

# **Navigating biodiversity conservation trade-offs in the social landscape: Understanding stakeholder perspectives and aspirations**

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# Preface

This cumulative dissertation comprises four chapters. **Chapter I** provides the conceptual background, the key findings and a synthesis of the dissertation. The following two chapters focus on the first case study of this dissertation, the Muttama Creek Catchment. **Chapter II** presents four different discourses on the production-biodiversity intersection, how those are shaped and what that means for biodiversity governance in agricultural landscapes. **Chapter III** discusses the Three Horizons Framework as a tool in future studies that helped participants develop six different pathways of change. **Chapter IV** focuses on the second case study of this dissertation, the Biosphere Reserve Spreewald. This chapter outlines three different landscape narratives and provides insight into improving collaborative governance for cultural landscape preservation. Each chapter provides either a conceptual framework or a brief literature review which defines the terms and concepts used in more detail. References for each chapter can be found at the end. All three chapters have supplementary materials that can be accessed via a link or are included at the end of the chapter.

The articles are the versions published in the journals, except for the last article, which will be submitted to the journal *Ecosystems and People* and was inserted as a Word document in the latest version.

The co-authored papers in **Chapters II-IV** of this dissertation were written in two research projects. The transdisciplinary action research project ‘ginkoo’ (Designing integrative innovation processes: New institutional and regional forms of coordination for sustainable land management) aimed to develop methods and tools to support the coordination of complex innovation processes for sustainable land management. The second project, ‘The Future of Farming and Biodiversity: the Muttama Creek Catchment area’, sought to explore options to harmonise profitable farming and successful biodiversity conservation.

I hope the research presented in this dissertation contributes new evidence and insights to sustainability science scholarship on biodiversity conservation trade-offs and inspires thinking about creative ways to engage with the kaleidoscope of different perceptions, values and aspirations in the social landscape.

## Photo credit

The photos on page 5 were taken by Dr Michael Mitchell (photo middle left), Dr Anett Kuntosch (photo middle right) and Tamara Schaal-Lagodzinski (photos top and bottom). Sebastian Kempke created the illustrations on page 37. Julia Roche created the artworks on page 53 and the photos were taken by Jack of Hearts/Jackie Cooper. The photo on page 75 was taken by Tamara Schaal-Lagodzinski.



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## Abstract

The global loss of biodiversity has been widely studied, yet it has many different facets depending on the context. Key drivers for biodiversity loss are anthropogenic, including agricultural intensification, expansion and land abandonment. Though the loss of biological diversity is an ecological phenomenon, it also has a social dimension. This makes the study of the social landscape, encompassing the multitude of perspectives and aspirations by different stakeholders, highly relevant for better navigating trade-offs between biodiversity conservation and other land use objectives. Engaging with and addressing contextual understandings of biodiversity is vital to develop socially palatable solutions for biodiversity loss.

This dissertation, therefore, takes a place-based approach to studying biodiversity conservation trade-offs and seeks to understand how the perspectives and aspirations of different stakeholders shape them. First, it aims to identify shared viewpoints as ensembles of perceptions and meanings about human-nature relations and biodiversity (research aim 1). Second, it aims to understand how biodiversity is valued and constructed in stakeholders' aspirations towards their landscape (research aim 2). To this end, a convergent mixed methods approach and case study design are used. Two cases were selected that face different underlying drivers of land-use change, resulting in loss of biodiversity. The Muttama Creek Catchment area is a farming landscape in south-eastern Australia where the ongoing intensification of agricultural production threatens native biodiversity. In the Spreewald Biosphere Reserve in north-eastern Germany, land abandonment and the resulting loss of the biodiversity-rich wet meadows presents a key challenge for biodiversity conservation. Narratives and discourses provide conceptual lenses through which I study biodiversity conservation trade-offs. Drawing on Q-methodology, this dissertation identifies biodiversity-production discourses for the first case study and cultural landscape narratives for the second case study. Moreover, based on a participatory futures approach, the Three Horizons Framework, it elicits narratives of change that highlight opportunities for biodiversity conservation in farming landscapes.

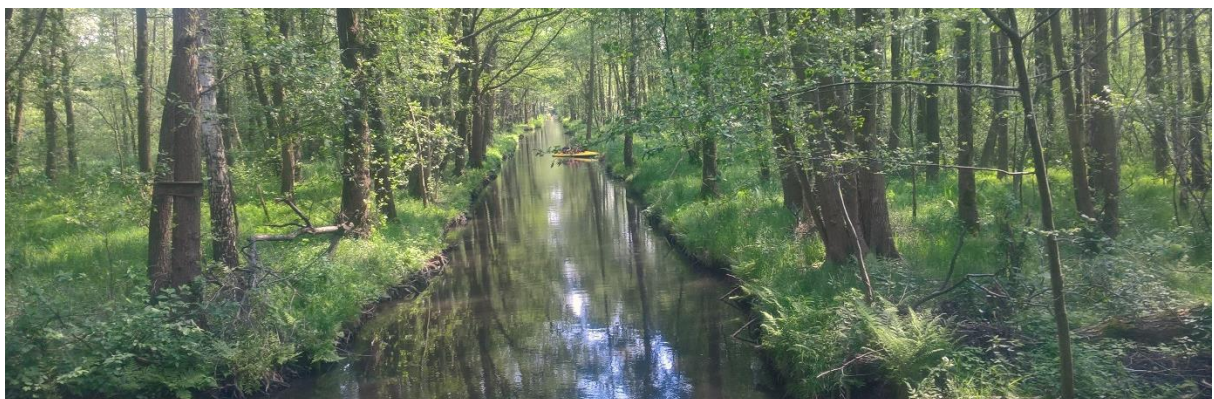
The findings highlight that despite some overlap in how stakeholders perceive biodiversity, contrasting problem framings and different biodiversity priorities present hindrances to concerted action to protect biodiversity and for collaboration (research aim 1). The findings also identify shared values among stakeholders (research aim 2). However, there is polarity and contestation around the role and importance of biodiversity in rural development. In conclusion, the findings contribute to three key themes in sustainability science and conservation debates: (1) They support calls for more inclusive and pluralistic biodiversity governance and highlight the need to engage holistically with multiple trade-offs with biodiversity conservation. (2) The empirical findings highlight the potential for stewardship as a broad value for place-based actions and biodiversity disvalues as another realm of engagement to improve conservation outcomes. (3) This dissertation demonstrates how a participatory approach helped identify opportunities for change and supported collective sensemaking about current issues and ways forward. Arts-based research is suggested as an avenue for future research to engage with different ways of knowing and thinking. In conclusion, this dissertation highlights how people value biodiversity differently based on their relative perspectives, the role of biodiversity in aspirations for the future and what this means for governing the transformative changes needed to address the issue of biodiversity loss.



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# Chapter I

## Framework paper



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## 1. Introduction

Canola fields as far as the eye can see, coral bleaching of the Great Barrier Reef and deforestation of the Amazon rainforest are prominent examples of the many faces of biodiversity loss. Biodiversity as the “diversity of genes, populations, species, communities, and ecosystems” (UN Global Compact and IUCN, 2012, p. 22) was introduced as a scientific concept by biologists in the 1980s to capture the phenomenon of species loss (Jetzkowitz et al., 2018). Since then, biodiversity loss has been well-studied and documented, especially globally (Butchart et al., 2010; IPBES, 2019). Evidence points to an unprecedented speed and extent of biodiversity loss, which has led many scientists to frame it as a sixth mass extinction (MA, 2005) and research suggests that especially genetic diversity has long passed planetary boundaries (Rockström et al., 2009; Steffen et al., 2015). As a result, the loss of biodiversity is considered one of the grand challenges that humanity is facing in the 21<sup>st</sup> century (e.g. MA, 2005; IPBES, 2019). The Aichi Biodiversity Targets and the United Nation’s (UN) Sustainable Development Goals, especially goals 15 (Life on land) and 14 (Life below water), set global goals for biodiversity conservation. For 2050, the Convention on Biological Diversity (CBD) set a vision of living in harmony with nature where “biodiversity is valued, conserved, restored and wisely used” (CBD, 2021, p. 4).

