; Turnhout 2024). Therefore, researchers need to reflect on how their methodological choices influence the volume of the voices at play. An imbalance in these voices would require the application or development of approaches to reduce the dominance of the loudest voices, creating space for others to be heard. Such methodological reflection and assessments are crucial for advancing an inclusive understanding of people-nature relationships, a focus that has been consistently highlighted throughout this thesis. The following three soundscapes, representing Chapters III–V, exemplify them.

Artistic credit: Isack Charles Shija (vocals), Kulwa Onesmo Sianga (vocals, guitar), McDonald Gregory Mlemwa (vocals, guitar), Steven David Lema (vocals)

Chapter III The questions we ask matter: insights from place-based research on Nature's Contributions to People

A monotonous soundscape of a single voice: The researchers, again viewed through their role as composers, amplify a single voice on stage, while no other voices are audible.

Chapter III employs a socio-cultural approach to identify context-specific NCP through interviews with three social actor groups: nature conservationists, tour guides, and tourists. A single voice, previously barely audible in the NCP song of Chapter II, now represents the faint notes of these diverse NCP perspectives captured by the socio-cultural and diverse-actor approach.

Two additional methodological choices further amplify this voice, allowing for an even richer diversity of NCP perspectives to emerge. First, the context-specific perspective of the NCP framework is applied, acknowledging that people's relationships with nature are inherently place-specific and may not be fully captured by a standardized analytical framework. By applying the context-specific perspective, the NCP *new and unique experiences* was revealed, which had not been documnted in the literature.

Second, existing literature advocates for the use of plural methods to reduce the risk of omitting NCP, while this chapter demonstrates how different question-framings can likewise contribute to a more comprehensive record of NCP. This suggests that researchers can amplify a previously faint voice and make more diverse perspectives audible by employing a within-method pluralizing approach, a novel approach that complements plural-method approaches.

Artistic credit: Kulwa Onesmo Sianga (guitar), McDonald Gregory Mlemwa (vocals, guitar)

Chapter IV Understanding variations in social actor preferences for Nature's Contributions to People for inclusive conservation: the case of Mount Kilimanjaro, Tanzania

A monotonous soundscape of a single voice: Viewed through their role as composers again, the researchers amplify another single voice on stage, while no other voices are audible.

The setup on stage mirrors that of Chapter III: A single voice represents the faint notes of a socio-cultural approach. Chapter IV aims to uncover preferences for those context-specific NCP identified in Chapter III. Since people have differing needs and interests in nature and to avoid disregarding perspectives, Chapter IV emphasizes the importance of considering diverse groups and their unique perspectives on how they prioritize NCP, as highlighted by existing literature. This highlights the necessity of a diverse-actor approach in research, in this case, nature conservationists, tour guides, and tourists.

The findings of this chapter demonstrate that NCP preferences vary not only between but also within social actor groups. They suggest that researchers can amplify the voice by recognizing that (potential) variation in NCP preferences exists not only between but also within social actor groups. Disregarding internal heterogeneity by treating members of a social actor group as homogenous in their NCP preferences risks stereotyping and oversimplifying social actors' needs and interests in nature, which keeps the volume of the voice low. By contrast, revealing more nuanced and diverse perspectives on social actors' NCP preferences, by acknowledging both between- and within-actor variation, amplifies their voice. This approach can essentially contribute to advancing a more inclusive understanding of people-nature relationships.

This chapter underscores the additional need to account for inclusivity, not just in the initial setup by opting for a context-specific NCP perspective and diverse-actor approach, but throughout the entire research process. It offers a much-needed approach for amplifying the often overlooked voice of within-actor variation in NCP preferences. Amplifying this voice based on predefined social actor categories, however, requires an intentional decision by researchers to achieve this.

Artistic credit: Kulwa Onesmo Sianga (vocals, guitar), McDonald Gregory Mlemwa (guitar)

Chapter V Broadening the arguments for inclusive conservation: values associated with Nature's Contributions to People

A monotonous soundscape of a single voice: The researchers, again portrayed as composers, amplify a third singular voice on stage, while all other voices remain inaudible.

The setup on stage reflects that of Chapters III and IV: A single voice, barely audible in the NCP song of Chapter II, represents the faint notes of a socio-cultural approach.

Chapter V addresses the limitation of focusing solely on NCP preferences or values, as widely studied, which may overlook crucial insights for inclusive conservation, if not addressed.

To this end, Chapter V, first, builds upon Chapter IV and proposes an additional methodological approach to ensure inclusivity in data analysis. It applies a clustering approach, grouping respondents representing farmers, nature conservationists, tour guides, and tourists based on emergent similarities in their NCP preferences. This approach fosters inclusivity grounded in the data, resulting in five distinct NCP clusters, with varying degrees of social heterogeneity. This finding underscores the variation in NCP preferences within social actor groups, suggesting that clustering approaches can help minimize the risk of stereotyping social actors, thereby acknowledging more nuanced and diverse perspectives that amplify the voice of this chapter.

Finally, by combining the NCP and plural valuation frameworks, Chapter V identifies five NCP clusters that express intrinsic, instrumental, and relational values, each with varying degrees of value pluralism. In the context of a narrow value spectrum (e.g., Chapter II), researchers who employ a plural valuation framework amplify the relative prominence of diverse value perspectives, thus enhancing the volume of the voice represented in this chapter. Notably, the most pronounced value pluralism was associated with preferences for material NCP. Since no single framework can fully capture the multidimensionality of people-nature relationships, ignoring the value pluralism within these NCP clusters risks keeping perspectives dormant, ultimately missing crucial ways forward for promoting inclusive conservation.

By using an analysis approach that identifies groups identified through emergent similarities in the NCP preferences and leveraging the complementarity of these frameworks, researchers can give a stronger voice to potentially overlooked and underexplored perspectives.

Artistic credit: Kulwa Onesmo Sianga (guitar), McDonald Gregory Mlemwa (guitar), Steven David Lema (vocals)

Chapter I Balancing the plural voices at play – framing chapter

A balanced soundscape of plural voices: The researchers balance the plural voices at play, ensuring they are more evenly represented, ultimately embracing the diversity of people-nature relationships.

Plural voices harmonize in the lyrics of the NCP song. In this soundscape, representing the framing chapter of this thesis, the voices embodying the rich diversity of perspectives on people-nature relationships are balanced. This thesis underscores the importance of critical methodological assessments and reflection on methodological decisions through a systematic literature review and three empirical studies. It demonstrates the influential role researchers have in embracing the diversity of perspectives on people-nature relationships and shaping their (relative) prominence in scientific evidence. To advance an inclusive understanding of people-nature relationships, this thesis identified the following three approaches as helpful:

(1) *How* data are gathered: Applying a within-method approach reduces the risk of knowledge omissions and thereby, increases the likelihood of yielding more comprehensive outcomes and scientific evidence base (Chapter III).

(2) *Who* participates and *how* data are analyzed: Reflecting on two approaches for data analysis to ensure inclusivity, extending beyond merely selecting diverse social actors as participants (Chapters IV and V).

(3) *What* is studied: Combining complementary frameworks to capture and represent the multidimensionality of people-nature relationships, providing a solid foundation for implications for inclusive conservation policy and practice (Chapter V).

Empirical studies conducted as part of this thesis tested these methodological approaches to complement approaches suggested by literature or used in previous studies to advance a more inclusive understanding of people-nature relationships (Approaches A–C in Table 1). Similarly, the three approaches proposed in this thesis do not yield ultimate completeness and have limitations. They can be further refined, expanded, or complemented by additional approaches to achieve more comprehensive outcomes. Nevertheless, this thesis makes an important empirical contribution by addressing the need for empirical studies that incorporate a critical methodological assessment to advance an inclusive understanding of people-nature relationships. The proposed approaches can serve as a meaningful starting point to inspire reflection on the influential role of the researchers and methodological decisions, not only for the basic research conducted in this thesis but for all types of research on and beyond people-nature relationships.

Capturing and representing the full diversity of people-nature relationships requires researchers to engage in deliberate assessment and reflection on how methodological choices function as knowledge-articulating institutions. This involves uncovering both the contextual and internal factors that drive these decisions, as they ultimately shape scientific outcomes and consequently, the empirical evidence produced.

Comprehensive and inclusive evidence on the diversity of people-nature relationships requires a broad range of methodological approaches (a key element of research pluralism), operationalized via deliberately varying methodological decisions guided by the normative stance of conducting research for the greater good. This means not ‘defaulting to the dominance of the loudest [voice]’ (McIntyre et al. 2023, p. 1963), but instead balancing the plural voices at play, as this soundscape seeks to demonstrate: This version of the NCP song acknowledges the dominant voice of monetary value perspectives in Chapter II, whose volume is intentionally reduced to allow other voices to emerge. These include the individual voices from Chapters III–V, which were previously drwoned but are now heard. This version also incorporates perspectives from other approaches such as the plural method approach (Approach A in Table 1), alongside alternative decisions to capture and represent the diversity of perspectives. While not directly explored in this thesis, these are, for example, proposed in Subsection 4.3 as potential ways forward.

Artistic credit: Isack Charles Shija (vocals), Julius John White (vocals), Kulwa Onesmo Sianga (vocals, guitar), McDonald Gregory Mlemwa (vocals, guitar), Rehema Julius Mwasenga (vocals), Steven David Lema (vocals).

4.2 Transfer: Value articulation at the science-policy-practice interface

To address the intertwined challenges of global biodiversity loss and diminishing human well-being, empirical evidence is needed to underscore the importance of incorporating the diversity of people-nature perspectives in conservation policy and practice. The results of this thesis suggest that beyond diversifying methodological approaches, also on the level of policy and practice, diversifying conservation strategies is a pivotal way forward. Specifically, the results show the importance of accounting for distinct NCP preferences and the plural values of diverse social actors in conservation, without jeopardizing biodiversity and ecosystem maintenance. How policymakers and practitioners engage with or dismiss evidence-based implications for diversifying

conservation strategies affects the ultimate inclusive conservation outcomes on the ground (Raymond et al. 2022). The engagement of policymakers with evidence can strongly differ, given that value perspectives and motivations underpinning conservation have pluralized over time. Initially centered on nature's value for its own sake (ca. 1960–2000), the framing of conservation was later complemented by a value perspective in which nature provides means to human ends (2000–2010) (Mace 2014). Since 2010, there has been a growing emphasis on the importance of nature and people, including their reciprocal dynamics. The latest conservation framing that brings people-nature relationships to the foreground calls for broadening conservation research, policy, and practice by moving beyond intrinsic or instrumental values to embracing plural values (Cumming et al. 2023; Mace 2014; Pascual et al. 2021), a call that this thesis aimed to respond to.

Despite growing acknowledgment of nature's plural values in scientific literature and at the science-policy-practice interface (e.g., IPBES 2022; Himes et al. 2024; Pascual et al. 2023), these advancements often fail to translate into concrete policies and practices. For instance, recent research has shown that conservation policies across eleven countries and five UN regional groups primarily represent instrumental values, while neglecting intrinsic and relational values (Murali et al. 2024). Another key challenge lies in the divergence of values between conservation researchers and practitioners, which can explain the limited uptake of researcher-driven recommendations and the perception among practitioners that researchers fail to address their practical needs (Luque-Lora et al. 2022; Pascual et al. 2023). Addressing the mismatches between research, policy, and practice requires open discussions to identify and reconcile opposing value perspectives and encourage mutual knowledge co-production at the science-policy-practice interface (Bennet et al. 2016; Kelemen et al. 2023; Montana et al. 2021).

The mismatches between research, policy, and practice might be explained by drawing on the concept of value-articulating institutions, which this thesis investigated for the case of research. Like conservation researchers, policymakers and practitioners are not neutral translators of scientific evidence but are influenced by (the breadth) of institutionalized and individual value-laden perspectives, which might have been reinforced over time (Ahmed 2012; Luque-Lora et al. 2022; Pascual et al. 2021; Salomon et al. 2023; Vatn 2005, 2009). A narrow range of value perspectives, evident in current conservation policies, heightens the risk of overlooking the (necessary) diversity of value perspectives in conservation policies (Pascual et al. 2023). While diversity is essential for effectively addressing conservation challenges (Cumming et al. 2023; Pascual et al. 2021), as the results of this thesis also conclude, a lack thereof might be overcome by, for example, increasing personal and professional diversity among those involved in conservation (Luque-Lora et al. 2022) and shifting societal norms and goals around conservation toward embracing value pluralism (Pascual et al. 2023). Although this may seem self-evident, it

introduces various challenges. Nevertheless, extending the results of this thesis underscores the importance of ensuring diversity of perspectives in both policy and practice.

4.3 Progress: Ways forward for researchers to advance an inclusive understanding of people-nature relationships

Building on the (methodological) essence of the research presented in this thesis (Table 6) and the key results discussed in subsections 4.1 and 4.2, I propose two complementary ways forward for research to further advance an inclusive understanding of people-nature relationships.

Way forward 1: New ways of combining the NCP and plural valuation frameworks

Discrete value domains and categories, as used in Chapter V, are useful to foster a conceptual understanding of values and, thereby, advance scientific theory. In people's lived experiences with nature, values rather manifest in assemblages (Ortiz-Przychodzka et al. 2023; Riechers et al. 2024). For instance, Ortiz-Przychodzka et al. (2023, p. 6) discussed how instrumental and relational values assemble along a 'blending continuum or a gradient emerging from relations'. Similarly, Chapman and Deplazes-Zemp (2024) found that instrumental, intrinsic, and relational values are interwoven and hence, difficult to disentangle without losing the essence of these assemblages. Therefore, the scientific discreteness may fall short in capturing these values assemblages. These assemblages, however, if acknowledged, can serve 'as a natural starting point for pluralistic valuation' (Himes et al. 2024, p. 36; Ortiz-Przychodzka et al. 2023; Stålhammar and Thorén, 2019).

Given that values appear as assemblages in people's perceptions of lived experiences rather than as discrete categories, I encourage researchers to account for these value assemblages in *how* they collect and analyze data. I suggest investigating the assemblages of values associated with NCP preferences to not just advance scientific understanding but also derive evidence-based implications for inclusive conservation that are closer to people's lived experiences. Addressing this research gap, however, presents challenges. Accounting for value assemblages might be particularly meaningful for researchers who aim at providing representative evidence-based conclusions to inclusive conservation policy and practice. Identifying value assemblages requires qualitative data, such as narratives, rather than quantitative approaches. Hence, such studies may be resource-intensive or face methodological challenges in linking NCP preferences identified through quantitative methods with value assemblages elicited qualitatively.

In addition to recognizing the value assemblages associated with NCP preferences, I propose integrating NCP preferences and values from the outset. For the research presented in this thesis, data on NCP preferences and plural values were collected separately, identifying their associations a posteriori during data analysis. Recognizing that people can value nature for multiple reasons

(Arias-Arévalo et al. 2017, 2018; Chapman and Deplazes-Zemp 2023) and considering the role of value- and NCP-articulating institutions in shaping outcomes, as emphasized throughout this thesis, I propose integrating NCP preferences and values already at the data-gathering stage. First, this combined approach could reveal more immediate associations between NCP preferences and values. Second, it proposes a novel methodological assessment and reflection by comparing empirical outcomes on this association across the data-gathering and data-analysis stages. This approach could also enhance the methodological understanding of how knowledge-articulating institutions operate and affect implications for inclusive conservation.

Finally, in Chapter V, value expressions were identified using individual statements rated on a Likert scale, consistent with previous research (e.g., Klain et al. 2017). A more nuanced understanding of which values might be more important to people could be achieved by introducing additional steps in the data collection process, similar to those used for NCP preferences. For example, research participants could rank the values they ascribe to nature or their NCP preferences (Step 2) and then allocate points to indicate their relative importance (Step 3). This layered approach would offer richer insights into the importance of values associated with NCP preferences.

Way forward 1 means: Acknowledging both discrete categories and assemblages of values and combining the NCP and plural valuation frameworks at the data collection stage can offer more nuanced insights into the complex tapestry of people-nature relationships, ultimately enriching inclusive conservation research, policy, and practice.

Way forward 2: Leveraging relational perspectives

This thesis has strongly focused on the decisions of researchers taken throughout the research process in investigating people-nature relationships. It did not consider (potential variation in the) researchers' philosophical assumptions underpinning these decisions. Yet, given their critical role in influencing researchers' decisions (see subsection 4.1), I hypothesize that variation in such assumptions could result in more diverse evidence, altogether advancing an inclusive understanding of people-nature relationships. Recent literature in the broader research field of sustainability science (Böhme et al. 2024; Walsh et al. 2021; West et al. 2020, 2024) which research on people-nature relationships relates to (Campbell and Gurney 2024; Paul et al. 2021) proposed adopting relational perspectives to investigate people-nature relationships. Such relational perspectives 'emphasiz[e] continually unfolding processes and relations' (West et al. 2020, p. 304), in which people *are* nature. Scholars argue that the hierarchical separation of people and nature is one of the root causes of the conservation crisis. Such separation is evident, for example, in value perspectives that view nature as a means to human ends. Applying relational perspectives might be more suitable when studying people whose understanding of their

relationships with nature does not align with the anthropocentric and dichotomous understanding grounded in widely spread mechanistic perspectives, and when drawing conclusions for the places they are related to (e.g., Gelves-Gomez et al. 2024; Kobluk et al. 2024). Hence, adopting relational perspectives can be suggested as being complementary, enabling research to more fully embrace the diversity of people-nature relationships.

The research presented in this thesis attempted to recognize the relationships between people and nature, as exemplified by the investigation of relational values (Chapter V). However, Luque-Lora (2024) argues that the anthropocentric and hence, dualistic framing of relational values does not fully align with true relational perspectives. Importantly, this research was not explicitly designed from relational perspectives, which remains a non-negotiable limitation. Particularly language plays a critical role, which differs across the perspectives (Eyster et al. 2023). The framing of the questions in both the interview guidelines (Chapter III) and survey questionnaire (Chapters IV and V) reflects an implicit dualism between people and nature, rather than fully embracing a relational understanding (as evident in, e.g., the following interview questions: ‘Do you think that nature at Mount Kilimanjaro provides benefits to humans?’ to identify NCP (Chapter III); and the following survey question: ‘Which are the five most important contributions you gain from nature in Kilimanjaro?’ investigate NCP preferences (Chapters IV and V)).

Investigating people-nature relationships from relational perspectives necessitates designing research with a relational understanding at its core. To this end, I propose that researchers must first recognize the perspectives they aare operating from (Pérez-Hämmerle et al. 2024; Thambinathan and Kinsella 2021; Trisos et al. 2021). If they are not relational, as in mechanistic and complex coupled system perspectives (West et al. 2020), I recommend that researchers actively train themselves to adopt relational perspectives. The use of relational language, for example, might a first step to begin with (Eyster et al. 2023). Building on West et al. (2020), training goes beyond a purely cognitive understanding and reflection but ideally involves experiencing relationality. Further, to fully embrace the diversity of people-nature relationships in research, researchers are encouraged to develop skills to acknowledge and integrate diverse perspectives to become epistemologically agile (Haider et al. 2018) and ultimately apply onto-epistemological and methodological pluralism, essential elements of research pluralism (Hertz et al. 2020; Pérez-Hämmerle et al. 2024; Wamsler 2020). Applying different onto-epistemological perspectives to investigating people-nature relationships might uncover a variety of complementary but likely also opposing perspectives on the relationships. Rather than seeking to resolve potential contestations, researchers will be tasked with navigating and embracing them (Horcea-Milcu 2022; Lazurko et al. 2024; Raymond et al. 2022).

In addition to training in and familiarizing oneself with relational perspectives, I strongly encourage not just to consult (both scientific and non-scientific) people who embody and represent relational perspectives, i.e., 'holders of relational perspective', but to collaborate and co-design research on an equal footing with them to embrace humility and adopt de/anti-colonial approaches (Caniglia et al. 2023; Hill et al. 2023; Staffa et al. 2022; Thambinathan and Kinsella 2021; Trisos et al. 2021; Turnhout 2024; Vanney et al. 2024). This aligns with arguments made in the context of Indigenous and local knowledge (ILK), emphasizing the importance of 'ILK holders' themselves representing these knowledge systems, rather than relying on external 'ILK experts' to act as intermediaries (Tengö et al. 2017). Individuals raised within relational understandings bring invaluable lived experiences and terminology (McIntyre et al. 2023; Pérez-Hämmerle et al. 2024; West 2020), which can guide crucial aspects of research, such as the phrasing of questions, survey prompts, and data analysis. These contributions ensure that relational perspectives are authentically represented. Additionally, they might also align more closely with how these people conceptualize and hence, articulate their relationship with nature within their specific (language) contexts (Anderson et al. 2022; Coscieme et al. 2020; Reed et al. 2024a; Trisos et al. 2021). A collaborative approach on equal footing minimizes the risk of misinterpretation or speculation by researchers who, despite their best intentions, may struggle to fully grasp relational perspectives due to their non-relational upbringing and 'learned' perspectives.

Way forward 2 means: By familiarizing oneself with relational perspectives and fostering inter- and transdisciplinary collaboration on equal footing, I hypothesize that researchers can better capture the complexity of people-nature relationships, paving the way for more comprehensive and inclusive evidence and implications for conservation policy and practice.

5 Conclusion

Capturing and representing the full diversity of people-nature relationships comprehensively and inclusively requires researchers to engage in deliberate and critical reflections on their methodological decisions – boldly put, understanding them as political choices. These reflections come along with unearthing contextual and internal factors that drive methodological decisions, as they ultimately shape scientific outcomes and consequently, the empirical evidence produced.

Comprehensive and inclusive evidence on the diversity of people-nature relationships demands research pluralism, necessitating a broad range of methodological approaches. Such methodological pluralism can be operationalized via deliberately varying methodological decisions guided by the normative stance of the researcher to make their research work for the good. This means not defaulting to the most dominant approaches and associated decisions but instead applying a diversity of approaches to balance the plural voices at play in collaboration, like in a team effort of composers. Embracing research pluralism requires researchers to acknowledge as well as to confidentially and agilely navigate diverse and potentially contradictory perspectives.

This includes perspectives both from the researchers themselves and the perspectives on people-nature relationships uncovered through (their) research. To bridge the gap between reflection and action, researchers must embark on a journey of learning, unlearning, and relearning. For those readers who want to draw inspiration from this research, this thesis dares offer a question for reflection and action: *How does, or will, your research contribute to balancing the plural voices at play?*

While critical methodological assessments and reflection are crucial to advancing an inclusive understanding of people-nature relationships, research on people-nature relationships will continue playing a pivotal role in informing conservation policymakers and practitioners to foster inclusive conservation. Yet, collaborative and participatory research approaches with conservation policymakers and practitioners, and other relevant non-academic partners might spark greater potential for achieving conservation success. Similar to researchers, a focus that has been consistently highlighted throughout this thesis, conservation policymakers and practitioners act driven by their values. Given the ubiquitous prioritization of a narrow range of market-oriented values in policies, their role as value-articulating institutions in shaping conservation policies and practices and their (in-)ability to diversify conservation strategies must not be overlooked. This will eventually impact how successfully the implications revealed by research, including this thesis, can be translated into actionable conservation strategies to ultimately bend the curve of biodiversity loss and improve the well-being of all.

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Chapter II Tourists' valuation of nature in protected areas: A systematic review

Milena Gross, Jasmine Pearson, Ugo Arbieu, Maraja Riechers,
Simon Thomsen, Berta Martín-López

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REVIEW

Tourists' valuation of nature in protected areas: A systematic review

Milena Gross, Jasmine Pearson, Ugo Arbieu, Maraja Riechers, Simon Thomsen, Berta Martín-López

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Abstract In the face of biodiversity loss, it is crucial to broaden the arguments for conservation of protected areas by acknowledging diverse values of nature. We systematically reviewed empirical studies to investigate tourists' values of nature in protected areas over time and across regions. To do so, we explored (1) the main ecological and social characteristics of the case studies; (2) methodological approaches; and (3) value types. Based on the review of 152 articles, we found that economic valuation has received the most scientific attention, while socio-cultural valuation approaches have recently increased. Values were primarily elicited and analyzed quantitatively and in monetary metrics, although valuation methods and frameworks have diversified over the past two decades. However, considering the role of valuation methods and frameworks as value-articulating institutions, we suggest that future research on nature valuation also applies qualitative and non-monetary methods, elicits diverse values, and conducts plural valuation.

Keywords Instrumental value · Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) · Intrinsic value · Relational value · The Economics of Ecosystems and Biodiversity (TEEB) · Total Economic Value (TEV)

INTRODUCTION

Despite the fact that protected areas are at the core of conservation efforts to bend the curve of biodiversity loss (Díaz et al. 2020), there is increasing pressure to provide economic justification for their existence (West et al. 2006; Balmford et al. 2009; do Val Simardi Beraldo Souza et al. 2018). One of the pivotal economic arguments is that nature-based tourism in protected areas has globally become one of the most rapidly growing economic sectors (Davenport et al. 2002; Buckley 2009; Balmford et al. 2015; Buckley et al. 2019). For example, the number of touristic visits to terrestrial protected areas is estimated to be 8000 million per year, which generates approximately USD 600 000 million annually in direct in-country expenditures (Balmford et al. 2015). Moreover, Buckley et al. (2019) calculated the economic value of protected areas through the improved mental health of tourists, resulting in USD 6 000 000 million per year as a conservative global estimation. Research has often determined the economic value of nature-based tourism by estimating the travel costs, tourists' willingness to pay to protect species, or to watch wildlife. For example, studies determined the economic value of wildlife species in Lake Nakuru National Park (Kenya) through the activity of tourism (Navrud and Mungatana 1994) and through tourists' willingness to pay for the protection of the Ethiopian wolf (Estifanos et al. 2021). In addition, several studies suggest that raising public awareness about the economic benefits of tourism in protected areas can contribute to increasing the investment for their conservation (Balmford et al. 2002; Bruner et al. 2004; McCarthy et al. 2012; Waldron et al. 2013).

The positive impacts of tourism in protected areas include, but are not limited to economic benefits. Tourists assign value to nature in protected areas in more ways than only in economic terms, for example, by expressing recreational or aesthetic values (Harmon 2004). In fact,

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nature-based tourism in protected areas can contribute to nurturing tourists' values of nature through direct experiences, such as recreational and touristic activities (Müller et al. 2019; Viirret et al. 2019) and aesthetic appreciation (Martínez Pastur et al. 2016; Gosal et al. 2018). For example, Yee et al. (2021) estimated the values of, among others, recreation and aesthetics in Tram Chim National Park (Vietnam) expressed by tourists. Conti and Lexhagen (2020) unraveled the recreational value of nature-based tourism in three Swedish national parks. In addition, researchers have demonstrated that these recreational and aesthetic experiences can promote people's care and stewardship for nature and hence, its conservation (Soga and Gaston 2016; Schild 2019), and can also nurture social relationships, when they are enjoyed as a collective (Chan et al. 2016).

Therefore, nature-based tourism in protected areas does not only offer economic arguments for their conservation, but is also important for non-economic reasons. Indeed, if a tourist is asked to value a given experience with nature, they might assign different values to that experience depending on which valuation method is used and how. For example, by investigating the assessment of 17 empirical valuation studies, Jacobs et al. (2018) demonstrated that no single valuation method could cover the whole range of values of nature and that each valuation method was suitable to elicit particular value types. In addition, most value types are embedded in three prevalent valuation frameworks: i.e., Total Economic Value (TEV) (Krutilla 1967; Pearce and Turner 1990), The Economics of Ecosystem Services and Biodiversity (TEEB) (TEEB 2010), and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) valuation framework (Díaz et al. 2015; Pascual et al. 2017). Therefore, the application of one or the other valuation framework also determines which values are elicited. For example, Martín-López et al. (2014) found that monetary valuation techniques embedded in TEV seemed to elicit the value of provisioning services, such as food and nature-based tourism, while socio-cultural valuation techniques promoted by TEEB appeared to unravel the value of regulating and cultural ecosystem services in Doñana Protected Area (Spain).

The TEV framework estimates the monetary value of nature by distinguishing between use and non-use values (Krutilla 1967; Pearce and Turner 1990). Use values refer to the consumption and enjoyment of nature through extractive and non-extractive experiences (i.e., direct use value); enjoyment of ecological processes (i.e., indirect use value); and potential use of nature in the future (i.e., option values). Non-use values refer to satisfaction that individuals derive from the existence of nature (i.e., existence value) and from knowing that other people can benefit from nature (i.e., bequest value) (Turner et al. 2003). The TEEB framework considers three value domains: biophysical, socio-cultural, and monetary (TEEB 2010). Finally, the IPBES framework conceptualizes three value types: nature as a means to human well-being (i.e., instrumental value); nature as an end in itself (i.e., intrinsic value); and the meaningfulness of human-nature relationships and social relationships mediated through nature (i.e., relational value) (Díaz et al. 2015; Pascual et al. 2017). Although these valuation frameworks are distinct, they can overlap since one value type embedded in a particular valuation framework might have a corresponding value in another. For example, Jacobs et al. (2018) found that the instrumental value (IPBES) was closely related with the direct and indirect use values (TEV) and economic value (TEEB).

Since tourists can value nature in protected areas in different ways, it is essential to understand how the choice of the valuation method(s) and framework influences the elicited values, which in turn can lead to different arguments for the conservation of protected areas. Therefore, the overall objective of our review is to assess how scientific studies have approached nature valuation by tourists in protected areas over time and across regions. Specifically, we seek to answer three research questions: (1) What are the main ecological and social characteristics of case studies on tourists' values of nature in protected areas? (2) Which methods were applied to elicit and analyze tourists' values of nature in protected areas? (3) Which values (embedded in the three valuation frameworks) of nature in protected areas were investigated for tourists in the scientific literature? Finally, we identify the key research gaps and priorities to foster future research on tourists' valuation of nature in protected areas, which can ultimately provide insights for the conservation of protected areas.

METHODS

Review process

We conducted a systematic literature review[1] of peer-reviewed scientific articles published in English on tourists' valuation of nature in protected areas, using the Scopus database. The review procedure followed the key steps recommended by Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al. 2009; Page et al. 2021) and the empirically validated review protocol by Luederitz et al. (2016) (Fig. 1, Supp. Materials S1 and S2).

The review followed a strict protocol of searching and inclusion criteria of articles to guarantee transparency and minimize bias. We chose the Scopus database in line with other systematic reviews in the field of human-nature

[1] This review was not registered.

interactions (Evers et al. 2018; Ferreira et al. 2020; Longato et al. 2021). We developed a search string that combined different terms related to tourists (i.e., touris* OR recreation* OR leisure OR travel* OR trip* OR journey*), value (i.e., *valu*), and protected areas (i.e., "protected area*" OR "protected landscape*" OR "biosphere reserve*" OR "nature reserve*" OR "natural monument*" OR "national park*" OR "natural park*" OR "biosphere area*" OR "conservation area*" OR "biosphere region*") (full search string in Supp. Material S2).

The search was applied to title, abstract, and keywords of peer-reviewed articles published in English until June 2021, resulting in 2526 articles. Although including scientific articles published in English can create a bias towards studies from countries with more resources for publishing in English-language journals, this is common for systematic reviews in the research field of human-nature interactions (Haase et al. 2014; Martín-López et al. 2019; Johnson et al. 2022; Vercillo et al. 2022). To ensure scientific quality based on peer-review process, we did not consider book chapters and conference proceedings (Haase et al. 2014; Martín-López et al. 2019; Johnson et al. 2022).

To identify relevant studies out of the 2526 articles, we applied five inclusion criteria. We selected articles that empirically (criterion 1) investigated values (criterion 2) of nature (criterion 3) in protected areas (criterion 4) expressed by tourists (criterion 5). To guarantee the use of empirical data (criterion 1) and to avoid redundancy (Pullin and Stewart 2006), we excluded reviews (five inclusion criteria described in Supp. Material S3).

We identified 846 articles as eligible for full text screening after examining the title and abstract based on

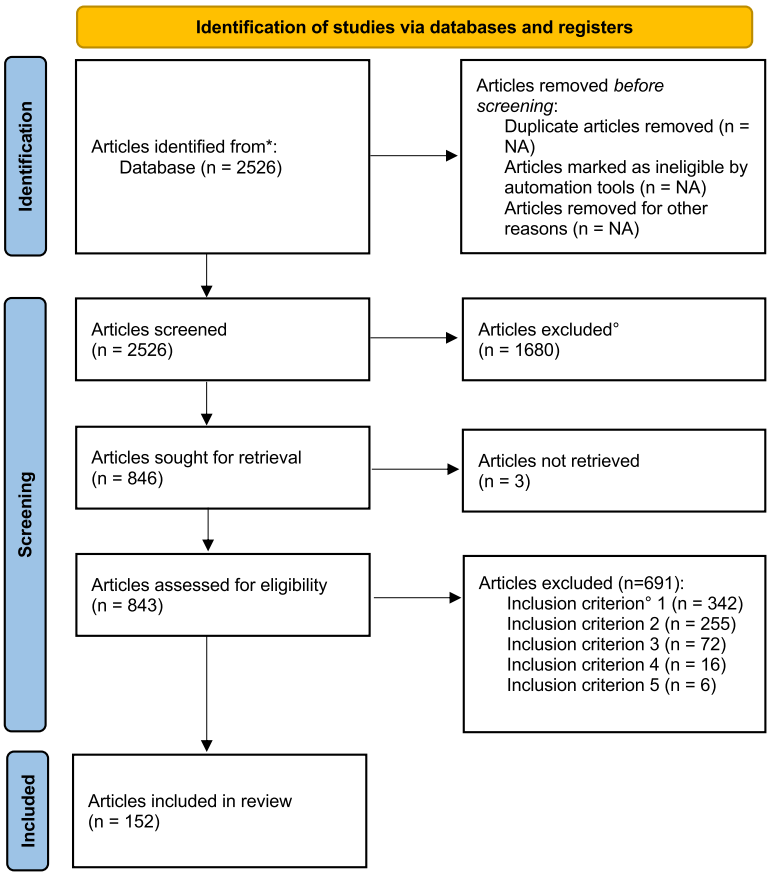

Fig. 1 Flow diagram for the systematic review, based on Moher et al. (2009). * Search string (full search string in Supp. Material Table S2); ° Inclusion criteria (logic behind the inclusion criteria in Supp. Material S3)

the above-mentioned five criteria. If the full text was not accessible, we contacted authors of the respective articles through email and ResearchGate,[2] if possible. Due to lack of access, we excluded three articles. After screening the full text of the remaining 843 articles, 152 articles fulfilled the five inclusion criteria and hence, were selected for in-depth analysis. Supp. Material S4 presents the list of articles considered in the systematic review.

Following a deductive-inductive two-step procedure, we developed a coding scheme to organize the database. We identified five sets of variables that represent the main topics of this review: (1) meta-information of the article; (2) biogeographical information of the empirical case studies; (3) valuation information; (4) information on data gathering and analysis; and (5) information on values. The final coding scheme consisted of 18 categories of variables. Information on categories (e.g., type of ecosystem) that could not be retrieved from the article was reinvestigated through searching reliable online sources. To categorize the value type and valuation framework, we extracted the information directly from the article. However, for those articles that did not explicitly state the value type(s) or valuation framework(s) used, we assigned them a posteriori. For example, if an article applied contingent valuation to estimate the willingness to pay to visit a protected area, we considered the value as economic value (TEEB). This economic value could also be classified as instrumental value (IPBES). However, since willingness to pay does not necessarily refer to the importance of nature as a means to an end (i.e., instrumental value), we classified willingness to pay as economic value only. Regarding non-economic values, for which the valuation framework was not stated, we generally classified them as a socio-cultural value (TEEB) (Rossi et al. 2020). Only if more information was given in the paper, we assigned a specific value type. For instance, we classified tourists' values regarding opportunities for recreation as recreational value (Müller et al. 2019). Since specific information on value types and frameworks was lacking for most articles, our results might therefore be biased towards TEEB (coding scheme described in Supp. Materials S5 and S6). In addition, we conducted qualitative content analysis to associate the value types with the three valuation frameworks. Supp. Material Table S10 presents quotes from the reviewed articles that reflect the association.

Five authors were involved in the coding. We accounted for inter-coder reliability by taking three measures. First, each author coded five articles individually. Then, results and questions were collaboratively discussed to deepen the mutual understanding of the coding scheme and to maximize coherence in the coding process. Second, the remaining articles were distributed among the five authors who then coded each article individually. Each author stated their coding confidence for each of the five sets of categories and added remarks and questions, if any. The first author reviewed them and discussed them with the other authors, if necessary. Third, the first author reviewed the data entries for coherence.

[2] https://www.researchgate.net/.

Data synthesis and quantitative analysis

For the variables used to answer the three research questions, we calculated the frequencies of articles (Table 1). In addition, we used the variables 'location of protected area' and 'latitude and longitude of the protected area' to spatially represent the scientific literature on tourists' valuation of nature in protected areas. Moreover, we compared the regional share of articles found in this review with the relative share of protected areas worldwide. To do so, we collected the information on protected areas worldwide from the World Database on Protected Areas (WDPA) (IUCN and UNEP-WCMC 2022).

We conducted a correspondence analysis (CA) with FactorMineR package (Lê et al. 2008) in RStudio (RStudio Team 2021) to explore the relationship between valuation methods and value types. CA allows investigating relationships among qualitative variables and has been broadly used in the field of human-nature interactions (Teixeira et al. 2019; Valente et al. 2020; Cifuentes-Espinosa et al. 2021). We excluded data for which the frequency was lower than four cases (e.g., narrative analysis (n = 3) and instrumental value (n = 2)) to reduce biases. This exclusion process was adopted in other multivariate statistics to explore relationships between variables in systematic reviews (Quintas-Soriano et al. 2022). We visualized the CA results in a biplot representing the scores of the first and second axes.

RESULTS

Temporal trend and regional distribution

We identified an increasing trend of empirical research on tourists' valuation of nature in protected areas from 1977 to 2021, in which different valuation techniques were used (Fig. 2). Economic valuation (n = 108 of all articles; 71%) was most frequently applied compared to socio-cultural valuation (n = 36; 24%) and a mixed approach (n = 8; 5%). Based on the release dates of the three valuation frameworks (i.e., TEV, TEEB, and IPBES), we distinguished three periods (Fig. 2). The first period (1977–2010), influenced by TEV, comprised 33 articles that mainly applied economic valuation (91%). The second period

Table 1 Overview of the variables analyzed to meet the overall objective and answer the research questions

Research questions	Variables analyzed
Meta-information of nature valuation by tourists in protected areas over time and across regions	Year of publication; Region of protected area
(1) Main ecological and social characteristics	Ecosystem of protected area; Object of value: nature; Object of value: non- natural elements Target social group; Main objective of article to conduct valuation
(2) Methods applied to elicit and analyze values	Classification of valuation technique/method; Broad method of valuation; Specific valuation method; Data type in value elicitation process; Value metric in value elicitation process; Data type in data analysis; Value metric in data analysis
(3) Values investigated	Value type

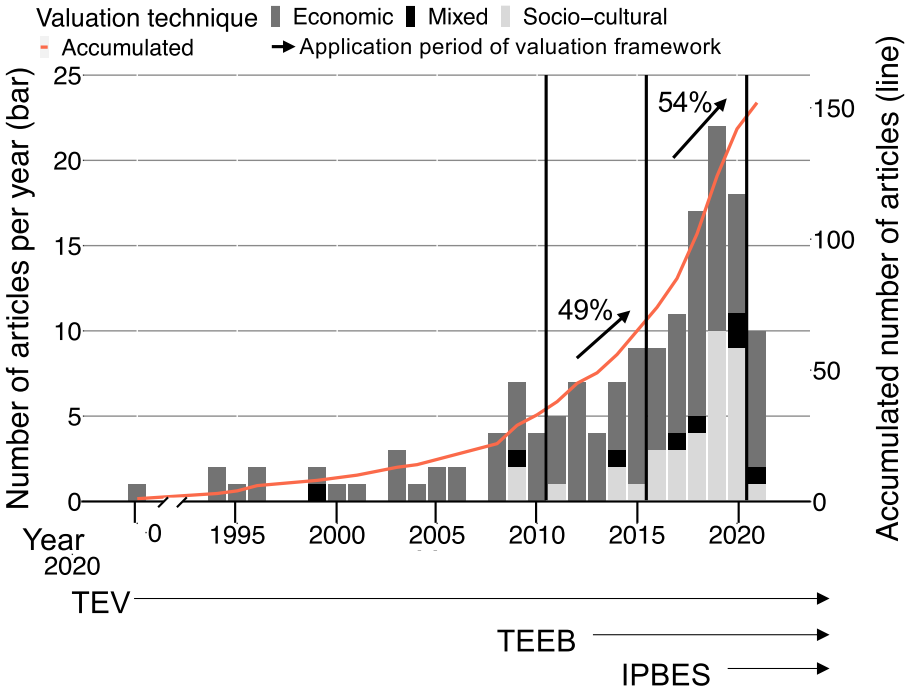

Fig. 2 Temporal distribution of 152 articles published on tourists' valuation of nature per year (bars and left *Y* axis) and accumulated number of articles (red line and right *Y* axis). Since we considered articles published until 23 June, 2021 (when the search was done), the actual number of articles issued in 2021 might be higher. *TEV* the Total Economic Value; *TEEB* The Economics of Ecosystems and Biodiversity; *IPBES* the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

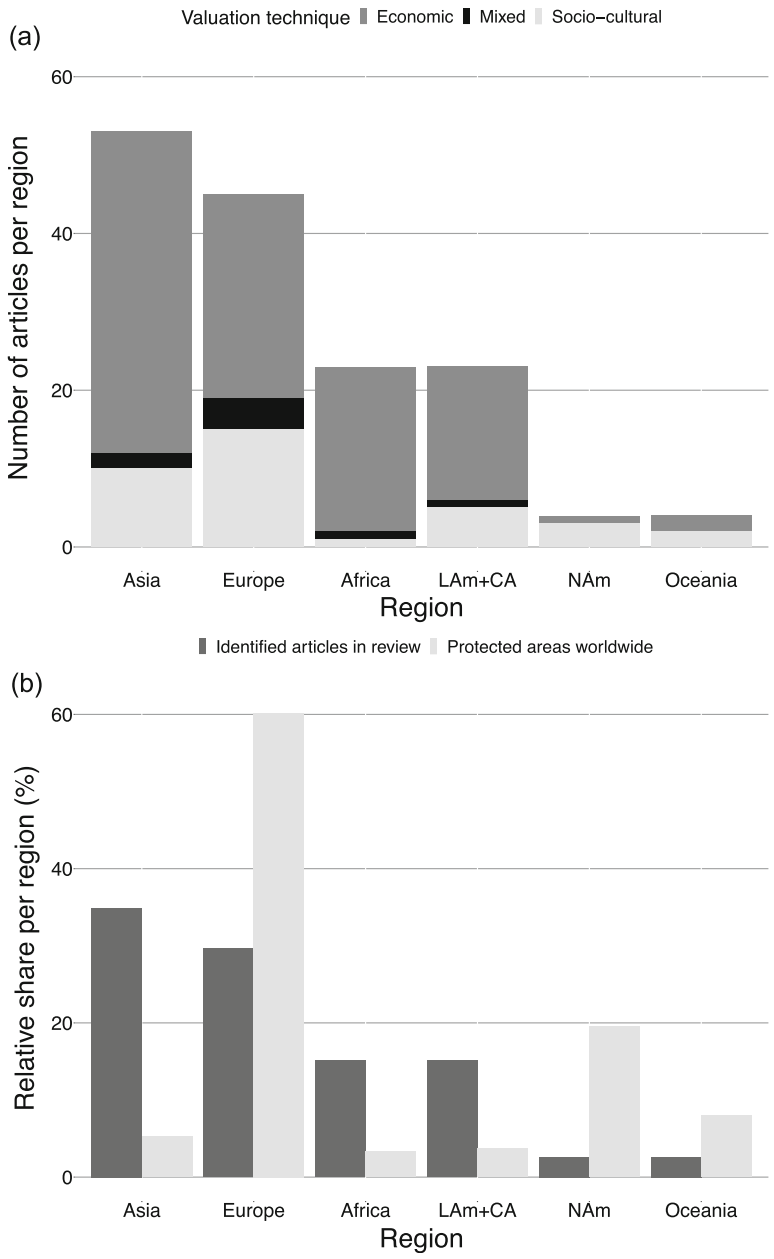

Fig. 3 Regional distribution of 152 articles published on tourists' valuation of nature. (**a**) Absolute number of articles per region and valuation techniques applied. (**b**) Regional share (%) of identified articles in this review (dark grey) and of protected areas worldwide (light grey). Information on numbers of protected areas worldwide was sourced from the World Database on Protected Areas (WDPA) (IUCN and UNEP-WCMC 2022). *LAm+CA* Latin America and the Caribbean; *NAm* North America

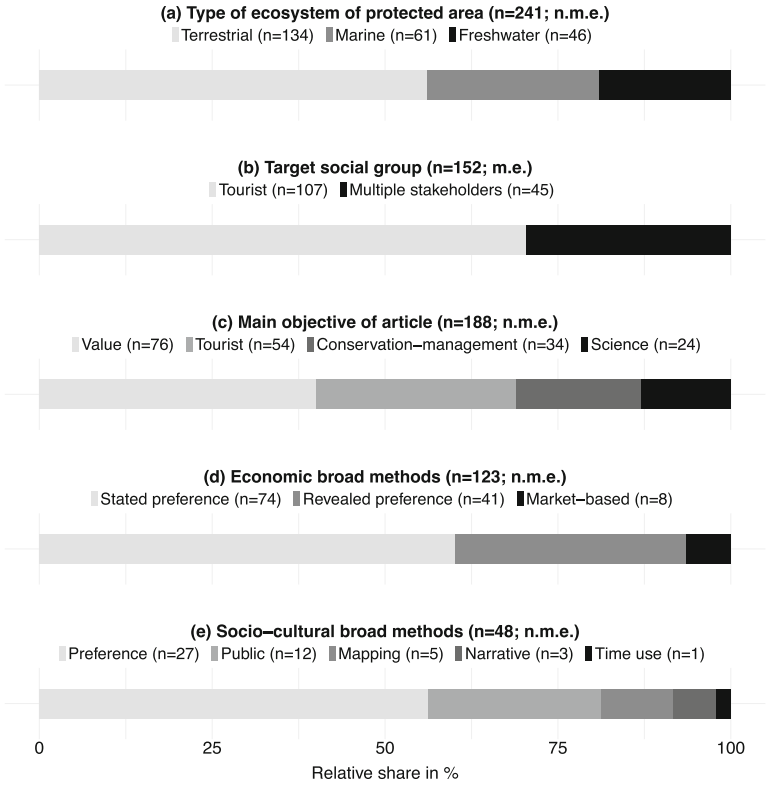

Fig. 4 Descriptive overview of the ecological and social characteristics of the valuation exercises (**a**–**c**) and broad methods of articles reviewed (**d**-**e**), as resulted from the qualitative content analysis of n = 152 articles. (**a**) Type of ecosystem. (**b**) Target social group. (**c**) Main objective of the article. Labels of the main objective of articles indicate their orientation (e.g., 'value' means value-oriented). (**d**) Economic valuation methods applied. (**e**) Socio-cultural valuation methods applied. *Preference* Preference assessment; *Public* Public methods; *Mapping* (Participatory) Mapping; *Narrative* Narrative analysis. The broad socio-cultural method(s) of three articles could not be specified and thus, they are not displayed. Absolute frequency (n) and relative share (bar) of each (sub-)category are presented. *n* absolute frequency of (sub-)category; *n.m.e.* Data are not mutually exclusive; *m.e.* Data are mutually exclusive

(2011 to 2015), influenced by TEEB, comprised 32 articles that mainly used economic valuation (84%). The third period (2016-2020), influenced by IPBES, included 77 articles. In this period, we found a remarkable increase of articles using socio-cultural valuation (38%). The number of articles in the second period increased by +49% compared to the previous five years (2006–2010) and by +54% in the third compared to the second period (Fig. 2).

Tourists' valuation of nature in protected areas was researched across the major regions of the world, but with an uneven distribution (Fig. 3a). Many articles focused on protected areas in Asia (n = 53 articles; 35% of all articles) and Europe (n = 45; 30%), while only four articles (3%) targeted protected areas in North America, although these articles investigated up to 38 protected areas (geographical overview of the protected areas represented in Supp. Material Fig. S1). Comparing the regional share of articles with the number of protected areas per region, tourists' valuation of nature was more studied in Asia, Africa, and Latin America and the Caribbean, but less in Europe, North America, and Oceania (Fig. 3b). Economic and socio-cultural valuation techniques were applied across all regions but with some regional differences (Fig. 3a). While tourists' value of nature in African protected areas was rarely studied with socio-cultural valuation methods (n = 1; 4% of all methods used in Africa), these techniques were applied above average in Europe (33%; n = 15), North America (75%; n = 3), and Oceania (50%; n = 2). Economic valuation was the most frequently applied technique in Asia (77%; n = 41 of all methods used in Asia), Europe

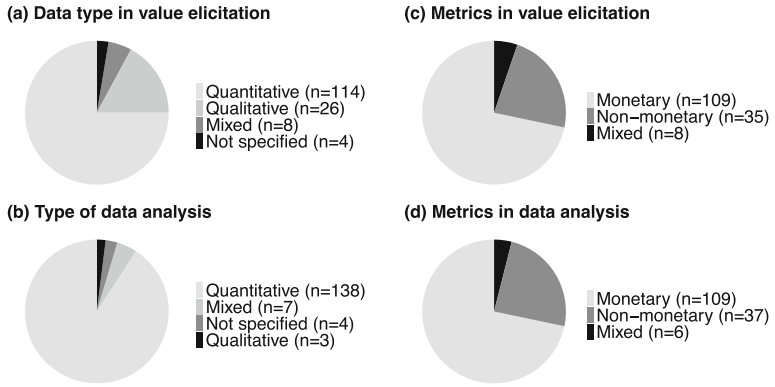

Fig. 5 Descriptive overview of (**a**) data type and (**b**) metrics in value elicitation, (**c**) type of data analysis and (**d**) metrics in data analysis, as resulted from the qualitative content analysis of n = 152 articles. Data are mutually exclusive. n absolute frequency of sub-category

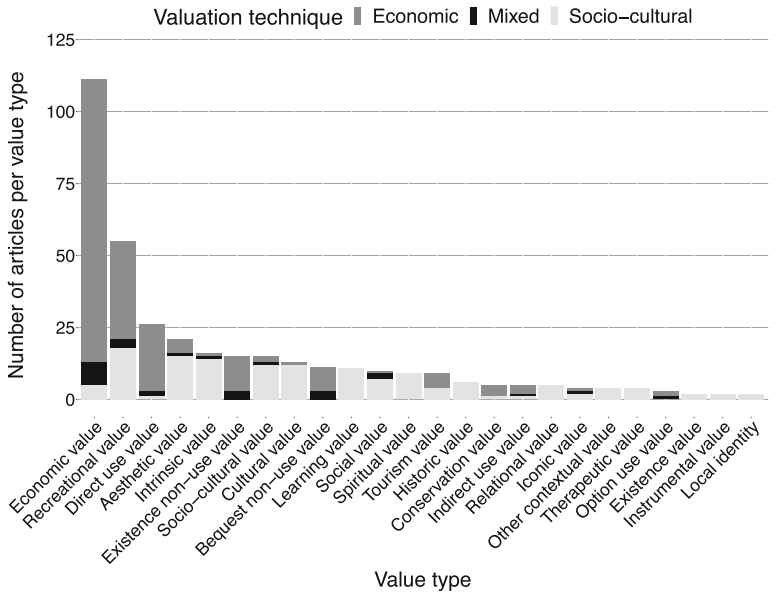

Fig. 6 Descriptive overview of value type and valuation techniques, as resulted from the qualitative content analysis of n = 152 articles. The different valuation techniques applied per value type are indicated with the different colors in the bars. 'Other contextual values' refers to, for instance, future (n = 2) and eudemonic value (n = 1). Data are not mutually exclusive

(58%; n = 26), Africa (91%; n = 21), and Latin America and the Caribbean (74%; n = 17).

Ecological and social characteristics of case studies

For ecological characteristics, we found that tourists' valuation took place in protected areas with various ecosystems. Terrestrial ecosystems were more studied (n = 134; 88%) than marine (n = 61; 40%) and freshwater ecosystems (n = 46; 30%) (Fig. 4a).

We also found that the natural element mostly chosen as object of valuation was the protected area itself (n = 100; 21% of all investigated natural elements), followed by cultural ecosystem services/non-material nature's contributions to people (NCP) (n = 61; 13%), land-/seascape (n = 29; 6%), and iconic animal species (n = 20; 4%) (Supp.

Valuation framework / Value type	TEV		TEEB		IPBES		
	Use	Non-use	Economic	Socio-cultural	Intrinsic	Relational	Instrumental
Economic	■	■	■	□			■
Recreational	■		■	■		⊡	⊡
Direct use	■		■	⊡			■
Aesthetic	■		■	■		⊡	⊡
Existence		■	■	■	⊡	⊡	⊡
Intrinsic		□	□	⊡	■		
Socio-cultural				■	⊡	⊡	⊡
Cultural	□	□	□	■	□	■	□
Bequest (Non-use)		■	■	■			□
Learning	□		□	■		⊡	⊡
Social	□	□	□	■	□	■	□
Tourism	■		■	■		⊡	⊡
Spiritual	□		□	■		■	■
Indirect	■		■	⊡			■
Conservation	□	□	■	■	⊡	⊡	⊡
Historical			□	■		■	■
Relational				■		■	
Iconic		⊡	⊡	■	■		
Therapeutic	□		□	■		■	□
Option (Use)	■		■	■			■
Instrumental	■	⊡	■	■			■
Local identity	□		□	■		■	□

■ **High association** | ⊡ **Medium association** | □ **Low association** | blank **No association**

Fig. 7 Association between value types identified in the literature review on tourists' valuation of nature in protected areas and the value types embedded in the valuation frameworks of the Total Economic Value (TEV), The Economics of Ecosystems and Biodiversity (TEEB), and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Biophysical values according to TEEB are not considered because they cannot be expressed by tourists. Supp. Material Table S10 presents the quotes found in the literature of this systematic review that prove the association between value types and valuation frameworks as found in the reviewed articles

Material Table S7). Additionally, 41 articles (27%) valued elements that are not derived from nature, such as interpretive signs and improved walking trails (Supp. Material Table S8).

Regarding the social characteristics of the studies, 70% (n = 107) of the articles only targeted tourists, whereas the remaining articles (n = 45; 30%) elicited the value(s) of tourists and other stakeholders, such as local people and conservation managers (Fig. 4b). Moreover, we identified

that the main objective of the studies was primarily value-oriented (n=76; 40% of all investigated main objectives) and tourist-oriented (*n* = 54; 29%), followed by conservation-management-oriented (*n* = 34; 18%) and science-oriented (*n* = 24; 13%) (Fig. 4c).

Methodological approaches of the case studies

Valuation methods

Economic valuation studies applied three different families of methods (i.e., broad methods): stated preference (*n* = 74; 60% of all economic broad methods applied), revealed preference (*n* = 41; 33%), and market-based methods (*n* = 8; 7%) (Fig. 4d). Within stated preference methods, 57 articles (46% of all economic specific methods applied) used contingent valuation and 17 articles applied choice experiment (14%) (Supp. Material Table S9)

Concerning socio-cultural valuation, articles used five broad methods: preference assessment (*n* = 27; 53% of all socio-cultural broad methods applied), public methods (*n* = 12; 23%), (participatory) mapping (*n* = 5; 10%), narrative analysis (*n* = 3; 6%), and time use method (*n* = 1; 2%) (Fig. 4e). The specific method used within preference assessment was ranking/rating (*n* = 27; 50% of all socio-cultural specific methods applied). Within the broad method of (participatory) mapping, three out of five articles specifically applied Public Participation Geographic Information Systems (PPGIS). Regarding public methods, studies applied photo-series analysis (*n* = 12; 22%) and netnography (*n* = 3; 6%) alongside photo-series analysis.

Regarding mixed approaches, only eight articles (5% of all articles) applied both economic and socio-cultural valuation. There were few cases in which two families of broad economic or socio-cultural methods were applied. Nine articles (8% of all articles that applied economic valuation) applied two broad economic methods in the same study: stated preference and revealed preference methods (*n* = 6), stated preference and market-based methods (*n* = 2), and revealed preference and market-based methods (*n* = 1). Five articles (14% of all articles that applied socio-cultural valuation) applied two socio-cultural broad methods: (participatory) mapping and preference assessment (*n* = 3), narrative analysis and public methods (*n* = 1), and narrative analysis and preference assessment (*n* = 1).

Data collection and analysis

Most articles collected quantitative data (*n* = 114; 75% of all articles), followed by qualitative data (*n* = 26; 17%) and both data types (*n* = 8; 5%) (Fig. 5a). Similarly, the majority of articles also conducted quantitative data analyses (*n* = 138; 91%), followed by mixed (i.e., quantitative

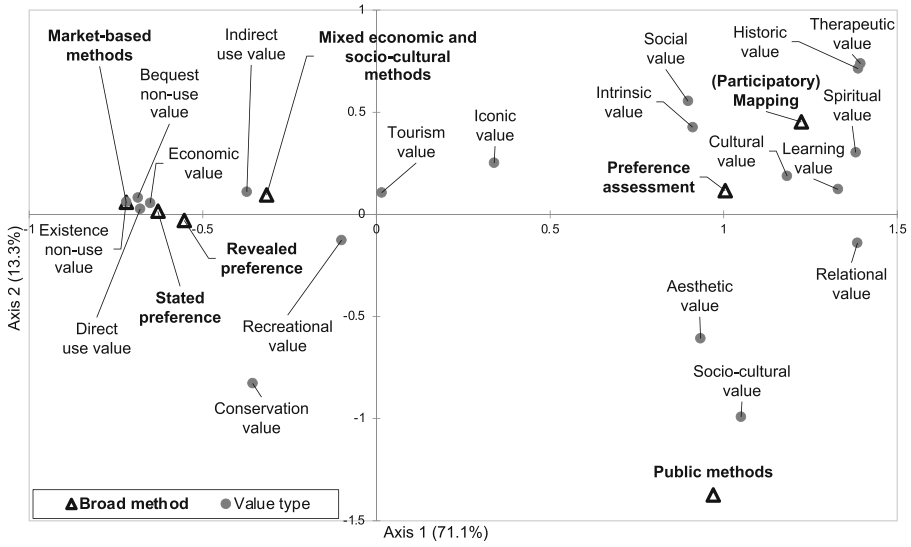

Fig. 8 Biplot of the first two axes of the correspondence analysis showing the relations between broad families of valuation methods and value types. Data for which the number of sub-categories was lower than four cases (narrative analysis (*n* = 3) and instrumental value (*n* = 2)) were excluded to reduce biases

and qualitative; n = 7; 5%) and qualitative data analyses (n = 3; 2%) (Fig. 5b). Some articles that collected qualitative data transformed the data to run quantitative analyses. For example, qualitatively extracted information from Likert scales was translated into quantitative information to compute statistical analyses, such as ANOVA test (e.g., van Marwijk et al. 2012) and Spearman rho correlation (e.g., Chakrabarty et al. 2019).

Most articles elicited values in monetary metrics (n = 109; 72%), followed by non-monetary (n = 35; 23%) and both metrics (n = 8; 5%) (Fig. 5c). The metric was usually not changed between the data collection and data analysis with a few exceptions (Fig. 5c, d). For example, Chen et al. (2019) and Zhang et al. (2019) asked respondents to rank social values by distributing monetary values, which were then converted to non-monetary values in the data analysis.

Value types and valuation frameworks

Literature on tourists' valuation of nature in protected areas referred to 24 different value types (Fig. 6). Economic value (n = 111; 30% of all identified value types) received the most scientific attention, followed by recreational (n = 55; 15%), direct use (n = 26; 7%), and aesthetic values (n = 21; 6%). Importantly, when eliciting specific value types, articles did not explicitly refer to a valuation framework. Yet, the different value types identified in the review could be associated with different value types embedded in the three valuation frameworks (i.e., TEV, TEEB, and IPBES) (Fig. 7). For example, recreational value could be associated with value types within all three valuation frameworks, that is, direct use value (TEV), economic and socio-cultural values (TEEB), and relational and instrumental values (IPBES). Supp. Material Table S10 shows a compilation of exemplary quotes found in the reviewed literature that represent the associations between value types and valuation frameworks.

Most value types were elicited through both economic and socio-cultural valuation techniques. However, there were specific value types that were elicited by applying particular socio-cultural valuation techniques (Fig. 6). For example, spiritual, historic, and therapeutic values were elicited by applying only ranking (e.g., Apps et al. 2019; Chen et al. 2019) and mapping (e.g., Zhang et al. 2019). Although economic value was mainly elicited with economic valuation techniques, there were studies that applied socio-cultural valuation to uncover tourists' economic value of nature in protected areas using the specific methods of ranking (e.g., Apps et al. 2019; Chen et al. 2019), rating (e.g., Mrotek et al. 2019), and mapping (e.g., Zhang et al. 2019). Moreover, value types that were originally embedded within TEV framework were primarily elicited with economic valuation techniques, with one notable exception: Apps et al. (2019) used the TEV framework, while applying the socio-cultural method of preference assessment. The application of socio-cultural valuation methods to elicit TEV values illustrates the connection between TEV and the socio-cultural value embedded in the TEEB framework (Fig. 7). For example, the direct use value of recreation (TEV) can be elicited by asking how much additional time a tourist is willing to travel to reach a protected area (e.g., Heyes and Heyes 1999), which represents a non-monetary metric and is considered a socio-cultural value under TEEB. See Supp. Material Table S10 for the specific quote that demonstrates this association.

Relations between value types and valuation methods

The correspondence analysis showed relations between broad families of valuation methods and specific value types, indicating a clear separation between economic and socio-cultural valuation methods and the value types elicited (Fig. 8). The first two factorial axes of the CA accumulated 84.4% of the total inertia. The first axis (71.1% of inertia) separated the two families of methods (i.e., economic and socio-cultural valuation methods) and specific value types. The negative scores of axis 1 represented economic valuation techniques and TEV, economic, and conservation values. The positive scores of axis 1 portrayed socio-cultural valuation techniques and many non-economic values, such as therapeutic, historical, relational, learning, and cultural value (Fig. 8). The second axis (13.3% of inertia) distinguished between the application of (participatory) mapping and public methods, both socio-cultural methods. The positive scores represented the application of (participatory) mapping and the elicitation of therapeutic, historical, and social values, whereas the negative scores portrayed the application of public methods and the elicitation of socio-cultural, conservation, and aesthetic values.

DISCUSSION

Trends, distribution, and research gaps in tourists' valuation of nature in protected areas

Tourists' valuation of nature in protected areas over time

Our results demonstrate an increase of studies on tourists' valuation of nature in protected areas over the last decade (Fig. 2). This increasing trend is consistent with previous systematic reviews focusing on valuation of ecosystem services/nature's contributions to people (Haase et al.

2014; Acharya et al. 2019; Rau et al. 2020). Moreover, while previous research reviewing valuation of ecosystem services/nature's contributions to people showed a stabilization of publications since 2015 (Martín-López et al. 2019), our review indicates an increasing trend in recent years of +54% in the last five years.

The temporal trend identified in this review also shows that economic valuation was predominant until 2015 and that there was an increase of socio-cultural valuation over the last five years (Fig. 2). These findings align with previous reviews demonstrating a dominance of economic valuation until 2010 (Gómez-Baggethun et al. 2010; Nieto-Romero et al. 2014; Chaudhary et al. 2015; Hackbart et al. 2017), while more interdisciplinary research by applying socio-cultural valuation has emerged in the last decade (Chaudhary et al. 2015; Acharya et al. 2019; Martín-López et al. 2019). In fact, socio-cultural valuation studies became most prominent after the release of the TEEB report (TEEB 2010) and even more so after the release of the IPBES conceptual framework that specifically advocated for diverse values and valuation of nature (Díaz et al. 2015). Hence, one might argue that such international initiatives are a crucial driving force not only for compiling research and delivering guidance to policy-makers, but also for setting the research agenda. Moreover, the increase in socio-cultural valuation of protected areas goes along with the increasing inclusion of social science research for the management and conservation of protected areas (Palomo et al. 2014; Gruby et al. 2016; Ghoddousi et al. 2022).

Despite these recent developments, our results clearly show an overall bias towards monetary values and quantitative approaches (Fig. 5) that can be explained by two main reasons. First, the prominent pressure to provide economic justification for the conservation of protected areas (West et al. 2006; Balmford et al. 2009; do Val Simardi Beraldo Souza et al. 2018) might have encouraged researchers to focus on providing evidence of the economic importance of nature-based tourism in protected areas (Thur 2010; Gelcich et al. 2013; Aseres and Sira 2020). For example, Witt (2019) applied contingent valuation method to investigate tourists' willingness to pay for increased entrance fees in five Mexican protected areas. Soe Zin et al. (2019) estimated the annual recreational expenditure by tourists to elicit the economic value of cultural ecosystem services in Popa Mountain National Park (Myanmar). Second, the TEV framework in the research agenda fit with institutional economic structures based on market-based strategies (Gómez-Baggethun et al. 2010). For example, Chiou et al. (2016) applied contingent valuation to estimate tourists' willingness to pay an entrance price in the Taitung Forest Park (Taiwan) to inform the Taitung Forest Park Administration Office about potential price making. The predominant economic logic in decision-making and management of protected areas might have prioritized the use of economic valuation and elicitation of economic values, often at the expense of the broad spectrum of other values. Corresponding with these results, the IPBES assessment highlights that the predominant economic decisions have generally fostered a narrow suite of instrumental values, particularly of those nature's contributions to people that are traded in markets, obscuring those non-market instrumental, relational, and intrinsic values (IPBES 2022). Since it has been proved that economic valuation fails to represent the diverse ways by which people value nature (Jacobs et al. 2016, 2018), recent voices from IPBES have called for plural valuation (Pascual et al. 2017; IPBES 2022). Our results show that there is ample room for a stronger integration of methods from the social sciences and humanities. This integration would promote a more comprehensive understanding of the diverse values of nature, which might help to raise awareness of the importance of protected areas and to provide a greater diversity of arguments for their conservation and potential expansion.

Tourists' valuation of nature in protected areas across regions

Research on tourists' valuation of nature in protected areas has given major attention to protected areas in Asia, Africa, and Latin America and the Caribbean and focused less on protected areas in Europe, North America, and Oceania (Fig. 3b). This contrasts to some extent the findings of the IPBES assessment which concluded that most valuation studies have been conducted in the Americas, Asia, Oceania, and Europe (IPBES 2022).

When comparing the regional share of articles identified in the review with the relative distribution of protected areas across regions, we found that usually overstudied regions, such as Europe and North America, are comparatively understudied in tourists' valuation of nature, whereas Asia, Africa, and Latin America and the Caribbean were overstudied (Fig. 3b). Moreover, our result implied a discrepancy between researched study areas and tourist interest in visiting protected areas considering the findings by Balmford et al. (2015). They estimated the number of visits to terrestrial protected areas based on the annual visit rate in each country from 1998 to 2007. While their results showed that Europe, North America, and Asia/Oceania are the regions of the world whose terrestrial protected areas received the highest visit rates, we found that these regions are relatively underrepresented in the research on tourists' valuation of nature. We also found a low number of articles focusing on regions with high biodiversity, such as Africa, where the need for biodiversity conservation is high and nature-based tourism is

essential for the livelihood security of local people (Sekar et al. 2014; Chung 2018).

Finally, our results suggested a bias towards the application of socio-cultural valuation in the Global North compared to the Global South (Fig. 3a). While studies in Africa applied socio-cultural valuation methods 20% less than the average application worldwide, studies in Europe applied them 9% more. The focus on economic valuation techniques in the Global South might be related to the fact that biodiversity conservation in protected areas tend to rely more strongly on revenues from nature-based tourism than those in the Global North. For example, in the Philippines, the National Ecotourism Strategy aims to integrate biodiversity conservation into ecotourism development and the funding mechanism for biodiversity conservation in protected areas (i.e., Integrated Protected Area Fund). The strategy is designed to ensure that visitor fees in protected areas are used for biodiversity conservation (Catibog-Sinha 2010). Yet, this bias could imply an underrepresentation of the non-economic values that tourists might hold on nature in protected areas in the Global South, which in turn could lead to an under-appreciation of these values in biodiversity conservation and protected area management. Here, we encourage the scientific community to elicit values of nature in those underrepresented regions by applying both economic and socio-cultural valuation. This is particularly important for protected areas in the Global South that attract a high number of tourists and where local people highly depend on the tourism sector for their livelihood security.

Tourists' valuation of nature: What, who, and why?

Most literature on tourists' valuation of nature focused, in addition to the protected area itself, on non-material nature's contributions to people and land-/seascapes (Supp. Material Table S7). The focus on these natural elements can explain why most of the research elicited recreational, direct use, and aesthetic values (in addition to economic values; Fig. 6). This echoes former reviews on cultural ecosystem services research which showed that recreation, tourism, and aesthetics are the most studied ecosystem services (Hernández-Morcillo et al. 2013; Milcu et al. 2013). Studies on land-/seascape perceptions are highly linked with eliciting aesthetic values, explaining the overrepresentation of both in the literature (Bogdan et al. 2019; Müller et al. 2019; Piñeiro-Corbeira et al. 2020). This result supports the findings by Hernández-Morcillo et al. (2013) who found that assessing landscapes retrospectively to identify the aesthetic values was a common method (Barthel et al. 2005; Vejre et al. 2010). In addition, reviews on ecosystem service research found that economic valuation techniques, particularly contingent valuation, are the most applied to measure recreational values (Hernández-Morcillo et al. 2013; Milcu et al. 2013). This can explain the bias towards non-material nature's contributions to people and land-/seascapes as well as recreational, direct use, and aesthetic values, in addition to the high number of economic values due to frequent application of economic valuation methods.

Regarding those who are targeted in the valuation exercises, only a third of the articles investigated the values of other social groups in addition to tourists (Fig. 4b). Recently, it has been argued that it is crucial to include multiple social groups to increase the success of conservation efforts in protected areas and mitigate potential conflicts among stakeholders (Kovács et al. 2015; Jacobs et al. 2016; Riechers et al. 2018). In addition, the consideration of the values of multiple stakeholders with different needs, interests, and worldviews is needed to represent the different voices in decision-making and management of protected areas (Jacobs et al. 2016, 2018). Here, we call for the inclusion of diverse stakeholder groups, such as tourists, local communities, and conservation managers, in future research on nature's values in protected areas.

Finally, we found that the main objective of most studies on tourists' values was value-oriented, aiming to compare values of different natural elements (Saayman and Saayman 2017; Robles-Zavala and Chang Reynoso 2018; Witt 2019) or elicit specific values derived from the protected area (Samdin et al. 2013; Dagiliūtė et al. 2017) (Fig. 4c). The second most frequent goal was tourist-oriented, whereby researchers aimed to identify the socio-economic or cultural characteristics of tourists that influence their value(s) (Queiroz et al. 2014; Pickering et al. 2020). Conservation management was the third most frequent research goal, through which researchers aim to provide guidelines for the conservation, management, and planning of the protected area (Can and Alp 2012; Saayman and Saayman 2014; Daly et al. 2015; Karahalil et al. 2015). Finally, science-oriented articles focused on the comparison of valuation methods or the development of conceptual frameworks (Font 2000; Walpole et al. 2001; Rossi et al. 2020).

Recent empirical research conducted in several case studies in the Global South have proved that when nature valuation aims to guide action on conservation and sustainability (i.e., conservation-management-oriented), research did not only succeed to elicit different values (for which different valuation methods are required), but also promote sustainability and environmental justice (Zafra-Calvo et al. 2020). For example, in Xalapa (Mexico), plural valuation was embedded in participatory action research and led to promote collective management of the protected area with successful conservation outcomes (Zafra-Calvo et al. 2020). In contrast, in the Otún watershed (Colombia),

research on plural valuation did not lead to the inclusion of different stakeholder views in management plans (Arias-Arévalo et al. 2017). Therefore, we suggest that, if the valuation exercise seeks to contribute to nature conservation management, future research needs to move from economic valuation methods that only consult stakeholders to participatory valuation methods that actively engage with different stakeholders through transdisciplinary research approaches.

Methods as value-articulating institutions

Research on tourists' values of nature in protected areas was skewed towards quantitative and monetary data collection and consequently, most data were analyzed quantitatively (Fig. 5). Moreover, economic valuation focused particularly on eliciting economic (TEEB) and TEV values (Fig. 6). In addition, our results show that the choice of the valuation method determined the value type elicited (Fig. 8). This finding supports recent empirical evidence which demonstrated that valuation methods act as value-articulating institutions (Martín-López et al. 2014; Jacobs et al. 2018). This is consistent with previous theoretical debates which argue that valuation methods are not neutral and valuation itself acts as a value-articulating institution (Vatn and Bromley 1994; Vatn 2005). In fact, the choice of the method is as important as the output itself because methods do not simply 'elicit', but also 'create' values (Gómez-Baggethun and Ruiz-Pérez 2011; Martín-López et al. 2014). Therefore, to recognize the broad scope of values of nature in protected areas, we need to implement plural valuation, which aims to elicit diverse values and accounts for different worldviews by including diverse stakeholder groups, social–ecological characteristics, valuation methods, and power relations (Jacobs et al. 2016, 2020; Arias-Arévalo et al. 2017; Pascual et al. 2017). Although plural valuation might be seen as a complex and resource-consuming approach, Jacobs et al. (2018) found that the elicitation of diverse values of nature could be achieved by combining methods that do not necessarily require a higher cost. This review shows that socio-cultural valuation techniques elicited all value types, whereas economic valuation techniques elicited a much narrower spectrum of values (Fig. 6). Moreover, the IPBES assessment regarding the diverse conceptualization of diverse values of nature and its benefits calls for the use of multiple complementary methods 'to make a wider diversity of values visible, while improving the quality and legitimacy of the information generated to support decisions about nature' (IPBES 2022, p. 5).

Furthermore, social and ecological contexts of protected areas are very diverse and there is no one-size-fits-all valuation technique. Hence, the choice of valuation methods needs to be both context-specific and complementary to articulate the diverse values of nature (IPBES 2022). Likewise, the selection of the valuation framework should represent the social and ecological realities, while enabling the visibility of the diverse values of nature in protected areas. Our results show that, albeit different valuation frameworks have evolved over the years (Fig. 2), the use of TEV has been dominant when eliciting tourists' values of nature (Fig. 6). Although the values found in the literature fit under the umbrella of different valuation frameworks (i.e., TEV, TEEB, and IPBES), these frameworks are not mutually exclusive and simultaneously used in current scientific literature (Fig. 7). In fact, the release of TEEB (TEEB 2010) or IPBES (Díaz et al. 2015) did not eclipse TEV, resulting in the use of multiple valuation frameworks today.

Implications for policy-making and management of protected areas

The broad spectrum of tourists' values of nature in protected areas requires the use of a variety of valuation techniques, and thus, the application of different methods may lead to several challenges when it comes to informing management decisions and policies (IPBES 2022). Furthermore, challenges might emerge when comparing results obtained through different valuation frameworks since their approaches, disciplines, and principles differ. Yet, these differences can precisely contribute to informing different aspects of protected area management. For example, while the TEV framework relies on economic values (and instrumental values) and can inform decisions related with market-based institutions (e.g., Payments for Ecosystem Services, entrance fee to visit a protected area), the emphasis on the relational values by the IPBES framework can inform decisions that nurture collective stewardship and design community-based management.

Despite the high potential to use the values of nature to inform management of protected areas, we found that only 34 articles aimed to provide recommendations for management or policy-making. In addition to the small share of research aiming to inform management and policy-making, the IPBES assessment regarding the diverse conceptualization of diverse values of nature and its benefits found that the great majority of peer reviewed studies on nature valuation does not seem to successfully impact real world decision-making (IPBES 2022).

Eliciting diverse values of nature does not seem to be enough to foster the uptake of valuation results in management and policy-making. Instead, Zafra-Calvo et al. (2020) found that valuation exercises can impact management decisions when the valuation process is embedded in transdisciplinary research. This finding corresponds the

recent policy messages of the IPBES assessment which conclude that the uptake of valuation seems to be fostered by inclusive bottom-up processes where valuation knowledge is co-produced with multiple stakeholders (including decision-makers) through the application of participatory and deliberative methods (IPBES 2022).

Based on the findings of this review, we propose two main actions to foster the incorporation of values of nature in the management of protected areas. First, we propose to apply different and complementary valuation methods that represent the diverse ways by which tourists and other stakeholders relate with nature. To apply complementary methods, there is a need for building capacities and skills, particularly in developing countries (IPBES 2022). Since the research on tourists' valuation of nature in developing regions is highly biased towards economic valuation, we suggest to build capacities and skills by applying socio-cultural valuation methods and mixed approaches to leverage the diverse values of nature into protected area management.

Second, we recommend to remove barriers that hinder the acknowledgement and expression of diverse values of nature in protected areas and to promote opportunities to do so (IPBES 2022). This might include, among others, an institutional (re-)orientation that moves towards nurturing and legitimizing worldviews and values of diverse types of tourists and other stakeholders. Here, we argue that IPBES acts as a key institution promoting the recognition and legitimation of multiple stakeholders' worldviews and values. To do so, there is the need to create informative, participatory, and empowering spaces to express, negotiate, and deliberate diverse values by various stakeholders.

Priorities for future research on tourists' valuation of nature in protected areas

This systematic review was undertaken to present the status of empirical research on tourists' values of nature in protected areas over time and across regions. As a result, we identified major research gaps and, accordingly, we suggest three priorities for the future research agenda:

(1) Reduce regional bias: Our results show a bias towards certain regions and only marginal information on others (Fig. 3). Hence, we need scientific knowledge regarding values of protected areas in regions and countries that are currently underrepresented or not represented at all and continuous research in regions and countries with high visitation rates and biodiversity hotspots.

(2) Diversify methods and stakeholders: Most research on eliciting values focused on quantitative and monetary approaches (Fig. 5), which are limiting the elicitation of some value types. Therefore, we advocate for the diversification of the toolset of methods by applying socio-cultural valuation techniques and mixed approaches that can provide insights into tourists' non-monetary values of nature in protected areas. In addition, when the valuation exercise seeks to inform conservation and sustainable tourism in protected areas, it is necessary to account for the values of not just far-distant societies, but also local stakeholders, and to broaden the toolset towards participatory methods to engage different stakeholders and their diverse needs, interests, and worldviews (Jacobs et al. 2020; Zafra-Calvo et al. 2020). The engagement of diverse types of tourists and other stakeholders also requires addressing power relations among stakeholders (IPBES 2022).

(3) Foster value pluralism: For a more comprehensive understanding on the diverse values that tourists and other stakeholder groups assign to nature in protected areas, research on value pluralism is a necessity. Recent developments, such as the IPBES valuation framework, have promoted the discussion of value pluralism in mainstream sustainability research. Our review, however, suggests that the uptake of value pluralism has been rather slow. Therefore, future research should be driven by new generations of researchers who are better trained in inter- and transdisciplinary approaches to overcome the disciplinary mindset in academia, acknowledge and research value pluralism, and allow the inclusion of diverse stakeholders.

CONCLUSION

Valuation methods and frameworks used to elicit and understand tourists' values of nature in protected areas have diversified in recent years. Considering their role as value-articulating institutions, we recommend that future research applies non-monetary and in-depth qualitative valuation methods, and conducts plural valuation to account for diverse stakeholders. This is essential for eliciting intrinsic, instrumental, and relational values, with the aim of fostering the conservation of protected areas and associated societal benefits.

