

Faculty of Biological and Environmental Sciences
University of Helsinki

TOWARDS INCLUSIVITY IN ECOSYSTEM GOVERNANCE

THE EPISTEMIC DIMENSION OF HUMAN-NATURE
CONNECTIONS AND ITS IMPLICATIONS FOR
SUSTAINABILITY SCIENCE

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DOCTORAL DISSERTATION

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ABSTRACT

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Achieving just transformations towards sustainability requires the inclusion of diverse people and perspectives into ecosystem governance. Inclusivity can be approached through the concept of plurality, necessitating the development of techniques for eliciting and managing the different epistemic (knowledge related) understandings of human-nature connections and allowing for contestations of views. Collaborative modes of knowledge production are increasingly used to navigate complex interactions between science, society and policy to create actionable knowledges. They can provide gateways into further understanding epistemic plurality in ecosystem governance. However, despite the proliferation of these approaches, there is currently little evidence about how to recognise and deal with the plurality of diverse knowledges and associated power structures held at different scales of ecosystem governance and knowledge production.

This thesis approaches the question of inclusivity in sustainability science by introducing the epistemic dimension of human-nature connections and studying it in different contexts and at scales including local and transnational ecosystem governance and international science-policy interfaces. The thesis consists of four scientific articles which employ qualitative and quantitative methods in a mixed method research design.

Paper I reviews five key concepts used in collaborative transdisciplinary research and proposes an integrative model that can help researchers and research participants to align their epistemic and conceptual views in transdisciplinary collaborations. Using an online survey, **Paper II** examines the epistemic worldviews of experts involved in the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) Values Assessment and how the different epistemic worldviews shape definitions of the multiple values of nature.

Using semi-structured interviews and participant observation, **Paper III** explores the intersections between perceptions of local knowledges, place belonging and agency in the High Coast/Kvarken Archipelago World Heritage Site in Sweden and Finland and highlights the plurality of positions stemming from diverse knowledge-place connections. Drawing on the results of online surveys sent to residents of the area, **Paper IV** develops and validates a psychometric scale of epistemic bonding (connections to a place through one's knowledge of/in a locale), and then examines the relationships between

epistemic bonding, place attachment and ecosystem management preferences across the countries.

Together, these four papers demonstrate that epistemic issues pervade at different scales of ecosystem governance and knowledge production, and that they need to be accounted for processes aiming at sustainability transformations. In recognising the epistemic dimension of human-nature connections through operationalising reflexivity, the focus on place-based connections and practicing epistemically attuned sustainability science can support inclusivity in ecosystem governance by facilitating the recognition and navigation of such a plurality of the views.

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LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following publications:

Paper I Hakkarainen, V., Mäkinen-Rostedt, K., Horcea-Milcu, A., D'Amato, D., Jämsä, J., & Soini, K. (2021). Transdisciplinary research in natural resources management: towards an integrative and transformative use of co-concept. *Sustainable Development*, 1-17.
doi: 10.1002/sd.2276

Paper II Hakkarainen, V., Anderson, C. B., Eriksson, M., Riper, C. J. Van, Horcea-Milcu, A. & Raymond, C. M. (2020). Grounding IPBES experts' views on the multiple values of nature in epistemology, knowledge and collaborative science. *Environmental Science and Policy*, 105, 11–18.
doi: 10.1016/j.envsci.2019.12.003

Paper III Hakkarainen, V., Soini, K., Dessein, J. & Raymond, C. M. (2022) Place-embedded agency: Exploring knowledge-place connections for enabling plurality in governance of social-ecological systems.
[*In press in People and Nature*]

Paper IV Hakkarainen, V., Soini, K. & Raymond, C. M. The knowledge dimension of place attachment: Measuring epistemic bonding.
[*Manuscript in review*]

GLOSSARY OF KEY TERMS

Agency – broadly refers to a capacity to act and exert power; in this thesis understood in relational terms as emerging from interactions between actors and places, referred as place-embedded agency

Ecosystem governance – “the interactions among structures, processes, and traditions that determine how power and responsibilities are exercised, how decisions are taken, and how citizens or other stakeholders have their say in the management of natural resources - including biodiversity conservation” (IUCN, 2004)

Epistemic – ‘relating to knowledge/belief’

Epistemic bonding – connections to a place through one’s knowledge of/in a locale

Epistemic worldview – philosophical ideas about knowledge shaped by various external, epistemic and personal factors

Epistemology – concerns the questions of how knowledge is created, what is deemed as possible to know including how knowledge claims are constituted, acquired and validated

Human-nature connections – refers to various ways to connect to nature and human embeddedness in nature and the biosphere; can be conceptualised through the concept of social-ecological systems (SES)

Knowledge interaction – an umbrella term for interactions that relate to knowledge processes between different actors including e.g. knowledge (co-)production, creation, exchange, validation and use of it; the word interaction emphasises actor relations in which knowledge processes are being formed

Knowledge-place connections – interplay between knowledges and places and how they shape actors’ (knowledge) interactions and ultimately agency

Ontology – concerns metaphysical questions about the nature of being, existence and reality and what we can acquire knowledge about in the human world

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The visualisation of Figures 1-3 by Anne-Mari Lahtinen (2021), Figure 4 by Jussi Aho (2020)

1 INTRODUCTION

The central and necessary question in sustainability science is how we can create more fair, diverse and sustainable futures on Earth for all (Wyborn et al., 2020). To cope with the interconnected crises of rapid biodiversity loss, climate change and growing inequalities, knowledge systems need to go beyond creating knowledge about the world to creating wisdom about how to act appropriately within it (Fazey et al., 2020). We also need new ways of using and producing knowledges that are open, collaborative, diverse and equitable (Fazey et al., 2020; Lang et al., 2017; Norström et al., 2020). The search for alternatives to top-down and technocratic solutions for managing and governing ecosystems has been an integral part of the formulation of sustainability science and social-ecological systems research (Gunderson, 1999; Folke, 2006). The past decade has seen growing calls for more mainstream collaborative and transformative approaches to knowledge production. Pluralistic and integrative approaches for creating action-oriented knowledges can contribute to inclusive ecosystem governance and related just sustainability transformations (Caniglia et al., 2020; Coscieme et al., 2020; Tengö & Andersson, 2021; Tengö et al., 2017).

Acknowledgement of the need for diversity and inclusion is beginning to be reflected in the language that is used to describe processes related to current sustainability crises. Concepts that were previously used in singular forms are now being pluralised; for example, knowledges (Haraway, 1988), epistemologies¹ (Ludwig, 2021) and senses of place² (Raymond et al., 2021). Such pluralisation of concepts reminds us to be sensitive about diversity and to recognise the legitimacy of multiple views, perspectives and experiences in environmental decision-making without homogenising and abstracting the sustainability problems and their solutions.

Although many academics emphasise the need for the pluralisation of knowledge production and use, there is still limited understanding on how to unpack and deal with “the plural”. Recent scholarly debates point to the need to move beyond eliciting plural values and knowledge systems, to considering *how* this epistemic diversity can be handled in ecosystem governance (Scoones et al., 2020; Stirling, 2011; Turnhout et al., 2020). This requires situating knowledge production (Haraway, 1988; Cote and Nightingale, 2012) in the cultural, social, political and environmental realities in which different ways of knowing interact and are created, exchanged and applied.

Addressing epistemic plurality remains crucial in sustainability science, which often draws on the post-normal, Mode-2 and participatory views on science including

¹ Epistemologies in plural challenge the universalism of epistemology and knowledge production institutionalised in Europe and North America, which ignores the global diversity of epistemic practices (Koskinen and Ludwig, 2021, p. 17).

² Senses of place in plural imply an epistemic attitude that recognises multiple knowledge production strategies and the multiple place experiences in the global world. It helps to acknowledge people’s bonds to various places and translate complex global social-ecological problems into the local, place-based level (Raymond et al., 2021, p. 4).

actors outside academia in knowledge production through various ways of collaborative research (Fazey et al., 2018; Lang et al., 2012). These modes also employ multiple disciplinary perspectives and concepts in an attempt to understand and solve intertwined social and environmental issues (Blythe et al., 2017; Ludwig, 2021).

Multi, inter and transdisciplinary perspectives are also at the core of the current relational turn in sustainability science, which builds on humanities and social sciences and proposes a more dynamic and holistic approach to human-nature connectedness. Relational thinking shifts the focus to embedded relations of the social and ecological, and emphasises situated and diverse knowledges for decision-making (West et al., 2020). In collaborative settings of knowledge production, researchers need to deal with multiple differing agendas and views on change and differing visions on how it could be achieved. Differing, and at times contradictory, claims of knowledges and values are often influenced by specific interests or political views, which can lead to tensions among and between participants and researchers (Chambers et al., 2022). What is deemed as the “just” way to transform is always situated in social and political practices (I. M. Young, 1990).

The epistemic dimension of human-nature connections presented and explored in this thesis offers a lens to unpack the plurality in sustainability science. It refers to the relational ways in which our knowledges and perceptions of knowledges shapes our values of nature and our actions towards the environment. The epistemic dimension is the result of a mutual interplay between individuals, social groups, and place in the environment (based on Jasonoff, 2004 and Ludwig, 2021; see section 2.2.1). In this thesis I am open to a diversity of worldviews, including different perspectives on anthropocentrism (human-centred, instrumental motivations for protecting the environment) (Norton, 1984) and biocentric views (nature-centred, inherent or intrinsic motivations) (Callicott, 1985). However, through case insights I demonstrate the importance of a relational view that builds on the profound interconnectedness of “the social” and “the ecological” and the need to consider humans embedded in the biosphere (Folke et al., 2016).

Understanding and dealing with the plurality of views and knowledges requires focusing on the different scales in which knowledge interactions take place. The challenges of the Anthropocene are global, but effective solutions are often context-specific and take into account various lived realities and knowledges (Wyborn et al., 2020; Sterling et al., 2017). In informing ecosystem governance, sustainability science has struggled to understand how the diversity of human-nature connections operate at and across different spatial and institutional scales (Balvanera et al., 2017; Merçon et al., 2019; Sterling et al., 2017). Knowledges such as local or scientific knowledges cannot therefore be treated aspatially. We need to look at how knowledges are mobilised and translated at different scales and interfaces of ecosystem governance, which consequently includes different knowledge interactions such as co-creation, production and exchange of knowledges (Tengö et al., 2017; van der Molen, 2018).

The importance of place-based research is increasingly articulated in sustainability science in contrast to global Earth system approaches. Place-based research can

contribute to better understandings of global social-ecological dynamics and facilitate transformative changes through local scale actions and innovations (Balvanera et al., 2017; Moriggi et al., 2020). However, it still needs to further address the interactions, situatedness and agency of actors in different social-ecological systems, who are working within or across different geographic scales, and the respective implications for actions and decision-making (Cockburn et al., 2018).

Places are contested in meanings, emotions and views related to them, which creates power-laden settings in which some knowledge claims are privileged over others (Ingalls et al., 2019). Hence, there is a pressing need to interconnect the epistemic sphere to place, scales and to actors' interactions in order to understand whose knowledges and realities counts in ecosystem governance and what are the dynamics of epistemic coherence and contradictory at various scales and places (Ingalls & Stedman, 2016).

1.1 AIMS AND RESEARCH QUESTIONS

This Ph.D. thesis explores the epistemic dimension of human-nature connections, focusing particularly on knowledge interactions between diverse actors at different spatial and institutional scales which shape ecosystem governance.

My work is guided by the following broad research question:

How can different epistemic understandings of human-nature connections be reconciled in ecosystem governance at different scales?

I adopt two points of entry in this thesis: I engage with sustainability science as a research field aiming to contribute to better practice within the field. I also apply a sustainability science approach to study the dynamics of social-ecological systems. This approach is adopted in order to recognise the plurality of views and realities in these systems, and tries to reconcile different knowledges in environmental decision-making. By “reconcile” I mean a way to weave different forms and systems of knowledges in ways that respect their integrity and validity (Tengö et al., 2017) without seeking to integrate and conflate the different perspectives. Consequently, the thesis has two main objectives: to find ways to understand and navigate diverse epistemic understandings in i. inter and transdisciplinary collaborations and ii. ecosystem governance.

The thesis consists of four academic papers focusing on different scales of knowledge interactions. These include the international, transnational and local/regional scales. Through the different cases, I analyse the possibilities and limitations for the inclusion of various epistemic understandings in ecosystem governance, which is related to the ideal of pluralism presented in current sustainability science discussion. Together the papers inform what diverse epistemic understandings of human-nature connections in ecosystem governance mean for interactions between actors who operate at and across different scales of ecosystem governance and knowledge production (Figure 1).

The knowledge interactions (interactions that relate to (co-)creating, producing, exchanging or applying knowledges) are approached through various lenses including researchers in collaborative transdisciplinary research (**Paper I**), international academic experts in the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (**Paper II**), and managers and local inhabitants in regional and transboundary management of a UNESCO World Heritage Site in Sweden and Finland (**Papers III and IV**). The latter case has a specific focus on place and its role in shaping actors' knowledge interactions.

The individual research papers address the following research questions:

Paper I: How can co-creation of knowledge be conceptualised in natural resources management to allow space for a plurality of views and approaches in transdisciplinary research?

Paper II: How do different epistemic worldviews shape interdisciplinary collaborations at the international science-policy interface?

Paper III: How do inhabitants' place belonging and perceptions of local knowledges contribute toward knowledge interactions and agency regarding ecosystem governance at the regional scale?

Paper IV: What are the relationships between epistemic bonding and other dimensions of place attachment, and how do they together influence management preferences in a transboundary governance context?

Paper I and II relate to inclusive research practice in inter and transdisciplinary collaborations unpacking the plurality of underlying epistemic understandings in such processes (Figure 1). **Paper I** presents reviews of five 'co-concepts' used in transdisciplinary research (co-creation, co-production, co-design, co-learning and co-management) and creates a heuristic model that can help researchers and other participants to recognise and align their epistemic and conceptual views in transdisciplinary research processes. **Paper II** studies the epistemic worldviews of IPBES experts of the Values Assessment³ and illustrates how transformative and constructive experts' views are underrepresented and how the different epistemic worldviews shape the understanding of the Values Assessment process and definitions of multiple values of nature.

Paper III and IV engage with the question of inclusive ecosystem governance from the perspective of knowledge-place connections (Figure 1). **Paper III** delves into

³ the IPBES *Methodological Assessment regarding the Diverse Conceptualization of Multiple Values of Nature and its Benefits, including Biodiversity and Ecosystem Services*

the intersections between perceptions of local knowledges and place belonging in the High Coast/Kvarken Archipelago World Heritage Site, and discusses how these different experiences shape knowledge interactions and actors' agency. The **Paper III** introduces the concept of place-embedded agency to unpack a plurality of positions in ecosystem governance. **Paper IV** creates and validates a psychometric scale to measure epistemic bonding and compares it to the existing dimensions of place attachment. It investigates the contribution of epistemic bonding and existing dimensions of place attachment to inhabitants' views on how the site should be managed. The paper reveals how epistemic bonding can help to understand responses to different ecosystem management and governance strategies at the local and regional scales.

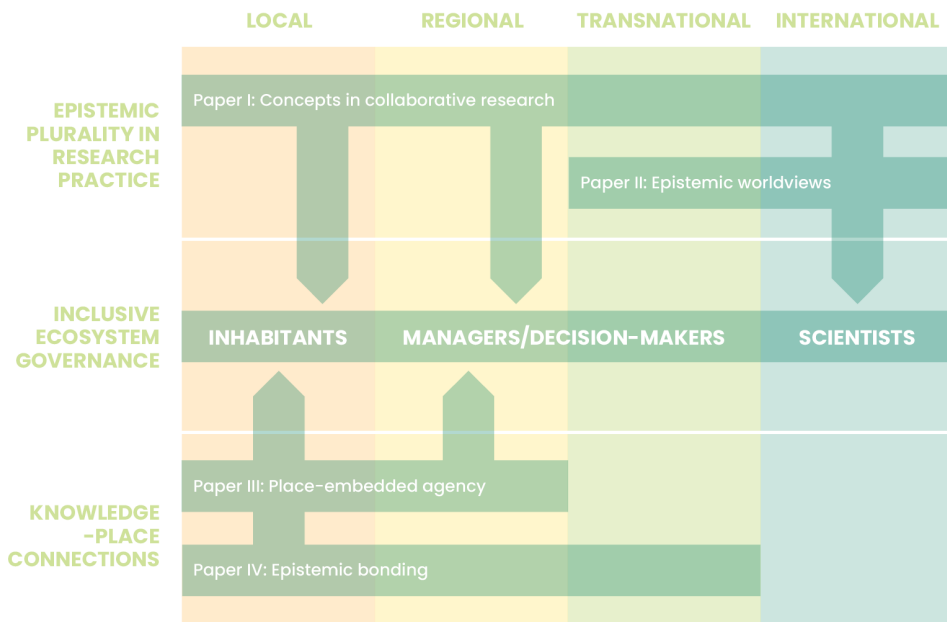


Figure 1. A summary of the scope of articles and their interconnections. The different actors groups are presented at the scales as studied in this thesis, not as in ecosystem governance/sustainability science settings in general.

