TALES of COEXISTENCE

A Cultural Ecosystem Assessment of Complex Socio-Ecological Dynamics

Joana Filipa Viana Canelas

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"We can no longer afford to remain captives to the tendency of the more traditional sciences to dissect phenomena and examine their fragments. We must combine them, relate them, and see them in their totality as well as their specificity."

Bookchin (1982: 21-22)

To my grandmother, Aleth Viana,
and all Great Mothers, Earth Mothers

ABSTRACT

The importance of bridging diverse worldviews and knowledge systems to enhance conservation outcomes is increasingly recognized. Yet, the cultural, social and political dimensions of ecosystems are still largely overlooked in conservation sciences, following the premisses of prevalent nature:culture dichotomies within managerialist approaches. Building from an interrogation of the ontological and epistemological limitations of ecosystem assessment frameworks, namely Ecosystem Services (ES) and Nature's Contributions to People (NCP), this thesis elaborates the potential role of Cultural Ecosystem Assessments to foster culturally adequate, socially equitable and ecologically sustainable conservation responses. As ecosystem assessments are influential frameworks to diagnose environmental issues and inform conservation strategies, recognizing the shortcomings of monetary valuations and biodiversity offsetting strategies requires discarding their economic frameworks and develop relational and place-based approaches to human–environment relationships which support struggles for environmental justice. Thus, enquiring which overlooked dimensions of human–environment relationships need to be considered and how can these be systematically integrated in ecosystem assessments, this thesis seeks to develop a framework for Cultural Ecosystem Assessments which conveys the context–specific dimensions of human–environment relationships, unveils their influence on complex social-ecological dynamics and assists developing effective, equitable and representative community-based strategies for the conservation of biocultural diversity.

Following an inductive approach, based on ethnographic and interpretive mixed methods research, the thesis explores the cultural, political and storied landscapes of local human-environment relationships in two contrasting case-studies: first, with local and indigenous communities in the Peruvian Amazon; and, second, with the provisional multi-ethnic communities of Ascension Island, in the South Atlantic. The results provide supporting evidence that (1) cultural practices (e.g. land management), benefits (e.g. identities) and values (e.g. ethical principles) are interdependent and mediate the co-production of all 'ecosystem services'; (2) relational values convey distinct articulations of reciprocity in human-environment relationships that regulate feedback processes between the social and ecological systems; (3) local and indigenous knowledge systems influence all dimensions of human–environment relationships, including cultural modes of production, consumption, representation and regulation of ecological processes; and (4) considering the socio-cultural and spatio-temporal variability of human–environment relationships, including

underlying social structures and power relationships, reveals the unequal social and geographical distribution of 'ecosystem services' supply and demand. The analysis demonstrates that Cultural Ecosystem Assessments may contribute to disclose complex socio-ecological dynamics from local to global scale, including ecosystem services flows, drivers of social and ecological change, feedback processes and emergent regulation mechanisms.

Then, through developing a biocultural and relational approach to socio-ecological systems, the thesis advances a conceptual, analytical and methodological framework for Cultural Ecosystem Assessments which contributes to address key knowledge gaps in sustainability sciences, by revealing: (1) the role of diverse worldviews, knowledge systems and relational values influencing the co-production of ES/NCP and shaping wider socio-ecological dynamics; (2) the influence of social structures, governance systems and power relationships in the distribution of ES/NCP and their role driving socio-ecological changes; (3) the unequal social and geographical distribution of ES/NCP supply and demand which underlies ES/NCP flows both within and across regions and society; and (4) the spatial and temporal dynamics of socio-ecological change, including trade-offs between distinct ES/NCP, feedback process and direct or indirect drivers of socio-ecological change. Ultimately, the framework recasts ecosystem assessments around context-specific perspectives, fostering assessments' ability to bridge diverse worldviews and knowledge systems, support struggles for environmental justice and inform community-based strategies for the conservation of biocultural diversity.

AUTHOR'S DECLARATION

The present thesis is my own original work and has not been previously submitted at this, or any other, academic institution for examination. All chapters were written and based on data collected and analysed by me. The study design and all chapters received comments and suggestions from my supervisors, Joseph Tzanopoulos and Robert Fish. All sources used are referenced and acknowledged in the bibliography. Collaborations with other researchers, both internal and external to the University of Kent, are detailed below.

Chapter 4 and 5 follow a study conceived and implemented by J. Canelas, with inputs from J. Narby and C. Nuñez. Data collection was carried by J. Canelas and audiovisual materials collected by M. Dias. J. Canelas performed the data analysis and wrote the chapters, with feedback and comments from R. Fish and J. Tzanopoulos.

Chapter 6 is based on a study part of a Natural Capital Assessment project, run by the South Atlantic Environmental Research Institute (SAERI), in collaboration with the University of Kent (UKC). The questionnaire used was designed by R. Fish and adapted by J. Canelas to Ascension Island. Data were collected and analysed by J. Canelas. Previous versions of the manuscript received comments from R. Fish (UKC), D. Bormpoudakis (UKC), N. Smith (SAERI) and T. Pelembe (SAERI). The chapter was written by J. Canelas, with feedback and comments from R. Fish and J. Tzanopoulos.

PREFACE

It might be a risk for someone holding a BSc in Physics and MSc in Complexity Science to embark on a PhD in Biodiversity Management which seeks inspiration from Environmental Anthropology. At times, I felt like a weed thriving in the space between disciplines, no longer solely belonging to one and not yet fully embracing the other. But, nonetheless, I regarded that as a necessary risk, considering the complexity of issues troubling both ecological communities and human societies — the type of issues born of multiplicity, entanglement and diversity which only interdisciplinary and multidisciplinary approaches might be able to grasp.

Indeed, my background is on exact and natural sciences — a BSc in Physics (University of Lisbon, 2009) and MSc in Complexity Sciences (University of Lisbon, 2014), which I concluded with a thesis titled "Land-Use Intensity and Stability of Ecosystems" (*Summa Cum Laude*), based on modelling the biodiversity impacts of diverse agroecological systems. Then, drawing inspiration from my previous work with different regenerative projects, I became a research associate in the Biodiversity Conservation group at iDiv, German Centre for Integrative Biodiversity Research (Leipzig, 2014-2015), assessing the biodiversity impacts of land-use systems. It was there that the intention to pursue the present thesis first emerged, as the recognition of a need to reconcile the sciences and work in the interface between nature and society. The emerging sense of a need to bridge local and indigenous knowledge systems, to understand the role of diverse worldviews shaping ecosystems and multispecies assemblages, to consider the social inequities and political struggles which shape society and our wider ecological communities, led me to embrace a journey seeking desirable modes of coexistence and co-resistance with more-than-human realms.

The journey would necessarily have its jumps and bumps, many of which required questioning my own assumptions when I first wrote its proposal. Its final result is certainly not what I initially foresaw. Nevertheless, it was undoubtedly rewarding at a personal level and, hopefully, at an academic level may inspire more interdisciplinary pathways, alliances and collaborations into the future. The characteristics of this journey make it a collaborative endeavour, enriched by both fruitful and challenging encounters, whose

contributions I wish to acknowledge even if, necessarily, all contents of this thesis are my own and exclusive responsibility.

First, this thesis wouldn't had been possible without the dedicated support of my supervisors, Robert Fish and Joseph Tzanopoulos, whom I wish to thank for all the insightful debates, helpful advice and reliable feedback which enriched this journey. I'm especially grateful for the opportunity and trust they bestowed on me, expressed in autonomy but also responsibility, which enabled the exploration of diverse paths and liminal spaces in the intersection between disciplines.

At the University of Kent, I wish to acknowledge and thanks also the opportunity to participate in various seminars and discussions linked to Environmental Anthropology at the School of Anthropology and Conservation, particularly the helpful insights provided by M. Alexiades, D. Peluso, R. Puri and D. Theodossopoulos. Thanks also to I. Bride for introducing me to woodland management and a refreshing side of academic life, with many joyful moments around the fire in Billhook Nook. Outside the University of Kent, I'm especially grateful to Jeremy Narby for his invaluable support enabling and assisting my fieldwork in the Peruvian Amazon.

I'm grateful to the University of Kent for supporting this study through the 50th Anniversary scholarship and for providing me with valuable teaching experience, incluing R. Fish and J. Tzanopoulos for the additional teaching allocations. Together with the Natural Capital Assessment project, funded by the UK Government's Foreign and Commonwealth Office, these opportunities provided the financial support that enabled this research.

Second, I would like to thanks Miguel Dias, dear old friend, for accepting embarking on an adventure to the Peruvian Amazon, assisting with documenting this part of the fieldwork journey. A special thank you goes to all indigenous teachers and students of Formabiap in the Peruvian Amazon, specially Never Tuesta, Haydeé Rosales, Richard Ricopa, Jenny Panduro, Emilio Cerrano and Rafael Chanchari for hosting me during fieldwork and for introducing me to the relevant contexts of indigenous people's histories and struggles. A special thank you goes also to the research team of the Sociodiversity group at IIAP, Instituto de Investigaciones de la Amazonía Peruana, especially Cecilia Nuñez, Manuel Brañas and Dennis Castillo (ProBosques group, IIAP) for all the technical and academic support.

In the Shawi communities, I'm deeply grateful to Yrma, who welcomed us like her own family, and also to Seni, Rolín, Jorge Chanchari, Wilson Pizango and all members of the communities of Balsapuerto, Nueva Luz and Puerto Libre for receiving us and sharing their ways of living. Similarly, in the Ticuna communities, I wish to thanks Mario Bereca, Rita Peña, Ernesto Curica, José Macedo and all members of the communities of Bufeo Cocha, Sta. Rita Mochilla and Nueva Galilea for hosting us, sharing their ways of living and knowing. I'm deeply grateful to all native communities with whom I had contact, for resisting colonialism and expressing a living relationship with the forest and all its entities that was deeply transforming and enlightening — through your eyes the forest became alive beyond what one can see, under the skin and through the distance. I wish this work may be helpful to support your ongoing struggles for a 'good living' and to secure land rights to your ancestral territories.

On Ascension Island, I would like to thanks R. Fish for the opportunity to take part in this study as well as Ness Smith, Diane Baum, Alasdair Bain and Kitty George for their valuable support preparing and concluding it. Special thanks goes to Jane Disley, Mark Nile, Mick Hill, Al Machattie, Sue Arms-Lawrence, Terence Young and to all those who participated on the survey for their contributions to the success of this study. Through your stories, mostly at the Saints Club, I found out the Ocean is itself a fluid continent.

Third, I'm grateful for all the support and motivation from my colleagues and friends at SAC, along with the insightful debates and cheerful retreats to the bluebells' woodlands, especially Kadi Kahir Abdul, Thirza Loffeld, Marko Barisic, Lissa Davies, Mick Bonnington, Joe Spence, Avi Heinemann, Tom Worsdell and Kjetil Nybo, throughout the various ups and downs of this journey. I've learned loads of both crucial and entertaining stuff with you all. Also, thanks to William Rowlandson for introducing me to some magical trees, sacred groves and mysterious tricksters around Canterbury, and to Karen Smith for sharing the mysteries of archetypes and ancient mythologies, recalling me of a nearly forgotten path, also lively and expressive here. Neither my research nor my stay in Kent would had been the same without you guys.

To my long-standing friends and life-long allies, particularly Fernando Sousa, Sara Ruas, Miguel Dias, Rosa Medina, Mary Jane, Marco Nunes, Xavi Arias and Luis Carmona, thank you for being there across the distance and through the time, both when things changed and when they stayed the same. I certainly wouldn't be the same without you.

Finally, I'll always be grateful to my core family, particularly, my mother whose sheltering and nurturing support allowed me to complete this thesis with a sense of peace, and to my father for his seasoned advice. To my aunt Clara Viana and my uncle João Mendes for always opening their house and letting me find there a needed retreat, thank you for your generous support, advice and insightful discussions about life and the world. To my grandparents, Aleth Viana and Francisco Viana, for all the everlasting love and for being my 'great' parents throughout my life: my gratitude goes beyond words.

Completing this thesis would certainly not have been possible without you all.

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LIST OF ABBREVIATIONS

CBD Convention on Biological Diversity

CES Cultural Ecosystem Services

ES Ecosystem Services

ILK Indigenous and Local Knowledge

IPBES Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

IUCN International Union for Conservation of Nature

NCP Nature's Contributions to People

SES Socio-Ecological System(s)

TEK Traditional Ecological Knowledge

WWF World Wide Fund for Nature

1. INTRODUCTION

Knowledge of lost habitats, species extinctions and climate change convey a world quickly, fundamentally and profoundly changing as the result of human action (Steffen et al., 2015; 2018), yet the underlying worldviews that foster environmental degradation and the cultural diversity threatened along ecosystems are still largely dismissed from devised solutions (Plumwood, 2002; Hanspach et al., 2020). Environmental degradation is increasingly articulated in the context of the so-called 'Anthropocene': an era where humans became geological actors, as global environmental impacts are now capable of leaving a footprint in the fossil records (Lorimer, 2015: 1-18). Yet, here, "humans become Humanity, a singular human enterprise" behind the ecological crisis (Moore, 2017: 4), regardless of the social inequities underlying their diverging responsibilities and consequences (IPBES, 2019; Marques et al., 2019; Menton et al., 2020). The notion of an Anthropocene reflects conservation science prevalent concerns and paradigms (Soulé, 1985; Kareiva and Marvier, 2012) and illustrates how environmental narratives are invested with complex meanings that reproduce dominant perspectives on human–environment relationships (Lorimer, 2015; Moore, 2017). Such narratives, often expressed along notions of crisis that conceal their contested nature along the diversity and heterogeneity of human ecological roles, convey a social concern with the environment which is central to the formulation of agendas and disciplines linked to biodiversity conservation (Soulé, 1985; Kareiva and Marvier, 2012).

Illustrating the above, the Anthropocene is "an argument wrapped in a word" (Paul Voosen, *in* Moore, 2017: 1), whose narrative both reflects and shapes the understanding of socio–ecological changes and environmental concerns — even when contested and critically articulated simultaneously by alternative concepts such as the Chthulucene (Haraway, 2016) or Capitalocene (Moore, 2017). With no other geological era named after a species, the Anthropocene arguably reproduces an anthropocentric perspective, which implicitly convey an image of human exceptionalism separated from — even if negatively impacting — the 'natural' world. As argued by Moore (2017: 4), the concept is based on the abstract conceptualization of both nature and society, emerging from a "kind of Cartesian virgin birth", where: on one hand, we have nature, somehow 'out there' and valued by its wilderness, as long as pristine and untouched by humans; and, on the other, we have society, with the whole humanity conceived as responsible for environmental degradation, without differentiation nor even reference to social inequities, power

relations, nor cultural diversity. This Cartesian duality carves a profound wound between society and nature, driving an historical attempt of 'mastery' over nature expressed through its appropriation and objectification (Bateson, 1972; Bookchin, 1982; Harvey, 1996) while still embedding current environmental concerns and paradigms in prevalent nature:culture dichotomies (Descola, 2013; Ellen, 1996). This duality is a canyon crossing deep through the landscape of our more-than-human relationships, which splits in two our ethical considerations and conceals the pluralism of human endeavours.

Then, the present looming ecological crises call for inexorable attention — set the current state of affairs — to those worldviews used, as well as those needed, for their interpretation and mitigation. The challenge is to address environmental concerns from a perspective that enables questioning the dominant cultures, worldviews and lifestyles driving environmental degradation while allowing distinct perspectives to be heard and recognized. Here, as their conceptual forms shape and reflect the understanding of their relationship, questioning prevailing conceptualizations of both nature and society stresses the need to understand those as mutually constitutive categories rather than discrete and separate domains (Descola, 2013). First, this entails embracing their inherent entanglements, inviting focus on the diverse expressions of interdependent relationships between distinct societies and natures. Second, this invites reconsideration of the ecological role of humans, considering their heterogeneity but also potential regenerative forms. Ultimately, this requires reflecting on how distinct multispecies entanglements are articulated by and characterize human–environment relationships (e.g., Haraway, 2008; Rival, 2007), acknowledging the unequal responsibilities and uneven consequences of unbalanced ecosystems (e.g., Bookchin, 1982; Harvey, 1996). As argued by Plumwood (2002: 8), perhaps the "contrived blindness to ecological relationships is the fundamental condition underlying our destructive and insensitive technology and behaviour", where the historical separation of culture from nature leave us with two major tasks: "(re)situating humans in ecological terms and non-humans in ethical terms".

To develop conservation strategies able to effectively address environmental degradation, it is crucial to overcome the discipline's tendency to overlook the cultural, social and political dimensions of both environmental issues and devised responses — as increasingly stressed in recent reports (e.g., IPBES, 2019; IPCC, 2019) and emergent debates (e.g., Díaz et al., 2018; Menton et al., 2020). Such harmful tendency agrees with the discipline's foundational definition (Soulé, 1985) and customary praxis (Cronon, 1996) yet, the modes of reflexive awareness

needed to address current challenges reveal, as posed by Lorimer (2015: 4), "the contested nature of any aspirations toward environmental management". And, indeed, also conservation science gathers a pluralism of perspectives (Mace, 2014). As such, ongoing debates over emergent and contested conservation approaches have fundamental contributions to navigate actual environmental challenges, namely by stressing the importance of cultural contexts (e.g., Díaz et al., 2018), seeking to bridge distinct knowledge systems (e.g., Tengö et al., 2017), developing inclusive governance systems (e.g., Brondízio and Tourneau, 2016) or addressing struggles for environmental justice (e.g., Menton et al., 2020). The present thesis is set to contribute to these debates, aiming to assist the integration of multiple voices in the design and planning of effective conservation strategies, that are simultaneously culturally appropriate, socially equitable and politically representative, by developing ecosystem assessment frameworks' ability to convey the context-specific dimensions of human–environment relationships and bring distinct worldviews into dialogue.

Ecosystem Assessments: Disclosing Knowledge Gaps and Research Aims

The present thesis reflects an understanding of ecosystems as multispecies assemblages comprising both human and more-than-human beings, while ecology, referring to the relationships between living creatures, concerns their modes and means of coexistence. The ecosystem approach reflects precisely the inherent entanglements and interdependences between different species, including humans, where ecosystems are a "dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit" (CBD, 1992; Article 2). Adopted by the Convention on Biological Diversity (CBD), the ecosystem approach recognizes humans' ecological roles and promotes resource management in sustainable, participatory and equitable ways (CBD, 2000). However, despite widely influential, the approach's formal 12 Malawi Principles were not yet fully embraced, particularly concerning their nuanced social aspects, by environmental management strategies, conservation initiatives and not least ecosystem assessment frameworks (Waylen et al., 2014). Recognising the diverse roles that humans play in ecological communities, Bookchin (ibid.: 22) argues that social ecology "provides more than a critique of the split between humanity and nature; it also poses the need to heal them". In this context, the present work pertains 'natural ecology' as much as 'social ecology', by considering that the conservation of landscapes and ecosystems requires the understanding and sustenance of those multispecies assemblages that, as posed by Bookchin (1982: 23), reflect the "interrelated social and organic factors that create the basis for a balanced ecological community".

Ecosystem assessments are fundamental tools to reveal the condition and trends of ecosystems, establish their relation to human well-being and inform the design and planning of adequate conservation strategies (IPBES, 2019; MA, 2005), reflecting both human vulnerability to and influence on ecological changes (e.g., Potschin and Haines-Young, 2016). Ecosystem assessment frameworks, such as Ecosystem Services (MA, 2005) or Nature's Contributions to People (Díaz et al., 2018), are designed to assist the diagnosis of environmental challenges and inform the development of effective policy responses and environmental management strategies, representing "the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems" (MA, 2005: ii). However, despite interdisciplinary and constructed around 'social processes' (Potschin and Haines-Young, 2016; Fish et al., 2016a), ecosystem assessments tend to use an economic framework to demonstrate the 'value' of nature and, by doing so, assert the importance of its conservation to policymakers (e.g., Costanza et al., 1997). Historically influenced by Cartesian worldviews and positivist epistemologies, such frameworks emphasise utilitarian perspectives based on the monetary valuation of environmental benefits (Sullivan, 2010) and remain inclined to deliver universal solutions based on neoliberal paradigms (Dunlap and Sullivan, 2019), disregarding other values held towards nature but also the distinct worldviews, social inequities and power relations influencing people's relationship with nature. Therefore, despite widely influential, ecosystem assessments still tend to overlook the cultural influences (Fish et al., 2016; Milcu et al., 2013) and social-political contexts which shape people's dependence on the environment, drive environmental changes and inform devised responses (Fish et al., 2016; Milcu et al., 2013; Mastrángelo et al., 2019; Poe et al., 2014).

Recent debates assert the relevance of moving beyond monetary valuations to consider relational values (Chan et al., 2012; 2016) and the Nature's Contributions to People framework represent efforts to address current ecosystem assessment limitations (Díaz et al., 2018), particularly advocating for bridging knowledge systems (Tengö et al., 2017) and integrating pluralistic valuations (Pascual et al., 2017). Nonetheless, systematic approaches to consider the cultural, social and political dimensions of ecosystems remain to be developed.

Knowing ecosystem assessments current limitations (Mastrángelo et al., 2019; Milcu et al., 2013; Sullivan, 2010) stresses the importance of developing conceptual and methodological approaches to systematically address the context-specific dimensions of socio-ecological systems (Fischer et al., 2015). This is crucial to move beyond universal panaceas and effectively navigate actual environmental challenges (Ostrom, 2007; 2009), particularly from a social and cultural perspective, but also to achieve sustainable development goals (Mastrángelo et al.,

2019) and enhance actions to jointly meet the 2020 Aichi Targets of the Strategic Plan for Biodiversity 2011-2020 (CBD, 2010; Marques et al. 2014) — as concerted efforts to meet those still fall short (CBD, 2020; Krug et al., 2014). Ultimately, if global efforts to advance sustainability and meet biodiversity targets do not systematically consider local unique perspectives and context-specific dimensions, including cultural diversity, social inequities and power relationships across multiple scales, these risk reproducing paradigms which may increase environmental injustices rather than foster social and environmental justice (Hanspach et al., 2020; Menton et al., 2020). As such, precisely due to their widespread implementation and crucial positioning to inform environmental management strategies, it is fundamental to question the ontological premisses, epistemological stances and ethico-political licenses that ecosystem assessments reproduce in the interpretation of both global and local environmental issues.

Then, the present thesis is inspired by the following question: are ecosystem assessment frameworks — as they stand today — adequate to assess socio-ecological systems and inform decision-making across diverse cultures and heterogenous societies?

The answer lies in the intersection of the distinct bodies of knowledge relevant to this question, namely the key contributions and knowledge gaps of actual research on socio-ecological systems, biocultural diversity and ecosystem assessment frameworks. In line with social ecology, the complexity of coupled social and ecological systems requires embracing their interdependent and entangled dynamics (Liu et al., 2007; Scheffer, 2009), moving beyond reductionist approaches towards a focus on interactions and feedback processes (Fischer et al., 2015), but also beyond universal solutions to fully consider their context-specific dimensions (Ostrom, 2007; Mehring et al., 2017). Here, along with insights from research in socio-ecological systems (Ostrom, 2009), research in biocultural diversity may also hold crucial contributions to reveal the diverse articulations of reciprocity in human–environment relationships, support the integration of indigenous and local knowledge systems and engage in the participatory development of community-based conservation strategies (Gavin et al., 2015; Hanspach et al., 2020; Winter et al., 2018). Combining insights from research in both socio-ecological systems (e.g. Berkes et al., 2003) and biocultural diversity (e.g. Maffi, 2005) is thus fundamental, if we wish to overcome unhelpful dichotomies and address major knowledge gaps in sustainability sciences (Fischer et al., 2015; Mastrángelo et al., 2019) pertaining to the enhanced understanding of context-specific dynamics (Fischer et al., 2015; Ostrom, 2007), the impact of diverse drivers of change (Carpenter et al., 2009; Mastrángelo et al., 2019) and the influence of distinct cultural

and social variables in human–environment relationships (Poe et al., 2014; Mehring et al., 2017).

The idiosyncrasies of these distinct approaches are fully detailed in the next chapter, concerning the literature review, while the specific context of their emergence within conservation science and their relevance to both historical and ongoing environmental debates are discussed in Section 1.2. Here, will suffice to say that the challenge is still to develop ecosystem assessments capacity to thoroughly address the complexity of dynamical socio-ecological systems (Carpenter et al., 2009; Mastrángelo et al. 2019), considering their general characteristics but also their context-specific dimensions and multi-level interactions across different scales (Fischer et al. 2015; Liu et al., 2007; Ostrom, 2007). These knowledge gaps support the need to develop context-specific strategies for the assessment of actual socio-ecological dynamics at local and regional scale, weaving together theoretical insights and empirical research on local modes of coexistence with ecological communities and their unique challenges. These lacunae attest that ecosystem assessments have, indeed, a limited ability to inform conservation decisions across cultures, as particularly evidenced in that, despite the established role of culture mediating interactions between people and nature (Ellen, 1996; Milton, 1996), cultural ecosystem services still play a marginal role in ecosystem assessments (Milcu et al., 2013; Fish et al., 2016).

Then, because cultural ecosystem services are positioned precisely at the intersection between nature and society, the present thesis aims to explore their potential contribution to unveil, communicate and support local modes of enacting, understanding and valuing human–environment relationships. Despite their acknowledged relevance (MA, 2005; IPBES, 2019), cultural services are often considered difficult to evaluate systematically (Milcu et al., 2013), not suitable for quantitative assessments (Daniel et al., 2012) and broadly lack comprehensive approaches for their evaluation (Hernández-Morcillo et al., 2013; Díaz et al., 2018). Therefore, developing a coherent framework for their assessment may constitute the starting point to support the inclusion of diverse worldviews and knowledge systems in ecosystem assessments, but also to further the understanding of local human–environment relationships and actual socio-ecological dynamics — conveying the influence of cultural, socioeconomic and political contexts. While the practice of ecosystem assessments may be itself contested and imposed land management strategies undesirable in various contexts, if assessments represent tools to inform decision-making across diverse cultures and societies, may these at least support the development of more socially equitable, culturally appropriate and politically legitimate conservation initiatives. With this aim, the present thesis pursues the following research questions:

(1) What cultural, social and political dimensions of human–environment relationships need to be considered in ecosystem assessments?

(2) How can those dimensions be adequately and systematically integrated in ecosystem assessments?

Through addressing these questions, the specific objectives of this thesis are: first, to develop a conceptual and methodological framework for the systematic assessment of cultural ecosystem services; second, to support the analysis of actual socio-ecological dynamics based on the recognition of context-specific dimensions of human–environment relationships; and, third, to provide a venue in conservation science for conveying the diverse perspectives, worldviews and knowledge systems that may assist a deeper understanding of current environmental challenges and inform desirable modes of coexistence with our wider ecological communities. As such, the aim is not to provide a comparative analysis of assessment practices but rather, considering current limitations of ecosystem assessment frameworks, to explore how usually overlooked dimensions of human–environment relationships may be relevant to inform adequate conservation responses, further developing conceptual and methodological tools for their systematic consideration.

How meeting these objectives may contribute to advance knowledge and hold the potential to catalyse effective, equitable and representative conservation responses is discussed below. First, in Section 1.1, by examining the ontological and epistemological premisses reproduced by distinct conceptualizations of nature and society, establishing the mediating role of culture in environmental debates and the relevance of considering diverse worldviews in conservation science. And then, in Section 1.2, by offering a brief contextualization of the present thesis in relation to dominant conservation approaches and emergent conservation debates, asserting its relevance to understand current environmental challenges and inform adequate conservation responses.

1.1 ON NATURES AND CULTURES

The conceptual dualism embedded in what is considered ‘natural’ or ‘cultural’ in western societies has been strongly criticised for reproducing a dichotomy that represents those as abstract and separated categories, concealing both concepts’ interdependence (Viveiros de Castro, 2005; Descola, 2013; Ellen, 1996). Their distinction is based on an abstract conceptualisation of both

human societies and nature which strongly influence environmental management strategies and bias the understanding of human–environment relationships worldwide (e.g., Lorimer, 2015). However, a fundamental aspect in discussing the dichotomy is also to acknowledge that neither are western representations of nature widely shared, as carefully shown by Descola in Configurations of Continuity (2013), nor is humanity a homogenous entity represented by a single human enterprise, as social inequities, cultural diversity and historical undertakings like colonialism determine its wide heterogeneity (Moore, 2017).

The alternatives proposed to a nature:culture dichotomy, however, have been so far mostly reduced to vague non-binary conceptualizations. As argued by Ellen (1996), going beyond the nature:culture dichotomy, by claiming their interconnection or by dismantling the distinction altogether, may not support the conceptual structures needed to even discuss the interrelation between both terms. Nonetheless, a conceptual duality does not always imply a metaphysical duality. Certain cosmologies do not rely on a separation between nature and culture, but that does not necessarily mean that both are not distinguished (Viveiros de Castro, 2012). Some worldviews may indeed deny a separation, while others may not explicitly distinguish between nature and culture but rather have those as covert categories, inferred from contrasts performed in ritual or portrayed in mythological narratives (Ingold, 1986). In this context, Descola (2013: 3-31) provides a detailed account of nature conceptualisations in several non-western cosmologies, arguing that most societies perform within a social continuum that encompasses both the human and more-than-human realms.

Within Amerindian cosmologies, for example, humans are not granted with exceptional capacities in terms of knowledge or subjectivity, beyond perhaps an exceptional awareness of their own relational roles in multispecies assemblages (Descola, 2005). As such, those cosmologies do not legitimate a hegemonic power over other species, used to subordinate the beyond-human to human needs, but rather perceive humans as co-participants in constant exchanges with the beyond-human, without necessarily enforcing a separation from nor objectification of nature (Descola, 2013). Nature and culture categories in such cosmologies are often merged under common contents and, instead of distinguishing between different ontological domains, rather point towards the relevance of relational contexts and the intrinsic relativity of interchangeable perspectives (Descola, 2013; Kohn, 2013; Viveiros de Castro, 1996). Thus, such cosmologies entail not only a change of contents but of status attributed to those categories (Viveiros de Castro, 1996).

The social perception of nature develops through the experience of interaction with nature (Ellen, 1996; Ingold, 2000), where its symbolic meaning has no sense apart from the world (Sahlins, 2013). How a society perceives nature depends on the relation between both and how this society affects and was affected by the environment. As such, when developing conservation and environmental management strategies, it is crucial to acknowledge that the concept of nature is itself a social, cultural and historical construction, subject to transformations triggered by social and ecological changes. Moreover, any conceptualisation of nature or society also influences the affiliated modes of knowledge production and reproduction (Ellen and Harris, 2000; Milton, 1996), such that is fundamental to question the scope and adequacy of associated epistemologies. Awareness of diversity is particularly relevant when addressing global environmental concerns, to avoid importing or exporting inadequate conceptualisations to and from context-specific cases. This is more so as, ultimately, nature:culture dichotomies are linked to an array of underlying sub-dichotomies, including the self:other and the subjective:objective (Haraway, 1991; Rose, 1993) but also the particular:universal and the human:nonhuman (Viveiros de Castro, 1996).

In this context, there are not culturally 'neutral' definitions, while these are affiliated to cultural, social and political contexts where definitions reproduce perceived realities rather than represent quintessential truisms. As posed by Milton (1996: 27), "definitions are only problematic if we insist that they define the true essence of things". As such, Viveiros de Castro (1996) suggests examining western dichotomies along with the perspectivism operating in Amerindian cosmologies, based on an intrinsic relativism of perspectives. This requires adopting an anti-essentialist approach to well-delimited categories, such as species, in the articulation of diversity and similarity (e.g., Kirksey and Helmreich, 2010; Ogden et al., 2013). Thus, instead of rejecting the underlying distinctions altogether, it is relevant to examine and explicitly acknowledge the assumptions held behind their dualistic character, such that particular conceptualisations and symbolic representations may be used for the interpretation, discussion and analysis of distinct realities, while being simultaneously endowed with a dynamical character and placed where they can be challenged when required.

On Natures: Things, Others and Essences

> *"The original condition common to humans and animals is not animality but rather humanity." (Viveiros de Castro, 2005: 40)*

In western cosmologies, the concept of "natural" may refer both to what is considered inherent in nature and what is considered normal in culture (Sahlins, 2013). Nature can mean both what a being is and everything that is, but also the context or environment of such beings, both specifically or generally, as well as including or withdrawing humanity from it — despite that its symbolic meanings generally express an opposition with all that is considered human or belonging to human society (Descola, 2013: 3-31). In this context, Ellen (1996) suggests to distinguish between three characteristic representations of nature: as the *thing*, based on the identification of discrete components and patterns between them, usually fragmented and decontextualized, as in the categories inferred by language; as the *other*, expressed in the contrasts between a self and the world, where nature is 'out there', an environment external to and distinct from human societies, as invoked by notions of wilderness; and as the *essence*, based on the recognition of intrinsic qualities, perceived as essential or static attributes of beings or things, in which case may refer to an ontological claim as much as to a moral evaluation or judgement.

In western conceptualizations, culturally ambiguous or ambivalent descriptions of nature are abundant, figuring simultaneously as robust and fragile, benign and malign, eternal and ephemeral depending on the historical context (Ellen, 1996). Moreover, drawing a clear boundary between what is natural and what is cultural, as between the organism and their environment, is nearly impossible. Domesticated plants and animals, as well as food and our own bodies are prone to be simultaneously represented as natural and cultural. Landscapes are also often considered simultaneously natural and cultural, being shaped by multispecies co-evolutionary processes that entail environmental changes led by both humans and beyond-humans, despite arguments for their conservation often evoking their wilderness — even when referring to otherwise historically domesticated landscapes, represented symbolically as an expression of cultural identity and heritage (Hirsch, 1995; Tilley, 1994). Thus, several examples testify to the difficulty of any straight-forward distinction, reflecting that defining something in the categories of natural or cultural ultimately depends on the level of abstraction, scale and context rather than on any intrinsic characteristics (Ellen, 1996) — what is identified as nature or culture shifts and merges through time as much as the set of associations implied by the distinction.

In indigenous cosmologies, what we might call natural elements are often conceived as persons with cognitive, moral and social qualities analogous to humans, enabling interactions between humans and non-humans to occur along a social continuum that comprises both (Descola, 2013; Hall, 2011). As argued by Kohn (2013), this notion entails the recognition of an 'ecology of selves' where, following Charles Pierce's notion of life as inherently semiotic, the beyond-

human is animated with intentionality and endowed with a shared sociability. Viveiros de Castro (2012) suggests these cosmologies follow a multinaturalism perspective, where subjectivity is universally shared among living beings (i.e., all share a common culture as selves) while objectivity belongs to the particularity of their own bodies (i.e., each has its own nature). Then, recognising common attributes to the human and beyond-human supports an extended concept of personhood where, blurring any ontological dualism, being 'human' does no longer refer to a species but to a condition (Descola, 2013: 11). As such, rather than exclusively human, personhood is based on shared attributes for the participation in social life, as intentionality and knowledge, implying a redistribution of attributes inherent to the conventional categories of 'nature' and 'culture' (Viveiros de Castro, 1996; 2012).

Indigenous cosmologies, which consider earth's abundance a gift that requires human's reciprocity to be renewed (Kimmerer, 2013), strongly contrast with conventional conservation paradigms, where resources need to be protected from humans to maintain their intrinsic value (Berkes, 2004). Resulting from a shared sociability, many indigenous cosmologies sustain the balance of human–environment relationships through complex stewardship ethics, based on relational values that acknowledge the interdependence between all beings (Descola, 2013; Hall, 2011). Thus, operating along a social continuum, these perspectives challenge classic distinctions between nature and culture, as their ontological dualism may not describe internal dimensions of non-western cosmologies (Viveiros de Castro, 2012) nor their positivist epistemologies may fully comprehend local socio-ecological dynamics based on subjective relational values. Applying foreign concepts and epistemologies, not representative of local worldviews, in local conservation initiatives or development strategies leads to misunderstandings on both sides that may foster power differentials and drive drastic cultural, social and political changes — as epitomized by the problematic implications of Natural Capital assessments (Dunlap and Sullivan, 2019). Besides causing numerous social conflicts (Colchester, 2004; Doolittle, 2007), such changes may further remove local incentives to maintain ethical-based resource management strategies and, ultimately, backlash against conservation goals (Alexiades, 2009).

Despite the veritable real-world impacts of particular conceptualizations, it is important to notice that any nature:culture dichotomy is no more than a pseudo-problem that arises from reflexive symbolic constructs, expressed in ordinary language and so within culture itself (Ellen, 1996). As language conveys how humans perceive and interact with the world, the distinction between representation and represented implies a distinction between 'nature' and nature — the symbolic representation and the actual nature represented (Ellen, 1996). In this context,

following a critical realism perspective, ur-nature refers precisely to the unconscious recognition of nature (Chatterjee, 2014), the nature which exists pre-representation and that lies beyond any affiliated cultural symbolic meaning. Yet, cultures — in all their different manifestations — are also necessarily a subclass of ur-nature as much as humans, languages and any symbolic constructions are as well. Therefore, because language is a subclass of culture and culture a subclass of nature, this implies that ur-nature cannot be fully specified by any ordinary language nor fully embraced in cultural representations. As in Russell's paradox, what involves the totality of a collection cannot be itself part of the collection (Irvine and Deutsch, 2014). So, precisely for this reason, we cannot speak about nature, either in terms of its depletion or its conservation, without acknowledging but also questioning the cultural constructions — and underlying assumptions — implied in its conceptualization.

On Human–Environment Relationships: The Role of Culture

The role of culture mediating human–environment relationships, as a mechanism through which humans interact with the world, is widely acknowledged in anthropology (Ellen, 1996; Milton, 1996: 37-40). This mediating role has been widely conceptualised and theorised, intending to answer questions of how different cultures originate and function as well as how these shape or are shaped by the environment. The topic gave rise to an intense debate in anthropology (Dove and Carpenter, 2008; Ellen, 1996), the formulations and contests of which are recounted in detail by Descola (2012) and Milton (1996: 37-68). The debate has been central to environmental anthropology, placing the mediating role of culture and the contextual role of the environment at the forefront of advanced conceptualisations of human–environment relationships. Nonetheless, as argued by Descola (2013), the debate has also often reproduced a nature:culture dichotomy, failing to fully embrace the intertwined and reciprocal nature of human–environment relationships.

In general, the social construction of nature in anthropological accounts have entailed two main approaches, in which either the perception of environment is *culturalized*, meaning that the 'constructed' environment is considered different from the 'real' environment; or human activities are *naturalised*, entailing that practical operations, processes and functions are considered as interactions purely shaped by the physical environment (Ellen, 1996). These major contrasting views would further develop into three main approaches, expressing distinct perceptions on the actual role of culture. As described by Milton (1996: 40):

> *"There have been three broad ways of conceptualising the relationship between human beings and their environments: first, human beings adapt to and are therefore shaped by their environments; second, human beings adapt their environments to suit their own needs, and therefore determine or shape those environments; third, human beings interact with their environments in such a way that they shape each other."*

The first approach, known as environmental determinism, explains cultural features as shaped by environmental influences, considering human's societies determined by their environments through a cultural process equivalent to natural selection. This approach intended to explain why societies in temperate climates would be more advanced than societies developing in more extreme climates, being widely criticised for its tendency to naturalise racism (Dove and Carpenter, 2008). The second model, known as cultural determinism, involves a general assumption that humans shape the environment to suit their needs, with culture pertaining exclusively what cannot be directly observed. This approach gave rise to ethnographic descriptions of cultural worldviews, disciplines concerned with ethnoecology and perspectives based on the social construction of the environment (Milton, 1996: 48-55). Finally, less deterministic approaches would emerge, claiming that both human's societies and the environment mutually shape each other, through processes of co-evolution based on reciprocal interactions (e.g., Ingold, 2000). Yet, if the first two models preserve the mediating role of culture largely unquestioned and at the centre of debates, this third model would eventually come to marginalize the cultural influences affecting human–environment relationships (Milton, 1996: 55-61).

The present thesis follows the influences of the third approach, without dwelling on the broader historical context and political implications of the other two models whose intricacies have been well documented elsewhere (Descola, 2012; Dove and Carpenter, 2008; Milton, 1996). This third model would be widely adopted by conservation and environmental sciences which, recognizing the role of both humans and more-than-humans constituting ecosystems, acknowledge their co-evolutive processes and the multiple interdependences that comprise complex socio-ecological systems. Yet, despite widely conveyed in scientific discourses nowadays, this approach would dismiss the cultural dimensions of human–environment relationships and their influence on actual socio-ecological dynamics, reproducing major limitations of current ecosystem assessment frameworks and socio-ecological systems research — as fully detailed in the next chapter. Therefore, it is fundamental to examine the influence of cultural variables in human–environment relationships, their modes of co-production of the environment and resulting socio-ecological dynamics at different spatial and temporal scales.

On Cultures: Ways of Living, Knowing and Relating

> *"…culture is more rapid, focused and flexible than either genetic or physiological adaptation, and is an engine for the production of diversity quite as complex but less predictable than any found in biological systems." (Ellen et al., 2013: 2)*

'Culture' is an elusive concept. According to Ellen and Harris (2000), culture performs the connection between the empirical and symbolic realms. It has been argued that culture emerges from the symbolic representation of objective reality (Sahlins, 2013), entailing its symbolic valuation and synthesis, but also the dissociation between experience and representation (Ellen, 1996). As such, culture comprises both perception and interpretation (Milton, 1996; Sahlins, 2013). However, while the concept of culture is central to anthropology, the discipline is also dominated by the distinction between interpretive, symbolic or cognitive approaches (e.g., Geertz, 1973) and more adaptive or materialist perspectives on culture (see Lett, 1987; Engelke, 2018: 25-55).

Here, I will not dwell on these long-standing anthropological debates, which go beyond the scope of the present study, but rather resort to inclusive conceptualizations of culture that, acknowledging the particular significance of symbolic meanings, recognise key cultural features on what and how people know, think and feel but also on their actions, practices, techniques and institutionalised behaviours (Milton, 1996; Mitchell, 2000). In this sense, culture is a way of thinking, knowing and interpreting the world while, simultaneously, comprises a range of 'things' from houses to pottery, costumes and food, such that "there is a materiality to culture. It is embodied and enacted" (Engelke, 2018:28). Indeed, following Mitchell's overview (2000:14), culture can be broadly understood as a 'way of life', including the meanings, practices and institutions comprising those; the processes through which their patterns of differentiation developed; the ways through which such patterns and processes are represented; and the cultural practices that produce and reproduce those, from modes of subsistence to artistic expressions and mass-produced commodities. Ultimately, culture may be understood as everything which is not nature, or all that "makes humans human" (ibid.), while invoking a "focus on the particular, not the general" (Engelke, 2018: 32).

Still, culture is a continuous process rather than any given set of meanings or practices. As argued by Mitchell (2000: xv-xvi), culture "is never anything, but is rather a struggled-over set of social relations, relations shot through with structures of power, structures of dominance and subordination", where 'culture wars' are precisely "those battles over the meaning and structure

of the social relationships". Making clear how culture is inextricably linked to the political and economic spheres of social life, such 'wars' seek to define clear boundaries between what is considered legitimate or not in terms of knowledge, behaviours and relationships. In this sense, "no culture exists in isolation. No culture is ever original; every culture is, we might say, always on a nomadic path" (Engelke, 2018:8) with 'culture wars' revealing how culture is always 'in the making' and "everywhere inextricably related to social, political, and economic forces and practices" (Mitchell, 2000: xvi). As such, understanding the context-specific ways through which culture mediates human–environment relationships requires understanding the established and contested relationships that link people to their social, political and ecological contexts and how these articulate or constitute their identities, livelihoods and struggles.

Nonetheless, as one may question nature's formulation as exclusively non-human, one may also question culture's conceptualisation as exclusively human. Here, drawing attention to the multispecies assemblages sustained by human–environment relationships, Kohn (2013) argues that if culture is a 'complex whole' (a seminal definition[1] by Tylor, 1871) then is also an 'open whole' by virtue of humans' entanglement with the beyond-human. Humans do not become human by themselves, but their entanglement with the environment is rather central to the reproduction of human identities, both personal, cultural and, generally, as a species (Haraway, 2008; Ingold, 2000). Humans do not exist isolated from the world, their experiences nor histories (Ingold, 2011) but rather 'become with' human and more-than-human others (Haraway, 2008). Moreover, if culture comprises both perception and interpretation, it is increasingly difficult to support that culture is exclusively human (Milton, 1996), as these attributes are shared by humans and non-humans alike — through indexes and icons even if not symbolic language — when life is considered inherently semiotic (Kohn, 2013; see also Charles Peirce's semiotics, in Hoopes, 2014). Then, it makes renewed sense considering how indigenous cosmologies recognise a shared culture in all beings (Viveiros de Castro, 2012) and articulate their relationships along a social continuum comprising both the human and more-than-human realms (Descola, 2013). These worldviews contrast with how 'industrial' societies tend to establish cultural representations that exclude non-humans from culture, with implications for their distinct modes of relating, understanding and managing the 'environment' (Hall, 2011). Yet, extending culture to the non-human does not imply the assumption of any unified non-human domain but rather paying attention to learned behaviours and established relationships in shared social settings:

[1] "Culture or Civilization, taken in its wide ethnographic sense, is that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society." (Tylor, 1871:1)

when ontological categories merge, the essentialist 'non-human' becomes relative and contextual (Viveiros de Castro, 2012).

Then, the cultural dimensions of ecosystems refer precisely to *how* human societies have shaped and been shaped by the environment, highlighting the relevance of 'contact zones' between multiple species (Haraway, 2008: 4), their joint processes of co-production of the environment (Hirsch, 1995) and the resulting multispecies assemblages that constitute their dwelling landscapes. Recognising how human's societies and the environment mutually shape each other, the cultural dimensions of ecosystems comprise the tangible and intangible dimensions of human–environment relationships, including the symbolic meanings, management practices and knowledge systems affiliated to particular environments. These represent the diverse manifestations of human–environment relationships embedded in actual landscapes and reproduced in particular ways of living. Yet, these also reflect that, like other wars, 'culture wars' are territorial and disputed over real spaces, places and landscapes (Mitchell, 2000: 3-36). As such, besides their intangible and contested dimensions, the cultural dimensions of ecosystems convey how culture is both inscribed in people's dwelling places and embodied by their economic practices, seasonal festivities and material cultures. Such notion follows Sauer's understanding of a cultural landscape, as a landscape "fashioned from the natural landscape by a cultural group" (1963; in Hirsch, 1995: 9), embodying their labour, needs and desires while also acknowledging their multiple successive, concurrent and disputed layers of meaning (Mitchell, 2000: 91-119).

Because cultures are never static nor exist isolated from their social and political contexts, the cultural dimensions of ecosystems also draw attention to the social structures and power relationships that may foster or constrain particular human–environment relationships. Cultural manifestations are articulated along continuous processes of exchange and transformation (Mitchell, 2000: 3-36), affecting the reproduction of affiliated meanings, practices and knowledges. Their "webs of significance" (Geertz, 1973: 5) are constantly 'in the making'. Then, considering the cultural dimensions of ecosystems requires questioning which cultures are represented on a given landscape? Who produces and reproduces those cultures? And who is represented inside or outside them, both human and more-than-human?

A concept of culture that comprises the tangible and intangible expressions of human–environment relationships, including their social, political and ecological dimensions, conveys the relevance of cultural variables for the understanding of actual socio-ecological dynamics. Such conceptualization emphasizes the role of culture — in the wider sense of social, economic and

political practices — influencing the structure and behaviour of complex socio-ecological systems. Yet, because culture provides the context to perception, interpretation and action, culture not only reflects a way of living but also a way of knowing: "a way of thinking about and understanding the world" as well as "the process through which that understanding is generated" (Milton, 1996: 23). In this context, enquiring culture may also reveal whether existing knowledge and practices are adjusted to actual socio-ecological conditions, if these are adaptive or maladaptive and which specific cultural features are or not ecologically sustainable (ibid.).

Environmental challenges, indeed, cannot be dissociated from the issues of values, equity and social justice that may drive ecological changes (Berkes, 2004) nor conveniently addressed disregarding the contextual value of knowledge and its intertwined relation with culture (Ellen and Harris, 2000) — i.e., how knowledge is produced and reproduced by meanings and practices affiliated to local contexts. This understanding establishes the relevance of cultural contexts and informs the development of the present thesis' theoretical framework, detailed in Chapter 3, which outlines pathways for considering cultural variables in ecosystem assessments as means to support the analysis of context-specific socio-ecological dynamics. Still, first, it's worth examining the relevance of developing such framework in the context of emergent conservation approaches and their major underlying premisses.

1.2 A CONTEXT TO CONSERVATION SCIENCE

> *"[W]e not only share a common history with nature, all the differences between nature and society aside, but also a common destiny." (Bookchin, 1982: 34)*

Conservation biology has emerged as a 'crisis discipline' to address ecosystems disturbed, "either directly or indirectly, by human activities or other agents", with the goal "to provide principles and tools for preserving biological diversity" (Soulé, 1985: 727). As "a new stage in the application of science to conservation problems", Soulé describes conservation as a crisis discipline in which, distinct from other biological sciences, "one must act before knowing all the facts" (ibid.: 727). However, in this conventional perspective, people are often excluded from a discipline concerned almost exclusively with the "welfare of nonhuman nature", where most people are represented as a threat and a few act as its protectors (Kareiva and Marvier, 2012). This perspective relies on the unquestioned assumption that humans cause the depletion of resources, regardless of the wider socio-ecological contexts driving environmental degradation (Chatty and Colchester, 2002). As such, despite concerned with global environmental issues,

conservation science tends to overlook contextual roles while reproducing particular rather than universal perspectives on human–environment relationships (e.g., see Descola, 2013). This fundamental incongruity invites reviewing the evolution of conservation paradigms and the main debates shaping its current approaches, including their underlying assumptions on both nature and society, to reveal the significance but also the shortcomings of emergent approaches that try to reconcile people and nature.

Inspiring the emergence of conservation and environmental sciences, 'environmentalism' reflects a concern over the environment and advocates for its protection "from the harmful effects of human activities" (Milton, 1996: 27). Such concern and care might be expressed in multiple ways and contexts, across diverse cultures and societies (Cepek, 2011; Hall, 2011). Yet, as a movement, environmentalism gains traction after the industrial revolution, a turning point in human proceedings, that led to the emergence of industrial societies, capitalism and modernity but also the birth of Green Thought (Lorimer, 2015; Moore, 2017). In this sense, despite the concern with the environment being certainly not exclusive to some societies or time periods (Descola, 2005; Hall, 2011), 'environmentalism' is to a large extent a feature of 'industrial' societies that may be described both as a social movement and, due to its influence on political discourses, an ideology (Milton, 1996). Nonetheless, as an opposing force to resources overexploitation and environmental damage, environmentalism appears also strongly in the interface between 'industrial' and 'non-industrial' societies (Dove, 2006) — for example, in the Chipko's movement in India (Peet, 2004) or the Mother Earth Rights' movement in Bolivia (Brien, 2010). Indeed, 'non-industrial' societies and, particularly, indigenous peoples have been often portrayed as models of sustainable living, in harmony with nature, both by western environmentalists (Ellen, 1996; Milton, 1996: 28-32) and in emergent conservation approaches (Colchester, 2004), in ways also deployed by indigenous peoples (Cepek, 2011; Dove, 2006).

Nonetheless, because 'humanity as a whole' is assumed to have negative environmental impacts, conventional conservation initiatives are often based upon the removal of local communities from the control of protected areas, national parks and natural reserves, resulting in their private management and the imposition of land-use categories (Colchester, 2004; Lorimer, 2015). This trend follows the postulates of a tragedy of commons (Hardin, 1968) which, despite extensively contested and arguably fallacious (Agrawal, 2014; Ostrom, 1990), are still used to justify the private management of resources and 'top-down' approaches to conservation (Alexiades, 2009; Chatty and Colchester, 2002). Such strategies are characterised by regulations and decision-making processes based on technical expertise and centralised bureaucratic systems,

being usually implemented by external stakeholders which enact prescribed universal solutions (Ostrom, 2007) rather than by actual resource users (Berkes et al., 2000). Epitomized in 'fortress conservation'[1] approaches (Brockington, 2002; Neuman, 1998), such initiatives adopt 'top-down' and protectionist strategies that typically place in disadvantage the local communities whose livelihoods depend on those resources and which conservation initiatives could ultimately benefit (Agrawal, 1995; Colchester, 2004). This conveys some problematic ontological and epistemological assumptions of conservation science, namely pertaining the general conceptualization of nature and society, and ultimately calls for questioning, as posed by Mace (2014): whose conservation and who benefits from it?

From 'Troubles with Wilderness' to Multiple Perspectives

Central to conservation paradigms has been a notion of nature tied to its 'wilderness', the idealised image of an untouched nature: "a single, timeless, and pure domain untouched by Society" (Lorimer, 2015: 1). As argued by Cronon (1996), the praise of wilderness would establish itself by the end of the nineteenth century, when the awe inspired by wild landscapes, previously seen as dangerous and worthless, would now deem those sacred and make them "frequently likened to Eden itself" (ibid.: 9) — as places where one might meet devils but also God. These would become designated sites, such as the Niagara Falls, Yosemite or Yellowstone in North America, which attracted a growing number of visitors. Their 'wilderness' would become the antidote for a rising modern and industrialized society, a 'vanishing frontier' at risk of disappearance, which emerged as a place of recreation for an elite of urban tourists, in a "peculiarly bourgeois form of antimodernism" (ibid.: 14). As argued by Cronon (1996: 16), "the dream of an unworked natural landscape is very much the fantasy of people who have never themselves had to work the land to make a living".

In this context, the first protected area was established in Yosemite in 1864 being followed, a few years later, by the Yellowstone National Park in 1872. Both were set at a time when "Indian wars" attempted to subdue indigenous people's autonomy, in areas that overlap with lands historically managed and tenured by native peoples, such as the Miwok, Lakota and Crow (Colchester, 2004). The uninhabited 'wilderness' of these areas required the denial of indigenous peoples' rights, their removal to reservations and the refusal of their historical entanglement with those landscapes, while their land management practices became regarded as inappropriate

[1] 'Fortress conservation' is characterised by the exclusion of local people from managing resources, enforcing boundaries to protected areas (e.g., 'fines and fences' approach) and allowing only recreational and scientific activities within those areas (Brockington, 2002; Doolittle, 2007).

or even illegal, to produce an illusory 'pristine' and 'original' nature (Chatty and Colchester, 2002; Cronon, 1996). Thus, ironically, preserving these landscapes' 'wilderness' required the removal of people, denying them rights and subsistence means, so these landscapes could be otherwise 'untouched' and set aside for recreational and scientific pursuits.

Despite their faults and incongruences, the 'fortress conservation' model would be exported and applied worldwide, influencing numerous conservation initiatives and policies during the twentieth century (Colchester, 2004) while being still nowadays disputed in international targets for protected areas (CBD, 2010; RRI, 2020). Critiques to this approach highlight its negative social impacts, leading to long-term social conflicts, increasing inequalities and communities' economic vulnerability (Brockington, 2002; Doolittle, 2007); but also their inconsistent ecological benefits, often increasing ecological pressures and driving biodiversity declines outside protected areas (Doolittle, 2007) while, due to their irregular management, present relatively poor performance in reverting biodiversity trends (Visconti et al., 2019) — as compared, for example, with biodiversity levels within indigenous territories (Schuster et al., 2019). Therefore, despite their persistent legacy, such approach also gathers central debates in conservation.

Protectionist approaches were contested since their onset, with two main environmentalisms emerging shortly after the foundation of Yosemite National Park: the 'conservationists' and the 'preservationists'. As described by Milton (1996: 74), manifest over the construction of Hetch Hetchy dam in Yosemite, the conservationists aimed to protect nature *for* human use, while the preservationists aimed to protect nature *from* human use. Both perspectives disclose a fundamental tension in conservation, which pertains contrasting perceptions on the relation between people and nature; but simultaneously, both reproduce an underlying dichotomy which conceives humans separated from nature. This debate, despite nuanced, is far from over and still reflected in contested environmental management strategies nowadays, note the opposing approaches of 'rewilding' (e.g., Navarro and Pereira, 2012) and community-based conservation initiatives (e.g., Berkes, 2004).

Since the 1970s, however, further contrasting views would emerge and contribute to shift conservation goals, through sometimes diverging and sometimes mutually supportive perspectives on the intended outcomes of conservation (Mace, 2014). Earlier attempts at reconciling people and nature include the Man and Biosphere Programme of UNESCO, launched in 1970, "to develop the basis within the natural and social sciences for the rational use and conservation of the resources of the biosphere and for the improvement of the global relationship between man and the environment" (UNESCO, 2017). This would inspire the emergence of the 'sustainable

development' concept, at the UN Conference on Environment and Development in 1992, which advocates for the decentralization and participatory development of conservation initiatives (Agrawal, 1995). Nonetheless, changing perceptions on the relation between people and nature also led to a pluralism of perspectives on desirable conservation aims. As described by Mace (2014), dominant perspectives ranged from protecting 'nature for itself' (e.g., through protected areas) and 'nature despite people' (e.g., natural resource management) to, since the 2000s, the rise of influential 'nature for people' approaches (e.g., ecosystem services) and, more recently, the prominent emergence of 'people and nature' perspectives. The present thesis is strongly influenced by the latter, which came to emphasise interdisciplinary approaches, focusing on the resilience of socio-ecological systems (e.g., Berkes et al., 2003) and the interdependence of cultural and biological diversity (e.g., Maffi, 2005), to highlight the need for conservation to sustain both people and nature (e.g., Fischer et al., 2015; Gavin et al., 2015).

From 'Nature for People' to 'People and Nature'

'Nature for people' approaches became particularly prominent with the emergence of the Ecosystem Services framework, after the Millennium Ecosystem Assessment (MA, 2005), switching focus from species to ecosystems and considering integrated management strategies to sustain the provision of environmental benefits (Mace, 2014). Stressing people's dependence on ecosystems, these approaches gathered efforts to promote biodiversity conservation by placing emphasis on valuing nature and arguing for its integration in the economy (e.g., Costanza, 1997; Ehrlich and Ehrlich, 1992). Indeed, this economic rationale for protecting nature determined how such approaches would become widely influential (Dunlap and Sullivan, 2019), despite reproducing old paradigms and again reducing ecological concerns to economic arguments rather than ethical considerations (Leopold, 1949). Then, recognizing humans as part of ecosystems turned to represent humans as consumers of environmental benefits, with nature as the provider of those. Still, either challenging or complying with neoliberal economic paradigms (Costanza et al., 2017), these influential approaches would be strongly criticised for promoting an utilitarian perspective on the environment, adopting monetary valuations and opening new ways for nature's commodification (Redford et al., 2009; Soulé, 2013; Sullivan, 2010); while, simultaneously, disregarding the influence of cultural contexts (Hirons et al., 2016; Milcu et al., 2013), the social and relational values affiliated to the environment (Chan et al., 2016; Pascual et al., 2017) and the diversity of human roles on the co-production of ecosystem services (Comberti et al., 2015). Ultimately, ecosystem services epitomize a cultural representation of

human–environment relationships strongly influenced by Cartesian and neoliberal environmental governance paradigms (Dunlap and Sullivan, 2019).

Moving from the utilitarian emphasis of 'nature for people' approaches, 'people and nature' perspectives reflect an increasingly refined acknowledgment of the coupled dynamics that link human societies and their environments (Liu et al., 2007; Ostrom, 2009), arguing for adaptive management strategies and focusing on complex socio-ecological dynamics (Folke et al., 2005). Such approaches challenged prevalent equilibrium-based perspectives, promoting a shift towards resilience thinking and the understanding of dynamical equilibria (Folke, 2006; Folke et al., 2010) — including the looming risks of planetary regime shifts (Barnosky et al., 2012; Steffen et al., 2018). Recognising the interdependence between socioeconomic factors and ecological processes (Ostrom, 2009), these insights would also strongly influence the development of ecosystem assessments (Carpenter et al., 2009; Loft et al., 2016). Nonetheless, despite early mentions to their relevance (Berkes et al., 2003; Folke, 2004), the cultural contexts, worldviews and knowledge systems that shape human–environment relationships would again become largely absent from consideration in socio-ecological research (Fischer et al., 2015) which, more theoretical than empirical, largely focused on universal characteristics while disregarding context-specific variables (Liu et al., 2007; Ostrom, 2007).

Simultaneously, influenced by developments in environmental anthropology (Maffi, 2005), emergent conservation approaches advocate for a shift from biodiversity towards biocultural diversity (Bridgewater and Rotherham, 2019; Gavin et al., 2015), reflecting a growing concern with indigenous peoples' rights and an enhanced understanding of the "inextricable link between biological and cultural diversity" (Posey and Dutfield, 1996: 2). Evidencing the common threats and accompanying declines affecting both global biological and cultural diversity, these approaches support and promote the articulation of scientific with indigenous and local knowledge systems (Mistry and Berardi, 2016) while advocating for participatory environmental governance systems across scales (Brondízio and Tourneau, 2016). These perspectives increasingly influence debates on ecosystem assessments, particularly in the more recent IPBES framework (Díaz et al., 2018; Tengö et al., 2017). Nonetheless, despite their contribution for more effective and equitable conservation efforts (Gavin et al., 2015), biocultural diversity approaches are still lacking full consideration of conservation ethical and political dimensions, namely on the role of power relations, governance systems and cultural practices (Merçon et al., 2019), the implications of knowledge appropriation (Alexiades, 2009) and the co-development of adaptive responses to environmental challenges (Hanspach et al., 2020).

Research on both biocultural diversity and socio-ecological systems represent a paradigm shift in conservation approaches, towards embracing the myriad entanglements between human societies and nature, whose insights may hold important contributions to enhance the practice of ecosystem assessments (Carpenter et al., 2009; Díaz et al., 2018). Particularly, as assessments represent tools for analysing the impacts of ecological changes on human well-being (MA, 2005; Daily et al., 2009), these approaches should be developed to assist identifying feedback processes linked to trends in social and ecological conditions, underlying trade-offs and drivers of change (Carpenter et al., 2009), but also to recognize a pluralism of values, perspectives and worldviews affiliated to the environment (Pascual et al., 2017), contributing to bridge distinct knowledge systems and developing more participatory governance systems (Tengö et al., 2017). All these are relevant for ecosystem assessments to move beyond current limitations and inform adequate conservation responses, which reflect both the complexity of socio-ecological systems and their context-specific diversity. Nonetheless, despite their divergent origins and contrasting perspectives, the potential complementary contributions of these approaches invite further examination of their underlying assumptions and pitfalls before applying their insights to the practice of ecosystem assessments.

Dominant Perspectives: The 'Dream of Mastery' and 'Naturalism'

The distinct viewpoints from which ecosystem services, socio-ecological systems and biocultural diversity arise may be contextualised within two dominant perspectives in conservation, which broadly reflect distinct pathways to deal with ecological crises and are described by Lorimer (2015: 1-18) as: the "dream of mastery" and the "dream of naturalism". First, the "dream of mastery" describes ecological crises through a need for further 'modernisation', as a scientific opportunity to develop more technology, gain more knowledge and establish better or 'more rational' forms of social and economic organisation. Second, the "dream of naturalism" opposes this 'modernization' and reaffirms the 'unnatural' aspects of modern society, advocating for a re-naturalisation of our modes of existence along with the valorisation of 'wilderness' and indigenous peoples' ways of living.

The 'dream of mastery' pursues the control or 'mastery' over nature which, following the hubris of Enlightenment reinforced by the industrial revolution, would influence philosophy and modern scientific thought while fostering the perception of separation between humans and nature (Harvey, 1996: 120-131; Moore, 2017). Under its influence, conservation science seeks "to preserve a fixed nature from modern, urban and industrial society" (Lorimer, 2015: 5), reproducing an epistemology where nature "can be known by objective Science and defended and

restored by rational environmental management" (ibid.: 2). This is reflected in 'managerialism' and later also in 'ecomodernist' approaches which, as argued by Weber, seek to legitimate control and domination based on rational authority (Harvey, 1996:120-131). Its management strategies emphasise yield predictability and quantitative cost-benefit analysis, intending to control natural cycles, resources provision and the efficient management of environmental benefits (Berkes et al. 2000; Chatty and Colchester, 2002; Klikauer, 2015). This view underlies the development of global markets for ecosystems services within corporate and technocratic interventions advocating for sustainable development (Sullivan, 2010) and, despite typically relying on an equilibrium-based understanding of ecosystems, would also incorporate the understanding of complex socio-ecological systems (Carpenter et al., 2009).

Yet, pursuing ecological stability as the desirable state, its approaches seek to simplify complexity and often lead to decreases in local resources diversity and consequent loss of socio-ecological resilience (Berkes et al., 2000) — as illustrated by the impacts of intensive agriculture (e.g., Green et al., 2005) and their unbalanced trade-offs (e.g., Raudsepp-Hearne et al., 2010). Here, those impacts are repeatedly concealed through the further development of new technologies and socioeconomic infrastructures which allow disturbances to be exported in space and/or time, as through the introduction of chemical fertilisers or economic incentives (Alexiades, 2009; Sullivan, 2010). Indeed, nature has never been tamed nor rationally ordered and, instead, "the unequal consequences of these activities are an established source of concern" (Lorimer, 2015: 1).

On the other hand, the 'dream of naturalism' follows a deep-green environmentalism which is closely tied to the 'myth of wilderness' and the romanticising of indigenous cultures, living 'in harmony with nature' (Ellen and Harris, 2000). As argued by Cronon (1996: 15), the myth of 'wilderness' would forge landscapes not for productive labour but for consumption, "one went to the wilderness not as a producer but as a consumer", namely of nature-based recreational activities and aesthetically pleasing landscapes — following a view that tends to fundamentally disregard how humans are and were involved in the co-production of those landscapes (e.g., Rival, 2007; Wolschke-Bulmahn, 2004). In this context, the concept of 'sustainable development' came to further privilege 'wilderness', triggering massive changes in policy globally, particularly after the publication of the Brundtland Report (Our Common Future, 1987). Here, the failures of modern development models, along with the rise of environmental concerns and a crisis of representation in scientific approaches promoted a shift towards participatory approaches (Chatty and Colchester, 2002), the rediscovery of traditional ecological knowledge

(Ellen and Harris, 2000) and changes in the symbolic, political and economic value of both cultural and biological diversity (Alexiades, 2009) — supporting the rise of biocultural diversity approaches (Bridgewater and Rotherham, 2019).

However, while central to new theories of development, such approaches would pose renewed challenges pertaining to the political representation of 'peripheral' and 'central' cores of society (Chatty and Colchester, 2002; Mistry and Berardi, 2016), the articulation between distinct knowledge systems (Agrawal, 1995; Alexiades, 2009) and the systematic disregard of embedded power relationships (Hanspach et al., 2020; Merçon et al., 2019). Hence, in line with economic growth, the increased appropriation and commodification of both culture and knowledge would raise increased concerns on the distribution of benefits and intellectual property rights (Alexiades, 2009; Greene, 2004).

In this context, both perspectives "fit into patterns of power, capital and nature" which, while linked to the industrial revolution and entwined with the history of capitalism and colonialism, set forth a "reshaping of global natures long before the steam engine" (Moore, 2017: 3). As argued by Lorimer (2015), despite their different backgrounds and rationales, both perspectives share a conceptual duality, reproducing a nature:culture dichotomy where humans are conceived as 'outside' of nature, placing value either on attempting its domination (i.e., intensely managed landscapes) or on preserving its wilderness (i.e., 'worlds without us'). In this context, both perspectives arguably reproduce what Sullivan (2010) identifies as "Imperial Ecologies", ecologies based on a conceptual duality between nature and culture which, being linked to self:other dichotomies (Haraway, 1991; Rose, 1993), articulate differences and similarities through genealogies of power that are eventually turned to legitimise domination, including the appropriation and commodification of both practices and resources, and the subjugation of both human and nonhuman *others.* Ultimately, both 'dreams' place humans as consumers of environmental benefits, either through emphasising or disregarding human's economic role in the co-production of those benefits, while both overlook the actual distribution of environmental costs and benefits along with their ethical and political implications. Hence, both 'dreams' reproduce a political flaw, by representing homogenised societies, that masks the "differential human responsibilities for and exposures to planetary changes" (Lorimer, 2015: 3), not just in terms of cultural diversity but also social inequity and environmental justice (Harvey, 1996; Menton et al., 2020).

Weaving Approaches to Develop Tools

Ecosystem services, socio-ecological systems and biocultural diversity approaches do not necessarily fit neatly in the above two dominant perspectives, first because these approaches are themselves internally nuanced, diverse and contested; and second, because these perspectives are not mutually exclusive and, indeed, may both intersect and constitute gradients between opposing views for any conservation approach. Nevertheless, these perspectives are helpful to identify major ontological, epistemological and ethico-political stances and pitfalls of both conventional and emergent conservation approaches, particularly pertaining to: (i) their distinct conceptualisations of nature and society and how these influence conservation praxis; (ii) their varying articulations of scientific knowledge's role in relation to distinct epistemologies; and (iii) their modes of considering or disregarding cultural diversity, social heterogeneity and environmental justice. Taking their current limitations, their stances call for the necessary articulation of a third option, where emergent conservation approaches would go beyond the conceptual dualities that characterise dominant perspectives, by highlighting the greater set of roles people assume within ecological communities and developing more socially and politically nuanced approaches to the varied entanglements between humans and their environments.

This means to consider the relational constitution of both nature and society, where the "organism (animal or human) should be understood not as a bounded entity surrounded by an environment but as an unbounded entanglement of lines in fluid space" (Ingold, 2011:64), subject to continuous processes of 'becoming-with' human and nonhuman others (Deleuze and Guattari, 1987:256-263). Hence, "what we have been accustomed to calling 'the environment' might, then, be better envisaged as a domain of entanglement" (Ingold, 2011:71), a mutually constitutive 'contact zone' between multiple species where the ongoing processes of 'becoming-with' others occur (Haraway, 2008:3-45). Then, environmental change would be better understood not in terms of an Anthropocene, as homogenizing perspectives, but rather the Chthulucene (Haraway, 2016:30-57), reflecting the ecological relations embedded in the myriad ways of living and coexisting with all those of the Earth (*Chthon*), who share a common history and destiny "made up of ongoing multispecies stories and practises of becoming-with in times that remain at stake" (ibid.: 55).

Ultimately, as argued by Bookchin (1982: 25), to assume that technology and modern science may be able to control ecological processes, or grant humans a degree of 'mastery' over nature, is not only "worse than arrogance" but also impairs human's ability to perceive their ecological role as, to a great extent, vulnerable to and dependent on a much broader, deeply complex web

of life. Yet, this does not mean relenting to a mythical nature beyond human influence nor any 'dream of naturalism' but rather, perhaps recalling the myths and forces of nature, grant us the responsibility of co-creating our ecological communities and co-producing our dwelling landscapes acknowledging that we, nature and society, share "a common destiny" (ibid.: 34). This necessary moderation in managing our common futures implies that, as posed by Charles Elton, "this management would not be just like a game of chess — more like steering a boat" (1972: 151). Then, we may choose the direction of our actions and responses, recognizing the inherent interdependence and reciprocity of human–environment relationships by following a land ethics that does not prevent economic management but rather embraces our ethical obligations towards wider ecological communities (Leopold, 1949).

Only by overcoming their specific blind spots, may the valuable insights from socio-ecological systems and biocultural diversity research significantly contribute to improve ecosystem assessments frameworks' dependability, representativity and political legitimacy. Weaving together such approaches may support considering in ecosystem assessments the specific cultural, social and political contexts that underly ecological crises, unveiling those hidden variables and joint dynamics that have been generally concealed from conventional conservation's paradigms — such as, those concerning the social equity and environmental justice of resource management strategies and their underlying drivers of environmental change. As posed by Kareiva and Marvier (2012: 963), if conservation focuses solely in biology, it is "likely to misdiagnose problems and arrive at ill-conceived solutions". As such, Soulé's (1985) earlier formulation of conservation biology does not necessarily represent the values held by most contemporary conservationists (Kareiva and Marvier, 2012; Mace, 2014), not least those adhering to emergent conservation approaches (Fischer et al., 2015; Gavin et al., 2015). Nonetheless, as argued by Moore (2017), we need to pay attention to how different conceptualisations of human societies and nature highlight certain human–environment relationships over others and how these make visible or invisible, conform or challenge, existent social and power structures.

1.3 FORMULATING THE ARGUMENT

The above contextualization discloses the critical positioning of this thesis concerning emergent conservation debates that assist and inspire its development, conveying the relevance of having a closer look at the context-specific entanglements between people and nature. Despite long-standing and well-informed critiques (e.g., Bookchin, 1982; Leopold, 1949), persistent limitations of conservation approaches comprise the overlooking of the cultural, social and political

variables underlying environmental challenges. Such limitations are arguably rooted in a Cartesian paradigm, which shapes the understanding of nature and society by reproducing pervasive nature:culture dichotomies (Lorimer, 2015) that, linked to further self:other dichotomies, are used to legitimize domination over human and non-human *others* (Haraway, 1991; Rose, 1993). Influential frameworks (e.g., ecosystem services) and emergent conservation approaches (e.g., socio-ecological systems and biocultural diversity) attempt to move beyond these dichotomies but, generally, end up still reproducing those persistent limitations by following universalizing perspectives that neglect the influence of cultural, social and political contexts (Fischer et al., 2015; Mastrángelo et al., 2019; Merçon et al., 2019). Based on the well-established interdependences between people and nature (e.g., Berkes et al., 2003; Maffi, 2005), the present thesis follows the proposition that, without fully addressing these limitations and overcoming those dichotomies, conservation science remains ill-equipped to understand the drivers of ecological changes and develop adequate responses.

This thesis intends to be a contribution in that direction, by exploring how the context-specific dimensions of human–environment relationships could be represented in ecosystem assessments frameworks in ways that support the further understanding of the socio-ecological dynamics behind environmental changes and inform the development of culturally adequate and socially equitable responses. It argues that:

First, to overcome prevalent dichotomies does not implies abandoning altogether the concepts of nature and society but rather conceptualizing these following a relational approach to consider their context-specific entanglements and interdependences (West et al., 2020). This entails examining the reproduction of nature and society through mutually constitutive processes, focusing on the characteristics and dynamics of their interactions, their modes of articulating reciprocity and how resulting landscapes embed both contested and established human–environment relationships.

Second, following the above, to address recurring blind spots in conservation science requires developing adequate conceptual and methodological tools to investigate the context-specific dimensions of human–environment relationships, conveying the influence of ecological but also cultural, social and political variables. This involves gathering insights from distinct conservation perspectives, developing biocultural approaches to socio-ecological systems research (Merçon et al., 2019; Hanspach et al., 2020) while following an interdisciplinary approach, that combines methods of both natural and social sciences.

Third, if ecosystem assessment frameworks are influential instruments to diagnose environmental issues and inform adequate responses (MA, 2005), then the conceptual and methodological tools needed to guide effective and equitable conservation outcomes may have their strategic placement here. This means addressing their current limitations, moving from an economic to a relational framework (Chan et al., 2016) while recognizing culture's role mediating interactions between society and nature (Milton, 1996), to convey the context-specific dimensions of human–environment relationships and their underlying socio-ecological dynamics.

As such, this thesis suggests cultural ecosystem services may represent the context-specific dimensions of human–environment relationships, including both their tangible (e.g., economic practices) and intangible expressions (e.g., symbolic meanings) that inform, influence or mediate actual socio-ecological dynamics. Hence, developing a conceptual and methodological framework for cultural ecosystem services may assist the systematic consideration of the cultural, social and political dimensions of human–environment relationships in ecosystem assessments and, therefore, in subsequent conservation responses, strategies and initiatives. Then, following the established role of culture mediating interactions between people and nature (Ellen, 1996; Milton, 1996), systematic cultural ecosystem assessments may contribute to further unveil the processes behind actual socio-ecological changes at local and regional scale (Fischer et al., 2015).