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Declarations

Conflict of interest The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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AUTHOR BIOGRAPHIES

Milena Gross (✉) is a doctoral candidate at the Social-Ecological Systems Institute at Leuphana University Lüneburg, Germany. Her research interests include sustainability science with a focus on plural valuation, the paradigm of nature's contributions to people (NCP), and human-nature relationships.
Address: Social-Ecological Systems Institute, Faculty of Sustainability Science, Leuphana University, Lüneburg, Universitätsallee 1, 21335 Lüneburg, Germany.
e-mail: milena.gross@posteo.de

Jasmine Pearson is a postdoctoral researcher at the Social-Ecological Systems Institute at Leuphana University Lüneburg, Germany. Her research interests include nature valuation, Indigenous and local knowledge (ILK), gender equity, and sustainable livelihoods.
Address: Social-Ecological Systems Institute, Faculty of Sustainability Science, Leuphana University, Lüneburg, Universitätsallee 1, 21335 Lüneburg, Germany.
e-mail: jasmine.pearson@leuphana.de

Ugo Arbieu is a postdoctoral researcher at the Senckenberg Biodiversity and Climate Research Centre, Germany. His research interests revolve around the human dimensions of wildlife conservation, including values, attitudes, and emotions in various contexts of human-wildlife coexistence.
Address: Senckenberg Biodiversity and Climate Research Centre, Frankfurt am Main, Georg-Voigt-Straße 14, 60325 Frankfurt am Main, Germany.
Address: Smithsonian Conservation Biology Institute, National Zoological Park, 1500 Remount Road, Front Royal, VA 22630, USA.
Address: Laboratoire d'Ecologie Systématique et Evolution, IDEEV, Université Paris-Saclay, Bât. 680 – 12, Route 128, 91190 Gif-sur-Yvette, France.
e-mail: ugo.arbieu@senckenberg.de

Maraja Riechers is a postdoctoral researcher at the Social-Ecological Systems Institute at Leuphana University Lüneburg, Germany. Her research interests include nature and biodiversity valuation, human-wildlife coexistence, and finding pathways for sustainability, especially by using the leverage points perspective.

Address: Social-Ecological Systems Institute, Faculty of Sustainability Science, Leuphana University, Lüneburg, Universitätsallee 1, 21335 Lüneburg, Germany.
e-mail: riechers@leuphana.de

Simon Thomsen is a research fellow at the Institute of Ecology at Leuphana University Lüneburg, Germany. His research interests include the usage of spatial data for the analysis of land use change dynamics and its socio-economic implications.
Address: Institute of Ecology, Faculty of Sustainability Science, Leuphana University Lüneburg, Universitätsallee 1, 21335 Lüneburg, Germany.
e-mail: simon.thomsen@leuphana.de

Berta Martín-López is a full professor at the Social-Ecological Systems Institute at Leuphana University Lüneburg, Germany. Her research focuses on understanding the dynamics of social ecological systems by assessing nature's contributions to people (NCP) from an interdisciplinary approach. She has led research about the role of value-, knowledge-, and governance systems on social-ecological dynamics
Address: Social-Ecological Systems Institute, Faculty of Sustainability Science, Leuphana University, Lüneburg, Universitätsallee 1, 21335 Lüneburg, Germany.
e-mail: martinlo@leuphana.de

Please note that errors have been identified in the first published version of the manuscript. While the figures are accurate and align with the dataset, inaccuracies have been found in the main text. The following correction has been published by Ambio[8]:

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[8] This publication differs from the version submitted as Ph.D. thesis; it provides the correction of the article but does not present the errors identified.

Chapter III The questions we ask matter: insights from place-based research on nature's contributions to people

Milena Gross, Daria Shepeleva, Friedericke Vogel, Tuyeni Heita Mwampamba,
Ugo Arbieu, Jasmine Pearson, Jennifer Kasanda Sesabo,
Fabia Codalli, Berta Martín-López

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Abstract

Inclusive management requires accounting for the diverse ways in which nature contributes to people's lives. To uncover the broad spectrum of Nature's Contributions to People (NCP) expressed by social actors, using plural methods has emerged as a useful approach in sustainability science. Yet, there is a lack of research on how different interview questions influence participant expressions of NCP. Given the paucity of studies that explore this, we investigated the effect of four distinct framings in interview questions (Appreciation, Benefits, Well-being, and Importance) on the NCP diversity expressed by different social actors. To this end, we analyzed interviews of nature conservationists (n=28), tour guides (n=20), and tourists (n=38) at Mount Kilimanjaro, Tanzania. We uncovered 27 NCP. Further, the framing of the questions worked differently for social actors to express NCP. Multiple question-framings were necessary for all social actors to express a diversity of NCP, i.e., conservationists expressed all 27 NCP, guides 25 NCP, and tourists 19 NCP, respectively. Moreover, ten NCP were sensitive to the question-framing, the social actor, or even both, suggesting that these factors conditioned the NCP diversity we uncovered. Arguing that methods used to uncover NCP serve as 'NCP-articulating institutions', we claim that researchers can reduce the risk of response omission by purposefully designing their research. Complementing previous calls for plural methods, our results showed that a 'within-method pluralizing' approach, i.e., using various question-framings as tools within one method, can also amplify social actors' NCP expression by drawing on the power of words.

Muhtasari

Usimamizi jumuishi unahitaji kuzingatia njia mbalimbali ambazo mazingira asili hunachangia katika maisha ya watu. Ili kugundua wigo mpana wa Michango ya Mazingira Asili kwa Watu (MMAW; NCP kwa kiingereza) unaolezwa na makundi ya kijamii, kwa kutumia mbinu mbalimbali kumeonekana kuwa njia yenye manufaa kwa sayansi endelevu. Hata hivyo, kuna upungufu wa utafiti kuhusu jinsi maswali tofauti ya mahojiano yanavyoathiri maelezo ya washiriki juu ya MMAW. Kutokana na uhaba wa tafiti zinazochunguza hili, tulichunguza athari za tungo nne tofauti za uundaji wa maswali (Tathmini, Faida, Ustawi, na Umuhimu) kuhusu utofauti wa MMAW unaolezwa na makundi mbalimbali ya kijamii. Kwa lengo hili, tulichanganua mahojiano kwa wahifadhi wa mazingira (n=28), waongozaji wa watalii (n=20), na watalii (n=38) katika eneo Mlima Kilimanjaro, Tanzania. Tuligundua MMAW 27. Pia, uundaji wa maswali uliathiri kwa namna tofauti katika kuelezeaMMAW kwa makundi ya kijamii. Namna tofauti za uundaji wa maswali ulikuwa muhimu kwa makundi yote kijamii ili kueleza utofauti MMAW, yaani, wahifadhi wa mazingira walieleza MMAW yote 27, waongozaji wa watalii walieleza MMAW 25, na watalii walieleza MMAW 19, mtawalia. Zaidi ya hayo, tuligundua kuwa MMAW kumi ilikuwa nyeti kwa uundaji wa maswali, makundi ya kijamii, au vyote viwili, ikionyesha kuwa sababu hizi ziliathiri utofauti wa elezwaji wa MMAW tuliogundua. Tunatoa hoja kuwa sababu kama hizi zinatumika kama 'taasisi za kuelezea MMAW', tunapendekeza kuwa watafiti wanaweza kupunguza hatari ya kutokujibiwa maswalikatika

ubunifu wa tafiti zao . Tukiungana na wito wa awali wa kutumia mbinu mbalimbali, matokeo yetu yalionyesha kuwa njia ya ' ndani ya mbinu mbalimbali', yaani, kutumia namna mbalimbali za uundaji wa maswali kama zana ndani ya mbinu moja, inaweza pia kuongeza maelezo ya makundi ya kijamii kuhusu MMAW kwa kutumia nguvu ya maneno.

Keywords

Context-specific perspective; Interviews; Methodological tools; Nature's Contributions to People (NCP); Plural valuation; Value-articulating institutions

Introduction

'If we are the tools of our tools, as suggested by [Henry David] Thoreau, then it can also be said that language is not only a vehicle for communication, it is the driver as well.' (Saltelli et al. 2020, p. 78)

Inclusive management of nature[10] requires accounting for multiple and diverse ways in which people relate to nature. This requires us (researchers) to recognize the need to include diverse voices, worldviews, and knowledge systems (Coscieme et al. 2020; Díaz et al. 2015, 2018; IPBES 2002; Salomon et al. 2023). The framework of Nature's Contributions to People (NCP) proposed by the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) (Díaz et al. 2015, 2018) represents a more holistic and inclusive way of understanding how nature supports human well-being by extending beyond traditional frameworks like 'ecosystem services' (Kadykalo et al. 2019). The context-specific perspective of the NCP framework 'recognizes that people have the right to interpret and make sense of their relationships with nature in their own ways' (Hill et al. 2021, p. 911). Recent research that has applied a place-based approach to uncover the diversity of NCP uncovered more nuanced human-nature relationships than would otherwise have been described using the ecosystem services framework. For example, Topp et al. (2022) found that land managers expressed 13 context-specific NCP associated with the South African *renosterveld* and the wider farming landscape. Nicolás-Ruiz et al. (2023) was able to detect 16 context-specific NCP provided by dry rivers of south-eastern Spain as articulated by ten social groups. Despite this incipient empirical evidence for place-based relationships between people and nature, we lack evidence on how the methodological approach can affect the diversity of NCP a study empirically uncovers.

[10]We acknowledge that people differ in their understanding of nature and perception of how they relate with nature, depending on the worldview and knowledge system they are embedded in (Coscieme et al. 2020; Díaz et al. 2015). We understand and use the term nature here in its most inclusive framing to recognize diverse understandings and perceptions.

Previous research in the field of sustainability science and nature valuation have demonstrated that methodological choices condition scientific results (Balaine et al. 2024; Saltelli et al. 2020; Vatn 2005, 2009; Vatn and Bromley 1994). Indeed, valuation methods have been referred to as value-articulating institutions (Vatn 2005, 2009; Vatn and Bromley 1994) because they do not only *capture* values. Rather they also *frame* the value space, i.e., the possible values the method can detect (Gross et al. 2023; Kaiser 2024). Following the recent IPBES Values Assessment, methods are 'based on rules [that define] which values can be expressed and in what form' (Anderson et al. 2022, p. 83). For instance, the valuation method of willingness-to-pay naturally yields monetary values (García-Llorente et al. 2011; Platania & Rizzo 2018). In contrast, using open-ended interviews as a valuation method allows to elicit intrinsic, instrumental, and relational values in mainly non-monetary but also possibly also monetary metrics (e.g., Arias-Arévalo et al. 2017; Topp et al. 2022). Hence, the method pre-determines the metrics that will be used and thus, the values that can emerge (Jacobs et al. 2018). Invariably, value omission is highly likely if the rationale of a selected method is incapable of capturing additional values that might be held by research participant (see empirical studies showing how different methods capture different values, e.g., Allen & Colson 2019; Martín-López et al. 2007, 2014).

To uncover a broad spectrum of values and to avoid 'response omission', i.e., missing out on important elements of a response, which reduces the accuracy and completeness of the information provided by the research participant, empirical studies are advised to apply plural methods (e.g., Martín-López et al. 2014; Jacobs et al. 2016, 2018, 2020; Termansen et al. 2022). Plural methods evoke value expression in different ways through which the values are made available for the participant to articulate. For example, Hensler et al. (2021) found that drawings and their narrated interpretation by members of the Forest Stewards Network in Xalapa, Mexico, were complementary methods to elicit diverse values. Likewise, Yuliani et al. (2023) applied semi-structured in-depth interviews, narrative walks, and focus group discussions to investigate the diversity of forest-related relational values of local communities in Sulawesi, Indonesia. However, such studies do not usually report on methods-result linkages such as which elicitation method was most effective in uncovering specific values.

Drawing on Vatn and Bromley's (1994) and Vatn's (2005, 2009) proposal to view valuation methods as value-articulating institutions, we argue that methods that seek to uncover NCP do not simply *capture* the expressed NCP, they also *frame* the NCP space i.e., the NCP the method can detect. In a similar vein, we propose that such methods are 'NCP-articulating institutions' because, through the methodological approach researchers select, they condition which framework is used to study human-nature relationships (the study topic of interest), whose perception is included (the research participants), and how data is consolidated, synthesized, and interpreted (data collection and analysis methods). Therefore, the methodological approach determines which NCP can be

accounted for as well as may be omitted. Researchers who want to uncover diverse NCP need to purposefully design their studies to use diverse methods that can deliberately lower the risk of NCP omission. Totino et al. (2023), however, claim that most studies applied plural methods to reveal different insights on NCP. A single method was used to identify NCP, i.e., which NCP a research participant perceives as present in a place (the focus of this study), and then (an) additional method/s to assess these NCP, i.e., how a research participant evaluates and demands NCP. In fact, NCP have been rarely *identified* through plural methods, which increases the risk of yielding an incomplete NCP set (Totino et al. 2023). For instance, Maestre-Andrés et al. (2016) identified 18 NCP provided by the natural park of Sant Llorenç, Spain, through non-participant observation, but unraveled eight additional NCP by conducting interviews. The value of method plurality is exemplified by Totino et al. (2023) who found that it was only by applying five socio-cultural methods that they could uncover 53 NCP expressed by peasant communities in the Dry Chaco eco-region, Argentina. No single method was able to uncover the overall detected NCP diversity, implying that the chosen methods were complementary and ultimately, reduced response omission.

Applying plural methods requires skills and financial resources that many studies do not have. It is worthwhile, therefore, to identify the extent to which some methods can – uncombined with other methods – capture diverse people-nature relationships including NCP and values. The IPBES Value Assessment (Termansen et al. 2022, p. 191) suggests that 'some single valuation methods can identify diverse values to some degree'. Moreover, if we understand methods to identify NCP diversity as NCP-articulating institutions, the risk of response omission could be lowered by developing strategies that maximize the NCP space of a single method approach. While a plural methods approach seeks to build upon different methods to broaden the NCP space and to make NCP for participants available to express, we propose that different tools might also be created without switching methods. For interviews, for example, framing open-ended questions differently might operationalize variation in such tools for two reasons (Briggs 1986). First, different questions are key to unlock the interviewee's internal perspectives of a multi-faceted framework such as NCP. Second, the meaning of words can vary depending on the interpretation of the interviewee (Treece and Treece 1986; Cairns-Lee et al. 2022), whereby even synonyms may not be identically interpreted (Gadimova 2023). Factors such as the interviewee's cultural context, linguistic background/vocabulary, and cognitive framework contribute to the 'meaning-making' of words, which also affects how people respond to interview questions (Briggs 1986; Kövecses 2010). We assume that different question-framings might evoke a wide range of meanings behind 'what [aspects of] nature contributes to people's good quality of life'. Such different question-framings may constitute a strategy to facilitate multiple opportunities for interviewees to think about nature's benefits from multiple angles without switching methods. In fact, there is empirical evidence on the power of question-framings in fields such as health sciences (e.g., Ely et al. 1999; Price and

Christentson 2013), psychology (e.g., Schwarz 1999), and consumer behavior (e.g., Magano et al. 2023) but, to our knowledge, not in the field of sustainability science, including NCP.

In addition to the methodological tools, research has shown that social actors affect the empirical evidence on NCP that can be uncovered through interviews. For example, in an agricultural landscape in the Colombian Andes, Kockelkoren et al. (2023) identified 32 NCP that were recognized by six different social actors. Each actor group expressed a different number of NCP, which together added to the overall diversity of NCP in the area. Likewise, Nicolás-Ruiz et al. (2023) detected differences in expressed NCP associated with dry rivers in Spain between ten social actors. Both empirical studies demonstrate that including different social actors enriches the NCP diversity that can be uncovered. Moreover, former studies explained that the expression of particular NCP was associated with social actors' interaction with nature (Felipe-Lucia et al. 2015; Ramos et al. 2018), suggesting that diversifying social actors based on this feature can reduce the risk of intentional NCP omission. However, the choice of which social actors participate in the study is not random; it is decided by the researchers. Drawing on the rationale of NCP-articulating institutions, we claim that researchers can – intentionally – affect whose NCP perception is worthy of consideration or not.

In this study, we investigated the effect of different framings of interview questions on the NCP diversity expressed by social actors. To this end, we draw on a qualitative place-based study conducted in the Kilimanjaro social-ecological system (hereafter referred to as Kilimanjaro), Tanzania. Specifically, we aimed to understand how (i) four differently framed open-ended questions affected the expression of diverse NCP (ii) by different social actors. We ultimately seek to reflect on how both the methodological tools and the social actors considered in the study affect the diversity of people-nature relationships that empirical research can uncover.

Case study

The case study we focused on is located at the nexus of nature conservation and nature-based tourism in the Kilimanjaro Region, Tanzania. We interviewed three groups of social actors living in, working in, and visiting Kilimanjaro, respectively: nature conservationists, tour guides, and tourists. This nexus serves as an ideal platform to investigate social actors' NCP expression for three reasons. First, the social actors' groups differ in their duration of lifetime spent in the study area and hence, their scope of experience and place attachment with nature in the study area varies. Locals (from the area and nationals), foreign residents, and foreign visitors are likely to perceive and express different aspects of nature's contributions to people (Masao et al. 2022; Pearson et al. 2024). Second, even among locals and residents, nature offers some of these social actors very different employment and livelihood opportunities i.e., nature as an 'employer', 'office', and 'service provider', whereas for tourists, Kilimanjaro offers diverse opportunities to experience a wide range of nature-based leisure time activities (Felipe-Lucia et al. 2015; Ramos et al. 2018).

Third, along its entire altitudinal gradient, NCP supply varies. Hence, Mount Kilimanjaro ecosystem offers different experiences and activities for the social actors, maximizing the diversity of potential NCP that one might experience from spending time in a global biodiversity hotspot (Tanzania National Parks 2023).

With the foundation of the Park in 1973, the ground was laid for the pursuit of the joint objectives of nature conservation and nature-based tourism in the region. Kilimanjaro National Park Authority (KINAPA Authority) under the mandate of Tanzania National Parks (TANAPA) started to 'sustainably conserve [the Park] (...) and optimiz[e] tourism development for human benefits' (Tanzania National Parks n.d.). Four years later, the Park opened its gates to tourists (Durrant 2004), and ever since, has successfully attracted (mainly international) tourists (Tanzania National Parks 2023). In the hiking season 07/2022 to 06/2023, for example, more than 43000 international tourists visited KINAPA, the fourth highest international visitor rate across the 22 Tanzanian national parks (average international visitor rate: 31700 visitors) (United Republic of Tanzania 2022). In contrast, the number of domestic visitors (ca. 6700 domestic tourists) is comparatively low and insignificant compared with the international rate and other national parks (average domestic visitor rate: 15800 visitors). KINAPA's tourism plays a crucial role in the national and local economy. After Serengeti National Park, its revenue is the second largest contribution to Tanzania's economy by national parks (Tanzania National Parks 2023). On a local scale, salaries and tips contribute to the livelihoods of tour guides and supporting crew members, such as porters and cooks, because hiking inside the Park requires tourists to be accompanied by professional tour guides (Peaty 2012).

While one- and multiple-day hikes are the most popular tourist activities inside KINAPA, nature-based activities such as visiting waterfalls and participating in bio-cultural experiences with local Chagga people are also offered outside the Park in non-protected areas (Tanzania National Parks 2023; interview with tour guides as part of this research). Likewise, conservation efforts are not restricted to the Park; they are also undertaken outside protected areas (personal communication with the natural resource officer at the Moshi district office and interviews with nature conservationists as part of this study). Governmental officers, e.g., natural resource officers, as well as local and international community-based organizations (CBOs) and non-governmental conservation organizations (NGOs) implement projects on the foothills of the mountain to conserve nature by planting seedlings and protecting old trees (C. Hemp et al. 2018). Additionally, some of these projects are coupled with nature-based tourism, i.e., tourists participate in their activities, or touristic revenue is generated from selling products to tourists that are derived from conservation activities such as the honey derived from beekeeping activities promoted to deter elephants from crop-raiding. In fact, such projects demonstrate that a vibrant nature-based conservation-tourism nexus exists outside protected areas.

Kilimanjaro supplies a high diversity of NCP within and beyond Kilimanjaro National Park (KINAPA; ranging from approximately 1600–2350 masl depending on the location on the mountain to 5895 masl (Hemp et al. 2017)) that meets the needs of different social actors. For example, Kilimanjaro's forests, located mainly inside the Park play a critical role in regulating water flow and purifying water, i.e., a regulating NCP, benefiting millions of people in and beyond the region (Said et al. 2021; Wamucii et al. 2021). Agricultural fields and forests on the mountain slopes provide material NCP such as *food*, *feed*, and *energy* (Kivumbi and Newmark 1991; Misana 2003). Additionally, non-material NCP, e.g., *cultural heritage and identity* and *recreation*, are supplied along the entire altitudinal gradient (Frömming 2009; Sébastien 2010). C*ultural heritage and identity* is, for instance, supplied by Chagga home gardens (< ca. 1700 masl) and ritual sites such as Kifunika Hill (2900 masl) (Frömming 2009). Recreational hiking is one of Kilimanjaro's major tourist attractions (Holroyd et al. 2016; Tanzania National Parks 2023).

Methods

Interview guide

We developed an English-language interview guide to guide face-to-face semi-structured conversation between the interviewee and a researcher (interview guides in Supporting Material S1). Two co-authors and a Tanzanian research assistant were trained to conduct the interview. We pre-tested the interview guide in iterative rounds with former tourists. The interview guide comprised open-ended questions about the interviewee's experience with Mount Kilimanjaro and people-nature relationships and closed-ended questions on socio-demographics. Open-ended questions allow interviewees to report their perceptions in their own words (Bryman 2016), required to acknowledge the context-specificity of the NCP framework.

The main component of our interview consisted of four NCP-targeting open-ended questions (Table 1) that used different framing to (seemingly) ask interviewees the same thing, i.e., the many ways of how they perceive nature contributes to their and other people's good quality of life. In version 1 of the question-framing (hereafter referred to as Appreciation), we used the framing 'appreciate', in version 2 'benefits' (Benefits), in version 3 'contributing to well-being/quality of life' (Well-being), and in version 4 'importance of nature' (Importance). All interviewees were asked all four question-framings followed in the same sequence with one exception: In tourist interviews, the question-framing of Well-being was posed second followed by the question-framing of Benefits.

We opted for these four framings based on two assumptions. First, we assumed semantic differences between the four framings distinct enough to capture the multi-faceted NCP framework. Despite such a clear semantic understanding on our end, this might not necessarily correspond

with that of the interviewees. The same question-framing can evoke various meaning-makings and hence, different NCP perceptions for different interviewees (Louise Barriball and While 1994; Treece and Treece 1986). How an interviewee interpreted and hence, made meaning of the question-framings was a confounding factor we could not control for but ultimately influenced how they expressed NCP and hence, the NCP diversity uncovered (Cairns-Lee et al. 2022). Therefore, using slightly different question-framings to (seemingly) ask interviewees the same 'thing' might overcome language barriers, particularly if they were non-native English speakers among the interviewees as in our study, and increases the chance that an interviewee reported the information we were interested to uncover. Moreover, the questions addressed both the interviewee themself and other people who reside on, work at, and come as tourists to Kilimanjaro (Table 1). We assumed that this might expand the scope of interviewee's perceptions beyond their own and thus, to uncover a broader NCP diversity. However, we did not use question-framings that could target specific NCP, e.g. pleasant or beautiful aspects of nature, which could lead to a response biased towards that NCP, e.g. *aesthetic enjoyment*.

Table 1 Summary of the four interview question-framings used to investigate their effect on the diversity of Nature's Contributions to People (NCP) uncovered (full interview guides in Supporting Material S1). In tourist interviews, the question-framing of Well-being was posed second followed by the question-framing of Benefits.

Question-framing	Interview questions
Appreciation	What do you appreciate about nature at Mount Kilimanjaro? And other people?
Benefits	Do you think that nature at Mount Kilimanjaro provides benefits to humans? If yes, what are the benefits of nature at Kilimanjaro? Are there any other contributions and/or benefits of nature at Mount Kilimanjaro to you and other people that you can think of? For example, in environmental, economic, social, or cultural terms?
Well-being	What does nature at Mount Kilimanjaro contribute to your well-being? And other people's well-being?
Importance	Do you think nature at Mount Kilimanjaro is important? Why? For you personally and for other people?

Qualitative data gathering

Between May 2021 and February 2022, we conducted 86 interviews with nature conservationists (n= 28 interviewees), tour guides (n= 20), and tourists (n=38) (Table 2). Importantly, interviewees might have multiple identities in their lives, thus belonging to various social actors. For example, a Tanzanian person who we approached as a nature conservationist according to our definition might also guide nature-based tours. In this study, we considered the social actor affiliation of interviewees as the identity they expressed at the time we encountered them. By selecting interviewees based on their social actor affiliation, we sought to guarantee that the interviewees cover a broad range of people-nature relationships.

Table 2 Overview of sampling characteristics of the social actors. *n* sample size. *CBOs* community-based organizations; *KINAPA Authority* Kilimanjaro National Park Authority; *NGOs* non-governmental organizations.

	Nature conservationists (n=28)	**Tour guides (n=20)**	**Tourists (n=38)**
Definition of social actors	conservation-related officers at governmental (working for KINAPA Authority), regional, and district level, and national and international members of environmental NGOs, CBOs, and advisory boards with conservation activities in Kilimanjaro	local and international tour guides and tour operators	Tanzanian and international tourists who attempted and succeeded to summit Mount Kilimanjaro
Social actor- specific sampling strategies in addition to snowball sampling	contacting governmental, regional, and district officers searching the web for nature conservationists working for NGOs, CBOs, and advisory boards	searching the web for tour guides and tour operators	identifying former tourists through various websites and social media platforms

We interviewed all tourists and five tour guides online (home countries of the online interviewees in Table S2.1 in Supporting Material S2), while interviews with the other tour guides and all nature conservationists took place in several locations in Kilimanjaro (Figure 1). Interviews lasted between 20 minutes and three hours, as they also included questions relevant to other researchers of the Kili-SES research unit (https://kili-ses.senckenberg.de/en).

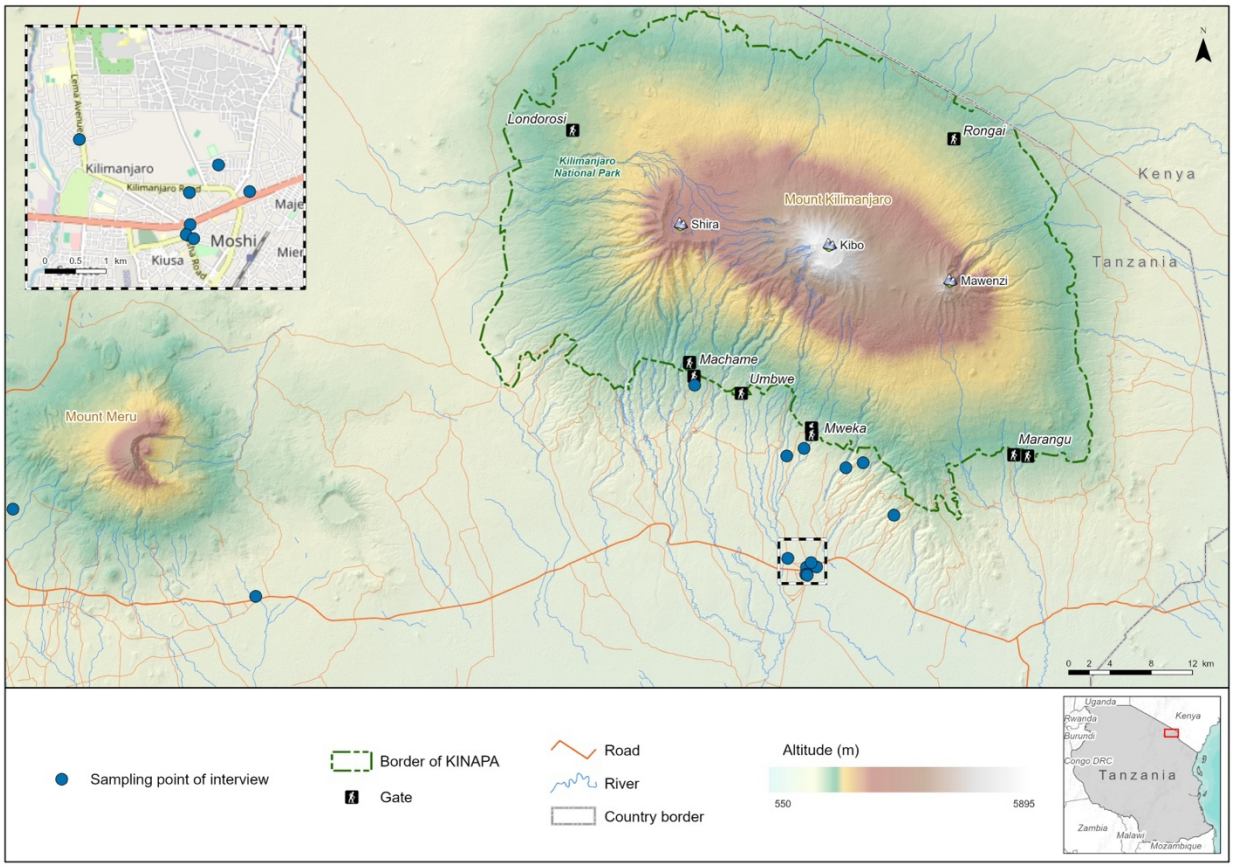

Figure 1 Map showing the sampling points of interviews conducted in Kilimanjaro (Environmental Systems Research Institute (ESRI) 2020). *KINAPA* Kilimanjaro National Park.

Ethics

The Ethics Committee at the university of the first author (EB-Antrag_202104-07-Martin-Lopez_KiliSES; EB-Antrag_202109-12-Martin-Lopez_KiliSES-02) granted ethics clearance based on an ethics application including the interview guides prior to data gathering. Additionally, the Tanzania Commission for Science and Technology (COSTECH; 2021-225-NA-2021-09), the Tanzanian Wildlife Research Institute (TAWIRI), and TANAPA issued research permits to conduct research in Kilimanjaro. As is required protocol for undertaking research in Tanzania, executive commissioners at regional and district level provided additional permissions in writing and in some cases orally.

Before the interview commenced, we informed prospective interviewees about the research goals and participants' requirements and rights through a written Participant Information Sheet and Declaration of Consent form (Supporting Material S3) and/or orally. Only interviewees at least 18 years of age were allowed to participate. We granted interviewees the right to withdraw their data entry before data analysis and hence, collected our data pseudo-anonymously. With written or oral

participant consent, we recorded interviews to transcribe them. All but one interviewee gave consent to be recorded and therefore, notes were taken in that one case. To account for potential language barriers, local understanding, and cultural values, the Tanzanian research assistant mainly interviewed Tanzanian interviewees and the Non-Tanzanian co-authors international interviewees. When one of the two co-authors interviewed a Tanzanian interviewee, the research assistant usually accompanied them.

Another ethical issue, in the context of any scientific work, concerns the researchers' positionality (first author's positionality statement in Supporting Material S4).

Qualitative content analysis

We analyzed the transcribed responses and the notes of one interview in MAXQDA 2022 (VERBI software 2021). We applied a qualitative content analysis to code context-specific NCP. To this end, we developed a coding scheme in an inductive-deductive process. We were cognitively guided by the NCP proposed as the generalizing perspective of the NCP framework (Díaz et al. 2018) (deductive process) and simultaneously, focused the contextual nuances of how nature contributed to people's good quality of life to account for the context-specific perspective of the NCP framework (inductive process).

Coding was a joint effort among five co-authors. To create an initial coding scheme, we identified context-specific NCP using a subset of three interviews. We extended the coding scheme from the remaining interviews using an iterative process that led to the final set of coded NCP when information got saturated and we could not identify additional NCP. While developing the coding scheme, we noticed that interviewees tended to refer to final benefits rather than the underlying regulating NCP. For example, references were made to the provision 'fresh air' or 'clean water' instead of the purification processes of air and water, i.e., regulating NCP. Considering that most interviewees were neither native English speakers nor natural science experts, we coded these expressions using regulating NCP terminology. Our coding process was accompanied by a living inter-coder agreement that documented our coding rules and the reasons for the decisions we took. Table S2.2 in Supporting Material S2 displays how we translated the interviewee's words into the scientific framework of context-specific and generalizing NCP by providing one example for each NCP expressed by each social actor. Upon completion, the first author double-checked all coded transcripts for consistency.

We analyzed the data in two steps. First, we coded context-specific NCP in all transcripts and the notes. We adapted the NCP descriptions by Díaz et al. (2018) and Pearson et al. (2024) and combined them with the specific words used by the interviewees (Table 3). We aimed to retain the contextual meaning behind NCP by honoring the terminology used by interviewees to express them. For example, *regulation of climate* refers to nature's regulation of atmospheric conditions,

including effects on greenhouse gases and temperature, carbon sequestration and storage, and pleasant weather conditions. Where possible, we also applied an interwoven approach (Hill et al. 2021) to associate the context-specific NCP we had identified with the generalizing NCP *sensu* Díaz et al. (2018).

Second, we identified whether the four question-framings (Table 1) affected the expression of NCP by the three social actors. Then, we categorized our findings into four groups: Group 1 comprised NCP expressed in response to all four question-framings and by all three social actors – neither the question-framing nor the social actor matters. Group 2 contained NCP expressed in response to not all four question-framings, i.e., a maximum of three question-framings, but by all three social actors – the question-framing matters. Group 3 covered NCP expressed in response to all four question-framings but not all three social actors, i.e., a maximum of two social actors – the social actor matters. Group 4 contained NCP in response to not all four question-framings expressed by not all three social actors – the question-framing and social actor matter.

Results

Interviewee profile

Our interview sample comprised 86 interviewees ranging from 22 to 81 years of age ($\bar{x}$=46 years; SD=13.8) (full summary of interviewees' socio-demographic attributes in Table S5.1 in Supporting Material S5). More than half (63% of the interviewees) of the interviewees were male. Most nature conservationists (82%) and tour guides (67%) were raised in Tanzania, while most tourists grew up in countries associated with the Global North (70%). The majority of nature conservationists (undergraduate degree: 32%; postgraduate degree 43%) and tourists (47%; 26%) achieved university degrees. Tour guides' levels of formal education ranged from primary and secondary school (25%) to college diplomas (25%) and university degrees (undergraduate degree: 25%; postgraduate degree:15%). All tourists who entered the Park intended to summit Mount Kilimanjaro and almost every tourists (92%) entered for the first time.

Context-specific NCP expressed by social actors

A total of 27 context-specific NCP were expressed across all interviewees of which ten were classified as regulating, five as material, and eleven as non-material NCP (Table 3). Furthermore, we identified *intergenerational benefits* which is understood as maintaining the existence of nature for future generations to experience (Table 3). Because this NCP cuts across all three NCP groups, we treated it as a separate NCP group (Díaz et al. 2018). All but one context-specific NCP *new and unique experiences* corresponded with one of the generalizing NCP perspective.

Table 3 Description of context-specific Nature's Contributions to People (NCP) expressed by nature conservationists (n=28), tour guides (n=20), and tourists (n=38) in Kilimanjaro, Tanzania. The descriptions were adapted from Díaz et al. (2018), Gross et al. (submitted), and Pearson et al. (2024). NCP group: ● regulating; ● material; ● non-material; ● intergenerational benefits. Icon design credit: Jelke Meyer.

	Description of the context-specific NCP
Regulating NCP	
	Habitat creation and maintenance refer to nature's processes and conditions to form a place for people and non-human organisms to live and thrive and to continue providing such.
	Pollination refers to animals' contribution of distributing pollen among flowers.
	Dispersal of seeds refers to animals' contribution to moving seeds.
	Regulation of air quality refers to nature's processes of purifying air to improve its quality for people.
	Regulation of climate refers to nature's regulation of atmospheric conditions, including effects on greenhouse gases and temperature, carbon sequestration and storage, and pleasant weather conditions.
	Regulation of freshwater quantity refers to nature's hydrological processes to regulate the water flow and function as a source of water for various people-related purposes, such as irrigation and water for domestic use.
	Regulation of freshwater quality refers to nature's processes of purifying water to improve its quality for people.
	Regulation of soil fertility and protection of soils refers to nature's processes to create and maintain soils and soil fertility, and to prevent soil erosion.
	Regulation of hazards and extreme events refers to nature's processes to prevent people and their infrastructure from damage caused by, for example, strong winds, and storms.
	Regulation of detrimental species refers to the controlling effects derived from organisms and abiotic conditions on organisms that are pests or transmit diseases, e.g., the temperature limits the spatial coverage of anopheles mosquitos that can transmit the Malaria disease.
Material NCP	
	Energy refers to the production of timber-based fuels such as firewood and hydropower.
	Food refers to the production of food and beverages derived from wild, managed, or domesticated organisms such as maize, banana, coffee, milk, and meat.
	Feed refers to the production of forage and fodder for domesticated animals such as grasses.
	Building materials refer to producing materials derived from nature to construct buildings such as timber.
	Medicine refers to the collection and production of materials derived from non-human organisms used for medicinal purposes such as insects and herbs.

Non-material NCP	
	Learning refers to the different levels of learning that can be experienced by and through nature, from education on different species to gaining new profound insights, which can influence one´s outlook on life.
	Aesthetic enjoyment refers to the pure enjoyment of the aesthetic appearance and beauty of nature.
	Recreation refers to the provision of opportunities for physical, including recreational and touristic, activities in nature.
	Challenging experiences refer to the provision by nature of opportunities for people to seek challenges, which test their mental and physical capabilities, often resulting in a sense of achievement.
	Therapeutic and restorative benefits refer to nature's opportunities for therapeutic and restorative benefits such as healing, stress-relief and relaxation.
	New and unique experiences refer to the provision by nature of new and unique opportunities for the human experience.
	Connectedness with nature refers to the opportunities for people to develop or deepen a feeling of being part of and immersed in nature.
	Cultural heritage and identity refer to the opportunities in which nature and cultural rootedness, traditions, historical incidences and people's identification blend, e.g., a whole country identifies with a natural entity.
	Sense of place refers to the opportunities for people to develop a sense of belonging or feeling at ´home´ in nature.
	Social cohesion and bonding refer to the basis of nature for people to develop new connections or nurture their existing relationships with other people.
	Spiritual experiences refer to the basis of nature for nurturing one´s religion or inner spirit by connecting to self or a higher entity.
Intergenerational benefits	
	Intergenerational benefits refer to maintaining the existence of nature for future generations to experience.

The effect of different question-framings on NCP expressed by social actors

We found that nature conservationists expressed all 27 NCP, tour guides 25 NCP, and tourists 19 NCP (Table 4). Across all social actors, no question-framing elicited all NCP. In fact, question-framings were complementary and necessary to enrich NCP expression. Moreover, each question-framing revealed different and new NCP in each social actor (Table 4; Figure 2). For example, all social actors expressed one NCP in response to the second question-framing that they did not mention in response to the first one (Nature conservationists: *cultural heritage and identity*; tour guides: *regulation of soil fertility and protection of soils*; tourists: *regulation of freshwater quantity*). While tour guides expressed the highest number of NCP (n=23 NCP) in response to the first question-framing of Appreciation, nature conservationists and tourists expressed the highest

number of NCP to the third question-framing of Well-being (n= 24) and final question-framing of Importance (n=16), respectively (Table 4). For tour guides, the question-framings of Benefits and Importance revealed one additional NCP each. In contrast, the other two social actors expressed five additional NCP, when being asked all additional question-framings. Thus, asking sequential question-framings was pivotal to uncovering the 'complete' NCP diversity for all social actors but particularly nature conservationists and tourists.

Table 4 Overview of the total number of Nature's Contributions to People (NCP) expressed by the social actors in response to the four question-framings (Table 1) and the number of additional NCP uncovered in the subsequent question-framing. The question-framing of Well-being was posed second followed by question-framing of Benefits in tourist interviews.

Social actor | Question-framing		**Nature conservationists**	**Tour guides**		**Tourists**
Appreciate	I	22	**23**	I	14
Benefits	II	18	19	III	13
Additional NCP uncovered		1	1		2
Well-being	III	**24**	15	II	12
Additional NCP uncovered		3	0		1
Importance	IV	19	15	IV	**16**
Additional NCP uncovered		1	1		2
Total number of NCP and of additional NCP uncovered in the subsequent question-framings (in parentheses)		27 (+5)	25 (+2)		19 (+5)

Our analysis revealed that the identification of specific NCP (n=10 NCP) was sensitive to the question-framing, the social actor, and the interaction of these two factors (Figure 2). The question-framing was key to identifying *cultural heritage and identity*, *connectedness with nature*, and *intergenerational benefits* (Group 2; ♠ in Figure 2). *Cultural heritage and identity* and *connectedness with nature* were expressed by all social actors but not in response to the final question-framing of Importance. In contrast, social actors expressed *intergenerational benefits* only in response to this particular question-framing. Moreover, nature conservationists and tour guides (but not tourists) expressed *feed* and *building materials*, indicating that the expression of these two NCP was sensitive to the social actor (Group 3; ♣ in Figure 2). Finally, particular question-framings and social actors were simultaneously crucial in uncovering five NCP (*dispersal of seeds*, *pollination, regulation of detrimental species*, *regulation of hazards and extreme events,* and *medicine*) (Group 4; ♦ in Figure 2). For example, nature conservationists and tour guides but not tourists expressed *dispersal of seeds* and *regulation of detrimental species* in response to all question-framings except for Benefits. Another example concerned *regulation of hazards and extreme events*. Nature conservationists were the only social actor group to express this NCP in response to the question-framings of Appreciation and Well-being. These results demonstrate that the expression of particular NCP was sensitive to the question-framing, social actor, and both.

Context-specific NCP		I. Appreciation			II. Benefits			III. Well-being			IV. Importance		
Regulating NCP													
Habitat creation and maintenance		•	•	•	•	•		•			•	•	
Pollination	♦	•			•						•		
Dispersal of seeds	♦		•					•			•		
Regulation of air quality		•	•	•	•	•		•	•	•	•	•	•
Regulation of climate		•	•		•	•		•	•		•	•	•
Regulation of freshwater quantity		•	•		•	•	•	•	•	•	•	•	•
Regulation of freshwater quality		•	•		•	•		•	•		•	•	•
Regulation of soil fertility and protection of soils		•	•		•	•	•	•	•		•		•
Regulation of hazards and extreme events	♦	•						•					
Regulation of detrimental species	♦	•	•					•					
Material NCP													
Energy		•	•	•	•	•		•		•	•	•	
Food		•	•	•	•	•	•	•	•		•	•	•
Feed	♣	•	•		•	•		•	•		•	•	
Building materials	♣	•	•		•	•		•			•		
Medicine	♦	•	•		•			•					
Non-material NCP													
Learning		•	•	•	•	•	•	•	•	•	•	•	•
Aesthetic enjoyment		•	•	•	•	•	•	•	•	•	•	•	•
Recreation		•	•	•	•	•	•	•	•	•	•	•	•
Challenging experiences		•	•	•			•	•		•			•
Therapeutic and restorative benefits		•	•	•	•	•	•	•	•	•	•	•	•
New and unique experiences		•	•	•		•	•	•	•	•	•	•	•
Connectedness with nature	♠	•	•	•			•	•	•	•			
Cultural heritage and identity	♠		•	•	•	•	•						•
Sense of place		•	•		•	•	•	•	•			•	•
Social cohesion and bonding				•		•	•	•	•	•		•	
Spiritual experiences			•	•		•	•	•		•			•
Intergenerational benefits													
Intergenerational benefits	♠										•	•	•

Figure 2 Overview of the context-specific Nature's Contributions to People (NCP) expressed by nature conservationists (n=28), tour guides (n=20), and tourists (n=38) in response to the four question-framings (Table 1). • NCP expressed; ♦ question-framing and social actor matter; ♣ social actor matters; ♠ question-framing matters; nature conservationist; tour guide; tourist. Icon design credit: Jelke Meyer.

Discussion

Varying question-framings provided social actors multiple opportunities to articulate which NCP they perceive which ultimately enriched the NCP diversity we uncovered. Here, we discuss how pluralizing across social actors broadens the expressed NCP diversity and the workings of the interview method as 'NCP-articulating institutions'. Building on previous calls for a plural method approach, we propose an approach that draws on the power of words as tools to amplify social actors' NCP expression: 'within-method pluralizing'. Finally, we suggest four endeavors to empirically advance this novel approach.

Diversity of social actors broadens the NCP diversity

Our study demonstrates that incorporating perspectives from a diverse set of social actors whose knowledge about and experiences with nature differs is necessary for broadening the diversity of NCP, as pointed out by other previous studies (Felipe-Lucia et al. 2015; Ramos et al. 2018). Kockelkoren et al. (2023) stressed how knowledgeable local social actors were about the NCP present in their natural surroundings. Our study also corroborates the importance of including local actors in NCP studies, as international tourists expressed the lowest number of NCP compared with nature conservationists and tour guides, comprising mainly Tanzanian interviewees (82% of the nature conservationists were raised in Tanzania; 58% of the tour guides). Moreover, nature conservationists expressed the highest number of NCP across the investigated social actors, a result like other studies (Cáceres et al. 2015; Kockelkoren et al. 2023; Masao et al. 2022). This suggests that nature conservationists are a key social actor to consider for identifying NCP diversity. Nevertheless, we still favor a multi-actor approach in studies that aim to capture NCP diversity for two reasons. First, no researcher can foresee whether a social actor will be able to express the 'complete' NCP diversity that can be uncovered by the study. Second, Kockelkoren et al. (2023) and Masao et al. (2022) found that environment-related actors expressed a broad but not the complete NCP diversity uncovered. Hence, including a single social actor or a narrow set of social actors can result in omitting NCP. Furthermore, such a multi-actor approach can contribute to conducting socially inclusive research that accounts for multiple and diverse ways in which people relate to nature, an essential pathway to provide meaningful insights for inclusive sustainable management (Jacobs et al. 2020; Zafra-Calvo et al. 2020).

Methods as NCP-articulating institutions

We uncovered a total of 27 context-specific NCP of which one does not fit within the established NCP of the generalized NCP framework (Nicolás-Ruiz et al. 2023). *New and unique experiences* was expressed by all three social actors and has not been reported by any other study, neither in Kilimanjaro (except for Pearson et al. (2024) who used the same tourist interview data) nor elsewhere. Our findings demonstrate the value of open-ended questions for enabling social actors to express a wide set of NCP (Nicolás-Ruiz et al. 2023). This underscores the importance of applying narrated responses with a context-specific NCP lens to fully capture the diverse ways

that nature contributes to people's lives as expressed by social actors (Díaz et al. 2018; Hill et al. 2021).

Different question-framings presented interviewees with multiple opportunities to think about nature and its contributions to themselves and other people. Our study provides evidence that varying question-framings was necessary to uncover all 27 NCP (Table 4; Figure 2), stressing the value of reframing questions and their workings as tools to amplify NCP expression. For example, without including the question framed to evoke perceptions of the importance of nature (question-framing Importance) participants would have omitted *intergenerational benefits* from the NCP expressed. In fact, we found NCP are sensitive to question-framing (Figure 2), i.e., certain framings evoke expressions of specific NCP. We cannot prove whether these differences are a result of the NCP perceptions inherent to the different social actor groups or how the interviewees made meaning of the question-framing in the interview setting (Briggs 1986; Kövecses 2010). Yet, experimental research on question-framing indicates that even slight changes in phrasing can significantly influence the responses given (Schuman & Presser 1981). Falling short on question-framings can omit context-specific NCP. Also, the influence of variation in question-framing varies across contexts (Bryman 2016). Thus, we cannot advise other studies on using these particular question-framing/s or a specific number of question-framings. We can, however, suggest using multiple question-framings to reduce the risk of NCP omission.

The design of research methods is a vector of inclusion as well as omission of scientific knowledge (Balaine et al. 2024; Saltelli et al. 2020; West and Schill 2022). Methods used to identify NCP diversity do not simply *capture* NCP but also *frame* the space in which NCP are expressed. Hence, we propose them as 'NCP-articulating institutions'. It is the responsibility of us (researchers) to frame different questions in a way that different social actors comprehend them to ultimately maximize NCP identification. In fact, the rules we (researchers) follow to identify NCP diversity can be a conscious and a 'political' choice to conduct research in a inclusive manner (Jacobs et al. 2023; West and Schill 2022). To account for the many and diverse ways in which nature contributes to people's lives, we encourage NCP researchers similarly to researchers in nature valuation (Jacobs et al. 2020) to purposefully design their research to amplify social actors' expression of diverse NCP.

Pluralizing within methods enriches the NCP diversity

Previous literature has advocated for employing a plural method approach to uncover the multiple and diverse ways in which people relate to nature (e.g., Jacobs et al. 2018, 2020; Termansen et al. 2022; Totino et al. 2023). We show that the question-framing served as a 'tweak' within the method of semi-structured interviews that provided multiple opportunities for the social actors to think about NCP from various angles without switching methods. Hence, we claim that pluralizing question-framing can function as tools within the same method to amplify NCP expression, an

approach we term as a 'within-method pluralizing' approach. Drawing on recent findings from the field of nature's valuation, we borrowed the terminology and rationale of the 'within-method pluralizing' approach from the plural method approach used to capture a rich spectrum of values that different social actors express (Jacobs et al. 2018, 2020; Termansen et al. 2022). In fact, this study contributes to the field of nature's valuation by demonstrating the relevance of pluralizing within the same method by implementing variation in question-framings across the different social actors interviewed. Hence, we claim that 'within-method pluralizing' is one potential complementary approach to operationalize plural valuation.

Recommendations for empirically advancing 'within-method pluralizing'

To our knowledge, this is the first study to investigate how question-framings can affect social actors' expression of NCP. To advance empirical evidence on 'within-method pluralizing', we propose four endeavors for future studies.

(1) Investigate other wordings

We encourage future research to investigate the effect of question-framings, including other wordings than the four question-framings we posed, on NCP diversity expressed by social actors. For example, question-framings such as 'What do you and other people *use* from nature?' (Nicolás-Ruiz et al. 2023) and 'What aspects of nature are *worth conserving*, for you, and other people?' can also constitute relevant question-framings to investigate the expression of diverse NCP.

(2) Compare 'within-method pluralizing' across methods

We studied 'within-method pluralizing' with semi-structured interviews. We suggest to researching the effect of 'within-method pluralizing' for and across different methods, including interviews (Cáceres et al. 2015; Totino et al. 2023), questionnaires with open-ended questions (e.g. Masao et al. 2022), focus group discussions (e.g., Ebner et al. 2022; Lau et al. 2018), and arts-based methods (e.g., Pearson et al. 2024; Totino et al. 2023). Such comparative analysis would provide insights into whether 'within-method pluralizing' and plural method approaches are complementary or redundant in uncovering NCP diversity.

(3) Consider variation within social actors

Empirical evidence suggests within- and across-variation of social actors concerning, for example, NCP preferences (Tauro et al. 2018) and attitudes towards species (Arbieu et al. 2023), hinting at the risk of stereotyping and over-simplifying social actors. We hypothesize that NCP diversity is not only a results of including different social actors but also that of the internal heterogeneity that

exists within each social actor, including their different ways of meaning-making, and hence, is worthwhile investigating.

(4) Reflect on the role of the methods and its application to articulate scientific knowledge
Our study suggests that methods used to identify NCP diversity condition the results and hence, function as NCP-articulating institutions. In addition to the methods used to gather data, we argue that data analysis also, i.e., the translation of the interviewee's words into the scientific language of the context-specific NCP framework, is not neutral but determined by frameworks used, e.g. NCP, and rules, e.g., followedTal by researchers in the context of an inter-coder agreement. Against this background, we propose that future research also investigates how the selection of the framework of interest and the rules set by the researchers in the data analysis process articulate scientific knowledge.

Conclusion

Uncovering the multiple and diverse human-nature relationships is a pivotal endeavor of sustainability scientists to inform inclusive sustainable management. To this end, scholars argued for applying plural methods to evoke the expression of diverse NCP by social actors. Building on their argument, our study revealed that pluralizing question-framings in an interview setting also amplifies social actors' expression of diverse NCP. This suggests that by implementing a so-called 'within-method pluralizing' approach, a single method can capture a broad NCP spectrum. Although our study indicates the potential of 'within-method pluralizing' in uncovering a rich NCP diversity, whether the 'within-method pluralizing' approach can grow into its 'full' potential is a matter of us (researchers) to reflect on the use of methods – as NCP-articulating institutions in the case of our study – and accordingly develop them further for the sake of inclusive research. Ultimately, is it our (researchers) willingness – and we even claim responsibility – to make our tools work for the good.

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Authoring team

Name	ORCID
Milena Gross	0000-0003-3148-627X
Daria Shepeleva	0009-0000-5577-0166
Friedericke Vogel	0009-0000-1640-6265
Tuyeni Heita Mwampamba	0000-0003-4635-5774
Ugo Arbieu	0000-0002-0655-8756
Jasmine Pearson	0000-0001-6341-1382
Jennifer Kasanda Sesabo	0000-0002-8518-9011
Fabia Codalli	0009-0003-5226-2352
Berta Martín-López	0000-0003-2622-0135

Credit authorship contribution statement

MG and BML conceived the idea and designed the methodology; MG, JP, and one field assistant conducted the interviews; MG, JP, DS, and FV developed the coding scheme and analyzed the data; FC created the map; MG supervised by BML led the writing of the first draft of the manuscript. THM, UA, and JKS contributed to the discussion section. All authors commented on previous versions of the manuscript and gave final approval for publication.

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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Chapter IV Understanding variations in social actor preferences for nature's contributions to people for inclusive conservation: the case of Mount Kilimanjaro, Tanzania

Milena Gross, Tuyeni Heita Mwampamba, John Sanya,
Jasmine Pearson, Jennifer Kasanda Sesabo, Berta Martín-López

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Abstract

1. Context and need for the work: Despite calls for social actor inclusion in conservation management, there is still the risk of stereotyping social actors and over-simplifying their differentiated preferences for Nature's Contributions to People (NCP). Unraveling the NCP preferences of diverse and within social actors results in arguments pivotal for more inclusive conservation measures.

2. Approach and methods used: Using a socio-cultural approach, we conducted 261 face-to-face surveys in Mount Kilimanjaro, Tanzania, to examine the preferences for 25 context-specific NCP of three social actors: nature conservationists (n=50), tour guides (n=55), and tourists (n=156). We also compared NCP preferences between and within the three social actors and explored how socio-demographic attributes and interaction with nature might drive NCP preferences.

3. Main results 1: Our results show that social actors preferred a large variety of NCP, although significant differences were observed between nature conservationists (who preferred mainly regulating and material NCP) and tourists (who preferred non-material NCP). Tour guides' NCP preferences were more diverse and overlapped with the preferences of the other two social actors.

4. Main results 2: Canonical correspondence analyses with partial least squares extension revealed that NCP preferences within social actors were associated with respondents' level of formal education and their interaction with nature, i.e., feeling close to nature and the actual time spent in nature. Given this, we argue that exploring the internal heterogeneity of social actors' NCP preferences is not only a matter of socio-demographic attributes but also people's interaction with nature.

5. Policy implications: Our results demonstrate the importance of accounting for plural NCP preferences between and within social actors to avoid stereotyping and over-simplifying social actors and to achieve more inclusive conservation.

Muhtasari

1. Muktadha na umuhimu wa kazi: Licha ya miito ya ushirikishwaji wa wadau katika usimamizi wa uhifadhi, bado kuna hatari ya kuwa na maoni potofu kwa wadau na kurahisisha tofauti ya chaguzi zao za Michango ya Mazingira Asili kwa Watu (MMAW; *NCP* kwa kiingereza). Utambuzi wa chaguzi za MMAW kwa wadau anuai na ndani ya makundi ya wadau unaweza kuzalisha hoja muhimu kwa ajili ya tathmini za uhifadhi jumuishi.

2. Mitazamo na mbinu za utafiti: Tulitumia mtazamo wa kijamii na kitamaduni, tulifanya dodoso la ana kwa ana kwa watu 261 katika eneo la Mlima Kilimanajro, Tanzania kutafiti uchaguzi wa Michango 25 ya Mazingira asili kwa Watu yenye mukhtadha mahususi kwa wadau wakuu watatu; wahifadhi wa mazingira (50), waongoza watalii (55) na watalii (156). Zaidi ya hapo, tulilinganisha chaguzi za MMAW baina na ndani ya makundi hayo matatu ya wadau na kuchunguza namna taarifa za kijamii na kidemografia, na tabia za mwingiliano wa mazingira zinazochangia chaguzi za MMAW.

3. Matokeo muhimu 1: Matokeo yanaonyesha kwamba wadau walipendelea aina tofauti za Michango ya Mazingira Asili kwa Watu (MMAW), ingawa tofauti kubwa zilionekana kati ya wahifadhi wa mazingira (ambao walipendelea zaidi faida zinazohuzu udhibiti na vitu) na watalii (amabao walipendelea faida zisizoonekana/shikika). Waongoza watalii walionesha umuhimu wa faida anuwai za MMAW na ulifanana ka kiasi na chaguzi za makundi mengine mawili ya wadau.
4. Matokeo muhimu 2: Uchambuzi wa njia ya *“Canonical correspondence”* kwa kutumia ‘*least squares extension*' ulionesha kwamba chaguzi za MMAW ndani ya makundi yote ya wadau ulihusishwa na kiwango cha elimu rasmi, na mwingiliano wao na mazingira asili, yaani; kuhisi ukaribu na muda halisi walioutumia katika mazingira asili. Kwa kuzingatia hili, uchunguzi wa uasili wa utofauti kuhusu chaguzi za MMAW kwa wadau sio jambo tu la taarifa za kijamii na kidemografia bali pia muungiliano wa watu na mazingira asili.
5. Umuhimu wake kisera: Matokeo haya yanaakisi umuhimu wa ujumuishaji wa uwingi wa chaguzi za MMAW baina na ndani ya makundi ya wadau ili kuepuka mawazo potofu na kutozingatia makundi ya wadau na kufanikisha uhifadhi jumuishi zaidi.

Keywords

Human-nature interaction; Interwoven NCP approach; National park; NCP demand; Stakeholder heterogeneity

Introduction

> “The single story creates stereotypes, and the problem with stereotypes is not that they aren't true, but they are incomplete. They make one story become the only story.” (Adichie, 2009)

Inclusive conservation calls for, among others, integrating diverse social actors into conservation approaches to overcome existing conservation measures that solely focus on the needs and interests of a single or particular social actor(s), i.e., social actor narrowness (Tallis & Lubchenco, 2014; Jacobs et al., 2016, 2018; Pascual et al., 2023). Yet, relying on the opposite, i.e., social actor pluralism, poses the risk of generalizing the needs and interests of the group members and hence, falling short of acknowledging a potential within-social actor heterogeneity (hereafter also referred to as internal heterogeneity). Interpreting the statement expressed by Adichie (2009), with which we open this work, translates into the following: Although using the social actor concept might reveal the "true” needs and interests of a social actor, their stereotyping and simplification into one story can lead to “incompleteness”. Thus, ignoring both social actor pluralism and the internal heterogeneity of social actors can jeopardize the inclusiveness of conservation approaches.

Conservation approaches that ignore social actor pluralism have been particularly observed for market-based conservation measures coupled with nature[11]-based tourism to generate revenues to fund conservation measures (e.g., Brockington, 2008; Honey, 2008; Nelson, 2012; Holroyd, 2016, 2017). Such approaches assume that focusing on tourists' needs and interests can contribute to designing measures that ensure tourist satisfaction while guaranteeing nature conservation. In contrast, they often override not just the needs and interests of social actors residing and working in those landscapes but also conservation efforts within and outside the protected area (Brockington, 2008; Honey, 2008; Sébastien, 2010; Nelson, 2012; Holroyd, 2016, 2017), such as the needs and interests of protected area managers, governmental and non-governmental conservation employees, and tour operators and tour guides. Although tourists, nature conservationists, and tour guides might overlap in their interest in protecting nature, their needs and interests in nature and hence, their arguments for its protection might differ. Such needs and interests can be investigated through their demand for Nature's Contributions to People (NCP), understood as "stated interests" or "preferences" (Iniesta-Arandia et al., 2014; Castillo-Eguskitza et al., 2018; Díaz et al., 2018) and hence, hereafter referred to as NCP preferences. For example, nature conservationists' primary goal is to preserve regulating NCP (e.g., Bidegain et al., 2019), while tourists are mainly interested in non-material NCP (e.g., Felipe-Lucia et al., 2015). Although several studies on NCP preferences in landscapes with protected areas have targeted multiple social actors, such as residents and tourists (e.g., Oteros-Rozas et al., 2014), tourists and conservation professionals (e.g., Iniesta-Arandia et al., 2014), or tour guides and conservation professionals (Felipe-Lucia et al., 2015), the simultaneous consideration of diverse social actors in the nexus of conservation and nature-based tourism has rarely been implemented (e.g., Ebner et al., 2022).

Understanding differences in NCP preferences between social actors but also within social actors is essential to developing more inclusive conservation measures to avoid stereotyping and over-simplifying NCP preferences (Tauro et al., 2018). Evidence on internal heterogeneity is not just absent in the nexus of nature conservation and nature-based tourism but also remains scarce for other social actors, such as farmers (Tauro et al., 2018), revealing a research gap critical to inclusive conservation. Moreover, NCP preferences vary due to a complex set of factors. Studies show that it is necessary to disaggregate NCP preferences by socio-demographic attributes, such as the level of formal education. Martín-López et al. (2012), for example, detected that respondents with lower levels of education preferred material NCP in landscapes with protected areas in Spain. In addition to socio-demographic attributes, the connection and scope of experience with nature

[11] We acknowledge that people differ in their understanding of nature and perception of how they relate with nature, depending on the worldview and knowledge system they are embedded in (Díaz et al., 2015; Coscieme et al., 2020). We understand and use the term nature here in its most inclusive framing to recognize diverse understandings and perceptions.

can impact the NCP preferences. Former studies discussed the link between people's disconnection with nature and NCP preferences, whereby the disconnection was usually investigated through proxies such as the rural-urban gradient, and urban respondents highly preferred regulating and non-material NCP (Martín-Lopéz et al., 2012; Zoderer et al., 2019). Yet, Bashan et al. (2021) argue that measured indicators that capture people's connection with nature, such as how close people perceive themselves as related to nature or the time spent in nature, are to be favored over proxies such as the rural-urban gradient. So far, it remains unclear how these two indicators, i.e., subjective "closeness with" and "time spent in" nature, are associated with NCP preferences.

To fill the aforementioned research gaps, we applied a socio-cultural approach to elicit the between- and within-social actor NCP preferences in the conservation and nature-based tourism nexus in an iconic mountain system of the Global South: Mount Kilimanjaro (hereafter also referred to as Kilimanjaro). Mountains offer an excellent platform to study the NCP preferences in this nexus, as they provide recreation opportunities but also many other NCP derived from conservation efforts (Grêt-Regamey et al., 2012; Walz et al., 2016; Martín-López et al., 2019). For example, mountains regulate various ecological processes, such as regulation of climate and air quality, and contribute to meeting basic needs such as freshwater and food provision to people (Payne et al., 2020; Wamucii et al., 2021). The diversity of NCP supplied by mountains can result in competing NCP preferences between various social actors in the nexus of conservation and nature-based tourism as well as within the social actor, leading to divergent opinions on management priorities (Ebner et al., 2022). To understand the NCP preferences of social actors in this nexus, i.e., nature conservationists, tour guides, and tourists, we addressed the following three research questions: (1) Which NCP provided by nature in Kilimanjaro do the social actors in the nexus of conservation and nature-based tourism prefer?; (2) How do the NCP preferences differ between the social actors?; and (3) Which social actors' socio-demographic attributes and interaction with nature drive NCP preferences between and within social actors? Based on the insights of our study, we discuss implications for inclusive conservation in landscapes with protected areas.

Case study

The social-ecological system of Kilimanjaro consists of the biophysical unit of Mount Kilimanjaro and the associated social actors, including nature conservationists, tour guides, and tourists. Mount Kilimanjaro is the highest free-standing mountain in the world, located 300 km South of the equator in East Tanzania. Across its elevational gradient, the mountain harbors a broad and unique range of ecosystems and hence, is a biodiversity hotspot (Hemp & Hemp, 2018). The vegetation types consist of lowland forest and savanna (700m–1100 masl); submontane and lower montane forest (1100m–1800 masl); middle montane *Ocotea* (Camphor) forest (1800m–2800 masl); upper montane *Ocotea* (Camphor) forest (2800m–3200 masl); subalpine *Erica* bushland and forest

(3200m–4000 masl); alpine *Helichrysum* vegetation (4000m–4600 masl); and upper alpine and nival zone bare of vegetation and presence of glaciers (4600m–5895 masl) (C. Hemp et al., 2018).

The different ecosystems foster a diverse NCP supply that can fulfill the needs of multiple social actors. Kilimanjaro's study area encompasses non-protected and officially protected landscapes. The non-protected Southern slopes of the mountain (700–ca. 1700 masl) are inhabited and cultivated as agricultural fields and Chagga home gardens. Cash crops such as coffee, maize, and sunflowers are grown in large-scale mono-crop fields, mainly providing food (Misana et al., 2003; Soini, 2005). The local communities who reside on the Southern slopes of the mountain mainly belong to the Chagga tribe. Chagga traditionally farm in a multilayered biodiverse coffee-banana agroforestry system with a vegetation system like the one found in humid tropical forests, known as Chagga home gardens (Hemp, 2006). Such supply material NCP, e.g., food and energy, but also non-material NCP, e.g., cultural heritage and identity (Sébastien, 2010). Other parts of the mountain have also been culturally important for the Chagga people. For example, Kifunika Hill, nowadays located inside the Kilimanjaro National Park (KINAPA, ranging from approximately 1600–2350 masl depending on the location on the mountain to 5895 masl (Hemp et al., 2017), has been one of the most significant sacrificial sites for Chagga (Frömming, 2009). Moreover, the Park primarily provides regulating NCP, including regulation of climate and freshwater, and other non-material NCP, such as recreation and aesthetic experiences (C. Hemp et al., 2018; Masao et al., 2022).

The iconic mountain is one of the most popular nature-based tourism attractions in Tanzania, with trekking being the main tourism activity (Kilungu et al., 2019). The Park officially opened for tourism in 1977, and its gates are the start and finish point for six multiple day climbing routes to reach the highest point, Uhuru Peak (5895 masl). With ca. 47000 tourists in 2022/2023, tourism in KINAPA plays a crucial role in the local and national economy (Tanzania National Parks, 2023). Moreover, the non-protected Southern slopes attract day-trip visitors interested in waterfalls and bio-cultural experiences with the Chagga (Kilungu et al., 2019; Tanzania National Parks; 2023). Locally, touristic actors, such as tour guides, sustain their livelihoods through salaries and tips (Peaty, 2012; Christie et al., 2014). The estimated income of a tour guide per year is $1830, an income that is significantly higher than the average national income ($300 per person), and hence, tour guiding has become an attractive job opportunity (Mitchell et al., 2009). Nationally, KINAPA generated US$51 million in revenue through governmental park fees in 2013 (Musa et al., 2015),the second-most revenue of any Tanzanian national park after Serengeti National Park (Christie et al., 2014). This revenue is proportionally reinvested in its conservation (Adili & Robert, 2016). A comparatively low share of the revenue also benefits development and infrastructure projects for local communities adjacent to KINAPA (Murusuri & Nderumaki, 2013).

Methods

Survey design

We collected data using an English-speaking questionnaire implemented in ArcGIS Survey 123 (Version 3.15.165) to guide face-to-face surveys between the researchers or the research assistant and the respondent. For this study, we used three sections from the questionnaire relevant to answer our research questions: (1) NCP preferences, (2) interaction with nature, and (3) socio-demographic attributes.

To elicit the NCP preferences, we applied an interwoven approach (Hill et al., 2021) that departed from the context-specific perspective to complement the generalizing perspective of the NCP framework (Díaz et al., 2018). To apply the context-specific perspective, we conducted 130 semi-structured interviews with people residing on, working at, and visiting Kilimanjaro (interview guides in Supporting information S1.1-S1.3; Supporting information on interview collection and analysis in Supporting information S2). While former studies have used socio-cultural methods to reveal ecosystem service preferences (e.g., Martín-López et al., 2012; García-Llorente et al., 2018; Zoderer et al., 2019), applying the context-specific perspective of the NCP framework in such methodological approach and with diverse social actors remains novel in empirical research. Through these interviews, we identified 25 context-specific NCP, which we linked back to the generalizing NCP categories (Díaz et al., 2018), using an interwoven approach (Hill, et al., 2021), except for the NCP *new and unique experiences.* Then, we classified them into regulating (n=10 NCP), material (n=6), and non-material (n=8) NCP groups (Table 1), following Díaz et al. (2018). Regulating NCP refer to ‘functional and structural aspects of organisms and ecosystems that modify environmental conditions experienced by people and/or regulate the generation of material and nonmaterial contributions’ (Díaz et al. 2018, 271), e.g., pollination. Material NCP comprise ‘substances, objects, or other material elements from nature that directly sustain people’s physical existence and material assets’ (Díaz et al. 2018, p. 271), e.g., food. Non-material NCP ‘are ‘nature’s effects on subjective or psychological aspects underpinning people’s quality of life, both individually and collectively’ (Díaz et al. 2018, p. 271), e.g., aesthetic enjoyment. Furthermore, the NCP *intergenerational benefits* cross-cuts the three groups and hence, we kept it separately (Díaz et al., 2018) (Table 1).

Table 1 Overview of the 25 context-specific Nature's Contributions to People (NCP) used in the survey, NCP descriptions based on the interviews (e.g., Pearson et al., 2024) and Díaz et al. (2018), and NCP linked with the generalizing NCP category (Díaz et al., 2018), using an interwoven approach (Hill et al., 2021). Icon design credit: Jelke Meyer.

NCP	Description	Generalizing NCP category
Regulating NCP		
Habitat creation and maintenance	Nature's processes and conditions to form and continue providing a place for human and non-human organisms to live and thrive	1. Habitat creation and maintenance
Pollination	Animals' contribution of distributing pollen among flowers	2. Pollination and dispersal of seeds and other propagules
Dispersal of seeds	Animals' contribution to moving seeds such birds and elephants as seed dispersers	
Regulation of air quality	Nature's processes of purifying air to improve its quality for people	3. Regulation of air quality
Regulation of climate	Nature's regulation of atmospheric conditions, including effects on greenhouse gases and temperature, carbon sequestration and storage, and pleasant weather conditions	4. Regulation of climate
Regulation of freshwater quantity	Nature's hydrological processes to regulate the water flow and function as a source of water for various people-related purposes, e.g., irrigation and water for domestic use	6. Regulation of freshwater quantity, location and timing
Regulation of freshwater quality	Nature's processes of purifying water to improve its quality for people	7. Regulation of freshwater and coastal water quality
Regulation of soil fertility and protection of soils	Nature's processes occurring in the top layer of the Earth's crust to sustain plant growth and to prevent the in/organic surface materials from erosion	8. Formation, protection and decontaminati on of soils and sediments
Regulation of hazards and extreme events	Nature's processes to prevent or reduce damage to people and their infrastructure caused by natural disasters and events such as strong floods, winds, and storms	9. Regulation of hazards and extreme events
Regulation of detrimental species	Controlling effects derived from organisms and abiotic conditions on organisms that are pests or transmit diseases, e.g., the temperature limits the spatial coverage of anopheles mosquitos which can transmit Malaria disease	10. Regulation of detrimental organisms and biological processes
Material NCP		
Energy	Production of timber-based fuels such as firewood and hydropower	11. Energy
Food	Production of eatables and beverages derived from wild, managed, or domesticated organisms for human	12. Food and feed

		consumption, e.g., maize, banana, coffee, milk, and meat	
	Feed	Production of forage and fodder for domesticated animals such as grasses	
	Building materials	Producing materials derived from nature to construct buildings such as timber	13. Materials, companion-ship and labor
	Materials for domestic use	Producing materials derived from nature to make furniture, everyday objects, tools, aids, and accessories	
	Medicine	Collection and production of materials derived from non-human organisms used for salutary purposes such as insects and herbs	14. Medicinal, biochemical and genetic resources
Non-material NCP			
	Learning	Different levels of acquiring knowledges and gaining insights that can be experienced by and through nature, from education on different species to cultural exchange and new profound perspectives, which can influence one´s outlook on life	15. Learning and inspiration
	Aesthetic enjoyment	Pure pleasure of the appealing appearance and beauty of nature	16. Physical and psychological experiences
	Recreation	Provision of opportunities for physical activities in nature such as hiking and animal watching	
	Therapeutic and restorative benefits	Nature's opportunities for improving physical and psychological well-being through for example a break from technology and modern life	
	New and unique experiences	Provision by nature of novel and special opportunities for people to encounter	*Context-specific NCP that cannot be linked*[12]
	Connectedness with nature	Opportunities for people to develop or strengthen relationships with nature, a feeling of being part of nature, and feeling emotionally, physically, and spiritually connected to nature	17. Supporting identities[13]
	Cultural heritage and identity	Nature's opportunities for maintaining culture through ongoing cultural practices, ancestral ties, sacred places, and/or the historical significance of nature that represents collective human identities and heritage	
	Social cohesion and bonding	Basis of nature for people to develop new connections or nurture their existing relationships with other people	

[12] This publication differs from the version submitted as Ph.D. thesis; *New and unique experiences* was marked as '16. Physical and psychological experiences'.

[13] This publication differs from the version submitted as Ph.D. thesis; *Connectedness with nature* was marked as 'Context-specific NCP that cannot be linked'.

Intergenerational benefits			
	Intergenerational benefits	Maintaining the existence of nature for future generations to experience	18. Maintenance of options

Based on these 25 context-specific NCP, we designed an interactive section in the survey to elicit the NCP preferences in three steps: First, we asked the respondents to select up to five NCP (out of a list with 25 NCP) according to the importance of the NCP to them and their life (e.g., Zoderer et al., 2019) (questionnaire in Supporting information S1.4). Secondly, we instructed respondents to place the five selected NCP as physical cards on a laminated ranking template, with rank one representing the most preferred NCP and rank five the least preferred NCP. Respondents could not rank two or more NCP on the same rank, if even they were equally preferred by them. It is, therefore, important to recognize that the ranking method forced an order. We also wanted to avoid that respondents did not take the time to thoroughly think about it by, for example, putting all selected NCP at the same level of preference. Nevertheless, we allowed respondents to nuance their ranking through a final step. Finally, respondents specified the importance by distributing between 1 and 100 points to the NCP ranked first and then subsequently lower points to the descending ranks (hereafter referred to as NCP points). To do so, we introduced the following three rules: First, respondents could not distribute the same number of points to two NCP, as we assumed that NCP could not be equally important, even if they are. However, the final step allowed respondents to express a one-point difference between similarly important NCP, while increasing the difference between two ranked NCP because one is certainly more important than the other. Second, the accumulated points did not have to add up to a specific sum. The last rule allowed respondents re-order the ranks assigned to the selected NCP and then re-distribute the points accordingly, if necessary.

We did not mention the terms NCP and ecosystem service to the respondent to ease understanding. Instead, we described the concept of NCP using laypeople's language and visual assistance (Martín-López et al., 2012; Supporting information S1.4). We provided respondents with laminated sheets presenting the 25 NCP (Supporting information S1.4). For each NCP, the laminated sheet presented its name, examples taken from the interviews as explanations, and two exemplary pictures as visual representations (Iniesta-Arandia et al., 2014; Oteros-Rozas et al., 2014). We created three sets of laminated sheets that presented the NCP in a randomized order (Supporting information S1.4). The software ArcGIS Survey 123 randomly chose the NCP set we presented to the participant.

To study people's interaction with nature, we considered two indicators in the survey: (1) the scale of closeness to nature based on Schultz' (2002) Inclusion with Nature in Self scale and (2) the relative share of time spent in nature during the week and on the weekend. Via Schultz' (2002)

scale, respondents stated to what extent they felt close to nature on a visual gradient with seven levels/pictures, ranging from complete separation to complete inclusion (scale displayed in S1.4). Each level/picture depicts two circles with one representing the self, i.e., the respondent, and the other one nature. The left side of the scale represents two circles next to each other, i.e., a relationship in which the respondent's self and nature are completely separate. The right side of the scale represents two overlapping circles, i.e., a relationship in which the respondent's self and nature are one. The levels/pictures in between display a gradient with an increasing closeness between the respondent's self and nature. Additionally, we designed a section on socio-demographic attributes with closed-ended questions covering information on age, gender, nationality, belonging to Kilimanjaro's local communities, and level of formal education. Supporting information S1.4 entails the survey questionnaire and material of the three sections and Table S2.2 describes the variables obtained from the questionnaire.

Data collection

Between August and November 2022, we ran the survey with respondents belonging to three different social actors, i.e., nature conservationists, tour guides, and tourists, who were at least 18 years old. We conducted the surveys in 51 locations, including offices of survey respondents, our fieldwork office, cafés, and restaurants in Moshi, and hotels, lodges, and hostels in Kilimanjaro (Fig. S2.1). Before collecting data, we pre-tested the questionnaire in iterative rounds with former tourists and students at the university of the first author and in Kilimanjaro.

Nature conservationists were working for the KINAPA Authority operating under Tanzanian National Parks (TANAPA) as well as water, forest, agricultural, and natural resource officers at the regional and district level, and members of, for example, environmental non-governmental organizations and community-based organizations, all of whom were engaged in conservation activities in Kilimanjaro. Conservation activities outside the Park comprised resolving human-wildlife conflicts, ecosystem restoration, and tree planting. There are also projects that couple livelihoods and the preservation of mature trees through, for example, traditional bee-keeping in trees and growing the oyster nut (*Telfairia pedata*), which has a nutritious and medicinal seed, on old trees (e.g., C. Hemp et al., 2018). *Tour guides* comprised both freelancing guides and tour operators, who have also been working as tour guides, all of whom operated in Kilimanjaro. Mountain tour guides in Kilimanjaro usually follow a professional ladder, starting as porters, advancing to assistant guides, and finally becoming full guides (personal communication with the KINAPA tourism officer and several senior guides). Guiding requires proper English communication skills and an official certificate issued after completing at least a four-week training program by the College of Wildlife Management, Mweka, or other recognized training institutions. Guides who lead tours to nature-based activities outside the Park are usually informally trained by friends and family members (personal communication with several senior guides). Most nature conservationists and tour guides comprised members of Kilimanjaro's local communities, i.e., their

family history is rooted in Kilimanjaro, and they might also be involved in typical livelihood activities such as farming. While tour guides used to be from Kilimanjaro's farming communities (Peaty, 2012), the share of tour guides originating from other parts of Tanzania has increased (personal communication with several senior guides in Kilimanjaro). There are also non-Tanzanian tour guides, often from Kenya (personal communication with senior full guides in Kilimanjaro). *Tourists* were predominantly international, with a small proportion of national visitors. We sampled tourists only after they had experienced at least one nature-based activity in Kilimanjaro. Such activities comprised a multiple-day tour to reach the summit, a one-day hike within the Park, hikes to waterfalls outside the Park, and activities in the Chagga home gardens. It is worthwhile noting that respondents might have taken on multiple identities in their lives. Hence, they could represent multiple, also non-targeted social actors, e.g., a local person who is a nature conservationist or a tour guide *sensu* our definition might also be a local smallholder in Kilimanjaro. In this study, we consider the respondents' social actor as their identity expressed when we encountered them. To avoid stereotyping and over-simplifying a respondent's multiple identities to the targeted social actor and instead, to account for potential variances of NCP preferences within one social actor, we additionally explored the internal heterogeneity within each social actor.

To determine the sample size for each social actor, we consulted the natural resource officer from Moshi municipality, district officers dealing with nature conservation, and the KINAPA tourism officer. Then, we estimated a representative sample size of respondents at a confidence level ranging from 90-98% with a margin error of 10%, i.e., nature conservationists (n=30), tour guides (n=46), and tourists (n=136) (Table S2.4). The final sample size was 261 respondents: 50 nature conservationists, 55 tour guides, and 156 tourists.

We identified respondents through (1) contacting governmental, regional, and district officers; (2) searching the web for tour guides and nature conservationists; (3) approaching tour guides and tourists, for example, at Machame and Mweka gates, in their offices or during nature-based activities; (4) contacting tour guides and nature conservationists who were previous interviewees; and (5) asking the respondent for prospective respondents upon completion of the survey.

The surveys lasted between 30 minutes to two hours. However, the duration of responding to the three sections we used was shorter, as the survey was a joint effort among several researchers of the Kili-SES Research Unit (https://kili-ses.senckenberg.de/en). We opted for a joint questionnaire over multiple shorter ones to minimize respondent fatigue. To succeed in the sampling process, we relied on a team composed of a Postdoctoral researcher, Ph.D. students, and research assistants who participated in survey training over six days (Supporting information S3). To account for potential language barriers and cultural values, Tanzanian field assistants mainly

surveyed local nature conservationists and tour guides, while international researchers surveyed tourists.