In the following sections, I situate this thesis and the research questions in the field of sustainability science and recent developments therein. I focus on human-nature connections, the collaborative turn in knowledge production and the normative nature of sustainability science. I then explain in detail the epistemic dimension of human-nature connections by linking it to the plural ideas of knowledge production and the different scales in which knowledge interactions occur. This is followed by presenting the importance of place and sense(s) of place for shedding light on and situating knowledge processes. Later in the thesis, I outline my own ontological and epistemological starting points and provide an overview of the applied methods and their limitations. The thesis concludes with a summary of the key findings of the four academic articles and a discussion of their major contributions to sustainability science.

2 THEORETICAL FOUNDATIONS

2.1 SUSTAINABILITY SCIENCE

2.1.1 SCIENCE RESPONDING TO SUSTAINABILITY CRISES

Sustainability science has developed amidst amplified global and local sustainability challenges and crises (Steffen et al., 2011; Rockström et al., 2009; Clark &, 2020). These challenges require science to take a holistic look at the intertwined connections between humans and nature and adopt a more prominent role in solving the problems beyond simply producing knowledge about them (Kates, 2016). In the early 2000s sustainability science was framed as its own field (Kates et al., 2001; Clark, 2007; Kates, 2011). Sustainability science is often defined by “the problems it addresses rather than by the disciplines it employs” (Clark, 2007, p. 1737). Hence, it is inherently an interdisciplinary branch of science.

The early focus of sustainability science on understanding complex systems dynamics in a descriptive, analytical and problem-oriented manner has been enriched and shifted toward more transformative research agendas. These aim at producing usable knowledge, solutions, bridging and weaving together different knowledge systems and engage with multiple values and political interests (Chambers et al., 2021; Lang & Wiek, 2021; Norström et al., 2020; Tengö et al., 2014; Tengö et al., 2017; Wiek et al., 2012). Contrary to more conventional fields of science, sustainability science takes an action-oriented approach to knowledge production through interdisciplinary collaboration between natural and social sciences (and more recently art and design, see e.g. Galafassi, 2018; Rathwell & Armitage, 2016) and transdisciplinary approaches that deeply involve actors outside academia in problem formulation and knowledge production (Lang et al., 2012; Kates, 2016). These approaches diversify scientists’ roles in society and policy from detached observers to actively involved actors in shaping the world (Clark & Dickson, 2003; Folke et al., 2005; Wittmayer & Schöpke 2014).

At the same time with the growing number of sustainability science institutes and official education programmes (Haider et al., 2018; Salovaara et al., 2020), the field itself is under constant evolution. It is characterised by a vast heterogeneity of different approaches and normative, institutional, theoretical and methodological underpinnings for studying and solving the different aspects of the sustainability problems at different scales (Miller, 2013). Due to the diversity within the field, Nagatsu et al. (2020) propose that further the development of the epistemological, conceptual and normative value-based aspects should be at the core of sustainability science. Although these domains are overlapping, this thesis is mostly grounded in advancing understanding of the epistemological domain of sustainability science including methodology, inter and transdisciplinarity, as well as the science-policy interface (Nagatsu et al., 2020).

Currently, sustainability science is beginning to establish a relational approach to understand human-nature connections. West et al. (2020) introduced the idea of a relational turn for sustainability science, which shifts the focus from “[...] *interactions between entities, towards emphasizing continually unfolding processes and relations* [...]” when “the social” and “ecological” spheres are studied (p. 304). This means for example a further focus on seeing the human and nature in an embedded way beyond the dual categories of “social and ecological”, emphasis of ethics and care, and considering researchers positioned inside the world on the contrary to studying it from outside (West et al., 2021). The call of the authors for empirical accounts of knowledge production that prompt more situated and diverse knowledges in decision-making and going beyond the pre-existing categories resonates with this thesis. However, I align with Raymond et al. (2021) who consider that relational thinking needs to be pragmatic to be able to study and understand the relational dynamics of systems. Yet I emphasise that we need to be aware of how categories structure the ways we make sense of world, and that they should be treated in a flexible way as they are always partially and incompletely formed by people with diverse perspectives (Jones, 2009).

Justice through an epistemic lens

The state of sustainability science is constantly being discussed in relation to the outcomes and impact it aims to achieve outside academia. Although consisting of several different sub-fields (e.g. transition studies, resilience thinking, ecological economics, social-ecological approaches), the common goal of sustainability science is to achieve positive social and environmental changes, often conceptualised as sustainability transformations (Horcea-Milcu et al., 2020) or defined as fundamental changes in and across various domains. These include individuals’ mind-sets, attitudes, beliefs, social norms and practices, as well as institutions and political systems (Abson et al., 2017; O’Brien, 2012).

Recently, the sustainability transformations narrative has more explicitly engaged with the justice perspective which relates to the social consequences of transformations (Bennett et al., 2019; Lahsen & Turnhout, 2021; Martin et al., 2020). According to Bennett et al.’s (2019) conceptual work, just transformations produce radical shifts towards socially-just and environmentally sustainable outcomes through forced, emergent or deliberate processes in social-ecological systems. Just transformations require including different views in shaping the future and understanding the political nature of these views and future aspirations. For example, Blythe et al. (2018) argue for the *politicisation* and *pluralisation* of transformation discourse in sustainability science – to become aware and transparent about the political nature of transformative approaches, and to include multiple framings into transformation discourse to avoid it being narrated from one dominant perspective. Shrivastava et al. (2020) suggest that the focus on natural sciences within sustainability science research has hindered achieving transformative outcomes. Therefore, it is crucial to engage with arts, social sciences and humanities, and to embrace diverse epistemologies navigating the tensions stemming from them, as well

as challenge the current economic system ultimately behind the sustainability crises (Shrivastava et al., 2020).

With this in mind, I engage with the justice perspective primarily through the aspect of recognition (Young, 1990). Recognition can be seen to underpin both distributive (distribution of burdens and benefits) and procedural (fairness of and participation in decision-making processes) justice in environmental decision making (Martin et al., 2016; Ruano-chamorro et al., 2021). According to Fraser (2001), recognition as a part of justice refers to the status of group members as full partners in social interaction. It concerns socio-cultural diversity, such as values, identities, cultures, knowledges, institutions, power, capacities, and rights (Martin et al., 2016).

Seen through the epistemic lens, recognition is fundamental for avoiding epistemic injustice: “*The failure of mutual recognition explains how epistemic injustice is possible*” (Giladi, 2018, 153). Epistemic injustice means unjust acts against someone’s capacity as a knower, which touches upon individual’s epistemic self-esteem, self-confidence and status as epistemically responsible (Fricker, 2018). In this sense, it relates to epistemic agency and selfhood (Giladi, 2018), which are gained in a society through being accepted as a credible knower and to be able to make recognised knowledge claims (McConkey, 2004).

Epistemic injustices are shaped by the social and political structures and relations determining what counts as knowledge. Epistemological systems themselves can also contribute to epistemic injustice as through domination and oppression they can effectively exclude a credible knower (Wylie, 2011; Dübgen, 2015). Issues of epistemic recognition are strongly related to the critical questions posed in the recent scholarship on co-production of knowledge, such as; whose knowledges and values are involved in environmental decision-making; who is involved in or excluded from problem framings and finding solutions to them (Mach et al., 2019; Turnhout et al., 2020).

This thesis does not directly seek to manage power relations and conflicts between actors but to deeply explore and explain the potential contributions of knowledge and place constructs to ecosystem governance. In addressing the need for more inclusivity in knowledge processes regarding ecosystem governance and related sustainability transformations (Coscieme et al., 2020; Lam et al., 2020), this thesis seeks to identify ways of recognising and incorporating epistemic plurality. In the political arenas of ecosystem governance, power is grounded in multiple, sometimes competing, meanings of place and values which are formed, shaped and negotiated by different forms of knowledges (Raymond et al., 2021).

In summary, the recent developments in the sustainability science field call for a greater understanding of the plurality of perceptions and epistemologies included in knowledge production, as well as their implications for actual transformative outcomes to meet the goal of fair futures for all (Wyborn et al., 2020). Different types of knowledges should not be romanticised in ecosystem management and governance - for example, relying solely on local knowledges or scientific knowledges does not

automatically mean an ability to manage resources in equitable and sustainable ways. Instead, studying the epistemic dimension and related tensions offers a possibility to address inclusivity such as marginalisation of certain voices and views and contribute to the legitimacy of environmental decision-making (Baker & Constant, 2020).

The next sections closely examine three core characteristics of sustainability science that relate to the epistemic dimension: human-nature connections; collaborative approaches to knowledge production; and in-built normativity of sustainability science.

2.1.2 HUMAN-NATURE CONNECTIONS

One of the key entry points of sustainability science is to understand the world through intertwined human and natural domains and try to (re)-connect humans with nature (Ives et al., 2017). Humanity depends on - and is embedded in - the biosphere, but at the same time in the Anthropocene ecological processes cannot be explained without taking account human influences on them. This crosscuts and bounds together the cultural, social and economic contexts for ecosystem governance (Folke et al., 2016).

The social-ecological systems (SES) approach often applied in sustainability science, particularly in the resilience research tradition (e.g. Gunderson & Holling, 2002; Folke, 2006), describes human-nature connections through complex, interdependent and adaptive system dynamics between the social and ecological spheres. This results in the need to apply inter and transdisciplinary methods and approaches to understand SES (Gain et al., 2020). Social-ecological interactions take place in multiple spatial and temporal scales, which requires both place-based and global insights to inform their sustainable governance (Balvanera et al., 2017).

The SES model emphasises the inclusion of different ways of knowing and mutual learning to enable adaptive and collaborative management and governance of SES (e.g. Folke et al., 2005; Armitage et al., 2011; Schultz et al., 2011; Fabricius & Currie, 2015). It is based on the idea that technocratic top-down ways of governing do not adequately deal with the uncertainties, complexities, and unpredictability of SES. It has been widely accepted that ecosystem governance requires weaving different knowledge systems together for finding and implementing acceptable and legitimate solutions (Tengö et al., 2014, 2017).

The ecological systems thinking origin of the SES concept (Holling, 1978) has been criticised within numerous fields of social sciences including geography, political and human ecology, anthropology and sociology (Stojanovic et al., 2016). Critics question the ability of the SES focus to connect with “the social” in the system (e.g. Boonstra, 2016; Cote & Nightingale, 2012; Stone-Jovicich, 2015). This body of literature stresses the importance of further studying SES, including power dynamics, politics and situatedness of the ways knowledges are produced, shared and created in society, which has implications for positive changes aspired towards in the ecological and social spheres. Similarly, recent work focusing on relational thinking in sustainability science has highlighted the importance of better integrating “the social” and “the ecological” and further advancing the understanding on the human connectedness to nature (Hertz et al., 2020; West et al., 2021).

The key question is then how to organize the governance of ecosystems in ways that enhance the well-being of humans and nature, respect differences of communities and individuals as well as transform current unsustainable trajectories. Since knowledge processes in environmental decision-making increasingly look beyond science towards other types of knowledge systems, it is important to examine the relationships between different ways of knowing in various knowledge interactions (Rist et al., 2007;

Wyborn, 2015). Hence, including normative questions of what are the dominant perspectives in ecosystem governance and how individuals and local communities are included in the decision-making process concerning them (Wyborn, 2015; MacKinnon & Derickson, 2013) can advance SES scholarship.

In this regard, it is important to consider the inner worlds of individuals and groups including emotions, thoughts, identities and beliefs, and how these aspects are operationalised in different places to support certain views on future directions in the context of other perspectives (Ives et al., 2020; Ingalls et al., 2019). Sense(s) of place scholarship (section 2.3.3) sheds light on this subjectivity in SES, and bridges the human embeddedness in places as well as inner meanings that can be mobilised for socially and culturally-just transformations (Grenni et al., 2019; Stedman, 2016). The subjectivity and plurality in ecosystem governance stemming from place bonds is explored in **Papers III** and **IV**.

In this thesis, I use ecosystem governance as the overarching context in which decisions regarding the environment are made. Ecosystem governance refers to “*the interactions among structures, processes, and traditions that determine how power and responsibilities are exercised, how decisions are taken, and how citizens or other stakeholders have their say in the management of natural resources—including biodiversity conservation*” (IUCN, 2004). With this understanding of ecosystem governance in mind, **Paper I** focuses on natural resources management; **Paper II** on the expert context of IPBES and **Papers III** and **IV** on the management of the UNESCO World Heritage Site in a transnational management and governance context. In **Paper IV**, I refer to ecosystem management and focus more on the day-to-day activities concerning preserving and use of natural resources, rather than a set of rules and frameworks of governance.

2.1.3 COLLABORATIVE APPROACHES TO PRODUCING ACTIONABLE KNOWLEDGES

The question of how to best produce actionable knowledges has remained crucial and often unsolved with sustainability science studies (Clark et al., 2016). Both inter and transdisciplinary strategies contribute to understanding SES holistically, connecting science, policy and society. Interdisciplinary research refers to collaboration between scientists with different academic/scientific backgrounds (Freeth & Caniglia, 2020). Although not having one unified definition, transdisciplinary research involves collaboration with actors outside academia in addition to an interdisciplinary research team, in the problem formulation, knowledge production and implementation stages (Lang et al., 2012; Polk, 2015). This type of research acknowledges the need to deeply involve local actors and their knowledges for navigating and fostering change (van der Hel, 2016).

Related to transdisciplinary research, co-creation or co-production of knowledge (conceptual differences are discussed in **Paper I**) has increasingly been applied to support the production of actionable knowledges within sustainability science (e.g.

Lemos et al., 2018; Jagannathan et al., 2019; Mach et al., 2019; Norström et al., 2020; Chambers et al., 2021). The collaborative turn in knowledge production is based on the ideas of inclusivity, democracy and action in knowledge production. It can be linked to traditions such as Mode-2 or post-normal science, participatory (action) research, citizen science, participatory planning in addition to sustainability science (Fazey, et al., 2018; Nowotny et al., 2001). The collaborative mode within sustainability science emphasises interactive arrangements within science, society and policy, as well as diverse participation of actors in defining problems and knowledge production, which creates new relationships and legitimate solutions to tackle sustainability crises.

In collaborative, transdisciplinary and action-oriented processes, the role of researchers can take various forms (Wittmayer & Schöpke, 2014), which has implications for the methods, strategies and concepts applied (Blythe et al. 2017; Horlings et al. 2020). Consequently, the scholarship related to collaborative research is rich in the terminology, methods and aims, which makes it ambiguous (Chambers et al., 2021, further explored in **Paper I**). Recent literature has put great hopes on the co-productive domain of knowledge production to catalyse transformative changes. However, the critical co-production scholarship asserts that by overlooking aspects such as power and politics in collaborative processes, sustainability science can actually impede transformations toward sustainability (Turnhout et al., 2020), and that collaborative research has rarely demonstrated outcomes beyond the research process (Jagannathan et al., 2019; Lemos et al., 2018). This thesis explores interdisciplinary (**Paper II**) and transdisciplinary collaborations (**Paper I**) through an epistemic lens, which offers an underexplored dimension to understanding these collaborative processes on a deeper level shedding light on inclusion and recognition.

2.1.4 IN-BUILT NORMATIVITY

Science in general is always value-laden and political (Sayer, 2011). The focus on action and problem solving brings the normativity to the forefront within sustainability science (Wiek et al., 2012). This requires recognising and taking into account the epistemic and value plurality, which is amplified by inter and transdisciplinary collaborations (Laursen et al., 2021; Stirling, 2011). Miller (2013) describes this in relation to sustainability science: *"the challenge is to construct a science that is able to convey important information in a way that allows a plurality of values and understandings to emerge"* (p. 290).

Researchers' different ontological and epistemological beliefs are at the foreground of this normativity, and shape what kinds of questions are asked and what kinds of evidence is considered valid in answering the questions (van der Hel, 2018). However, previous studies have not examined how epistemic worldviews shape one's understandings of the multiple values of nature. This is the starting point for **Paper II** which unpacks knowledge interactions at the global scale science-policy interface (IPBES) which in turn affect understandings of human-nature relationships.