Much of the debate about biodiversity loss has been dominated by the natural sciences, focusing on quantifying biodiversity loss. Although natural processes impact biodiversity, e.g. climate change or natural hazards, key drivers for biodiversity loss are anthropocentric (IPBES, 2019). On land, the globalisation of food systems and the pursuit of economic growth (e.g. Clapp, 2015) have led to intensification and land abandonment, which are direct drivers of biodiversity loss (Díaz et al., 2015). However, biodiversity loss does not just have a biophysical dimension but “[m]any (arguably all) conservation problems are social in nature” (Adams and Sandbrook, 2013, p. 333). Understanding social systems is vital when human actions create environmental problems (Clement, 2021). Moreover, biodiversity is not a neutral term but is tied to normative objectives of nature conservation (Jetzkowitz et al., 2018) and due to the multiple values and meanings related to this concept, it is difficult to condense this issue into one single, quantifiable target (Turnhout and Purvis, 2020). Therefore, understanding the direct and indirect drivers of loss also requires engaging with the different values pertaining to nature and how they shape human actions (IPBES, 2019). A value can be “a *principle* associated with a given worldview or cultural context, a *preference* someone has for a particular state of the world, the *importance* of something for itself or for others, or simply a *measure*” (Pascual et al., 2017, p. 9).

In recent years, scientific understanding of the multiple benefits that nature and healthy ecosystems provide to humans has proliferated (IPBES, 2019; Hill et al., 2021; IPBES, 2022). Social science research is well-versed in understanding human subjectivity of decision-making and aspects influencing direct drivers of change. The social or human dimension of conservation encompasses a broad range of concepts used in different disciplines, including values, perceptions, and meanings (Bennett, 2016; Moon et al., 2019; Bennett et al., 2022). For example, nature perceptions and place values are vital to understanding local environmental stewardship (Cortés-Capano et al., 2020). Further, the increasing calls for fundamental, system-wide transformations require including diverse social groups and recognising diverse values

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among different societal actors (Pascual et al., 2017; Martin et al., 2022). Therefore, engaging with the kaleidoscope of perspectives (Gould et al., 2018) and social diversity in conservation (Sandbrook et al., 2019) is vital to identify barriers and opportunities for improving biodiversity outcomes. These insights can help improve conservation practice, policy and governance (Bennett et al., 2017; Bennett et al., 2022). The different perspectives and values of individuals and social groups shape how biodiversity loss is perceived and managed and thus provide vital insights for improving biodiversity and sustainable land management.

In a time when humans have become the dominant driver of change, we face global challenges, but solutions require attention to context and the local level (Wyborn et al., 2020). Research shows that biodiversity loss impacts regions differently (e.g. Kehoe et al., 2017) and how people benefit from nature is unequally distributed among social groups (IPBES, 2019). Context thus matters not only for understanding the indirect drivers of change that shape environmental problems (Visseren-Hamakers et al., 2021) but also for developing solutions (Pascual et al., 2021). For example, if local meanings of nature and place are not considered, this can create barriers to land-use interventions (Masterson et al., 2019). Instead of drawing up more global maps designating areas for biodiversity conservation, there is a need to engage with context-specific and diverse ways of knowing biodiversity (Wyborn and Evans, 2021). Understanding the context-specific drivers of biodiversity loss and finding ways to protect biodiversity thus requires engaging with place-based understandings of biodiversity.

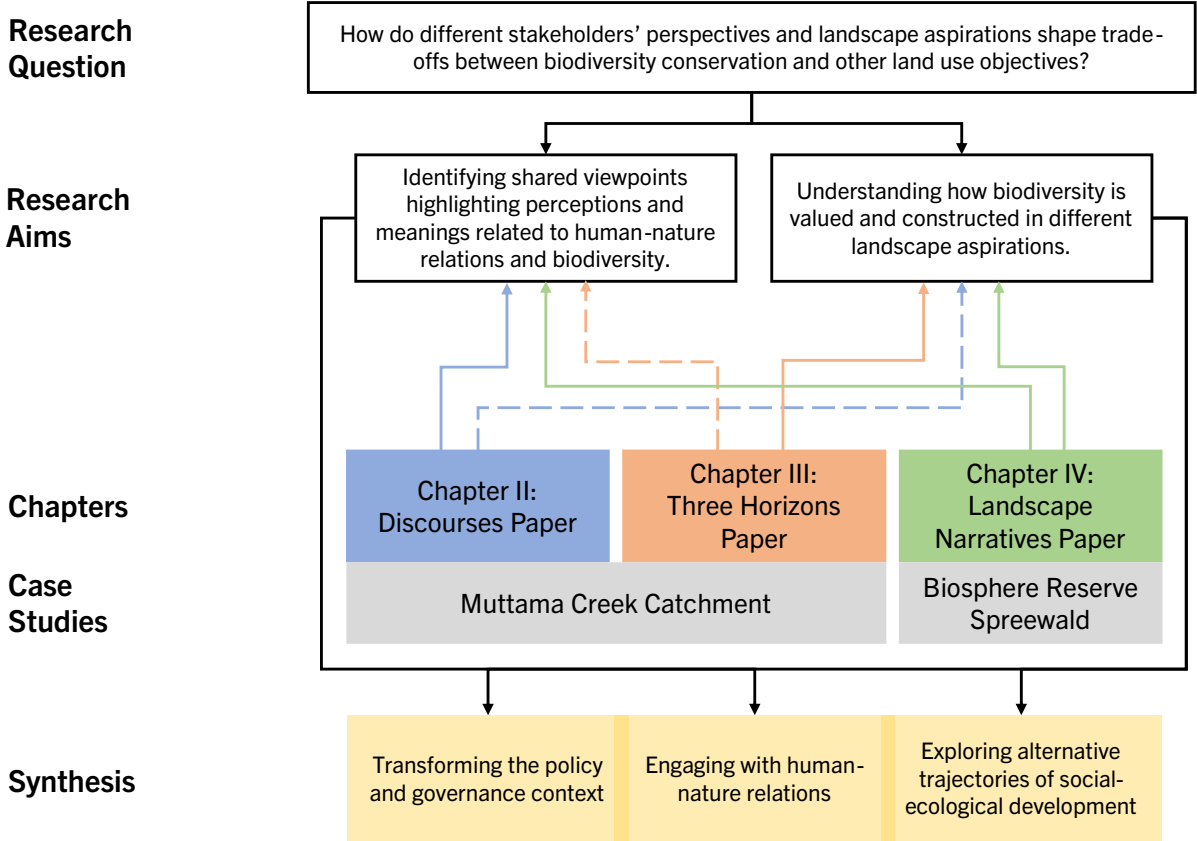
Through mixed methods case-study research, this doctoral dissertation aims to contribute to a better understanding of place-based biodiversity conservation trade-offs. I study the social landscape, i.e. the range of stakeholders who either influence or are influenced by conservation (c.f. Freeman, 1984), to understand how biodiversity loss is conceptualised and how its materialities are perceived, valued and interpreted by a range of different stakeholders. I aim to understand how this contextualisation shapes trade-offs in land management in two different case studies. By better understanding how biodiversity conservation competes with other land use objectives and how this tension shapes biodiversity outcomes, this dissertation can inform research on biodiversity governance and help design socially palatable policy and management options for biodiversity protection.

The overarching research question of this PhD is therefore: **How do different stakeholders' perspectives and landscape aspirations shape trade-offs between biodiversity conservation and other land use objectives?** Trade-offs here refer to situations where conservation objectives conflict with other land use objectives and are traded off in favour of the latter. This includes trade-offs between conservation and production in agricultural contexts (e.g. Lécuyer et al., 2021) or between conservation and local community development (e.g. Masterson et al., 2019). People face trade-offs and decisions between conservation and other goals for various reasons. These include differences in what people value, different meanings of biodiversity and because the context plays a vital role in biodiversity conservation, e.g. creating conflict between top-down, prescriptive approaches and local environmental knowledge or development preferences.

This dissertation, therefore, has the following two research aims:

- 1) Identifying shared viewpoints that reflect ensembles of perceptions and meanings related to human-nature relations and biodiversity.
- 2) Understanding how biodiversity is valued and constructed in different landscape aspirations.