Ultimately, cultural ecosystem assessments may go beyond the assessment of 'cultural services', as ecological contributions to human well-being, to rather represent their underlying interdependent processes, including humans' contributions to enhance or hinder ecological functions, such as 'services to ecosystems' (Comberti et al., 2016). This is consistent with a relational and non-linear approach to 'cultural services' (Chan et al., 2012; Fish et al., 2016; West et al., 2020), not so concerned with quantifying the economic benefits provided by nature but rather, recognising its role sustaining life in myriad locally significant ways, reflecting the relational values or ethical principles guiding human–environment relationships and influencing their ability to mutually constitute balanced ecological communities.

Recognizing ecosystem assessments as cultural constructs themselves entails opening their conceptual and analytical frameworks to local unique perspectives, grounding assessments in their cultural contexts — or the context-specific perspectives of Nature's Contributions to People (Díaz et al., 2018). This means to understand 'nature' in terms of its local significant meanings and modes of co-production, rather than exclusively as a 'provider of services'. Then, adopting a biocultural approach to socio-ecological systems (Merçon et al., 2019; Hanspach et al., 2020)

requires integrating *emic* perspectives and engaging with indigenous and local knowledge systems (Mistry and Berardi, 2016; Tengö et al., 2017) — as knowledge-practice-belief complexes (Berkes, 1999: 1-20).

As such, a comprehensive framework for cultural ecosystem assessments requires developing adequate methodologies to explore the ontological, epistemological and political dimensions of human–environment relationships across diverse societies, following an interdisciplinary and interpretive approach which gathers insights from both natural and social sciences to enquire their diverse manifestations.

1.4 THESIS OUTLINE

To address the study's research questions, the present thesis conforms a journey through theoretical and empirical observations while following the thread to enquire the adequacy of ecosystem assessments across diverse cultures and heterogenous societies. To explore diverse expressions of human–environment relationships, the research follows an ethnographic and interpretive approach to gather insights from two distinct case-studies, which embody contrasting cultural, social and ecological contexts: first, with two distinct ethnic groups in the Peruvian Amazon; and second, with the provisional multi-ethnic communities of Ascension Island, on the South Atlantic.

The bulk of empirical research is contained in three chapters, written as stand-alone and self-contained papers, which present distinct approaches to cultural ecosystem assessments based on the case research. Prior to these, two chapters contextualize the research by presenting, respectively, a review of relevant literature and the theoretical framework that informs this study. Then, the final chapter presents a joint discussion of the empirical results, advancing a conceptual and analytical framework for operationalizing cultural ecosystem assessments.

Advancing the theoretical background, the second chapter presents a review of relevant literature pertaining to ecosystem assessment frameworks, socio-ecological systems (SES) and biocultural diversity (BCD) research. In particular, it discusses the theoretical foundations, significant contributions and main knowledge gaps of these approaches to human–environment relationships, namely: the main debates around ecosystem assessment frameworks, the shortcomings of monetary valuations and the pitfalls of subjacent conceptualizations of cultures and natures, leading to the nominal role of Cultural Ecosystem Services (CES); the relevance of

advances in socio-ecological systems research to sustainability science, the remaining knowledge gaps and major challenges in considering their complex dynamics and, particularly, their significance to ecosystem assessments; and, finally, examines the key contributions of biocultural diversity research to understand the diverse entanglements between people and nature, the importance of integrating Indigenous and Local Knowledge (ILK) and develop participatory environmental governance systems in conservation initiatives.

Following the recognition of culture's mediating role in complex SES dynamics, the literature review sets the ground for the third chapter to advance the theoretical, analytical and methodological framework of the present thesis. Understanding SES as complex and dynamical networks, this chapter presents a two-fold analytical framework for cultural ecosystem assessments based on, first, a relational approach to the sensorial, embodied and storied dimensions of human–environment relationships and, second, a spatially-explicit approach to their cultural, political and storied landscapes. Then, the chapter advances the research's methodology, based on an ethnographic and participatory approach, disclosing the rationale behind the choices made, my own positionality in these case studies, the ethical considerations this research implied and the potential limitations of the study's approach. This informs the case research presented in the following chapters, providing the overarching rationale for adapting cultural ecosystem assessments to distinct social and research contexts.

The fourth chapter focus on the storied landscapes of two distinct ethnic groups in the Peruvian Amazon, investigating the contribution of local narratives to cultural ecosystem assessments. Following an ethnographic approach based on participant observation and semi-structured interviews, the study gathers situated narratives about distinct landscape features to explore the relevance of oral tradition, particularly through personal and mythological storied accounts, to the reproduction of local knowledge systems, cultural heritage and relational values. The analysis reveals the symbolic meanings affiliated to diverse landscape features, emphasizing the ethical-based cultural values that regulate resource management practices along with their role reproducing a sense of belonging and cultural identity, articulated through extended social relations with multispecies communities. The results convey the relevance of oral-tradition for enabling the assessment of cultural practices, relational values and local knowledge systems, revealing usually implicit or concealed dimensions of human–environment relationships. Thus, narrative analysis constitutes an adequate methodology for cultural ecosystem assessments, while further assisting their spatially explicit multidimensional mapping.

The fifth chapter explores the cultural and political landscapes of these two ethnic groups in the Peruvian Amazon, following an ethnographic approach to reveal the link between distinct sociocultural variables and complex regional SES dynamics. The study is based on participant observation, semi-structured interviews and the spatial mapping of three distinct social groups, namely affiliated to indigenous territories, regional conservation areas and economic development projects. The analysis compares the social and spatial distribution of distinct cultural practices, values and benefits reproduced by these groups to discuss how their interactions may drive regional socio-ecological changes, underlying deforestation and cultural erosion. Then, establishing a link between cultural variables and the production, consumption and representation of all other ES, the study reveals the impacts of regional ES flows on the reproduction of indigenous cultural practices, knowledge systems and affiliated ecological communities. The research reveals the complex SES dynamics underlying high deforestation rates, supporting the identification of main drivers of cultural and social change, namely social structures and power relationships, that negatively impact indigenous ways of living and threaten regional biocultural diversity.

The sixth chapter presents the study of Ascension Island, assessing 'cultural services' through exploring the significance of its natural and cultural landscape to the local population. The study is based on participant observation and face-to-face interviews, involving the implementation of an extensive survey and participatory mapping exercise with a representative sample of Ascension's population. It investigates CES spatial and social variability across the landscape, reflecting on the distinct cultural practices, relational values and identities affiliated to Ascension's environment. The analysis draws attention to the diverse relationalities that link people to Ascension and Ascension to the world, revealing their multispecies affinities and the various temporalities embedded on its natural and cultural heritage. The study supports the significance of SES connectivity across distinct spatial and temporal scales, leading multiple ES inward and outward flows, while presents evidence on the relevance of cultural diversity and social heterogeneity to ecosystem assessments — highlighting how, even on this small island, distinct social groups reproduce different practices, values and identities through human–environment relationships.

Following the above, the seventh chapter discusses the main contributions of the present thesis to current conservation debates, examining empirical evidence which show that systematic cultural ecosystem assessments: (1) enable the consideration of context-specific dimensions of

human–environment relationships; (2) support the further understanding of complex SES dynamics; and (3) contribute to enhance the cultural adequacy, social equity and political legitimacy of ecosystem assessments across diverse cultures and societies. Based on the empirical results, this chapter identifies four major limitations of current ecosystem assessment frameworks, namely Ecosystem Services and Nature Contributions to People, advancing a conceptual framework for cultural ecosystem assessments which supports the systematic consideration of the cultural, social and political dimensions of human–environment relationships along with the analysis of context-specific SES dynamics in ecosystem assessments. Developing pathways to address those major limitations, this chapter examines means to operationalize cultural ecosystem assessments by advancing a set of essential CES variables; how relational values articulate reciprocity in human–environment relationships; the importance of sociocultural variables to convey the heterogenous distribution of ES supply and demand; and available means to bridge indigenous and local knowledge systems in ecosystem assessments. As such, this chapter advances a conceptual and analytical framework for cultural ecosystem assessments, asserting that the design of adequate conservation strategies relies on understanding context-specific SES dynamics and developing effective collaborations with multiple stakeholders.

In conclusion, the present thesis presents evidence on the importance of considering the cultural, social and political dimensions of human–environment relationships to understand complex context-specific SES dynamics and develop adequate conservation strategies that support both people and nature. The advanced conceptual and methodological framework for cultural ecosystem assessments represents a significant contribution in this direction: as a tool to inform the development of more culturally adequate, socially equitable and politically legitimate conservation initiatives. To understand, communicate and support local ways of living, knowing and valuing the environment may open pathways that assist conservation science and the broader society to regard humans in ecological terms and more-than-humans in ethical terms, revealing the diverse modes by which humans shape, constitute and coexist with ecological communities. This understanding may assist developing effective community-based conservation strategies, contributing to overcome dichotomies which have historically legitimized the domination, appropriation and colonization of different modes of existence. Ultimately, to place humans in ecological terms requires being sensitive to their constitutive modes of entanglement with their dwelling landscapes, the diverse natural and social ecologies that sustain our common existences.

2. LITERATURE REVIEW

This chapter presents a review of relevant literature, discussing the theoretical background, main contributions and critical limitations of three different approaches which are used to describe human–environment relationships in conservation science and inform the development of the present thesis, namely: Ecosystem Services (ES), Socio-Ecological Systems (SES) and Biocultural Diversity (BCD). The chapter briefly examines the ontological premisses embedded in their distinct conceptualizations of nature and society, following the previously discussed context of their emergence within conservation and subjacent nature:culture dichotomies. Positioning their underlying assumptions where they may be questioned and contested if required, this discussion contributes to disclose different approaches to human–environment relationships, to identify major cultural variables generally overlooked in conservation and to develop the theoretical framework of the present thesis, advanced in the next chapter.

The following discussion starts by: first, reviewing the main debates and limitations of current ecosystem assessment frameworks (Section 2.1), epitomized in Ecosystem Services and Nature Contributions to People (NCP), addressing the ethical and political licenses these reproduce, discussing the shortcomings of quantitative and monetary valuations and highlighting the need for systematic approaches to Cultural Ecosystem Services (CES); second, this chapter examines the main contributions and knowledge gaps of SES research (Section 2.2), unveiling the need to consider their context-specific dynamics and disclosing current shortcomings to address both SES complexity and specificity in ecosystem assessment frameworks; and, third, the chapter discusses the contributions of BCD approaches (Section 2.3), questioning the epistemological stances of conventional conservation strategies by stressing the relevance of indigenous and local knowledge systems (ILK) along with participatory approaches for the design and implementation of ecosystem assessments that may inform adequate conservation strategies. This review contributes to identify context-specific dimensions of human–environment relationships generally overlooked in conservation science, revealing entanglements and interdependences which, despite often dismissed, highlight the crucial role of cultural variables mediating actual socio-ecological dynamics.

2.1 ECOSYSTEM ASSESSMENTS AND CULTURAL SERVICES

The Ecosystem Services framework focus on the valuation of environmental costs and benefits (Adams, 2014; Costanza et al., 2017), yet largely overlooks the cultural dimensions of ecosystems (Fish et al., 2016; Milcu et al., 2013) and, in consequence, lacks a stronger nexus with the context-specific dimensions of socio-ecological systems (Mastrángelo et al., 2019; Mehring et al., 2018). A focus on monetary valuations of environmental benefits have been contested for representing insufficient means to assess the myriad ways ecosystems may be important to people (Adams, 2014; Gunton et al., 2017), while may further hinder — because do not fully reflect — a comprehensive understanding of the values that people assign to or hold towards ecosystems (Chan et al., 2016; Pascual et al., 2017). In this context, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) advanced a Nature's Contributions to People (NCP) framework which, despite vowing to address some critical limitations of the ES framework (Díaz et al., 2018; Pascual et al., 2017), triggered an intense debate that risks hindering its practical implementation and promised potential to challenge dominant assessment paradigms (Braat, 2018; Kenter, 2018; Peterson et al., 2018).

Ecosystem assessments are currently framed by these frameworks and, due to their central role informing conservation initiatives and environmental policies, it is fundamental to review the ontological and epistemological premisses these reproduce when addressing global environmental issues. Here, the nominal role of Cultural Ecosystem Services (CES) in ecosystem assessments (Costanza et al., 2017; Milcu et al., 2013) epitomizes fundamental ES/NCP limitations, exposing their current biases and weaknesses, while by reflecting the context-specific entanglements between people and nature, CES may provide an ideal ground for challenging dominant conservation paradigms and environmental management strategies.

The Ontologies of Ecosystem Assessments

The concept of Ecosystem Services is not new, being first mentioned in the 1970s as part of an argument to halt species extinctions and environmental degradation (Holdren and Ehrlich, 1974; Ehrlich and Ehrlich, 1981; Ehrlich and Mooney, 1983) — for a history of the concept please see Gómez-Baggethun et al. (2010) or Potschin and Haines-Young (2016). Nonetheless, it gained considerable momentum and visibility after the publication of the Millennium Ecosystem Assessment in 2005 (MA, 2005), which established a framework for the assessment of ecosystem values based on their contribution to human well-being — see Fig. 2.1. Since then, the ES conceptual framework has been widely adopted, valuation methods further developed

and applied worldwide in ecosystem assessments at different scales, following the efforts of an interdisciplinary body of academics from both the natural and social sciences (Constanza et al., 2017; Braat, 2018). Its implementation in a broad variety of conservation and policy-making contexts gave rise to a diverse array of publications contributing to the topic (Constanza et al., 2017; Gómez-Baggethun et al., 2010; Potschin and Haines-Young, 2016), along with several parallel initiatives which led the further development of valuation methods (e.g. TEEB, 2012), global classification schemes (e.g. CICES: Haines-Young and Potschin, 2012) and the IPBES's conceptual framework (Pascual et al., 2017; Díaz et al., 2018).

Ecosystem services are generally defined as the "ecological characteristics, functions, or processes that directly and indirectly contribute to human wellbeing" (Costanza et al. 2017: 3; see also MA, 2005; TEEB, 2012). The Millennium Ecosystem Assessment (MA, 2005) classifies these contributions to human wellbeing in four broad categories: provisioning (e.g., food and water), regulating (e.g., climate regulation and flood control), cultural (e.g., spiritual and recreational) and supporting services (e.g., nutrient cycling and primary production). The ES framework highlights the human dependence on functioning ecosystems, aiming for the assessment and integration of natural resources in economic accounts to inform decision-making in resource management. As such, the ES framework builds upon contributions from the natural sciences to define ecological production functions and quantify the supply of services, addressing ecosystems as stocks of natural capital used by humans, while using economic assessments to estimate the monetary value of flows between ecosystems and human societies, based on their demand and contribution to human well-being (Alcamo et al., 2003; MA, 2005). Advancing an initial estimate of the total economic value of global ecosystems ranging between US $16-54 trillion per year (Costanza et al., 1997), the rationale behind monetary valuations was to communicate and make explicit the huge contributions of functioning ecosystems to global economies, aiming to raise public interest in biodiversity conservation and assist decision-making when multiple trade-offs exists, while assuming that if natural capital was not fully 'captured' in economic markets it would continue to be disregarded in policy decisions (Costanza et al., 2017; Gómez-Baggethun et al., 2010).

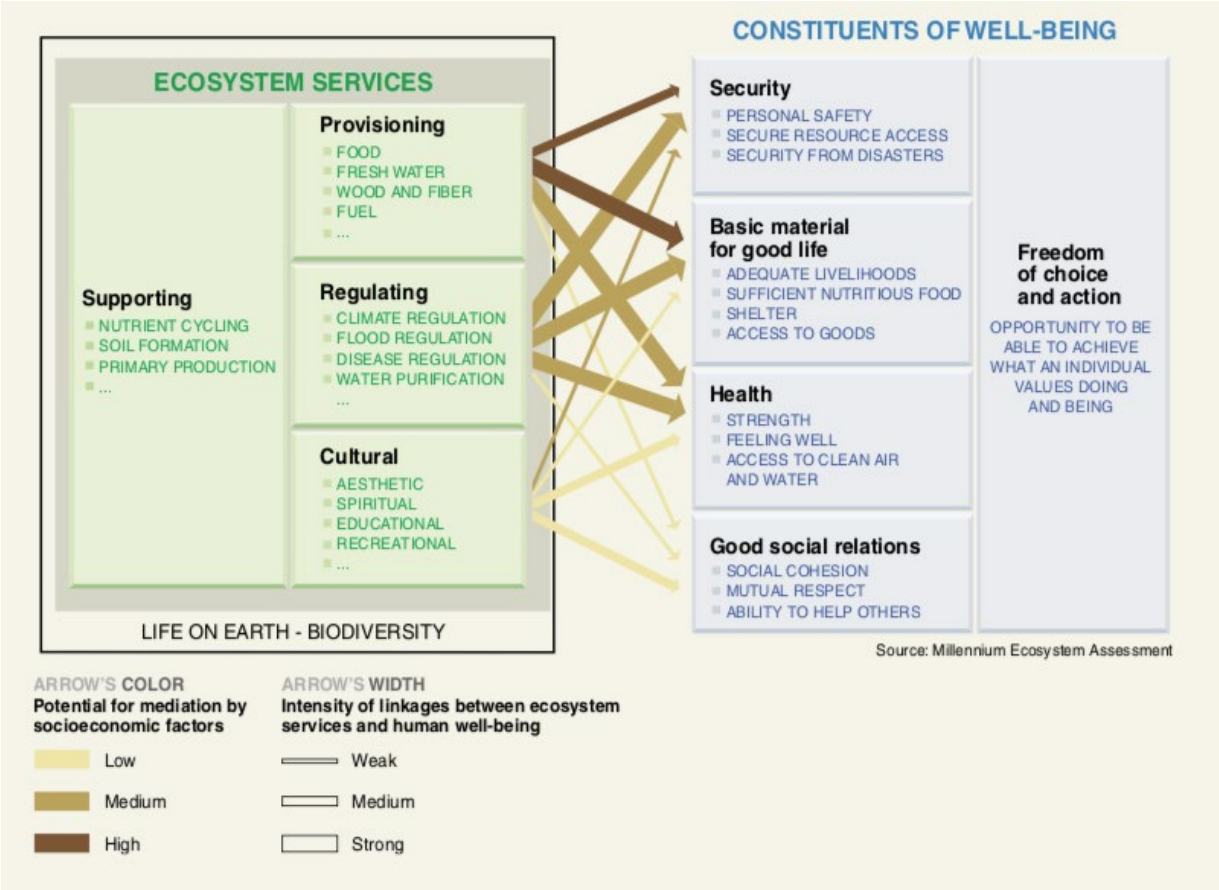


***Figure 2.1** — Representation of Ecosystem Services links to different categories of human well-being (source: MA, 2005), where cultural services are portrayed as holding weak links to human well-being which are poorly mediated by socioeconomic variables.*

Ultimately, the utilitarian framing of ecological functions gained momentum, raising political support for biodiversity conservation while setting a trend towards the commodification of ecosystem services, with the initial conceptualization of nature's benefits as use values becoming mostly understood as exchange values in Neoclassical economics (Gómez-Baggethun et al., 2010). Since their onset, emergent market regulations based on payments for ecosystem services, carbon markets (REDD+) or biodiversity offsetting were strongly criticized for promoting the further monetization and appropriation of nature based on notions of substitutability (Chan et al., 2012; Dunlap and Sullivan, 2019; Sullivan, 2010). Yet, despite often overlooked, the distinction between services, benefits and values is central to the ES framework, with Chan et al. (2012: 9) suggesting that "services are the production of benefits (where benefits may take the form of activities), which are of value to people". Then, services are the ecosystem's processes that provide benefits and the level at which ecosystem's properties are considered in management; while benefits are the goods and experiences valued and the level at which people may relate to ecosystems. Yet, the monetary valuation of environmental benefits has been

widely criticized for not reflecting the diverse range of shared and social values people assign to and hold towards ecosystems (Kenter et al., 2015; Kumar and Kumar, 2008; Pascual et al., 2017), as epitomized by the increasing relevance given to relational values in the ES/NCP literature (Chan et al., 2016; Pascual et al., 2017).

Besides its utilitarian approach and excessive focus on monetary valuations, the ES framework have been also strongly criticized for overlooking the role of cultural services (e.g. Daniel et al., 2012; Fish et al., 2016), lacking consideration for local communities' worldviews and knowledge systems (e.g. Comberti et al., 2015; Hirons et al., 2016) and disregarding the underlying social heterogeneity in the distribution of ES costs and benefits (e.g. Brooks et al., 2014; Cáceres et al., 2015; Chaudhary et al., 2018). Addressing some of these critiques, the IPBES recently advanced a conceptual framework based on the notion of Nature's Contribution to People (NCP) whose major innovations were the integration of diverse stakeholders, worldviews and knowledge systems (Díaz et al., 2015; Díaz et al., 2018) while adopting a more pluralistic valuation approach (Pascual et al., 2017).

Built upon the ES framework, the NCP framework advocates for a paradigm shift in ecosystem assessments, developing previous approaches in important new directions and addressing some of ES major limitations. The NCP approach aims to increase the representativeness and political legitimacy of ecosystem assessments, emphasising culture's role mediating human–environment relationships and focusing on indigenous and local knowledge systems to better understand those (Díaz et al., 2018) while embracing pluralistic valuations and recognizing power differentials between different stakeholders (Pascual et al., 2017). In this context, the IPBES argues for the need to incorporate not only instrumental values in ecosystem assessments but also the relational aspects through which those values are constructed (Díaz et al., 2015), with further contributions focusing on moving beyond the ES economic framework towards integrating a broader diversity of worldviews (e.g., Christie et al., 2019; Ellis et al., 2019; Kohler et al., 2019).

However, the NCP framework also raised multiple critiques, ranging from questioning its innovative character (Braat, 2018; de Groot et al., 2018) or its operational capacity (Peterson et al., 2018) to claims that it doesn't fully address the current ES framework's limitations (Kenter, 2018). Defending its innovative character, Díaz et al. (2018b) argues that NCP are "epistemologically, ontologically and methodologically more pluralistic" than ES, providing a broader and more inclusive framework. Its pluralism, as the capacity for integrating diverse values, worldviews and knowledge systems, is based on a distinction between generalising and context-

specific approaches epitomised by the role of cultural contexts. Yet, as the NCP framework lacks a systematic approach to context-specific perspectives, its formulation raises uncertainty on how assessments could be implemented 'in practice' and the ongoing debate between NCP and ES advocates risks paralysing joint efforts, confusing policymakers and, ultimately, undermining international commitments to safeguard biodiversity (Braat, 2018; de Groot et al., 2018; Peterson et al., 2018). Moreover, despite consideration for cultural roles being acknowledged as "essential not only for advancing knowledge but also for the political legitimacy of assessments" (Díaz et al., 2018: 270), the lack of an operational framework raises concerns over the further marginalisation of culture in ecosystem assessments and exposes how coherent methodologies for considering the cultural dimensions of ecosystems are still largely missing.

The Epistemologies of Cultural Ecosystem Services

While provisioning and regulating services are associated with the material benefits provided by ecosystems, Cultural Ecosystem Services (CES) have been broadly associated with the non-material benefits obtained by humans from interactions with their environments (Chan et al., 2012; Fish et al., 2016; Milcu et al., 2013). Definitions of CES may vary but, like other ES categories, these have been strongly influenced by the MA (2005: 8), where CES are defined as "the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences". Here, Chan et al. (2012: 9) argue that CES might be understood as the "ecosystem's contribution to the non-material benefits that arise from human-ecosystem relationships" while Fish et al. (2016: 212) consider that CES are better defined as "the contributions ecosystems make to human well-being in terms of the identities they help to frame, the experiences they help enable and the capabilities they help equip". Further advancing a conceptual framework for CES assessment, Fish et al. (2016) highlight that cultural services correspond to cultural practices which embody interactions between people and culturally constructed spaces, such as landscapes — see Fig. 2.2. Indeed, the intangibility of CES has been contested and most recent debates have been either centred on the construction of culture so it is consistent with the ES framework or, alternatively, elaborating culture exceptional positioning as an assessment category, as proposed by the NCP framework (Díaz et al., 2018).

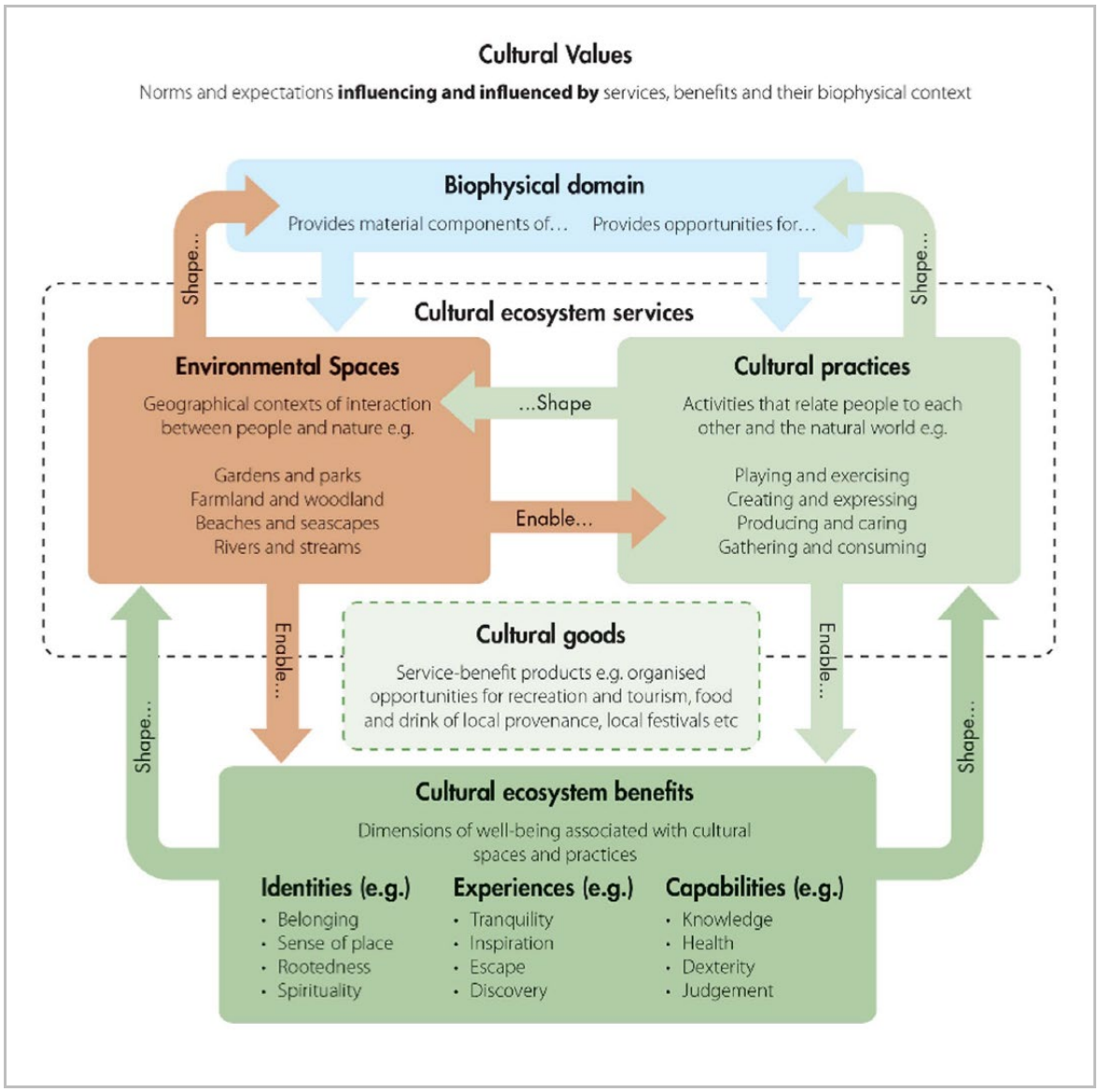


Figure 2.2 - *Conceptual framework for Cultural Ecosystem Services, where services correspond to cultural practices (e.g. playing, creating, producing and consuming) which shape and are enabled by particular environmental spaces (e.g. gardens, farmlands, beaches and rivers); cultural benefits (e.g. identities, experiences and capabilities) refer to dimensions of well-being derived from cultural practices; and cultural values pertain the norms and expectations which influence and are influenced by cultural services and benefits (Source: Fish et al., 2016).*

The relevance of CES to human well-being is widely recognised, representing central motivations for people to get involved in conservation (Hirons et al., 2016; Kumar and Kumar, 2008; Schaich et al., 2010). However, despite the growing body of research on the topic, CES are still largely nominal in the broader ES literature, with only around 2% of publications explicitly

addressing cultural services[1]. A review of CES assessments reveals that over 70% of case studies were held in Europe and North America (Milcu et al., 2013), while a biased ethnocentric approach to CES as "leisure-time" brought a consequent focus on recreation, tourism and aesthetic values (Hirons et al., 2016; Schaich et al., 2010; see Costanza et al., 2017). In this context, CES illustrates an understanding of socio-ecological systems, in science and policymaking, still hindered by perspectives which overly simplify the relationship between human societies and nature.

In practice, CES stated subjective and intangible nature led to its marginalization in assessments concerned with the monetary valuation of environmental benefits. Indeed, CES have been often considered not suitable for quantitative assessments (Daniel et al., 2012; Fish et al., 2016), poorly reflected in economic indicators and rarely marketable (Hirons et al., 2016; Milcu et al., 2013; Schaich et al., 2010). These characteristics resulted in CES being broadly considered difficult to evaluate in a systematic way (Milcu et al., 2013), with some authors claiming that CES valuation is often inadequate or not possible at all (Fish et al., 2016; Kumar and Kumar, 2008), criticizing CES for including wellbeing components not directly linked to ecosystems (e.g., Kirchhof, 2012) or asserting that CES do not fully captures human–environment relationships (e.g., Winthrop, 2014). Cultural benefits are inherently 'non-economic' benefits even if deriving from cultural economic practices, so CES epitomizes the 'non-profitable' blind spots of neoliberal paradigms while, simultaneously, raising concerns on how applying economic valuation techniques to culture would transform its meaning, as "the issue is not only whether nature should be valued as an economic asset, but culture as well" (Fish et al., 2016: 210).

The integration of CES in the ES framework requires establishing a relation between specific ecosystems' structures in the biophysical domain and dimensions of human well-being in the sociocultural domain (Díaz et al., 2018; Daniel et al., 2012) while, paradoxically, researchers have attributed an idea of intangibility to cultural services. Indeed, CES challenge the methodologies and assumptions held by the ES framework, where ecosystems are valued based on what can be observed and measured against standard independent variables. However, associating CES exclusively with the non-material benefits that humans obtain from ecosystems, as the "aesthetic, spiritual, psychological and other benefits that humans derive from ecosystems" (TEEB, 2010: 79; MA, 2005), is the expression of a normative interpretation of culture — one

[1] According to a search in the Web of Knowledge database, using keywords "Ecosystem Services" and "Cultural Ecosystem Services" since 1970 to date (Accessed: 22nd July 2019).

that ignores how the ES framework is itself a cultural representation of human–environment relationships and assigns to CES all the non-material aspects left out in economic valuations.

In this context, relevant approaches to culture coming from the social sciences have generally taken two directions, described by Fish et al. (2016: 210) as: the cognitive approach, understanding CES in terms of the "psychological realm of human experience and perception"; and the ethnographic approach, emphasizing the cultural contexts of land and resource's management by considering local ways of living, based on the notion of "culture as life expressed in situ".

Recognising a wider meaning of 'culture', recent contributions to CES highlight the need to embrace both its tangible and intangible dimensions as manifest in particular ways of living and knowing — i.e., comprising the local modes of perceiving and interpreting the environment but also the affiliated socially constructed behaviours and practices (Milton, 1996). Such approaches understand cultural identities, heritages and knowledges as reproduced by human–environment relationships and mediated by particular spaces, places and landscapes (Berkes et al., 2000; Daniel et al., 2012; Rival, 2007). For example, cultural heritage is defined by the UNESCO (2020) as including both tangible (e.g., biophysical components and landscapes) and intangible aspects (e.g., knowledge systems and ritual performances), inherited by a social group from the symbolic meanings and cultural practices of past generations. Particularly, pertaining to landscapes, the tangible and intangible aspects of cultural heritage are indissociable, reflecting both local land management practices, knowledge systems and identities (Daniel et al., 2012; Tengberg et al., 2012).

In accordance, Fish et al. (2016) argue that cultural services may be understood as cultural practices that embody human interactions with ecosystems, including recreational (e.g., exercising and picnicking outdoors), creative (e.g., painting and ritual performances), productive (e.g., agriculture and fishing) and consuming activities (e.g., local gastronomy and aesthetically pleasant landscapes), from which cultural benefits might be derived (e.g., identities, experiences and capabilities). Such approach recognizes that cultural practices are fundamental modes of reproducing local identities (Rival, 2007), preserving a sense of place and social cohesion by enacting local knowledge systems (Berkes et al., 2000), manifesting cultural heritages (Tengberg et al., 2012) and reflecting the community's social shared values (Pascual et al., 2017; Kenter et al., 2015). Then, CES are not understood as "a priori products of nature" from which people benefit but rather as relational processes "that people actively create and express through interactions with ecosystems" (Fish et al., 2016: 211).

Embracing CES tangible and intangible dimensions may support the further understanding of the shared social values that inform human–environment interactions (Chan et al., 2016; Comberti et al., 2015; Hirons et al., 2016) — broadly understood as cultural values, where shared values refer to values held in common by a particular group and social values to those held in relation to others and society (Kenter et al., 2015). Among these, relational values reflect those behaviours considered appropriate in relationships with nature and others, comprising the social principles, preferences and norms associated with interpersonal relationships (Chan et al., 2016). Relational values are expressed in physical and experiential interactions with the environment, represented in affiliated symbolic meanings and manifested in people's ways of living, playing a fundamental role in the reproduction of cultural identities and in supporting what is considered a good life (Pascual et al., 2017). As such, Chan et al. (2016: 1463) argue that "recognising relational values may also solve the dilemma that cultural ecosystem services are both everywhere and nowhere". On one hand, CES are 'nowhere' because the conceptual and methodological challenges posed by CES led their assessment to become nominal and largely disregarded. On the other, CES are 'everywhere' because their crucial role mediating socioecological interactions implies these are also inherently intertwined with provisioning and regulating services, influencing the production, valuation and distribution of all environmental benefits. Thus, Chan et al. (2016: 1463) argue that CES may be "better understood as the filters of value through which other ecosystem services and nature derive importance".

As acknowledged by the NCP framework (Díaz et al., 2018), cultural contexts influence all other categories of ecosystem services, such as provisioning and regulating services. Then, to consider CES without including services considered elsewhere becomes nearly impossible (Chan et al., 2012) and, again, CES do not fit well in the conventional ES framework, "lack[ing] the well-defined measurement boundaries and internal consistency of other ecosystem services" (Fish et al., 2016: 210). As noted by Tengberg et al. (2012), it is a conceptual artefact to enforce a 1:1 equivalence between ecosystem services (i.e., ecological processes and functions) and the benefits derived from those (e.g., food and cultural identity). And, indeed, the nature:culture dichotomy reproduced by the ES framework enforces a separation between categories that, despite asserting to serve management purposes, does not necessarily communicate the reality of actual socio-ecological systems. Instead, reproducing dominant cultural paradigms, the framework overlooks the human's labour co-producing ES, the role of subsistence practices and the relational values guiding environmental decisions. Hence, CES represents all those dimensions

of human–environment relationships that do not fit neatly in ecosystem assessments, either because these are non-quantifiable, non-economic or non-independent from all other categories, while exposing the cultural biases of assessment frameworks.

Recognising the inherent entanglement between CES and other ES categories leads to concerns on double-counting; however, this problematic persists only if assessments are used to calculate total economic values. Understanding the cultural dimensions of ecosystems reinforces the importance of using descriptive categories instead of accounting ones to represent services that may be simultaneous constituents of multiple categories, recognising that "many services produce many benefits which may be important for many kinds of reasons" (Chan et al., 2012: 12). Therefore, reframing the understanding of CES is crucial to move beyond dominant dichotomies, consider pluralistic valuations and embrace actual socioecological entanglements, centring assessments around local unique perspectives and context-specific challenges — i.e., questioning the ES/NCP general premisses about nature and society to elaborate culture's exceptional positioning for the understanding of local ecosystems.

Limitations: From Managing 'Global Environments' to Relationality

Attempting to represent nature — and for that matter culture as well — in economic terms raises multiple issues. First, discourses based on the notion of 'natural capital' promote the economy as a rationale for environmental concerns, influencing people's perceptions and behaviours towards the environment. This rationale contributes to weaken relational values and ethical-based management practices, eventually working against conservation goals (Alexiades, 2009; Blackmore et al., 2013: 25-44). Second, an unquestioned conceptualization of 'nature as provider' conceals the reciprocity of human–environment relationships (Comberti et al., 2015) and hinders the understanding of complex socio-ecological dynamics, where multiple feedbacks processes influence the production and consumption of environmental benefits (Mehring et al., 2018). Here, reducing nature to a utility provider neglects how people, from varied backgrounds, may sustain intricate kinship or stewardship relations with specific ecosystems (Chan et al., 2016). Third, economic valuation techniques should not be applied to processes outside the market (Chan et al., 2016; Fish et al., 2016), as reflected by contingent valuation methods being highly criticized within economics. Despite widely adopted in ecosystem assessments, these methods raise numerous concerns pertaining the errors and biases affecting the validity and reliability of results (Venkatachalam, 2004). In this context, despite their conceptual flaws, the practical need for adequate assessment tools to inform global conservation strategies conveys the urgency of addressing these limitations.

Sullivan's (2010) critique of the ES framework highlights the impacts of integrating ecosystems in economic assessments, arguing that ES reproduce the logic of 'Imperial Ecologies' and help build a discourse through which ecosystems can be absorbed by neoliberal markets, namely by: (1) promoting a conceptual break down of ecosystems into distinct new categories, amenable to the economic quantification of their benefits; (2) assigning monetary values to ecological processes, structures and functions, turning these into commodities; and (3) creating new markets where these ecological commodities, or 'services', can be traded and exchanged, engendering new property rights over ecological processes. Epitomized by the implementation of carbon markets, payments for ES or biodiversity offsetting projects, the ES framework reproduces a rationale for global environmental management which is not only highly contested but may also negatively impact the collective management of common resources (Ostrom, 1990), deepen socioeconomic inequities and further on-going colonization processes (Dunlap and Sullivan, 2019). Ultimately, the quantitative focus of the ES/NCP frameworks promote a conceptualization of nature further dissected and abstracted, removed from the embodied relationships that ecological processes represent. As posed by Sullivan (2010: 112),

> *"The widening disjunctions between human and non-human worlds that this produces are fuelled further by the increased capture of nature's sensual reality into the prolific and endlessly exchangeable spectacle of 'celluloid nature', paradoxically making nature's screened and replicated presence both more vividly consumable, at the same time as being somehow less experientially reachable."*

According to several studies, people do not calculate ecosystems' utility in economically logical ways but rather state personal and collective values based on relational processes that, expressing their concern and dependence on the environment, contribute to define their social and ecological identities (Kumar and Kumar, 2008). As such, the values assigned to landscapes or resources are not independent of the humans who sustain those values, in which sense it's not intrinsic nor instrumental nor merely derived from utilitarian calculations. People do not make choices based solely on intrinsic or utilitarian values but more often based on the particular relations they hold with the 'things' valued. Their attitudes and behaviours convey the meanings attributed to social and ecological relationships where, supporting what is considered a good life, "relational values are not present in things but derivative of relationships and responsibilities to them" (Chan et al., 2016: 1462). Yet, the ES framework tends to favour a positional valuation, based on equivalent-exchange transactions, instead of a relational valuation, based on notions of reciprocity and human happiness. Then, approaching ES based on their relational

dimensions may contribute to convey the diversity of values affiliated to the environment (Kenter et al., 2015; Pascual et al., 2017), unveil their inherently heterogenous distribution (Brooks et al., 2014; Cáceres et al., 2015) and highlight the reciprocity of human–environment relationships (Comberti et al., 2015).

Reciprocity may be expressed in resource management practices which, as argued by Comberti et al. (2015), entail 'services to ecosystems' — i.e., enhance particular ecological functions, such as food production or soil fertility. Here, recognizing the reciprocity of human–environment relationships require acknowledging their non-linearity, rejecting a unidirectional understanding of ecosystems' contributions to human well-being and embracing the diverse human roles in the co-production of the environment. This non-linearity is characteristic of complex socio-ecological dynamics, where multiple feedback loops at various temporal and spatial scales support adaptive and co-evolutive processes (Liu et al., 2007; Scheffer, 2009). This reflects the interdependence of both systems, as illustrated by the increased economic vulnerability arising from changing ecological conditions or the drastic landscape changes driven by increasing human populations. Then, while natural processes contribute to people's well-being, diverse social and cultural factors also contribute to enhance or hinder specific ecological functions, resulting from land management practices, social structures and power relations affecting both ES production and the social distribution of benefits (Berbés-Blázquez et al., 2016; Mehring et al., 2018). These interdependences assert the relevance of understanding actual socio-ecological dynamics and underlying feedback processes to effectively address environmental issues (Fisher et al., 2015; Ostrom, 2007); however, fundamental knowledge gaps persist today for considering context-specific dynamics in ecosystem assessments (Mastrángelo et al., 2019).

These considerations illustrate how the ES framework fails to engage with fundamental dimensions of human–environment relationships, including their sociocultural dimensions and their role mediating complex SES dynamics. The scientific and economic epistemologies that dominate the ES framework entail a challenge to research inquiries, by urging the understanding of not only CES but SES to adapt to such framework. Yet, once again, the separation between natural and cultural systems in the ES framework may serve management purposes within managerial and neoliberal paradigms but does not necessarily reflect the complexity and diversity of actual SES. In fact, not only CES but all ES are cultural constructions which shape the subjective understanding of human–environment relationships in terms of economic benefits, despite all other symbolic meanings and shared social values affiliated to the ecological processes

upon which life depends. Then, the many features that make CES exceptional within the framework extend to other ES, regarding their non-quantifiable interdependencies but also the reproduction of particular worldviews, knowledge systems and management practices. As acknowledged by the NCP framework, 'ecosystem services' need to be understood in terms of local worldviews (Díaz et al., 2018), reflecting the ecological processes and the practices, values and attitudes that comprise actual human–environment relationships. In this context, CES are both a product of cultural values and the context in which these can be understood (Fish et al., 2016; Chan et al., 2012; Pereira et al., 2005) or, indeed, all other ES may be understood — being central not only for the assessment of ES but the processes that shape and enable those 'services'.

Understanding CES supports the recognition of how diverse ways of living and knowing are tied to specific worldviews and relational values, manifest in distinct modes of shaping and adapting to the landscape. Such understanding follows a cultural geography perspective which, as posed by Fish et al. (2016), comprehends human–environment relationships in both contextual and tangible terms. Then, the cultural dimensions of ecosystems are socially constructed and inherently interpretive, even in their materialist expressions, comprising both symbolic meanings and cultural practices that evolved from adaptive relationships maintained between humans and their environments for generations (Berkes et al., 2000; Milton, 1996). Therefore, considering the cultural dimensions of ecosystems emphasizes the tangible implications of cultural diversity, contributing to disclose how sociocultural variables influence ES supply and demand, the social inequities and power differentials embedded in ES flows and the context-specific SES dynamics in which all these play (Comberti et al., 2015; Mehring et al., 2017; Poe et al., 2014). In what follows, this chapter weaves in the contributions of SES and BCD research into the understanding of relevant dimensions of human–environment relationships, to inform a biocultural approach to socio-ecological dynamics based on the development of a conceptual and analytical framework for cultural ecosystem assessments — presented in the next chapter.

2.2 APPROACHES TO SOCIO-ECOLOGICAL SYSTEMS

> *"Understanding a complex whole requires knowledge about specific variables and how their component parts are related." (Ostrom, 2009: 420)*

It is widely acknowledged that human activities drive large-scale changes in ecosystems and biodiversity (Foley et al., 2005; Pereira et al., 2012; Rockström et al., 2009), as reflected in

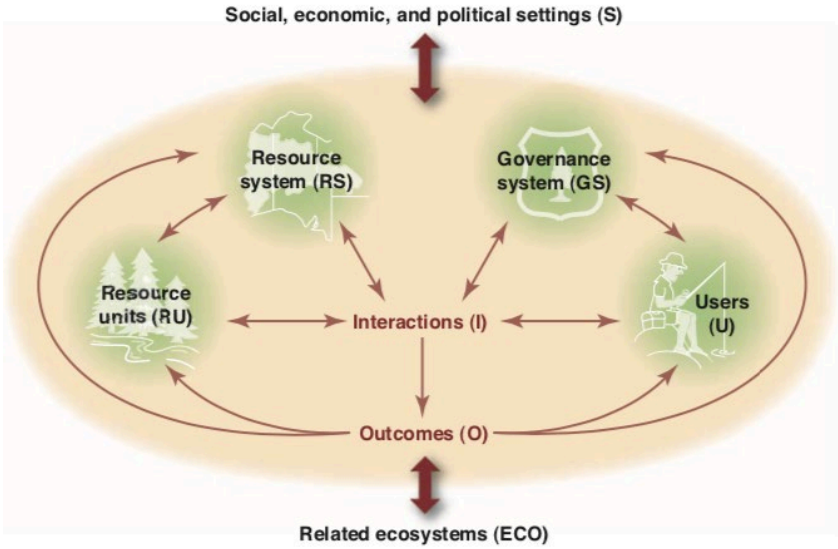
preservationist notions of protecting nature from humans (Milton, 1996), within 'nature for itself' or 'nature despite people' paradigms (Mace, 2014), or even the concept of Anthropocene (Lorimer, 2015). Simultaneously, there's a growing recognition that human well-being depends on ecosystems in multiple ways (Díaz et al., 2006), as expressed in 'nature for people' paradigms and the Ecosystem Services framework (MA, 2005). In this context, most conventional conservation approaches tend to focus on one aspect of human–environment interactions: human impacts on ecosystems or human's dependence on them.

Exclusively looking at unidirectional flows, however, conceals the interdependence of human–environment relationships. As such, the importance of understanding the complex and dynamical links between human societies and the environment has been highlighted by emergent approaches to conservation (Carpenter et al., 2009; Fischer et al., 2015; Liu et al., 2007; Ostrom, 2009), arguing for the relevance of research on coupled social and ecological systems to effectively address actual environmental challenges. As posed by Fischer et al (2015: 144),

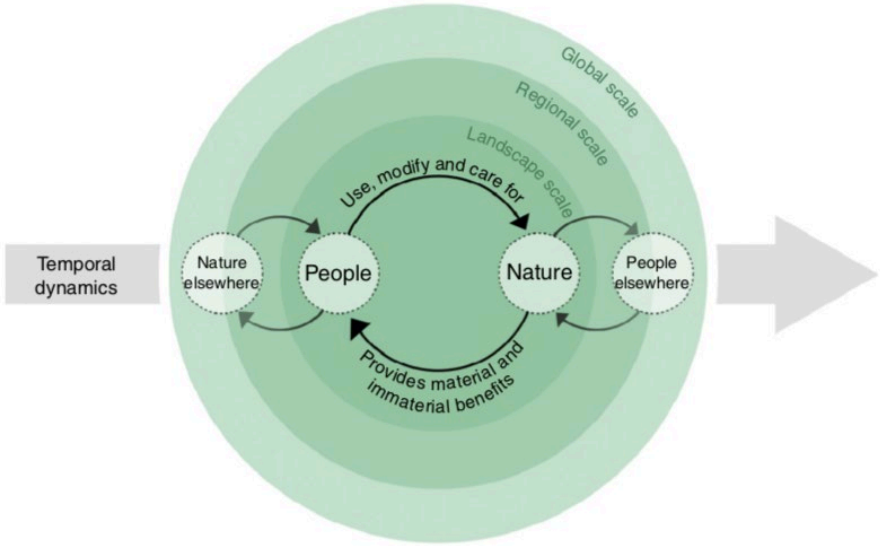
> *"[T]he conservation of tropical forests cannot be achieved without also considering expanding agricultural markets and increased demand for agricultural commodities. Food security, in turn, depends not only on securing environmentally sustainable agricultural production, but also requires institutions that ensure a more equitable distribution of agricultural products. Similarly, the sustainability of the world's fisheries cannot be addressed separately from the livelihoods of coastal communities, or from the management of other potential protein sources such as agriculture, aquaculture, or bushmeat."*

The concept of Socio-Ecological Systems (SES) reflects the entanglement and mutual interdependence between human and natural systems, where people may "use, modify and care for nature" while nature may "provide material and immaterial benefits to people" (Fischer et al., 2015: 145). Diverse representations of these interactions are found in the literature, emphasising SES distinct features (Raymond et al., 2013), as depicted in Fig. 2.3. Here, following established definitions, SES are considered complex adaptive systems (Fischer et al., 2015; Liu et al., 2007; Loft et al., 2016) comprising large networks of elements (including biophysical components, social actors and institutions) whose interactions lead to emergent nonlinear and adaptive dynamics, based on feedback processes, learning and self-organizing behaviours (Mitchell, 2009: 13).

A


Social, economic, and political settings (S)
Resource system (RS)
Governance system (GS)
Resource units (RU)
Interactions (I)
Users (U)
Outcomes (O)
Related ecosystems (ECO)

B


Global scale
Regional scale
Landscape scale
Use, modify and care for
Temporal dynamics
Nature elsewhere
People
Nature
People elsewhere
Provides material and immaterial benefits

C

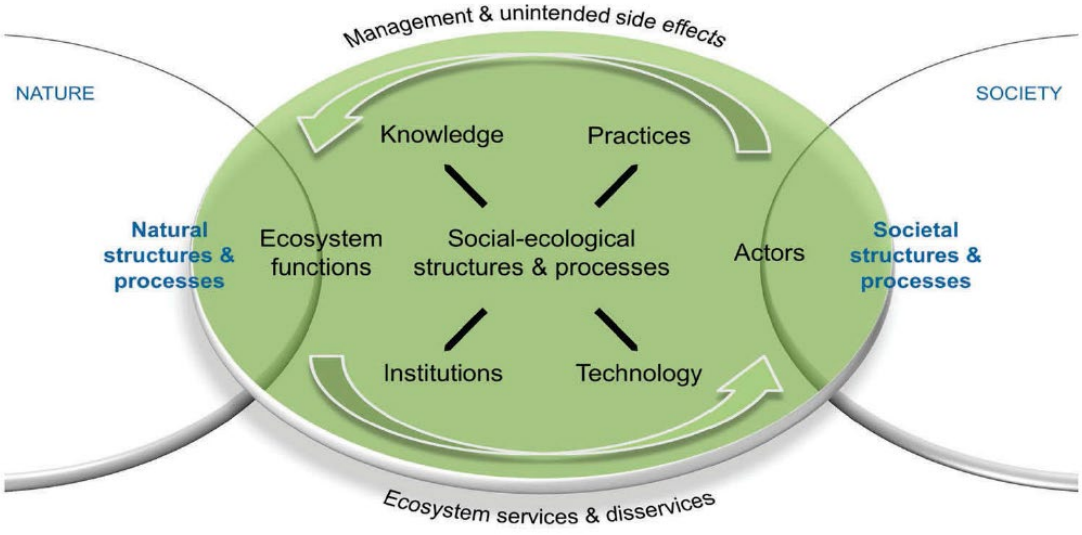

Management & unintended side effects
NATURE
SOCIETY
Knowledge
Practices
Natural structures & processes
Ecosystem functions
Social-ecological structures & processes
Actors
Societal structures & processes
Institutions
Technology
Ecosystem services & disservices

***Figure 2.3** - Different representations of SES in literature. A: Core subsystems constituting SES, as part of a framework for analysing SES sustainability (Ostrom, 2009: 420). B: The nested structure of SES, with the interdependent links between people and nature across scales, reflecting that people both shape and depend on ecosystems while interactions are subject to change through time (Fischer et al., 2015: 145). C: Processes mediating human–environment relationships in SES (Mehring et al., 2017: 175).*

Any SES comprise multiple subsystems, each composed by diverse elements, which interact with each-other at multiple levels, in ways "analogous to organisms composed of organs, organs of tissues, tissues of cells, cells of proteins, etc." (Ostrom, 2009: 419). Interactions between distinct elements give rise to outcomes at SES level in ways which affect inner subsystems and their components, where feedback processes assist the self-regulation of the whole system (Liu et al., 2007). Yet, such large networks of interactions result in complex dynamics, typically characterized by: emergent behaviours, not predictable from the sole characteristics of isolated elements; self-organising behaviours, as self-regulating structures and processes that arise without the influence of a central control; and nonlinear dynamics, characterised by regime shifts and other deterministic but often unpredictable dynamics, whenever the system's initial conditions are not precisely known (Mitchell, 2009).

Characteristics and Challenges of Socio-Ecological Systems

Studies across different cultural, socioeconomic and political contexts reveal that SES share common characteristics, presenting reciprocal feedback loops across multiple scales, high heterogeneity, legacy effects from past conditions and nonlinear dynamics, with critical thresholds and high unpredictability (Liu et al., 2007). These lead to surprising behaviours when SES complexity is not well understood. This hard-to-predict behaviour is often associated to regime shifts, typical of nonlinearity, where cumulative changes on slow variables may go unnoticed until passing a critical threshold, after which these trigger abrupt system-wide changes (Folke et al., 2010; Scheffer et al., 2012).

Tipping points may occur across diverse temporal and spatial scales and their relevance to understand complex SES dynamics and design effective responses is widely acknowledged (Liu et al., 2007; Scheffer, 2009). These are represented, for example, in the notion of planetary boundaries potentially leading the Earth system out of the Holocene period (Rockström et al., 2009; Steffen et al., 2015). Here, the concept of resilience is increasingly used to describe de-

sirable SES dynamics, referring to the system's capacity for absorbing change while maintaining its overall functions, re-organization capacity and development potential (Folke et al., 2010; Scheffer et al., 2012). These insights support a fundamental paradigm shift to adaptive forms of socio-ecological governance (Berkes et al., 2000; Folke et al., 2005), contesting the dominant stable-equilibrium perspective on ecosystems and societies, by stressing notions of resilience and adaptation to build the system's capacity for dealing with disturbance and transformation.

In this context, the relevance of developing SES research has been increasingly recognised, moving traditional discipline-bound research on discrete components to focus on interactions between human societies and nature (Berkes et al., 2003; Carpenter et al., 2009; Liu et al., 2007). However, despite numerous studies on human–environment interactions (e.g., Cardinale et al., 2012; Díaz et al., 2006) and efforts to include SES understanding on Ecosystem Services assessments (e.g., Carpenter et al., 2009; Mehring et al., 2017; Raymond et al., 2013), the complexity of SES is still not well understood nor fully embraced (Fisher et al., 2015; Mastrángelo et al., 2019; Mehring et al., 2018).

First, this is partially due to the traditional separation between social and natural sciences, whose methods and conceptual approaches do not necessarily combine easily (Liu et al., 2007; Ostrom, 2009). Addressing SES requires then joint efforts to develop strong collaborations across disciplines, leading to an increased number of interdisciplinary and transdisciplinary research programmes as well as the development of major policy frameworks (Fisher et al., 2015; Liu et al., 2007; Loft et al., 2016) — such as the IPBES (Díaz et al., 2018).

Second, previous work on complex adaptive system has been mostly theoretical rather than empirical (Liu et al., 2007), fostering a tendency to prescribe universal solutions based on simple theoretical models which, lacking the context-specific dimensions of SES, often result in flawed environmental policies (Ostrom, 2007; 2009). This is linked to numerous knowledge gaps on actual feedback processes and the impact of different drivers of change in SES dynamics (Carpenter et al., 2009; Mastrángelo et al., 2019), but also to a general tendency for overlooking the context-specific cultural and social dimensions of SES (Poe et al., 2014; Mehring et al., 2017) — as illustrated by the marginal role of CES in the ES framework (Daniel et al., 2012; Fish et al., 2016).

As argued by Fischer et al. (2015), SES potential to support social and ecological sustainability still depends on a better understanding of socio-ecological interactions between different regions; the long-term drivers that influence SES dynamics (e.g., slow variables, as cultural norms

and economic systems); and how power relationships, social inequities but also different worldviews and cultural values interact and affect environmental management outcomes. As such, advancing SES research also requires the development of stronger collaborations between researchers and distinct stakeholders, including policymakers, practitioners and local communities (Fischer et al., 2015), for example through participatory approaches that support the integration of multiple knowledge systems (Folke et al., 2005). Moreover, local and regional SES are nowadays increasingly affected by global socioeconomic dynamics, being nested in a globalised world characterised by a high connectivity of SES worldwide (Scheffer et al., 2012). A central challenge on identifying conditions that support SES sustainability is, thus, to examine interactions across multiple organisational levels and spatial scales (Ostrom, 2009) as well as between SES within and across distinct geographical regions (Liu et al., 2007; Scheffer et al., 2012).

Despite recent advances on anticipating signs of fragility and resilience (Folke et al., 2010; Scheffer et al., 2012), a common framework is still needed to support a systematic understanding of SES complexity across different spatial and temporal scales (Ostrom, 2009). Different frameworks have been used to analyse SES, hindering researchers' ability to identify common variables linked to the system's resilience or vulnerability to changes (Ostrom, 2009), such that relevant information is still fragmented and not consistent (Carpenter et al., 2009; Fischer et al., 2015). A systematic understanding of SES requires developing sets of indicators that support linking observations between different SES with relevant scientific hypothesis, to support decision-making (Carpenter et al., 2009). In this context, Ostrom (2007; 2009) suggests addressing SES complexity through its division into four major subsystems: resource systems (e.g., forest), resource units (e.g., timber or bushmeat), users (e.g., farmers) and governance systems (e.g., local or regional institutions). Each subsystem comprises several multi-level variables, such as predictability of resource system and its importance to users, with several variables being known to influence SES self-organizing and adaptive capacity (Ostrom, 2009).

Socio-Ecological Systems in Ecosystem Assessments

The Millennium Ecosystem Assessment (MA, 2005) developed the ES framework and promised to deliver a global SES assessment; however, as a science-policy interface which represents an acknowledged simplification of complexity, ES pledge to embrace SES was limited by an excessive focus on ES supply which generally overlooked the context-specific dimensions of human–environment relationships and the feedback processes influencing overall SES dynamics (Carpenter et al., 2009; Loft et al., 2016; Mastrángelo et al., 2019; Mehring et al., 2017).

The MA (2005) represents an unprecedented effort to link trends on direct (e.g., land-use change) and indirect (e.g., socioeconomic growth) drivers of change affecting ecosystem processes and biodiversity to the provision of ecosystem services that sustain human well-being worldwide, aiming to assess and develop effective policy responses (Carpenter et al., 2009; Pereira et al., 2010) — see Fig. 2.4. As such, the ES framework could enable SES assessments but, as argued by Raymond et al. (2013), the understanding of SES in ecosystem assessments is still hindered by a focus on utilitarian perspectives which requires integrating multiple metaphors to actually 'close the loop' of environmental relationships.

In this context, Mastrángelo et al. (2019) identify seven major knowledge gaps in ecosystem assessment frameworks to achieve global sustainability goals. Namely, these require improved understanding on: (1) feedback processes between social and ecological systems; (2) synergies and trade-offs between biodiversity, ES production and social preferences; (3) the role of institutions influencing ES socially heterogenous distribution; (4) the role of local and indigenous knowledge systems supporting ES production; (5) which governance systems may be adequate to foster desirable SES changes; (6) how diverse worldviews and values systems influence well-being and ES demand; and (7) the effect of multiple direct and indirect drivers on ES provision and SES temporal dynamics. These represent persistent knowledge gaps in the ES framework since the MA (2005) and reveal how the cultural, social and political dimensions of SES have been generally overlooked.

As such, if the ES framework aims to embrace SES complexity, it needs to address key research priorities pertaining to the further understanding of embedded interactions, namely reflected in ES flows (e.g., their social heterogeneity and spatial-temporal distribution), feedback processes (e.g., direct and indirect drivers of change), the influence of governance systems (e.g., power relations and institutions) and diverse worldviews (e.g., knowledge and values systems). Addressing these knowledge gaps requires further understanding the social heterogeneity underlying the co-production, access to and dependence on particular ES (Fischer et al., 2015; Mehring et al., 2018), the mismatch between the spatial and temporal distributions of ES supply and demand (Mehring et al., 2017; 2018), the role of institutions and power relationships on ES distribution (Fischer et al., 2015; Berbés-Blázquez et al., 2016) and how distinct worldviews, knowledge systems and values influence particular SES dynamics (Mastrángelo et al., 2019; Poe et al., 2014).

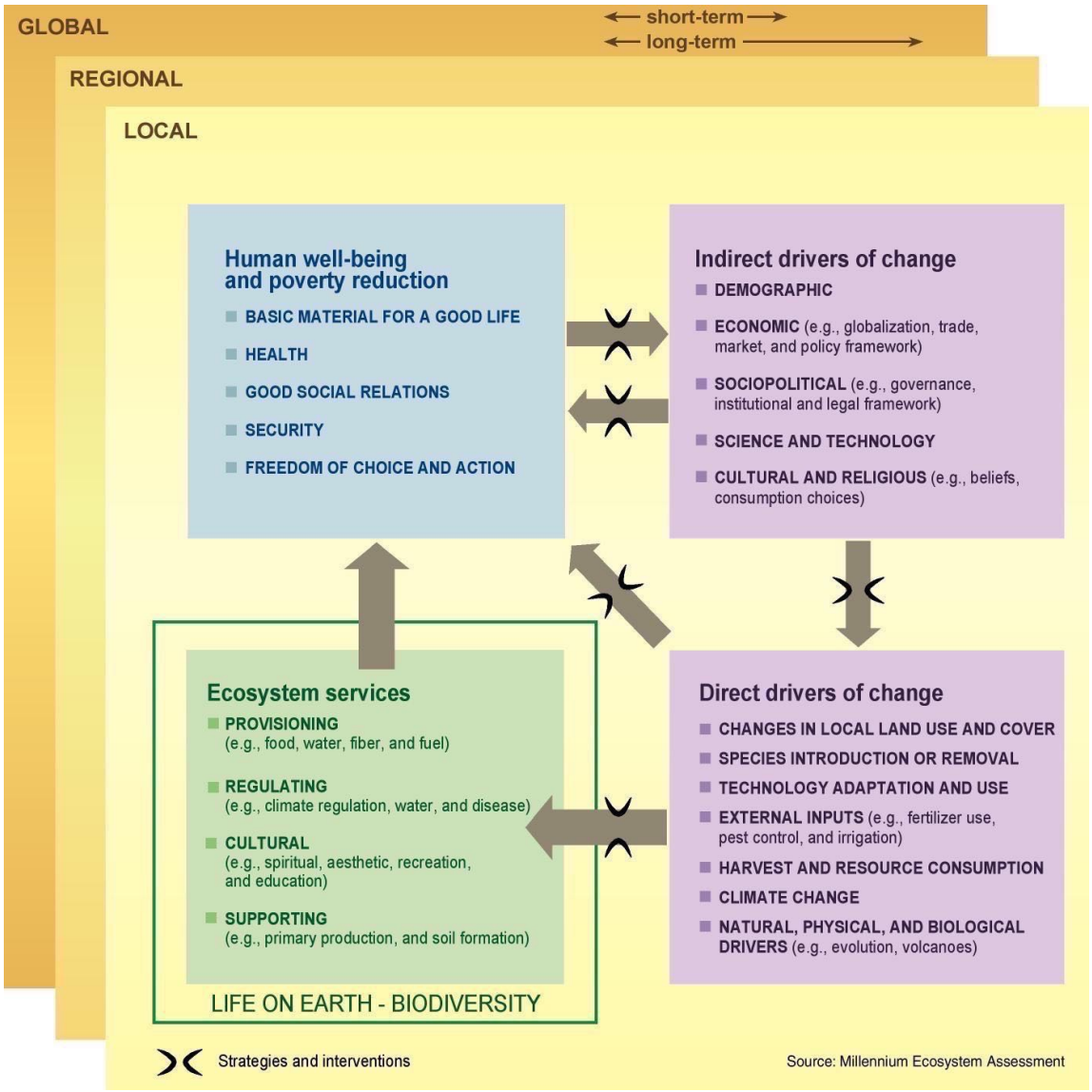


Figure 2.4 *- Representation of feedback loops in the Ecosystem Services framework, with direct and indirect drivers of change affecting ES supply and human well-being (source: MA, 2005).*

Ultimately, if ecosystem assessments are to inform adequate environmental policies and strategies, it is fundamental to develop and integrate systematic approaches to SES analysis within their frameworks, addressing the above knowledge gaps and enhancing assessment's ability to grasp SES complexity in terms of their local specificity. Offering a more empirical counterpoint to SES research, the next section discusses the evolution of research in biocultural diversity, reviewing relevant contributions and lasting pitfalls of BCD approaches which may inform adequate means for integrating the context-specific dimensions of human–environment relationships in ecosystem assessments.

2.3 BIOCULTURAL DIVERSITY AND INDIGENOUS KNOWLEDGE

> *"[T]he two sciences were fundamentally distinct in that "the physical world is approached from opposite ends in the two cases: one is supremely concrete, the other supremely abstract." (Levi-Strauss, 1962; in Berkes et al., 2000: 1251)*

The concept of 'sustainable development' emerges in the context of raising environmental concerns and frustration with the failure of modern solutions which, predicated on positivism and universality, rejected traditional knowledge systems and ways of living while promoting consumption-based progress around 'core' socioeconomic centres (Alexiades, 2009; Ellen and Harris, 2000). In response, following proceedings from the United Nations Conference on the Environment and Development in 1992, the concept of 'sustainable development' came to privilege context-specific approaches (Alexiades, 2009; Agrawal, 1995), with decentralisation and participation becoming part of a common language for development (Chatty and Colchester, 2002). Simultaneously, postmodernism brought diversity to the centre of global endeavours, articulating debates on indigenous peoples and marginalised perspectives (Jørgensen, 2010) while fostering changes in the political and economic value of both biological and cultural diversity (Alexiades, 2009). It was in this context that research on the links between biological, linguistic and cultural diversity, taken during the 1980's and 90's, would start to attract the attention of conservation organisations, "concerned with implementing the mandate of sustainable development" (Maffi, 2005: 606). In particular, the rediscovery of indigenous and local knowledge (ILK) would play a strategic role in new 'sustainable development' strategies, despite more often prompted by a cultural idealisation rather than its own merits (Ellen and Harris, 2000).

The Emergence of Biocultural Diversity

The emergence of the biocultural diversity concept reflects a growing understanding of the common threats faced by both biological and cultural diversity along with their overlapping distributions (see Harmon, 1996; Maffi, 2005). Concerns with the conservation of biocultural diversity followed observations, in the mid-1990's, that "the ongoing worldwide loss of biodiversity is paralleled by and seems interrelated to the 'extinction crisis' affecting linguistic and cultural diversity" (Maffi, 2005: 601). Nonetheless, interest in the links between culture and the environment had precedents in ethnobiology and environmental anthropology, with numerous studies on indigenous knowledge, local resources' uses and traditional management practices pointing towards the diverse roles of local communities on the co-production of landscapes

worldwide (e.g., Posey, 1983; for a review, see Maffi, 2005; Bridgewater and Rotherham, 2019). These earlier studies set the ground for the Declaration of Belém which, issued after the First International Congress of Ethnobiology in 1988, acknowledged the "inextricable link between biological and cultural diversity" (Posey and Dutfield, 1996: 2), influencing numerous studies afterwards (e.g. Berkes et al., 1994; Davis and Wali, 1994; Gadgil et al., 1993; Sillitoe, 1998) and leading the establishment of the biocultural diversity concept itself (Maffi, 2005; Bridgewater and Rotherham, 2019; Gavin et al., 2015).

Biocultural diversity highlights the role of local communities co-producing their environments (Balée, 2013; Rival, 2006), arising from a recognition of the problems posed by conventional conservation approaches based upon the separation of human societies from nature (Bridgewater and Rotherham, 2019; Chatty and Colchester, 2002; Cronon, 1996). Indigenous people's lands host most global biodiversity and, their ways of living, represent much of global cultural diversity (FPP, 2020; Maffi, 2005; Sobrevilla, 2008). Nonetheless, many indigenous peoples and local communities have experienced the hardship of colonialism and marginalisation, nowadays still severely increasing their social and economic vulnerability by denying their access to land and resources (Colchester, 2004; FPP, 2020). Then, contrasting with 'imperial ecologies' (Sullivan, 2010), the notion of biocultural diversity highlights the need to develop conservation approaches that support the rights of indigenous peoples and local communities, promoting social and environmental justice through fostering decentralised and participatory environmental governance systems (Maffi, 2005; Bridgewater and Rotherham, 2019; Gavin et al., 2015). As posed by Gavin et al. (2015: 141), the conservation of biocultural diversity entails "conservation actions made in the service of sustaining the biophysical and sociocultural components of dynamic, interacting and interdependent social–ecological systems". Hence, biocultural diversity approaches emphasise that the success of conservation initiatives depends on acknowledging the entangled relationship between people and nature along with their local cultural, social, economic and political contexts.

Since its onset, a central argument for the conservation of biocultural diversity has been based on recognizing the importance of local ecological knowledge for the maintenance of multiple habitats (Berkes, 1999; Davis and Wali, 1994; Gadgil et al., 1993), supporting the need for bridging distinct knowledge systems, developing participatory governance models and establishing effective collaborations between technical experts and local communities (Berkes, 2007; Mistry and Berardi, 2016; Tengö et al., 2017). Gavin et al. (2015: 143) argue that, by

integrating “the worldviews and resource management frameworks that form the basis of multiple knowledge systems”, biocultural approaches “increase the adaptive capacity of conservation by involving more stakeholders with a vested interest in success” and, therefore, improve “the chances of long-term success, given the uncertainty inherent in complex and dynamic social–ecological systems”. This understanding underpins the philosophical and ethical foundations of biocultural approaches based on arguments that, as posed by Maffi (2005: 603), stress “the evolutionary significance of diversity” as means for “keeping options alive” and expand “the pool of knowledge from which we can draw” when adapting to changing environmental conditions. Therefore, highlighting the relevance of dynamical co-adaptive and context-specific processes, biocultural diversity offers a counterpoint to the stable-equilibrium perspective reproduced by conventional conservation approaches — sharing common perspectives with SES research on the relevance of dynamical processes while differing by placing emphasizes on their contextual specificities.

Biocultural diversity stresses the importance of considering the ontological, epistemological and ethico-political dimensions of conservation approaches (Merçon et al., 2019), namely: (1) the local communities’ role on the co-production of their dwelling environment through the creation, management and maintenance of diverse habitats (e.g. Balée, 2013); (2) the local knowledge systems affiliated to particular cultural groups and landscapes, requiring adequate methodological approaches to bridge distinct knowledge systems and support effective collaborations between multiple stakeholders (e.g. Tengö et al., 2017); and (3) the role of governance systems, institutions and power relationships driving socio-ecological changes, recognizing the need for effective participatory approaches to improve the social equity, political legitimacy and ultimate success of conservation initiatives (e.g. Mistry and Berardi, 2016).

In this context, the notion of biocultural diversity holds fundamental contributions to conservation approaches and, particularly, ecosystem assessments. First, it challenges the prevalent nature:culture dichotomies reproduced by dominant conservation paradigms, conveying the diverse and unique entanglements between people and nature, exposing the common threats faced by both and stressing the relevance of their joint conservation (Maffi, 2005). Second, it assists the development of conceptual and methodological approaches for the further understanding of context-specific drivers of change, feedback processes and socio-ecological dynamics (Merçon et al., 2019). And third, it grounds the implications of complex SES dynamics in need for participatory environmental governance systems and community-based conservation approaches (Berkes, 2004; Gavin et al., 2015). Hence, ultimately, it fosters the recognition of indigenous

land rights (FPP, 2020) along with land management practices that support both people and nature (van Bommel and Turnhout, 2012; Wiersum, 2004).

The recognition of indigenous peoples' rights to their territories, ways of living and knowledge systems may be historically as significant as the anti-slavery movement (Chatty and Colchester, 2002) but, nonetheless, the concern to include people in conservation also raises new challenges. First, the implications of recent approaches to the integration of ILK in sustainable development initiatives raises concerns pertaining to knowledge's appropriation and the reproduction of power relationships, such as by subjecting ILK to validation by modern science (Agrawal, 1995). Second, including people in conservation should not exchange the idea of people being environmentally damaging with the idealised notion of indigenous and local communities as 'noble ecologists' (Chatty and Colchester, 2002; Dove, 2006). Both are simplistic views of the highly context-dependent entangled relationships between people and nature which, to be overcome, require finding practical ways to empower indigenous and local communities in developing adequate conservation strategies.

Indigenous and Local Knowledge Systems

Following insights from environmental anthropology studies, the Rio Earth Summit in 1992 (UN Conference on Environment and Development) would establish at an international policy level the relevance of ILK to biodiversity conservation and the sustainable use of resources (Berkes, 1999; Gadgil et al., 1993; Inglis et al., 1993). This is conveyed in the Rio Declaration's Principle 22, stating that indigenous and local communities hold a "vital role in environmental management and development because of their knowledge and traditional practices". A perspective further reflected on the requirements expressed in the Agenda 21, where:

> *"national and international efforts to implement environmentally sound and sustainable development should recognize, accommodate, promote and strengthen the role of indigenous people and their communities" (Chapter 26).*

The term Traditional Ecological Knowledge (TEK) would become established by the IUCN working group with that name (Berkes et al., 2000). Nonetheless, the connotation of terms like 'traditional' with "simple, savage and static" (ibid.: 1251), led to an array of alternative terms being adopted by scholars since then, including indigenous knowledge (IK), indigenous and local knowledge (ILK) or local ecological knowledge (LEK), generally considered as less

value-laden terms (Berkes et al., 2000; Ellen and Harris, 2000). Recently, the former terminology of IK or ILK has been preferred by IPBES (Díaz et al., 2018; Tengö et al., 2017) and widely adopted by scholars (Mastrángelo et al., 2019; Mistry and Berardi, 2016). Yet, each terminology carries its own potential strengths and pitfalls, for example, by emphasizing the particularities of ILK holders (e.g., IK) or the local character of knowledge itself (e.g., LEK). In what follows, I will refer to indigenous and local knowledge (ILK) reflecting a decentralization of conventional centres of power, to discuss what the concept refers to and the main debates surrounding it.

Reflecting a detailed knowledge on ecological processes, changes and patterns (Huntington, 2000), ILK plays a crucial role in the further understanding of ecological dynamics, contributing to inform environmental impact assessments and enhance the sustainable management of resources (FPP, 2020; Mistry and Berardi, 2016; Tengö et al., 2017). Still, ILK debates usually emphasize differences between 'modern science' and 'traditional knowledge', denoting an underlying dichotomy between these epistemologies. However, as argued by Agrawal (1995), the distinction between indigenous and scientific knowledge relies on the assumption that knowledge's systems are independent, culturally delimited and constant over time or space, such that it's possible to precisely define the elements of each category. Substantial, methodological and contextual differences as well as similarities exist within and across distinct knowledge systems (ibid.), such that no adequate methodology exists to distinguish science from non-science (Hansson, 2015). Therefore, the distinction is mostly political and its relevance intimately linked to the intertwined nature of knowledge and power (Agrawal, 1995; Alexiades, 2009), concerning to whom is given or not the power to 'know'.