Multiple conceptualisations used within sustainability science, such as ‘desirable state’, ‘tipping point’ and ‘transformation’, imply a subjective judgement of the direction for a sustainable future and reflect the normative nature of action-oriented science (Stedman, 2016). This context requires asking the following reflexive question about scientific impact: “*who benefits and loses from that, and how this can be justified*” (Turnhout, 2018, p. 368). The persistent challenge is thus to understand and navigate this plural sphere of normative interactions and mobilise action-oriented knowledges (Caniglia et al., 2020) in a way that they embrace diversity (Fazey et al., 2020) and are able to challenge existing power dynamics and hegemonies (Shrivastava et al., 2020). The need for the inclusion of epistemic plurality in shaping the futures creates the baseline for this thesis as elaborated in **Papers I-IV**.

The next sections delve into the specific conceptual and theoretical underpinnings of the notions of knowledges, scales and place used in this thesis.

2.2 KNOWLEDGE AND PLURALITY

2.2.1 THE EPISTEMIC DIMENSION OF HUMAN-NATURE CONNECTIONS

In recent years, knowledge-related scholarship has been blooming in the field of sustainability science (Apetrei et al., 2021). Knowledge is recognised as one of the most crucial aspects in the failure or success in achieving positive changes toward sustainability in the world. For example, Abson et al. (2017) identify re-thinking the ways knowledge are produced as one of the three main areas of focus in catalysing sustainability transformations. Knowledge processes - the ways knowledge is created, shared and used – are part of ecosystem governance. Being able to understand what kinds of views are presented, where they come from and how different ways of knowing are informed by differing values and political interests can enable legitimate and well-informed governance arrangements. This ideally contributes to balancing conservation of the natural environment and the utilisation of resources in a sustainable way (van der Molen, 2018). The term *knowledge interaction* used in this thesis helps to see knowledge processes and governance arrangements fundamentally stemming from actors' relations and interactions.

Epistemology refers to the ways we create knowledge and what we deem as possible to know including how knowledge claims are constituted, acquired and validated (Moon & Blackman, 2014). In other words, it refers to understanding how we come to know what we know. In Ludwig's (2021) words "*different ways of producing knowledge reflect different ways of being in the world [...]*" (p.6), which links epistemology to values and beliefs about the world determining views on what is possible to know about it (ontologies). In a similar vein, Foucault (1980) describes how knowledge processes are fundamentally tied to power relations and thus never neutral. While knowledge itself is an extremely contested concept, in this thesis, I approach it through seeing knowledge as processes of perception, acting and being with others (Ingold, 2011). I understand knowledge as a justified belief used to claim a truth (Jacobson, 2007). The truth or falsehood of knowledge is not a determining feature of knowledge but the acceptance of it in a context based on different sets of criteria (van Kerkhoff & Lebel, 2006). Widespread acceptance within society is what determines a 'credible knower', while knowledge is determined by the ways in which a given society acknowledges knowledge claims (McConkey, 2004). The phrase 'different ways of knowing' highlights how knowledge is always situated and intertwined with culture, power, values and beliefs (Harris, 2007).

The reason why knowledge is such a fundamental part of being a human and relating to our surroundings is described by Sheila Jasonoff (2004, p. 2-3) as:

“[...] the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it. Knowledge and its material embodiments are at once products of social work and constitutive of forms of social life; society cannot function without knowledge any more than knowledge can exist without appropriate social supports.”

In particular, Jasonoff describes the role of social processes in shaping knowledge. Similarly, also knowledge about environment shapes actions within it, or in other words, knowledge represents the environment at the same time when it constitutes the environment (Turnhout et al., 2016).

What is the epistemic dimension of human-nature connections? By conceptualising the knowledge sphere of human-nature connections with the notion of ‘epistemic’, I include not only knowledges into the consideration but also perceptions of them, their creation and validation. The word epistemic means “relating to knowledge/belief” including its extent, linguistic expression and degree of validation (Hazlett, 2016). My definition of the epistemic dimension of human-nature connections draws on Jasonoff’s (2004) notion of knowledge as an inseparable part of living and Ludwig’s (2021) notion of epistemology as a reflection of being in the world.

The epistemic dimension of human-nature connections includes:

- i. the ways our knowledges and perceptions of different knowledges shape our relationships, motivations and actions toward nature including decision-making concerning it
- ii. the ways in which knowledges and perceptions of knowledges are shaped by nature
- iii. the processes behind how different knowledge claims related to decision-making about nature are being justified at and across different scales and interfaces in knowledge interactions

I argue that the particular focus on the epistemic dimension of human-nature connections helps us to achieve a deep level understanding of complex social-ecological problems (Abson et al., 2017) and recognise the plurality of views to inform inclusive ecosystem governance.

2.2.2 PLURALISATION OF KNOWLEDGE

The current call for pluralisation (Caniglia et al., 2020; Fazey et al., 2020; Turnhout et al., 2020) or multiplicity (Zanotti & Palomino-Schalscha, 2016; Turnhout & Purvis, 2020) of knowledge production and participation within sustainability science recognises that knowledges are always partial and stresses the need to situate knowledge production in the world that is plural containing many expressions, meanings, realities and epistemic and ontological underpinnings (Escobar, 2018).

Multiple conceptualisations of knowledges are present within sustainability science (Apetrei et al., 2021). One of the main ways to approach the plurality of knowledges is through the concept of knowledge systems (e.g. Cornell et al., 2013), which can be defined as social systems which encompass knowledge claims, groups of actors and ways of creating and exchanging knowledge, which constitute a particular worldview or perspective on reality (van der Molen, 2018). However, sharp divisions between knowledge systems have long been deemed artificial and overly simplistic due to the subjective nature of knowledges based on personal interpretation and different contexts shaping individuals' understandings (Raymond et al., 2010). For example, Agrawal (2009, p. 157) argues *“after all, knowledge can be useful or useless, politically salient or meaningless, socially relevant or irrelevant, empirically testable or irrefutable, and ideologically open or blind, without reference to whether it is indigenous or scientific”*.

It is crucial to realise that multiple conceptualisations of knowledge-related systems and processes may actually reflect the uncertainty around understanding how humans think, as pointed out by Varghese and colleagues (2020). They cite Minsky (1986 p. 39): *“the things we deal with in practical life are usually too complicated to be represented by neat, compact expressions. [...] one must not mistake defining things for knowing what they are.”* Therefore, through conceptualisations and definitions we can structure phenomena, such as knowledges, to be study and talk about different aspects of them, while perhaps not fully grasping them.

The critical question remains how to work together and embrace inclusivity, with Bruno Latour (2010, p. 473–474) suggesting that: *“things have to be put together while retaining their heterogeneity.”* This idea of plurality seeks alternatives for the integration of knowledges, which often tend to prioritise one type of knowledge – typically Western scientific and expert – as the dominant perspective (Mistry & Berardi, 2016; Tengö et al., 2014). An emphasis on diversity alone along the lines of knowledge integration risks overlooking the tensions between heterogeneous epistemic communities and various ontologies and values (Ludwig, 2021).

The discussion about knowledge interactions between scientists and with actors outside academia highlights the need for various epistemologies in defining the normative goals of sustainability science regarding transformations beyond scientific knowledges created in Western societies (Johnson et al., 2016; Lam et al., 2020; Watson, 2013). Pluralisation of epistemologies is crucial within interdisciplinary collaborations between scientists as well. Blythe et al. (2018, p. 1217) write:

“emphasising plurality is particularly important for environmental sustainability discourse since contributions from the social sciences are largely dominated by environmental social scientists with positivist epistemologies.” Epistemological pluralism recognises the multiple ways of knowing which contribute to understanding and managing complex social-ecological issues (Miller et al., 2008). It *“creates scope to highlight differences and, enable the contestation of interests, views, and knowledge claims”* (Turnhout et al., 2020, p. 18), which, if properly recognised, enables inclusivity.

2.3 KNOWLEDGE INTERACTIONS AT SCALES AND IN PLACES OF ECOSYSTEM GOVERNANCE

The environmental crises such as biodiversity loss and ecosystem changes amplified by climate change are simultaneously global and local in their nature. Drivers of ecosystem change include different land use practices, policies and agreements, which can have both global and local consequences (Reid et al., 2006). Therefore, the epistemic dimension of human-nature connections manifests itself at different scales of ecosystem governance in which different institutions of decision-making and knowledge production operate. This thesis includes international scale knowledge interactions (**Paper II**) and the local, regional and transnational scales (**Paper III and IV**) to understand the dynamics of the epistemic dimension. **Paper I** has a cross-cutting focus as it concerns transdisciplinary processes which can take place at different scales.

While the international scale does not represent one physical place, the local and regional scales are tightly connected to place-based research, which can also inform decision-making at the higher scales (Balvanera et al., 2017). According to Balvanera et al. (2017), place is crucial for different scales, through i) understanding how local insights can contribute to managing sustainability problems at higher scales; ii) triggering transformations at local and regional scales which can be up-scaled; and ii) enabling the co-construction of solutions drawing on biological and cultural knowledges in specific places to help cope with present and future global challenges. Hence, knowledge interactions taking various forms of negotiation, creation, exchange and validation need to be studied at and across different scales.

2.3.1 DEFINING SCALES AND INTERFACES

Scales are used as a spatial, temporal, quantitative or analytical dimension to understand a phenomenon (Cash et al., 2006; Gibson et al., 2000). In this thesis scales are used to help to structure the phenomena recognising that they are socially and politically constructed and navigated by complex networks and relationships (Wyborn & Bixler, 2013).

Knowledges are often understood to operate at the different scales. Generalised scientifically produced knowledges are seen to operate at higher scales e.g. in global assessments whereas so called local and traditional (ecological) or place-based knowledges operate at lower scales (Cash et al., 2006; Reid et al., 2006). However, a mismatch or “problem-of-fit” has been detected between the scales of decision-making and what is known about the world (Cash et al., 2006; Epstein et al., 2015; Sterling et al., 2017). Sterling et al. (2017) further problematise the disconnectedness between scales from the perspective of sustainability indicators and suggest integrating local perspectives and values into global scale indicators to work across multiple knowledge systems. However, scales and related governance practices are human constructs and as such are considered to be contested concepts (Buizer et al., 2011). Therefore, it is crucial to deepen our understanding of the knowledge processes which inform these scales.

Knowledges also operate at the interfaces between science, policy and society at and across different scales (Clark et al., 2016). Understanding how to create actionable knowledges and addressing issues of inclusivity and representation requires paying attention to these interfaces. Conventionally, knowledge transfers between science and society/policy have been considered as linear processes and the existence of a gap between knowledge and action has been suggested to hinder transformative actions (Kirchhoff et al., 2013; Mach et al., 2019). However, more recently the dominant understanding has shifted to considering the complex web of interactions, relationships and socio-political contexts of which collaborative modes of knowledge production supports (Fazey et al., 2013; Mach et al., 2019; Toomey, 2016; van Kerkhoff & Lebel, 2015; West et al., 2019). Consequently, collaborative knowledge production in different interfaces is characterised by multiple perspectives, conceptualisations and aims of the process. **Paper I** clarifies these multiple definitions and proposes a heuristic model for bridging the different understandings of actors in the spheres of science, policy and society. **Paper II** studies epistemic worldviews of actors at the international scale, demonstrating how these deep, personal, views on knowledge shape the interdisciplinary process of IPBES and the science-policy interface in which it operates.

2.3.2 PLACE AS A COMPLEX AND DYNAMIC LOCUS OF INTERACTIONS

As emphasised in this thesis, the epistemic dimension of human-nature connections is inextricably connected to the material world. Place is crucial in situating the epistemic dimension and understanding how it emerges in different contexts.

A place refers to a meaningful location (Lewicka et al., 2019). Broadly-speaking, place has been studied from two different perspectives: essential and progressive. The essential perspective often considers place through enclosure and rest, fixity and stability (Relph, 1976). Accordingly, place is seen as central to identifying what and who we are as human beings (Seamon & Sowers, 2008). In contrast to essentialism, progressive understandings emphasise movement and the need to consider places in

relation to other places and influences, cultures and life styles, which meet in certain places but also allude to a more global sense of place (Massey, 1991, 1994). Accordingly, there is no clear inside nor outside - the idea of the progressive place is rooted in mobility and movement (Creswell, 2004; Di Masso et al., 2019; Raymond et al., 2021).

In this thesis, my analysis of place-knowledge connections draws on the phenomenological understanding of place as presented by David Seamon. In his book, *Life takes Place* (2018), he thoroughly explores the ways in which human life is inseparable from the places we are embedded in, even in a mobile, hypermodern world. He defines a place as “*any environmental locus that gathers human experiences, actions, and meanings spatially and temporally*” (p. 2). In the phenomenological view, place has a spatial dimension that influences and shapes human beings, experiences, meanings and events in different ways. Yet, it is not the material environment which is distinct from people but the phenomenon of people-experiencing-place - place is complex and can evoke both negative and positive feelings (Seamon, 2018). Human experience, agency and meaning are deeply connected to place (Janz, 2005). Although phenomenology has its roots in the essentialist approach to place, it does not neglect the interconnected and dynamic nature of places (Seamon, 2021).

By drawing on phenomenology, I also embrace both the constructivist and relational ways of understanding places, which help us to understand how social, political and cultural processes construct and shape places and the meanings attached to them through mobility and webs of social interactions (Duff, 2011; Massey, 2004; Horlings, 2016). **Paper III** links the physical place to actors’ interactions and agency through place belonging and perceptions of local knowledges. **Paper IV** examines the epistemic bond to a place through knowledge obtained in different ways. I align with Lewicka’s (2011) notion of seeing the progressive and essential understandings as complimentary rather than contradictory. Seamon’s phenomenology offers a means to tie knowledge to physical places and “lived emplacement” (2021, p. 30) as a phenomenon central to what it is to be a human being.

2.3.3 SENSE(S) OF PLACE: TOWARDS THE EPISTEMIC DIMENSION

Sense of place is a rich concept used in various ways across different fields such as human geography, environmental psychology and, increasingly, in sustainability science. Sense of place can broadly be defined as the meanings and attachment to a geographic locale held by an individual or group (Tuan, 1977). In this thesis, I build on the systemic meta-theory of sense of place that considers a place as social-ecological assemblage in which people are embedded in and which is affecting and affected by both the social and ecological features of the place (Williams & Miller, 2021).

In the SES-related literature, sense of place is often divided into two main components: place meanings and place attachment (Stedman, 2016). Place meanings are descriptive attributes of place, symbolical meanings or place characters

(Masterson et al., 2017). Here, sense of place is often linked to ideas about stewardship as enabling or, in the case of contested place meanings, hindering protective actions toward the environment (Chapin & Knapp, 2015). Place meanings are constructed by both the biophysical and social aspects of a place (Stedman, 2003a). Place attachment on the other hand is an evaluative concept typically studied using quantitative methods which measures strength of attachment to a place (Lewicka, 2011; Stedman, 2003b). It refers to the emotional bonds between individuals and groups with their environment (Masterson et al., 2017) and is understood to include multiple dimensions such as place dependence and identity, nature bonding and social/family bonding (Raymond et al., 2010).

The way knowledges mediate sense of place has gained little attention in the scholarship relating to place meaning and attachment (Castro, 2021). Paula Castro (2021, p. 260) points out that neither of the concepts of place attachment and meanings includes “[...] *the theorisation and study of how knowledge of/in a locale weaves bonds to place*”. She presents the idea of epistemic bonds as an additional dimension to sense of place scholarship, which requires more focus on local knowledges. This thesis further builds on the understanding of the epistemic dimension in sense of place literature. It explores perceptions of local knowledges and place belonging and their influence on agency in knowledge interactions (**Paper III**). The results of **Paper III** informed the development of a psychometric scale of epistemic bonding, which was tested and validated in **Paper IV**. These papers interrogate sense of place and the epistemic dimension from both explorative and evaluative perspectives to provide a holistic understanding of people-place bonds through knowledges. The scope of these papers is limited to local and regional scales belonging and attachment, as is typically the case within the sense of place and ecosystem management research traditions. However, it is likely that individuals’ place attachment at different scales (such as local, national and global) also informs knowledge interactions and processes across the scales (Devine-Wright & Batel, 2017; Devine-Wright, 2013).

The pluralist paradigm observed in relation to knowledge processes is also influencing sense of place research. Recently, Raymond et al. (2021) pluralised the concept to *senses* of place to underline and highlight an epistemic attitude that recognises the various ways of producing and expressing senses of place in a rapidly changing world. This understanding builds on the progressive tradition of place research. The plural notion gives space for contestations and fluidity as well as understanding the complexity of place-related phenomena (Raymond et al. 2021). The epistemic lens is one way to pluralise senses of place (Castro, 2021). While my research was initially rooted in the essentialist tradition, my exploratory enquiry of knowledge interactions led me towards multiple meanings of place represented by the epistemic dimension. Therefore, I use the plural form of senses of place in **Paper IV**.