This framework paper synthesises the results of the empirical research presented in Chapters II-IV (Fig. 1). The research draws on two case studies where biodiversity loss presents a key issue as a result of land use changes: ongoing agricultural intensification in the Muttama Creek Catchment in south-eastern Australia (Chapters II-III) and land abandonment in the Spreewald Biosphere Reserve in north-eastern Germany (Chapter IV). This dissertation focuses on understanding how local perspectives and aspirations shape biodiversity conservation trade-offs.



**Fig. 1.** Overview of the dissertation. The figure shows how the overarching research question was sub-divided into two aims which were answered through the three publications of this dissertation.

In Section 2, I introduce the key conceptual foundations of this dissertation: (1) governing biodiversity conservation trade-offs, (2) the role of the social landscape of conservation, and (3) discourses and narratives about the (agri-)environment. In Section 3, I outline the mixed methods, case study-based research approach of this dissertation before summarising the findings around shared viewpoints on trade-offs and landscape aspirations from the three publications in Section 4. I then synthesise and discuss the findings in Section 5 by tying them

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in with debates on transformative biodiversity governance, changing human-nature relations and future trajectories of social-ecological development. I conclude this dissertation in Section 6 by summarising the main findings, highlighting contributions to the literature and avenues for future research.

## **2. Conceptual framing**

### **2.1 Governing biodiversity conservation trade-offs**

The idea that ecological goals and human development are not incommensurable but can be achieved simultaneously is one of the central ideas of sustainable development (e.g. Kates et al., 2001). Subsequently, how trade-offs between conservation and human wellbeing can be avoided plays a vital role in sustainability science (Kates, 2011; McShane et al., 2011) and in discussions about land systems and biodiversity (e.g. Ellis et al., 2019). However, conservation conflicts entail trade-offs and tough choices (McShane et al., 2011) and the objectives laid out in the CBD reflect a tension between conservation on the one hand and sustainable use on the other hand (Jetzkowitz et al., 2018). Intensification and expansion from agricultural activities are key drivers of biodiversity loss (Foley et al., 2011; Tilman et al., 2011), which has led to ongoing debates about how to achieve both production and conservation objectives (e.g. Sayer et al., 2013) and, in view of global population growth and simultaneous ecosystem degradation, to ensure biodiversity conservation and food security simultaneously (Foley et al., 2011; Tilman et al., 2011; Hanspach et al., 2017). This includes, for example, the prominent debate on land-sparing versus land sharing (e.g. Green et al., 2005) as different approaches to how land management can consider multiple objectives. However, debates that focus predominantly on ecological aspects and quantitative trade-off analysis, e.g. between different ecosystem services (e.g. Aryal et al., 2022), fail to consider the social dimension of trade-offs. For example, changes to the land may have a positive value for some people or groups and a negative impact on something of value to others (Lliso et al., 2022). Navigating trade-offs between multiple land management objectives and considering different perspectives on biodiversity conservation presents a key challenge for biodiversity governance.

Governance encompasses “all those activities of social, political and administrative actors that can be seen as purposeful efforts to guide, steer, control or manage” (Kooiman, 2010, p. 2). Biodiversity governance thus includes the broad range of actors that directly and indirectly shape biodiversity outcomes through their actions. For example, governance frameworks are purposeful interventions at multiple scales aiming to achieve broad goals such as biodiversity conservation (Paavola et al., 2009). In contrast, governance regimes encompass formal and informal institutions more broadly that shape biodiversity outcomes (Paavola et al., 2009). This highlights the multi-level and multi-actor nature of biodiversity governance. For example, protected areas management and governance in the Czech Republic entail multiple trade-offs between nature conservation and agriculture, tourism or infrastructure development (Daněk et al., 2023). Various agricultural and environmental policies have been developed to protect biodiversity on land and avoid or reduce trade-offs with other land use objectives. These policies include incentives or restricted access and use, the establishment of protected areas,

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environmental assessments and participatory approaches (e.g. Young et al., 2010). For example, the spectrum of instruments to address conflicts between agriculture and biodiversity conservation in the European Union (EU) includes regulatory, market-based, and incentive-based, voluntary approaches (Henle et al., 2008; Lécuyer et al., 2021). Apart from these approaches targeting individual land holders, there is also a range of collaborative approaches, such as community-based natural resource management or landscape-scale collaborative approaches (Lécuyer et al., 2021). However, if biodiversity loss is not considered in an integrated way, policies might create trade-offs with other objectives. For example, novel approaches to farming with climate or water protection objectives may result in trade-offs with biodiversity (Pe'er et al., 2022). Therefore, conservation goals must be considered together with social or rural development goals (e.g. Cortés-Capano et al., 2020).

Due to the ongoing loss of biodiversity and ecosystem degradation, IPBES (2019) pushes for transformative changes to address underlying degradation drivers and change how people interact with nature. Concomitantly, how we govern biodiversity needs to change (Visseren-Hamakers et al., 2021) and fundamental changes to the governance system are needed (Leventon et al., 2021). However, such changes are anything but easy to implement. Transforming the governance system entails considering plural values and different knowledge systems (Leventon et al., 2021). Moreover, governance needs to be simultaneously integrative to overcome sectoral and fragmented approaches, inclusive to address different stakeholders' values, adaptive to adjust to the complexity of biodiversity challenges and pluralist to consider biodiversity loss from different perspectives (Visseren-Hamakers et al., 2021). For the EU context, Leventon et al. (2019) discussed an alternative governance system which would consider both multiple decision-making levels and ecological scales. It presents an example of multi-stakeholder decision-making around biodiversity goals, thus allowing to better address trade-offs emerging from siloed, sectoral thinking (ibid.). These and other alternative approaches to biodiversity governance have been explored with different stakeholders for the agricultural context (e.g. Mitchell et al., 2016; Velten et al., 2018), highlighting both opportunities and barriers for change. However, implementing such holistic changes to the governance system of biodiversity remains a key challenge.

## **2.2 The role of the social landscape for biodiversity conservation**

Managing land resources entails increasing demands of a wide range of stakeholders, resulting in conflicts over how land should be used and managed (Ellis et al., 2019). The social landscape around biodiversity conservation is anything but homogenous, resulting in conflict and tensions around how conservation objectives should be achieved and how important they are. Social landscape refers to “a wide range of topics related to public attitudes, perceptions, values, behaviours, and activities, as well as community related topics” (Ryan, 2011, p. 362). These intangible concepts and themes characterise the social landscape, much like the tangible features such as natural elements and human-made structures we associate with ‘physical’ landscapes. They thus constitute the “social fabric of landscapes” (Ellis et al., 2019, p. 90). The social landscape of conservation thus refers to the variety of actors that either influence or are influenced by achieving biodiversity conservation objectives (c.f. Freeman, 1984).



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Studying the social landscape of biodiversity conservation can help identify areas of consensus and disagreement over biodiversity objectives. Different people or groups of people hold different views about biodiversity, including biodiversity values and meanings (c.f. Jetzkowitz et al., 2018). Even among conservationists, perspectives on the value of biodiversity and how to protect it differ (Berry et al., 2018; Sandbrook et al., 2019), presenting a challenge for designing policy measures to address biodiversity loss. Furthermore, vast differences in perspectives also exist between different actor groups. Maas et al. (2021) show how perceptions of the importance of biodiversity and ecosystem services for agricultural production vary between farmers and scientists. A large body of literature has focused on understanding farmers' acceptability of agri-environmental policy measures to improve conservation outcomes (e.g. Massfeller et al., 2022). However, many factors influence farmers' decision-making, and they are not a homogenous group (Brown et al., 2021). For example, Busse et al. (2021) showed how farmers in two German case studies have vastly different views about whether insect biodiversity loss occurs. Though farmers are a key stakeholder group for land use decisions, such a focus may fail to understand conflicts and contentions around biodiversity at the local or community level. Different people may hold vastly different aspirations towards the same landscape (Milcu et al., 2014; Jiren et al., 2023), resulting in challenges to develop concerted actions to protect biodiversity. For example, different perspectives on conservation can result in difficulty to agree on priorities in conservation practice, particularly when this results in trade-offs (Sandbrook et al., 2019).