Ethics

Before we collected any data, the Ethics Committee at the university of the first author (reference number: EB-Antrag_202104-07-Martin-Lopez_KiliSES; EB-Antrag_202109-12-Martin-Lopez_KiliSES-02; EB-Antrag_202206-11-Martin-Lopez_KiliSES 02) approved the interview and survey based on an ethics application including the interview guides and questionnaire, respective Tanzanian institutions, including Tanzania Commission for Science and Technology (COSTECH; 2021-225-NA-2021-09; 2022-308-NA- 2021-09), Tanzanian Wildlife Research Institute (TAWIRI), and TANAPA granted research permits. As is required protocol for undertaking research in Tanzania, executive commissioners at regional and district levels as well as tour guides, tour operators, or tour agents had provided written or oral permission.

We explained (prospective) respondents the procedure and goals of the survey and their rights as research participants. Most respondents volunteered to provide their contact details, allowing us to share our written explanation form and a detailed consent form beforehand (Supporting information S4.1 and S4.2). We presented the forms at the survey appointment if we could not share them beforehand. Moreover, we granted respondents the right to withdraw their data entry before data analysis. We did not attach personal information to their data entry to guarantee anonymity and hence, collected our data pseudo-anonymously by handing out a randomly chosen and unique ID to each respondent on an ID card. We attached a numeric ID to the data entry of each respondent but not to any information that would allow us to identify the person and reveal contact details. To exercise their right, we informed respondents orally and on the ID card to email the first author, state their ID, and request to remove their data entry. Furthermore, the ID card entailed a thank you note, the link to the research project website, and the first author's email address to request a summary of the results in laypeople's terms. For all respondents, we obtained written informed consent.

Another ethical issue – in the context of any scientific work – concerns the researchers' positionality (first author's positionality statement in Supporting information S4.3).

Quantitative analyses of NCP preferences

For all analyses, we used the NCP points (details in 3.1 Survey design) as a variable representing the NCP preferences. First, we conducted descriptive statistical analyses of the relative share of NCP preferences expressed by all respondents and each social actor. Secondly, we used the non-parametric Kruskal-Wallis test for each NCP to unravel differences in their preferences between social actors because the Shapiro-Wilk Normality Test did not indicate the normal distribution of the NCP points. When the Kruskal-Wallis tests achieved 95% significance, we applied Dunn's

pairwise comparison tests with Bonferroni adjustment to detect the differences between the three social actors. We ran these statistical tests using the *stats* (R Core Team, 2013) and *FSA* packages (Dinno, 2017; Ogle et al., 2022) in RStudio Version 1.4 (RStudio Team, 2021). Thirdly, in a Venn diagram, we visualized the overlaps and discrepancies of the ten most preferred NCP, i.e., 40% of all NCP expressed by each social actor, between the three social actors. Finally, we performed predictive canonical correspondence analyses (partial least squares extension; hereafter referred to as CCA-PLS; ter Braak & Schaffers, 2004) in XLSTAT Version 2020.3.1 (Addinsoft, 2020) to assess the strength of socio-demographic attributes and variables representing people's interaction with nature in predicting NCP preferences. We ran one CCA-PLS for all respondents to compare between the social actors, and one CCA-PLS for each social actor to reveal the internal heterogeneity. To counteract potential biases of variables with low frequencies in the analyses, we removed the variable diverse gender (n=1 respondent). In addition, we excluded NCP that were <5% chosen by all respondents and tourists, and increased the exclusion threshold to <10% for nature conservationists and tour guides due to their comparatively smaller sample sizes (excluded NCP in Table S2.5). We visualized the CCA-PLS results in four biplots, one for all respondents and one for each social actor. We applied a log (x + 1) transformation for the quantitative variables NCP points and age in the Kruskal-Wallis test and CCA-PLS.

Results

Sample characteristics

The sample consisted of 261 respondents, whose age ranged from 18 to 81 years ($\bar{x}$=36.5 years; SD=12), predominantly men (67% of respondents) (full summary of sample characteristics in Table S5.1). Most nature conservationists (94%) and tour guides (98%) were Tanzanian citizens. Almost every second nature conservationist (42%) and more than half of the tour guides (62%) belong to Kilimanjaro's local communities. The tourists' sample consisted of citizens from all regions of the world, with the majority from Europe and Central Asia (65%) and the Americas (22%), followed by Africa (7%) and Asia and Oceania (6%) (IPBES Technical Support Unit on Knowledge and Data, 2020). Formal education (hereafter also referred to as education) varied between the social actors: tour guides mainly received school education and vocational training, whereas the majority of nature conservationists (82% of respondents) and tourists (76%) completed academic degrees. Almost every survey respondent (95%) visited the Park; 74% had additionally visited at least one other protected area in the world within the past year. Most tourists (82%) visited Kilimanjaro for the first time, and 93% of tourists hiked to the top of Mount Kilimanjaro or attempted to do so.

Regarding the respondents' interaction with nature, both nature conservationists and tour guides felt closer (median=6 on a scale from lowest (1) to highest (7) closeness to nature) than tourists (median=4.5) to nature. Tour guides spent the most time in nature during the week ($\bar{x}$=67.5% of their time, SD=23.8) and on the weekend ($\bar{x}$=65.8%, SD=25.8), followed by nature conservationists

and tourists (Table S5.1). While nature conservationists also spent more time in nature during the week ($\bar{x}$=57.8%, SD=29.1) than on the weekend ($\bar{x}$=43.0%, SD=30.7), the opposite pattern was visible for tourists (week: $\bar{x}$=26.8%, SD=22.5; weekend: $\bar{x}$=45.8%, SD=22.2).

Which social actor prefers which NCP?

The respondents preferred all 25 NCP, with different levels of preference. Overall, they gave the highest preference to *food*, *regulation of freshwater quality* and *air quality*, whereas minor preference to the *regulation of detrimental species*, *materials for domestic use*, and *dispersal of seeds* (Fig. S5.1). We detected significant differences in the preferences for 17 out of 25 NCP between the social actors (Fig. 1; Table S5.2).

Nature conservationists and tour guides expressed significantly higher preferences for five regulating NCP – *pollination, regulation of air quality*, *freshwater quantity and quality*, *soil fertility and protection of soils* – and three material NCP – *food*, *feed*, and *building materials*. At the same time, tourists expressed higher preferences for four non-material NCP – *aesthetic enjoyment*, *therapeutic and restorative benefits*, *new and unique experiences*, and *connectedness with nature.* Furthermore, nature conservationists preferred *energy* more than tour guides and tourists (Fig. 1; Table S5.2). Compared with tour guides, the other two social actors expressed higher preferences for *regulation of* climate. In contrast, tour guides and tourists expressed higher preferences for *learning* and *social cohesion and bonding* than nature conservationists (Fig. 1; Table S5.2). The NCP *intergenerational benefits* was more preferred by tour guides than the other social actors (Fig. 1; Table S5.2).

All social actors ranked among the ten most preferred NCP *habitat creation and maintenance*, *regulation of air quality*, and *recreation* (Fig. 2). Nature conservationists and tour guides coincided in having high preferences for *regulation of freshwater quantity* and *quality*, and *food*; nature conservationists and tourists for *regulation of climate*; and tour guides and tourists for *learning*, *new and unique experiences*, and *social cohesion and bonding*. Only nature conservationists expressed high preferences for *regulation of soil fertility and protection of soils*, *energy*, and *medicine*; tour guides for *intergenerational benefits*; and tourists for *aesthetic enjoyment*, *therapeutic and restorative benefits*, and *connectedness with nature* (Fig. 2)

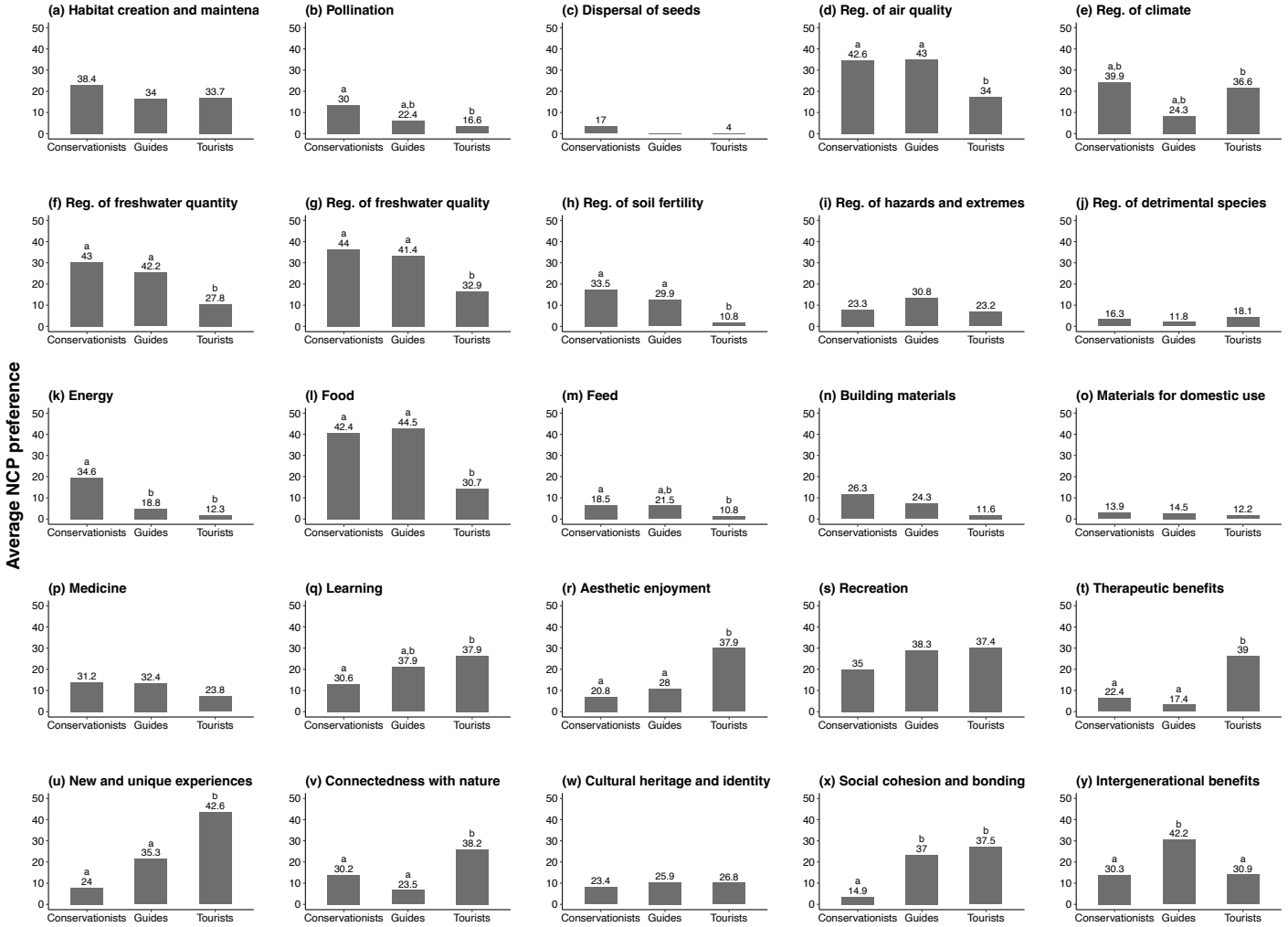

Figure 1 Bar plots representing the mean value of Nature's Contributions to People (NCP) preferences – the number above the bar indicates the standard deviation – for each social actor, and statistical differences for each NCP between the social actors based on Kruskal-Wallis test (df=2) (full summary of mean values, standard deviation, and test results in Table S5.2). Data of NCP preferences is based on NCP points. Significance level of $P < 0.05$. Bar plots with different letters (a, b, or c) indicate significant differences from pairwise comparison t-test based on the Dunn test with Bonferroni correction ($P < 0.01$). *Reg.* Regulation; *Reg. of hazards and extremes* Regulation of hazards and extreme events; *Reg. of soil fertility* Regulation of soil fertility and protection of soils; *Therapeutic benefits* Therapeutic and restorative benefits.

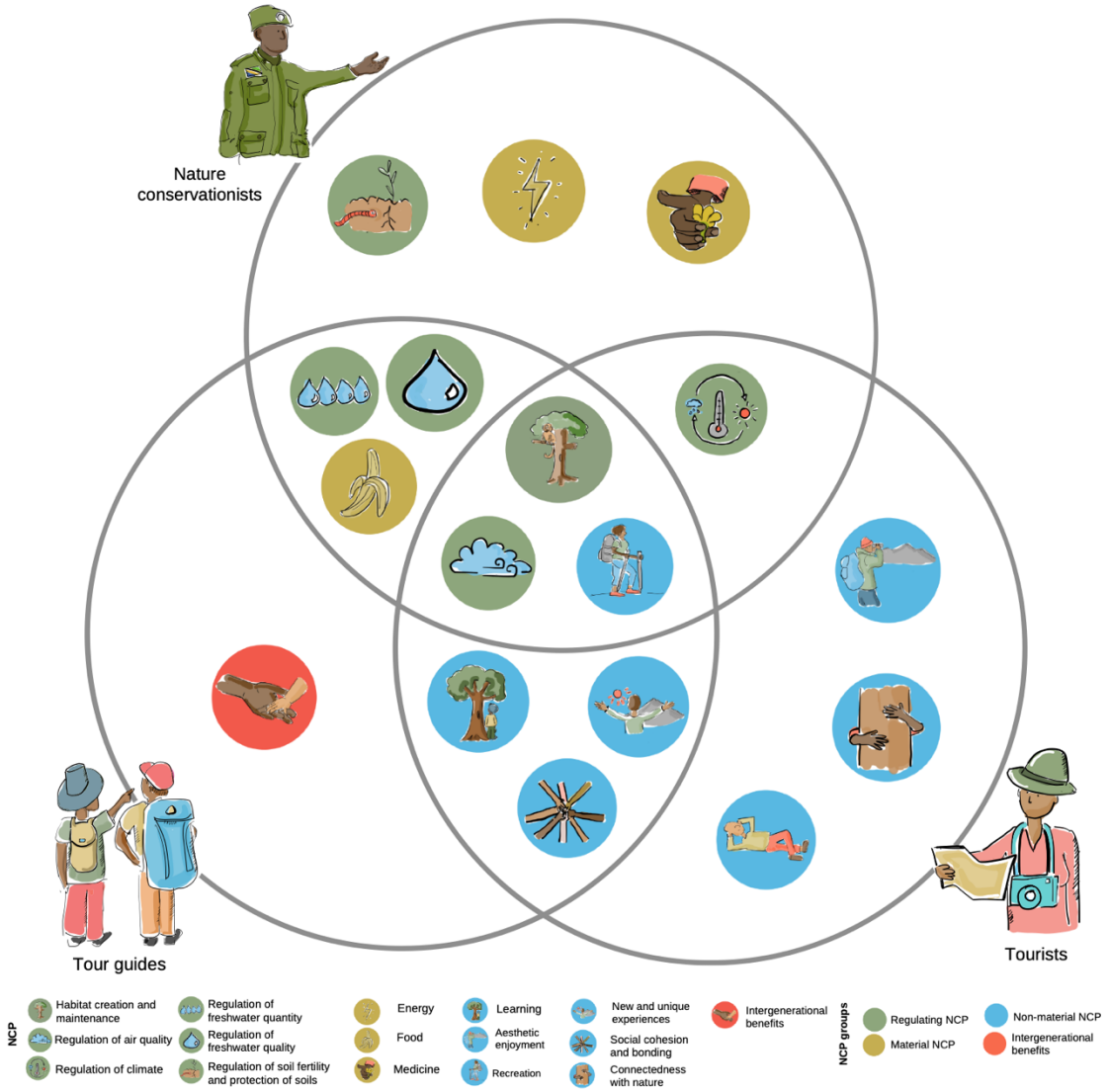

Figure 2: Venn diagram visualizing the overlaps in the preferences for the ten most important Nature's Contributions to People (NCP) expressed by nature conservationists, tour guides, and tourists (descriptive results in Fig. S5.1b-d). Design credit: Jelke Meyer.

What drives between- and within-social actor NCP preferences?

The four CCA-PLS revealed the effects of different variables associated with socio-demographic attributes and interaction with nature on the NCP preferences (Fig. 3; Table S5.3). Across all CCA-PLS, we found that age, gender, and the visit to another protected area did not explain NCP preferences. In contrast, variables related to formal education and interaction with nature, i.e., closeness to nature and time spent in nature, were pivotal.

For all respondents, the first axis of the CCA-PLS (89.7% of the explained variance) distinguished two groups of respondents (Fig. 3a; Table S5.3a). Positive scores of the first axis represented a mix of regulating – *pollination*, *regulation of air quality*, *freshwater quantity* and *quality*, *soil fertility and protection of soils* – and material NCP – *energy*, *food*, *feed*, *building materials*, and *medicine*. The positive scores were explained by feeling very close to nature, spending much time in nature during the week, and being from the Global South. *Regulation of climate* and *detrimental species, learning*, *aesthetic enjoyment*, *recreation*, *therapeutic and restorative benefits*, *new and unique experiences*, *connectedness with nature*, and *social cohesion and bonding* were represented in the negative scores. These NCP preferences were explained by the respondents' origin in the Global North and the social actor tourists. The positive scores of the second axis (10.3%) revealed that highly educated respondents were associated with the preferences for *cultural heritage and identity*. In contrast, the negative scores showed that those who felt very close to and spent much time in nature were more likely to prefer *habitat creation and maintenance*.

For nature conservationists, the first axis (61.7%) captured a gradient between those conservationists who spent more time in nature during the week versus during the weekend (Fig. 3b; Table S5.3b). In positive scores, conservationists who spent much time in nature during the week expressed higher preferences for *pollination*, *regulation of air quality*, *medicine*, *learning*, and *intergenerational benefits*. In negative scores, conservationists with graduate degrees or higher who are in nature on the weekend were associated with preferences for *habitat creation and maintenance, regulation of climate, freshwater quantity*, *learning*, and *cultural heritage and identity*. The negative scores of axis 2 (38.3%) represented those conservationists who felt extremely close to nature and spent much time in nature and preferred *recreation* and *connectedness with nature*. In contrast, those who felt moderately close to nature and spent less time in nature expressed preferences for *regulation of soil fertility and protection of soils*, *regulation of hazards and extreme events, energy*, *feed,* and *building materials* (positive scores of axis 2).

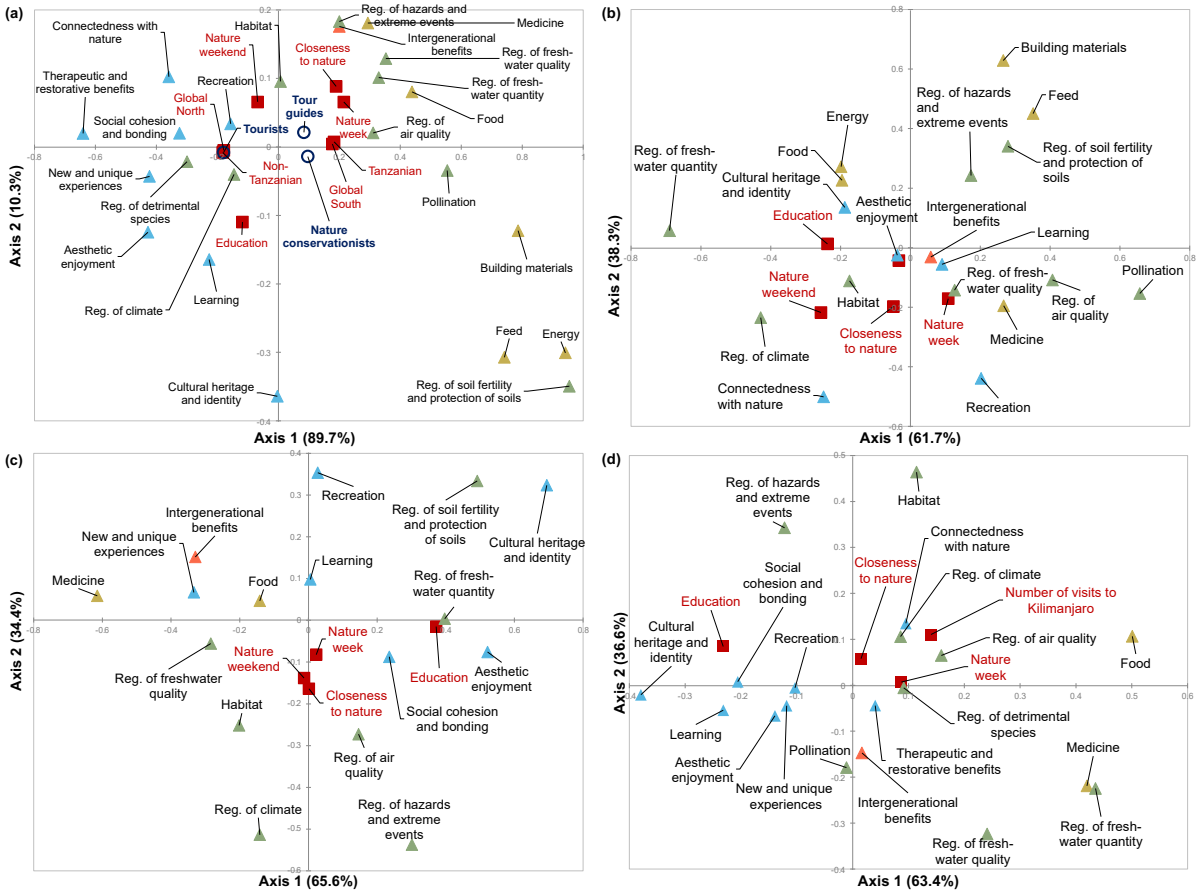

Figure 3 Biplots of the first two axes of the predictive Canonical Correspondence Analyses (partial least squares extension) (CCA-PLS), showing the association between preferences for Nature's Contributions to People (NCP) (▲ Regulating NCP, ▲ Material NCP, ▲ Non-material NCP, ▲ Intergenerational benefits) and explanatory variables (■ Explanatory variables and ○ Social actor) for (**a**) all respondents, (**b**) nature conservationists, (**c**) tour guides, and (**d**) tourists. The biplots do not represent NCP preference variables with squared cosines below 0.6 and explanatory variables with absolute values of standard coefficients below 0.3. Full statistical results are available in Table S5.3. NCP with the lowest frequencies were excluded in the CCA-PLS to reduce biases and, thus, are not displayed; detailed procedure of NCP exclusion in Methods. *Habitat* Habitat creation and maintenance; *Nature week* Time in nature during the week; *Nature weekend* Time in nature on the weekend; *Reg.* Regulation.

Regarding tour guides, we found that only tour guides with undergraduate degrees preferred *regulation of freshwater quantity*, *soil fertility and protection of soils*, *aesthetic enjoyment*, *cultural heritage and identity*, and *social cohesion and bonding* (positive scores of axis 1; 65.6%) (Fig. 3c; Table S5.3c). By contrast, less educated tour guides, i.e., mainly with school diplomas and vocational training, preferred diverse NCP, i.e., *regulation of freshwater quality*, *food*, *medicine*, *new and unique experiences*, and *intergenerational benefits* (negative scores). The second axis (34.4%) captured a gradient between non-material and regulating NCP, which the level of interaction with nature explained. Tour guides who felt moderately close to nature and spent little time in nature during the weekend were related to *learning* and *recreation* (positive scores). Tour guides who felt extremely close to nature and spent much time in nature on the weekend preferred *habitat creation and maintenance, regulation of air quality, climate,* and *hazards and extreme events* (negative scores).

For tourists, the first axis of the CCA-PLS (63.4%) revealed preferences distinct in NCP groups: regulating and material NCP (positive scores) versus non-material NCP (negative scores) (Fig. 3d; Table S5.3d). Tourists who spent much time in nature during the week and frequently visited Kilimanjaro preferred *regulation of air quality*, *freshwater quantity*, *detrimental species*, *food*, and *medicine* (material NCP). However, tourists with (post-)graduate degrees who spent less time in nature during the week and visited Kilimanjaro once or a few times preferred *learning*, *aesthetic enjoyment*, *recreation*, *new and unique experiences, cultural heritage and identity*, *social cohesion and bonding*. Axis 2 (36.6%) reflected a gradient of NCP preferences explained by education, closeness to nature, and the number of visits to Kilimanjaro. Tourists with undergraduate degrees and higher who felt close to nature and frequently visited Kilimanjaro preferred *habitat creation and maintenance*, *regulation of climate*, *hazards and extreme events*, and *connectedness with nature* (positive scores). By contrast, tourists with academic and non-academic degrees who felt more separated from nature and visited Kilimanjaro once or a few times preferred *pollination*, *regulation of freshwater quality*, and *intergenerational benefits* (negative scores).

Discussion

Our results show that social actors in the nexus of conservation and nature-based tourism preferred a large diversity of NCP, particularly *food*, *regulation of freshwater quality,* and *regulation of air quality*. Between-social actor variations in NCP preferences revealed that nature conservationists predominantly preferred regulating and material NCP, whereas tourists non-material NCP and tour guides NCP across all NCP groups. Remarkably, tour guides overlap in NCP preferences in the studied nexus. Moreover, the internal heterogeneity of social actors in NCP preferences was conspicuously driven by the respondent's level of formal education and their interaction with nature, i.e., feeling close to nature and the time spent in nature during the week and on the weekend. In the following sections, we discuss our findings on the NCP preferences

by social actors in the nexus of conservation and nature-based tourism and within each social actor to assess their implications for inclusive conservation.

NCP preferred by the different social actors in the nexus of conservation and nature-based tourism

Our results indicate that f*ood*, *regulation of freshwater quality* and *air quality* are the three most preferred NCP by the social actors in the nexus of conservation and nature-based tourism, a finding that corresponds with the literature that highlights the significance of mountains in providing essential NCP, such as food and regulation of freshwater quality (Grêt-Regamey et al., 2012; Martín-López et al., 2019; Payne et al., 2020). Moreover, in a participatory workshop in the study area of Kilimanjaro, Masao et al. (2022) found that diverse social actors, among others, conservation professionals and tourism sector representatives, also stated these three NCP as most important. The high preference for *food* corresponds with existing evidence depicting Kilimanjaro as a direct source of food for local people either through subsistence farming (Misana et al., 2003; Sébastien, 2010) or as being one of the largest cash crop regions in Tanzania (Agrawala et al., 2003; Misana et al., 2003). Furthermore, given the life-supporting role of Kilimanjaro as a water tower for millions of downstream users (Sébastien, 2010; Said et al., 2019), the high preference for *regulation of freshwater quality* (Fig. S5.1) is not surprising and align with studies in other tropical mountains in East Africa, e.g., Mount Kenya (Dell'Angelo et al., 2016). Respondents' high preference for *regulation of air quality* can be explained by the health benefits provided by forests in Kilimanjaro in contrast to the rather poorly vegetated savannah that surrounds its foothills (Misana et al., 2003; Hemp, 2009; Hemp & Hemp, 2018).

Despite the similarities in NCP preferences across social actors, they also expressed different NCP preferences (Table S5.2, Fig. S5.1): nature conservationists highly preferred regulating NCP, while tourists mostly preferred non-material NCP, a result that aligns with former research (e.g., Bidegain et al., 2019; Masao et al., 2022). The highest preference expressed by tourists was for *new and unique experiences,* an NCP distinct from other NCP categories portrayed in the generalizing perspective of the NCP framework, identified by applying the context-specific perspective (Díaz et al., 2018).

Finally, we found that tour guides expressed high preferences for diverse NCP (groups) (Fig. S5.1), reflecting their need to fulfill basic needs through *food*, *regulation of air quality* and *freshwater quality* as well as their interest in maintaining nature for younger and yet-to-be-born future generations, i.e., *intergenerational benefits*. Three reasons can explain this result. First, more than half of the tour guides (62%) belong to Kilimanjaro's local communities that traditionally grow, as smallholders, (a share of) their food in their home gardens and source water from Kilimanjaro's springs and streams (Hemp, 2006; Sébastien, 2010). Second, tour guides spend much time in nature and are likely to perceive and discuss issues of the perpetuity of nature with colleagues

and tourists. Also, the mandatory training program run by Mweka College for Wildlife Management on behalf of KINAPA Authority trains tour guides to act as “stewards of the mountain” (Murusuri & Nderukmaki, 2013, p. 74). Finally, tour guides are more aware of the significance of nature in providing jobs for future generations, as proved by their NCP preferences associated with their work, such as *recreation* and *intergenerational benefits.* Also, non-economic reasons can explain this preference: local tour guides might experience a strong attachment to Kilimanjaro’s nature that they want to maintain for future generations to experience. Moreover, tour guides had the highest overlap with nature conservationists and tourists concerning NCP preferences (Fig. 2). This result suggests that conservation management focusing on tour guides’ preferences might maximize NCP satisfaction also for (other) social actors in the nexus of conservation and nature-based tourism.

Unraveling the factors that drive within-social actor heterogeneity of NCP preferences

The level of formal education and interaction with nature powerfully drive within-social actor variations in NCP preferences. For all three social actors, local social actors with vocational training and tourists with undergraduate degrees, respectively, were more likely to express preferences for *medicine* and *intergenerational benefits* (Fig. 4). In contrast, those with (higher) academic degrees were likely to express preferences for non-material NCP. This result implies that more formally educated people have the opportunity and means to enjoy intangible benefits from nature and, in the particular case of tourists, their basic needs depend less on (material) NCP supplied by Kilimanjaro. Similarly, Martin-López et al. (2012) and Zoderer et al. (2019) found that people with lower levels of formal education preferred material NCP, while those with higher education preferred non-material NCP. Yet, these findings and our results do not align with Lau et al. (2018) who found that the years of formal education did not influence NCP preferences expressed by fisher communities across four countries in the western Indian Ocean. Moreover, the CCA-PLS results for tour guides show that those with non-academic degrees were more likely to prefer *intergenerational benefits* (Fig. 4), which can be explained by the assumption that those tour guides who are less educated have limited opportunities to take on other well-paid jobs that can contribute to the welfare of their children.

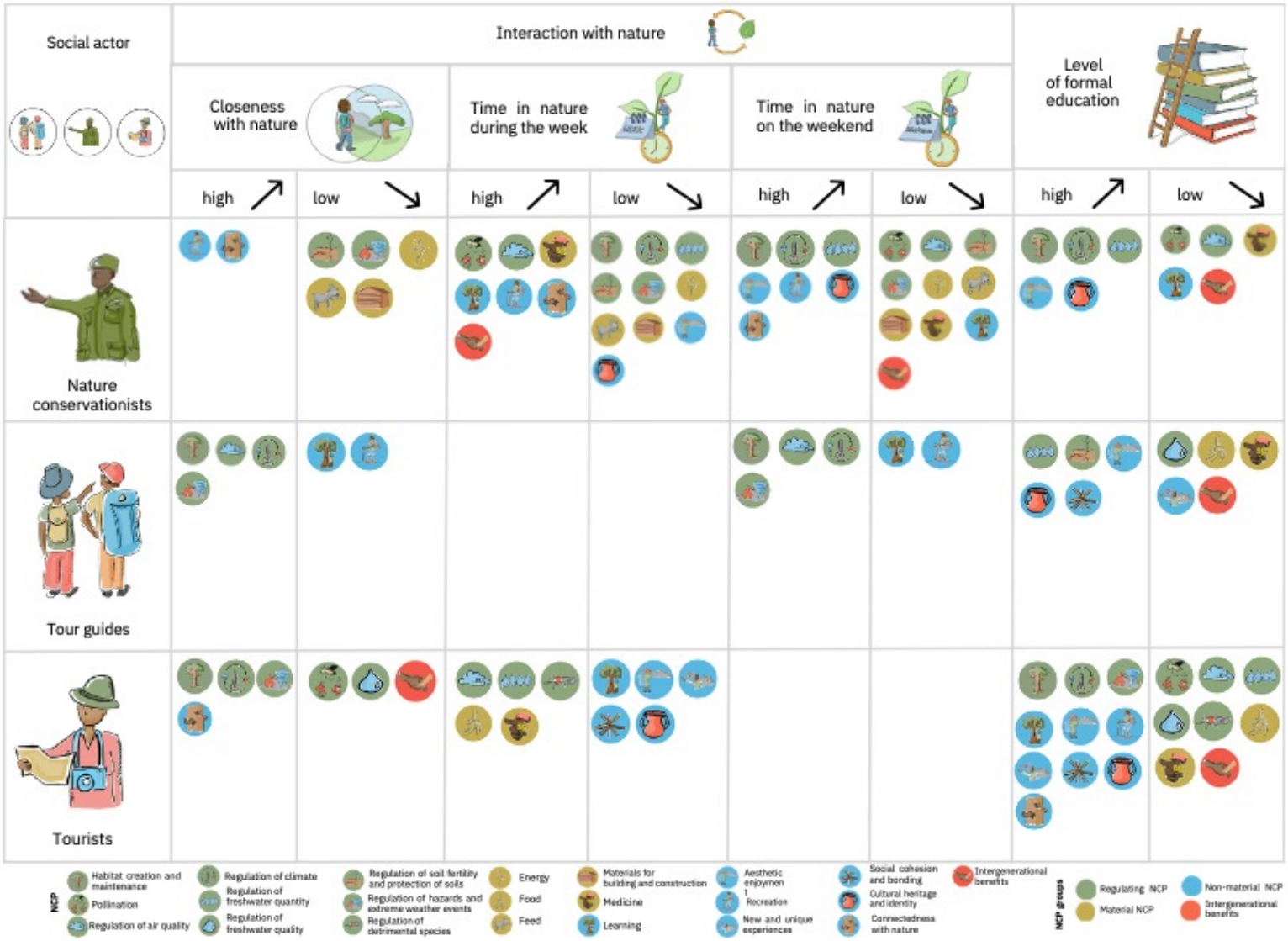

Figure 4 Overview of the driving factors, i.e., interaction with nature and level of formal education, related to the preferences for Nature's Contributions to People (NCP) for each social actor. Design credit: Jelke Meyer.

Second, respondents' interaction with nature drove NCP preferences (Fig. 4). Mainly, nature conservationists who felt moderately close to nature showed a relationship with nature based on material NCP, while those who felt highly connected to nature showed a relationship based on non-material NCP. At the same time, people in all social actor groups who felt close to nature were more likely to appreciate regulating NCP and the non-material NCP *connectedness with nature* (Fig. 4). Scientists have debated how the loss of time spent in nature, i.e., the loss of experience with nature, and the resulting disconnection with nature might impair biodiversity conservation (Soga & Gaston, 2016; Soga et al., 2023). According to our results, the loss of the experience of nature does not necessarily lead to a lack of NCP appreciation but rather leads to particular NCP preferences distinct for each social actor (Fig. 4). For example, those tour guides who spent little time in nature on the weekend were more likely to prefer *learning* and *recreation*, while those who spent more time in nature were associated with preferences for regulating NCP (Fig. 4). Likewise, those tourists who spent less time in nature during the week were more likely to prefer non-material NCP, while those who spent more time in nature were associated with regulating NCP and *food* and *medicine,* presumably because their need for non-material NCP is mainly covered by spending more time in nature and, therefore, they expressed preferences for other NCP.

Implications for inclusive conservation

Management of protected areas and the landscapes in which they are embedded needs to respond to multiple simultaneous objectives that respond to the differing needs and interests of societies, represented by the between- and within-social actor NCP preferences. In Tanzania, where tourism is the second largest contributor to national income (Kyara et al., 2021) and the National Park Authority aims to conserve these landscapes for the benefit of "humans" and "mankind" versus *just* "Tanzanians" (Tanzania National Parks, n.d., p 1), a focus on fulfilling tourists' expectations and their NCP preferences can overlook the needs and interests of local social actors which, as shown in this study through the preferences of tour guides, can be different.

Our between-social actor results show that local social actors residing and working in the landscape, i.e., nature conservationists and most tour guides, prefer NCP, i.e., material NCP and *intergenerational benefits*, that tourists – generally – do not. This expression of NCP preferences distinct for the different social actors shows that those conservation measures that mostly prioritize tourists' and conservation interests might overlook the interests of local people, presumably resulting in social conflicts (Kovács et al., 2015; García-Llorente et al., 2018). In the case of Kilimanjaro, for example, local people lost access to an important social buffer forest – known as the Half-Mile Forest Strip – and forest-related NCP in 2005, when it was entirely integrated into the Park for conservation purposes (Sébastien, 2010; Holroyd, 2016; personal communication with the KINAPA ecologist officer). Although the National Park Authority assessed a ban as the most effective conservation measure to remove extractive pressure from the forest, it induced not only (armed) tension between park management and local people (Holroyd, 2016)

but also increased the demand for material NCP in the surroundings of the protected area (personal communication with the KINAPA ecologist officer). This implies that conservation approaches in landscapes with protected areas should not halt at the border of the protected area but consider the social needs and interests adjacent to the protected area (Palomo et al., 2014). Therefore, it requires a holistic and people-inclusive approach to conservation for which NCP preferences can provide excellent insights for two reasons. First, it reveals insights into which NCP are preferred and by whom, which allows conservation management to account for fulfilling the NCP preferences of all (social actors). Second, it provides insights into a potential translocation of and increased human pressure in the surroundings of the protected area, if people are excluded from areas upon which they used to rely for meeting basic needs, ultimately impacting ecosystem functioning and NCP supply (Palomo et al., 2014). Against this background, particularly in areas with long-term coupled people-nature relationships, such as Kilimanjaro, we might also need to challenge our Westernized conservation approach – yet still inherent to the postcolonial history of Tanzania and reflected in establishing and maintaining protected areas at the expense of locals – of separating people from nature to achieve conservation (Mace 2014; Holroyd 2016; Hill et al., 2019; Cumming et al., 2023; Salomon et al., 2023). Instead, inclusive conservation can support the connection between people and nature or, in other words, those who demand and benefit from NCP and those natural entities that supply NCP, which ultimately broadens the conservation management beyond the limits of protected areas (Palomo et al., 2014). In Kilimanjaro, in fact, the territory below the National Park is comprised by the Chagga home gardens that host more than 700 species and are the third species-richest ecosystem in Kilimanjaro, after forests and grasslands (Hemp, 2006). Thus, a holistic and inclusive approach to conservation management that takes local circumstances within and beyond the protected areas into account can ensure that the NCP preferences by various social actors are explicitly accounted for in conservation management (García-Llorente et al., 2018).

Moreover, considering the commonalities in NCP preferences of tour guides with nature conservationists and tourists, inclusive conservation might benefit from the bridging role of tour guides with other social actors. As Kilimanjaro's nature is the office of the tour guides and they are trained to act as "stewards of the mountain" (Murusuri & Nderukmaki, 2013, p. 74), they align with the interests of nature conservationists. At the same time, through their daily interaction with tourists, tour guides also serve as "intercultural mediators (…) who reveal unfamiliar destinations to their guests in a culturally sensitive manner" (Scherle & Nonnenmann, 2008, p. 120). In the case of hiking Kilimanjaro, this can mean five to seven days of intercultural exchange in which there is ample opportunity for guides to converse with tourists about the landscape that they traverse, the mission and vision of conservation management, and the local culture. Given how crucial the role of guides is in determining tourist experience, management should ensure that multiple management platforms are available for collaborating with guides to design a tourism experience that not only focuses on fulfilling tourists' non-material NCP preferences but also

sensitizes them to the importance of nature for local communities. Here, cultural eco-tourism can play a crucial role – also proposed by several interviewees – in two regards. First, tourists can experience local people's way of living and relating with nature firsthand, instead of solely hearing about them from tour guides. Second, local communities directly gain economic benefits from cultural eco-tourism and hence, support the conservation of biodiversity and cultural heritage of Chagga home gardens (Anderson 2013; Mgonja et al., 2015), presumably contributing to reducing the conflict between conservationists and local communities.

Our within-social actor results show that the effect of the level of formal education and interaction with nature may be the essential variables that lead to differences in NCP preferences. Here, we argue to consider the internal heterogeneity within social actors when designing inclusive conservation. Sesabo (2007) supports this argument, suggesting that conservationists and policymakers should look beyond classical portrayals of social actors when designing strategies for nature conservation to account for the diversity within them. In the case of Kilimanjaro, this might mean, for example, offering different touristic activities to visitors beyond hiking up Kilimanjaro. Particularly, eco-tourism experiences in the Chagga home gardens can also inform tourists about the importance of regulating and material NCP. This is a clear example that shows that inclusive conservation considers both the management of landscapes within and adjacent protected areas and the internal heterogeneity of tourists when managing nature-based tourism. We conclude that to make conservation measures truly more inclusive, it is not only necessary to assess the NCP preferences by various social actors, i.e., social actor pluralism, but also to assess NCP preferences according to the internal heterogeneity within the social actors.

Conclusion

To meet the NCP preferences of the various social actors in the nexus of conservation and nature-based tourism, we suggest that conservation accounts for the differences between and within the social actors. We found that the NCP preferences do not only differ between nature conservationists, tour guides, and tourists but also according to the distinct formal education and people's interaction with nature within each social actor. Regarding education, based on our results, we hypothesize that more formally educated people might depend less directly on material NCP to meet their basic needs and have the resources to enjoy nature through *recreation* and *aesthetic enjoyment.* Regarding people's interaction with nature, we conclude that the loss of the experience of nature does not necessarily lead to a lack of appreciation of NCP but instead to distinctive NCP preferences. Therefore, we conclude – in line with Adichie (2009) – that a social actor-narrow but also -stereotyped story on NCP preferences can jeopardize inclusive conservation; instead, the plural stories on between- but also within-social actor variations of NCP preferences can altogether reveal "more complete" arguments for inclusive conservation.

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Authoring team

Name	ORCID
Milena Gross	0000-0003-3148-627X
Jasmine Pearson	0000-0001-6341-1382
John Sanya	0000-0002-2986-9813
Tuyeni Heita Mwampamba	0000-0003-4635-5774
Jennifer Kasanda Sesabo	0000-0002-8518-9011
Berta Martín-López	0000-0003-2622-0135

Credit authorship contribution statement

MG, JS, BML, and JP conceived the ideas, conducted the interviews, identified context-specific NCP, and designed the methodology; MG, BML, and their field assistants collected the data; MG and BML analyzed the data; MG supervised by BML led the writing of the manuscript. THM and JKS contributed to the discussion section. All authors contributed critically to the drafts and gave final approval for publication.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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Dear Milena Groß,

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Chapter V Broadening the arguments for inclusive conservation: values associated with nature's contributions to people

Milena Gross, Henrik von Wehrden, Tuyeni Heita Mwampamba, John Sanya,
Jasmine Pearson, Jennifer Kasanda Sesabo, Maraja Riechers,
Ugo Arbieu, Katrin Böhning-Gaese, Berta Martín-López

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Abstract

Overlooking the diverse values associated with Nature's Contributions to People (NCP) undermines conservation efforts. To address the lack of empirical evidence on this association, we combined the NCP and plural valuation frameworks to investigate how values are associated with groups of people sharing similar NCP preferences, referred to as NCP clusters. We identified five NCP clusters through 623 surveys conducted in Kilimanjaro, Tanzania, comprising 362 farmers, 50 nature conservationists, 55 tour guides, and 156 tourists. Our results showed a broad array of intrinsic, instrumental, and relational values, i.e., a prominent value pluralism, associated with preferences for material benefits. No single framework fully captures the complexity of people-nature relationships. Instead, combining both NCP and plural valuation frameworks reveals ways forward for conservation. For conservation to be inclusive to diverse clusters necessitates recognizing their distinct NCP preferences and diverse values through diversifying place-based approaches within wider social-ecological systems.

Muhtasari (Abstract in Swahili)

Kutojali thamani anuai zinazohusishwa na Michango wa Mazingira Asili kwa Watu (MMAW; *NCP* kwa kiingereza) hudhoofisha jitihada za uhifadhi. Ili kukabiliana na pengo la uhaba wa tafiti katika uhusiano huu, tuliunganisha dhana ya MMAW na mfumo wa uthaminishaji anuai ili kuchunguza namna thamani zinavyohusishwa na makundi ya watu wenye chaguzi sawa za MMAW, yaani, vifungu vya MMAW.Tuligundua vifungu vitano vya MMAW kupitia dodoso kwa watu 623 katika eneo la mlima Kilimanjaro, Tanzania, likijumuisha wakulima 362, wahifadhi 50, waongoza watalii 55, na watalii 156. Matokeo ya utafiti wetu yalionyesha kuwa safu pana ya thamani ya asili, ya kutumika, na yenye uhusiano, ikimaanisha kwamba thamani kuu ya uwingi ilihusiswa na mapendeleo ya 'faida zinazoonekana na kushikika'. Pia, hakuna mfumo mmoja unaoeleza kikamilifu uchangamano wa mahusiano bainda ya watu na mazingira asili. Badala yake kuunganisha mifumo yote miwili huonesha njia zaidi za uhifadhi. Kwa uhifadhi kuwa jumuishi kwa makundi anuai ya watu unahitaji kutambua mapendeleo tofauti ya MMAW na thamani tofauti kupitia mbinu mbalimbali zinazotegemea mahali ndani ya mifumo mipana ya kijamii na kiikolojia.

Introduction

Disregard for people's value pluralism, i.e., people ascribe diverse values to nature, in conservation has been identified as one of the root causes of failures in conservation efforts (Martín-López & Montes 2015; Kenter 2018; Pascual *et al.* 2023). If we frame conservation – which is per se value-laden (Mace 2014) – as the 'just, sustainable use and cohabitation of people with nature, in a way that maintains biodiversity and ecosystem functions' (Cumming *et al.* 2023, p. 4), it is necessary to consider the many ways in which people benefit from and value nature (Martín-López & Montes 2015). Against this backdrop, an inclusive framing of conservation necessitates representing people who are diverse in their interactions with nature (hereafter merely diverse voices) (Tallis & Lubchenco 2014). Hence, acknowledging the diverse values of

nature associated with beneficial Nature's Contributions to People (NCP) preferred by diverse voices is pivotal to inclusive conservation (Pascual *et al.* 2023; Tallis & Lubchenco 2014). Combining the Nature's Contributions to People (NCP) (Díaz *et al.* 2018) and plural valuation frameworks (Pascual *et al.* 2017, 2023) proposed by the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) offers a promising way forward towards inclusive conservation.

Beneficial NCP are nature-derived benefits that support well-being, spanning across three overlapping categories: (1) regulating NCP, which include natural processes like pollination that influence environmental conditions; (2) material NCP, which provide direct resources like food; and (3) non-material NCP, which enhance subjective or psychological well-being, such as through cultural identity (Díaz *et al.* 2018). Previous studies found that people can be grouped based on their similarity in their NCP preferences, a clustering phenomenon referred to as NCP clusters (Schmidt *et al.* 2017). Ignoring that people differ in their NCP preferences can cause social tensions and jeopardize conservation success (García-Llorente *et al.* 2018).

While the NCP framework is key to investigating *what* [aspect of] nature contributes to human well-being, it cannot capture the full range of reasons *why* nature matters to people (Chan *et al.* 2016; Jax *et al.* 2018). The 'importance, worth, or usefulness' ascribed to nature and NCP is conceptualized as specific values of nature (hereafter merely values), grouped into three value domains (Díaz *et al.* 2015; Pascual *et al.* 2017, 2023): (1) Intrinsic values refer to nature's importance regardless of human use (Arias-Arévalo *et al.* 2017) or experience (Pascual *et al.* 2017); (2) instrumental values refer to nature's importance as a substitutable means to meet an end (Arias-Arévalo *et al.* 2017); and (3) relational values refer to the meaningfulness of non-substitutable people-nature relationships and social relationships mediated by nature, comprising the motivations potentially facilitating conservation efforts (Chan *et al.* 2016; Jax *et al.* 2018).

A conservation framing that brings people-nature relationships to the foreground, while ensuring this focus does not come at the expense of biodiversity and ecosystem functioning, calls for broadening conservation approaches by moving beyond intrinsic or instrumental values to embrace value pluralism (Mace 2014; Murali *et al.* 2024). Hence, valuation studies that seek to inform inclusive conservation need to capture the value pluralism of diverse voices. Yet, its empirical elicitation remains scarcely investigated in the context of conservation (but see, e.g., Ghijselinck *et al.* 2023). Moreover, people can value nature and NCP for different reasons (Arias-Arévalo *et al.* 2017; Chapman & Deplazes-Zemp 2022), suggesting that multiple values can be associated with particular NCP preferences. Yet, there is little empirical evidence on these associations (but see, e.g., Brück *et al.* 2024; Kachler *et al.* 2024).

To contribute to inclusive conservation, we aimed to investigate the values associated with NCP clusters expressed by social actors in Kilimanjaro by combining the NCP (Díaz *et al.* 2018) and the plural valuation frameworks (Pascual *et al.* 2017; 2023). Specifically, we sought to (i) identify NCP clusters, and (ii) explore the values associated with these NCP clusters. We drew on the social-ecological system of Mount Kilimanjaro (hereafter merely Kilimanjaro) due to its ecological and social heterogeneity: Kilimanjaro is characterized by, e.g., biodiverse traditional agroforestry systems, a national park, and manifold opportunities for nature-based tourism, hosts various social actors, supplies NCP that can meet the demand of various social actors, and nurtures diverse values (e.g., Hemp 2006; Holroyd 2016; Masao *et al.* 2022).

By combining the two frameworks, we detected that not just instrumental but a broad array of intrinsic, instrumental, and relational values, i.e., a prominent value pluralism, was associated with preferences for material benefits. We argue that each framework falls short of capturing diverse dimensions of people's relationships with nature. In contrast, combined insights on *what* [aspects of] nature contribute to people's well-being (NCP) and *why* nature matters (values) to them can benefit inclusive conservation.

Methods

Study area

Kilimanjaro consists of the biophysical unit of Mount Kilimanjaro, the world's highest free-standing mountain (5,895 meters above sea level (masl)). The mountain hosts unique biodiversity (Peters *et al.* 2016), providing various NCP to social actors, particularly subsistence-based farmers, mountain tour guides, nature conservationists (Masao *et al.* 2022), and tourists. Most farmers belong to the Chagga tribe which consists of people who cultivate biodiverse traditional home gardens on the southern slopes (ca. <1650 masl) (Hemp 2006). The protected Kilimanjaro National Park (ranging from approximately 1600–2350 masl depending on the location on the mountain to 5895 masl) and adjacent areas serve as one of Tanzania's premier nature-based destinations attracting tourists and guides (Holroyd 2016; TANAPA 2023). Simultaneously, the Kilimanjaro National Park Authority protects its biodiversity while benefiting from tourist revenues (Holroyd 2016; TANAPA 2023). Governmental and non-governmental bodies run conservation projects outside the national park, partially coupled with tourism.

Data collection

We conducted 623 face-to-face surveys in Kilimanjaro with four social actors, i.e., smallholder farmers (n=362 respondents), conservationists (n=50), guides (n=55), and tourists (n=156), from August to November 2022. We used three independent survey sections, as ordered in the questionnaire: (1) interactive exercise on NCP preference (NCP clusters), (2) rating of statements representing values of nature (value expression), and (3) profile attributes (questionnaire in Appendix A1; additional information on data collection, ethics, and data analysis in Appendix A2;

declaration of consent in Appendix A3; and first author's positionality statement in Appendix A4). To acknowledge people-nature relationships within the Kilimanjaro context, we identified context-specific NCP from 130 interviews with all four social actors. Value statements were developed based on a literature review and tailored to the Kilimanjaro context using verbatim excerpts reflecting values from the interviews (Table A2). We instructed respondents to (1) select up to five of the 25 context-specific NCP they considered most important, and (2) indicate their (dis-)agreement with 20 value statements representing intrinsic, instrumental, and relational values.

Data analysis

We ran Ward's cluster analysis to identify NCP clusters, i.e., groups of respondents similar in their preference for the five most important NCP, and an indicator species analysis (Dufrêne & Legendre 1997) to identify the NCP associated with these clusters. Two reasons justified the selection of the final clusters. First, we decided on several NCP clusters that would meaningfully represent an NCP set that consistently emerged from the respondents' expressed preference to allow for interpretability. Second, based on the indicator analysis, we opted for the highest number of significant NCP within the clusters. This allows for the largest separation of clusters that is still explained by significant indicator words. Then, we ran a Chi-Square test to explore the relation between the social actors and NCP clusters and identified the social actor with the highest share in each group. Next, we described the value expression of each NCP cluster and ran Chi-Square tests to explore the association between respondents' agreement with the value statements and NCP clusters. *P* values were corrected for multiple tests. Table A5 presents the variables used in the different analyses.

Results

We identified five NCP clusters (agglomerative coefficient of the cluster analysis: 0.93): (1) 'Intangible benefits', (2) 'Tangible benefits', (3) 'Health-related benefits', (4) 'Resilience-related benefits', and (5) 'Regulating benefits' (Figure 1; more detailed and additional results in Appendix A5), with a significant relation between the NCP clusters and social actors (Chi-Square test result: $X2 = 276.48$, p value < 2.2e-16).

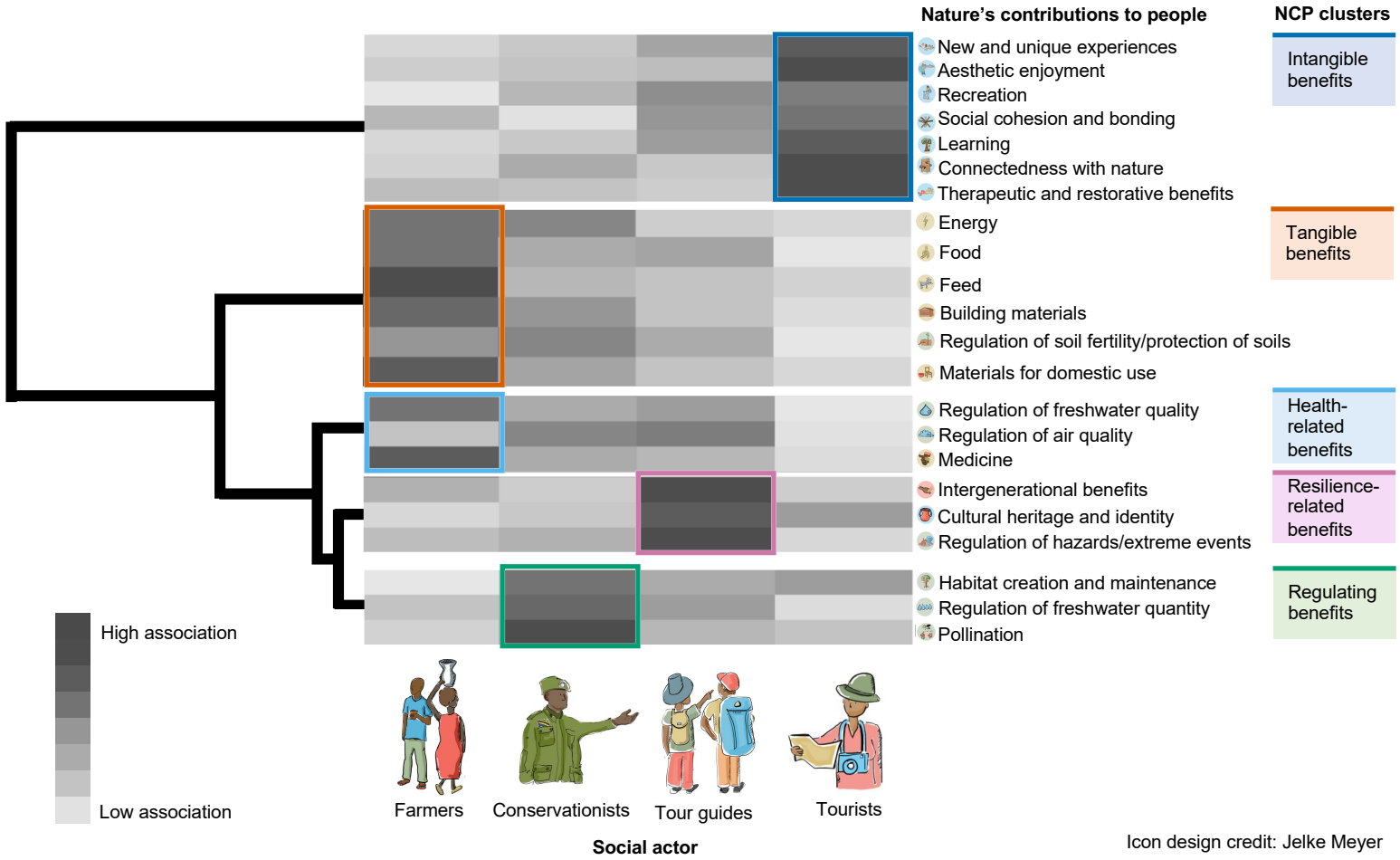

Figure 1 Hierarchical dendrogram and heat map of expressed preferences for Nature's Contributions to People (NCP), shown for the five NCP clusters, i.e., groups of respondents similar in their NCP preferences. The colored box around the NCP clusters indicates the related social actor (Chi-Square test result: $X2 = 276.48$, p value < 2.2e-16). NCP group: regulating; material; non-material; cross-cutting. See Figure A2 for the original dendrogram and Table A1 for magnified NCP icons.

'**Intangible benefits'** comprised a group of respondents similar in preferring seven non-material NCP, i.e., new and unique experiences, aesthetic enjoyment, recreation, social cohesion and bonding, learning, connectedness with nature, and therapeutic and restorative benefits (Figure 1, Table A6). One-hundred-eight respondents (17% of all respondents) were associated with this group, of which 80% were tourists (Figure A3, Table A7); 55% of all tourist respondents, i.e., the highest share across all clusters, assembled here (Table A8). Although 'Intangible benefits' respondents generally agreed with all value domains, their expression of diverse values was less prominent compared to the other NCP clusters. They highly expressed intrinsic values and specific relational values derived from and experienced through nature-based (touristic) activities (Figure 2, Table A10).

'**Tangible benefits**': A group of respondents similar in preferring five material NCP, i.e., *energy*, *food*, *feed*, *building materials*, *materials for domestic use*, and *regulation of soil fertility and protection of soils* constituted this cluster (Figure 1, Table A6). We understood the regulating NCP in this cluster to be crucial for providing the five material NCP and, thus, named the cluster 'Tangible benefits'. One-hundred-twenty-four respondents (20% of all respondents) were associated with 'Tangible benefits', of which 90% were farmers (the highest share of farmers across all clusters (31% of all farmers) belonged to here (Table A8)) and 63% were women, i.e., the only cluster with a greater share of female than male respondents (Figure A3, Table A7). 'Tangible benefits' respondents were associated with a prominent value pluralism, i.e., the highest level of value expression with three exceptions: the relational values of social relations, stewardship, and aesthetics, whereby only stewardship statistically differed between the clusters (Figure 2, Table A10).

'Health-related benefits': A group of respondents similar in preferring the NCP *regulation of freshwater quality*, *regulation of air quality*, and *medicine* comprised this cluster (Figure 1, Table A6). Due to the high preference given to good water and air, and pharmaceutical resources, we labeled this cluster 'Health-related benefits'. One-hundred-thirty-six respondents (22% of all respondents) were associated with this group, of which 77% were farmers (Figure A3, Table A7); here, the second highest farmer share across all clusters (29% of all farmers) grouped. Like 'Tangible benefits', 'Health-related benefits' respondents were associated with a prominent value pluralism, although value expression tended to be lower (Figure 2, Table A10).

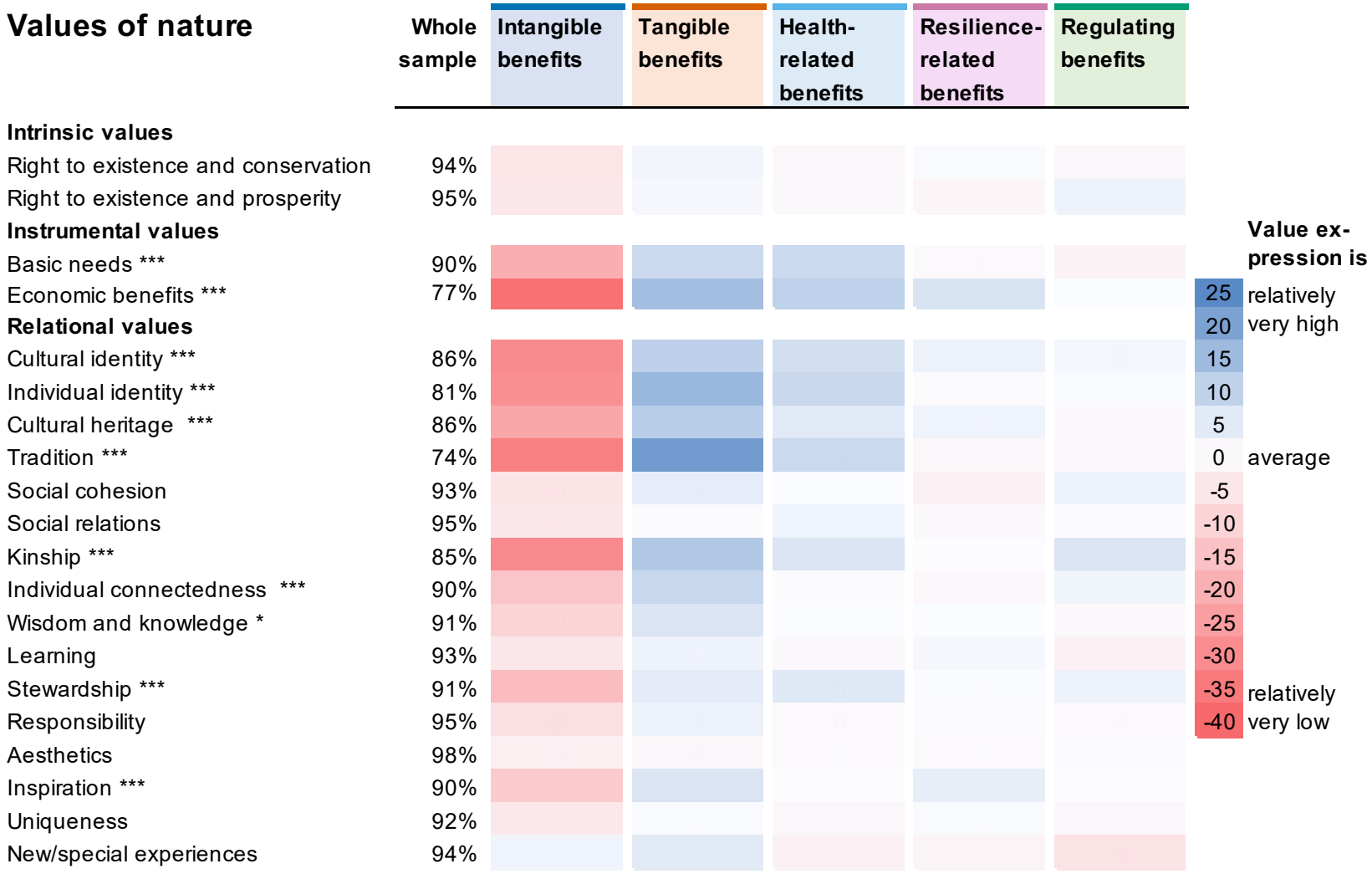

Figure 2 The relative share of the whole sample that agrees with the value statement, i.e., expresses the value. Comparison of value expression between the NCP clusters, i.e., groups of respondents similar in their NCP preferences, based on their deviation from the relative share of the whole sample. Chi-Square test results (full summary in Table A8): * = *p* value < 0.05; ** = *p* value < 0.01; *** = *p* value < 0.001.

'**Resilience-related benefits'** is a group of respondents similar in preferring the NCP *intergenerational benefits*, *cultural heritage and identity*, and *regulation of hazards and extreme events* (Figure 1, Table A6). These NCP are related to guaranteeing the continuity of people-nature relationships, i.e., relevant to the future, originating from the past, and emphasizing nature's function to secure people's integrity. Hence, we termed this cluster 'Resilience-related benefits'. One-hundred-fifty respondents (20% of all respondents) made up this socially heterogeneous cluster with the highest share of guides across all clusters (44% of all guides; 16% of 'Resilience-related benefits' respondents) (Figure A3, Table A7). The expression of diverse values was rather average with minor nuances, i.e., a moderate value pluralism (Figure 2, Table A10). For example, the share of 'Resilience-related benefits' respondents who relationally valued nature in Kilimanjaro for its inspiration (94% of 'Resilience-related benefits' respondents agreed) was above average, while the share who valued nature for meaningful relations regarding individual identity (82%) and tradition (74%) was below average.

'**Regulating benefits'** consisted of a group of respondents similar in preferring NCP *habitat creation and maintenance*, *regulation of freshwater quantity*, and *pollination* (Figure 1, Table A6). Hence, we labeled the cluster 'Regulating benefits'. One-hundred-five respondents (17% of all respondents) belonged to this cluster characterized by a distinct social actor heterogeneity (Figure A3, Table A7). Noteworthily, the highest share of conservationists across all clusters (30% of all conservationists; 14% of 'Regulating benefits' respondents) (Table A8), is assembled here. 'Regulating benefits' respondents' value expression was like the moderate value pluralism of 'Resilience-related benefits' with minor differences (Figure 2, Table A10).

Discussion

Investigating how NCP preferences are associated with diverse values is key to informing inclusive conservation because such an approach accounts for people's diverse perceptions of *what* [aspects of] nature contribute to good lives (NCP) and *why* nature matters to them (values). Investigating the values associated with each NCP cluster revealed that a prominent value pluralism was associated with farmer-related preferences for material benefits. We found that focusing on NCP preferences alone cannot capture other dimensions of people's relationships with nature such as the motivations potentially facilitating conservation efforts. We, therefore, conclude that combining the two frameworks provides complementary insights for inclusive conservation (Figure 3).

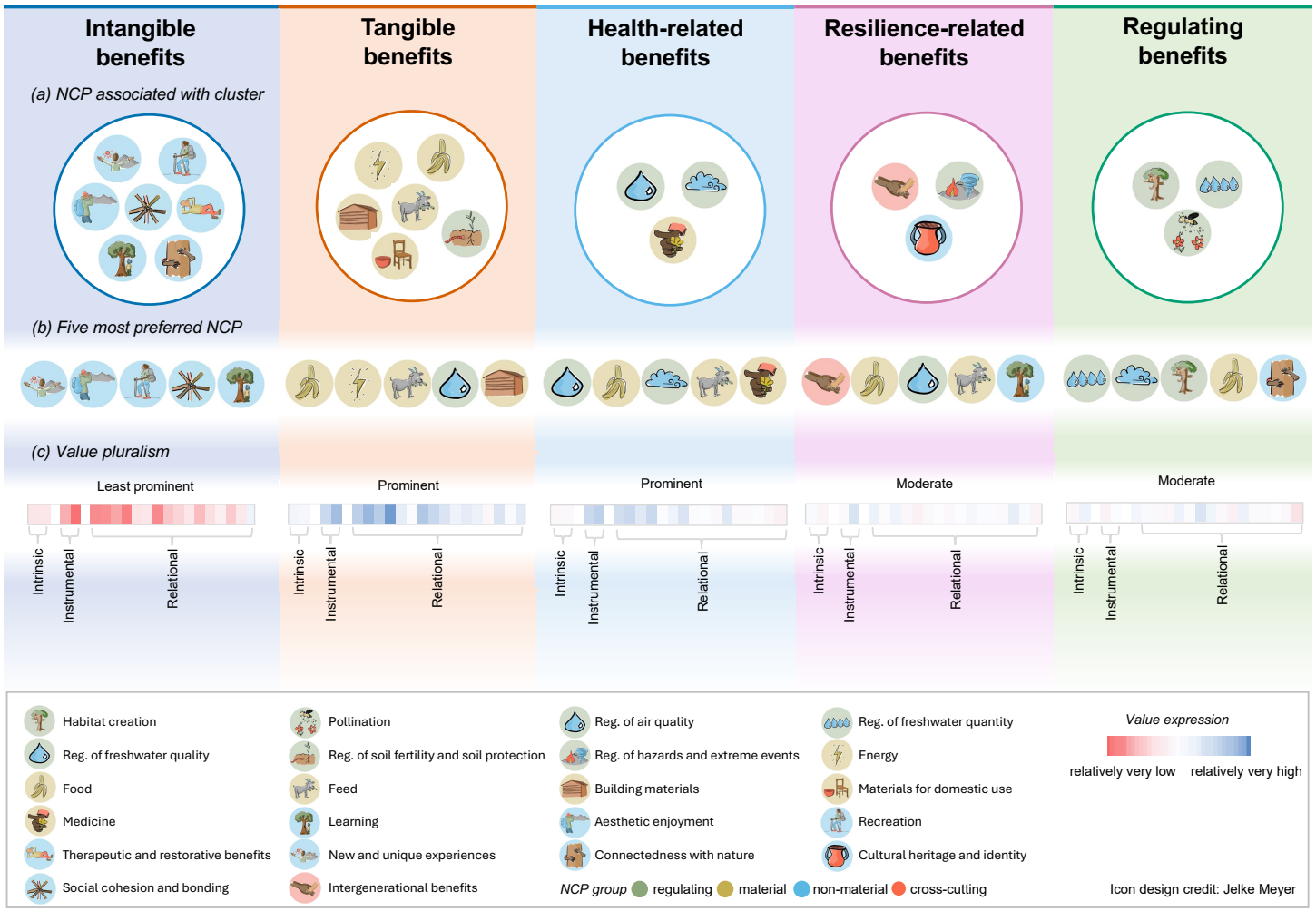

Figure 3 Consolidated results from combining the Nature's Contributions to People (NCP) and plural valuation frameworks to draw implications for inclusive conservation. *Intrinsic* Intrinsic values; *Instrumental* Instrumental values; *Reg.* Regulation; *Relational* Relational values.

Broadening arguments for inclusive conservation: complementarity of NCP and values

We found that NCP preferences can be grouped into five NCP clusters related to specific social actors (Figure 1). First, conservation approaches must be diversified to cover the distinct NCP preferences. Second, our results on the relation between NCP clusters and social actors correspond with previous studies. For example, Zoderer *et al.* (2019) found that, in a European mountain landscape, visitors tended to acknowledge non-material NCP, farmers preferred mostly material NCP, and residents who supported environmental programs appreciated mainly regulating NCP. However, our results indicate that people have different reasons for why they value nature, regardless of their preferences for particular NCP sets (Figure 2). These NCP preferences do not reflect *why* nature matters to people, including motivations that potentially facilitate conservation efforts reflected in, for example, relational values (Chan *et al.* 2016). Hence, we argue that recognizing the diverse values associated with preferred NCP rather than solely relying on NCP preferences might reveal complementary insights that are key to making conservation more inclusive.

Not only instrumental values associated with preferences for material benefits

We found a broad array of intrinsic, instrumental, and relational values, i.e., a prominent value pluralism, associated with farmer-related preferences for material benefits, i.e., 'Tangible benefits' and 'Health-related benefits' (Figures 2 and A4; Table A9). This suggests that those people whose NCP preferences are geared towards material NCP recognized not only instrumental but also intrinsic and relational values. Recent studies – predominantly on smallholding farmers – revealed that relational values can co-exist and even gradually overlap with instrumental and intrinsic values (e.g., Chapman & Desplazes-Zemp 2022; Ortiz-Przychodzka *et al.* 2023). Preferences for material benefits, which scholars sometimes assess as a threat to biodiversity (Delabre *et al.* 2020), do not necessarily risk conservation efforts because other values than purely instrumental ones underpin these preferences. Our results support those claims seeking to re-frame the understanding of preferences for material benefits from material-*depending* to material-*relating* (Dawson *et al.* 2023), emphasizing reciprocal motivations to conserve nature and therefore, a much-needed way forward towards inclusive conservation.

Implications for inclusive conservation

A social-ecological approach to protected areas suggests that conservation efforts should extend beyond the borders of protected areas and be integrated into the wider social-ecological systems in which these areas are embedded, including those areas where diverse voices experience and relate with nature (Ghoddousi *et al.* 2022; Palomo *et al.* 2014). A more recent framing of conservation emphasizes people-nature relationships (Cumming *et al.* 2023; Mace 2014), requiring inclusive approaches that recognize diverse voices (Tallis & Lubchenco 2014) in a

manner that preserves biodiversity and ecosystem functions. Against this backdrop, our findings highlight the need for conservation approaches to integrate insights from complementary frameworks while recognizing distinct NCP preferences and value pluralism. Ignoring varied NCP preferences (e.g., García-Llorente *et al.* 2018) or prioritizing specific values (e.g., Yuliani *et al.* 2023) risks creating tensions between people and hindering conservation success.

We hypothesize restricting access to natural areas in favor of maintaining biodiversity can disrupt meaningful connections with these places, diminishing relational values that can support conservation efforts. Limiting access to protected areas eroded the responsibility that relocated communities once held for nature (Cundill *et al.* 2017). While borders around protected areas may support biodiversity conservation and nature-based tourism objectives, they often reflect the NCP preferences and values of non-locals, such as tourists, and conservationists and guides in their professional roles (Holroyd 2016), while jeopardizing locals' relationships with nature (Xu & Huntsinger 2022). Thus, excluding locals from natural areas risks overlooking key relational values and motivations that can foster conservation. This highlights the trade-offs of such exclusionary approaches, which often fail in their inclusiveness of diverse voices and their values.

Inclusive conservation approaches in social-ecological systems with protected areas and an evaluation of local value pluralism require fostering spaces where locals can meet their NCP preferences and nurture their diverse values. We propose that homegardens, which sustain biodiversity, long-term people-nature relationships, and livelihoods (Hemp & Hemp 2008; Sébastien 2010), exemplify such spaces. Unlike intensified farming often tied to instrumental values (Ortiz-Przychodzka *et al.* 2023), stewardship of homegardeners supports such a threefold bottom-up conservation approach. Thus, in social-ecological systems with (a) protected area/s and diverse voices, NCP preferences, and values, conservation approaches must embrace place-based, relational approaches and adopt deliberate diversification to ensure inclusiveness (Kobluk *et al.* 2024; Salomon *et al.* 2023).

Conclusion

Broadening the arguments for inclusive conservation involves acknowledging diverse voices and their NCP preferences and values. Combining the NCP framework (Díaz *et al.* 2018) with plural valuation frameworks (Pascual *et al.* 2017; 2023) reveals complementary insights into people-nature relationships that neither framework alone captures. A prominent value pluralism reflected in a broad array of intrinsic, instrumental, and relational values characterizes people who prefer material benefits. Inclusive conservation must extend beyond protected areas to embrace people-nature relationships within the broader social-ecological systems they inhabit, without jeopardizing biodiversity and ecosystem maintenance. This requires accounting for distinct NCP preferences and the plural values of diverse voices in conservation by diversifying place-based approaches across multiple spaces to ensure inclusiveness.

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Authoring team

Name	ORCID
Milena Gross	0000-0003-3148-627X
Henrik von Wehrden	0000-0003-2087-5552
Tuyeni Heita Mwampamba	0000-0003-4635-5774
John Sanya	0000-0002-2986-9813
Jasmine Pearson	0000-0001-6341-1382
Jennifer Kasanda Sesabo	0000-0002-8518-9011
Maraja Riechers	0000-0003-3916-8102
Ugo Arbieu	0000-0002-0655-8756
Katrin Böhning-Gaese	0000-0003-0477-5586
Berta Martín-López	0000-0003-2622-0135

Credit authorship contribution statement

MG, BML, JS, and JP conceived the ideas, identified context-specific NCP and values through interviews, and designed the methodology; MG, JS, BML, colleagues of the research unit and associated field assistants collected the survey data; HVW, MG, and BML analyzed the data; MG supervised by BML led the writing of the manuscript. All authors contributed critically to the drafts and gave final approval for publication

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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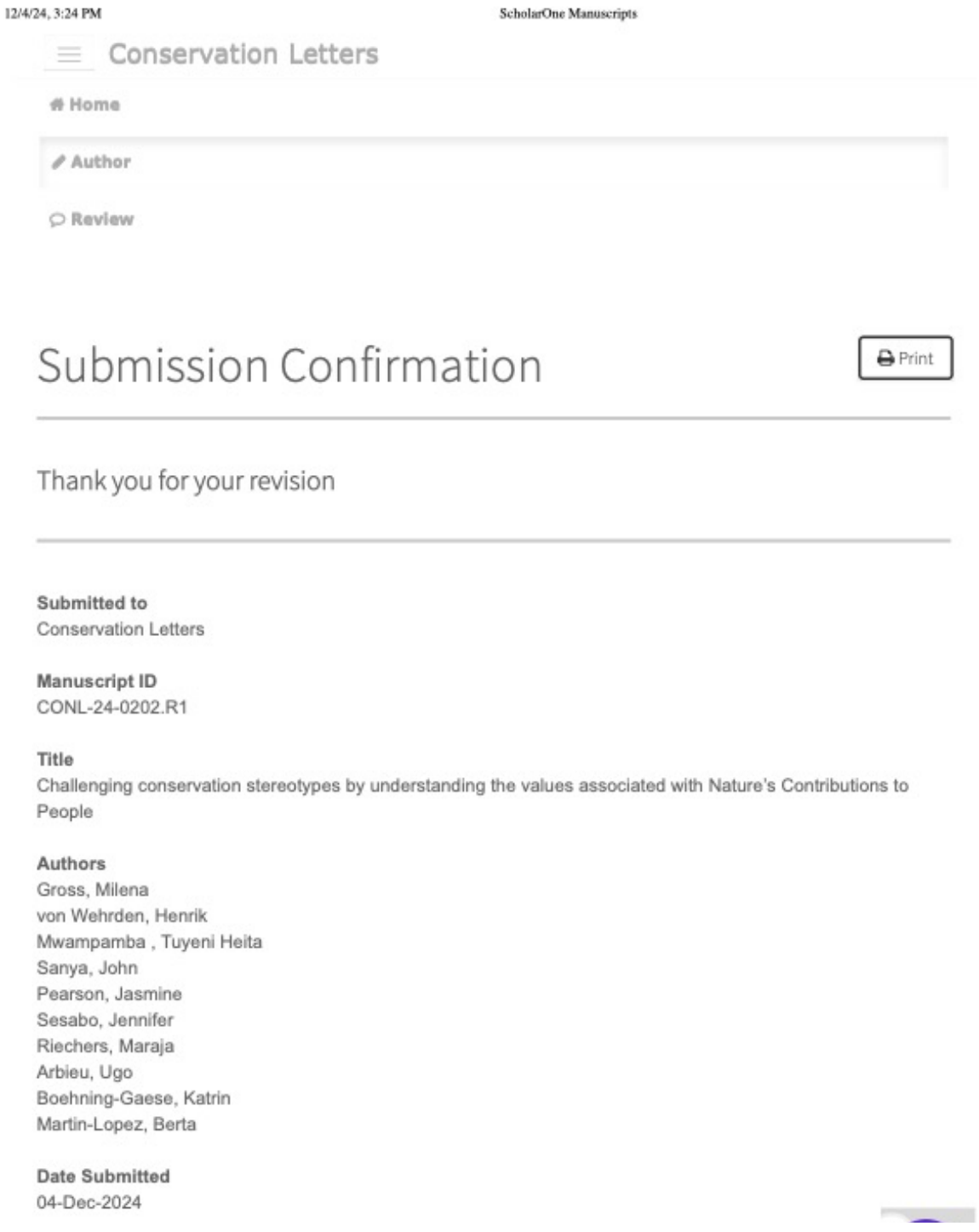

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Authors
Gross, Milena
von Wehrden, Henrik
Mwampamba , Tuyeni Heita
Sanya, John
Pearson, Jasmine
Sesabo, Jennifer
Riechers, Maraja
Arbieu, Ugo
Boehning-Gaese, Katrin
Martin-Lopez, Berta

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04-Dec-2024

Appendices

Please note: Most pages of the appendices have been printed in black and white for sustainability purposes. For the colored version, kindly refer to the digital copy.