This said, ILK is generally an attribute of societies with historical continuity in local resource use, resulting from the practical experience of ecological disturbances (Berkes et al., 2000) and reflecting an ecological understanding upon which the community's livelihood depends (Ellen and Harris, 2000; Huntington, 2000). According to Berkes (1999), ILK is a knowledge–practice–belief complex, conveying empirical knowledge based on observation and experimentation; reflecting practices, as those applied to local resources management; and belief, concerning the worldviews and cosmologies that inform people's relationship with the environment. As such, Ellen and Harris (2000) suggest eight general characteristics of ILK, namely being: (1) contextual, as its local character is embedded in particular communities, places or sets of experiences; (2) orally transmitted, mostly reproduced in storied accounts and through demonstration-imitation; (3) functional, based on a 'know-how' that arises from a practical experience

and engagement with the environment; (4) empirical, strongly relying on direct observation rather than theoretical formulations; (5) dynamical, being constantly transformed by actual social or ecological conditions; (6) segmentary, such that its distribution is asymmetric and socially differentiated (e.g. by gender or age) with specialists being defined by experience or political authority; (7) fragmentary, as despite holding a certain degree of social coherence, ILK does not exist in its totality in any one place nor individual; and (8) holistic, implying that the differentiation between technical and non-technical knowledge is often problematic.

Nonetheless, it is important to note that ILK cannot be fully defined by any specific system of meanings but is rather a set of techniques to constitute one, a system of practices for knowing (Viveiros de Castro, 2012) — which is what makes it intrinsically dependent on its context of transmission. Therefore, ILK is not static but rather evolves through adaptive processes in response to socio-ecological changes. Such adaptive processes rely on practices that constantly monitor and respond to ecosystem changes, entailing a flexible resource management based on a great diversity of resources, which contribute to minimise impacts of ecological disturbances and ensure the resilience of local livelihoods (Berkes et al., 2000). Moreover, as the collective dimension of ILK refers to the contextual processes through which knowledge is produced (Nemogá, 2004), its socially heterogenous distribution plays a fundamental role in the adaptation to micro-environments, which may result in widespread sociocultural change in face of ecological disturbances (Vayda, 1990). Indeed, ILK's reproduction is often tied to complex SES dynamics, following rules crafted by local users and institutions contingent on the knowledge accumulated through monitoring resource trends, informing adaptive management practices that adjust to ecological feedbacks and environmental changes (Berkes et al., 2000; Tengö et al., 2017).

However, maintaining ILK adaptive dynamics requires that communities hold sufficient levels of sovereignty over land and related knowledge systems (Gómez-Baggethun and Reyes-García, 2013), in accordance with previous studies on requirements for the sustainable management of common resources (Ostrom, 1990; 2009). Contesting the rationale behind the 'tragedy of commons' (Dietz et al., 2003; Ostrom, 1990), research conveys the crucial role of social structures to enable the collective management of common resources, determining the adaptive capacity of local communities (e.g., for adapting practices to actual conditions), their ability to assume or delegate responsibilities (e.g., local institutions' roles) or their control of management outcomes (e.g., secured access to land, knowledge and resources). Overall, these factors influence the local communities' resilience to socio-ecological changes, reflecting how social structures

determine the access to knowledge, land and resources while conditioning how knowledge is reproduced, applied and transformed (Berkes et al., 2000; Ellen and Harris, 2000). Ultimately, the community's resilience depends on its capacity to reproduce and adapt knowledge through practice, more than on the mere existence of knowledge itself (Gómez-Baggethun and Reyes-García, 2013). Then, the sociocultural mechanisms supporting sustainable management practices and affiliated knowledge systems are not separate phenomena but rather coevolving processes, relying on multiple feedback loops (e.g., trial and error) that lead the emergence of self-regulating mechanisms at various scales (Berkes et al., 2000) — including, for example, environmental ethics conveyed in local worldviews and relational values (e.g., Kimmerer, 2013).

In this context, unquestioned acceptance of ILK might be as flawed as unquestioned rejection, as not all ILK is ecologically adaptive and some might be erroneous or even become maladaptive over time (Berkes et al., 2000; Gómez-Baggethun and Reyes-García, 2013; Huntington, 2000). Conservation and sustainable management are not necessarily a goal *per se* for local communities but a consequence of prevalent management practices (Berkes et al., 2000), contingent on related social structures and their capacity of adaptation to changing socio-ecological conditions. ILK depends on people's ability to practice their ways of living, resulting from the contextual and relational ties between people and place; while, simultaneously, as posed by Berkes (2004), the feasibility of community-based conservation depends on actual ILK's condition, its adaptive capacity and internal consistency, resulting from the community's socioecological history and other politico-economic factors. As such, researchers' tendency for perceiving ILK as static and homogeneous raises concerns (Alexiades, 2009) while, despite ILK dynamical characteristics and complex social construction, changes are usually perceived as lost knowledge and little effort has been put on understanding the conditions for ILK regeneration (Cámara-Leret et al., 2019; Gómez-Baggethun and Reyes-García, 2013) — i.e., the same conditions that support the communities' resilience and resources' sustainable management.

Understanding ILK's adaptive dynamics reveals the need to question the recent fascination of 'industrial' societies with indigenous cultures, which neglects the processes from which their livelihoods, associated knowledge systems and worldviews emerge (Smith, 2008: 1-18). Criticising the imperial and colonial methodologies which continue to make available indigenous knowledge for further exploitation, Smith (2008) argues for the need to be sceptical in relation to the mystical discourse associated to, and sometimes also employed by, indigenous people to describe their "relationships with the land and the universe" (p.12). Speaking from a Maori indigenous background, she states:

> *"I believe that our survival as peoples has come from our knowledge of our contexts, our environment, not from some active beneficence of our Earth Mother. We had to know to survive. We had to work our ways of knowing, we had to predict, to learn and reflect, we had to preserve and protect, we had to defend and attack, we had to be mobile, we had to have social systems which enabled us to do these things. We still have to do these things." (ibid.: 12-13)*

This implies that ILK's fundamental contributions to inform comprehensive ecosystem assessments, support sustainable resource management and design effective conservation strategies (IPBES, 2019) are contingent on upholding the indigenous and local communities' rights to their territories, values and knowledge systems along with their customary land and resource tenure practices (FPP, 2020). Recognising the cultural influence in what people know and think as well as on how people know and act (Mitchell, 2000), entails that ILK represents key cultural expressions of their ways of living (Berkes, 1999). ILK influences environmental perceptions, management practices and cultural values while is influenced by affiliated worldviews and social structures, such that it is fundamentally intertwined with culture (Milton, 1996). Simultaneously, defining ILK as a knowledge-practice-belief complex entails that culture is also necessarily reproduced in and through affiliated knowledge systems (Ellen and Harris, 2000). As such, recognising ILK as a cultural expression of particular identities and heritages, representing a conceptual and practical tool to sustain the resilience of local communities' livelihoods, conveys the relevance of considering the social, cultural and political dimensions of environmental challenges. These cannot be adequately addressed while disregarding their socioecological contexts, so ILK contributes to understand how distinct sociocultural variables may influence complex SES dynamics, including the ways human societies participate and shape particular ecological processes. The above sets ILK fundamental relevance to ecosystem assessments, particularly, to inform community-based conservation strategies based on a biocultural approach to local socio-ecological dynamics.

The Rise and Challenges of Indigenous Knowledges

In line with economic growth, appropriate technology and participatory approaches, ILK became central to new theories of sustainable development. In 1993, the World Bank held a conference on "Traditional Knowledge and Sustainable Development", acknowledging ILK's relevance for "a cost-effective, participatory and sustainable development process" (Agrawal, 1995: 417). Already in 1992, the widespread recognition of ILK's importance for conservation and SES sustainability led the Convention on Biological Diversity (CBD) to require that states,

as far as possible and under the national legislations, "respect, preserve and maintain knowledge" that pertain to "indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological resources" (CBD, 1992: Article 8j). Since 1996, the World Wide Fund for Nature (WWF) also acknowledges the need to engage with indigenous peoples (WWF, 2008), endorsing in 2007 the United Nations (UN) Declaration on the Rights of Indigenous Peoples, including indigenous people's rights to use, manage and own their territories and to their own self-representation, self-governance and self-determination, as means to support and maintain their distinct identities. Being followed by the International Union for Conservation of Nature (IUCN), in 2008, promoting the integration of ILK in protected areas and acknowledging indigenous peoples' right to their territories and to participate in related decision-making processes (Chatty and Colchester, 2002).

More recently, ILK's importance to conservation has been inscribed in the Aichi targets for 2020 (CBD, 2010), namely Target 18, considered to enhance the implementation of the Strategic Plan for Biodiversity 2011-2020 (Strategic Goal E), urging indigenous and local communities' knowledge and practices to be "respected" and "fully integrated" in conservation initiatives. Furthermore, in the Global Strategy for Plant Conservation 2011-2020 (GSPC: CBD, 2012), two targets explicitly convey the importance of ILK to effectively preserve and manage plant resources sustainably; in particular, relating to the potential contribution of ILK for the effective conservation (Objective II - target 9) and for the sustainable and equitable use of plant diversity (Objective III - target 13). However, not only are these targets extremely complex to measure, with limited information available and low confidence on progress towards ILK integration in conservation initiatives (CBD, 2014; FPP, 2020); but also, despite increases in the international recognition of ILK's importance, targets have not been met as there is little or no evidence of their implementation in national legislations, supporting indigenous people's rights or their actual participation in decision-making processes (CBD, 2020). Reporting on the contributions of indigenous peoples and local communities to the implementation of the Aichi Targets, the Local Biodiversity Outlooks 2 (FPP, 2020: 1) further asserts:

> *"Ongoing disregard of the vital contributions of indigenous peoples and local communities (IPLCs) to biodiversity conservation and sustainable use—including in national biodiversity strategies and action plans—constitutes a major missed opportunity for the United Nations Decade on Biodiversity 2011–2020. This neglect has affected the underachievement of all 20 Aichi Biodiversity Targets, with fundamental lessons remaining to be learnt about securing the future of nature and cultures."*

Indeed, widespread participatory approaches to development have been often expressed in nominal participation (Brondizio and Tourneau, 2016) and the populist rhetoric advocating for ILK's relevance to sustainable development have not always been translated into practice (Agrawal, 1995; Mistry and Berardi, 2016). Chatty and Colchester (2002) describe how participatory approaches tend to rely on passive participation, merely based on informative or consultive approaches (e.g., informing communities and communicating local perspectives to experts), with few adopting functional or interactive approaches (e.g., based on joint analysis and collective action plans) or respecting people's self-determination (e.g., supporting independent local initiatives). Thus, despite the popularity of participatory approaches in sustainable development projects, these frequently fail to take in consideration local institutions and decision-making processes while, in some cases, are even used to justify external decisions (Brondizio and Tourneau, 2016), such that progress towards meeting biodiversity conservation targets has been "inconsistent and hampered by political and economic factors built in to dominant economic, cultural and production models" (FPP, 2020: 5).

Key knowledge gaps remain for understanding the impacts of global SES changes on ILK's reproduction and adaptive capacity (Cámara-Leret et al., 2019; Gómez-Baggethun and Reyes-García, 2013), including changes driven by power differentials between science experts and ILK holders or by ILK's documentation as a static and fixed asset, fostering its appropriation and commodification in new globalized markets (Alexiades, 2009; Greene, 2004). An utilitarian perspective has been often adopted by development projects, which attribute value to ILK based on its significance for biodiversity conservation, sustainable resource management, poverty alleviation or economic development (Alexiades, 2009) — following what Agrawal (1995) calls, 'neo-indigenism'. As argued by Alexiades (2009), this utilitarian approach led ILK's importance to be absorbed by market strategies for economic growth, where cultural diversity in terms of worldviews and knowledge systems supports the continuous development of new commodities and the diversification of new niche markets. Such approaches raise concerns pertaining to ILK's appropriation and commodification, embedding problematic power relations in the articulation of ILK with modern science which foster ILK integration by subjecting it to external validation by science experts (Mistry and Berardi, 2016; Tengö et al., 2017), lead ILK's decontextualization by entailing changes in its uses and applications (Agrawal, 1995; Berkes et al., 2000) and overlook ILK holders' intellectual rights and the consequences of an unequal distribution of benefits (Alexiades, 2009; Greene, 2004).

Assuming ILK's utility can be transmitted as an 'object' from local communities to science experts ignores the complex sociocultural and historical dynamics tied to its reproduction, where focus on ILK's preservation through documentation does not ensure the necessary conditions for maintaining its adaptive capacity nor traditional modes of reproduction (Berkes et al., 2000; Ellen and Harris, 2000). As such, flows of knowledge between 'peripheral' and central 'cores' of society entail multiple challenges related to the representation of ILK holders and impacts on ILK's reproduction processes that need to be addressed (Alexiades, 2009; Mistry and Berardi, 2016). As argued by Tengö et al. (2017), critical challenges in ILK articulation with scientific knowledge include bridging distinct knowledge systems by creating settings for knowledge exchange across different dimensions, namely: (1) engaging diverse actors, through the establishment of effective collaborations between multiple stakeholders (Mistry and Berardi, 2016); (2) involving institutions at multiple levels, to support an equitable distribution of benefits, respecting ILK's intellectual property rights and ILK holders decision-making processes (Alexiades, 2009; Greene, 2004); and (3) develop collaborative processes with meaningful participation in all project stages, addressing power asymmetries and methodological challenges to mobilise, translate, negotiate, synthesise and apply knowledge contributions from diverse stakeholders and interdisciplinary fields (Mistry and Berardi, 2016; Tengö et al., 2017).

Articulating diverse knowledge systems in ecosystem assessment frameworks represents a central research priority to achieve global sustainability goals (Mastrángelo et al., 2019), reflecting ILK's relevance to better understand ecological processes, biodiversity patterns and socio-ecological changes but also to increase the political legitimacy and representativeness of conservation initiatives, as highlighted by the IPBES (Díaz et al., 2018; Tengö et al., 2017), and foster the implementation of international Biodiversity Strategies, as stressed by Local Biodiversity Outlooks (FPP, 2020). In this context, it is crucial to overcome the above challenges by developing both adequate methodologies for bridging distinct knowledge systems through engaging multiple stakeholders and suitable strategies for preserving ILK's adaptive capacity by supporting indigenous and local communities' rights of self-determination over their biophysical, cultural, spiritual and intellectual territories. Therefore, while biocultural diversity research conveys the inextricable entanglements between natures and cultures, it also invites new narratives and partnerships to solve current environmental challenges. In particular, it may inform a biocultural approach to complex socio-ecological systems, supporting consideration for cultural practices, plural values, governance systems and power relationships in ecosystem assessments (Merçon et al., 2019), while calling for the co-development of sustainable and equitable conservation strategies amidst socio-ecological changes (Hanspach et al., 2020).

Then, insights from research in biocultural diversity, along with research in socio-ecological dynamics, contribute to address key knowledge gaps and shortcomings of current ES/NCP frameworks. This informs the development of a theoretical and methodological framework for cultural ecosystem assessments which, based on participatory and relational approaches, seek to convey the context-specific entanglements between people and nature in a changing world.

3. THEORETHICAL FRAMEWORK AND METHODOLOGY

> *"Social ecology is based on the conviction that nearly all of our present ecological problems originate in deep-seated social problems." (Bookchin, 2007: 19)*

The previous sections enable to grasp and contextualise the critical limitations of current ecosystem assessment frameworks, revealing the wider implications of dismissing cultural variables from socio-ecological analysis while, simultaneously, suggesting pathways to address and overcome the inherent shortcomings of dualistic representations. The contributions of both biocultural diversity and socio-ecological systems research convey the inextricable entanglements between people and nature, yet in distinct ways: the former, highlighting the co-evolutive processes and sociocultural variables, including values and knowledge systems, which mediate the co-production of the environment and the contextual expressions of human–environment relationships; and, the latter, stressing the complex nonlinear and adaptive dynamics of coupled social and ecological systems, where multiple interdependences and feedback processes may either support the system's resilience to socioecological changes or lead to catastrophic regime shifts. As such, if the former comprises mostly empirical and place-based research, with biocultural approaches being called to move from describing the co-production of nature and culture to co-develop sustainability solutions (Hanspach et al., 2020), the latter constitutes a mostly theoretical body of knowledge, which still lacks engagement with the empirical and context-specific dimensions of socio-ecological systems (Fischer et al., 2015).

Then, because ecosystem assessments articulate a theoretical and empirical analysis of human–environment relationships, assessment frameworks may greatly benefit from integrating insights from these two bodies of research while, simultaneously, reframing assessment frameworks may contribute to address their current shortcomings. Following biocultural diversity research, local articulations of 'natures' and 'cultures' convey the role of cultural variables mediating human–environment relationships, stressing the relevance of moving beyond discrete categories in nature:culture dichotomies by extending culture to embrace nature and *vice-versa*. This notion invites assessments to reimagine human–environment relationships not as occasional interactions between separate domains but rather as continuous and mutually constitutive ecological processes, taking place in the 'contact zones' between multiple species (Haraway, 2008). Simultaneously, understanding the context-specific entanglements between people and

nature may assist ecosystem assessments to consider the empirical and contextual manifestations of complex socio-ecological dynamics, including embedded feedback processes and self-regulation mechanisms. Then, developing a biocultural and relational approach to ecosystem assessments may contribute to advance knowledge of actual socio-ecological systems while harnessing assessments' capacity to inform conservation responses may assist the co-development of adequate strategies for the conservation of biocultural diversity.

These insights support a paradigm shift in ecosystem assessment frameworks, namely by: (1) renouncing to monetary valuations based on notions of substitutability, which foster new markets for the appropriation and commodification of nature, to rather embrace pluralistic valuations focusing on the relational values that guide human–environment relationships; and (2) rejecting dualistic conceptualizations of nature and culture, reproduced in ill-informed top-down strategies based on removing people from conservation and nature from development projects, to rather acknowledge the constitutive, reciprocal and dynamical interdependences between people and nature to inform effective community-based conservation strategies.

This entails recognizing the role of culture mediating human–environment relationships by placing cultural practices, values and benefits at the core of ecosystem assessment frameworks. Integrating insights from biocultural diversity and socio-ecological systems research in assessment frameworks may contribute to address some of their most critical limitations, improving assessments' overall validity and representativeness while contributing to address current knowledge gaps in sustainability sciences (Fischer et al., 2015; Hanspach et al., 2020; Mastrángelo et al., 2019). Ultimately, combining approaches, rather than picking one or the other, may advance knowledge and foster better informed solutions to environmental challenges. As such, by rendering insights from the distinct bodies of knowledge discussed in the previous chapter, the following sections advance the theoretical, analytical and methodological framework of the present thesis, discussing how cultural ecosystem assessments may contribute to bridge diverse worldviews, values and knowledge systems as well as enhance the understanding of complex socio-ecological dynamics to inform more equitable and effective conservation responses.

3.1 THEORETICAL FRAMEWORK: Culture in Socio-Ecological Systems

In ways analogous to the attributes of biodiversity (Noss, 1990), SES complexity pertains to its composition (i.e., constitutive human and non-human elements), structure (i.e., the type and

distribution of interactions) and functional processes (i.e., emergent dynamics and behaviours). Because SES are nested systems, these dimensions should be also considered across multiple levels (e.g., species, ecosystem and landscape) and spatial scales (e.g., local, regional and global). Such approach is consistent with understanding SES as a complex dynamical network — or *rhizome-like* structure in Deleuze and Guattari terms (1987: 3-29) — following a social ecology perspective where human societies are part of wider ecological communities and environmental challenges cannot be dissociated from the corresponding social challenges (Bookchin, 1982). In this context, following an inclusive understanding of culture (Milton, 1996; Mitchell, 2000), cultural ecosystem assessments go beyond the notion of 'cultural services' and are rather concerned with characterizing the typology and distribution of human–environment relationships, contingent on their cultural, social and political contexts. Then, by unveiling affiliated worldviews, relational values and knowledge systems as well as their social distribution, cultural ecosystem assessments may simultaneously enable the understanding of context-specific SES dynamics and contribute to address actual knowledge gaps in SES research.

As posed by Bascompte (2009: 416), "biodiversity research typically focuses on species richness and has often neglected interactions". Such tendency is found across disciplines, linked to reductionist epistemologies, where the understanding of nature reflects a pursuit of objectivity built upon the assumption that knowledge is independent from the relationship established with the 'thing' known (Ellen, 1996) and natural elements are defined by an inner essence, or intrinsic constitution, not affected by their interactions nor dependent on their contexts (Ingold, 2011). These "ideological doctrines of disembodied scientific objectivity" (Haraway, 1991: 184) led the decontextualization of living organisms from their environments (Hall, 2011), historically hindering the holistic and systemic understanding of ecological communities. Yet, the heterogeneity and connectivity of elements in complex networks are key variables affecting the system's overall stability, resilience and vulnerability to change (Scheffer et al. 2012) — i.e., SES dynamics are determined by both its elements' characteristics and their interactions' type and distribution (Bascompte, 2009; Scheffer et al., 2012). Such interactions embed flows (e.g., resources or information), define feedback loops (e.g., indirect drivers of change) and ultimately determine overall SES dynamics, including attributes of resilience and regime shifts (Scheffer, 2009). In a world increasingly globalized, such interactions must be considered within and across SES levels but also across regions (Ostrom, 2009).

Therefore, to enhance global SES resilience and avoid unpredictable regime shifts, it is crucial to embrace the relational complexity of multispecies assemblages by understanding the structure and dynamics of their constitutive interactions at distinct organizational levels and spatial-temporal scales. This requires identifying the variables (i.e., structures or processes) that may adequately characterize human–environment relationships, i.e., the interactions themselves along with the elements or subsystems that compose each SES.

As posed by Loft et al. (2016: 90), these structures and processes are emergent "hybrid constructs" pertaining to both social and ecological elements, arising from interactions between human and non-human entities. Ostrom (2009) advances a framework for SES analysis comprising four major subsystems (namely resource systems, resource units, users and governance systems) along with several processes and activities that may characterize interactions (e.g., deliberation processes, information sharing and investment activities). Hummel et al. (2011) systematizes these by suggesting four main structures that mediate human–environment interactions, namely (1) resource management practices, (2) knowledge on resources and interactions, (3) social institutions governing resource use, and (4) technology used to exploit resources (see also Loft et al., 2016; Mehring et al., 2017). In ecosystem assessments, a relevant example is the conceptual framework for CES advanced by Fish et al. (2016), where human–environment relationships are characterized by cultural practices (i.e., recreational, creative, productive and consuming activities) which, being affiliated to environmental spaces, assist the reproduction of cultural benefits (i.e., identities, experiences and capabilities) and cultural values (i.e., principles, norms and preferences). Due to its established role in ecosystem assessments (e.g., UK National Ecosystem Assessment, see Church et al., 2014), the latter framework is particularly significant for the present study, particularly informing its focus on cultural practices, values and identities.

Because 'cultural services' concern the context-specific dimensions of human–environment relationships, these are strategically placed to enable SES analysis in ecosystem assessment frameworks — see Fig. 3.1. Here, culture is understood as an ecological process, in the sense that culture is both the way people interact with their environments, to sustain their livelihoods, and the way people adapt to their environments, producing knowledge and meaning (Milton, 1996). As such, drawing on the significance of culture discussed in the previous section, sociocultural variables may reflect the role of culture mediating human–environment relationships and represent processes of co-production and co-evolution with the environment. Embracing both its interpretative and materialist expressions, relevant sociocultural variables should reflect

the symbolic meanings and land management practices affiliated by people to particular environmental spaces, including their worldviews, knowledge systems and relational values along with economic, religious and recreational activities but also the social structures and power relationships influencing those (Milton, 1996; Mitchell, 2000). Such variables may embed the ecological role of culture, as people's influence on and perception of ecological processes, and assist characterizing the context-specific cultural, social and political dimensions of human–environment relationships — in their systemic, historical or ephemeral manifestations.

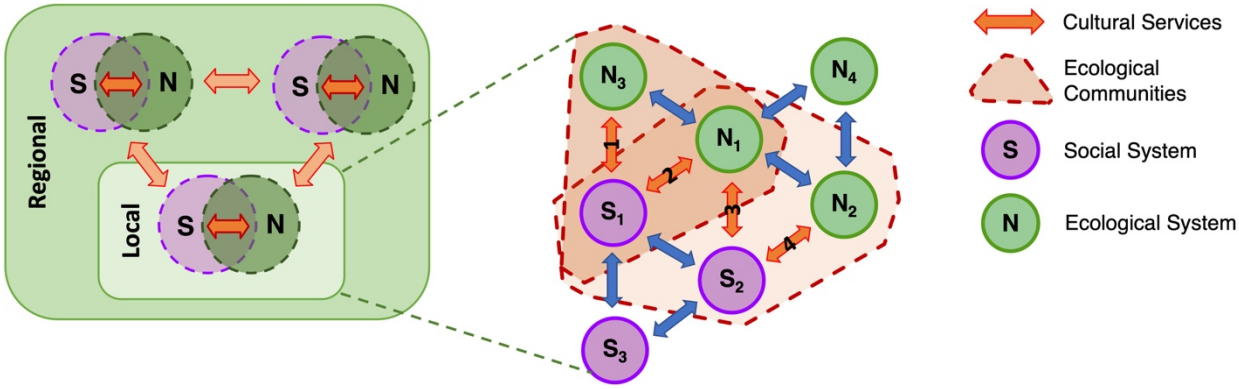


Figure 3.1 - *Graphical representation of socio-ecological systems with interactions, in orange, representing human–environment relationships, or cultural services, in the entanglement between the social and ecological systems (left). Other interactions between distinct social (Si) or ecological elements (Ni) are depicted in blue. On the left, the figure portrays SES at various scales illustrating their open and constitutive overlapping and, on the right, represents details of a complex network of interacting social and ecological elements. Examples of ecological communities are surrounded by red dotted lines. Social and natural elements may represent different organizational levels within the system, such as N_i corresponding to species, ecosystems or landscapes, and S_i corresponding to communities, social groups or institutions.*

As previously discussed, CES expose fundamental limitations of the ES framework and may provide a ground for challenging dominant conservation and environmental management paradigms, conveying the role of cultural diversity and social inequity in manifesting divergent ecological strategies. CES represents context-specific and dynamical processes, which may be subject to multiple feedback loops, including direct and indirect drivers of change, across diverse temporal and spatial scales (e.g., Berkes et al., 2000; Ellen and Harris, 2000). Thus, to

enable SES analysis in ecosystem assessments, these social structures and cultural processes must be systematically considered. Only then, ecosystem assessments may foster environmental justice and inform both effective and adequate responses to actual environmental challenges. Yet, CES inherent characteristics require a focus on qualitative rather than quantitative approaches (Chan et al., 2012; Fish et al., 2016; Tengberg et al., 2012), while its marginal placement in the ES/NCP frameworks — arising precisely from their limited conceptualization of entanglements between people and nature — require reframing CES understanding in terms of broader cultural ecosystem assessments. This entails the need to develop adequate analytical and methodological tools to assist comprehensive and systematic cultural ecosystem assessments.

3.2 ANALYTICAL FRAMEWORK

Developing culturally adequate tools for CES assessment requires embracing the sensorial, embodied and storied dimensions of human–environment relationships, through which cultural practices, values and benefits are reproduced, while also exploring how these are embedded in wider cultural, political and storied landscapes. Following Pink (2009), ethnographic research entails engaging with the means of knowledge production and reproduction held by local communities in relation to their dwelling landscapes. As their ways of knowing constitute and inform their ways of living, their epistemological stances cannot be dissociated from their ontological realities (and *vice-versa*), such that to acquire knowledge about the latter is necessary to gain an understanding of local perceptions and modes of knowledge reproduction. This notion is central to participant observation methodologies concerned with local ways of living and knowing (Pink, 2009; Puri, 2011), being intimately linked to debates on knowledge systems and environmental perceptions (e.g., Ingold, 2011; Tilley, 1994).

These notions inform the analytical framework for CES assessment, depicted in Fig. 3.2, which guide the present research. Adopting reflexive modes of engagement with research places, this framework follows a relational approach to human–environment relationships based on exploring their sensorial (e.g., perception and interpretation), embodied (e.g., practices and places) and storied (e.g., narratives and discourses) dimensions. These reflect often implicit rather than explicit modes of engagement with the environment while, because they are interdependent, narratives may convey local perceptions and assist the interpretation of embodied practices and sensorial experiences. These relational dimensions are consistent with local modes of reproducing knowledge, preserving information and meaning in collective memories (Kane, 1998;

Santos-Granero, 2005; Tilley, 1994), while open the research to a cultural understanding of both perception and experience (Pink, 2009; Ingold, 2000).

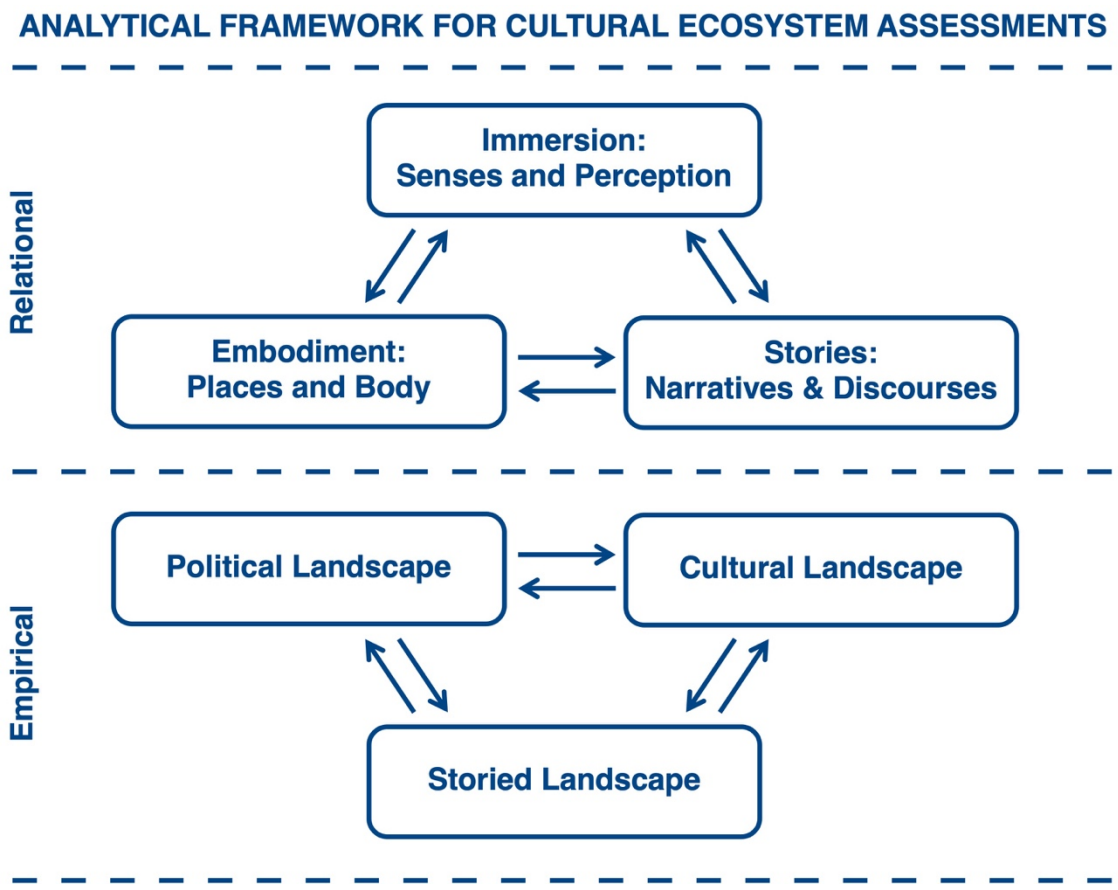


Figure 3.2 *- Analytical framework for Cultural Ecosystem Assessments portraying the relational (e.g., personal) and empirical dimensions (e.g., collective) of human–environment relationships. Immersion reflects the sensory experiences, including perception and interpretation of the environment. Embodiment refers to the modes and practices through which places and landscapes are perceived. Stories reflect the articulation of experiences through narratives and discursive practices, including those assisting knowledge reproduction. These relational dimensions manifest to variable degrees in the empirical dimensions of human–environment relationships, which are embedded and comprise cultural, political and storied landscapes.*

Sensorial experiences, embodied practices and the narratives that make sense of those convey processes of cultural reproduction, which are central to the understanding of how people form their identities, experience the environment and reproduce knowledge (Ellen et al., 2013). The

transmission of knowledge is a social, participatory and embodied process that, more than just relying on passing on a set of representations, also involves the introduction to contexts that provide the opportunity for specific experiences (Ellen et al., 2013; Pink, 2009: 25-71). As such, sensorial and embodied experiences reproduce local modes of understanding the world, following that perception and interpretation are not separate activities but rather different aspects of the same activity — the experience of a whole organism immerse in the world (Ingold, 2000: 157-171). Then, to engage with processes of knowledge reproduction requires addressing the sensorial experiences and embodied practices through which knowledge is produced (i.e. which inform how human–environment relationships are established and managed) while, to understand people's perception of their environments and the influence of wider social contexts, it is fundamental to pay attention to the narratives and discourses used to make sense of those particular practices, experiences and places (Ingold, 2011; Tilley, 1994).

Considering the sensorial, embodied and storied dimensions of human–environment relationships is consistent with the processes through which historical and collective memories are transmitted, particularly in both literate and non-literate societies. Santos-Granero (2005) describes three modes through which information is traditionally kept and reproduced, namely through: (1) oral tradition, including mythology and related narratives but also non-mythological narratives, such as folklore, historical and personal accounts; (2) embodied practices, pertaining ritual performances but also other cultural practices that provide the context for specific experiences, such as recreational and subsistence activities; and, (3) the inscription in the landscape of collective memories, entailing the association of specific places and landscape features with particular historical events, narratives or practices, for example through naming or erected monuments. As noted by Tilley (1994), Kane (1998: 53-84) and Ingold (2000), the transmission of collective memories plays a central role in the reproduction of local knowledge systems, being linked to the reproduction of identities, their cultural heritage, the social construction of a sense of place and the strengthening of social cohesion.

Nonetheless, consistent with reflexive research practices, understanding human–environment relationships also requires engaging with notions of perception (Pink, 2009: 25-50). As argued by Ingold (2000), the environment is revealed through an active process of engagement, involving both mind and body, rather than constructed by perceptions passively received. Following Merleau-Ponty (1962), the body is not a mere physical object but rather intelligent, such that consciousness and knowledge are not independent of the body but rather embodied. Sensation is then central to perception and can only exist in relation to a body of knowledge. Yet, as

argued by Howes and Classen (2013: 1), "the way we use our senses, and the ways we understand and create our sensory world, are shaped by culture". Perception is then informed by the personal significance of a sensation but also the social values it carries, being linked to cultural categories that give meaning to sensory experiences which, simultaneously, are integral to the production of those same categories (Pink, 2009: 32). Intellectualised societies, for example, may withdraw from many aspects of direct sensation by favouring vision and devaluing other senses. Simultaneously, environmental features may also impose a "reorganisation of sensibility" (Hirsch, 1995: 21): as in dense forest environments, for example, what is visible becomes *per* definition what is close and the 'visible' landscape becomes a soundscape, where hiddenness is not a form of invisibility but inaudibility. Then, defining perception as the information gathered by the senses together with the interpretation or meaning attributed to these (Ingold, 2000: 157-171; Pink, 2009: 25-50), makes relevant engaging with a phenomenological approach to space and place as the context of human experiences and, particularly, of human–environment relationships.

To embrace the relational dimensions of human–environment interactions within their broader socioecological contexts, the analytical framework for cultural ecosystem assessments advanced here adopts an empirical approach to human–environment relationships based on exploring the processes through which these co-produce, constitute and are embedded in wider cultural, political and storied landscapes — again, see Fig. 3.2. Human–environment relationships are situated both on the physical bodies that take part in interactions and in the places that are co-produced by and enable such interactions (Cresswell, 2004; Hirsch, 1995). Thus, notions of space and place are useful to understand human–environment relationships in the context of the particular landscapes which sustain and manifest those (Mitchell, 2000). This means to articulate the relational dimensions of human–environment relationships, linked to sensory experiences and embodied practices, with the constitutive processes through which landscapes are co-produced, reproduced and contested — in the entanglement between humans and more–than–humans.

According to the European Landscape Convention (2000), "Landscape means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (*in* Thompson et al., 2013: 1). As such, observing the landscape and its work provides a window into the cultural and political processes embedded on it (Hirsch, 1995; Mitchell, 2000). Sauer (1925) particularly influenced this conception, showing how the rise and fall of different cultural features would constantly recreate dwelling places, while gradually

carving layers of distinct influences and meanings in the landscape. Here, movement through the landscape reveals it to the observer, bringing different places in relation to each other along the network of paths that connect them. According to Tilley (1994), space exists then as a set of relations between places, being created by the social relationships established with natural and cultural elements, which become embedded in the landscape. Moreover, as human experience is inseparable from place, places constitute centres of symbolic meaning. Places are then simultaneously 'internal' and 'external' to the subject (Tilley, 1994), while the experience of place is socially constructed through processes that make space meaningful (Gupta and Ferguson, 1992). For Massey (2005: 9-15), places are spatial-temporal events, involving the coming together of different processes rather than things. Thus, these are constantly changing and being redefined, despite remaining consistent enough to allow re-visiting, establishing and maintaining multiple relationships (Pink, 2009: 37). In this context, the environment is not the mere surrounding of organisms but a zone of entanglement, not exclusively internal nor external but processual and relational.

In those zones of multispecies entanglements, the cultural landscape is co-produced by embodied practices, including subsistence and recreational activities, but also by the symbolic meanings affiliated to both those practices and the landscapes that sustain them, including their specific habitats and ecosystems. Here, over time, "the rhythms of the land and the seasons correspond to and are worked into the rhythms of life" (Tilley, 1994: 26), such that human–environment relationships become embedded in the landscape and life and death exchanges, for example, become part of a complex play between the visible and invisible, the background and foreground of the living landscape (Hirsch, 1995). These exchanges often entail the establishing of complex kinship relations with the land (Gow, 1995), where personal and cultural identities become attached to place, as places gather processes of social reproduction which give rise to a sense of place and belonging (Tilley, 1994). Yet, the attempt to generalize a linear relation between cultural identity and place tends to overlook the different layers of sedimented meanings, such as overlaps and exchanges between distinct cultural groups, that resist and contest their own categorization (Gupta and Ferguson, 1992).

Constituting a political landscape, social and power structures regulate the reproduction of knowledge systems, symbolic meanings and embodied practices, affecting how place and space are realized, by whom and when (Gupta and Ferguson, 1992). Regulations and prescribed behaviours, conveyed by shared social values or enforced by power differentials, may restrict the

participation in spatial experiences and the access to places to individuals of certain class, gender or lineage. In this context, processes of co-production of the landscape involve interactions, exchanges and negotiations between distinct social groups, both locally and across various spatial scales. Comprising multiple inward and outward flows, such exchanges embed political discourses and cultural meanings (Pink, 2009: 40) which influence the reproduction of cultural practices, benefits and values — or CES in its broader sense — and may include the de/reterritorialization of distinct modes of existence, relationalities and multispecies affinities. Ultimately, those flows and exchanges represent social processes of place-making which, far from static, become "embodied practices that shape identities and enable resistances" (Gupta and Ferguson, 1997: 6). As such, social and power structures become embedded in the spatial organization of a landscape and shape their associated flows (Cresswell, 2004; Mitchell, 2000).

Yet, places and landscapes are also made meaningful through narratives and discourses, which convey and constitute their storied landscape (Ingold, 2011; Tilley, 1994). As posed by Tilley (1994: 33), "places help to recall stories that are associated with them, and places only exist (as named locales) by virtue of their emplotment in a narrative" — responsible for converting space into place. Moreover, through narratives and discourses, the places of here-and-now may expand in time and space, recalling their history and geographical connections by revealing ongoing relationships with past events, other places or even distant horizons (Gow, 1995). In this context, the movement through the landscape is also a movement through spatial-temporal experiences, reflecting personal and historical memories, where knowledge exists in relation to a narrative of events (Ingold, 2011). Then, the landscape conveys particular modes of existence and coexistence as a form of tangible built environment but also as a form of representation, which embodies the emergence, transformation and vanishing of cultures, their history of domination, oppression and subjugation, along with their works, struggles and exchanges (Mitchell, 2000: 93-121).

Still, an important distinction must be drawn between narratives and discourses (Currie, 2016), as the former conveys a discursive articulation of events and experiences while the latter represents those to specific contexts and with particular intentions, conveying prescribed behaviours while holding the power to represent and set dominant meanings. Therefore, like the relational dimensions of CES analytical framework, also the empirical dimensions are interdependent and, if the "art of understanding of place, movement and landscape must fundamentally be a narrative understanding" (Tilley, 1994: 31), situated narratives may convey not only the

storied but also the cultural and political landscapes affiliated to human–environment relationships.

Situating embodied practices, contested meanings and storied narratives in the landscape enables a spatially explicit approach to CES assessment, conveying the wider cultural, political and storied landscapes which human–environment relationships constitute and in which these dwell. A landscape approach to the empirical dimensions of human–environment relationships assists revealing diverse modes of cultural reproduction, including the collective and historical processes of co-production of the environment (Hirsch, 1995; Ingold, 2000), the social and power structures which shape and constrain those (Gupta and Ferguson, 1992; Mitchell, 2000) as well as the narratives and discourses that articulate and make sense of those processes, places and landscapes (Gow, 1995; Ingold, 2011; Tilley, 1994). Moreover, while two-dimensional cartographic maps remove any participation from their topology, the spatial distribution of cultural practices, meanings and narratives constitute multidimensional maps which embody the memories and manifestations — not only through knowledge but action, concern and relational power — of multiple historical and current relationalities (Tilley, 1994). These dimensions represent modes of social and cultural reproduction which, in contrast with two-dimensional maps, have the power to transform abstract space into place (Cresswell, 2004; Hirsch, 1995; Tilley, 1994).

3.3 METHODOLOGICAL TOOLS

The present thesis follows an interdisciplinary approach, weaving natural and social sciences while adopting a mixed methods approach, based on both qualitative and quantitative research, to investigate the context-specific dimensions of human–environment relationships in diverse cultural and geographical settings. Following an ethnographic approach (Bryman, 2008), the research seeks to gather in-depth insights on people's perceptions and ways of living by further developing a participatory research approach (Newing, 2011) which, adapted to the research context, strongly relies on participant observation, narrative analysis and reflexivity, while enquiring into people's particular modes of co-production of the landscape (Hirsch, 1995; Tilley, 1994). The research does not seek a comparative analysis of assessment practices but rather, taking in account the current limitations of ES/NCP frameworks, to gather insights from two contrasting case-studies representative of contexts generally overlooked in cultural services assessments (Milcu et al., 2013): first, in the Peruvian Amazon, with two different ethnic groups whose ancestral territories lie in the luxuriant but threatened Amazonian rainforest; and, second,

on Ascension Island, with the multi-ethnic provisional communities of this isolated and mostly barren island of the South Atlantic.

Because cultural expressions are inherently interpretive, being invested with subjective meanings and shaped by social contexts (Bryman, 2008: 27-32), the methodology adopted complies with established social sciences methods to explore the diverse expressions of human–environment relationships embedded in distinct cultural, political and storied landscapes. Moreover, to minimize the influence of culturally biased preconceptions, this thesis embraces a reflexive approach on the positioning of the researcher by adopting an inductive research process inspired on grounded theory (Bryman, 2008: 567-575), to investigate the empirical manifestations of human–environment relationships in distinct socio-ecological contexts. Ultimately, the present research reflects an understanding of "culture as life expressed in situ" (Fish et al., 2016: 3), adopting a phenomenological approach to human experiences of place (Tilley, 1994) by considering the embodied practices and symbolic meanings which constitute and reproduce people's dwelling landscapes (Hirsch, 1995).

Such approach is in accordance with the conceptual framework for cultural ecosystem services advanced by Fish et al. (2016), which emphasizes the cultural practices articulated in and through particular environmental spaces; while, influenced by Sauer (1925), understands human–environment relationships as embedded in and constitutive of wider cultural and political landscapes (Hirsch, 1995; Mitchell, 2000), which are revealed and made meaningful through the narratives and discourses linked to them (e.g. Tilley, 1994). These theoretical contributions have been already discussed in the theoretical and analytical framework of this research, presented in previous sections. Therefore, here, I will focus on how these theories inform the chosen methodological approach and enable to explore diverse dimensions of human–environment relationships, while the specific methods used in each case-study are fully detailed in each empirical chapter.

This study's ethnographic approach relies on three complementary research methods: participant observation (Puri, 2011), narrative analysis (Bryman, 2008) and, due to the central role of the researcher, reflexivity (Watson, 2011). These were adapted to the research context by being further combined with a range of complementary methods, including semi-structured interviews, questionnaires, focus groups, participatory mapping and structured observations (Bryman, 2008; Puri, 2011b), concerned with gaining an *emic* understanding of participants' ecological perceptions and ways of living. Here, respecting local modes of knowledge reproduction

and social organization was particularly relevant to inform the choice of methods in each research context (Pink, 2009), considering differences between literate and non-literate societies but also reflecting a concern for potential biases and power relations influencing the research and my relation with participants.

By adopting an ethnographical approach, the study relies on the researcher's immersion in the social and cultural settings studied for a sustained period of time (Bryman, 2008). Here, more than drawing on ethnographical writing, the research emphasizes the relevance of participant observation to disclose the distinct dimensions of human–environment relationships since, by combining structured observations with active participation on people's ways of living, it enables an in-depth perspective of local cultural, economic and political contexts (Puri, 2011). By documenting those experiences, participant observation aims to describe "how and why people do what they do" (ibid.: 86), supporting the understanding of people's relationships with their environments, including their articulation of various perceptions, experiences and activities along with the regulations, norms and motivations that guide those (Bryman, 2008; Pink, 2009). As such, the research also entailed walkabouts with informants to relevant environmental spaces, including landmarks, agricultural fields or other sites; engaging with the community's daily routines of cultural and economic practices, as farming, fishing or eating; participating in both formal and informal social gatherings, as local festivities and communal activities; and, through either informal conversations or in-depth semi-structured interviews, inviting participants to share their views on the significance of particular practices, environmental features or related discourses. This enabled to disclose local modes of managing resources and reproducing ecological relationships, including their variation within and across diverse social groups, while supporting the researcher in gaining appreciation for the sensorial experiences, embodied practices and empirical knowledges that constitute and shape people's perceptions of their dwelling landscapes.

To realize the significance of people's ecological relationships in local terms, the present research focused on the analysis of situated narratives by gathering personal, historical and mythological accounts pertaining local environmental spaces, elements or features. Narratives are a discursive articulation of experiences, comprised by a sequence of events (i.e., a story) told from a certain point of view (i.e., the storyteller) (Tilley, 1994). Narratives are fundamental means of knowledge reproduction (Ingold, 2011), conveying the historical events, empirical experiences and symbolic meanings affiliated to people's dwelling environments (Kane, 1998; Tilley, 1994). Storytelling, and particularly oral tradition, enacts the collective memories that

link people to place (Gow, 1995; Santos-Granero, 2005), carrying the meanings that may transform space into place and on which the understanding of the landscape fundamentally relies (Tilley, 1994). As discursive practices, narratives might be also considered to constitute and reproduce people's social and ecological relationships (Bryman, 2008), being tightly connected to the discourses that convey their intentional articulation to set meanings in social contexts. In this context, the research carried a structural, functional and thematic analysis of local narratives (Allen, 2017), overtly and intentionally gathered during informal conversations or in-depth interviews with informants, focusing on people's relation to their dwelling environments. The analysis explored by coding the narratives' main plot elements, motifs and purposes along with the ways their discourses enacted and reproduced local human–environment relationships. Then, narrative and discourse analysis supported revealing the local significance of cultural practices, landscape features and ecological relations, in ways which respected local modes of knowledge reproduction and, combined with participatory mapping, enabled the spatially explicit assessment of cultural practices, values and benefits.

Particularly in the context of qualitative cross-cultural research, the practice of reflexivity is crucial to ensure the research's reliability and address potential biases, or conflicts of interest, carried by the researcher when interpreting research subjects, analysing data, reporting results and developing theory (Koot et al., 2020; Twyman et al., 1999). Research places are not the same as the actual experienced places, as the former results from the researcher's interpretation and representation of the latter, entailing, as posed by Pink (2009: 48), the "interweaving of theory, experience, reflection, discourse, memory and imagination". As such, my positionality in terms of my own worldviews, theoretical stances and personal background; my positioning towards participants and the research project context, including patrons, key informants and gatekeepers; the local community's perceptions and expectations towards myself, as a researcher; and my own awareness of and adaptation to local norms and social contexts; were all aspects that I, as a researcher, had to attentively navigate throughout all case research, acknowledging their potential for profoundly impacting the research process, including who participates on the study, what information they share and how this was interpreted and conveyed in the study (Holmes, 2020; Watson, 2011). Thus, to investigate the context-specific dimensions of human–environment relationships required questioning the cultural bias, social structures and power relationships that could influence research interactions and their interpretation. To address these influences, the present thesis contends that reflexivity requires carefully adapting to local social norms while engaging with local modes of knowledge reproduction through sensorial, embodied and discursive practices to assist the understanding of local unique perspectives

(Pink, 2009: 11-12); while, simultaneously, the research adopts an interpretive and constructivist approach, recognizing the researcher participation in the co-production of research places and acknowledging that results always present a specific and subjective rather than definitive and objective version of the social reality studied (Bryman, 2008: 27-34).

Additionally, the research sought to minimise the influence of the researcher's own cultural biases and theoretic preconceptions by performing an iterative research process, influenced by a grounded theory approach (Strauss and Corbin, 1998), interweaving the processes of data collection and analysis. As such, during fieldwork, the coding of empirical observations informed the formulation of general categories (e.g., aspects of human–environment relationships) which, supporting the formulation of hypotheses (e.g., relations between those aspects), were then tested through further data collection, until reaching theoretical saturation (Bryman, 2008: 567-575). This was particularly relevant in the context of the Peruvian Amazon research, due to its contrasts with my own cultural background; while, due to the chronology of fieldwork, moving from the Amazon to Ascension research, it enabled testing and reformulating hypothesis in distinct research contexts, to support the development and refinement of both substantive and formal theoretical insights. This iterative process informed the development of a conceptual and analytical framework for cultural ecosystem assessments, guiding the case research on the dimensions of human–environment relationships relevant to ecosystem assessments, their diverse possible expressions in distinct settings and how to best represent those in assessment frameworks.

Nonetheless, the researcher' reflexivity required also attentive adaptation to research contexts, local social norms and modes of knowledge reproduction. Then, in the Peruvian Amazon, the research emphasised the study of local narratives (Ingold, 2011), respecting local norms and modes of knowledge transmission (Smith, 2008); while, instead of seeking only individual consent, held focus groups with local communities to convey the study's objectives, obtain informed consent, discuss the research design and designate participants, respecting local communal decision-making processes. On Ascension Island, the research focuses on semi-structured interviews centred around a questionnaire (Newing, 2011), concerned with representing diverse groups of Ascension's population; while, along with an article in the local newspaper, approached key local organizations and social gathering places to obtain informed consent, convey the study's objectives, inform the research design and select participants, reflecting how local social structures mediate the access to participants. In both cases, informed consent was then obtained, in all instances, also by individual participants. As such, the research approach

reflects a participatory methodology, concerned with developing collaborative research processes that communicate and support local people's perspectives and concerns (Newing, 2011: 14-15), whenever possible, by including the views of local communities in the research design and data analysis processes as means to inform decision-making and promote 'participatory action research'.

Finally, to ensure the research's validity and reliability (Bryman, 2008: 389-399), the research applied both a theoretical and snowball sampling approach (Newing, 2011; 65-82), relying on a purposive sampling strategy by intentionally seeking participants relevant to the research questions, such as those considered to master certain cultural practices or with exceptional access to certain environmental spaces while diversifying in participants' gender, age and social status. In this context, the research process involved seeking respondent's validation in numerous instances; performing triangulation through cross-checking information with multiple informants and data sources; and pursuing, as much as possible, the representation of different perspectives within the same social setting. Moreover, abiding to quality criteria for qualitative research (ibid.: 393) further implied holding throughout the research a commitment to engaging with research subjects in rigorous ways, during data collection, analysis and reporting; seeking transparency in the methodology and theoretical frameworks adopted, through a reflexive stance on their own limitations; and a sensitivity to context, including respecting and adapting to local social norms, being aware of my own positionality and possible ethical issues. Again, the details of how research's validity and reliability was ensured in each case-study are discussed in the next section and fully disclosed in each empirical research chapter.

As such, the present thesis abided by the principles of ethical research (ASA, 2011; Watson, 2011), namely by: (1) obtaining informed consent from all participants individually in the most appropriate way to their social context, allowing time for the consideration of research implications, renegotiating consent whenever necessary and disclosing my presence and purpose in all relevant situations; (2) ensuring no harm was inflicted to participants, preserving their confidentiality and anonymity, reflecting on the likely impacts of the research to the communities studied and, whenever possible, seeking a fair return for their assistance through the principle of reciprocity and mutual benefit; (3) respecting participants rights, interests, values, sensitivities, privacy and safety by carefully considering potential power differentials, ethical issues and conflicts of interest throughout the research, from data collection to publication; (4) recognizing that research entails personal and moral responsibilities primarily towards the communities studied, gatekeepers, participants and their wider ecological communities, but also to sponsors,

advisors, assistants and other members of academic institutions, which require establishing relationships of trust and reciprocity that do not end with the completion of fieldwork nor the research project.

Ultimately, this methodological approach enabled to explore different dimensions of human–environment relationships, disclosing the collective articulations of diverse cultural practices, relational values and knowledge systems while reflecting an understanding that, besides being always contested and continuously reshaped, culture is inextricably linked to the social, economic and political spheres of society (Mitchell, 2000: 3-36). Following an interpretivist approach (Bryman, 2008: 28-31) which recognizes the subjective meaning of both social and natural worlds, emphasis is placed on attempting the understanding rather than explanation of local human–environment relationships in terms of local people's perceptions, knowledges and values. Yet, like in any research, this methodological approach holds limitations.

First, by adopting an ontological and epistemological constructivist approach (ibid.: 33-34), the study acknowledges that cultural and social phenomena are always under construction, debate and revision; further recognizing that researchers are involved in the co-production of research places and, therefore, that the research necessarily presents a specific rather than an universal or definitive perspective of the phenomena studied. This positioning carries intrinsic limitations for this study's replicability, yet such limitations are considered inherent to interpretive research and, while the research's quality is warranted, do not comprise the validity, reliability and applicability of its results. Second, concerning generalization, the present study's findings can be considered representative of their own social settings but, while not corresponding to definitive nor universal perspectives, theoretical inferences based on these shall never generalize to entire populations but rather to theory (Bryman, 2008: 406). Here, the study's findings may be considered instances of a broader set of possible manifestations of human–environment relationships. Therefore, a *moderatum* generalization (Williams, 2000), based on representative instances, still offers enough supporting evidence on the potential relevance of certain context-specific dimensions of human–environment relationships that have been generally neglected in ecosystem assessments frameworks — thus, contributing to address the thesis' research questions.

3.4 STUDY SITES: Peruvian Amazon and Ascension Island

To examine how cultural ecosystem assessments may both reveal the context-specific dimensions of human–environment relationships and unveil actual socio-ecological dynamics, the present thesis followed an inductive approach to explore the empirical manifestations of those relationships and dynamics in distinct cultural and geographical contexts.

My awareness of current limitations in ecosystem assessment frameworks, particularly their culturally biased approach to human–environment relationships (Milcu et al., 2013; Hirons et al., 2016), led me to seek case-studies that offered disparate historical, cultural and ecological contexts to those of Western societies. This informed the choice of working with indigenous communities of tropical forest environments, leading to a 6-month period of fieldwork in the Peruvian Amazon from June to December of 2016. The specific communal sites and ethnic groups, namely the Shawi communities of Balsapuerto district and the Ticuna communities of Ramón Castilla district, both in Loreto department, were chosen following the respective availability of Formabiap[1] and IIAP[2] members' to be gatekeepers. Still, their territories provide a valuable diversity in cultural, social, historical and even ecological settings.

Only later came out the opportunity to work with the provisional resident communities of a small and isolated island in the South Atlantic, Ascension Island. In early 2019, I was invited there to undertake a cultural services assessment, integrated in a Natural Capital Assessment programme across the UK South Atlantic Overseas Territories, based on a collaboration between SAC[3] and SAERI[4], funded by the UK Foreign and Commonwealth Office. The overall project design provided for one month of fieldwork performing a natural capital survey, with members of Ascension Island government, particularly the Conservation team, and Georgetown main social gathering place, the Saints Club, being instrumental in providing initial access to the local community.

These case studies represented widely distinct socioecological realities which, besides holding in common being both quickly changing, comprised strikingly different ecological, cultural, social, economic, political and historical contexts. These represented also disparate research contexts as, in the Amazonian case, I was to a large extent an independent researcher working

[1] Formabiap, Training Program for Bilingual Teachers of the Peruvian Amazon.
[2] IIAP, Peruvian Amazon Research Institute, Sociodiversity Research Group.
[3] School of Anthropology and Conservation of the University of Kent, Canterbury.
[4] SAERI, South Atlantic Environmental Research Institute.

in collaboration with local communities and organizations; and, in the Ascension case, despite holding considerable autonomy in all research process, I was commissioned to undertake a cultural services assessment within a larger Natural Capital research project. These different contexts required adapting the research process to their specific characteristics, applying distinct research designs and methodological approaches while dealing with distinct social contexts, ethical issues and research constrains. Still, avoiding the risks of generalizing local unique perspectives (i.e., their external validity), the different research approaches to these case studies were embraced as a source of diversity both in terms of the research process and the studied subjects which, not making this a comparative study, provided supporting evidence on relevant context-specific dimensions of human–environment relationships and enabled testing distinct methods to assess those in disparate social research contexts.

The Peruvian Amazon, being a tropical rainforest rich in cultural and biological diversity, presents highly diverse and interconnected multispecies communities with extensive territories historically managed by indigenous peoples. Highly politicized, the Amazonian rainforest and its native communities face nowadays multiple environmental, social and economic pressures, which drive drastic changes in both indigenous ways of living and their ecological communities. Here, Shawi and Ticuna people belong to different linguistic families and share distinct cosmologies, histories and geographies. Shawi settlements sit along tributaries of the Huallaga River, where their ancestral territories mostly comprise mountain rainforest of difficult access to colonial settlers. On the other hand, Ticuna settlements occupy low-land rainforest areas along the main tributaries of the Amazon River, where people faced several forced migrations particularly during the 'rubber boom' (1920-1940's). As such, their territories, identities, histories, economies and livelihoods strategies differ significantly while also face distinct socio-ecological challenges, conferring the Amazonian study with a valuable sociocultural diversity that conveys different perceptions and contexts on human–environment relationships. Moreover, the complexity of Amazonian societies is further stressed by continuous interactions between distinct social groups across regions, representing socioecological systems at various levels while constituting a highly connected and multi-layered network whose contours are constantly under negotiation. Here, respecting local modes of knowledge reproduction, the research emphasized narrative analysis, strongly relying on participant observation, semi-structured interviews and focus groups to engage with the cultural practices and oral tradition of native societies.

In contrast, being a relatively small island, Ascension represents a complex and open but, in many ways, well-delimited socio-ecological system strongly connected to the ocean, which simultaneously opens and encloses it to the world. This remote island comprises a mostly barren volcanic landscape and hosts particularly unique ecosystems, with low species diversity but rich in endemisms, besides a drastic *terraforming* experiment that converted Green Mountain into a tropical rainforest (Wilkinson, 2004). Ascension's strategic geographic position, however, makes it a central node in a globalized world, particularly for military, spatial and communication agencies, historically resulting in multiple inward and outward flows of both people and resources which still drive major changes in its social and ecological communities. Ascension has no native inhabitants but a small temporary multi-ethnic population, mostly consisting of Saint Helenian, British and North American families on fixed-term contracts. As such, Ascension's historical, geographical, social, economic and political contexts provide a uniquely diverse setting to explore human–environment relationships in multi-ethnic communities which embody diverse temporalities and relationalities. Due to these social characteristics and the wider project constrains, the research process emphasized semi-structured interviews, participant observation and participatory mapping while conducting a survey on the cultural practices, values and benefits linked to Ascension's natural environment.

These case studies provide widely contrasting social and research contexts to explore human–environment relationships, supporting the analysis of various socio-ecological dynamics, the testing of adequate methodologies and the development of a consistent and comprehensive framework for cultural ecosystem assessments. Yet, being a European white women and doctoral researcher certainly influenced the settings I had access to and the ways people perceived me during fieldwork in both case-studies, at times to my advantage and others not. For example, as an outsider in the Peruvian Amazon, initially I could only access male informants while, being female, later allowed my participation in women settings. As an European researcher on Ascension Island, I was at first presumed to integrate the British community and side with the government's conservation department, conditioning my access to informants from other ethnic backgrounds and the information they would share, until I was able to clarify those misconceptions (e.g., research purposes and own nationality). In both settings, I was able to crosscheck information in multiple instances and with diverse informants, such that I believe my positioning did not compromise the accuracy and validity of results. Still, it was crucial that I could speak fluently the official languages in both Peru and Ascension (respectively, Spanish and English) to clarify major misconceptions and avoid mutual misunderstandings.

The Amazonian context undoubtedly required a tougher adaptation to local customs, ranging from eating and conversational norms to wayfaring, to gain the trust of participants. This required an extended fieldwork period, with most data collected during its second half. Conversely, the time constraints on Ascension research were balanced by my familiarity with British contexts and by structuring observations around a comprehensive survey. Nonetheless, in both cases, reciprocity meant ensuring that participants' views, perceptions, values and stances were accurately represented and that the research made publicly available respected and supported their best interests along with the ones of their communities and wider environments. Therefore, adapting to local social norms and remaining open to local unique perspectives, including their idiosyncrasies and contested meanings, was crucial to ensure the validity of case research.

4. TALES OF COEXISTENCE: A Cultural Ecosystem Assessment of Storied Landscapes in the Peruvian Amazon

4.1 INTRODUCTION

> *"Ongoing disregard of the vital contributions of indigenous peoples and local communities (IPLCs) to biodiversity conservation and sustainable use—including in national biodiversity strategies and action plans—constitutes a major missed opportunity for the United Nations Decade on Biodiversity 2011–2020." (FPP, 2020: 22)*

Indigenous people manage over 30% of Amazon biome (WWF, 2014), with their territories presenting at least as much biodiversity as protected areas (Schuster et al., 2019). Globally, indigenous and local communities (IPLC) manage at least 50% of world's land surface and, despite only 10% being officially recognised, these territories host most global biodiversity (FPP, 2020; RRI, 2020), estimated around 80% (Sobrevilla, 2008). Since 1992, the Convention on Biological Diversity acknowledges the need to consider IPLCs' "traditional knowledge, innovations and practices" which are "relevant for the conservation and sustainable use of biodiversity" (CBD, 2010; 2014). And, indeed, the relevance of indigenous and local knowledge (ILK) to biodiversity conservation and sustainable resource use is increasingly recognised by intergovernmental bodies, acknowledging the underlying requirement to secure IPLC's land tenure rights (IPBES, 2019; IPCC, 2019). Yet, the corresponding Aichi Biodiversity Target 18, respecting IPLC's knowledge and participation in decision-making processes, have not been met (CBD, 2020) and, arguably, "this neglect has affected the under-achievement of all 20 Aichi Biodiversity Targets" (FPP, 2020).

In this context, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) acknowledges IPLC's role safeguarding biodiversity and emphasises the central role of culture and local knowledge systems mediating local human–environment relationships (Díaz et al., 2018; Tengö et al., 2017), but their systematic consideration in ecosystem assessments still lacks operationalisation. Ecosystem assessment frameworks, such as Ecosystem Services (MA, 2005; Costanza et al., 2017) and Nature's Contributions to People (Díaz et

al., 2018), play a crucial role informing biodiversity conservation strategies and policymaking; yet, traditionally framed around economic valuation processes with focus on environmental benefits, still tend to overlook the cultural dimensions of ecosystems (Chan et al., 2016; Fish et al., 2016; Milcu et al., 2013). This is partially due to Cultural Ecosystem Services (CES) being generally regarded as intangible contributions to human well-being, often considered not suitable for quantitative assessments and difficult to evaluate in a systematic way (Daniel et al. 2012; Hirons et al., 2016; Milcu et al., 2013). As such, CES publications comprise less than 2% of the broader 'Ecosystem Services' (ES) literature[1], while a focus on economic indicators led these to be represented as "leisure-time" based on recreation, tourism and aesthetic values (Hirons et al., 2016; Schaich et al., 2010; Costanza et al., 2017). With more than 70% of CES assessments held on Europe and North America (Milcu et al., 2013), such approach arguably reflects an ethnocentric bias reproduced by the conceptual and methodological limitations of current ecosystem assessment frameworks.

Cultural Ecosystem Services (CES) are placed at the intersection between the social and ecological systems; therefore, these may hold a strategic positioning to question prevalent paradigms by bridging knowledge systems and enhancing consideration of pluralistic values and diverse worldviews in ecosystem assessments (Díaz et al., 2018; Pascual et al., 2017; Tengö et al., 2017). A way forward is to realize the relevance of IPLCs for the sustainability of socio-ecological systems by fostering an epistemological and conceptual shift in ecosystem assessments, towards supporting the conservation of biocultural diversity (Maffi, 2005; Mackey and Claudie, 2015; Rozzi et al., 2018) and the development of participatory environmental governance approaches (Brondizio and Tourneau, 2016; Gavin et al., 2015; Hanspach et al., 2020). As argued by Kareiva and Marlier (2012: 963), an exclusive focus on ecology is "likely to misdiagnose problems and arrive at ill-conceived solutions", so to inform effective conservation strategies and enhance their engagement with diverse human societies, ecosystem assessments should develop culturally adequate approaches to consider the context-specific dimensions of human–environment relationships.

It is widely recognised that storytelling provides an important way by which ILK is reproduced culturally (Kane, 1998; Ingold, 2011a), yet our understanding of the contributions that narra-

[1] Results of Web of Science's search with these keywords, since 1970 to date (22nd July 2019).

tives can make to the practice of ecosystem assessments remains unclear. This chapter investigates the contribution of IPLC's oral tradition narratives in the Peruvian Amazon to the further understanding of local human–environment relationships, exploring the relevance of narrative analysis for cultural ecosystem assessments methodologies. Following a relational approach, the analysis examines how place-based narratives assist ILK reproduction and may constitute complex 'storied landscapes', which convey the symbolic meanings, cultural practices and relational values affiliated by local communities to their dwelling environments. Particularly, it seeks to identify the predominant landscape's elements and leitmotifs in local narratives, to explore their representation in locally significant terms. Then, narrative analysis assists the spatial-explicit mapping of more-than-human territories in cultural ecosystem assessments, disclosing relevant context-specific dimensions of human–environment relationships while bridging knowledge systems and conveying diverse worldviews. As such, this chapter contributes to advance cultural ecosystem assessments' ability to inform biocultural approaches to conservation.

4.2 THEORETICAL FRAMEWORK

Cultural Ecosystem Services

The present study follows the conceptual framework for CES assessment advanced by Fish et al. (2016), approaching CES as the diversity of cultural practices that shape and are enabled by particular environmental spaces and from which sets of cultural goods and benefits are derived. Cultural practices represent interactions between people and their environments, including recreational, creative, producing and consuming activities, which support the reproduction of cultural benefits such as identities, experiences and capabilities (Fish et al., 2016), including knowledge systems, sense of place and their cultural heritage. Moving beyond economic valuations, this study further focus on the social shared values that regulate human–environment interactions (Kenter et al., 2015), conveying the ethical principles, norms and preferences that guide socially prescribed behaviours in relation to others and the environment (Chan et al., 2012; 2016). These may be understood as relational values, "not present in things but derivative of relationships and responsibilities to them" (Chan et al., 2016: 1462), which support a 'good living' (Acosta, 2013; Pascual et al., 2017).

Following an interpretive approach to 'culture', this study considers CES tangible and intangible dimensions as invested with subjective meanings and shaped by social contexts (Bryman, 2008: 27-32), being concerned with the cultural practices, symbolic meanings and knowledge systems that inform local human–environment relationships, shape their biophysical landscapes and assist the reproduction of local ways of living, represented in cultural benefits. By recognizing culture's role mediating human–environment relationships (Ellen, 1996; Milton, 1996), this entails also recognizing ILK as both a conceptual and practical intermediate between the social and ecological systems (Ellen and Harris, 2000). Following Berkes (1999: 1-20), ILK is understood as a knowledge-practice-belief complex which plays a central role on processes of cultural reproduction as well as on the representation and interpretation of the environment. Therefore, approaching CES as the context-specific dimensions of human–environment relationships, to a great extent, relies on understanding the knowledge systems that emerge from and shape those relationships, promoting the recognition of diverse worldviews and epistemologies in conservation paradigms (Huntington, 2000; Mistry and Berardi, 2016) while fostering biocultural approaches to sustainability (Hanspach et al., 2020; Merçon et al., 2019).

Indigenous and Local Knowledge

> *"I believe that our survival as peoples has come from our knowledge of our contexts, our environment, not from some active beneficence of our Earth Mother. We had to know to survive." (Smith, 2008: 12-13)*

ILK is an attribute of societies with historical continuity in local resource use, resulting from the empirical experience of and adaptation to local ecological processes, patterns and disturbances (Ellen and Harris, 2000). ILK represents an ecological understanding on which the community relies to sustain their livelihoods, ensure their resilience and minimize the impacts of ecological changes (Huntington, 2000). Then, the importance of ILK to sustainable resources management derives from its potential to further the understanding of ecological processes and biodiversity patterns in the context of environmental changes (Huntington, 2000; Berkes et al., 2000), as local communities rely on practices that constantly monitor and respond to ecological changes, accumulating knowledge about ecosystems past and current trends and dynamics (Berkes et al., 2000). ILK may contribute to inform equitable and sustainable conservation and resource management strategies (Mistry and Berardi, 2016), while improving ecosystem assessments' political legitimacy and representativeness (Díaz et al., 2018; Tengö et al., 2017).

ILK emerges from adaptive management practices which adjust to ecological feedbacks and are influenced by complex socio-ecological dynamics, yet our understanding of how global changes may impact ILK reproduction is still limited (Cámara-Leret et al., 2019; Gómez-Baggethun and Reyes-García, 2013). ILK constitutes a system of practices for knowledge production (Viveiros de Castro, 2012), being dynamical and constantly transformed by actual socio-ecological conditions and changes (Ellen and Harris, 2000), while ILK's asymmetric and socially differentiated distribution across the population (e.g., by gender or age) supports adaptation to ecological disturbances (Vayda, 1990). As such, ILK's condition depends on historical, social and economic factors (Berkes, 2004) and 'preserving' ILK requires maintaining its adaptive dynamics by protecting the community's ability to practice their ways of living (Berkes et al., 2000), as through securing IPLC's sufficient levels of autonomy (Gómez-Baggethun and Reyes-García, 2013) and customary land rights (IPBES, 2019; IPCC, 2019).

Storied Knowledge

"The subject of myth is the ideas and emotions of the Earth" (Kane, 1998: 34)

The importance of storytelling is being increasingly explored to convey multispecies entanglements (Haraway, 2016) and inform adequate conservation strategies (Fernández-Llamazares and Cabeza, 2017; Russel, 2020). Narrative structures are arguably as universal as language itself (Tilley, 1994), with the relevance of storytelling going back in time as a vital device for the reproduction of knowledge and collective memories (Kane, 1998: 32; Santos-Granero, 2005). Their ontological significance play a fundamental cosmological, institutional and creative role in human societies, assisting the construction and reproduction of symbolic meanings, social structures, cultural values and economic practices as well as the incorporation of new elements, as in initiation rites (Propp, 1978: 21-22). Narratives are, thus, intrinsically connected to human livelihoods and represent a critical resource to understand local worldviews, including the processes underlying the (re)production of cultural practices, relational values and knowledge systems.

In its fundamental form, a narrative comprises a sequence of events made by actors and actions — i.e. a story — and a storyteller (Tilley, 1994). Narratives are contextual, being necessarily conveyed from a certain perspective — i.e. the storyteller's, responsible for bringing previous experiences to present contexts — and always situated, making reference to particular places. As such, narratives are means to understand the world which make sense of places, actions and

events by combining those in coherent ways and providing a structure from which meanings can be derived (Ingold, 2011; Santos-Granero, 2005). Because every story involves a temporal movement and a spatial experience, stories may transform space into place through the discursive articulation of experiences. Then, storied landscapes convey a spatially explicit storied knowledge which, as argued by Tilley (1994: 31), reflect that the "art of understanding of place, movement and landscape must fundamentally be a narrative understanding".

Here, storied knowledge conveys that "to know something is to know their story" (Ingold, 2011a), a notion shared across many indigenous cultures, where to 'know' something requires to understand the history of their genealogical relations (Hall, 2011: 103) — i.e., the sequence of events that brought it to existence. In this context, Kane (1998: 27-51) argues that myths have a 'semi-wild existence' by drawing inspiration not from the centres of human endeavours but from their surrounding environments, where the subject of myth are those natural powers — often represented as some sort of supernatural beings — that exist in a constant state of transition. Indeed, storied knowledge codifies their meanings into the tapestry of life: the embodied experience of 'being in the world' (Ingold, 2011a). Then, storied knowledge is relational, situated and contingent on the empirical experiences that may unfold its meanings, reflecting knowledge as a dynamical experience of participation in the world that emerges from historical and relational connectedness (Pink, 2009: 40).

ILK emerges from experiences, reproduced by specific practices, which exist in relation to a sequence of events, or narrative (Tilley, 1994). Again, knowledge is known by way of their practice and subsists through carrying the processes for its reproduction rather than its products (Viveiros de Castro, 2012). Thus, stories and myths transmit the means for knowledge's production by conveying: (1) the meanings through which experiences may be understood; (2) the set of practices through which experiences may be reproduced; and (3) the narratives that link both, reproducing the moral or ethical codes of prescribed behaviours that guide social and ecological but also power relationships. In this sense, narratives are common to any science, both to the 'supremely concrete' and the 'supremely abstract' (Lévi-Strauss, *in* Berkes, 1999:9) and, indeed, knowledge is intimately related to power and always constructed upon a narrative, or discourse (Foucault, 1980).