Identifying and engaging with different ways of viewing biodiversity and humans' engagement with nature can help identify pathways of sustainable development. Not only have scientific constructions of human-nature relationships evolved over time (Mace, 2014), but researchers have also made tremendous progress in identifying the manifold ways in which nature and biodiversity are valued (Chan et al., 2016; IPBES, 2019). To this end, there is a need to systematically explore the multiple perspectives on biodiversity conservation in the stakeholder landscape. Understanding different stakeholder perspectives can help improve policy and management and help identify common ground (Iversen et al., 2022). Furthermore, understanding areas of consensus and conflict between the landscape aspirations of different stakeholders is an important aspect of sustainable landscape management (Jiren et al., 2023). Moreover, others have highlighted the importance of engagement and consultation with stakeholders with different perspectives on conservation policies and management (e.g. Fitzgerald et al., 2021; Iversen et al., 2022).

### **2.3 Discourses and narratives about the (agri-)environment**

The terms discourse and narrative are frequently used in everyday language and play a key role in environmental and sustainability science. In the constructivist tradition, both concepts have in common that they help identify shared or prevalent ways of sense-making of a phenomenon and meaning attribution (c.f. Dryzek, 2013; Louder and Wyborn, 2020). A discourse is "an ensemble of ideas, concepts, and categories through which meaning is given to social and physical phenomena" (Hajer, 2006, p. 67). Moreover, Dryzek (2013) points out that discourses "construct meanings and relationships, helping define common sense and legitimate knowledge" (p. 9). The academic interest in discourses rests on the assumption that language is

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not neutral but that it shapes how we view the world and what we perceive to be reality (Hajer, 2006). The concepts of discourse and narrative are often used in conjunction, for example, where discourses draw on narratives or storylines (e.g. Hajer, 2006). Narratives are storylines about a particular subject, consequentially linking sequences of events (c.f. Roe, 1994; Riessman, 2008). At their most basic, they are stories consisting of a beginning, middle and end (Soliva, 2007). Narratives reflect different ontological assumptions about the world and conceptualise different topics. In contrast to narrations as individual accounts of experiences, narratives display patterns and are, to some degree, socially accepted (Koch et al., 2021). Thus, discourse and narratives provide conceptual lenses to study the meaning of a subject, issue or place.

Key sustainability challenges, such as climate change or biodiversity loss, are surrounded by discourses and narratives that provide competing framings of the problems and suggest different intervention strategies. For example, biodiversity loss has been narrated in different, even competing, ways (Louder and Wyborn, 2020). Interest in narratives in sustainability science has been both to understand place-based perspectives on environmental topics and to create new, positive narratives about human-nature evolution. For example, Hinkel et al. (2020) argue that the dominant climate change narrative is one of ‘fear and doom’ pointing to the challenges and negative impacts of climate change and advertising “global top-down solutions” (p. 503). In contrast, alternative narratives help draw attention to the opportunities that come with climate change and action (Hinkel et al., 2020). Moreover, narratives can reveal different perceptions of ecological loss, trajectories of change and place meanings (Eakin et al., 2019) and provide inside into land-use conflicts (Plieninger et al., 2018). Biodiversity narratives are one of the thematic focus areas that Wyborn et al. (2020) identify as a way to rethink biodiversity research and action. They argue that “[n]arratives analysis can identify the values, histories, knowledge systems, and worldviews that shape how human–nature relationships are perceived and offer insight into how biodiversity research and action could become more diverse, effective, and just” (Wyborn et al., 2020, p. 1091). Attention to different narratives and how issues are framed can provide insights for sustainability transformations (Marshall et al., 2021). Narratives are powerful, particularly when widely shared among people in a community. For example, by referring to United States (US) environmental history, Gould et al. (2018) highlight how narratives of marginal groups have been underscored by a dominant narrative reflecting a white, colonialist view of conservation.

Similarly, discourse analysis has helped identify the central debates and framings of the (agri-) environment. For example, the prominence of the ecological modernisation discourse in environmental policy can be explained by its appeal to solve environmental problems within existing institutional arrangements (Hajer, 1995). Moreover, discourses can help shed light on different constructions of biodiversity (Gustafsson, 2013) or conservation discourses around iconic species (Benitez-Capistros et al., 2016). Analysing discourses can also illuminate conflicts over the meaning of environmental problems (Dryzek, 2013). For example, Masterson et al. (2019) highlight how place meanings in local communities' discourses contrast with the dominant conservation discourse. Discourses can create new meanings, and when they are institutionalised, they can become hegemonic (Hajer, 1995). For example, for the EU's Common Agricultural Policy, Erjavec and Erjavec (2015) show how a productivist discourse

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translated into key policy elements during the reform. Conservation and biodiversity research is an evolving field demonstrated by the broad range of overlapping discourses. In the scientific community, four different eras can be distinguished, highlighting different views of nature and human-nature relationships and scientific approaches to conservation research (Mace, 2014). The current discourse highlights the intricate links between ‘people and nature’ and is represented through the most recent IPBES report (IPBES, 2019). Discourses and narratives are dynamic; they are in flux, for example, when new information becomes available.

In this thesis, I draw on the concepts of narrative and discourse because they construct how people conceive the world and ascribe meaning to it. Both concepts help explore context-specific spaces of contestation and convergence that shape biodiversity trade-offs.

### **3. Research approach**

#### **3.1 Research design and methodology**

Rooted in the normative and problem-focused approach of sustainability science (Clark and Dickson, 2003; Kates, 2011), I sought to gain an in-depth understanding of place-based biodiversity conservation trade-offs in this dissertation. To this end, I used a mixed methods research approach and focused on two case studies. Mixed methods research combines or integrates qualitative and quantitative data either in a sequential or convergent approach, allowing one to gain an in-depth understanding of a research problem (Creswell and Creswell, 2018). This dissertation is rooted in the epistemological position of constructionism (Creswell and Creswell, 2018), which contends that reality and knowledge are constructed (c.f. Tracy, 2013) and that the researcher’s representation of the social world is never definite but in flux (Bryman, 2016). Here, the materialities of the biophysical landscape are the ‘raw material’ for meaning-making (c.f. Stedman, 2016). To answer the exploratory research question of this dissertation, I chose a case study design. Case studies allow for an in-depth study of a phenomenon in its context (Yin, 2014; Bryman, 2016), and they are, therefore, an appropriate approach to answer the research question. Thus, case study research can illuminate policy-relevant questions such as why and how policies fail to protect biodiversity in the respective context. Though statistical generalisation from a case is not possible, generalisation at the conceptual level is possible, e.g. by uncovering new concepts (Yin, 2014). Both cases selected for this dissertation can be characterised as typical cases (Yin, 2014) in that they presented key land use challenges in industrialised countries.

The research conducted for this dissertation was based on a participatory approach whereby I collaborated with local organisations in developing and refining the research questions for the individual papers and the research approach. In Germany, the Spreewald Biosphere Reserve administration was the local partner; in Australia, I partnered with the Muttama Creek Landcare Group. For the papers, the co-authors and I drew on two participatory methods with increasing application in environmental and sustainability science: the Q-methodology and the Three Horizons Framework. The methods were selected to capture the perspectives of people in the social landscape and how different meanings will illuminate my topic of interest (c.f. Yin,

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2014). In the following, I briefly outline how the two methods were employed to generate quantitative and qualitative data and how questionnaires supplemented them.