Appendix 1: The song ‘Uhai ni mazingera asili’ (page III)

English translation of the NCP song

LIFE IS NATURE

Hello, hello sir
How are you, very well
Guests, you are welcome
Tanzania, no worries

Walk slowly, no worries
Let's conserve the environment, no worries
Get medicine too, no worries
Learning is important, no worries
Enjoying the scenery, no worries

Hello, hello sir
How are you, very well
Guests, you are welcome
Kilimanjaro, no worries

The trees are great, no worries
The vegetation is fine, no worries
Beautiful environment, no worries
Guests are nice, no worries
The locals are cool, no worries

Hello, hello sir
How are you, very well
Guests, you are welcome
To Mama Tembo, no worries

Great environment, no worries
And cool people, no worries
Food is love, no worries
And water is life, no worries
Food is love, no worries

Hello, hello sir
How are you, very well
Guests, you are welcome
Real life, no worries

Whitey (Julius John White) and Malaika (Steven David Lema)

Figure A1.1 Artistic contributors to the different versions of the NCP song, used as metaphors throughout this Ph.D. thesis to illustrate the various research approaches Kili-SES SP3 applied to understanding of people-nature relationships and operationalizing/guidance to an *all* embracing approach: Milena Gross (author of this Ph.D. thesis), Rehema Julius Mwasenga (vocals), McDonald Gregory Mlemwa (vocals, guitar), Kulwa Onesmo Sianga (vocals, guitar), Isack Charles Shija (vocals), Julius John White (vocals), Steven David Lema (vocals) (from left to right); recorded at Maisha Khalisi, Moshi, Tanzania. Photo credit and gratitude to James Barker Marealle.

Appendix 2: Ethics review committee approvals and research permits

Appendix 2.1: Ethics review committee approval for the interviews with tourists

LEUPHANA
UNIVERSITÄT LÜNEBURG

Leuphana Universität Lüneburg · Ethikbeirat· 21335 Lüneburg

An
Frau Prof. Dr. Berta Martín-López
Frau Milena Groß

– im Hause –

Beirat für Ethikfragen in der Forschung

Leuphana Universität Lüneburg
Universitätsallee 1
21335 Lüneburg

ethikbeirat@leuphana.de

Vorsitz
Prof. Dr. Dirk Lehr
Prof Dr. jur. Tim Dornis, JSM
Prof. Dr. Alexander Freund

www.leuphana.de

11. Mai 2021

Ihr Antrag an den Ethikbeirat der Leuphana Universität Lüneburg EB-Antrag_202104-07-Martin-Lopez_KiliSES
Tourist demand and values of Nature's Contributions to People (NCP) in the
Mt Kilimanjaro region
SP 3: Demand and values of Nature's Contributions to People (NCP)

Sehr geehrte Frau Professorin Martín-López, sehr geehrte Frau Groß,

Ihr oben genannter Antrag wurde am 16.04.2021 eingereicht und vom Ethikbeirat im Umlaufverfahren beraten.

Mit dem abschließenden Votum beurteilt der Ethikbeirat die Studie als **„ethisch unbedenklich"**.

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Mit freundlichen Grüßen

Prof. Dr. Dirk Lehr
Vorsitz

Der Bewertung liegen folgende Unterlagen zugrunde:

- EB-Antrag mit den folgenden Anlagen
  - Vorhabenbeschreibung
  - Erklärung zum Datenmanagement
  - Muster von Aufklärungstext und Einwilligungserklärung
  - Interviewleitfaden
  - DFG Drittmittelantrag

Appendix 2.2: Ethics review committee approval for the interviews with nature conservationists and tour guides

LEUPHANA
UNIVERSITÄT LÜNEBURG

Leuphana Universität Lüneburg · Ethikbeirat· 21335 Lüneburg

An
Frau Prof. Dr. Berta Martín-López
Frau Milena Groß

– im Hause –

Beirat für Ethikfragen in der Forschung

Leuphana Universität Lüneburg
Universitätsallee 1
21335 Lüneburg

ethikbeirat@leuphana.de

Vorsitz
Prof. Dr. Dirk Lehr
Prof Dr. jur. Tim Dornis, JSM
Prof. Dr. Alexander Freund

www.leuphana.de

29. September 2021

Ihr Antrag an den Ethikbeirat der Leuphana Universität Lüneburg EB-Antrag_202109-12-Martin-Lopez_KiliSES-02
Tour operators' and nature conservationists' demand and values of Nature's Contributions to People (NCP) in the Mt Kilimanjaro region
(DFG funded project: The role of nature for human well-being in the Kilimanjaro Social-Ecological System (Kili-SES)
SP 3: Demand and values of Nature's Contributions to People (NCP)

Sehr geehrte Frau Professorin Martín-López, sehr geehrte Frau Groß,

Ihr oben genannter Antrag wurde am 15.09.2021 eingereicht und vom Ethikbeirat im Umlaufverfahren beraten.

Mit dem abschließenden Votum beurteilt der Ethikbeirat die Studie als **„ethisch unbedenklich"**.

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  - Erklärung zum Datenmanagement
  - Muster der Aufklärungstexte und Einverständniserklärungen
  - Leitfäden: Interview und Fokusgruppendiskussion
  - DFG Drittmittelantrag

Appendix 2.3: Ethics review committee approval for the interviews with farmers

LEUPHANA
UNIVERSITÄT LÜNEBURG

Leuphana Universität Lüneburg · Ethikbeirat· 21335 Lüneburg

An
Frau Prof. Dr. Berta Martín-López

- im Hause -

Beirat für Ethikfragen in der Forschung

Leuphana Universität Lüneburg
Universitätsallee 1
21335 Lüneburg

ethikbeirat@leuphana.de

Vorsitz
Prof. Dr. Dirk Lehr
Prof Dr. jur. Tim Dornis, JSM
Prof. Dr. Alexander Freund

www.leuphana.de

7. Dezember 2021

Ihr Antrag an den Ethikbeirat der Leuphana Universität Lüneburg EB-Antrag_202111-17-Martin-Lopez_KiliSES-03
Local values of Nature's Contributions to People in the Mount Kilimanjaro, Tanzania
(DFG funded project: The role of nature for human well-being in the Kilimanjaro Social-Ecological System (Kili-SES)
SP 3: Demand and values of Nature's Contributions to People (NCP)

Sehr geehrte Frau Professorin Martín-López,

Ihr oben genannter Antrag wurde am 19.11.2021 eingereicht und vom Ethikbeirat im Umlaufverfahren beraten.

Mit dem abschließenden Votum beurteilt der Ethikbeirat die Studie als **„ethisch unbedenklich"**.

Wir wünschen Ihrer wissenschaftlichen Arbeit viel Erfolg.

Mit freundlichen Grüßen

Prof. Dr. Dirk Lehr
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Der Bewertung liegen folgende Unterlagen zugrunde:

- EB-Antrag mit den folgenden Anlagen
  - Vorhabenbeschreibung
  - Erklärung zum Datenmanagement
  - Muster der Aufklärungstexte und Einverständniserklärungen
  - Leitfaden für Interviews
  - DFG Drittmittelantrag

Appendix 2.4: Ethics review committee approval for the surveys with all social actors

LEUPHANA
UNIVERSITÄT LÜNEBURG

Leuphana Universität Lüneburg · Ethikbeirat· 21335 Lüneburg

Frau Prof. Dr. Martín-López

– im Hause –

Beirat für Ethikfragen in der Forschung

Leuphana Universität Lüneburg
Universitätsallee 1
21335 Lüneburg

ethikbeirat@leuphana.de

Vorsitz
Prof. Dr. Dirk Lehr
Prof Dr. jur. Tim Dornis, JSM
Prof. Dr. Alexander Freund

www.leuphana.de

12. Juli 2022

Ihr Antrag an den Ethikbeirat der Leuphana Universität Lüneburg EB-Antrag_202206-11-Martin-Lopez_KiliSES 02
The role of nature for human well-being in the Kilimanjaro Social-Ecological System (KiliSES)
SP 3: Demand and values of Nature's Contributions to People (NCP))

Sehr geehrte Frau Professorin Martín-López,

Ihr oben genannter Antrag wurde am 13.06.2022 eingereicht und vom Ethikbeirat im Umlaufverfahren beraten.

Mit dem abschließenden Votum beurteilt der Ethikbeirat die Studie als **„ethisch unbedenklich"**.

Wir wünschen Ihrer wissenschaftlichen Arbeit viel Erfolg.

Mit freundlichen Grüßen

Prof. Dr. Dirk Lehr
Vorsitz

Der Bewertung liegen folgende Unterlagen zugrunde:

- EB-Antrag mit den folgenden Anlagen
  - Vorhabenbeschreibung
  - Datenmanagementkonzept
  - Aufklärungstext
  - Muster der Einverständniserklärung
  - Fragebogen

Appendix 2.5: Research permit for interviews with nature conservationists and tour guides

UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

TANZANIA COMMISSION FOR SCIENCE AND TECHNOLOGY

RESEARCH PERMIT

Permit No.	2021-225-NA-2021-09
Date issued	21st April 2021
Researcher's Name	Milena Gross
Nationality	German
Research Title	The role of nature for human well-being in the Kilimanjaro Socio-Ecological System SP 3: Demand and values of Natural's contribution to people (NCP)
Research Area(s)	Kilimanjaro
Validity	From: 21st April 2021 to 20th April 2022
Contacts of local collaborator (*with affiliated institution*)	Dr. Jennifer Kasanda Sesabo, Mzumbe University

PROGRAM OFFICER **FOR DIRECTOR GENERAL**

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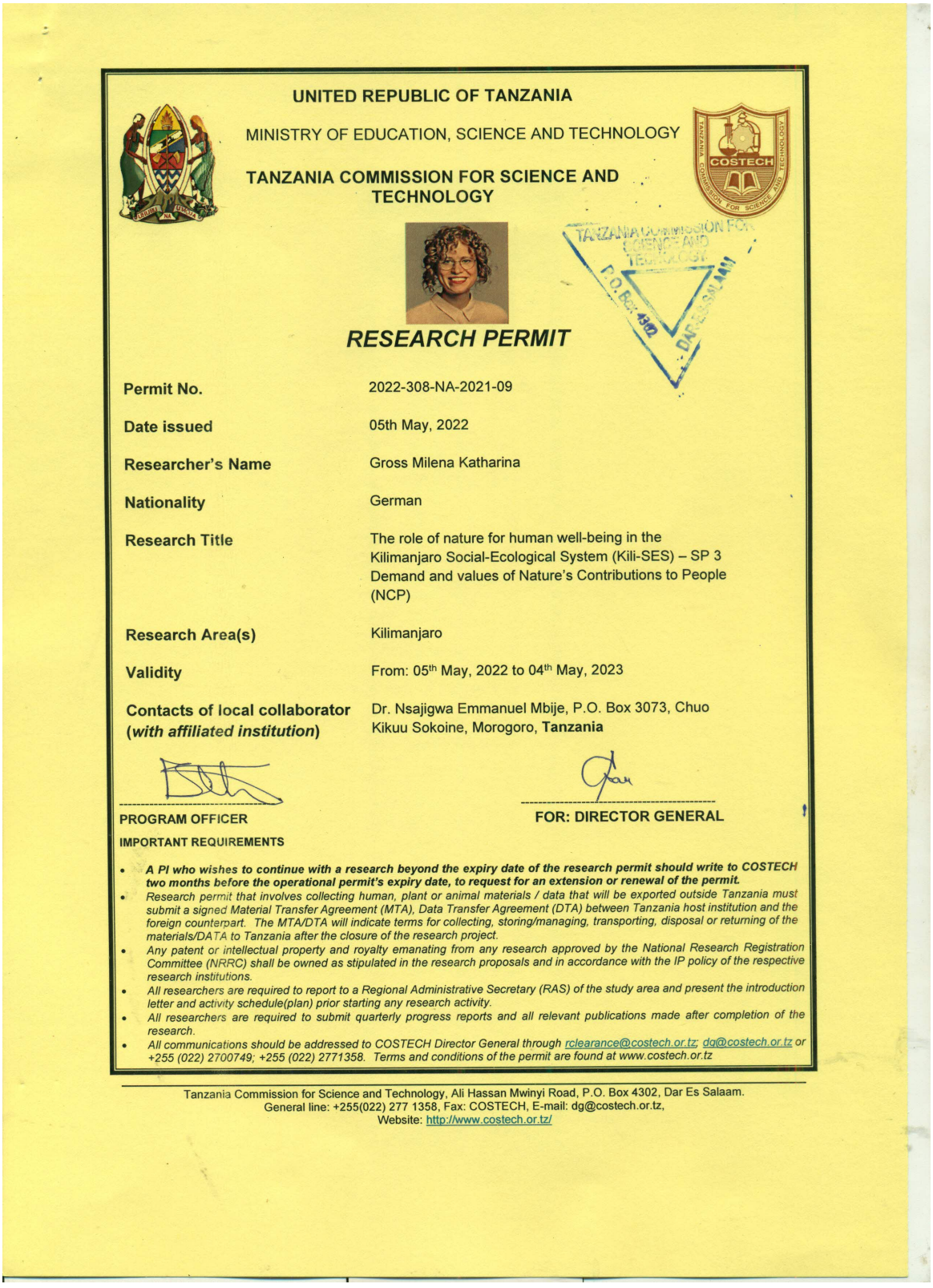
General line: +255(022) 277 1358, Fax: COSTECH, E-mail: dg@costech.or.tz,
Website: http://www.costech.or.tz/

Appendix 2.6: Research permit for surveys with all social actors



UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

TANZANIA COMMISSION FOR SCIENCE AND TECHNOLOGY

TANZANIA COMMISSION FOR SCIENCE AND TECHNOLOGY P.O. Box 4302 DAR ES SALAAM

RESEARCH PERMIT

Permit No.	2022-308-NA-2021-09
Date issued	05th May, 2022
Researcher's Name	Gross Milena Katharina
Nationality	German
Research Title	The role of nature for human well-being in the Kilimanjaro Social-Ecological System (Kili-SES) – SP 3 Demand and values of Nature's Contributions to People (NCP)
Research Area(s)	Kilimanjaro
Validity	From: 05th May, 2022 to 04th May, 2023
Contacts of local collaborator (*with affiliated institution*)	Dr. Nsajigwa Emmanuel Mbije, P.O. Box 3073, Chuo Kikuu Sokoine, Morogoro, **Tanzania**

PROGRAM OFFICER **FOR: DIRECTOR GENERAL**

IMPORTANT REQUIREMENTS

- ***A PI who wishes to continue with a research beyond the expiry date of the research permit should write to COSTECH two months before the operational permit's expiry date, to request for an extension or renewal of the permit.***
- *Research permit that involves collecting human, plant or animal materials / data that will be exported outside Tanzania must submit a signed Material Transfer Agreement (MTA), Data Transfer Agreement (DTA) between Tanzania host institution and the foreign counterpart. The MTA/DTA will indicate terms for collecting, storing/managing, transporting, disposal or returning of the materials/DATA to Tanzania after the closure of the research project.*
- *Any patent or intellectual property and royalty emanating from any research approved by the National Research Registration Committee (NRRC) shall be owned as stipulated in the research proposals and in accordance with the IP policy of the respective research institutions.*
- *All researchers are required to report to a Regional Administrative Secretary (RAS) of the study area and present the introduction letter and activity schedule(plan) prior starting any research activity.*
- *All researchers are required to submit quarterly progress reports and all relevant publications made after completion of the research.*
- *All communications should be addressed to COSTECH Director General through rclearance@costech.or.tz; dg@costech.or.tz or +255 (022) 2700749; +255 (022) 2771358. Terms and conditions of the permit are found at www.costech.or.tz*

Tanzania Commission for Science and Technology, Ali Hassan Mwinyi Road, P.O. Box 4302, Dar Es Salaam.
General line: +255(022) 277 1358, Fax: COSTECH, E-mail: dg@costech.or.tz,
Website: http://www.costech.or.tz/

Appendix 3: Knowledge exchange tour

We, the core team of Kili-SES subproject 3 (Berta Martín-López, PI, Jasmine Pearson, Postdoctoral Researcher, John Sanya Julius, Ph.D. Candidate, and the first author) embarked on an ‘knowledge exchange tour ‘ around Mount Kilimanjaro in early 2023. We communicated our results to research participants and others who were involved in our research or wanted to learn about our results. We welcomed more than 160 guests in total in seven locations. Those locations comprised three villages to address local villagers, particularly those women who were focus group participants, and tour guides (Figure A3.1a, b); the headquarters of the Kilimanjaro National Park Authority (KINAPA) to address conservation managers (Figure A3.1c); College for Wildlife Management, Mweka to address conservation experts and students, a COSTECH representative, and research assistants (Figure A3.1d); International School of Moshi – Kilimanjaro Hiking Club to address tour guide, expats, and international hikers (Figure A3.1e); and Matriarch Hill Safari to address Tanzanian counterpart Jennifer Kasanda Sesabo, representatives of conservation initiatives, and tour guides. We hosted a poster presentation and photo exhibition (Figure A3.1f) at all locations with the addition of an oral presentation at two sites (Figure A3.1d). We encouraged the audience to ask questions, to reflect on our results and conclusions, to engage in discussions with us, and to network with other guests.

Jelke Meyer designed four posters that presented various results from, e.g., our interviews, i.e., Chapter III, and surveys, i.e., Chapters IV and V, in Swahili and English (Figures A3.2-5). We archived all posters in high resolution (link to the poster series: https://doi.org/10.48548/pubdata-78). Jelke Meyer wrote her bachelor’s thesis about ‘A creative approach for social-ecological science communication at Mt Kilimanjaro in Tanzania’ (link to the video of her defense presentation: https://www.youtube.com/watch?v=YGQFpwQQTJA).

Figure A3.1 Visual impressions from the knowledge exchange tour. (a) Poster presentation for focus group participants in Nshara village; (b) Public poster presentation by the author at Shimbwe Meadows Guesthouse; (c) Group photo with members of the Kilimanjaro National Park Authority (KINAPA) and Kili-SES subproject 3; (d) Public project and poster presentation by Berta Martín-López at Mweke College for African Wildlife Management; (e) Public poster presentation in collaboration with the Kilimanjaro Hiking Club; (f) Photo exhibition in Maharo village. Photo credit and gratitude to (a), (c), (e) Berta Martín-López: (b) John Sanya; (d), (f) author's own.

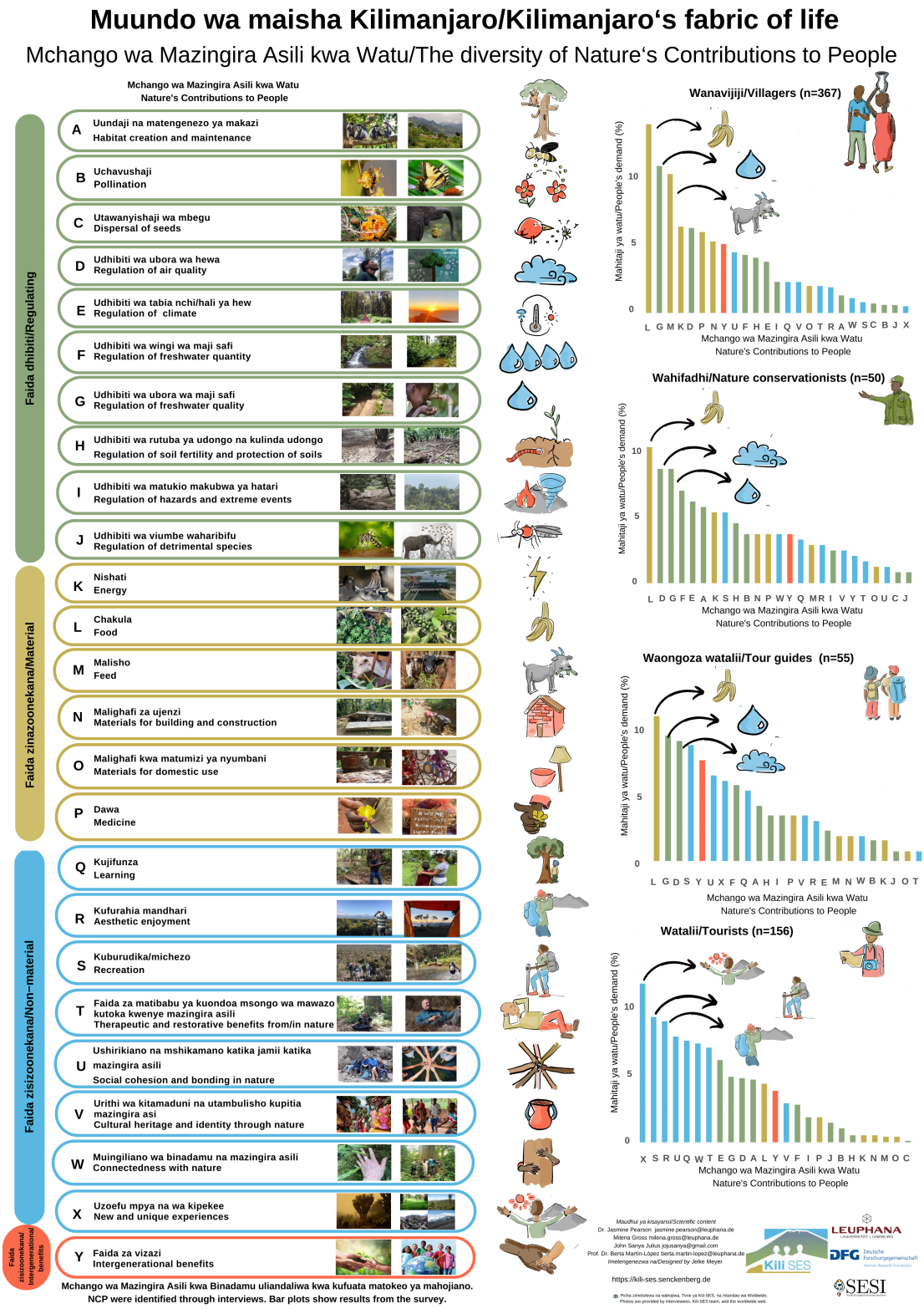


Figure A3.2 Overview of the context-specific Nature's Contributions to People (NCP) and associated NCP groups, as results from interviews with four social actors, i.e., farming villagers (n=44), nature conservationists (n=28), tour guides (n=20), and tourists (n=38) (left), and the relative NCP preferences, indicated as NCP demand, expressed by each social actor, resulting from the survey (right).

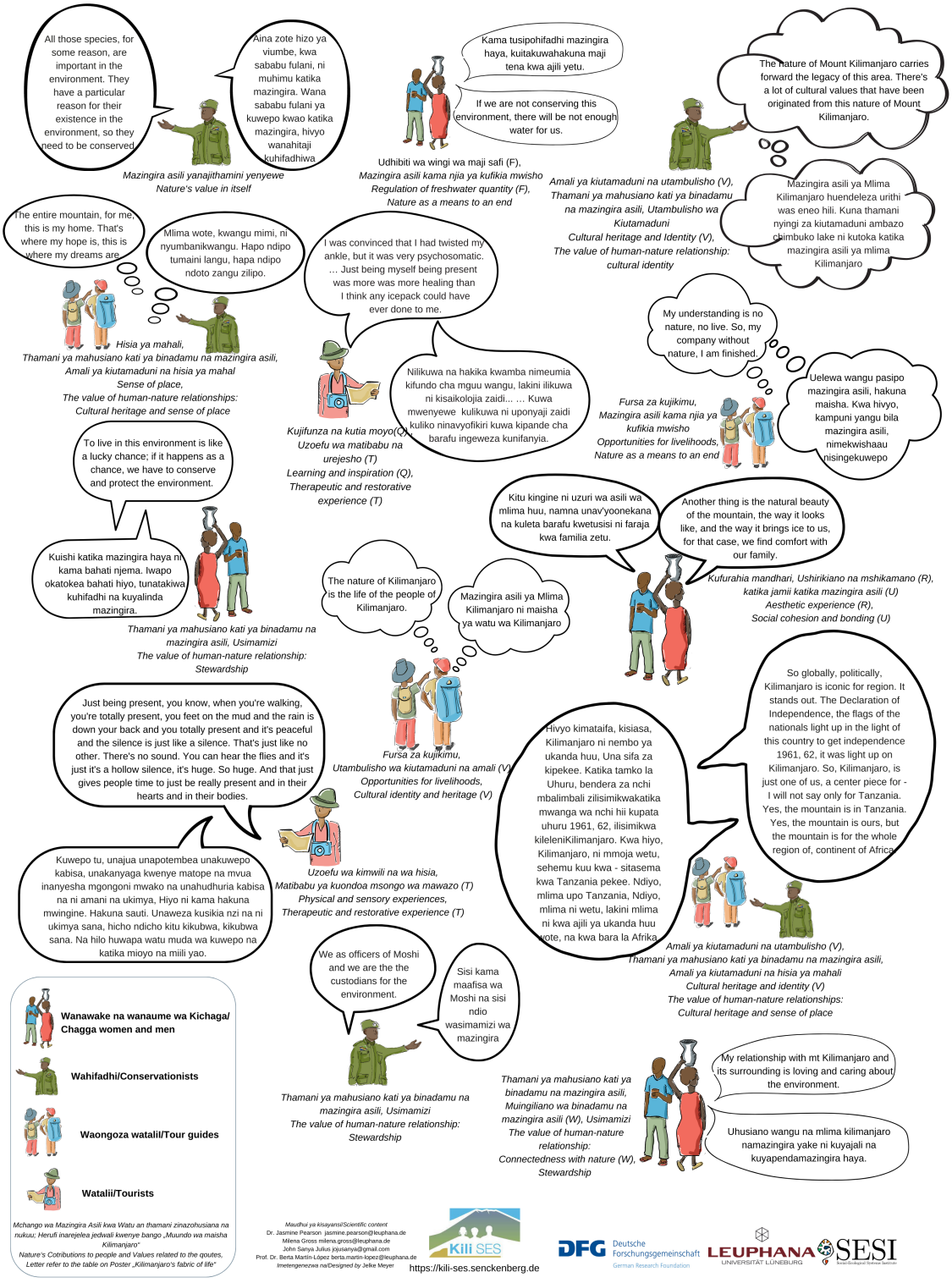


Figure A3.3 Overview of verbatims regarding context-specific nature's contributions to people (NCP) and values ascribed to nature expressed by the four social actors, i.e., Chagga women and men (n=44), nature conservationists (n=28), tour guides (n=20), and tourists (n=38), resulting from interviews.

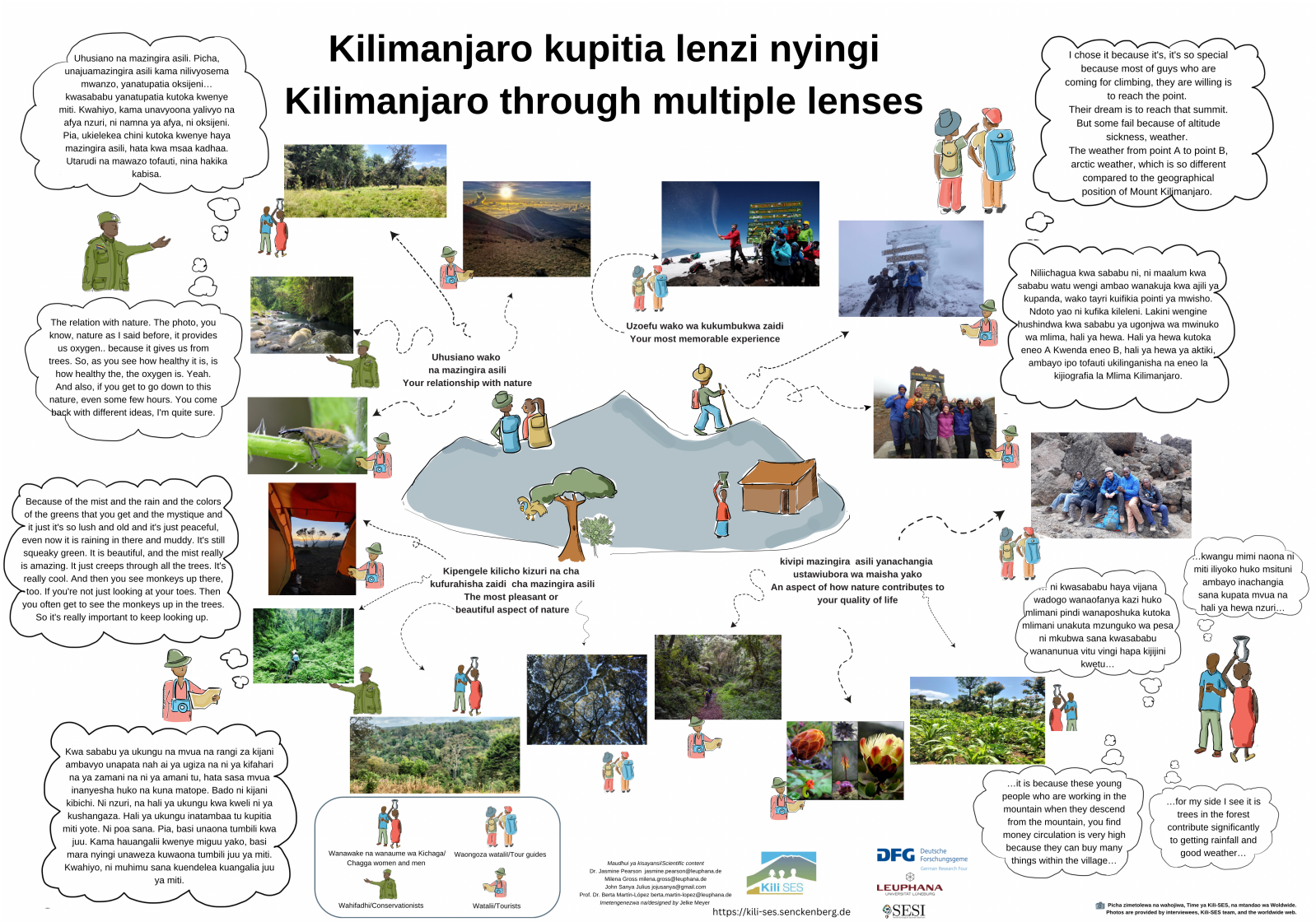


Figure A3.4 Overview of photos contributed by and verbatims expressed by research participants, resulting from interviews, photo-voice, and photo-elicitation and their associated narratives. Interviewees represented the four social actors, i.e., Chagga women (n=10) and men (n=16), nature conservationists (n=28), tour guides (n=20), and tourists (n=30).

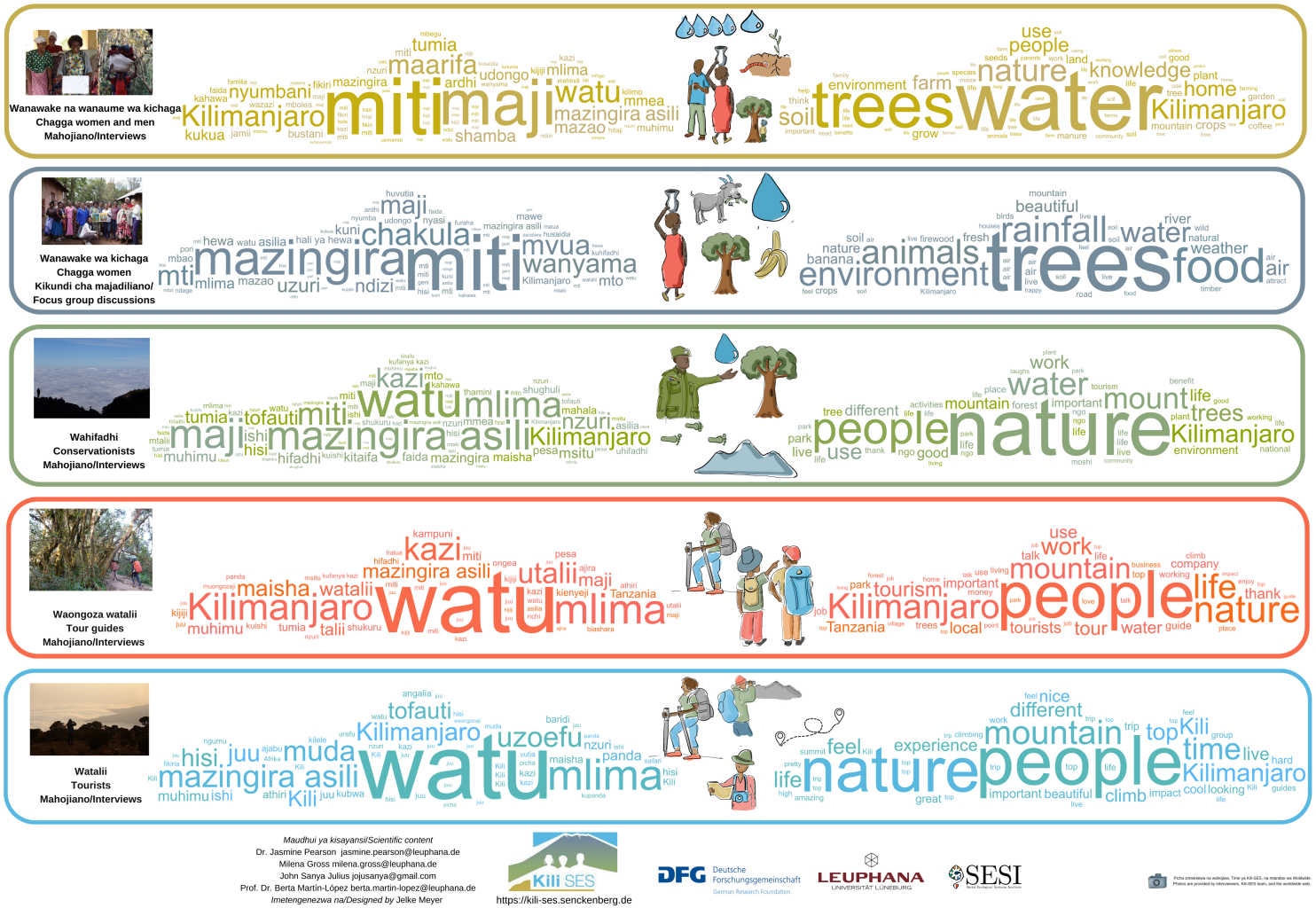


Figure A3.5 Figure A3. Word-mountains – analog to word clouds – representing the main topics brought up by interviewees of the four social actors, i.e., Chagga women and men (n=44), nature conservationists (n=28), tour guides (n=20), and tourists (n=38), and participants of focus group discussions, i.e., Chagga women (n= 33). Please note that this Ph.D. thesis did not consider the results of the focus group discussions, as they were the research topic of the postdoctoral researcher associated with Kili-SES subproject 3.

Appendix 4: Supplementary Material for Chapter II

Supplementary Material S1

Table S1 Prisma checklists for systematic literature reviews based on Page et al. (2021).

Section and Topic	Item #	Checklist item	Location where item is reported
Title			
Title	1	Identify the report as a systematic review.	Title, Abstract, Methods
Abstract			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Drafting of abstract was guided by criteria and considered, if limited numbers of words allowed to do so.
Introduction			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Introduction
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Introduction
Methods			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Methods, Supp. Material S2, Supp. Material S3
Information sources	6	Specify all databases, registers, websites, organizations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Methods, Supp. Material S2
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Methods, Supp. Material S2
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Methods, Supp. Material S2

Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Methods
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g., for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	NA
	10b	List and define all other variables for which data were sought (e.g., participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	NA
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Methods
Effect measures	12	Specify for each outcome the effect measure(s) (e.g., risk ratio, mean difference) used in the synthesis or presentation of results.	NA
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g., tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	All articles were eligible.
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Supp. Material S5, Supp. Material S6
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Methods
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Methods
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g., subgroup analysis, meta-regression).	NA
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	NA
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	NA

Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	NA
Results			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Methods, Supp. Material S2
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Supp. Material S3
Study characteristics	17	Cite each included study and present its characteristics.	Supp. Material S4
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	NA
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g., confidence/credible interval), ideally using structured tables or plots.	NA
Results of syntheses	20a	For each synthesis, briefly summarize the characteristics and risk of bias among contributing studies.	Methods, Supp. Material S3
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g., confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Results, Figure 8
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	NA
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	NA
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	NA
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	NA

Discussion			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Discussion
	23b	Discuss any limitations of the evidence included in the review.	Methods, Supp. Material S3
	23c	Discuss any limitations of the review processes used.	Methods, Supp. Material S3
	23d	Discuss implications of the results for practice, policy, and future research.	Discussion
Other information			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Footnote in Methods
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Supp. Material S2
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	NA
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Acknowledgements
Competing interests	26	Declare any competing interests of review authors.	Declaration of competing interest
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Publicly available on ResearchGate 10.13140/RG.2.2.29999.00161

Supplementary Material S2

Table S2 Review procedure based on Luederitz et al. (2016) and Pullin and Stewart (2006).

Review steps	Procedure	Result
1. Data gathering	Database search on Scopus using the following search string with redundant search words for subject: tourists; object: value; focus of value: nature; study area: protected area. (TITLE-ABS-KEY (touris* OR recreation* OR leisure OR travel* OR trip* OR journey*) AND TITLE-ABS-KEY (*valu*) AND TITLE-ABS-KEY ("protected area*" OR "protected landscape*" OR "biosphere reserve*" OR "nature reserve*" OR "natural monument*" OR "national park*" OR "natural park*" OR "biosphere area*" OR "conservation area*" OR "biosphere region*"))) AND (LIMIT-TO (DOCTYPE , "ar")) AND (EXCLUDE (SUBJAREA , "BIOC") OR EXCLUDE (SUBJAREA , "ENGI") OR EXCLUDE (SUBJAREA , "MEDI") OR EXCLUDE (SUBJAREA , "IMMU") OR EXCLUDE (SUBJAREA , "COMP") OR EXCLUDE (SUBJAREA , "PHYS") OR EXCLUDE (SUBJAREA , "CHEM") OR EXCLUDE (SUBJAREA , "PHAR") OR EXCLUDE (SUBJAREA , "VETE") OR EXCLUDE (SUBJAREA , "MATH") OR EXCLUDE (SUBJAREA , "NEUR") OR EXCLUDE (SUBJAREA , "CENG") OR EXCLUDE (SUBJAREA , "MATE")) AND (LIMIT-TO (LANGUAGE , "English") TITLE-ABS-KEY indicates search word appearing in title, abstract, and/or keywords. LIMIT-TO indicates restrictions (to type of publication (ar: article), i.e., exclusion of, e.g., book chapter and conference proceedings) to avoid including the same empirical data more than once, and language (English)). EXCLUDE indicates exclusion (of subject areas here). We excluded articles associated with non-related Web of Science Categories (e.g., Engineering, Medicine, and Neuroscience) a priori. Search terms were grouped by the three sets subject, object, and study area. The Boolean operator 'OR' was added to separate search words within a set and the operator 'AND' to separate the four sets. The asterisk * was added to account for diverse prefixes and suffixes. By doing so, potentially relevant articles contain at least one word from each set (Pullin et al. 2013). Language of the articles was restricted to English. Only peer-reviewed articles were considered. Subject areas[14] that do not relate to the	Bibliographic information of 2526 potentially relevant articles available as of 23 June, 2021.

[14] BIOC: Biochemistry, Genetics and Molecular Biology; CENG: Chemical Engineering, CHEM: Chemistry; COMP: Computer Science; ENGI: Engineering; IMMU: Immunology and Microbiology; MATH: Mathematics; MEDI: Medicine; NEUR: Neuroscience; PHAR: Pharmacology, Toxicology and Pharmaceutics; PHYS: Physics and Astronomy; VETE: Veterinary.

	focus of the study were excluded a priori. No date restrictions were applied.	
2. Data screening	Based on an iterative process, numerous articles were screened to define inclusion criteria.	Definition of inclusion criteria.
3. Data cleaning	Screening of title and abstract of 2526 articles, guided by the following five inclusion criteria: 1. Subject: Are *tourists* sampled? 2. Object: Does the article elicit tourists' (contextual) *value(s)* through a valuation method(Martín-López et al. 2009; Saayman and Saayman 2014; Estifanos et al. 2021)? 3. Focus of value: Is the (contextual) value of (any element of) *nature* collected? 4. Study area: Was the study area a *protected area*? 5. Case study: Does the article provide *empirical data* on the research topic? Inclusion criteria are described in detail in Supp. Material S3. If the abstract was missing or information insufficient, articles were accepted for full text screening.	846 potentially relevant articles were identified.
4. Data scoping	Download of all articles classified as potentially relevant. Three articles were not accessible, although articles were requested through email from at least one author and/or ResearchGate. (A reminder was sent as well.)	Download of 843 potentially relevant studies.
5. Article classification	Screening of full text of potentially relevant articles according to inclusion criteria.	152 articles that contain relevant information serving the overall objective and the three research questions (Supp. Material S4).
7. Article review	Analysis of relevant articles using 18 review categories (Supp. Material S5).	Coherent dataset of 152 articles with 18 review categories each. See Supp. Material S6 for examples of coded articles.
8. Data analysis	Analysis of all relevant data using RStudio.	See Results.

Supplementary Material S3

Description of inclusion criteria

1. Inclusion criterion: case study

Case study: Does the article provide empirical data on the research topic?

Search string terms: We intentionally did not include any search term related to case studies because of the selection rule specified below.

We only included studies that provide empirical data on the research topic, whereas we excluded, for example, purely theoretical and conceptual articles, systematic literature reviews, meta-analysis, and gray literature to avoid including the same empirical data more than once and to assure scientific quality of the reviewed articles. Hence, we did not include any (redundant) search terms related to the inclusion criterion case study in the search string because we did not want to restrict the search of potentially relevant articles due to missing search terms. This inclusion criterion is rather a matter of reading and interpreting title, abstract, and main text. Case study and empirical study, for example, were indicator words for this inclusion criterion.

2. Inclusion criterion: value

Object: Does the article elicit tourists' (contextual) *value(s)* through a valuation method?

Search string terms: *valu* - positively identifiable words in title, abstract, and key words, e.g., (to) value, value, valuation; singular and plural versions and different tenses of some search terms.

There are many definitions of and uses for the term value found in the literature (Kenter et al. 2015). To be consistent in this review, we included contextual values only according to the definition stated in Kenter et al. (2015, p. 92), that is, "opinions about the importance or worth of something". Therefore, we developed the following four selection rules:

(1) Articles on, e.g., transcendental values, value-belief-norm, new environmental paradigm, pro-environmental behavior and attitude, and those that used buzzwords such as values of nature-based tourism or ecotourism and proxies such as number of tourists or financial benefit did not meet our inclusion criterion value and hence, were excluded. Because of this selection rule, the following article was excluded, for example, Vásquez Lavín et al. (2016).

(2) We only included articles in which the authors clearly stated what they referred to as value and/ or applied a valuation method, i.e., valuation exercise. We did not interpret additional data nor extract data beyond the author's definition. For example, Abu Bakar et al. (2016), whose ranking/rating exercise can be used to elicit contextual values but was not stated by the authors as a valuation method, was excluded from the final set of relevant articles.

(3) We only included articles, which displayed the results of tourists' valuation exercise. Because of this selection rule the following article was excluded, for example, Heslinga et al. (2017).

(4) Articles were excluded if they were found in the Scopus search due to the appearance of the terms 'valuable' or 'evaluation' in title, abstract and/or key words but did not refer to a contextual value or valuation method/exercise. Because of this selection rule the following articles were excluded, for example, Kulczycki and Halpenny (2014) and Mills et al. (1980).

Our search string term for the inclusion criterion value might have overlooked research on tourists' values of nature in protected areas because we decided to not use synonyms. Two

reasons explain this decision. First, since the aim of this research was to explore how the scientific literature has approached nature valuation, we deliberately targeted those articles that had used the concept of value/valuation. Former systematic reviews have applied a similar approach by narrowing their search string to value/valuation and not adding synonyms for valuation (e.g., Acharya et al. 2019). Second, the use of other terms in the search that could potentially refer to value, such as perceptions, can lead to many articles that do not focus on nature valuation but on related yet different concepts such as beliefs, attitudes, and norms.

3. Inclusion criterion: nature

Focus of value: Is the (contextual) value of (any element of) *nature* elicited?

Search string terms: We intentionally did not include any search term related to natural elements because they are diverse, and we did not want to restrict the search due to potentially missing search terms. We specified the following three selection rules:

(1) We referred to nature as any abiotic, biotic, tangible, and intangible element of nature and any nature-mediated element, e.g., landscape, animal, species composition, sound, ecosystem, clouds, and rocks, scuba-diving, and Ecosystem Services/Nature's Contributions to People.
(2) Articles on management and conservation plans and/or scenarios that considered elements of nature in the valuation exercise met the inclusion criterion nature (e.g. Iranah et al. 2018).
(3) Articles on general management and/or conservation plans and/or scenarios, that is, they did not target natural elements specifically but only non-natural management options of protected areas (e.g., maintenance of trails, educational programs, facilities, and number of benches) through the valuation exercise (mainly, e.g., choice experiments and willingness to pay exercises), did not meet the inclusion criteria nature and hence, were excluded.

Table S3 provides an exemplary overview with arguments for inclusion or exclusion of valuation methods to elicit the value of natural and non-natural elements of nature.

Table S3 Overview of inclusion and exclusion criteria for inclusion criterion nature.

Valuation method and object of value	Argument for inclusion and exclusion	Natural element	Reference
Willingness to pay for management and conservation operation	Exclusion. We don't know whether the management and conservation operation refer to (a) natural element(s) because the authors did not specify.	NA	Abu Bakar et al. (2016)
Willingness to pay for ecotourism development	Exclusion. The authors did not specify the (potential) element of nature.	NA	Chen and Jim (2012)
Willingness to pay for conservation of forest	Inclusion. The focus of conservation is the natural element forest.	Forest	Iranah et al. (2018)
Willingness to pay for invasive species management	Inclusion. Invasive species are an element of nature qua definition.	Invasive species	García-Llorente et al. (2011)
Willingness to pay for entering national park	Inclusion. The entrance fee provides access to the national park.	National Park	Mathieu et al. (2003)
Choice experiment: 1. Area (size of the area protected, km^2) 2. Ethiopian wolf population (number of wolves) 3. Interpretive signs and improved walking trails 4. Access (access to the wolf habitat) Fee (park entry fee per person per day in ETB)	Inclusion. The protected area and the Ethiopian wolf are, for example, natural elements qua definition. Interpretive signs and improved walking trails are considered as non-natural elements.	Protected area, wolf	Estifanos et al. (2021)
Choice experiment: 1. Level of encounters with other visitors 2. Ecological condition of official Trail 3. Number of people with access to trails 4. Trail management	Exclusion. Only non-natural elements are valued.	NA	Cahill et al. (2007)

4. Inclusion criterion: study area

Study area: Is the study area a *protected area*?

Search string terms: "protected area*" OR "protected landscape*" OR "biosphere reserve*" OR "nature reserve*" OR "natural monument*" OR "national park*" OR "natural park*" OR "biosphere area*" OR "conservation area*" OR "biosphere region*" - positively identifiable words in title, abstract, and key words: singular and plural versions of the search terms

The definition of the term protected area was broad and context-specific because it was based on any sub-national, national and/or international (e.g., IUCN categories of protected areas) legal definition of a *natural* area that is under protection qua law. Furthermore, we specified three selection rules:

1. Articles that scrutinized tourists' value of nature in a protected area, nature of a network of protected areas, and/or of multiple protected areas met the inclusion criterion study area. Because of this selection rule the following articles were excluded, for example, Pereira et al. (2019) and Vianna et al. (2012).
2. Articles on a hypothetical protected area or a study area adjacent to a protected area did not meet the inclusion criterion study area. Because of this selection rule the following article was excluded, for example, Vianna et al. (2018).
3. If the study area included both protected and non-protected areas but the results were not separated for them, the article did not meet the inclusion criterion study area.

5. Inclusion criterion: tourist

Subject: Are *tourists* sampled?

Search string terms: touris* OR recreation* OR leisure OR travel* OR trip* OR journey* - positively identifiable words in title, abstract, and key words, e.g., tourist, tourism, touristic, recreation, recreational; singular and plural versions of some search terms.

Originally, we wanted to develop a precise definition of the inclusion criterion tourist, e.g., based on the distance travelled from home to the protected area. However, after screening potentially relevant articles to develop such a definition (see review step 2 data screening in Table S2), we found that the majority of the reviewed articles did not provide a precise definition and thus, it was not possible to develop a consistent definition and apply it across all potentially relevant articles. In fact, we also assumed the definition of tourist depends on the local context. Therefore, articles generally met the inclusion criterion 'tourist', if authors used the term tourist to describe their target group or one of their investigated target groups, e.g., local, non-local, national, and international tourists.

While screening the relevant articles, we learnt authors used synonyms for the term tourist, such as visitors, travelers, foreigners, and non-locals, to describe their target group. Therefore, we developed, first, our working definition (see (1) below) of the term tourist and, second, inclusion rules to account for synonyms of the term tourist aligned with our working definition (see (2) below). Finally, we could not apply our working definition and inclusion rules to two valuation methods that were used in the articles found in the Scopus search, that is, zonal travel cost and public method based on social media and photo-based data. At the same time, we did not want to neglect this information on values, as the rationale inherent to the valuation method did not allow us to apply our working definition and selection rules. Thus, we defined specific selection rules for these two valuation methods (see (3) below).

Working definition of the term tourist:

We defined a tourist as any person who travels to and visits the protected area in their free time for hours to days, that is, day and overnight tourists. We did not apply a minimum travel distance to classify a person as a tourist because this information was also not stated by the majority of the articles (with two exceptions see (3) below). People who are present in or in the surroundings of the protected area in the context of their daily life (e.g., (indigenous) residents, local people, local community, visitors from the region) and job duties (e.g., park managers and decision-makers) or we investigated through a household survey in or in the surroundings of the protected area were not considered tourists. Hence, articles that sampled these target groups only were excluded.

Selection rules to account for synonyms of the term tourist:

While screening the articles, we encountered potential synonyms for the term tourist, e.g., visitor, traveler, foreigner, and non-local. We did not want to bias our sampling process by just including articles that strictly use the term tourist, as we would have excluded many relevant articles that use synonyms. Thus, we interpreted the synonyms based on our working definition. To make consistent decisions, we developed standardized selection rules to account for the synonyms. The terms traveler, foreigner, and non-local, for example, generally met our working definition. The term visitor seemed to be more challenging because it is less specific than the term tourist: All tourists are visitors but not all visitors are tourists. The term visitor can include local people who visit the protected area, for example, but local people[15] do not meet our working definition of the term tourist. Therefore, the following six selection rules were developed and applied to avoid extracting data from mixed samples, i.e., mainly local people and tourists.

(1) If authors used the terms tourists and visitors as synonyms, the article met the inclusion criterion.
(2) If authors used the term visitors but not tourists and did not specify the geographical origin of the visitors, the article did not meet the inclusion criterion tourist and hence, was excluded to avoid having a mixed sample that included, e.g., local and foreign visitors. Because of this selection rule, the following articles were excluded, for example, Becker et al. (2005) and Englin et al. (2006).
(3) If authors used the term visitor to describe a target group and distinguished it from local people as a separate target group, these visitors were considered tourists and hence, the article met the inclusion criterion tourist.
(4) If the authors distinguished between local and foreign *visitors*, foreign visitors only met the inclusion criterion tourist.
(5) If the authors distinguished between any of the three groups local/nearby(in-state), domestic/national/long-distance (out-of-state), and foreign/international *visitors*, local visitors did not but the other type of visitors met the inclusion criterion tourist, e.g., Richardson et al. (2006).
(6) If the authors distinguished between the terms *non-visitor* and a *visitor* who visits the protected area in their leisure time, non-visitors did not but visitors who visited the protected area in their leisure time met the inclusion criterion tourist.

Definition of the term tourist regarding specific methods:

We defined specific selection rules for zonal travel cost method as well as social media and photo platform-based valuation methods. Articles applying these valuation methods usually use the term visitor to describe their samples.

1. Zonal travel cost method: If the authors considered ‘visitors’ who travelled a minimum distance of 100km to the protected area and display their travel cost, the article met the inclusion criterion. Because of this selection rule the following article was excluded, for example, Becker et al. (2005).
2. Public method based on social media and photo-based data: Articles analyzed the social media content of users and (other) photo platforms, such as Flickr.com, to elicit visitor’s values to protected areas. Authors did not personally consult the users or photographers. Hence, critical information on the role they took on in the protected area was missing. Thus, values investigated for different target groups such as locals and tourists can hardly be distinguished in the valuation method of public method (e.g., Martínez Pastur et al. 2016). Nevertheless, we decided that such articles met the inclusion criterion, as the method used did not allow the authors to provide this

[15] We decided to differentiate between the target groups residents, locals or local people and target groups tourists/travelers/foreigners because authors argue that these groups value natural elements differently due to their different place attachments with the respective protected area (Larkin and Beier 2014; Mrotek et al. 2019). Thus, we only considered articles to meet this first inclusion criterion tourist if articles displayed tourists’ values distinctively from the other target groups. By doing so, we avoided to extract data from mixed samples.

information. We are aware that values of locals might have been included in our literature review and see this decision as a limitation of our review. However, we recognized the value of this rather new valuation method, e.g., to elicit values from visitors based on a large database that is easily and globally accessible and wanted to demonstrate how the scientific community has been applying this method in the scientific field of tourists' values of nature in protected areas.

Supplementary Material S4

Table S4 List of the 152 articles analyzed in this literature review.

Author(s)	Title	Year	Journal title	DOI
Affek A.N., Kowalska A.	Ecosystem potentials to provide services in the view of direct users	2017	Ecosystem Services	10.1016/j.ecoser.2017.06.017
Ågren J., Nyyssölä C., Stage J.	The potential for monopoly rents from Etosha National Park, Namibia	2003	South African Journal of Economic and Management Sciences	10.4102/sajems.v6i3.3300
Amirnejad H., Ataie Solout K.	Economic valuation of use values of environmental services in lar national park in Iran	2021	Journal of Agricultural Science and Technology	
Amirnejad H., Jahanifar K.	Comparison of contingent valuation and travel cost method in estimating the recreational values of a forest park	2018	Journal of Environmental Science and Management	
Anna Z., Saputra D.S.	Economic valuation of whale shark tourism in Cenderawasih Bay National Park, Papua, Indonesia	2017	Biodiversitas	10.13057/biodiv/d180321
Antoušková M.	Economic value of recreation - Determinants influencing the willingness to pay in natural region with low-intensity agriculture	2012	Agris On-line Papers in Economics and Informatics	
Antoušková M.	Comparison of take-it-or-leave-it and take-it-or-leave-it with follow-up elicitation formats - case study of Czech national parks	2012	Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis	10.11118/actaun201260070019
Apps K., Dimmock K., Lloyd D.J., Huveneers C.	What values do tourists place on a marine protected area? White shark cage-dive tourists and the Neptune Islands	2019	Tourism in Marine Environments	10.3727/154427319X15567690274868
Asafu-Adjaye J., Tapsuwan S.	A contingent valuation study of scuba diving benefits: Case study in Mu Ko Similan Marine National Park, Thailand	2008	Tourism Management	10.1016/j.tourman.2008.02.005

Aseres S.A., Sira R.K.	Estimating visitors' willingness to pay for a conservation fund: sustainable financing approach in protected areas in Ethiopia	2020	Heliyon	10.1016/j.heliyon.2020.e04500
Badola R., Hussain S.A., Mishra B.K., Konthoujam B., Thapliyal S., Dhakate P.M.	An assessment of ecosystem services of Corbett Tiger Reserve, India	2010	Environmentalist	10.1007/s10669-010-9278-5
Baral N., Hazen H., Thapa B.	Visitor perceptions of World Heritage value at Sagarmatha (Mt. Everest) National Park, Nepal	2017	Journal of Sustainable Tourism	10.1080/09669582.2017.1291647
Baral N., Kaul S., Heinen J.T., Ale S.B.	Estimating the value of the World Heritage Site designation: a case study from Sagarmatha (Mount Everest) National Park, Nepal	2017	Journal of Sustainable Tourism	10.1080/09669582.2017.1310866
Barry S.J.	Using social media to discover public values, interests, and perceptions about cattle grazing on park lands	2014	Environmental Management	10.1007/s00267-013-0216-4
Bennett J., Gillespie R., Powell R., Chalmers L.	The economic value and regional economic impact of national parks	1996	Australian Journal of Environmental Management	10.1080/14486563.1996.10648360
Bhat M.Y., Bhatt M.S.	Economic valuation of biodiversity in South Asia: The case of Dachigam National Park in Jammu and Kashmir (India)	2019	Asia and the Pacific Policy Studies	10.1002/app5.266
Bhattarai B.R., Morgan D., Wright W.	Equitable sharing of benefits from tiger conservation: Beneficiaries' willingness to pay to offset the costs of tiger conservation	2021	Journal of Environmental Management	10.1016/j.jenvman.2021.112018

Bogdan S.M., Stupariu I., Andra-Topârceanu A., Năstase I.I.	Mapping social values for cultural ecosystem services in a mountain landscape in the Romanian Carpathians	2019	Carpathian Journal of Earth and Environmental Sciences	10.26471/cjees/2019/014/072
Can Ö., Alp E.	Valuation of environmental improvements in a specially protected marine area: A choice experiment approach in Göcek Bay, Turkey	2012	Science of the Total Environment	10.1016/j.scitotenv.2012.09.002
Castaño-Isaza J., Newball R., Roach B., Lau W.W.Y.	Valuing beaches to develop payment for ecosystem services schemes in Colombia's Seaflower marine protected area	2015	Ecosystem Services	10.1016/j.ecoser.2014.10.003
Castellini A., Devenuto L., Ragazzoni A.	The marine environment as tourism-recreational resource. An economic assessment of the demand	2009	New Medit	
Chakrabarty P., Pan S., Mandal R.	Promoting wildlife tourism on geotourism landscape: A study in Manas and Kaziranga National Parks of Assam, India	2019	Geojournal of Tourism and Geosites	10.30892/gtg.24115-352
Chen F., Wu J., Liu J., Hu Y., Chen X., Lim P.-E., Aznan Abdullah W.M., Sjafrie N.D.M., Adirianto B.	Comparison of social-value cognition based on different groups: The case of Pulau Payar in Malaysia and Gili Matra in Indonesia	2019	Ocean and Coastal Management	10.1016/j.ocecoaman.2019.02.010
Chiou C.-R., Lin J.-C., Liu W.-Y., Lin T.-W.	Assessing the recreational value of protective forests at Taitung Forest Park in Taiwan	2016	Tourism Economics	10.5367/te.2015.0468
Chopra K., Adhikari S.K.	Environment development linkages: Modelling a wetland system for ecological and economic value	2004	Environment and Development Economics	10.1017/S1355770X03001037

Christie M., Remoundou K., Siwicka E., Wainwright W.	Valuing marine and coastal ecosystem service benefits: Case study of St Vincent and the Grenadines' proposed marine protected areas	2015	Ecosystem Services	10.1016/j.ecoser.2014.10.002
Conti E., Lexhagen M.	Instagramming nature-based tourism experiences: a netnographic study of online photography and value creation	2020	Tourism Management Perspectives	10.1016/j.tmp.2020.100650
Crespo-Cebada E., Díaz-Caro C., Robina-Ramírez R., Sánchez-Hernández M.I.	Is biodiversity a relevant attribute for assessing natural parks? Evidence from Cornalvo natural park in Spain	2020	Forests	10.3390/F11040410
Cunha J., Elliott M., Ramos S.	Linking modelling and empirical data to assess recreation services provided by coastal habitats: The case of NW Portugal	2018	Ocean and Coastal Management	10.1016/j.ocecoaman.2017.12.022
Czeszczewik D., Ginter A., Mikusiński G., Pawłowska A., Kałuża H., Smithers R.J., Walankiewicz W.	Birdwatching, logging and the local economy in the Białowieża Forest, Poland	2019	Biodiversity and Conservation	10.1007/s10531-019-01808-6
Dagiliūtė R., Žalandauskas M., Sujetovienė G., Žaltauskaitė J.	Willingness to pay for the authenticity of the Curonian spit	2017	Environmental Processes	10.1007/s40710-017-0238-7
Daly C.A.K., Fraser G., Snowball J.D.	Willingness to pay for marine-based tourism in the Ponta do Ouro Partial Marine Reserve, Mozambique	2015	African Journal of Marine Science	10.2989/1814232X.2015.1012556
Dehghani M., Farshchi P., Danekar A., Karami M., Aleshikh A.A.	Recreation value of hara biosphere reserve using willingness-to-pay method	2010	International Journal of Environmental Research	

Dicken M.L.	Socio-economic aspects of boat-based ecotourism during the sardine run within the Pondoland marine protected area, South Africa	2010	African Journal of Marine Science	10.2989/1814232X.2010.502642
Dicken M.L., Hosking S.G.	Socio-economic aspects of the tiger shark diving industry within the Aliwal Shoal marine protected area, South Africa	2009	African Journal of Marine Science	10.2989/AJMS.2009.31.2.10.882
Do Y., Kim J.Y.	An assessment of the aesthetic value of protected wetlands based on a photo content and its metadata	2020	Ecological Engineering	10.1016/j.ecoleng.2020.105816
Dong C.-M., Lin C.-C., Lin S.-P.	Study on the appraisal of tourism demands and recreation benefits for Nanwan Beach, Kenting, Taiwan	2018	Environments - MDPI	10.3390/environments5090097
Dong X., Zhang J., Zhi R., Zhong S., Li M.	Measuring recreational value of world heritage sites based on contingent valuation method: A case study of Jiuzhaigou	2011	Chinese Geographical Science	10.1007/s11769-011-0445-5
Du P., Zhang C., Yang L.	The impact of perceived value and group norm on environmentally friendly behavior of mangrove reserves in coastal cities: The mediating role of tourism satisfaction	2020	Journal of Coastal Research	10.2112/JCR-SI111-043.1
Du Preez M., Dicken M., Hosking S.G.	The value of tiger shark diving within the aliwal shoal marine protected area: A travel cost analysis	2012	South African Journal of Economics	10.1111/j.1813-6982.2011.01292.x
Edge A., Henley M., Daday J., Schulte B.A.	Examining Human Perception of Elephants and Large Trees for Insights Into Conservation of an African Savanna Ecosystem	2017	Human Dimensions of Wildlife	10.1080/10871209.2017.1298168

Esfehani M.H., Albrecht J.N.	Roles of intangible cultural heritage in tourism in natural protected areas	2018	Journal of Heritage Tourism	10.1080/1743873X.2016.1245735
Estifanos T., Polyakov M., Pandit R., Hailu A., Burton M.	What are tourists willing to pay for securing the survival of a flagship species? The case of protection of the Ethiopian wolf	2021	Tourism Economics	10.1177/1354816619880430
Font A.R.	Mass tourism and the demand for protected natural areas: A travel cost approach	2000	Journal of Environmental Economics and Management	10.1006/jeem.1999.1094
Frontuto V., Dalmazzone S., Vallino E., Giaccaria S.	Earmarking conservation: Further inquiry on scope effects in stated preference methods applied to nature-based tourism	2017	Tourism Management	10.1016/j.tourman.2016.11.017
Füzyová L., Lániková D., Novorolský M.	Economic valuation of Tatras National Park and regional environmental policy	2009	Polish Journal of Environmental Studies	
García-Llorente M., Martín-López B., Nunes P.A.L.D., González J.A., Alcorlo P., Montes C.	Analyzing the social factors that influence willingness to pay for invasive alien species management under two different strategies: Eradication and prevention	2011	Environmental Management	10.1007/s00267-011-9646-z
Gelcich S., Amar F., Valdebenito A., Castilla J.C., Fernandez M., Godoy C., Biggs D.	Financing marine protected areas through visitor fees: Insights from tourists willingness to pay in Chile	2013	Ambio	10.1007/s13280-013-0453-z
González R.M., Marrero Á.S., Navarro-Ibáñez M.	Tourists' travel time values using discrete choice models: the recreational value of the Teide National Park	2018	Journal of Sustainable Tourism	10.1080/09669582.2018.1527342
Gürlük S., Rehber E.	A travel cost study to estimate recreational value for a bird refuge at Lake Manyas, Turkey	2008	Journal of Environmental Management	10.1016/j.jenvman.2007.07.017

Hazen H.	Valuing natural heritage: Park visitors' values related to World Heritage sites in the USA	2009	Current Issues in Tourism	10.1080/13683500802538260
Hein L.	Economic benefits generated by protected areas: The case of the Hoge Veluwe Forest, the Netherlands	2011	Ecology and Society	10.5751/ES-04119-160213
Heyes C., Heyes A.	Willingness to pay versus willingness to travel: Assessing the recreational benefits from Dartmoor National Park	1999	Journal of Agricultural Economics	10.1111/j.1477-9552.1999.tb00799.x
Iranah P., Lal P., Wolde B.T., Burli P.	Valuing visitor access to forested areas and exploring willingness to pay for forest conservation and restoration finance: The case of small island developing state of Mauritius	2018	Journal of Environmental Management	10.1016/j.jenvman.2018.07.008
Ison S., Ison T., Marti-Puig P., Needham K., Tanner M.K., Roberts J.M.	Tourist Preferences for Seamount Conservation in the Galapagos Marine Reserve	2021	Frontiers in Marine Science	10.3389/fmars.2020.602767
Jaung W., Carrasco L.R.	Travel cost analysis of an urban protected area and parks in Singapore: a mobile phone data application	2020	Journal of Environmental Management	10.1016/j.jenvman.2020.110238
Juutinen A., Mitani Y., Mäntymaa E., Shoji Y., Siikamäki P., Svento R.	Combining ecological and recreational aspects in national park management: A choice experiment application	2011	Ecological Economics	10.1016/j.ecolecon.2011.02.006
Karahalil U., Başkent E.Z., Köse S.	Integrating visitor characteristics and preferences into forest management plans in protected areas: A case study in Köprülü Canyon National Park	2015	Eco.mont	10.1553/eco.mont-7-2s5

Lal P., Wolde B., Masozera M., Burli P., Alavalapati J., Ranjan A., Montambault J., Banerjee O., Ochuodho T., Mugabo R.	Valuing visitor services and access to protected areas: The case of Nyungwe National Park in Rwanda	2017	Tourism Management	10.1016/j.tourman.2017.01.019
Lara-Pulido J.A., Mojica Á., Bruner A., Guevara-Sanginés A., Simon C., Vásquez-Lavin F., González-Baca C., Infanzón M.J.	A business case for marine protected areas: Economic valuation of the reef attributes of cozumel island	2021	Sustainability (Switzerland)	10.3390/su13084307
Latinopoulos D.	The role of ecotourism in the Prespa National Park in Greece. Evidence from a travel cost method and hoteliers' perceptions	2019	Journal of Environmental Management and Tourism	10.14505/jemt.v10.8(40).03
Lee C.-H., Chen Y.-J., Chen C.-W.	Assessment of the economic value of ecological conservation of the Kenting coral reef	2019	Sustainability (Switzerland)	10.3390/su11205869
León C.J., de León J., Araña J.E., González M.M.	Tourists' preferences for congestion, residents' welfare and the ecosystems in a national park	2015	Ecological Economics	10.1016/j.ecolecon.2015.07.003
Liston-Heyes C., Heyes A.	Recreational benefits from the Dartmoor National Park	1999	Journal of Environmental Management	10.1006/jema.1998.0244
Liu W.-Y., Chen P.-Z., Hsieh C.-M.	Assessing the recreational value of a National Forest Park from ecotourists' perspective in Taiwan	2019	Sustainability (Switzerland)	10.3390/su11154084
Lopes P.F.M., Villasante S.	Paying the price to solve fisheries conflicts in Brazil's Marine Protected Areas	2018	Marine Policy	10.1016/j.marpol.2018.03.016

Louda J., Vojáček O., Slavíková L.	Achieving robust and socially acceptable environmental policy recommendations: Lessons from combining the choice experiment method and institutional analysis focused on cultural ecosystem services	2021	Forests	10.3390/f12040484
Mancini F., Coghill G.M., Lusseau D.	Quantifying wildlife watchers' preferences to investigate the overlap between recreational and conservation value of natural areas	2019	Journal of Applied Ecology	10.1111/1365-2664.13274
Mandziuk A., Parzych S., Studnicki M.	Benefits of recreation in the "nad tanwią" nature reserve determined by the travel cost method	2020	Baltic Forestry	10.46490/BF407
Martín-López B., Gómez-Baggethun E., Lomas P.L., Montes C.	Effects of spatial and temporal scales on cultural services valuation	2009	Journal of Environmental Management	10.1016/j.jenvman.2008.03.013
Martínez Pastur G., Peri P.L., Lencinas M.V., García-Llorente M., Martín-López B.	Spatial patterns of cultural ecosystem services provision in Southern Patagonia	2016	Landscape Ecology	10.1007/s10980-015-0254-9
Marzetti Dall'Aste Brandolini S.	Investing in biodiversity: The recreational value of a natural coastal area	2006	Chemistry and Ecology	10.1080/02757540600720227
Mathieu L.F., Langford I.H., Kenyon W.	Valuing marine parks in a developing country: A case study of the Seychelles	2003	Environment and Development Economics	10.1017/S1355770X03000196
Matthew N.K., Shuib A., Ramachandran S., Mohammad-Afandi S.H.	Economic valuation using travel cost method (TCM) in Kilim Karst Geoforest Park, Langkawi, Malaysia	2019	Journal of Tropical Forest Science	10.26525/jtfs2019.31.1.078089

Mayer M.	Can nature-based tourism benefits compensate for the costs of national parks? A study of the Bavarian Forest National Park, Germany	2014	Journal of Sustainable Tourism	10.1080/09669582.2013.871020
Menkhaus S., Lober D.J.	International ecotourism and the valuation of tropical rainforests in Costa Rica	1996	Journal of Environmental Management	10.1006/jema.1996.0031
Mercer E., Kramer R., Sharma N.	Rain forest tourism - estimating the benefits of tourism development in a new national park in Madagascar	1995	Journal of Forest Economics	
Molina J.R., González-Cabán A., Rodríguez y Silva F.	Wildfires impact on the economic susceptibility of recreation activities: Application in a Mediterranean protected area	2019	Journal of Environmental Management	10.1016/j.jenvman.2019.05.131
Moran D.	Contingent valuation and biodiversity: measuring the user surplus of Kenyan protected areas	1994	Biodiversity and Conservation	10.1007/BF00126859
Mrotek A., Anderson C.B., Valenzuela A.E.J., Manak L., Weber A., Van Aert P., Malizia M., Nielsen E.A.	An evaluation of local, national and international perceptions of benefits and threats to nature in Tierra del Fuego National Park (Patagonia, Argentina)	2019	Environmental Conservation	10.1017/S0376892919000250
Mukanjari S., Muchapondwa E., Demeke E.	Recreation demand and pricing policy for international tourists in developing countries: evidence from South Africa	2020	Journal of Environmental Economics and Policy	10.1080/21606544.2020.1853609
Müller S.M., Peisker J., Bieling C., Linnemann K., Reidl K., Schmieder K.	The importance of cultural ecosystem services and biodiversity for landscape visitors in the biosphere reserve Swabian Alb (Germany)	2019	Sustainability (Switzerland)	10.3390/su11092650

Muñoz L., Hausner V., Brown G., Runge C., Fauchald P.	Identifying spatial overlap in the values of locals, domestic- and international tourists to protected areas	2019	Tourism Management	10.1016/j.tourman.2018.07.015
Mwebaze P., MacLeod A.	Valuing marine parks in a small island developing state: A travel cost analysis in Seychelles	2013	Environment and Development Economics	10.1017/S1355770X12000538
Naidoo R., Adamowicz W.L.	Biodiversity and nature-based tourism at forest reserves in Uganda	2005	Environment and Development Economics	10.1017/S1355770X0400186X
Navrud S., Mungatana E.D.	Environmental valuation in developing countries: The recreational value of wildlife viewing	1994	Ecological Economics	10.1016/0921-8009(94)90024-8
Navrud S., Vondolia G.K.	Using contingent valuation to price ecotourism sites in developing countries	2005	Tourism	
Nikodinoska N., Foxcroft L.C., Rouget M., Paletto A., Notaro S.	Tourists' perceptions and willingness to pay for the control of Opuntia stricta invasion in protected areas: A case study from South Africa	2014	Koedoe	10.4102/koedoe.v56i1.1214
Nikodinoska N., Paletto A., Franzese P.P., Jonasson C.	Valuation of ecosystem services in protected areas: The case of the Abisko National Park (Sweden)	2015	Journal of Environmental Accounting and Management	10.5890/JEAM.2015.11.005
Nitanan K.M., Shuib A., Sridar R., Kunjuraman V., Zaiton S., Syamsul Herman M.A.	The Total Economic Value of Forest Ecosystem Services in the Tropical Forests of Malaysia	2020	International Forestry Review	10.1505/146554820831255551
Ortega-Becerril J.A., Polo I., Belmonte A.	Waterfalls as Geological Value for Geotourism: the Case of Ordesa and Monte Perdido National Park	2019	Geoheritage	10.1007/s12371-019-00366-1
Pandit R., Dhakal M., Polyakov M.	Valuing access to protected areas in Nepal: The case of Chitwan National Park	2015	Tourism Management	10.1016/j.tourman.2014.12.017

Parsons G.R., Thur S.M.	Valuing changes in the quality of coral reef ecosystems: A stated preference study of SCUBA diving in the Bonaire National Marine Park	2008	Environmental and Resource Economics	10.1007/s10640-007-9171-y
Pavlović S., Belij M., Vesić M., Jovanović S.S., Manojlović I.	Improvement of the relationship between environment and tourism: Case study of the National Park Derdap in Serbia	2020	Mitteilungen der Osterreichischen Geographischen Gesellschaft	10.1553/MOEGG161S251
Peh K.S.-H., Thapa I., Basnyat M., Balmford A., Bhattarai G.P., Bradbury R.B., Brown C., Butchart S.H.M., Dhakal M., Gurung H., Hughes F.M.R., Mulligan M., Pandeya B., Stattersfield A.J., Thomas D.H.L., Walpole M., Merriman J.C.	Synergies between biodiversity conservation and ecosystem service provision: Lessons on integrated ecosystem service valuation from a Himalayan protected area, Nepal	2016	Ecosystem Services	10.1016/j.ecoser.2016.05.003
Perez Loyola R., Wang E., Kang N.	Economic valuation of recreational attributes using a choice experiment approach: An application to the Galapagos Islands	2021	Tourism Economics	10.1177/1354816619885236
Pickering C., Walden-Schreiner C., Barros A., Rossi S.D.	Using social media images and text to examine how tourists view and value the highest mountain in Australia	2020	Journal of Outdoor Recreation and Tourism	10.1016/j.jort.2019.100252
Piñeiro-Corbeira C., Barreiro R., Olmedo M., De la Cruz-Modino R.	Recreational snorkeling activities to enhance seascape enjoyment and environmental education in the Islas Atlánticas de Galicia National Park (Spain)	2020	Journal of Environmental Management	10.1016/j.jenvman.2020.111065
Pires N.M., Garla R.C., Carvalho A.R.	The economic role of sharks in a major ecotourism archipelago in the western South Atlantic	2016	Marine Policy	10.1016/j.marpol.2016.06.016

Piriyapada S., Wang E.	Modeling Willingness to Pay for Coastal Tourism Resource Protection in Ko Chang Marine National Park, Thailand	2015	Asia Pacific Journal of Tourism Research	10.1080/10941665.2014.904806
Platania M., Rizzo M.	Willingness to pay for protected areas: A case of Etna Park	2018	Ecological Indicators	10.1016/j.ecolind.2018.04.079
Pongkijvorasin S., Chotiyaputta V.	Climate change and tourism: Impacts and responses. A case study of Khaoyai National Park	2013	Tourism Management Perspectives	10.1016/j.tmp.2012.10.002
Queiroz R.E., Guerreiro J., Ventura M.A.	Demand of the tourists visiting protected areas in small oceanic islands: the Azores case-study (Portugal)	2014	Environment, Development and Sustainability	10.1007/s10668-014-9516-y
Rathnayake R.M.W.	Pricing the enjoyment of 'elephant watching' at the Minneriya National Park in Sri Lanka: An analysis using CVM	2016	Tourism Management Perspectives	10.1016/j.tmp.2016.01.002
Rathnayake R.M.W.	Turtle watching': A strategy for endangered marine turtle conservation through community participation in Sri Lanka	2016	Ocean and Coastal Management	10.1016/j.ocecoaman.2015.10.014
Ribeiro F.P., Ribeiro K.T.	Participative mapping of cultural ecosystem services in Pedra Branca State Park, Brazil	2016	Natureza e Conservacao	10.1016/j.ncon.2016.09.004
Richardson R.B., Loomis J., Weiler S.	Recreation as a spatial good: Distance effects on changes in recreation visitation and benefits	2006	Review of Regional Studies	
Robles-Zavala E., Chang Reynoso A.G.	The recreational value of coral reefs in the Mexican Pacific	2018	Ocean and Coastal Management	10.1016/j.ocecoaman.2018.02.010
Romagosa F., Miró A., Buchaca T., Ventura M.	Residents' versus visitors' knowledge and valuation of aquatic mountain ecosystems in the Catalan Pyrenees	2020	Mountain Research and Development	10.1659/MRD-JOURNAL-D-19-00040.1

Rossi S.D., Barros A., Walden-Schreiner C., Pickering C.	Using social media images to assess ecosystem services in a remote protected area in the Argentinean Andes	2020	Ambio	10.1007/s13280-019-01268-w
Saayman M.	The non-consumptive value of selected marine species at Table Mountain National Park: An exploratory study	2014	South African Journal of Economic and Management Sciences	10.4102/sajems.v17i2.455
Saayman M., Saayman A.	Is the rhino worth saving? A sustainable tourism perspective	2017	Journal of Sustainable Tourism	10.1080/09669582.2016.1197229
Saayman M., Saayman A.	Who is willing to pay to see the Big 7?	2014	Tourism Economics	10.5367/te.2013.0347
Saayman M., Saayman A., Ferreira M.	The socio-economic impact of the Karoo National Park	2009	Koedoe	10.4102/koedoe.v51i1.158
Samdin Z.	Willingness to pay in Taman Negara: A Contingent Valuation Method	2008	International Journal of Economics and Management	
Samdin Z., Aziz Y.A., Radam A., Yacob M.R.	Sustainability of ecotourism resources at taman negara national park: Contingent valuation method	2013	International Journal of Business and Society	
Saminpanya S., Wisarttavisit P., Chumnankid C.	Development of management guidelines from tourist and stakeholder consultations: The case of dongphayayen-khao yai forest complex, Thailand	2009	Managing Leisure	10.1080/13606710902945042
Scheufele G., Bennett J.	Valuing biodiversity protection: Payment for Environmental Services schemes in Lao PDR	2019	Environment and Development Economics	10.1017/S1355770X19000111
Schutgens M.G., Hanson J.H., Baral N., Ale S.B.	Visitors' willingness to pay for snow leopard Panthera uncia conservation in the Annapurna Conservation Area, Nepal	2019	ORYX	10.1017/S0030605317001636

Sekar N., Weiss J.M., Dobson A.P.	Willingness-to-pay and the perfect safari: Valuation and cultural evaluation of safari package attributes in the Serengeti and Tanzanian Northern Circuit	2014	Ecological Economics	10.1016/j.ecolecon.2013.10.012
Sessions C., Wood S.A., Rabotyagov S., Fisher D.M.	Measuring recreational visitation at U.S. National Parks with crowd-sourced photographs	2016	Journal of Environmental Management	10.1016/j.jenvman.2016.09.018
Sinclair M., Ghermandi A., Sheela A.M.	A crowdsourced valuation of recreational ecosystem services using social media data: An application to a tropical wetland in India	2018	Science of the Total Environment	10.1016/j.scitotenv.2018.06.056
Sinclair M., Mayer M., Woltering M., Ghermandi A.	Valuing nature-based recreation using a crowdsourced travel cost method: A comparison to onsite survey data and value transfer	2020	Ecosystem Services	10.1016/j.ecoser.2020.101165
Soares J.O., Soares F.C.	The Recreational Value of Azibo Beaches: A Case Study in the Interior North of Portugal1 [O Valor Recreativo Das Praias De Azibo: Um Estudo De Caso No Interior Norte De Portugal]	2021	Revista Portuguesa de Estudos Regionais	
Soe Zin W., Suzuki A., Peh K.S.-H., Gasparatos A.	Economic value of cultural ecosystem services from recreation in Popa Mountain National Park, Myanmar: A comparison of two rapid valuation techniques	2019	Land	10.3390/LAND8120194
Suresh K., Wilson C., Quayle A., Khanal U., Managi S.	Which national park attributes attract international tourists? A Sri Lankan case study	2021	Tourism Economics	10.1177/13548166211019865

Teh L.S.L., Teh L.C.L., Jolis G.	An economic approach to marine megafauna conservation in the coral triangle: Marine turtles in Sabah, Malaysia	2018	Marine Policy	10.1016/j.marpol.2017.12.004
Thanh An L., Markowski J., Bartos M., Thoai T.Q., Tuan T.H., Rzenca A.	Tourist and Local Resident Preferences for the Northern Yellow-Cheeked Gibbon (Nomascus annamensis) Conservation Program in the Bach Ma National Park, Central Vietnam	2018	Tropical Conservation Science	10.1177/1940082918776564
Thur S.M.	User fees as sustainable financing mechanisms for marine protected areas: An application to the Bonaire National Marine Park	2010	Marine Policy	10.1016/j.marpol.2009.04.008
Tisma S., Boromisa A.-M., Farkas A., Tolic I.	Socio-economic evaluations of nature protected areas: health first effect	2020	European Journal of Geography	10.48088/ejg.s.tis.11.1.108.123
Torquati B., Tempesta T., Vecchiato D., Venanzi S., Paffarini C.	The value of traditional rural landscape and nature protected areas in tourism demand: A study on agritourists' preferences	2017	Landscape Online	10.3097/LO.201753
Trivourea N.M., Karamanlidis A.A., Tounta E., Dendrinos P., Kotomatas S.	People and the Mediterranean monk seal (Monachus monachus): A study of the socioeconomic impacts of the National Marine Park of Alonissos, Northern Sporades, Greece	2011	Aquatic Mammals	10.1578/AM.37.3.2011.305
Trujillo J.C., Carrillo B., Charris C.A., Velilla R.A.	Coral reefs under threat in a Caribbean marine protected area: Assessing divers' willingness to pay toward conservation	2016	Marine Policy	10.1016/j.marpol.2016.03.003

Trujillo J.C., Navas E.J., Vargas D.M.	Valuing coral reef preservation in a Caribbean marine protected area. Economic impact of scuba diving in corals of Rosario and San Bernardo national natural park, Colombia [Valorar la preservación de los arrecifes de coral en un área marina protegida del caribe. Impacto económico del buceo en los corales de Rosario y el parque nacional natural San Bernardo, Colombia]	2017	Cuadernos de Desarrollo Rural	10.11144/Javeriana.cdr14-79.vcrp
Van Beukering P.J.H., Cesar H.S.J., Janssen M.A.	Economic valuation of the Leuser National Park on Sumatra, Indonesia	2003	Ecological Economics	10.1016/S0921-8009(02)00224-0
Van Marwijk R.B.M., Elands B.H.M., Kampen J.K., Terlouw S., Pitt D.G., Opdam P.	Public Perceptions of the Attractiveness of Restored Nature	2012	Restoration Ecology	10.1111/j.1526-100X.2011.00813.x
Veisten K., Dybedal P., Grue B.	Measuring the economic value of nature and national parks: Indirect valuations from travel cost method and tourism satellite accounts	2012	International Journal of Tourism Policy	10.1504/IJTP.2012.052559
Vieira F.A.S., Bragagnolo C., Correia R.A., Malhado A.C.M., Ladle R.J.	A salience index for integrating multiple user perspectives in cultural ecosystem service assessments	2018	Ecosystem Services	10.1016/j.ecoser.2018.07.009
Viirret E., Raatikainen K.J., Fagerholm N., Käyhkö N., Vihervaara P.	Ecosystem services at the Archipelago Sea Biosphere Reserve in Finland: A visitor perspective	2019	Sustainability (Switzerland)	10.3390/su11020421
Viteri Mejía C., Brandt S.	Managing tourism in the Galapagos Islands through price incentives: A choice experiment approach	2015	Ecological Economics	10.1016/j.ecolecon.2015.05.014

Walpole M.J., Goodwin H.J., Ward K.G.R.	Pricing policy for tourism in protected areas: Lessons from Komodo National Park, Indonesia	2001	Conservation Biology	10.1046/j.1523-1739.2001.99231.x
Walyoto S., Peranginangin J.	Economic analysis of environmental and cultural impacts of the development of palm oil plantation	2018	International Journal of Energy Economics and Policy	
Wang P.-W., Jia J.-B.	Tourists' willingness to pay for biodiversity conservation and environment protection, Dalai Lake protected area: Implications for entrance fee and sustainable management	2012	Ocean and Coastal Management	10.1016/j.ocecoaman.2012.03.001
Widawski K., Jary Z., Oleniewicz P., Owczarek P., Markiewicz-Patkowska J., Zaręba A.	Attractiveness of protected areas for geotourism purposes from the perspective of visitors: The example of Babiogórski National Park (Poland)	2018	Open Geosciences	10.1515/geo-2018-0028
Widawski K., Oleśniewicz P., Rozenkiewicz A., Zareba A., Jandová S.	Protected areas: Geotourist attractiveness for weekend tourists based on the example of Gorcza Nski National Park in Poland	2020	Resources	10.3390/RESOURCES9040035
Witt B.	Tourists'willingness to pay increased entrance fees at Mexican protected areas: A multi-site contingent valuation study	2019	Sustainability (Switzerland)	10.3390/su11113041
Woodfield A., Cowie D.	The milford track: valuation estimates of a recreation good	1977	Australian Journal of Agricultural Economics	10.1111/j.1467-8489.1977.tb00197.x
Xu L., Ao C., Mao B., Cheng Y., Sun B., Wang J., Liu B., Ma J.	Which is more Important, Ecological Conservation or Recreational Service? Evidence from a Choice Experiment in Wetland Nature Reserve Management	2020	Wetlands	10.1007/s13157-020-01348-8

Yee J.Y., Loc H.H., Poh Y.L., Vo-Thanh T., Park E.	Socio-geographical evaluation of ecosystem services in an ecotourism destination: PGIS application in Tram Chim National Park, Vietnam	2021	Journal of Environmental Management	10.1016/j.jenvman.2021.112656
Yu B., Cai Y., Jin L., Du B.	Effects on willingness to pay for marine conservation: Evidence from Zhejiang Province, China	2018	Sustainability (Switzerland)	10.3390/su10072298
Zambrano-Monserrate M.A., Silva-Zambrano C.A., Ruano M.A.	The economic value of natural protected areas in Ecuador: A case of Villamil Beach National Recreation Area	2018	Ocean and Coastal Management	10.1016/j.ocecoaman.2018.02.020
Zhang H., Gao Y., Hua Y., Zhang Y., Liu K.	Assessing and mapping recreationists' perceived social values for ecosystem services in the Qinling Mountains, China	2019	Ecosystem Services	10.1016/j.ecoser.2019.101006

Supplementary Material S5

Table S5 Categories of variables used in the review to organize the database.