2.4 SUMMARY: SITUATED KNOWLEDGE INTERACTIONS FOR THE EPISTEMIC DIMENSION OF HUMAN-NATURE CONNECTIONS

Figure 2 presents the overview of the scope and key concepts of this thesis. The intersection between knowledges and place is a natural starting point for understanding the plurality in human-nature connections. Accounting for the situatedness of knowledges is most famously linked to Donna Haraway (1988), who argues that all knowledges come from positional perspectives that are shaped by the contexts of our life practices and social locations. **Papers I** and **II** offer a means to unpack these positionalities among actors in inter and transdisciplinary collaborations, which sustainability science often includes, through focus on diverse conceptual understandings and epistemic worldviews.

Not only personal and social settings shape the perceptions of knowledges - as underlined in **Papers III** and **IV**, the numerous social and material dimensions of *place* should be considered. I use the concept of 'knowledge interaction' for highlighting how knowledges *take place* in interactions among people but also with place. In these articles, I highlight the role of knowledge-place connections (for example in a form of epistemic bonding) for agency and management preferences.

Although my conceptual focus lies in the epistemic sphere, I want to emphasise that knowledges are never neutral - they mediate the values, beliefs, meanings and experiences which are presented and visible in decision-making (**Papers I-IV**). Hence, knowledges, ethics and actions are interconnected components which structure human nature connections (Wyborn et al., 2020). Nature valuation is a good example of a context in which normative positions distinguished as knowledge need to be unpacked and pluralised (Jacobs et al., 2020) to understand implications for ecosystem governance (**Paper II**). With the sustainability science lens of interconnected social and ecological processes, the epistemic dimension becomes an analytical tool oriented towards action. It helps to understand the plurality which is needed to ensure inclusivity in ecosystem governance and co-create actionable and legitimate knowledges for just sustainable futures.

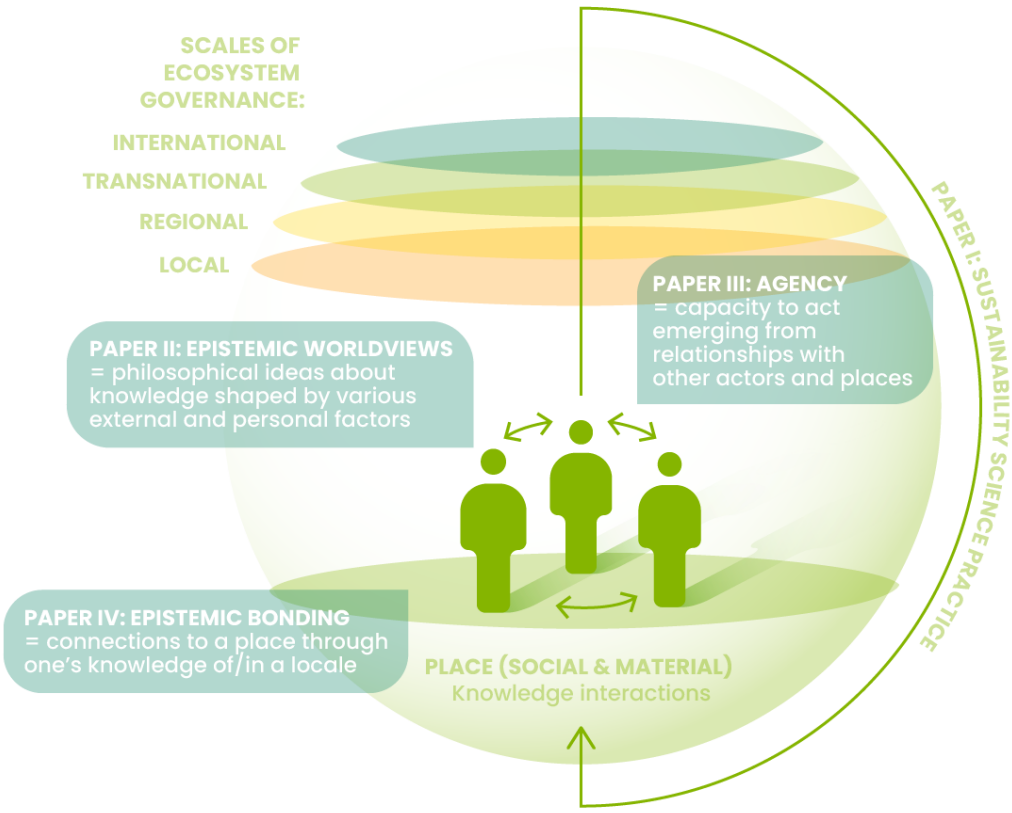


Figure 2. Summary of the key concepts and their connections.

3 METHODOLOGY

3.1 OVERVIEW OF THE METHODOLOGY

In this chapter, I introduce my ontological and epistemological underpinnings drawing on Barad's (2007) agential realism, which highlights the situatedness and ethical considerations of knowledge production in the world. I elaborate the mixed method research strategy, including both qualitative and quantitative methods, informed by the need to consider multiple ways of producing knowledges as outlined in agential realism. The methods applied in the thesis include scoping literature reviews, online surveys, participant observation and semi-structured interviews (Figure 3). I then describe the study cases and contexts: transdisciplinary research in natural resources management, the IPBES Values Assessment and the UNESCO World Heritage Site High Coast/Kvarken Archipelago. In the end of the chapter, I present the methods and analysis applied in more detail paper by paper. I conclude the chapter by reflecting my positionality and research ethics in the Ph.D. process.

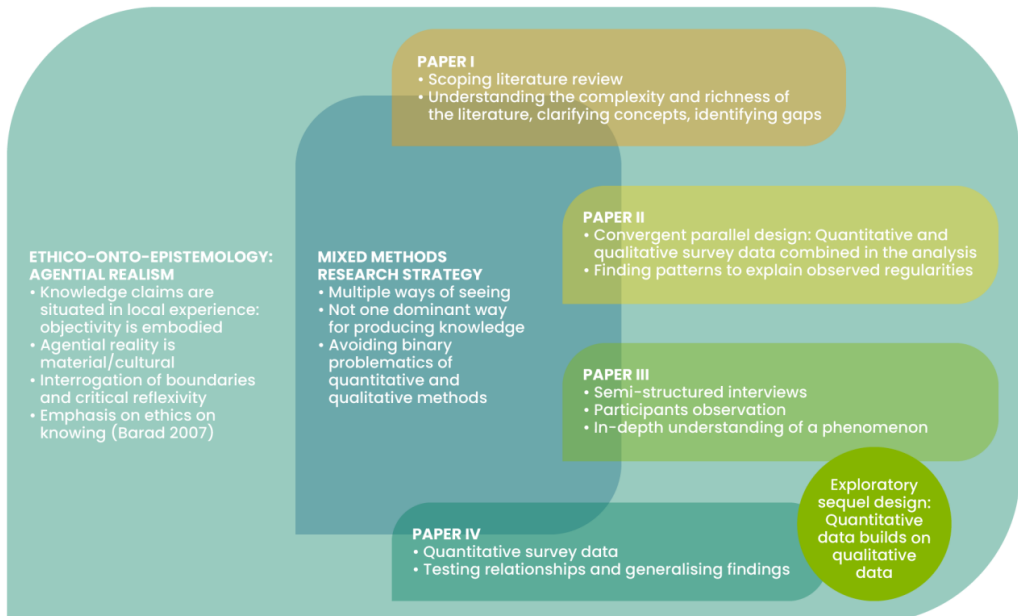


Figure 3. Overview of the methodology.

3.2 ONTOLOGY AND EPISTEMOLOGY: “WE KNOW BECAUSE WE ARE OF THE WORLD”

This thesis touches upon epistemic assumptions of others. Therefore, it is pertinent to introduce my own ontological and epistemological standing points which have shaped the ways I approach the research topics and knowledge production. I substantially draw upon *agential realism* as presented by Barad (2007). It can be described as an ethico-onto-epistemology of knowing and being, which ties the ontological, epistemological and ethical questions together into one framework.

Ontologically, agential realism rejects naïve realism’s claim of a possibility to observe an objective reality, but it also questions the socially constructed nature of all objects. Instead, according to agential realism, reality is dynamic and plural, in which knowledge is a co-construction between humans and reality (Barad, 2007). Agential realism is a form social-constructivism that does not reject objectivity and also does not consider knowledge only through power dynamics or language (Barad, 2007). It can thus be situated between positivist and subjectivist approaches to social science, close to critical realism (Raymond et al., 2010, supplementary material).

Agential realism departs from the critical realist views that focus on interplays between separate concrete structures and human perceptions of them by having embedded relations of entities and their intra-actions as a starting point (Flatschart, 2017). It is a relational epistemology which emphasizes that knowledge production happens in relation to the ways humans engages with and experience the world as embedded in it (West et al., 2021). It is this embeddedness which links to knowledge production: *“practices of knowing and being are not isolable; they are mutually implicated. We don't obtain knowledge by standing outside the world; we know because we are of the world. We are part of the world in its differential becoming.”* (Barad, 2007, p. 185). This embeddedness touches upon the definition of the epistemic dimension of human-nature connections provided in this thesis.

Agential realism draws on new materialism, which gives importance and agency to the non-human materiality (Rosiek, 2018). Scholars, such as Donna Haraway, Bruno Latour and Karen Barad stress the need to consider how non-human materiality affects culture and knowledge production. The phenomenological approach to a place applied in this thesis allows for the recognition of the material dimensions of the world.

The origins of agential realism in new materialism also brings into question the ethics and politics of knowing. Since researchers shape the world by being part of intra-actions, reflexivity is crucial in understanding how different boundaries are constructed and knowledge claims are situated. Knowledge is always a view from somewhere and knowledge has material consequences, which has implications for the ethical responsibility (or “response-ability”) of knowledge production and expands responsibility to the “non-human” (Barad, 2007; Haraway, 2008, p. 88). Furthermore, the notion of situatedness of knowledges, and the embodied and partial nature of knowledges that it leads to, demands recognition of power relations in the

processes of knowledge production. This relates to political practices such as domination, privilege and oppression and requires posing questions about dominant and marginalised voices and views (Haraway, 1988).

Ultimately, inter and transdisciplinary research requires openness in encounters and collaborations and an ability to understand one's view point as relative and one amongst other perspectives (Polk, 2015). This requires respecting the plurality and acknowledging that there is no one correct way of approaching the complexity of different phenomena (Manzo et al., 2021). Hence, I acknowledge that my starting points for unpacking the epistemic dimension of human-nature connections are incomplete and should be enriched with other perspectives and inquiries to knowledges.

3.2.1 MIXED METHODS RESEARCH DESIGN

The ethico-onto-epistemological starting points have implications for the methods applied in the data collection. According to agential realism, we can only “meet the universe halfway” (Barad, 2007) in the co-constructed intra-actions of humans and the reality. Therefore, there is a need to approach intra-actions, phenomena, with different methods acknowledging that they always lead to partial presentations of the world. Barad (2007, 2014) proposes the diffraction methodology that engages with different research traditions dialogically. Diffraction refers to “break[ing] apart in different directions” (Barad, 2007, p. 168), which can be used in (transdisciplinary) research to blur boundaries of disciplines and provoke new thoughts. To this end, I employ a mixed method research strategy to address my research questions with diverse methodologies.

In accordance with agential realism, a mixed methods research design enables “multiple ways of seeing” (Creswell & Plano Clark, 2011). To capture the situated nature of knowledges, mixed methods minimise the risk a domination of views produced by one research method, and allow this thesis to achieve a richer description of results (Nightingale, 2003). In this way, mixing qualitative and quantitative approaches in a research project can make up for the weaknesses of one method searching for the most complete explanation for a phenomenon (Creswell & Plano Clark, 2011). The quantitative and qualitative methods I employ in this thesis (see Table 1 for an overview) aim at moving beyond the binary problem of these methods and recognise there are multiple perspectives and epistemologies related to phenomena (Williams, 2014; Manzo & Pinto de Carvalho, 2021). Accordingly, there is no one privileged methodological position from where knowledge can be produced (Barad, 2007) but the multiple methods can help to shed light on different aspects of the plural realities (Williams, 2014).

Table 1. An overview of applied methods in the research papers.

Method	Literature review	Online survey	Participant observation	Semi-structured interviews
Paper I	x			
Paper II		x		
Paper III			x	x
Paper IV		x		

Paper I is based on a qualitative approach to literature review in a form of a scoping review and thematic coding of articles. It aims to synthesise knowledge and build a new perspective. **Paper II** builds on a convergent parallel design in which both qualitative and quantitative data are collected simultaneously and then combined in the analysis. In this case the data were collected through a survey including Likert scale and open-ended questions.

The development of the epistemic dimension of sense(s) of place in **Papers III** and **IV** follows an exploratory sequel design, in which qualitative findings presented in **Paper III** inform the implementation of quantitative data collection in **Paper IV**. The data were collected and analysed in separate phases. This is a suitable strategy due to the recent emergence of this research topic (Creswell & Plano Clark, 2011). Consequently, each article has distinct epistemological underpinnings: **Paper III** builds on a social-constructive/relational phenomenological approach to qualitative data collection. In this view, place has always a relational structure while people present human-environmental relationships formed through lived experiences, meanings and situations created in relation to places (Seamon, 2018). **Paper IV** uses a quantitative research strategy stemming from the analytical phenomenological and post-positivist research tradition, which often uses psychometric measures to understand interlinkages between constructs (Seamon, 2018).

I am aware that drawing on different epistemic underpinnings, an essential part of a mixed methods research design (Creswell & Plano Clark, 2011), can be inherently contradictive. In this thesis, I have moved from more exploratory to explanatory and evaluative approaches, which are traditionally understood to employ different epistemological and ontological origins. Applying realism (agential among other directions such as critical realism) in mixed methods research helps integrate different approaches and clarifies their relationships. Accordingly, the different paradigms can be considered as tools used to “do the job” in contrast to floundering in consistency (Maxwell, 2010). Consistency, in the world of co-existing ontologies and epistemologies as well as politics and ethics, is not a productive standard, but the different approaches can be contrasted to highlight coherence but also contradictions between them (Barad, 2007; Maxwell, 2010).

The methods I have applied have differing views on sample representativeness, validity and data abstraction. From the agential realist point of view, the evidence required depends on the question explored (Maxwell, 2010). Qualitative methods aim to map a variety of voices and understand the depth, breadth and complexity of the situation, including understanding the diverse knowledge systems linked to the context. Broadly speaking, this is the approach in **Papers I and III**. Quantitative techniques instead often aim at testing the strength and direction of relationships between variables, and seek to generalise those patterns across contexts. Also, quantitative studies tend to sample larger numbers of given subjects to enable statistical comparisons between variables (Creswell & Plano Clark, 2011). **Paper II and IV** follow this way of thinking.

Drawing on agential realism, it is simpler to acknowledge diversity as a phenomenon and study it as such (Maxwell, 2010) rather than aim to find generalisable patterns. Of the papers in this thesis, **Paper IV** is mostly firmly rooted in the quantitative tradition, as it presents a distinct approach to understanding the epistemic dimension of human-nature connections compared to the other papers. The choice of this method was a consequence of the COVID-19 pandemic (3.4.1). The chosen methods also reflect the Ph.D. process and the willingness to learn new skills and evolve as a scholar. Researchers with an interdisciplinary sustainability science education such as myself are caught between methodological groundedness and epistemological agility, which is described by Haider et al. (2018) as the undisciplined journey. To navigate this sphere and produce rigorous sustainability science one needs to be epistemologically aware and use alternative epistemological lenses to be able to apply and develop a deep understanding of suitable methodological approaches regarding the question at hand (Haider et al., 2018).

3.3 CONTEXTS AND CASES

This thesis builds on a literature review on transdisciplinary research in natural resources management (NRM) contexts and two empirical case studies to be able to explore the different scales in which knowledge interactions take place. Below I present an overview of the contexts and cases pertinent to **Papers I-IV**.

Paper I – Review of collaborative transdisciplinary research in NRM

Paper I concerns the use of the collaborative research approaches in transdisciplinary research in an NRM context. NRM was chosen to frame the scope of the literature review because it is a context where transformations toward sustainability are necessary. Moreover, in the SES resilience research NRM is often approached through the ideal of collaborative and adaptive management and governance (Berkes et al., 2003), which necessitates the inclusion multiple actors from science, society and policy spheres, ranging from local resource users to scientists and managers and decision-makers at various scales. Transdisciplinarity provides a way to engage with these different perspectives.

Paper II - Interdisciplinary expert collaboration in IPBES

Paper II studies the views of academic experts across the world in the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). This case provides a way to assess diverse epistemic worldviews and their implications for interdisciplinary academic collaborations that actively shape policy and decision-making at different scales.