William Stephenson developed Q-methodology in the 1930s, the novelty of the technique being that factor analysis was inverted (Stephenson, 1935). This inverted factor analysis is employed to study peoples' subjective views on a topic or issue by presenting them with a set of items they are asked to rank based on a sorting question (Brown, 1980; McKeown and Thomas, 2013). As a result, research participants instead of personality traits are treated as variables (e.g. Watts and Stenner, 2012; McKeown and Thomas, 2013). Q-methodology does not focus on individuals' perspectives but seeks to identify shared social viewpoints (Watts and Stenner, 2012). We conducted interviews for the *Discourses* and *Landscape Narratives Papers* to collect quantitative data (ranking of statements) and qualitative data (sorting explanations). In both papers, we employed a convergent mixed methods approach, integrating the qualitative and quantitative data collected during the interviews during the analysis stage. This contrasts with the widespread application of Q-methodology, where the quantitative analysis is informed by qualitative data (e.g. Iversen et al., 2022). Quantitative data analysis, i.e. factor analysis, seeks to identify latent or underlying variables that explain different viewpoints (Watts and Stenner, 2012). Factor analysis follows the logic of abduction whereby analysis starts with a surprising insight, and the analyst seeks to explain the emerging factors (Watts and Stenner, 2012). Qualitative data provided the basis for exploring the meanings related to the items. As photos were used as items in the Spreewald case study, interpretation of the meanings of the items was pivotal, and the *Landscape Narratives Paper*, therefore, had a more qualitative focus.

For the *Three Horizons Paper*, we used the Three Horizons framework, a participatory futures method (Sharpe et al., 2016). We drew on quantitative and qualitative data obtained through two workshops for this publication. Workshop group presentations and discussions were recorded, transcribed and subjected to inductive thematic clustering. Moreover, participants were asked to complete questionnaires to obtain demographic information and understand participants' assessment of the workshop approach for six critical dimensions of futures research.

## **3.2 Case studies**

### **3.2.1 Muttama Creek Catchment**

The Muttama Creek Catchment is a farming landscape in south-eastern Australia. It is part of the so-called sheep-wheat belt, a productive farming region that relies on both cropping and livestock. It is also an area that still contains remnants of the Box-gum grassy woodlands, ecosystems native to Australia which have been substantially decimated since European colonisation started in the early 19<sup>th</sup> century in that area. Most farmers in the study area manage their land conventionally, including stubble burning, using synthetic fertilizers and continuous grazing; on farms of almost 1,000 ha in size (NSW DPI, 2018). In late 2018, local land managers and land holders started the Muttama Creek Landcare Group, which aims to protect and restore natural vegetation in the catchment area<sup>1</sup>. Landcare is a widely known form of community-based natural resource management in Australia (Curtis et al., 2014), making it possible for

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<sup>1</sup> <https://www.facebook.com/muttamacreeklndcare>, accessed 12 August 2022

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groups to apply for government funding. Due to the above characteristics, the catchment presented an interesting case study to explore trade-offs at the intersection of agricultural production and biodiversity conservation in a typical farming landscape of south-eastern Australia.

### **3.2.2 Biosphere Reserve Spreewald**

The Spreewald, which received the denomination as United Nations Educational, Scientific and Cultural Organization (UNESCO) Biosphere Reserve in 1990, is located in eastern Germany, roughly 100 km south-east of Berlin. The Spreewald is a known cultural landscape characterised, *inter alia*, by small-scale land areas, biodiversity-rich wet meadows and the cultural heritage of the Sorbs and Wends, a West Slavic ethnic group that settled in the area as early as the 6<sup>th</sup> century. Today, the Spreewald is an important touristic destination. In 2005-2006, a citizen foundation started its activities to include citizens in preserving the cultural landscape, including small-scale land management and the typical settlement structure<sup>2</sup>. In particular, it has been collecting donations to fund land care to counteract the ongoing trend of land abandonment and subsequent bush encroachment. The Spreewald stretches across three administrative districts, and since German reunification, there have been attempts to coordinate and bundle activities better to preserve the landscape. However, workshops with people in the area suggested no unifying vision of the cultural landscape. For these reasons, this case study was selected as an interesting case to study trade-offs between biodiversity and broader landscape development objectives in a cultural landscape.

### **3.3 Researcher positionality**

The findings of this PhD and the approach taken in this dissertation would not be the same had they not been conducted by myself and partly during the COVID-19 pandemic. In the following, I want to reflect on how my subjective views, biases and normative perspectives influenced knowledge creation, vital elements of a self-reflexive scientist (c.f. Wittmayer and Schöpke, 2014). This includes my background, major dispositions, and key instances that made me question my research approach. Reflexivity refers to “awareness and acknowledgement of the role of the researcher as part and parcel of the construction of knowledge” (Bryman, 2016, p. 388). Reflexive practice includes considering how the researcher’s positionality shaped the research design, stakeholder engagement and interpretation of data (Moon et al., 2019). Moreover, other aspects influenced by the researcher’s position include access to research participants, the relationship between the researcher and research participants and the influence of the researcher’s background on the research process and outcomes (Berger, 2015).

Two key topics are relevant to this reflection, i.e. past experiences with the research problem and how those have shaped my interpretation of the data (c.f. Creswell and Creswell, 2018). The topic of biodiversity conservation, specifically in farming in the EU, has been central to my research trajectory prior to commencing my PhD. I was familiar with the key policy instruments to achieve biodiversity conservation in the EU, key stakeholders and central academic debates about conflicts between nature conservation and agricultural production. Before my employment in both projects, I had no personal or professional connections to the

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<sup>2</sup> <https://www.spreewaldstiftung.de/startseite>, accessed 12 August 2022

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two study areas. My lack of in-depth understanding of the respective contexts and close connection to the study areas made me feel like an ‘outsider’ for most of my research journey. There are several dimensions to this notion of an outsider. It includes residency, i.e. I did not permanently live in the study areas. The fact that English is not my mother tongue immediately stood out to everyone I spoke to in Australia. Moreover, even though I am German, having grown up in south-western Germany meant that I did not share the same experiences as people who experienced the German reunification and its ramifications in Eastern Germany, where the Spreewald is located. Lastly, I grew up in an urban area and am a female, white, young<sup>3</sup> PhD student who conducted research in rural areas with people who were predominantly older than me, including in the field of agriculture, which tends to be quite masculine (e.g. Newsome, 2020). This sense of outsider-ness or lack of expertise in practical issues brought challenges in understanding the local vernacular, cultural references and some of the nuances in peoples’ accounts and experiences. I perceived this to be a more significant challenge for the work in Australia due to the cultural difference and as I am a non-native speaker of English.

The COVID-19 pandemic hugely impacted this place-based research and resulted in the necessity to adjust the research (see also Hermans et al., 2021). It added to a physical disconnect from research participants in the Muttama Creek Catchment area because I had to leave the country on short notice and could not return before the project's end. It also completely changed my fieldwork plans, such that I had to resort to online interviewing and had to hand over the responsibility for on-ground workshop organisation and data recording to my Australian collaborators. I used different strategies to overcome the limitations of studying the unfamiliar. In the Spreewald case study, I benefitted from the work conducted in the project before my start and the interaction with the ‘practice partner’ in the Biosphere Reserve. For the Australian case study, the close collaboration with my field assistant Annie was invaluable for unpacking cultural references and better understanding the context. Moreover, I drew on member checking, which meant that I discussed preliminary findings with research participants and other people from the local communities.

My outsider-ness, however, also had several benefits: it put interviewees in an expert position, and I could ask different questions that I believe I could not have asked otherwise (c.f. Berger, 2015). I believe that this outsider lens also made me more aware of the role I played and was assigned to in the social landscapes of the study areas. For example, I became aware that regenerative agriculture is a very contentious topic in Australian farming and decided to not actively engage with this topic in the research. I instead sought to maintain my stance as an impartial researcher curious about and interested in peoples’ opinions but with no vested interest in the study areas. Additionally, I recognise that as a researcher, I cannot view the world through the eyes of the research participants, but I aim to gain an ‘empathic understanding’ (Tracy, 2013). For example, there were specific instances that made me question my own biases. During the Spreewald interviews, one interviewee felt that the photos I had selected presented a strong bias towards land management in the cultural landscape and an ignorance of cultural history. This critique was vital during the interpretation of my data in that I kept

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<sup>3</sup> This is not an objective classification but I base this assessment on the questions I was asked and comments made by people I interacted with during fieldwork.

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questioning whether I had imposed my understanding of the cultural landscape on the data. Moreover, feedback provided by participants during the piloting of the Q-items in Australia suggested that our set of items was biased towards environmental statements. As a result, I worked on ensuring that the importance of production interests and the role of farmers as food producers with a focus on productivity and net profit (see e.g. Primdahl et al., 2013) was better acknowledged through the statements. Finally, all interviews and workshop discussions were transcribed when audio recordings were available to decrease the risk of bias.