Number of category	Name of category	Description of category shown as the question to be answered by the coder	Type of extracted data	Examples/codes of category	Source of data	Inductive process-based development of categories
Meta-information of the article						
1	Year of publication	Which year was the article published?	Numeric	1990; 2021	Data were extracted from the article.	No
Biogeographical information						
2	Name of protected area(s)	What's the name of the protected area(s) that was/were investigated?	Text	Black Forest; Kilimanjaro National Park; PAs in Scotland - not specified	Data were extracted from the article.	No
3	Region of protected area(s)	Which region is/are the projected area(s) located in?		Africa; Asia; Oceania; Europe; Latin America and the Caribbean; North America (Canada and United States)		
4	Location of protected area(s)	Which country/countries is/are the projected area(s) located in?		United States; South Africa; Australia		
5	Geographical location: Latitude and longitude of investigated protected area	What's the latitude and latitude of the center point of each investigated protected area?	Numeric	Latitude Kilimanjaro National Park -3.04947 Longitude Kilimanjaro National Park 37.35979	Information was extracted from Google Maps.	

6	Type of ecosystem of protected area	Which type(s) of ecosystem is/are investigated? NA indicates that the study took place in a/multiple not specified protected area(s) and hence, type(s) of ecosystems could not be reinvestigated.		"Two archipelagos with coral reefs, mangroves, tropical dry forests, and the rocky and sandy coastlines" (Trujillo et al. 2016)		Yes (Data are not mutually exclusive.)
Valuation information						
7	Main objective of article to conduct valuation	Why was/were the valuation exercise(s) conducted? First consider the broader objective(s) related to valuation. If broader objective(s) is/are not related to valuation, consider specific objective(s).	Text and then translated to nominal.	"This exploratory study aimed to determine firstly the non-consumptive value of five marine species (whales, the Great White shark, penguins, dolphins and seals) and secondly the sociodemographic and behavioural variables that influence willingness to pay to see these species." (Saayman 2014)	Data were extracted from the article.	Yes (Data are not mutually exclusive.)
8	Specific valuation method	Which specific valuation method(s) was/were used following Harrison et al. (2017)?	Text and then translated to nominal.	Contingent method; Photo-series analysis; Choice Experiment		

9	Broad valuation method	Which broad valuation method(s) was/were used following Harrison et al. (2017)?		Stated preference methods; Preference assessment		
10	Classification of valuation technique/method	How is/are broad method(s) classified?		Socio-cultural classification; Economic classification; Mixed		
Data gathering and data analysis						
11	Target social group	Was/were the (contextual) value(s) of target groups other than tourists (e.g., citizens, residents, policy-makers, and park staff) identified based on a valuation method?	Dummy variable	1 = yes 0 = no	Data were extracted from the article.	No
12	Data type in value elicitation process	Which type(s) of data was/were collected in the value elicitation process?	Numeric	1 = only quantitative 2 = only qualitative, e.g., most Likert scales 3 = mixed, i.e., quantitative and qualitative		
13	Value metric in value elicitation process	Was/were monetary, non-monetary or both value metric(s) collected?		1 = only monetary 2 = only non-monetary 3 = mixed, i.e., monetary and non-monetary		
14	Data type in data analysis	Which type(s) of data was/were used in data analysis?		1 = only quantitative 2 = only qualitative 3 = mixed, i.e., quantitative and qualitative		

15	Value metric in data analysis	Was/were monetary, non-monetary or both value metric(s) used in data analysis?		1 = only monetary 2 = only non-monetary 3 = mixed, i.e., monetary and non-monetary		
Value						
16	Value type	Which (contextual) value(s) was/were gathered? State all contextual values mentioned by the author. Definition of contextual value type (mainly to distinguish from transcendental value and value indicator) was based on Kenter et al. (2015).	Text	Recreational value; Economic value; Non-use value; Social value; Intrinsic values	Data were extracted from the article. If a contextual value was not stated in the article, missing information was added. See Methods for procedure.	Yes (Data are not mutually exclusive.)
17	Elements provided by nature	Which natural, e.g., abiotic, biotic, tangible, and intangible, element(s) of nature or element(s) mediated by nature was/were valued as stated in the article? For Travel cost method, protected area was used as the valued natural aspect by default, if not specified by the article. For contingent valuation, please		Protected area; Seascape; Wolf; Water quality		

		insert question. For choice experiments, please insert all natural elements here.	
18	Non-natural elements	Which non-natural element(s) was/were valued? For choice experiments, please insert all non-natural elements here.	Information boards; Tourism facilities; Safari; Crowdedness

Supplementary Material S6

Table S6 Four examples of coded articles.

	Name of category	Use of data (Original data: OD; Data Analysis: DA; Database: DB; Revised/ added: RA)	Description of category shown as the question to be answered by the coder (OA) / examples of (sub-)categories (DA / DB)	Type of extracted data	Examples and/or codes of category, if applicable	Example article 1	Example article 2	Example article 3	Example article 4
Meta-information of the article	**Author(s)**					Pickering C., Walden-Schreiner C., Barros A., Rossi S.D.	Witt B.	Ison S., Ison T., Marti-Puig P., Needham K., Tanner M.K., Roberts J.M.	Mrotek A., Anderson C.B., Valenzuela A.E.J., Manak L., Weber A., Van Aert P., Malizia M., Nielsen E.A.
	Title					Using social media images and text to examine how tourists view and value the highest mountain in Australia	Tourists' willingness to pay increased entrance fees at Mexican protected areas: A multi-site contingent valuation study	Tourist Preferences for Seamount Conservation in the Galapagos Marine Reserve	An evaluation of local, national and international perceptions of benefits and threats to nature in Tierra del Fuego National Park (Patagonia, Argentina)

	Year of publication		Which year was the article published?	Numeric	2000; 2021	2020	2019	2021	2019
	Journal					Journal of Outdoor Recreation and Tourism	Sustainability (Switzerland)	Frontiers in Marine Science	Environmental Conservation
	DOI					10.1016/j.jort.2019.100252	10.3390/su11113041	10.3389/fmars.2020.602767	10.1017/S0376892919000250
Biogeographical data	**Name of protected area**	OD	What's the name of the protected area?	Text	Black Forest; Kilimanjaro National Park; Protected Areas in Scotland - not specified	Kosciuszko National Park	Calakmul Biosphere Reserve, Cobá Archaeological Zone, Palenque National Park, Sian Ka'an Biosphere Reserve, and Yum Balam Nature Reserve	Galapagos Marine Reserve	Tierra del Fuego National Park
	Region of protected area	OD	Which region(s) is/are the projected area(s) located in?	Text	Africa; Asia; Oceania; Europe; Latin America and the Caribbean; North America (Canada and United States)	Oceania	Latin America and the Caribbean	Latin America and the Caribbean	Latin America and the Caribbean
	Africa	DA		Dummy variable	1 = yes 0 = no				
	Asia	DA		Dummy variable	1 = yes 0 = no				
	Oceania	DA		Dummy variable	1 = yes 0 = no	1			

	Europe	DA		Dummy variable	1 = yes 0 = no				
	Latin America and the Caribbean	DA		Dummy variable	1 = yes 0 = no		1	1	1
	North America	DA		Dummy variable	1 = yes 0 = no				
	Location of protected area	OD	Which country/countries is/are the projected area(s) located in?	Text	United States; South Africa	Australia	Mexico	Ecuador	Argentina
	Number of investigated protected area(s)	DA	How many protected areas were mentioned? Name of protected area(s) must be stated to identify geographical location.	Numeric	1;2;3	1	5	1	1
	Protected Area 1 Coordinate: Latitude	DA		Numeric	Latitude Kilimanjaro National Park -3.04947	-36.243.092	18.498.568	-0.626318	-54.841.197
	Protected Area 1 Co-ordinates: Longitude	DA		Numeric	Longitude Kilimanjaro National Park 37.35979	148.519.786	-89.556.117	-90.350.466	-68.555.331
	Protected Area 2 Coordinate: Latitude	DA		Numeric	Latitude Kilimanjaro National Park -3.04947		20.490.926		

	Protected Area 2 Co-ordinates: Longitude	DA		Numeric	Longitude Kilimanjaro National Park 37.35979		-87.732.520		
	Protected Area 3 Coordinate: Latitude	DA		Numeric	Latitude Kilimanjaro National Park -3.04947		17.484.830		
	Protected Area 3 Co-ordinates: Longitude	DA		Numeric	Longitude Kilimanjaro National Park 37.35979		-92.049.246		
	Protected Area 4 Coordinate: Latitude	DA		Numeric	Latitude Kilimanjaro National Park -3.04947		19.837.569		
	Protected Area 4 Co-ordinates: Longitude	DA		Numeric	Longitude Kilimanjaro National Park 37.35979		-87.638.969		
	Protected Area 5 Coordinate: Latitude	DA		Numeric	Latitude Kilimanjaro National Park -3.04947		21.270.526		

Protected Area 5 Co-ordinates: Longitude	DA		Numeric	Longitude Kilimanjaro National Park 37.35979		-88.443.382		
Ecosystem of protected area	OD	What type(s) of ecosystem was/were investigated? State all types of ecosystem named in the article. NA indicates that the study took place in multiple protected areas and and hence, type(s) of ecosystems could not be reinvestigated.	Text		mountain (broader alpine area (> 1800 m))	Caribbean coast, beaches, rainforest, wetlands and mangrove forests	Seamount	Sub-Antarctic Forest Biome Ecologically, this biome hosts the world's southernmost forests, and TFNP's landscape consists of a diverse mosaic of forests (Nothofagus spp.) and peat bogs (Sphagnum spp.) within a highly variable topography of coastline, mountains, valleys, rivers and lakes.
Terrestrial eco-system(s)	DA	see DB for terrestrial ecosystem(s) below	Dummy variable	1 = yes 0 = no	1	1		1
Freshwater eco-system(s)	DA	see DB for freshwater ecosystem(s) below	Dummy variable	1 = yes 0 = no		1		1
Marine eco-system(s)	DA	see DB for marine ecosystem(s) below	Dummy variable	1 = yes 0 = no		1	1	1

	Terrestrial ecosystem	DB	Forest; woods; woodlands	Dummy variable	1 = yes 0 = no		1		1
	Terrestrial ecosystem	DB	Savanna; wood pasture	Dummy variable	1 = yes 0 = no				
	Terrestrial ecosystem	DB	Low-shrub vegetation; scrubland; shrubland	Dummy variable	1 = yes 0 = no				
	Terrestrial ecosystem	DB	Mediterranean ecosystem	Dummy variable	1 = yes 0 = no				
	Terrestrial ecosystem	DB	Grassland; natural meadows; steppe	Dummy variable	1 = yes 0 = no				
	Terrestrial ecosystem	DB	Heathland	Dummy variable	1 = yes 0 = no				
	Terrestrial ecosystem	DB	Alpine, subalpine, subnival vegetation	Dummy variable	1 = yes 0 = no	1			
	Terrestrial ecosystem	DB	Peatland; peat bog; moorland	Dummy variable	1 = yes 0 = no				1
	Terrestrial ecosystem	DB	Ice fields; glacier	Dummy variable	1 = yes 0 = no				
	Terrestrial ecosystem	DB	Desert	Dummy variable	1 = yes 0 = no				
	Terrestrial ecosystem	DB	Tundra	Dummy variable	1 = yes 0 = no				
	Terrestrial ecosystem	DB	Mountain ecosystem(s)	Dummy variable	1 = yes 0 = no	1			1
	Terrestrial ecosystem	DB	Archipelago; island	Dummy variable	1 = yes 0 = no				
	Terrestrial ecosystem	DB	Beach; dunes; sand; coast at the sea	Dummy variable	1 = yes 0 = no		1		1
	Terrestrial ecosystem	DB	Terrestrial unspecified	Dummy variable	1 = yes 0 = no				

	Terrestrial ecosystem	DB	Semi-natural ecosystem (e.g., cultural landscape; grazing areas; heathland; agriculturally used ecosystems)	Dummy variable	1 = yes 0 = no				
	Terrestrial ecosystem	DB	Non-natural ecosystem	Dummy variable	1 = yes 0 = no				
	Terrestrial ecosystem	DB	Geological rock formations; rocky outcrops; volcano; geysers	Dummy variable	1 = yes 0 = no				
	Freshwater ecosystem	DB	Lakes; rivers; freshwater water bodies	Dummy variable	1 = yes 0 = no				1
	Freshwater ecosystem	DB	Estuarine	Dummy variable	1 = yes 0 = no				
	Freshwater ecosystem	DB	Freshwater wetland	Dummy variable	1 = yes 0 = no		1		
	Freshwater ecosystem	DB	Freshwater unspecified	Dummy variable	1 = yes 0 = no				
	Freshwater ecosystem	DB	Marsh	Dummy variable	1 = yes 0 = no				
	Freshwater ecosystem	DB	Saltwater wetland	Dummy variable	1 = yes 0 = no				
	Marine ecosystem	DB	Beach; dunes; sand; coast at the sea	Dummy variable	1 = yes 0 = no		1		1
	Marine ecosystem	DB	Estuarine; coastal wetland; salt marshes; salt water wetland	Dummy variable	1 = yes 0 = no				
	Marine ecosystem	DB	Mangrove	Dummy variable	1 = yes 0 = no		1		

	Marine ecosystem	DB	Coral Reef	Dummy variable	1 = yes 0 = no				
	Marine ecosystem	DB	Seagrass	Dummy variable	1 = yes 0 = no				
	Marine ecosystem	DB	Marine unspecified	Dummy variable	1 = yes 0 = no				
	Marine ecosystem	DB	Open marine water bodies; seamount	Dummy variable	1 = yes 0 = no			1	
	Marine ecosystem	DB	Archipelago; island	Dummy variable	1 = yes 0 = no				

Valuation information	**Main objective of article to conduct valuation**	OD	Why was/were the valuation exercise(s) conducted? First consider the broader objective(s) related to valuation. If broader objective(s) is/are not related to valuation, consider specific objective(s).	Text		To examine temporal differences in the views and values of tourists associated with locations and activities within a natural area using the content of images and the words used in tags and titles to describe them.	For this reason, a survey of a number of different PA within one country or region, using identical metho-dology, would better identify how visitor WTP varies between sites and what a realistic fee policy might look like. In addition, these stated preference surveys can estimate potential changes in visitation numbers if entrance fees were to be changed. While this type of methodologically consistent, multi-site study is rare, there are a few previous examples from Costa Rica, South Africa, and Tanzania. This study aims to add to this small body of research, with 877 respondents surveyed at five -south-eastern Mexican protected areas, using a double-bounded dichotomous choice contingent valuation survey, combined with extensive questions on visitor characteristics. The use of identical survey methodology at five different sites allows for valid and systematic comparisons between site results.	To date, there is one known valuation study in the Galapagos focusing on ecosystem services provided by mangroves and our research adds further evidence to the policy and conservation-oriented valuations in the management of the Galapagos archipelago (Tanner et al., 2019). (1) Adds to the evidence base on the relative importance of non-use values for Marine Protected Areas. (2) Explores the potential influence of tourists' willingness to pay for seamount conservation in the Galapagos Marine Reserve. (3) Identifies knowledge gaps and recommendations for future research into management measures applicable to seamounts in the Galapagos which we can build on in future research.	In this context, we conducted a socio-cultural evaluation of nature in Tierra del Fuego National Park (TFNP), Argentina. Specifically, a representative sample of Park users was surveyed to determine: (1) their valuation of how the Park contributes to people (i.e., benefits); and (2) their assessment of disturbances that impact the Park (i.e., threats). We compared perceptions between: (1) local Ushuaia residents; (2) national visitors from other Argentine provinces; and (3) international tourists.

	Value-oriented	DA	Elicitation / determination of recreational value, economic value, economic benefits, social value, social importance, value to people; comparison of different elements of natures, e.g., ecosystem services; value pluralism, comparing different types of contextual values; value comparison of multiple protected areas	Dummy variable	1 = yes 0 = no		1	1	1
	Tourist-oriented	DA	Visitor characteristics as predictors; influence of socio-demographic, socio-economic, background information of tourist on valuation of nature; comparison among tourist types; impact of significant attributes, characteristics, quality of protected area on travel decisions and perceptions; impact of entrance fee on travel decisions	Dummy variable	1 = yes 0 = no	1			

	Conser-vation-manage-ment-oriented	DA	Potential impacts of various pricing strategies on revenues; adaptation of entrance fee; suggestions, guidelines for efficient park management; to address policy implications under alternative park management strategies; developing and maintaining a sustainable tourism; policy development; solution to social conflicts; benefits of management alternatives to improve environmental quality; conservation of nature	Dummy variable	1 = yes 0 = no			1	
	Science-oriented	DA	Comparison of methods; comparison of data types; combination of data types; new method; valuation tool; methodological and conceptual framework	Dummy variable	1 = yes 0 = no				

	Specific valuation method	OD	Which specific valuation method(s) was/were used following Harrison et al. (2017)?	Text	Contingent method; photo-series analysis; choice Experiment	Flickr photo-series analysis and culturomics analysis of the text	Contingent valuation method (Willingness to pay)	Contingent valuation method (WTP) Ranking	Survey
	Specific method of valuation	RA		Text		Photo series analysis, Netnography (posts)			Ranking / rating
	Travel cost method	DA		Dummy variable	1 = yes 0 = no				
	Market price	DA		Dummy variable	1 = yes 0 = no				
	Choice experiment	DA		Dummy variable	1 = yes 0 = no				
	Contingent valuation	DA		Dummy variable	1 = yes 0 = no		1	1	
	Contingent activity method	DA		Dummy variable	1 = yes 0 = no				
	Ranking / rating	DA		Dummy variable	1 = yes 0 = no			1	1
	Photo-series analysis	DA		Dummy variable	1 = yes 0 = no	1			
	Netno-graphy (posts and audio)	DA		Dummy variable	1 = yes 0 = no	1			
	(Participa-tory) Mapping	DA		Dummy variable	1 = yes 0 = no				

	Public Partici-pation Geographic Information Systems								
	Interview	DA		Dummy variable	1 = yes 0 = no				
	Not available	DA		Dummy variable	1 = yes 0 = no				
	Multiple economic specific methods	DA	(related to specific valuation method: contingent valuation; choice experiment; travel cost method; market price)	Dummy variable	1 = yes 0 = no				
	Multiple socio-cultural specific methods	DA	(related to specific valuation method: ranking / rating; interview; (participatory) mapping; Public Participation Geographic Information Systems (PPGIS); contingent activity method; netnography (post and audio); photo-series analysis)	Dummy variable	1 = yes 0 = no	1			

	Broad valuation method	OD	Which broad valuation method(s) was/were used following Harrison et al. (2017)?	Text	Stated preference methods; preference assessment	Photo-series analysis	Stated preference methods	Stated preference methods Preference assessment	Preference assessment
	Broad method of valuation	RA		Text		Public methods			
	Stated preference methods	DA	(related to specific valuation methods: contingent valuation, choice experiment)	Dummy variable	1 = yes 0 = no		1	1	
	Revealed preference methods	DA	(related to specific valuation method: travel cost method)	Dummy variable	1 = yes 0 = no				
	Market-based method	DA	(related to specific valuation method: market price)	Dummy variable	1 = yes 0 = no				
	Preference assessment	DA	(related to specific valuation method: ranking / rating)	Dummy variable	1 = yes 0 = no			1	1
	Narrative analysis	DA	(related to specific valuation method: interview)	Dummy variable	1 = yes 0 = no				
	(Participa-tory) mapping	DA	(related to specific valuation methods: (participatory) mapping, Public Participation Geographic Information Systems (PPGIS))	Dummy variable	1 = yes 0 = no				

	Time use method	DA	(related to specific valuation method: contingent activity method)	Dummy variable	1 = yes 0 = no				
	Public methods	DA	(related to specific valuation methods: netnography (post and audio); photo-series analysis)	Dummy variable	1 = yes 0 = no	1			
	Not available			Dummy variable	1 = yes 0 = no				
	Multiple economic broad methods	DA	(related to broad methods: stated preference methods; revealed preference methods; market-based methods)	Dummy variable	1 = yes 0 = no				
	Multiple socio-cultural methods	DA	(related to broad valuation methods: (participatory) mapping; narrative analysis; preference assessment; public methods; time use)	Dummy variable	1 = yes 0 = no				

	Classifi-cation of valuation technique / method	OD	How is/are broad method(s) classified following Harrison et al. (2017)?	Nominal	1 = socio-cultural (beyond strictly monetary measure-ments) 2 = economic (monetary measure-ments) 3 = mixed, i.e. socio-cultural and economic	1	2	3	1
	Economic valuation	DA	(related to broad methods: stated preference methods; revealed preference methods; market-based methods)	Dummy variable	1 = yes 0 = no		1		
	Socio-cultural valuation	DA	(related to broad valuation methods: (participatory) mapping; narrative analysis; preference assessment; public methods; time use)	Dummy variable	1 = yes 0 = no	1			1
	Mixed economic and socio-cultural methods	DA		Dummy variable	1 = yes 0 = no			1	

Data gathering and data analysis	**Target social group**	OD	Was/were the (contextual) value(s) of target groups other than tourists (e.g., citizens, residents, policy-makers, park staff) identified based on a valuation method? If so, state target group(s).	Text	Text				local Ushuaia residents (n = 122)
	Target social group	DA		Dummy variable	1 = yes 0 = no				1
	Data type in value elicitation process	OD / RA / DA	Which type(s) of data was/were collected in the value elicitation process?	Nominal	1 = only quantitative 2 = only qualitative 3 = mixed, i.e., quantitative and qualitative	2	1	3	2
	Value metric in value elicitation process	OD / RA / DA	Was/were monetary, non-monetary, or both value metric(s) collected?	Nominal	1 = only monetary 2 = only non-monetary 3 = mixed, i.e., monetary and non-monetary	2	1	3	2

	Data type in Data analysis	OD / RA / DA	Which type(s) of data was/were used in data analysis?	Nominal	1 = only quantitative 2 = only qualitative 3 = mixed, i.e., quantitative and qualitative	3	1	1	1
	Value metric in data analysis	OD / RA / DA	Was/were monetary, non-monetary, or both value metric(s) used in data analysis?	Nominal	1 = only monetary 2 = only non-monetary 3 = mixed, i.e., monetary and non-monetary	2	1	3	2

Value	**Value type**	OD	Which (contextual) value type(s) was/were investigated? State all contextual value type(s) mentioned by the author(s). Definition of contextual value type was based on Kenter et al. (2015), mainly to distinguish from transcendental value and value indicator.	Text	Recreational value; Economic value; Non-use value; Social value; Intrinsic value	sociocultural value; aesthetic value	WTP value	social value in economic terms: non-use value; Although the use-values (i.e., economic value) of seamount ecosystem services are important components to take into consideration for management, this study considers primarily the non-use values (i.e., social value) provided by Galapagos seamounts using a stated preference survey to understand visitors preferences for conservation of seamounts in the Galapagos Single choice: Reason for expressing a positive willingness to pay: I want to preserve the seamount biodiversity for future generations (bequest value); Because the biodiversity on seamounts is unique (existence value); Because the biodiversity on seamounts has a positive impact on the marine economy (direct-use value); I want to personally contribute to projects that protect the environment (warm glow); Because I can afford it (warm glow); Other (specify) 2	national visitors: highest valued observation, biodiversity, existence; lowest valued: economic, human needs, recreation international visitors: highest valued observation, biodiversity, existence; lowest valued: border protection, human needs, economic Argentine visitors valued the relational benefits of TFNP significantly more than international tourists national visitors valued the Park significantly more for its contribution to local identity and border protection. Argentines reported significantly higher perceived values as well for both history and culture and education and science than international tourists.
	Value type	RA		Text			Economic value		
	Recreation-al value	DA	Leisure, recreation(al), sightseeing value; observation	Dummy variable	1 = yes 0 = no				1
	Leisure value	DB		Dummy variable	1 = yes 0 = no				

Recreation-(al) value	DB		Dummy variable	1 = yes 0 = no				1
Sightseeing value								
Observation	DB		Dummy variable	1 = yes 0 = no				1
Tourism value	DA	Tourism, tourist(ic) value	Dummy variable	1 = yes 0 = no				
Conserva-tion value	DA	Conservation value	Dummy variable	1 = yes 0 = no				
Economic value	DA	Welfare, gross benefit, consumer surplus, economic, monetary, marketing value	Dummy variable	1 = yes 0 = no		1	1	1
Welfare value	DB		Dummy variable	1 = yes 0 = no				
Gross benefit value	DB		Dummy variable	1 = yes 0 = no				
Consumer surplus value	DB		Dummy variable	1 = yes 0 = no				
Economic / monetary value	DB		Dummy variable	1 = yes 0 = no		1	1	1
Marketing value	DB		Dummy variable	1 = yes 0 = no				
Direct use value	DA	Direct use, non-consumptive (use), recreational(al) use value; use value from recreation	Dummy variable	1 = yes 0 = no			1	
Indirect use value	DA	Indirect use value	Dummy variable	1 = yes 0 = no				

Bequest (non-use) value	DA	Bequest non-use value	Dummy variable	1 = yes 0 = no			1	
Existence (non-use) value	DA	Existence non-use value	Dummy variable	1 = yes 0 = no			1	
Option (use) value	DA		Dummy variable	1 = yes 0 = no				
Instrumen-tal value	DA	Subsistence, instrumental value; human needs	Dummy variable	1 = yes 0 = no				1
Subsistenc e	DB		Dummy variable	1 = yes 0 = no				
Instrumenta l value	DB		Dummy variable	1 = yes 0 = no				1
Human needs	DB		Dummy variable	1 = yes 0 = no				1
Socio-cultural value	DA	Experience, perceived, extrinsic, socio-cultural value	Dummy variable	1 = yes 0 = no	1			
Socio-cultural value	DB		Dummy variable	1 = yes 0 = no	1			
Extrinsic value	DB		Dummy variable	1 = yes 0 = no				
Experience value	DB		Dummy variable	1 = yes 0 = no				
Perceived value	DB		Dummy variable	1 = yes 0 = no				
Cultural value	DA	Cultural diversity, cultural value	Dummy variable	1 = yes 0 = no				1
Cultural diversity	DB		Dummy variable	1 = yes 0 = no				1

	Cultural value	DB		Dummy variable	1 = yes 0 = no				
	Social value	DA	Social value	Numeric	>0 = yes 0 = no			1	
	Aesthetic value	DA	Aesthetics, aesthetical, attractiveness, landscape value	Dummy variable	1 = yes 0 = no	1			
	Aesthetics value	DB	Aesthetics, aesthetical value	Dummy variable	1 = yes 0 = no	1			
	Attractive-ness value	DB		Dummy variable	1 = yes 0 = no				
	Landscape value	DB		Dummy variable	1 = yes 0 = no				
	Local identity	DA	Local identity	Dummy variable	1 = yes 0 = no				1
	Other contextual value	DA	Future, eudemonic, utopian, epistemic, emotional value; border protection	Dummy variable	1 = yes 0 = no				1
	Future value	DB		Dummy variable	1 = yes 0 = no				
	Eudemonic value	DB		Dummy variable	1 = yes 0 = no				
	Utopian value	DB		Dummy variable	1 = yes 0 = no				
	Epistemic value	DB		Dummy variable	1 = yes 0 = no				
	Emotional value	DB		Dummy variable	1 = yes 0 = no				
	Border protection	DB		Dummy variable	1 = yes 0 = no				1
	Spiritual value	DA	Religious, spiritual value	Dummy variable	1 = yes 0 = no				1

Spiritual value	DB		Dummy variable	1 = yes 0 = no				
Religious value	DB		Dummy variable	1 = yes 0 = no				
Learning value	DA	Cognitive, scientific, educational, learning, inspiration value	Dummy variable	1 = yes 0 = no				1
Cognitive value	DB		Dummy variable	1 = yes 0 = no				
Scientific value	DB		Dummy variable	1 = yes 0 = no				1
Educational value	DB		Dummy variable	1 = yes 0 = no				
Learning value	DB		Dummy variable	1 = yes 0 = no				1
Inspiration value	DB		Dummy variable	1 = yes 0 = no				
Therapeutic value	DA	Therapeutic value	Dummy variable	1 = yes 0 = no				1
Historic value	DA	Historic value	Dummy variable	1 = yes 0 = no				1
Relational value	DA	Relational value	Dummy variable	1 = yes 0 = no				1
Iconic value	DA	Outstanding universal, importance, authenticity value	Dummy variable	1 = yes 0 = no				
Outstanding universal value	DB		Dummy variable	1 = yes 0 = no				
Importance value								
Authenticity value	DB		Dummy variable	1 = yes 0 = no				

	Existence value	DA	Existence value	Dummy variable	1 = yes 0 = no				1
	Intrinsic value	DA	Ecological, biocentric, life sustaining, biological diversity, biodiversity, environmental, intrinsic value	Dummy variable	1 = yes 0 = no				1
	Ecological value	DB		Dummy variable	1 = yes 0 = no				
	Biocentric value	DB		Dummy variable	1 = yes 0 = no				
	Life sustaining value (intrinsic)	DB		Dummy variable	1 = yes 0 = no				
	Natural value	DB							
	Biological diversity / Biodiversity value (Intrinsic)	DB		Dummy variable	1 = yes 0 = no				1
	Environ-mental value	DB		Dummy variable	1 = yes 0 = no				
	Intrinsic value	DB		Dummy variable	1 = yes 0 = no				1

	Object of value: nature	OD	Which natural, e.g., abiotic, biotic, tangible, and intangible, element(s) of nature or element(s) mediated by nature was/were valued as stated in the article? For Travel cost method, protected area was used as the valued natural element by default, if not specified by the article. For contingent valuation, please insert question. For choice experiments, please insert all natural elements here.	Text	Protected area; Seascape; Wolf; Water quality	landscapes, geological features, fauna and flora	protected area entrance fees were first asked if they would be willing to pay a specified price p to enter the site;	Protected area (deep-sea ecosystems, species, biodiversity) The Galapagos National Park is under the management of the Galapagos National Park Directorate. In the near future, they are proposing to increase the tourist entry fee in order to allocate more funds for deep-sea seamount conservation. The generated funds will be used for seamounts conservation projects, education and outreach [. . .] Please select the maximum amount you would definitely be willing to pay (USD) in additional entrance fees to fund seamount biodiversity conservation programs, education and outreach.	material, non-material and regulating benefits providing potable water; other human needs, such as food, firewood, etc.; economic resources; regulation of natural phenomena, such as hydrological cycles, erosion observing nature; recreation and picnicking; historical and cultural values; education and science; local identity; spiritual values; border protection biodiversity; existence
	Biocultural elements	DA	Heritage; folklore; traditions; art	Dummy variable	1 = yes 0 = no				
	Protected area	DA	Protected area (per se and/or increase in its size)	Dummy variable	1 = yes 0 = no		1	1	
	Land-/ seascape	DA	Landscape; seascape; scenery	Dummy variable	1 = yes 0 = no	1		1	

Landscape	DB	Landscape	Dummy variable	1 = yes 0 = no	1			
Scenery	DB	Scenery	Dummy variable	1 = yes 0 = no				
Seascape	DB	Seascape	Dummy variable	1 = yes 0 = no			1	
Sound-scape	DA	Soundscape	Dummy variable	1 = yes 0 = no				
Smellscape	DA	Smell	Dummy variable	1 = yes 0 = no				
Non-natural ecosystem	DA	Non-natural ecosystem	Dummy variable	1 = yes 0 = no				
Semi-natural ecosystem	DA	Semi-natural ecosystem	Dummy variable	1 = yes 0 = no				
Ecosystem	DA	Forest; grassland; wetland; pasture; meadows; freshwater bodies; desert; steppe; tundra; open woodland; savanna; Mediterranean ecosystem (fynbos; nama-karoo; succulent-karoo; thickets); mountain; estuaries; glacier; beach; coral reef; marine forest; mangrove; island; archipelago; coast	Dummy variable	1 = yes 0 = no				
Forest	DB	Forest	Dummy variable	1 = yes 0 = no				
Grassland	DB	Grassland	Dummy variable	1 = yes 0 = no				

Wetland	DB	Wetland	Dummy variable	1 = yes 0 = no				
Pasture, meadows	DB	Pasture; meadows	Dummy variable	1 = yes 0 = no				
Freshwater bodies	DB	Freshwater bodies	Dummy variable	1 = yes 0 = no				
Desert steppe	DB	Desert steppe	Dummy variable	1 = yes 0 = no				
Tundra	DB	Tundra	Dummy variable	1 = yes 0 = no				
Open woodland	DB	Open woodland	Dummy variable	1 = yes 0 = no				
Savanna	DB	Savanna	Dummy variable	1 = yes 0 = no				
Mediterra-nean eco-system(s)	DB	Mediterranean ecosystem (Fynbos; Nama-karoo; Succulent-karoo; Thickets)	Dummy variable	1 = yes 0 = no				
Mountain	DB	Mountain	Dummy variable	1 = yes 0 = no				
Estuaries	DB	Estuaries	Dummy variable	1 = yes 0 = no				
Glacier	DA	Glacier	Dummy variable	1 = yes 0 = no				
Beach	DB	Beach	Dummy variable	1 = yes 0 = no				
Coral reef	DB	Coral reef	Dummy variable	1 = yes 0 = no				
Marine forest	DB	Marine forest	Dummy variable	1 = yes 0 = no				

	Mangrove	DB	Mangrove	Dummy variable	1 = yes 0 = no				
	Island, archipelago	DB	Island; archipelago	Dummy variable	1 = yes 0 = no				
	Coast	DB	Coast	Dummy variable	1 = yes 0 = no				
	Ecological quality and functioning	DA	Ecological health, integrity, quality; visibility; Supporting Ecosystem Service(s)	Dummy variable	1 = yes 0 = no				
	Cultural Ecosystem Service(s) / non-material Nature's Contribu-tions to	DA	Cultural Ecosystem Service(s); non-material Nature's Contribu-tions to People	Dummy variable	1 = yes 0 = no				1
	Regulating Service(s) / regulating Nature's Contribu-tions to People	DA	Regulating Service(s); regulating Nature's Contributions to People	Dummy variable	1 = yes 0 = no				1
	Provisio-ning Service(s) / material Nature's Contribu-tions to People	DA	Provisioning Service(s); material Nature's Contributions to People	Dummy variable	1 = yes 0 = no				1

	Ecosystem Service(s) / Nature's Contribu-tions to People unspecified	DA	Ecosystem Service(s) / Nature's Contribu-tions to People unspecified	Dummy variable	1 = yes 0 = no				
	Animal and plant diversity	DA	Flora and fauna: Biodiversity; species richness	Dummy variable	1 = yes 0 = no	1			1
	Endangered animal and plant species	DA	Endangered animal and plant species	Dummy variable	1 = yes 0 = no				
	Wildlife	DA	Wildlife	Dummy variable	1 = yes 0 = no				
	Invasive species	DA	Invasive species	Dummy variable	1 = yes 0 = no				1
	Protected species	DA	Protected; rare; endangered species	Dummy variable	1 = yes 0 = no				
	Animal diversity	DA	Biodiversity; species composition; functional group; several species; species richness (number of species); unspecified	Dummy variable	1 = yes 0 = no				
	Bio-diversity, species composition	DB	Biodiversity; species composition	Dummy variable	1 = yes 0 = no				
	Functional group	DB	Functional group	Dummy variable	1 = yes 0 = no				

	Several species	DB	Several species	Dummy variable	1 = yes 0 = no				
	Species richness (Number of species)	DB	Species richness (Number of species)	Dummy variable	1 = yes 0 = no				
	Unspecified	DB	Unspecified	Dummy variable	1 = yes 0 = no				
	Mammal	DA	Mammal	Dummy variable	1 = yes 0 = no				1
	Reptile	DA	Reptile	Dummy variable	1 = yes 0 = no				
	Amphibian	DA	Amphibian	Dummy variable	1 = yes 0 = no				
	Fish	DA	Fish	Dummy variable	1 = yes 0 = no				
	Bird	DA	Bird	Dummy variable	1 = yes 0 = no				
	Vertebrates	DA	Vertebrates	Dummy variable	1 = yes 0 = no			1	
	Invertebra-tes	DA	Invertebrates	Dummy variable	1 = yes 0 = no			1	
	Iconic animal species	DA	Iconic; flagship species	Dummy variable	1 = yes 0 = no				
	Plant diversity	DA	Unspecified; functional community; several species; biodiversity; species composition	Dummy variable	1 = yes 0 = no				
	Unspecified	DB	Unspecified	Dummy variable	1 = yes 0 = no				
	Flora: Functional community	DB	Flora: Functional community	Dummy variable	1 = yes 0 = no				

	Several species	DB	Several species	Dummy variable	1 = yes 0 = no				
	Bio-diversity, species composition	DB	Biodiversity; species composition	Dummy variable	1 = yes 0 = no				
	Single plant species	DA	Single plant species	Dummy variable	1 = yes 0 = no				
	Geological elements	DA	Geosites; geological formation and features; waterfalls; geysers and volcanoes	Dummy variable	1 = yes 0 = no	1			
	Abiotic resources	DA	Minerals, thermal water	Dummy variable	1 = yes 0 = no				
	Weather / climate	DA	Weather (phenomena); climate; climatic change	Dummy variable	1 = yes 0 = no				1
	Object of value: non-natural elements	OD	Which non-natural element(s) was/were valued? For choice experiments, please insert all non-natural elements here.	Text	Information boards; Tourism facilities; Safari; Crowdedness	Cultural history, tourism facilities		Please select the maximum amount you would definitely be willing to pay (USD) in additional entrance fees to fund seamount biodiversity conservation programs, education and outreach.	Use by residents Trash, dirt road Tourists
	Object of value: non-natural elements	DA		Dummy variable	1 = yes 0 = no	1		1	1

Learning and recreation programs	DA	Information boards; walking safari; tours; programs offering nature-based recreational activities; implementation of an environmental education program; education; scientific project	Dummy variable	1 = yes 0 = no			1	
Mainten-ance of protected area	DA	Fence the park; employment of more personnel; elimination of wildlife damages, waste	Dummy variable	1 = yes 0 = no				1
Touristic infrastruc-ture and services	DA	Infrastructure; facilities; touristic services; benches; size and number of resting places; viewpoints; (hiking) parking places; railway; transportation; hotel; camping; garbage removal; outreach	Dummy variable	1 = yes 0 = no	1		1	
Cultural landscape and history	DA	Urban, cultural landscape; artificial scenes; cultural history; cultural heritage; buildings (e.g., farms; garden sheds); traditional architecture	Dummy variable	1 = yes 0 = no	1			

	Economic contribution	DA	Economic contribution; local industry; business profit; employment; income of individuals; community welfare	Dummy variable	1 = yes 0 = no				
	Traditional knowledge	DA	Local, traditional knowledge; customs	Dummy variable	1 = yes 0 = no				
	Local interaction	DA	Local interaction; use by residents	Dummy variable	1 = yes 0 = no				
	Visitors	DA	Number of visitors; visitor congestion; crowdedness; use by residents, visitor movement	Dummy variable	1 = yes 0 = no				1
	Trip expendi-tures	DA	Trip expenditures; travel time	Dummy variable	1 = yes 0 = no				

Supplementary Material S7

Additional results

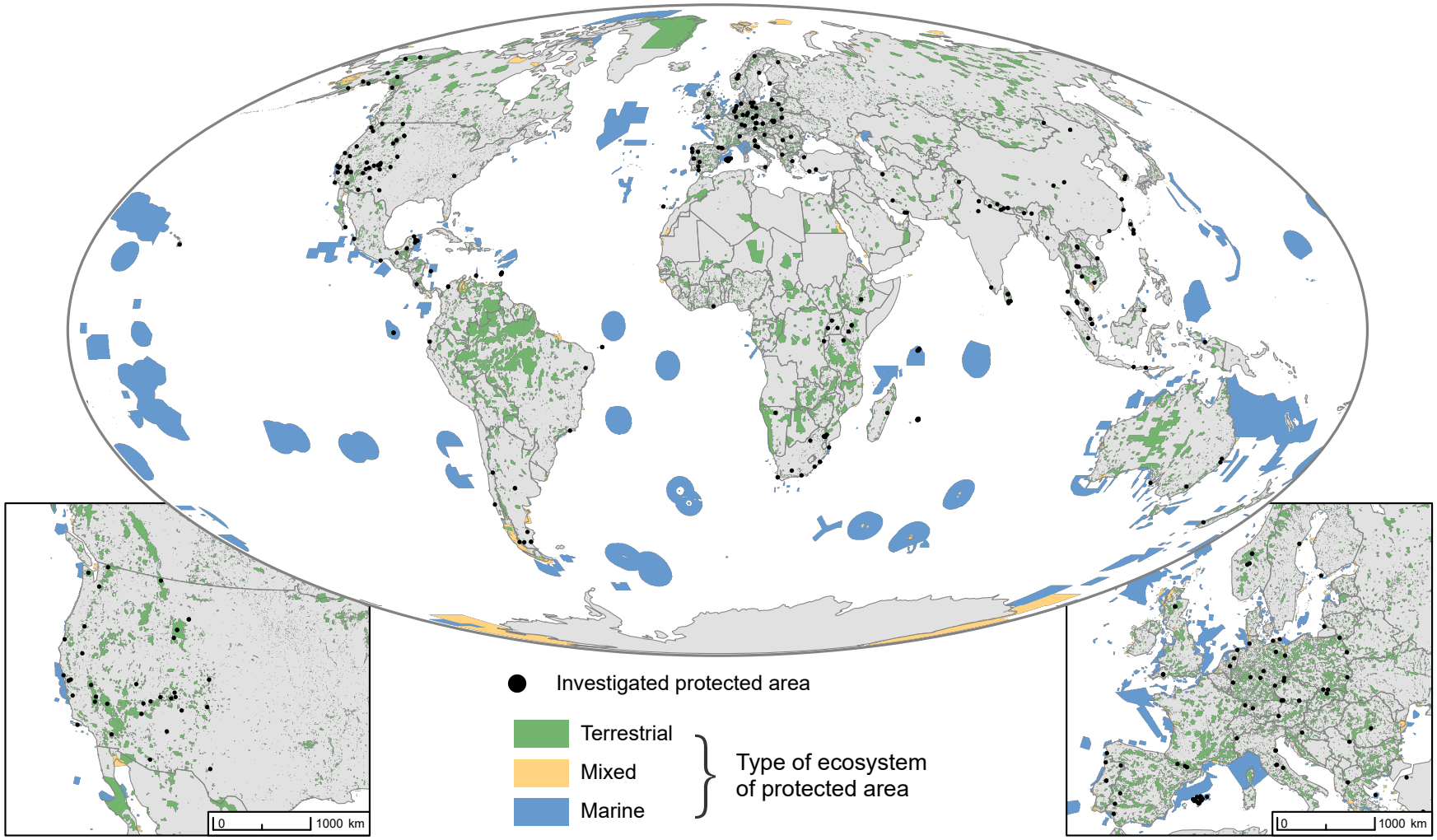


Figure S1 Geographical overview of the protected areas investigated by the articles displayed on the global distribution of publicly available protected areas. The figure was created with the software ARCGis 10.6.1 (Environmental Systems Research Institute ESRI 2018, https://www.esri.com/en-us/home); information on the global distribution of protected areas was sourced from the World Database on Protected Areas (WDPA) (IUCN and UNEP-WCMC 2021) but was not publicly exhaustively available for, e.g., China, India, and Turkey.

Table S7 Summary of tangible and intangible elements of nature identified in literature review and number of articles that investigated each element of nature as object of value. Data are not mutually exclusive.

Natural element as object of value	Number of articles that investigated natural element
Protected area	100
Cultural ecosystem service(s)/non-material nature's contributions to people	61
Ecosystem	30
Land-/seascape	29
Ecological quality and functioning	25
Animal and plant diversity	26
Iconic animal species	20
Mammal	18
Animal diversity	17
Fish	17
Plant diversity	16
Biocultural elements	14
Geological elements	14
Regulating service(s)/regulating nature's contributions to people	10
Wildlife	10
Provisioning service(s)/material nature's contributions to people	9
Bird	9
Soundscape	5
Invasive animal species	5
Invasive plant species	5
Invertebrates	4
Protected animal species	4
Weather/climate	4
Smellscape	3
Semi-natural ecosystem	3
Ecosystem Service unspecified	3

Natural element as object of value	Number of articles that investigated natural element
Reptile	2
Protected plant species	2
Abiotic elements	2
Non-natural ecosystem	1
Endangered animal and plant species	1
Amphibian	1
Vertebrates	1
Single plant species	1

Table S8 Summary of non-natural elements identified in literature review and number of articles that investigated each non-natural element as object of value. Data are not mutually exclusive.

Non-natural element as object of value	Number of articles that investigated non-natural element
Touristic infrastructure and services	24
Learning and recreation programs	14
Cultural landscape and history	12
Use by visitors	11
Traditional knowledge	5
Economic contribution	3
Trip expenditures	3
Maintenance of protected areas	2
Local interaction	2

Table S9 Summary of specific valuation methods identified in the literature review and number of articles that applied specific valuation methods. Data are not mutually exclusive.

Specific valuation method	Classification of value elicitation	Number of articles that applied specific valuation method
Contingent valuation	Economic	57
Travel cost method	Economic	41
Ranking/rating	Socio-cultural	27
Choice experiment	Economic	17
Photo-series analysis	Socio-cultural	12
Market price	Economic	8
Public Participation Geographic Information Systems (PPGIS)	Socio-cultural	3
Not specified	Socio-cultural	3
Netnographie: social media/online content (posts and audio)	Socio-cultural	3
Interview	Socio-cultural	3
(Participatory) Mapping	Socio-cultural	2

Table S10 Association between value types as identified in the literature review on tourist's valuation of nature in protected areas and the value types embedded in the three most commonly used valuation frameworks: the Total Economic Value (TEV), The Economics of Ecosystems and Biodiversity (TEEB), and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) valuation framework. This table deepens the information presented in Figure 7 in the main text and shows the quotes found in the literature of this systematic review that prove the association between value types identified in the reviewed literature and those embedded in the three valuation frameworks. The background color represents the degree of association between each value type identified in the literature review and the different value types used in the three valuation frameworks: high association (black background), medium association (dark gray background), low association (light gray background), and no association (white background). Example quotes from articles of systematic literature review are presented in black and white (Black and white were chosen to improve readability against the background.). Examples without a reference (in green) are added by authors of the literature review (Different shades of green were chosen to improve readability against the background.). Biophysical values according to TEEB were not considered, as they cannot be elicited for tourists. We considered that use and non-use values (TEV) measured through non-monetary metrics can represent socio-cultural values (TEEB) in certain cases. For example, the direct use value can be elicited in non-monetary terms by the (additional) time a tourist is willing to travel to reach a protected area, that is, medium association.

Valuation framework / **Value type**	**TEV**		**TEEB**		**IPBES**		
	Use	Non-use	Economic	Socio-cultural	Intrinsic	Relational	Instrumental
Economic	Beach erosion is an imminent problem in San Andres Island. If the beaches were reduced in size (by half the width), would you come back for another visit? If you would come back, would you be willing to pay the same price you paid this time even if the beaches were smaller by half? If you won't pay the same price for half the beach, how	Willingness to pay of tourists to the conservation of whale sharks. (Anna and Saputra 2017)	Willingness to pay of tourists to the conservation of whale sharks. (Anna and Saputra 2017) Beach erosion is an imminent problem in San Andres Island. If the beaches were reduced in size (by half the width), would you come back for another visit? If you would come back, would you be willing to pay the same price you paid this time even if the beaches were smaller by half? If you won't pay the same price for half the beach, how much (%) of your package price would you be willing to	I value it because it provides opportunities for fisheries, minerals and tourism (such as outfitting and guiding). (Chen et al. 2019)			I value it because it provides opportunities for fisheries, minerals and tourism (such as outfitting and guiding). (Chen et al. 2019)

Valuation framework / Value type	TEV		TEEB		IPBES		
	Use	Non-use	Economic	Socio-cultural	Intrinsic	Relational	Instrumental
	much (%) of your package price would you be willing to pay for your next visit? (Castaño-Isaza et al. 2014)		pay for your next visit? (Castaño-Isaza et al. 2014)				
Recreational	Travel cost model. (Pongkijvorasin and Chotiyaputta 2013) Crowdsourced travel cost model. (Sinclair et al. 2020) Willingness to pay for use of the recreation value of forests and natural ecosystems. (Dehghani et al. 2010)		Travel cost model. (Pongkijvorasin and Chotiyaputta 2013) Crowdsourced travel cost model. (Sinclair et al. 2020) Willingness to pay for use of the recreation value of forests and natural ecosystems. (Dehghani et al. 2010)	Mapping of recreational value: It provides a place for my favorite outdoor recreation activities. (Bogdan et al. 2019)		Expression of the (relational) value on recreation and picnicking based on Likert scale. (Mrotek et al. 2019)	Travel cost model. (Pongkijvorasin and Chotiyaputta 2013) Crowdsourced travel cost model. (Sinclair et al. 2020) Mapping of recreational value: It provides a place for my favorite outdoor recreation activities. (Bogdan et al. 2019) Willingness to pay for use of the recreation value of forests and natural ecosystems. (Dehghani et al. 2010)
Direct use	Willingness to pay for the use of the recreation value of forests and natural ecosystems. (Dehghani et al. 2010)		Willingness to pay for the preservation or use of the recreation value of forests and natural ecosystems. (Dehghani et al. 2010) Reason for expressing a	How much additional time are you willing to travel to reach Dartmoor National Park? (Heyes and Heyes 1999)			Willingness to pay for the use of the recreation value of forests and natural ecosystems. (Dehghani et al. 2010) Reason for expressing a positive willingness to

Valuation frame-work / Value type	TEV		TEEB		IPBES		
	Use	Non-use	Economic	Socio-cultural	Intrinsic	Relational	Instrumental
	Reason for expressing a positive willingness to pay: Because the biodiversity on seamounts has a positive impact on the marine economy. (Ison et al. 2021)		positive willingness to pay: Because the biodiversity on seamounts has a positive impact on the marine economy. (Ison et al. 2021)				pay: Because the biodiversity on seamounts has a positive impact on the marine economy. (Ison et al. 2021)
Aesthetic	The aesthetic value of the scenic sights, smells, sounds of the protected area measured as willingness to pay.		The aesthetic value of the scenic sights, smells, sounds of the protected area measured as willingness to pay.	Aesthetic value of protected wetlands based on a photo content and its metadata. (Do and Kim 2020) Mapping of aesthetic value: I enjoy the scenery, sights, sounds, smells, etc. (Bogdan et al. 2019)		Aesthetic value of protected wetlands based on a photo content and its metadata (people in the photo). (Do and Kim 2020) Mapping of aesthetic value: I enjoy the scenery, sights, sounds, smells, etc. (Bogdan et al. 2019)	Aesthetic value of protected wetlands based on a photo content and its metadata (hints of recreational use). (Do and Kim 2020)
Existence		Willingness to pay of tourists to the conservation of whale sharks. (Anna and Saputra 2017)	Willingness to pay of tourists to the conservation of whale sharks. (Anna and Saputra 2017)	Interpretation of Panoramio photographs regarding existence values, which included photos directly related to individual species of flora and fauna, both native and allochthonous. (Martínez Pastur et al. 2016)	The moral responsibility expressed by a tourist to conserve a particular species because of its right to exist.	The moral responsibility expressed by a tourist to conserve a particular species that derived from the connection with the species.	Willingness to pay of tourists to the conservation of whale sharks. (Anna and Saputra 2017)
Intrinsic		Intrinsic value	Intrinsic value of a	Expression of the	Expression of the		

Valuation frame-work / Value type	TEV		TEEB		IPBES		
	Use	Non-use	Economic	Socio-cultural	Intrinsic	Relational	Instrumental
		of a species in the protected area expressed by a tourist measured as willingness to conserve the species for its right to exit.	species in the protected area expressed by a tourist measured as willingness to conserve the species for its right to exit.	intrinsic value of biodiversity based on Likert scale. (Mrotek et al. 2019)	intrinsic value of biodiversity based on Likert scale. (Mrotek et al. 2019)		
Socio-cultural				The respondents were asked to evaluate the importance of each habitat as a producer of different ecosystem services using Likert scale. (Viirret et al. 2019)	The value of biodiversity diversity as expressed by a tourist in terms of its right to exist.	Expression of (relational) values on, e.g., observing nature; recreation and picnicking; historical and cultural values; education and science; local identity; spiritual values, based on Likert scale. (Mrotek et al. 2019)	Expression of (instrumental) values on, e.g., providing potable water; food, firewood, or other economic resources, based on Likert scale. (Mrotek et al. 2019)
Cultural	The cultural value of the scenic sights, smells, sounds of the protected area measured as willingness to pay.	The value of biocultural diversity, measured as willingness to pay to conserve it for future generations.	The cultural value of the scenic sights, smells, sounds of the protected area measured as willingness to pay.	I value it because it is a place for me to continue and pass down the wisdom, knowledge, traditions and way of life of my ancestors. (Chen et al. 2019) The respondents were asked to evaluate the importance of each studied habitat as a producer of each ES including the significance of the habitat as contributing to local heritage, such as	The value of biocultural diversity as expressed by a tourist in terms of its right to exist.	I value it because it is a place for me to continue and pass down the wisdom, knowledge, traditions and way of life of my ancestors. (Chen et al. 2019)	The respondents were asked to evaluate the importance of each studied habitat as a producer of each ES including the significance of the habitat as contributing to local heritage, such as traditional land uses and other cultural practices typical for the Archipelago Sea region. (Viirret et al. 2019)

Valuation framework / Value type	TEV		TEEB		IPBES		
	Use	Non-use	Economic	Socio-cultural	Intrinsic	Relational	Instrumental
				traditional land uses and other cultural practices typical for the Archipelago Sea region. (Viirret et al. 2019)			
Bequest (Non-use)		Reason for expressing a positive willingness to pay: I want to preserve the seamount biodiversity for future generations. (Ison et al. 2021)	Reason for expressing a positive willingness to pay: I want to preserve the seamount biodiversity for future generations. (Ison et al. 2021)	Time spent by a tourist in tree planting activities in or nearby the protected area because of their value of future uses of future generations.			Reason for expressing a positive willingness to pay: I want to preserve the seamount biodiversity for future generations. (Ison et al. 2021)
Learning	Learning value of the protected area for providing opportunities to learn about the environment expressed by a tourist measured as willingness to pay.		Learning value of the protected area for providing opportunities to learn about the environment expressed by a tourist measured as willingness to pay.	Mapping of education and learning: I can learn about the environment through scientific observation or experimentation. (Bogdan et al. 2019) Mapping of inspiration value: It represents an inspiration source for folklore, artistic manifestations or national symbols. (Bogdan et al. 2019)		Mapping of education and learning: I can learn about the environment through scientific observation or experimentation. (Bogdan et al. 2019) Mapping of inspiration value: It represents an inspiration source for folklore, artistic manifestations or national symbols. (Bogdan et al. 2019)	Mapping of education and learning: I can learn about the environment through scientific observation or experimentation. (Bogdan et al. 2019) Mapping of inspiration value: It represents an inspiration source for folklore, artistic manifestations or national symbols. (Bogdan et al. 2019)

Valuation frame-work / Value type	TEV		TEEB		IPBES		
	Use	Non-use	Economic	Socio-cultural	Intrinsic	Relational	Instrumental
Social	The value of opportunities of visiting the protected area with friends and family expressed by a tourist as willingness to pay.	The value of opportunities for future generations to visit the protected area with friends and family expressed by a tourist as willingness to pay.	The value of opportunities of visiting the protected area with friends and family expressed by a tourist's willingness to pay.	Expression of the social value: *Protected area are important because they provide opportunities for social activities.* based on Likert scale. (Muñoz et al. 2019)	The value of biodiversity expressed by a tourist in terms of its right to exist.	Expression of the social value: *Protected area are important because they provide opportunities for social activities.* based on Likert scale. (Muñoz et al. 2019)	Expression of the social value: *Protected area are important because they provide opportunities for social activities* based on Likert scale. (Muñoz et al. 2019)
Tourism	Travel cost model. (Pongkijvorasin and Chotiyaputta 2013)		Travel cost model. (Pongkijvorasin and Chotiyaputta 2013)	Ecotourism value in terms of attraction through biodiversity and wildlife watching indicated on a Likert scale (Chakrabarty et al. 2019)		Preference for a protected area expressed by a tourist because touristic activities such as wildlife watching nurture their relationship with nature.	Travel cost model. (Pongkijvorasin and Chotiyaputta 2013)
Spiritual	Spiritual value of the protected area for providing sacred, religious, or spiritual activities expressed by a tourist measured as willingness to pay to participate in them.		Spiritual value of the protected area for providing sacred, religious, or spiritual activities expressed by a tourist measured as willingness to pay to use these places as tourist attractions.	Mapping of spiritual and religious values: It offers a special spiritual experience or it is the place where I feel a strong connection with nature. (Bogdan et al. 2019) I value it because it is a specially spiritual place to me, or I feel the respect and reverence for nature there. (Chen et al. 2019)		Mapping of spiritual and religious values: It offers a special spiritual experience or it is the place where I feel a strong connection with nature. (Bogdan et al. 2019) I value it because it is a specially spiritual place to me, or I feel the respect and reverence for nature there. (Chen et al. 2019)	Spiritual value of the protected area for providing sacred, religious, or spiritual activities expressed by a tourist measured as willingness to pay to use these places as tourist attractions.

Valuation frame-work / Value type	TEV		TEEB		IPBES		
	Use	Non-use	Economic	Socio-cultural	Intrinsic	Relational	Instrumental
Indirect	Willingness to pay expressed by a tourist to preserve the Regulating Services/regulating Nature's Contributions to People in the protected area.		Willingness to pay expressed by a tourist to preserve the Regulating Services/regulating Nature's Contributions to People in the protected area.	Individual preferences to preserve Regulating Services/regulating nature's contributions to people, e.g., climate regulation or air purification.			Willingness to pay expressed by a tourist to preserve the Regulating Services/regulating Nature's Contributions to People in the protected area.
Conservation	Willingness to pay to conserve a particular species/habitat in the protected area for recreational use.	Willingness to pay to conserve a particular species/habitat for their right to exist.	Willingness to pay to conserve a particular species/habitat.	Use of recreational value based on social media content analysis to estimate conservation value. (Chakrabarty et al. 2019)	Conservation values as a measure of nature's value as an end in itself.	Conservation value of a protected area because it fosters human-nature connectedness and provides the space for social relationships among people.	Willingness to pay to conserve a particular species/habitat in the protected area for recreational use.
Historical			Historical value of places in the protected area expressed by a tourist measured as willingness to pay to use these places as tourist attractions.	I value it because it has places and things of natural and human history that matter to others, the nation, or me. (Chen et al. 2019)		I value it because it has places and things of natural and human history that matter to others, the nation, or me. (Chen et al. 2019)	Historical value of places in the protected area expressed by a tourist measured as willingness to pay to use these places as tourist attractions.
Relational				Expression of relational values on, e.g., observing nature; recreation and picnicking; historical and cultural values; education and science; local identity; spiritual values, based on Likert scale. (Mrotek et al. 2019)		Expression of relational values on, e.g., observing nature; recreation and picnicking; historical and cultural values; education and science; local identity; spiritual values, based on Likert scale. (Mrotek et al. 2019)	

Valuation frame-work / Value type	TEV		TEEB		IPBES		
	Use	Non-use	Economic	Socio-cultural	Intrinsic	Relational	Instrumental
Iconic		Willingness to pay for the conservation of the authenticity of the protected area. (Dagiliūtė et al. 2017)	Willingness to pay for the conservation of the authenticity of the protected area. (Dagiliūtė et al. 2017)	Preference assessment: This park represents a unique landscape found nowhere else on earth. (Baral et al. 2017)	The iconic value of a protected area expressed by tourists because the protected area has the right to be preserved because of its uniqueness.		
Therapeutic	Therapeutic value of places in the protected area expressed by a tourist measured as willingness to pay for mental and physical health benefits gained through the visit.		Therapeutic value of places in the protected area expressed by a tourist measured as willingness to pay for mental and physical health benefits gained through the visit.	I value it because it makes me feel better, physically and/or mentally. (Chen et al. 2019)		The therapeutic value of a protected area expressed by a tourist because the experience in the protected area nurtures them physically and/or mentally.	Therapeutic value of places in the protected area expressed by a tourist measured as willingness to pay for mental and physical health benefits gained through the visit.
Option (Use)	Willingness to pay for the maintenance of a protected area to travel to it in the future.		Willingness to pay for the maintenance of a protected area to travel to it in the future.	Time spent by a tourist in tree planting activities in or nearby the protected area because of their value of potential future uses.			Willingness to pay for the maintenance of a protected area to travel to it in the future.
Instrumental	Instrumental value of the protected area expressed by a tourist measured as willingness to pay for necessary food and supplies to sustain their life.	Donation to rainforest protection to contribute to the existence of wildlife for future generations to enjoy them.	Instrumental value of the protected area expressed by a tourist measured as willingness to pay for necessary food and supplies to sustain their life.	Expression of instrumental values on, e.g., providing potable water; food, firewood, or other economic resources, based on Likert scale. (Mrotek et al. 2019)			Expression of instrumental values on, e.g., providing potable water; food, firewood, or other economic resources, based on Likert scale. (Mrotek et al. 2019)

Valuation frame-work / Value type	TEV		TEEB		IPBES		
	Use	Non-use	Economic	Socio-cultural	Intrinsic	Relational	Instrumental
Local identity	Travel costs expressed by tourists to visit a protected area where ancestors lived.		Travel costs expressed by tourists to visit a protected area where ancestors lived.	Number of geo-tagged photographs regarding local identity, which included heritage, folklore, traditions, art and local workers (ranching, forestry, artisanal fishing, mining, and oil extraction). (Martínez Pastur et al. 2016)		The preference for a protected area expressed by tourist because it connects them with their ancestors.	Travel costs expressed by tourists to visit a protected area where ancestors lived.

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Appendix 5: Supplementary Material for Chapter III

Supporting Material S1 Interview guides

Text S1.1 Nature conservationists and tour guides

Introduction

Hello, my name is (Milena Gross, Victor Lazaro, OR Jasmine Pearson). I am a researcher OR field assistant at Leuphana University Lüneburg in Germany.
First of all, thanks so much for taking the time to participate in this interview. You are making a valuable contribution to research by improving our understanding of how nature contributes to people's good life.
The interview is structured into two sections. I will start with a series of questions on how you experience, benefit from and value nature at Mt Kilimanjaro. We will finish off the interview with some standard socio-demographic questions about yourself and a few final wrap-up questions.
As stated in the consent form, your information will be treated fully confidential. All answers given are anonymous and cannot be traced back to you.
We planned the interview for 30-45 min. However, please feel free to expand on the topic or talk about related ideas. I have sufficient time. Depending on how much you want to expand on the questions, our experiences proved: The interview can take longer. I just want to know whether you have to 'leave' at some point or how much of your time you are willing to dedicate to our research project. (In case time is limited: If I sense that we won't finish in the time available, is it okay, if I let you know)
Please note that there are no wrong answers to our questions. I am interested in your honest opinion and perspectives. Your answers do not need to be profound. It is ok to say ´I don´t know´ for questions that you are unable to answer. I don't want you to make up answers because you feel you have to.
If there is any question that you are not comfortable answering, please let me know and we can skip it. If *you* have any questions for me at any point during the interview, please don't hesitate to ask.
Let me know when you are ready and I will start the recording.

Introductory questions about interviewee

A. What is your current job title?

Questions related to Nature's Contributions to People (NCP)

1. (I. Appreciation) What do you appreciate about nature at Mount Kilimanjaro (We consider the entire mountain area, i.e., from the foothills of the mountain with its agricultural fields and settlements to its top including the National Park)?
    a. What do you think other people (who live on, work at and come as tourists to Mount Kilimanjaro) appreciate about nature at Mount Kilimanjaro?
2. (II. Benefits) Do you think that nature at Mount Kilimanjaro provides benefits to humans? If yes, what are the benefits of nature at Kilimanjaro?
    a. For you?
    b. For your family?
    c. For local communities and society as a whole?
3. (III. Well-being) What does nature at Mount Kilimanjaro contribute to
    a. your well-being? Feel free to think about 'well-being' in the broadest sense of the word including any type or dimension of 'well-being'. This can be related to mental and physical well-being or beyond.
    b. other people (who live on, work at and come as tourists to Mount Kilimanjaro)'s well-being?
4. (II. Benefits) Are there any other contributions and/or benefits of nature at Mount Kilimanjaro to you and other people (who live on, work at and come as tourists to Mount Kilimanjaro) that you can think of?
    a. for example, in environmental, economic, social or terms?
5. (IV. Importance) Do you think nature at Mount Kilimanjaro is important? Why?

a. Optional, if not addressed before: For you personally? Why?
b. Optional, if not addressed before: in the role of <insert profession name>? Why?
c. Optional, if not addressed before: For other people (who live on, work at and come as tourists to Mount Kilimanjaro)? Why?

Socio-demographic information

i) What is your age?
ii) What is your gender? [Determined by the interviewer for Tanzanian interviewees.]
iii) What is your highest level of formal education?
iv) Where do you currently live?
    i. How many years of your life did you live / have you been living in the Mount Kilimanjaro area?

Final questions

6. That's all the questions I have got for you. Is there anything else you would like to add to the interview? Do you have any questions for me?
7. Optional, if we still need interviewees: Is there anyone else you know who might be able to participate in this interview?

Thanks so much for your time and for sharing your experience with nature at Mount Kilimanjaro with me. I'll also be in touch with information about the results of this work.

Text S1.2 Tourists

Introduction

Hello, my name is (Milena Gross OR Jasmine Pearson) and I am a researcher at Leuphana University Lüneburg in Germany.
First of all, thanks so much for taking the time to participate in this interview. You are making a valuable contribution to research by improving our understanding of how nature contributes to people's good life.
The interview is structured into three sections. I will start with some general questions about your experience at Mount Kilimanjaro followed by a series of questions on how you have benefited from and value nature at Mt Kilimanjaro. We will finish off the interview with some standard socio-demographic questions about yourself and a few final wrap-up questions.
As stated in the consent form, your information will be treated fully confidential. All answers given are anonymous and cannot be traced back to you.
We planned the interview for 30-45 min. However, please feel free to expand on the topic or talk about related ideas. I have sufficient time. Depending on how much you want to expand on the questions, our experiences proved: The interview can take longer. I just want to know whether you have to 'leave' at some point or how much of your time you are willing to dedicate to our research project. (In case time is limited: If I sense that we won't finish in the time available, is it okay, if I let you know)
Please note that there are no wrong answers to our questions. I am interested in your honest opinion and perspectives. Your answers do not need to be profound. It is ok to say ´I don´t know´ for questions that you are unable to answer. I don´t want you to make up answers because you feel you have to.
If there is any question that you are not comfortable answering, please let me know and we can skip it. If *you* have any questions for me at any point during the interview, please don't hesitate to ask.
Let me know when you´re ready and I will start the recording.

General experience of Mount Kilimanjaro

A. When did you visit Mount Kilimanjaro (month and year)?
    a. Is that the only time you have been?
    b. How long was your visit/s? (number of days) (record for all visits)

B. Did you enter the National Park? (record for all visits)
    a. If they climbed, did you climb to the top? (record for all visits)

Questions related to Nature's Contributions to People (NCP)

1. (I. Appreciation) a. What did you appreciate about nature at Mount Kilimanjaro? (Our questions refer to when you visited Mount Kilimanjaro and your perception afterwards).
    b. What do other people appreciate? These examples can be either things you've witnessed personally or that you've heard from other people.
2. (III. Well-being) What did nature at Mount Kilimanjaro contribute to
    a. your well-being? Feel free to think about 'well-being' in the broadest sense of the word including any type or dimension of 'well-being'. This can be related to mental and physical well-being or beyond.
    b. other people's well-being?
3. (II. Benefits) What are some other contributions and/or benefits of nature at Mount Kilimanjaro to you and other people that you can think of?
    a. for example, in environmental, economic, social or cultural terms?
4. (IV. Importance) Do you think nature at Mount Kilimanjaro is important? Why?
    a. Optional, if not addressed before: For you personally? Why?
    b. Optional, if not addressed before: For others? Why?

Socio-demographic information

i) What is your age?
ii) What is your gender?
iii) What is your highest level of formal education?
iv) Where do you currently live?

Final questions

5. That's all the questions I have got for you. Is there anything else you would like to add to the interview? Do you have any questions for me?
6. Optional, if we still need interviewees: Is there anyone else you know who might be able to participate in this interview?

Thanks so much for your time and for sharing your experience with nature at Mount Kilimanjaro with me. I'll also be in touch with information about the results of this work.

Text S1.3 Definition of nature and the study area

We did not define the term nature and the scope of the geographical area of Kilimanjaro for the interviewees. Language and cultural background can impact the conceptual understanding of nature and hence, we asked interviewees to draw on their conceptualization of nature (Coscieme et al. 2020; Masao et al. 2022).

S2 Additional information on study design and data gathering

Table S2.1 Online interviewees' country of residence

Table S2.1 Overview of the countries of residence for tour guides (n=5) and tourists (n=38; one tourist resided in two countries) who we interviewed online via Zoom from May to December 2021.

Country of residence	Number of tour guides	Number of tourists
Argentina	0	1
Australia	0	3
Austria	0	1
Canada	0	1
Croatia	0	1
Ecuador	0	1
Guatemala	1	0
Germany	0	6
Israel	0	1
Italy	0	1
Netherlands	0	2
South Africa	0	2
Spain	0	1
Switzerland	1	1
United Kingdom	1	2
United States of America	1	14
Vietnam	0	1
Tanzania	2	0

Table S2.2 Translation of interviewees' words into context-specific Nature's Contributions to People

Table S2.2 Context-specific Nature's Contributions to People (NCP) in Kilimanjaro identified through interviews with nature conservationists (n=28), tour guides (n=20), and tourists (n=38) and exemplary quotes to showcase how we translated the interviewees' words (in bold) into context-specific NCP, i.e., the scientific framework. Appreciation (What do you and other people appreciate about nature at Mount Kilimanjaro?), Benefits (What are the benefits of nature at Kilimanjaro?), Well-being (What does nature at Mount Kilimanjaro contribute to your and other people's well-being and quality of life?), and Importance (Why you think nature at Mount Kilimanjaro is important, for you and other people?) indicate the question in whose response the quote was identified. If applicable, we clean edited quotes to improve their readability without changing their meaning (Corden and Sainsbury 2006). NA indicates that no interviewee of the respective social actor expressed the NCP. Context-specific NCP were linked with generalizing NCP (Díaz et al. 2018), using an interwoven approach (Hill et al. 2021). NCP group: regulating; material; non-material; cross-cutting. Icon design credit: Jelke Meyer.