IPBES was found in 2012 and formed by 94 governments to be an independent intergovernmental body. It aims to strengthen the science-policy interface for supporting conservation of biodiversity and ecosystem services and contributing to long-term human well-being and sustainable development⁴. It is a boundary organisation that operates in the ‘gap’ between science and policy. The functions of IPBES include: i) conducting assessments on the state of knowledge on biodiversity; ii) capacity building across knowledge and policy spheres; iii) providing policy support tools, and iv) support generating new knowledge (Montana, 2017). IPBES differs from other environmental science-policy interfaces, for example from the Millennium Ecosystem Assessment, with its focus on both ‘rigorous’ and ‘legitimate’ information and not simply on academic rigor. IPBES is trying to create co-constructive processes with multiple sources of information, although there is a bias toward science⁵. IPBES has been criticised for its technocratic and managerial discourses and tendency to rely heavily on natural sciences despite its stated aim to constitute expertise including social sciences and Indigenous and local knowledges (Gustafsson & Lidskog, 2018; Turnhout, 2014). Despite the recent improvements in inclusion of these knowledge

⁴ <https://ipbes.net/about>, last accessed October 12th, 2021

⁵ Personal communication with Christopher Anderson, 20th of October, 2021.

systems, transformative learning and reflexivity in IPBES has been hindered by the attempt to produce outcomes quickly and efficiently with narrow and linear views on scientific credibility and expertise (Borie et al., 2020), as well as an emphasis on consensus, which may override a diversity of views (Montana, 2017).

Paper II concerns the underlying epistemic worldviews of the experts involved in the IPBES *Methodological Assessment regarding the Diverse Conceptualization of Multiple Values of Nature and its Benefits, including Biodiversity and Ecosystem Services* (called the Values Assessment) first author meeting. The meeting involved academic experts from various fields holding different roles such as lead authors, fellows and co-chairs in the process, but not actors outside academia. Accordingly, I refer to this case as interdisciplinary collaboration. The Values Assessment can be described as a unique example of an assessment that has advanced the IPBES objectives of legitimacy and inclusivity by being the first assessment which is not dominated by natural scientists and embodies the principles of gender and geographic equity throughout its work⁵. Hence, the IPBES Values Assessment acts as a compelling example of the need to deepen the understanding of how epistemic assumptions and perspectives on values can be brought together and operate at the international scale. Another important aspect is how these collaborations can be improved to support “understanding, managing and living with diverse natures and peoples”⁵.

Papers III and IV - Transboundary management of The High Coast/Kvarken Archipelago World Heritage Site

Papers III and **IV** focus on the UNESCO transnational natural World Heritage Site High Coast/Kvarken Archipelago having local, regional and transboundary viewpoints to knowledge interactions. This case study area is interesting when it comes to implementations of nature protections and the World Heritage Site in general, which has caused tensions between managers and local inhabitants. Local knowledge has been identified as a key question for improved participation (Svels, 2017), which provides a fruitful starting point for unpacking different interactions and contributing to knowledge of transboundary governance contexts. Focusing on a specific case as a choice of a research design enables more a comprehensive understanding on phenomena and applying a set of different tools in the same case (Yin, 2014).

The High Coast area in Västernorrland in Sweden gained UNESCO World Heritage status in 2000. The Kvarken Archipelago located in Ostrobothnia in Finland followed the same path in 2006. Since then, they form a transnational World Heritage Site in which the boundary is the Gulf of Bothnia between Sweden and Finland. World Heritage status was assigned due to the geological uniqueness of the area: the two sites represent examples of some of the highest rates of post-glacial uplifting landscape (land rise) in the world: the High Coast has the highest known rebound (285 m) of land uplift and the Kvarken Archipelago including 5,600 islands exhibits glacial depositional formations (e.g. De Geer moraines) constantly rising from the sea.⁶

⁶ <https://whc.unesco.org/en/list/898/>, last accessed: October 12th, 2021

The High Coast includes two municipalities, Kramfors and Örnsköldsvik, with circa 5000 inhabitants in the actual World Heritage Site and 74,000 in the wider municipalities. The Kvarken Archipelago spreads over areas within five municipalities: Korsholm, Korsnäs, Malax, Vaasa and Vörå, with 2,500 inhabitants within the World Heritage Site and 94,000 in the municipalities. The areas share tight historical connections, and social and cultural similarities. Recent trends include outmigration and a shift from traditional livelihoods based on natural resources use, such as fishing and hunting, to tourism-based industries (Svels, 2015).

The transnational World Heritage Site represents a multi-level governance context, in which the international organisation UNESCO gives a mandate to national and regional actors. In Sweden, at the national level the governance of World Heritage Sites is under the National Heritage Board and Environmental Protection Agency and in Finland under the Ministry of Education and Culture and the Ministry of Environment. However, day-to-day management issues in both countries are handled by regionally operating management bodies with varying degrees of representation from authorities, municipalities and local stakeholders. In Sweden, the main executive power is in the County Board of the Västernorrland. In Finland the area is managed by a state-led management body Metsähallitus Parks and Wildlife Finland. World Heritage management in Finland includes a regional group called the World Heritage Delegation, which consists of the representatives from Metsähallitus, the World Heritage municipalities and a position of a resident representative that is open to apply for everybody. The World Heritage status does not imply direct nature protections. Maintaining the area in a state that the World Heritage status is done through national environmental legislations. Currently, 37 % of the whole World Heritage Site is national park or belongs to the Natura 2000 network of protected areas⁶.

The transboundary element of the management of the World Heritage Site is a joint transnational management group of local politicians, civil servants and World Heritage coordinators from both countries who meet twice a year⁷. In 2021, the first joint management plan for the site is being formulated, which will further develop and institutionalise guidelines for the future transboundary management of the site, which currently is largely based on the personal relationship of the Finnish and Swedish World Heritage coordinators. Due to the regional management arrangement, the scale of investigation in **Papers III** and **IV** is the regional.

The World Heritage Site is an example of a transboundary management and governance, which has different histories of community engagement with regards to ecosystems. The Finnish site has a historical conflict stemming from the implementation of Natura 2000 sites. The process was implemented at the end of the 1990s in a top-down manner within a tight schedule and included scant stakeholder participation, although Natura 2000 areas also concern private landowners' land (Björkell, 2008). The legacy of this rushed implementation process can be felt in the

⁷ <https://highcoastkvarken.org/about-us/management/>, last accessed: October 12th, 2021

discussion of the management of the area and has created a degree of mistrust towards World Heritage and associated management bodies.

The High Coast is a well-marketed tourist destination beyond the parameters of the World Heritage Site. Unlike in the Kvarken Archipelago, World Heritage Status has not been as crucial for tourism development in the area (Svels, 2015). However, the qualitative and quantitative data collected in this research project indicates that the question of the impact of tourism on nature in the area seems to be of increasing concern for the residents. In both countries, local community engagement has been dependent on who is in the position of the World Heritage coordinator, each of them having had their personal agenda and views (Svels, 2015). Participation of local inhabitants is still a key question when it comes to the formulation of the new transnational management plan. Therefore, the question of inclusivity of plural epistemic understandings in management is crucial in an area in which the environment is changing for example due to the geological phenomenon of land rise as well as accelerating tourism.

3.4 RESEARCH METHODS AND DATA ANALYSIS PAPER BY PAPER

Paper I

Paper I applies scoping literature reviews to build coherence in the literature concerning collaborative research concepts in transdisciplinary processes. The paper was initiated through discussions in a monthly reading group on co-creation of knowledge that I lead and organised with my supervisor in 2019-2020. After a preliminary appraisal of the literature, it became clear that the terminology around collaborative research was incoherent and many articles related to the concepts of collaborative research did not touch upon the theoretical and conceptual underpinnings of these concepts. Hence, to make sense of the body of literature, we chose to conduct scoping reviews. This method can help understand the complexity and richness of the literature, here concerning the five co-concepts (co-creation, co-production, co-design, co-learning and co-management) and clarify the concepts and identify gaps in the literature (Munn et al., 2018).

The articles of the scoping review were included based on the following criteria developed with the group of the co-authors: articles that focused on conceptual development or considered more than one co-concept together, and review articles that focused on academic discussion on the concepts. The literature searches were undertaken on the Web of Science with articles gathered between the years 2000-2019. The chosen review and conceptual papers were further used for snowball sampling for more relevant articles (see the Supplementary material of **Paper I** for detailed explanation of the review process). Each concept review was discussed and cross-checked within the whole team to increase reliability of the reviews.

Altogether, 78 articles were reviewed by looking for origins and definitions of the concepts, their relation to natural resources management and the promises they set for transdisciplinary research. In addition to reviewing concepts through these topics, linkages between three main overlapping concepts of co-creation, co-production and co-design were conducted on the qualitative coding programme Atlas.ti basing on 40 articles (see the supplementary material of **Paper I**). The aim was to find out how these interlinkages are presented and discussed in the previous literature. We applied abductive reasoning aimed at building new theories against existing evidence (Timmermans & Tavory, 2012). Through the understanding gained in the review and coding processes, we built a heuristic model by combining all the co-concepts for transformative transdisciplinary research in natural resources management.

Paper II

Paper II uses data from a survey sent to 94 experts (Co-Chairs, Coordinating Lead Authors, Lead Authors and Fellows) of the IPBES Values Assessment first author meeting via email (see Appendix I for survey instrument) in 2018. Forty-eight responses were received. The survey included both Likert scale questions analysed using quantitative approaches and open-ended questions analysed using qualitative approaches.

The quantitative data analysis divided respondents into four clusters presenting different epistemic worldviews using an agglomerative average linkage cluster analysis in which each observation is first in its own cluster and then merged to a larger cluster when one moves up in the hierarchy (Kaufman & Rousseeuw, 1990). I analysed the qualitative responses of the open-ended questions thematically, identifying prominent themes and patterns through multiple rounds of coding on the NVivo software. During the process, I presented and discussed the coding structure with the research team to ensure inter-rater reliability of the identified themes. I connected the coding from the open-ended questions to the clusters and identified patterns between the different epistemic worldviews regarding the questions of respondents' motivation for the IPBES process, confirmation needed for valid knowledge and their definitions of multiple values of nature. These components of the theoretical framework (validation, motivation and objectivity) are based on epistemological and ontological challenges in interdisciplinary research teams identified by Eigenbrode et al. (2007).

The paper applies deductive reasoning to identify clusters based on four worldviews categorised by Creswell (2014) measuring objectivity. It then relates the worldview clusters to the qualitative data to find patterns to explain observed regularities in the data, thereby increasing the complexity of the level of abstraction.

Paper III

The data collection of **Paper III** is based on a series of visits in the High Coast and Kvarken Archipelago, each entailing participant observation and/or semi-structured

interviews. I first met several people living in the area and who worked with World Heritage to gain a basic understanding of the local context through informal chats. In 2018 and 2019, I participated in five workshops organised by the County Board of Västernorrland and Metsähallitus in both Finland and Sweden. By participating in the different discussion groups and exercises in the workshops, I conducted participant observation to understand the key issues in the sites, peoples' interactions with and stances towards different topics, and established connections with key actors in the area. After the workshops, I conducted semi-structured interviews with 28 people (see Appendix II for the interview guide). Following the criteria of probability sampling (Bernard, 2006) the interviewees included workshop participants as well as individuals absent from the workshops in order to include some people who would not participate in official events. The interviews were audio recorded and transcribed and the data were triangulated with the field notes from participant observation, which confirmed that I had obtained similar understanding using the two qualitative methods.

This data were analysed thematically on Atlas.ti through multiple rounds of coding (Castleberry & Nolen, 2018). The coding started with an inductive and open approach resulting in a high number of codes. The initial focus on local knowledge and knowledge processes in the World Heritage management was enriched with the importance of place, which required shifting to abductive reasoning and drawing on the sense of place literature to organise the coding and explain the findings. I applied an axial coding strategy relating codes to one another to create a typology of knowledge-place intersections and build toward the concept of place-embedded agency to explain actors' agency in knowledge interactions and how it is shaped by place.

Paper IV

A quantitative online questionnaire (see Appendix III for the survey instrument) was used as the data collection method for **Paper IV**. I designed the survey based on knowledge gained from the field visits and semi-structured interviews in the World Heritage Site as well as with input from the World Heritage coordinators in Finland and Sweden to measure and deepen understanding on the important topics in the World Heritage Site.

I sent invitations to the survey to 3000 randomly sampled inhabitants, between 18-80 years, in Finland and in Sweden who either lived within the boundaries of the World Heritage Site or close by within the World Heritage municipalities. The first invitation was sent out in October 2020 and a reminder in November 2020. In total, 306 usable responses were received. **Paper IV** focuses on the creation of a psychometric scale for assessing the epistemic bonding construct using deductive reasoning. I used SPSS version 25 to conduct the analyses which included a set of statistic tests to assess the internal consistency, reliability and validity of the created

scale as well as its relationships to other place attachment dimensions and views on the management of the site.

3.4.1 REFLECTIONS ON RESEARCH METHODS

As going through a Ph.D. is a learning process, it is inevitable that the chosen methods and their execution could have been improved. Applying a systematic literature review in **Paper I** could have resulted in even more robust and systemised descriptions of each concept, although the scoping reviews proved effective at highlighting the main aspects of the concepts in academic discussion and building a heuristic model based on the state of the academic discourse. In **Paper II**, the survey format was not the most appropriate way to elicit respondents' reflections on difficult issues such as defining multiple values of nature. Complementary in-depth interviews could have supported the richness of the qualitative data - however, it was a way to create clusters of different epistemic worldviews and study their prominence in the Values Assessment.

Paper III is based on qualitative data, but for an even deeper understanding and richer and thicker description, I could have spent more time in the field participating in more local events and creating more connections. However, I deemed that the data had reached a saturation point (Saunders et al., 2018) when no new and unexpected themes seemed to emerge in the interviews. It was therefore decided not to spend more time and resources pursuing semi-structured interviews. The representativeness of the survey respondents in **Paper IV** could have been improved by a targeted sampling of less educated, younger and female residents through alternative techniques, including telephone interviews. Sending out even more reminders could have contributed to a higher response rate, but would likely not have engaged those quieter voices.

I am also aware of the biases related to conducting social sciences research. The deference effect - in which interviewees tell what they think a researcher wants to hear - and the social desirability bias - referring to research participants responding in ways that make themselves look good (Denzin & Lincoln, 2011) - were aimed to be minimised by making all the collected data anonymous. Moreover, critical views were expressed very openly in qualitative interviews. The level of openness exceeded the limits of general politeness and was sometimes a surprise to me as a researcher.

It is always possible to go more in-depth with the data collection, but at the same time only a fraction of the material that I collected during the past years is used in the publications included in this thesis. I hope to be able to make use of more of this data in the future, honouring those people's time who contributed to this research process as participants.

COVID-19 impact on the data collection

Over half of my Ph.D. journey was shadowed by the uncertainty brought about by the covid-19 pandemic. This dissertation would have looked very different without the

need to navigate the impacts of the pandemic on both my personal and professional life. When the pandemic hit, I was planning the next phase of the data collection in the World Heritage Site having conducted the data collection for **Paper III**. The initial goal was to test some ideas presented in **Papers I-III** in collaborative and co-created workshops. In spring 2020, I was planning these workshops with the coordinators of the World Heritage Site to contribute to the formulation of the new management plan for the area. By summer 2020 it became clear that the strategy was not going to be feasible because the pandemic situation was not drastically improving. Consequently, I ended up using an alternative method - a quantitative survey which did not require human contact and enabled me to move forward in the Ph.D. process.

In other words, the quantitative turn in this thesis was a rather unexpected but not necessarily a negative consequence of COVID-19. The adoption of a purely quantitative research approach from the post-positivist research tradition required a rethink to enhance my understanding of this line of reasoning. Nevertheless, it equipped me with a new skillset, research experiences and theoretically enabled to create and examine the construct of epistemic bonding (**Paper IV**). Due to this change, I am writing about collaborative research in a meta-level in this thesis without truly employing more transdisciplinary or co-creative ways of conducting research.

3.5 MY POSITIONALITY AND MULTIPLE ROLES

A researcher's positionality refers to the stance of a researcher in relation to the social and political aspects of the study context ranging from the ontological and epistemological beliefs, explored above, to attributes such as age, gender, race, nationality as well as political views and life experiences (Darwin Holmes, 2020). My main empirical case study and fieldwork took place in the transnational World Heritage Site between Sweden and Finland. This choice was suitable and partly a consequence of my life history and situation as a Finnish woman living in Sweden for seven years. Moving between the two countries (and languages) was easy for me during the data collection phase, and the transnational way of living has helped me to understand nuances in the Swedish and Finnish perspectives. However, I am not originally from the case study area from Finland, which makes me an outsider to this context as well as to the Swedish equivalent, which both have a unique and rich cultural and social history including for example rich historical stories, political tensions and dialects. Moreover, I have grown up and always lived in cities - studying a more rural context therefore revealed me somehow different realities and questions of importance such as when it comes to nature protection and resources extraction than often experienced in the urban, also challenging some of my pre-assumptions.