## 4. Key findings

### 4.1 Research aim 1: shared viewpoints

For this research aim, I sought to identify shared viewpoints highlighting perceptions and meanings of human-nature relations and biodiversity to understand biodiversity conservation trade-offs.

We investigated archetypal viewpoints on the biodiversity-production intersection in the *Discourses Paper* (Chapter II). Whereas the *Benefit Discourse* posited that biodiversity conservation is essential for the viability of farming, the *Trade-off Discourse* reflected an understanding that on-farm conservation entails reduced profitability. In contrast, the *Balance Discourse* held that biodiversity and production could be balanced in the farm business. Finally, in the *Payment Discourse*, biodiversity was considered separate from farming and money was seen as the linchpin to successful conservation. The four identified discourses differed concerning three key dimensions, namely (1) how the relationship between farming and biodiversity is understood; (2) what roles and responsibilities farmers have; and (3) what solutions are believed to improve biodiversity outcomes. The four discourses conceptualised biodiversity differently, from productivist to more ecological framings of this relationship (1). Though the notion of stewardship resonated with all interviewees, it translated differently into understandings of the role of farmers, for example, as food producers or temporary custodians (2). Similarly, perceptions of how to best protect biodiversity ranged from monetary incentives to building ecological literacy (3). Between the discourses, perceptions of biodiversity loss and the importance of biodiversity conservation varied substantially.

In the *Three Horizons Paper* (Chapter III), we considered biodiversity outcomes from different trajectories of future rural development. It complemented the *Discourses Paper* by highlighting how different priorities and understandings of the farming-biodiversity intersection led to different views on preferred systems change. The preferred system differed between the pathways, and workshop participants had different perspectives on levers of change, e.g. individual farmers or institutional changes and types of innovations such as technology or improved education. The findings confirmed that perspectives on what role biodiversity played in change dynamics and which factors led to improved biodiversity outcomes varied substantially between people in the Muttama Creek Catchment area.

In the *Landscape Narratives Paper* (Chapter IV), we sought to understand archetypal ways of narrating human-nature relations. In the *Nature Narrative*, the landscape was created and

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shaped by humans and was conceptualized as the connection between traditional land use and nature. The *People Narrative* focused on interactions between human use and nature and the role of the landscape as a place to live and produce. In the *Land Use Narrative*, human use of the landscape took centre stage, whereby ongoing management sustains the Spreewald. The three narratives differed concerning three aspects: 1) key topics, 2) negative aspects or threats to the landscape, and 3) landscape values. Key themes included physical aspects of the landscape, landscape meanings and types of management (1). The narratives also revealed different perceptions of issues, including natural succession, large-scale farming or overconsumption by tourists (2). Finally, the narratives highlighted different combinations of aesthetic, cultural, ecological and economic values (3). The *Landscape Narratives Paper* thus revealed the range of meanings and understandings of the notion of cultural landscape among key stakeholders in the Spreewald.

In conclusion, the discourses and narratives provided insight into how biodiversity is perceived and what its conservation means in two different landscapes based on peoples' relative perspectives. The findings highlighted areas of overlap but also contrasting problem framings, views on the role of biodiversity and different contextual values, which create barriers to concerted action and collaboration.

#### **4.2 Research aim 2: landscape aspirations**

For this research aim, I sought to explore peoples' aspirations for their respective landscapes and how they influence approaches to and preferences for how biodiversity should be managed and protected.

The *Three Horizons Paper* (Chapter III) aimed to explore different ideas about what constitutes positive futures and the mechanisms of change to achieve them. The *Utopia Pathway* sought to increase local food production and understanding of agricultural landscapes through changes to the farming system and education. The *Grassroots Pathway* focused on improving the viability of small and medium-sized farms and the health of Muttama Creek through changes to the regulatory framework and bottom-up activities. The *Vision Pathway* aimed to improve community and landscape health through increased connectivity and support for smaller rural businesses and farms. The *Farming Story Pathway* sought to improve ecosystem and livestock health with trickle-on effects on the community through revegetation measures. The *Spider Web Pathway* aimed to build ecosystem resilience and biodiversity by improving collaboration and integration between governmental organisations. The *Best Practice Pathway* focused on improving farm viability and, thus, environmental outcomes through changed farming practices and technological innovations. The findings showed a broad range of values and aspirations related to the future, including social aspects such as community well-being, economic viability and biodiverse and healthy ecosystems. Biodiversity and nature-related aspirations more broadly played different roles in the pathways. For example, biodiversity loss or change was the motivator for change in two pathways (*Vision* and *Farming Story Pathways*), ecosystem health was the explicit aim of two pathways (*Spider Web* and *Farming Story Pathways*), and in the other pathways, improved environmental outcomes were the result of the changes. The six pathways provided a nuanced perspective on the multiple ways in which participants value nature and biodiversity.



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The *Discourses Paper* (Chapter II) showed a divide in preferences and values and highlighted how aspirations to protect biodiversity varied. In some discourses, economic objectives outweighed biodiversity objectives, for example, in the *Trade-off Discourse*. Peoples' relation with the agri-environment expressed through the four discourses even pointed to an underlying polarity between pro-environment and pro-production viewpoints. Though the six pathways in the *Three Horizons Paper* did not necessarily display this polarity, how they narrated change, starting from a key issue and leading to imagined futures, showed how workshop participants valued different aspects of their community, farming systems and landscape.

In the *Landscape Narratives Paper* (Chapter IV), we explored how narratives construct landscape meanings around different core values. How the landscape evolution and ongoing developments were narrated highlighted that stakeholders valued the landscape differently. All three narratives reflected different combinations of landscape values, i.e. ecological and cultural; cultural, economic and aesthetic; and economic and aesthetic values, which highlight different development preferences for the landscape. Nature and biodiversity played different roles in these landscape aspirations. The *Nature Narrative* highlighted the landscape's ecological values, primarily through little or no human intervention and the desire to be close to or in harmony with nature. The *People Narrative* reflected an appreciation for the relationship between people and their environment and wet meadows as distinct ecosystems of the area. The *Land Use Narrative* expressed an appreciation of nature-friendly farming practices as a way to sustain the landscape. Despite some overlap in the values, the narratives also reveal differences in worldviews, i.e. ecocentric vs. anthropocentric perspectives.

In conclusion, the empirical findings of this dissertation show in what way biodiversity is valued and what role it plays vis-à-vis broader landscape and rural development objectives. The findings highlight areas of consensus with regard to landscape development preferences and shared future aspirations but also spaces of contestation around the role and importance of conservation in the two study areas. Our findings thus reveal different views on human-nature relations and contextual values concerning the two landscapes.

## 5. Synthesis

This dissertation provides a socially situated understanding of biodiversity conservation trade-offs, i.e. how biodiversity conservation objectives conflict with other land use objectives. Drawing on the key findings summarised in Section 4, I tie the findings in with discussions on transformations of the broader policy and governance context around biodiversity conservation, the role human-nature relations play for the diversity of perspectives and how alternative pathways of social-ecological development can be developed and the role that human agency plays therein.

### 5.1 Conflicts over biodiversity conservation objectives: transforming the policy and governance context

This dissertation elicited place-based discourses and narratives that are shared by a range of different stakeholders, including but not limited to farmers. Complementing the large body of

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literature seeking to understand farmers' environmental motivations, values and behaviours (e.g. Brown et al., 2021), the empirical findings in this dissertation highlight the importance of the broader social landscape to identify barriers and opportunities for biodiversity conservation. For example, the archetypal viewpoints identified through Q-methodology could not be attributed to individual stakeholder groups. It has been suggested that dialogue should include plural meanings and different solutions for equitable and sustainable stewardship (Masterson et al., 2017). This dissertation highlights shared viewpoints and landscape aspirations that shape conservation trade-offs by employing participatory research methods and by drawing on the concepts of discourses and narratives. Identifying the landscape aspirations held by different stakeholders provides an important basis for building a collective vision and understanding consensus and conflict (Nieto-Romero et al., 2016), which can help plan participatory workshops (Jiren et al., 2023). The findings point to areas of convergence and divergence and highlight levers of engagement with conservation trade-offs. For example, the *Discourses* and *Landscape Narratives Papers* highlighted contrasting problem framings that can present a barrier to collaborative actions at the landscape scale, which are increasingly called for in biodiversity policy (e.g. Pe'er et al., 2022). Both drivers of biodiversity loss and solutions to this challenge are context-specific (Pascual et al., 2021), which makes an understanding of place-based conservation trade-offs vital for designing governance and policy measures to protect biodiversity.