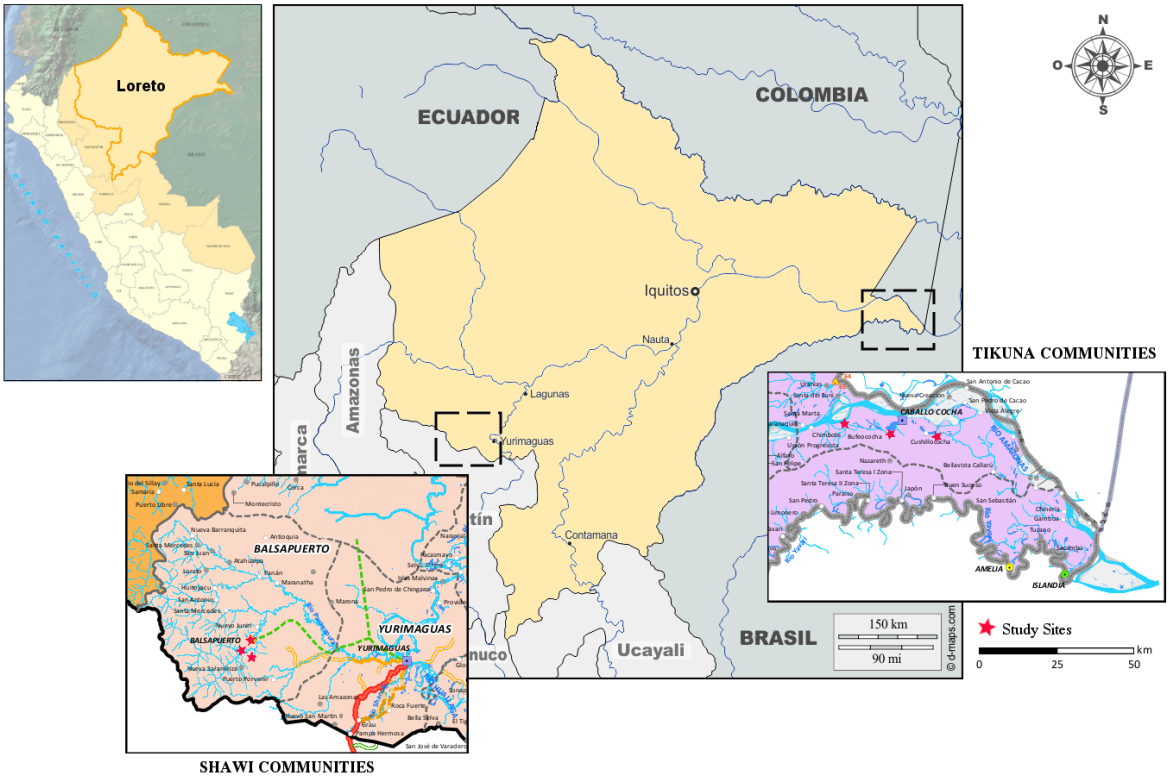
4.3 MATERIALS AND METHODS

Study Site

The Peruvian Amazon hosts 51 different ethnic groups of 17 distinct linguistic families (Aparício and Bodmer, 2009), supporting its classification as a global biocultural diversity hotspot (Loh and Harmon, 2005) and its choice for study site. Loreto department sits entirely within the Amazon biome and comprises over 50% of the Peruvian Amazon. With nearly 1 million habitants (INEI, 2007), Loreto is home to over 1700 native communities, which represent over 30% of its population, despite only 60% being recognised with official land rights (IBC, 2016).

The present study is based on a 6-month period of fieldwork in Loreto, where research was conducted with indigenous Shawi and Ticuna communities — see Map 4.1. Study's participants are members of three Shawi communities (Balsapuerto, Nueva Luz and Puerto Libre), sitting along the Cachiyacu river in Balsapuerto district, province of Alto Amazonas; and members of three Ticuna communities (Bufeo Cocha, Sta. Rita Mochilla and Nueva Galilea), besides the Amazon River in Ramón Castilla district, province of Mariscal Ramón Castilla. Members of these communities are predominantly indigenous, with a minority who report a 'mestizo' (or mixed blood) identity. These communities were chosen based on the availability of 'gate-keepers' to enter the Shawi and Ticuna territories, while their distinct geographical and cultural characteristics confer the present study with a valuable social and ecological diversity.

Shawi and Ticuna communities belong to different linguistic families and share distinct cosmologies, while dwell in contrasting historical, social and economic contexts — see Table 4.1. All six communities strongly rely on swidden agriculture, hunting and fishing for subsistence, yet complement the household economy distinctly with cash-crops plantations (e.g. Ticuna) or cattle rising (e.g. Shawi). Their cosmologies concern the existence of specific mythical beings associated also to different 'worlds'. Here, the Ticuna identify three worlds, each ruled by their own entities: one underwater, one underground and one in the sky (AIDESEP, 2000); while the Shawi identify nine worlds, each again ruled by their own entities: two underwater, one underground, one terrestrial, three in the sky, and two in space (ibid.). Here, landscape geography further influenced the communities' economy and their history of contact with colonial settlers, strongly affecting the reproduction of their cultural identity and heritage.



Map 4.1 - *Loreto department in Perú (yellow), with study site locations for Shawi (orange) and Ticuna (purple) communities.*

Shawi and Ticuna territories hold important geographical differences. The Alto Amazonas' province is mostly comprised by mountain rainforest, covering the eastern slopes of Andean hills, where Shawi settlements sit along tributaries of the Huallaga River and spread towards their headwaters. The Ramón Castilla district, on the other hand, is mostly comprised by low-land jungle, with extensive floodable areas and *restingas* (islands formed during the rainy season), where Ticuna settlements occupy dense forest areas retreated from the margins of the Amazon River and main tributaries. Here, the proximity to major rivers facilitated the settling of colonial institutions, determining their impact on local livelihoods. In result, the Ticuna suffered several forced migrations, while the Shawi still inhabit their ancestral territories. Moreover, because populations depend on navigable rivers for transportation, the rivers' seasonal cycles dictate their access to trade routes and reliance on external markets — again, much stronger in the case of Ticuna communities.

	Shawi	Ticuna
Geography	Mountain rainforest, along Paranapura and Huallaga tributaries and towards river headwaters;	Lowland jungle, along the Amazon River and main tributaries;
Isolation	Relative geographical isolation, including from missionaries and traders;	Long-term contact with missionaries, traders and extractivist industries, e.g. rubber and coca;
Territory	Still inhabiting their ancestral territory, with multiple mythological references to the landscape, e.g. Kumpanama's Rock;	Several forced migrations, along and away from the Amazon River, e.g. during the 1920-40's 'rubber boom';
Economy	Subsistence agriculture relying on diverse resources with changing economy towards the market based on cattle, timber and cacao production;	Subsistence agriculture relying on diverse resources with dependence on market economy based on cash crops production, e.g. coca or cacao;

Table 4.1 - *Historical and socio-ecological aspects of Shawi and Ticuna communities. These may be associated to the strength of perceived cultural identity, heritage and social cohesion. Comparison based data collected through participant observation and ethnographic literature (Fuentes, 1988; Goulard, 2009).*

Methodology

The study followed an ethnographic approach, based on participant observation and semi-structured interviews, to collect situated narratives about particular landscape features and people's relationships to these. Members of Formabiap[1] and IIAP's Sociodiversity[2] group were gatekeepers to the Shawi and Ticuna territories, respectively. Previous informed consent was obtained through an initial focus group in each community, where the research process and objectives were discussed. Then, participants were selected following a purposive sampling strategy (Newing, 2011; 65-82), based on their storytelling skills. Focus groups, semi-structured interviews and informal conversations were held in Spanish, spoke fluently by both the researcher and participants, without resorting to translators.

[1] Formabiap, Training Program for Bilingual Teachers of the Peruvian Amazon

[2] IIAP, Peruvian Amazon Research Institute, Research Program on Cultural Diversity and Amazonian Economy

Stories were intentionally gathered in individual visits to participants' homes and, occasionally, in informal conversations during meals, social gatherings, while wayfaring through the forest or in visits to specific places (e.g., farm plots, waterfalls or other villages). Participants were invited to share personal stories, folktales and myths about their dwelling environment and surrounding area[1], such as *el monte* (the bush), *el rio* (the river), *la chacra* (farm plot) or *la purma* (fallow land). Locally gathered stories were recorded in audio and complemented with narratives documented in relevant literature, namely assembled by indigenous organisations (AIDESEP, 2000; Formabiap, 2014). The present study's entailed a focus on the content, structure and function of those stories, concerned with 'how people make sense of their environments and to what effect', rather than how or by whom those were conveyed (Bryman, 2008: 582-585). Then, further semi-structured interviews were held with various participants to clarify the meanings and purposes of main stories' leitmotifs.

For the qualitative analysis, 'stories' were defined as accounts comprised by 'characters' performing 'actions', or functions. Stories collected were coded according to their spatial location (i.e. the storied place); their main characters (i.e. the storied subjects); their plot (i.e. the functions performed by the main characters); and the related cultural practices (e.g. hunting, fishing or healing). This enabled the identification of "character's functions", as the distinct roles or spheres of action that subjects played in the story's plot — considered constant and fundamental constitutive elements of folktales (Propp, 1978:58). Following critiques of Propp's formalism (Dundes, 1997), we use the concept of "character's functions" to identify and qualitatively describe distinct subjects and plots, avoiding a comprehensive analysis of all 'narrative functions' of Amazonian folktales — which would be beyond this study's scope.

This study focuses on an emergent category of stories whose main characters are 'bush mothers' (*madres del monte*). These are a sample of the stories collected which portray places (e.g., waterfalls) and non-human entities (e.g., animals) as storied subjects. The so-called 'bush mothers' may be considered mythical entities, linked to specific places or species but performing similar character's functions, which may be named differently (e.g., Yashingo, Chullachaki or Kurupira) depending on the region (e.g., Shawi and Ticuna territories) or their particular characteristics (e.g., linked to the 'forest' or 'water' world). As a widespread category of Amazonian folktales (AIDESEP, 2000), 'bush's mother' narratives offer a rich material for analysis by

[1] For example, by asking 'what's the story of this place?', 'do you know any story about this river?' or 'would you tell me a story about *el monte*?'

illustrating how more-than-human entities, including plant and animal species or landscape elements, are perceived and represented locally.

Stories were coded through an iterative process to identify main 'themes', or functions, and data collection stopped when new accounts of 'bush mothers' did not add new functions to the characters (Propp, 1978:63), reaching data saturation. Stories were then classified as belonging to the 'forest' or 'water world', according to their storied places and/or their storied subjects. Plant and animal species were identified by asking participants to confirm the species in an illustrated guide of Amazonian Fauna and Flora (Martín Brañas, 2009). Finally, the storied plots were analysed in terms of the cultural practices represented and the relational values these reproduce, cross-checking their interpretation in multiple instances with various participants.

4.4 RESULTS

From a total of 105 stories collected, 63 relate to the forest, 27 to the water and 15 were classified in 'other', including accounts of mixed or other locations (e.g., settlements). Amongst these, 45 comprise 'bush mothers' narratives. In total, 33 participants were interviewed, 12 from Ticuna ethnicity, 14 Shawi and 7 'mestizos' (or mixed-blood). Responses were anonymised and a code AX used to identify participants, where A corresponds to self-reported ethnic identity (S = Shawi, T = Ticuna and M = Mestizo) and X to a unique identification number assigned to each respondent (e.g., S11). Narratives were identified by a code ST.Y, where Y corresponds to their unique identification number (e.g., ST. 7). Please see Supplementary Materials, Appendix 4.A for respondents' demographic data (Table 4.A1) and stories' themes classification (Table 4.A2), and Appendix 4.B for a sample of these narratives.

All accounts collected represent distinct landscape elements either as storied places or storied subjects, offering a rich diversity of animal and plant species as well as habitats represented — see Table 4.2. Forest stories typically include storied subjects such as terrestrial animals (e.g., Jaguar, *Panthera onca*) and tree species (e.g., Lúpuna, *Ceiba pentandra*), along with shamans and forest mothers (e.g., Yashingo). The most common storied places include remote forest

areas, salt and gold mines, particular habitats (e.g., *colpas*[1] and *restingas*[2]) and specific landmarks, often represented by tree species (e.g., Ojé, *Ficus insipida*). Water stories typically portray rivers, lakes or waterfalls as storied places and their central characters are water entities, such as the Anaconda (*Eunectes murinus*), Pink Dolphin (*Inia geoffrensis*) or mythical entities, such as mermaids and water mothers (e.g., Yacuruna). Regarding their spatially explicit locations, the narratives collected constitute a storied landscape, here portrayed for the Shawi territory along the Cachiyacu river — see Map 4.2.

STORIED PLACES	**Key Locations**	Remote forest areas, specific tree species, particular habitats (e.g. *colpas* and *restingas*), salt and gold mines, rivers, lakes and waterfalls
STORIED SUBJECTS	**Key Species**	Anaconda (Boa, *Eunectes murinus*), Pink Dolphin (Boto, *Inia geoffrensis*), Jaguar (Tigre, *Panthera onca*) and Kapok tree (Lúpuna, *Ceiba pentandra*)
	Mammals	Oncilla (Tigrillo, *Leopardus tigrinus*), Agouti (Añuje, *Dasyprocta variegata*), Tapir (Sachavaca, *Tapirus terrestris*), White-lipped Peccary (Huangana, *Tayassu pecari*), Collared Peccary (Sajino, *Pecari tajacu*) and Spotted Paca (Majás, *Cuniculus paca*)
	Birds	Curassow (Paujil, *Crax globulosa*), Macaw (Guacamayo, *Ara ararauna* or *A. macao*), Tinamou (Panguana, *Crypturellus undulatus*) and Grey-winged Trumpeter (Trompetero, *Psophia crepitans*)
	Fish & Reptiles	Black Cayman (Lagarto-negro, *Melanosuchus niger*), Catfish (Carachama, *Pseudorinelepis genibarbis*), Black Prochilodus (Boquichico, *Prochilodus nigricans*) and Paiche (*Arapaima sp.*)
	Trees	Ojé (*Ficus insipida*), Cedro (*Cedrela angustifolia*), Tornillo (*Cedrelinga cateniformis*), Renaco (*Ficus trigonata*), Huito (*Genipa americana*), Chuchuhuasi (*Maytenus laevis*), Ana Caspi (*Apuleia leiocarpa*), Macambo (*Theobroma bicolor*) and Leche Caspi (*Couma macrocarpa*)
	Palm trees	Aguaje (*Mauritia flexuosa*), Pijuayo (*Bactris gasipaes*), Huacrapona (*Iriartea deltoidea*), Açaí (*Euterpe oleracea*) and Yarina (*Phytelephas macrocarpa*)
	Other Plants	Tobacco (*Nicotiana rustica*), Ajosacha (*Mansoa alliacea*), Barbasco (*Lonchocarpus nicou*), Ayahuasca (*Banisteriopsis caapi*), Coca (*Erythroxylum coca*) and Chacruna (*Psychotria viridis*)

[1] *Colpas* are places where animals gather to bath.

[2] *Restingas* are elevated land areas which form islands during the rainy season.

Table 4.2 – *Main landscape elements represented as storied places and storied subjects in local narratives, including significant locations, animal and plant species mentioned by participants. Common and scientific names were identified by asking respondents to confirm the species in an illustrated guide of Amazonia Fauna and Flora (Martín Brañas, 2009).*

Water Stories: Anacondas, Dolphins and Mermaids

In Shawi mythology, the rivers and hills were formed by a huge Anaconda who, when killed by Kumpanama — the mythological hero, gives birth to many anacondas. These chase Kumpanama till the Sillay river's headwaters, forming the rivers along the way with their 'snaking' movements through the land (AIDESEP, 2000:183). As such, the Anaconda is said to be the mother of all rivers and waterfalls, implying that their shape and changes are attributed to its movements, but also that rivers may dry if the Anaconda leaves (ST. 1). The Yacuruna is also said to be a water mother, who mothers all fish and may bewitch people by trapping the unwary soul underwater or, when kindly asked to, assist fishing practices (ST. 6).

Across the Amazon basin, the pink dolphins are considered able to metamorphose as humans, at times appearing elegantly dressed in communal festivities and seducing the single girls, who may eventually become pregnant or be taken to live underwater (ST. 2–3). Similarly, stories with mermaids show them appearing to humans, usually as beautiful ladies with long hair, who attempt to take humans to live with them underwater (ST. 4–5).

Forest Stories: Lúpuna Trees, Jaguars and Bush Mothers

The Ticuna mythology tells a time when there was no light in the world, because the sun was covered by a huge Lúpuna (Kapok tree), Wone, suspended by a sloth's claws to the sky. The two primordial brothers, Yoxí and Ípi, decided to end the darkness, asking a squirrel to drop a chilli in the sloth's eye, so they could cut down the tree. When the huge Lúpuna fell, it formed the rivers, streams and lakes (AIDESEP, 2000:236). Nowadays, the Lúpuna's cultural significance is further illustrated by many local narratives portraying this tree (ST. 7), where the Anaconda, the butterfly (or its maggot) and the Yashingo may represent its mothers, respectively for the roots, fins and trunk (T9). Amongst both the Shawi and Ticuna, forest mothers are said to live in the Lúpuna and other 'large trees with fins': "Kurupira's shadow is like the Lúpuna and there is where he lives in the forest, his house up its branches" (T8) or "those large trees with fins are where the forest mothers live, in the Cedros, Tornillos, Lúpunas, Ojés…" (S5).

~ CACHYACU RIVER ~
Storied Landscape

ST. 10 –Stealing People

Sometimes the children, in the afternoon, when they cry... when they are crying too much, their mother says, 'why are you crying so much?'... On the little while that their mother leaves, then comes their mother or their grandmother who appear to them, 'oh my baby, why are you crying?', they say, 'let's go, come to my house'. The child, thinking it is their grandmother, says 'yá, ya grandma'. The grandmother carries a basket, puts the child there and carries them away, takes them. When they are far far away, then the child looks around and then they see··· they are already being taken through the forest, they are not anymore walking through a path or anything, but instead they are being taken through the bush. So then the father was returning home from hunting, he was coming back. The child cries, 'Mom! Dad!', they go crying through the bush (...) And there he was returning and then he hears his son's voice, 'damn··· my son!'. So he runs and he finds him under those big trees with fins, like this, there's the child hiding under those fins (...) Many used to get lost like this before, but nowadays it doesn't happen so often anymore, now we don't lose them like that. That's the story, we wanted to tell. So once the father grabs the son, he asks, 'son, how did you got here?' and the child replies, 'daddy, that's how... it appeared like grandma'. (...) And oh yes, all these mountains, the mountains have a mother. The waterfalls have a mother. The rivers have a mother. Sometimes, before we existed, as my grandparents said, before we existed and the grandparents followed each other... they went into the bush and they would get lost, they wouldn't come back, they wouldn't come home anymore (...) That's how it was then. [S4]

ST. 4 –Nuevo Junin and Mermaids

When I was 6 years old, in the village of Nuevo Junin, the village of my grandparents, I went with a friend to the river. We went down there, to where was a whirlpool, there was a very beautiful beach, where we went to swim. But then I don't remember how, I just remember that suddenly I was in the middle of the whirlpool and I didn't know how I ended up there. And I freaked out, that whirlpool was big, about 10m diameter (...) So I got even more scared. Then I noticed there were some grams, about 5m away. I didn't know how to swim but I knew how to dive, so I had to gain courage, because I was already sinking and so I jumped into the water and grabbed the grass. Then with all my strength and almost missing my breath, I climbed up to the beach and started to run away. I did not say anything to anyone. And the night arrived. And when I was sleeping, in my dreams, I saw me walking towards that whirlpool again (...) and then I saw a woman coming out of the water there. A beautiful, blonde woman. She was naked with all her hair covering her breasts. And when she rised above the water, I could see... it was a mermaid and she was standing in the water. She looked at me and smiled, 'How brave are you, it's thanks to you being so brave that you are not here now with me. If you weren't so brave, you would be here now". And so, while she was still smiling I woke up. But look how she made me dream! The mermaid wanted to steal me. [M2]

ST. 13 –Santa Lucia and the Yacuruna

In front of Santa Lucia there is a beach and one day my father was with his scull in the canoe there. His friend gets out. He removes the scull and when he's about to stand, he listens to something just behind them. There's a pool there, not a whirlpool, and he hears something like uaaaasssshhh. And when you get something evil, your body swells. So my father slipped down the canoe and saw his body all like that. His friend was calling him but he couldn't answer. He was aware but then you can not talk nor move, I know cós it happened to me too. So he was in the canoe... and his friend was calling him. And until his body started to shrink··· took him about 10 min, until he could move again. So it took time until he could move again, and then he said, 'damn, the Yacuruna almost takes me!'. His friend, who was a witchdoctor, then grabbed his tobacco and started to blow it on him. [M2]

ST. 2 –The Dolphins and the Underwater Cities in San Gabriel de Varadero

The river is a world. There are spirits as the Sacharuna, the Yacuruna... And, specially under the big rivers, there are cities. In Varadero, the mouth of Cachiyacu with Paranapura river, there are huge whirlpools and many say that, underwater, there are big cities. People who are taken by these whirlpools, enchanted by mermaids or pink dolphins, if they come back they tell how they had a life, they got married and had kids on these cities, and they found all the animals there behaving like persons... And for the people outside the time they spent underwater seems just like a few minutes, but to those who visit these cities it seems they spent many years there (···) One of those animals who steal people are the dolphins, the pink dolphins have something of demoniac. They have been seen at parties, on roads, in villages. In parties they appear well dressed, they have shoes that are like catfish, like a prehistoric scaly fish, and they appear in the parties all well dressed with a hat to cover the hole they have on the top of their head to breath. On the roads they appear as men or women depending on whom they appear to, so that they flirt with people passing by... Then they deceive people into the water and those who return say there are big cities underwater, where they are all dressed and have shoes. But··· the majority doesn't return, right? (···) And there are many stories who tell how women got pregnant of dolphins. And here, you see, when a woman gets pregnant, people blame the dolphin. Who was? The dolphin, they say. [M1-2]

ST. 18 –The Salt Mine and Hunting

The forest of the high mountains, the virgin forest, has its mother. Like a human being, a tree when it's cut its mother cries. That's why one cannot open many farms, do too much slash , so that she can also lives (···) Everything has a mother. The trees, the mountain, that stone, waterfalls... And sometimes we sleep on those hills and then we dream they have a mother.

Beyond the salt mine, once we went five or six to hunt, see those mountains as they are. The bush mothers look just like a human being. When we are making noise, they answer. When we fall asleep they makes us dream, so they appeared and said, 'we are all quiet here, in silence, why are you coming and making noise?' Sometimes they also send rainfall. So we asked the forest's owner, 'we came here to hunt, to walk', and we asked them to not do us any harm, that there is no rain. We always ask to have a good hunt, cós when they find us strange, when they don't know us, when we don't talk in dreams, when we don't share with them, then they close their of springs inside big rocks, so that nobody can hunt them. No one sees them anymore, nobody finds them. So, their mother hides them. And how do we ask to not hide them? We go to a big tree, those trees with big fins, and there we ask, 'I'm here to hunt, give me your brood so I can take them home'. And then when we sleep, we dream they telling us they'll give us their of spring. Those large trees with fins is where the bush mothers live, in the Cedros, Tornillos, Lúpunas, Ojés (···) and the bush's mothers are like grandparents, grandmothers, they are old and they also like to smoke their cigar. [S5]

ST. 14 –Behind the Mountains

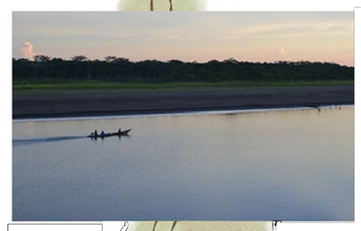
People say there's a place, walking two hours from here, there's a sacred place where no one can get in. When people get in, the wind starts to blow, it starts to rain heavily, no one can get in. When someone gets in they can die. Hunters cannot get in neither. But there was once a hunter, who was also a witchdoctor and making discourses, saying icaros, he wanted to go and see that place. So he walked some 10 meters and then he started vomiting, vomiting, vomiting. So, he couldn't get in either. We don't know what's in there. It has a mother, maybe all bush mothers are there, gathered. That's why people can't get in that place, only animals can go and that's why the hunter wanted to go there too. That how it's in the mountains. There's sacred places. [S11]

ST. 1 –San Lorenzo and the Anaconda

From here when we cross to San Lorenzo, that stream has a mother and it's an anaconda, more or less of this width [signal with hands] and 15 meters length. People have already seen it several times. And that anaconda before··· the stream didn't use to be so deep, we could cross it walking. Now it became deeper and, if you go upstream, there is a huge pool which no one can cross anymore. (...) Then there was the food in middle March... April... which covered everything, an immense food. And what happened then? The stream became very very shallow, really small. On the third day you could just cross it, so shallow it was then. And what happened? Why did it become like this? So everyone said the food made its mother leave, it took its mother away. It took the anaconda away. Some say its mother is the anaconda, others say it is a huge black cayman. Then, I found it strange too because now I'd cross it on the other side, where before no one could cross. But then another food came, I don't know what happened, but the stream became deep again. It turned back to same, deep like before. 'It's mother has returned now', people said then, 'the anaconda came back'. [M3]

ST. 15 –The Path from Arica

I was born and raised here and my parents always said, 'before entering a forest where you have never walked by, on that path, there you say, you ask: I will enter and ask nothing happens to me'. Because while you're walking, as I said, you often hear noises, for example, when you walk through the virgin forest. When you walk in the virgin forest you often hear these sounds, it's something mysterious and also... terrifying at times. Because it's a horrible sound and when you find yourself alone in the middle of these mountains and you hear that, these sounds, like moans, like whistles··· So our parents used to tell us, 'this is because the mountain doesn't recognise us', my dad told me, 'don't look. Don't look in the direction where the sound comes from'. 'But why dad?', we said. 'because otherwise at night you will have fever', he told us. So we kept walking, but we were curious then. And we looked. And truth there, I don't know if it's by chance or what, but then we had fever. And what did they say? We went to the witchdoctor and she would say, 'the mother of the mountains has found her strange [extrañar]', she told us, 'the mountains don't know her'. (...) When we are walking, I have heard those sounds several times, walking on the way from Arica, for example, crossing that hill over there. There I heard that. (...) Because you, your spirit, your smell, everything, you are known, no? [M3-4]



ST. 6 –Nueva Alianza and the Yacuruna

There in Nueva Alianza, going down there, there was a whirlpool. A big one. And my mother used to say, 'there, there is the Yacuruna, you cannot bath there because otherwise the Yacuruna will steal you', my mother always said, 'don't bath there or the Yacuruna takes you away'. So we didn't go there, we'd go a bit downstream. But, when she went fishing, we'd go to the whirlpool and then, we were all there and my mom would say, 'Yacuruna, yacurunita give me your fish', she said, 'Yacuruna give me your fish'. And then she would go and grab her fish. And sometimes my dad would go as well, without saying anything and then he wouldn't grab anything, so my mom would tell him, 'why didn't you ask Yacuruna to give you fish? That's why you don't caught anything' (...) There it was full of gravel, it wasn't sand but clay, where the catfish likes to throw holes and all that. And there we would grab catfish, we would grab boquichico [black prochilodus], cós all those fishes would go there to eat in the gravel. And he would go there but don't grab anything. So my mom always said that when we ask, the Yacuruna gives us. The Yacuruna is the Yacumama, it's like a person. I don't know if when it gets in the water it becomes an anaconda, but when it comes out it's a person. And when people sees it, it does like that bruup! and throws itself back in the water (...) And there we would find it, she'd always find it there, when she was going to fish and that's why she would never go alone, 'come on, come with me so the Yacuruna runs away', she said. There yes, there lived the Yacuruna. My mom saw it several times, but it always jumped away. So, it looks like a little girl but it's an old old lady with long hair, my mother said. [M3]

***Map 4.2** – Storied Landscape of Shawi Communities along the Cachiyacy River.*

Jaguar stories are also common across the Amazon region, where accounts portray these appearing during the night and surprising those, on hunting trails, who stay overnight in the forest (ST. 8–9). The jaguar is associated to the Yanapuma or Sacharuna, another bush mother: "Yanapuma is a big tiger, a bush mother… a tiger with 5 meters, the biggest tiger in the world" (S6). Yet, other forest mothers also often appear in hunting stories, presenting themselves in dreams or otherwise to confront the hunter for killing their preys or hunting too much (ST. 16–17). These may cause rainfall or react if people make too much noise, prevent people from cutting a tree, open a farm plot or even walk through the forest, while may also facilitate hunting, by offering their 'offspring' to the hunters, when respected and kindly asked through discourses (ST. 18–19).

In both Shawi and Ticuna accounts, bush mothers are often represented as being able to metamorphose into humans or in a variety of other shapes. Typically, these are responsible for kidnaping people, appearing as someone familiar and deceiving humans to follow them, such that they get lost, loose reasoning or acquire animal behaviours and are unable to return home (ST. 10 - 11). They may also mischief by shocking people, causing their body to swell or other illnesses (ST. 12 - 14). To those considered 'strangers' or who they 'find strange' (*extrañar*), bush mothers may cause the person to acquire characteristics of certain animals (*cutipar*) or get the 'forest illness' (*mal del bosque*), by trapping the person's soul deep in the forest (ST. 15). Yet, under certain conditions, forest mothers may also crucially assist people on their endeavours, particularly 'plant teachers' or 'doctors', by providing advice, healing and/or teachings on how to heal certain illnesses (ST. 20).

Bush Mothers

Bush mothers are associated to every plant and animal, water bodies and the forest itself: "The Lúpuna has its mother… all plants have their mother, the water, everything" (S10). As an archetypical mother, these protect and 'breed' those species and places: if the mother leaves, the river may dry out (as with the Anaconda, e.g. ST. 1), if it withdraws, the plant or animal may disappear (as in hunting stories, e.g. ST. 18). Another term used along with 'mother' (*madre*) is 'owner' (*dueño*), such that to say something has a mother or owner means there is an entity who takes care of such place, plant or animal:

> *"That's something I know, as we raise our cattle, so the Yashingo breeds theirs too, those are their offspring, there's the turkey, the curassow, the peccary, the tapir… all the animals and all the birds we see are the Yashingo's offspring, those are its brood" (T5)*

As such, accounts of bush mothers assign them one of three distinct general roles, or character's functions: (1) *tricksters*, where they mischief and playfully mislead humans or bewitch them (e.g. ST. 11), by metamorphosing into humans, attempting to kidnap people or by causing diverse illnesses; (2) *guardians*, where they protect the forest from overexploitation, unknown wayfarers or any disrespectful actions, such as excessive noise (e.g. ST. 17), by confronting hunters, making ill those considered strangers or causing sudden changes in the weather or the landscape; and (3) *helpers* or teachers, where they assist hunting or fishing by offering their prey, facilitate healing practices or provide advice in crucial matters, including how to develop certain skills (e.g. ST. 20). Therefore, despite holding characteristics similar to other mythical beings who perform tricksters' roles, the way bush mothers manifest themselves may vary, depending on their role in the story's plot — see Table 4.3.

Bush mothers may be seen, heard or may appear in dreams and visions. When seen, they may appear in different forms, holding an ability to metamorphose into human, animal or any other shape. As tricksters or guardians, they may appear as a small old man with a worn-out costume, an old lady with long white hair, or as any familiar person to those who see it. In the case of plant teachers, they may look like a nurse or doctor. Still, when seen, forest mothers as the Chullachaqui, Kurupira or Yashingo are always identifiable by having some sort of asymmetry, such as one foot turned backwards or one ear larger than other:

> *"Yashingo, the mother of Lúpuna, it's like the Kurupira. Let's say, we have our feet like this, they have one backwards and the other right, you see… That's how my grandma always told us" (T7-8)*

Practices: Discourses and Diets

Bush mothers' narratives appear associated to diverse cultural practices, such as hunting, fishing, farming, healing or wayfaring through the forest — see Table 4.4. Their simultaneous role as tricksters and guardians, however, requires people to avoid their potential damage through practices that intend to establish 'good' relationships with such entities. Such regulating practices include performing discourses, smoking *mapacho* and following strict dietary restrictions.

Character Functions		Shawi	Ticuna
Bush Mothers			
Trickster	Metamorphosis	ST. 6, 10, 18	ST. 7, 11, 16
	Deceiving / Stealing people	ST. 6, 10, 13	ST. 7, 11, 12, 19
	Cause shock or illness	ST. 6, 13, 14, 15, 18	ST. 11, 12, 19
Guardian	Confront hunters	ST. 8, 18	ST. 9, 16, 17
	Protect from strangers	ST. 14, 15, 18	-
	Change weather / landscape	ST. 1, 14, 18	-
Helpers	Facilitate hunting / fishing	ST. 6, 18	ST. 16, 19
	Facilitate healing	-	ST. 20
	Provide advice / teaching	-	ST. 20
Overall	Appear in Dreams / Visions	ST. 6, 18	ST. 7, 16, 17, 20
	Forest mothers' farm	ST. 18	ST. 12, 17, 19
	'Mal del bosque' / 'Cutipar'	ST. 15	ST. 11
Dolphins & Mermaids			
Dolphins	Metamorphosis	ST. 2	ST. 3
	Deceiving / Stealing people	ST. 2	ST. 3
	Underwater Cities	ST. 2	ST. 3
Mermaids	Deceiving / Stealing people	ST. 4 - 5	-
	Appear in Dreams	ST. 4 - 5	-
	Underwater Cities	ST. 4 - 5	-

Table 4.3 - *Character functions in bush mother narratives, as well as dolphin and mermaid stories, with reference to examples of Shawi and Ticuna narratives.*

Smoking tobacco *mapacho* is used for protection and to keep evil spirits away, both while crossing the forest and during shamanic practices (e.g. ST. 11), allowing forest entities to recognise their people:

> *"We always carry tobacco mapacho so we can blow it, so they know us, so they know we are from these mountains and do not mischief us. We carry mapacho so we know each other, so the forest mothers don't find us strange and don't niggle. And we say that we come because we need, like an ícaro[1] we do when we blow our cigar." (S6)*

[1] *Ícaros* are medicine songs used to heal and ask forest mothers for help.

Discourses are widespread practices, involving short speeches directed towards the bush mothers, which may be performed with diverse purposes, including to ask for protection when crossing the forest (as above) or for assistance with hunting, fishing or healing practices (e.g. ST. 6, 18 or 20). Discourses may be performed by any community's member and are directed towards any bush mother or specific plant and animal's species. Generally, these ask for permission or assistance before extracting any forest's resource, but also to receive bush mothers' powers, teachings or advice:

> *"People want to take medicine, they have to diet. To remove a tree bark, from where the sun rises, from where the sun sets, one has to make a speech: 'I'm going to take your bark, do not hurt me, I want to acquire your power. As you are strong, I also want to be strong'." (S11)*

> *"My grandfather used to say, 'hey compadre, give us your wood, we want such a thing'. That's how he started. But without seeing anyone. Just going and doing it when they are entering to work, like asking its owner for permission, 'cos we know that the animals, the trees have a mother." (T10)*

Healers (*curanderos*) are particularly equipped to communicate with bush mothers and receive their teachings or advice. They acquire this ability through, among other practices, following strict dietary restrictions and secluding in the forest for long periods of time (e.g. ST. 20). This set of practices enables healers to communicate with and receive power and knowledge from bush mothers. This supports their healing capacity, as healers use bush mothers' teachings both for diagnosis and for prescribing adequate medicines, diets or behaviours. In this context, healers are also assigned the role to establish and manage the community's relationship with forest entities, even if other community's members may also meet these entities in dreams or otherwise.

The significance of the healers' relationship with bush mothers extends beyond their healing abilities, as the "vision" they receive grants them the responsibility to advise a broad range of matters, pertaining both the human and beyond-human realms. As such, healers are often consulted by the community whenever advice is needed on any aspect of personal or social relations, including the best way or time to perform a certain task, regulating subsistence practices or warfare and, most generally, before taking any important communal decision:

"Formerly, the healer and the chief took the decisions with respect to the community. Now, decisions are taken in communal assemblies, but still often they suggest or propose what must be done. The healer is a very respected figure, as he has the broader vision of what is happening and what may happen, as he can speak with the forest's mothers and with the plants to know what must be done." (S3)

Cultural Practices		**Shawi**	**Ticuna**
Hunting	Assisted by bush mothers, when asked to offer their prey, require only taking what one needs and sharing any surplus	ST. 8, 14, 18	ST. 9, 16, 17, 19
Fishing	Assisted by bush mothers, when asked to offer their prey, require only taking what one needs and sharing any surplus	ST. 6, 13	-
Opening *chacras*	Requires asking permission from bush mothers, making offers of tobacco *mapacho*	ST. 18	ST. 11, 19
Wayfaring	Requires cautious and respectful behaviour, so bush mothers do not mischief nor trap one's soul (*mal del bosque*)	ST. 1, 15	ST. 7, 12, 19
Smoking *Mapacho*	Used for protection, healing and for being recognised by bush mothers	ST. 5, 13, 18	ST. 11, 17, 20
Discourses	Performed to ask protection and assistance from bush mothers in diverse activities	ST. 14, 15, 18	ST. 19, 20
Diets	Used to restore balance with the environment, healing and acquiring diverse skills	-	ST. 20
Healing	Bush mothers provide advice and healing powers, while blowing *mapacho* wards off evil spirits	ST. 13	ST. 11, 20
Shamanic practices	Enable healers to have broader vision on human and non-human affairs, by establishing a relation with bush mothers	ST. 13, 14, 15	ST. 7, 11, 20

***Table 4.4** – Cultural practices mentioned in narratives and their relation to bush mothers, with examples of Shawi and Ticuna narratives.*

4.5. DISCUSSION

Bush mother's narratives are reproduced by indigenous communities across the Peruvian Amazon, conveying a landscape endowed with agency and acting power. Bush mother's accounts are pervasive across the Amazon basin, being associated both to the forest and water worlds, while also shared across different social and ethnic groups, with distinct cultural and historical backgrounds. A wide variety of landscape's elements, including distinct habitats, animal and plant species are represented in these narratives. Here, landscape's elements are often portrayed simultaneously as storied places and storied subjects: the Lúpuna, for example, may refer both to the place of action and a character which perform actions; while the Anaconda may represent both the animal and, through its movements, their habitat — the rivers. In what follows, I explore how narrative analysis may assist cultural ecosystem assessments, discussing how ILK is reproduced in local narratives and examining how these convey symbolic meanings attached to the landscape and reveal their influence on the cultural practices, benefits and values affiliated to local human–environment relationships.

Bush mothers may be considered mythical entities but, due to the roles these perform, their manifestations (e.g. create rainfall and illnesses) and influence in people's livelihoods (e.g. discourses and dietary restrictions) are, nonetheless, very tangible — i.e. their character is not purely spiritual nor immaterial. Indeed, bush mothers are related to the forest itself or any of its inhabitants (i.e., each species and being has their *mother*) while, due to their embodied characteristics, their representation in local narratives does not present the forest and its *mothers* as disparate entities, but rather as interdependent and integrated ones. Following studies of Amerindian cosmologies (Viveiros de Castro, 2005; Descola, 2005), bush mothers' narratives concur with manifesting shared symbolic meanings linked to similar empirical experiences, across Amazonian cosmologies. Arguably sustained by the similarities of their ecological contexts, this shared perception[1] articulates and makes sense of common phenomenological experiences which, personified in bush mothers' archetypes, inform shared processes of engagement with the environment (Ingold, 2000).

Narratives transmit detailed knowledge about specific places, species and ecosystems, conveying the prescribed relationships between storied subjects (Descola, 2005) through the use of

[1] We use perception here as resulting from an "an active process of engagement" with the environment (Ingold, 2000) where, following Gibson (1994), "perception is not the achievement of a mind in a body but of the organism as a whole in its environment".

archetypes, or forest characters (Kane, 1998). Simultaneously, situated narratives transmit the means of knowledge production (Ingold, 2011a), reproducing the prescribed practices of engagement with the environment (Ingold, 2000), through which knowledge may be acquired and 'good' relationships established (Pink, 2009). Then, local cultural practices support common empirical experiences, which constitute shared storied knowledges (Ingold, 2011a) which, in turn, inform shared social values (Kenter et al., 2015) and relational values (Chan et al., 2016; Pascual et al., 2017) — which, again, shape cultural practices. As such, local narratives are central to ILK reproduction, with the notion of 'bush mothers' being central for the discursive articulation of IPLCs relationships with local ecosystems and having profound implications for understanding local cultural practices, relational values and ways of living in local terms.

More–Than–Human Cultures

Indigenous oral traditions often use metamorphosis as a device to express the interpenetration of different realms, including the human and beyond-human, tied to the notion that all beings share "an immediate, earthly kinship" (Hall, 2011: 101). Here, the representation of natural powers with a formidable transformational capacity becomes "the source of a vital, life-giving power" (Kane, 1998: 35), where characteristics assigned to human selves become extendable to beyond-human others and species classifications remain relative and contextual (Descola, 2005). Ontological categories become then interchangeable under the prevalent possibilities of metamorphosis, where any species may transform into another. This supports an extended concept of personhood, also articulated through extended kinship relations, where the recognition of animal and plant species' relational characteristics entitle these, along with humans, to the category of persons (Descola, 2005; Hall, 2011).

Bush mother's narratives convey aspects of Amerindian perspectivism (Viveiros de Castro, 1996; 2012), where the interchangeability of perspectives between humans, plants and animals depends on their relational roles (e.g., in predator–prey relationships) and personhood becomes a matter of context, degree or, ultimately, agency. As illustrated by the multiple possibilities of metamorphosis, here, the conventional categories of *nature* and *culture* interpenetrate through the recognition of an inherent responsive subjectivity in plant and animal species. Such dissolution of a *nature* and *culture* dichotomy is well-documented and common across Amerindian societies (Descola, 2013: 3-31). Such cosmologies open the possibility of recognizing distinct plants and animals' cultures, as conveyed by Amerindian perspectivism (Viveiros de Castro, 2012), while strongly support Kohn's suggestion of culture as an "open whole" (2013: 15),

existing intertwined with more–than–human worlds. Extending culture to the beyond-human reflects how local modes of cultural reproduction involve and constitute multispecies entanglements (Haraway, 2016; Kirksey and Helmreich, 2010), embedded in the storied landscapes of those ecological communities.

Relational Values: Reciprocity and Respectful Action

Bush mother narratives convey a forest perceived as alive, perceptive, responsive and knowledgeable, which actively participates in humans' endeavours. The forest and its mothers are interdependent entities, emerging from the recognition of a forest's self that is alive and responsive, endowed with subjectivity and intentionality — epitomised by the *bush mothers*. Here, the forest's self is recognized both in the collective entity, as illustrated by pan-entities such as the Yashingo or Kurupira, and its individual elements, as single plant or animal mothers. The forest is an assemblage of living beings, comprising an "ecology of selves" which, by engaging in semiotic processes, become invested with relational power (Kohn, 2013: 16). Yet, beyond-human selves may refer also to the overarching *forest,* an emergent collective self — the forest *gestalt*. Recognizing the forest's self entails managing human–environment relationships through extended social relations, where relational values based on ethical principles of reciprocity and respectful action, common to many animist societies (Hall, 2011: 100), inform prescribed behaviours towards human and non-human others (Chan et al., 2016).

Bush mother's narratives illustrate how animistic societies, as argued by Descola (2005), rather than classifying species in genealogical models, establish a classification of prescribed relationships between human and more–than–human beings. Here, non-human entities are treated as subjects in interpersonal relationships, being endowed with common attributes to humans and an active role in social life, based on kinship and ethical codes. Thus, people do not live *in* but rather *with* the forest and, in this context, the symbolic meanings reproduced by bush mother narratives convey the relational values that guide extended social relations towards forest entities. These values inform cultural practices designed to maintain balanced ecological communities — i.e., the socially prescribed behaviours that guide human–environment relationships, based on ethical principles and social norms (Chan et al., 2016; 2012), to sustain a 'good living' (Acosta, 2013; Pascual et al., 2017).

Indeed, bush mother's narratives portray subsistence and ritual practices, such as hunting, fishing, harvesting and healing, or even wayfaring, as requiring a constant negotiation with more–

than–human entities, in accordance to previous studies (Descola, 2005), in order to establish 'good' relationships and sustain a 'good living' (Acosta, 2013). Those cultural practices articulate social obligations and prohibitions towards beyond-human entities, namely through discourses, asking permission for taking certain resources; diets, prescribing allowed or forbidden foods and activities; smoking *mapacho*, conferring protection and enabling people's recognition by bush mothers; along with other social norms, forbidding to take more than one needs and obliging to share any surplus with the community. Ultimately, bush mother narratives convey the need for respectful action towards forest beings, reproducing an understanding that forest resources do not belong to humans but to the forest itself.

Local human–environment relationships articulate social obligations and prohibitions towards the forest, reproducing relational values based on reciprocity and respectful action — a notion shared by many animist societies (Hall, 2011: 99-119). The forest as an "ecology of selves" is a complex web of dynamical relationships between subjects (Kohn, 2013), which brings the forest and its entities to the realm of the community's social relations — as an active participant of a shared social sphere. This notion, shared across many indigenous peoples (Hall, 2011; Kimmerer, 2013), entails that subsistence practices require establishing reciprocal relationships with the more–than–human, by recognising the web of living relations that sustain the community's life. The reproduction of life is, thus, regulated by relational values which seek establishing 'good' relationships with the wider ecological community, where multispecies entanglements entail a constant negotiation of life and death relations within more–than–human territories.

Cultural Benefits: Supporting People's Ways of Living

Situated narratives play a fundamental role communicating experiences and shaping shared perceptions of the environment, embedding a discursive articulation of the symbolic meanings and practices through which cultural identities, relational values and knowledge systems are reproduced. As such, narratives convey the cultural benefits which, derived from environmental interactions (Fish et al., 2016), sustain local ways of living, knowing and relating.

Narratives reproduce a detailed ***knowledge*** about ecological processes and patterns, including plant seasonal cycles, animal behaviours and their specific habitats, particularly discursively establishing the relationship between distinct species and their habitats — in accordance with previous studies (Descola, 2005; Viveiros de Castro, 2012). Furthermore, narratives convey

humans' positioning within complex webs of multispecies entanglements, reproducing means of knowledge production through socially prescribed practices of engagement with the environment (Ingold, 2000; 2011). Then, situated narratives convey fundamental dimensions of ILK, as a knowledge–practice–belief complex (Berkes, 1999), including the cultural practices, symbolic meanings and knowledge systems that, embedding people's cultural heritage, assist the reproduction of their cultural identities and support their ways of living.

Situated narratives further articulate a ***sense of place*** by revealing the community's storied landscape, transforming space into relational places (Tilley, 1994). These storied landscapes comprise ancestral territories, defined by the overlap between land and knowledge — i.e., establishing the network of extended social relationships that sustain local ways of living and constitute their more–than–human territories (Echeverri, 2005). Here, situated narratives further convey notions of belonging by reflecting the socially prescribed practices through which people may 'belong to' these territories: as illustrated by forest mothers who may *know* or *strange* someone (e.g. ST. 17). Belonging is then articulated through a set of prescribed behaviours, or cultural practices, which define an 'open territory' delimited by the overlap of two concurrent bodies of knowledge, constituted by a reciprocal relationship of mutual recognition between the people and the forest: the forest *known* by people is the forest that *knows* them.

In this sense, the communities' ***cultural heritage*** constitutes an 'open territory' where knowledge exists intertwined with the landscape (Echeverri, 2005), comprising the symbolic meanings, subsistence practices and knowledge systems that, reproducing multispecies entanglements, sustain local livelihoods and shape local environments (Hirsch, 1995). As such, ILK is embedded in the landscape and retrieved by situated narratives, transmitting the relationships historically established with the beyond-human (Gow, 1995; Santos-Granero, 2005). Those relationships themselves constitute a cultural heritage, which define their 'open territories', by shaping their dwelling landscapes as much as sustaining the communities' ways of living and knowing.

Therefore, situated narratives are deeply connected to the reproduction of people's ***cultural identities***, as 'forest-dwellers', conveying the cultural practices, relational values and knowledge systems that support the reproduction of local ways of living, knowing and relating — in accordance with Rival (2007) and Cepek (2011). Bush mother narratives reproduce the notion of culture as an 'open whole', conveying the physical and symbolical landscape of those 'open territories' embodied by local human–environment relationships (Echeverri, 2005). As

such, ‘forest-dwellers’ identities exist in ‘contact zones’ between multiple species where, as posed by Haraway (2008: 4-7), knowing the other implies ‘becoming with’ other — as selves may merge and emerge into different kinds through interactions with others (Kohn, 2013).

Ultimately, storied knowledge portrays people’s processes of ‘becoming with’ multispecies entanglements (Haraway, 2008) and assist determining their more–than–human territories — as ‘non-areolar’ symbolic, relational and biophysical territories (Echeverri, 2005). Then, situated narratives enable a spatial-explicit analysis of local human–environment relationships while revealing cultural dimensions of ecosystems in locally significant terms. This may contribute to significantly improve ecosystem assessments, enabling conservation initiatives to effectively partner with local communities, by understanding their complex modes of coexistence with their dwelling landscapes.

4.6 CONCLUSIONS

This study presents evidence on the significant contributions that storied knowledge may hold to cultural ecosystem assessment, advancing a methodology which, based on the analysis of situated narratives, complies with local modes of cultural reproduction. Storied landscapes contribute to further the understanding of local human–environment relationships, as situated narratives reproduce the relational values, cultural practices and knowledge systems that shape people’s interactions with their environments. Moreover, storied knowledge reproduces the cultural heritage that link people to their environment, contributing to recognise IPLC’s ‘non-areolar’ territories, and their affiliated ways of living, knowing and relating. Then, storied knowledge supports the recognition of distinct cosmologies and epistemologies in ecosystem assessments, revealing how particular cultural practices and relational values contribute, in fundamental ways, to the reproduction of cultural benefits — as the identities, experiences and capabilities that support local ways of living. Then, as situated narratives are embedded in the landscape, such approach enables a spatially explicit assessment of cultural practices and benefits, while conveying the relational values that guide local human–environment relationships. Then, the present study establishes a methodology for cultural ecosystem assessments which, while respecting local modes of knowledge reproduction, contributes to bridge distinct knowledge systems, improve the representativeness of ecosystem assessments and enable the development of biocultural approaches to conservation.

5. WITHIN THE FOREST: A Cultural Ecosystem Assessment of Complex Socio-ecological Dynamics in the Peruvian Amazon

5.1 INTRODUCTION

The Amazonia epitomizes a landscape where diverging interests for economic development, biodiversity conservation and native communities' rights converge (Nugent, 2018), driving complex socio-ecological dynamics which threaten both its biological and cultural diversity. As the world faces an impending climate and biodiversity crisis, tropical forests play a crucial role in both climate change mitigation and biodiversity conservation (Butchart et al., 2010; Gibbs et al., 2007). Yet, tropical forest loss was responsible for 8-10% of global CO_2 emissions in 2018 (Gibbs et al., 2018; IPCC, 2019), with permanent land-use change for commodity production (e.g., beef, soy and palm oil) being the main driver of deforestation globally (Curtis et al., 2018). Simultaneously, tropical forests are known for hosting high levels of cultural diversity (Gorenflo et al., 2012; Maffi, 2005) which also face numerous threats and a rapid decline (Merçon et al., 2019), despite the critical role indigenous peoples and local communities (IPLC) play safeguarding biodiversity (IPBES, 2019; FPP, 2020). The Amazonia invokes idealized notions of 'pristine natures' inhabited by 'primitive societies', that historically contributed to foster both conservation and economic development discourses which tend to overlook the complexity of its cultural landscape (Balée, 2013; Nugent, 2018).

Playing a crucial role in climate change mitigation, the Amazon rainforest absorbs an estimated 2.2 billion tons of carbon per year (Espírito-Santo et al., 2014), corresponding to 25% of CO_2 emissions derived from fossil fuels (Fleisher et al., 2019), and stores between 150 billion to 200 billion tons of carbon (Gibbs et al., 2007; Pan et al., 2011). However, the Amazon rainforest lost over 17% of forest cover in 50 years (WWF, 2014; Lovejoy and Nobre, 2018). Globally, tropical forests lost 12 million hectares in 2018 (Gibbs et al., 2018) and 64% of tropical forest loss in Latin America is driven by permanent land-use change for agriculture, pastures and mining industries (Curtis et al., 2018). Yet, tropical forest loss is mostly driven by commodity production to be consumed elsewhere and, for example, over 80 million tons of CO_2 emissions produced in Central and South America during 2011 were for consumption in Europe

and North America (Marques et al., 2019). In the Amazonia, the combined effect of deforestation and climate change, diminishing rainfall and extending the dry season, may lead to drastic changes — with an estimated 20-25% deforestation potentially triggering a regime shift, turning the rainforest into a savannah ecosystem (Lovejoy and Nobre, 2018).

The Amazonia is the most biodiverse biome on Earth, comprising 40% of global tropical forests and hosting around 10-15% of global biodiversity (Nobre et al., 2016). Global interests in tropical forests conservation reflect their crucial role for climate change mitigation (Bastin et al., 2019) and biodiversity conservation (Butchart et al., 2010; Barnosky et al., 2011) with protected areas, nowadays, covering a significant 25% of Amazon biome (WWF, 2014). Yet, protected areas often adopt 'fortress conservation' strategies (Doolittle, 2007; Neumann, 1998), following 'top-down' approaches that exclude local communities from resources management and prioritize nature conservation over indigenous people's rights (Chatty and Colchester, 2002; RRI, 2019). These projects foster social conflicts over land use and tenure, following a deficient recognition of indigenous territories by government bodies (IPBES, 2019; RRI, 2019). Globally, indigenous territories overlap with 40% of terrestrial protected areas and 'ecologically intact landscapes' (Garnett et al., 2018) and, independently of size and geographical location, these often present equal or higher biodiversity than protected areas (Schuster et al., 2019). This supports the relevance of developing approaches for the conservation of biocultural diversity (Gavin et al., 2015; Merçon et al., 2019).

Research increasingly supports IPLC's crucial role safeguarding biodiversity (IPBES, 2019; FPP, 2020), with indigenous territories estimated to host over 80% of global biodiversity (Sobrevila, 2008). The Amazon's population comprises over 34 million people and more than 350 ethnic groups (Aparício and Bodmer, 2009). Indigenous territories cover at least 30% of the Amazon biome (WWF, 2014), yet less than 10% are officially recognised with secure land rights (FPP, 2020; RRI, 2019). Moreover, advocates for economic development, based on notions of 'industrialized societies', portray the Amazon as unproductive land and IPLCs as lacking sufficient technology to domesticate nature (Nugent, 2018; Bentes, 2005). Considering these 'primitive societies' neglects the historical complexity of Amazonian societies, which developed complex adaptive management practices to partially domesticated its landscape (Clement et al., 2015; Heckenberger et al., 2007; Rival, 2006). Based on archaeological evidence, Balée (2013) estimates that at least 12% of Amazon rainforest is of anthropogenic origin and, indeed, Amazonian societies have historically modified local forest systems by enhancing forest resources' availability to sustain their livelihoods (Balée, 2013; Clement et al., 2015), in

ways that once supported much higher population densities (Heckenberger et al., 2007; Rival, 2006).

As posed by Nugent (2018), idealized notions of the Amazonia play a crucial role in "how the region continues to be treated in terms of international politics, commercial ventures, environmentalist interventions and developmental prescriptions". Here, international development projects tend to reflect the economic interests of industrialised societies, threatening the continuity of Amazonian societies (Lovejoy and Nobre, 2018; Rival, 2007) and fostering a political landscape characterised by high levels of social conflict (AIDESEP, 2013; SERVINDI, 2019). Conversely, international conservation initiatives, such as the Strategic Plan for Biodiversity 2011-2020 and Reducing Emissions from Deforestation and Degradation (REDD+), resulted so far in poor engagement with forest communities (Bayrak and Marafa, 2016) and were not reflected in positive biodiversity trends (CBD, 2020; IPBES, 2019). The missed opportunity for engaging with IPLC's in conservation has been exposed in the latest Local Biodiversity Outlook (FPP, 2020) while, addressing a long-standing 'missing link', both the IPCC (2019) and the IPBES (2019) recently endorsed IPLC land rights as crucial for forest conservation and climate change mitigation —estimating IPLC's customary tenure of 50% global terrestrial land, including 76% world's tropical forests (RRI, 2019).

Despite the growing evidence of IPLC's key role safeguarding biodiversity (LBO, 2020; Schuster et al., 2019) and the relevance of biocultural approaches to conservation (Hanspach et al., 2020; Merçon et al., 2019), it is still poorly understood how global economic development and biodiversity conservation interests may drive changes in the biocultural diversity of IPLC's territories (e.g., Cámara-Leret et al., 2019). In this context, the present study proposes a socially disaggregated analysis of Cultural Ecosystem Services (CES) to examine how interactions between economic development projects, biodiversity conservation initiatives and indigenous people may drive complex socio-ecological dynamics in the IPLC territories of Loreto department, Peruvian Amazon. Following an ethnographic approach, this study aims to (1) provide a cultural ecosystem assessment of IPLC territories, examining the role of IPLC's cultural practices, values and benefits to support the local biocultural diversity; (2) explore how cultural ecosystem assessments are linked to the supply and demand of distinct Ecosystem Services (ES), presenting a socially disaggregated analysis of CES; and (3) describe the complex socio-ecological dynamics that impact IPLC territories, driving changes on indigenous ways of living (e.g. knowledge systems, relational values and management practices) and/or their biophysical environments (e.g. biodiversity and forest cover).

5.2 THEORETICAL FRAMEWORK

Ecosystem Assessments and Socio-Ecological Dynamics

Since the Millennium Ecosystem Assessment (MA, 2005), the Ecosystem Services framework has been widely adopted for monitoring ecosystem change, assess impacts on human well-being and inform adequate policy responses (e.g., see Costanza et al., 2017). Yet, despite the ES framework highlighting ecosystems' contribution to human well-being, the cultural dimensions of ecosystems have been largely overlooked, with cultural services figuring in only 2% of the broader ES literature[1]. Here, challenges to quantify cultural services in economic terms while interpreting culture as a category of intangible services (MA, 2005; TEEB, 2010), adding to over 70% of case studies being held in Europe or North America (Milcu et al., 2013), prompted assessments to reproduce an ethnocentric bias by generally representing CES as 'leisure-time' along recreation, tourism and aesthetic values (Hirons et al., 2016; Costanza et al., 2017). Besides the undesirable implications of monetary valuations (e.g., Dunlap and Sullivan, 2019), the ES framework also tends to conceal human roles on the co-production of ecosystem services (Comberti et al., 2015); the unequal distribution of benefits across society (Cáceres et al. 2014; Chaudhary et al. 2018); and how ES supply and demand may drive profound social and ecological changes (Mehring et al., 2017; Santana-Cordero et al., 2016).

The present study seeks to address these limitations by exploring how cultural ecosystem assessments, considering cultural practices, values and benefits (Fish et al., 2016), may unveil complex socio-ecological dynamics in Loreto department, Peruvian Amazon. Following the conceptual framework advanced by Fish et al. (2016), this study considers CES produced by cultural practices which, affiliated to environmental spaces, embody symbolic, recreational and productive expressions of human–environment relationships. Then, cultural benefits comprise the identities, experiences and capabilities derived from such interactions (ibid.) while cultural values are understood as the socially prescribed behaviours, such as norms and preferences, that guide relationships with others and the environment (Kenter et al., 2015) — thus, embedding relational values "not present in things but derivative of relationships and responsibilities to them" (Chan et al., 2016). Following an understanding of culture's mediating role in human–environment relationships (Milton, 1996: 13-22), this approach recognises a cultural influence

[1] Based on search results in the Web of Science with these keywords, since 1970 to date (22nd July 2019)

on the symbolic meanings, relational values and knowledge systems which, linked to the environment, are enabled by and shape particular land management practices (e.g., Balée, 2013; Rival, 2007).

Extending Schaich et al. (2010) approach to political landscapes, this study further draws attention to the social structures and power relations that comprise the political spheres of social life (Mitchell, 2000: 3-36), disaggregating CES analysis to reveal how distinct social groups are involved in the production and/or consumption of multiple ES. Then, adopting a drivers-pressures-state-impact-responses framework (DPSIR) for reporting environmental issues (EEA, 2019), this approach supports the analysis of complex socio-ecological dynamics behind the production and consumption of distinct ES, contributing to reveal how interactions between different social groups may drive cultural, social and ecological changes in IPLC territories, threatening their biocultural diversity (Hanspach et al., 2020; Maffi, 2005). Here, following previous studies on indigenous territories (e.g., Echeverri, 2005), IPLC territories are understood not only as the biophysical but also the symbolic and relational landscapes tenured by indigenous people.

5.3 MATERIALS AND METHODS

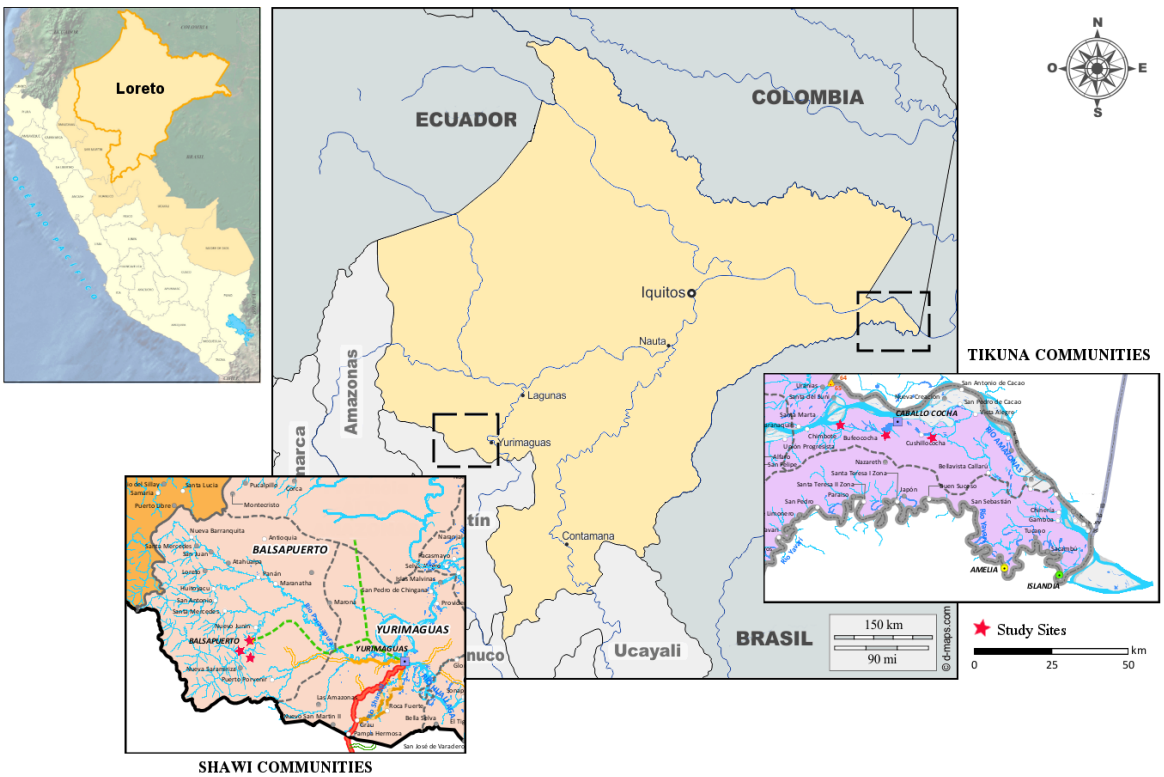
Study Site

The present study is based on research carried in Loreto department, Peruvian Amazon, with both Shawi and Tikuna communities. In Peru, over 47% of its forests are tenured by native and rural communities, despite nearly 4 thousand communities still not being officially recognised (IBC, 2016). The Peruvian Amazon comprises circa 12% of the Amazon biome, where over 17% are defined as protected areas and around 26% are indigenous territories, corresponding to 20 million hectares (WWF, 2014). The Peruvian Amazon is home to over 59 different ethnic groups and 14 linguistic families (Aparício and Bodmer, 2009). The department of Loreto, with nearly 37 million hectares, sits entirely within the Amazon biome and represents over 50% of the Peruvian Amazon. Loreto has over 1 million habitants and more than 1500 native communities, of which only 60% are recognised with official land rights (IBC, 2016).[1] Here, 20% of regional GVA results from mining, gas and oil extraction activities and 10% from agriculture,

[1] Regional indigenous organisations (e.g., AIDESEP) estimate that 20 million hectares, corresponding to over 1,300 indigenous communities, are still pending territorial demarcation and land titling (Romero, 2018).

forestry and animal husbandry, where cassava and plantain are main cultivars (BCRP, 2016). Since 2001, Loreto lost 624 thousand hectares of tropical forest, resulting in 313Mt of CO_2 emissions (GFW, 2019).

The region's globally important biocultural diversity (Loh and Harmon, 2005) and complex political landscape (e.g., Nugent, 2018) supports its relevance for the present study. The research draws insights from fieldwork with three Shawi communities (Balsapuerto, Nueva Luz and Puerto Libre) along the Cachiyacu river in Balsapuerto district, Alto Amazonas province; and three Tikuna communities (Bufeo Cocha, Sta. Rita Mochilla and Nueva Galilea), along the Amazon River in Ramón Castilla district, Mariscal Ramón Castilla province — see Map 5.1. The different historical, geographical and cultural contexts of these communities, despite their similar modes of subsistence, provide a diverse gradient of perceived conditions, pressures and impacts linked to indigenous ways of living — see Table 5.1.



Map 5.1 - *Study area in Loreto department (yellow) with the location of Shawi and Tikuna communities (red stars) in Balsapuerto (orange) and Rámon Castilla district (purple).*

	Shawi	Tikuna
Geography	Mountain rainforest, towards the river headwaters of Paranapura and Huallaga tributaries	Lowland jungle, along the Amazon River and main tributaries
Territory	Ancestral territory with multiple cosmological references to the landscape, e.g., Kumpanama's Rock	Several forced migrations, along and away from the Amazon River, e.g., during the 1920-40's 'rubber boom'
Economy	Shifting agriculture with high dependence on NTFPs, changing towards market economy based on cattle, timber and cash-crops (e.g., Cacao and Sacha-inchi)	Shifting agriculture with high dependence on NTFPs, complemented with market economy based on cash crops, (e.g., Coca and Cacao)
Social Contexts	Relative geographical isolation, with overlapping Conservation Areas and recently built road infrastructure	Long-term contact with missionaries, traders and extractivist industries, e.g., rubber

Table 5.1 - *Geographical and socio-ecological characteristics of Shawi and Tikuna communities, based on data collected during fieldwork and in ethnographic literature (Fuentes, 1988; Goulard, 2009).*

The geography of Shawi and Tikuna territories hold major differences. The former, sitting in the eastern slopes of Andean hills, is comprised by mountain rainforest with Shawi settlements spreading towards the headwaters of secondary rivers, mostly tributaries of the Paranapura river. The latter is characterized by dense low-land jungle with extensive areas of floodable land and *restingas*, islands formed during the rainy season, with Tikuna settlements retreated within the forest along the Amazon River and main tributaries. All studied communities hold mixed modes of subsistence based on shifting cultivation and foraging, with local economies highly dependent on NTFPs and often complemented with cash-crops or, in Shawi's case, cattle rising. Still, geographical differences influence the communities' economies as well as their historical vulnerability to colonial forces, market pressures and conservation interests.

In the Amazon basin, rivers represent main transportation means and their seasonal cycles dictate the communities' access to other settlements, trade routes and local markets, with seasonal contrasts accentuated in low-land regions. Then, the proximity to major navigable rivers determined how colonial institutions (e.g., religious missions) and market pressures (e.g., 'Rubber boom') accessed indigenous territories and impacted the communities' livelihoods. Occupying an area difficult to reach, between the Andean peaks and impenetrable jungle, the Shawi managed to find reclusion from colonial invaders on river's headwaters, where even missionaries

and traders who eventually arrived didn't record a long dwelling. In contrast, the Tikuna historically occupied territories of easier access, along main trade routes, which entailed a higher vulnerability to colonial forces, leading to labour exploitation during the 'rubber-boom' (1920-40's) and several forced migrations away from the Amazon River.

Methodology

The present study follows an ethnographic approach based on a 6-month period of fieldwork with Shawi and Tikuna communities, during 2016 in Loreto department (Peru). First, to characterize the cultural landscape of IPLC territories, the study performed a cultural ecosystem assessment exploring the cultural practices, values and benefits reproduced by indigenous communities. Here, participant observation and semi-structured interviews were carried to identify and interpret the cultural practices reproduced by members of Shawi and Tikuna communities, particularly focusing on land management practices and affiliated knowledge systems, relational values and ecological benefits. Data collection was complemented with visits to significant sites, including agricultural fields, forest areas and natural protected areas; and information gathered from relevant ethnographic literature (e.g., Gasché and Mendonza, 2011), regional reports (e.g., Pitman et al., 2014) and national habitats and species inventories (e.g., MINAM, 2015). A free listing of culturally significant species, such as cultivated varieties and wild forest species (e.g., NTFPs), was asked from participants in diverse occasions, particularly during visits to farm plots and forest areas. Species mentioned were identified by cross-checking local species inventories made by IIAP's and Formabiap experts, published studies on NTFPs (e.g., Alexiades and Shanley, 2005) and national habitats and species inventories (e.g., MINAM, 2015).

Interviews were carried in Spanish and participants selected using a snowball sampling method (Newing, 2011), starting with members of Formabiap[1] and IIAP's Sociodiversity[2] group to access Shawi and Tikuna territories, respectively. These 'gate-keepers' enabled the entrance in indigenous communities and facilitated the contact with communal leaders, who provided settings for gathering interest and obtaining informed consent from participants.

Second, to understand the social and ecological changes affecting IPLC territories, this study examined their political landscape by (1) identifying the main drivers of change, pressures and

[1] Formabiap. Training Program for Bilingual Teachers of the Peruvian Amazon.

[2] IIAP, Peruvian Amazon Research Institute, Research Program on Cultural Diversity and the Amazonian Economy.

impacts perceived by indigenous communities; and (2) characterizing the main social groups enacting those through a disaggregated CES analysis of the cultural practices, values and benefits these reproduce. Hence, one focus group was conducted at Formabiap with members of diverse ethnic groups, including Shawi, Kukama and Quechua, to identify main resource flows coming in and out of IPLC territories and the major drivers of change impacting indigenous territories and ways of living. Additionally, these questions were explored in local community's meetings and individual interviews. Together, these contributed to identify three primary social groups responsible for enacting or opposing main drivers of change, namely affiliated to indigenous and local communities, economic development projects and biodiversity conservation initiatives. To characterize these social groups and further understand their interactions, additional semi-structured interviews were conducted with members of regional conservation projects (e.g., Regional Conservation Areas), research institutes (e.g., IIAP) and indigenous organisations (e.g., AIDESEP).

Finally, to assess the complex socio-ecological dynamics behind changes in IPLC territories, the study characterized interactions between distinct social groups through a qualitative spatially-explicit analysis, comprised of three steps: (1) examining the ecosystem services flows embedded in interactions, by linking cultural services to the production and consumption of multiple ecosystem services based on the benefits reported by respondents and inferred ecosystem services supported; (2) mapping the geographical location of distinct social groups, to reveal spatially-explicit overlaps and areas of potential land-use conflicts, based on published data for approved development projects, regional conservation areas and officially recognised indigenous territories (e.g. IBC, 2016); and (3) the qualitative assessment of regional socio-ecological dynamics affecting IPLC territories, following the drivers-pressures-state-impact-responses framework (DPSIR) for reporting on environmental issues (EEA, 2019) to describe interactions between distinct social groups and resulting non-linear dynamics, based on cross-checking participants responses and published data. The analysis of socio-ecological dynamics is based on data previously gathered in structured observations, interviews and relevant publications, including local news sources (e.g., ORPIO, 2019; Servindi, 2019), regional organizations' reports (e.g., AIDESEP, 2013; Romero, 2018) and other published data (e.g., EJAtlas, 2016; IBC, 2016; Pitman et al., 2014).

5.4 RESULTS

Interviews were conducted with a total of 37 participants from Tikuna (12) and Shawi (14) communities as well as other members of local communities and institutions (11), including Regional Conservation Areas (e.g., Cordillera Escalera), research institutes (e.g., IIAP) and indigenous organisations (e.g., Formabiap) — see Supplementary Materials, Appendix 5.A, Table 5.A1. Responses were anonymised and participants identified with a code AX, where A corresponds to self-reported ethnic identity (S = Shawi, T = Tikuna and O = Other) and X to a unique identification number assigned to each respondent (e.g., S11).

5.4.1 INDIGENOUS TERRITORIES

In both Shawi and Tikuna communities, subsistence practices entail a set of adaptive land management practices based on shifting agriculture, hunting, fishing and foraging, strongly articulated around a forest management for NTFPs. Other cultural practices include rituals, diets and discourses which, linked to the above, reproduce cultural values and constitute social structures for who, when and how to perform certain tasks. Despite mostly identical, land management practices of Shawi and Tikuna communities hold few significant differences arising from their distinct geographies, with local economies relying on varying species distribution to support local livelihoods and commercial activities; distinct cultural contexts, with diversified rituals and mixed religious practices influenced by contact with missionaries; or the distinct social and ecological impacts of particular drivers of change, affecting local social structures, management practices and cultural values. These differences are clarified below whenever relevant.

Land Management Practices

Each household manages about one hectare of land through shifting cultivation, with a quarter of hectare being cleared every two to three years. Vegetation is chopped down and the area burnt a few months later, when vegetation is dry. Major wild fruit trees are left standing for the purpose of shade or fruit. Cultivars are planted starting with maize and, after harvest, followed by cassava, plantain, sugar cane, pineapple and other cultivars. Papaya and other fruits, such as zapote (*Matisia cordata)* and caimito (*Pouteria caimito)*, may also be sowed and, when grown, selected and thinned to mature. Different varieties of cassava and plantain are cultivated — e.g., among the Tikuna, these include up to 7 varieties of sweet cassava, 5 varieties of bitter cassava and 16 different varieties of plantain (T4, T7 and O9). There are no tillage and planting make use of specific wood sticks or animal bones,

> *"To sow we look for a stick that gives good fruits, like Guaba… Why? So, it comes out similar, with many fruits (…) that's how we sow the Pijuayo and also Sachapapa, Camote (…) so for tasty Pijuayo's fruits, we sow it with a tortoise bone or a monkey bone, with that we dig the earth." (T10 - T11)*

Farm plots (*chacras*[1]) may be open in floodable areas (*bajial*), where river sediments increase soil fertility, or in upper areas (*restingas*), where soil fertility is managed through rotation cycles. After two years, corresponding to a cassava plantation cycle, the field is traditionally left fallow for a period between five to ten or more years, depending on land availability. Fallow land (*purma*) is left to regenerate, resulting in patches of secondary forest with high fruit diversity and abundance of valuable NTFPs species providing food, medicine or craft materials. These areas, ideally left fallow for more than ten years, are an important resort for gathering fruits but also hunting animals, attracted there by those fruits. In Alto Amazonas, a local forest engineer reports the Regional Conservation Area comprises approximately 2% *chacras* and 35% secondary forest (O10), providing a baseline estimate for the wider region.

Additionally, a wide variety of trees, palms, lianas and shrub species, providing a diversity of resources to sustain local communities' material and ritual life, may also be intentionally selected, protected, thinned or propagated along certain forest patches. These species may further sustain a diversity of animal, fish and bird species, with their distribution determining seasonal calendars for hunting, fishing and harvesting (e.g., during fruiting season). Numerous cultural practices are also linked to NTFPs extraction, processing and transformation, expressing a detailed knowledge on useful plant components, harvesting times and specific procedures for harnessing their properties. In Shawi communities, for example, fishers use barbasco (*Lonchocarpus utilis*) and huaca (*Clibadium remotoflorum*) to either kill or inebriate fish, applying it in certain river areas (e.g., river inlets) and outside spawning season to not damage fish populations. Indeed, besides *chacras* and *purmas*, the forest represents a fundamental productive area linked to subsistence and ritual practices, whose cultural and economic significance is illustrated by several respondents:

> *"The forest is our market. There we have all sort of trees, leaves to make our roofs, we get tamshi to weave our baskets, there we hunt all sorts of animals (…) That's why it's important." (S11)*

[1] Regional vocabulary (Spanish)

> *"The forest is important for us, to defend our land, protect our territory (...) we use the forest for everything" (S13)*

Culturally and economically significant plant species, the benefits derived from these and the ecosystem services supported by associated forest management practices are detailed in Table 5.A2 (Appendix 5.A). These species illustrate how cultural services, linked to resource management practices, may support diverse provisioning and regulating services. Nowadays, among the Shawi, subsistence practices are often complemented with animal breeding, including cows, pigs and poultry, raised not for self-consumption but as an economic asset, for exchange in local markets. Some families also do commercial plantations of cacao or other cash-crops, such as sacha-inchi (*Plukenetia volubilis*). In contrast, among the Tikuna, household economies are mostly complemented with cash-crop plantations, namely coca (*Erythroxylum coca)* and cacao (*Theobroma spp.)*, with trading of staple crops' surplus (e.g., plantain and cassava).