I conducted this Ph.D. work in my mid-20s, and when I look back at the past three years, I have a sense that the ideas explored developed in tandem with my own personal development. This process is reflected in my epistemological and ontological assumptions that shifted from pure social constructivism to more pragmatic and relational assumptions enriched with the realist materiality. This process also has a practical dimension - leading academic collaborations as an early-career researcher is a huge learning process, particularly when you are not only young in academic terms but also in real life. Yet it is difficult to separate this sensation from the experiences and learning gained during the Ph.D. and growing as an academic and what can be attributed to one's actual age.

Positionality is also linked to the different roles a researcher adopts and can adopt during a research process. Throughout my Ph.D. project, I have been caught between the co-production of actionable knowledge and the exploration of theoretical and abstract questions, which are not mutually exclusive. The drastic need to transform human-nature connections to more sustainable and just ones asks researchers to direct their knowledge towards those transformations. Being painfully aware of the ethical consequences and considerations in sustainability science through my previous research experiences (explored in Hakkarainen et al., 2020), the question of positionality and who am I to try to engage with real world issues aiming at impact while having the urge to do so has been challenging. I have navigated this within the limits of practical and personal resources during the research process. This thesis presents works in which I have a role of a more conventional "reflective researcher" and a "self-reflective researcher" (Wittmayer & Schöpke, 2014) studying dynamics and interactions while reflecting my own positionality in knowledge production.

Outside the scope of the publications included in the thesis, I have aimed to create relationships and collaborations with actors who could be interested in the research findings adopting the roles of knowledge broker and process-facilitator (Wittmayer & Schöpke, 2014). For example, I consulted the World Heritage coordinators in Finland and Sweden regarding a survey I conducted in the area to include themes that were usable for the management of the area. I have also on a few occasions shared my research findings and facilitated a workshop for the transnational steering group of the World Heritage Site, in which we explored different visions for a new management plan. Although this thesis draws on participatory approaches to science and my role as a researcher has diversified, the research process is not transdisciplinary. I acknowledge these collaborations could have been more profoundly collaborative for producing actionable knowledge and not to stay so much in the meta-level of reflection of knowledge processes.

My underlying normative position embraces the inclusivity of knowledges in environmental decision-making. The inclusivity perspective asks us to recognise the politics of knowledge (Turnhout et al., 2016) and to go beyond the false objectivity of science and the hegemonic power of Western scientific knowledge by creating spaces for voices and knowledges not heard and recognised in decision-making before. From the agential realist perspective “*science is movement between meanings and matter, word and world, interrogating and redefining boundaries, a dance not behind or beyond but in “the between”, where knowledge and being meet*” (Barad 2007, p. 185) Hence, working in science requires acknowledging the contextual nature of it, it is embeddedness in the material-cultural worlds and that science is a social practice.

3.6 RESEARCH ETHICS

The works included in this thesis follow the ethical guidelines of the Finnish National Board of Research Integrity (TENK) and my host institutes Natural Resources Institute Finland and the University of Helsinki. I implemented an ethics review at the beginning of the project, which was iteratively revisited when the research plan and design changed. The review was approved by the Natural Resources Institute Finland and the Resourceful and the ethics committee of the Resilient Communities (RECOMS) Marie Skłodowska-Curie Innovative Training Network (EU Horizon 2020 grant agreement No 765389). During data collection, I obtained informed consent for participation from the research participants after providing a plain language statement of the project including an explanation of GDPR compliance. Research participants were provided the right to withdraw their consent at any point of the research process. The data collected were anonymised with individual numeric codes given to each participant in the different data sets. The research project has followed the principles of open science and all the publications are/will be published as open-access journal articles. The strictly anonymised data from the World Heritage Survey has been uploaded to an open-access data repository⁸ to enable further use by others.

During the research process I have not encountered major ethical dilemmas. I am aware that a position of a researcher always entails some power which comes with institutional affiliations and resources. I have aimed to minimise this by following and revisiting ethics procedures and being transparent about my interests and aims in my collaborations and encounters during the research project. I consider openness and social accountability important principles in research and therefore have aimed to share my research findings in the World Heritage Site especially so that they may contribute to decision-making about the area.

⁸ DOI of the uploaded dataset: [10.5281/zenodo.5243244](https://doi.org/10.5281/zenodo.5243244)

4 RESEARCH PAPERS AND KEY FINDINGS

In this section I provide an overview of the papers included in the thesis focusing on the key findings. The next chapter will build on the key findings to discuss the major contributions to new knowledge and their implications for sustainability science.

4.1 PAPER I: TRANSDISCIPLINARY RESEARCH IN NATURAL RESOURCES MANAGEMENT: TOWARDS AN INTEGRATIVE AND TRANSFORMATIVE USE OF CO- CONCEPTS

Paper I probes the current trend of using different concepts with a “co-“prefix in research. It departs from the notion that these concepts have a rich scholarly background by positing that they imply multiple meanings. As a result, the use of concepts such as co-creation, co-production, co-design, co-learning and co-management is often incoherent. Often, academics do not define what they mean by these concepts in transdisciplinary research processes. The multiple perspectives related to transdisciplinary research create a setting in which different and at times contested views of contents and aims of different concepts need to be acknowledged and navigated (Blythe et al., 2017). In addressing the question “*How can co-creation of knowledge be conceptualised in natural resources management to allow space for a plurality of views and approaches in transdisciplinary research?*”, we highlight natural resources management as a context in which transdisciplinary collaborative processes are often set at place to facilitate sustainability transformations.

Through the scoping literature reviews of each of the five concepts, the paper introduces the different origins of the concepts, their purposes and aims for transdisciplinary processes in NRM. We confirm the multiple uses and meanings related to each concept and identify shared tensions within the application of the concepts. These tensions relate to epistemological differences and value pluralism through engagement of multiple people and practical tensions stemming from different views regarding timing and purpose of collaborative approaches.

To move beyond the state-of-the-art, we propose an integrative model that maps the conceptual and temporal relationships of the concepts in a research process (Figure 4). This model is a heuristic one that aims to aid researchers and other participants in transdisciplinary processes to align their perspectives which can contribute to formulating and realising transformative aims. Lastly, the paper emphasises and discusses three praxis recommendations that, together with conceptual and temporal clarity gained through applying the integrative model, may facilitate the transformative potential of collaborative transdisciplinary research. These recommendations include: i) practicing reflexivity at individual and group

levels; ii) considering the power and politics of co-concepts; and iii) valuing process-orientation.

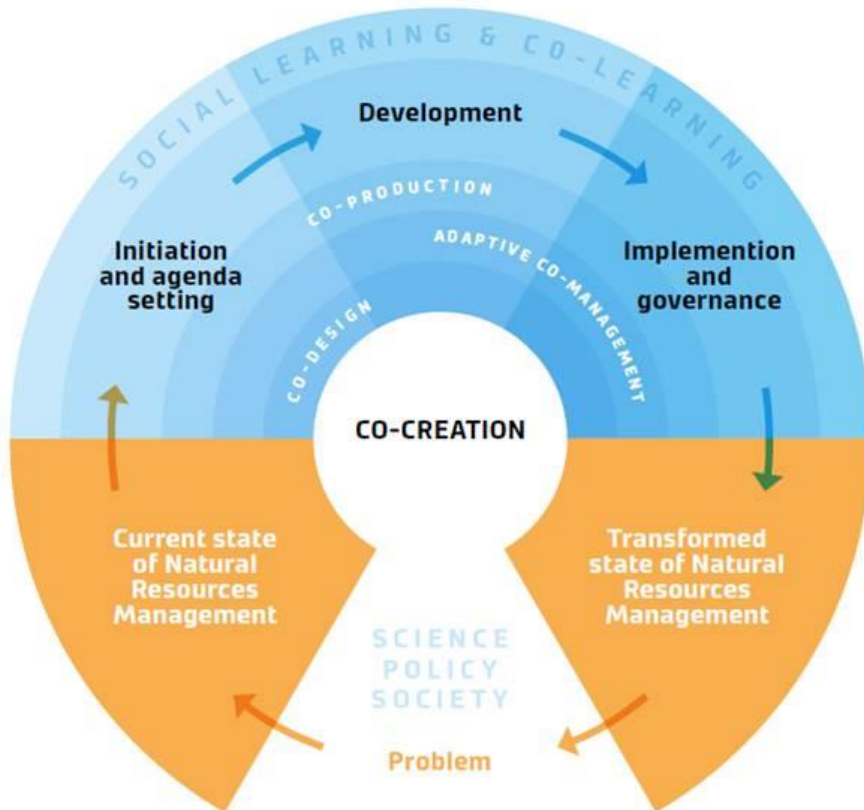


Figure 4. An integrated understanding of the “co-concepts” (co-creation, co-production, co-design, co-learning, (adaptive) co-management) aimed at supporting transdisciplinary collaboration (Paper I).

4.2 PAPER II: GROUNDING IPBES EXPERTS' VIEWS ON THE MULTIPLE VALUES OF NATURE IN EPISTEMOLOGY, KNOWLEDGE AND COLLABORATIVE SCIENCE

Paper II provides a deep level assessment on how epistemic worldviews (Table 2) matter in interdisciplinary processes regarding nature valuation, and answers the question “*How do different epistemic worldviews shape interdisciplinary collaborations at the international science-policy interface?*” Addressing the epistemic sphere offers a way of understanding how people with different perspectives on knowledge come together and how this plurality links to practice through scientific assessment informing environmental policy.

Table 2. Epistemic worldviews as studied in Paper II according to Creswell (2014).

Epistemic worldview	Description
Post-positivist	Post-positivist frequently uses a reductionist approach to verify theory and determine supposedly objective facts about an object or process of study. Post-positivism challenges the traditional notion of absolute truth and recognises that we cannot use positivist knowledge claims when studying humans and their actions and behaviour.
Constructivist	Constructivist seeks to develop a better understanding of phenomena, often generating theory on a social and historical approach that recognizes multiple meanings and significances of the same "facts." Constructivists often focus on interactions between humans and specific contexts in order to understand the historical and cultural settings of participants.
Pragmatist	Pragmatist is oriented towards real-world problem-solving and applies a pluralistic approach to concepts and methods. Problems themselves and addressing them matter more than the focus on specific methods.
Transformationist	Transformative view is collaborative and practical It takes on a political and power-explicit perspective that seeks to not only conduct research, but also affect change. Empowerment, inequality, oppression, domination and suppression are often topics in transformative research.

In the paper, we demonstrate that the sample of the IPBES Values Assessment experts included fewer experts with Constructive and Transformative worldviews compared to Pragmatists and Post-positivists despite this IPBES assessment including the greatest number of social scientists of all IPBES assessments to date⁹. Only one Transformationist expert was identified. Based on our findings, we suggest that to enhance inclusivity, interdisciplinary collaborations should be assessed beyond disciplinary divisions through the underlying epistemic perspectives that have implications for practice. We also delineate that Post-positivist experts align less with relational values when they define the multiple values of nature, whereas they were most important for Pragmatists. Constructivists aligned with all the value types. Another interesting notion is the relationship to agreement in the constitution of valid knowledge. Post-positivists were more likely to emphasise high levels of agreement whereas Pragmatists and Constructivists did not consider agreement so important, which may indicate a possible area for tensions in interdisciplinary processes.

4.3 PAPER III: PLACE-EMBEDDED AGENCY: EXPLORING KNOWLEDGE- PLACE CONNECTIONS FOR ENABLING PLURALITY IN GOVERNANCE OF SOCIAL-ECOLOGICAL SYSTEMS

Paper III is an explorative investigation of the epistemic dimension of sense of place. The paper starts with the notion that that focusing on a place, and particularly sense of place, can help unpack different views and subjectivity related to SES and knowledge interactions in them. It aims to contribute to the further understanding of subjectivity to facilitate a broader inclusion of actors with different views in the management of SES. The paper bridges perceptions of local knowledges and actors' place belonging and their implications for agency, shedding light on the question *“How do inhabitants' place belonging and perceptions of local knowledges contribute toward knowledge interactions and agency regarding ecosystem governance at the regional scale?”*

The findings highlight the multiple perceptions of local knowledges ranging from cultural, historical to ecological perspectives, but also the difference between what is considered local knowledge in general and what kind of local knowledge a person considers self-having. These different subjective positions are categorised in relation to place belonging resulting in a typology of five different positions of knowledge-place connections. We discuss the implications of these positions to knowledge interactions and agency. To be able to recognise this plurality in positions caused by the interplay of knowledges and place, we propose the concept of place-embedded agency (Figure 5). The concept underpins the need to consider power dynamics in knowledge interactions linking to questions such as who has the right to present local knowledge and a place, and how local knowledges are included in decision-making about SES.

⁹ Personal communication, C. Anderson, 2021

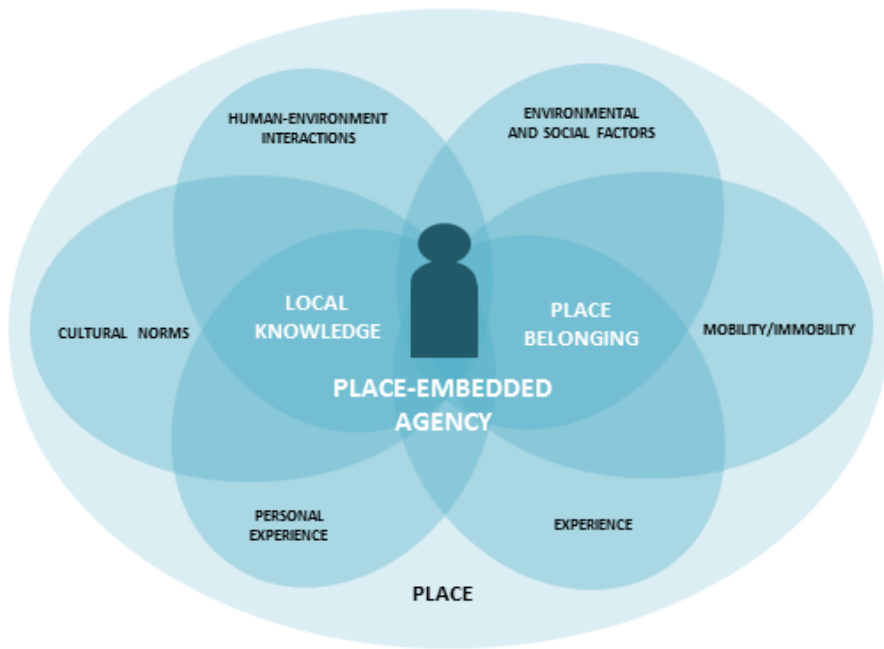


Figure 5. Place-embedded agency, situated at the intersections of local knowledge and place belonging, shapes interactions and actions in a place.

4.4 PAPER IV: THE KNOWLEDGE DIMENSION OF PLACE ATTACHMENT: MEASURING EPISTEMIC BONDING

Paper IV examines the epistemic dimension of sense of place through a quantitative approach to ‘epistemic bonding’ - knowledge of/in the locale which creates bonds to place. This is the first time the knowledge aspect of sense of place is quantified. The construct of epistemic bonding is related to existing dimensions of place attachment (place identity, dependence, nature bonding, family and friends bonding) investigating the question of “*What are the relationships between epistemic bonding and other dimensions of place attachment, and how do they together influence ecosystem management preferences in a cross-boundary management context?*”

The results show that epistemic bonding (Table 3) can be considered a separate yet interrelated construct from other place attachment dimensions. It is most strongly correlated with place dependence and place identity. We argue that epistemic bonding could add to sense of place literature in addition to place attachment and meanings literature to further understand the plurality in the *senses* of place. We find that epistemic bonding can be a particularly powerful construct in explaining different stances toward management options in contested places such as the Kvarken Archipelago World Heritage Site, in which higher levels of epistemic bonding translate to negative responses towards official regulation efforts. Unlike the other place attachment dimensions, the epistemic bonding dimension was the only item that explained differences in all the tested statements regarding preferences for ecosystem management. Accordingly, it is deeply related to interactions between different ways of knowing in local and regional environmental decision-making.

Table 3. The set of scale items created to measure epistemic bonding in Paper IV.

Epistemic bonding scale items

- My knowledge about the area is an important part of my connection to it.
 - I have more knowledge about the area than other places in the world.
 - The knowledge I obtain through my connection with others in the area helps to define who I am.
 - I have knowledge about the natural environment of the area.
 - My knowledge of the area is created through interaction with local environment and community.
 - It would be difficult to gain as deep knowledge of other places as I have of the area.
-

5 MAJOR CONTRIBUTIONS

I posed the question: “*How can different epistemic understandings of human-nature connections be reconciled in ecosystem governance at different scales?*” This question probes the ways to recognise and include various voices to make fair and legitimate decisions contributing to inclusive forms of ecosystem governance (Brondizio & Tourneau, 2016; Wyborn et al., 2020). Inclusivity can be approached through the notion of plurality that emphasises the need to rethink consensus and integration in ecosystem governance allowing for contestation, compromise and giving space for epistemic diversity relating to different ways of knowing and strategies of knowledge production (Turnhout et al., 2020).