This dissertation highlights the myriad of ways in which biodiversity objectives are constructed against other land management priorities, i.e. at the agriculture-production nexus (*Discourses Paper*) and as set within broader rural development (*Three Horizons* and *Landscape Narratives Papers*). For the trajectories of both landscapes, there is a tension between economic interests and biodiversity conservation objectives. In the Muttama Creek Catchment case study, farming was constructed around productive agriculture in some discourses and as an activity that balances conservation and production in others. The Spreewald Biosphere Reserve case study highlighted trade-offs between a more protectionist approach to nature conservation and human use. There is ample evidence that economic incentives play a role in land managers' decision-making, but that decision-making includes various aspects (e.g. Siebert et al., 2006; Cortés-Capano et al., 2020). The findings from this dissertation confirm that economic incentives in agriculture must ensure that they simultaneously create economic and biodiversity benefits (Turnhout et al., 2021) to overcome a dualistic understanding of the economy as separate from biodiversity. Economic rationales of food production are leading to increased intensification and subsequent decreasing on-farm biodiversity in the Muttama Creek Catchment case study and to farmland abandonment and resultant biodiversity loss in the Spreewald. The findings from this dissertation highlight that agricultural and environmental policies must actively and holistically address multiple trade-offs, e.g. between biodiversity conservation and agriculture, carbon farming or tourism development (see also Daněk et al., 2023).

The polarity and tensions that the empirical findings highlight did not emerge in a vacuum, but the policy and governance context played a crucial role in shaping them. Although the broader governance and policy landscapes are very different in the two case studies, both have been dominated by productivist framings of land management. In Australia, environmental and conservation policies have been critiqued for their economic framing (Kusmanoff et al., 2017),

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thus sustaining an understanding of farmers as food producers. In the EU, rural development policies are ill-aligned to the context of traditional farming landscapes (Mikulcak et al., 2013), and the Common Agricultural Policy has remained insufficiently designed to improve biodiversity conservation (Leventon et al., 2017; Pe'er and Lakner, 2020). This highlights the limitations of current environmental and biodiversity policies in addressing place-based biodiversity conflicts and improving biodiversity outcomes. In addition to considering trade-offs more holistically, findings from both case studies point to the need to initiate broader debates about what biodiversity means in the respective context and how it can be protected. For example, Herzon et al. (2022) highlight interlinked societal processes which reinforce the extinction of threatened semi-natural habitats, including their role in policy, education and the public's perceptions. These socio-economic processes are also relevant for native biodiversity in the Muttama Creek Catchment and wet meadows in the Spreewald cultural landscape.

Including plural perspectives and values in biodiversity research (c.f. Pascual et al., 2021) also means considering those currently marginal in discussions about biodiversity conservation. This dissertation highlighted aspects that remain marginalised in mainstream or dominant discussions by studying the broader social landscape. In the Muttama Creek Catchment, a topic mostly absent from the interviews and only slightly touched on during the workshops was that of Indigenous biocultural knowledge, i.e. “knowledge that encompasses people, language and culture and their relationship to the environment” (Ens et al., 2015, p. 135). Only four of the 94 participants we interviewed referred to this topic during the interviews. Our findings thus highlight that indigenous biocultural knowledge is currently only a marginal topic in debates about biodiversity conservation in the Muttama Creek Catchment area. A more pluralist and inclusive approach to governance (c.f. Visseren-Hamakers et al., 2021) and a governance system that acknowledges multiple knowledge systems (c.f. Leventon et al., 2021) would help overcome such limitations.

## **5.2 The kaleidoscope of perspectives on biodiversity conservation: engaging with human-nature relations**

Human-nature relationships have become a heavily researched topic in sustainability science (e.g. West et al., 2020; Beery et al., 2023). This includes different worldviews, i.e. anthropocentric, ecocentric, cosmocentric and pluricentric, but also different types of values (Martin et al., 2022). This dissertation highlights how different human-nature relations manifest in the discourses and narratives and how these shape viewpoints on biodiversity conservation trade-offs. The papers highlighted dualistic perspectives on biodiversity for the Muttama Creek Catchment area and fragmentation between biophysical and cultural landscape aspects for the Spreewald. In both case studies, we distinguished between more anthropocentric and ecocentric perspectives, which influence views on biodiversity in the case studies. In line with recent critiques of dichotomous views on humans and nature as separate entities in sustainability science (e.g. West et al., 2020; Biermann, 2021), our findings highlight how fostering a more integrated perspective would help avoid or reduce perceived trade-offs.

Despite the spaces of contestation that the discourses and narratives highlight, research participants shared a sense of responsibility, care and connection to place, which can be seen as elements of stewardship (c.f. Bieling and Plieninger, 2017). Stewardship can refer to

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different scales, such as the whole planet (c.f. Steffen et al., 2015) or landscapes (c.f. Plieninger and Bieling, 2017). Moreover, it is not a fixed term, but the understanding of what landscape stewardship means varies (Raymond et al., 2016; Bieling et al., 2020). The Australian model of Landcare provides an example of a form of stewardship. It led to the creation of social-ecological imaginaries that do not consider nature and production as siloes but focused on how practice changes lead to ecological changes on the farm (Beilin and Bohnet, 2015). The findings suggest that enacting place-based stewardship would provide an opportunity to bring different stakeholders together under a broad, common value. Aiming towards multiple objectives, including diverse viewpoints and a participatory approach to land use and management would be central to such an approach (c.f. Plieninger and Bieling, 2017). The findings of this dissertation suggest that place-based stewardship would provide an opportunity to address biodiversity conservation trade-offs in a socially amenable way.

In contrast to positive human-nature relations, disconnections from nature is a topic that remains under-researched (Beery et al., 2023). Both the *Discourses* and *Landscape Narratives Papers* reflect different values of biodiversity and what Lliso et al. (2022) refer to as nature's disvalues. The latter refers to "values with a negative valence" (Lliso et al., 2022, p. 1). Whereas the *Landscape Narratives Paper* highlighted how a process of natural succession is perceived to be detrimental to landscape aesthetics, the *Discourses Paper* showed how biodiversity on farms could be considered a disvalue due to its adverse effects on farmers' incomes. Such perceptions of the negative value of biodiversity on production have also been witnessed in other contexts (e.g. Cortés-Capano et al., 2020). They provide examples of instrumental disvalues, i.e. where nature "leads to an undesirable end with regard to human wellbeing, or when it serves as an obstacle to reach a desired level of wellbeing" (Lliso et al., 2022, p. 3). The concept of disvalues can help shed light, for example, on different positions vis-à-vis environmental policy (Lliso et al., 2022), reflecting different perspectives on human-nature relations. The concept of disvalues as negative values shares some similarities with the concept of ecosystem disservices. There has been much less attention in the academic literature on ecosystem disservices, yet they provide important insights about peoples' perspectives and actions regarding ecosystems (Blanco et al., 2019). This body of research on disservices highlights the need to understand perceptions of the negative impacts of ecosystem processes. Engagement with aspects that make biodiversity or the landscape undesirable is equally insightful for improving biodiversity governance. For example, the *Landscape Narratives Paper* referred to negative associations with a museum landscape or a 'back to nature' scenario where land abandonment results in ecological succession, raising questions about the viability of traditional wet meadows (see also Lomba et al., 2020). Therefore, the concept of disvalues is highly relevant for understanding perceptions of biodiversity conservation trade-offs.