Context-specific NCP	Nature conservationists	Tour guides	Tourists	Generalizing NCP
Regulating NCP				
Habitat creation and maintenance	If you **compare (the mountain) to a flat area […], you have many more habitats**. With this, you have many more species living there. So, it's also a **home for many plants and animals, which could not live and not grow here without this mountain**. (Nature conservationist 23; Importance)	That lake popped up in the plains of Amboseli and created a swamp area which let elephants be part of, which let **elephants become residents in that area**. (Tour guide 4; Appreciation)	I am in territory that is […] outside civilization and this is **other creatures' home**. I am a **guest in their home**. (Tourist 26; Appreciation)	1. Habitat creation and maintenance
Pollination	We have the forest, we have **bees**, and the bees, we know, are the **pollinators**. **When they pollinate the crops, the people get food**. (Nature conservationist 13; Importance)	NA	NA	2. Pollination and dispersal of seeds and other propagules
Dispersal of seeds	Through **elephants**. Because they can **disperse the seeds**. (Nature conservationist 13; Well-being)	**An elephant grows a tree**. (Tour guide 4; Appreciation)	NA	
Regulation of air quality	They like the **fresh air**. They realized, oh yeah, we have **a lot of trees**. **The air is much fresher than going to town**. (Nature conservationist 17; Appreciation)	We'll get **good oxygen, full oxygen**. (Tour guide 18; Well-being)	The **freshness of the air**. […]. If you come from a big city and you go into that (mountain area), you feel that **fresh mountain breeze and fresh mountain air**. (Tourist 2; Appreciation)	3. Regulation of air quality

Context-specific NCP		Nature conservationists	Tour guides	Tourists	Generalizing NCP
	Regulation of climate	The **vegetation regulates the climate**. (Nature conservationist 18; Importance)	**Kilimanjaro is like this control remote of the region's weather, the patterns, the weather parameters in Tanzania, in Africa**. (Tour guide 12; Appreciation)	There must be effects on the area around from Kilimanjaro because it is such an isolated and very high mountain and **it makes its own atmosphere and weather**. No, **it's truly important for the weather around the area**. (Tourist 36; Importance)	4. Regulation of climate
	Regulation of freshwater quantity	Mount Kilimanjaro, we referred to it as **a very big water tower**. It's a tower which gives or provides water to I could say maybe **to the whole of Moshi in Kilimanjaro**. **All these rivers that you see around here, all of them originate from the mountain**. (Nature conservationist 20; Appreciation)	(The mountain) also allows us to **have common rainfalls**. I mean, **all year because of the major forest** we have. And from this then, as **many people doing agriculture here, will depend on rain rather than irrigation**. (Tour guide 7; Benefits)	The Africans call it, I don't like the word, but the Africans **call the mountain a water tap**. You know, **it's just a huge in capturing and regulating water for the whole region**. (Tourist 29; Benefits)	6. Regulation of freshwater quantity, location and timing
	Regulation of freshwater quality	We get **quality water**. (Nature conservationist 15; Well-being)	We get like **good water**, I mean, **clean water**. (Tour guide 18; Well-being)	I think nature give us a lot of things and not just resources or not just clean air or not just **clean water**… (Tourist 8; Importance)	7. Regulation of freshwater and coastal water quality
	Regulation of soil fertility and protection of soils	The **fertile land supports agriculture** and the life in this area is because the nature is well conserved. There is **a big difference between the environment and the soil fertility in Kilimanjaro, if you compare it with the other areas** where there is no fertile soil and no land to support agriculture. (Nature conservationist 27; Appreciation)	Because the **soil is fertile**, everything is good. (Tour guide 20; Appreciation)	I think for the people living there, this is an important resource because it's like **fertile lands**. (Tourist 35; Benefits)	8. Formation, protection and decontamination of soils and sediments
	Regulation of hazards and extreme events	We were **not suffering from these strong winds.** (Nature conservationist 5; Appreciation)	NA	NA	9. Regulation of hazards and extreme events

Context-specific NCP		Nature conservationists	Tour guides	Tourists	Generalizing NCP
	Regulation of detrimental species	There is one species, it's called mdavia'fuko and this means 'catch the mole rat', because **Chagga use this plant for catching these mole rats in the ground**. (Nature conservationist 23; Appreciation)	And especially here in Shimbwe and other **places on Kilimanjaro, which are more than one 1550 meters in elevation, there is no malaria mosquito**. (Tour guide 2; Appreciation)	NA	10. Regulation of detrimental organisms and biological processes
Material NCP					
	Energy	We have **hydroelectric power**. […] It gives us light because that **water gives us light.** It provides us with energy. (Nature conservationist 8; Appreciation)	They reached a point, they said **only ladies can go to collect firewood**. (Tour guide 14; Appreciation)	I think **those people would enter the park and use the trees for firewood**. (Tourist 3; Well-being)	11. Energy
	Food	The economic livelihood of most community members depends on **farming**. So if nature can't support them, obviously they're going to become poor because they can't do anything. Everything should be suffering from getting it. But for now, it is very simple. You can't die of hunger in Kilimanjaro because **a lot of crops are there and available**. (Nature conservationist 26; Benefits)	The **vegetation or crop cultivation nearby gives foods** for the people who are living (there). Some are growing **maize**, **beans**, **wheat** and **most of the crops are used for food**. (Tour guide 17; Importance)	The **base of the mountain provides so much food** to so many people and like seeing people working on the farms and realizing, oh, **this is the food that's going to nourish us going up**. (Tourist 24; Appreciation)	12. Food and feed
	Feed	They keep cows inside. Then they **take grasses from the area around to feed them** (Nature conservationist 10; Benefits)	They have **a chicken** in the garden, which they don't have to take care of. **It's just roaming around and eating**. (Tour guide 13; Importance)	NA	
	Building materials	People use the forest in different ways. **Timber production poles**, etc. (Nature conservationist 27; Well-being).	You can use everything **for building your house, for making a roof**, everything is there. (Tour guide 20; Appreciation)	NA	13. Materials, companionship and labor
	Medicine	If you see the history, there is a **medicinal value also from the**	I really appreciate nature of Kilimanjaro because we also have	NA	14. Medicinal, biochemical and

Context-specific NCP		Nature conservationists	Tour guides	Tourists	Generalizing NCP
		forest where people get medicines. **Traditional medicine from nature**. (Nature conservationist 27; Appreciation)	[…] **lots of medicine that we as local can use to heal ourselves. And mostly they are organic**. (Tour guide 2; Appreciation)		genetic resources
Non-material NCP					
	Learning	And also it's **help for education**. **Students who are learning from different species** of plants. (Nature conservationist 18; Importance)	The different leaves of trees. Why is it oval, why is it triangle? And all these things, you know? And there are parasitic trees, you know? And all these insects, you know? There's a lot you can see there. If someone is interested in nature, if someone is interested in the insects only, if somebody interested in flowers only, if someone is interested in trees only, if you want to see about the parasite trees or flora and fauna, you name it. **The nature of Kilimanjaro has taught me quite a lot.** (Tour guide 5; Appreciation)	I think nature gives us a lot of things and not just resources or not just clean air or not just clean water, but to be able **to experience these amazing activities or to leave these experiences, which just makes us learn a lot of things from ourselves, from the environment** and from other people or culture, I think is very important for everybody and for lot of people, for foreign people or for - even for people that are nowhere near that area. (Tourist 8; Benefits)	15. Learning and inspiration
	Aesthetic enjoyment	These **rotting trunks are glowing in green, in a green color**. These were **these bacteria and fungi** and so on. So, it was **really like an avatar on Kilimanjaro**. Yeah, this was one of the most amazing experiences I have had. (Nature conservationist 23; Appreciation)	When we are sitting here for, for breakfast and **the birds are in the tree, it's our breakfast TV**. So we always are happy if you see our **eagles flying around and if you hear them, then we look**. (Tour guide 20; Well-being)	**Every water drop** on there is **beautiful**. **Spider web** - its **awe**. (Tourist 20; Importance)	16. Physical and psychological experiences
	Recreation	I like to **go a little bit up just for hiking**. (Nature conservationist 11; Well-being)	My food, my honey - before **my morning run**, it's just my coffee cup (Tour guide 12; Well-being)	It has very **important recreation possibilities**, because even if you don't enjoy plants or landscapes, it's a physical challenge. So, you know, in terms of recreation (Tourist 29; Benefits)	

Context-specific NCP		Nature conservationists	Tour guides	Tourists	Generalizing NCP
	Challenging experiences	**It's actually the exercise. I was really proud that I was still able to walk in the height.** Of course, this is somehow hard. (Nature conservationist 22; Well-being)	It pushes**, the nature, the weather push people to limits that they've never experienced before**. They realize in nature you can sleep outside for seven days or eight days. They see things like the Barranco Wall, which may seem really intimidating, but when you actually go up, it only takes an hour and a half and it's very realistic. (Tour guide 9; Appreciation)	That telling your friends you climbed the Kilimanjaro (laughs). Yeah, well, just it's, yeah, I think **it's a challenge, and if you overcome that challenge, it makes you feel better**. It's just like, why would you run a marathon? It's like the same feeling. You know, **it's going to be tough, but you still want to do it**. (Tourist 15; Well-being)	
	Therapeutic and restorative benefits	It's also a very **good place for psychological to help with issues**. Because when you go around Mount Kilimanjaro, you feel different from where you're coming. And sometimes I also walk to the gate at Marangu. I come back, I feel like I was on top of Mount Kilimanjaro. So **psychologically, it helps people to be okay**. (Nature conservationist 19; Benefits)	when I go on Mount Kilimanjaro, hundred percent, **it gives me a room to meditate**. I know in my back head I'm working. But really, when I am in nature, **I feel as a place to (exhales loudly) to release**. (Tour guide 15; Appreciation)	Every single one of us **found it to be a time to be able to relax and to not worry about all the external pressures and just concentrate on the next steps so to say**, you know. It's just being out there in the middle of it and just **enjoying everything that's around you and not having the clutter of everything else in your life**, that kind of gets in the way of just realizing, you know, where you are, what you do and who you're with. (Tourist 4; Well-being)	
	New and unique experiences	It is a hot place, but when you are in Kilimanjaro it is like you are not there. You are in another country, you see? […] So I think **the experience and the uniqueness of the mountain to be in Africa but with the glacier. The Kilimanjaro is in Africa, but with the glacier, which it is not normal in Africa**.	The magical piece on Kilimanjaro is there are **a lot of magical plants on Kilimanjaro, things that you don't typically see in other locations** that kind of are striking to people (Tour guide 6; Benefits)	But in this case, **everything I saw was new**. You know, like I said, the plants, the type of plants, the way that you when you go up the mountain, you're in different zones and everything, and **each zone is so different from the zone above and below it**. And it's, you know, it's just an incredible experience	*Context-specific NCP that cannot be linked*

Context-specific NCP		Nature conservationists	Tour guides	Tourists	Generalizing NCP
		Yeah. (Nature conservationist 26; Appreciation)		and... I know it's pretty cool to me how it all, you know, **they're all different, and yet they all rely on one another and just seeing the way that it all interacts**. Pretty cool. (Tourist 4; Importance)	
	Connectedness with nature	I am **feeling myself as a part of this ecosystem because my responsibility is to make sure that the ecosystem is existing**. […] It makes me very comfortable, being part of that nature. (Nature conservationist 7; Well-being)	And just the sense of peace and serenity in **living in unison with, you know, like with nature**, really? (Tour guide 10; Appreciation)	I felt a bit of a **stranger to the flora** when we arrived. But then it seemed like **it adopted me** somehow. I **became part of it**. (Tourists 10; Well-being)	17. Supporting identities
	Cultural heritage and identity	People living around here like **Chaggas their histories established from the existence of this nature of Mount Kilimanjaro**. It **carries the legacy from those days up to even this new generation**. (Nature conservationist 21; Benefits)	So globally, **politically, Kilimanjaro is iconic for the region.** It stands out. The Declaration of Independence, **the flags of the nationals light up in the light of this country to get independence 1961, 62**. It was light up on Kilimanjaro. So, Kilimanjaro is one of us, a center piece for, I will not say only for Tanzania. Yes, the mountain is in Tanzania. Yes, **the mountain is ours, but the mountain is for the whole region, the continent of Africa**. (Tour guide 12; Benefits)	I think people, I mean living there, I think they're all very, very proud of the mountain and it's also a **culturally very important piece of their identification with this area, with this region**. (Tourist 38; Appreciation)	
	Sense of place	The p**eople of Kilimanjaro have this real attachments and rootedness in land**. [...] There's a really **sense of place of the Chagga people [...] that is tied to the mountain itself** (Nature conservationist 1; Appreciation)	The whole mountain **for me is my home. That's where my hope, this is where my dreams are**. […] For me as an athlete, I travel the world to see places, and **I always come back home as the place where I belong. I think Kilimanjaro is my home. It's where my heart is**. And	So just that **sense of homecoming**. I think that's a personal benefit. (Tourist 16; Importance)	

Context-specific NCP		Nature conservationists	Tour guides	Tourists	Generalizing NCP
			I've seen various, different parts of the world, different mountains. And certainly, **I have no argument, this is my home**. (Tour guide 12; Appreciation)		
	Social cohesion and bonding	I realized that even local people, they would like to go somewhere where it's quiet **just to drink a beer on Sunday, Mbege, talking with friends, sitting under a tree and talking**. (Nature conservationist 11; Well-being)	Groups start to work really well together, to look after each other. I've rarely seen **discord amongst group members, even though they've been totally different people**. You know, **totally different politically, totally different socially. As a group, they've become and they will become the same**. (Tour guide 6; Benefits)	And they really said quite sincerely**, having climbed to the peak together, we know we can do anything together in our in our lives**. So it's, it **becomes a symbolic marker for a lot of people**. And I think it was **for my son and I as well. It did something really good for our relationship**. You **touched on that even more than a decade later**. We look back on and we know we did this together. (Tourist 23; Appreciation)	
	Spiritual experiences	They do believe the **Mount Kilimanjaro is** the **residence of the Chagga ancestor spirit**. (Nature conservationist 9; Well-being)	We have some **plant that we use to communicate with our ancestors**. (Tour guide 2; Benefits)	Like if there's anything in your life you got to do, you got to go there and experience. It's not like here, it's such a different world, you know. It's **more of a spiritual experience than anything else**. (Tourist 21; Appreciation)	
Intergenerational benefits					
	Intergenerational benefits	We need to **keep it more for us and for other generations**. (Nature conservationist 19; Importance)	I think what is very important here is to make people understand that it's **not only important for them and their children and their children's children. It's important for the whole country.** (Tour guide 20; Importance)	To **maintain something like that for future generations**, I think is really cool. (Tourist 16; Importance)	18. Maintenance of options

S3 Explanation form and declaration of consent

Text S3.1 Explanation form

We are inviting you to participate in this research project, which will involve an interview on your experience with nature in the Mount Kilimanjaro region.

Investigators

This project is being undertaken by Milena Gross (PhD student), Dr Jasmine Pearson (Postdoctoral researcher) and Prof Berta Martín-López (Principal Investigator) at Leuphana University Lüneburg. Please reach out to Milena Gross if you have any questions about this project.
Milena Gross' contact details are: milena.gross@leuphana.de

What is involved?

This research will involve interviews with people who travel to, live and/or work on Mount Kilimanjaro. You must be 18 or older to participate in the study. The interview will take place in person or online (via Zoom through Leuphana University's server) and will take approximately 30-45 minutes. However, please feel free to expand on the topic or talk about related ideas. The interview will involve a series of questions relating to: socio-demographics; your experience at Mount Kilimanjaro; and how you benefit from and value nature. You will also be given the option to send 1-4 photos of your experience which you can refer to during the interview. As a participant in this research, your participation is *entirely voluntary*. You are welcome to leave at any time if you do not feel comfortable being involved in this study. You may refuse to answer any questions you do not feel comfortable answering at any time.

Confidentiality and anonymity

Your identity and information will *remain completely confidential and anonymous* so we can ensure that this is not revealed in any outcomes from this study. *If permitted*, the interviews will be recorded in order to preserve and analyze the information given which will be later translated. You are also free to ask any questions or raise any concerns you may have about this study at any time. You will also be able to stay in contact after this study has been completed to provide feedback or access the final outputs. Upon completion of this project, all data will be stored in a secure location (and destroyed after exceeding the legal retention period of ten years).

What are the benefits of this project?

In the Mount Kilimanjaro region, competing land uses and impacts from climate change have led to a dramatic increase of the demand for nature. Understanding these demands and how this is distributed among social actors has been acknowledged as essential for the effective assessment and the sustainable management of nature. Addressing this knowledge gap entails seeking to understand how social actors, among them nature conservationists, tour guides, and tourists, demand and value nature, why they demand and express preferences for different natural resources. This project will provide much needed empirical data for policy- and decision-making at both international and national levels. On a personal level, you might benefit from the study, as you reflect on your own relation to nature and your experience with nature in the Mount Kilimanjaro region.

What are the risks?

We do not foresee any risks with your participation in this research. However, we will aim to avoid any potential distress or discomfort by ensuring the following:

- avoidance of questions of a highly personal and sensitive nature;
- the option of participants to not discuss some aspects of the research; and
- the ability of participants to terminate the interview at any time with no need to give any reasons for such.

How can you access the findings of this study?

The findings/outcomes of this project will be published as peer-reviewed journal articles. We will also develop a short summary of the key findings/outcomes to send to participants who are interested.

Ethics

This study adheres to the guidelines of the ethical review process of the Ethical Review Board of Leuphana University Lüneburg. Whilst you are free to discuss your participation in this study with project staff (Milena Gross is contactable on milena.gross@leuphana.de), if you would like to speak to an officer of the university not involved in the study, you may contact the Ethics Board Secretariat: ethikbeirat@leuphana.de.

Text S3.2 Declaration of consent

I acknowledge that I have read and understood the information provided on this project. I hereby provide consent to be a participant in this interview as part of this research project on social actors' demands and values of nature in the Mount Kilimanjaro region.

- I have received clear and concise information, both written and verbal, about this research, and I understand what is required of me during the interview.
- I acknowledge that my participation is entirely voluntary and there will be no direct benefit or reimbursement for my role in this study.
- *If permitted* (see tick box below), I acknowledge that the interview will take place in person or through Zoom and a recording device will be used to record the interview and be later transcribed.
- *If permitted* (see tick box below), I acknowledge that the data used during photovoice methods will be stored securely and may be used in the outcomes of this study.
- All information related to this study will be securely stored.
- I acknowledge that my identifying information will remain confidential and will not be used in any publications or other outlets.
- I understand that I am able to leave the interview at any time or refuse to answer any questions without any explanation or penalty.
- I acknowledge that I am able to make contact with the persons involved in this study in order to seek any information about the current and future use of this research and to raise any concerns if necessary.

Please indicate if you consent to the following:

☐ I consent to the interview being recorded, and transcribed.

☐ I consent to sending photos to be used within the interview.

☐ I consent to sending photos to be used in the outcomes of the study.

We appreciate your participation and thank you for contributing to scientific research. If you would like to receive a summary of the results, please write your email address below: ……..

Participant's Name…….……

Participant's Signature ……..……

Date…….……..

Please complete and sign this form electronically and then send back to Milena Gross (milena.gross@leuphana.de) via email. Alternatively, you can print off, scan and then email your signed form to us.

S4 Positionality statement

Researchers advocate that – as a default ethical practice – we (researchers) should position ourselves and our research (e.g., Beck et al. 2021; Darwin Holmes 2020; Horlings et al. 2020; Popa & Guillermin 2017; Reyes 2020; Soedirgo & Glas 2020). As I position myself within the feminist scholar community, it was inarguable to me to investigate and reflect on how the choices by researchers and my own condition(ed) methodological approaches, results, and interpretations in academic works. This is particularly important in the context of this article, in which we argue that research and methodological decisions are not neutral. Here, I, the first author of this article, want to position myself in the field of sustainability science.

I am an able-bodied, White woman socialized in Germany, possessing a German passport based at a German university in an academic system shaped by Western worldviews and at the final stages of my Ph.D. studies in Sustainability Science. I acknowledge that these socio-demographic traits and other visible and invisible tools (Reyes 2020) influenced the research process, outcomes, and interpretations presented in this study.

Throughout my Ph.D. research, my awareness of ontological and epistemological assumptions and their impact on research deepened. I learned more about my own assumptions through non-academic experiences, engaging with literature, and when confronted with perspectives, such as the notion of an objective researcher and scientific neutrality, that differ starkly from mine. One key example involves people-nature relationships: despite growing up and spending over 20 years in the heart of the city of the German capital city Berlin, my time in the countryside has fostered a closer, more intimate bond with nature than the urban-tech life. I, therefore, view these relationships as interconnected. Additionally, I recognize that a mechanistic perspective, which separates people from nature, rather than a relational perspective has shaped my understanding of people-nature relationships. This influence became especially clear when contrasting my perspective with literature by Indigenous scholars or on Indigenous worldviews.

In this context, I would also like to acknowledge my non-academic training. This experience profoundly shaped my uncovering process of who I am, how others and I see the world, how others and I approach research, and others and my values (my core values: accountability, care, courage, humility, and good and committed relations with and between places and people), more than any academic training I had previously received. Throughout my Ph.D. research, I came to identify with the feminist scholarly community that views scientific knowledge as inherently partial, contextual, and situational (e.g., Haraway 1988; Madge 1993; Rose 1997; Staffa et al. 2022). I do not think that scientific knowledge production is objective. Rather, I think that the knowledge we – researchers – produce and our interpretation of it is influenced by what is important to us, i.e., our values, and depends on how we see the world, i.e., our ontology. At this stage – having only recently begun to explore ontological and epistemological assumptions, and not having designed the research with these in mind – I tend to relate to the epistemology of the social constructionist/interpretivist paradigm that assumes there is not just one reality but many realities ‘that can be articulated based on the values, standpoints, and positions of the author’ (Daly 2007, p. 33) (Aliyu et al. 2015). Therefore, my interpretation of people’s relationships with nature that is presented in this work is one of many possible interpretations that mirrors how I position myself relative to the research I have undertaken, the study area, and the research participants.

With this positionality statement, I aim to give readers insight into how my positionality has shaped this work, to the extent that I have been able to uncover. Although ontological and epistemological assumptions can evolve over time (Ives et al. 2023) – in fact, Haider et al. (2018) emphasize that epistemological agility is essential for sustainability scientists to collaborate effectively with researchers who hold differing assumptions about how knowledge is produced –, I acknowledge that I have not yet fully identified my own at this stage. As I continue to delve deeper and learn more about the nuanced distinctions between different

ontological and epistemological perspectives, it is likely that I will describe these assumptions differently in future work.

My academic background

Professionals and peers at German, Swedish, and U.S. American universities and research centers academically trained me over a total of nine years. My academic profiling in sustainability science has benefited from 'undisciplinary' (Haider et al. 2018), innovative, and competency-based teaching approaches, the mindset of looking outside the box within, across, and beyond traditional disciplines and academia (Wiek et al. 2011), as well as caretaking classmates and colleagues from all around the globe, embracing an ethos of care approach (Puig de la Bellacasa, 2017; Staffa et al. 2022). Western academic education, scientific traditions, and literature have shaped my ontological and epistemological perspectives, particularly in how I understand the nature of social realities and the production of knowledge. This also directed the scientific knowledge production of this study.

Authoring team

The author team of this work represents female and male researchers from diverse personal and academic backgrounds. Members of the author team grew up, lived, learned, and/or worked in different countries, including Tanzania, and are at different stages of their academic careers, ranging from undergraduate students to full professors.

Research approach, data collection, and analysis

I advocate for qualitative place-based research approaches, as applied in this article, because such allow researchers to recognize that people-nature relationships are contextual and hence, do not 'force' researchers to fit them into generalizing categories. Through semi-structured interviews, an inductive-deductive content analysis, and the context-specific lens of the nature's contributions to people (NCP) framework (Díaz et al. 2018) – which tend to be underrepresented in the field of sustainability science relative to quantitative approaches based on predefined categories –, I sought to investigate people's perceptions on people-nature relationships in more depth than – overrepresented – quantitative approaches can do justice. By choosing the context-specific lens over the generalizing NCP perspective, I aimed to conduct this study with humility and a commitment to understanding the complex and diverse realities of people-nature relationships experienced by different social actors in Kilimanjaro. My goal was to contribute to scientific knowledge production in a way that respects and incorporates the voices and knowledge systems of both local and international social actors.

The framing of this article was motivated by feminist theory. Instead of presenting the NCP diversity we uncovered for the different social actors and recognizing that social actors differed in their NCP expression, I consciously opted for a methodological investigation. I wanted to empirically investigate (and challenge) the claim of scientific objectivity. I identify with the epistemology of the social constructionist/interpretivist paradigm, which argues that scientific knowledge is co-created by the researchers and research participants. Hence, I believe that the 'reality 'out there'' (West & Schill 2022, p. 1) cannot be truthfully represented in scientific results but is constructed. I, therefore, agree with claims arguing, for example, that researchers determine what kind of knowledge and whose knowledge is considered but also – intentionally or unconsciously – omitted. In this study, we showed that the questions we posed to the different social actors evoked the expression of diverse context-specific NCP. Assume we had decided to not ask the question of Importance or ignore the social actors of nature conservationists; we would have missed particular NCP and hence, the study would have found a different, i.e., rather 'incomplete', NCP diversity. Hence, how and whom I and co-authors of this articles asked conditioned the scientific results, ultimately allowing us to argue that our methods to uncover NCP diversity serve as 'NCP-articulating institutions'.

Similarly, the translation process of interviewees' words into the scientific language of the NCP framework was not neutral but influenced by our interpretation of their responses and our coding decisions, which ultimately affected the NCP diversity we uncovered in the study. Our positions as outsiders relative to all three social actor groups influenced how we interpreted

the local realities and the insights shared by both local and international social actor groups. We recognize the potential for our interpretations to be influenced by my Western academic training and worldview on people-nature relationships, which may not fully capture the nuances of the Tanzanian context (Coscieme et al. 2020). To mitigate these influences, I have taken several steps to engage with the local context more deeply and to ensure that my research is culturally sensitive and reflexive. People-nature relationships have evolved in the social-ecological history and are embedded in the context of the place and hence, may be better understood, if history and context are considered. I spent nine months living, working, and conducting research in situ. I claim that the knowledge I gained from formal and informal conversations and observations during my research stays has directed my understanding and interpretation of the people-nature relationships in Kilimanjaro presented in this article. For example, during my visit to Shimbwe village, I was introduced to various medicinal and nutritious plants (NCP medicine) and materials (NCP building materials) derived from Kilimanjaro's nature, traditionally utilized by the Chagga. I observed tangible objects in use or in typical contexts that interviewees described orally, though often only at a superficial level. Informal conversations also offered deeper insights into the spiritual significance of Mount Kilimanjaro for local people before the arrival of Christian missionaries. I have also decided to collaborate with Tanzanian researchers to guide my understanding of the social-ecological dynamics at play.

Finally, to maximize the standardization of coding among the researchers involved, I and several co-authors developed a coding scheme and inter-coder agreement. From my perspective, the process was relatively smooth and free of tension, even though it involved intense discussions that spanned many hours. The collaborative approach enhanced a mutual understanding of the coding scheme, transparency about , and accountability for the coding decisions, reflected in the scientific results.

Access to interviewees

Given Tanzanian's colonial history, and the continued class differences between local people and Western foreigners, being a Western Ph.D. Candidate might have given me easier access to interviewees and allowed me to establish a supporting network that would not be immediately available to others. Within the author team, we discussed this as a privilege that I was granted but could not actively control. It was ultimately the interviewee who determined whether this part of my identity positively affected their trust in me and their willingness to support or participate in the study. Their final decision might have been motivated by hopes for 'a positive outcome' by interacting with me.

Interviewer – interviewee interaction

During interviews, I intended to create a space where the interviewees felt empowered to share their perspectives, knowing that their insights are valued and respected. I viewed the interviewees as being knowledgeable based on their lived experiences and capable of understanding the interview questions and articulating their relationships with nature. I was interested in capturing their honest response to my questions and minimizing how the questions and how I asked them might have 'directed' their response. I understood my role as an interviewer as a passive listener to the responses of the interviewees; I listened to them with curiosity and open-mindedness. This is not to suggest that the interview situation was entirely unaffected by me or our interaction. However, I made an effort to minimize my influence by, for instance, refraining from imposing words on the interviewee. Instead, I focused on attentively listening to what they said and encouraged them to express their thoughts in their own words, rather than sharing or imposing my interpretation on them A role and skill that (in my case) have been fundamentally deepened by my professional non-academic training. According to our protocol, we asked interviewees to express themselves freely and stated that there were no right and wrong answers before any data was collected. I trusted their ability and confidence to do so.

I am particularly mindful of the power dynamics that arise from my position as a Western researcher and the implications this has for knowledge production. My assumptions of

‘confident’ and ‘independent’ interviewees and being a passive listener was challenged by some interviewees, particularly by tour guides. I experienced that interviewees asked me during or after the interview whether the answers they provided were correct and aligned with what I wanted to hear. This led to confusion on my end because I had stated that I wanted to hear their opinion. Reflecting on it, I wondered whether these interviewees might not have perceived the interview setting as a ‘casual’ conversation that was free from desired or expected responses, as I had intended. Rather, they might have perceived the interview as an exam in which right and wrong responses were possible. Because of these experiences, I cannot guarantee that the results presented in this study are unaffected by a social desirability bias, especially a willingness to please the interviewer, and/or pressure to provide correct answers. Additionally, I was sometimes unsure whether tour guides perceived me in the role of a researcher or whether they implicitly hoped for ‘a positive outcome’, i.e., that I would become their client, especially if only the answers they provided were correct. In such a context, I was confronted with my power-laden and hence, imbalanced relationship with some interviewees, assumingly as a byproduct of my comparatively privileged background. Such factors were difficult or even impossible for me to control or avoid and yet, might have biased the responses and hence, impacted the validity of the results.

Supporting Material S5 Additional results

Table S5.1 Socio-demographic attributes

Table S5.1 Information on socio-demographic attributes of all interviewees and each social actor. The countries were classified as Global North or Global South *sensu* Finance Center for South-South Cooperation (Finance Center for South-South Cooperation 2015). The sample included one tour guide and two tourists with their place of childhood from two different countries. *n* number of respondents; % relative share of respondents; / data not collected; *NA* not available, *various unknown* grew up in various unknown countries.

Socio-demographic attribute	**Level of variable**	**All interviewees (n = 86)**		**Nature conservationists (n = 28)**		**Tour guides (n = 20)**		**Tourists (n=38)**	
		n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Gender	Female	32	37%	8	29%	6	30%	18	48%
	Male	54	63%	20	71%	14	70%	20	52%
	Diverse	0	0%	/		/		0	0%
Country of place of childhood	Australia	3	4%					3	7.5%
	Austria	1	1%					1	2.5%
	Bhutan	1	1%					1	2.5%
	Bulgaria	1	1%			1	4.8%		
	Canada	2	3%					2	5%
	Congo	1	1%			1	4.8%		
	Croatia	1	1%					1	2.5%
	Ecuador	1	1%					1	2.5%
	Germany	11	13%	4	14%	2	9%	5	12.5%
	Israel	1	1%					1	2.5%
	Italy	1	1%					1	2.5%
	Kenya	1	1%					1	2.5%
	Kyrgyzstan	1	1%					1	2.5%
	Namibia	1	1%			1	4.8%		
	Netherlands	1	1%					1	2.5%
	Saudi Arabia	1	1%					1	2.5%
	South Africa	4	5%	1	4%			3	7.5%
	Spain	1	1%					1	2.5%
	Switzerland	2	3%			2	9%		

Socio-demographic attribute	Level of variable	All interviewees (n = 86)		Nature conservationists (n = 28)		Tour guides (n = 20)		Tourists (n=38)	
		n	%	n	%	n	%	n	%
	Tanzania	36	40%	23	82%	12	58 %	1	2.5%
	UK	2	3%			1	4.8%	1	2.5%
	USA	13	14%			1	4.8%	12	30%
	various unknown	1	1%					1	2.5%
	NA	1	1%					1	2.5%
Location of place of childhood	Global North	39	44%	4	14%	7	33%	28	70%
	Global South	48	54%	24	86%	14	67%	10	25%
	unknown	1	1%					1	2.5%
	NA	1	1%					1	2.5%
Formal education	Primary or secondary education	10	12%	3	11%	5	25%	2	5%
	College diploma / vocational training	16	19%	4	14%	5	25%	7	18%
	Undergraduate degree	32	37%	9	32%	5	25%	18	47%
	Postgraduate degree and Ph.D.	25	29%	12	43%	3	15%	10	26%
	NA	3	3%			2	10%	1	2%
Frequency of visiting Mount Kilimanjaro				/		/			
	One visit							35	92%
	Two visits							1	3%
	Three visits							1	3%
	Four visits							1	3%
	NA							/	
Age	**Statistical measures**								
	Lowest age	22		29		24		22	
	Highest age	81		73		81		72	
	Average age	46		44		48		45	
	Standard deviation	13.8		13.2		13.5		14.2	

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Appendix 6: Supplementary Material for Chapter IV

Supporting Information S1 Interview guides, survey questionnaire, and material

S1.1 Interview guide for nature conservationists and tour guides

Introduction

First of all, thanks so much for taking the time to participate in this interview.
The interview is structured into three sections. I will start with some general questions about your experience at Mount Kilimanjaro followed by a series of questions on how you value nature at Mount Kilimanjaro. We will finish off the interview with some standard socio-demographic questions about yourself and a few final wrap-up questions.
We 'planned' the interview for 30-45 min. However, please feel free to expand on the topic or talk about related ideas. I have plenty of time but if you need to leave at any point just let me know.
As stated in the consent form, your information will be treated fully confidential. All answers given are anonymous and cannot be traced back to you.
There are no wrong answers to our questions. I am interested in your honest opinion and perspectives. It is ok to say ´I don´t know´ for questions that you are unable to answer. I do not want you to make up answers because you feel you have to.
If there is any question that you are not comfortable answering, please let me know and we can skip it. If you have any questions for me at any point during the interview, please do not hesitate to ask.
Let me know when you are ready and I will start the recording.

'Introductory questions' about interviewee

1. What is your current job title?
    a. Who do you work for?
2. When did you start working as a <insert profession name>?
3. What motivated you to start working as a <insert profession name> ?
4. What does your role as a <insert profession name> involve?
5. Tour guides: Where do you offer guided tours in the Kilimanjaro region for tourists?
    a. How often do you visit the <insert places of tours> ?
    b. Do you enter the National Park? If so, how often?
6. What do you enjoy most about your job? Why?

Questions related to Nature's Contributions to People (NCP)

7. What do you appreciate about nature at Mount Kilimanjaro (We consider the entire mountain area, i.e. from the foothills of the mountain with its agricultural fields and settlements to its top including the national park.?
    a. What do you think other people (who live on, work at and come as tourists to Mount Kilimanjaro) appreciate about nature at Mount Kilimanjaro?
8. What do you use and/or need from nature at Mount Kilimanjaro? Why?
    a. What does your <insert name of (employing) company> use and/or need from nature at Kilimanjaro? Why?
    b. What do you think other people (who live on, work at or come as tourists to Mount Kilimanjaro) use and/or need from nature? Why?
9. Do you think that nature at Mount Kilimanjaro provides benefits to humans? If yes, what are the benefits of nature at Kilimanjaro?
    a. For you?
    b. For your family?
    c. For local communities and society as a whole?
10. What does nature at Mount Kilimanjaro contribute to your well-being and quality of life? Feel free to think about 'well-being' in the broadest sense of the word including

any type or dimension of 'well-being'. This can be related to mental and physical well-being or beyond.
    a. What does nature at Mount Kilimanjaro contribute to (the success of) your tour guiding business/conservation efforts? If so, how so?
    b. Other people (who live on, work at and come as tourists to Mount Kilimanjaro)'s well-being and quality of life?
11. Are there any other contributions and/or benefits of nature at Mount Kilimanjaro to you and other people (who live on, work at and come as tourists to Mount Kilimanjaro) that you can think of?
    a. For example in environmental, economic, social, or cultural terms?
    b. Tour guides: From your point of view, why does nature at Mount Kilimanjaro attract tourists? Which elements of nature attract tourists?
12. Are there any aspects of nature at Mount Kilimanjaro that you find particularly pleasant or beautiful?
    a. Can you describe how and why?
13. What is your most memorable experience of nature at Kilimanjaro?
    a. Can you describe it? What made that experience special?
14. What is your relationship with nature at Mount Kilimanjaro? Would you say you feel connected with nature at Kilimanjaro?
    a. If yes, how and why?
15. What does nature at Mount Kilimanjaro contribute to your quality of life?
16. Has your time working at Mount Kilimanjaro had an impact on your understanding of nature?
    a. If yes, how so?
17. Are there aspects of nature at Kilimanjaro that you find unpleasant or affect you/your work negatively?
    a. Can you describe why it/they affected you and your experience?
18. What threats and/or negative impacts does nature have on your tour operating business/ conservation efforts?
    a. Where do these threats and/or negative impacts occur?
    b. When do these threats and/or negative impacts occur?
19. Do you think nature at Mount Kilimanjaro is important? Why?
    a. Optional, if not addressed before: For you personally? Why?
    b. Optional, if not addressed before: in the role of <insert profession name>? Why?
    c. Optional, if not addressed before: For other people (who live on, work at and come as tourists to Mount Kilimanjaro)? Why?
20. Do you think your work at Mount Kilimanjaro affects nature? How and why? (reciprocal relationship between nature and people)
    a. Positively?
    b. Negatively?
21. Does your work at Mount Kilimanjaro affect your relationship with:
    a. People (who live on, work at and come as tourists to Mount Kilimanjaro)?
22. Do you think conserving nature at Mount Kilimanjaro is important? Why/why not?
    a. Which elements of nature are worth conserving? Why?

Socio-demographic information

A. What is your age?
B. What is your gender? [We learnt it is inappropriate to ask locals for their gender, particularly a diverse gender identity, in the cultural context of the survey. Hence, interviewer inserted the interviewee's gender [female or male]]
C. Where is your company/organization based?
D. How many people work in your company/organization?
E. What is your highest level of formal education?
F. Where do you currently live?

G. Is your current place of residence: urban, semi-urban, or rural?
H. How many years of your life did you live/have you been living in the Mount Kilimanjaro area?
I. Where did you grow up (age: 0-12 years)?

Final questions

That's all the questions I have got for you. Is there anything else you would like to add to the interview? Do you have any questions for me?

Optional, if we still need interviewees: Is there anyone else you know who might be able to participate in this interview?
Thanks so much for your time and for sharing your experience with nature at Mount Kilimanjaro with me. I'll also be in touch with information about the results of this work.

S1.2 Interview guide for tourists

Introduction

First of all, thanks so much for taking the time to participate in this interview.
The interview is structured into three sections. I will start with some general questions about your experience at Mount Kilimanjaro followed by a series of questions on how you value nature at Mount Kilimanjaro. We will finish off the interview with some standard socio-demographic questions about yourself and a few final wrap-up questions.
We 'planned' the interview for 30-45 min. However, please feel free to expand on the topic or talk about related ideas. I have plenty of time but if you need to leave at any point just let me know.
As stated in the consent form, your information will be treated fully confidential. All answers given are anonymous and cannot be traced back to you.
There are no wrong answers to our questions. I am interested in your honest opinion and perspectives. It is ok to say ´I don´t know´ for questions that you are unable to answer. I do not want you to make up answers because you feel you have to.
If there is any question that you are not comfortable answering, please let me know and we can skip it. If you have any questions for me at any point during the interview, please do not hesitate to ask.
Let me know when you are ready and I will start the recording.

'Introductory questions' about interviewee

1. When did you visit Mount Kilimanjaro (month and year)?
    a. Is that the only time you have been?
    b. How long was your visit/s? (number of days) (record for all visits)
2. Were you alone or did you go with others? If yes, with who? (record for all visits)
3. Did you enter the National Park? (record for all visits)
    a. If they climbed, did you climb to the top? (record for all visits)
    b. If they climbed, would you call yourself an experienced climber?
4. Why did you decide to visit Mount Kilimanjaro? (record for all visits)
5. What were your expectations before visiting Mount Kilimanjaro? (record for all visits)
6. Did Mount Kilimanjaro meet your expectations? Why and how /why not? (record for all visits)

Questions related to Nature's Contributions to People (NCP)

7. a. What did you appreciate about nature at Mount Kilimanjaro? (Our questions refer to when you visited Mount Kilimanjaro and your perception afterwards).
   b. What do other people appreciate? These examples can be either things you've witnessed personally or that you've heard from other people.
8. What did nature at Mount Kilimanjaro contribute to

   a. your well-being? Feel free to think about 'well-being' in the broadest sense of the word including any type or dimension of 'well-being'. This can be related to mental and physical well-being or beyond.
   b. other people's well-being?
9. What are some other contributions and/or benefits of nature at Mount Kilimanjaro to you and other people that you can think of?
   a. For example, in environmental, economic, social or cultural terms?
10. a. Which of these contributions and/or benefits did you personally desire (and were you looking forward to), when travelling Mount Kilimanjaro? Why?
    b. Were there any contributions or aspects of nature that you were hoping to experience but did not get to at Mount Kilimanjaro?
11. Do you think nature at Mount Kilimanjaro is important? Why?
    a. Optional, if not addressed before: For you personally? Why?
    b. Optional, if not addressed before: For others? Why?
12. Did your experience at Mount Kilimanjaro have an impact on your relationship with:
    a. The members of your travel group [specify based on Q2]?
    b. Local people?
    c. If yes, how so?
13. Did your experience at Mount Kilimanjaro have an impact on your understanding of nature?
    a. If yes, how so?
14. Are there aspects of nature at Kilimanjaro that you found unpleasant or affected your experience negatively?
    a. Can you describe why it/they affected you and your experience?
15. Do you think your experience at Mount Kilimanjaro affected nature? How and why?
    a. Positively?
    b. Negatively?
16. Do you think conserving nature at Mount Kilimanjaro is important? Why/why not?
17. Let's imagine we can turn back time and you want to climb to the top of Mount Kilimanjaro for the first time. You have got two options: hiking up yourself or using an excellent virtual reality tool at home. Which one would you choose?
    a. Why would you make this decision? Why does one option matter to you more than the other?
    b. What's gained and what's lost?

Socio-demographic information

A. What is your age?
B. What is your gender?
C. What do you do for a living?
D. What is your highest level of formal education?
E. Where do you currently live?
F. Is your current place of residence: urban, semi-urban, or rural?
G. Have you always lived there? If not, where did you grow up as a child?
H. Was your place of residence, when you grew up, childhood (0-12 years): urban, semi-urban, rural, or multiple, in case you moved?

Final questions

That's all the questions I have got for you. Is there anything else you would like to add to the interview? Do you have any questions for me?

Optional, if we still need interviewees: Is there anyone else you know who might be able to participate in this interview?

S1.3 Interview guide for famers

Please note: The interview guide was translated into English to align with the language of this work, while the interviews with famers were conducted in Swahili, see text in parentheses.

'Introductory questions' about interviewee

1. What is your current job (confirm job title if already pre-discussed with interviewee)? Kazi yako ya sasa (thibitisha cheo cha kazi ikiwa tayari imejadiliwa kabla ya kuhojiwa)?
2. Are you self-employed, or do you work for a farming organization? Je, umejiajiri, au unafanya kazi kwa shirika/kikundi cha kilimo?
3. In how many farms are you working? And where are they? Ni katika mashamba mangapi unafanya kazi? Na yako wapi?
4. Do you own the farm/s? Or is it shared? Je, unamiliki shamba au mashamba? Au ni ya kushirikiana?
5. When did you start working as a <insert profession name>? Ni lini ulianza kufanya kazi hii kama < weka jina la taaluma>?
6. What do you enjoy most about your job? Why? Je, Unapenda nini zaidi kutokana na kazi yako? Kwanini?

Questions related to Nature's Contributions to People (NCP)

7. What do you use and/or need from nature at Kilimanjaro (considering the entire mountain area, i.e., from the foothills of the mountain with its agricultural fields and settlements to its top, including the national park and the land where you live)? Why? Unahitaji au unatumia nini kutoka katika mazingira ya mlima Kilimanjaro (kwa kuzingatia eneo lote la mlima, yaani kutoka maeneo ya mabondeni, mashamba ya kilimo na makazi hadi kileleni, ikiwa ni pamoja na Hifadhi ya Taifa na eneo la ardhi unapokaa)? Kwanini?
    a. What about your family? Vipi kuhusu familia yako?
    b. Your community? Jamii yako?
8. What do you appreciate the most about nature at Mount Kilimanjaro and its surroundings? Unathamini nini zaidi kuhusu uasili na mfumo mzima wa mazingira ya Mlima Kilimanjaro?
    a. What about your family? Vipi kuhusu familia yako?
    b. Your community? Jamii yako?
9. Do you think that nature at Mount Kilimanjaro provides benefits to humans? If yes, what are the benefits of nature at Kilimanjaro?
   Je, unadhani kwamba uasili na mfumo mzima wa mazingira ya Mlima Kilimanjaro hutoa faida kwa binadamu? Kama ndiyo, ni faida gani kutoka uasili katika mazingira ya Kilimanjaro?
    a. What about your family? Vipi kuhusu familia yako?
    b. Your community? Jamii yako?
10. What does nature at Mount Kilimanjaro contribute to your well-being and quality of life? Feel free to think about 'well-being' in the broadest sense of the word, including any type or dimension of 'well-being'. This can be related to mental and physical well-being or beyond.
    Uasili na mazingira ya Mlima Kilimanjaro yanachangia nini katika ustawi na ubora wa maisha yako? Jisikie huru kufikiri juu ya 'ustawi' kwa maana pana zaidi ya neno, ikiwa ni pamoja na aina yoyote au mwelekeo wa 'ustawi'. Hii inaweza kuhusiana na ustawi wa akili na kimwili au zaidi.
    a. What about your family? Vipi kuhusu familia yako?
    b. Your community? Jamii yako?
11. Do you think nature at Mount Kilimanjaro is important? Why?
    Je, unafikiri uasili wa Mlima Kilimanjaro ni muhimu? Kwanini?
    Optional, if not addressed before: Hiari; ikiwa haijajibiwa hapo awali:
    a. For you personally? Why? Kwa wewe binafsi? Kwanini?

   b. For your family? Why? Kwa familia yako? Kwanini?
   c. For your community? Why? Kwa jamii yako? Kwanini?

Socio-demographic information

12. Would you like to tell us your age? Je, ungependa kutuambia umri wako?
13. (Age ranges: <21, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, > 81)
14. What is your gender? [We learnt it is inappropriate to ask locals for their gender, particularly a diverse gender identity, in the cultural context of the survey. Hence, interviewer inserted the interviewee's gender [female or male]]
15. What is the highest level of formal education that you have achieved?
16. Ni kiwango gani cha juu cha elimu ambacho umefanikiwa kukipata?
    a. No formal education. Elimu isiyo rasmi
    b. Primary school education. Elimu ya Shule ya msingi
    c. Secondary school education. Elimu ya shule ya sekondari
    d. Tertiary education (e.g., college, university). Elimu ya juu (chu cha ufundi, chou kikuu)
    e. How many years of your life did you live/have you been living in the Mount Kilimanjaro area? Umeishi katika eneo la Mlima Kilimanjaro kwa miaka mingapi ya maisha yako?
17. Where did you grow up (age: 0-12 years)? Umekulia wapi ulipokuwa na umri wa miaka 0-12?

S1.4 Survey questionnaire and material

Introductory paragraph

Nice to meet you. My name is [your name] and I am a [professor, postdoctoral researcher, PhD student, field assistant] in the Kili-SES research project. We would like to thank you for taking the time to participate in this survey. The survey is part of a scientific project, funded by the German Research Foundation. By taking part in this survey, you are making a valuable contribution to improve the understanding of the interaction between people and nature at Kilimanjaro. We planned the survey for one hour. Based on pre-tests we experienced that it might take a little longer. We don't want you to feel rushed. So please take your time! Is that okay for you or do you have to leave earlier, at a specific time [If the time is limited, please watch the time and make sure that you don't rush but move on to the sections Socio-demographics and Thank you 5-10 minutes before the participant has to leave]? Please note that for most of the questions there is no right or wrong answer. We are interested in your opinion. If there is any question you feel uncomfortable answering, please let us know. You are always free not to answer. If you have any questions at any point during the survey, please don't hesitate to ask.

[Respondent with appointment and received explanation form and declaration of consent through email from Milena Gross:]
Milena Gross sent you the detailed explanation form and declaration of consent form (Supporting Information S4) via email beforehand. Those documents state the information I just shared with you in even more depth. Do you need to read them again? [If no, continue. If yes, provide the explanation form and declaration of consent.] Do you have any questions? [If no, continue. If yes, please answer the questions.] To make sure you can make use of all rights stated in the documents, I would like to give you your ID card now [Give ID card to the participant]. Your information will be treated fully confidential. All your answers given are recorded anonymously and cannot be traced back to you. We don't record any personal data, e.g., name and email address, together with your responses. If you want to withdraw your answers after the survey, we can delete them, if you email Milena Gross and state your ID. Your ID is [Read the number out loud.] and is written down here [Show number on ID card.]. We recommend taking a photo of the ID card. In case you lose it for example, you can still make use of your rights.

Before starting the survey, we would like to ask for your consent to participate in this survey. Please do this by signing on the tablet.
[Select yes for the participation question below and let participant sign on the signature field.]

[No appointment with respondent and no explanation form and declaration of consent through email from Milena Gross:]
We prepared a detailed explanation form and declaration of consent form that state the information I just shared with you in even more depth. Do you need to read them? [If no, continue. If yes, provide explanation form and declaration of consent.] Do you have any questions? [If no, continue. If yes, please answer the questions]. If you want to receive a digital copy of these two documents, my colleague Milena Gross is happy to email them to you. Milena Gross' email is written down on your ID Card [Give ID card to participants.]. There are more purposes to this ID Card, that is, to make sure you can make use of all rights stated in the documents. As stated, your information will be treated fully confidential. All your answers given are recorded pseudo-anonymously and cannot be traced back to you. We don't record any personal data, e.g., name and email address, together with your responses. Therefore, if you want to withdraw your answers after the survey, we can delete them, if you email Milena Gross and state your ID. Your ID is [Read the number out loud] and is written down here [Show

number on ID card]. Before starting we would like to ask for your consent to participate in this survey. Do you want to participate?

- Yes
- No

Social actor determined by the first author before the start of the survey

Which social actor does the respondent belong to? Nature conservationists, Tour guide, Tourist

Activities specific for tourists

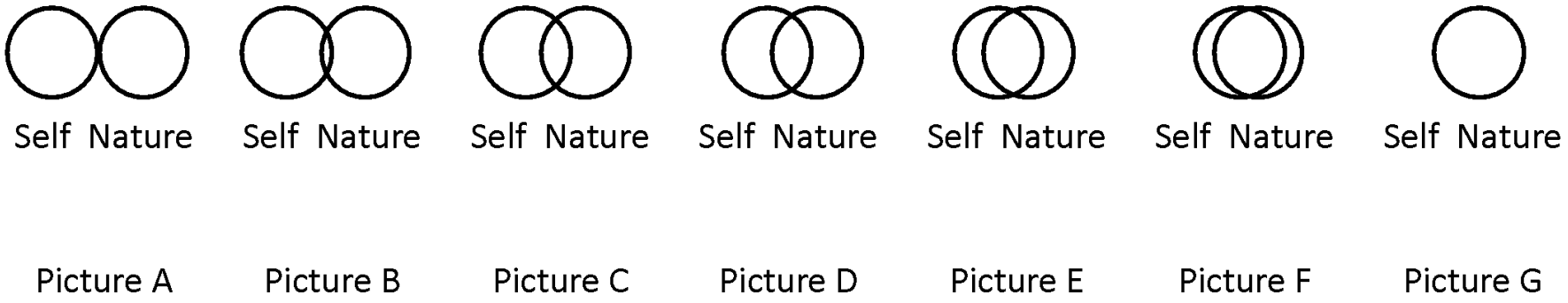
How many times have you visited Kilimanjaro (from lowlands to Uhuru peak, i.e., beyond the border of the national park) (including this trip)? *[Variable: Number of visits to Kilimanjaro]*

Which activities have you taken part in or do you intend to do at Kilimanjaro? Please name the letter(s) and activity/ies. *[Variables: Activities and Bio-cultural activities]*

A. Hike up (to the top of) Mount Kilimanjaro in a multiple day tour
B. A recreational one-day tour on Mount Kilimanjaro within the national park
C. A recreational one-day tour on Mount Kilimanjaro outside the national park, e.g., hiking to a waterfall
D. Recreational multiple day tour on Mount Kilimanjaro outside the national park, e.g., Kilimanjaro friendship trail
E. Coffee tour
F. Cultural tour
G. Visiting a Chagga village/home garden and learning about/experiencing the Chagga culture
H. Relaxing at the hot springs
I. Recreational activity/ies at Lake Chala
J. Recreational activity/ies in Rau Forest
K. Wildlife watching at Mount Kilimanjaro
L. Enjoying hotel retreat at Mount Kilimanjaro
M. Other

Relationship with nature

Now, [Present scale to respondent.] I am presenting a scale to you that describes relationships with nature. The right circle represents nature and the left circle represents you. Picture A describes a relationship in which you and nature are completely separate. Picture G describes a relationship in which you and nature are one. The pictures in between, that is pictures B to F, display a gradient with an increasing relationship/overlap between you and nature in the pictures from left to right. I would like to ask you which picture best describes your relationship with nature. Please show the picture or read out the name of the picture. *[Variable: Closeness to nature]*



Interactive exercise on preferences for Nature's Contributions to People (NCP)

We are interested in contributions you gain from nature at Kilimanjaro (from lowlands to Uhuru peak, i.e., beyond the border of the national park) which are important for you and your life [For Swahili-speaking respondents, nature understood as mazingira asili]. We have identified 25 contributions through interviews with people who live on, work at, or visited Kilimanjaro [Provide set A/B/C (software randomly selects a set) to the participant.]. I would like to show you a list with these 25 identified contributions. [Show column "name"!] We added examples that interviewees mentioned for each of the contributions [Show column "examples".], and example pictures that represent them [Show column "exemplary photos".]. You can ignore the letters [Point a first column with letters.]. They don't have a ciit for you but help us to correctly insert your responses.

Step 1: Please carefully read the list and select up to five contributions according to their importance for you and your life. Which are the five most important contributions – important for you and your life? If you need some aid to memory, feel free to take the pen and add some symbols/comments. When you have finished your selection, please name the contributions you have selected, so we can proceed. Please take your time reading through the list and then read out the contributions you selected [1. Pick the selected NCP cards mentioned by the participant from the set of all NCP cards (plastic sleeve). 2. Put the NCP set sheets aside to have space for the next step. 3. Provide ranking template.].

Step 2: Now that you selected the five most important contributions, I would like you to arrange these selected contributions in the form of these cards [Show the five cards with the selected contributions.] in order of importance placing the most important card here [Show where to place the card on the template.] at the top and the least important among those selected contributions here [Show where to place the card on the template.] at the bottom.

Step 3: Now that you ranked the contributions, I would like you to specify the importance of each contribution by distributing up to 100 points to each selected contribution. 100 points represent the highest importance for you and your life and one point represents the lowest importance for you and your life based on this point scale. This means, the contribution on the top [Point at card on the top.] will get the highest number of points and the following ranks will get lower numbers with the contribution at the bottom getting the lowest number of points [Point at card at the bottom.]. You can't give the same number of points to two contributions and they don't have to add up to a specific sum in the end. If you need to reorder the contributions, when you distribute the points, please feel free to do so.

Let's start with the contribution that you placed, so the most important contribution for you and your life. How many points on a scale from 1 to 100 would you distribute here [Point at card on the top.] to show the importance of this contribution to you and your life? Take the pen and write down the numbers yourself [Check correct distribution of points at the end of this task.]. *[Variable: NCP points]*

SET A

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
A	**Habitat creation and maintenance**	• Habitat for animals • Habitat for people • Forest is home to animals and plants • Elephants as architects of the ecosystem		
B	**Pollination**	• Pollination by insects such as bees • Pollination by birds		
C	**Dispersal of seeds**	• Seed dispersal by animals, for example elephants and birds		
D	**Regulation of air quality**	• Fresh and clean air • Nature, e.g., plants, trees, provides oxygen		
E	**Regulation of climate**	• Carbon sink and sequestration • Shade for temperature or moisture control • Microclimate of Kilimanjaro • Pleasant and nice weather of Kilimanjaro		
F	**Regulation of freshwater quantity**	• Rainfall • Water flow in catchments, lakes, streams or rivers • Glaciers producing water		
G	**Regulation of freshwater quality**	• Nature improves the quality of the water • Drinking, clean and safe water		

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
H	**Regulation of soil fertility and protection of soils**	• Fertile and rich soil • Nutrients in the soil • Planting trees to prevent soil erosion		
I	**Regulation of hazards and extreme events**	• Trees help to prevent landslides • Trees as windbreakers • Without nature, there will be droughts [dry periods]		
J	**Regulation of detrimental species**	• Disease prevention • Less mosquitoes in higher elevation • Bees deter elephants • Plant used to catch the mole rat		
K	**Energy**	• Firewood • Charcoal • Hydropower		
L	**Food**	• Crops for eating such as fruit and vegetables • Coffee • Animal products such as milk, meat, honey etc. • Mbege [banana beer]		
M	**Feed**	• Fodder • Grass for livestock animals such as cows, goats etc. • Food scraps such as banana peels for livestock		
N	**Materials for building and construction**	• Raw materials to build infrastructure • Timber as building material for, e.g., sheds and houses • Rock as construction material		

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
O	**Materials for domestic use**	• Timber to make furniture • Banana materials used for beds, roof of houses, baskets, umbrellas, seed base, etc. • Jewellery made from oyster nut shells • Lianas used as ropes		
P	**Medicine**	• Nature used for medicinal purposes • Medicinal honey from stingless bees • Traditional medicine		
Q	**Learning**	• Improved knowledge and understanding • Cultural exchange • Influence on life perspective • Personal or emotional growth		
R	**Aesthetic enjoyment**	• Nature is beautiful • Visually pleasant scenery • Picturesque and incredible views • The beauty of the mountain		
S	**Recreation**	• Animal-watching • Camping • Swimming • Hiking, walking or exercising		
T	**Therapeutic and restorative benefits from / in nature**	• Break from technology and modern life • Healing • Peace and solitude • Relaxation and stress-relief		

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
U	**Social cohesion and bonding in nature**	• Social relations with other people • Bonding and comradery • Community building • Friendship or family ties		
V	**Cultural heritage and identity through nature**	• Ancestral ties • Cultural identity • Local, traditional and Indigenous heritage • Sacred places		
W	**Connected-ness with nature**	• Emotional, physical or spiritual connection with nature • Being ´one with´ nature and/or feeling like part of it • Friendship, family ties or other relationship with nature, e.g., the trees are my best friends		
X	**Inter-generational benefits**	• Continued existence of biodiversity • Conservation of benefits for future generations • I want my children and grandchildren to see the beauty of nature • Preserve nature for future generations		
Y	**New and unique experiences**	• Nature´s uniqueness • Diversity of ecosystems on one mountain • Snow and glaciers in the tropics • I have never experienced nature like this before		

SET B

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
Y	**New and unique experiences**	• Nature´s uniqueness • Diversity of ecosystems on one mountain • Snow and glaciers in the tropics • I have never experienced nature like this before		
X	**Inter-generational benefits**	• Continued existence of biodiversity • Conservation of benefits for future generations • I want my children and grandchildren to see the beauty of nature • Preserve nature for future generations		
U	**Social cohesion and bonding in nature**	• Social relations with other people • Bonding and comradery • Community building • Friendship or family ties		
V	**Cultural heritage and identity through nature**	• Ancestral ties • Cultural identity • Local, traditional and Indigenous heritage • Sacred places		
W	**Connected-ness with nature**	• Emotional, physical or spiritual connection with nature • Being ´one with´ nature and/or feeling like part of it • Friendship, family ties or other relationship with nature, e.g., the trees are my best friends		
S	**Recreation**	• Animal-watching • Camping • Swimming • Hiking, walking or exercising		

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
R	**Aesthetic enjoyment**	• Nature is beautiful • Visually pleasant scenery • Picturesque and incredible views • The beauty of the mountain		
T	**Therapeutic and restorative benefits from / in nature**	• Break from technology and modern life • Healing • Peace and solitude • Relaxation and stress-relief		
Q	**Learning**	• Improved knowledge and understanding • Cultural exchange • Influence on life perspective • Personal or emotional growth		
P	**Medicine**	• Nature used for medicinal purposes • Medicinal honey from stingless bees • Traditional medicine		
M	**Feed**	• Fodder • Grass for livestock animals such as cows, goats etc. • Food scraps such as banana peels for livestock		
N	**Materials for building and construction**	• Raw materials to build infrastructure • Timber as building material for, e.g., sheds and houses • Rock as construction material		

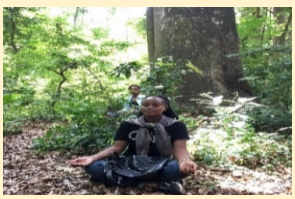
	NAME	EXAMPLES	EXEMPLARY PHOTOS	
O	**Materials for domestic use**	• Timber to make furniture • Banana materials used for beds, roof of houses, baskets, umbrellas, seed base, etc. • Jewelry made from oyster nut shells • Lianas used as ropes		
L	**Food**	• Crops for eating such as fruit and vegetables • Coffee • Animal products such as milk, meat, honey etc. • Mbege [banana beer]		
K	**Energy**	• Firewood • Charcoal • Hydropower		
F	**Regulation of freshwater quantity**	• Rainfall • Water flow in catchments, lakes, streams or rivers • Glaciers producing water		
H	**Regulation of soil fertility and protection of soils**	• Fertile and rich soil • Nutrients in the soil • Planting trees to prevent soil erosion		
G	**Regulation of freshwater quality**	• Nature improves the quality of the water • Drinking, clean and safe water		

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
A	**Habitat creation and maintenance**	• Habitat for animals • Habitat for people • Forest is home to animals and plants • Elephants as architects of the ecosystem		
J	**Regulation of detrimental species**	• Disease prevention • Less mosquitoes in higher elevation • Bees deer elephants • Plant used to catch the mole rat		
I	**Regulation of hazards and extreme events**	• Trees help to prevent landslides • Trees as windbreakers • Without nature, there will be droughts [dry periods]		
B	**Pollination**	• Pollination by insects such as bees Pollination by birds		
E	**Regulation of climate**	• Carbon sink and sequestration • Shade for temperature or moisture control • Microclimate of Kilimanjaro • Pleasant and nice weather of Kilimanjaro		
D	**Regulation of air quality**	• Fresh and clean air Nature, e.g., plants, trees, provides oxygen		
C	**Dispersal of seeds**	• Seed dispersal by animals, for example elephants and birds		

SET C

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
N	**Materials for building and construction**	• Raw materials to build infrastructure • Timber as building material for, e.g., sheds and houses • Rock as construction material		
O	**Materials for domestic use**	• Timber to make furniture • Banana materials used for beds, roof of houses, baskets, umbrellas, seed base, etc. • Jewelry made from oyster nut shells • Lianas used as ropes		
P	**Medicine**	• Nature used for medicinal purposes • Medicinal honey from stingless bees • Traditional medicine		
L	**Food**	• Crops for eating such as fruit and vegetables • Coffee • Animal products such as milk, meat, honey etc. • Mbege [banana beer]		
M	**Feed**	• Fodder • Grass for livestock animals such as cows, goats etc. • Food scraps such as banana peels for livestock		
K	**Energy**	• Firewood • Charcoal • Hydropower		

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
J	**Regulation of detrimental species**	• Disease prevention • Less mosquitoes in higher elevation • Bees deter elephants • Plant used to catch the mole rat		
I	**Regulation of hazards and extreme events**	• Trees help to prevent landslides • Trees as windbreakers • Without nature, there will be droughts [dry periods]		
E	**Regulation of climate**	• Carbon sink and sequestration • Shade for temperature or moisture control • Microclimate of Kilimanjaro • Pleasant and nice weather of Kilimanjaro		
G	**Regulation of freshwater quality**	• Nature improves the quality of the water • Drinking, clean and safe water		
H	**Regulation of soil fertility and protection of soils**	• Fertile and rich soil • Nutrients in the soil • Planting trees to prevent soil erosion		
D	**Regulation of air quality**	• Fresh and clean air • Nature, e.g., plants, trees, provides oxygen		

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
B	**Pollination**	• Pollination by insects such as bees • Pollination by birds		
C	**Dispersal of seeds**	• Seed dispersal by animals, for example elephants and birds		
A	**Habitat creation and maintenanc e**	• Habitat for animals • Habitat for people • Forest is home to animals and plants • Elephants as architects of the ecosystem		
F	**Regulation of freshwater quantity**	• Rainfall • Water flow in catchments, lakes, streams, or rivers • Glaciers producing water		
V	**Cultural heritage and identity through nature**	• Ancestral ties • Cultural identity • Local, traditional and Indigenous heritage • Sacred places		
U	**Social cohesion and bonding in nature**	• Social relations with other people • Bonding and comradery • Community building • Friendship or family ties		
T	**Therapeutic and restorative benefits from / in nature**	• Break from technology and modern life • Healing • Peace and solitude • Relaxation and stress-relief		

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
W	**Connected-ness with nature**	• Emotional, physical or spiritual connection with nature • Being ´one with´ nature and/or feeling like part of it • Friendship, family ties or other relationship with nature, e.g., the trees are my best friends		
S	**Recreation**	• Animal-watching • Camping • Swimming • Hiking, walking or exercising		
X	**Inter-generational benefits**	• Continued existence of biodiversity • Conservation of benefits for future generations • I want my children and grandchildren to see the beauty of nature • Preserve nature for future generations		
Y	**New and unique experiences**	• Nature´s uniqueness • Diversity of ecosystems on one mountain • Snow and glaciers in the tropics • I have never experienced nature like this before		
Q	**Learning**	• Improved knowledge and understanding • Cultural exchange • Influence on life perspective • Personal or emotional growth		
R	**Aesthetic enjoyment**	• Nature is beautiful • Visually pleasant scenery • Picturesque and incredible views • The beauty of the mountain		

Ranking template

Contributions	Rank	Points
	1	<Note: You can provide max. 100 points for the contribution at rank 1.>
	2	<Note: You are asked to distribute less points than for the contribution at rank 1.>
	3	<Note: You are asked to distribute less points than for the contribution at rank 2.>
	4	<Note: You are asked to distribute less points than for the contribution at rank 3.>
	5	<Note: You are asked to distribute less points than for the contribution at rank 4.>

General environmental behavior and socio-demographics

Have you ever been inside Kilimanjaro National Park? *[Variable: Visited Kilimanjaro National Park]*
On a regular weekday, how much percent of your time do you spent in nature (excluding the time spent sleeping) [Present scale to respondent.]? By nature, we mean the natural environment including cultivated setting such as domestic gardens and urban greenspaces. *[Variable: Time in nature during the week]*

☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

On a regular weekend day, how much percent of your time do you spent in nature (excluding the time spent sleeping) [Present scale to respondent.]? By nature, we mean the natural environment including cultivated setting such as domestic gardens and urban greenspaces. *[Variable: Time in nature on the weekend]*

☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

Have you visited any protected area (excluding Kilimanjaro National Park) during the last 12 months? *[Variable: Visited a protected area]*

specific for tourists
In which year were you born? *[Variable: Age]*
What is your nationality? *[Variables: Region of nationality, Location of nationality, Tanzanian citizen]*
What is your highest level of formal education? *[Variable: Formal education]*
If I may ask, what is your gender? Male, Female, Diverse, or You don't want to answer the question. *[Variable: Gender]*

specific for nature conservationists and tour guides
In which year were you born? *[Variable: Age]*
What is your nationality? *[Variables: Region of nationality, Location of nationality, Tanzanian citizen]*
Have your parents lived in Kilimanjaro? *[Variable: Kilimanjaro's local communities]*
What is your highest level of formal education? *[Variable: Formal education]*

Thank you!

That's the end of the survey! Thank you for participating in our research project! We highly appreciate your contribution. If you would like to receive a summary of the results, please email Milena Gross. Her email address is stated on the ID card that I gave you before the survey.
[Please ask this question only, if we still need more participants of the social actor:] Is there anyone else you know who visits Kilimanjaro as a tourist, works as a tour guide or nature conservationist and might be able to participate in this survey?

specific for nature conservationists and tour guides; determined by survey taker after the survey was finished
We learnt it is inappropriate to ask locals for their gender, particularly a diverse gender identity, in the cultural context of the survey. Hence, survey taker inserted gender [female or male] of survey respondent after survey was finished. *[Variable: Gender]*

Supporting information S2 Additional information on data collection and analysis

Interview collection and analysis

We created interview guides to facilitate a face-to-face semi-structured conversation between the interviewee, i.e., a representative of one of the four social groups, and a researcher or a local research assistant. The interview guide entailed open-ended questions about the interviewee's experience with nature at Mount Kilimanjaro, open-ended questions on Nature's Contributions to People (NCP), and questions on socio-demographics (interview guides in S1.1-S1.3). Open-ended questions, as used in our interviews, allow interviewees to respond how they want and express their relationship with nature in their own words. In turn, such an approach allows the researchers to investigate a research theme more holistically (Bryman, 2016). In our case, we could identify context-specific NCP and interviewees' perceptions to contextualize survey prompts. Therefore, we phrased NCP-related questions in a general manner but used different words to evoke responses for the different NCP (groups), such as *appreciate*, *benefit*, *contributing to well-being/quality of life*, and *importance of nature*, and addressed beneficiaries, i.e., the interviewee and/or other people who reside on, work at and come as tourists to Mount Kilimanjaro. To minimize biased answers, we did not ask questions that targeted specific NCP. Former tourists and famers supported the pre-testing of the interview guides.

We gathered 130 interviews between May 2021 and March 2022 after obtaining ethical approval from the university of the first author and research permits from the Tanzanian institutions at the national, regional, district, and local levels, other authorities such as the first warden of the Kilimanjaro National Park Authority (KINAPA Authority) and tour guides and agents. We also obtained oral or written consent from interviewees prior to each interview. To cover a broad social heterogeneity, we targeted representatives of four social actors who were 18 years of age or older: famers (n=44), nature conservationists (n= 28 interviewees), tour guides (n= 20), and tourists (n=38) (Table S2.1). We interviewed all tourists and five tour guides online, while interviews with additional tour guides and all famers and nature conservationists happened in different locations at or near Mount Kilimanjaro (Fig. S2.1). We interviewed famers in Swahili and interviewees of the other social actors in English. The duration of the interviews varied between 20 minutes and three hours. The actual duration of our interviews was shorter because several researchers of the Kili-SES research unit (https://kili-ses.senckenberg.de/jointly collected data to reduce the potential fatigue of the interviewees.

We transcribed all recorded interviews. One local co-author and two local research assistants who are native Swahili speakers and hence, could account for potential language barriers and local understanding translated the interviews with the famers to English. We imported the English transcripts and the notes of one interview – one tourist interviewee did not consent to record the interview – into MAXQDA 2022 (VERBI software, 2021), a software program to analyze qualitative data (Kuckartz & Rädiker, 2019).

We conducted a content analysis to categorize context-specific NCP, developing a coding framework through an inductive-deductive process. While we were guided by the broad perspective of the NCP framework (inductive), we meticulously considered how nature contributed to people's quality of life to capture context-specific NCP (deductive process). Initially, we identified context-specific NCP from a subset of interviews to formulate a preliminary coding framework. This framework was then iteratively refined as we applied it to the remaining interviews to account for the emergence of additional context-specific NCP. Eventually, we established a comprehensive coding framework comprising 25 context-specific NCP. Additionally, we described these context-specific NCP by integrating definitions from previous studies (Díaz et al., 2018; Pearson et al., 2024) and incorporating terminology used by the interviewees (Table 1). Furthermore, we employed an interwoven approach to link context-specific NCP with NCP of the generalizing perspective (Hill

et al., 2021). All identified context-specific NCP correlated with the generalizing perspective, except for the NCP new and unique experiences.

During the coding process, we observed that interviewees often articulated final benefits rather than the intermediate regulating benefits proposed by Díaz et al. (2018). For instance, references were made to fresh air or clean water rather than the actual processes of air and water purification. Recognizing that many interviewees were neither non-native English speakers nor (natural) scientists, we coded these expressed final services of regulating NCP accordingly.

Coding was a collaborative endeavor involving the first -author, multiple co-authors, and research assistants who trained together to identify context-specific NCP. Initially, we individually applied the coding framework to three interviews, then compared and discussed our results to resolve any discrepancies, establishing an ongoing inter-coder agreement. Throughout the process, we addressed challenging instances and refined our inter-coder agreement accordingly.

Table S2.1 Overview of sampling characteristics of the interviewed social actors. *n* sample size. *CBOs* community-based organizations; *KINAPA* Kilimanjaro National Park Authority; *NGOs* non-governmental organizations.

	Famers(n=44)	**Nature conservationists (n=28)**	**Tour guides (n=20)**	**Tourists (n=38)**
Definition of social actors	Famers residing in 15 villages (Fig. S2.1) that were distributed along an altitudinal gradient according to three agro-ecological zones (Soini 2005) and a three-level latitudinal gradient based on the districts, i.e., West (Siha and Hai districts), Central (Moshi Rural district), and East (Rombo district)	Conservation-related officers at governmental (working for KINAPA Authority), regional, and district level, and national and international members of environmental non-governmental NGOs, CBOs and advisory boards with conservation activities on Kilimanjaro	Local and international tour guides and tour operators	Tanzanian and international tourists who attempted and/or succeeded to summit Mount Kilimanjaro
Social actor-specific sampling strategies	Stratified sampling based on residency in the target village across the altitudinal and latitudinal gradient; final selection by the village leader	Contacting governmental, regional, and district officers searching the web for nature conservationists working for NGOs, CBOs, and advisory boards Snowball sampling	Searching the web for tour guides and tour operators Snowball sampling	Identifying former tourists through various websites and social media platforms Snowball sampling

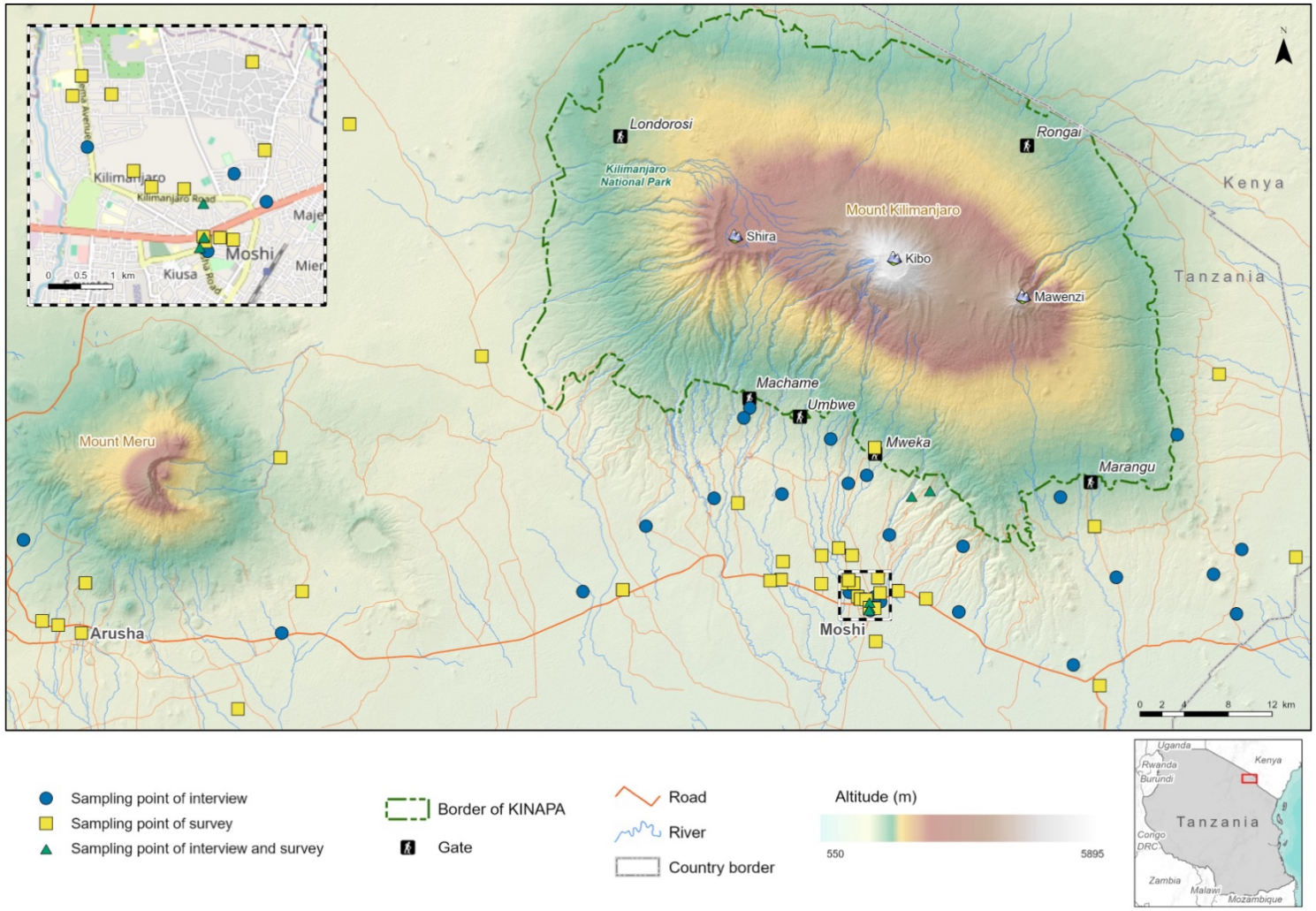


Figure S2.1 Geographic overview of sampling points of interviews and surveys conducted in the social-ecological system of Mount Kilimanjaro. The locations of the interviews with tour guides (n=5) and tourists (n=38) who we interviewed online via Zoom are not displayed (Environmental Systems Research Institute (ESRI), 2020).

Table S2.2 Overview of variables used in data analysis and additional information concerning the final data set, data gathering, and data analysis. *Kilimanjaro* the social-ecological system of Mount Kilimanjaro; *NC* Nature conservationists; *NCP* Nature's Contributions to People; *TG* Tour guides; *TT* Tourists; *x* applies.

Variable	**Name of variable in the final data set**	**Data gathering**				**Data analysis**	
		Survey section/question	Data collected			Data type	Comment/deduction from responses/ reference
			NC	TG	TT		
NCP points	<abbreviation of NCP (see Table S2.3)>_points	Nature's contributions to people: Step 3 I would like you to specify the importance of each contribution by distributing up to 100 points to each selected contribution.	x	x	x	Continuous	Data (x+1) log-transformed for data analysis.
Age	age	In which year were you born?	x	x	x	Continuous	Respondents seemed more comfortable stating the year they were born than their age. Hence, the given year was subtracted from 2022 to identify the respondent's age. Data (x+1) were log-transformed for data analysis.
Gender	gender	NC and TG: The survey taker determined the gender. TT: If I may ask, what is your gender?	x	x	x	Nominal	
Region of nationality	IPBES_region	What is your nationality?	x	x	x	Nominal	Regions were classified based on IPBES regional assessments (IPBES Technical Support Unit on Knowledge and Data, 2020), and information was sourced from the nationality/ies of the respondent. Because of potentially multiple nationalities, data are not mutually exclusive.
Location of nationality	globaln_s	What is your nationality?	x	x	x	Nominal (binary)	Classification of countries associated with Global North and Global South was based on United Nations FCFSSC (2015) Data were sourced from the nationality/ies of the respondent.

Variable	Name of variable in the final data set	Data gathering				Data analysis	
							Because of potentially multiple nationalities, data are not mutually exclusive.
Tanzanian citizen	tanzanian	What is your nationality?	x	x	x	Nominal (binary)	Information was sourced from the nationality/ies of the respondent. No Tanzanian citizen had (a) dual/multiple nationality/ies. Because of potentially multiple nationalities, data are not mutually exclusive.
Kilimanjaro's local communities	local	Have your parents lived in Kilimanjaro?	x	x		Nominal (binary)	We followed the definition of local communities *sensu* the IPBES glossary (IPBES, 2022, p. 929): 'non-indigenous communities with historical linkages to places and livelihoods characterized by long- term relationships with the natural environment, often over generations.' Hence, we considered the respondent to belong to the local community, if their parents also lived there.
Formal education	education	What is your highest level of formal education?	x	x	x	Ordinal	
Visited Kilimanjaro National Park	visited_np	Have you ever been inside Kilimanjaro National Park?	x	x	x	Nominal (binary)	
Visited a protected area	visited_protected_area	Have you visited any protected area (excluding Kilimanjaro National Park) during the last 12 months?	x	x	x	Nominal (binary)	
Bio-cultural activities	cultural_experience	Which activities have you taken part in or do you intend to do at Kilimanjaro?			x	Nominal (binary)	Fulfilled, if respondent took part in or intended to participate in E. Coffee tour, F Cultural tour, and/or G Visiting a Chagga village/home garden and learning about/experiencing the Chagga culture
Activities	activities: hike_only	Which activities have you taken part in or do you intend to do at Kilimanjaro?			x	Nominal	Hiking to the top of Mount Kilimanjaro only: Fulfilled, if respondent participated

Variable	Name of variable in the final data set	Data gathering				Data analysis	
							in or intended to participate in A but not in B – L.
	activities: hike_other_s						Hiking and other activities: Fulfilled, if respondent took part in or intended to participate in A and any of the other activities B – L.
	activities: other_s						Activities except for hiking to the top: Fulfilled, if respondent participated in or intended to participate in activities B – L but not A.
Time in nature during the week	time_in_nature_wd_quant	On a regular weekday, how much percent of your time do you spend in nature (excluding the time spent sleeping)? By nature, we mean the natural environment including cultivated settings such as domestic gardens and urban greenspaces.	x	x	x	Continuous	0% of time - 100% of time in 10% intervals
Time in nature on the weekend	time_in_nature_we_quant	On a regular weekend day, how much percent of your time do you spend in nature (excluding the time spent sleeping)? By nature, we mean the natural environment including cultivated settings such as domestic gardens and urban greenspaces.	x	x	x	Continuous	0% of time - 100% of time in 10% intervals
Closeness to nature	ins	I am presenting a scale to you that describes relationships with nature. … Which picture best describes your relationship with nature?	x	x	x	Ordinal	The Inclusion with nature in self (INS) scale (Schultz, 2022) is based on a graphical question. Seven pictures with two circles each describe relationships with nature. The right circle represents nature and the left circle represents the respondent/self. Picture A describes a relationship in which the respondent/self and nature are completely separate. Picture G describes a relationship in which the respondent/self and nature are one. The pictures in between, that is

Variable	Name of variable in the final data set	Data gathering		Data analysis	
					pictures B to F, display a gradient with an increasing relationship/overlap between the respondent/self and nature in the pictures from left to right.
Number of visits to Kilimanjaro	tourist_no_visits	How many times have you visited Kilimanjaro (from lowlands to Uhuru peak, i.e., beyond the border of the national park) (including this trip)?	x	Continuous	

Table S2.3 Overview of terminology of Nature's Contributions to People (NCP) in the data set and manuscript.