By highlighting the epistemic sphere in sustainability science as the epistemic dimension of human-nature connections, I aim to make it visible and easier to assess and recognise epistemic plurality in ecosystem governance. I conceptualised the epistemic dimension as being mutually shaped by our knowledges (and diverse perceptions of knowledges) about nature and nature shaping our knowledges about it, underpinning the embeddedness of human beings in the biosphere.

The cases explored in this thesis demonstrate that by studying the epistemic dimension, it is possible to gain insights on deeper levels of plurality related to the knowledges, worldviews and beliefs which shape individuals' actions and interactions. This is a starting point towards greater recognition of diverse views and sheds light on the power relations between dominant and marginalised voices (Giladi, 2018). I present three main insights which contribute to reconciling different epistemic understandings of human-nature connections in ecosystem governance: i) epistemic issues need to be explicitly acknowledged as they pervade at different scales and within different knowledge systems; ii) achieving inclusivity requires operationalising reflexivity at different knowledge interactions and interfaces at different scales; and iii) recognising epistemic bonding as part of sense(s) of place can help to manage and include plural positions to ecosystem governance.

5.1 EPISTEMIC ISSUES PERVADE ACROSS SCALES AND KNOWLEDGE SYSTEMS

Epistemic issues pervade in the contexts of sustainability science and ecosystem governance at different scales. Being able to handle and deal with the plurality of epistemic understandings (linked to the epistemic dimension of human-nature connections) requires assessing how these views are constructed. The epistemic issues explored in this thesis include clarifying diverse conceptual understandings in transdisciplinary NRM research (**Paper I**), the representation of different epistemic worldviews in a science-policy interface (**Paper II**), perceptions of local knowledge and place belonging and how they shape knowledge interactions and agency (**Paper**

III), as well as epistemic bonding to comprehend connections to a place through knowledge and how they explain different responses to management options (**Paper IV**). These are all examples of cases in which the focus on epistemic issues reveals diverse positions and consequently sheds light on tensions, such as issues related to representation, validation, and practical aims of environmental decision-making, which can emerge from differing views and knowledges.

The focus on the epistemic dimension provides a way to address tensions possibly in prior conflicts. **Paper I** revealed differences in views about the conceptualisations of transdisciplinary processes. In part, they can be addressed by acknowledging the different starting points and what possibilities they hold for the transdisciplinary collaborative knowledge production. When the different views are understood they can be negotiated in such processes (Obermeister, 2017). **Paper II** revealed differences in understandings regarding validating and integrating knowledge within the global science-policy interface. We demonstrated that these tensions can, in part, be addressed by employing reflexive processes for understanding different perspectives during the course of interdisciplinary collaborations. Such processes also hold promise in identifying possible missing voices such as transformative worldviews in the IPBES Values Assessment (**Paper II**).

Knowledge-place connections prominently illustrated tensions between what was perceived as local knowledges in relation to other knowledge sources such as natural sciences as well as who has right to present the place and whose knowledge counts in the management context (**Paper III** and **IV**). Moreover, differences in levels of epistemic bonding help explain differing views to management options in contested places (**Paper IV**). In these contested places such as in Kvarken Archipelago, the feeling of not being recognised as a credible knower among local inhabitants or partial, instrumentalised, recognition by managers can cause mistrust and long-lasting narratives of conflicts (**Paper III**). In part, such tensions can be reconciled by unpacking the dominant narratives about the place - whether presented by people working in the management or (some of) the local inhabitants - and creating space for dialogue between differing perspectives.

These findings indicate the need to build (epistemic) trust between people with different connections to place and ways of knowing to create mutual understanding between local inhabitants and management bodies. Trust in relation to ecosystem governance requires dialogue and a willingness to share power in terms of knowledge and policy implementation (J. C. Young et al., 2016). In epistemic terms it also emphasises mutual belief and communication between people (McCraw, 2015).

Power dynamics such as those related to participant selections, agenda and rule setting and to social and material resources (Fritz & Binder, 2020; Hakkarainen et al., 2020) underpin knowledge interactions at different scales, which when ignored has led to shortcomings of collaborative approaches in sustainability science (Jagannathan et al., 2019; Karcher et al., 2021; Lemos et al., 2018; Turnhout et al., 2020). The way to move beyond only acknowledging the need to take account of power dynamics in collaborative sustainability science (Norström et al., 2020; Turnhout et

al., 2020) is to explicitly assess and interrogate the deep beliefs and potential tensions and injustices arising from diverse epistemic starting points as well as emphasise the importance of plurality to support inclusive ecosystem governance. The epistemic dimension shapes the world, for example as shown in **Paper II** through impacting how multiple values of nature were defined by different IPBES Values Assessment participants, which can have implications on what kinds of values will be emphasised in globally environmental policy.

However, an increased understanding of epistemic issues and trust are not simple solutions to fix deep-rooted and structural forms of epistemic exclusion, the reduction of one's agency and ability to participate as a credible knower. The often unequal dynamics of knowledge production between the Global South and North or Western scientific knowledge and Indigenous ways of knowing is a key example of this (Baker & Constant, 2020; L. T. Smith, 2012). While completely avoiding epistemic exclusion might be impossible, understanding the epistemic dynamics in different contexts and scales might serve as the first step towards recognition and acknowledgement of epistemic injustices (Dotson, 2012).

Epistemic issues relating to human-nature connections emerge across multiple scales, which makes it possible to address them in multiple ways. In **Paper II**, studying epistemic worldviews stemming from Western philosophy of science (Creswell, 2014), including perceptions of valid scientific knowledge production, was deemed a good way to understand expert scientists' views. In **Paper III**, unpacking connections to place together with knowledge offered a feasible way to understand various epistemic and place-based viewpoints among local inhabitants and managers. However, these approaches are not mutually exclusive – instead, science too should be recognised as a set of local practices (Turnbull, 1997). Applying a place-based perspective to interdisciplinary collaborations and science-policy interfaces could enable deeper understandings of epistemic complexity within these processes.

The epistemic dimension ties together with the ways people at different scales and in places deem what is legitimate, credible and salient knowledge (Cash et al., 2006; Clark et al., 2016). However, as discussed in **Paper III**, strictly dividing different actors to different knowledge systems based on their official positions such as managers may amplify tensions and hinder recognising diverse ways of knowing and perceptions of knowledge. This can lead to decision-making which is less inclusive, widely perceived as less legitimate, and which sustains narratives that hinder collaborations between different actors.

5.2 INCLUSIVITY REQUIRES OPERATIONALISING REFLEXIVITY

Reflexivity is increasingly identified as the way to improve transdisciplinary and collaborative research processes targeting transformative changes (e.g. Schöpke et al., 2018; Caniglia et al., 2020; Fazey et al., 2020; Norström et al., 2020; Louder et al., 2021). The findings from **Papers I** and **II** indeed suggest that reflexivity is an important approach to improve inclusivity of different epistemic understandings and worldviews in inter and transdisciplinary collaborations.

Reflexivity can help point out biases, understand power dynamics and assess outcomes of knowledge creation processes. Reflexivity needs to go beyond reflection of a set of aspects in research processes to greater humility and explicit consideration of one's positionality as a researcher (Stirling, 2006). This includes reflexivity at the individual and group levels (**Paper I**), which is targeted towards understanding one's normative insights and their relation to action, others and consequently on the environment (van der Molen, 2018).

Reflexivity is a way to recognise differences, instead of relying on a difference-blind approach in the name of non-discrimination (I. M. Young, 1990). Applied at the group level, reflexivity can help deconstruct power in relations and voices including ethical questions about responsibility and agency of diverse actors (Gilbert & Slied, 2009). It may enable realising how there is always a plurality of answers regarding the political questions about the direction of the future(s) (Escobar, 2020). In this way, the question of turning knowledge into action in sustainability science (Tengö & Andersson, 2021) gains a deeper level epistemic framing, which is needed not only to produce solutions for sustainability but to find solutions that are meaningful and minimise epistemic exclusion (Dotson, 2012) at different scales of ecosystem governance.

The papers included in this thesis provide ways to approach reflexivity in practice. **Paper I** introduces a conceptual model including clarifications of five co-concepts (co-production, co-creation, co-design, co-learning, adaptive co-management) and their interlinkages rather than focusing on simply one or a few of the overlapping concepts (Chambers et al., 2021; Mauser et al., 2013; Moser, 2016). It adjusts aligning understandings in research projects making it possible to make different conceptualisations stemming from different epistemic understandings more visible. **Paper II** suggests that the organisation of science-policy/society interface could benefit from assessing different epistemic worldviews beyond disciplinary views in the early phases of collaboration to ensure inclusivity of diverse perspectives and understand how people engage with the process with differing perceptions. Both approaches aid individual and group level reflexivity.

Similarly, reflexivity around the different epistemic underpinnings and positions related to a place in natural resources and SES management contexts can help bridge different views. **Paper III** proposes the typology of knowledge-place connections and the concept of place-embedded agency to make these diverse positions visible. It

makes the connection between knowledge interactions and place as forming agency in a relational way, which enables analyses of new forms of agency needed in transformation studies (Wolfram et al., 2016). **Paper IV** introduces a psychometric scale to highlight the different ways to connect to a place through one's knowledge. Both of these approaches aim to establish ways of recognising the plurality of knowledges in management and governance contexts to make it possible to create space for reflexivity and inclusion. Here, recognition of different positionalities could contribute to realising reflexive governance models (Voß & Bornemann, 2011), which underpin that there is no one best way to frame problems or solve them, and they instead draw on a diversity of perspectives, expectations and searches to retain various strategies and openness of futures. However, these models of governance would urgently require operationalising reflexivity in SES management.

Reflexivity does not take place without effort. Therefore, sustainability science and research related to collaborative processes need to move beyond naming reflexivity to implementing it, and provide tools to facilitate reflexivity in research processes in different contexts. This thesis attests that reflexivity needs to be operationalised in sustainability science practice as it is crucial to be institutionalised in science-policy interfaces such as IPBES (Borie et al., 2020) to ensure inclusivity based on epistemic pluralism. Well-implemented reflexivity could also help to assess the process-outcome balance (Lemos et al., 2018) of collaborative projects and the actual impacts of research projects (Karcher et al., 2021). Reflexivity needs to be an in-built aspect, and not an additional layer of these processes. A concrete way to increase reflexivity in sustainability science could be including separate work packages for reflexivity in research projects, activities of which, however, should be deeply integrated with other parts of research.

5.3 EPISTEMIC BONDING IS ANOTHER DIMENSION OF SENSES OF PLACE

This thesis demonstrates that connecting knowledge and place can help to unpack the plurality of different epistemic understandings and include diverse people-nature bonds to management of SES. Place plays a crucial role in understanding different positionalities in local and regional level SES. It shapes knowledge interactions and related agency, and mediates questions such as who can present local knowledges and whose knowledge counts in environmental decision-making (**Paper III**).

The knowledge-related aspects have been overlooked in sense(s) of place literature. However, as shown in **Paper IV**, they can contribute to understanding views on management options and related tensions because the governance processes concerning the management and development of places are often epistemic (van der Molen, 2018). There is unrealised potential in understanding the role of knowledge-place connections for management and governance, shaping possibilities of

participation and the ways different people work together. The epistemic dimension compliments the model of sense(s) of place used in SES research consisting of place meanings and place attachment (Castro, 2021). Masterson et al. (2019) outline that place attachment indicates roots and motivation for protective and restorative actions towards nature whereas place meanings indicate what people might aim to preserve in a place. In this thesis, I align with Castro's (2021) findings and propose that epistemic bonding explains the reactions towards legislation such as formal nature protection as well as reflects perceptions of legitimacy of different knowledges that are used in deciding these actions (**Paper IV**).

The emergent idea of the plural senses of place that emphasise diverse epistemic understandings (Raymond et al., 2021) benefits from considering the epistemic dimension in researching senses of place. This can add to our understanding of subjectivity that is suggested as one of the key contributions of sense of place research combined with SES approaches in sustainability science (Stedman, 2016). Here we can start to move toward interconnected inclusivity of epistemic plurality, meanings, values and diverse motivations in SES. Moreover, the epistemic dimension of human-nature connections could provide a pathway to manage ontological security of individuals and groups (Raymond et al., 2021), and particularly, the desire to manage some form of place stability through connections to specific people and places, while drawing on their knowledges and agency to navigate different forms of place change.

5.4 WAYS FORWARD: EPISTEMICALLY ATTUNED SUSTAINABILITY SCIENCE

The three insights of this thesis are pertinent to several fundamental aspects of sustainability science. In general, the epistemic dimension and reflexivity around the different epistemic starting points among sustainability scientists could help bridge the different research approaches in the field when needed, ranging from systemic analytical and problem-oriented approaches to transformative and solutions-oriented ones (Lang & Wiek, 2021) to contribute to creation of actionable knowledge. To be able to approach the epistemological sphere, sustainability scientists need to draw on the reflexivity of social sciences (Longo et al., 2021) and have basic training on the philosophy of science concerning implications of diverse epistemologies and ontologies on their work. Hence, the question of critical reflexivity should not be dividing natural and social scientists in the field but "*as a useful resource for better sustainability science*" (Nagatsu & Thorén, 2021, p. 93).

The relational turn in sustainability science (West et al., 2020; 2021) aligns with the plural view of knowledge and human-nature connections presented in this thesis, and helps unearth the epistemic issues at play. For example, it helps us to embed scientists in the systems they are studying and highlight the ethical nature of

knowledge production (Barad, 2007) as well as recognise the value-laden and political nature of scientific knowledge to open up for questions of representation and accountability and domination and oppression (Haraway, 1988; Turnhout et al., 2020).

Yet relationality in practice might be difficult to achieve without rethinking conceptualisations and practices in sustainability research which need to move towards managing relations between people and the natural systems instead of describing separate entities (Hertz et al., 2020). In these relations, we need ways to acknowledge and deal with the epistemological and ontological issues. However, the question of greater academic structures in enabling or hindering the relational turn and reflexivity remains important. Reflexivity cannot only be the responsibility of an individual researcher (**Paper I**) but is best fostered in collaborative and supportive academic institutional environments (Leitheiser et al., 2022; Shrivastava et al., 2020).

This thesis contributes to recent place-based scholarship which flags the role of place for better understanding of SES dynamics in sustainability science (Balvanera, et al., 2017; Della Bosca, 2020; Lam et al., 2019; Moriggi et al., 2020). Place cannot be forgotten or neglected – rather, it must be placed in dialogue with other scales of ecosystem governance and knowledge production in sustainability science. Place is an epistemically important area in which we can start to understand how different views come together, and whose voices are the most dominant in ecosystem governance and framing transformations towards sustainability. As Seamon (2018) states “life takes place” so do as well transdisciplinary and collaborative knowledge processes. Therefore, *epistemically attuned sustainability scholarship* understands that epistemic considerations do not concern only scientific knowledge production, but all the occasions in which knowledges are co-created or exchanged and most crucially when these knowledge interactions aim at having real-world transformative impacts. Epistemically attuned sustainability science recognises differences and aims to minimise its contribution to epistemic injustices. Aligning with feminist scholarship, it seeks to create spaces for counter discourses and ways of creating knowledge (Dübgen, 2015).

6 LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This thesis is limited in its assessment of the epistemic dimension of human-nature connections to the Western context of NRM and SES as well as the Western scientific knowledge in interdisciplinary collaborations. However, there are severe epistemic violations between Western-centric knowledge production in the Global North and knowledges of Indigenous people as well as knowledge production situated in Global South. These include, for example, colonialism and neo-colonialism destroying Indigenous people's ways of knowing (Hountondji, 2002; L. T. Smith, 2012), the tendency to consider Western scientific knowledge as the universal truth (Turnbull, 1996) or structural marginalisation of academics in the Global South in scientific knowledge production (Dübgen, 2020).

This thesis primarily draws on sustainability science scholarship. Sustainability science can play a part in Western epistemic domination (as exemplified in Johnson et al. 2016; Watson, 2013; Lam et al. 2020), which calls for decolonial perspectives (e.g., Datta, 2018; Denzin et al., 2008; Escobar, 2015) to be included in sustainability science. The epistemic dimension must be recognised in different geographic places and contexts by people holding different epistemologies and ontologies. In this way, it also has potential to be further employed as a way to address imbalances between the Global North and South in knowledge production and representation.