Regulations and Cultural Values

Several regulations are applied to land management practices, determining who, when and how tasks are performed. Fishing practices using natural toxins (e.g., barbasco) are subject to communal decisions, pertaining to when and where to fish without damaging fish populations, gathering the whole community so the catch is distributed evenly. In hunting practices, the prey must also be shared with the whole community: "When we get a big prey, we bring it home and invite everyone to share. If we find a big animal, we share it all, only if it's small and just enough for a family we don't" (S12). Hunting skills also play a crucial role on the reproduction of social structures, such as marriage: "You have to hunt, otherwise you don't keep your wife" (T6). Social prescriptions, as described above, are part of wider regulations, norms and preferences that support what is considered a 'good-life', including social obligations to share any surplus; prohibitions to harvest, hunt or fish more than one needs; seasonal calendars for when, what and where to harvest, fish or hunt; and other prescriptive practices, such as diets, which restrict allowed foods or activities during certain time periods. These prescribed behaviours regulate human–environment relationships, conveying cultural values based on reciprocity and respectful action.

Additionally, discursive practices are performed towards forest entities (e.g., 'bush mothers'), asking for permission or protection from these (e.g., asking their 'offspring' as prey), before

opening a *chacra*, hunting or harvesting resources. These express a respectful action in resources management, where natural resources are not perceived as owned by the community:

> *"We take care of the forest by not taking everything, so that forest mothers don't 'strange' us, don't 'mischief', so they give us what we need, 'cos they know us and we take care of the forest together" (S6)*

> *"In the bush, the forest mothers are the owners of everything (...) we ask them prey to hunt, that's how we go into the forest. Sometimes we find, sometimes not. But, when we find animals, we give them thanks." (T10)*

Bush mothers are powerful anthropomorphic beings of local folklore which, appearing pervasively in narratives linked to natural forces, may be portrayed as tricksters (e.g., capturing people); as facilitators (e.g., assisting healing, hunting or fishing); or, generally, as guardians (e.g., confronting those who are greedy). Witchdoctors are responsible for managing the community's relationship with these entities and communicate the prescribed behaviours, diets and taboos: "if you follow the diets, the forest mothers then give you their power, then in dreams they make you see how to heal, then they show you everything" (T3). Thus, witchdoctors perform an authority role within the community, regulating human–environment relationships and being consulted before any important personal or communal decision.

5.4.2 POLITICAL LANDSCAPE

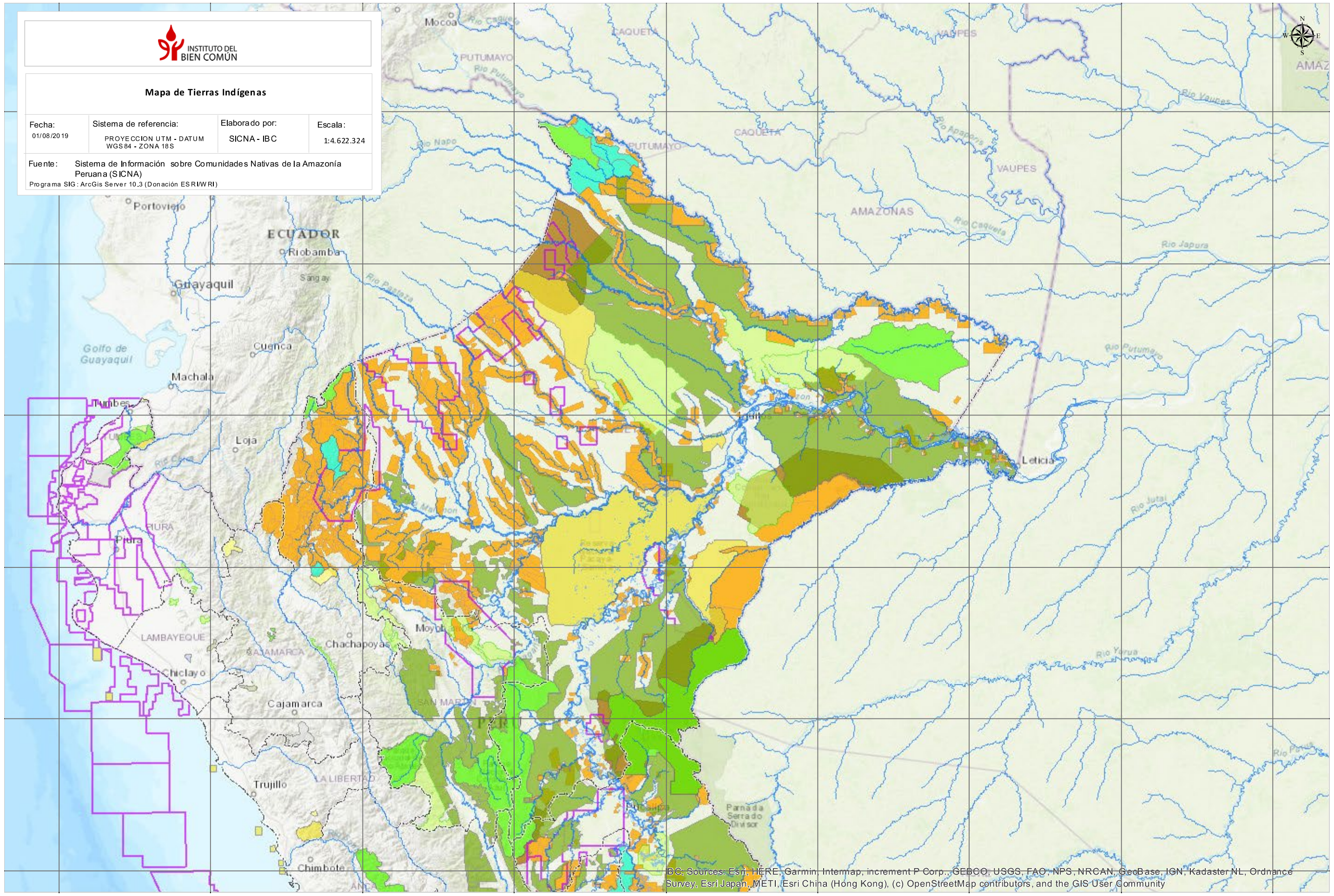
Economic development and biodiversity conservation initiatives are reported by indigenous people as major drivers of social and ecological change in Loreto. Most significant development projects impacting indigenous territories include extractive industries (e.g. petroleum), market pressures leading to land-use intensification and road infrastructures, reported for fostering contamination, deforestation, land-grabs and numerous social conflicts (e.g. EJAtlas, 2016) while driving changes in indigenous cultural practices and values; but also poverty alleviation and educational initiatives, supporting local communities, yet often placed in contradiction to indigenous ways of living. Conversely, conservation initiatives mentioned refer to the impact of protected areas, imposing restrictions on land use while extensively overlapping indigenous territories, hindering communities' subsistence means, forcing changes in resource management practices and leading to high levels of social conflict (e.g., Morris, 2018).

These projects embody the agency of distinct social groups, whose geographical distribution is represented in Map 5.2 based on IBC/SICNA data for: (1) indigenous territories, as communities with officially recognised land rights; (2) development projects, as extractivist industries (e.g. oil and mining concessions) and Permanent Production Forests areas (e.g. managed for timber and NTFP extraction); and (3) conservation initiatives, as designated protected areas, including National Reserves and Regional Conservation Areas. Their contrasting worldviews are illustrated by indigenous respondents, referring to development projects, and regional conservation officers, defending the need of protected areas:

> *"With their money they can do whatever they want, they don't care about deforesting hectares because, despite the floods coming or the sun burning, they are living off their money. If they get sick, they go to the hospital. If they want to eat, they go to the market." (S3).*

> *"Native communities have been ancestrally deforesting (...) [the Regional Conservation Area] wants to exchange the ancestral forest use for economic alternatives, such as tourism, recreation activities and alternatives to timber resources, as rubber extraction" (O10).*

Indeed, these social groups are characterised by the reproduction of distinct resource management practices, cultural values and associated benefits, supporting different cultural, provisioning and regulating services — see Table 5.2. Development projects are generally guided by monetary values with focus on the production or consumption of provisioning services, such as energy, raw materials and food, supporting land management practices strongly based on extractivist industries (e.g., oil and rubber) and agricultural intensification (e.g., cacao). On the other hand, conservation initiatives are guided by environmental values, expressed on regulations that restrict resources' use within protected areas, promoting management practices to protect biodiversity and enhance regulation services (e.g., climate) by minimizing human intervention while encouraging economic returns based on tourism and recreational activities. Finally, as previously described, indigenous land management practices are mediated by relational values, based on reciprocity and respectful action, supporting multiple provisioning and regulating services, such as food production, maintenance of distinct habitats and regulation of soil fertility, also linked to diverse cultural benefits (e.g., identities and capabilities). Therefore, following the IPBES classification scheme, these social groups may be further characterised by their affiliation to the production and consumption of multiple ecosystem services, detailed in Table 5.3.



Map 5.2 - *Geographical distribution of officially recognized indigenous territories (orange) and indigenous reserves (brown), protected areas as National Reserves (yellow) and Regional Conservation Areas (light green), Permanent Production Forests (dark green) and oil concessions blocks (delimited by purple line) in Loreto Department, Peru (source: IBC/SICNA, 2019).*

Social Groups	Cultural Ecosystem Services			Ecosystem Services Supported
	Management Practices	**Values**	**Benefits**	**Other Services**
Indigenous Communities	Subsistence practices based on shifting agriculture, hunting, fishing and forest management for NTFPs	Relational Values, based on reciprocity, respectful action and 'good living' principles	Capabilities (e.g., knowledge); Experiences (e.g., sense of place); Identities (e.g., cultural diversity);	Provisioning (e.g., food); Regulation (e.g., soil fertility); Supporting (e.g., maintenance of habitats);
Economic Development	Land-use intensification through extensive monocultures and pastures, extractivist industries for oil, ore or timber and exploitation of other forest resources (e.g., rubber)	Economic Values, based on market incentives for resources extraction and intensified production	Capabilities (e.g., technology);	Provisioning (e.g., energy, food and materials);
Biodiversity Conservation	Natural Protected Areas, implementing environmental restrictions for agriculture, hunting, fishing and resources extraction along with population limits	Environmental Values, based on protecting biodiversity, advancing knowledge and promoting tourism	Capabilities (e.g., knowledge); Experiences (e.g., recreation and tourism);	Supporting (e.g., maintenance of habitats); Regulation (e.g., climate);

Table 5.2 - *Cultural Ecosystem Services reproduced by distinct social groups, including their cultural practices, values and benefits alongside other Ecosystem Services supported.*

	IPBES Category	Benefits Production			Benefits Consumption		
		IP	ED	BC	IP	ED	BC
1	Habitat creation and maintenance	++	-	++	+	o	+
2	Pollination and dispersal of seeds and other propagules	++	o	o	+	o	+
3	Regulation of air quality	+	-	+	+	+	+
4	Regulation of climate	+	-	+	+	+	+
5	Regulation of ocean acidification	+	-	+	o	o	o
6	Regulation of freshwater quantity, location and timing	+	-	+	+	+	+
7	Regulation of freshwater and coastal water quality	+	-	+	++	+	+
8	Formation, protection and decontamination of soils and sediments	++	-	+	++	o	+
9	Regulation of hazards and extreme events	+	-	+	+	o	+
10	Regulation of detrimental organisms and biological processes	+	-	o	+	o	+
11	Energy	++	-	-	++	++	+
12	Food and feed	++	++	-	++	++	+
13	Materials, companionship and labour	++	++	-	++	++	+
14	Medicinal, biochemical and genetic resources	++	o	-	++	++	o
15	Learning and inspiration	++	o	++	++	o	++
16	Physical and psychological experiences	++	o	++	++	o	++
17	Supporting identities	++	-	-	++	o	o
18	Maintenance of options	++	-	++	++	+	+

Table 5.3 - *Ecosystem services' flows between different social groups (IP = Indigenous People, ED = Economic Development, BC = Biodiversity Conservation), represented through their affiliation to the production and consumption of distinct ecosystem services, based on IPBES classification scheme. Green cells refer contributions to the enhanced production or consumption of benefits through direct (++) or indirect means (+); red cells to negative effects on benefits production (-); and yellow cells to neutral effects on production or consumption of benefits (o).*

5.4.3 SOCIO-ECOLOGICAL DYNAMICS

Regional socio-ecological dynamics are contingent on a complex network of interactions between distinct social groups, where the type and strength of interactions depends on a combination of geographical, historical and socioeconomic factors. These interactions embed ecosystem services flows, described in Table 5.3, while the resulting dynamics reflect the distinct drivers, pressures, impacts and responses behind social and ecological changes — depicted in Fig. 5.1. The historical factors and major drivers of change, affiliated to economic development and biodiversity conservation initiatives, which convey pressures and impacts on indigenous territories nowadays, including their ways of living and forest cover, are detailed below.

Historical Factors

Following colonization, religious and educational institutions were reported by indigenous people as historical factors with long-standing impacts in the reproduction of indigenous knowledge, social structures and cultural values. Religious missions influenced local discourses, practices and values, fostering the replacement of indigenous worldviews with 'westernised' ones. Simultaneously, foreign schools, conveyed in Spanish rather than native languages, removed children from participating in daily activities and practices alongside their parents, hindering intergenerational modes of knowledge transmission based on practical experience. Both institutions embody colonization processes where indigenous ways of living were consistently portrayed as 'primitive' and underdeveloped, fostering changes in cultural values alongside inner and outer social conflicts, where power relations seek to shape local economies and social structures. The construction of schools and churches also led different families to gather in villages around these institutions, when prior settlements were dispersed and centred on a familiar hut, the *maloca*. This entailed further changes in daily communal and subsistence practices (O11), implying the relocation of agricultural work away from the household centre,

with *chacras* now up to an hour distance from the village — depending on land availability and the perceived risk of cultivars being stolen.

Economic Development Pressures

Extractivist industries, market-led initiatives and road infrastructures were reported as main drivers of socio-ecological change by indigenous communities, with roads and extensive monocultures being highlighted, by IIAP's forest research director, as main drivers of deforestation in the region (O8). These development projects tend to occupy territories with non-recognized indigenous land rights and rarely comply with norms for obtaining prior informed consent from local communities. Their effects on indigenous lands, nonetheless, are detailed below and illustrated by several respondents:

> *"One major threat we face here is the oil companies (...) all the natural resources we have here are taken by private companies for the state's benefit but we don't benefit from it, the people here don't benefit." (S3)*

> *"Nowadays we don't find so many animals, because with increasing population animals run out and same with natural resources (...) People make chacras, cut the trees, because they need money too, they make big pastures to raise cattle, to plant cacao and so the resources slowly run out." (S11)*

> *"Now comes the road and comes the invasion… All land grabbers, they grab a space (...) while our brothers here, with little knowledge, with little economies, can do nothing. They have the money, they want the road and position in the territory, to work there and make more money." (S3)*

Extractivist Industries: Despite a lack of official numbers, news media document at least 45 oil spills in the Peruvian Amazon during the last 5 years and more than 25,000 oil barrels leaked since 2011, resulting on the contamination of main hydrographic basins (e.g., Corrientes, Tigre and Pastaza rivers) and affecting the subsistence of more than 25,000 people (EJAtlas, 2016; ORPIO 2019a; Servindi, 2019). Oil companies operating in Loreto, namely Petroperú (national company) and Pluspetrol (international private company), are responsible for numerous oil spills and high levels of social conflict, leading to several protests and blockades (ORPIO, 2019b) which denounce the contamination of indigenous territories alongside the lack of previous informed consent from local communities.

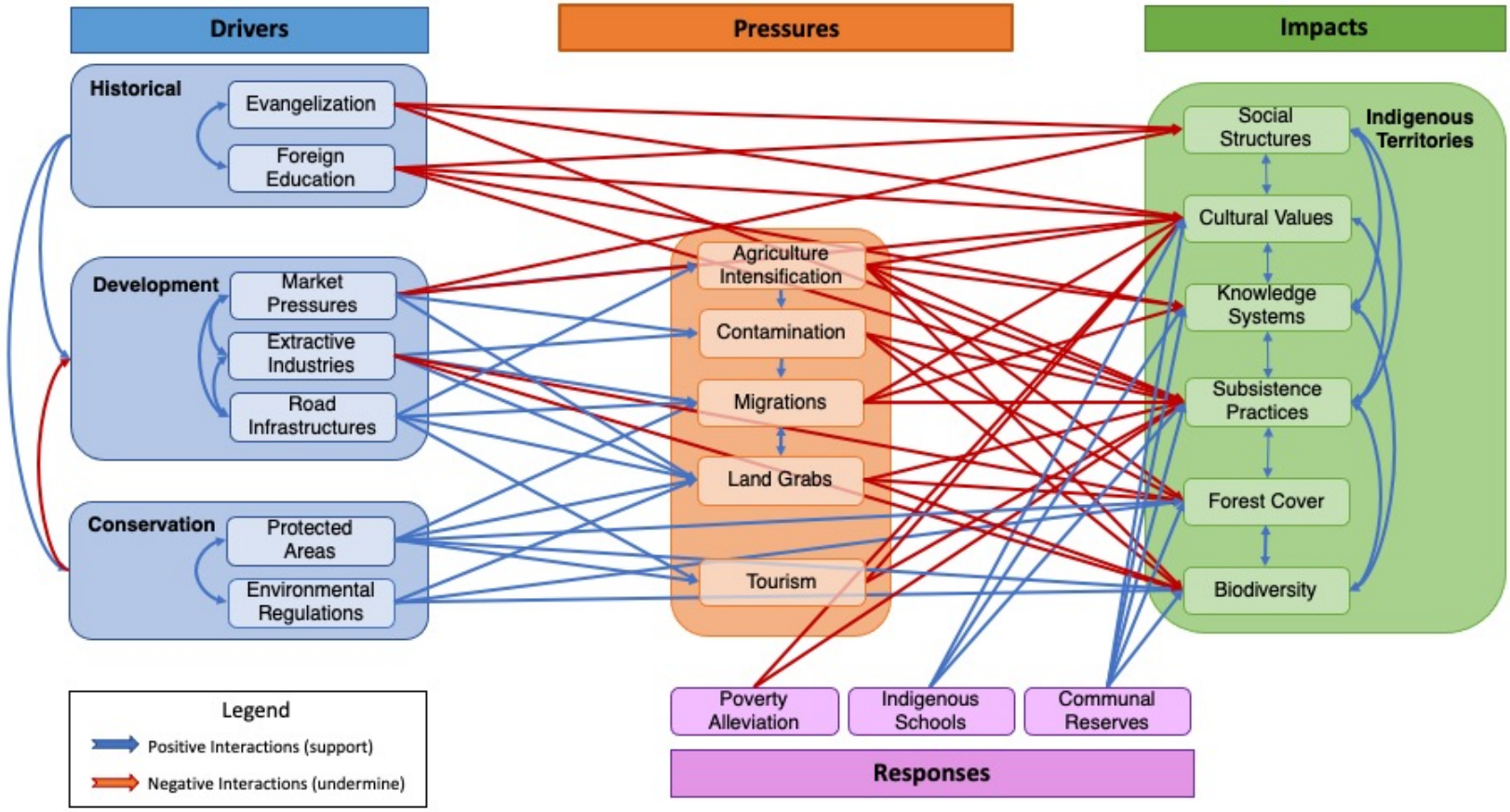


Figure 5.1 - *Socio-ecological network representing interactions between different social groups through their affiliation to distinct drivers of change, pressures, impacts and responses affecting indigenous cultural ecosystem services and the environment in Loreto department, Peru.*

Simultaneously, the concession of Permanent Production Forests (PPFs) areas to private parties, for the extraction of timber and NTFPs, has also been problematic due to its extensive overlap with indigenous-managed forest areas.

Market-Led Initiatives: In the Alto Amazonas, cash crops include sacha-inchi, papaya, cacao, coffee and cotton. These products are occasionally subject to wide price fluctuations, like the sacha-inchi which suffered a sudden 95% market devaluation during the economic crisis and left numerous families deprived of economic returns (O3). Nowadays, cacao production occupies a significant parcel of communal lands — up to 20 hectares in some communities (S3), resulting from governmental incentives and promising market prices. Since the 1980's, in the border with Colombia and Brazil, Tikuna communities derived an important source of income from coca plantations. As argued by a IIAP's social researcher, this didn't support a luxury lifestyle but rather increased opportunities to access education and improve housing infrastructures (O9). Since 2014, however, a governmental campaign against narcoterrorism (CORAH) was set to eradicate coca plantations, leading to a struggle for alternative sources of income, followed by the implementation of a governmental incentive's program (DEVIDA, 2016-2021) for intensifying cacao production, based on the donation of seedlings and chemical compounds (e.g., pesticides). Conversely, in both Shawi and Tikuna territories, logging is an important commercial activity mostly promoted by foreign parties. Here, despite size or quality, trees with valuable timber (e.g., Kapok or Cedro) are often sold to foreign traders for a fraction of its market value (sometimes less than 1%), mostly through individual agreements which evade communal decisions or dividends.

Road Infrastructures: Since 2016, a road connects Balsapuerto to Yurimáguas, capital of province. Prior to its inauguration, private investors and companies arrived looking for buying or leasing land from local communities which, despite knowing these may become permanent settlements difficult to reclaim, eventually give in to the pressure and accept the new income. Along the road, several hectares of forest were already cleared for agriculture, opening way for new cattle pastures along papaya, cacao and rice plantations. These land acquisitions often occupy 'free' land between officially recognized communal territories, entailing imminent conflicts with Shawi's territorial claims. As posed by a respondent, "another threat we face are the invaders and the road projects… look Moyobamba road, it's all deforested there, what was previously forest is now papaya, cacao, coffee, everything. So, when the road arrives here it will be the same, the road arrives and the invasion comes with it" (S3). The road also facilitates

access to tourists and traders, who promise new sources of economic returns, despite local communities' apprehension with such changes also triggering raises in criminality.

Development projects promote agricultural intensification, drive environmental contamination and foster the land grabbing of indigenous territories, leading to increased deforestation rates and general declines on resources availability (e.g., wild species populations). Supporting economic development projects, road infrastructures facilitate the access to once remote forest areas, fostering further land grabs on 'unclaimed' territories and market-driven large-scale deforestation, sometimes in a 10km wide corridor along the road (Pitman et al., 2014). Environmental impacts, including forest cover loss or soil and water contamination, directly impact local communities by curtailing their subsistence means and increasing their economic vulnerability in ways which often lead to forced migrations, with the subsequent erosion of cultural heritage, sense of place, knowledge systems and cultural identities entwined with indigenous ancestral territories (O9). Simultaneously, economic vulnerability resulting from land grabbing and reduced resources availability drive changes in indigenous land management practices towards intensification, based on cash-crops and livestock production.

Biodiversity Conservation Pressures

The Regional Conservation Area of Cordillera Escalera was created in 2005 and covers nearly 150 thousand hectares of which 35% are secondary forests, resulting from ancestral tenure by indigenous people. Thus, despite its perimeter partially respecting officially recognized territories, the conservation area substantially overlaps with indigenous territorial claims and its demarcation was imposed without adequate prior consultation (AIDESEP, 2013). The project seeks to protect biodiversity and promote economic alternatives, such as tourism and recreation, along with the 'environmental education' of local communities, 'enhancing' agricultural practices and limiting forest use to areas assigned for shifting agriculture (2%), while legally penalizing those who open new *chacras*, as criminal offence (O10). Similarly, in the Pacaya-Samiria National Reserve, environmental regulations apply population limits and restrictions on agriculture, hunting and fishing which, constraining indigenous means of subsistence, raised intense social conflicts and forced local economies reliance on tourism, through becoming field guides, selling craftwork or staging ritual dances (O5, O11).

Protected areas based on the implementation of National Reserves (e.g., Pacaya-Samiria) and Regional Conservation Areas (e.g., Cordillera Escalera) contribute to halt economic developments on delimited areas, preserving forest cover and biodiversity. However, imposed environmental regulations drive changes in local economies and land management practices, by promoting tourism and constraining local means of subsistence, often forcing native communities' migration. Meanwhile, community-based conservation initiatives have been successfully implemented in Pacaya-Samiria (Morris, 2018), yet 'top-down' conservation initiatives continue to be normative, ultimately contributing to place further pressures on land and resources available to native communities while, simultaneously, fostering indigenous responses for the integral recognition and protection of their ancestral territories.

> *"I believe we indigenous people have the right to protect and care for our forest. Now that many are speaking about climate change, we need to create projects which support the people who protect our forests. That's what we are doing (...) fighting for the recognition of Shawi's ancestral territory." (S3)*

Impacts on Indigenous Territories

Land grabbing associated to market-driven intensification significantly reduce land availability which, in turn, reinforced by increasing populations, drive changes in forest management practices and disrupt traditional rotation periods. In Tikuna communities, for example, *purmas* are eventually left fallow for only three years, despite the acknowledged importance of longer fallow periods for managing soil fertility and diversifying resources available (T1, T5, T7 and T12). Moreover, development discourses allied to economic vulnerability, resulting from land and resources scarcity, reinforce changes in local economies and forest management practices (O8), opening the way for market pressures to enter indigenous communities in ways which contribute to weaken their cultural values, knowledge systems and social structures (O9).

Indigenous social structures are also significantly affected by socio-ecological changes, particularly indigenous leaders and witchdoctors' roles within the community. Among the Shawi, at least 13 witchdoctors were killed in 2016, allegedly because of power disputes with members of local institutions (S1). The prosecution and murder of local healers (*curanderos*) is, simultaneously, often justified by accusations of them killing people through witchcraft (S1, O4). Concurrently, the regional increase on 'shamanic tourism' fosters the commodification of ritual

practices, such as ayahuasca ceremonies, where a thousand dollars market promote their appropriation by charlatans: "now there's not so many healers, mostly there is many impostors who pretend to be healers, but the majority just deceive people" (T8).

Institutional and Indigenous Responses

Indigenous ways of living are conventionally perceived, by 'western' standards, under a socially constructed concept of poverty, with Loreto being considered one of the poorest regions in Peru. In this context, among the Tikuna, poverty is often articulated under an alleged abandonment by the government, supported by a perceived lack of income opportunities, institutional support and the stated underdevelopment of their own community. Among the Shawi, however, poverty discourses are contested and contrasted with the perceived richness of their territory: "We are tired of all those organisations who come here saying we are poor. We are not poor, look all this richness around us!" (S14). Poverty alleviation initiatives led by NGOs and governmental institutions tend to overlook indigenous cultural practices and values, fostering a dependence on external inputs and undermining their autonomies (O11). Still, indigenous responses to social and ecological changes are rich and varied, including the implementation of educational programmes in native languages which support local knowledge systems and ways of living (e.g. Formabiap); and strategies to reclaim secure land tenure for indigenous ancestral territories, through establishing communal reserves (based on shared governance and alliance with National Protected Areas) and requesting collective land titling for indigenous integral territories (based on the historical, biological and social reconstruction of ancestrally tenured lands).

Indigenous organisations (e.g., AIDESEP) estimate that at least 310 native communities are still pending territorial demarcation in Loreto, in total demanding recognition of indigenous land rights to 20 million hectares in the Peruvian Amazon. As argued by a IIAP's forest management researcher, territory recognition is "fundamental to avoid land use conflicts, between native communities and any other entities, or even to enable ecosystem service payments, as everything depends on that" (O8). However, factors hindering the official recognition of indigenous territories include the restricting bureaucracy, clashing economic interests and land-conflicts derived from property rights or use concessions by third parties, for example through contracts for resources extraction (e.g., PPFs) and national forestry investment strategies (AIDESEP, 2013). Despite the forest's cultural and economic significance for indigenous people, official recognition of indigenous' land rights based on communal tenure excludes involving forest areas, to which may be assigned use concessions, resulting in fragmented territories vulnerable

to the occupation or land grabbing of 'unclaimed' areas between communities. Responding to increasing land pressures, Shawi communities seek the land titling of Shawi's ancestral territory as one single integral territory (*Kampu Piyawi*),

> *"This forest is kept by Shawi people since way before, and it is being invaded now (...) They say to recognise a native community and give land rights we have to live there for 5 years, but there no one lives, right? Because it's bush, there's animals and all the forest richness. So, we must find a way to protect it, so we can all benefit, and that's what we are doing. So, this land is recognised by the state as one single territory, Shawi's ancestral territory (...) so this forest may continue being forest and the state respects indigenous people's rights" (S3)*

5.5 DISCUSSION

Following the conceptual framework advanced by Fish et al. (2016), this study demonstrates how CES assessments, focusing on cultural practices, values and derived benefits, may contribute to reveal processes of co-production of the landscape. The results advance new evidence of CES relation to the production and consumption of multiple ecosystem services, while providing further evidence of people's role supporting diverse cultural, provisioning and regulating ecosystem services, or 'services to ecosystems' (Comberti et al., 2016). These results further contribute to disclose how cultural values, which may include but are not limited to monetary values, inform distinct resource management practices affiliated to divergent topologies of human–environment relationships. This extends the acknowledged relevance of cultural and relational values (Chan et al., 2012; Kumar and Kumar, 2008; Pascual et al., 2017), stressing the significance of worldviews based on reciprocity and respectful action to the sustenance of biodiverse ecosystems.

Yet, the analysis also demonstrates how the cultural and biological diversity of IPLC territories is in constant negotiation with the complex social, economic and political processes behind their transformation, contingent on interactions between multiple social actors. In accordance with the notion of "nature in the making" (Tsing, 2001), the political landscape where distinct social groups meet and interact constitutes a "troubled space that connects and overlays" them (ibid.: 13). Therefore, as the present study shows, CES categories are dynamical, rather than static, and interdependent, rather than separate — i.e., cultural values influence practices that

determine benefits and *vice-versa* (Fish et al., 2016), while dependent on historical contexts and subject to numerous feedback processes which may reinforce or arrest their transformations.

Cultural Practices, Benefits and Values

IPLC territories are fruit of long-term interactions with the biophysical environment, embedding a cultural heritage in which adaptive land management practices, indigenous knowledge systems and landscape features exist inextricably intertwined. Here, the results show how local communities have maintained or even enhanced biodiversity through managing both 'wild' and 'domesticated' species, preserving and regenerating different habitats within their territories. Following Wiersum's classification (1997; 2004), our results demonstrate that IPLC forest management practices include the cultivation of improved varieties; the propagation or tending of culturally and economically valued species; and the protection and regeneration of forest resources through fire control, rotational practices and selective harvesting. These practices result in distinctively modified forest areas, from resource-enriched forests, through selective propagation of certain species; to reconstructed forest and mixed arboriculture areas, such as *purmas*, comprising cultivated, regenerated and protected species (Ros-Tonen, 2012; van Bommel and Turnhout, 2012). These practices constitute 'forest gardens' within IPLC territories, where indigenous forest management practices result in 'intermediate' land-use systems along a nature-culture continuum, neither uniquely wild nor entirely domesticated (Wiersum, 2004).

Nonetheless, the notion of 'intermediate' land-use systems allows to deconstruct an evolutionary continuum of resource exploitation, as both the 'domesticated' and fiercely 'wild' aspects of Amazonian landscape are fundamental for the symbolic construction as well as the social and biological reproduction of IPLC territories. IPLC forest management practices are "modes of practical and intentional engagement with the environment" (Rival, 2006: 86), intimately connected to the reproduction of particular ways of living and cultural identities as 'forest-dwellers' (Cepek, 2011; Rival, 2007). As demonstrated in this study, NTFPs represent an important economic safety net for forest-dwelling people (Ros-Tonen, 2012; Alexiades and Shanley, 2005) which is central both to the subsistence and cultural reproduction of society (Rival, 2007), being strongly linked to IPLC cultural identities, knowledge systems and relational values. Here, cultural values are expressed in social obligations and prohibitions towards the forest (e.g., diets, discourses and sharing duties), with forest mothers epitomising those natural forces that convey the prescribed behaviours, based on reciprocity and respectful action, that regulate

human–environment relationships — in agreement with many indigenous worldviews worldwide (Descola, 2013; Hall, 2011). This presents further evidence of how forest management practices constitute complex social structures (Alexiades and Shanley, 2005), supporting the negotiation of life and death cycles with forest entities, to establish balanced ecological communities within IPLC territories.

In this context, the assessment of cultural practices, values and benefits in IPLC territories provide supporting evidence of CES relation to the production and consumption of multiple ES, namely provisioning services, such as food, medicines and raw materials; and regulating services, such as soil fertility, climate and maintenance of distinct habitats. Here, IPLC forest management practices are shown to support both people and nature, in accordance with a growing body of evidence on indigenous role safeguarding biodiversity (Schuster et al., 2019; LBO, 2020). Yet, agreeing with previous research on NTFPs (e.g., Clark and Sunderland, 2004; Ros-Tonen, 2012), our results also convey that market-led resource extraction may result in overexploitation and detrimental environmental impacts, highlighting how sustainable resource use is contingent on cultural, economic and political variables (Ostrom, 2009) — including secure land tenure rights. This is further demonstrated by disaggregating CES analysis, where revealing the cultural practices, values and benefits affiliated to distinct social groups contributes to disclose how economic development and biodiversity conservation initiatives are involved in the production and/or consumption of different provisioning and regulating services.

Thus, in agreement with previous studies supporting its relevance for ecosystem assessments (Mehring et al., 2017; Chaudhary et al., 2018), the analysis presents evidence of the socially heterogeneous distribution of ES supply and demand, further disclosing the influence of divergent cultural values in its distribution (Brooks et al., 2014; Cáceres et al., 2015). This heterogeneity reveals the ecosystem services flows embedded in interactions between different social groups, linked to global economic markets and/or global conservation concerns, unveiling these groups responsibility in either driving further environmental degradation (Marques et al., 2019) or supporting ecological regeneration (Comberti et al., 2016) along with their role leading social and ecological changes in IPLC territories.

Social and Ecological Dynamics

This study presents evidence of how economic development and biodiversity conservation projects constitute social and ecological pressures that impact IPLC territories, driving deforestation along with changes in cultural values, knowledge systems and subsistence practices. Following Ostrom's (2009) work on the sustainable use of commons, our results suggest that self-regulation mechanisms mediate indigenous forest management practices, supporting their sustainability based on shared relational values, detailed knowledge about forest dynamics and communal decision-making processes. However, socio-ecological pressures exerted by economic development and biodiversity conservation initiatives have profound impacts on IPLC ways of living, particularly reducing land and forest resources availability, with the former driving environmental contamination, agricultural intensification and successive land grabs; and the latter excluding IPLCs from protected areas, limiting access to forest areas and constraining indigenous forest management practices. These lead to changes in IPLC's modes of subsistence which, as shown by our results, reinforce changes in cultural values, knowledge systems and social structures — often towards land-use intensification, resulting on multiple feedback loops driving further cultural erosion and resources overexploitation.

As such, in accordance with prior studies on commons' management (Ostrom, 1990; 2009), the results support that sustainable land management by IPLC communities is contingent on (1) the effective reproduction of local knowledge systems and shared cultural values; and (2) the secure access to forest areas and resources, comprising indigenous ancestral territories — being most hindered by the communities' economic vulnerability, resulting from lack of secure land rights and entailed reduced land and resources availability.

Therefore, insecure land tenure rights are critical for understanding the socio-ecological dynamics affecting IPLC territories in Loreto region — in accordance with the IPCC (2019), IPBES (2019) and LBO (2020) which recently endorsed indigenous and community land rights as crucial for forest conservation and climate change mitigation, and as supported by IUCN Chair Alcorn (2014), who sustains this represents worldwide "a major driver of conflict, disrupted investments, environmental degradation, climate change, and cultural extinction" (RRI, 2015: vii). Accounting for the number of indigenous communities and average size of their territories,[1] we estimate that nearly 20 million hectares in Loreto are managed by native people,

[1] Loreto has 36 885 thousand hectares and around 1500 native communities of which only 60% are officially recognised by government (IBC, 2016). In Peru, in average each territory comprises 13 thousand hectares (WWF, 2014).

i.e., circa 53% of Loreto area, despite over 11 million hectares not being officially recognised. Here, besides entailing a bureaucratically and financially difficult process, official recognition of indigenous territories poses a number of additional issues: first, the demarcation of communal territories is not representative of indigenous territories, which comprise forest areas ancestrally used and managed, to which official bodies attribute only use concessions (AIDESEP, 2013); and second, as supported by the present study, current recognition results in fragmented territories vulnerable to land grabs by foreign parties which, linked to increased deforestation and the depletion of forest resources, reinforce the economic vulnerability of IPLC communities. Then, the results present evidence of the critical need for official recognition of IPLC territories, particularly based on indigenous notions of integral territory, i.e., extending land rights to forest managed areas and constituting single whole territories for indigenous groups.

Forest areas have been extensively and remarkably managed by indigenous communities, as widely supported by studies on Amazonian historical ecologies (Balée, 2013; Clement et al., 2015; Rival, 2006) and pre-Columbian settlements in Loreto (Kelly et al., 2018). However, protectionist 'top-down' approaches to conservation, already widely criticised (Brockington, 2002; Colchester, 2004), are here shown to accentuate the economic vulnerability of IPLC communities, restricting access to forest areas and fostering social conflicts over land-use, which ultimately hinder sustainable forest management practices. Therefore, building on studies advocating for the integration of IPLC's knowledge and management practices in conservation (e.g., IPBES, 2019; LBO, 2020; RRI, 2020), the present study highlights the need for strengthening alliances between indigenous communities and conservation initiatives, to foster both rights-based conservation and enhance its outcomes. 'Forest-dwellers' identities are already used by indigenous people to promote solutions and find allies in common struggles (Cepek, 2008); communal reserves have been established, representing fruitful collaborations in the shared governance of common resources (AIDESEP, 2013; Praeli, 2018); and National Parks, as the Pacaya-Samiria Reserve, are building successful community-based conservation initiatives (Morris, 2018). Within these promising collaborations, nonetheless, indigenous people are not reducible to utilitarian roles, based on either 'noble ecologists' or 'primitive savages' (Cepek, 2008), but rather are active proponents whose self-determination must be respected, by understanding conservation and indigenous discourses as an articulation of multiple worlds — with diverse and at times conflictive worldviews — which share contemporary challenges across complex political landscapes.

5.6 CONCLUSIONS

This study advances an approach to cultural ecosystem assessments that reveals the cultural, social and political dimensions of complex socio-ecological dynamics, disclosing the impacts of economic development and biodiversity conservation initiatives in IPLC territories. Conveying how these groups embody distinct worldviews, through their affiliation to disparate cultural practices, benefits and values, the study demonstrates their connection to different ES flows underlying deforestation and cultural change in the Peruvian Amazon. As such, the study contributes evidence of the socially heterogenous distribution of ES supply and demand across society, concluding that: (1) cultural ecosystem assessments reveal different social groups affiliation to the production and consumption of multiple ES, by establishing a link between land management practices, relational values and embedded social structures; (2) different social groups reproduce distinct CES which are linked to distinct ES flows and drive changes, impacts and responses in IPLC territories' social and ecological characteristics; and (3) CES and ES categories are dynamical, interdependent and influenced by complex socio-ecological dynamics that result from interactions across multiple social actors.

Moreover, by comparing IPLC communities, economic development and biodiversity conservation projects, this study identifies two complementary strategies to support tropical forests conservation: first, securing IPLC land rights (IPBES, 2019; FPP, 2020), following indigenous notion of integral territory and decision-making processes; and, second, supporting a shift from protectionist to community-based conservation approaches, where indigenous people actively participate in the design, implementation and management of protected areas (RRI, 2019). This means securing IPLC's land tenure rights while engaging in the co-development of fair, equitable and effective biocultural approaches to conservation (Gavin et al., 2015; Hanspach et al., 2020; Merçon et al., 2019).

6. ISLANDS WITHIN AN ISLAND: A Cultural Ecosystem Assessment of Ascension Island

6.1 INTRODUCTION

> *"Instead of being simply a paradise, the island became the medium or metaphor for a much more fundamental questioning of the nature of existence, societies and the self and consequently for fictional or experimental constructions of new societies and analysis of old ones." (Grove, 1995: 225-227)*

Cultural Ecosystem Services (CES) invite consideration of how human–environment relationships support the cultural reproduction of local ways of living, focusing on the myriad ways people may interact with, assign significance to and co-produce the natural environment within specific socio–ecological contexts. As such, CES comprises dimensions of human–environment relationships which are central to human wellbeing (Kumar and Kumar, 2008; Schaich et al., 2010; Hirons et al., 2016) despite that, being generally linked to non-material benefits (MA, 2005), its assessment become nominal in the broader Ecosystem Services (ES) literature, being explicitly addressed in only 2% of publications[1] and mostly associated to recreation, tourism and aesthetic values (Milcu et al., 2013; Costanza et al., 2017). Assigning CES to 'leisure-time' and 'intangible benefits' reflects an ethnocentric approach, which follows a normative understanding of culture as the "aesthetic, spiritual, [and] psychological" dimensions of human life (TEEB, 2010). Drawing attention to CES constitutive dimensions, corresponding to the "relational processes and entities that people actively create and express through interactions with ecosystems" (Fish et al., 2016: 211), the present study explores the geographical and sociocultural diversity of human–environment relationships on Ascension Island, a small South Atlantic Island part of UK overseas territories.

[1] Publications addressing "Ecosystem Services" and "Cultural Ecosystem Services" since 1970 to date, according to search results with these keywords in the Web of Knowledge database (Accessed: 22nd July 2019)

Here, assessing CES on islands enables to explore how islands comprise 'relational spaces', simultaneously constituting insular peripheries and centres of complex global interactions (Baldacchino, 2006), well-delimited by fixed boundaries and unsettled by fluid mobilities, which may contribute to reveal how more-than-human entanglements perform within multiple relationalities and temporalities (Pugh, 2018). Embracing the contribution of social sciences, emergent ethnographic approaches to CES follow the notion of "culture as life expressed *in situ*" (Fish et al., 2016: 210), supporting an interpretative understanding of 'culture' which comprehends both the tangible and intangible dimensions of human–environment relationships. These approaches seek to investigate how cultural practices and meanings may materially shape patterns in nature and constitute processes of adaptation to particular environmental conditions (Milton, 1996), which influence both the environmental benefits produced and their geographical distribution (Mehring et al., 2017; Mitchell, 2000). Then, emphasizing the role of cultural practices in the co-production of environmental spaces contributes to establish a relational approach to CES (Fish et al., 2016), reflecting the diverse constellations of physical embodiments, symbolic representations and empirical knowledges embedded in both past and present interactions with the biophysical domain (Chan et al., 2016; Daniel et al., 2012).

CES subjective and intangible dimensions challenge the limits of ES frameworks to adequately represent human–environment relationships, based on quantitative assessments of independent variables, conveying the need for more inclusive and comprehensive approaches to the cultural dimensions of ecosystems (Comberti et al., 2015; Daniel et al., 2012; Hirons et al., 2016). Thus, extending CES understanding beyond recreational activities and aesthetic values, the present study advances a cultural ecosystem assessment of Ascension Island through the characterisation and mapping of the diverse human–environment relationships affiliated to its natural environment, examining both their multiple relationalities and constitutive temporalities, by mapping culturally significant places associated to distinct work and leisure activities and following a pluralistic valuation of derived cultural benefits. Rejecting notions of unidirectional ecosystem contributions to human well-being (Comberti et al., 2015), such approach seeks to reveal CES variability across time and space, unveiling sociocultural influences leading widespread landscape changes and determining major ecosystem services flows; but also, asserting the importance of relational values "not present in things but derivative of relationships and responsibilities to them" (Chan et al., 2016: 1462), to convey the social and geographical distribution of diverse relationalities expressed in the norms, principles and preferences that guide human–environment relationships (Chan et al., 2016; Pascual et al., 2017). Hence, cultural ecosystem

assessments may inform adequate environmental and conservation policies on Ascension Island, considering their potential impacts and opportunities across distinct social groups by identifying culturally significant places, practices and needs of local communities.

6.2 THEORETICAL FRAMEWORK

CES are broadly considered difficult to evaluate in a systematic way, because these are often not suitable for quantitative assessments (Kumar and Kumar, 2008; Daniel et al., 2012) and weakly represented in economic indicators (Schaich et al., 2010; Hirons et al., 2016) or, in sum, "lack the well-defined measurement boundaries and internal consistency of other ecosystem services" (Fish et al., 2016: 210). In this context, recent debates either seek constructing CES to be consistent with the ES framework (e.g., CICES, TEEB) or further developing culture's exceptional positioning within assessment categories (e.g. Díaz et al., 2018). This study adopts the latter approach, examining how sociocultural variables influence people's affiliations to and entanglements with the more-than-human assemblages that constitute their dwelling landscapes.

The present study is informed by the CES conceptual framework advanced by Fish et al. (2016), where CES are understood as the "contributions that ecosystems make to human well-being in terms of the identities they help frame, the experiences they help enable and the capabilities they help equip" (ibid.: 212). It considers cultural ecosystem services as produced by cultural practices which shape and are enabled by specific environmental spaces, from which specific sets of cultural goods and benefits are derived. Simultaneously, following a pluralistic valuation, the study explores the relational values affiliated to such practices and benefits (Chan et al., 2012; 2016), as the shared social values that guide human–environment relationships (Kenter et al., 2015), conveying the principles and preferences that support what is considered a 'good living' (Chan et al., 2016; Pascual et al., 2017).

Adopting a participatory mapping strategy (Puri, 2011), the approach enables to further explore CES variability across the landscape, contributing to understand how human–environment relationships are distributed geographically and mediated by social variables. Acknowledgement of ES socially heterogeneous distribution has been largely dismissed from ES literature, representing an urgent and significant development in CES assessments (Brooks et al., 2014; Cáceres et al., 2015; Chaudhary et al., 2018), while exploring CES from a relational perspective emphasizes the understanding of multiple entanglements between nature and society by considering,

through a spatially explicit and social disaggregated analysis (Burkhard et al., 2012; Mehring et al., 2017), the environment as subject of varied interpretations and affiliations.

6.3 MATERIALS AND METHODS

Study Site

Ascension Island is an isolated island of the South Atlantic: 7º56 south the Equator, about 1000 miles from Africa and 1400 miles from Brazil, and 800 miles from the nearest island, St. Helena. With an area of 34 square miles and no inland water bodies, Ascension is a relatively young volcanic island with an estimated age of about one million years.[1] The last volcanic eruption on the island was recently identified as dating back 500 years (Preece et al., 2018), well below the threshold for volcanos to be considered extinct. Ascension was first discovered in 1501 by João da Nova, as an uninhabited and desolated land where seabirds abound. Yet, only in 1815 would it become permanently inhabited, with a British garrison of Royal Marines established to secure Napoleon's exile in St. Helena (Hart-Davis, 2016). In meantime, it would mostly figure in the history of castaways, as the HMS Roebuck commanded by William Dampier or the case of Leondert Hussenlosch, exiled on the island (Agnos, 1979; Ritsema, 2010). Since then, the geographic location of this once desert island would become strategic for various reasons and in diverse situations: from a military island to a prominent role in global communication networks and monitoring space expeditions. As described by Captain Burnett in 1858, Ascension is perhaps: "one of the strangest places on the face of Earth" (Avis, 2001).

Like other islands, Ascension's remoteness and isolation enabled the evolution of particular ecosystems, both unique and fragile, typically rich in species endemism and poor in species richness. Endemic species of ferns, mosses and grasses evolved there along with endemic invertebrates, land crabs and seabirds. Since the discovery of Ascension, however, the fate of those species was inevitably linked to the history of human settlements. Nowadays, Ascension's biodiversity patterns reflect an intertwinement between its natural and cultural landscapes, as successive human settlements aspired to turn Ascension's inhospitable landscape into a more agreeable one. Particularly, a remarkable terraforming experiment was conducted on Ascension under the guidance of Joseph Hooker, later director of Kew Royal Botanical Gardens, who visited Ascension in 1843. Arguably following Humboldt's insights, the experiment imported

[1] More about the geology of Ascension Island can be found in the Ascension Volcanology website and linked publications: https://ascension-island-volcanology.com/ [accessed 15/04/2019]

hundreds of species from around the world aiming to create soil, increase rainfall and improve water supply for the first settlers[1] (Grove, 1995), producing a mosaic forest that quickly turned Green Mountain into a tropical rainforest (Wilkinson, 2004; Gray, 2004) — with profound impacts on Ascension's landscape, climate and endemic populations (Gray et al., 2005).

Nowadays, two centuries after the first settlement, the UK government still denies the right of abode on Ascension: "Ascension is a working island. That means that everyone on island is here to work or to be with someone who works" (AIG, 2019). As such, nobody is officially from Ascension, fixed-term contracts last typically for 24 months and may be renewed but, despite how many years one may live here, everyone is a temporary visitor on Ascension Island. This implies a high mobility among the population which, in March 2018, comprised 763 people: 66% St. Helenian, 17% British and 8% of American nationality.[2] Simultaneously, the successive historical waves of inhabitation have become imprinted on the landscape as well as on Ascension's complex relationalities to 'outside worlds' (particularly Europe, Africa and South America), while uneasy multi-faceted identities converge on its unique socio-ecological assemblages and entanglements.

Methodology

Fish et al.'s (2016) CES conceptual framework informed the design of an extensive survey and participatory mapping exercise used for CES assessment within the Natural Capital Assessment project across the UK South Atlantic Overseas Territories (Bormpoudakis et al., 2019). This survey was adapted by the author to the local context of Ascension Island and can be found entirely in Appendix 6.A.

The study's design followed a three-fold methodology for CES assessment on Ascension Island, based on a socially disaggregated and spatially-explicit analysis of local perceptions, cultural practices and benefits derived from local human–environment relationships. As such, the implementation of an extensive survey involved: (1) the characterisation of Ascension's natural

[1] Hooker made four proposals, documented in a report to Ascension's Admiralty, 'Terrestrial ecology of Ascension Island': "(1) plant the higher levels with trees of large growth; 'this is of first importance as thereby the fall of rain will be directly increased'; (2) clothe the steep sides of the valley to help soil formation by accumulation of vegetable matter, reduce evapotranspiration and conserve moisture condensed on the mountain; (3) plant the most promising spots of the lower dry valleys with trees and shrubs adapted to dry soil conditions; (4) introduce tropical and European plants to mountain gardens." (Grove, 1995: 364)

[2] Based on the 2018 census of Ascension's population (Ascension Island Government).

environment, including the aspects of Ascension's biodiversity, natural and cultural heritage most significant to people; (2) the identification of cultural practices, associated with work and leisure activities, performed on distinct environment spaces; and (3) the valuation of cultural benefits obtained from distinct interactions with Ascension's environment, in terms of the experiences and capabilities that contribute to human's well-being (e.g. sense of belonging or achievement). Considering people's perceptions and preferences contributes to reveal the relational values held by people towards Ascension's natural environment (Chan et al., 2016; Pascual et al., 2017), while addressing significant cultural practices and activities unveils the processes which shape Ascension's environment and enable the reproduction of cultural benefits (Fish et al., 2016), assessed in terms of the well-being components these support.

Additionally, the survey included four mapping exercises to collect spatially-explicit evidence on culturally significant elements of Ascension's landscape, namely: first, pertaining to the perceived 'essence' of Ascension's natural environment, based on a subjective evaluation of the landmarks most representative of Ascension's 'intrinsic' nature, or 'nature' as 'essence' (Ellen, 1996); second, the cultural practices performed outdoors, associated with both 'work' and 'leisure' activities, representing processes of co-production of the environment (Fish et al., 2016); and, third, the landscape's aspects linked to 'negative' feelings, as somewhat unpleasant, neglected or degraded places (not in the present analysis).

The survey's completion was based on face-to-face interviews with a representative sample of Ascension's residents over 16 years old, during one-month's field work in January 2019. Participants were selected through chain-referral sampling, following a purposive sampling strategy which sought the representation of participants from distinct ethnic backgrounds, gender, age and social status (Bryman, 2012: 416-428). Sampling started with contacts from Ascension Island Government (AIG), AIG Conservation Department and those established with locals at the Saints Club, a main social gathering place in Georgetown. Additionally, intentional participants contacted the researcher directly, following an article published by the author in 'The Islander' (the local weekly newspaper) and emails sent to the main employers on Ascension (e.g., Interserve, Babcock and Wolf Creek). Interviews' data was complemented with participant observation, including visits to relevant sites across the Island and participation on cultural practices that bring people outdoors; informal discussions with key stakeholders on Ascension Island's history; and a review of selected bibliographic resources on Ascension's history, such as Avis (2001) and Hart-Davis (2016).

Survey data was analysed using a mixed methods approach (Bryman, 2012: 627-650), following a qualitative approach based on participant observation to explore how Ascension's residents interpret their natural environment (Bryman, 2012: 430-464; Puri, 2011b); and a quantitative approach to identify major patterns on CES distribution, exploring the geographical distribution of significant cultural practices, benefits and values across spatial and social variables, including ethnicity, gender and age (Newing, 2011; Puri, 2011). Spatial data from the participatory mapping exercises were analysed using Geographic Information Systems (GIS), relying on R and Excel software for the statistical analysis and graphical representations of the remaining survey data.

To address the complexity of interdependent socio-ecological processes, the present study placed emphasis on a qualitative assessment, based on descriptive categories rather than discrete accounting categories — which would entail challenging delimitation and double-counting issues (Chan et al., 2012). Still, because quantitative mapping is important to inform management decisions, we adopted a participatory mapping approach for CES assessment (Puri, 2011). This mapping approach supported a spatially explicit CES assessment which helped identify the environmental spaces most culturally significant to Ascension's community, the processes underlying the reproduction of 'cultural services' (i.e., cultural practices) and the diverse relational values reproduced by these. These values express the community's norms and preferences regarding Ascension's environment (Chan et al., 2016; Pascual et al., 2017), revealed by the symbolic meanings (e.g., 'essence') and physical interactions (e.g., 'work' and 'leisure') affiliated to those spaces, which support the community's well-being (e.g., identities, sense of place and social cohesion).

The alternative to participatory mapping, based on mapping landscape features such as habitats or natural designations, may be used in areas that have been extensively surveyed (e.g. EU countries, see Maes et al. 2016) but, as such approach disregards the social diversity and heterogeneity underlying CES reproduction, it was not compatible with this study's scope. Nonetheless, a spatially explicit approach to CES may hold several limitations pertaining to the representation of places as discrete locations. Particularly, because places may exist at varying scales and overlap each other, places represented as points-on-maps should not be understood as discrete well-delimited areas but rather as a simplified representation of complex socio-ecological processes (Cresswell, 2004; Ingold, 2011; Pink, 2009), which assign significance to converging characteristics within diverging spatial and social typologies, i.e. simultaneously conferring to places tangibility along with multiple overlapping significances (Hirsch, 1995; Tilley, 1994).

6.4 RESULTS

> *"I was born and brought up on the island and am happy to call Ascension my home even though I know I will have to leave one day!" (S38)*

A total of 72 questionnaires were completed, corresponding to 9.4% of Ascension's population. The sample covered residents of the three main settlements (i.e., Georgetown, Two Boats and Travellers Hill) and is representative of distinct population groups in terms of gender, age, place of up-bringing and education level — see Supplementary Materials, Appendix 6.B, Table 6.B1. Ethnic groups were assigned based on crossing information of respondent's place of up-bringing and reported ethnic identity, with Ascension-born people mostly reporting St. Helenian ethnicity. All responses were anonymized and participants coded with a unique identification AX, where A corresponds to ethnicity (S = Saint Helenian, B = British and O = Other) and X to an identification number, assigned to each respondent (e.g. S15).

There was a statistically significant relation between education level and ethnic identity (Chi-square test, p-value < 0.01), with most UK-born respondents completing Higher Education (79%) and the majority of sampled St. Helenians holding either secondary or vocational education levels (95%). Most sampled population was in full-time employment (86%) and moved to Ascension due to a job appointment (72%), reflecting that Ascension is a 'working island'. Nonetheless, there was a significant difference between the motivations for moving to Ascension of St. Helenian women and UK-born men (Chi-square test, p-value < 0.05), with most of those who moved to accompany family being St. Helenians (71%) and women (59%); while motivations were also significantly related to education levels (Chi-square test, p-value < 0.05), with most people with higher education moving to Ascension for employment.

Once on Ascension, the number of years spent living here showed a significant relationship to both ethnicity and education level (Chi-square test, p-value < 0.01), where the sampled population presented two distinct tendencies: those who live on the Island for two years, the period of one working contract, being mostly from the UK (76%) and with higher education (69%); and those who, through renewing contracts, live here for 10 or more years, being mostly St. Helenians (89%) and with secondary or vocational education (86%). This pattern was likely representative of wider settlement dynamics on Ascension's population which, as illustrated in next sections, also conveyed distinct affiliations to Ascension's natural environment.

6.4.1 PERCEPTIONS: Ascension's Natural Environment

> *"…the sandy beaches and that's a volcanic island, that's what makes Ascension, Ascension." (O1)*

As one arrives to Ascension Island, the bare and arid landscape dominates the first impression, as if one has "landed on the moon" (S2). The young volcanic island comprises more than 40 craters and cinder lava cones, from which flows of distinct lava types and eruption styles (from basaltic and silica lava flows to pumice deposits and pyroclastic formations) spread towards the ocean, forming rugged lava plains. Along with the volcanic landscape, two other main elements dominate the landscape: one, Green Mountain, Ascension's highest peak, 858m above sea level and covered by a tropical rainforest, "with its unique man-made cloud forest that dominates the island" (B7); the other, the Ocean, with a constant presence in sight, smell and sound, simultaneously confining and opening the island to the rest of the world, as "you can see it from wherever you go, (…) it's the background of all our work" (B3).

When asked to describe Ascension's natural environment, the most frequent words used by respondents are "unique", "diverse" and "beautiful" which, along with the words "barren", "unspoilt" or "moon-like" also often used, reflect a general perception of a landscape that may inspire a sense of desolation while, simultaneously, being remarkable for its uniqueness and diversity — see Fig. 6.1. As described by one respondent, Ascension's landscape is "very unique, it's wild without being too wild. Not that there's no human input, but it is untamed. Beautiful." (B19). Still, despite invasive species being "one of the big things changing the environment here" (B21), an other-worldly resemblance with mars or the moon is prevalent in respondents' description: "We used to regard it as the moon, when we first came here, it was all barren up to English Bay. We used to say if they wanted to make a movie about the moon or mars, they could make it here" (S26).

Ascension's contrasts are portrayed by respondents' comments describing its landscape either as "post-apocalyptic, a volcanic tundra" (B29) or in "one word: I call it paradise, I feel like we live in a tropical paradise" (S24). The juxtaposition of extremes is highlighted by respondents, as "it depends what part of Ascension, if it was Green Mountain, I would describe it as lush, but if it is anywhere else what comes to my mind is barren" (B18). These contrasts reflect the remarkable diversity of Ascension's landscape, "it's very diverse, it goes from almost mars-looking areas on the south of island up to Green Mountain that is forest" (O1); which, perhaps, is also what makes it so unique, "it's like nowhere I've seen before" (B9) and "there's no place

like Ascension" (S19). As such, Ascension is certainly appreciated by those living here: "from day one, I felt in love with this place, people would give anything to live in a place like this" (S2).

Differences can be noted, however, on how distinct social groups describe Ascension's natural environment, with UK-born people showing a tendency to perceive Ascension as a somehow pristine and immutable landscape, portrayed as "wild", "unspoilt" and "isolated". St. Helenians, on the other hand, may rather highlight its "hot" and "dry" landscape, comparing Ascension to St. Helena, "here is different from St. Helena… very dusty at times" (S25), and emphasizing how "a lot changed" and how much "greener" Ascension became with the introduction of invasive species, such as the Mexican thorn (*Prosopis juliflora*), which "the BBC brought it to assist or prevent soil erosion, but now spreads across the whole island" (S31). As posed by a respondent living on Ascension for 18 years, "it's a lot different than when I first came here, all the Mexican thorn wasn't here, it was a lot more barren then" (S13).

Figure 6.1 - *Words and expressions most used by respondents to describe Ascension's natural environment.*

Change is pervasive across Ascension's history and St. Helenians, despite their permanence on island entailing a privileged position to notice those, were not alone in perceiving the quick and drastic changes affecting Ascension's landscape. As explained by a UK-born respondent: "seeing the spread of introduced species, we are close to a point of no return where this place will be completely dominated by certain species of plants and animals that will completely change it" (B6). Landscape changes, in this context, create a further tension between the perceived "unspoilt" natural environment and human detrimental impacts, linked to issues with waste management and invasive species: "it's conflictive, some of it is so unspoilt and in other parts of the island… there's a contrast between unspoilt and spoilt places" (B22). A tension that AIG Conservation efforts try to tackle by controlling invasive species while protecting endemic bird and plant species, "since a couple years conservation plays a big part here" (S25).

6.4.2 MAPPING RELATIONALITIES: 'Essence', Practices and Heritage

The cultural significance of Ascension's natural environment was illustrated by respondents' relationship with three main aspects of its landscape: the coast and ocean (81 mentions), the volcanic landscape (84 mentions) and the Green Mountain (72 mentions). These environmental spaces embody contrasting elements of Ascension's landscape which respondents asserted to represent the 'essence' of Ascension's environment, support diverse cultural practices and embed distinct relationships to Ascension's cultural and natural heritage. Culturally significant places for the 'essence' of Ascension's natural environment as well as for 'work' and 'leisure' activities are portrayed in Map 6.1, showing a considerable convergence between the perceived intrinsic qualities of Ascension natural landscape and preferred places for outdoors practices.

The Coast and Ocean

The pier-head expresses the close relationship those living on Ascension have to "the ocean" which, along with "the coast" and "all beaches", figured strongly as part of Ascension's 'essence'. The pier represents a fundamental aspect of Ascension's 'essence' because, as stated by respondents, "it connects us with the outside world" (B18) and "it's the real-life part of the island, as ships come and go, and bring things to the island" (B22). As such, the significance of coastal places arises along notions of connectedness and fluid mobilities, while embodying a boundary space which delimits the Island: "the island is so small, all the boundary between land and sea is important" (B3). Here, the sandy beaches were prominently associated to Ascension's 'essence', namely English Bay (23 mentions), Long Beach (15), Comfortless Cove (14), North-

east Bay (10) and Southwest Bay (7). Nonetheless, besides the boundary coastline and the oceanic connectivity, the underwater marine environment figured also strongly as representative of Ascension's 'essence', portrayed in shipwrecked vessels and stunning lava forests, "beyond Catherine Point, there's a ship sunk, a Normandie steam vessel, and also an underwater lava forest: it's stunning" (B5), but also in the "unique wonder" hiding at Shelley beach, with its "brine pond with endemic shrimp in like some sort of primordial soup" (B29).

Comprising marginal spaces of core importance, these places are linked to key recreational practices such as swimming, snorkelling and diving, but also important social activities (e.g. BBQing in beach huts) and major subsistence practices (e.g. coastal and inshore fishing). The ocean's importance, "whether it be for scuba diving or fishing" (O3), is strongly connected to a rich marine biodiversity portrayed as 'pristine', 'abundant' and 'plentiful', as conveyed by respondents: "the marine wildlife, to me seems untouched" (B18) and "there's such an abundance of fish… [when fishing] you never come back without a fish" (S7). Then, particularly the pier-head, English Bay and the various beach huts along the coast were shown to support fundamental aspects of Ascension's social life, fostering social cohesion and the reproduction of local ways of living, linked to subsistence practices and the island's connectedness to the *outside world*.

The Volcanic Landscape

The volcanic landscape embodied the "barren" and "moon-like" aspects of Ascension's environment, where "it seems we are in another planet" (B5). Its other-worldly resemblance was, nonetheless, intimately linked to the 'essence' of Ascension, as "the volcanic features are what the island is all about" (B15). However, the barren landscape is quickly changing and particularly vulnerable to the threat of invasive species, as the Mexican thorn (*P. juliflora*), therefore being tied to notions of (im)permanence by representing "Ascension before the invasive species arrived at the island" (B18). Here, the area from Daly's Crags to Sister's Peak (13 mentions), the Letterbox peninsula (12) and the Wideawake Fairs (10) were perceived as "pretty much unspoiled by human interference" and represented "the last glimpses of what the island used to be like" (B6). Simultaneously, reinforcing the distinct temporalities embedded in this volcanic landscape, the diverse lava cones and flows "capture a moment in geological time" (B29) while the "endless rocks covered in old guano" (B6) are a reminder of both gone and extant seabird colonies. Indeed, its significance to Ascension's 'essence' was strongly associated to native seabird populations with, nowadays, the Letterbox peninsula representing again a main nesting site for the endemic Frigatebird (*Fregata aquila*) amongst other native species; and the rugged

volcanic rocks at the Wideawake Fairs, next to Mars Bay, being the nesting ground of thousands of Sooty terns (*Onchyprion fuscata*). These places are "a striking landmark on the island, with all the birds and history" (B23) and where "you get a close encounter with wildlife" (B17).

Despite its reported significance for Ascension's 'essence', the 'hot' and 'dry' volcanic landscape supported few cultural practices, being almost exclusively enjoyed in hiking activities, such as letterbox walks. This series of over 30 trekking trails across the whole island, each with individual stamps, represented an important recreational practice for specific groups of Ascension's residents — particularly those on short-term contracts, who strive to collect all stamps. In contrast, the Devil's Ashpit (14 mentions) and the old NASA site (8), on the southeast side of Ascension, embodied an aspect of its 'essence' most significant to recreational and social activities of long-term residents, such as taking picnics, BBQing and camping: "out there it's like untouched" (S26), so "families would go there to have a picnic and relax" (S2), despite that "now there's too many rats and people don't go there so often anymore" (S13). Still, besides recreational activities, the BBC relay station near English Bay "reminds you that Ascension's is a communication island and, back in the days, if you didn't work for communications, you were not supposed to be here" (S26). These are still a peculiar landmark on Ascension, where "the lava flows and rocks with radio transmitters" (B23) connect the *other-worldly* landscape with *outside worlds*, articulating relationships both towards other-worlds (e.g. NASA site) and within global networks (e.g. BBC site).

Green Mountain

Green Mountain is undoubtedly tied to the perceived 'essence' of Ascension's natural environment, being mentioned by all participants and portrayed as "the major landmark associated with Ascension" (B14), which "very much feels like the heart of the island in some way" (B25) or "where everything somehow converges" (B18). Green Mountain was generally mentioned for the National Park (32 mentions) or, particularly, the Dew Pond (16), Red Lion (8), the Peak (6) or Breakneck Valley (5), along with its diverse historical paths, such as the Elliot's and the Bishop's path (7). Nonetheless, as its tropical rainforest originates from an early 'terraforming' experiment, its significance for notions of Ascension's 'essence' embodied multiple tensions between its 'endemic' and 'introduced' species and its simultaneous 'natural' and 'cultural' dimensions. Despite representing a "man-made cloud forest" (B5), as highlighted by several respondents, Green Mountain's cultural significance is strongly linked to its biodiversity, reflected on its remarkable plant diversity, as it seems "you walk through four different continents getting from Two Boats to the very top, looking at the completely alien species of plants which

exist at different altitudes" (B6). Here, portraying a "really good balance between endemics and introduced species" (B9), Green Mountain illustrates how introduced species brought forward a reterritorialization[1] of distant places to the core of Ascension's 'essence'.

Indeed, the notion of escaping or being somewhere else appeared pervasively linked to Green Mountain, as "it's like being in a completely different place" (S32, S33) and bring up memories of another places, "just reminds me of home [St. Helena]" (S26), here people may find shelter from Ascension's otherwise desolated landscape, "it's a lovely place to get away" (S24). Still, Green Mountain's significance was tied to the contrasts it offered, "because it's so different to the rest of the island, everything else is rock and barren, while there is lush and green" (S30); but also undoubtedly to Ascension's particular history, embedded in "lots of historic buildings, paths, beautiful walks and views" (S32) recalling the first Royal Marines' settlement and subsequent developments (e.g. water catchment infrastructures). Here, Green Mountain supported diverse recreational and subsistence practices which embody the convergence of distinct cultural identities on the Island while representing crucial activities to strengthen social cohesion — from taking picnics, BBQing or camping to hiking their historical paths, foraging for food and growing vegetables on the allotments. Nonetheless, Green Mountain's central significance was tied not only to all the history it embodies, the biodiversity it hosts and the contrasts it offers, but also — as much an escape it might be — to being the place from where the whole island is visible: "because you go all the way around the peak and see all different perspectives over Ascension's Island" (B7).

Ascension's Natural and Cultural Heritage

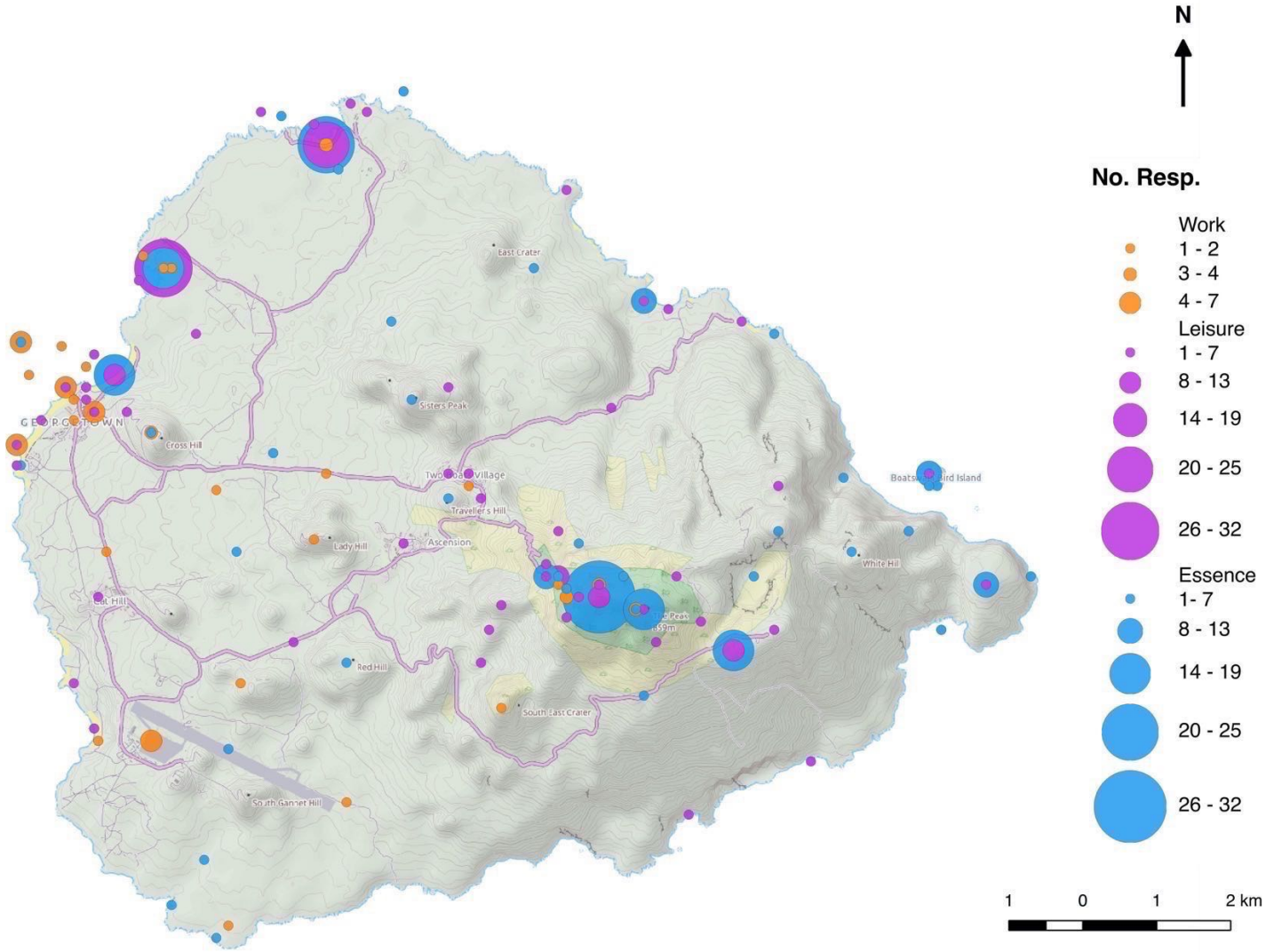
These environmental spaces were also valued for their significance in terms of Ascension's natural and cultural heritage. Their heritage evoked the symbolic meanings through which these environmental spaces become culturally significant places, while illustrating Ascension's movement through distinct temporalities (i.e., revealing the history embedded in its landscape) and affiliation to diverse relationalities (i.e., in relation to its landscape and in connection to *outside worlds*). From its geostrategic positioning and military role to the 're-engineering' of Green Mountain, the arrival of the BBC broadcasting station or the NASA space monitoring

[1] As the complementary aspect of a relative deterritorialization (Deleuze and Guattari, 1980), entailed by Ascension's settlements.

program, all conveyed processes of deterritorialization of people, plants, animals and technology which led profound changes on Ascension's biophysical landscape, its affiliated relationalities and embedded temporalities — illustrated in Map 6.2.

The desolate landscape of early castaways' hardships, where the romantic idealisation of 'new worlds' contrasted with its inhospitable environment, reproduced the imagery of a desert and pristine island (Grove, 1995). This isolated island was, nonetheless, linked to successive historical events that situated Ascension among global endeavours — from Napoleon's exile, the West Africa Squadron, Atlantic Telegraphy to Apollo 11 and the Falklands War. Here, different settlement periods embodied a particular meshwork of relations to 'outside worlds' (e.g. Europe, Africa or South America) or even 'other worlds' (e.g. the Moon), brought in by institutions such as the BBC or NASA, which become embedded in the 'inner' relationalities with Ascension's landscape, its affiliated identities (e.g. 'military' or 'communications' island) and more-than-human assemblages (e.g. 'terraforming' experiment). Those multiple relationalities convey the global importance of its fluid boundaries, embodying the economic and political relevance of the South Atlantic connectivity while embedding diverse historical relations to Ascension's landscape 'inner' and 'outer' worlds — further illustrated by the way its unique biological and cultural diversity articulates the influence of several continents.

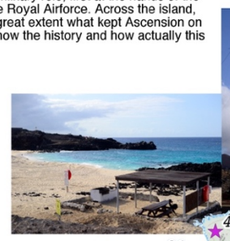
Here, the volcanic landscape and marine biodiversity are interdependent aspects of Ascension's natural heritage, expressing an important "balance between endemic birds and marine wildlife" (B2) while endemic species, as noted by a respondent, "are all a big part of Ascension and its history" (S32). Nonetheless, the fragile balances between endemics and introduced species were also reported as significant aspects of Ascension's heritage: "the endemic plants but also the introduced plants… are all part of Ascension" (B6). In particular, the cultural significance of introduced species in Ascension, people's economic and recreative relationships to those and also the ecological threats these entail, was reflected on how specialised terminologies became part of common language — with generalised mentions to 'endemics', 'invasive' and 'introduced' species. Widespread local debates around these issues conveyed the perceived threats posed by invasive species to endemic populations, the conservation efforts to protect native habitats, plant and animal species (including the nesting sites of Green turtles, *Chelonia mydas*; Ascension Frigatebirds, *F. Aquila*; and Land crabs, *Johngarthia lagostoma*), but also how particular introduced species became central features of Ascension's natural and cultural heritage: including the feral donkeys and sheep, now portrayed on tourist postcards, or the plant diversity constituting Green Mountain's rainforest.