NCP terminology in data set	NCP terminology in manuscript
aesthetic_enjoyment	Aesthetic enjoyment
air_quality	Regulation of air quality
building_materials	Building materials
climate_regulation	Regulation of climate
cultural_heritage	Cultural heritage and identity through nature
domestic_materials	Materials for domestic use
energy	Energy
feed	Feed
food	Food
freshwater_quality	Regulation of freshwater quality
freshwater_quantity	Regulation of freshwater quantity
habitat	Habitat creation and maintenance
hazard_regulation	Regulation of hazards and extreme events
intergenerational_benefits	Intergenerational benefits
learning	Learning
medicine	Medicine
nature_connectedness	Connectedness with nature
new_experiences	New and unique experiences
pollination	Pollination
recreation	Recreation
seed_dispersal	Dispersal of seeds
social_cohesion	Social cohesion and bonding
soils	Regulation of soil fertility and protection of soils
species_regulation	Regulation of detrimental species
therapeutic_benefits	Therapeutic and restorative benefits

Orientation regarding NCP selection

When responding to the interactive section to elicit the NCP preferences, we noticed that respondents reflected on which standpoint they should take when selecting, ranking, and weighing NCP. Like Lamarque et al., (2011), we observed that some respondents wondered whether the importance for them and their life referred to themselves personally, to their work, family, organization, or company. When this concern emerged, we standardized our response as follows: If your work and/or those people you are just referring to is/are important for you and your life, you can consider your work/them in your selection.

Definition of nature and the study area

Throughout the questionnaire, we did neither provide a specific definition of nature nor of the geographical area of the social-ecological system of Mount Kilimanjaro (hereafter also referred to as Kilimanjaro). First, we asked respondents to rely on their understanding of nature because the concept can differ between languages and cultures (Coscieme et al., 2020; Masao et al., 2022). However, we mentioned the Swahili translation of nature (*mazingara asili*) to the Swahili-speaking respondents. Second, we introduced Kilimanjaro at the beginning of

the questionnaire as the area from the lowlands of the mountain to the very peak, including but also expanding beyond the border of Kilimanjaro National Park.

Sample size

Table S2.4 Overview of deduction of samples, population size (*N*), sample size (*n*), confidence level, and sample size (*n*) in the data set for each social actor. *Kilimanjaro* the social-ecological system of Mount Kilimanjaro. *KINAPA Authority* Kilimanjaro National Park Authority.

Social actor	Deduction of sample	N	n	Confidence level (%)	n in the data set
Nature conservationists	Number of governmental and non-governmental institutions/officers contributing to nature conservation in Kilimanjaro (consulting the natural resource officer from Moshi municipality, district officers dealing with nature conservation)	42	30	95	50
Tour guides	Number of tour operators in Kilimanjaro (consulting the tourism officer working for KINAPA Authority)	137	46	90	55
Tourists	Number of one-day and multiple-day visitors who entered Kilimanjaro National Park in 2021/2022 (consulting the tourism officer working for KINAPA Authority)	32846	136	98	156

Challenges during data collection

Despite sampling during the high season (August – October 2022) and increasing numbers of tourists after COVID-19-related travel constraints, we encountered major challenges in surveying tourists. Tourists' fatigue, time constraints after the hike, and spontaneous changes in the travel itinerary caused unexpectedly high cancellations and no-shows. Scheduled appointments with ca. 850 tourists did not take place. Another sampling challenge was limited access to hostels, hotels, and lodges, where most tourists would only stay a couple of hours or overnight after the hike.

Table S2.5 Overview of Nature's Contributions to People (NCP) excluded in the predictive Canonical Correspondence Analyses (partial least squares extension) (CCA-PLS) for all respondents and each social actor.

	All respondents	**Nature conservationists**	**Tour guides**	**Tourists**
Exclusion threshold	<5% chosen	<10% chosen	<10% chosen	<5% chosen
			Pollination	
	Dispersal of seeds	Dispersal of seeds	Dispersal of seeds	Dispersal of seeds
				Regulation of soil fertility and protection of soils
		Regulation of detrimental species	Regulation of detrimental species	
			Energy	Energy
			Feed	Feed
			Building materials	Building materials
	Materials for domestic use	Materials for domestic use	Materials for domestic use	Materials for domestic use
			Connectedness with nature	
		Therapeutic and restorative benefits	Therapeutic and restorative benefits	
		New and unique experiences		
		Social cohesion and bonding		
Number of excluded NCP	2	6	9	6

Supporting information S3 Training week and team agreement

Please note: Data collection was a joint effort among several researchers of the Kili-SES research unit. We, therefore, trained all survey takers simultaneously, although some sections were not relevant for our study. For our study, we used data from underlined survey sections and derived from surveys with nature conservationists, tour guides, and tourists. Researchers and field assistants belonging to the so-called 'Na(Tour) team' surveyed nature conservationists (shared survey script in English), tour guides (shared survey script in English), and tourists (specific survey script in English).

Schedule of training week

Goal: How can we become experts in conducting the survey, while feeling confident, comfortable, and having fun!

Day 1 (Let's meet in person and learn)					
Time	Duration in min.	Activity	Responsible SP/person	Material	Comment
9:00	30	Arrival to research station and welcome to training week	Milena, Susann	Tea, coffee, chocolate, and cookies	
9:30	40	Introduction of each of participant with check-in question and "box" game		Box	
10:10	40	Expectation management 1. Assistant qualities: What do would you expect/ask from your field assistant? 2. Supervisor qualities: What do would you expect/ask from your supervisor? 3. What do you expect from the training week? What needs to be achieved for the training week to be a success? 4. Which needs do we as a team need to accommodate during data collection? Writing team agreement for training week, among others based on the responses, and introduction to general team agreement		Sticky notes and pens	Send draft team agreement to PhDs/Postdoc in advance and ask for feedback until tomorrow evening.
11:20	30	Introduction to the project and role of survey within the overall project, survey structure, survey mode, and social actors		Document: overview of survey structure	Inform about differences between social actors.

Day 1 (Let's meet in person and learn)					
		Overview of the training week with four different training modes (presentation, demonstration, practice run, and cross-observation) Find a team name for those who survey nature conservationists, tour guides, and tourists. Result: 'Na(Tour) team'			
11:50	40	Hand out tablets, headphones, chargers, and survey material (step by step) to all team members Introduction to Survey123 survey application Time for preliminary questions		Tablets, headphones, charger, folder with laminated sheets, material for economic games	Everybody signs on material hand out – return document.
12:30	15	Participant information and consent form – ask team members to read and ask questions Introduction to importance and application of IDs to pseudo-anonymize data entries			Separately for villagers' and Na(Tour) team members
12:45	60	Lunch break			
13:45	20	Presentation (responsible SP/team member(s): general introduction to section and what is important to know and to pay attention to while conducting the section) of first survey section: Life satisfaction Demonstration of how to conduct survey section with a random respondent represented by a team member in front of the whole team. Additionally, for Na(Tour) team members: Introductory questions specific for tourists	Susann	Laminated sheets	Include introduction of best practice surveying style along these sections.
14:05	20	Practice run of survey section in pairs of two			Separately for villagers' and Na(Tour) team members
14:25	10	Learning from each other: Q&A with all team members based on practice run			
14:35	20	Cross observation of survey section: two team members who are new to the section demonstrate the section in front of everybody. Reflection of demonstrating team members what went well and what to improve next time			Randomly draw two names for two people to present in front of the group

Day 1 (Let's meet in person and learn)					
		Time for questions Discussion of possible challenging situations Feedback from the other team members what the duo paid attention to, what they did well, and how they could improve			
14:55	25	Presentation and demonstration: Relationship with nature (Inclusion of nature in self scale) and interactive exercise on preferences for Nature's Contributions to People (NCP)	John, Milena	Laminated sheets, non-permanent pens, cleaning material	Explanation of randomization and NCP sets
15:20	40	Practice run			
16:00	10	Learning from each other: Q&A with all team members based on practice run			
16:10	10	Coffee break			
16:20	40	Cross observation	John, Milena		
17:00	10	Check out	Milena, Susann		

Day 2 (Let's learn)					
Time	Duration in min.	Activity	Responsible SP/person	Material	Comment
9:00	30	Check-in and recap of/questions from yesterday's section	All SPs		
9:30	10	Presentation and demonstration: New Environmental Paradigm and value statements	Milena, John	Laminated sheets, non-permanent pens, cleaning material	
9:40	25	Practice run			
10:05	15	Learning from each other: Q&A with all team members based on practice run			
10:20	25	Presentation and demonstration: Livelihood and relation with market	Susann	Laminated sheets	Separately for villagers' and Na(Tour) team members
10:45	20	Practice run			
11:05	10	Learning from each other: Q&A with all team members based on practice run			
11:15	40	Presentation and demonstration: Farming practices, Cooperation and Networks, Land use change and property rights	Verena		
11:55	35	Practice run			
12:30	10	Learning from each other: Q&A with all team members based on practice run			
12:40	60	Lunch break			
13:40	30	Soundscapes	Eugenia	Headphones, laminated sheets	
14:10	35	Practice run			
14:45	10	Learning from each other: Q&A with all team members based on practice run			

Day 2 (Let's learn)					
14:55	15	Coffee break and group picture			Ask everybody to sign their consent for group picture.
15:10	100	Cross observation of today's sections	All SPs		Separately for villagers' and Na(Tour) team members
16:50	10	Check Out	Milena, Susann		Send draft version of team agreement to field assistants to read and comment on. Deadline: Day 4 evening

Day 3 (Let's learn and facilitate)					
Time	Duration in min.	Activity	Responsible SP/person	Material	Comment
9:00	30	Check-in and recap of/questions from yesterday's sections	All SPs		
9:30	20	Presentation and demonstration: General environmental behavior, socio-demographics, and personal number		Laminated sheets	Separately for villagers' and Na(Tour) team members Villagers' only: personal number
9:50	20	Practice run			
10:10	10	Learning from each other: Q&A with all team members based on practice run			
10:20	90	Practicing entire survey round 1 (Villagers': day 1; Na(Tour) team: tour guides/nature conservationists)			
11:50	20	Learning from each other: Q&A with all team members based on practice run			
12:10	60	Lunch break			
13:10	90	Practicing entire survey round 2 (Villagers': day 1; Na(Tour) team: tour guides/nature conservationists)	All SPs		
14:40	20	Learning from each other: Q&A with all team members based on practice run			
15:00	15	Coffee break			
15:15	90	Cross observation round 1	All SPs		
16:45	20	Learning from each other: Q&A with all team members based on practice run			
17:05	5	Check-out	Milena, Susann		

Day 4 (Let's team up and facilitate)					
Time	**Duration in min.**	**Activity**	**Responsible SP/person**	**Material**	**Comment**
9:00	30	Check-in and recap of/questions from yesterday's sections	All SPs		
9:30	80	Villagers' team: Presentation and demonstration: Economic games Na(Tour) team: Practicing tourists' survey round 1	Susann, Milena	Preference material: laminated sheets, cards, bags with balls	
10:50	40	Practice run: Economic games			Na(Tour) team members don't need to be introduced but could imitate respondents.
11:30	10	Learning from each other: Q&A with all team members based on practice run			
11:40	20	Villagers' team: Presentation and demonstration: Market access and personality	Susann		
12:00	30	Practice run			Na(Tour) team members don't need to be introduced but could imitate respondents.
12:30	60	Lunch break			
13:30	80	Practicing survey (round 1: Villagers': day 2; round 2: Na(Tour) team: tourists)	All SPs		
14:50	10	Learning from each other: Q&A with all team members based on practice run			
15:00	15	Coffee break			
15:15	80	Practicing survey (round 1: Villagers': day 2; round 3: Na(Tour) team: tourists)	All SPs		
16:35	15	Learning from each other: Q&A with all team members based on practice run			
16:50	10	Check-out	Susann, Milena		

Day 5 (Let's get ready)					
Time	**Duration in min.**	**Activity**	**Responsible SP/person**	**Material**	**Comment**
9:00	30	Check-in	All SPs		
9:30	90	Cross observation: round 2 (Villagers': day 2; Na(Tour) team: tourists)			
11:00	60	Learning from each other: Q&A with all team members			
12:00		Lunch break			
13:00	90	Field work: outlook (survey schedule, sampling strategies) and practicalities	Susann, Milena		Separately for villagers' and Na(Tour) team members
14:30	90	Discussing questions and comments regarding the team agreement Sign team agreement including section about data privacy after questions and comments resolved (See pages below for final team agreement.)			Discuss details for villagers' and Na(Tour) team with team members separately.
16:00	40	Check-out/feedback Time for questions 1. On a scale from 0 (lowest) – 10 (highest), how confident do you feel to conduct the survey? 2. What's missing to a 10? Playing the game: I am packing my suitcase and I am taking … (a lesson learnt from the training week).	All SPs	Tea, coffee, chocolate, and cookies	
16:40	20	Payment of field assistants	Susann, Milena	receipt book	

Day 6 (Sign contracts)					
Time	**Duration in min.**	**Activity**	**Responsible SP/person**	**Material**	**Comment**
8:30	90	Ride to project office	Milena, Susann		We need two cars. Pick up field assistants in Moshi town.
10:00	120	Sign contracts			Which documents do the field assistants have to present?

Survey Team Agreement

Team members who coordinate and conduct the survey: Aloyce, Berta, Dalha, Emma, Erick, Ester, Eugenia, Gloria, Hafidhi, John, Joyce, Milena, Neema, Rehema, Rosemary, Rosemery, Susann, Verena, Victor, Wivina

We appreciate everybody's contribution to our ambitious, mutual, and amazing endeavor, that is, conducting more than 600 surveys with different social actors within the next months to understand interactions and interdependencies between people and nature in Kilimanjaro under land-use, climate, and governance change. We hope our results will provide a scientific basis for political and societal decision-making that will facilitate transformation towards sustainable relationships between nature and people in Kilimanjaro.

Each team member involved in (be it coordinating and/or conducting) the survey, that is, field assistants, PhD students, post docs, and professors, is going to sign this team agreement which explains how we want to work together. This includes rules, as we are approximately 20 people who are involved in the sampling process which requires a lot of coordination and relying on each contributor.

We highly rely on everybody's engagement so we would like to provide the best possible working conditions for all of us and appreciate everybody's unique contribution. The goal of the training is for all of us to become experts in coordinating and conducting the survey, while feeling confident, comfortable, and having fun.

Training week

During the training days, the PhD/PostDoc team members aimed to explain the survey well to everybody. In case you don't understand, please ask us individually (one of the PhD/PostDoc team members) or in the regular learning from each (Q&A) section. The PhD/PostDoc team members prefer to explain sections and answer questions multiple times to maximize a mutual understanding of the research objectives and survey/questionnaire and coherence within the process of data gathering, rather than receiving malicious data. It is on you to ask questions; we can't take that responsibility for you. Nobody will be judged for asking (too) many questions. Instead, this is as a way of how you seek to understand the survey in detail to facilitate it in your best way. Eugenia is in charge of the communication with the people who arrive with the dala dala each morning. Please let her know in case you are running late.

General agreements

You can always reach our three coordinators, Aloyce (responsible for villagers' team), Milena(responsible for Na(Tour)- team), and Susann (responsible for villagers' team) <phone numbers of first author and two other team member removed to respect privacy in this Ph.D. thesis>, in case of questions, concerns, or difficulties. Please reach out to Aloyce, Milena, and Susann, if you lost material and need replacement, you don't feel well and need to be substituted, or an appointment with a survey respondent needs to be postponed. We are always seeking a solution-oriented approach and highly appreciate transparency and honesty. In the first team session, we all agreed to appreciate receiving feedback from everybody, that is, PhD students/Postdoc giving feedback to field assistants and vice versa.
The following photos represent the outcome of the first team sessions, addressing four questions:

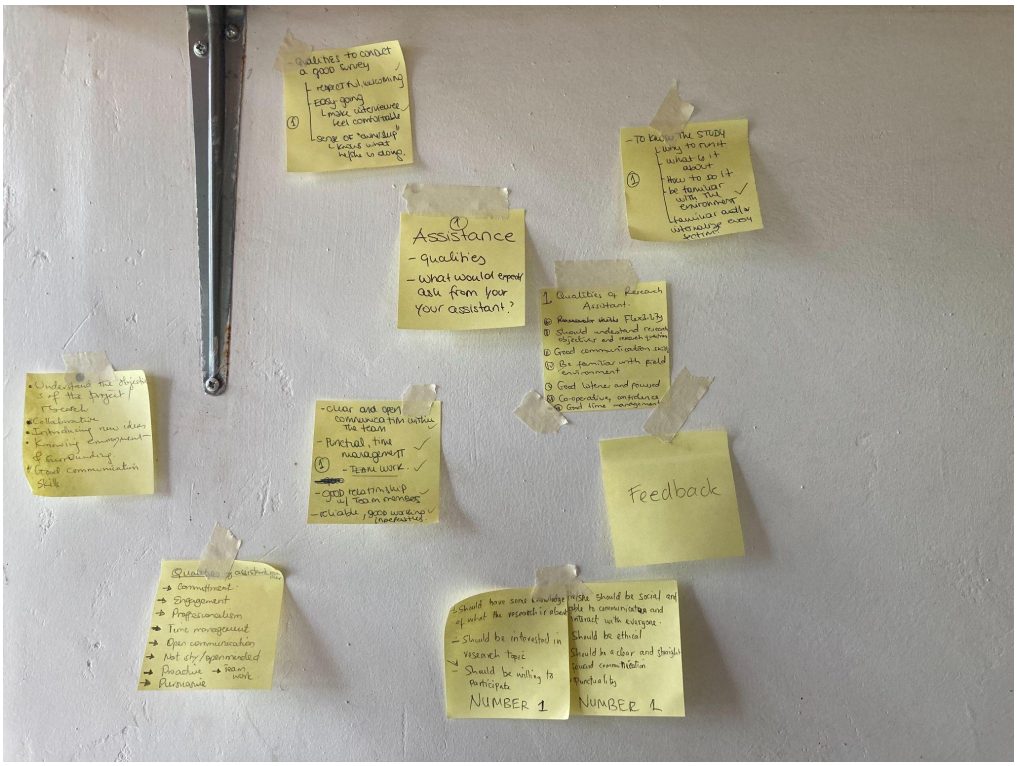


Figure S3.1 Responses to: Assistant qualities: Imagine you take on the role of the researcher, what do you expect from your assistant? Which qualities do you appreciate? Photo credit: author's own.

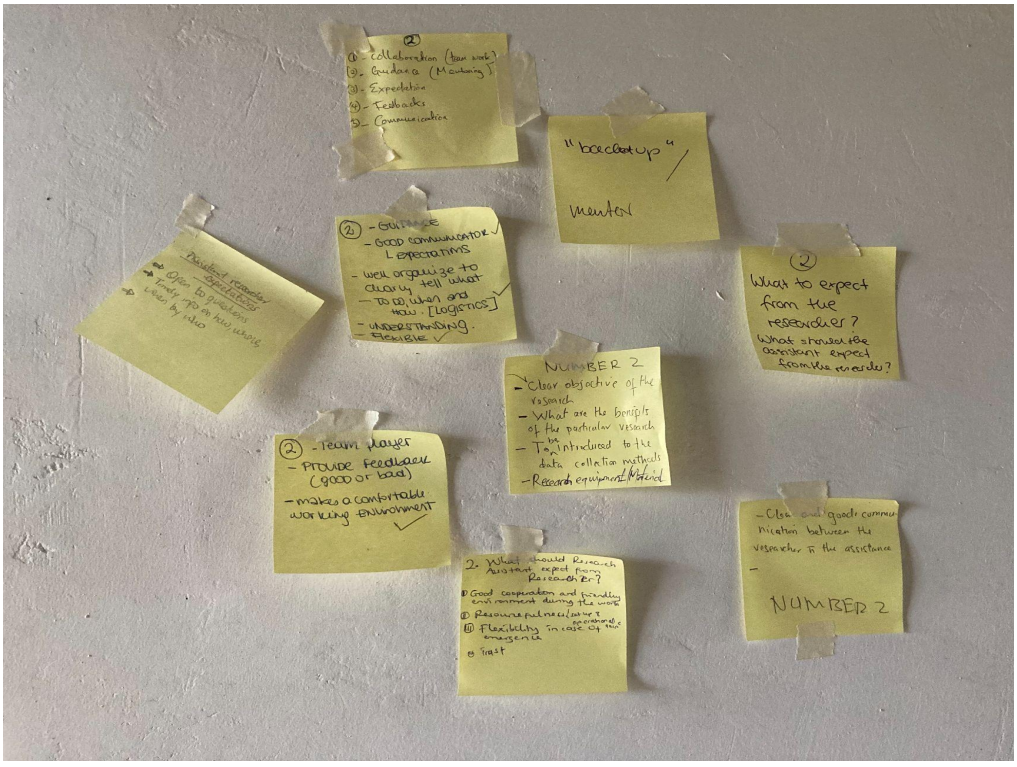


Figure S3.2 Responses to: Supervisor qualities: Imagine you take on the role of the field assistant, what do you expect from your supervisor? Which qualities do you appreciate? Photo credit: author's own.

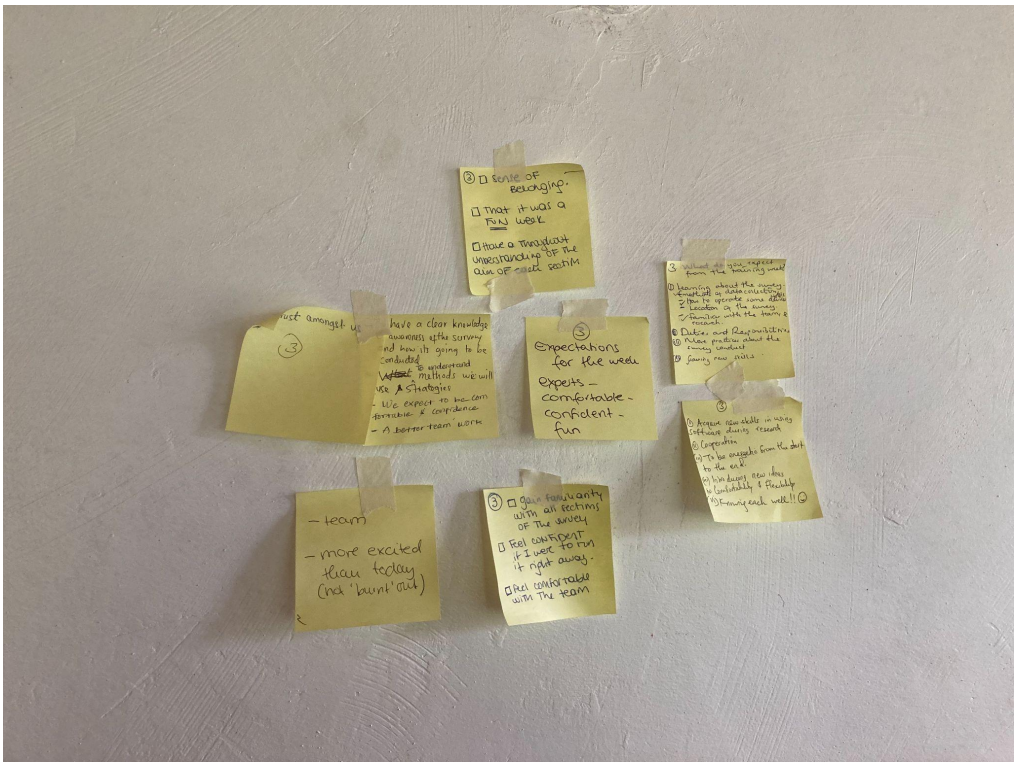


Figure S3.3 Responses to: What do you expect from the training week? What needs to be achieved to call the training week successful? Photo credit: author's own.

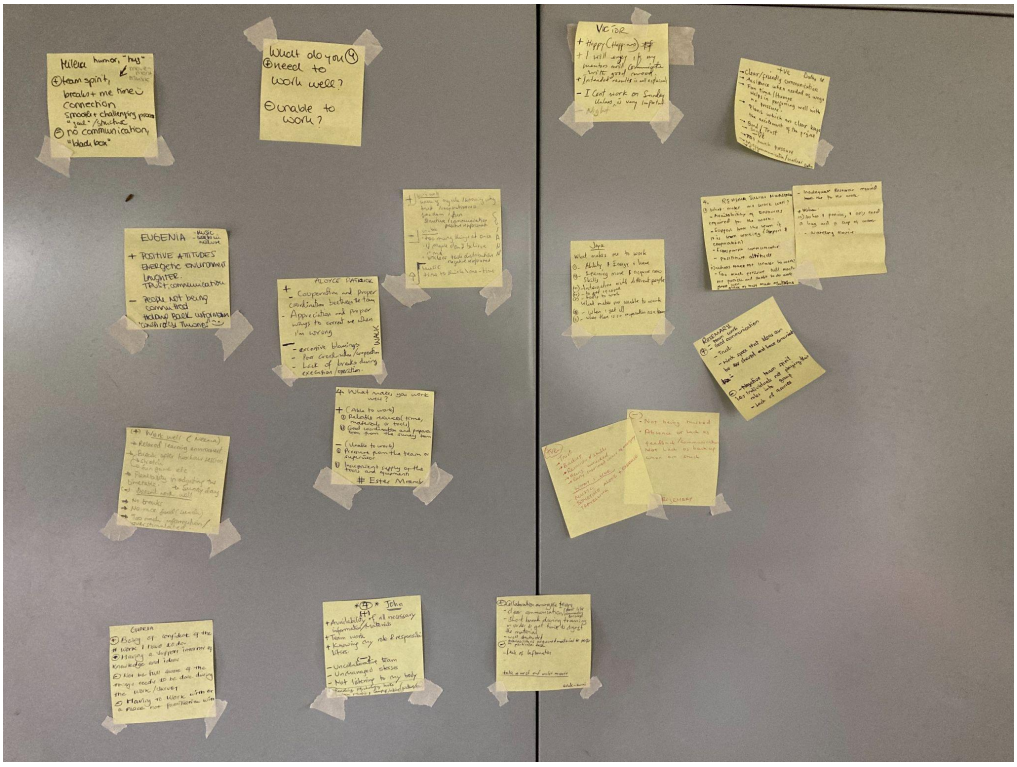


Figure S3.4 Responses to: What makes you work well (+)? What makes you unable to work (-)? What do you need/like to do, when you are unable to work? Photo credit: author's own.

We, as any contributor, agree to be flexible and patient, communicate reliably, and show up on time for meetings with the team and also appointments with survey respondents. Our regular working hours are Monday to Friday from 8AM to 6PM (and also on Saturday, when tourists

are surveyed) and communication hours from 8AM to 8PM. From experience and this especially applies to Na(Tour) (see description below), respondents, who we are going to have appointments with, might be available on short notice only. Hence, last minute updates/changes may also be sent later and on the weekend but shall remain an exception. In case of urgent matters, please message and/or call the respective team members and/or the coordinators. In case the call is missed, they get back to you as quickly as possible. In case you are sick, please don't come to work but stay home, inform us about your situation and projected absence, and rest. Your contract covers a few days of sickness, that is, you will still be paid. If you happen to be sick for more than a week, we will make a decision case by case. We expect those, who the Kili-SES research unit has short- and long-term field assistance contracts with, to be available to work in our project as their main work activity. If you happen to have an appointment elsewhere, please inform Milena and Susann to discuss whether and how we can work around it, if it conflicts with the work schedule. The earlier they are informed, the more likely we can find a good solution for everybody involved.

The sampling strategies differ between people who live in the villages (so called villagers surveyed by the villagers' team), who are tour guides, nature conservationists, and who visit Kilimanjaro as tourists (the latter three also referred to as Na(Tour) surveyed by the Na(Tour) team), and thus also the mode of sampling.

Villagers' team

For villagers, Susann, Aloyce, and John are in charge. We aim at visiting two villages per week from the XX.08 on. Each village is interviewed on two consecutive days. The village interview team will always meet in the morning, travel to villages together and come back home in the evening together. Transport is arranged by Aloyce. Please inform him, if you will be late in the morning or need to be dropped off on the way in the evening. The interviews in a village are scheduled from 9AM to 4PM. If all works out as planned, Wednesday will be a day off. However, this day is used as a backup day for interviews in case there are interviews left to be done in one village. For this reason, please arrange for availability for all five days (Monday through Friday) during the surveying weeks. In case you envision any conflicts with your availability during the surveying weeks, please inform Aloyce, John, and Susann as early as possible so that we can arrange for a substitute.

Na(Tour)- team

For tour guides, nature conservationists, and tourists, Milena oversees coordinating survey appointments and has created a spreadsheet (<link to spreadsheet removed to respect privacy in this Ph.D. thesis>) where she updates the schedule and responsibilities as the sampling starts. Communication happens primarily via WhatsApp and email; the latter being mainly used in communication with the survey respondent. Milena informs the assigned team member about their sampling duty, name of survey respondents, sampling place, and time via WhatsApp and might ask to check their emails via WhatsApp. Based on our sampling strategy, we plan to conduct most surveys with tour guides and some surveys with nature conservationists in their offices (preferably) or in cafés in Moshi town. These surveys are mainly conducted independently by one responsible team member who has also to make sure that the tablet works (e.g. is charged) and to bring the survey material and headphones along. For appointments outside Moshi town and for surveying tourists, Milena is going to arrange transportation for everybody involved, that is, we meet at a meeting point at a fixed time, e.g., Machame junction, a fixed place in Moshi town, and then head off together. Please make sure that the tablet works (e.g. the tablet is fully charged) and to bring the survey material (e.g. refill the water bottles) and headphones (e.g. the headphones are fully charged) along.

The project is going to compensate for booking a booth at the co-working space Ndoto Compass in the NSSF building (Aga Khan Rd Kilimanjaro Commercial Complex NSSF New Building First Floor Opposite EFTA Moshi –- Tanzania https://ndotocompass.com/) and a bottle of water for the survey respondent which will be bought by the survey taker. Therefore, Milena is going to give some money to each person who conducts the survey with tourists, tour guides, and nature conservationists. Please keep track of your expenses in the table *Expenses,* keep

all receipts and pass the filled out table and receipts on to Milena, as we need these to get reimbursed by the university. After all surveys have been conducted, surplus money has to be returned to Milena on your own responsibility. We are also responsible for treating respondents respectfully and according to ethical standards proposed from our universities, e.g., respondents' identity and information has to remain completely confidential and anonymous (for more examples see explanation form and declaration of consent and our ethics applications). This aligns with our expectation that data are not made up but entered carefully. We agree that all data has to be treated confidentially, is owned by the Kili-SES research unit and thus, has to be passed on to the research team, and uploaded. For the villagers' team and for mutual sampling of the Na(Tour) team with Milena, there will always be mobile data available to upload the data. If contributors of the Na(Tour) team conduct surveys individually, we would like to ask you to upload the data, using the hotspot at Ndoto Compass.

General agreements

We must handle the data very carefully. The tablet, the survey material, and headphones are borrowed to everybody and need to be returned on your own responsibility after data collection. The last salary functions as a deposit and will only be paid, if you return the tablet, the survey material, and headphones after you finished conducting the survey. Please don't hesitate to reach out to us, in case of questions! We expect some days to be challenging but we aim to also enjoy ourselves and honor humor, if appropriate. We are grateful for everybody's contribution and are looking forward to collecting the survey together.

Photo use

I agree that photos taken during the training week and data collection that also show me may be published and used in publications, workshops, and websites.

Figure S3.5 Kili-SES survey team during the training week. Photo credit and gratitude to Isaack Kinawa.

<signatures removed to respect privacy in this Ph.D. thesis>

Supporting information S4 Ethics

S4.1 Explanation form

Thank you for participating in this research project, which will involve a survey on your perspective on the role of nature for human well-being in the Kilimanjaro Social-Ecological System.

Investigators

The survey within the Kili-SES research project (https://kili-ses.senckenberg.de/is being undertaken by PhD students and Postdoctoral researchers. Please reach out to Milena Gross if you have any questions about this project. Milena Gross' contact details are: milena.gross@leuphana.de (Milena Gross speaks English.)

What is involved?

This research will involve surveys with people who live on, work on and travel to Mount Kilimanjaro. You must be 18 or older to participate in the study. The survey will take approximately 30- 45 minutes (for tourists) and 60 minutes (for tour guides and nature conservationists) and will involve a series of questions relating to: to how nature contributes to your quality of life, specifically how you perceive, relate to, interact with, benefit from and/or manage nature, your living conditions and personality characteristics. As a participant in this research, your participation is *entirely voluntary*. You are welcome to leave at any time if you do not feel comfortable being involved in this study. Please note that there are no wrong answers to our questions. We are interested in your honest opinion and perspectives. Your answers do not need to be profound. It is ok to say ´I don´t know´ for questions that you are unable to answer. We don´t want you to make up answers because you feel you have to. You may refuse to answer any questions you do not feel comfortable answering at any time by saying ´I want to move on to the next question´.

Confidentiality and anonymity

Your identity and information will remain completely confidential and anonymous so we can ensure that this is not revealed in any outcomes from this study. You are also free to ask any questions or raise any concerns you may have about this study at any time. You will also be able to stay in contact after this study has been completed to provide feedback or access the final outputs. Upon completion of this project, all data will be stored in a secure location (and destroyed after exceeding the legal retention period of ten years).

What are the benefits of this project?

In the Mount Kilimanjaro region, competing land uses and impacts from climate change have led to a dramatic increase of the demand for nature. This project will provide much needed empirical data for policy- and decision-making at both international and national levels by providing insights into the components of nature at Mount Kilimanjaro that lead to societal benefits from nature; people's values of, relationship with, (trade-off between supply of and) demand for, (collaborative) management of and access to nature as perceived by different social actors; the determinants of nature's contribution to human well-being. On a personal level, you might benefit from the study by reflecting on your relationship to nature; benefits you derive from nature; your personality.

What are the risks?

We do not foresee any risks with your participation in this research. However, we will aim to avoid any potential distress or discomfort by ensuring the following: (1) avoidance of questions of a highly personal and sensitive nature; (2) the option of participants to not discuss some aspects of the research; and (3) the ability of participants to terminate the survey at any time with no need to give any reasons for such.

How can you access the findings of this study?

The findings/outcomes of this project will be published as peer-reviewed journal articles. We will also develop a short summary of the key findings/outcomes to send to participants who are interested.

Ethics

This study adheres to the guidelines of the ethical review process of the Ethical Review Board of Leuphana University Lüneburg and the Kiel Institute for the World Economy. Whilst you are free to discuss your participation in this study with project staff Milena Gross' contact details are: milena.gross@leuphana.de), if you would like to speak to an officer of the University not involved in the study, you may contact the Ethics Board Secretariat: <email removed for ethikbeirat@leuphana.de.

S4.2 Declaration of consent

I acknowledge that I have read and understood the information provided on this research project. I hereby provide consent to be a participant in this survey as part of this research project on people's perspectives on the role of nature for human well-being in the Kilimanjaro Social-Ecological System.

- I have received clear and concise (at least verbal) information about this research, and I understand what is required of me during the survey. I am aware I can receive a full digital version of the explanation and consent form upon request via email. I was offered to take a photo of the (signed) consent form.
- I acknowledge that my participation is entirely voluntary and there will be no direct benefit or reimbursement for my role in this study.
- I acknowledge that the survey will take place in person and my data will be saved digitally.
- I am aware that all information related to this study will be securely stored.
- I acknowledge that my identifying information will remain confidential and will not be used in any publications or other outlets.
- I understand that I am able to leave the survey at any time or refuse to answer any questions without any explanation or penalty.
- I acknowledge that I am able to make contact with the persons involved in this study in order to seek any information about the current and future use of this research and to raise any concerns if necessary.
- I was given information about my personal identification number (e.g. to withdraw my answers from the research) and contact details of the researchers (e.g. in case of questions and to receive results of the study).

We appreciate your participation and thank you for contributing to scientific research. If you would like to receive a summary of the results, please write an email to Milena Gross. Milena Gross' contact details are: milena.gross@leuphana.de

Participant's Signature ……..…… [Respondent signs on tablet.]

S4.3 Author's positionality statement

Scholars advocate that – as a default ethical practice – researchers should position themselves and their research (e.g., Beck et al., 2021; Boyce et al., 2021; Holmes, 2020; Popa & Guillermin, 2017; Reyes, 2020; Soedirgo & Glas, 2020). Here, I, the first author of this work, want to position myself in the field of sustainability science, particularly inclusive conservation:

Throughout my Ph.D. research, my awareness of ontological and epistemological assumptions – and their impact on research – deepened. I learned more about my own assumptions through non-academic experiences, engaging with literature, and when confronted with perspectives, such as the notion of an objective researcher and scientific neutrality, that differ starkly from mine. One key example involves people-nature relationships: despite growing up and spending over 20 years in the heart of the city of the German capital city Berlin, my time in the countryside has fostered a closer, more intimate bond with nature than the urban-tech life. I, therefore, view these relationships as interconnected. Additionally, I recognize that a mechanistic perspective, which separates people from nature, rather than a relational perspective has shaped my understanding of people-nature relationships. This influence became especially clear when contrasting my perspective with literature by Indigenous scholars or on Indigenous worldviews.

In this context, I would also like to acknowledge my non-academic training. This experience profoundly shaped my uncovering process of who I am, how others and I see the world, how others and I approach research, and others and my values (my core values: accountability, care, courage, humility, and good and committed relations with and between places and people) – more than any academic training I had previously received. Throughout my Ph.D. research, I came to identify with the feminist scholarly community that views scientific knowledge as inherently partial, contextual, and situational (e.g., Haraway, 1988; Madge, 1993; Rose, 1997; Staffa et al., 2022). I do not think that scientific knowledge production is objective. Rather, I think that the knowledge we – researchers – produce and our interpretation of it is influenced by what is important to us, i.e., our values, and depends on how we see the world, i.e., our ontology. At this stage – having only recently begun to explore ontological and epistemological assumptions, and not having designed the research with these in mind – I tend to relate to the epistemology of the social constructionist/interpretivist paradigm that assumes there is not just one reality but many realities 'that can be articulated based on the values, standpoints, and positions of the author' (Daly 2007, p. 33) (Aliyu et al., 2015). Therefore, my interpretation of people's relationships with nature that is presented in this work is one of many possible interpretations that mirrors how I position myself relative to the research I have undertaken, the study area, and the research participants.

With this positionality statement, I aim to give readers insight into how my positionality has shaped this work, to the extent that I have been able to uncover. Although ontological and epistemological assumptions can evolve over time (Ives et al., 2023) – in fact, Haider et al. (2018) emphasize that epistemological agility is essential for sustainability scientists to collaborate effectively with researchers who hold differing assumptions about how knowledge is produced –, I acknowledge that I have not yet fully identified my own at this stage. As I continue to delve deeper and learn more about the nuanced distinctions between different ontological and epistemological perspectives, it is likely that I will describe these assumptions differently in future work.

My academic background

Professionals and peers at German, Swedish, and U.S. American universities and research centers academically trained me over a total of nine years using both traditional and 'different' scientific styles. My academic profiling in sustainability science has benefited from 'undisciplinary' (Haider et al., 2018), innovative, and competency-based teaching approaches, the mindset of looking outside the box within, across, and beyond traditional disciplines and academia (Haider et al., 2018; Wiek et al., 2011), as well as caretaking classmates and

colleagues from all around the globe, embracing an ethos of care approach (Puig de la Bellacasa, 2017; Staffa et al., 2022). Western academic education, scientific traditions, and literature directed the knowledge production and interpretation presented in this work.

Author's team

The author team of this work represents female and male researchers from diverse personal and academic backgrounds. Members of the author team grew up, lived, learned, and/or worked in different countries, including Tanzania, and are at different stages of their academic careers, ranging from Ph.D. candidates to full professors.

My approach to inclusive conservation

'Whose conservation?' was the title of Joanna Macy's seminal work, highlighting that conservation at its core is inherently value-laden (Mace 2014). Feeling a sense of belonging to the sustainability science community, my approach to 'nature' conservation has never been exclusive to preserving 'biodiversity and ecosystem functioning' alone. Instead, I advocate for integrating different facets of people-nature relationships as experienced and expressed by diverse voices, including those from underrepresented (groups of) people. Embracing this diversity, I believe, is essential for achieving meaningful and lasting conservation success (e.g., Cumming et al., 2023; Salomon et al., 2023; Tallis & Lubchenco 2014). To yield empirical evidence for more inclusive conservation, I investigated how different groups of people similar in their NCP preferences perceived and assessed their relationships with nature. My perspective on inclusive conservation has undoubtedly influenced this study motivated by my personal values and beliefs.

Study design

I opted for a sequential mixed-methods approach by combining qualitative and quantitative data gathering and analysis methods to advance the understanding of people-nature relationships. In doing so, I aimed to gain representative results, while respecting the context of the study area operationalized through context-specific NCP and values contextualized to Kilimanjaro. Because this study aimed to gain generalizable results based on a large-scale survey to inform assessments and policy-making at higher scales, I am motivated to critically reflect on how our analytical tools can stereotype and thereby, over-simplify members of social actor groups and hence, making conservation arguments not more but less inclusive. Additionally, I claim that the knowledge I gained from formal interviews, informal conservations, and observations during the nine months I spent living, working, and conducting research *in situ* allowed me to get a better understanding of people-nature relationships in Kilimanjaro , informed my interpretation of the quantitative results, and the framing of this article. For example, hiking different routes on the mountain and ultimately summiting Mount Kilimanjaro allowed me to observe how the social actor tourist engages with nature on the mountain and how their isolation from local daily life shapes their exposure to particular non-material NCP, probably mirrored in their stereotyped preferences for these NCP.

Access to research participants

Given Tanzanian's colonial history, and the continued class differences between local people and Western foreigners, being a Western Ph.D. Candidate might have given me easier access to research participants and allowed me to establish a supporting network that would not be immediately available to others. Within the author team, we discussed this as a privilege that I was granted but could not actively control. It was ultimately the research participant who determined whether this part of my identity positively affected their trust in me and their willingness to support or participate in the study. Their final decision might have been motivated by hopes for 'a positive outcome' by interacting with me.

Survey taker – research participant interaction

I viewed the research participants as being knowledgeable based on their lived experiences and capable of understanding our survey questions and articulating their relationships with nature. I was interested in capturing their honest response to my questions and minimizing how the questions and how I asked them might have 'directed' their response. I understood

my role as a survey taker as a passive listener to the responses of the research participants; I listened to them with curiosity and open-mindedness. A role and skill that – in my case – have been fundamentally deepened by my professional non-academic training. According to our protocol, I asked research participants to express themselves freely and stated that there were no right and wrong answers before any data was collected. I trusted their ability and confidence to do so.

My assumptions of 'confident' and 'independent' research participants and being a passive listener was challenged by some research participants, particularly by tour guides. I experienced that research participants asked me during or after the survey whether the answers they provided were correct and aligned with what I wanted to hear. This led to confusion on my end because I had stated that I wanted to hear their opinion. Reflecting on it, I wondered whether these research participants might not have perceived the survey setting as a 'casual' conversation that was free from desired or expected responses, as I had intended. Rather, they might have perceived the survey as an exam in which right and wrong responses were possible. Because of these experiences, I cannot guarantee that the results presented in this work are unaffected by a social desirability bias, especially a willingness to please the survey taker, and/or pressure to provide correct answers. Additionally, I was sometimes unsure whether tour guides perceived me in the role of a researcher or whether they implicitly hoped for 'a positive outcome', i.e., that I would become their client, especially if only the answers they provided were correct. In such a context, I was confronted with my power-laden and hence, imbalanced relationship with the research participant, assumingly as a byproduct of my comparatively privileged background. Such factors were difficult or even impossible for me to control or avoid and yet, might have biased the responses and hence, impacted the validity of the results.

Statistical analysis

Due to the large sample size, I trusted the robustness of statistical analysis to yield scientifically rigorous results. Statistics can uncover representative patterns in people's preferences for Nature's Contributions to People (NCP) that are not available to us researchers without using these analytical tools. Such statistical tools – typically associated with scientific objectivity and positivist epistemology, for example (Aliyu et al., 2015) – might seem contradictory to the fundamental epistemological assumptions I outlined earlier. However, the choice of statistical tools could also reflect the initial steps toward embracing epistemological agility (Haider et al., 2018) combined with a practical solution, i.e., an approach necessary for selecting the analytical tools best suited to addressing the research questions at hand.

My position relative to the research participants

Whether a researcher is an insider or outsider relative to the research participants is always contextual and multifactorial (Reyes, 2020). I found myself as an outsider, considering the following factors. Neither my ancestors nor I grew up and lived in Kilimanjaro. Neither do guide tours nor am I involved in nature conservation in Kilimanjaro. If one would claim any degree of 'insiderness', I might be an insider relative to a female Western tourist because we are both women raised and living in a Western country and visiting Kilimanjaro. Nevertheless, I assume that her holiday experience is distinct from my research stay. Hence, I interpreted the results from an outsider's perspective.

Supporting information S5 Additional results

Table S5.1 Information on socio-demographic attributes and interaction with nature for all respondents and each social actor. The classification of regions follows the IPBES regional classification (IPBES Technical Support Unit on Knowledge and Data, 2020). The sample included five tourists with nationalities from two different regions. Supporting Information S2, particularly Table S2.1, entails information on data gathering and analysis of the variables. Kilimanjaro the social-ecological system of Mount Kilimanjaro; n frequency; % relative share;/ data not collected; NA not available.

Socio-demographic attribute	**Level of variable**	**All respondents (n=261)**		**Nature conservationists (n=50)**		**Tour guides (n=55)**		**Tourists (n=156)**	
		n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Gender	Female	85	33%	8	16%	4	7%	73	47%
	Male	175	67%	42	84%	51	93%	82	53%
	Diverse	1	<0.1%	/		/		1	<0.1%
Region of nationality	Africa	112	42%	46	94%	55	100%	11	7%
	Asia and Oceania	9	3%					9	6%
	Subregion: Oceania	4	2%					4	2%
	Europe and Central Asia	108	41%	3	6%			105	65%
	Subregion: Western Europe	97	37%					97	60%
	Americas	36	14%					36	22%
	Subregion: North America	29	11%					29	18%
	NA	1	<0.1%	1	2%				
Location of nationality	Global North	137	52%	3	6%			134	86%
	NA	1	<0.1%	1	2%				
	Global South	123	48%	46	90%	55	100%	22	14%
	NA	1	<0.1%	1	2%				

Socio-demographic attribute	Level of variable	All respondents (n=261)		Nature conservationists (n=50)		Tour guides (n=55)		Tourists (n=156)	
		n	%	n	%	n	%	n	%
Tanzanian citizen	Tanzanian	104	40%	46	94%	54	98%	4	3%
	Non-Tanzanian	156	60%	3	6%	1	2%	152	97%
	NA	1	<0.1%	1	2%				
Kilimanjaro's local communities		55	21%	21	42%	34	62%	0	0%
	NA	3	1%	2	4%	1	2%		
Formal education	Primary school	2	1%			2	4%		
	Middle school	14	5%	1	2%	7	13%	6	4%
	High school	27	10%			3	5%	24	15%
	Vocational training	47	18%	8	16%	32	58%	7	4%
	Undergraduate degree	98	38%	25	50%	9	16%	64	41%
	Graduate degree	55	21%	15	30%			40	26%
	Postgraduate degree	15	6%	1	2%			14	9%
	NA	3	1%			2	4%	1	1%
Visited Kilimanjaro National Park		249	95%	48	96%	54	98%	147	94%
Visited a protected area		193	74%	35	71%	46	84%	112	72%
	NA	1	<0.1%	1	2%				
Bio-cultural activities		/		/		/		38	24%
Activities	Hiking to the top only	/		/		/		96	62%
	Hiking and other activities	/		/		/		49	31%
	Activities except for hiking to the top	/		/		/		11	7%

Socio-demographic attribute	**Level of variable**	**All respondents (n=261)**		**Nature conservationists (n=50)**		**Tour guides (n=55)**		**Tourists (n=156)**	
		n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Socio-demographic attribute	Statistical measure	All respondents (n=261)		Nature conservationist (n=50)		Tour guide (n=55)		Tourist (n=156)	
Age [years]	Mean	36.5		41.5		36.2		35.1	
	Standard deviation	12.0		12.4		8.8		12.5	
	NA	3 (1%)		3 (6%)					
Time in nature during the week (0% of time – 100% of time in 10% intervals)	Minimum–Maximum	0-100%		10-100%		0-100%		0-100%	
	Mean	41.3%		57.8%		67.5%		26.8%	
	Standard deviation	30.0%		29.1%		23.8%		22.5%	
Time in nature on the weekend (0% of time – 100% of time in 10% intervals)	Minimum–Maximum	0-100%		0-100%		0-100%		0-100%	
	Mean	49.5%		43%		65.8%		45.8%	
	Standard deviation	26.1%		30.7%		25.8%		22.2%	
Closeness to nature based on 'Inclusion of nature in self scale' (INS) (0=lowest – 7=highest) (Schultz, 2002)	Minimum–Maximum	1-7		4-7		3-7		1-7	
	Median	5		6		6		4.5	
Number of visits to Kilimanjaro	Minimum–Maximum	/		/		/		1–20	
	Mean	/		/		/		1.8	
	Standard deviation	/		/		/		2.7	

Table S5.2 Summary of mean values and standard deviation (SD) for all respondents and for each social actor, and statistical differences for each Nature's Contributions to People (NCP) between the social actors based on Kruskal-Wallis test (df=2). Significance level of $P < 0.05$. Mean values with different letters (a, b, or c) indicate significant differences from pairwise comparison t-test based on Dunn test with Bonferroni correction ($P < 0.01$). Bold values represent the social actor with the highest mean value for each NCP. *Reg.* Regulation; *SD* standard deviation.

NCP	All respondents		Nature conservationists		Tour guides		Tourists		Chi^2	*P*
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Regulating NCP										
Habitat creation and maintenance	18.0	34.7	**22.9**	38.4	16.3	34.0	17.1	33.7	1.14	0.567
Pollination	5.9	21.3	**13.6**[a]	30.0	6.1[a,b]	22.4	3.4[b]	16.6	8.41	0.015
Dispersal of seeds	0.8	8.1	**3.4**	17.0	0.0	0.0	0.3	4.0	4.60	0.100
Reg. of air quality	24.3	38.6	34.6[a]	42.6	**34.9**[a]	43.0	17.3[b]	34.0	12.67	0.002
Reg. of climate	19.3	35.4	**24.4**[a,b]	39.9	8.3[a]	24.3	21.6[b]	36.6	8.27	0.016
Reg. of freshwater quantity	17.5	35.4	**30.4**[a]	43.0	25.4[a]	42.2	10.5[b]	27.8	13.48	0.001
Reg. of freshwater quality	23.8	38.0	**36.3**[a]	44.0	33.3[a]	41.4	16.4[b]	32.9	12.51	0.002
Reg. of soil fertility and protection of soils	7.0	22.6	**17.3**[a]	33.5	12.5[a]	29.9	1.7[b]	10.8	21.74	<0,001
Reg. of hazards and extreme events	8.4	25.0	7.9	23.3	**13.3**	30.8	6.8	23.2	2.25	0.324
Reg. of detrimental species	3.8	16.6	3.3	16.3	2.0	11.8	**4.5**	18.1	1.22	0.544
Material NCP										
Energy	5.9	20.9	**19.5**[a]	34.6	4.9[b]	18.8	1.9[b]	12.3	28.03	<0,001
Food	25.4	38.6	40.7[a]	42.4	**42.7**[a]	44.5	14.4[b]	30.7	30.29	<0,001
Feed	3.5	15.3	**6.5**[a]	18.5	6.3[a,b]	21.5	1.5[b]	10.8	11.21	0.004
Building materials	4.9	18.7	**11.6**[a]	26.3	7.3[a,b]	24.3	1.9[b]	11.6	14.17	0.001

Materials for domestic use	2.1	13.0	**2.9**	13.9	2.7	14.5	1.7	12.2	2.07	0.356
Medicine	9.9	27.4	**13.9**	31.2	13.5	32.4	7.3	23.8	3.92	0.141
Non-material NCP										
Learning	22.6	36.8	13.1[a]	30.6	21.1[a,b]	37.9	**26.3[b]**	37.9	6.82	0.033
Aesthetic enjoyment	21.5	34.7	6.9[a]	20.8	10.9[a]	28.0	**30.0[b]**	37.9	24.59	<0,001
Recreation	27.9	37.2	19.9	35.0	28.8	38.3	**30.2[b]**	37.4	4.05	0.132
Therapeutic and restorative benefits	17.6	34.3	6.4[a]	22.4	3.3[a]	17.4	**26.2[b]**	39.0	27.56	<0,001
New and unique experiences	32.0	40.8	7.9[a]	24.0	21.4[a]	35.3	**43.5[b]**	42.6	39.15	<0,001
Connectedness with nature	19.6	35.0	13.8[a]	30.2	6.7[a]	23.5	**26.0[b]**	38.2	15.92	<0,001
Cultural heritage and identity	9.8	25.9	8.1	23.4	**10.5**	25.9	10.1	26.8	0.37	0.833
Social cohesion and bonding	21.8	35.3	3.5[a]	14.9	23.4[b]	37.0	**27.1[b]**	37.5	18.04	<0,001
Intergenerational benefits										
Intergenerational benefits	17.4	34.0	13.8[a]	30.3	**30.5[b]**	42.2	14.0[a]	30.9	9.68	0.008

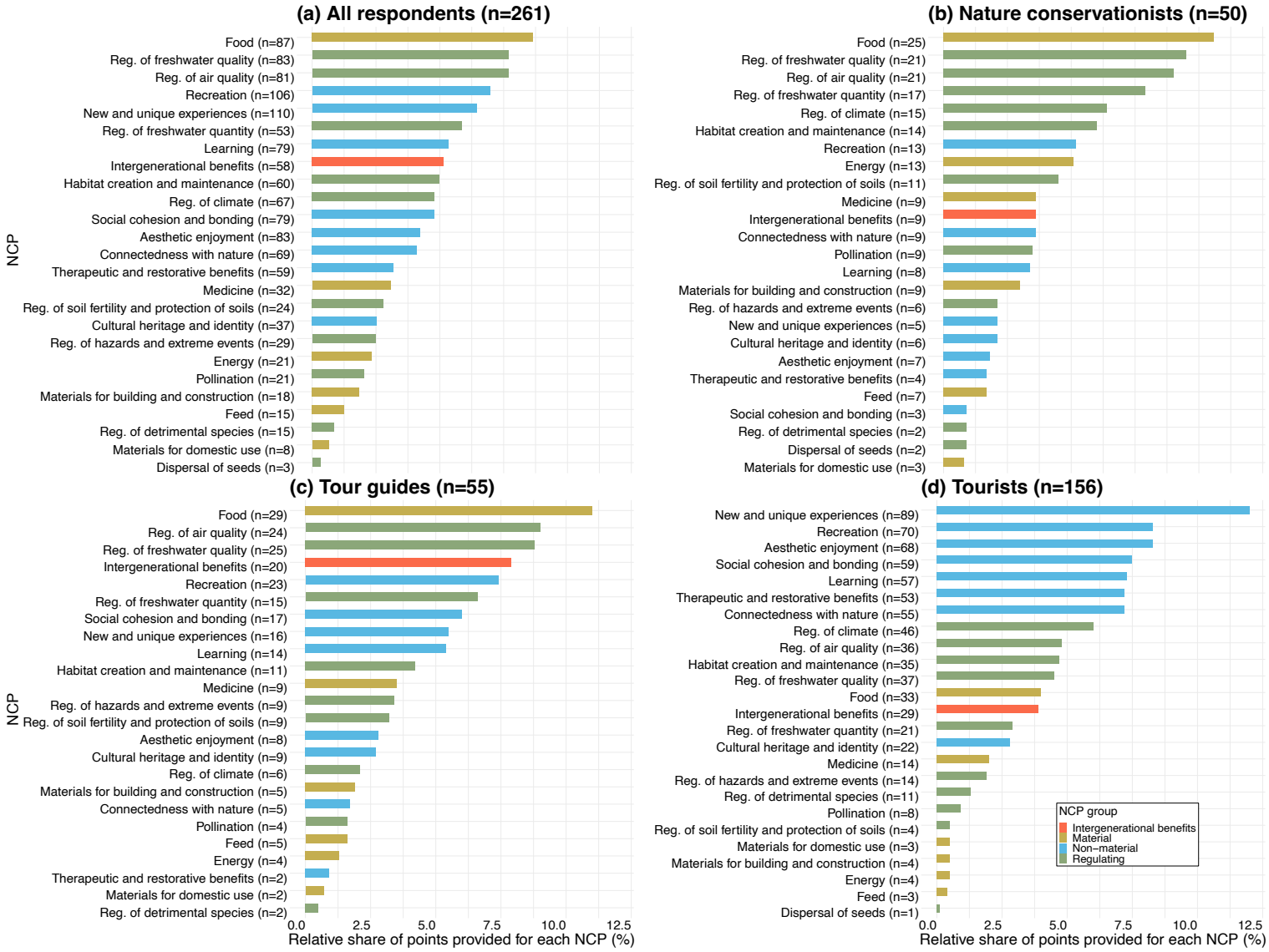


Figure S5.1 Descriptive overview of the relative share of points provided for each Nature's Contributions to People (NCP), i.e., NCP preference, for (**a**) all respondents and (**b-d**) each social actor. For (a) unequal sample sizes of the social actors were weighted based on the sample size of each social actor. *n* absolute frequency of NCP selected in step 1 of the interactive NCP exercise. *Reg.* Regulation.

Table S5.3a-d Summary and statistics of predictive Canonical Correspondence Analysis (partial least squares extension) (CCA-PLS) results for all respondents (**a**) and each social actor (**b-d**), showing the explanatory influence of socio-demographic attributes and interaction with nature variables on preferences for Nature's Contributions to People (NCP). The first section of each table, entitled *NCP preferences (*Response variables*)*, displays the standard coordinates of each NCP. In bold, we indicate those response variables with associated squared cosines higher than 0.6 (values not displayed). The second section of each table, entitled *Explanatory variables*, displays the principal coordinates of the explanatory variables. In bold, we display those explanatory variables whose absolute values of standard coefficients are higher than 0.3 (values not displayed). The last section of each table, entitled *CCA statistics*, displays the explained variation and permutation test's significance. Monte Carlo permutation test with 1000 iterations; $P < 0.05$. We describe NCP in Table 1, socio-demographic attributes, and interaction with nature variables in Table S4.2. *Kilimanjaro* the social-ecological system of Mount Kilimanjaro.

Table S5.3a CCA-PLS results for all respondents.

	Axis 1	**Axis 2**
Response variables		
NCP preferences		
Regulating NCP		
Habitat creation and maintenance	0.007	**0.096**
Pollination	**0.553**	-0.034
Regulation of air quality	**0.311**	0.021
Regulation of climate	**-0.146**	-0.040
Regulation of freshwater quantity	**0.329**	0.101
Regulation of freshwater quality	**0.352**	0.129
Regulation of soil fertility and protection of soils	**0.954**	-0.348
Regulation of hazards and extreme events	0.200	0.183
Regulation of detrimental species	**-0.300**	-0.021
Material NCP		
Energy	**0.941**	-0.300
Food	**0.438**	0.081
Feed	**0.741**	-0.306
Building materials	**0.786**	-0.122
Medicine	**0.293**	0.181
Non-material NCP		
Learning	**-0.227**	-0.164
Aesthetic enjoyment	**-0.428**	-0.124
Recreation	**-0.157**	0.034
Therapeutic and restorative benefits	**-0.641**	0.020
New and unique experiences	**-0.423**	-0.043
Connectedness with nature	**-0.359**	0.103
Cultural heritage and identity	-0.004	**-0.363**
Social cohesion and bonding	**-0.325**	0.020
Intergenerational benefits		
Intergenerational benefits	0.200	0.176
Explanatory variables		
Social actors		
Nature conservationists	0.096	-0.014
Tour guides	0.084	0.022
Tourists	**-0.180**	-0.008
Socio-demographic attributes		
Female	-0.087	0.000
Male	0.087	0.000
Age	0.021	-0.010
Education	-0.118	**-0.109**
Global South	**0.177**	0.005
Global North	**-0.179**	-0.005

Tanzanian citizen	**0.183**	0.008
Non-Tanzanian citizen	**-0.183**	-0.008
Interaction with nature		
Closeness to nature	**0.189**	**0.089**
Time in nature during the week	**0.214**	**0.066**
Time in nature on the weekend	-0.068	**0.066**
Visited a protected area	0.000	0.013
Visited Kilimanjaro National Park	0.009	0.021

CCA statistics		
Explained variation (%)	89.7	10.3
Cumulative variation (%)	89.7	100
Permutation test *P* value	<0.0001	

Table S5.3b CCA-PLS results for nature conservationists.

	Axis 1	Axis 2
Response variables		
NCP preferences		
Regulating NCP		
Habitat creation and maintenance	**-0.174**	-0.110
Pollination	**0.657**	-0.152
Regulation of air quality	**0.407**	-0.106
Regulation of climate	**-0.429**	-0.233
Regulation of freshwater quantity	**-0.690**	0.059
Regulation of freshwater quality	0.126	-0.141
Regulation of soil fertility and protection of soils	0.279	**0.341**
Regulation of hazards and extreme events	0.173	**0.243**
Material NCP		
Energy	-0.198	**0.273**
Food	-0.196	0.227
Feed	0.351	**0.451**
Building materials	0.266	**0.629**
Medicine	**0.267**	-0.193
Non-material NCP		
Learning	**0.090**	-0.054
Aesthetic enjoyment	**-0.038**	-0.024
Recreation	0.203	**-0.436**
Connectedness with nature	-0.249	**-0.498**
Cultural heritage and identity	**-0.188**	0.137
Intergenerational benefits		
Intergenerational benefits	**0.058**	-0.030
Explanatory variables		
Socio-demographic attributes		
Female	-0.004	-0.017
Male	0.004	0.017
Age	0.020	0.022
Education	**-0.238**	0.014
Interaction with nature		
Closeness to nature	-0.048	**-0.195**
Time in nature during the week	**0.108**	**-0.169**
Time in nature on the weekend	**-0.256**	**-0.216**
Visited a protected area	-0.033	-0.042
CCA statistics		
Explained variation (%)	61.7	38.3
Cumulative variation (%)	61.7	100
Permutation test *P* value	0.043	

Table S5.3c CCA-PLS results for tour guides.

	Axis 1	**Axis 2**
Response variables		
NCP preferences		
Regulating NCP		
Habitat creation and maintenance	-0.202	**-0.253**
Regulation of air quality	0.146	**-0.274**
Regulation of climate	-0.142	**-0.515**
Regulation of freshwater quantity	**0.397**	0.003
Regulation of freshwater quality	**-0.285**	-0.056
Regulation of soil fertility and protection of soils	**0.491**	0.334
Regulation of hazards and extreme events	0.301	**-0.539**
Material NCP		
Food	**-0.142**	0.046
Medicine	**-0.615**	0.058
Non-material NCP		
Learning	0.005	**0.098**
Aesthetic enjoyment	**0.521**	-0.077
Recreation	0.027	**0.354**
New and unique experiences	**-0.334**	0.066
Cultural heritage and identity	**0.235**	-0.088
Social cohesion and bonding	**0.694**	0.323
Intergenerational benefits		
Intergenerational benefits	**-0.330**	0.151
Explanatory variables		
Socio-demographic attributes		
Female	-0.003	-0.003
Male	0.003	0.003
Age	0.002	0.001
Education	**0.372**	-0.016
Interaction with nature		
Closeness to nature	0.001	**-0.165**
Time in nature during the week	0.022	-0.083
Time in nature on the weekend	-0.013	**-0.139**
Visited a protected area	-0.009	-0.027
CCA statistics		
Explained variation (%)	65.6	34.4
Cumulative variation (%)	65.6	100
Permutation test *P* value	0.021	

Table S5.3d CCA-PLS results for tourists.

	Axis 1	**Axis 2**
Response variables		
NCP preferences		
Regulating NCP		
Habitat creation and maintenance	0.114	**0.464**
Pollination	-0.011	**-0.178**
Regulation of air quality	**0.159**	0.066
Regulation of climate	0.086	**0.107**
Regulation of freshwater quantity	**0.435**	-0.223
Regulation of freshwater quality	0.241	**-0.322**
Regulation of hazards and extreme events	-0.122	**0.343**
Regulation of detrimental species	**0.091**	-0.005
Material NCP		
Food	**0.501**	0.107
Medicine	**0.420**	-0.218
Non-material NCP		
Learning	**-0.232**	-0.053
Aesthetic enjoyment	**-0.139**	-0.065
Recreation	**-0.103**	-0.005
Therapeutic and restorative benefits	0.040	-0.043
New and unique experiences	**-0.206**	0.008
Connectedness with nature	0.095	**0.135**
Cultural heritage and identity	**-0.118**	-0.043
Social cohesion and bonding	**-0.379**	-0.020
Intergenerational benefits		
Intergenerational benefits	0.017	**-0.146**
Explanatory variables		
Socio-demographic attributes		
Female	0.016	-0.003
Male	-0.016	0.003
Age	-0.026	0.007
Education	**-0.232**	**0.085**
Global North	-0.003	0.002
Interaction with nature		
Closeness to nature	0.015	**0.058**
Time in nature during the week	**0.087**	0.008
Time in nature on the weekend	0.022	0.014
Visited a protected area	0.007	0.009
Number of visits to Kilimanjaro	**0.140**	**0.111**
Visited Kilimanjaro National Park	0.001	-0.001
Bio-cultural activities	0.008	0.006
CCA statistics		
Explained variation (%)	63.4	36.6
Cumulative variation (%)	63.4	100
Permutation test *P* value	0.013	

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Appendix 7: Appendix for Chapter V

Appendix A1 Survey questionnaire and material

Profile attributes

Which social actor does the respondent belong to? [Variable: social actor] determined by the first author before the start of the survey

- Farmer
- Nature conservationist
- Tour guide
- Tourist

Introduction *specific for nature conservationists, tour guides, and tourists*

Nice to meet you. My name is [your name] and I am a [professor, postdoctoral researcher, PhD student, field assistant] in the Kili-SES research project. We would like to thank you for taking the time to participate in this survey. The survey is part of a scientific project, funded by the German Research Foundation. By taking part in this survey, you are making a valuable contribution to improve the understanding of the interaction between people and nature at Kilimanjaro.
We planned the survey for one hour. Based on pre-tests we experienced that it might take a little longer. We don't want you to feel rushed. So please take your time! Is that okay for you or do you have to leave earlier, at a specific time [If the time is limited, please watch the time and make sure that you don't rush but move on to the sections Profile attributes and Thank you 5-10 minutes before the participant has to leave]?

Please note that for most of the questions there is no right or wrong answer. We are interested in your opinion. If there is any question you feel uncomfortable answering, please let us know. You are always free not to answer. If you have any questions at any point during the survey, please don't hesitate to ask.

[Respondent with appointment and received explanation form and declaration of consent through email from Milena Gross:]
Milena Gross sent you the detailed explanation form and declaration of consent form (Appendix A3) via email beforehand. Those documents state the information I just shared with you in even more depth. Do you need to read them again? [If no, continue. If yes, provide the explanation form and declaration of consent.] Do you have any questions? [If no, continue. If yes, please answer the questions.] To make sure you can make use of all rights stated in the documents, I would like to give you your ID card now [Give ID card to the participant]. Your information will be treated fully confidential. All your answers given are recorded pseudo-anonymously and cannot be traced back to you. We don't record any personal data, e.g., name and email address, together with your responses. If you want to withdraw your answers after the survey, we can delete them, if you email Milena Gross and state your ID. Your ID is [Read the number out loud.] and is written down here [Show number on ID card.]. We recommend taking a photo of the ID card. In case you lose it for example, you can still make use of your rights.

Before starting the survey, we would like to ask for your consent to participate in this survey. Please do this by signing on the tablet.
[Select yes for the participation question below and let participant sign on the signature field.]

[No appointment with respondent and no explanation form and declaration of consent through email from Milena Gross]
We prepared a detailed explanation form and declaration of consent form that state the information I just shared with you in even more depth. Do you need to read them? [If no, continue. If yes, provide an explanation form and declaration of consent.] Do you have any questions? [If no, continue. If yes, please answer the questions]. If you want to receive a digital copy of these two documents, my colleague Milena Gross is happy to email them to you.

Milena Gross' email is written down on your ID Card [Give ID card to participants.]. There are more purposes to this ID Card, that is, to make sure you can make use of all rights stated in the documents. As stated, your information will be treated fully confidential. All your answers given are recorded anonymously and cannot be traced back to you. We don't record any personal data, e.g., name and email address, together with your responses. Therefore, if you want to withdraw your answers after the survey, we can delete them, if you email Milena Gross and state your ID. Your ID is [Read the number out loud.] and is written down here [Show number on ID card]. Before starting we would like to ask for your consent to participate in this survey. Do you want to participate?

- Yes
- No

specific for farmers; the survey taker reads out the following introduction to the farmers

Thank you for agreeing to this meeting today. We are conducting a survey that is part of a scientific project, funded by the German Research Foundation. This project is a collaboration between Tanzanian and international researchers and attempts to better understand how people interact with nature at Mount Kilimanjaro.

For this research we survey people who live on, work on, and travel to Mount Kilimanjaro. You must be 18 or older to participate in the study. The survey will take approximately 90 minutes. As a participant in this research, your participation is entirely voluntary. You are free to leave at any time if you do not feel comfortable being involved in this study. You may refuse to answer any questions you do not feel comfortable answering at any time. Please note that for most of the questions there is no right or wrong answer. We are interested in your opinion. If you have any questions at any point during the survey, please don't hesitate to ask.

Your identity and information will remain completely confidential and anonymous so we can ensure that this is not revealed in any outcomes from this study. You are also free to ask any questions or raise any concerns you may have about this study at any time. You will also be able to stay in contact after this study has been completed to provide feedback or access the final outputs. Upon completion of this project, all data will be stored in a secure location and destroyed after exceeding the legal retention period of ten years.

Do you want to participate in this survey?

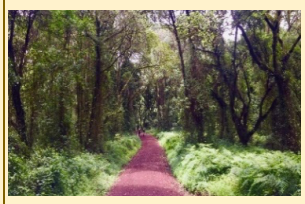
- Yes
- No

Interactive exercise on preferences for Nature's Contributions to People (NCP) (NCP clusters)

We are interested in contributions you gain from nature at Kilimanjaro (from lowlands to Uhuru peak, i.e., beyond the border of the national park) which are important for you and your life [For Swahili-speaking respondents, nature understood as mazingira asili]. We have identified 25 contributions through interviews with people who live on, work at, or visited Kilimanjaro [Provide set A/B/C (software randomly selects a set) to the participant.]. I would like to show you a list of these 25 identified contributions. [Show column 'name'.] We added examples that interviewees mentioned for each of the contributions [Show column 'examples'.], and example pictures that represent them [Show column 'exemplary photos'.]. You can ignore the letters [Point a first column with letters.]. They don't have a meaning for you but help us to correctly insert your responses.

Please carefully read the list [The survey taker reads the list to the farmers.] and select up to five contributions according to their importance for you and your life. Which are the five most important contributions – important for you and your life? If you need some aid to memory, feel free to take the pen and add some symbols/comments. When you have finished your selection, please name the contributions you have selected, so we can proceed. Please take your time reading through the list [The survey taker repeats the list to the farmers if need be.] and then read out the contributions you selected. *[Variable: NCP preference]*

SET A

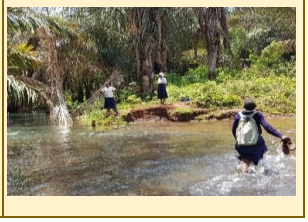
	NAME	EXAMPLES	EXEMPLARY PHOTOS	
A	**Habitat creation and maintenance**	• Habitat for animals • Habitat for people • Forest is home to animals and plants • Elephants as architects of the ecosystem		
B	**Pollination**	• Pollination by insects such as bees • Pollination by birds		
C	**Dispersal of seeds**	• Seed dispersal by animals, for example elephants and birds		
D	**Regulation of air quality**	• Fresh and clean air • Nature, e.g., plants, trees, provides oxygen		
E	**Regulation of climate**	• Carbon sink and sequestration • Shade for temperature or moisture control • Microclimate of Kilimanjaro • Pleasant and nice weather of Kilimanjaro		
F	**Regulation of freshwater quantity**	• Rainfall • Water flow in catchments, lakes, streams or rivers • Glaciers producing water		
G	**Regulation of freshwater quality**	• Nature improves the quality of the water • Drinking, clean and safe water		

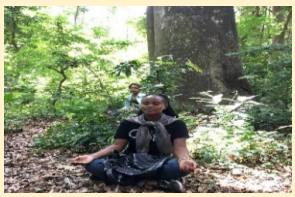
	NAME	EXAMPLES	EXEMPLARY PHOTOS	
H	**Regulation of soil fertility and protection of soils**	• Fertile and rich soil • Nutrients in the soil • Planting trees to prevent soil erosion		
I	**Regulation of hazards and extreme events**	• Trees help to prevent landslides • Trees as windbreakers • Without nature, there will be droughts [dry periods]		
J	**Regulation of detrimental species**	• Disease prevention • Less mosquitoes in higher elevation • Bees deter elephants • Plant used to catch the mole rat		
K	**Energy**	• Firewood • Charcoal • Hydropower		
L	**Food**	• Crops for eating such as fruit and vegetables • Coffee • Animal products such as milk, meat, honey etc. • Mbege [banana beer]		
M	**Feed**	• Fodder • Grass for livestock animals such as cows, goats etc. • Food scraps such as banana peels for livestock		
N	**Materials for building and construction**	• Raw materials to build infrastructure • Timber as building material for, e.g., sheds and houses • Rock as construction material		

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
O	**Materials for domestic use**	• Timber to make furniture • Banana materials used for beds, roof of houses, baskets, umbrellas, seed base, etc. • Jewellery made from oyster nut shells • Lianas used as ropes		
P	**Medicine**	• Nature used for medicinal purposes • Medicinal honey from stingless bees • Traditional medicine		
Q	**Learning**	• Improved knowledge and understanding • Cultural exchange • Influence on life perspective • Personal or emotional growth		
R	**Aesthetic enjoyment**	• Nature is beautiful • Visually pleasant scenery • Picturesque and incredible views • The beauty of the mountain		
S	**Recreation**	• Animal-watching • Camping • Swimming • Hiking, walking or exercising		
T	**Therapeutic and restorative benefits from / in nature**	• Break from technology and modern life • Healing • Peace and solitude • Relaxation and stress-relief		

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
U	**Social cohesion and bonding in nature**	• Social relations with other people • Bonding and comradery • Community building • Friendship or family ties		
V	**Cultural heritage and identity through nature**	• Ancestral ties • Cultural identity • Local, traditional and Indigenous heritage • Sacred places		
W	**Connected-ness with nature**	• Emotional, physical or spiritual connection with nature • Being ´one with´ nature and/or feeling like part of it • Friendship, family ties or other relationship with nature, e.g., the trees are my best friends		
X	**Inter-generational benefits**	• Continued existence of biodiversity • Conservation of benefits for future generations • I want my children and grandchildren to see the beauty of nature • Preserve nature for future generations		
Y	**New and unique experiences**	• Nature´s uniqueness • Diversity of ecosystems on one mountain • Snow and glaciers in the tropics • I have never experienced nature like this before		

SET B

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
Y	**New and unique experiences**	• Nature´s uniqueness • Diversity of ecosystems on one mountain • Snow and glaciers in the tropics • I have never experienced nature like this before		
X	**Inter-generational benefits**	• Continued existence of biodiversity • Conservation of benefits for future generations • I want my children and grandchildren to see the beauty of nature • Preserve nature for future generations		
U	**Social cohesion and bonding in nature**	• Social relations with other people • Bonding and comradery • Community building • Friendship or family ties		
V	**Cultural heritage and identity through nature**	• Ancestral ties • Cultural identity • Local, traditional and Indigenous heritage • Sacred places		
W	**Connected-ness with nature**	• Emotional, physical or spiritual connection with nature • Being ´one with´ nature and/or feeling like part of it • Friendship, family ties or other relationship with nature, e.g., the trees are my best friends		
S	**Recreation**	• Animal-watching • Camping • Swimming • Hiking, walking or exercising		

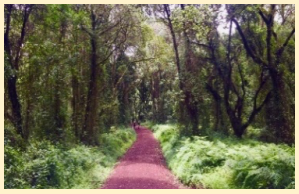
	NAME	EXAMPLES	EXEMPLARY PHOTOS	
R	**Aesthetic enjoyment**	• Nature is beautiful • Visually pleasant scenery • Picturesque and incredible views • The beauty of the mountain		
T	**Therapeutic and restorative benefits from / in nature**	• Break from technology and modern life • Healing • Peace and solitude • Relaxation and stress-relief		
Q	**Learning**	• Improved knowledge and understanding • Cultural exchange • Influence on life perspective • Personal or emotional growth		
P	**Medicine**	• Nature used for medicinal purposes • Medicinal honey from stingless bees • Traditional medicine		
M	**Feed**	• Fodder • Grass for livestock animals such as cows, goats etc. • Food scraps such as banana peels for livestock		
N	**Materials for building and construction**	• Raw materials to build infrastructure • Timber as building material for, e.g., sheds and houses • Rock as construction material		

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
O	**Materials for domestic use**	• Timber to make furniture • Banana materials used for beds, roof of houses, baskets, umbrellas, seed base, etc. • Jewelry made from oyster nut shells • Lianas used as ropes		
L	**Food**	• Crops for eating such as fruit and vegetables • Coffee • Animal products such as milk, meat, honey etc. • Mbege [banana beer]		
K	**Energy**	• Firewood • Charcoal • Hydropower		
F	**Regulation of freshwater quantity**	• Rainfall • Water flow in catchments, lakes, streams or rivers • Glaciers producing water		
H	**Regulation of soil fertility and protection of soils**	• Fertile and rich soil • Nutrients in the soil • Planting trees to prevent soil erosion		
G	**Regulation of freshwater quality**	• Nature improves the quality of the water • Drinking, clean and safe water		

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
A	**Habitat creation and maintenance**	• Habitat for animals • Habitat for people • Forest is home to animals and plants • Elephants as architects of the ecosystem		
J	**Regulation of detrimental species**	• Disease prevention • Less mosquitoes in higher elevation • Bees deer elephants • Plant used to catch the mole rat		
I	**Regulation of hazards and extreme events**	• Trees help to prevent landslides • Trees as windbreakers • Without nature, there will be droughts [dry periods]		
B	**Pollination**	• Pollination by insects such as bees Pollination by birds		
E	**Regulation of climate**	• Carbon sink and sequestration • Shade for temperature or moisture control • Microclimate of Kilimanjaro • Pleasant and nice weather of Kilimanjaro		
D	**Regulation of air quality**	• Fresh and clean air Nature, e.g., plants, trees, provides oxygen		
C	**Dispersal of seeds**	• Seed dispersal by animals, for example elephants and birds		

SET C

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
N	**Materials for building and construction**	• Raw materials to build infrastructure • Timber as building material for, e.g., sheds and houses • Rock as construction material		
O	**Materials for domestic use**	• Timber to make furniture • Banana materials used for beds, roof of houses, baskets, umbrellas, seed base, etc. • Jewelry made from oyster nut shells • Lianas used as ropes		
P	**Medicine**	• Nature used for medicinal purposes • Medicinal honey from stingless bees • Traditional medicine		
L	**Food**	• Crops for eating such as fruit and vegetables • Coffee • Animal products such as milk, meat, honey etc. • Mbege [banana beer]		
M	**Feed**	• Fodder • Grass for livestock animals such as cows, goats etc. • Food scraps such as banana peels for livestock		
K	**Energy**	• Firewood • Charcoal • Hydropower		

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
J	**Regulation of detrimental species**	• Disease prevention • Less mosquitoes in higher elevation • Bees deter elephants • Plant used to catch the mole rat		
I	**Regulation of hazards and extreme events**	• Trees help to prevent landslides • Trees as windbreakers • Without nature, there will be droughts [dry periods]		
E	**Regulation of climate**	• Carbon sink and sequestration • Shade for temperature or moisture control • Microclimate of Kilimanjaro • Pleasant and nice weather of Kilimanjaro		
G	**Regulation of freshwater quality**	• Nature improves the quality of the water • Drinking, clean and safe water		
H	**Regulation of soil fertility and protection of soils**	• Fertile and rich soil • Nutrients in the soil • Planting trees to prevent soil erosion		
D	**Regulation of air quality**	• Fresh and clean air • Nature, e.g., plants, trees, provides oxygen		

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
B	**Pollination**	• Pollination by insects such as bees • Pollination by birds		
C	**Dispersal of seeds**	• Seed dispersal by animals, for example elephants and birds		
A	**Habitat creation and maintenanc e**	• Habitat for animals • Habitat for people • Forest is home to animals and plants • Elephants as architects of the ecosystem		
F	**Regulation of freshwater quantity**	• Rainfall • Water flow in catchments, lakes, streams, or rivers • Glaciers producing water		
V	**Cultural heritage and identity through nature**	• Ancestral ties • Cultural identity • Local, traditional and Indigenous heritage • Sacred places		
U	**Social cohesion and bonding in nature**	• Social relations with other people • Bonding and comradery • Community building • Friendship or family ties		
T	**Therapeutic and restorative benefits from / in nature**	• Break from technology and modern life • Healing • Peace and solitude • Relaxation and stress-relief		

	NAME	EXAMPLES	EXEMPLARY PHOTOS	
W	**Connected-ness with nature**	• Emotional, physical or spiritual connection with nature • Being ´one with´ nature and/or feeling like part of it • Friendship, family ties or other relationship with nature, e.g., the trees are my best friends		
S	**Recreation**	• Animal-watching • Camping • Swimming • Hiking, walking or exercising		
X	**Inter-generational benefits**	• Continued existence of biodiversity • Conservation of benefits for future generations • I want my children and grandchildren to see the beauty of nature • Preserve nature for future generations		
Y	**New and unique experiences**	• Nature´s uniqueness • Diversity of ecosystems on one mountain • Snow and glaciers in the tropics • I have never experienced nature like this before		
Q	**Learning**	• Improved knowledge and understanding • Cultural exchange • Influence on life perspective • Personal or emotional growth		
R	**Aesthetic enjoyment**	• Nature is beautiful • Visually pleasant scenery • Picturesque and incredible views • The beauty of the mountain		

Rating of statements representing values of nature (value expression)

[Provide set D/E (software randomly selects a set) to the participant.] How much do you agree or disagree with the following statements? Indicate with X. [The survey taker provides the template to nature conservationists, tour guides, and tourists, while the survey taker reads the list to the farmers and inserts the response.] There are no right and wrong answers. We are interested in your personal opinion. *[Variable: Value expression]*

SET D

	How much do you agree or disagree with the following statements? Indicate with X. There are no right and wrong answers. We are interested in your personal opinion.	Strongly disagree	Dis-agree	Agree	Strongly agree	I don't know
1	I value nature at Kilimanjaro because I feel part of it.					
2	I value nature at Kilimanjaro because it has its own right to exist and prosper.					
3	I value nature at Kilimanjaro because it connects me with who we are as a culture/ethnic group/community.					
4	I value nature at Kilimanjaro because I economically benefit from it.					
5	My care for nature at Kilimanjaro helps me to lead a good and fulfilling life.					
6	I value nature at Kilimanjaro because my relationship to it is an important part of my culture.					
7	I value each species in nature at Kilimanjaro because it has its particular reason for its existence, and therefore, it is worthy of conservation.					
8	I value nature at Kilimanjaro because it connects me with my traditions and the way of life of my ancestors [former family members].					
9	I value nature at Kilimanjaro because its uniqueness fulfills me.					
10	I value nature at Kilimanjaro because it is like family/friend/community to me.					
11	I value nature at Kilimanjaro because it is relevant for the heritage and history of myself/our people/the nation.					
12	I value nature at Kilimanjaro because it fulfills me with new/special experiences that I have not experienced elsewhere.					
13	I value nature at Kilimanjaro because I learn from and with it.					
14	I value nature at Kilimanjaro because it contributes to meeting my basic needs such as clean air and water.					