There are practical limitations concerning the epistemic dimension of human-nature relationships explored in this thesis. It is easy to get stuck in the plurality of human-nature connections and forget the pragmatism (and the balance between concreteness and pluralism) necessary to achieve rapid sustainability transformations (Smith & Stirling, 2007; Raymond et al., 2021). Methods need to be developed to support co-creation that recognises diverse epistemic understandings and worldviews, but at the same time this recognition needs to be translated into practice. At the same time, the nature of transformative research often requires balancing scientific rigour and excellence, impact and engagement and self-care (Sellberg et al., 2021). It therefore consumes both scientists' and participants' personal resources. Certain pragmatism is needed in research practice to ensure individuals' well-being.

There are also multiple political, social and legal feasibility issues that impede sustainability transformations (Patterson et al., 2021) that cannot be fully understood by simply describing the plurality of relationships between knowledges, sense of place and ecosystem governance. In this thesis, I do not assume that unpacking this plurality will enable transformations, but rather I demonstrate that unpacking the epistemic dimension is essential to inclusivity (particularly regarding recognition justice) in ecosystem governance. Future research needs to consider if, how and to what extent

different knowledge-place connections support (or inhibit) just sustainability transformations.

Knowledges relate to many aspects such as beliefs, power, resources, and institutions and epistemic and value pluralism go hand in hand (**Paper I**, Horcea-Milcu et al., 2019; Laursen et al., 2021). Inclusivity in ecosystem governance requires recognising other aspects such as emotions, values and feelings of care (Moriggi et al., 2020; West et al., 2018). Consequently, interconnections of these aspects to knowledges merit further attention from sustainability scholars.

7 CONCLUSIONS

Understanding and dealing with epistemic plurality in ecosystem governance is necessary for inclusivity and just sustainability transformations, yet, these knowledge-related issues are not currently fully understood, nor are they fully incorporated to inter and transdisciplinary collaborations and ecosystem governance. This thesis makes a significant contribution to conceptualising and assessing the epistemic dimension of human-nature connections in the field of sustainability science. Whilst knowledge-related scholarship is growing in the field, this thesis is novel in its in-depth exploration and examination of the epistemic dimension of human-nature connections operating at different scales in sustainability science practice and ecosystem governance.

The findings demonstrate that the epistemic issues need to be explicitly addressed at different scales and contexts of ecosystem governance and related approaches of collaborative knowledge production in sustainability science and provides tools and perspectives to approach the sphere. The thesis presents knowledge as an additional dimension to the sense(s) of place scholarship to be further able to deal with subjectivity and plurality of views in social-ecological systems. The findings also underpin the role of reflexivity in all knowledge-related processes. Knowledge processes need to move beyond naming reflexivity to actually surface epistemic issues, assess them, understand their influence on human-nature connections across the scales and ultimately to use them to foster and navigate just sustainability transformations.

Overall, the future research on the epistemic dimension of human-nature connections has two lines of inquiry: the theoretical and practical. Theoretically, epistemic issues are further expanded and integrated to place and justice scholarships as well as to values, meanings and feelings of care. Practically, we are in an urgent need of new tools and methods which enable reflexivity of epistemic issues in different contexts and cultivating epistemic recognition in practice.

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10 APPENDICES

10.1 APPENDIX I: THE IPBES SURVEY

Survey instrument used in Paper II.

Section 1: Your expectations of the *IPBES Values Assessment*

Please describe what you see as the main purpose of the *IPBES Values Assessment*.

Please describe what you think is the most pressing issue that experts will address during the *IPBES Values Assessment*.

On a scale of 1-5, how likely do you think it is that the *IPBES Values Assessment* will promote each of the following:

Broad social change
Change of policy
Change of understanding within the individual
Change of understanding within a wider social unit
Inclusion of marginalized groups
Your professional network

Section 2: Your views on the multiple values of nature

How would you define “the multiple values of nature”?

Do you prefer to use any particular conceptual framework(s) to examine the relationships between the multiple values of nature, including biodiversity and ecosystem services? If so, please describe.

Section 3: Your views on knowledge and how you understand reality in science

What types of evidence do you believe is needed to constitute valid knowledge in this *IPBES Values Assessment*?

What level of agreement is needed in the literature to constitute valid knowledge in this *IPBES Values Assessment*?

On a scale of 1-5, to what extent do you agree or disagree with the following statements:

The natural world is external and objective

Researchers should formulate hypotheses and then test them

Researchers should use multiple methods to establish different types of data

Researchers should try to develop ideas through induction from data

Please indicate on a scale from 1-5 how important the following forms of knowledge systems are to your work:

Local knowledge

Generalizable knowledge

Informal knowledge

Formal knowledge

Novice knowledge

Expert knowledge

Traditional knowledge

Scientific knowledge

Indigenous Knowledge

Other (Please describe)

Do you prefer to use any particular conceptual framework(s) to examine the relationships between the multiple values of nature, including biodiversity and ecosystem services? If so, please describe.

Section 4: Your views on knowledge and how you understand reality in science

What types of evidence do you believe is needed to constitute valid knowledge in this *IPBES Values Assessment*?

Do you believe it is possible to integrate the multiple values of nature if they are grounded in different knowledge systems? YES/NO

What methods would you suggest be used by experts to support the integration of the multiple values of nature across knowledge systems in this *IPBES Values Assessment*?

What factors do you believe hinder the integration of the multiple values of nature across knowledge systems?

In what ways could IPBES's processes be improved to build your confidence in working across knowledge systems during the *IPBES values assessment*?

Do you believe such improvements to IPBES's processes will improve the validity of the results of the values assessment for multiple stakeholders? If so, how? If not, why not?

Section 5: Background Information

Would you please enter your email address in the space below?

In what country do you currently live?

In what country do you conduct the majority of your work?

Please state your primary academic discipline.

What is the name of the department or agency where you are currently employed?

How many years have you been working with diverse conceptualizations of the multiple values of nature?

What year were you born?

To which gender identity do you mostly identify?

Female

Male

Transgender female

Transgender male

Gender variant not-conforming

Not listed

Prefer not to answer

What is your main role working with the *IPBES Values Assessment*?

(Please check one)

Co-chair

Lead author

Fellow

Co-ordinating lead author

Contributing author

Other (please describe)

If you have any additional thoughts that were not reflected in the questions above, please share them here.

10.2 APPENDIX II: SEMI-STRUCTURED INTERVIEW GUIDES

Interview guide used in Paper III

*This is the initial interview guide used for the semi-structured interviews in **Paper III**. The interviews were originally conducted in Finnish and Swedish. The order of the questions varied depending on the position of the interviewee and the general flow of the interview. Additional questions were added if important themes were raised by the interviewee, which were not included in the initial guide or if more explanation was considered to be needed about the discussed topics. Furthermore, as a part of the interviews, a map of the World Heritage Site was used to facilitate discussion about meaningful and important places and belonging to the area.*

PERSONAL HISTORY

Can you describe your background?

Where are you originally from? Where are you living now? How long have you been living there? Why did you decide to move there?

LOCAL KNOWLEDGE

What aspects do you relate to 'local knowledge'?

What does local knowledge include in your mind?

Do you think you have local knowledge? To what do you relate it?

How have you gained this knowledge?

Is there some kind of knowledge that is important in general for a person who lives in this area?

Culturally or environmentally important knowledge?

Who do you think has local knowledge in the area?

Have you experienced that local knowledge as you consider it has changed in some ways? How? Do you consider you have and use local knowledge in your everyday life?

In what kinds of situations? Do you use local knowledge at your professional position?

How?

WORLD HERITAGE SITE

What is your relationship to the World Heritage area? Professionally and personally.

How well do you know it and how have you become familiar with it?

What do you think, on what kind of knowledge is the governance of the World Heritage Site based on?

Whose knowledge is used in the governance of the World Heritage Site?

What do you think, how this knowledge is obtained?

How are decisions made in the world heritage site?

Are there any forms of exchange of knowledge between people living in the area and the people in the management? What are these forms?

What kind of knowledge could you bring to the discussion about the World Heritage Site?

How is your knowledge different from the other knowledge sources?

Do you think you have experiences and knowledge that could be useful for the governance of the area?

Are there some perspectives that are not included into the governance of the area?

What are these?

What are the biggest challenges in the area?
What are the biggest possibilities in the area?
What kind of knowledge is needed to utilise the possibilities and/or overcome the challenges?

In general, what do you think is the role of local knowledge for the governance of the World Heritage Site?
Can it, and if so how, be utilised in the governance of the area?

PLACE

Are you interested in the area and/or local environment?
If yes, how have you developed this interest?
What is important for you in this area? Why?
Are there places that are important for you? Why are these important?
Have there been any changes in these places you consider important?
Any other comments about the themes we have talked about today?

10.3 APPENDIX III: THE WORLD HERITAGE SURVEY

The survey used in Paper IV.

Separate surveys concerning only either the High Coast or the Kvarken Archipelago were sent to the resident of the areas.. Here the surveys are combined into one.

A Country

Finland/Sweden

B I use the Kvarken Archipelago/High Coast World Heritage Site for (mark all the relevant options)

Living
Leisure living
Spending time in the nature
Enjoying silence
Enjoying scenery
Enjoying plants and wildlife (e.g. birdwatching)
Enjoying cultural heritage
"Getting away from it all"
Learning about nature
Learning about culture and history
Research/Scientific purposes
Getting to know nature with children
Spending time in the nature with friends or family
Photographing
Exercising
Hiking
Swimming
Water sports (e.g. sailing)
Foraging (e.g. berries and mushrooms)
Fishing
Forestry
Hunting
Agriculture
Livelihoods based on natural resources
Livelihoods based on tourism
I don't use the area
Other

C To what extent do you agree or disagree with the following statements?

1 = disagree strongly, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = agree strongly

Kvarken Archipelago/High Coast is very special to me.

Living in/close to Kvarken Archipelago/High Coast says a lot about who I am.

I learn a lot about myself when spending time in the natural environment of Kvarken Archipelago/High Coast.

I am very attached to the natural environment in Kvarken Archipelago/High Coast

My relationships with my family in Kvarken Archipelago/High Coast are very special to me.

Kvarken Archipelago/High Coast means a lot for me.

I feel that Kvarken Archipelago/High Coast is part of me.

I would feel less attached to Kvarken Archipelago/High Coast if the native plants and animals that live there disappeared.

Doing my activities in Kvarken Archipelago/High Coast is more important to me than doing them in any other place.

Belonging to volunteer groups/associations/organization in Kvarken Archipelago/High Coast is very important to me.

I am very attached to Kvarken Archipelago/High Coast.

When I spend time in the natural environment in Kvarken Archipelago/High Coast, I feel a deep feeling of oneness with natural environment.

The friendships developed by doing various community activities strongly connect me to Kvarken Archipelago/High Coast.

I identify strongly with Kvarken Archipelago/High Coast.

No other place can compare to Kvarken Archipelago/High Coast.

Kvarken Archipelago/High Coast is the best place for the activities I like to do.

I live in/close to Kvarken Archipelago/High Coast because my family is here.

I would not substitute any other area for the activities I do in Kvarken Archipelago/High Coast.

Without my relationships with family in Kvarken Archipelago/High Coast, I would probably move.

In my family history, there are connections to the Kvarken Archipelago/High Coast.

My knowledge about the Kvarken Archipelago/High Coast is an important part of my connection to it.

I am more knowledgeable about the Kvarken Archipelago/High Coast than other places in the world.

The knowledge I obtain through my connections with others in this place helps to define who I am.

I have knowledge about the natural environment of the Kvarken Archipelago/High Coast.

My knowledge of the Kvarken Archipelago/High Coast is created through interaction with local environment and community.

It would be difficult to gain as deep knowledge of other places as I have of the Kvarken Archipelago/High Coast.

D To what extent do you agree with the following statements?

1 = disagree strongly, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = agree strongly

"Kvarken Archipelago/High Coast is valuable..."

1. ... because it has attractive or pleasing landscapes.
2. ... because it has recreation opportunities.
3. ...because it provides for a variety of plants, wildlife, or marine life.
4. ...because it provides for food, fibre, fishing or the raising of animals.
5. ...because it provides places that support local businesses.
6. ...because it helps to produce clean air and fertile soil, clean surface or ground water, or provides materials and food from nature that sustain human life.
7. ...because it represents history or provides opportunities to express and appreciate culture or cultural practices such as art, music, and history.
8. ... because it provides places where we can learn about geographical phenomena through observation or study.
9. ... because it provides opportunities for social interaction or provides places for community services such as sporting clubs.
10. ... in its own right, no matter what I or others think about them.
11. ... because it has sacred, religious, or spiritually special places or because I feel reverence and respect for nature here.

E To what extent do you agree with the following statements?

1 = disagree strongly, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = agree strongly

Nature values should be prioritized when decision about the development of the World Heritage Site are made.

Developing infrastructure (e.g. roads, bridges, transport) is a necessity for the vitality of the World Heritage Site

It is important that the value of the World Heritage Site is secured by adding regulations towards using natural resources and natural areas.

The management of the World Heritage Site needs to take better into account needs of local residents.

New nature protection areas are needed in the World Heritage Site.

Natural resources management of the area is based too much on natural sciences forgetting history and culture and people's lived experience.

Tourism poses a threat for nature values of the area.

The goal of the management of the area should be to support new working opportunities and livelihoods for example in tourism.

The managing agency is not doing enough to maintain the nature values in the World Heritage Site.

Rights of local residents to use nature should be prioritized over nature protection in the area.

The managing agency uses the World Heritage Site status as means to motivate nature protection in the area and hinder development.

Economic possibilities of the World Heritage status are prioritised over the conservation of nature in the World Heritage Site.

F To what extent do you agree with the following statements?

1 = disagree strongly, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = agree strongly

The World Heritage Site is managed in a way that enables protecting nature values and development of the area simultaneously.

Economic possibilities and livelihoods are taken well into account in the management of the World Heritage Site.

Nature and use of natural resources are well managed in the area.

The managing agencies work in a way that meets my expectations.

Overall, I am satisfied with the way the World Heritage Site is managed.

I am willing to rely on the decisions made by the management agency.

I am confident that management agencies make the right decisions regarding questions that are important for me in the World Heritage Site.

I think that the management agency provides good decisions and guidance about the World Heritage Site based on their expertise.

I trust that the management agency has the knowledge necessary to do their job in the World Heritage Site.

I would offer my opinions and views if they were asked by the management agency.

I trust that the managers think that it is important to do the right thing.

G How would you classify the level of trust between local residents and the management agency in charge of the World Heritage Site?

- 1 = No trust
- 2 = A low level of trust
- 3 = Medium level of trust
- 4 = A high level of trust
- 5 = A very high level of trust
- 6 = I don't know

H To what degree you agree with the following statements?

1 = disagree strongly, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = agree strongly

Local residents who are impacted by different decisions (e.g. nature protection) are heard in the process of decision-making in the World Heritage Site.

The decision-making processes in the World Heritage Site favour some interests over others.

Decisions about the World Heritage Site are made without including local inhabitants.

Overall, I think that decisions made about the management and development of the World Heritage Site benefit a wide range of local inhabitants.

There are not sufficient platforms for communication between local inhabitants and the management agencies in the World Heritage Site.

New decisions made about the World Heritage Site are well-motivated to the local inhabitants.

I Below are statements about your knowledge and other residents' knowledge about the World Heritage Site How strongly do you agree or disagree with these statements?

Knowledge of local people in the World Heritage Site should be included into management.

Knowledge of local residents is not very relevant for the management of the World Heritage Site.

I would like to share my knowledge about the World Heritage Site with the management agencies

I have valuable knowledge about the World Heritage Site.

Local residents' knowledge is a part of the management of the World Heritage Site.

Decisions about the World Heritage Site are made in the end without knowledge of local residents.

The knowledge of officials and researchers is often privileged over the knowledge of local residents.

Local residents are treated as experts about the World Heritage Site by the managing agencies.

Knowledge of local residents and knowledge of officials and researchers are equally valued in the decision-making processes at the World Heritage Site.

I think that local residents in general in the World Heritage Site consider their knowledge valuable for decision-making about the Site.

My knowledge about the World Heritage Site is valued by the managing agencies.

I find local residents' knowledge related to the World Heritage Site equally relevant as the knowledge of officials and researchers.

J Your year of birth

K Your gender

L What is your current life situation?

- 1 = Works (employee, entrepreneur)
- 2 = Serves in the military
- 3 = Unemployed
- 4 = Home parent without paid employment
- 5 = Retired because of age
- 6 = Early retirement
- 7 = Part-time employed
- 8 = Long-term sick leave
- 9 = Student
- 10 = Does not work for other reasons

M Which of the following is your highest level of education?

- 1 = None
- 2 = Elementary school
- 3 = Gymnasium
- 4 = Post-secondary education shorter than 3 years
- 5 = Post-secondary education 3 years or more
- 6 = Doctorate
- 7 = My education level is not on the list (specify)