Map 6.1 - *Significant places for the 'essence' of Ascension's natural environment (blue), outdoor 'leisure' (purple) and 'work' activities (orange).*

ASCENSION ISLAND: NATURAL AND CULTURAL HERITAGE

History - A Military Island
Since the first settlements, Ascension had a military role, first at the hands of the Royal Marines and then, during the WWII, the Royal Airforce. Across the island, its strategic geographic positioning was to a great extent what kept Ascension on the map: "the three forts around town, they show the history and how actually this place was used" (A53).



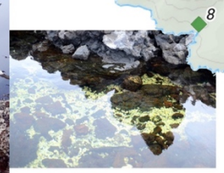
History - The BBC Relay Station and NASA Apollo Missions
The opening of the Suez Canal drastically reduced the number of ships calling on Ascension, turning it into a 'sleepy backwater' until 1899, when the Eastern Telegraph Company brought ashore the first submarine cables and made a relay station on Ascension (Avis, 2001). This would set a new era, affirming Ascension's strategic geographic position for communications between Europe, Africa and, later, also South America. Reaffirming this positioning, in 1964, the BBC set up a radio relay station in English Bay, broadcasting to both Africa and South America. In the same decade, the US Apollo space programme led the construction of a NASA tracking station at Devil's Ashpit along with a Cable & Wireless Earth Station at Donkey Plain. Ascension was then known as 'The Rock' by those sent here to work in these stations, or at the US military base established at the same time (Kovalchik, 2014). Some claim that images from the successful moon landing of Apollo 11, with the famous Neil Armstrong communication, were first received there, at the NASA site.

History - Comfortless Cove and the Fever Station
During the 1830s, Ascension would become a victualling point for passing ships, in particular functioning as a base for the West Africa Squadron — Royal Navy ships patrolling the African coast following a British anti-slavery policy (Avis, 2001). During this time, tropical diseases and fevers commonly assaulted the ships' crew and many anchored in Clarence Bay, looking for rest, fresh water and food to recover. This eventually forced Ascension to develop a fever station, where ships could be placed in quarantine and the infected crew kept separate from the garrison. Infected ships were then sent to a place called Comfort Cove, which would become known as Comfortless Cove, used for this purpose for at least 30 years and behind which lies the Bonetta Cemetery — named after one of the many ships set ashore here.

Biodiversity - Invasive Species
Across the island, common and invasive plant species include the Mexican thorn (Prosopis juliflora), Guava (Psidium guajava), Prickly pear (Opuntia vulgaris) and Yellowboy (Tecoma stans). Amongst others, such as the Guava and Prickly pear on the lower slopes of Green Mountain, the Mexican thorn is the most aggressive species conquering the lava plains. Introduced in the 1960s, when Two Boats village was built to house newly arrived BBC workers, Mexican thorn was planted around the village to control soil erosion. The vegetation is too hard and thorny to offer adequate grazing, but donkeys feed on the young leaves and seedpods, accelerating its spread. These are now a major threat to both the perceived 'essence' of Ascension's landscape and its natural heritage.
The once barren red lava cones are being slowly invaded by vegetation, an image illustrated by the Red Hill now mostly green. Invasive plant species threaten endemic species as well as the perceived uniqueness of this once desert island, spreading through Ascension's barren lava plains, including the nesting grounds of native seabirds and the sandy beaches, globally important green turtles' nesting sites. Unfortunately, the associated undergrowth also provides the perfect habitat for rats and rabbits — already difficult populations to control.

Biodiversity - The Turtle Ponds
The turtle ponds, next to Long Beach, were once used to keep green turtles before these were shipped to the UK, or eaten in soup by the garrison, being not only representative of Ascension's cultural heritage but also of its relationship with the natural environment. The turtle ponds reminds of "an industry that thank god is gone" (A52) but, after being abandoned for their original purpose, the ponds were also used as a safe place to swim, figuring in the historical memory of St. Helenians, who were not allowed in the Exile's pool: "the turtle ponds are important for historical reasons... as the Exile's pool wouldn't allow us to swim in their pool, I've lots of good memories there" (A5).

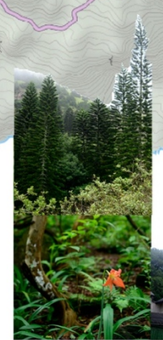
History - Mars Bay
In 1877, the astronomer David Gill was sent on a 6-month scientific expedition to Ascension Island, funded by the Royal Astronomical Society, to observe the opposition of Mars and measure the distance between the Sun and the Earth. He was based on what would become known as Mars Bay and the journey would be documented by his wife, Isobel Gill, in what is both a historical and personal account of a 'behind-the-scenes' XIX century scientific expedition (Gill, 1878 [2017]).



Biodiversity - Native and Endemic Species
Ascension hosts the second largest nesting population of green turtles (Chelonia mydas) and is one of the most important seabird nesting sites in the Atlantic Ocean, supporting 11 species of breeding seabirds, including the endemic Ascension frigatebird (Fregata Aquila) and the largest Atlantic nesting population of Sooty terns (Onchyprion fuscata). Ascension's land crab (Johngarthia lagostoma) is the only native land animal, occurring there and on just three other small South Atlantic islands. Along the coast and lowland lava plains, one may find the only endemic flowering plant species, Euphorbia origanoides, while up Green Mountain and on its lower slopes, there are another six endemic plant species: Pteris adscensionis, Ptisana purperascens, Sporobolus caespitosus, Stenogrammatis ascensionensis, Asplenium ascensionis and Arogramna ascensionis. Near Shelly beach, in small inland seawater pools, there are also two endemic species of shrimps (Typhlatya rogersi and Procaris ascensionis) while Ascension's globally important marine biodiversity includes at least 11 endemic species of fish, including the Resplendent angelfish (Centropyge resplendens) and Ascension goby (Priolepsis ascensionis), along with many other more common but important marine species, such as Humpback whale (Megaptera novaeangliae), Yellowfin tuna (Thunnus albacares) and Atlantic blue marlin (Makaira mazara).
Over time, there is a long history of green turtles, seabirds and their eggs being exploited as an important source of fresh food for early castaways as well as successive generations of garrisons, during the first two centuries of Ascension's settlement (Hart-Davis, 2016). The green turtles were so appreciated as a food source that they were exported alive to UK — often in an unsuccessful journey. Green turtles are still a significant part of Ascension's heritage: "the green turtles would have nested here since the island's creation" (A65).

Biodiversity - Fragile Balances and Introduced Species
Before the first garrison of Royal Marines was established in 1815, goats and rats had already been introduced to the island: the former, left ashore to reproduce and provide a source of fresh meat for passing ships; the later, as the unintended passengers of those ships which used the opportunity to colonise new land (Avis, 2001). Over time, the goats disappeared and the rats proliferated. Donkeys were brought ashore for transport and later became feral, with the arrival of cars and other machinery. Sheep, pigs, cattle and poultry were brought to the farm, then abandoned when it closed down and, of all these, now only feral sheep remain. In meantime, cats were introduced to control the rat population, then dogs introduced to control cats and rats, with no success. Feral cats became a threat to many native seabirds populations and their mainland nesting grounds, leading bird populations to seclude on the only safe refuge, Boatswain Bird Island. Recently, a feral cat control programme, implemented by the Ascension Island Government and the Royal Society for the Protection of Birds (RSPB), successfully managed to eradicate the feral cat population by 2006. Consequently, seabirds are now back nesting on mainland while rats proliferated again.
Linked to the early settlements and farm's history, the donkeys and sheep, now feral across the island, have become a key feature of Ascension's natural heritage and are now portrayed on Ascension postcards: "I guess the donkeys have quite an history on the island, they truly descend from the first people that lived here, they played a big part on building the island and all structures up the mountain, they probably played the biggest role on what's Ascension now" (A53).

History - Leaving Messages at Letterbox
"The earliest use of the term "letterbox" on Ascension Island dates back to 1673 when Father Navorette reported after a visit that there was a 'cache or letterbox' where passing ships left messages for those going in the opposite direction. Unfortunately, the good cleric failed to record where he has seen this letterbox but it is generally agreed that it was unlikely to have been in the area of the Island nowadays called Letterbox given its inaccessibility from the sea. It is more likely to have been located somewhere on the more accessible northern or western coasts.
Nothing further is heard of letterboxes on Ascension again until 1913 when a green tin box was found, this time at Letterbox (south-eastern part of the island and inland). Notes were left in the box in the hope that later walkers would collect them and take them to Georgetown Post Office. This box was still in use in 1942 when it was relocated so that the area could then be used for bombing practice.
The current series of boxes began being set-up in 1979 by Sean Newbery, the BBC Resident Engineer and keen walker. The first two modern day walks were Sister's Peak and Letterbox. At this stage in addition to affording walkers the opportunity to leave messages (book provided) for later walkers, a rubber stamp (as Newbery recalled from walks in Devon, England) was located in the boxes so that walkers could record their visit and (perhaps in a more cynical and unbelieving world) prove to their friends that they had indeed walked as they claimed. The letterboxes tend to be located at or toward the end of each walk." (Rambling Wombat, 2017)



History - Built Heritage, the Red Lion, Marines Barracks and Water Catchment
The Red Lion, the Garden cottage, the Rock cottage and Bate's cottage (or Northeast cottage) were built during successive settlements and supported Green Mountain's farm. These, along with the old Marine barracks, the water catchment area and Dampier's Drip, all hold strong cultural significance. The old Marine Barracks represent the history of Ascension's first settlements, being an important aspect of Ascension's cultural heritage, which "shows how Ascension played a big part in the war" (A58). Years later, the exceptional engineering of the water system up Green Mountain, commissioned by Captain William Bate, Ascension's Commandant from 1828 until 1838, still remains an object of admiration: "the water catchment shows the importance of water for early settlers and their ingenuity" (A66).

History - Green Mountain's 'Re-Engeneering' and the Farm
The strategy to increase rainfall and create soil by introducing vegetation on the steep slopes of the mountain was designed by Joseph Hooker, leading to more than 200 exotic species from Kew Gardens as well as Europe, South Africa and Argentina were shipped to Ascension, which successive garrisons strived to grow on the island. The top of Green Mountain, where before only a handful of ferns, mosses and some grasses species were found, most of them endemic to Ascension, quickly became a tropical rainforest with an unique mixture of endemics and introduced species. In fact, 20 years later, the visibility on top of the mountain decreased and the humidity increased so much, as a result of the expanding forest cover, that the old Marine Barracks and surveillance paths set there become unfit for purpose and had to be relocated.
By 1829, the farm located there was already growing sufficient crops to feed both the Royal Navy's garrison and to supply passing ships with potatoes, tomatoes, turnips, peppers and cassava. In 1922, the farm employed more than 20 people, responsible for looking after the vegetable plots as well as pigs, sheep and cows, and would continue to be productive until the early 20th century, when it was abandoned due to the high maintenance costs.

Legend

- History
- Coast
- Volcanic
- Mountain
- Biodiverse
- Cultural
- Militar

1 0 1 km

Infograph by Joana Canelas, December 2019

Map 6.2 - *Places and environmental features significant for the natural and cultural heritage of Ascension Island, including those relevant for the history, biodiversity, sociocultural activities and military role of Ascension (please see Supplementary Material - Portfolio for full size image).*

Still, changes in local human–environment relationships reflect diverse temporalities in settlers relationship with Ascension natural landscape and their articulation with diverse 'outside worlds'. These 'inner' and 'outer' relationalities are illustrated by historical attempts to set a productive farm in Green Mountain, embedding diverse flows of imported resources, technologies and species to secure food production on the Island, with the subsequent farm abandonment entailing the discontinuation of productive practices and a renewed reliance on 'outside worlds', through the importation of all necessary basic goods to sustain life on the Island. Like global communication's networks, multispecies entanglements set to supply settlers' food needs and preferences brought in Europe, Africa and South America to the otherwise 'isolated' Ascension, conveying a reterritorialization of specific human–environment relationships affiliated to diverse geographical origins and particular historical temporalities through a series of successive flows of people, resources and technologies. As such, the constitutive natural and cultural diversity of Ascension's landscape, manifest in introduced species but also people's affiliations to those, convey how settlers relationships to 'outside worlds' became embedded in its landscape through multiple processes of reterritorialization seeking to answer settlers' needs for water and food; ultimately, crafting unique more-than-human assemblages in the uneasy intersection between a 'natural' and 'cultural' landscape.

6.4.3 PRACTICES: The Lived Environment

> *"It's both my work and my leisure time, a way to relax, it's where I'm chilling as well as where I'm active. The island is so small that the environment is where we live." (B3)*

As conveyed by the above quote, Ascension's environment was not just the background of daily activities but an active presence in daily life. Ascension's natural environment permeated people's lives and daily activities, being part of either every day or most days work and leisure activities for, respectively, 49% and 69% respondents — see Appendix 6.B, Table 6.B2 and 6.B3.

There was a significant relation between gender and the frequency of outdoors work (Fisher's test, p-value < 0.05), with men being more likely to be outdoors every day (72%) while women were more likely to never work outdoors (77%). Those working outdoors everyday were mostly St. Helenians (68%) and those with secondary or vocational education (80%). Patterns on working activities in relation to ethnicity further revealed that direction, management and governmental officer positions were largely dominated by UK-born people (91%), while St. Helenians were responsible for the majority of technical, administration, construction and maintenance jobs (86%). Around 57% respondents reported working outdoors either in or around town (e.g., Georgetown, Travellers Hill or Two Boats); and 51% reported working further afield, all over the island or on the sea — see Table 6.B4. There was no significant relation between the location of work outdoors and gender, ethnicity or education level; however, tasks that involved working all over the island or on the sea were held in their majority by men (63%).

All respondents reported spending leisure time outdoors, 44% everyday, 25% most days and 29% most weeks. The frequency of leisure outdoors was not gendered but rather presented a significant relation with respondents' education level (Fisher's test, p-value < 0.05) and years living on Ascension (Fisher's test, p-value < 0.05). Most respondents living on Ascension for less than two years (93%) or with higher education (83%) spent time outdoors either every day or most days. In contrast, 46% of respondents living on Ascension for 10 years or more spent time outdoors most weeks, of which 76% were St. Helenians and 86% those with secondary or vocational education — perhaps because, as mentioned before, these groups tend to work outdoors every day. Most respondents enjoyed leisure time across the island (60%) or in the sea (61%), while those who stayed in town (47%) comprised mostly women (62%) — see Table 6.B5. Where respondents spent leisure outdoors presented a statistically significant relation with ethnicity (Fisher's test, p-value < 0.05), with most respondents who stayed in or around town being St. Helenians (74%), while most UK-born respondents spent time across the island (72%) or in the sea (79%). Here, long distance hiking and diving activities were mostly enjoyed by UK-born people (90% and 59%, respectively), while fishing and foraging were predominantly enjoyed by St. Helenians (85% and 48%, respectively).

Indoors and Outdoors Activities

A total of 38 major indoor and outdoor leisure activities, expressing respondents' range of interactions with Ascension's natural environment, were grouped for analytical purposes into seven broad categories — detailed in Table 6.B6. Extending Fish et al.'s (2016) four general

categories of cultural practices, “playing and exercising” activities were split in Movement & Exercising (e.g. hiking, cycling and outdoors team sports), Social Gathering & Contemplation (e.g. sitting, camping and BBQing outdoors) and Water Sports (e.g. diving and swimming); “creating and expressing” activities (e.g. crafting with natural materials, outdoors photography and religious activities); “producing and caring” activities, comprise here Producing & Subsistence (e.g. gardening and fishing) and Caring & Understanding practices (e.g. wildlife watching and nature conservation); and, finally, “gathering and consuming” activities, were renamed as Consuming & Displaying practices (e.g. consuming local products, displaying landscape pictures).

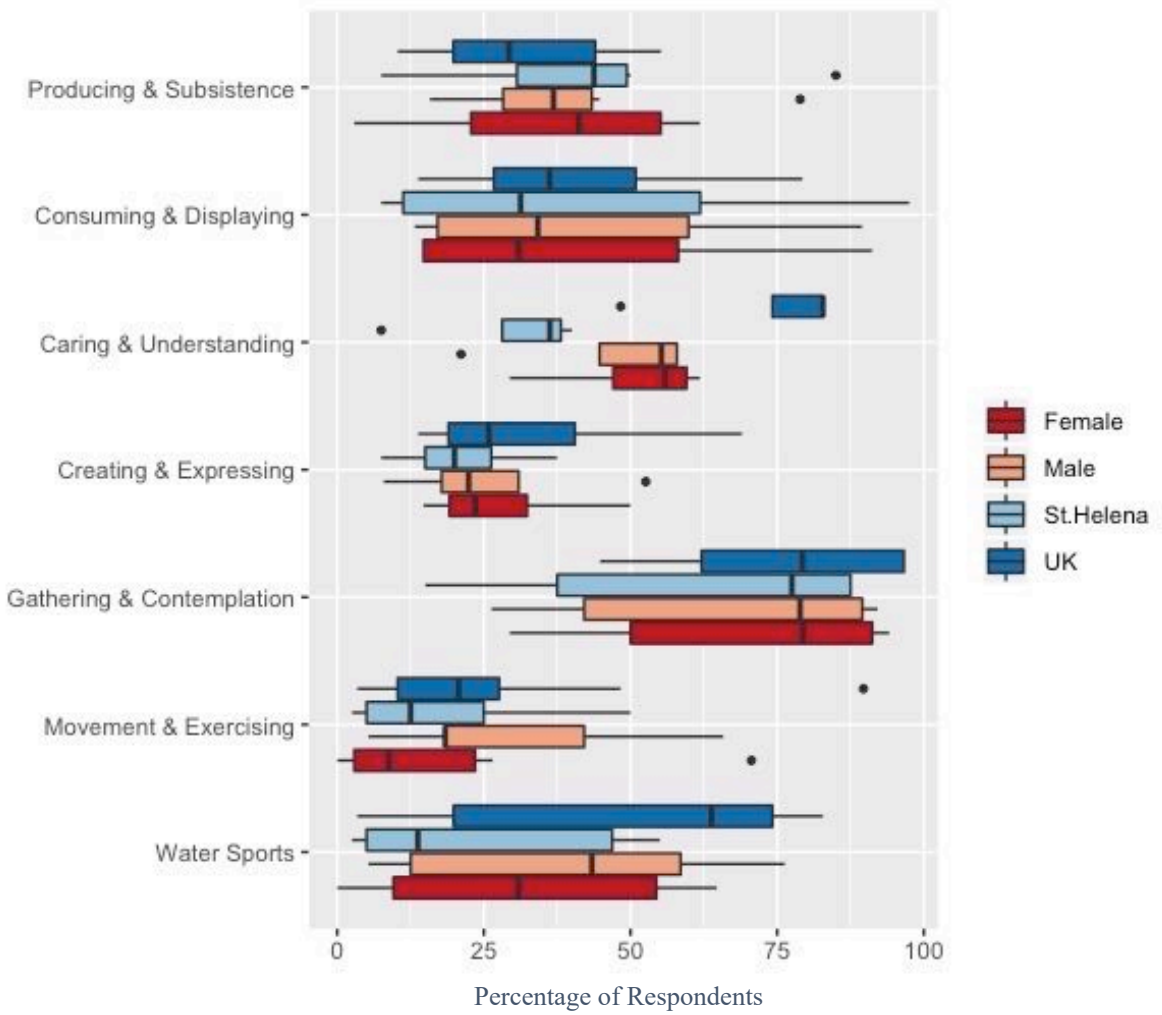


Figure 6.2 – *Social distribution of indoor and outdoor activities, through which people engage with Ascension's natural environment, per gender and ethnicity. Each category comprises diverse activities (see Table 6B.6), with variation in box plots representing the percentage of respondents who practice distinct activities within each category.*

Across the population, preferred outdoors activities entailed interactions with the environment through Social Gathering & Contemplation, including walking (92%), having picnics and BBQing (92%). Other important outdoor activities included Water Sports, such as swimming in the sea (68%) or in outdoor pools (63%), and Producing & Subsistence Practices, such as rock fishing (71%). Nonetheless, activities were heterogeneously distributed across distinct social groups, defined by gender and ethnicity, particularly presenting a significant statistical relationship with ethnicity (Fisher's test, $p < 0.01$) — see Fig. 6.2. For example, pertaining to Movement & Exercising activities, long-distance hiking (e.g., 'letterboxing') were mostly enjoyed by UK-born (90%) while outdoor team sports were mostly performed by males (64%) and St. Helenian respondents (68%). On the other hand, Creative & Expressing activities, as indoors painting and drawing, were mostly enjoyed by women and UK-born respondents (both 21%).

Activities predominantly performed by UK-born respondents comprised Caring & Understanding practices, such as conservation activities and wildlife watching (both 83%); and Water Sports, particularly swimming (83%), diving (59%) and snorkelling (76%). In contrast, most St. Helenians rather engaged in Subsistence & Gardening practices, including rock fishing (85%), growing vegetables (50%) or foraging food (48%). On average, only 32% of UK-born respondents performed Subsistence & Gardening activities. Nonetheless, Consuming & Displaying activities, such as preparing and eating local products or displaying Ascension's pictures at home, were evenly distributed across the population, with most respondents enjoying available locally sourced products (90%), particularly fresh fish. In this context, the social distribution of cultural practices conveyed how distinct cultural identities are expressed in people's activities, relationships and affiliations to the local environment.

6.4.4 HUMAN WELL-BEING: Cultural Practices and Benefits

To assess the benefits derived from outdoor activities, respondents were asked about the positive experiences and capabilities enabled by outdoor work or leisure activities, which express their relationship with specific environmental spaces (Fish et al., 2016). Following previous assessments in the NCA project (Bormpoudakis et al., 2019), these experiences and capabilities were grouped in five categories: Tranquillity, Inner Peace and Contentment; Freedom, Escape and Independence; Exhilaration, Excitement and Stimulation; Achievement, Accomplishment and Purpose; and Belonging and Attachment. Based on a series of statements related to these, respondents were asked to score their experiences in each category from "I strongly agree" to

"I strongly disagree". For the analysis, their levels of agreement were then converted to a Likert's scale, with 1 corresponding to "strongly agree" and 5 to "strongly disagree".

Work Outdoors

Most respondents agreed (score 1 or 2) to, while working outdoors, often experiencing feelings of Achievement (85%), Freedom (79%), Belonging (74%), Exhilaration (68%) and Tranquillity (66%) — see Fig. 6.3. Respondents tended to strongly agree with experiencing Achievement (43%), while Tranquillity had the highest rate of disagreement (11%), as illustrated by respondents' comments: "as I go outside, I'm fixing problems so it's not really relaxing" (S2).

The experience of Tranquillity while working outdoors appeared significantly related to both gender (Fisher's test, p-value < 0.05) and years living on Ascension (Fisher's test, p-value < 0.05). Perhaps because women did not work outdoors as frequently, 91% reported experiencing Tranquillity — against 48% men. Respondents living on Ascension either for less than one year or more than 20 years tended to strongly agree they often experienced it (57% and 50%, respectively). On the other hand, experiencing Belonging presented a significant relation with ethnicity (Fisher's test, p-value < 0.01), where 90% of UK-born respondents agreed to often experience it, against only 61% of St. Helenians, who often reported to neither agree nor disagree (29%). Here, St. Helenians described Belonging as a 'tricky' feeling because, despite how long one has lived here, there's no right of abode on Ascension.

Moreover, the experience of Achievement correlated with the frequency of work outdoors (Fisher's test, p-value < 0.05), decreasing with how often respondents worked outside; whilst the location of work outdoors appeared related to experiences of Tranquillity (Fisher's test, p-value < 0.05) and Freedom (Fisher's test, p-value < 0.05). Most respondents working outdoors most days reported experiencing Exhilaration (90%), Freedom (80%) and Tranquillity (70%), while those only rarely working outdoors presented the lowest rate of agreement for feelings of Exhilaration (33%) and Achievement (44%). In terms of location, all respondents who worked further afield agreed to experiencing Achievement (100%) and, together with those working on sea, also Freedom (100%) and Exhilaration (100%). In comparison, those working in town or in its wider vicinity were those who least experienced Tranquillity (36% and 46%), Freedom (32% and 39%) and Exhilaration (both 39%).

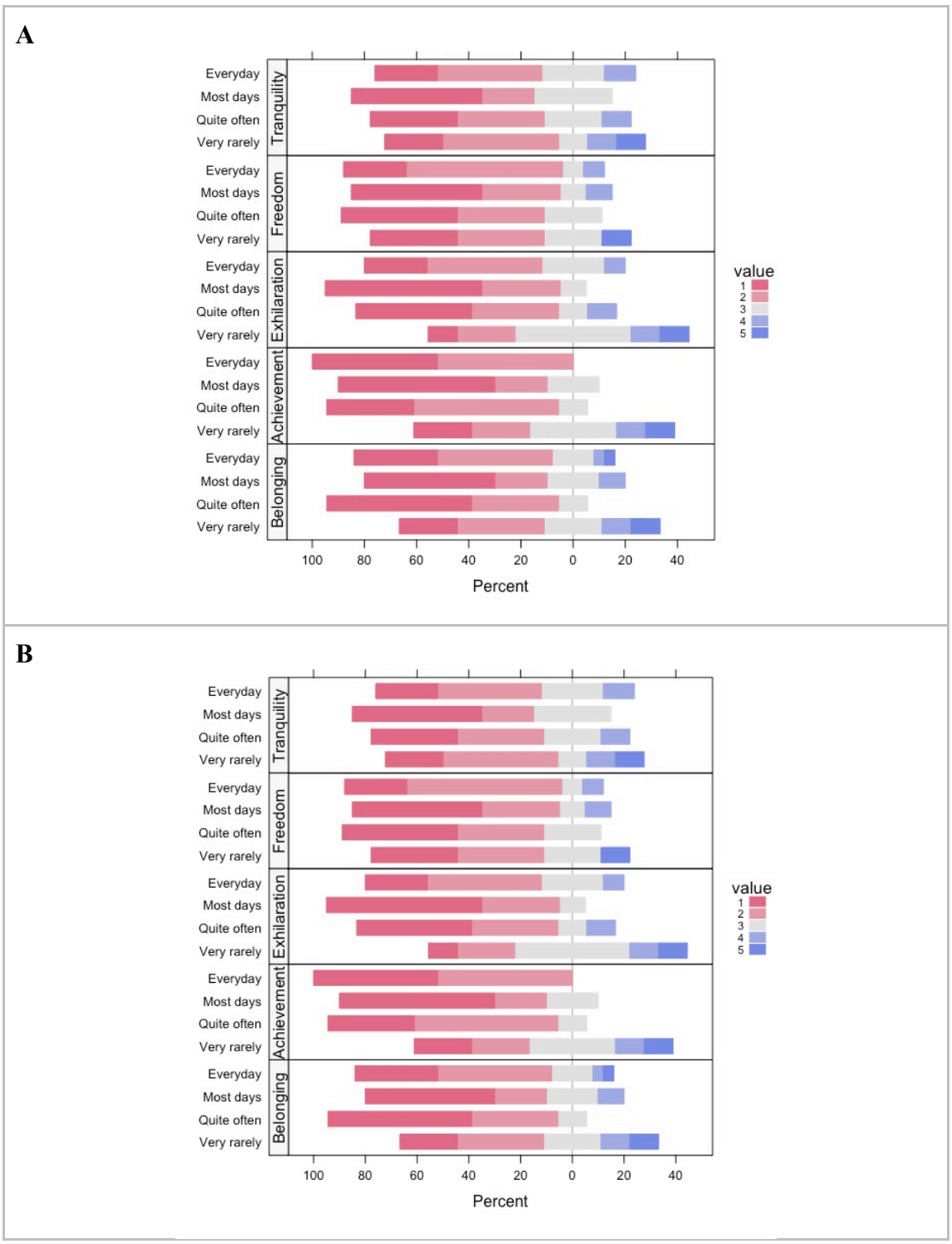


Figure 6.3 - *Experiences of Tranquillity, Freedom, Exhilaration, Achievement and Belonging reported during work outdoors per frequency (A) and location (B) of work activities, in percentage of the study's population. Levels of agreement are presented in a Likert scale, where 1 corresponds to strongly agree; 2 to tend to agree; 3 to neither agree nor disagree; 4 to tend to disagree; and 5 to strongly disagree.*

Leisure Outdoors

During leisure outdoors, most respondents reported experiencing feelings of Freedom (96%), Tranquillity (92%), Excitement (89%), Belonging (79%) and Achievement (78%), particularly strongly agreeing to experience Tranquillity (58%) and Freedom (61%) — see Fig. 6.4. The experience of Exhilaration presented a statistically significant relation to both ethnicity (Fisher's test, p-value < 0.05) and number of years living on Ascension (Fisher's test, p-value < 0.05), with most UK-born respondents (62%) and those living here for less than a year (80%) strongly agreeing to experience it. The figure dropped with the number of years spent on Ascension and reflected also how residency patterns were related to ethnicity.

Experiences associated with leisure outdoors didn't relate significantly to how frequently people went outdoors but rather with the location of leisure activities. Still, respondents who spent time outdoors everyday were those who most strongly agreed to experience Freedom (75%), Tranquillity (69%) and Achievement (63%), while were also the least experiencing Exhilaration (16%). Overall, those going outdoors most days were who most experienced Tranquillity and Exhilaration (both 94%) but also who less experienced Achievement (33%). Consistent with the majority being St. Helenians (76%) and living on Ascension for over 10 years (76%), respondents going outdoors most weeks were those who most experienced feelings of Belonging (86%) — revealing the underlying contradictions associated with 'belonging and attachment' to Ascension.

In terms of leisure location, where respondents spent time outdoors presented a significant relation with experiencing both Achievement (Fisher's test, p-value < 0.05), higher when going across the island or in the sea, and Freedom (Fisher's test, p-value < 0.03), which all respondents experienced when going further afield or in the sea. Respondents spending time across the island or in the sea consistently presented the highest agreement on all categories; in particular, most strongly agreeing to experience Freedom (65% and 71%), Tranquillity (63% and 66%) and Achievement (58% and 55%, respectively). Perhaps not surprisingly, those who spent leisure outdoors in town or in its wider vicinity were who less experienced most categories, particularly Achievement (21% and 38%) and Belonging (21% and 25%).

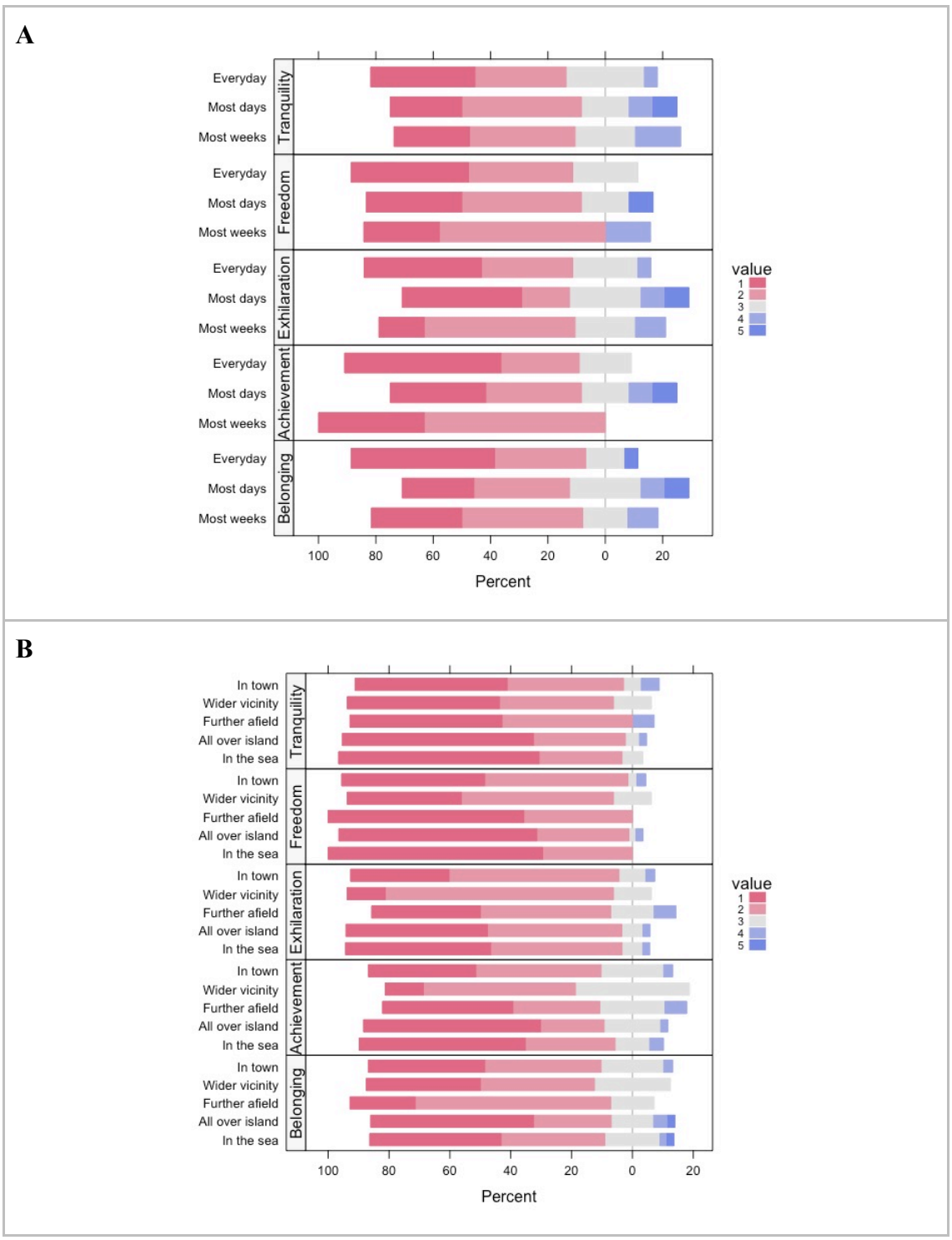


Figure 6.4 - *Experiences of Tranquillity, Freedom, Exhilaration, Achievement and Belonging reported during leisure outdoors per frequency (A) and location (B) of leisure activities, in percentage of the study's population. Levels of agreement are presented in a Likert scale, where 1 corresponds to strongly agree; 2 to tend to agree; 3 to neither agree nor disagree; 4 to tend to disagree; and 5 to strongly disagree.*

6.5 DISCUSSION

The coast and ocean, the volcanic landscape and Green Mountain embody different aspects of people's relationship with Ascension's environment, comprising distinct but interdependent environmental spaces, which support the reproduction of specific cultural practices, values and benefits. Following the conceptual framework advanced by Fish et al. (2016), this study demonstrates how CES are produced by diverse cultural practices, including subsistence and recreational activities which embody physical interactions with the environment, contributing to assert their relevance in the reproduction of diverse cultural benefits (e.g. identities, experiences and capabilities) and the co-production of diverse environmental spaces (e.g. Green Mountain). As widely acknowledged in cultural studies (e.g., Mitchell, 2000), this reflects the shortcomings of approaches focusing solely on CES recreational and aesthetic dimensions; particularly, when CES assessment may rather concern the manifold articulations of human–environment relationships in processes influencing both the co-production of diverse landscapes and the reproduction of distinct identities (Hirsch, 1995; Rival, 2007). In this context, this study further presents evidence of CES variability across temporal, spatial and sociocultural dimensions, which embed multiple ecological flows that may lead widespread landscape changes.

Here, Green Mountain embodies the possibility of large-scale ecosystem reconstruction (Wilkinson, 2004; Gray, 2004), conveying settlers' struggle to make Ascension's otherwise inhospitable landscape more agreeable by modifying its constitutive more-than-human assemblages, importing and renewing multispecies affinities and, in doing so, reterritorializing diverse identities. Contesting essentialist conservation approaches, seeking to preserve 'pristine' natures despite people (Mace, 2014), Green Mountain illustrates the problematics of any straightforward distinction between nature and culture (e.g. Descola, 2013; Ellen, 1996) while embodying simultaneously fundamental aspects of the cultural heritage and perceived 'essence' of Ascension's natural environment. As such, CES assessment reveals diverse strategies of survival and adaptation embedded in Ascension's landscape, disclosing how human–environment relationships enable and manifest multispecies entanglements which both constitute identities and embody multiple 'becoming-with' human and more-than-human others (Haraway, 2008: 244). This demonstrates cultural practices' role intertwining 'natural' and 'cultural' elements in the landscape (Hirsch, 1995), asserting CES assessment contribution to unveil the complex socio-ecological processes constituting Ascension's landscape, by providing evidence of the various

more-than-human relationalities, historical temporalities and ecological flows that converge on Ascension, conferring its symbolic meanings and shaping its biophysical characteristics.

Where islands are exceptional research contexts to explore the production of locality and identity (Baldachino, 2006; Hay, 2006), this research reflects their articulation (e.g., as sense of place) through multiple inward and outward flows of people, resources and technologies, which are reflected in local human–environment relationships and their unique assemblages. Indeed, islands are "part of complex and cross-cutting systems of regional and global interaction" (Baldacchino, 2006: 10), where such flows embody multiple relationalities established within, across but also beyond their fluid boundaries (Pugh, 2018), towards outside and even 'other worlds'. In particular, on Ascension, those outward relationalities embed distant places (e.g. Europe, Africa or South America) as much as other-worldly resemblances (e.g. moon-like landscape) in its inward relationalities, manifesting in local human–environment relationships a connectivity with multiple places and modes of existence, which is reflected in the convergence on Ascension of distinct identities, practices and perceptions across various historical (e.g. global events) and personal temporalities (e.g. residents' permanence) — for example, in their articulation with historical events, technological developments or global communication networks. Thus, following a relational approach which intersects CES (Chan et al., 2012; 2016) and island studies (Pugh, 2018; Stratford et al., 2011), our research highlights the relevance of situating human–environment relationships within their constitutive inward and outward flows across various spatial and temporal dimensions, by conveying the influence of global processes in shaping local environments along with their inner relationalities and manifold identities.

In accordance with previous studies, the present research further contributes evidence on the relevance of pluralistic valuations (Christie et al., 2019; Hirons et al., 2016; Pascual et al., 2017), centred around relational values (Chan et al., 2012; 2016) and their social distribution (Brooks et al., 2014; Cáceres et al., 2015). In particular, through identifying culturally significant aspects of Ascension's environment, this study demonstrates the contribution of diverse relational values in constituting particular places, as illustrated by a systematic overlap between notions of 'essence', natural and cultural heritage and preferred locations for work and leisure activities (i.e. multiple values converging in place); while, simultaneously, portraying their geographical distribution across both the landscape and distinct social groups. Indeed, Ascension's landscape holds multiple contrasts, embedding manifold relationalities and temporalities

which manifest in a diversity of perceptions and interactions strongly mediated by social variables, as reflected for example in the social distribution of subsistence and recreational practices or derived cultural benefits. Despite often overlooked, this sociocultural diversity in modes of interacting, perceiving and valuing the environment stress the importance of considering the social distribution of ecosystem services in assessments, particularly the norms and preferences that mediate human–environment relationships — as supported by previous studies (Cáceres et al., 2015; Chaudhary et al., 2018; Mehring et al., 2017).

The present study advances evidence of how social heterogeneity is reflected on the distribution of cultural practices, values and benefits but also on distinct affiliations to different environmental spaces. The results reveal emergent patterns of social and geographical differentiation in cultural practices, values and benefits, contributing to the further understanding of CES distribution within and across both space and society. In particular, distinct social groups reproduce distinct cultural practices and are affiliated to distinct environmental spaces, reflected for example in how leisure location relates to ethnicity or the frequency of outdoors work with gender. Besides these significant patterns, our results further support the following propositions:

1. *Different practices are associated to different environmental spaces* (e.g., the volcanic landscape with hiking and the coast with BBQing)*, support different benefits* (e.g., Achievement is mostly linked to work outdoors and Tranquillity to leisure) and *are reproduced by different social groups* (e.g., how leisure activities relate to ethnicity);

2. *Different benefits are derived from interactions with different environmental spaces* (e.g., how Tranquillity and Freedom relate to work location) and *affiliated to different social groups* (e.g., while working outdoors, Tranquillity relates to gender and Belonging to ethnicity);

3. *Different relational values are linked to different environmental spaces* (e.g., holding distinct symbolic meanings), *to different practices* (e.g., embodying specific physical interactions) and *to different social groups* (e.g., expressing unique preferences for leisure location);

Still, CES dimensions reflect also the diverse temporalities pervading Ascension Island, in terms of the historical events shaping its landscape and the residents permanence shaping their perception of Ascension's environment. Namely, articulating change with permanence, the perception of widespread landscape changes and their socio-ecological impacts are mediated by

the dwelling patterns of distinct social groups, as length of stay on Ascension. Moreover, these temporalities embed distinct historical relationships with the natural environment, evident on Green Mountain's terraforming experiment and the successive waves of introduced species that radically transformed Ascension's landscape (e.g. following Humboldt insights), the contemporary conservation attempts to preserve its native and endemic species, but also the different socioeconomic processes, technological developments and management strategies that led, for example, to the Green Mountain's farm implementation, its subsequent abandonment and the actual thorough reliance on the importation of all basic goods. This conveys how historical dynamics influence environmental discourses, perceptions and interactions, reflected on distinct norms and preferences for specific ecosystem services bundles (e.g. water and food provisioning versus the conservation of native species) — a largely disregarded aspect in the ES framework (Renard et al., 2015). Nowadays, such influences are most evident in the impacts of global socio-ecological dynamics on local human–environment relationships, affecting differentially particular social groups and reflected not only in their temporalities (e.g., landscape changes and residents permanence patterns) but also their embedded relationalities (e.g., relational values conveyed by inward and outward flows of people and resources).

Ultimately, CES do not represent static, discrete nor isolated interactions but rather dynamic and interdependent relationships, expressing continuous adaptive processes to new socio-ecological conditions, while embodying identities and changes as much as nature and society do. As such, CES assessment enables a detailed socially disaggregated characterization of human–environment relationships on Ascension Islands along with a spatially-explicit analysis of culturally significant places, practices and preferences linked to Ascension's natural environment. These may inform adequate environmental policies in response to current challenges and opportunities, highlighting the need to examine their impacts across distinct social groups and design management strategies adapted to the context-specific practices, values and needs of local communities.

6.6 CONCLUSIONS

The present study demonstrates the capacity of CES assessment to address multiple dimensions of human–environment relationships, highlighting the diversity of relational values embodied by interactions with Ascension's landscape, their expression in widely diverse cultural practices and their heterogeneity within and across multiple social, spatial and temporal dimensions.

These relationships, articulated through inward and outward relationalities across distinct temporalities, reflect the relational entanglements that constitute places as culturally significant, their role supporting the reproduction of cultural identities and the possibilities of their reterritorialization through the co-production of more-than-human assemblages. Here, participatory methodologies for CES assessment are shown to be effective tools to disclose complex socio-ecological dynamics, supporting the increased equity and representativity of ecosystem assessments. As such, this study contributes to a growing body of literature concerned with operationalizing assessments from a social and cultural perspective (Chan et al., 2012; Fish et al., 2016; Pascual et al., 2017; Díaz et al., 2018), by considering the relational dimensions, social heterogeneity and dynamical entanglements of human–environment relationships in ecosystem assessments, to inform both adequate and equitable responses to current environmental challenges.

7. DISCUSSION

> *"...the revolution required by our time must draw its poetry not from the past but from the future, from the humanistic potentialities that lie on the horizons of social life" (Bookchin, 1982:20)*

Precisely due to their crucial role and widespread application to inform conservation initiatives, it is fundamental to question the ontological and epistemological assumptions that ecosystem assessment frameworks reproduce when addressing local, regional or global environmental issues. Such that, are Ecosystem Services (ES) and Nature's Contributions to People (NCP) frameworks suitable to assess complex socio-ecological dynamics across diverse cultures and heterogenous societies?

What are the links that connect people to place and to more-than-human assemblages that have been systematically disregarded or made 'invisible'? Are those broader symptoms of forgotten connections to our living environments and/or sit within ongoing suppressions of other ways of living with multispecies assemblages? How do those embed overlooked socio-political implications of current biodiversity conservation discourses? Can we effectively address environmental issues without considering their underlying social, cultural, political and ecological dimensions or considering these as discrete and separate rather than entangled processes? Can we move forward leaving part of us behind, our constitutive intertwined processes of 'becoming-with' human and more-than-human others?

The former questioning inspired the development of the present thesis. Its underlying implications, however, go beyond ecosystem assessment frameworks as these, more generally, concern and shape biodiversity conservation approaches, resource management policies and predominant environmental discourses. Indeed, as argued by Harvey (1996:119), "all proposals concerning 'the environment' are necessarily and simultaneously proposals for social change", from which follows the requirement to explicitly consider the socio-political implications of both assessment practices and derived policy or management responses. In this regard, current ecosystem assessment frameworks are tainted by their articulation with 'Natural Capital' and long-standing 'Imperial Ecologies' (Sullivan, 2010), where the reproduction of positivist 'top-down' approaches seek to inform various types of 'Corporate and State managerialism' (Harvey,

1996:177) and, set to avoid a fallacious 'tragedy of commons' (Hardin, 1968; Ostrom, 1990), contribute to foster substitutability discourses, ongoing colonization processes and the further appropriation and commodification of nature (Dunlap and Sullivan, 2019).

Particularly, focusing on quantitative assessments and advancing monetary valuations, such assessment frameworks instantiate technical-scientific rationalities to sustainable and efficient global resource management which not only tend to overlook all the relational, subjective and affective dimensions of human–environment interactions but, in fact, are prone to dismiss all their non-easily defined, measurable and profitable expressions. This is evidenced by the way cultural ecosystem services (CES) assessments play a marginal role in the ES literature (e.g., Milcu et al., 2013; Hirons et al., 2016) and, despite emphasizing their relevance, are removed from the general NCP framework to play a contextual role (Díaz et al., 2018), but also by a whole body of critical contributions asserting the importance of considering, generally overlooked, relational values (Chan et al., 2016; Pascual et al., 2017). Moreover, the socio-political implications to devised responses can be inferred by how giving prominence to the environmental benefits obtained generally conceals underlying matters of environmental justice (Chaudhary et al., 2018; Ernstson, 2013), disregarding the social and power differentials behind an unequal access to resources and the socially differentiated distribution of their production, consumption and representation (e.g. Berbés-Blázquez et al., 2016; Cáceres et al., 2015; Mehring et al., 2017).

The faults and limitations of current ecosystem assessment frameworks have been already discussed throughout the thesis, especially in Chapter 2; so here, considering my first research question, I wish to demonstrate how this thesis' case-studies convey the critical relevance of those disregarded and non-quantifiable dimensions for developing adequate environmental responses and, therefore, assert their necessary consideration in ecosystem assessments. Hence, I start by briefly discussing in Section 7.1 the main flaws reproduced by both Ecosystem Services (ES) and Nature's Contributions to People (NCP) frameworks, to outline their implications and how I suggest addressing them. Then, to answer my first research question — **which cultural, social and political dimensions of human–environment relationships need consideration in ecosystem assessments** —, I examine in Section 7.2 the main insights conveyed by the thesis' case research, discussing the relevance of distinct context-specific dimensions of human–environment relationships and exploring pathways to make visible those unaccounted perspectives. Following this, to answer my second research question **— how those dimensions can be**

adequately and systematically considered in assessments —, I advance in Section 7.3 a conceptual framework and set of essential variables for cultural ecosystem assessments, examining their interdependences and implications for assessment practices; and, in Section 7.4, I discuss the relevance of the analytical framework used for developing a relational and empirical approach to cultural ecosystem assessments.

Ultimately, I argue ES/NCP flaws cannot be bypassed through suggesting amendments to these frameworks but rather require subverting the whole meaning, practice and purpose of ecosystem assessments, reframing their scope around context-specific perspectives. I suggest doing this by redefining the understanding of 'cultural services' within such frameworks. As argued by Bookchin (2007:19), is likely that “nearly all of our present ecological problems originate in deep-seated social problems", therefore "ecological problems cannot be understood, let alone solved, without a careful understanding of our existing society and the irrationalities that dominate it". Precisely because cultural services are situated at the complex intersection between nature, culture and politics (Hirons et al., 2016), these arguably expose fundamental limitations of the ES/NCP frameworks, conveying the blind spots epitomized by disregarded sociocultural variables and, thus, contributing to challenge biased ecosystem assessment, management and conservation paradigms. Indeed, both Harvey (1996) and Bookchin (2007) signal the inextricable connection, in complementary directions, between social and ecological challenges and devised responses. Therefore, the concept of 'cultural services' may be instrumental to communicate what matters in terms of the non-quantifiable poetics and complexities of people's constitutive entanglements with ecosystems.

Yet, redefining the understanding of 'cultural services' is not intended to serve more effective 'top-down' management initiatives but rather, questioning the purpose of ecosystem assessments set within 'Imperial Ecologies' (Sullivan, 2010), support a better diagnosis of environmental issues and the development of more representative and equitable environmental responses. Indeed, fitting culture in ecosystem assessment frameworks may serve management purposes but does not necessarily represent the complexity of actual socio-ecological systems, nor the voices of actual people whose lives depend on ecosystems. Thus, developing culture’s exceptional positioning in these frameworks requires to, first, challenge their emphasis on quantitative assessments, to rather employ a qualitative approach to those non-quantifiable relational, symbolic and affective dimensions which matter in people's relationships to nature (e.g., Chan et al., 2016; Pascual et al., 2017). Second, it implies to question any static, discrete or homogenous conceptualization of 'nature' and 'society', to embrace their mutually constitutive

overlapping by focusing on interdependent processes rather than isolated categories while considering diversity and heterogeneity in their modes of coexistence (e.g., Descola, 2013; Rival, 2007). Third, it entails rejecting notions of unidirectional flows with emphasis in the benefits received (e.g., ES/NCP), to consider multidirectional flows between people and nature and disclose subsequent feedback loops, including distinct articulations of reciprocity (e.g., Hall, 2011; Kimmerer, 2012) and adaptive management practices (e.g., Berkes et al., 2003; Folke et al., 2010). And fourth, it requires participatory approaches to bridge diverse worldviews, knowledge systems and relational values through all stages of assessments (Pascual et al., 2017; Tengö et al., 2017), in ways designed to foster the self-determination of local and indigenous communities dealing with social and ecological change.

These are necessary conditions (but not necessarily sufficient) for cultural ecosystem assessments to represent the relational complexities that link people to nature, including their embodied affective and symbolic but also practical significances to sustain particular livelihoods along with their embedded conflicts and struggles, while diverting and intentionally averting the capture of nature by the prolific tentacles of neoliberal and corporate managerial discourses which relentlessly seek to absorb its vivid sustenance power into exchangeable markets (Dunlap and Sullivan, 2019; Sullivan, 2010). Again, neither the understanding of environmental issues nor devised responses can be dissociated from their cultural, socioeconomic and political contexts, reflecting both human vulnerability to, and responsibility for social and ecological changes. Therefore, developing a framework for cultural ecosystem assessments implies the reformulation of ecosystem assessments' conceptual tools, methodological practices and managerial purposes, in ways which — as supported by the present case-studies and fully detailed in the next sections — may simultaneously enable integrating insights from research in biocultural diversity (e.g. bridging diverse ontologies and epistemologies), assist the analysis of complex context-specific socio-ecological dynamics (e.g. disclosing drivers of change and feedback processes) and, therefore, contribute to both a deeper understanding of current environmental challenges and the recognition of diverse modes of coexistence with ecological communities.

To answer my first research question, I demonstrate the relevance of context-specific variables and, therefore, their necessary consideration in assessments based on the present thesis' case research, following an inductive reasoning to assume that, if those are relevant in at least some cases, then their consideration is necessary in all cases. Then, to answer the second research question, I advance a conceptual and analytical framework for cultural ecosystem assessments which might provide tools for the analysis of complex socio-ecological dynamics, contributing

to address key limitations of ecosystem assessment frameworks (Mastrángelo et al., 2019), main knowledge gaps in socio-ecological systems (Fischer et al., 2015) and advance biocultural approaches to sustainability (Merçon et al., 2019; Hanspach et al., 2020). However, the variables identified, necessarily and *per* definition, are but a limited set of many other possible ones that may constitute and influence the vastly diverse expressions of human–environment relationships. In practice, these variables may be considered high-level dimensions, potentially comprised by manifold context–dependent sub-variables. As such, the advanced conceptual and analytical framework for cultural ecosystem assessments is context-sensitive and seeks to enact the reflexive awareness needed in assessment practices, as an invitation to remain open and sensible to all those possible but often forgotten relationalities which, with their own integrity, live beyond our capacity of assessment. As posed by Bookchin (1982 [2005]: 20):

> *"Poetry and imagination must be integrated with science and technology, for we have evolved beyond an innocence that can be nourished exclusively by myths and dreams."*

The opposite stands true, for in a technocratic society seeking the 'mastery of nature' one must reclaim the affective ingenuity of *not knowing,* through the richness of myths and dreams, as science and technology *per se* cannot embrace not least explain all significant dimensions of our coexistences with the more-than-human. Then, not seeking to integrate but rather to weave poetry and science, the present work aspires to recall the poetry and imagination that permeate our common lives, imbue with significance our relationships and inspire the potentialities of our co-resistances, as the only attainable language of the intangible. Throughout, those possible relationalities are then to remain open and present, holding the potential to subvert the seemingly prevalent modes of living and thinking that erase from consideration — or even dismiss overall as option — the sensitive feasibility of multispecies coexistence. Recalling those entanglements that support our common dwellings, in their beautiful simplicity (permeable to the sensorial experience) and intricate complexity (not reducible to quantitative rationalities), entails the challenge of walking on and with a double-edged sword. What follows is an attempt to embrace this challenge, in open and never definitive ways, weaving in the empirical and subjective manifestations of those entanglements and weaving out their possible conceptual and analytical forms.

7.1 ENTANGLED WHOLES: 'Missing Links' in Assessment Frameworks

During the last decade, the Ecosystem Services (ES) framework has been widely adopted in diverse socio-ecological contexts and applied to ecosystem assessments and policy-making at different scales (Constanza et al., 2017; Potschin and Haines-Young, 2016), giving rise to a diversified array of publications (see Braat, 2018) and multiple parallel initiatives involving an interdisciplinary body of academics from the natural and social sciences (CICES: Haines-Young and Potschin, 2012; IPBES: Díaz et al., 2018; TEEB, 2012). Set to contribute for the 'sustainable use of biodiversity' and 'long-term human well-being', the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)[1] recently advanced the Nature's Contributions to People framework, whose major innovations were the integration of diverse stakeholders, worldviews and knowledge systems (Díaz et al., 2015; Díaz et al., 2018). Built upon the ES framework established by the MA (2005), the IPBES approach developed the NCP framework aiming to increase the representativeness and political legitimacy of ecosystems assessments by embracing a pluralistic valuation approach, recognising a diversity of worldviews and existing power relations across different stakeholders' groups (Pascual et al., 2017), while placing emphasis on culture's central role mediating human–environment relationships and on local knowledge systems to better understand those (Díaz et al., 2018). In this context, the NCP framework opened a fundamental debate (e.g., Braat, 2018; de Groot et al., 2018; Peterson et al., 2018), which urges a critical examination of the assumptions and limitations reproduced by current ecosystem assessment frameworks.

The NCP framework advocates for a paradigm shift in ecosystem assessments, addressing some — already strongly criticised — limitations posed by the conventional ES framework, such as its excessive focus on instrumental values and monetary valuations (e.g. Chan et al., 2012; Sullivan, 2010); the marginal consideration of cultural ecosystem services (e.g. Daniel et al., 2012; Fish et al., 2016); and the lack of systematic consideration for local communities' worldviews and knowledge systems (e.g. Comberti et al., 2015; Hirons et al., 2016). Nonetheless, simultaneously, the NCP conceptual framework triggered an intense debate following multiple critiques that range from questioning its innovative character, by stating that NCP and ES are in fact synonymous (de Groot et al., 2018), that the NCP do not fully acknowledge the vast ES literature (Braat, 2018) or that it does not really address the problems of the ES framework (Kenter, 2018), to questioning its operational capacity and usefulness beyond IPBES (Peterson

[1] IPBES website: https://www.ipbes.net/about (Accessed: 26th July 2018)

et al., 2018). Still, sustaining its innovative character, Díaz et al. (2018b) argues that NCP are "epistemologically, ontologically and methodologically more pluralistic" than ES, providing a broader and more inclusive framework for the integration of diverse worldviews and knowledge systems, based on a distinction between generalising and context-specific approaches. Yet, lacking a consistent and systematic approach to context-specific perspectives, namely epitomised by the role of cultural contexts, the uncertainty on how NCP assessments could be implemented 'in practice' originates a debate between NCP and ES advocates that risks paralysing joint efforts, confuse policymakers and ultimately undermine the international commitment to IPBES (Braat, 2018; de Groot et al., 2018; Peterson et al., 2018).

A consistent framework to context-specific approaches is required to effectively embrace the complexity of socio-ecological systems (Fischer et al., 2015; Liu et al., 2007; Ostrom, 2009). Nonetheless, key research gaps remain for ecosystem assessment frameworks to fully consider complex socio-ecological dynamics, including ecosystem services flows, direct and indirect drivers of change, feedback processes and the influence of diverse worldviews in devised resource management strategies (Mastrángelo et al., 2019; Fischer et al., 2015). Moreover, despite its important contributions, the NCP framework still reproduces critical limitations of the ES framework, particularly linked to the instrumentalization of nature as 'provider of services' and an unidirectional representation of flows in human–environment relationships (Kenter, 2018). As such, the NCP framework advocates for the integration of diverse worldviews (Díaz et al., 2018) but, in its core generalizing perspective, still reproduces problematic conceptualisations of nature and society articulated along notions of natural capital. Moving beyond an ontologically dualistic, based on a nature:culture dichotomy, while epistemological and cosmologically monistic conceptualisation of nature, as 'provider of services', is crucial to adequately address both the diversity of human–environment relationships and the complexity of socio-ecological systems.

In this context, key limitations of the ES/NCP frameworks reflect the need to advance ecosystem assessments in four important ways which, constituting the main contributions of the present thesis, are briefly described below and fully disclosed in the next sections. Namely:

(1) Despite recognizing the role of cultural contexts in the NCP framework (Díaz et al., 2018), both the NCP and ES frameworks lack an operational framework for cultural ecosystem assessments;

A systematic approach to cultural ecosystem assessments relies on identifying relevant variables to describe the context-specific dimensions of human–environment relationships, which reflect their articulation through distinct cultural practices, benefits and values along with their sociocultural variability and spatial-temporal dynamics. The identification of these variables is supported by the case research (Section 7.2) and integrates insights from Fish et al.'s (2016) conceptual framework for cultural services, Hall's circuit of culture (1997), research in relational values (Chan et al., 2016; Kenter et al., 2015) and biocultural approaches to sustainability (Hanspach et al., 2020; Merçon et al., 2019). Based on this set of essential variables, I advance a conceptual framework for cultural ecosystem assessments (Section 7.3) which highlights the role of sociocultural variables mediating complex socio-ecological dynamics.

(2) Both the ES and NCP frameworks require explicit consideration of reciprocal relationships to disclose feedback processes and regulation mechanisms behind complex socio-ecological dynamics;

To explicitly address feedback processes between social and ecological variables, ecosystem assessments should consider multidirectional flows by using pluralistic valuations to convey diverse articulations of reciprocity in human–environment relationships. This follows insights from the case research (Section 7.2) and previous studies on relational values (Chan et al., 2012; Kenter et al., 2015), reciprocal interactions (Comberti et al., 2015; Raymond et al., 2013) and socio-ecological dynamics (Liu et al., 2007; Ostrom, 2009). Highlighting the role of values regulating environmental behaviours (Dietz et al. 2005) and people's diverse modes of co-producing the environment (Fish et al., 2016; Hirsch, 1995), such formulation enables ecosystem assessments to move beyond notions of 'nature as provider', by embracing diverse worldviews to 'close the loop' and consider multidirectional flows in human–environment relationships.

(3) The NCP framework advocates for the integration of indigenous and local knowledge systems (Díaz et al., 2018), yet falls in a problematic and unnecessary dichotomy between context-specific and generalizing perspectives;

Integrating indigenous and local knowledge (ILK) is crucial for ecosystem assessments to inform adequate conservation strategies (e.g., FPP, 2020), but requires recognizing that all knowledge systems are context-specific and reproduced in cultural practices, benefits and values. As supported by the case research, ILK is embedded in all dimensions of

human–environment relationships so, to avert ILK misrepresentation and appropriation, bridging knowledge systems requires moving beyond power-laden epistemological distinctions (Agrawal, 1995; Alexiades, 2009), integrating insights from biocultural approaches to sustainability (Hanspach et al., 2020; Merçon et al., 2019) and developing effective participatory approaches (Mistry and Berardi, 2016; Tengö et al., 2017). Then, centring ecosystem assessments in context-specific perspectives, framed as cultural ecosystem assessments, is crucial to improve their political legitimacy and representativeness (Díaz et al., 2018) and develop adequate strategies for the conservation of biocultural diversity (Maffi, 2005).

(4) Neither the ES nor NCP frameworks explicitly address the implications of sociocultural and spatial-temporal variability in the distribution of ES/NCP supply and demand;

To systematically consider cultural diversity, social structures and power relations along with spatial and temporal variability in ecosystem assessments is fundamental to reveal the unequal distribution of ES/NCP supply and demand, underlying ES/NCP flows and their role driving social and ecological changes. This contributes to address key knowledge gaps in socio-ecological systems research (Fischer et al., 2015; Mastrángelo et al., 2019) and stands in accordance with previous studies, including biocultural approaches to sustainability (Hanspach et al., 2020; Merçon et al., 2019), which reflect the relevance of considering social structures, power relations and embedded ES/NCP flows (Berbés-Blázquez et al., 2016; Mehring et al., 2018; Pascual et al., 2017) to support struggles for environmental justice (Chaudhary et al., 2018; Ernstson, 2013) and reveal actual socio-ecological dynamics across various scales (Liu et al., 2007; Ostrom, 2007; 2009).

The ES/NCP frameworks emphasise only one aspect of human–environment relationships, ‘what humans obtain from ecosystems’. This focus on environmental benefits, particularly their quantification and economic valuation, has been widely critiqued for not representing the myriad ways people care for nature (Chan et al., 2016; Kumar and Kumar, 2008) while contributing to foster ongoing colonization processes, deepening social inequities and promoting the further appropriation and commodification of nature (Dunlap and Sullivan, 2019; Sullivan, 2010). The processes of co-production of the environment, particularly how humans shape and have historically shaped ecosystems, constitute multispecies assemblages and adapt to changing ecological conditions (e.g., Ellen, 1996; Hirsch, 1995), all become concealed in notions of ‘ecosystem services’ or ‘nature’s contributions to people’. Indeed, the ES/NCP frameworks are

themselves cultural representations of human–environment relationships, set within a dualistic worldview which tends to focus on what-nature-gives but overlooks the giving-to-nature.

This implies the ES/NCP frameworks generally disregard not only 'what humans do, did and have done' to shape their dwelling environments but also 'what humans give to ecosystems' — the so-called 'services to ecosystems' (Comberti et al., 2015). In consequence, these frameworks overlook an important component of all feedback processes in socio-ecological dynamics. Closing the loop of human–environment relationships is fundamental to convey how humans shape and care for ecosystems (Raymond et al., 2013), but also to disclose how self-regulation mechanisms mediate feedback loops and adaptation processes to social and ecological changes (Berkes et al., 2000; Liu et al., 2007). This is to some extent considered in the cultural ecosystem services' framework advanced by Fish et al. (2016), which emphasizes the role of cultural practices in the production of cultural benefits; yet, within cultural services assessments, cultural practices may reflect how people shape ecosystems but not necessarily the regulation mechanisms which, for example, express notions of care towards ecosystems (Comberti et al., 2015; Raymond et al., 2013) and/or inform adaptive management practices (Berkes et al., 2000; Folke et al., 2010).

In this regard, the notion of 'reciprocity' is crucial, particularly how it is expressed in ritual and subsistence practices, reproduced in stories and socially articulated in different contexts. Notions of reciprocity seek to regulate a give-and-take balance in relationships with others and nature (Comberti et al., 2015; Hall, 2011; Kimmerer, 2013), being tightly linked to the reproduction of relational values (Chan et al., 2012; 2016) and the sustenance of a 'good living' (Pascual et al., 2017) — particularly, as a decolonizing alternative to development paradigms in which well-being is conceived, not in individual nor economic terms, but rather contingent on a harmonious coexistence with diversity and the wider social and ecological community (Acosta, 2013).[1] In this context, relational values are expressed in social norms and prescribed behaviours (Chan et al., 2012; Kenter et al., 2015), conveying explicit or implicit regulations of human–environment relationships, which are also informed by local knowledge systems. While central to the reproduction of worldviews, at their best, such values shape and rely on a detailed knowledge of ecological processes, supported by the empirical observation of their relationships and reproduced through practice, ritual and storytelling (Berkes et al., 2000).

[1] The concept of 'good living' or 'living well' (*buen vivir* in Spanish) emerged in South America and is instrumental in the articulation of indigenous struggles against colonization and capitalist worldviews.

Hence, notions of reciprocity articulated in and through relational values are, simultaneously, central to the regulation of adaptive management practices (e.g., Hall, 2011; Kimmerer, 2013) and to the reproduction of people's cultural identities, knowledge systems and ways of living (Berkes et al., 2000; Chan et al., 2012; Pascual et al., 2017).

In this context, I argue that ecosystem assessments should be centred around context-specific perspectives, framed as Cultural Ecosystem Assessments, which reflect relevant dimensions of human–environment relationships and contribute to both reveal actual socio-ecological dynamics and develop biocultural approaches to sustainability. Relevant variables for describing human–environment relationships were identified through the case research and are discussed in Section 7.2, while their contribution for reframing current ecosystem assessment frameworks is fully discussed in Section 7.3.

7.2 WAYS of LIVING: Cultural Contexts in Ecosystem Assessments

Context-specific dimensions of human–environment relationships may be inferred from examining their local unique expressions and manifestations across local communities in the Peruvian Amazon and Ascension Island. Based on insights from these contrasting case-studies, this section discusses how those context-specific dimensions are conveyed in cultural practices, relational values and knowledge systems along with their role shaping actual socio-ecological dynamics at various scales. This enables to identify relevant place-based variables to represent the diversity of human–environment relationships which, being usually disregarded, require systematic consideration in ecosystem assessments. This discussion does not seek to provide a comparative analysis of assessment practices but rather, based on the case research and the former discussion of ES/NCP limitations, to present evidence which supports the necessary consideration of these context-specific dimensions in assessments and outline their ontological and epistemological implications, as means to inform the development of a conceptual framework for cultural ecosystem assessments (Section 7.3).

Adopting a constructivist approach (Bryman, 2008: 33-34), the following discussion understands the cultural and social phenomena represented as always under construction and debate while, following an interpretivist approach (ibid.: 28-31), it recognizes the subjective meaning of these phenomena by seeking to understand local human–environment relationships in local people's terms (i.e., their perceptions and values). Then, all insights drawn present a specific rather than a definitive or universal version of the reality studied, one that is contingent on the

research context as much as on the researcher own positionality in those research places while, averting the risks of generalizing local unique perspectives, findings representative of their social settings can only be considered instances of broader phenomena.

First, concerning the research context, the different research settings entailed distinct degrees of adaptation to local customs, demanding a lengthier fieldwork period in the Peruvian Amazon, while allowing to test the adequacy and flexibility of my research approach, particularly respecting the time constrains of Ascension's research. Here, despite being commissioned to undertake a cultural services assessment, I had enough freedom to independently adapt the research design and further extend its scope to also meet the present research's purposes, namely by adapting and complementing the questionnaire with participant observation and in-depth semi-structured interviews. Undertaking this research, after the lengthier fieldwork period in the Peruvian Amazon, allowed me to explore different methodological tools in distinct socio-ecological contexts, testing their adequacy and ability to grasp local perspectives while under a project's tight timeline with a more narrowly defined research's scope. Their distinct challenges did not compromise the richness of insights provided by these contrasting research contexts, supporting the feasibility of in-depth cultural ecosystem assessments in varying contexts and granting this thesis with a source of diversity in research's design and context which, ultimately, substantiates relevant context-specific dimensions and adequate methodologies for cultural ecosystem assessments.

Second, concerning my own positionality, being a Latin European women and doctoral researcher certainly influenced the settings I had access to, the ways I perceived and interpreted those as well as the ways people perceived me during fieldwork, at times to my advantage and others not. For example, as an outsider in the Peruvian Amazon, initially I could only access male informants while, being a female, later allowed my participation in women settings. As a European researcher on Ascension Island, I was at first presumed to side with the government's conservation department, conditioning my access to informants and the information they would share, until I was able to clarify those misconceptions (e.g., research purposes). Still, undoubtedly, the Amazonian context required a more scrupulous adaptation to local customs, from food to wayfaring and conversational norms, not possible without a lengthier field-work period to establish rapport and gain respondents' trust. In contrast, Ascension's small area and population, with greater familiarity to European customs, allowed a less demanding adaptation and shorter research period. In both settings, while I was able to establish rapport, seek respondent's validation and cross-check information in numerous instances with diverse respondents, I'm

confident the validity and applicability of results were not compromised. Still, inferences based on these results are not generalizable to entire populations but rather to theory (Bryman, 2008: 406) and, while the study's findings are representative of their social settings, these allow a *moderatum* generalization (Williams, 2000), considering them instances of a broader set of possible relevant dimensions of human–environment relationships.

In this context, the case research presents supporting evidence that cultural ecosystem assessments should consider both tangible and intangible context-specific dimensions of human–environment relationships, namely: (1) the distinct modes of co-producing the environment, including all ES/NCP, reflected in cultural practices, adaptive land management strategies and symbolic meanings that people reproduce through interactions with the environment; (2) the distinct modes of articulating responsibilities towards human and more-than-human others, embedded in social shared or relational values which inform and guide human–environment interactions; (3) the knowledge systems that inform both embodied practices and relational values through which people reproduce their cultural identities; (4) the social structures and power relationships that support or constrain the reproduction of distinct ways of living, including access to resources, influencing the distribution of all ES/NCP costs, benefits and values across society; and (5) their spatial and temporal dynamics, including those reflected in ES/NCP flows and their role driving socio-ecological changes.

Below, I briefly outline the research's main findings which, as fully discussed in the following sections, inform my assertion that ecosystem assessments should be centred around context-specific and placed-based variables, framed as Cultural Ecosystem Assessments. Indeed, the case research provides sufficient evidence, across diverse societies and socio-ecological contexts, to support a non-essentialist approach to 'more-than-human cultures'. This means extending the notion of 'culture' to embrace their constitutive and contextual more-than-human affinities, reflecting the distinct modes' people adapt to and co-produce their environments (Ellen, 1996; Hirsch, 1995; Milton, 1996), reproduce multispecies affinities and constitute multispecies assemblages, articulating their own identities through processes of 'becoming-with' human and nonhuman others (Deleuze and Guattari, 1987; Haraway, 2008). The notion of 'more-than-human cultures' follows the acknowledged role of culture mediating human–environment relationships (Milton, 1996) and, therefore, locally influencing all ES/NCP (Díaz et al., 2018). This enables developing a biocultural approach to socio-ecological systems (Merçon et al., 2019), as supported by the research's main insights:

- Cultural ecosystem assessments convey how particular ways of living and knowing manifest in interactions with the environment, reflecting multispecies affinities and modes of co-production of the environment reproduced in cultural practices, benefits and values;

- Cultural practices involve the production, consumption and representation of all ES/NCP, conveying modes of constituting and reproducing multispecies assemblages, which are regulated by cultural values (e.g., relational values) and sustain cultural benefits (e.g., identities and knowledge systems);

- Cultural values reflect the regulations, principles and preferences that guide human–environment relationships and give significance to all ES/NCP, influencing environmental behaviours and conveying distinct articulations of reciprocity towards nature (e.g., responsibilities nurtured) that regulate multidirectional ES/NCP flows, underling feedback processes and adaptive management practices;

- Cultural benefits emerge from relational processes which, embedding all other ES/NCP benefits, support the reproduction of cultural identities, experiences and capabilities (e.g., knowledge systems) affiliated to local ways of living and constitutive of more-than-human biophysical and symbolic territories characterized by a sense of place and cultural heritage;

- Cultural ecosystem assessments reveal the unequal distribution of ES/NCP supply and demand, disclosing how cultural diversity, social structures and power relations determine the distribution of cultural practices, benefits and values, influencing ES/NCP distribution and driving multiple ES/NCP flows both within and across regions and societies;

- Cultural ecosystem assessments enable the analysis of complex socio-ecological dynamics from a biocultural diversity perspective, characterizing human–environment interactions along with their wider ecological communities and contributing to determine ES/NCP spatial and temporal dynamics, direct and indirect drivers of social and ecological change, feedback processes and emergent regulation mechanisms.

Cultural practices, benefits and values along with their sociocultural and spatial-temporal variability reflect subsets of socio-ecological variables that characterize human–environment rela-

tionships and should be considered in cultural ecosystem assessments. Nonetheless, these variables represent interdependent processes rather than discrete or isolated categories. Recognising the entanglement between nature and society may raise concerns pertaining double counting in ES/NCP categories, however, these are only problematic to quantitative assessments based on accounting categories (Chan et al., 2012). As asserted by Tengberg et al. (2012), there is no 1:1 equivalence between ecosystem 'services' and 'benefits' — as ecological processes may provide multiple benefits while specific benefits may be supported by multiple ecological processes, including those people nurture towards ecosystems (Comberti et al., 2016). Then, the separation between nature and society may serve management purposes but does not necessarily represent the complexity of actual socio-ecological systems.

As such, implementing qualitative assessments based on descriptive categories may enable the recognition of interdependent socio-ecological processes that contribute simultaneously to multiple categories (Chan et al., 2012); while, as supported by the present research, to adequately comprehend and represent their subjective and context-specific manifestations requires thoroughly developing participatory methodologies within mixed methods approaches.

Cultural Practices: The Co-Production of Landscapes

Following Fish et al. (2016), cultural practices are constitutive of interactions between people and nature, being enabled by and shaping distinct environmental spaces through processes understood, within the ES framework, as 'cultural ecosystems services'. Cultural practices convey people's ways of living, their modes of subsistence as well as their modes of relating to and with others, embodying the symbolic meanings, relational values and knowledge systems affiliated to the environment as much as to people's cultural identities. As such, cultural practices are especially relevant to understand people's modes of coexisting with and constituting multispecies assemblages, particularly how people shape and adapt to ecological communities, reproducing multispecies affinities and co-producing their environments.

The Peruvian Amazon and Ascension Island portray differently modified landscapes, reflecting how distinct historical, cultural, social and ecological contexts influence people's modes of co-production of their environments. In the Peruvian Amazon, the co-production of the environment entailed establishing multispecies assemblages through the domestication, selection and propagation of native plant species, particularly those linked to non-timber forest products (e.g., fruits, medicines and crafting materials), while fostering forest succession and regeneration through rotational cycles for the creation and maintenance of enriched habitats (Chapter 5).