	How much do you agree or disagree with the following statements? Indicate with X. There are no right and wrong answers. We are interested in your personal opinion.	Strongly disagree	Dis-agree	Agree	Strongly agree	I don't know
15	I value being responsible for nature at Kilimanjaro and taking care of it.					
16	I value nature at Kilimanjaro because I enjoy the beauty of its sights/sounds/smells.					
17	I value nature at Kilimanjaro because it inspires me with new ideas and creativity.					
18	I value nature at Kilimanjaro because it enables a sense of community.					
19	I value nature at Kilimanjaro because it is relevant for my wisdom and knowledge.					
20	I value nature at Kilimanjaro because it gives me the opportunity to enjoy and deepen relationships with friends, family, and other people.					

SET E

	How much do you agree or disagree with the following statements? Indicate with X. There are no right and wrong answers. We are interested in your personal opinion.	Strongly disagree	Dis-agree	Agree	Strongly agree	I don't know
1	My care for nature at Kilimanjaro helps me to lead a good and fulfilling life.					
2	I value nature at Kilimanjaro because it gives me the opportunity to enjoy and deepen relationships with friends, family, and other people.					
3	I value nature at Kilimanjaro because it enables a sense of community.					
4	I value nature at Kilimanjaro because I economically benefit from it.					
5	I value nature at Kilimanjaro because my relationship to it is an important part of my culture.					
6	I value nature at Kilimanjaro because it inspires me with new ideas and creativity.					
7	I value nature at Kilimanjaro because I learn from and with it.					
8	I value nature at Kilimanjaro because it is relevant for the heritage and history of myself/our people/the nation.					
9	I value nature at Kilimanjaro because its uniqueness fulfills me.					
10	I value nature at Kilimanjaro because it has its own right to exist and prosper.					
11	I value nature at Kilimanjaro because it contributes to meeting my basic needs such as clean air and water.					
12	I value nature at Kilimanjaro because I enjoy the beauty of its sights/sounds/smells.					
13	I value nature at Kilimanjaro because it connects me with my traditions and the way of life of my ancestors [former family members].					
14	I value nature at Kilimanjaro because it fulfills me with new/special experiences that I have not experienced elsewhere.					
15	I value nature at Kilimanjaro because it is relevant for my wisdom and knowledge.					

	How much do you agree or disagree with the following statements? Indicate with X. There are no right and wrong answers. We are interested in your personal opinion.	Strongly disagree	Dis-agree	Agree	Strongly agree	I don't know
16	I value nature at Kilimanjaro because I feel part of it.					
17	I value each species in nature at Kilimanjaro because it has its particular reason for its existence, and therefore, it is worthy of conservation.					
18	I value being responsible for nature at Kilimanjaro and taking care of it.					
19	I value nature at Kilimanjaro because it is like family/friend/community to me.					
20	I value nature at Kilimanjaro because it connects me with who we are as a culture/ethnic group/community.					

Profile attributes continued *specific for tourists*

What is your nationality? *[Variable: Tanzanian citizen]*
If I may ask, what is your gender? Male, female, diverse, or you don't want to answer the question. *[Variable: Gender]*

specific for farmers, nature conservationists, and tour guides
Have your parents lived in Kilimanjaro? *[Variable: Parents lived in the social-ecological system of Mount Kilimanjaro (hereafter also referred to as Kilimanjaro)]*
What is your nationality? *[Variable: Tanzanian citizen]*

Thank you!

That's the end of the survey!
specific for nature conservationists, tour guides, and tourists
Thank you for participating in our research project! We highly appreciate your contribution. If you would like to receive a summary of the results, please email Milena Gross. Her email address is stated on the ID card that I gave you before the survey.
[Please ask this question only, if we still need more participants of the social actor:] Is there anyone else you know who visits Mount Kilimanjaro as a tourist, is as a tour guide or nature conservationist and might be able to participate in this survey?

specific for farmers
This is the end of the questionnaire. Thank you so much for taking the time to answer this survey! I really appreciate your willingness to share your experience and perspective on nature at Mount Kilimanjaro. You have made a valuable contribution to this research project. As a thank you we would like to compensate you [Survey taker gives the compensation to the respondent.].

Also, here is my card with contact information. You can find more information about our research project here: https://kili-ses.senckenberg.de/en. If you would like to receive a signed consent/consent form to participate in our study, please send an email to Wivina Msembeni. You can withdraw your answers anytime for any reason and without penalty. If you want to do so, please contact Wivina Msembeni and state your ID. If you would like to receive a summary of the results, please contact Wivina Msembeni.

specific for farmers, nature conservationists and tour guides; determined by survey taker after the survey was finished because it was inappropriate to ask locals for their gender, particularly a diverse gender identity, in the cultural context of the survey
The survey taker inserted gender [female or male] of survey respondent after the survey was finished. *[Variable: Gender]*

Appendix A2 Additional information on data collection, analysis, and ethics

Questionnaire design

This study is based on three questionnaire sections pertinent to addressing our research questions: (1) interactive exercise on preferences for Nature's Contributions to People (NCP) (NCP clusters) (2) rating of statements representing values of nature (value expression), and (3) profile attributes. We tailored the content of sections (1) and (2) to the context of the study area, i.e., the social-ecological system of Mount Kilimanjaro (hereafter also referred to as Kilimanjaro). To this end, we drew on insights on NCP and values gained from 130 semi-structured interviews that we had conducted with the four social actors between May 2021 and March 2022.

For section (1), we detected 25 context-specific NCP in the interviews that we linked back to the NCP in the generalizing perspective (Díaz *et al.* 2018), by using an interwoven approach (Hill et al. 2021), except for the NCP *new and unique experiences* (Gross *et al.* submitted) (Table A1). Furthermore, we classified the 25 NPC into three NCP groups, i.e., ten regulating, six material, and eight non-material NCP. The NCP *intergenerational benefits* cross-cuts all three groups, and therefore, we maintained it as a distinct group. Drawing on the 25 NCP mentioned above, we created a survey exercise to investigate NCP preferences. We gave each respondent a set of laminated sheets that featured the 25 NCP (Appendix A1), i.e., the NCP name, examples drawn from our interviews, and two illustrative pictures to provide visual representations (Iniesta-Arandia *et al.* 2014; Oteros-Rozas *et al.* 2014). To enhance respondent comprehension and to convey the NCP framework without mentioning the terms NCP or ecosystem services, we employed plain language and visual aids (Martín-López *et al.* 2012). We instructed respondents to choose up to five NCP from a list of those 25 NCP that were important to them and in their lives (e.g., Zoderer *et al.* 2019), i.e., the five most preferred NCP using the terminology of this work. To ensure randomness, we generated three distinct sets A/B/C of laminated sheets for shuffling the order of NCP presentation (Appendix A1). The software ArcGIS Survey 123 selected one of these sets at random to present to each participant.

Table A1 Overview of the context-specific 25 Nature's Contributions to People (NCP) used in the survey, NCP descriptions based on 130 semi-structured interviews previously conducted with the four social actors, and NCP linked with NCP in generalizing perspective (Díaz *et al.* 2018), using an interwoven approach (Hill *et al.* 2021). Table A1 is based on Gross *et al.* (submitted). Icon design credit: Jelke Meyer.

NCP		Description	Generalizing NCP category
Regulating NCP			
	Habitat creation and maintenance	Nature's processes and conditions to form and continue providing a place for human and non-human organisms to live and thrive	1. Habitat creation and maintenance
	Pollination	Animals' contribution of distributing pollen among flowers	2. Pollination and dispersal of seeds and other propagules
	Dispersal of seeds	Animals' contribution to moving seeds such birds and elephants as seed dispersers	
	Regulation of air quality	Nature's processes of purifying air to improve its quality for people	3. Regulation of air quality

NCP		Description	Generalizing NCP category
	Regulation of climate	Nature's regulation of atmospheric conditions, including effects on greenhouse gases and temperature, carbon sequestration and storage, and pleasant weather conditions	4. Regulation of climate
	Regulation of freshwater quantity	Nature's hydrological processes to regulate the water flow and function as a source of water for various people-related purposes, e.g., irrigation and water for domestic use	6. Regulation of freshwater quantity, location and timing
	Regulation of freshwater quality	Nature's processes of purifying water to improve its quality for people	7. Regulation of freshwater and coastal water quality
	Regulation of soil fertility and protection of soils	Nature's processes occurring in the top layer of the Earth's crust to sustain plant growth and to prevent the in/organic surface materials from erosion	8. Formation, protection and decontaminati on of soils and sediments
	Regulation of hazards and extreme events	Nature's processes to prevent or reduce damage to people and their infrastructure caused by natural disasters and events such as strong floods, winds, and storms	9. Regulation of hazards and extreme events
	Regulation of detrimental species	Controlling effects derived from organisms and abiotic conditions on organisms that are pests or transmit diseases, e.g., the temperature limits the spatial coverage of anopheles mosquitos which can transmit Malaria disease	10. Regulation of detrimental organisms and biological processes
Material NCP			
	Energy	Production of timber-based fuels such as firewood and hydropower	11. Energy
	Food	Production of eatables and beverages derived from wild, managed, or domesticated organisms for human consumption, e.g., maize, banana, coffee, milk, and meat	12. Food and feed
	Feed	Production of forage and fodder for domesticated animals such as grasses	
	Building materials	Producing materials derived from nature to construct buildings such as timber	13. Materials, companionship and labor
	Materials for domestic use	Producing materials derived from nature to make furniture, everyday objects, tools, aids, and accessories	
	Medicine	Collection and production of materials derived from non-human organisms used for salutary purposes such as insects and herbs	14. Medicinal, biochemical and genetic resources
Non-material NCP			
	Learning	Different levels of acquiring knowledges and gaining insights that can be experienced by and through nature, from education on different species to new profound perspectives, which can influence one´s outlook on life	15. Learning and inspiration
	Aesthetic enjoyment	Pure pleasure of the appealing appearance and beauty of nature	16. Physical and

NCP		Description	Generalizing NCP category
	Recreation	Provision of opportunities for physical activities in nature	psychological experiences
	Therapeutic and restorative benefits	Nature's opportunities for improving physical and psychological well-being	
	New and unique experiences	Provision by nature of novel and special opportunities for people to encounter	*Context-specific NCP that cannot be linked*[16]
	Connectedness with nature	Opportunities for people to develop or strengthen a feeling of being part of nature or feeling emotionally connected to nature	17. Supporting identities[17]
	Cultural heritage and identity	Nature's opportunities for maintaining culture through ongoing cultural practices, traditions, and/or the historical significance of nature that represents collective human identities e.g., a whole country identifies with a natural entity	
	Social cohesion and bonding	Basis of nature for people to develop new connections or nurture their existing relationships with other people	
Intergenerational benefits			
	Intergenerational benefits	Maintaining the existence of nature for future generations to experience	18. Maintenance of options

Section (2) followed an integrated valuation approach to determine respondents' value expression. We presented 20 value statements (Table A2) to the respondents for which we asked them to state their agreement and disagreement, respectively, based on a four-point Likert scale, i.e., (1) strongly disagree, (2) disagree, (3) agree, and (4) strongly agree. We also granted respondents the option to state 'I don't know.'. To ensure randomness, we generated two distinct sets of laminated sheets for shuffling the order of value statements (Appendix A1). The software ArcGIS Survey 123 selected one of these sets D/E at random to present to each respondent.

The value statements represented three different value domains of the IPBES classification (Pascual *et al.* 2017): two statements related to intrinsic values as well as instrumental values and 16 statements related to relational values (Table A2, Sanya *et al.* (submitted)). We phrased the statements to represent the different and specific nuances of the value domains and categories. In doing so, we were guided by an extensive literature review and quotes related to the three value domains and categories that we revealed in the interviews.

[16] This publication differs from the version submitted as Ph.D. thesis; *New and unique experiences* was marked as '16. Physical and psychological experiences'.

[17] This publication differs from the version submitted as Ph.D. thesis; *Connectedness with nature* was marked as 'Context-specific NCP that cannot be linked'.

Table A2 Overview of values of nature used in this study (left column: acronym in the data set) and value statements used to assess respondents' value expression, adapted from Sanya *et al.* (submitted).

Acro-nym	Value of nature	Value statement
Intrinsic values		
inc_1	Right to existence and conservation	I value each species at Kilimanjaro because it has its reason for its existence and is therefore worthy of conservation.
inc_2	Right to existence and prosperity	I value nature at Kilimanjaro because it has its own right to exist and prosper.
Instrumental values		
inl_1	Basic needs	I value nature at Kilimanjaro because it contributes to meeting my/our basic needs such as clean air and water.
inl_2	Economic benefits	I value nature at Kilimanjaro because I/we economically benefit from it.
Relational values		
rv_1	Cultural identity	I value nature at Kilimanjaro because it connects me/us with who we are as a culture/ethnic group/community.
rv_2	Individual identity	I value nature at Kilimanjaro because our/my relationship with it is an important part of my/our culture.
rv_3	Cultural heritage	I value nature at Kilimanjaro because it is relevant to the heritage and history of myself/our people/the nation.
rv_4	Tradition	I value nature at Kilimanjaro because it connects me/us with my/ our traditions and the way of life of my/our ancestors [former family members].
rv_5	Social cohesion	I value nature at Kilimanjaro because it enables a sense of community.
rv_6	Social relations	I value nature at Kilimanjaro because being in nature at Kilimanjaro gives me the opportunity to enjoy and deepen relationships with friends, family, and other people.
rv_7	Kinship	I value nature at Kilimanjaro because it is like family/friend/community to me/us.
rv_8	Individual connectedness	I value nature at Kilimanjaro because I/we feel part of it.
rv_9	Wisdom and knowledge	I value nature at Kilimanjaro because it is relevant for wisdom and knowledge of myself/our people.
rv_10	Learning	I value nature at Kilimanjaro because I/we learn from and with it.
rv_11	Stewardship	My/our care for nature at Kilimanjaro helps me/us to lead a good and fulfilling life.
rv_12	Responsibility	I value being responsible for nature and caring for it at Mount Kilimanjaro.
rv_13	Aesthetic	I value nature at Kilimanjaro because I/we enjoy the beauty of its sights/sounds/smells.
rv_14	Inspiration	I value nature at Kilimanjaro because it inspires me/us with new ideas and creativity.
rv_15	Uniqueness	I value nature at Kilimanjaro because its uniqueness fulfills me/us.
rv_16	New/special experiences	I value nature at Kilimanjaro because it fulfills me/us with new/special experiences that I have not experienced elsewhere.

The intrinsic value statements referred to the importance people express towards right of nature to exist, 'regardless of its *usefulness* or *utility* for others, mainly humans' (Muraca 2016,

p. 26) and human experience, i.e., the notion of nature as an end in itself. Instrumental value statements represented the direct and indirect benefits people obtain from nature, i.e., the notion of nature as a means to specific ends, such as benefits that fulfill people's basic needs or monetary benefits (Arias-Arévalo *et al.* 2017). Statements regarding relational values revolved around the importance of meaningful relationships between nature and people as well as among people (Chan *et al.* 2016). Due to potential nuances in such relationships, we elaborated 16 statements (Sanya *et al.* (submitted)) that reflected the different nuances within meaningful people-nature relationships and people-people relationships mediated in nature (Riechers *et al.* 2022), including the preservation of cultural and collective identities (e.g., Bambridge *et al.* 2021, McCright & Dunlap 2015; Schröter *et al.* 2020), cultural heritage (e.g., Daniel *et al.* 2012), social cohesion (e.g., Chan *et al.* 2016), responsibility, stewardship, learning, and aesthetics for example (e.g., Pratson *et al.* 2023). The object of relational values, i.e., what is relationally valued, can often be represented by a non-material NCP such as cultural identity. While some overlap or double-consideration of the same or similar aspects, such as cultural identity, is unavoidable, we approached this aspect from distinct perspectives. This was achieved by employing two complementary frameworks that address different dimensions or perceptions of people-nature relationships: the NCP framework, which focuses on what [aspects of] nature contributes to human well-being, and the plural valuation framework, which emphasizes the context-sensitive and non-substitutable meaningfulness and thus, the relational value attributed to (nature-based/related) cultural identity.

To tailor the value statements to the context of the study area, we relied on value-related quotes that interviewees had expressed. For example, a nature conservationist (Nature conservationist 23) stated: 'All those species are, for some reason, important in the environment. They have a particular reason for their existence, so they need to be conserved.' We understood this statement as reflecting a notion of intrinsic value (Intrinsic value: Right to existence and conservation). Additionally, a tour guide (Tour guide 15) expressed the following which we considered in an instrumental value statement (Instrumental value: Economic benefits): 'My understanding is no nature, no live. So, my company without nature, I am finished.' The quote 'So globally, politically, Kilimanjaro is iconic for the region. It stands out. The Declaration of Independence, the flags of the nationals light up in the light of this country to get independence 1961. So, Kilimanjaro, is just one of us, a centerpiece for – I will not say only for Tanzania. But the mountain is for the whole continent of Africa.' expressed by a tour guide (Tour guide 12) sharpened our understanding of a meaningful people-nature relationship mediated through the cultural heritage which led to the phrasing of a relational value statement that represented such (Relational value: Cultural heritage). We had clean-edited the three quotes to improve readability (Corden & Sainsbury 2006).

Section (3) covered questions on profile attributes such as the social actor, Tanzanian citizenship, parental residence in Kilimanjaro, and gender (Appendix A1).

We implemented the questionnaire (Appendix A1) in the ArcGIS Survey 123 application (Version 3.15.165) to guide face-to-face surveys between the researcher or field assistant and the respondent. We used a questionnaire in Swahili to survey farmers and an English translation to survey the other three social actors. We iteratively pre-tested the questionnaire with individuals within the study area and students at the university of the first author.

Although we aimed for maximizing the standardization of data collection between the social actors, and we preferred to minimize the interaction between the respondent and survey taker and hence, potential influences evoked through e.g., social desirability, we accounted for respondents' potential analphabetism or limited vision due to age. Thus, we decided to read out the questionnaire and the templates to farmers because of the reasons just represented. In contrast, respondents of the other social actors read the NCP list and value statements, and indicated their responses on the templates themselves.

Sampling process

Table A3 summarizes the definition of each social actor and the sampling strategies we applied. For all social actors, the minimum age required to participate was 18 years.

We determined representative sample sizes for each social actor (Table A4) with a margin of error of 10% and a confidence interval ranging from 90% to 99.99%.

Table A3 Definition of the social actors considered in this study and overview of sampling strategies, adapted from Gross *et al.* (submitted) and Sanya *et al.* (submitted). *CBOs* community-based organizations; *Kilimanjaro* the social-ecological system of Mount Kilimanjaro; *KINAPA* Kilimanjaro National Park; *KINAPA Authority* Kilimanjaro National Park Authority; *NGOs* non-governmental organizations.

Definition of social actor	
Farmers	Head of the household regardless of the gender and if not present, another adult who lives in the household
Nature conservationists	Conservation-related officers at governmental (working for KINAPA Authority), regional, and district level, and national and international members of environmental NGOs, local members of CBOs, and advisory boards with conservation activities in Kilimanjaro
Tour guides	Local tour guides and operators who have experience with guiding tours through nature in Kilimanjaro
Tourists	Tanzanian and international tourists who participated in at least one-day and/or multiple day nature-based activity/ies below and inside KINAP
Stratified sampling	
Farmers	Sampling of households in 14 villages that were distributed along an altitudinal gradient according to three agro-ecological zones (Soini 2005) and a three-level latitudinal gradient based on the districts, i.e., West (Siha and Hai districts), Central (Moshi Rural district), and East (Rombo district) (Sanya *et al.* (submitted)) Determining the to be surveyed households in each village by randomly selecting geographical coordinates and choosing the household that is closest to the coordinates
Random sampling strategies in addition to snowball sampling	
Nature conservationists	Approaching former interviewees Approaching additional governmental, regional, and district officers Searching online for additional nature conservationists working for NGOs, CBOs, and advisory boards
Tour guides	Approaching former interviewees Approaching tour guides, for example, at Machame gate, Mweka gate, in their offices, or during nature-based activities
Tourists	Approaching tourists, for example, at Machame gate, Mweka gate, or during nature-based activities

Table A4 Overview of deduction of sample, population size (*N*), sample size (*n*), confidence level, and sample size (*n*) in the data set based on a margin of error of 10%, shown for the social actors considered in this study. *Kilimanjaro* the social-ecological system of Mount Kilimanjaro; *KINAPA* Kilimanjaro National Park; *KINAPA Authority* Kilimanjaro National Park Authority.

Social actor	Deduction of sample	N	n	Confidence level (%)	n in data set
Farmers	Population data of the districts Hai, Moshi Rural, Rombo, and Siha sourced from the preliminary census for population and housing in 2022 (United Republic of Tanzania 2022)	1191135	271	99.9%	362
Nature conservationists	Number of governmental and non-governmental institutions/officers contributing to nature conservation in Kilimanjaro (personal communication with the natural resource officer from Moshi municipality, district officers dealing with nature conservation, officers working for KINAPA Authority)	42	30	95	50
Tour guides	Number of tour operators in Kilimanjaro (personal communication with the tourism officer working for KINAPA Authority)	137	46	90	55
Tourists	Number of one-day and multiple-day visitors who entered KINAPA in 2021/2022 (personal communication with the tourism officer working for KINAPA Authority)	32846	136	98	156

Background information on farmers

Following the stratified sampling strategy for farmers, we surveyed Chagga farmers and farmers belonging to other tribes. The term ‘Chagga’ refers to the largest ethnic group on the mountain’s southern and eastern slopes (Mariki 2013). Chagga are Bantu speakers who originated from various African tribes through migration and settled in elevations from 1200 meters above sea level (masl) to the border of the National Park (ca. 1600 masl) in the once-forested Kilimanjaro foothills (Fernandes et al. 1985). The traditional Chagga livelihood revolves around biodiverse home gardens, i.e., multilayered coffee-banana agroforestry systems that resemble the structure of humid tropical forests, with diverse vegetation including trees, shrubs, herbs, lianas, and epiphytes (Hemp 2006). Typically ranging from 0.5 to 1.7 hectares (Mdoe & Wiggins 1997), these home gardens have been central to Chagga life for generations (Hemp & Hemp 2008). Home gardens provide a broad array of material NCP, such as food, feed, energy, and medicine, as well as regulating NCP, like soil fertility, and non-material NCP, including cultural heritage and identity (Fernandes et al. 1985; Hemp 2006; Sébastien 2010). The rich biodiversity and sustained supply of NCP are supported by favorable climate, fertile volcanic soils, and a well-developed system of streams and springs that feed an efficient furrow irrigation network (Fernandes et al. 1985; Masao 1974). Other Tanzanian tribes reside in the lowlands below 1200 masl, engaging in socio-economic activities like agriculture and livestock farming (Kilima et al. 2015; Misana et al. 2003; Mushi et al. 2020).

In the sample for this study, farmers were small-scale, subsistence-based producers. Sixty percent of the farmers obtained half or more of their food from their own farms. Moreover, 44% of the farmers sold a relatively small portion of their produce in local markets. Farmers in Kilimanjaro have a strong family connection to the region, with 88% of the surveyed farmers reporting that their parents also lived in Kilimanjaro.

Data collection

Surveys spanned between 30 minutes and three hours. In practice, the actual time spent on the three sections used in this study was shorter, as data collection was a collaborative effort covering data needs of several researchers associated with the research unit (https://kili-ses.senckenberg.de/en) to mitigate participant fatigue. Also, several local research assistants supported us in collecting our data. We relied on field assistants who had previously been employed by the research unit but also advertised open positions in local newspapers and at the College of African Wildlife Management, Mweka. We appraised applicant's suitability and capability during a six-day training, while we also allowed applicants to learn and improve their skills based on individual and group feedback. The training also encompassed aspects of how to conduct in-person surveys and how to utilize the ArcGIS Survey 123 application as well as emphasizing the importance of research ethics and collaboration within the team.

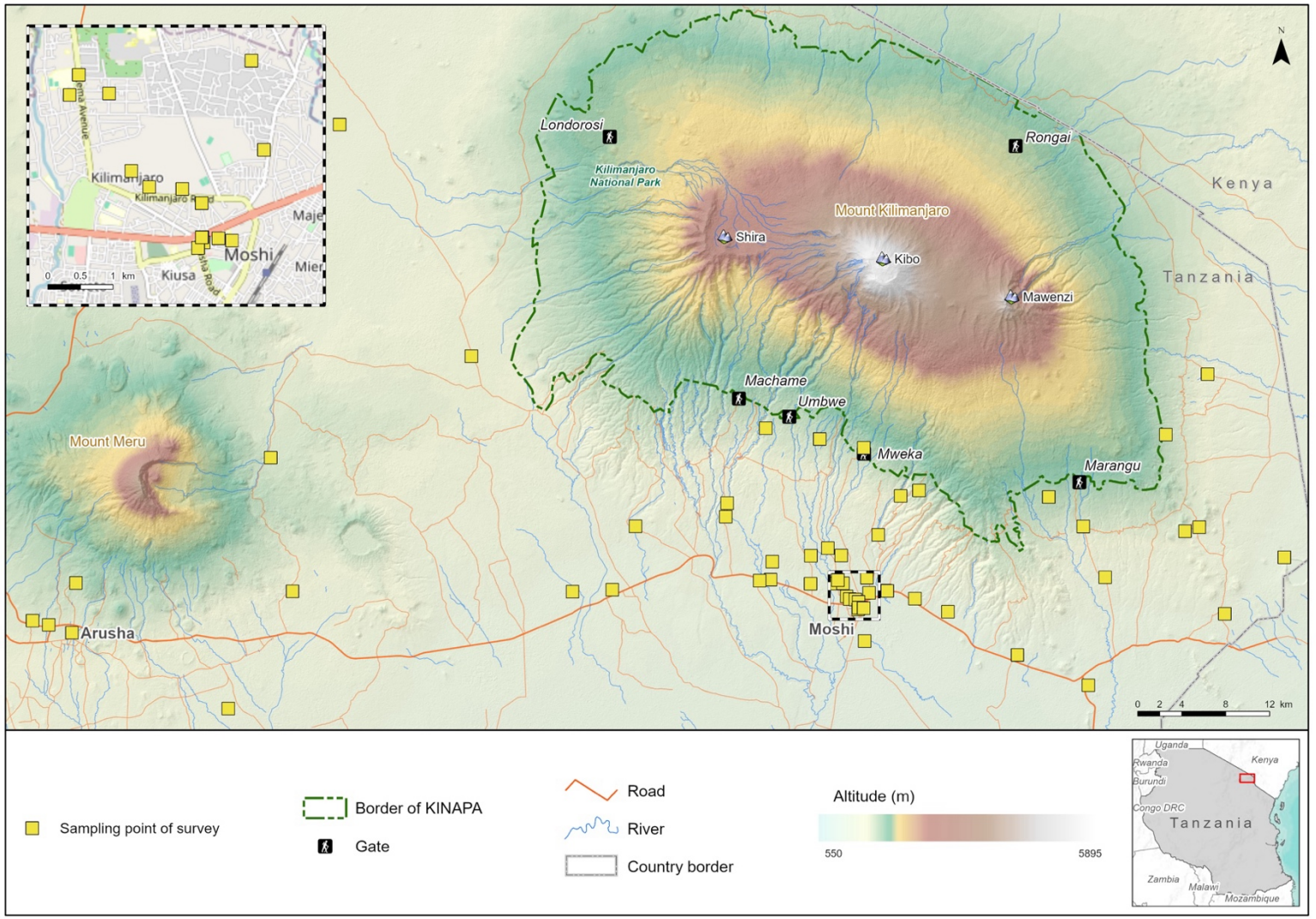


Figure A1 Geographic overview of the survey sampling points in the social-ecological system of Mount Kilimanjaro (Environmental Systems Research Institute (ESRI) 2020). *KINAPA* Kilimanjaro National Park.

Ethics

Based on an ethics application including the interview guide and questionnaire, the Ethics Committee at the university of the first author (EB-Antrag_202104-07-Martin-Lopez_KiliSES; EB-Antrag_202109-12-Martin-Lopez_KiliSES-02; EB-Antrag_202206-11-Martin-Lopez_KiliSES 02) approved our survey before data collection. Additionally, the Tanzania Commission for Science and Technology (COSTECH; 2021-225-NA-2021-09; 2022-308-NA-2021-09), the Tanzanian Wildlife Research Institute (TAWIRI), and Tanzanian National Parks (TANAPA) provided us with research permits. As is required protocol for undertaking research in Tanzania, we also secured written or oral permission from authorities at regional, district, and village levels, tour guides, tour operators, and tour agents.

To ensure transparency and respect for the rights of our (prospective) respondents, we thoroughly explained the survey's procedure and objectives. Most respondents willingly offered their contact information, enabling us to provide our written explanation form and consent form in advance (Appendix A3). In cases where pre-sharing of the forms was not feasible and for all surveys with farmer respondents, we presented or orally summarized them at the beginning of the survey appointment.

Furthermore, we respected the rights of respondents by, for example, granting them the option to retract their data prior to data analysis. To maintain anonymity, we refrained from associating any personal information with the data entries. Instead, we adopted a pseudo-anonymous approach by assigning a randomly generated and unique ID to each respondent on an ID card. This numeric ID was attached to the data entry but contained no information that could be used to identify the respondent or reveal their contact details.

To exercise their right to withdraw, we verbally informed respondents and included instructions on the ID card, directing them to contact us, provide their assigned ID, and request the removal of their data entry. The ID card also featured a note of gratitude, a link to the website of our research unit, and our contact details, allowing respondents to request a summary of the results in a language accessible to the general public, once the scientific works were published. Importantly, we obtained written or oral informed consent from all respondents.

The village executive officer and his support team as well as the farmer respondents received a compensation of 10,000 TSH (ca. €4.35 or US$4.35) for supporting the survey process within the village and for participating in the survey, respectively.

Data analysis

All statistical analyses were performed in R (R Core Team 2023).

Table A5.1 Overview of variables used in data analysis and additional information on data analysis. *NCP* Nature's Contributions to People.

People-nature relationships	Name of variable in data set	Data analysis	
		Data type	**Comment/deduction from responses/ reference**
NCP preference	<abbreviation of NCP in Table A5.2>_dummy	Nominal (binary)	
Value expression	values_ <acronym inTable A2>	Nominal (binary)	To perform the Chi-Square test for each value statement, we reduced data from the four-point-scale ((1) strongly disagree, (2) disagree, (3) agree, and (4) strongly agree) to two dimensions, i.e., (1) and (2) disagreement and (3) and (4) agreement.
Profile attributes			
Gender	gender	Nominal	
Tanzanian citizen	local	Nominal (binary)	Information was sourced from the nationality/ies of the respondent. There was no Tanzanian citizen with a dual or multiple nationality/ies.
Parents lived in Kilimanjaro	parents_kili	Nominal (binary)	
Social actor	stakeholder	Nominal	Determined by the first author

Table A5.2 Overview of terminology of Nature's Contributions to People (NCP) in the data set and manuscript.

NCP terminology in data set	NCP terminology in manuscript
aesthetic_enjoyment	Aesthetic enjoyment
air_quality	Regulation of air quality
building_materials	Building materials
climate_regulation	Regulation of climate
cultural_heritage	Cultural heritage and identity
domestic_materials	Materials for domestic use
energy	Energy
feed	Feed
food	Food
freshwater_quality	Regulation of freshwater quality
freshwater_quantity	Regulation of freshwater quantity
habitat	Habitat creation and maintenance
hazard_regulation	Regulation of hazards and extreme events
intergenerational_benefits	Intergenerational benefits
learning	Learning
medicine	Medicine
nature_connectedness	Connectedness with nature
new_experiences	New and unique experiences
pollination	Pollination
recreation	Recreation
seed_dispersal	Dispersal of seeds
social_cohesion	Social cohesion and bonding
soils	Regulation of soil fertility and protection of soils
species_regulation	Regulation of detrimental species
therapeutic_benefits	Therapeutic and restorative benefits

Appendix A3 Explanation form and declaration of consent

Explanation form

Thank you for participating in this research project, which will involve a survey on your perspective on the role of nature for human well-being in the Kilimanjaro Social-Ecological System.

Investigators

The survey within the Kili-SES research project (https://kili-ses.senckenberg.de) is being undertaken by PhD students and a Postdoctoral researcher. Please reach out to Milena Gross if you have any questions about this project. Milena Gross´ contact details are: milena.gross@leuphana.de (Milena Gross speaks English.)

What is involved?

This research will involve surveys with people who live on, work on, and travel to Mount Kilimanjaro. You must be 18 or older to participate in the study. The survey will take approximately 30- 45 minutes (for tourists) and 60 minutes (for tour guides and nature conservationists) and will involve a series of questions relating to: how nature contributes to your quality of life, specifically how you perceive, relate to, interact with, benefit from and/or manage nature, your living conditions and personality characteristics. As a participant in this research, your participation is *entirely voluntary*. You are welcome to leave at any time if you do not feel comfortable being involved in this study. Please note that there are no wrong answers to our questions. We are interested in your honest opinion and perspectives. Your answers do not need to be profound. It is ok to say ´I don´t know´ for questions that you are unable to answer. We don´t want you to make up answers because you feel you have to. You may refuse to answer any questions you do not feel comfortable answering at any time by saying ´I want to move on to the next question´.

Confidentiality and anonymity

Your identity and information will remain completely confidential and anonymous so we can ensure that this is not revealed in any outcomes from this study. You are also free to ask any questions or raise any concerns you may have about this study at any time. You will also be able to stay in contact after this study has been completed to provide feedback or access the final outputs. Upon completion of this project, all data will be stored in a secure location (and destroyed after exceeding the legal retention period of ten years).

What are the benefits of this project?

In the Mount Kilimanjaro region, competing land uses and impacts from climate change have led to a dramatic increase of the demand for nature. This project will provide much needed empirical data for policy- and decision-making at both international and national levels by providing insights into the components of nature at Mount Kilimanjaro that lead to societal benefits from nature; people's values of, relationship with, (trade-off between supply of and) demand for, (collaborative) management of and access to nature as perceived by different social actors; the determinants of nature's contribution to human well-being. On a personal level, you might benefit from the study by reflecting on your relationship to nature; benefits you derive from nature; your personality.

What are the risks?

We do not foresee any risks with your participation in this research. However, we will aim to avoid any potential distress or discomfort by ensuring the following: (1) avoidance of questions of a highly personal and sensitive nature; (2) the option of participants to not discuss some aspects of the research; and (3) the ability of participants to terminate the survey at any time with no need to give any reasons for such.

How can you access the findings of this study?

The findings/outcomes of this project will be published as peer-reviewed journal articles. We will also develop a short summary of the key findings/outcomes to send to participants who are interested.

Ethics

This study adheres to the guidelines of the ethical peer review of the Ethical Review Board of Leuphana University Lüneburg and the Kiel Institute for the World Economy. Whilst you are free to discuss your participation in this study with project staff (Milena Gross' contact details are: milena.gross@leuphana.de), if you would like to speak to an officer of Leuphana University Lüneburg not involved in the study, you may contact the Ethics Board Secretariat: ethikbeirat@leuphana.de.

Declaration of consent

I acknowledge that I have read and understood the information provided on this research project. I hereby provide consent to be a participant in this survey as part of this research project on people's perspectives on the role of nature for human well-being in the Kilimanjaro Social-Ecological System.

- I have received clear and concise (at least verbal) information about this research, and I understand what is required of me during the survey. I am aware I can receive a full digital version of the explanation and consent form upon request via email. I was offered to take a photo of the (signed) consent form.
- I acknowledge that my participation is entirely voluntary and there will be no direct benefit or reimbursement for my role in this study.
- I acknowledge that the survey will take place in person and my data will be saved digitally.
- I am aware that all information related to this study will be securely stored.
- I acknowledge that my identifying information will remain confidential and will not be used in any publications or other outlets.
- I understand that I am able to leave the survey at any time or refuse to answer any questions without any explanation or penalty.
- I acknowledge that I am able to make contact with the persons involved in this study in order to seek any information about the current and future use of this research and to raise any concerns if necessary.
- I was given information about my personal identification number (e.g. to withdraw my answers from the research) and contact details of the researchers (e.g. in case of questions and to receive results of the study).

We appreciate your participation and thank you for contributing to scientific research. If you would like to receive a summary of the results, please write an email to Milena Gross. Milena Gross´ contact details are: milena.gross@leuphana.de

Participant's Signature ……..…… [Respondent signs on tablet.]

Appendix A4 Positionality statement

Scholars advocate that – as a default ethical practice – researchers should position themselves and their research (e.g., Beck *et al.* 2021; Boyce *et al.* 2021; Holmes 2020; Popa & Guillermin 2017; Reyes 2020; Soedirgo & Glas 2020). Here, I, the first author of this work, want to position myself in the field of sustainability science, particularly inclusive conservation:

I am an able-bodied, White woman socialized in Germany, possessing a German passport based at a German university in an academic system shaped by Western worldviews and at the final stages of my Ph.D. studies in sustainability science. I acknowledge that these socio-demographic traits and other visible and invisible tools (Reyes 2020) will have influenced the research process, outcomes, and interpretations presented in this study. Throughout my Ph.D. research, my awareness of ontological and epistemological assumptions and their impact on research deepened. I learned more about my own assumptions through non-academic experiences, engaging with literature, and when confronted with perspectives, such as the notion of an objective researcher and scientific neutrality, that differ starkly from mine. One key example involves people-nature relationships: despite growing up and spending over 20 years in the heart of the city of the German capital city Berlin, my time in the countryside has fostered a closer, more intimate bond with nature than the urban-tech life. I, therefore, view these relationships as interconnected. Additionally, I recognize that a mechanistic perspective, which separates people from nature, rather than a relational perspective has shaped my understanding of people-nature relationships. This influence became especially clear when contrasting my perspective with literature by Indigenous scholars or on Indigenous worldviews.

In this context, I would also like to acknowledge my non-academic training. This experience profoundly shaped my uncovering process of who I am, how others and I see the world, how others and I approach research, and others and my values (my core values: accountability, care, courage, humility, and good and committed relations with and between places and people), more than any academic training I had previously received. Throughout my Ph.D. research, I came to identify with the feminist scholarly community that views scientific knowledge as inherently partial, contextual, and situational (e.g., Haraway 1988; Madge 1993; Rose 1997; Staffa *et al.* 2022). I do not think that scientific knowledge production is objective. Rather, I think that the knowledge we – researchers – produce and our interpretation of it is influenced by what is important to us, i.e., our values, and depends on how we see the world, i.e., our ontology. At this stage – having only recently begun to explore ontological and epistemological assumptions, and not having designed the research with these in mind – I tend to relate to the epistemology of the social constructionist/interpretivist paradigm that assumes there is not just one reality but many realities ‘that can be articulated based on the values, standpoints, and positions of the author’ (Daly 2007, p. 33) (Aliyu *et al.* 2015). Therefore, my interpretation of people’s relationships with nature that is presented in this work is one of many possible interpretations that mirrors how I position myself relative to the research I have undertaken, the study area, and the research participants.

With this positionality statement, I aim to give readers insight into how my positionality has shaped this work, to the extent that I have been able to uncover. Although ontological and epistemological assumptions can evolve over time (e.g., Ives *et al.* 2023) – in fact, Haider *et al.* (2018) emphasize that epistemological agility is essential for sustainability scientists to collaborate effectively with researchers who hold differing assumptions about how knowledge is produced –, I acknowledge that I have not yet fully identified my own at this stage. As I continue to delve deeper and learn more about the nuanced distinctions between different ontological and epistemological perspectives, it is likely that I will describe these assumptions differently in future work.

My academic background

Professionals and peers at German, Swedish, and U.S. American universities and research centers academically trained me over a total of nine years using both traditional and 'different' scientific styles. My academic profiling in sustainability science has benefited from 'undisciplinary' (Haider *et al.* 2018), innovative, and competency-based teaching approaches, the mindset of looking outside the box within, across, and beyond traditional disciplines and academia (Haider *et al.* 2018; Wiek *et al.* 2011), as well as caretaking classmates and colleagues from all around the globe, embracing an ethos of care approach (Puig de la Bellacasa 2017; Staffa *et al.* 2022). Western academic education, scientific traditions, and literature directed the knowledge production and interpretation presented in this work.

Author's team

The author team of this work represents female and male researchers from diverse personal and academic backgrounds. Members of the author team grew up, lived, learned, and/or worked in different countries, including Tanzania, and are at different stages of their academic careers, ranging from Ph.D. candidates to full professors.

My approach to inclusive conservation

Joanna Macy's seminal work 'Whose Conservation?' underscores that conservation at its core is inherently value-laden (Mace 2014). Feeling a sense of belonging to the sustainability science community, my approach to 'nature' conservation has never been exclusive to preserving 'biodiversity and ecosystem functioning' alone. Instead, I advocate for integrating different facets of people-nature relationships as experienced and expressed by diverse voices, including those from underrepresented (groups of) people. Embracing this diversity, I believe, is essential for achieving meaningful and lasting conservation success (e.g., Cumming *et al.* 2023; Salomon *et al.* 2023; Tallis & Lubchenco 2014). To yield empirical evidence for more inclusive conservation, I investigated how different groups of people similar in their NCP preferences perceived and assessed their relationships with nature. My approach to inclusive conservation motivated by my personal values has undoubtedly influenced this study.

Study design

I opted for a sequential mixed-methods approach by combining qualitative and quantitative data gathering and analysis methods to advance the understanding of people-nature relationships. In doing so, I aimed to gain representative results, while respecting the context of the study area operationalized through context-specific NCP and values contextualized to Kilimanjaro. Although this study seeks to gain generalizable results based on a large-scale survey to inform assessments and policy-making at higher scales, I claim that the knowledge I gained from formal interviews, informal conservations, and observations during the nine months I spent living, working, and conducting research *in situ* allowed me to get a better understanding of people-nature relationships in Kilimanjaro, informed my interpretation of the quantitative results, and the framing of this article. Visits to Shimbwe and Materuni villages, for example, provided me with firsthand experience of the traditional Chagga way of life and allowed me to observe the deeply intertwined and reciprocal relationship between the farmers' livelihoods and the natural environment and their care for and responsibility of nature, as well as their sense of care and responsibility toward nature.

I opted for a socio-cultural valuation approach to investigate the values ascribed to nature to apply a valuation approach that is underrepresented in the scientific literature. Socio-cultural valuation approaches are urgently needed to counterweight economic-driven conservation arguments, dominant in the literature because of the frequent application of monetary valuation (e.g., Gross *et al.* 2023; Martín-López *et al.* 2019; Pascual *et al.* 2023). Agreeing with scholars in the field, investigating monetary values can be misleading as it might imply that nature's worth is derived only from its monetary value. Instead, this work investigated the plural non-monetary values to empirically prove that people ascribed value to nature for multiple non-

monetary reasons, i.e., intrinsically, instrumentally, and relationally. This investigation approach corresponds with and hence, justifies the application of the valuation framework chosen for this study, i.e., the valuation framework proposed by the Intergovernmental Platform on Biodiversity and Ecosystem Services (Pascual *et al.* 2023), while, for example, the Total Economic Value framework (TEV) (Krutilla 1967; Pearce & Turner 1990)) would have not been suitable to study plural (non-monetary) values, as I intended. In this context, I am also motivated to critically engage in conservation discourses that fall short of acknowledging value pluralism to make conservation arguments more inclusive.

Access to research participants

Given Tanzanian's colonial history, and the continued class differences between local people and Western foreigners, being a Western Ph.D. Candidate might have given me easier access to research participants and allowed me to establish a supporting network that would not be immediately available to others. Within the author team, we discussed this as a privilege that I was granted but could not actively control. It was ultimately the research participant who determined whether this part of my identity positively affected their trust in me and their willingness to support or participate in the study. Their final decision might have been motivated by hopes for 'a positive outcome' by interacting with me.

Survey taker – research participant interaction

I viewed the research participants as being knowledgeable based on their lived experiences and capable of understanding our survey questions and articulating their relationships with nature. I was interested in capturing their honest response to my questions and minimizing how the questions and how I asked them might have 'directed' their response. I understood my role as a survey taker as a passive listener to the responses of the research participants; I listened to them with curiosity and open-mindedness. A role and skill that – in my case – have been fundamentally deepened by my professional non-academic training. According to our protocol, I asked research participants to express themselves freely and stated that there were no right and wrong answers before any data was collected. I trusted their ability and confidence to do so.

My assumptions of 'confident' and 'independent' research participants and being a passive listener was challenged by some research participants, particularly by tour guides. I experienced that research participants asked me during or after the survey whether the answers they provided were correct and aligned with what I wanted to hear. This led to confusion on my end because I had stated that I wanted to hear their opinion. Reflecting on it, I wondered whether these research participants might not have perceived the survey setting as a 'casual' conversation that was free from desired or expected responses, as I had intended. Rather, they might have perceived the survey as an exam in which right and wrong responses were possible. Because of these experiences, I cannot guarantee that the results presented in this work are unaffected by a social desirability bias, especially a willingness to please the survey taker, and/or pressure to provide correct answers. Additionally, I was sometimes unsure whether tour guides perceived me in the role of a researcher or whether they implicitly hoped for 'a positive outcome', i.e., that I would become their client, especially if only the answers they provided were correct. In such a context, I was confronted with my power-laden and hence, imbalanced relationship with the research participant, assumingly as a byproduct of my comparatively privileged background. Such factors were difficult or even impossible for me to control or avoid and yet, might have biased the responses and hence, impacted the validity of the results.

Statistical analysis

Due to the large sample size, I trusted the robustness of statistical analysis to yield scientifically rigorous results. Statistics can uncover representative patterns in people's preferences for Nature's Contributions to People (NCP) and values that are not available to us researchers without using these analytical tools. Such statistical tools – typically associated with scientific objectivity and positivist epistemology, for example (Aliyu *et al.* 2015) – might seem

contradictory to the fundamental epistemological assumptions I outlined earlier. However, the choice of statistical tools could also reflect the initial steps toward embracing epistemological agility (Haider *et al.* 2018) combined with a practical solution, i.e., an approach necessary for selecting the analytical tools best suited to addressing the research questions at hand.

My position relative to the research participants

Whether a researcher is an insider or outsider relative to the research participants is always contextual and multifactorial (Reyes 2020). I found myself as an outsider, considering the following factors. Neither my ancestors nor I grew up and lived in Kilimanjaro. Neither do I farm, guide tours, nor am I involved in nature conservation in Kilimanjaro. If one would claim any degree of 'insiderness', I might be an insider relative to a female Western tourist because we are both women raised and living in a Western country and visiting Kilimanjaro. Nevertheless, I assume that her holiday experience is distinct from my research stay. Hence, I interpreted the results from an outsider's perspective.

Appendix A5 Detailed and additional results

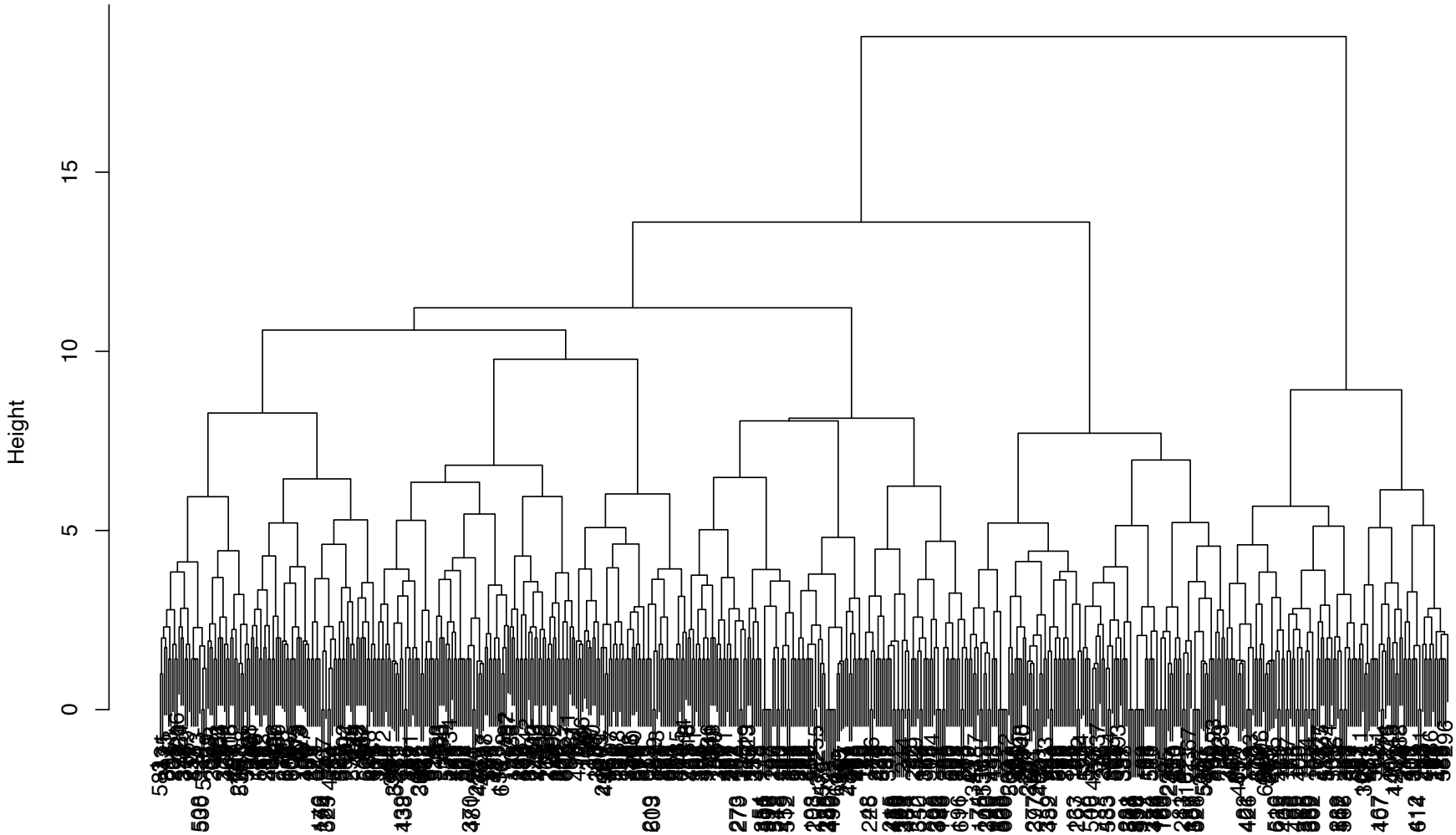


Figure A2 Dendrogram of Wards cluster analysis based on the preferences for Nature's Contributions to People (NCP) expressed by respondents associated with the four social actors (n=623). Agglomerative coefficient = 0.93.

Table A6 Test statistics of the indicator analysis for Nature's Contributions to People (NCP) with the NCP clusters, i.e., groups of respondents similar in their NCP preferences, identified by using Wards cluster analysis.

NCP	NCP cluster	Indicator value	Probability
New and unique experiences	Intangible benefits	0.5454	0.001
Aesthetic enjoyment		0.3192	0.001
Recreation		0.2918	0.001
Social cohesion and bonding		0.2069	0.001
Learning		0.1858	0.001
Connectedness with nature		0.1841	0.001
Therapeutic and restorative benefits		0.1727	0.001
Energy	Tangible benefits	0.5978	0.001
Food		0.2651	0.001
Feed		0.2347	0.001
Building materials		0.1781	0.001
Regulation of soil fertility and protection of soils		0.1076	0.001
Materials for domestic use		0.0689	0.001
Regulation of freshwater quality	Health-related benefits	0.3391	0.001
Regulation of air quality		0.1958	0.001
Medicine		0.0943	0.006
Intergenerational benefits	Resilience-related benefits	0.3301	0.001
Cultural heritage and identity		0.0914	0.001
Regulation of hazards and extreme events		0.0601	0.026
Habitat creation and maintenance	Regulating benefits	0.2405	0.001
Regulation of freshwater quantity		0.2282	0.001
Pollination		0.0426	0.019

Profile of the whole sample

Respondents belonged to the four different social actors, namely farmers (58.2% of all respondents), tourists (25.0%), tour guides (8.8%), and nature conservationists (8.0%) (Figure A3, Table A7). Respondents were evenly distributed between men (51.5%) and women (48.3%), with 0.2% of the respondents identifying as diverse. The share of Tanzanian citizens (74.8%) compared to non-Tanzanian citizens was remarkably higher. Likewise, there were slightly more respondents (59.9%) whose parents lived in Kilimanjaro.

Profile of the NCP clusters

'**Intangible benefits'** cluster comprised a group of respondents similar in preferring seven non-material NCP: *new and unique experiences*, *aesthetic enjoyment*, *recreation*, *social cohesion and bonding, learning, connectedness with nature,* and *therapeutic and restorative benefits* (Figure 1, Table A6). The first five of these NCP were also the five most preferred NCP expressed by the respondents associated with this cluster (Figure A4). One-hundred-eight respondents (17% of all respondents) were associated with this NCP cluster, of which 80% were tourists (Figure A3, Table A7). Gender distribution was slightly biased towards male (55% of 'Intangible benefits' respondents) respondents in comparison to female (44 %) and diverse (1%) respondents. Most respondents were non-Tanzanian citizens (78%).

'Tangible benefits' cluster: A group of respondents similar in preferring five material NCP, i.e., *energy*, *food*, *feed*, *building materials*, *materials for domestic use*, as well as *regulation of soil fertility and protection of soils* assembled in this cluster (Figure 1, Table A6). *Energy*, *food*, *feed*, *regulation of water quality*, and *building materials* were the five most preferred NCP (Figure A4). One-hundred-twenty-four respondents (20% of all respondents) were associated with 'Tangible benefits', of which 90% were farmers (Figure A3, Table A7). 'Tangible benefits' respondents were represented by a higher share of women (63% of 'Tangible benefits' respondents) than men, i.e., the only cluster with a greater share of female than male respondents. Likewise, the highest proportion of Tanzania citizens (98% of 'Tangible benefits'

respondents) and respondents whose parents lived in Kilimanjaro (85%) assembled in this cluster.

'Health-related benefits' cluster**:** A group of respondents similar in preferring the NCP *regulation of freshwater quality*, *regulation of air quality*, and *medicine* (Figure 1, Table A6). Noteworthily, *food* and *feed* were additionally among the five most preferred NCP (Figure A4). One-hundred-thirty-six respondents (22% of all respondents) were associated with this cluster, of which 77% were farmers (Figure A3, Table A7). The profile of 'Health-related benefits' respondents was similar to that of 'Tangible benefits' respondents, with 90% of 'Health-related benefits' respondents being Tanzanian citizens and 75% of the respondents' parents lived in Kilimanjaro. Moreover, the gender distribution of the 'Health-related benefits' respondents was slightly biased toward male respondents (55 % of 'Health-related benefits' respondents).

'**Resilience-related benefits'** cluster is a group of respondents similar in preferring NCP *intergenerational benefits*, *cultural heritage and identity*, and *regulation of hazards and extreme events* (Figure 1, Table A6). *Intergenerational benefits* was the most preferred NCP expressed by 'Resilience-related benefits' respondents, followed by *food*, *regulation of freshwater quality*, *feed*, and *learning* (Figure A4). Strikingly, 'Resilience-related benefits' respondents expressed importance for several NCP that were not associated with this NCP cluster based on the Legendre Indicator analysis (Figure A4, Table A6). One-hundred-fifty respondents (20% of all respondents) made up this cluster with the largest share of tour guides (16% of 'Resilience-related benefits' respondents) across all five clusters (Figure A3, Table A7). Respondents associated with the 'Resilience-related benefits' cluster were heterogeneous in their social actor composition: farmers (59%), tour guides (16%), tourists (16%), and nature conservationists (9%). Hence, the shares of 'Resilience-related benefits' respondents who were Tanzanian citizens (83%) and whose parents were born in Kilimanjaro (65%) were accordingly lower than 'Tangible benefits' and 'Health-related benefits'. The gender distribution in this cluster was slightly skewed towards male (56%) respondents.

'**Regulating benefits'** cluster consisted of a group of respondents similar in preferring NCP *habitat creation and maintenance*, *regulation of freshwater quantity*, and *pollination* (Figure 1, Table A6). The first two mentioned NCP as well as *regulation of air quality*, *food*, and *connectedness with nature* that were not associated with this NCP cluster based on the indicator analysis (Table A6) were selected as the five most preferred NCP (Figure A4). One-hundred-five respondents (17% of all respondents) belonged to this cluster characterized by a distinct social actor heterogeneity (Figure A3, Table A7). Noteworthily, the greatest proportion of nature conservationists (14% of 'Regulating benefits' respondents) across all clusters assembled in 'Regulating benefits'. The gender distribution of 'Regulating benefits' respondents was slightly skewed towards male (55%) respondents. The share of 'Regulating benefits' respondents with Tanzanian citizenship (70%) and parental residency in Kilimanjaro (51%) were below average, indicating a high share of non-local respondents

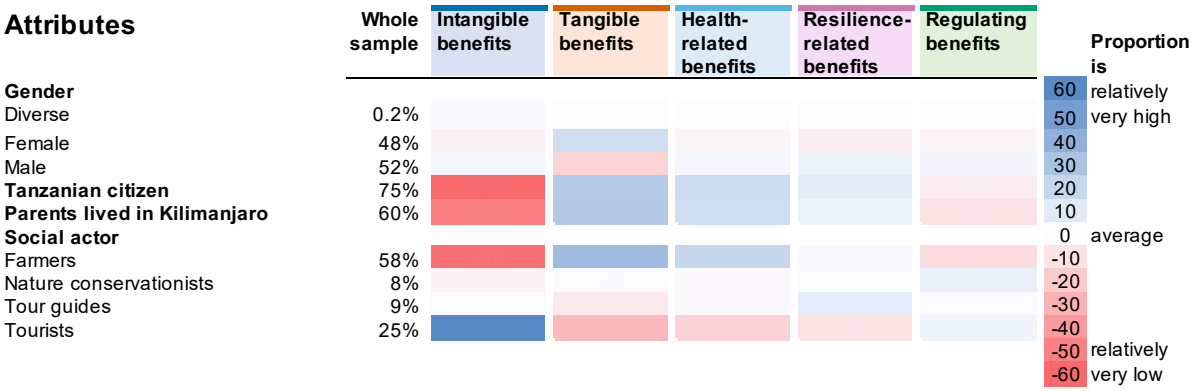


Figure A3 The relative share [%] of the whole sample shown for each profile attribute. Comparison of profile attributes between the NCP clusters, i.e., groups of people similar in their preferences for Nature's Contributions to People (NCP), based on their deviation from the proportion of the whole sample [%]. Descriptive overview in Table A7.

Table A7 Descriptive information on the profile attributes of the whole sample and the five NCP clusters, i.e., groups of people similar in their preferences for Nature's Contributions to People (NCP). *n* number of respondents; *NA* not available; *%* relative share of respondents.

Attributes	Whole sample		Intangible benefits		Tangible benefits		Health-related benefits		Resilience-related benefits		Regulating benefits	
	n	%	n	%	n	%	n	%	n	%	n	%
Respondents	623	100%	108	17%	124	20%	136	22%	150	24%	105	17%
Gender												
Diverse	1	0.2%	1	1%								
Female	297	48%	48	44%	76	63%	61	46%	65	44%	47	45%
Male	317	52%	59	55%	44	37%	73	55%	84	56%	57	55%
NA	8				4		2		1		1	
Tanzanian citizen	462	75%	24	22%	122	98%	122	90%	123	83%	71	70%
NA	5						1		1		3	
Parents lived in Kilimanjaro	373	60%	16	15%	105	85%	102	75%	97	65%	53	51%
NA	9		1		3		1		3		1	
Social actor respondents within each NCP bundle												
Farmers	362	58%	9	8%	111	90%	104	77%	89	59%	49	47%
Nature conservationists	50	8%	4	4%	9	7%	9	7%	13	9%	15	14%
Tour guides	55	9%	9	8%	2	2%	10	7%	24	16%	10	10%
Tourists	156	25%	86	80%	2	2%	13	10%	24	16%	31	30%

Table A8 Descriptive information on the absolute (n) and relative (%) share of respondents from the same social actor group within each NCP cluster, i.e., groups of people similar in their preferences for Nature's Contributions to People (NCP).

Social actor	Whole sample		Intangible benefits		Tangible benefits		Health-related benefits		Resilience-related benefits		Regulating benefits	
	n	%	n	%	n	%	n	%	n	%	n	%
Farmers	362	100%	9	2%	111	31%	104	29%	89	25%	49	14%
Nature conservationists	50	100%	4	8%	9	18%	9	18%	13	26%	15	30%
Tour guides	55	100%	9	16%	2	4%	10	18%	24	44%	10	18%
Tourists	156	100%	86	55%	2	1%	13	8%	24	15%	31	20%

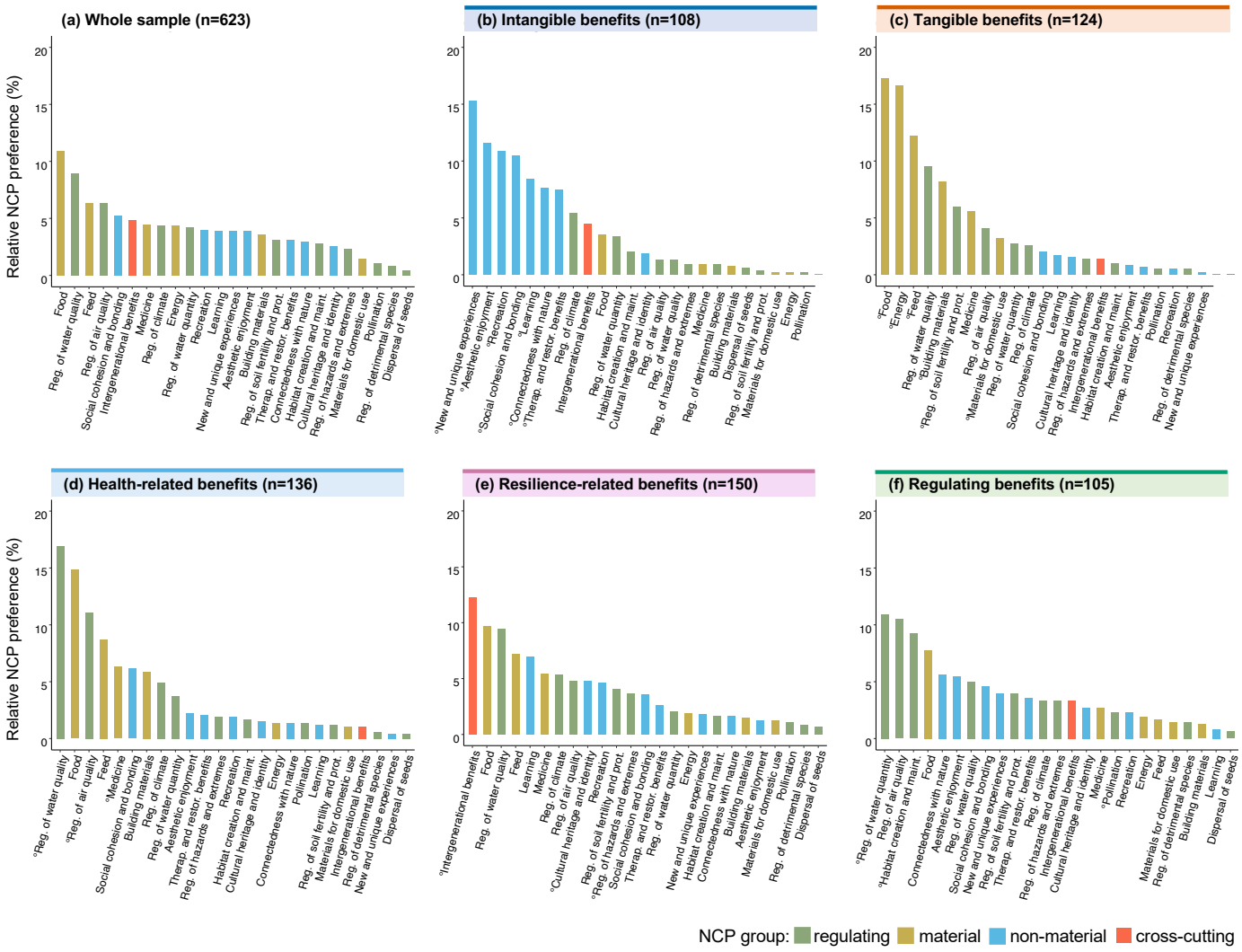


Figure A4 Relative share of respondents who selected the Nature's Contributions to People (NCP) among the five most preferred NCP, shown for (a) the whole sample and (b-f) for each NCP cluster, i.e., groups of people similar in their NCP preferences. ° indicates NCP that belongs to the NCP cluster. *extremes* extreme events; *maint.* maintenance; *n* number of respondents*; prot.* protection of soils; *Reg.* Regulation; *Therap. and restor.* Therapeutic and restorative; *wate*r freshwater.

Table A9 Descriptive information on the share of respondents who selected the Nature's Contributions to People (NCP) among the five most preferred NCP, shown for the whole sample and for each NCP cluster, i.e., groups of people similar in their NCP preferences. *n* number of respondents; *%* relative share of respondents.

NCP	Whole sample		Intangible benefits	Tangible benefits	Health-related benefits	Resilience-related benefits	Regulating benefits
	n	%	%	%	%	%	%
New and unique experiences	118	3.9%	15.3%	0.2%	0.4%	1.8%	4.0%
Aesthetic enjoyment	117	3.9%	11.6%	0.8%	2.2%	1.2%	5.5%
Recreation	119	4.0%	10.8%	0.5%	1.9%	4.6%	2.3%
Social cohesion and bonding	157	5.2%	10.4%	2.0%	6.1%	3.5%	4.6%
Learning	118	3.9%	8.4%	1.7%	1.2%	7.0%	0.8%
Connectedness with nature	89	3.0%	7.6%	0.0%	1.3%	1.6%	5.7%
Therapeutic and restorative benefits	94	3.1%	7.5%	0.7%	2.1%	2.6%	3.6%
Energy	131	4.4%	0.2%	16.6%	1.3%	1.9%	1.9%
Food	328	10.9%	3.5%	17.3%	14.8%	9.7%	7.8%
Feed	191	6.4%	0.0%	12.2%	8.7%	7.2%	1.7%
Building materials	108	3.6%	0.7%	8.1%	5.8%	1.5%	1.3%
Regulation of soil fertility and protection of soi	94	3.1%	0.4%	5.9%	1.2%	4.1%	4.0%
Materials for domestic use	43	1.4%	0.2%	3.2%	1.0%	1.2%	1.5%
Regulation of freshwater quality	269	9.0%	1.3%	9.5%	16.9%	9.4%	5.0%
Regulation of air quality	190	6.3%	1.3%	4.1%	11.1%	4.8%	10.5%
Medicine	133	4.4%	0.9%	5.6%	6.3%	5.5%	2.7%
Intergenerational benefits	145	4.8%	4.5%	1.4%	1.0%	12.3%	3.4%
Cultural heritage and identity	77	2.6%	1.9%	1.5%	1.5%	4.8%	2.7%
Regulation of hazards and extreme events	69	2.3%	0.9%	1.4%	1.9%	3.7%	3.4%
Habitat creation and maintenance	84	2.8%	2.1%	1.0%	1.6%	1.6%	9.2%
Regulation of freshwater quantity	126	4.2%	3.4%	2.7%	3.7%	2.0%	10.9%
Pollination	32	1.1%	0.2%	0.5%	1.3%	1.1%	2.3%
Regulation of climate	132	4.4%	5.4%	2.5%	4.9%	5.3%	3.4%
Regulation of detrimental species	25	0.8%	0.9%	0.5%	0.6%	0.8%	1.5%
Dispersal of seeds	14	0.5%	0.6%	0.0%	0.4%	0.7%	0.6%

Table A10 Overview of the relative share of respondents who agreed with the value statement, i.e., expressed the value, shown for the whole sample and each NCP cluster, i.e., groups of people similar in their preferences for Nature Contributions to People (NCP), and the Chi-Square test results for values of nature. p values were adjusted for multiple testing based on Holm method. See Table A2 for the value statements used in the survey.

Values of nature	Whole sample	Intangible benefits	Tangible benefits	Health-related benefits	Resilience-related benefits	Regulating benefits	χ^2 value	*p* value
Intrinsic values								
Right to existence and conservation	94.4%	88.8%	97.5%	94.5%	95.9%	94.1%	9.10	3.52E-01
Right to existence and prosperity	94.8%	90.5%	96.6%	95.3%	93.8%	98.0%	7.29	4.52E-01
Instrumental values								
Basic needs	89.6%	69.3%	98.3%	97.7%	90.4%	88.0%	63.43	8.25E-12
Economic benefits	76.8%	38.7%	90.7%	86.8%	83.4%	78.0%	110.01	1.45E-21
Relational values								
Cultural identity	86.5%	56.3%	97.5%	94.5%	90.2%	89.0%	101.75	7.94E-20
Individual identity	81.3%	51.9%	96.6%	89.8%	82.1%	82.7%	84.99	2.44E-16
Cultural heritage	85.9%	63.2%	96.6%	91.3%	88.9%	86.0%	60.34	3.44E-11
Tradition	74.4%	40.6%	95.8%	82.8%	74.1%	74.5%	97.11	7.31E-19
Social cohesion	92.7%	86.8%	96.6%	93.8%	90.8%	96.0%	10.67	0.214
Social relations	95.0%	89.7%	95.8%	97.7%	95.2%	96.0%	8.52	0.372
Kinship	84.8%	54.5%	97.5%	91.4%	86.2%	90.5%	93.98	3.18E-18
Individual connectedness	90.1%	76.2%	99.1%	91.3%	89.7%	93.1%	34.71	6.41E-06
Wisdom and knowledge	90.8%	80.8%	96.5%	92.1%	92.1%	91.0%	17.58	0.015
Learning	92.8%	87.6%	95.8%	93.0%	95.2%	91.2%	7.47	0.452
Stewardship	90.5%	74.0%	94.9%	96.1%	91.7%	94.0%	41.76	2.43E-07
Responsibility	94.6%	87.7%	98.2%	95.3%	95.9%	95.0%	13.65	0.068
Aesthetics	97.5%	95.4%	96.6%	98.4%	97.9%	99.0%	3.94	0.828
Inspiration	89.9%	77.1%	95.6%	90.6%	93.6%	90.7%	25.19	5.07E-04
Uniqueness	92.4%	88.5%	94.1%	92.2%	94.4%	92.1%	3.66	0.828
New/special experiences	94.0%	97.1%	99.2%	92.2%	93.1%	88.2%	14.24	0.059

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Appendix 8: Author contribution statements

(in accordance with the Guideline for cumulative Ph.D. theses enacted at the School of Sustainability in January 2012; *IF* Journal impact factor (Gurav 2024))

Article No.	Bibliography	Publication status	Specific author contributions	Specific contribution of Ph.D. candidate	Weighing factor	Public talk / Conference presentation
I	Gross, M., J. Pearson, U. Arbieu, M. Riechers, S. Thomsen, and B. Martín-López. 2023. Tourists' valuation of nature in protected areas: A systematic review. *Ambio* 52: 1065–1084. doi:10.1007/s13280-023-01845-0.	Published in *Ambio* (IF = 5.8)	**Milena Gross, Berta Martín-López**: conceptualization, data collection, data analysis, data interpretation, writing (original draft), review & editing; **Jasmine Pearson**, **Ugo Arbieu**, **Marara Riechers**: conceptualization, data collection, review & editing; **Simon Thomsen**: data analysis, review & editing	Co-author with predominant contribution	1.0	No public talk or conference presentation
I	Gross M, Shepeleva D, Vogel F, et al (submitted to Sustainability Science in 10/2024) The questions we ask matter: insights from place-based research on nature's contributions to people	Accepted for publication in 2025[18] with *Sustainability Science* (IF = 5.1)	**Milena Gross**, **Berta Martín-López**: conceptualization, data collection, data analysis, data interpretation, writing (original draft), review & editing; **Berta Martín-López**: conceptualization, data analysis, data interpretation, writing (original draft), review & editing; **Jasmine Pearson**: data collection, data analysis, review & editing; **Johanna Hofmann, Daria Shepeleva**, **Friedericke Vogel**: data analysis, review & editing; **Tuyeni Heita Mwampamba**, **Ugo Arbieu**, **Jennifer Kasanda Sesabo; Fabia Codalli**: review & editing	Co-author with predominant contribution	1.0	Knowledge exchange tour, Kilimanjaro, Tanzania, February and March 2023 PECS-III, Montréal, Canada, August 11-14, 2024
III	Gross, M., Mwampamba, T. H., Sanya, J., Pearson, J., Sesabo, J. K., & Martin-Lopez, B. (submitted to People and Nature in 06/2023). Understanding variations in social actor demand for nature's contributions to people: The case of Mount Kilimanjaro, Tanzania.	Resubmitted after major revisions with *People and Nature* (IF = 4.2)	**Milena Gross; Berta Martín-López**: conceptualization, data collection, data analysis, data interpretation, writing (original draft), review & editing; **Jasmine Pearson; John Sanya**: data collection, review & editing; **Tuyeni Heita Mwampamba**, **Jennifer Kasanda Sesabo**: data interpretation, review & editing	Co-author with predominant contribution	1.0	Knowledge exchange tour, Kilimanjaro, Tanzania, February and March 2023
IV	Gross, M., Von Wehrden, H., Mwampamba, T.H., Sanya, J., Pearson, J., Sesabo, J.K., Riechers, M., Arbieu, U., Böhning-Gaese, K. & Martín-López, B. (submitted to Conservation Letters in 08/2024). Broadening the arguments for inclusive conservation: values associated with Nature's Contributions to People.	Resubmitted after major revisions with *Conservation Letters* (IF = 7.7)	**Milena Gross**, **Berta Martín-López**: conceptualization, data collection, data analysis, data interpretation, writing (original draft), review & editing; **Henrik von Wehrden**: data analysis, data interpretation, review & editing; **Tuyeni Heita Mwampamba**, **Jennifer Kasanda Sesabo**: data interpretation, review & editing; **John Sanya**, **Jasmine Pearson**: data collection, review & editing, **Ugo Arbieu**, **Katrin Böhning-Gaese**, **Maraja Riechers**: review & editing	Co-author with predominant contribution	1.0	Kili-SES assembly, Moshi, Tanzania, February 13, 2024 SSWG Conservation Social Science Conference, online, November 21-22, 2024

[18] This publication differs from the version submitted as Ph.D. thesis; the manuscript was marked as 'in revision with minor revisions'.

Declaration (according to § 16 of the guideline for cumulative Ph.D. theses):
I avouch that all information given in this appendix is true in each instance and overall.

Lüneburg, December 18, 2024

Milena Groß

Explanatory Notes:

Specific contribution of PhD candidate submitting the Ph.D. thesis / Author status according to § 12 of the guideline for cumulative Ph.D. theses
Single author: own contribution amounts to 100%.
Co-author with predominant contribution: own contribution is greater than the individual share of all other co-authors and is at least 35%.
Co-author with equal contribution: (1) own contribution is as high as the share of other co-authors, (2) no other co-author has a contribution higher than the own contribution, and (3) the own contribution is at least 25%.
Co-author with important contribution: own contribution is at least 25%, but is insufficient to qualify as single authorship, predominant or equal contribution.
Co-author with small contribution: own contribution is less than 20%.

Weighing Factor according to § 14 of the guideline for cumulative Ph.D. theses

Single author	1.0
Co-author with predominant contribution	1.0
Co-author with equal contribution	1.0
Co-author with important contribution	0.5
Co-author with small contribution	0

Appendix 9: Declaration

Milena Groß
Leuphana University
School of Sustainability
Universitätsallee 1
21335 Lüneburg
Germany
milena.gross@posteo.de

Declaration

I hereby declare that I have not yet taken a doctoral examination or applied for admission to one.

I certify that the dissertation *Balancing the plural voices at play – approaches of researchers to advancing an inclusive understanding of people-nature relationships* has not been submitted to any other university for review in the present or any other version.

I declare in lieu of oath that I have written the submitted dissertation *Balancing the plural voices at play – approaches of researchers to advancing an inclusive understanding of people-nature relationships* independently and without any unauthorized outside help. I have not made use of any aids or writings other than those specified by me. I have labelled all passages taken literally or analogously from other writings.

I have been informed of the consequences under criminal law in accordance with Art. 156 of the German Criminal Code.

Lüneburg, December 18, 2024

Milena Groß