Here, forest management practices convey co-adaptive processes which led to ‘intermediate’ land-use systems, not fully ‘domesticated’ nor entirely ‘wild’ (Wiersum, 2004), shown to support multiple ecological processes including provisioning (e.g., food production) and regulating services (e.g., soil fertility). Yet, historical and ongoing colonization processes, entailing increased exchanges with distinct groups from distant places, still lead nowadays profound cultural and ecological changes reflected in subsistence practices, relational values and knowledge systems (e.g., agricultural intensification) and the landscape itself (e.g., deforestation).

On Ascension, the co-production of its environment entailed the reterritorialization of multispecies assemblages, brought ashore to implement a ‘terraforming’ experiment which would turn Ascension's landscape more amenable to human settlements. This represented a reterritorialization of human–environment relationships, where settlers imported to Ascension diverse cultural practices, knowledges and multispecies affinities from distant places and in renewed forms, adapted to constitute new ecological communities. Nowadays, these endeavours drive conservation efforts to control invasive species and protect endemic species and habitats. Here, the co-production of the environment relied on inward and outward flows of people, species, knowledge, preferences and norms, through different historical periods, which left successive expressions of human–environment relationships in the landscape. Still, the convergence of distinct identities on Ascension is made visible by how distinct recreational and subsistence practices are affiliated to distinct environmental spaces as well as to distinct social groups, being socially differentiated by gender and ethnicity, who derive distinct benefits from environmental interactions (even when performing the same activities).

These case studies illustrate how landscapes may embed distinct engagements with multispecies assemblages that reflect diverse human modes of co-production of the environment, through which people may enhance (e.g., food production) or prevent certain ecological processes (e.g., soil erosion) while adapting to changing social and ecological conditions. That humans shape and adapt to their environments is widely recognised in environmental anthropology (e.g., Ellen, 1996; Hirsch, 1995; Rival, 2007) and increasingly pointed out in the ES/NCP literature (Comberti et al., 2015; Fish et al., 2016; Mehring et al., 2017). Yet, these case studies also illustrate the socio-ecological processes behind adaptation, presenting cultural changes linked to landscape changes, as the result of pressures and impacts on people’s ways of living and exchanges between distinct social groups, where increased flows of tangible (e.g. resources) and intangible (e.g. knowledge) benefits or costs convey the 'reterritorialization' of distinct ways of living — as the complementary aspect of their relative deterritorialization

(Deleuze and Guattari, 1987). Cultures are intrinsically dynamical and interconnected, rather than static and discrete (Mitchell, 2000). The implications for the ES/NCP frameworks, particularly their ability to address complex context-specific socio-ecological dynamics, invites some further considerations.

Through engaging with their dwelling landscapes, humans become involved in the co-production of provisioning (e.g., food) and regulating services (e.g., soil fertility). However, cultural practices are linked not only to the production (e.g., through subsistence practices) but also to the consumption (e.g., through recreational activities) and representation (e.g., through creative activities) of all other ES/NCP and derived benefits, in highly context-specific ways. This contributes evidence to the overlap between cultural and other ecosystem services, also pointed out in previous studies (Chan et al., 2012; Díaz et al., 2018), but also to its role shaping ES/NCP supply and demand (Mehring et al., 2017). Again, culture does not fit well in conventional assessment frameworks, first, because ES/NCP categories do not reflect functional interdependences between social and ecological processes; and second, because such processes produce benefits that may correspond simultaneously to multiple categories (Tengberg et al., 2012). Modes of food production, for example, constitute cultural practices that may support cultural (e.g., identities), provisioning (e.g., food itself) and regulating benefits (e.g., soil fertility). This reveals culture's entanglement with ecological processes, with the supply, demand and valuation of ES/NCP being largely conditional on cultural contexts.

Each in their own way, these landscapes convey how human–environment relationships are deeply connected to the reproduction of cultural identities (Cepek, 2008; Rival, 2007). Distinct ways of living are tied to particular multispecies assemblages, embodying the reproduction of cultural practices, relational values and knowledge systems, which support a sense of place and belonging. Then, engagement with the environment assists processes of cultural reproduction, affiliated to particular identities (Rival, 2007) and knowledge systems (Berkes et al., 2000; Ingold, 2011), which are further manifested in the social and geographical distribution of cultural practices, benefits and values. Indeed, this emphasises the inextricable link between cultural practices and the reproduction of multiple cultural and ecological benefits, in ways that contribute to disclose how cultural practices, benefits and values are distributed across distinct social groups and through the landscape, constituting evidence of the need for socially disaggregated ES/NCP analysis (Brooks et al., 2014; Chaudhary et al., 2018; Ernstson, 2013).

Moreover, interdependences between cultural and ecological processes convey that humans do not become human by themselves but, instead, their multispecies entanglements are key to the

reproduction of their own identities in social (e.g., gender), cultural (e.g., ethnicity) and, generally, ecological (e.g., human species) terms (Haraway, 2008; Ingold, 2000). In this context, despite the conventional exclusion of nature from culture (Mitchell, 2000), it is increasingly difficult to support that culture is exclusively human (Milton, 1996) when its understanding may rather extend to their modes of reproducing multispecies affinities and constituting multispecies assemblages (Kohn, 2013; Rival, 2007). Modes of cultural reproduction through the environment portray how distinct cultures may be characterized by their constitutive, relational and symbolic entanglements with the more-than-human — for example, by articulating complex kinship relations with plants and animals (Hall, 2011; Viveiros de Castro, 2005). This, as argued by Kohn (2013:15), supports the recognition of cultures as both 'complex' and 'open wholes'. As such, human–environment relationships perform along a nature:culture continuum, reflected in how social norms are extended to the nonhuman (Descola, 2005; Viveiros de Castro, 2005) and consequent gradients of 'intermediate' land-use systems, simultaneously 'domesticated' and 'wild' (Wiersum, 2004; van Bommel and Turnhout, 2012).

Precisely because cultural processes operate in the interface between nature and society (Ellen, 1996; Hirsch, 1995), cultural ecosystem assessments are crucial to reveal complex socio-ecological dynamics behind environmental degradation or regeneration. This is emphasized by culture inextricable link to the production, consumption and representation of all ES/NCP through the regulation of underlying socio-ecological processes, particularly, in the way cultural practices influence ES/NCP supply and demand, cultural identities shape ES/NCP distribution and human–environment interactions may embed multiple ES/NCP flows both across distinct regions and societies. These exchanges may drive profound cultural and ecological changes, representing complex socio-ecological dynamics which, in a globalized world, may span from local to global scales and include the delocalized impacts of global trade (Lenzen et al., 2012; Marques et al., 2019), local knowledge changes (Cámara-Leret et al., 2019) and biocultural diversity loss (Merçon et al., 2019). That cultural contexts mediate the co-production of all ES/NCP is acknowledged by the NCP framework (Díaz et al., 2018), yet its implications are not fully considered beyond promoting a split between generalizing and contextual perspectives. Here, I suggest moving beyond abstract conceptualizations of nature and society in generalist approaches. I propose that cultural ecosystem assessments may reframe current ES/NCP frameworks, centring the understanding of human–environment relationships in context-specific perspectives in ways that support consideration of actual socio-ecological dynamics.

Relational Values: Reciprocity in Human–Environment Relationships

Shared values express the values held in common by particular social groups, while social values refer to the cultural norms and principles that guide social situations, such as implicit and explicit regulations which prescribe adequate behaviours towards others (Kenter et al., 2015) — for example, those embedded in laws. Then, cultural values are shared social values which convey a "shared sense of what is worthwhile and meaningful" (ibid.: 88), while informing the guiding principles and norms that guide socially prescribed behaviours in relationships to others and nature (Chan et al., 2016). People state individual and shared values towards nature through relational processes, based on ethical principles for maintaining reciprocity for example, reproducing their identities through attitudes and behaviours that reflect their particular modes of affiliation, concern and dependence on the environment (Kumar and Kumar, 2008). As such, relational values convey the symbolic meanings affiliated to human–environment relationships that guide embodied practices, becoming inextricably linked to the reproduction of people's cultural identities, knowledge systems and ways of living while supporting a sense of place, social cohesion and, more broadly, what is considered a 'good quality of life' (Pascual et al., 2017) or their shared principles for sustaining a 'good living' (Acosta, 2013).

Both in the Peruvian Amazon and Ascension Island, relational values conveyed distinct relationalities and affiliations to the landscape, manifest in the social distribution of cultural practices, symbolic meanings and derived benefits linked to the environment. In the Peruvian Amazon, the distinct relationalities embodied by indigenous people, economic development and biodiversity conservation endeavours express their contrasting perceptions of the forest, respectively, as a 'living entity', 'untapped resources' or 'pristine nature' (Chapter 5). Here, indigenous worldviews, where earth's abundance is considered a gift that requires reciprocity (Berkes, 2004; Hall, 2011), stay in sharp contrast with the worldviews reproduced by conventional conservation paradigms, where resources are protected to maintain their intrinsic value (e.g., Cronon, 1996); or economic development ones, where the possibility of resources exploitation attributes market values based on supply and demand (e.g., Costanza et al., 1997). As such, the implications of distinct worldviews are reflected in relational values and manifest on the land management practices, knowledge systems and symbolic meanings affiliated to human–environment relationships and through which distinct social groups reproduce their identities.

Similarly, on Ascension, diverse relational values could be inferred by people's preferences for environmental spaces, their assigned significances but also their affiliations to distinct cultural practices. Here, symbolic meanings and physical interactions with the environment were both

geographically and socially differentiated by gender and ethnicity, embedding relational values that express a different significance of Ascension's natural and cultural heritage to distinct social groups. Hence, both the Ascension and Amazon's case-studies demonstrate how different relational values may converge on specific environmental spaces (i.e., diverse values in one place), their spatial distribution across the landscape (i.e., diverse values to diverse places) but also their divergent affiliations to distinct social groups (i.e., diverse values by diverse people), in terms of the preferences, norms and notions of meaningfulness guiding local human–environment relationships. Following the long-standing criticism of the ES framework's focus on monetary values (e.g. Sullivan, 2010; Dunlap and Sullivan, 2019), this case research contributes to assert the relevance of pluralistic valuations with emphasis on relational values (Chan et al., 2016; Hirons et al., 2016; Pascual et al., 2017) while supporting the need for a spatial-explicit and socially disaggregated analysis to convey their heterogenous distribution (Berbés-Blazquéz et al., 2016; Brooks et al., 2014; Cáceres et al., 2015).

Nonetheless, because relational values are more often implicit rather than explicit, it's their manifestation in discourses — as those constituting the oral-tradition of native Amazonian people (Chapter 4) or put-forward by economic development and biodiversity conservation advocates (Chapter 5) — that may more distinctively convey the symbolic meanings affiliated to human–environment relationships, their socially differentiated distribution and their implications for resource management practices and strategies. In the Peruvian Amazon, narratives reproduced by indigenous people portray both landscape features and their more-than-human inhabitants endowed with agency, intentionality and relational power. Such narratives convey the relational values that guide human–environment interactions, their embedded symbolic meanings and the socially prescribed processes of engagement with the environment. These values are reproduced in ritual practices and regulate forest management, hunting and fishing practices by conveying social obligations and prohibitions towards both human and nonhuman others. Such regulations are based on principles of reciprocity and respectful action towards the forest and its beings, for example expressed in obligations to ask permission, take only what one needs and share any surplus when gathering and managing forest resources. As such, expressing the responsibilities nurtured by humans towards both human and nonhuman others (Chan et al., 2016; Kenter et al., 2015; Pascual et al., 2017), relational values may assist 'closing the loop' in ecosystem assessment frameworks by conveying distinct modes of acting and relating *towards* the environment — in accordance with the role of values informing attitudes and norms that shape environmental behaviours (Barr and Gilg, 2007; Dietz et al., 2005).

In this context, the recognition of distinct species' relational roles in their wider ecological communities supports the principles of reciprocity and respectful action that guide local human–environment relationships. Such principles express a detailed ecological knowledge of species' functional roles, behavioural patterns and interdependent ecological processes (Berkes et al., 2000; Ellen and Harris, 2000), articulated in and through relational values based on an extended concept of personhood — i.e. where plant and animal species may be conceived as persons with cognitive, moral and social qualities analogous to humans (Descola, 2005; Viveiros de Castro, 2005), following the notion of a shared "earthly-kinship" (Hall, 2011: 101). Here, because the more-than-human is endowed with subjectivity and intentionality, the forest as a multispecies assemblage becomes an "ecology of selves" (Kohn, 2013: 16), where plant and animal species are recognised as subjects in interpersonal relationships (Descola, 2005; 2013). Then, human–environment relationships perform along a nature:culture continuum, with elements assigned to subject:object and self:other dichotomies becoming contextual to their role in social relationships (Descola, 2005; Viveiros de Castro, 2005), both among each other and humans. Social relations no longer belong exclusively to human societies but are rather extended to ecological communities, while personhood is not an unconditional nor special human attribute but rather contingent on abiding to those norms and principles that sustain balanced ecological communities (Descola, 2013).

The diversity of global worldviews entails the need to adopt an anti-essentialist approach to well-delimited categories, such as self:other and nature:culture, in the articulation of local perceptions of diversity and similarity (Kirksey and Helmreich, 2010; Ogden et al., 2013). Again, recognizing culture as more-than-human may reflect how plant and animal species may themselves have culture (e.g., as learned behaviours and a shared sociability) but also how human cultures extend to and comprise the more-than-human (e.g., through extended social relations). Such anti-essentialist approach to 'nature' and 'culture' does not imply the assumption of an unified nonhuman domain (Viveiros de Castro, 2012) nor extending categories of human moral values to the more-than-human (Ogden et al., 2013), but rather entails fading the boundaries of ontological categories so these become contextual to their embodied relationalities (Descola, 2005; Viveiros de Castro, 2012). Then, more-than-human cultures may reflect the articulation of multispecies affinities in human–environment relationships, both in terms of their constitutive components but also their specific modes of coexistence with multispecies assemblages — as the ethical principles and regulations that inform responsibilities towards the more-than-human.

In this context, relational values may convey how reciprocity is differently played in human–environment relationships by distinct social groups, revealing distinct modes of regulating ecological processes, regenerating ecological communities and supporting a 'good living' (or, equally, their absence). This notion challenges ecosystem assessment's valuation approaches, reverting the focus to how social values inform environmental behaviours (Barr and Gilg, 2007; Dietz et al., 2005), expressed in distinct articulations of multispecies entanglements. Ultimately, this may be further illustrated by contrasting biodiversity conservation and economic development worldviews, where the former excludes humans from ecological communities (e.g., natural reserves); while the later excludes the more-than-human from their dwellings, through their appropriation and commodification (e.g., extractivist industries). Both reproduce ontological distinctions that give preference to certain 'subjects' while socialising particular 'objects', to define which social relations entail ethical responsibilities, with implications for their modes of coexistence with multispecies assemblages and their ecological balances. The significance of reciprocity to reframe ecosystem assessment frameworks has been already asserted in previous studies (Comberti et al., 2015; Raymond et al., 2013) and it is widely acknowledged as a central aspect of many indigenous worldviews (Kimmerer, 2013; Hall, 2011). Here, I suggest considering distinct articulations of reciprocity across society, along a gradient of ethical responsibilities towards human and nonhuman others (e.g., 'give-and-take' balances), to explicitly address how social values and norms convey regulation processes in ecological relationships. This is fundamental to further understand local socio-ecological dynamics, particularly contributing to disclose co-adaptive processes, feedback loops and regulation mechanisms which, embedded in relational values and enacted by human–environment relationships, modulate the characteristic non-linear dynamics of complex socio-ecological systems (Carpenter et al., 2009; Fischer et al., 2015; Scheffer et al., 2012).

Relational Processes: Cultural Identities and Knowledge Systems

Indigenous and local knowledge (ILK) is a practical consequence of engagement with the environment in everyday life: showing components of empirical knowledge, based on the direct experience and observation of the environment; practice, based on the modes of engagement with the environment through land and resources management systems; and believe, pertaining people's perception and interpretation of the environment and their relationship with it (Berkes, 1999). Thus, acknowledging the central role of ILK supporting the reproduction of cultural identities and local ways of living (Berkes et al., 2000; Ellen and Harris, 2000; Gavin et al.,

2015) is instrumental to understand local unique perspectives on human–environment relationships, including how knowledge systems are shaped by and inform relational values and adaptive management practices.

Among indigenous communities in the Peruvian Amazon (Chapter 4), narratives play a fundamental role in the reproduction of detailed ecological knowledge about diverse species behaviours, distribution patterns, seasonal cycles, interdependent processes and ecological functions. In accordance with previous studies (Berkes et al., 2000; Ellen and Harris, 2000; Mistry and Berardi, 2016), such knowledge informs what, how and when to perform certain subsistence practices, such as hunting, fishing or harvesting, while supporting adaptive resource management strategies based on continuous observation of actual ecological conditions. Here, rather than a classification of species in genealogical models, narratives transmit an ecology of relationships between forest entities (Descola, 2005), based on their interdependencies, which inform the prescribed behaviours and ethical codes humans must follow to maintain the ecological balance. These prescriptions are conveyed by 'forest mothers', who epitomize regulation mechanisms for human engagements with the environment. By respecting those norms, knowledge is transmitted by forest entities to people rather than simply being acquired: 'forest mothers' teach the properties of certain medicinal plants, assist hunting through offering their preys and recommend adequate diets to develop certain skills (e.g., become a good hunter or witchdoctor). Then, because knowledge is reproduced in the context of specific practices (Ellen and Harris, 2000; Ingold, 2011; Pink, 2009), narratives are not passive means of knowledge transmission but rather convey the means of knowledge production — transmitting the sets of practices through which empirical experiences and knowledge may be produced (Ingold, 2011; Viveiros de Castro, 2012).

Such knowledge systems rely on the experience of participation in the world (Ingold, 2011), where knowledge depends on the relationship established with the 'thing' known (Ellen and Harris, 2000; Hirsch, 1995) — i.e., on *knowing* its story (Hall, 2011: 103). This contrasts with the pursued objectivity of positivist knowledge systems, where classificatory systems based on genealogical models assume that each element is defined by an intrinsic constitution (an 'inner essence') not affected by their relationalities nor dependent on their contexts (Ellen and Harris, 2000; Ingold, 2011) — i.e., a direct correspondence between the world and its representation (Ingold, 2011). As such, positivist knowledge systems tend to rely on the objectification of 'things' known which, conceptualised as discrete and static elements, are comprehended

through their decontextualization and decoupled from their constitutive relationalities and contexts (Haraway, 1991; Pink, 2009). In contrast, situated knowledges are based on those relationalities, being deeply rooted in the landscapes and extended networks of ecological relationships that sustain people's livelihoods.

Here, land and knowledge exist inextricably intertwined. Following what Echeverri (2005: 237) calls the 'non-areolar territory', this notion is in accordance with indigenous peoples' representation of their ancestral integral territories, constituting not a geographically delimited area but rather a weaved network of relationships that support the reproduction of human life. Then, the relationalities embedded in multispecies assemblages define an open physical, symbolic and political territory — the 'storied' territory of more-than-human relationships. Because narratives reproduce situated knowledge, narratives can transform space into place (Tilley, 1994), further assisting the articulation of a sense of place, belonging and social cohesion while reproducing an embedded cultural heritage. In contrast with the "political-administrative zoning" of two-dimensional cartographic maps (Echeverri, 2005: 238; see also Hirsch, 1995; Tilley, 1994), situated narratives constitute a storied landscape which supports the reproduction of people's ways of living, their cultural identities and heritage while transmitting the history of their dwelling territories.

As observed in the Peruvian Amazon (Chapter 4 and 5) and in accordance with literature (Berkes et al., 2000; Ellen and Harris, 2000; Pink, 2009), local knowledge systems are intimately linked to the reproduction of people's ways of living, their identities and land management practices but also their cultural heritage. Nonetheless, situated knowledges are highly dependent on their contexts of reproduction and, as evidenced by this case research as well as previous studies (Cámara-Leret et al., 2019; Gómez-Baggethun and Reyes-García, 2013), ILK relies on empirical observations and embodied practices for adapting to changing socio-ecological conditions but may also itself be subject to substantial changes, for example resulting from economic development's pressures and impacts. Such knowledge changes are also implicit on the temporalities of Ascension's successive land management practices, such as those that led the terraforming experiment on Green Mountain, creating conditions to support the first settlement's livelihoods; or the actual conservation efforts to preserve the 'uniqueness' of Ascension's volcanic landscape, maintain native habitats and control invasive species populations. Their contrasts are evidence of historical changes in dominant worldviews, as the former emphasizes human's ability to remarkably change the landscape and improve life-conditions;

while the latter attempts to avert human-induced changes and their negative environmental impacts, following a somewhat more essentialist approach to landscape conservation. These observations invite some further considerations.

First, ILK plays a central role in the conservation of many habitats, with landscapes managed by native communities holding important carbon stocks and most global biodiversity (Garnett et al., 2018; Mistry and Berardi, 2016; Schuster et al., 2019). As such, ILK is undoubtedly relevant for ecosystem assessments, particularly to inform adequate management strategies and policy responses — as widely recognised by previous studies (e.g., FPP, 2020) and, particularly, the NCP framework (Díaz et al., 2018; Tengö et al., 2017). Furthermore, bridging knowledge systems is crucial to support effective collaborations in conservation initiatives and increase their political legitimacy and representativeness (Brondizio and Tourneau, 2016; Díaz et al., 2018; Tengö et al., 2017). However, these valuable outcomes require to explicitly address power asymmetries between distinct stakeholders (Alexiades, 2009; Mistry and Berardi, 2016; Tengö et al., 2017); in particular, the modern tendency for generalising perspectives by decontextualizing knowledge, subjecting ILK to external validation processes and fostering its commercial appropriation (Alexiades, 2009; Greene, 2004; Huntington, 2000). Thus, it's fundamental to recognise that, as posed by Mistry and Berardi (2016: 1275), "all forms of knowledge, including scientific knowledge, are produced by socially situated actors and are value-laden", such that all knowledge systems are context dependent (Jørgensen, 2010) and there is no straightforward distinction between ILK and Science (Agrawal, 1995).

Second, bridging knowledge systems in ecosystem assessments entails not only recognising their instrumental value but also considering their processes of reproduction within their cultural, socioeconomic and political contexts and their underlying socio-ecological dynamics. ILK carries the sets of symbolic meanings and embodied practices which support local livelihoods, where the sustainable management of resources is a consequence of adaptive management practices (Berkes et al., 2000). Yet, the community's resilience depends on ILK adaptive capacity but also on historical, political and economic factors (Gómez-Baggethun and Reyes-García, 2013), being contingent on social and power structures (e.g., nested institutions and regulations) which may either support or hinder its reproduction and adaptation, for example by imposing land management changes or restricting intergenerational succession (Berkes et al., 2000; Ellen and Harris, 2000). Knowledge dependence on multiple socioeconomic and political factors (Agrawal, 1995; Alexiades, 2009) implies that it may not always be ecologically adaptive and might even become maladaptive over time (Berkes et al., 2000; Ellen and Harris,

2000; Huntington, 2000). Ultimately, ILK integration in ecosystem assessments should be promoted by their own merits rather than by cultural idealization (Ellen and Harris, 2000); hence, acknowledging that both ILK and Science are context-dependent requires considering their local processes of reproduction to evaluate whether and how these may support or hinder ecologically sustainable practices.

This conveys how knowledge reproduction is inextricably linked to complex socio-ecological dynamics, where systematic cultural ecosystem assessments may not only support the integration of multiple voices in ecosystem assessments (Díaz et al., 2018; Tengö et al., 2017) but also contribute to assess actual ILK condition and the underlying socio-ecological dynamics driving ILK losses or changes (Cámara-Leret et al., 2019; Gómez-Baggethun and Reyes-García, 2013).

Socio-Ecological Dynamics: Social Structures, Power Relations and Flows

Following environmental anthropology scholars (Ellen, 1996; Descola, 2013; Viveiros de Castro, 2012), to fully embrace the entangled and reciprocal character of human–environment relationships is necessary to move beyond problematic nature:culture dichotomies. Particularly, one based on the abstract conceptualisation of human societies, as homogenous entities, and nature, as independent and somehow 'untouched' wholes (Moore, 2017). Similarly, an adequate conceptualisation of socio-ecological systems (SES) requires focus on the interactions between multiple elements, rather than dealing with both realms separately (Liu et al., 2007; Ostrom, 2009). Nonetheless, despite numerous studies highlighting the relevance of considering SES dynamics in ES/NCP assessments, particularly the spatial and temporal distribution of ES supply and demand (e.g., Burkhard et al., 2012; Mehring et al., 2017), drivers of socio-ecological changes and underlying feedback processes (e.g., Carpenter et al., 2009; Fischer et al., 2015), their understanding has not been fully integrated in ecosystem assessments (Mastrángelo et al., 2019).

Here, I argue that, because 'cultural services' represent the context-specific dimensions of human–environment relationships at the interface between nature and society, cultural ecosystem assessments are the 'missing-link' to enable consideration of actual SES dynamics in the ES/NCP frameworks, particularly contributing to identify their constitutive elements (e.g. multispecies assemblages), characterize their interactions (e.g. cultural practices and ES/NCP flows) and describe their non-linear dynamics, determining feedback loops, regulation processes and major drivers of change.

As previously discussed, because cultural practices assist the co-production of the environment and the reproduction of cultural identities (Hirsch, 1995; Rival, 2007), distinct social groups become differently involved in the production and consumption of various ES/NCP. This was observed both in the Peruvian Amazon, comparing indigenous communities, biodiversity conservation and economic development land management practices and the ES/NCP benefits each produce and/or consume (Chapter 5); and on Ascension (Chapter 6), looking at the social distribution of subsistence practices (e.g., fishing and foraging) and the consumption of distinct experiences (e.g., diving or hiking). This manifests distinct social groups affiliation to different cultural practices (e.g., production, consumption and representation), benefits (e.g., cultural identities and knowledge systems) and values (e.g., preferences and norms) but also to different environmental spaces (e.g., places and landscapes), expressing preferences (e.g., the coast or mountain on Ascension) or prescribed norms (e.g., restrictions to access natural reserves in the Peruvian Amazon). In accordance with previous studies (Berbés-Blázquez et al., 2016; Chaudhary et al., 2018; Mehring et al., 2017), this constitutes evidence of the heterogenous social and geographical distribution of ES/NCP across distinct social groups, as those defined by gender, class or ethnic origin.

Often, social inequities underly the unequal distribution of ES/NCP costs and benefits, determining a differential access to and dependence on resources, places or landscapes as well as the unequal exposure to enhanced or degraded ecosystems (Berbés-Blázquez et al., 2016; Chaudhary et al., 2018; Harvey, 1996). The geographical distribution of distinct ES/NCP has been the focus of several spatially explicit studies (Burkhard et al., 2012; Burkhard and Maes, 2017) while, despite their relevance, the implications of the socially heterogenous distribution of ES/NCP benefits and values have been largely overlooked in the literature (Brooks et al., 2014; Cáceres et al., 2015; Chaudhary et al., 2018). In this context, because cultural practices are involved in the production, consumption and representation of all ES/NCP, while influenced by people's identities, knowledge systems and relational values but also underlying social structures and power relationships, these sociocultural variables are shown to mediate the distribution of ES/NCP supply, demand and values (as both preferences and regulations). Therefore, considering sociocultural variability in cultural ecosystem assessments contributes to reveal the social and geographical distribution of ES/NCP in terms of their production, consumption and valuation, supporting the explicit consideration of social structures, underlying power relationships and concerns for environmental justice (Berbés-Blázquez et al., 2016; Chaudhary et al., 2018; Dunlap and Sullivan, 2019; Ernstson, 2013).

Distinct social groups' interactions may reproduce power relationships which, despite largely determining the distribution of ES/NCP, have been extensively disregarded in the ES literature and are only starting to be acknowledged in the NCP framework (Berbés-Blázquez et al., 2016; Ernstson, 2013; Pascual et al., 2017). Such power relations are articulated with social structures, embedded in ES/NCP flows and historically manifest, in multiple ways, through interactions between and across distinct social groups. On Ascension, these entailed controlling the access to different spaces based on ethnicity (e.g., Exiles Club); while, in the Peruvian Amazon, these appear embedded in socioeconomic and political discourses that assist to legitimize control over land and resources, expressed in imposed regulations (e.g., restrictions in resource use within natural reserves) and denied access to benefits (e.g., land grabbing and resources appropriation by development projects). As such, in accordance with literature (Berbés-Blázquez et al., 2016; Chaudhary et al., 2018; Dunlap and Sullivan, 2019), power relationships may influence access to ES/NCP benefits, increase social inequities and foster ongoing colonization processes which drive major social and ecological changes. Therefore, closely linked to environmental justice (Ernstson, 2013; Chaudhary et al., 2018; Menton et al., 2020), power relationships play a critical role for the understanding of complex SES dynamics, particularly the role of institutions and governance systems determining ES/NCP distribution, controlling decision-making processes or influencing social and ecological changes.

Furthermore, distinct social groups' interactions may embed multiple ES/NCP flows, both between those social groups and across different geographical regions. These include both tangible (e.g., resources) and intangible (e.g., knowledge) flows between different social groups and regions, such as when distinct social groups or regions are assigned the production or consumption of particular ES/NCP benefits (e.g., food), as embodied by the importation of basic goods from the UK to Ascension or the exportation of valuable NTFPs from the Peruvian Amazon to USA. Such flows reflect the social and geographical distribution of ES/NCP, in terms of resources provisioning (e.g., food) but also recreational activities (e.g., tourism), while further embedding delocalized environmental pressures and impacts (Lenzen et al., 2012; Marques et al., 2019). See, for example, the ecological changes entailed by introduced species on Ascension or the major drivers of deforestation in the Peruvian Amazon. Moreover, as observed both on Ascension and the Peruvian Amazon, such flows may also embody a reterritorialization of cultural practices (e.g., production, consumption and representation), while driving changes in cultural benefits (e.g., knowledge systems) and relational values (e.g., principles and regulations). As highlighted in previous studies (Burkhard et al., 2012; Mehring et al., 2018; Mastrángelo et al., 2019), this contributes evidence on the need for considering ES/NCP flows in ecosystem

assessments, particularly how embedded pressures and impacts may act as major drivers of social and ecological change (e.g., Marques et al., 2019).

Ultimately, cultures are never static nor discrete but rather involve continuous processes of exchange and 'becoming-with' human and nonhuman others (Haraway, 2008), played through multiple interactions, exchanges and ongoing struggles over the meaning of relationships (Mitchell, 2000: 3-36). Distinct cultures coexist and interact with each other in any given place, such that cultures are never isolated and well-delimited boundaries cannot be traced between one culture and the other (Gupta and Ferguson, 1992; Jørgensen, 2010). Therefore, considering cultural diversity and social heterogeneity across various geographical scales is fundamental, further contributing to reveal the nested structure of complex SES at various levels. Moreover, sociocultural variables (e.g., practices and values) reflect co-evolutive and adaptive processes, such that assessments must consider those not as 'snapshots' in time but instead across various temporal scales, including the history of socio-ecological changes and their actual trends. The relevance of such spatial and temporal dimensions for understanding complex SES dynamics is widely acknowledged in the literature (Carpenter et al., 2009; Ostrom, 2009) and considering those contributes to address key knowledge gaps in ES/NCP frameworks (Fischer et al., 2015; Mastrángelo et al., 2019). Here, both case-studies demonstrate how cultural ecosystem assessments may evidence the distinct spatial and temporal dynamics influencing human–environment relationships, embedded in their dwelling landscapes and shaping their natural and cultural heritage. Considering these discloses direct and indirect drivers of social and ecological change, including multiple feedback processes between sociocultural variables and ES/NCP supply and demand, the role of different institutions within nested systems and the adequacy of existing regulation mechanisms (e.g., knowledge systems and relational values).

Then, cultural ecosystem assessments are crucial to reveal complex context-specific SES dynamics, contributing to address key knowledge gaps of both SES research and ES/NCP frameworks, namely by disclosing underlying feedback processes, trade-offs between distinct ES/NCP, institutions' influence on ES/NCP distribution and the temporal dynamics of socio-ecological changes (Mastrángelo et al., 2019) but also the role of slow variables and long-term drivers of change, power relationships and social structures' influence on those and the impacts of socio-ecological interactions between and across regions (Fischer et al., 2015). This is in accordance with the mediating role of culture in human–environment relationships (Descola, 2013; Milton, 1996; Mitchell, 2000), reflecting how sociocultural variables influence the co-production of all ES/NCP as well as their social and geographical distribution, thus contributing

to identify relevant variables for characterising complex SES structure and dynamics (Liu et al., 2007; Ostrom, 2009; Scheffer, 2009).

7.3 IMPLICATIONS: Advancing Cultural Ecosystem Assessments

The NCP framework has recognised the need to move beyond monetary valuations towards more pluralistic ones, acknowledging the heterogeneity of values held by different stakeholders, the importance of relational values and the role of power relations in the distribution of benefits (Pascual et al., 2017), while recognising the importance of culture, different worldviews and local knowledge systems for an inclusive understanding of human–environment relationships (Díaz et al., 2018). However, despite the important contributions made by the IPBES, the NCP framework presents a lack of consistency that may hinder its practical implementation and operationalisation (Peterson et al., 2018) while still reproducing critical limitations of the ES framework, linked to the instrumentalization of nature as 'provider of services' and an unidirectional representation of human–environment relationships (Kenter, 2018). Therefore, it's fundamental to critically examine these limitations and develop systematic approaches for representing cultural, social and political dimensions in ecosystem assessments, moving beyond economic and cultural biases through the explicit consideration of different levels of complexity and variability across socio-ecological systems.

Most recent debates on cultural services have been centred on the construction of culture to fit existing ecosystem assessment frameworks, focusing on isolated categories and quantitative methodologies (Fish et al., 2016; Costanza et al., 2017). That cultural contexts influence all ES/NCP is acknowledged by the NCP framework (Díaz et al., 2018), yet its implications are not fully considered beyond suggesting a split between generalizing and contextual perspectives. Then, the ES/NCP frameworks' failure to consistently address the role of cultural contexts and their relevance to inform adequate and equitable responses, requires further elaborating culture's exceptional positioning in ecosystem assessments. Because the ES/NCP frameworks tend to disregard people's role in the co-production of the environment (e.g. Fish et al., 2016), their inherent reciprocal interactions (e.g. Comberti et al., 2015) and their heterogenous social and geographical distribution (e.g. Berbés-Blásquez et al., 2016), considering these dimensions implies to challenge, first, the ES/NCP conceptual frameworks based on generalist static and isolated categories to rather focus on contextual interdependent processes and interactions; and,

second, the ES/NCP methodological frameworks based on the quantitative assessment of environmental benefits to rather deploy participatory and mixed methods approaches to describe complex socio-ecological dynamics from a biocultural perspective.

In this context, the mutual dependence between sociocultural variables and all ES/NCP, demonstrated in the case research, supports the framing of ecosystem assessments around context-specific perspectives, specifically Cultural Ecosystem Assessments. These convey the context-specific dimensions of human–environment relationships, characterizing multidirectional interactions in the interface between the social and ecological system, along with their sociocultural and spatial-temporal variability. Because sociocultural variables mediate human–environment interactions, as evidenced by the present research and supported by literature (e.g., Ellen, 1996; Milton, 1996), cultural ecosystem assessments should be understood as inherently intertwined with all other ES/NCP. Indeed, such variables mediate the co-production, consumption, representation and regulation of the environment (du Gay et al., 1997; Hall, 1997), including all material and non-material benefits obtained by people and their distribution within and across societies. As such, cultural ecosystem assessments embed a non-essentialist approach to the understanding of 'more-than-human cultures' which recognizes their diverse contextual modes of constituting ecological communities and embracing more-than-human realms, further considering these as relational processes which embody multiple exchanges, struggles and resistances while being always under construction and debate. Then, cultural ecosystem assessments not only provide a much richer picture of actual human–environment relationships, including their cultural diversity and social heterogeneity, but may also reveal the complex socio-ecological dynamics behind environmental change and support the development of biocultural approaches to sustainability.

Following the above, I advance a conceptual framework for cultural ecosystem assessments which addresses fundamental limitations of the ES/NCP frameworks, by: (1) proposing a set of essential variables to operationalize cultural ecosystem assessments, which considers context-specific dimensions of human–environment relationships along with their sociocultural and spatial-temporal variability; (2) embracing relational values within pluralistic valuations, as distinct articulations of reciprocity in human–environment relationships that convey regulation mechanisms and influence feedback processes between social and ecological systems; (3) bridging indigenous and local knowledge systems in ecosystem assessments, recognizing ILK reproduction in cultural practices, benefits and values while developing interactive participa-

tory approaches to inform community-based equitable and sustainable solutions; and (4) considering how cultural diversity, social structures and power relationships influence ES/NCP distribution and flows, drive social and ecological changes and influence wider socio-ecological dynamics.

These developments recognize the interdependence between multiple social and ecological variables, supporting the practical implementation of cultural ecosystem assessments in ways that contribute to address key knowledge gaps in socio-ecological systems (Fischer et al., 2015; Mastrángelo et al., 2019) and biocultural approaches to sustainability (Hanspach et al., 2020; Merçon et al., 2019), namely:

- Understand the role of diverse worldviews, knowledge systems and relational values in human–environment relationships, particularly their long-term influence on the co-production of ES/NCP (Mastrángelo et al., 2019), determining ES/NCP contributions to a 'good living' (Mastrángelo et al., 2019; Pascual et al., 2017) and shaping wider socio-ecological dynamics (Fischer et al., 2015);

- Consider the influence of social structures, governance systems and power relationships on the distribution of ES/NCP supply and demand (Berbés-Blázquez et al., 2016; Mastrángelo et al., 2019), their role driving social and ecological changes (Fischer et al., 2015; Mastrángelo et al., 2019) and their implications for environmental justice (Fischer et al., 2015; Merçon et al., 2019; Hanspach et al., 2020);

- Address ES/NCP flows both within and across regions and society, revealing social inequities behind the production, access to and dependence on diverse resources (Berbés-Blázquez et al., 2016; Fischer et al., 2015), the geographical distribution of ES supply and demand (Mehring et al., 2018; 2017) and the spatial and temporal dynamics of socio-ecological change (Mastrángelo et al., 2019);

- Disclose interdependent processes, as interactions between multiple variables (e.g., practices, values and benefits), to reveal trade-offs between distinct ES/NCP (Mastrángelo et al., 2019), feedback process between the social and ecological systems (Mastrángelo et al., 2019; Fischer et al., 2015) and direct or indirect drivers of socio-ecological change affecting slow variables, such as cultural norms (Fischer et al., 2015);

- Bridge knowledge systems and pluralistic values across all assessment categories, to consider the ontological and epistemological dimensions of biocultural diversity (Kohler

et al., 2019; Merçon et al., 2019), co-produce knowledge for devising equitable and sustainable solutions (Hanspach et al., 2020) and inform participatory environmental governance approaches (Brondizio and Tourneau, 2016; Mistry and Berardi, 2016).

Ultimately, cultural ecosystem assessments propose an empirical and relational approach to socio-ecological systems research, by grounding interactions in locally relevant perspectives — thus, supporting biocultural approaches to sustainability (Merçon et al., 2019). Simultaneously, these suggest framing human well-being in collective terms, instead of individual or economic ones, by seeking to understand its articulation with the well-being of wider ecological communities. In accordance with 'good living' principles (Acosta, 2013), this reflects how relational values may convey modes of sustaining harmonious coexistences with human and non-human others (Chan et al., 2012; Pascual et al., 2017). And, finally, cultural ecosystem assessments may contribute to locally challenge the fallacy of a 'tragedy of commons' (Ostrom, 1990), providing tools to assess place-based regulation mechanisms for sustainable resource management, by embedding in its set of essential variables aspects pertaining to local governance, knowledge and values systems that determine the sustainability of socio-ecological systems (Ostrom, 2009). Then, cultural ecosystem assessments may contribute to inform biocultural approaches to the successful development of 'bottom-up' and community-based conservation strategies (Berkes et al., 2007; Brooks et al., 2013).

The Role of Cultural Contexts

The cultural dimensions of ecosystems are co-produced by people's interactions with the environment and comprise both the tangible and intangible expressions of human–environment relationships. These include the cultural practices, symbolic meanings and knowledge systems which mediate people's interactions with environmental spaces, the cultural identities reproduced and the shared social values held by people towards nature. Thus, the cultural dimensions of ecosystems can be understood as the multiple ways through which culture is produced and reproduced in relation to the environment. Applying Hall's influential circuit of culture (du Gay et al., 1997; Hall, 1997) to cultural ecosystem assessments, I suggest that considering the cultural dimensions of ecosystems requires addressing the interrelations between the production, consumption, representation and regulation of the environment along with the affiliated identities, that shape and are shaped by those. This means looking at a landscape from multiple cultural angles, addressing distinct but interdependent expressions of human–environment relationships, while considering their diversity and heterogeneity within and across societies at various geographical scales.

Here, following the conceptual framework advanced by Fish et al. (2016), the most tangible dimensions of human–environment relationships are those reproduced in interactions affecting the biophysical domain, where cultural services correspond to cultural practices, including creative, productive and consuming activities. Applying Hall's circuit of culture (1997: 1-12), this notion implies understanding how environmental spaces, such as places and landscapes, enable activities involved on their coproduction, as through land management practices (e.g., agriculture); consumption, through active or passive engagements with the environment (e.g., food and drinks); and representation, as the reproduction of meaning in creative and symbolic artifacts (e.g., artistic expressions). In accordance with Fish et al. (2016), cultural practices involve work and leisure activities that support cultural benefits, including personal and shared experiences (e.g., sense of place) and capabilities (e.g., knowledge systems) linked to the reproduction of cultural identities (e.g., belonging). Such practices, nonetheless, are subject to regulations which convey cultural values, including the principles, preferences and norms that guide socially prescribed behaviours towards others and nature (Chan et al., 2016). All these dimensions are subject to variability, considering their social heterogeneity and cultural diversity, while reflecting the social structures, governance institutions and power relationships that influence the geographical distribution of all ES/NCP costs (e.g., labour), benefits (e.g., food) and values (e.g., preferences).

In this context, to operationalize consideration for the cultural dimensions of ecosystems, I advance a conceptual framework along with a set of essential variables for cultural ecosystem assessment, see Fig. 7.1 and Table 7.1. These variables convey that, as previously discussed, sociocultural factors influence the production, consumption, representation and regulation of all other ES/NCP categories (e.g., provisioning and regulating services), while reflecting their affiliations to particular identities. Together these core sociocultural variables, at the interface between the social and ecological systems, correspond to cultural practices, benefits and values and reflect process of cultural reproduction through the environment; but , while subject to sociocultural and spatial-temporal variability, the set of essential variables for cultural ecosystem assessments also necessarily extends to the social structures and power relationships influencing complex socio-ecological dynamics along with ES/NCP distribution and flows. How each of these variables relate to the others convey the cultural, social and political processes behind the reproduction of local ways of living, highlighting their interdependent and dynamical characteristics but also underlying feedback loops and potential chains of impacts triggered by distinct drivers of socio-ecological change.

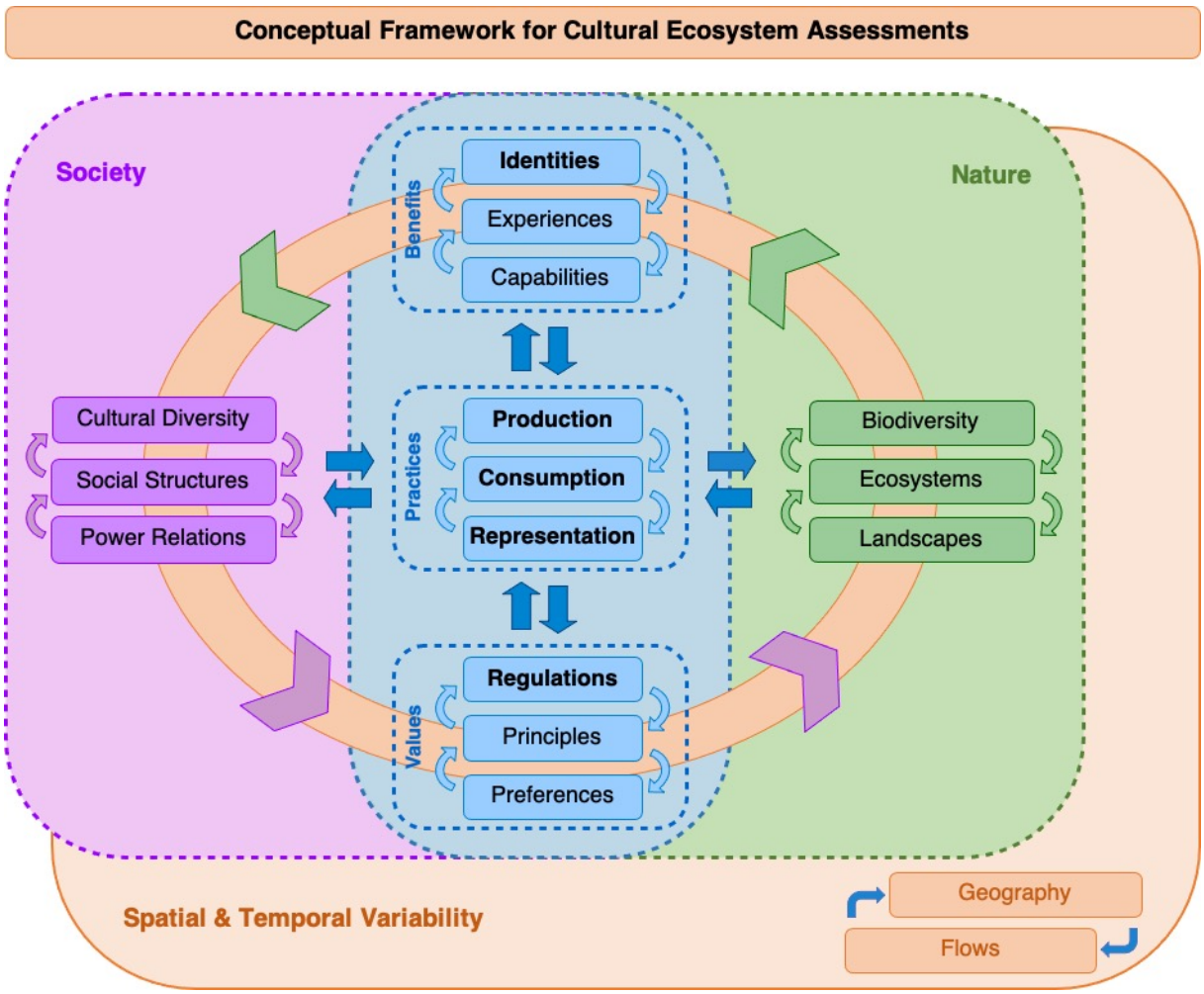


Figure 7.1 - *Conceptual framework for cultural ecosystem assessments, representing context-specific dimensions of human–environment relationships. In* ***blue****, cultural practices, values and benefits mediate the interface between the social and ecological systems and express dimensions of indigenous and local knowledge systems.* ***Practices*** *are enabled by and shape particular environmental spaces, through the production, consumption and representation of the environment;* ***values*** *refer to relational values which convey the regulations, principles and preferences that inform behaviours in human–environment relationships; and* ***benefits*** *comprise the identities, experiences and capabilities reproduced through interactions with the environment. In* ***purple*** *and* ***green****, dimensions of social and ecological systems reflect the socio-ocultural and spatial-temporal variability of human–environment relationships.* ***Society*** *is constituted by cultural diversity, social structures and power relationships at various geographical scales.* ***Nature*** *includes the co-produced environmental spaces and multispecies assemblages, represented in biodiversity, ecosystems and landscapes.* ***Spatial and temporal variability*** *reflect the* ***geographical*** *distribution and* ***flows*** *between distinct elements, from which result complex socio-ecological dynamics at various spatial and temporal scales.*

VARIABLES	DESCRIPTION	EXAMPLE (Food Systems)
Benefits		
Identities	Cultural benefits are derived from interactions with environmental spaces and often intangible, contributing to establish relational bonds with others and the dwelling environment. Identities emerge from shared experiences and capabilities, including the reproduction of cultural heritage. Experiences reflect the perception and interpretation of interactions with the environment, which may produce knowledge. And capabilities include skills emerging from processes of knowledge production and reproduction.	e.g., sense of belonging associated with land-use and gastronomy
Experiences		e.g., sense of place and social cohesion arising from land-use practices or shared meals
Capabilities		e.g., reproduction of cultural heritage and knowledge on food resources and processing
Practices		
Production	Cultural practices correspond to interactions are enabled by and shape particular environmental spaces. These include the so-production of the environment (e.g., land management practices); the consumption of tangible or intangible features (e.g., resources or recreational practices); and the representation of environmental features (e.g., in discourses and creative activities). Cultural practices are regulated by cultural values and benefits while being also mediated by social structures and power relations.	e.g., land and resources management practices based on agriculture or agroforestry
Consumption		e.g., consumption of local gastronomy and pleasant agricultural landscapes
Representation		e.g., symbolic meanings associated to agricultural practices and landscapes
Values		
Regulations	Cultural values are relational or shared social values that inform prescribed behaviours in human–environment relationships. These include regulations supporting or constraining the access to places, experiences and knowledge; the norms and principles which mediate what, when and how cultural practices are performed as well as by who; and the preferences for ways of living, landscapes or perceived environmental benefits. All these integrate different degrees of social convergence or divergence.	e.g., environmental regulations on land management practices
Principles		e.g., prescribed behaviours for gathering food or sharing meals
Preferences		e.g., types and origin of food resources used in local gastronomy

Socio-Cultural Variability		
Cultural Diversity	Cultural diversity highlights how cultural practices, values and benefits are interpreted differently by people affiliated to distinct cultural identities and worldviews. Social structures refer to the social institutions and governance systems that mediate a heterogeneous distribution of practices and benefits across distinct social groups, defined by gender, class, age or ethnicity. Power relationships convey interactions between distinct social groups, constraining the access to resources or enforcing regulations. All these play at various geographical scales, from local to regional or global.	e.g., affiliation of agricultural practices and gastronomies to distinct cultural identities
Social Structures		e.g., distribution of agricultural practices across gender, class or ethnicity
Power Relations		e.g., market pressures affecting resources availability and land-use practices.
Spatial-Temporal Variability		
Geography	Geographical distribution, permanent or mobile, of cultural diversity, social heterogeneity and natural resources, including their seasonal variability. Flows of practices, benefits and values are embedded in interactions across both social groups and regions, reflecting ES/NCP supply and demand. These result in socio-ecological dynamics at various spatial (e.g., local, regional or global) and temporal scales (e.g., historical, seasonal or future trends).	e.g., geographical distribution of food production and consumption
Flows		e.g., regional and global trade on food resources and labour

Table 7.1 - *Essential variables for cultural ecosystem assessments, describing the general components of the context-specific dimensions of human–environment relationships, as cultural practices, benefits and values, along with their dimensions of sociocultural and spatial-temporal variability. The example illustrates how these variables could describe local food systems.*

The operationalization of cultural ecosystem assessments contributes to disclose the context-specific dimensions of human–environment relationships and further understand local socio-ecological dynamics, while enabling devised responses to consider issues pertaining to environmental justice and social equity. Their implementation, nonetheless, requires recognizing that any conceptual framework reproduces modes of representing interactions with the environment that may not necessarily adequately reflect those affiliated to distinct identities. Therefore, it is crucial to remain open to other possible formulations relevant to local contexts and special attention must be given to how assessment practices may assist the reproduction of power relationships, even when aiming at representing or integrating distinct worldviews and knowledge systems. The systematic consideration of these variables in cultural ecosystem assessments, ultimately, like bridging knowledge systems, requires implementing interactive participatory approaches and establishing effective collaborations between multiple stakeholders (Tengö et al., 2017; Mistry and Berardi, 2016). Then, cultural ecosystem assessments may support the self-determination of local communities and the development of successful community-based strategies for the conservation of biocultural diversity (Brooks et al., 2013; Gavin et al., 2015).

Integrating Reciprocal Interactions and Feedback Processes

Both the ES and NCP approaches reproduce a dichotomy between nature and culture that not only is not widely shared across non-western worldviews, but also fails to fully embrace the interdependent and reciprocal qualities of human–environment relationships (Comberti et al., 2015; Kenter, 2018). This notion is embedded in a conceptualisation of nature as 'provider of services', represented by one-way flows, which neglect how landscapes are co-produced by both humans and non-humans (Hirsch, 1995; Mehring et al., 2017). Human societies shape and adapt to their environments in multiple ways and for multiple reasons, including through enhancing the provision of certain services (e.g., food) or controlling particular ecological processes (e.g., floods). As such, the co-production of landscapes involves multispecies processes and often embeds human labour (Ingold, 2000; Mitchell, 2000b) — see, again, the historical ecologies of Amazonia (Balée, 1995; Rival, 2007). In this context, how the ES/NCP frameworks make invisible these processes reflect political stances which emphasize certain aspects of human–environment relationships while concealing others.

Human–environment relationships evolve through co-adaptive processes, where regulatory feedback loops support adaptation to changing social and ecological conditions (Berkes et al.,

2000; Folke et al., 2005). These relationships constitute 'building blocks' of socio-ecological systems which, widely acknowledged for their complexity, are characterised by large networks of interacting elements and the development of non-linear dynamics, resulting from feedbacks loops and potential regime shifts at multiple levels and spatial-temporal scales (Liu et al., 2007; Ostrom, 2009; Steffen et al., 2018). This implies, first, that human–environment relationships involve adaptive land and resource management strategies which evolve through time, resulting on emergent behaviours and socio-ecological dynamics dependent on their particular contexts (Berkes et al., 2000; Gómez-Baggethun and Reyes-García, 2013); and, second, that cumulative changes on either social or ecological conditions are interdependent and may mutually influence each other in ways that, as widely documented, may potentially lead to catastrophic regime shifts (i.e. widespread changes in the equilibrium state) when reinforced through positive feedbacks (Barnosky et al., 2012; Scheffer et al., 2012). Studies on socio-ecological dynamics, therefore, reinforce the relevance of acknowledging that: one, assessment categories are not static nor isolated, requiring consideration for interactions among them; and two, human societies and their environments are interdependent and linked through reciprocal relationships (e.g., Comberti et al., 2015), requiring assessments to integrate multidirectional flows (e.g., Raymond et al., 2013).

In particular, the co-production of ES/NCP results from multidirectional interactions that occur within complex socio-ecological systems at various spatial and temporal scales. As such, the distinction between cultural practices, benefits and values becomes key to understand the role of human–environment relationships mediating complex socio-ecological dynamics, particularly the regulation mechanisms that influence how people may adapt to and shape ecological processes in context-specific ways. Here, as previously discussed, cultural practices may intentionally or unintentionally, directly or indirectly, shape ecological processes and multispecies assemblages in ways that determine all other ES/NCP (e.g., provisioning and regulating services). Nonetheless, cultural values, as relational or shared social values, are those which convey the ethical principles and responsibilities nurtured by people towards nature and more-than-human others (Kenter et al., 2015; Chan et al., 2016), informing the preferences, norms and regulations that guide socially prescribed behaviours in human–environment relationships. Therefore, while environmental benefits can be understood as the products of such interactions received by society, relational values rather reflect the regulations, principles and preferences that guide human–environment relationships, embedding distinct articulations of reciprocity towards nature. The relevance of reciprocity in human–environment relationships is supported

by several studies (Comberti et al., 2016; Hall, 2011; Kimmerer, 2013; Raymond et al., 2013), based on which I argue it constitutes regulatory mechanisms that inform who, how and when people may enhance or hinder specific ecological processes.

Then, distinguishing cultural practices, benefits and values assists the consideration of multidirectional flows between nature and society and contributes to 'close the loop' in ecosystem assessment frameworks, see Fig. 7.2, in ways that support the further understanding of the adaptive processes, regulation mechanisms and feedback loops which influence socio-ecological dynamics.

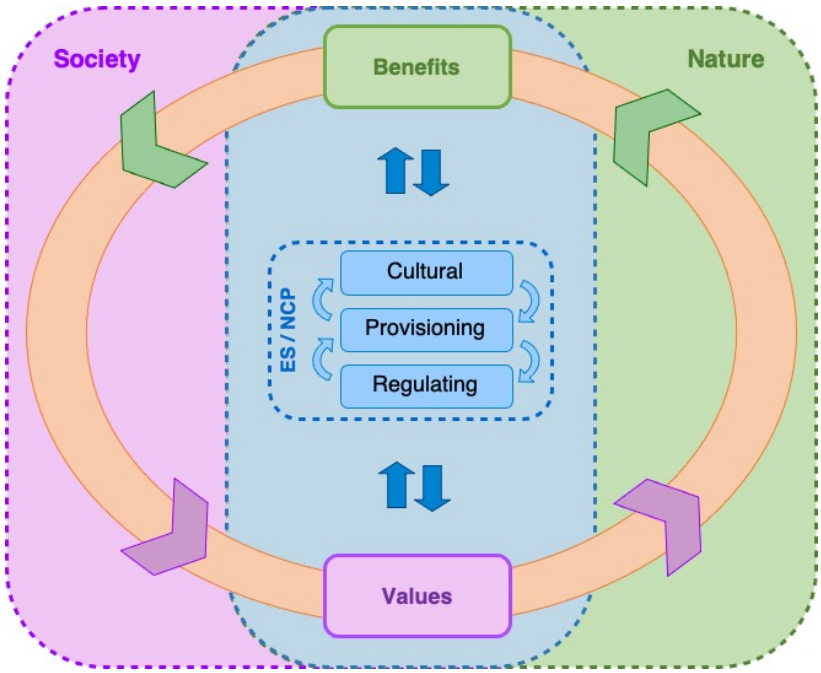


Figure 7.2 - *Detail of the conceptual framework for considering multidirectional flows in assessments, in the overlap between society and nature, reflecting articulations of reciprocity in human–environment relationships embedded in relational values (e.g., principles) and cultural benefits (e.g., identities), as regulation mechanisms of feedback processes that influence the co-production of all ES/NCP.*

Bridging Indigenous and Local Knowledge Systems

The relevance of indigenous and local knowledge systems (ILK) to inform adequate environmental responses and support effective conservation strategies is widely acknowledged (FPP, 2020; Mistry and Berardi, 2016; Tengö et al., 2017). Yet, the IPBES proposal to split the NCP framework in context-specific and generalising perspectives reproduces an ILK:Science dichotomy that is both problematic and unnecessary. First, the dichotomy is problematic because there is no straightforward distinction between knowledge systems (Agrawal, 1995), so distinguishing between modes of understanding contextual realities and those to produce universal knowledge reproduces long-standing power relationships between scientific and local experts, which risk hinder their effective collaboration (Alexiades, 2009; Tengö et al., 2017). Second, I argue the dichotomy is unnecessary if ecosystem assessments explicitly and systematically address the cultural, social and political dimensions of ecosystems, following a context-specific approach to human–environment relationships which reflects the processes of knowledge production and reproduction embedded in cultural practices, benefits and values.

As argued by Agrawal (1995), the conceptual scope and methodological approaches of different knowledge systems share significant differences and similarities both within and across knowledge systems, condemning to failure any formal distinction between 'Science' and 'non-Science'. In particular, the epistemological distinction between ILK and 'Science' often lies, even if not exclusively, on the ethnic-cultural origin of knowledge's holders (Ellen and Harris, 2000), reproducing a dichotomy that is political and fundamentally linked to the intertwined relation between knowledge and power (Alexiades, 2009; Jørgensen, 2010). Thus, the dichotomy reproduces problematic power relationships, through defining who has the power to know what, while concealing how any knowledge system is contextual to their cultures and environments. Knowledge is produced through the experience of engagement with the world (Ingold, 2011; Pink, 2009) and, therefore, it is always situated and contextual to the practices of its production (Jørgensen, 2010) — for example, as seen earlier, to the modes of coexistence with multispecies assemblages and their symbolic representations. Hence, knowledge systems always reflect context-specific dimensions of human–environment relationships and, particularly, cultural processes of knowledge production and reproduction.

ILK expresses an understanding of the world that combine knowledge, practice and belief (Berkes, 1999), reproducing fundamental cultural dimensions of ecosystems while informing modes of co-production, representation and regulation of the environment, such as adaptive

management practices and relational values. Then, knowledge systems are key to understand the ways of living and knowing which sustain the community's livelihood and enable their adaptation to changing socio-ecological conditions (Berkes et al., 2000; Ellen and Harris, 2000; Huntington, 2000). However, as previously discussed, due to their dependence on multiple socio-political factors, ILK is not always adaptive and might even become maladaptive over time (Gómez-Baggethun and Reyes-García, 2013). Therefore, their integration in ecosystem assessments requires a systematic consideration of the cultural, social and political dimensions of human–environment relationships, explicitly and reflexively addressing the modes of knowledge production and reproduction held by different stakeholders, along with how these may influence and be influenced by wider socio-ecological dynamics. As such, cultural ecosystem assessments may contribute to understand ILK adaptive capacity in the context of socio-ecological changes (e.g., Cámara-Leret et al., 2019; Milton, 1996).

Following the recognition of knowledge as contextual (Jørgensen, 2010) and reproduced through embodied practices of engagement with the environment (Ingold, 2011; Pink, 2009), the systematic integration of ILK in ecosystem assessments requires focus on context-specific approaches, based on comprehensive cultural ecosystem assessments. Yet, to avoid knowledge misrepresentation or appropriation (Alexiades, 2009; Greene, 2004), assessments are required to develop interactive participatory approaches that effectively support the self-determination of local communities (Colchester, 2004) along with the collaborative potential between different stakeholders (Tengö et al., 2017; Mistry and Berardi, 2016). Depending on their contexts, this requirement may pose diverse methodological challenges (Huntington, 2000; Tengö et al., 2017) but, nonetheless, supports the need to develop more inclusive governance systems (Brondízio and Tourneau, 2016; Mistry and Berardi, 2016) and to move beyond universal panaceas, by contributing to reveal the context-specific dimensions of actual socio-ecological dynamics (Ostrom, 2007; 2009).

Considering Sociocultural and Spatial-Temporal Variability

Human–environment relationships are diverse and heterogenous, presenting high variability within and across societies resulting from diverse cultural, socioeconomic, political and ecological processes at various scales (e.g., Ernstson, 2013; Harvey, 1996). Across cultures, this variability is primarily expressed in a diversity of worldviews and their affiliation to distinct management practices, knowledge systems and cultural values — i.e., the so-called biocultural diversity (Maffi, 2005; van Bommel and Turnhout, 2012). Nonetheless, social heterogeneity is

also found on the unequal access to land, resources and knowledge, often resulting from power relationships and leading to varying degrees of social inequity and economic vulnerability, as illustrated by the asymmetrical roles of distinct social groups on the production and consumption of environmental benefits or on bearing the costs of environmental degradation (Berbés-Blázquez et al., 2016; Chaudhary et al., 2018). Despite the NCP framework recognising the need for pluralistic valuations (Pascual et al., 2017), a systematic consideration of social heterogeneity, cultural diversity and power relations in ecosystem assessments is fundamental for the representativeness of these frameworks and the equity of any derived initiatives, as demonstrated by a growing body of evidence (Cáceres et al., 2018; Chaudhary et al., 2018; Ernstson, 2013).

In this context, there are two dimensions of variability that need consideration in ecosystem assessments: a socio-cultural and a spatio-temporal. First, socio-cultural variability reflects that all societies present varying degrees of cultural diversity and social heterogeneity, often articulated within social structures and mediated by power relationships. Here, diversity refers to variability in the worldviews, knowledge systems and relational values held within and across societies; while heterogeneity describes the varying roles taken by distinct social groups on the production, consumption and representation of environmental costs and benefits, as expressed in the distribution of labour or resources across different social groups defined by gender, class or ethnicity. As such, considering sociocultural variability in cultural ecosystem assessments reveals the distribution of cultural practices, benefits and values across society and, therefore, the socially heterogenous distribution of ES/NCP supply and demand. This enables consideration of social inequities and power relations while disclosing the role of social structures and institutions, including governance systems, in the distribution of ES/NCP and their ability to lead desirable socio-ecological change — contributing to address major knowledge gaps to achieve global sustainability goals (Fischer et al., 2015; Mastrángelo et al., 2019), develop biocultural approaches to sustainability (Hanspach et al., 2020; Merçon et al., 2019) and support ongoing struggles for environmental justice (Menton et al., 2020).

Second, spatial-temporal variability reflects the geographical distribution of ES/NCP supply and demand, in terms of cultural practices, benefits and values, at various spatial scales (e.g. from local habitats, ecosystems and landscapes to regional and global exchanges); but also describes the variation along time of ES/NCP supply and demand, in terms of how interactions between distinct social groups and their environments were and are shaped by complex socio-

ecological dynamics, at various temporal scales (e.g. from seasonal cycles to historical processes). Here, interactions between different social groups across regions may embed multiple exchanges and ES/NCP flows reflected, for example, in the geographical distribution of ES/NCP supply and demand at local, regional and global scales. Such flows are often mediated by social structures and power relations (Berbés-Blázquez et al., 2016; Mehring et al., 2017) and may drive major social and ecological changes, for example in biodiversity patterns (Marques et al., 2019) and local knowledge systems (Cámara-Leret et al., 2019). Moreover, socio-ecological dynamics may occur seasonally, reflecting resources availability and distinct social groups varying dependence on them (e.g., Mehring et al., 2017). Therefore, considering seasonal variability along with the local history of resource use, management practices and landscape changes offer an analytical depth to cultural ecosystem assessments, revealing the socio-ecological trends and dynamics behind current ES/NCP flows. Again, this contributes to address major knowledge gaps to achieve sustainability, disclosing major drivers of change and feedback processes between social and ecological systems (Fischer et al., 2015; Mastrángelo et al., 2019).

7.4 WAYS of KNOWING: Adequate Methodologies

The ES and NCP frameworks are cultural representations of human dependence on the environment which, despite their wide implementation and different formulations, still do not appropriately represent the complexity of socio-ecological systems (Liu et al., 2007; Ostrom, 2009; Scheffer, 2009) nor the diverse worldviews that shape actual human–environment relationships (Descola, 2013; Kohler et al, 2019). In this context, considering my first research question, this research identifies several context-specific dimensions of human–environment relationships whose relevance, demonstrated in the case research, requires their necessary consideration in ecosystem assessments. Then, answering my second research question, I advance a conceptual framework and set of essential variables for cultural ecosystem assessments, which operationalizes consideration of context-specific perspectives. Cultural ecosystem assessments convey context-specific dimensions of human–environment relationships and contribute to overcome key limitations of ES/NCP frameworks by addressing knowledge gaps in socio-ecological systems (Fischer et al., 2015; Mastrángelo et al., 2019), developing biocultural approaches to sustainability (Merçon et al., 2019; Hanspach et al., 2020) and supporting struggles

for environmental justice (Dunlap and Sullivan, 2019; Menton et al., 2020). Then, cultural ecosystem assessments improve current frameworks' ability to inform equitable and sustainable solutions to pressing environmental challenges.

Nonetheless, understanding the complex entanglements between people and nature implies questioning a purely protectionist approach to biological or cultural diversity, rethinking environmental issues in light of their cultural, social and political contexts — i.e., in relation to local livelihoods, social structures and power relationships — while developing a biocultural approach to socio-ecological systems (Merçon et al., 2019; Hanspach et al., 2020). This supports moving beyond 'imperial ecologies' strategies towards community-based solutions for environmental justice, by devising responses that support struggles for a 'good living', in which well-being is not conceived in individual nor economic terms, but rather framed collectively as the possibility of a harmonious coexistence with diversity within our ecological communities (Acosta, 2013). This implies framing conservation responses in the context of local worldviews, relational values and knowledge systems and, therefore, it requires the development of adequate community-based conservation strategies, based on the understanding of context-specific socio-ecological dynamics and the implementation of interactive participatory approaches at all stages (Gavin et al., 2015; Merçon et al., 2020).

Still, the integration of the cultural dimensions of ecosystems on positivist approaches to environmental management may entail a series of challenges and potential limitations. First, the integration of diverse worldviews, in particular knowledge and values systems, requires resolving tensions between universal and context-specific approaches through addressing complexity across multiple scales — i.e., understanding how the context-specific dimensions of human–environment relationships are embedded in global socio-ecological dynamics and contingent on socioeconomic and political discourses. Second, to avoid knowledge appropriation and a misleading representation of local perspectives, biocultural approaches to conservation should adopt 'bottom-up' strategies rooted in the self-determination of local communities and collective leadership. Thus, another set of challenges is linked to the practical implementation of participatory approaches which, to go beyond nominal participation and enhance resources' sustainable management, must take in consideration local institutions and decision-making processes (Chatty and Colchester, 2002; Ostrom, 2009). Ultimately, acknowledging the diversity

and heterogeneity of human–environment relationships in ecosystem assessments requires embracing the complexity of their constitutive relational processes, by finding culturally adequate assessment methodologies along with practical ways to empower people back in conservation.

Analytical and Methodological Framework

The methodology adopted is consistent with established social sciences methods to address the cultural, social and political dimensions of human–environment relationships (Bryman, 2008; Newing, 2011; Pink, 2009), following an ethnographic approach that relies on three complementary research methods: participant observation, narrative analysis and, due to the interpretative role of the researcher, reflexivity. These methods are shown to support comprehensive cultural ecosystem assessments in very diverse socio-ecological contexts, as demonstrated by the case research in the Peruvian Amazon and Ascension Island (Chapters 4-6), enabling flexibility and adaptation to distinct contexts through a range of complementary methods, such as semi-structured interviews, focus groups and questionnaires. Here, participant observation played a crucial role revealing how participants engage with the environment (Puri, 2011), further assisting to retrieve the sensorial experiences, embodied practices and situated narratives which convey how and why people do what they do. Then, as demonstrated in both case-studies, narrative analysis and semi-structured interviews support cultural ecosystem assessments by further revealing the significance of particular practices and places; while focus groups and questionnaires, including participatory mapping exercises, assist to survey emergent patterns and the degrees of cultural consensus pertaining distinct cultural dimensions (Bryman, 2012).

The analytical framework, advanced as part of this thesis' theoretical framework (Chapter 3), results from emergent research processes of interweaving theory and practice. The framework informed the practice of assessment both in the Peruvian Amazon and Ascension Island (Chapters 4-6) while, simultaneously, emerged from the reflexive analysis of sensorial and embodied experiences during field work, which supported the engagement of the researcher with research places and participants. Recognising the researcher role co-producing research places and potentially reproducing power relationships, led me to seek adapting research methodologies to local modes of knowledge production and reproduction (Pink, 2009; Smith, 2008). Then, the case research relied on participatory methodologies and the reflexive engagement with the research process, in ways that enabled to disclose diverse context-specific dimensions of human–environment relationships while respecting local modes of knowledge reproduction. As dis-

cussed below, the advanced conceptual and analytical framework for cultural ecosystem assessments contribute then to both ground assessments in local contexts and to enhance their validity, representativeness and legitimacy.

Pertaining to the analytical framework's relational dimensions, the methodology enabled to situate sensorial experiences, embodied practices and storied narratives on the landscape, supporting the spatially explicit assessment of cultural practices (e.g., production), benefits (e.g., sense of place) and values (e.g., preferences), as illustrated both in the Peruvian Amazon and Ascension Island. Spatial-explicit approaches reflect processes of cultural reproduction embedded on the landscape (Hirsch, 1995), revealing the cultural practices and symbolic meanings affiliated to places along with their cultural heritage, as the biophysical and symbolic territories to which people attribute significance (Ingold, 2000; Tilley, 1994). Yet, precisely because there is no linear relation between culture and place, spatial-explicit approaches may also reveal the social and geographical distribution of cultural practices, benefits and values across the landscape. Indeed, cultures are not discrete, static nor homogenous entities (Jørgensen, 2010) and, instead of a tidy mosaic of distinct cultures, such maps convey the historical and ongoing exchanges and overlaps which occur both within and across societies (Gupta and Ferguson, 1992). As such, in contrast with two-dimensional spatial maps where participation is absent from their topology, cultural ecosystem maps and, particularly, storied maps comprise multidimensional maps which embody multiple spatial and temporal relationalities that transform space into place (Tilley, 1994).

Concerning the empirical dimensions, the analytical framework suggests to further address the entangled processes of co-production of the landscape by looking at the intersection between the cultural, political and storied landscapes. As supported by the case research, this framework contributes to, respectively, unveil the distinct relationalities which manifest in cultural practices and constitute multispecies assemblages across the landscape (Hirsch, 1995; Tilley, 1994); reveal the diverse relationalities that emerge from social structures, power relations and flows between and across distinct social groups (Gupta and Ferguson, 1992; Mitchell, 2000); and those spatial and temporal relationalities conveyed in situated narratives, which allude to the significance of the cultural heritage embodied in practices, experiences and multispecies affinities (Ingold, 2011; Kane, 1998; Tilley, 1994). Then, supporting its adequacy to cultural eco-

system assessments, this analytical framework respects local processes of knowledge reproduction through oral-tradition, embodied practices and historical events inscribed in the landscape (Santos-Granero, 2005).

Moreover, the case research illustrates how this analytical framework may reveal diverse relational and empirical dimensions of human–environment relationships in distinct socio-ecological contexts, presenting evidence of its adequacy to support cultural ecosystem assessments across diverse cultures and societies. In particular, this analytical framework invites consideration of not only explicit empirical manifestations but also implicit relational expressions of human–environment relationships, namely the sensorial experience of the landscape, inextricably linked to its perception (e.g. Pink, 2009; Hirsch, 1995); the embodied practices that constitute places and assist the interpretation of the landscape (e.g. Echeverri, 2005; Ingold, 2000); and the situated narratives that make sense of specific places, practices and experiences (e.g. Ingold, 2011; Tilley, 1994). Together, these comprise three faces of a relational and empirical approach to the local processes of knowledge reproduction that shape, enable and constitute context-specific dimensions of human–environment relationships, which are fundamental to avert the misrepresentation of local unique perspectives and support comprehensive cultural ecosystem assessments in culturally adequate ways.

7.5 WAYS FORWARD: Final Remarks and Future Work

The many perspectives navigated throughout the present thesis, ultimately, convey that the fundamental contributions of integrating culture in ecosystem assessments are threefold. First, it enables consideration of multiple worldviews and knowledge systems in conservation approaches, where embracing pluralism and the diversity of human–environment relationships entails recognising the need for a shift in conservation goals towards the conservation of biocultural diversity (Gavin et al., 2015; Merçon et al., 2019) — i.e., to address the context-specific entanglements between human societies and nature. This contributes to enhance the representativeness of conservation initiatives and their adequacy to local contexts. Second, because processes of cultural reproduction are dynamical, integrating culture in conservation supports consideration of the cultural, socioeconomic and political dimensions of human–environment relationships, acknowledging the role of social structures and power relationships in the reproduction and distribution of environmental costs and benefits (Berbés-Blázquez et al., 2016; Ernstson, 2013; Poe et al., 2014). This contributes to support struggles for social equity and

environmental justice in conservation initiatives. Third, considering the cultural dimensions of ecosystems enables the further understanding of complex socio-ecological systems' structure and dynamics, recognising the processes that constitute ecological communities and sustain their ecological balance, through building understanding of interactions between multiple social and ecological actors (Fischer et al., 2015; Liu et al., 2007; Ostrom, 2009). This contributes to consider the direct and indirect drivers of social and ecological change that underly environmental issues, supporting the design and implementation of effective solutions.

In this context, two main sets of challenges remain ahead, those pertaining the implementation of cultural ecosystem assessments and those referring to the further understanding of socio-ecological dynamics. First, to integrate diverse worldviews and knowledge systems in ecosystem assessments requires establishing effective collaborations between multiple stakeholders, including local communities and technical experts (Tengö et al., 2017). In fact, addressing the cultural, social and political dimensions of ecosystems relies on the design and implementation of interactive participatory approaches, which respect the self-determination of local communities (Alexiades, 2009; Chatty and Colchester, 2002), to improve the representativeness and political legitimacy of ecosystem assessments and devised environmental management and policy responses. As such, pertaining the implementation of cultural ecosystem assessments, most challenges lie in developing collaborations that successfully support struggles for social equity and environmental justice. This implies supporting 'bottom-up' and community-based initiatives for the conservation of biocultural diversity (Colchester, 2004; Gavin et al., 2015), where the success of such initiatives depend, among other factors, on ensuring that the community's decision-making processes as well as rights to land and resources are respected (Chatty and Colchester, 2002; Ostrom, 2009), particularly indigenous and local communities' land rights (FPP, 2020; RRI, 2020).

Second, the success of biocultural approaches to conservation largely depends on accurately identifying feedback processes and drivers of social and ecological change, that negatively impact the reproduction of local ways of living and the ecological balance of their dwelling landscapes. The assessment of complex adaptive socio-ecological systems, describing large network of interactions across diverse scales (i.e., their structure) along evaluating actual feedback loops and potential regime shifts (i.e., their dynamics), is known for posing multiple analytical challenges (Liu et al., 2007; Scheffer et al., 2012). This is due to high levels of uncertainty

associated to complex nonlinear dynamics and the management of multiple trade-offs (Carpenter et al., 2009; Scheffer, 2009). Here, developing adequate modelling approaches, which reflect the interdependence between distinct sociocultural variables and relate those to ecological changes, may support the analysis of complex socio-ecological dynamics and the simulation of various outcomes in distinct socio-ecological scenarios (Pereira et al., 2010; Purves et al., 2013). Nonetheless, understanding socio-ecological dynamics requires recognising that the communities' resilience depends on preserving its adaptive capacity, where the sustainable management of resources is contingent on sufficient levels of autonomy (e.g., land rights), which sustain adaptation to changing social and ecological conditions (Berkes et al., 2000; Ostrom, 2009). In this context, cultural ecosystem assessments may inform adequate strategies to support local communities' adaptive capacity, principles for a 'good living' and struggles for environmental justice, by recognizing that biodiversity is ontologically, epistemologically and ethically linked to human well-being in a myriad of relational, context-specific ways. Then, I conclude, only through addressing the cultural, social and political dimensions of ecosystems, the implementation of ecosystem assessments may assist the development of more equitable, socially adequate and politically legitimate conservation initiatives, which are able to successfully support both people and nature.

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SUPPLEMENTARY MATERIALS

APPENDIX 4.A: Demographics and Stories' Themes

Table 4.A1 – Participants demographic data with ethnicity per gender, age and community of origin.

	Shawi	**Tikuna**	**Mestizo**	**Total**
Gender				
Female	2	4	3	9
Male	12	8	4	24
Age				
< 25	2	-	1	3
26 - 35	1	-	1	2
36 - 45	1	7	1	9
46 - 55	4	3	3	10
56 - 65	4	-	1	5
> 65	2	2	-	4
Location				
Balsapuerto	2	-	6	8
Nueva Luz	8	-	-	8
Puerto Libre	4	-	-	4
Bufeo Cocha	-	2	-	2
Nueva Galilea	-	6	-	6
Sta Rita Mochila	-	4	-	4
Iquitos	-	-	1	1
Total	**14**	**12**	**7**	**33**

Table 4.A2 – Total stories collected with themes classified as storied location per participants' ethnicity and entities represented.

	1 : Forest	**2 : Water**	**3 : Other**
A : Shawi	13	2	2
B : Ticuna	31	4	3
C : Mestizo	19	21	10
Entities Represented			
1 : Anaconda	3	7	0
2 : Jaguar	5	0	0
3 : Dolphins	0	8	0
4 : Bush Mothers	38	7	0
5 : Chullachaqui	2	0	0
6 : Kurupira	2	0	0
7 : Shapshico	1	0	0
8 : Yashingo	9	0	0
9 : Yacuruna	0	5	0
10 : Mermaids	1	8	0
11 : Witchdoctors	13	2	1
12 : Other	15	1	6

APPENDIX 4.B: Storied Accounts

Transcriptions of storied accounts collected in Shawi and Ticuna communities (translation from Spanish by author). Respondents were anonymised and assigned an identification code AX, where A is the self-reported ethnicity (S = Shawi, T = Ticuna and M = Mestizo) and X a unique identification number (e.g. S11).

ST. 1 - Anaconda [M3]

From here when we cross to San Lorenzo, that stream has a mother and it's an anaconda, more or less of this width [signal with hands] and 15 meters length. People have already seen it several times. And that anaconda before… the stream didn't use to be so deep, we could cross it walking. Now it became deeper and, if you go upstream, there is a huge pool which no one can cross anymore. Upstream, before I used to cross it there everyday to get to my farmland, everyday. But now it's impossible and the water is dark, dark. Ah, I get scared, I don't even want to bath there because I think the anaconda is going to come and screw me. [silence] Then there was the flood in middle March... April... which covered everything, an immense flood. And what happened then? The stream became very very shallow, really small. On the third day you could just cross it, so shallow it was then. And what happened? Why did it become like this? So everyone said the flood made its mother leave, it took its mother away. It took the anaconda away. Some say its mother was the anaconda, others say it was a huge black lizard [black-cayman]. Then, I found it strange too because now I'd cross it on the other side, where before no one could cross. But then another flood came, I don't know what happened, but the stream became deep again. It turned back to same, deep like before. "Its mother has returned now", people said then, "the anaconda came back" (...) So now, it's deep again. It has its mother, it's living there, it grows there. It comes one season, then another one and it grows, grows, until it becomes so big that it's going to need a bigger place because that stream will become small. Then it will start bearing already, when its mother gets in... because that stream down there, that's not its natural course, its natural course is through the other side, over there.

ST. 2 - Dolphins [M1-2]

The river is a world. There are spirits as the sacharuna, the yacuruna, that are devils of the water. And, specially under the big rivers, there are cities. In Varadero, the mouth of Cachiyacu with Paranapura river, there are huge whirlpools and many say that, underwater, there are big cities. People who are taken by these whirlpools, or enchanted by mermaids, or pink dolphins, if they come back they tell how they had a life, they got married and had kids on these cities, and they found the animals there all behaving like persons, the dolphins are the police and so on. And for the people outside the time they spent underwater seems just like a few minutes, but to those who visit these cities it seems they spent many years there.

(...) One of those animals who steal people are the dolphins, in particular the pink dolphins have something of demoniac. They have been seen at parties, on roads, in villages. In parties they appear well dressed, they have shoes that are like catfish [Pseudorinelepis genibarbis], like a prehistoric scaly fish, and they appear in the parties all well dressed with a hat to cover the hole they have on the top of their head to breath. On the roads they appear as men or women depending on whom they appear to, so that they flirt with people passing by and there's some chemistry. Then they deceive people into the water and those who return say there are big cities underwater, where they are all dressed and have shoes. But… the majority doesn't return, right?

(...) And so there are many stories who tell how women got pregnant of dolphins. And here, you see, when a woman gets pregnant, people blame the dolphin. Who was? The dolphin, they say.

ST. 3 - Dolphins [T3]

There in the Napo's river, that's like a story... there was a fisherman who liked to fish at night while his lady was at home. And the dolphin, when the man was going to fish, the dolphin would come, transforming himself as if it was her husband, and live with the woman. Well, until one day, when the man comes back and… he came in the house and the woman says, 'but you just left, where are you coming from?', the woman said, 'so you are not going anymore?', and the man says, 'but, how? It wasn't me then'. So the man starts thinking and he has an idea, 'I'm going to check what's going on, who was this man?'. So he pretended to go fishing, took his canoe, left it a bit up the river, and came down the road again to see who was this person that

was with his wife. And so he sees, 'the dolphin came swimming', he said. He sees him transforming into himself, taking his own canoe and walking up to the house. The guy came to the door as her husband. And well... there the man, armed with his weapon, he had his harpoon you see, and he ran to see who was entering his house, 'hey! Or I stop him or I'll spike this guy'. The man was about to enter the house and in that moment the dolphin, transformed in person, ran through the door like jumping fast, ah if those people jump!, and so the man threw his spear and stung it there, right in the buttock, but the dolphin jumped in the water with the rope and harpoon and all, wounded, and then disappeared. (…)

ST. 4 - Mermaids [M2]

When I was 6 years old, in the village of Nuevo Junin, the village of my grandparents, I went with a friend to the river. We went down there, to where was a whirlpool, then there was a very beautiful beach, where we were going to swim. But then I don't remember how, I just remember that suddenly I was in the middle of the whirlpool and I don't know how I end up there. And I freaked out, that whirlpool was bog, about 10m diameter. I felt the ground under my feet, but I raised one foot and couldn't feel any ground around, it was deep all around. So I got even more scared. Then I noticed there were some grams, about 5m away. I did not know how to swim but I knew how to dive, so I had to gain courage, because I already felt I was sinking, and so I jumped into the water and grabbed the grass down. Then with all my strength and almost missing my breath, I climbed up to the beach and started to run away. I did not say anything to anyone. And the night arrived. And when I was sleeping, in my dreams, I saw that I walking towards that whirlpool again. I started to look and saw the whirlpool and saw a light inside that was becoming clearer and clearer, and then I saw a woman coming out of the water there. A beautiful, blonde woman. She was naked with all her hair covering her breasts. And when she started to rise above the water, I could see that this part was bent. It was a mermaid and she was standing in the water. She looked at me and smiled, 'How brave are you, it's thanks to you being so brave that you are not here with me. If you weren't so brave, you would be here now". And so, while she was still smiling I woke up. But look how she made me dream! The mermaid wanted to steal me.

ST. 5 - Mermaids [M7]

My uncle-grandfather is now 97 years old. When he was about 20 years old, he always went to swim. Once he was passing a little bridge, while smoking a mapacho cigar [tobacco], around 6pm in the afternoon, and he heard the sound of a tinamou, a bird that looks like a chicken. It seemed right there, on his side, so he decided to follow the sound, but when he walked in that direction the sound start getting scattered. So he began to doubt, thinking that perhaps was some jungle's devil deceiving him. But, just as he was passing by the bridge, he heard something on the water and out of nowhere it suddenly appeared a large stone in the middle of the water and sitting on top there was a lady with long hair, bathing with half of her body inside the water. And so she asked him, 'Don Antonio, where are you going?', and he replied, 'I'm listening to a tinamou, I'm going to hunt it'. But when he came back later, resigned that it was not a bird but the forest's spirits, he looked at the water and there was nothing, neither the rock nor the woman. And then, when he was crossing the bridge, he saw all the trees bouncing and making a loud noise, so he got scared and ran home. Then that night he dreamt about the woman. In the dream, she told him, very flirtatious: 'If you were not smoking that mapacho, you would be here with me now'. That is why until today he didn't bath in the river ever again.

ST. 6 - Yacuruna [M3]

As I was telling you, there in a Nueva Alianza, going down there, there was a whirlpool. A big one. And my mother used to say, 'there, there is the yacuruna, you cannot bath there because otherwise the yacuruna will steal you', my mother always said, 'don't bath there or the yacuruna takes you away'. So we didn't go there, we'd go a bit downstream. But, when she was fishing, we'd go to the whirlpool and then, we were all there and my mom would say, 'yacuruna, yacurunita give me your fish', she said, 'yacuruna give me your fish'. And then she would go and grab her fish. And sometimes my dad would go as well, without saying anything and then he wouldn't grab anything, so my mom would say to him, 'why didn't you ask yacuruna to give you fish? That's why you don't caught anything'. 'Cos he didn't catch anything, not one of all that fish. There it was full of gravel, it wasn't sand but clay, where the catfish likes to throw holes and all that. And there we would grab catfish, we would grab boquichico [black prochilodus], 'cos all those fishes would go there to eat in the gravel. And he would go there but didn't grab anything. So my mom always said that when we ask, the yacuruna gives us. The yacuruna is the yacumama, it's like a person. I don't know if when it gets in the water it becomes an anaconda, but when it comes out it's a person. And when people sees it, it does like that

bruup! and throws itself back in the water. It jumps on the water. And my mother said, 'the yacuruna jumped on the water', when we heard like that, bluuup! And what a noise, who would be doing that sound in the water, 'the yacuruna got in the water, she was sitting there', my mother used to say. And there we would find it, she'd always find it there, when she was going to fish and that's why she would never go alone, 'come on, come with me so the yacuruna runs away', she said. There yes, there lived the yacuruna. My mom saw it several times, but it always jumped away. So, it looks like a little girl but it's an old old lady with long hair, my mother said.

(...) And there, in that bit, we bathed sometimes and all my life I dream of that whirlpool. And I still dream look, I'm 54 years old and I still dream of that whirlpool! Why I dream of that? I don't know, but I know that sometimes we bounced to the whirl in a topa [a light tree used to make rafts]. We'd hug the trunks and then jump on the whirlpool, so we'd float around it, and there we played. But if my mom saw us there, she would tell us to go further down. She didn't like we played there, it was dangerous. (...) And when I told my mom what I dream, she told me, 'surely the yacuruna wants to steal your spirit, your soul, she has trapped you down there in the water, that's why you dream of it'. You know what happens if the yacuruna steals your spirit, you don't live in peace. You live like you always want to go in the river. It calls you. That's what happens when it steals your spirit, your soul. [Silence] That's what I know about the yacuruna, 'cos if it exists, exists.

ST. 7 - Kapok Tree [T10]

And there, back in the days, all that about the Kapok tree, there everything was visible. Passing by the road that goes to Tarapacá, until now we say, Tarapacá has a long story. From Tarapacá going to Nariño, there is a trail and in that trail, there was a Kapok tree that was the house of the butterfly, they always heard it there. And the witchdoctors, those who practice witchcraft, let's say the healers, it always made them dream. And there, let's say, it was all visible that the butterfly was an old woman who lived in the Kapok tree. That Kapok had such high fins, from the first branches, the fins came to the ground, and so that was her house. The road passed near that tree, people had to pass there and, each time they passed by, they'd listen to a door opening and then closing, people always heard it sounding like that. But you see, on a simple Kapok tree, not a house. But through dreams, the witchdoctors could see it was a big house, so

they knew it was a house and there lived an old woman with her children. A woman, an old woman. A person, the old butterfly. And people passed by and they were afraid to go down that road because she used to steal the little ones. One mistake, let's say, one moment the mother wasn't paying attention to the children while walking on that road, and one would be missing. Sometimes two got missing. They'd look for them and wouldn't find them anymore. Through the witchdoctors' dreams, they knew it was the butterfly who took the children. And so it was. And so that's the story of Tarapacá road. The butterfly's story.

And how did we got to know that? The butterfly is going one day, she told her children to stay there while she was going for some mocambos [wild cacao fruit], to get mocambos. Mocambo for her was the children she'd steal, she'd have them like fruit. And so, when a group was passing by, she took one of them who was already big, let's say, that could reason already. She took a little boy, about the age they already have understanding, right? And the butterfly, let's say, took the boy and put him in her basket, a canasta. The butterfly, she called the boy mocambo so, for her, he was a fruit. Mocambo is a fruit but, for the butterfly, mocambo were the creatures she grabbed. She said to her children she was going to bring mocambo, so she puts him in the basket and walks away. The old butterfly returns home. She's walking with the basket on her back when she passes under a tree, a fallen tree on the way, carrying her basket with the load and leaning over so that she can pass under it. She's carrying the little boy but, 'cos the boy was a bit tall already, he grabbed the branch on the tree and hanged there, but she didn't realise that her load, the creature, stayed behind so she kept walking. When she finally realised, she was already far away. Then she said, 'and the load where is it?'. Her mocambo, she looks for her mocambo and it wasn't in the basket anymore. Since it was big enough, the creature left. The boy escaped and so the story arrived home. So the story came to the house, that the butterfly was who stole him and how he ran away. That's how we know that was the butterfly who stole children away. And that's how they got to know that was the butterfly who took the children.

ST. 8 - Jaguar [S6]

Before people didn't have shotguns, they used blowguns and spears to hunt in the mountains. They'd make a camp to stay for 3 or 4 days. So a group went in the bush, to hunt, and one

stayed in the camp. They returned with nothing. But, when they returned, one of them went to get water, so they could cook, and on his way back he saw a footprint, a tiger had passed there, near the camp. When he got back to the camp, he said 'hey I found a footprint, a jaguar footprint'. But the others didn't believe him. Nobody listened to him. The man who found the footprint began to worry, 'let's go back home', he told them. But the others said, 'ah you cheating us, 'cos you scared, chicken-hearted!', they said, 'he's afraid, that's why he wants to return'. 'No, I've seen the jaguar's footprint, if it comes here we're all done, it will eat us all'. But they ignored him.

Then, at night, it sounded, the jaguar was moving, it was coming. It was approaching the camp. But everyone was sleeping, they were tired. And the man who saw the jaguar's footprint was worried, 'what am I going to do? how do I save myself?'. Before he'd seen a huacrapona, just like a pijuayo, a huge palm tree. So the man starts thinking. The jaguar is coming and it's getting closer and closer, so he begins to climb the huacrapona, going high up with his spear, 'from here I hope I'll save myself', he said. He tried to wake up the others. He could hear the jaguar but the others nothing, they were sleeping and well, they didn't want to wake up. 'Pucha, I'm going to save myself now. I told them before, that early, but they didn't listen to me, so well then… when the jaguar comes, it will eat them', he thought as he climbed. He grabbed the huacrapona's trunk and climbed up up, very high. He got high up there with his spear, he seated down there and so the day dawned. There was the jaguar already. His brothers were screaming, the jaguar was eating them. Well, he escaped. The jaguar ate them all and then came after him too, so to get everyone, it also wanted to grab him. The jaguar got to the huacrapona and began to climb, climb, climb up the trunk where the man was. What could he do? With his spear then he started to poke the jaguar until he managed to spike it. And there, with the spear spiked on it, the jaguar dropped to the ground and so the man was safe. So he climbed down to find his family, to see if they were alive, but they were all dead. Poor man, he was left alone, everyone had been killed. The man began to cry, 'what am I going to do?'. He grabbed his spear, took it off the jaguar. That's how he managed to save himself, the jaguar was dead next to the huacrapona, so he says, 'I'm going back home, I'll warn the village, my wife, my family, so we can come pick them up'. So the man returned back home, when he got home he told everyone what happened, 'I warned them but nobody believed me' and so he told how he saved himself, 'thank God I killed that jaguar'. And that's the story of Yanapuma. (…) The Yanapuma is a big jaguar, a forest's mother, a bush mother. It's a jaguar with 5 meters, the biggest in the world.

It's a bush mother. Now there isn't any anymore, too many people arrived and they finished, but back in the days yes, there were.

ST. 9 - Jaguar [T6]

Well, about hunters, there are many stories. Over there, just below the Amazon, a man went hunting with a shotgun and... he went looking for animals, he said, and he stopped with the shotgun, just looking like that, and suddenly it presented to him an agouti. So he begins to whistle, 'cos the agouti are called through whistles, right? fiiiiu fiiiiiu fiiiiiu… And so the man pulls out his whistle and begins to call it but then, before even starting, he heard a noise... scurrying animals, he said, but he thought it was the agouti so he grabbed the shotgun and began to whistle, he's calling, fiiiiu fiiiiiu fiiiiiu and again fiiiiu fiiiiiu fiiiiiu, hmmmm… then suddenly, when the man realizes, the jaguar was next to him. He had no foot to run, so what did he do? Instead of killing the jaguar with the shotgun, he threw the shotgun on the jaguar, look at him (laughs). He did not had time to shoot it even. But right there was a tree [beluco] and so he climbed up as fast as a monkey. But left the shotgun on the ground, jeez!, and the jaguar just below, under the tree and looking at him, he says. He screamed, bellowing, just like the cows, he says, 'damn! how was I calling the jaguar?', he said. He couldn't get down because the jaguar was just there. I don't know how many hours he stayed like this. The jaguar couldn't stand it anymore, it wanted to hunt the man and so it started walking around, smelling the shotgun, then it bit the rear of the shotgun and grabbed it, 'damn, the jaguar is gonna steal my gun now', he said. The jaguar took a piece of it, maybe thinking it was a christian no?, and then left it there and ran away, he said, leaving everything there. The man took another three hours, 'who knows if the tiger might come back', he thought, but the tiger didn't return. It didn't want anything to deal with the man anymore. So he climbed down the tree, grabbed the shotgun and let's go, he returned home, but fearful no?, he didn't want anything to do with hunting animals anymore. (laughs)

ST. 10 - Stealing People [S4]

Sometimes the children, in the afternoon, when they cry... when they are crying too much, their mother says, 'why are you crying so much?', she goes to check them and then leaves them on the sidewalk, in front of the house. On the little while that their mother leaves, then comes their mother or their grandmother who appear to them, 'oh my baby, why are you crying?', they say,

'let's go, come to my house'. The child, thinking it is their grandmother, says 'ya, ya grandma'. The grandmother carries a basket, puts the child there and carries them away, takes them. When they are far far away, then the child looks around and then they see… they are already being taken through the forest, they are not anymore walking through a path or anything, but instead they are just being taken through the bush.

So then the father was returning home from hunting, he was coming back. The child cries, "Mom! Dad!", they go crying through the bush. And, as the father was returning from hunting, loaded, carrying a meat sack. Before they used spears, there were no shotguns, there were spears and blowguns, with that people hunted. And there he was returning and then he hears his son's voice, "damn… my son!". So he runs and he finds him under those big trees with fins, like this, there's the child hiding under those fins. So then it appears the demon who was taking the child, it hits him and then leaves the child there, the little boy. Many used to get lost like this before, but nowadays it doesn't happen so often anymore, now we don't lose them like that. That's the story, we wanted to tell. So once the father grabs the son, he asks, 'son, how did you got here?' and the child replies, 'daddy, that's how... it appeared like grandma'. (...) So that's how the demon grabbed him and took him and once they caught the child, they said, 'now, let's go son'.

(...) Oh yes, mostly hills, the hills have a mother. The waterfalls have a mother. The rivers have a mother. Sometimes, before we existed, as my grandparents said, before we existed and the grandparents followed each other... they would go to the bush and got lost, they wouldn't come back, they wouldn't come home anymore. When a man was hunting, said an old man, when they couldn't find anything, any animal, 'what am I going to take home?', they asked. And they looked for something, but they didn't kill anything, not even a bird nor an agouti, and so when they'd came back they were transformed. People said, 'a demon came and killed him'. They'd appear and tell them, 'so much he wanted to eat my liver, now I'm going to eat his liver', they'd say. That's how it was then.

ST. 11 - Stealing People [T3]

Over there, by the Atacuara, a lady was also taken by the Yashingo. We were there working with my brother, he was the qualified there. And, let's say, here was my brother's camp and the other friend had his like just over there. There was his hut. And... well, they all left. And the woman was left alone, by herself. The woman stayed in the hut cooking. She was there by herself

but the people were not far away… no more let's say, than from here to Don Ramón's house [~200m]. So that's where people were working, with the cedar wood, chopping, opening a path, to get over the stream. The woman was married and she says, he introduced himself in the form of her husband, 'come on, let's have a drink, take the massato' [cassava bear], as she had her flour's bowl there, 'bring that', he said. And the woman, obedient, followed him... He was just like her husband, he took her through the forest for a while, and then she disappeared. She didn't know how to return anymore so the woman got crazy, she got mad and screamed, screamed, but the Yashingo didn't let her go. Her husband searched for her, damn, they couldn't get hold of the woman, she had become… better said, she turned wild.[1] *Her husband ran like an animal through the mountains to bring a witchdoctor from there... witchdoctor, they say of the one who heals, no? So this man knew how to heal. So they went to get him from… what's the name of the place… Catalán, the place where the healer came from. So he came there, he started calling, singing the name of this woman and then she came during the night, they say, the woman came to present herself at their hut. Then people surrounded her and already grabbed her but she wanted to bite, they say, the woman was fierce wild! ['Brava pues brava!'] And so the witchdoctor began to blow tobacco, to heal her, to remove that evil from her body, and the woman got better. Hence the woman no longer wanted to be there anymore, on that mountain, so her husband took her away. The forest beings are dangerous, they present themselves as if they were your brother, as if they were your husband, or your father, they present themselves in all forms. And so if you don't know them, sometimes you follow them, they draw you, they take you away. That's what happened.*

ST. 12 - Swelling Body [T7-8]

The Yashingo… well, it has value this one, strength! It's a little man, better said, but it's fierce, it's strong strong, this asshole. Because in reality this animal has, how to say, it's like he has a secret and when he gets close to you it makes all your body swell, so he's able to defeat you. He grabs you and done, that's it.

Because once here, when my daughter was a little girl… she's now in San Jose but then she was a little girl. So, it was like now, bad weather and I said, 'daughter come with me, we're going to such part, let's go'. So she followed me... and then there was this noise, it was like a

[1] *'chúcara', used to refer to wild cattle*

whistling. It was whistling and she answered, my daughter responded. I was cutting branches and then I hear, 'dad! dad!', and she came running to where I was working. 'Dad', she said, 'why did I come, I'm scared, this seems to… it's getting my body', she told me. 'What do you have? It's maybe 'cos you answered that it's screaming now', I said. 'Yes, it got me'. Ahhh, then it got me too, it gave me darkness in a moment. It was coming, coming, and suddenly it gets close and I also think my body was swelling. And in reality it almost beats me! It hits me and I almost fainted there! That thing, why is it following us? So it happened to me and I said, 'my daughter, this is so deadly, this is the Yashingo', I told her. Yes, my body was swelling like that because that devil was close by. This happens when you don't think of God, if you don't think of God... [T8] Yes, it gets close, it approaches you so it takes you away, these are the bush's mothers. If you pray, thinking of God… then the mothers let you go, maybe then that devil runs away. [T7]

I didn't even noticed, it presented itself where I was like that. When you go in the bush, there's a tree, all clean around, and there he is, still. And if you have value, if you have strength, you have to escape, you cannot talk to him, you have to go. And if he looks at you… as he has a hat, then all your body starts swelling with his hair.

ST. 13 - Swelling Body [M2]

In front of Santa Lucia there is a beach, and one day my father was with his scull in the canoe. His friend gets out. He removes the scull and when he's about to stand, he listens to something just behind them. There's a pool there, not a whirlpool, and he hears something like uaaaah sssshhh. And when you get something evil, your body swells. So my father slipped down the canoe and saw his body all like that. His friend was calling him but he couldn't answer. He was aware but then you can not talk nor move, I know 'cos it has happened to me too. So he was in the canoe, about 10m away, and his friend was calling him. And until your body starts to shrink… took him about 10 min, until he could move again. So it took time until he could move again, and then he said, 'damn, the yacuruna almost takes me!'. His friend, who was a witch-doctor, then grabbed his tobacco and started to blow it on him.

ST. 14 - Vomiting [S11]

People say there's a place, walking two hours from here, there's a sacred place where no one can get in. When people get in, the wind starts to blow, it starts to rain heavily, no one can get in. When someone gets in they can die. Hunters cannot get in neither. But there was once a hunter, who was also a witchdoctor and making discourses, saying ícaros, he wanted to go and see that place. So he walked some 10 meters and then he started vomiting, vomiting, vomiting. So, he couldn't get in either. We don't know what's in there. It has a mother, maybe all bush mothers are there, gathered. That's why people can't get in that place, only animals can go and that's why the hunter wanted to go there too. That how it's in the mountains. There's sacred places.

ST. 15 - To Strange Someone [M3-4]

I was born and raised here and my parents always said, 'before entering a forest where you have never walked by, on that path, there you say, you ask: I will enter and I ask nothing happens to me'. Because while you're walking, as I said, you often hear noises, for example, when you walk through the virgin forest. When you walk in the virgin forest you often hear these sounds, it's something mysterious and also... terrifying at times. Because it's a horrible sound and when you find yourself alone in the middle of these mountains and you hear that, these sounds, like moans, like whistles… So our parents used to tell us, 'this is because the mountain doesn't recognise us', my dad told me, 'don't look. Don't look in the direction where the sound comes from'. 'But why dad?', we said. 'because otherwise at night you will have fever', he told us. So we kept walking, but we were curious then. And we looked. And truth there, I don't know if it's by chance or what, but then we had fever. And what did they say? We went to the witchdoctor and she would say, 'the mother of the mountains has found her strange [extrañar]', she told us, 'the mountains don't know her, was this the first time you took the girl down there?', 'Yes', he said. When we are walking, I have heard those sounds several times, walking on the way from Arica, for example, crossing that hill over there. There I heard that. So then I would tell my children too, when I walked with them, when they come from Lima, I'd tell them, 'don't turn back if you hear something, don't look back, just keep walking, keep walking'. With my children, when they were young I'd never left them behind, 'you come in the middle, your father ahead and I behind'. It's like to protect them. Because you, your spirit, your smell, everything, you are known, no? And my children, when they came from far, they had another scent, so

nature finds them strange. It seems made up, but it's true. When they are little children, then they have fever at night, they cry, they vomit. It's the mothers who are grabbing them.

This is what we call 'cutipar', when the bush mothers find someone strange, or we say their soul got trapped in the mountain [M3]. No, that's not 'cutipar', because that's when a being in nature trapped some part of the child's soul. 'Cutipar' is when the child gets something of the animal, that's when the animal 'cutipa' them. For example, if the spotted paca 'cutipa' a child, that child can not sleep at night, you have to calm them down so they can sleep [M4]. No, when the spotted paca 'cutipa' them, the child then makes like ronc-ronc when they sleep, they hoarse. It's something like they cannot breathe. So, people say: the paca has 'cutipado' them. And what do they have to do? They burn a bristle of paca and make the child smell it. Then, that's how you heal that. And that's the forest's illness ('mal del bosque'), when something steals a bit of your spirit, your animus, your soul gets stuck there, it happens especially with children… and old people too, sometimes when they get lost. [M3]

ST. 16 - Hunting Dreams [T3]

In those days, when I was young… I was 27 years old I think, more or less… I dedicated myself to make oncilla furs, jaguar, all kinds of fine furs, like the wolf and all that. I'd go to a mountain far away, out there by the Javarí, more or less, there I'd arrive to a virgin forest where nobody would came. That is entering, crossing by San Paulo, because the Javarí goes like this and there's another river, so between the Amazon and the Javarí is that mountain, very wide. There are places which people don't reach and those kind of mountains are rough, dangerous, there's all kinds of wild animals. And so we went there, we were two, me and my partner, and between both, just the two of us, we went for furs over there. We got to a place that turned out to have a lot of animals, oncillas, jaguars... Here I tell you this, there in the afternoon it came some... for me these were devils, Yashingo, what could it be? It came and it shouted all around our hut. Horrible! An horrible scream, pure terror, to run away with fear. And we, as we had our guns, we shot bullets there!, caramba, paah paah!, and just after another shot, paah! (laughs) So we tamed it, with so many bullets we put there. And well, we fell asleep then. And in dreams I see it coming... it was not a person, if not a devil, all its hair covered its face, its chest was all open and its heart was like a bell, playing there inside and tearing blood all around, and its nails were like this, huge. So I'm almost falling asleep and it comes and grabs me here, my throat,

jeez!, I kicked and kicked there, zas zas!, 'this fool', I told him and I shot him there. And there it was, silent, it didn't scream anymore, nothing now. Well, so then I fell asleep. And... and I dream of a person, a black guy… he was not diabolical anymore but just a person already, and he said to me, 'Look, you are very brave', he said, 'you dominated me. Take, there's all the wealth, do what you want with this mountain'. Damn! And true there… look, we had already put up our rows of traps for the oncilla and the jaguar, and I tell you, in one night I grabbed nine, nine oncillas!, and on the second night fourteen!, and on the third night we had already some twenty oncillas, for what more? Let's go. So we left, me and my partner. I was owing 7,000 soles to the employer who had enabled the cartridges, shotgun… everything we take to the mountain. So I paid my bills and I throw a good balance. And again, there we go again. But then my partner got away from me, so I said, 'well, if you want to go away, I go alone'. And so we went, they required company but he was working by his side and I by my side now… So, I started to put together my traps and I tell you, this one... don't know what power it gave me, it was crashing me there, it gave me that power. So then, my friend puts together his traps, and... well, he didn't catch anything. I'm going to check… and there were all the oncillas there, locked in the cages. And so he got resentful, no? I said, 'oh my!' and he said, 'damn! how did you do this?'. So, all the power was with me, that the bush mother gave me. It didn't give it to him 'cos he was scared, he was younger and he was afraid. I was the one who shot that animal, better said, I was the one who tamed it and that's why it gave me all its power. I stayed three days, no more, and I came back with 33 oncilla furs. I didn't want more. And besides, the oncilla furs' price was already decreasing. I was going to sell those and the boss told me, 'this isn't worth for you anymore', he said, 'because suddenly these will be worth nothing, you'll make furs for pleasure, who will buy it from you?'. Ah that way I stopped there. I didn't go to that mountain again. And they, they stayed there for almost another 18 days and brought only three little rabbits, look. It was not with them, the power was not with them, that's what the black man gave me. What a fierce spirit! I'd say, perhaps it was the mountain's mother, because the mountain has its mother, it's the Yashingo. It's the Yashingo, because it transforms itself in anything, it becomes a devil, it becomes a person, in every way it can transforms itself.

ST. 17 - Hunting Dreams [T10]

Back in the days, when my father was young, he handled the blowpipe. Formerly, the ancient people used to hunt with the blowgun, with that they killed animals, no? And so my dad once,

in the forest… there are trees in the bush that bear fruit, and that fruit is eaten by all kinds of birds, birds up there and animals down here, right? The fruit that falls on the ground from the trees it's eaten by the animals there on the ground and, those fruits up the tree, those are eaten by the birds. There's the the curassow, the macaw… those are all birds that eat the fruits up there. And the fruits that fall on the ground, the animals on the ground eat them, like the tinamou, the trumpeter, the collared peccary, the white-lipped peccary, and let's say during night, the spotted paca [and others] during the night. I mean, those fruits sustain the animals in the bush. And so the Yashingo is their owner.

And my dad once, with the blowpipe, he made a little shed, we call it 'chapana', when we make like a fence in the bush with leaves, we cover it like that, so the animals cannot see us. Then, inside the fence, we make a little room and it was from there that my dad hunted the animals, there on the ground, with the blowpipe. So the animals came there to eat, under the tree, all kinds of animals, and since they couldn't see my father, he could shoot them. The trumpeter is a bird that moves in herd, in group. It has a part with long yellow feathers and almost three colours. And so those animals, those birds came, and my dad shoot them… and as they were several, he almost finishes with the whole group, no? But then at night, my dad dreams. Through dreams, it complains, the owner of the birds, the Chullachaqui. It presents itself to my dad at night, through dreams, it presents itself and confronts my father, complaining about his animals, 'why did you kill my birds?', he said, 'now we have to fight and let's see who is stronger'. My dad says that he was like a little man, small but fierce, and so they start fighting. He was fighting with my dad for his animals, he confronted my dad in dreams, the owner of the birds, 'why you had to kill all those animals in my house? on my pasture? You shouldn't had touch them'. So he starts fighting with my dad. And during the fight, my dad couldn't beat him, he couldn't win but it was like they nearly equalled each other on the fight, he couldn't beat him as much neither, and so the owner of the birds said, 'since you almost won, let's smoke a cigar'. And so his cigar is those tiny ropes stuck on some tree trunks, you know? the dirt attached to the trunk, right? So he begins to gather that, puts it together, and that was his tobacco. He starts to mince that and starts making his cigar and they start smoking. That was his cigar and he shared it with my dad. Because he couldn't win my dad, he offered him his friendship, so they could be friends. Well he didn't win but he complained and confronted my dad. That's how we know that all animals have a mother, the forest has a mother. When there are many animals, let's say, that gather because of the tree's fruits, it is because that's a farm. In other

words, it's the Yashingo's farm and that forest is like his pasture, that's why the animals are all there, that's where he breeds them.

ST. 18 - Dreams and Discourses [S5]

The forest of the high mountains, the virgin forest, has its mother. Like a human being, a tree when it's cut its mother cries. That's why one cannot open many farms, do much slash n'burn, so that she can also lives (...) Everything has a mother. The trees, the mountain, that stone, waterfalls... And sometimes we sleep on those hills and then we dream they have a mother. Beyond the salt mine, once we went five or six to hunt, to see those mountains as they are. The bush mothers look just like a human being. When we are making noise, they answer. When we fall asleep they makes us dream, so they appeared and said, 'we are all quiet here, in silence, why are you coming and making noise?'. Sometimes they also send rainfall. So we asked the forest's owner, 'we came here to hunt, to walk', and we asked them to not do us any harm, that there is no rain. We always ask to have a good hunt, 'cos when they find us strange, when they don't know us, when we don't talk in dreams, when we don't share with them, then they close their pigs or their offspring inside big rocks, so that nobody can hunt them. No one sees them anymore, nobody finds them. So, their mother hides them. And how do we ask to not hide them? We go to a big tree, those trees with big fins, and there we ask, 'I'm here to hunt, give me your brood so I can take them home'. And then when we sleep, we dream they tell us they'll give us their offspring. Those large trees with fins is where the bush mothers live, in the Cedros, Tornillos, Lúpunas, Ojés…

(...) When we want to open a farm plot in the forest we have a secret, we take a cigar and ask for permission near a big tree, 'I want to open this farm, do not make me ill, do not hurt me, take your cigar'. We light it and we leave it. Because sometimes you get sick, you hurt yourself, you have a headache, your stomach ache and you cannot work with your arm, you can't work anymore, you get hurt, because the forest has its mother… and the bush's mothers are like grandparents, grandmothers, they are old and they also like to smoke their cigar.

ST. 19 - Dreams and Discourses [T5]

My grandfather use to tell, as the Yashingo took him twice, because he was walking so much his way in these mountains, that once a witchdoctor told him, 'so that the Yashingo doesn't bother you, when you go into these mountains you always have to ask for permission', 'so then how do I ask for permission?', he asked. One has to go to the mountain, but to the highest part, where is the wildest, where people say are the bravest woods, 'cos those here are mild, right? So my grandfather used to say, 'I'm going into your jungle and I want you to give me a little, a few of your animals to kill, because I'm hungry and I want to eat'. He would just say so and then go in the bush and, for real, he'd find spotted paca, collared peccary, and killed them already. But it was the Yashingo giving him that. (...) That's something I know, as we raise our cattle, so the Yashingo breeds theirs too, those are their offspring, there's the turkey, curassow, the peccary, the tapir... all the animals, all the birds we see are the Yashingo's offspring, those are its brood. Just as we breed our cattle, our fowls nowadays, right? Everything. That's how the Yashingo does too, with the trees, everything. If you want those, you need to ask him.

(...) Before, my deceased grandmother told us, formerly, before we lived, when the old grand-parents lived, before... one asked to a trunk... a trunk like that when you cut, you cannot cut it down [makes signal of cutting], because this trunk if you want to cut it, it screams, ai ai ai, it cries. If you want to cut that tree, this one here, it screams, it cries. So, one day, back in the days, my grandmother told that if you wanted to open a farm, you wouldn't cut anything, you wouldn't cut but start the day no more by saying, 'I ask directly God to help me, to give me my farm', so they sowed their pineapple, their cassava, their plantain and on the second day, they looked and it was all free, that was all pure plantain and cassava. Then it was like this, before, my old grandmother tells. Now, it's no longer like this, now one has to cut it oneself, that's how it is. Now it's not anymore but before it was like that.

ST. 20 - Plant Teachers [T3]

The kapok's mother is a giant. When you call the kapok's mother, it appears a giant. Because the Kapok is immense. And there it asks what do you want, why did you call it. And there you tell them, what do you want, if you want... lets say, learn something from them, you say 'I want to learn, I want you to teach me, I want you to give me your wisdom'. Then it tells you 'ok, come such day', you'll leave a cup with tobacco and on the second day you'll see that there this a phlegm, so you have to swallow that... You are going to put that, this tobacco here and then you

go by yourself already, alone, and in your dreams it's going to say what you have to diet so that you can have their gifts, from their genius… The kapok's power is to be a doctor.

(...) and that's the way of the mountains. The ojé is like a doctor too, the ojé's mother is a white guy… (silence) That's how the vegetables are, those that one knows. There are many healing vegetables. You take, take. For example, the ajosacha, that's also a plant and when you take it, 9am you take it and you start dreaming of its mother, it comes to you and blows in your head and asks why do you take it, if you want to learn something from it, or you are taking it as a remedy. And there you tell them if you want a remedy, if there's something in your body, you tell it, 'I'm taking for this, so that I take your power in my body', and there it will tell you, well, if your body is admitted for this, its touch hits you straightaway. But it sees if you are going to resist or not the diet, 'cos these diets… you have to diet then, and often the diet is what puts you off. The plant itself tells you, they are going to tell you how and for how long you have to diet.

(...) Well, when you have mastered that already, so to say you have completed your diet, then they give you their power. Then you can already go outside and heal, calling their spirits. Now when you see that you are healing a patient, lets say, that you cannot, then you call their spirits, the tree's spirits, there are all kinds of spirits and so they come. Then they already teach you how to cure, with what plants, what plants you use to treat the patient and what you are going to diet, the patient also has to diet so they can be healed. That's how it is with the medicines.

(...) Those diets are long and ruin you quite a bit, that's why many don't want to continue this profession because it ruins them and they are afraid, oh they are afraid! Because you have to go in the bush, on those mountains, more than anything. In the bush is where you can diet, because there's nothing there, you only eat your plantain, your meat, like that just cold, without salt. For a month, two months… if you follow well the diet, then they already give you their power, the plant you are taking. There, by dreams it makes you see how you're going to heal, how you can heal a sick person, everything, the genius of the plant then teaches you. So it is.

APPENDIX 5.A: Demographics and Significant NTFPs

Table 5.A1 – Participants demographic data with ethnicity per gender, age and community of origin.

	Shawi	**Ticuna**	**Other**	**Total**
Female	2	4	4	10
Male	12	8	7	27
< 25	2	-	1	3
26 - 35	1	-	1	2
36 - 45	1	7	3	11
46 - 55	4	3	4	11
56 - 65	4	-	1	5
> 65	2	2	1	5
Balsapuerto	2	-	6	8
Nueva Luz	8	-	-	8
Puerto Libre	4	-	-	4
Bufeo Cocha	-	2	-	2
Nueva Galilea	-	6	-	6
Sta Rita Mochila	-	4	-	4
Iquitos	-	-	4	4
Yurimáguas	-	-	1	1
Total	**14**	**12**	**11**	**37**

Table 5.A2 - List of plant species with cultural or economic significance to Shawi and Ticuna people, establishing a relation between non-timber forest products (NTFPs), the benefits derived and ecosystem services supported. Species identification is based on local inventories made by IIAP's and Formabiap experts, cross-checking information with published studies on NTFPs (e.g. Alexiades & Shanley, 2005) and national habitats and species inventaries (e.g. MINAM, 2015). Common names refer to regional vocabulary in Spanish.

Common Name	Scientific Name	Parts Used	Ecosystem Services Supported	Benefits Derived
Achiote	*Bixa orellana*	Seeds;	13 Materials, companionship and labour 14 Medicinal, biochemical and genetic resources 16 Physical and psychological experiences 17 Supporting identities	Aromatics (e.g. Condiment); Biochemicals (e.g. Body paint);
Aguaje *	*Mauritia flexuosa*	Fruits; Leaves; Timber;	1 Habitat creation and maintenance 2 Pollination and dispersal of seeds / propagules 12 Food and feed 13 Materials, companionship and labour 17 Supporting identities	Food (Fruits, heart-of-palm and 'Suris', edible maggots); Construction materials (e.g. roof thatch and timber)
Ajo sacha	*Mansoa allinacea*	Roots;	14 Medicinal, biochemical and genetic resources 15 Learning and inspiration 16 Physical and psychological experiences	Medicinal products;
Algodón *	*Gossypium barbadense*	Boll (seed);	2 Pollination and dispersal of seeds / propagules 13 Materials, companionship and labour	Utensils (e.g. fibber for clothes);
Anacaspi	*Apuleia leiocarpa*	Timber;	13 Materials, companionship and labour	Construction materials;
Ayahuasca *	*Banisteriopsis caapi*	Vine;	2 Pollination and dispersal of seeds / propagules 14 Medicinal, biochemi-	Medicinal products;

			cal and genetic resources 15 Learning and inspiration 16 Physical and psychological experiences 17 Supporting identities	
Barbasco	*Lonchocarpus utilis*	Roots;	14 Medicinal, biochemical and genetic resources	Biochemicals (e.g. fishing toxin);
Cacao *	*Theobroma glaucum*	Fruits; Seeds;	2 Pollination and dispersal of seeds / propagules 12 Food and feed	Food (also Cash-crop);
Cacao de monte *	*Theobroma cacao*	Fruits; Seeds;	2 Pollination and dispersal of seeds / propagules 12 Food and feed	Food;
Caimito *	*Pouteria caimito*	Fruits;	2 Pollination and dispersal of seeds / propagules 12 Food and feed	Food;
Caoba	*Swietenia macrophylla*	Timber;	13 Materials, companionship and labour	Construction materials (also export);
Cedro	*Cedrela odorata*	Timber;	13 Materials, companionship and labour	Construction materials (also export);
Chambira	*Astrocaryum chambira*	Leaves;	1 Habitat creation and maintenance 2 Pollination and dispersal of seeds / propagules 13 Materials, companionship and labour 15 Learning and inspiration 17 Supporting identities	Medicinal and Ritual products; Utensils (e.g. fibber for rope, hammocks);
Chuchuhuasi	*Maytenus macrocarpa*	Bark;	14 Medicinal, biochemical and genetic resources 16 Physical and psychological experiences 17 Supporting identities	Medicinal products;

Clavo huasca	*Tynanthus panurensis*	Bark;	14 Medicinal, biochemical and genetic resources	Medicinal products;
Coca *	*Erythroxylum coca*	Leaves;	1 Habitat creation and maintenance 2 Pollination and dispersal of seeds / propagules 14 Medicinal, biochemical and genetic resources 15 Learning and inspiration 16 Physical and psychological experiences 17 Supporting identities	Medicinal products (also cash-crop);
Coco *	*Cocos nucifera*	Fruits;	1 Habitat creation and maintenance 2 Pollination and dispersal of seeds / propagules 12 Food and feed	Food;
Cocona *	*Solanum sessiliflorum*	Fruits;	1 Habitat creation and maintenance 2 Pollination and dispersal of seeds / propagules 12 Food and feed 17 Supporting identities	Food;
Granadilla *	*Passiflora sp.*	Fruits;	1 Habitat creation and maintenance 2 Pollination and dispersal of seeds / propagules 12 Food and feed	Food;
Guaba *	*Inga edulis*	Fruits;	1 Habitat creation and maintenance 2 Pollination and dispersal of seeds / propagules 12 Food and feed	Food;
Guanabana *	*Annona muricata*	Fruits;	1 Habitat creation and maintenance 2 Pollination and dispersal of seeds / propagules 12 Food and feed	Food;
Guayaba *	*Psidium guajava*	Fruits;	1 Habitat creation and maintenance	Food;

			2 Pollination and dispersal of seeds / propagules 12 Food and feed	
Huaca	*Clibadium remotoflorum*	Leaves;	14 Medicinal, biochemical and genetic resources 17 Supporting identities	Biochemicals (e.g. toxin for fishing);
Huacapu	*Minquartia guianensis*	Bark; Timber;	13 Materials, companionship and labour 14 Medicinal, biochemical and genetic resources	Medicinal products (Bark); Construction materials (Timber);
Huacapurana	*Campsiandra angustifolia*	Bark;	14 Medicinal, biochemical and genetic resources	Medicinal products;
Huacrapona	*Socratea sp. & Iriartea deltoidea*	Leaves; Timber;	13 Materials, companionship and labour	Construction materials (e.g. roof thatch and timber);
Huayruro	*Ormosis coccinea*	Seeds;	13 Materials, companionship and labour 15 Learning and inspiration 17 Supporting identities	Ornamentals (e.g. seed neckless);
Huaruma	*Ischnosiphon arouma & I. puberulus*	Stem;	13 Materials, companionship and labour 15 Learning and inspiration 17 Supporting identities	Utensils (e.g. fibber for baskets);
Huasai	*Euterpe oleracea & E. precatoria*	Fruits; Leaves; Timber;	1 Habitat creation and maintenance 12 Food and feed 13 Materials, companionship and labour	Food (fruits and heart-of-palm); Construction materials (e.g. roof thatch and timber)
Huito	*Genipa americana*	Fruits;	13 Materials, companionship and labour 14 Medicinal, biochemical and genetic resources 16 Physical and psychological experiences 17 Supporting identities	Biochemicals (e.g. body paint); Medicinal and Ritual products;

Leche caspi	*Couma macrocarpa*	Sap; Fruits;	12 Food and feed 13 Materials, companionship and labour 14 Medicinal, biochemical and genetic resources	Medicinal products (Sap); Food (Fruits); Biochemicals (Sap, e.g. latex and resin);
Macambo	*Theobroma bicolor*	Fruits; Seeds;	12 Food and feed	Food;
Maní *	*Arachis hypogaea*	Seeds;	2 Pollination and dispersal of seeds / propagules 12 Food and feed	Food;
Ojé	*Ficus insipida*	Sap; Bark;	1 Habitat creation and maintenance 13 Materials, companionship and labour 14 Medicinal, biochemical and genetic resources 15 Learning and inspiration 16 Physical and psychological experiences 17 Supporting identities	Medicinal products (Sap); Utensils (Bark, e.g. fibber for clothes);
Palta *	*Persea americana*	Fruit;	2 Pollination and dispersal of seeds / propagules 12 Food and feed	Food;
Papaya *	*Carica papaya*	Fruit;	2 Pollination and dispersal of seeds / propagules 12 Food and feed	Food;
Pijuayo *	*Bactris gasipaes*	Fruit;	2 Pollination and dispersal of seeds / propagules 12 Food and feed	Food;
Piri piri	*Cyperus laxus*	Root;	14 Medicinal, biochemical and genetic resources	Medicinal products;
Pona	*Iriartea deltoidea*	Timber;	13 Materials, companionship and labour	Construction materials; Utensils (e.g. house tools);

Quinilla	*Manilkara bidentata*	Bark;	14 Medicinal, biochemical and genetic resources 17 Supporting identities	Medicinal products;
Renaco	*Ficus sp.*	Sap;	14 Medicinal, biochemical and genetic resources 15 Learning and inspiration	Medicinal products;
Remo caspi	*Aspidosperma excelsum*	Bark; Timber;	13 Materials, companionship and labour 14 Medicinal, biochemical and genetic resources 17 Supporting identities	Medicinal products (Bark); Construction materials (Timber);
Sacha inchi *	*Plukenetia volubilis*	Seeds;	2 Pollination and dispersal of seeds / propagules 12 Food and feed	Food (also Cash-crop);
Sangre de Grado	*Crotom lechleri*	Sap;	14 Medicinal, biochemical and genetic resources	Medicinal products;
Shiringa	*Hevea guianensis*	Sap;	1 Habitat creation and maintenance 13 Materials, companionship and labour 14 Medicinal, biochemical and genetic resources	Biochemicals (e.g. látex);
Tamshi	*Heteropsis sp. & Thoracocarpus bissctus*	Roots;	1 Habitat creation and maintenance 13 Materials, companionship and labour 14 Medicinal, biochemical and genetic resources 15 Learning and inspiration 17 Supporting identities	Utensils (e.g. fibber for baskets); Medicinal and Ritual products;
Toé *	*Brugmansia suveolens*	Leaves; Flowers; Seeds;	2 Pollination and dispersal of seeds / propagules 14 Medicinal, biochemical and genetic resources	Medicinal and Ritual products;

			15 Learning and inspiration 16 Physical and psychological experiences 17 Supporting identities	
Topa	*Ochroma pyramidale*	Timber;	13 Materials, companionship and labour	Construction materials;
Tornillo	*Cedrelinga cateniformis*	Timber;	13 Materials, companionship and labour	Construction materials;
Uña de gato	*Uncaria guianensis*	Bark;	14 Medicinal, biochemical and genetic resources	Medicinal products;
Uvilla de monte	*Pourouma minor*	Fruits;	12 Food and feed	Food;
Wingo	*Crescentia cujete*	Fruits;	1 Habitat creation and maintenance 13 Materials, companionship and labour 15 Learning and inspiration 17 Supporting identities	Utensils (e.g. recipients);
Yarina	*Phytelephas macrocarpa*	Fruits; Leaves;	1 Habitat creation and maintenance 12 Food and feed 13 Materials, companionship and labour	Food (Fruits); Construction materials (e.g. roof thatch);
Zapote *	*Matisia cordata*	Fruits;	1 Habitat creation and maintenance 12 Food and feed	Food;
Main Cultivars (Staple Crops) *			**Varieties**	
Plátano	*Musa spp*	Fruits;	2 Pollination and dispersal of seeds / propagules 12 Food and feed 14 Medicinal, biochemical and genetic resources	16 varieties (africano, bellaco, bogotano, capirona, coto, filipino, guineo, isla, isleño,

			16 Physical and psychological experiences 17 Supporting identities	kindiu, manzana, pildorita, prata, sapucho, seda, tosquiño)
Yuca	*Manihot esculenta*	Roots;	2 Pollination and dispersal of seeds / propagules 12 Food and feed 14 Medicinal, biochemical and genetic resources 16 Physical and psychological experiences 17 Supporting identities	***Yuca dulce*** - 7 varieties (arawuana, indio, lombriz, señorita, tres mesino, veja, verde); ***Yuca brava -*** 5 varieties (waira, lupuna, mandioca, motelo, santa rita)
* Found in *chacras* and/or *purmas*				

APPENDIX 6.A: Ascension's Questionnaire

Adapted from NCA project survey across UK South Atlantic Overseas Territories (Bormpoudakis et al., 2019).

NATURAL CAPITAL ASSESSMENT

Public Survey on ASCENSION'S NATURAL ENVIRONMENT

January 2019

Dear Resident,

The Natural Capital Assessment Project (NCA) is conducting a survey about the people's views and relationships with the natural environment across Ascension Island, as part of the UK South Atlantic Overseas Territories. This project is run by the South Atlantic Environmental Research Institute (SAERI) in collaboration with researchers from the University of Kent (UK) and funded by the UK Government's Foreign & Commonwealth Office.

The NCA project aims to support decision-making in the sustainable management of these territories' natural environment, from which humans derive a wide range of economic and cultural benefits that sustain their well-being. To assist with the economic development and environmental protection of these territories, the NCA project recognises then the importance of integrating people's views and preferences in the spatial planning of marine and terrestrial areas.

With your participation, we hope to identify the areas of the Island's terrestrial and marine environment that are important for the community and to understand the Islander's priorities for the sustainable management of their natural environment. Your participation is fundamental to understand people's relationship with the Island's natural environment, what particular features people value the most and those qualities that make those important or special for them.

We are delighted that you consider to participate on this survey. The survey should be answered by **ONE** resident of the Ascension Island **AGED 16** years or over. Please answer with as much or as little detail as you can, knowing that every response really counts for us!

All responses will be anonymised. Results will be published and made publicly available, if you would like to hear about the findings please give your details at end, for **staying in contact!**

If you would like to recommend another participant for this survey, or if you require any further information, please do not hesitate to contact me.

Yours sincerely,
Joana Canelas

Natural Capital Project, Research Assistant
School of Anthropology and Conservation
University of Kent, United Kingdom
Email: *jfc21@kent.ac.uk*
Phone: *24746516*

The South Atlantic Environmental Research Institute

SAERI is an academic organisation conducting research in the South Atlantic from the tropics down to the Antarctica. It's remit includes the natural and physical sciences. It aims to conduct world class research, teach students, and build capacity within and between the South Atlantic Overseas Territories.
You can find out more at: *http://www.south-atlantic-research.org/*

1

CULTURAL VALUES AND INTERACTIONS WITH ASCENSION'S NATURAL ENVIRONMENT

Q1. What WORDS or PHRASES would you choose to describe Ascension's NATURAL ENVIRONMENT? *Choose any words or phrases that come spontaneously to you.*

Q2. What WORDS or PHRASES would you choose to describe your RELATION to this NATURAL ENVIRONMENT? *Choose any words or phrases that come spontaneously to you.*

Q3. Which places do you feel best capture the 'ESSENCE' of Ascension's NATURAL ENVIRONMENT?

- *Try to think of **THREE** places, terrestrial or maritime, that capture this essence.*
- *Please mark and number these on map (MAP 1 - ESSENCE).*
- *In boxes below, please briefly explain these choices.*

PLACE 1:

PLACE 2:

PLACE 3:

Q4. Are there any features of the Ascension's NATURAL environment that you would consider a particularly important part of its HERITAGE? *Try to be as specific as you can.*

- *These might include particular types and areas of the island's terrestrial and maritime landscape, as well as specific types of animal or plant life.*
- *Please, briefly explain these choices.*

Q5. Are there any features of the Ascension's BUILT environment that you would consider a particularly important part of its HERITAGE? *Try to be as specific as you can.*

- *These might include particular historical sites, buildings or monuments or more general aspects such as architecture.*
- *Please, briefly explain these choices.*

Q6. Are there any species of ANIMALS, terrestrial or marine, that you consider particularly important or representative of Ascension's NATURAL ENVIRONMENT? *Please, briefly explain these choices.*

Q7. Are there any species of PLANTS OR VEGETATION TYPE that you consider particularly important or representative of Ascension's NATURAL ENVIRONMENT? *Please, briefly explain these choices.*

Q8. What is your employment status? *Tick the box that best applies.*

Full-time paid work (+30h per week)		Retired	
Part-time paid work		Unemployed (seeking work)	
Full-time education		Unemployed (not seeking work)	
Self-employed		Other: _____	

NOTE: If 'unemployed', please go to **Question 13.**

Q9. What do you do for a living? *If you have more than one job, please list them all.*

1. First Job _____
2. Second Job _____
3. Third Job _____

Q10. How often does GOING OUTSIDE feature in your typical WORK ROUTINES? *Circle the box that most applies.*

Never	Very rarely	Quite Often	Most days	Every day	All the time

NOTE: If 'never', please go to **Question 13**.

Q11. When you spend time <u>WORKING OUTDOORS</u> is this primarily occurring:

In your settlement / village / town?	
In the wider vicinity of your settlement / village / town?	
Generally further afield: over extensive distances?	
All over the Island: both near and far?	
In the sea, around the coast?	
On the sea, either inshore or offshore?	

Please can you tell a bit about the kind of work you do that takes you outdoors:

Q12. To what extent do you agree with the following statements? *Tick the box that best applies.*

*As I spend time **WORKING OUTDOORS** I often experience feelings of…*

	Strongly agree	*Tend to Agree*	*Neither Agree nor Disagree*	*Tend to Disagree*	*Strongly disagree*
Tranquillity, inner peace & contentment					
Freedom, escape &independence					
Exhilaration, excitement & stimulation					
Achievement, accomplishment & purpose					
Belonging & attachment					

If you feel able to expand on any of your responses, please do so here:

Q13. As you go about your WORK, are there any places in the NATURAL ENVIRONMENT that you have come to feel are particularly special, significant or important to you?

- *Try to think of **THREE** places, terrestrial or maritime, that are in some way significant.*
- *Please mark and number these on map (MAP 2 – WORK).*
- *In boxes below, please briefly explain these choices.*

PLACE 1:

PLACE 2:

PLACE 3:

Q14. Is spending TIME OUTDOORS a feature of your LEISURE time?

Yes	No

***NOTE**: If 'NO', please go to **Question 21**.*

Q15. Excluding holidays and vacations, HOW FREQUENTLY do you spend your FREE TIME OUTDOORS? *Please circle the box that most applies.*

Less than once a month	Most weeks	Most days	Everyday	All the time

Q16. Excluding holidays and vacations, WHERE do you mostly spend your FREE TIME OUTDOORS? *Please circle ALL boxes that apply.*

In and around your settlement / village / town?	
In the wider vicinity of your settlement / village / town?	
Generally further afield: over extensive distances?	
All over the Island: both near and far?	
In the sea, around the coast?	
On the sea, either inshore or offshore?	

Q17. Do you ever participate in the following? *Please circle ALL boxes that apply.*

Ascension's Day Celebrations	Sports Final's Day
Christmas Float Parade	Other Calendar Events

If 'OTHER', please specify: _____

Q18. Do you spend your free time doing any of the following OUTDOOR ACTIVITIES?

	ACTIVITY	*Tick all that apply*	*Tick if major activity*
1	*Walks / gentle strolls around nearby nature spots*		
2	*Long distance trekking / hiking (incl. letterboxing, geocaching)*		
3	*Running (incl. jogging, marathon or half marathon)*		
4	*Cycling or mountain biking*		
5	*Motocross*		
6	*Off-roading / Dirting*		
7	*Camping*		
8	*Eating in the natural environment (e.g. barbeques, picnics, etc)*		
9	*Creative activities in a natural setting (e.g. photography or painting)*		
10	*Sitting & Contemplation of natural scenes*		
11	*Practising Faith or Religious Activities*		
12	*Informal wildlife watching (e.g. birdwatching, whale or shark watching)*		
13	*Recording / Documenting wildlife or environment*		
14	*Environmental conservation (e.g. beach cleaning, tree planting)*		
15	*Growing fruit, vegetables or herbs in a kitchen garden / allotment*		
16	*Foraging for food (e.g. wild berries) or medicine (e.g. aloe)*		

17	*Collecting plants – Ornamental*		
18	*Dog walking*		
19	*Playing Golf*		
20	*Climbing / Bouldering*		
21	*Practicing Yoga or Meditation*		
22	*Outdoor team sports (e.g. football, cricket, softball)*		
23	*Kayaking*		
24	*Wind and kite-surfing, paddle boarding*		
25	*Swimming in the Sea*		
26	*Swimming in outdoor pool*		
27	*Diving*		
28	*Snorkling*		
29	*Coastal / Rock fishing*		
30	*Inshore Sea fishing*		
31	*Offshore Sea fishing*		
32	*Spearfishing*		
33	*Shooting / Rifling*		
34	*Hunting (e.g. rabbits and pheasants)*		
35	Other, please specify: _____		

Q19. Do the activities above involve you taking part in any organised groups / clubs?

Yes	No

If **'YES'** please specify the groups/clubs: _____

Q20. To what extent do you agree with the following statements? *Tick the box that best applies.*

As I spend my LEISURE time outdoors I often experience feelings of…

	Strongly agree	*Tend to Agree*	*Neither Agree nor Disagree*	*Tend to Disagree*	*Strongly disagree*
Tranquillity, inner peace & contentment					
Freedom, escape &Independence					
Exhilaration, excitement & stimulation					
Achievement, accomplishment & purpose					
Belonging & attachment					

If you feel able to expand on any of your responses, please do so here:

Q21. As you spend LEISURE time outdoors, are there any places in the NATURAL ENVIRONMENT that you feel are particularly special, significant or important to you?

- *Try to think of **THREE** places, terrestrial or maritime, that are in some way significant.*
- *Please mark and number these on map (MAP 3 – LEISURE).*
- *In boxes below, please briefly explain these choices.*

PLACE 1:

PLACE 2:

PLACE 3:

Q22. In general, would you say you spend as much time outdoors as you would like?

Yes	No

Q23. What sort of reasons might stop you spending time outdoors? *Please, circle all boxes that apply.*

Weather	Poor health / disability	Lack of companion	Access to transport
Time / Other priorities	Safety concerns	Lack of suitable places	Other

If '**OTHER**', please specify: _____

Q24. Do you do any of the following <u>INDOOR</u> based activities?

ACTIVITY	*Tick all that apply*	*Tick if major activity*
Painting and drawing the natural world (e.g. landscapes, wildlife)		
Attending talks or events about the Island's landscape, environment and wildlife		
Displaying pictures or photographs of natural scenes from Ascension in your home		
Preparing and eating local produce from Ascension (e.g. fresh tuna)		
Creating arts and crafts using local natural materials		
Using natural products for medicinal or spiritual purposes		
Other, please specify: _____		

Q25. How do you source MOST of your FOOD CONSUMPTION? *Please circle the box that best applies.*

Buy Local Products	Buy Imported Products	Own Food Production	Own Catch / Hunt

If 'Buy Imported Products', please specify their main origin: _____

Could you please describe the main ingredients of your househod diet? Give three examples.

Q26. Are there any places in the NATURAL ENVIRONMENT that you feel NEGATIVE about?

- *Try to think of **THREE** places that you feel negative about in some way. These may be, for instance: places you feel are important but changing for the worse, neglected or challenged; OR places you feel are unpleasant, disagreeable or threatening.*
- *Please mark and number these on map (MAP 4 – NEGATIVE).*
- *In boxes below, please briefly explain these choices.*

PLACE 1:

PLACE 2:

PLACE 3:

Q27. Overall on a scale of 1-10 *(where 1 = not at all and 10 = completely):*

	Value (1 to 10)
How satisfied are you with life nowadays?	
How anxious did you feel yesterday?	
To what extent do you feel that the things you do in your life are worthwhile?	
How happy did you feel yesterday?	

About Respondent

Place of residence: _____
In total, how long have you lived on the Island? _____ Years

Is this your first time living here?	No	Yes	If NO, please specify: _____
Did you grow up in Ascension?	No	Yes	If NO, please specify where: _____
Have you ever lived outside Ascension?	No	Yes	If YES, please specify where: _____

Why did you move to Ascension? *Please circle the box that best applies.*

Job Appoitment	Accompanying Family	Other, please specify: _____

What is your highest level of education attainment? *Please circle the box that best applies.*

Primary	Secondary	Vocational	Higher Education

Gender:

Male	Female	Other

Age:

16-24	25-34	35-44	45-54	55-64	>65

How many people live in your household? _____ **How many under 16 years?** _____

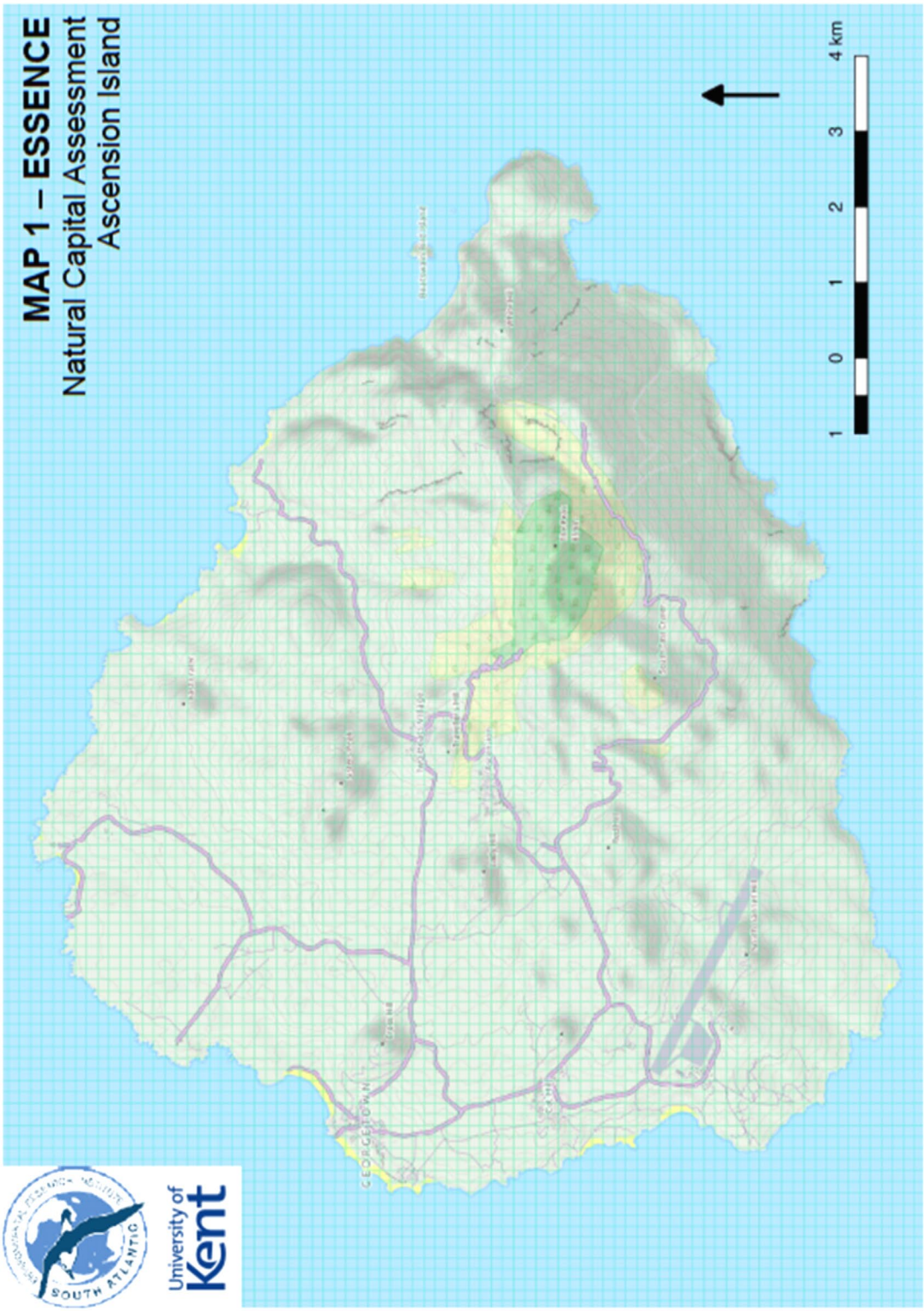
How would you describe your ethnicity? _____

THANK YOU FOR PARTICIPATING IN THIS SURVEY!

Staying in contact!
If you would like to hear directly about the findings of this survey please give your details below.

Please note these details will be separated from any information you provide in the survey.

Mapping Exercise



APPENDIX 6.B: Data Tables

Table 6.B1 - Sample population demographics, as percentage of surveyed population.

Gender		**%**
Female	34	**47.2**
Male	38	**52.8**
Place of residence		**%**
Georgetown	35	**48.6**
Travelers Hill	21	**29.2**
Two Boats	14	**19.4**
Other *	2	**2.8**
Age		**%**
16 – 24	10	**13.9**
25 – 34	17	**23.6**
35 – 44	15	**20.8**
45 – 54	13	**18.1**
55 – 64	15	**20.8**
>65	2	**2.8**
Up-Bringing		**%**
St. Helena	28	**38.9**
UK	29	**40.3**
Ascension	12	**16.7**
Other	3	**4.2**
Level of education		**%**
Higher Education	27	**37.5**
Secondary	28	**38.9**
Vocational	17	**23.6**
Total Result	**72**	**100.0**

** Includes people who live at US base and Residency*

Table 6.B2 - Frequency table for how often respondents work outdoors per gender, ethnicity, education level and age.

		Everyday	Most days	Quite often	Very rarely	Never
Gender	Female	7	6	3	6	10
	Male	18	4	6	3	3
Ethnicity	Other	0	0	1	0	1
	St. Helena	17	5	3	6	8
	UK	8	5	5	3	4
Ed. Level	Higher Ed.	5	6	5	3	5
	Secondary	12	2	2	6	5
	Vocational	8	2	2	0	3
Age	16 – 24	3	2	0	2	3
	25 – 34	4	3	4	3	2
	35 – 44	6	1	3	1	3
	45 – 54	7	3	1	1	1
	55 – 64	5	0	1	2	3
	> 65	0	1	0	0	1
	Total	**25**	**10**	**9**	**9**	**13**

Table 6.B3 – Frequency table for how often respondents spend leisure time outdoors per gender, ethnicity, education level, age and number of years living on Ascension.

		Everyday	Most days	Most weeks	Once a month
Gender	Female	14	10	9	1
	Male	18	8	12	0
Ethnicity	Other	1	2	0	0
	St. Helena	14	9	16	1
	UK	17	7	5	0
Ed. Level	Higher Ed.	16	8	3	0
	Secondary	8	9	11	0
	Vocational	8	1	7	1
Age	16 – 24	2	4	4	0
	25 – 34	9	5	3	0
	35 – 44	11	2	2	0
	45 – 54	2	5	6	0
	55 – 64	7	2	5	1
	> 65	1	0	1	0
Years on AI	< 1	6	3	1	0
	1 – 2	11	7	1	0
	2 – 10	2	3	3	0
	10 – 20	5	1	10	1
	> 20	8	4	6	0
	Total	**32**	**18**	**21**	**1**

Table 6.B4 – Frequency table for location of work outdoors per gender, ethnicity, education level and age.

		In town	Wider vicinity	Further afield	All over island	On the sea
Gender	Female	13	4	5	9	2
	Male	15	9	2	14	5
Ethnicity	St. Helena	19	8	2	13	3
	UK	8	5	4	9	4
	Other	1	0	0	0	0
Ed. Level	Higher Ed.	7	4	4	9	4
	Secondary	13	6	3	9	3
	Vocational	8	3	0	5	0
Age	16 – 24	3	2	1	4	1
	25 – 34	6	3	4	8	2
	35 – 44	3	4	0	4	2
	45 – 54	11	3	0	2	2
	55 – 64	4	0	2	5	0
	> 65	1	1	0	0	0
	Total	**28**	**13**	**7**	**23**	**7**

Table 6.B5 – Frequency table for location of leisure outdoors per gender, ethnicity, education level, age and number of years living on Ascension.

		In town	Wider vicinity	Further afield	All over island	In the sea
Gender	Female	21	5	6	19	19
	Male	13	3	8	24	25
Ethnicity	Other	2	0	0	3	3
	St. Helena	24	7	9	19	18
	UK	8	1	5	21	23
Ed. Level	Higher Ed.	11	2	5	18	20
	Secondary	16	5	7	14	17
	Vocational	7	1	2	11	7
Age	16 – 24	7	2	3	4	7
	25 – 34	6	0	4	12	15
	35 – 44	8	1	3	8	12
	45 – 54	5	3	1	9	4
	55 – 64	6	2	3	8	6
	> 65	2	0	0	2	0
Years on AI	< 1	3	0	2	7	8
	1 – 2	9	2	3	12	17
	2 – 10	3	0	3	5	5
	10 – 20	7	3	2	10	6
	> 20	12	3	4	9	8

Table 6.B6 – Classification key for categories of indoor and outdoor activities.

CATEGORIES OF INDOOR AND OUTDOOR ACTIVITIES	
Movement & Exercising	Long distance trekking / hiking
	Running (incl. jogging)
	Cycling or mountain biking
	Climbing or bouldering
	Practicing yoga outdoors
	Outdoor team sports (e.g. football)
	Playing golf
	Motocross
	Off-roading and dirting
Gathering & Contemplation	Walks around nearby nature spots
	Camping
	Eating outdoors (barbeques, picnics)
	Sitting and contemplation of natural scenes
	Dog walking
Producing & Subsistence	Growing food (e.g. allotment)
	Foraging for food or medicines
	Coastal and rock fishing
	Inshore sea fishing
	Offshore sea fishing
	Spearfishing
Caring & Understanding	Informal wildlife watching (e.g. birdwatching)
	Recording and documenting wildlife
	Environmental conservation (e.g. beach cleaning)
	Attending talks or events
Consuming & Displaying	Collecting ornamental plants
	Displaying pictures of Ascension's environment
	Prepare and eat local products
	Use local natural medicines
Creating & Expressing	Creative activities outdoors (e.g. photography)
	Painting and drawing natural scenes
	Create arts and crafts with natural materials
	Practising faith or religious activities outdoors
Water Sports	Kayaking
	Wind and kite-surfing
	Diving
	Snorkling
	Swimming in the sea
	Swimming in outdoor pool