### **5.3 Pathways of transformation: exploring alternative trajectories of social-ecological development**

In light of the projections of ongoing biodiversity loss and climate change, stories about these phenomena are predominantly negative. For example, the concept 'Anthropocene' was introduced to environmental sciences in 2000 (Crutzen, 2002) and has since become an influential scientific narrative about "human resource exploitation, planetary thresholds and

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environmental urgency” (Lövbrand et al., 2015, p. 211). Due to the negative projections of biodiversity loss and global narratives such as that of the Anthropocene, there is a need for positive visions that can inspire people to act (Pereira et al., 2018; Raudsepp-Hearne et al., 2020). Such visions and imagined positive futures can guide where to go and thus play an important role in sustainability transformations (Wiek and Iwaniec, 2014). The *Three Horizons* and *Landscape Narratives Papers* addressed the normative question of how the respective case study areas should develop. The findings revealed vastly different motivations for change, including economic and nature conservation interests. Moreover, dialogue among a broad range of actors, especially marginalised groups, is beneficial for effective and innovative actions (Drimie et al., 2018). The Three Horizons approach enabled a dialogue among different people in the social landscape. While not all transformative, the outcomes of the Three Horizons workshops highlight opportunities for change and to engage with the biodiversity-production trade-off. Participatory methods can involve various stakeholders and diverse aspirations to explore trade-offs. For example, participatory scenario development has been used to explore trade-offs and synergies between food security and biodiversity conservation (Hanspach et al., 2017; Jiren et al., 2020) or between different future pathways (Harmáčková et al., 2022). By creating momentum, mobilising action and supporting experimentation, analysing multiple futures is valuable for understanding transformative change (Norström et al., 2022). Moreover, collective futures approaches can include local ecological knowledge and help to consider a sustainable landscape and pathways towards it (Beilin and Bohnet, 2015). Both Q-methodology and the Three Horizons Framework as participatory methods helped identify opportunities for change that can reduce trade-offs and benefit the broader community and landscape, for example, agritourism or local food production systems.

Human agency is a recurring topic in the study of sustainability transformations. Agency refers to “the capacity of individuals to act independently to make their own free choices” (Brown and Westaway, 2011, p. 322). Fostering human agency to bring about transformative change is crucial in enabling approaches to transformation (Scoones et al., 2020) and helps understand how to bring about change locally (Falardeau et al., 2019). Human agency is central to the Three Horizons Framework (Sharpe et al., 2016). Whereas Q-methodology helped narrate desirable cultural landscape trajectories, the Three Horizons Framework went a step further and addressed how research participants, individually and collectively, can bring about change towards diverse positive futures. Both the *Three Horizons* and *Landscape Narratives Papers* identified overlapping values and meanings which can provide a basis for transformative interventions (c.f. Charli-Joseph et al., 2018). Whereas the *Landscape Narratives Paper* highlighted different problem framings, the Three Horizons approach helped with collective sensemaking, e.g. a joint problem understanding.

Despite the limitations of the Three Horizons approach concerning lasting on-ground changes, considering future landscape trajectories through a narrative lens proved helpful in exploring opportunities for system change. Narratives are a building block “for creative and emotive ways of imagining the future” (Wyborn et al., 2020, p. 1092). Creative approaches play an increasingly important role in conservation to engage with diverse narratives and perspectives on the environment based on lived experiences of a broad range of people (Gould et al., 2018). Furthermore, Pereira et al. (2019) highlight the need for participatory processes that are both

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inclusive and creative. Photo-based Q-methodology and the Three Horizons Framework offered the opportunity to hear a broad range of voices, including marginal ones, and the storytelling approach offered a creative way of developing narratives of change. The recent sustainability science literature has increasingly discussed the potential of arts-based approaches for sustainability transformations (e.g. Raatikainen et al., 2020; Norström et al., 2022). Arts-based approaches can help uncover underexplored human-nature relations (Benavides-Frias et al., 2022), draw on alternative ways of knowing and create new stories and narratives about transformations (Bentz et al., 2022). This can help overcome prescriptive, one-size-fits-all approaches and allow for innovative engagement with place-based notions of biodiversity. As a novel way to discuss biodiversity conservation trade-offs, arts-based approaches present an avenue for future research on social-ecological trajectories.

## 6. Conclusions and future research directions

Preventing and halting the loss of biological diversity ranks highly on the (global) political agenda, and anthropogenic drivers of biodiversity loss are widely recognised in academia. However, context is vital for shaping how this issue plays out in the social arena and can be managed. Even within the same landscape, perspectives on successfully managing biodiversity can vary substantially. How to govern biodiversity thus remains a pertinent question in conservation and sustainability science. In this dissertation, I examined place-based biodiversity conservation trade-offs. I sought to contribute to a better understanding of the role of the social landscape in influencing trade-offs between biodiversity and other land use objectives through mixed methods research in two case studies. In the following, I first highlight the main findings of this dissertation before synthesising the key insights and discussing future research directions. Finally, I highlight the relevance of the findings for practitioners and policymakers.

The conceptual framing of this dissertation focused on key themes that help illuminate conservation conflicts and trade-offs. I drew on the concepts of narratives and discourses to explore shared perspectives on landscape development, land management and aspirations towards the future. **For the first research aim**, I identified shared viewpoints pointing to diverse perceptions of the importance of biodiversity, problem framings and preferred land use options. I showed how these relative viewpoints result in different understandings of biodiversity conservation trade-offs. **For the second research aim**, I explored different contextual values and aspirational ambitions towards biodiversity conservation and rural development. The findings highlighted what role biodiversity conservation trade-offs play in future imaginaries and visions of broader landscape development.

These findings were subsequently synthesised into three overarching themes. **(1)** I highlighted how engaging with different perspectives is vital to address underlying causes of biodiversity conservation trade-offs. In light of the calls to transform the governance system of biodiversity, the findings of this dissertation highlighted the importance of holistically addressing multiple trade-offs with biodiversity conservation and inclusive approaches, especially towards marginal viewpoints. **(2)** I discussed the role of underlying human-nature relations in understanding

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trade-offs. This dissertation pointed to the potential of place-based stewardship and disvalues, which remain an under-studied topic in the literature but can yield important insights into barriers to conservation actions. (3) I highlighted the value of participatory engagement with future aspirations to identify areas of convergence that can help mobilise action to improve conservation outcomes. Creative and arts-based approaches are increasingly discussed in sustainability scholarship and, in light of the findings, were suggested as a promising approach for futures studies.

This dissertation also provided insights into managing biodiversity conservation trade-offs for policymakers and practitioners. **First**, current environmental and biodiversity policies draw on a broad range of different instruments to address the ongoing loss of biodiversity. However, the findings highlighted the limitations of prescriptive approaches that are not contextually sensitive and those that promote only instrumental or monetary biodiversity values. Global and national priorities for biodiversity conservation have been set, and there is a need to close the gap between those top-down goals and bottom-up approaches to conservation. Approaches including various stakeholders at scales meaningful to people present opportunities to discuss the inherently normative questions of biodiversity conservation. **Second**, the Three Horizons Framework was developed by practitioners and constitutes a promising tool to engage with and activate the imaginary potential of a diverse group of people. It is a versatile tool not only for practitioners but also for transdisciplinary research.

Notwithstanding calls for synergies and win-win solutions for conservation, studying biodiversity trade-offs, i.e. trade-offs between biodiversity conservation and other land use objectives, highlights opportunities for change. The key challenge for current and future biodiversity conservation lies in finding ways to navigate the resulting tensions and conflicts that are “not only in harmony with the landscape, but in harmony with those living and working there” (Iversen et al., 2022, p. 8). So far, policies to protect or enhance biodiversity have not yielded the desired effects. By studying the broader social landscape, this dissertation spotlighted the intersection between biodiversity and other land use objectives in two place-based case studies. Through the mixed methods, participatory approach of this dissertation, I elicited place-based conceptions of biodiversity trade-offs and pointed to opportunities for systems change to enhance conservation outcomes. This dissertation thus provided insights into how management and governance of biodiversity can be improved by highlighting shared values and how divergent perspectives and aspirations can be navigated. In conclusion, this dissertation provided empirical evidence on how biodiversity is conceptualised in two case studies and how the participatory approach helped create spaces for imagination and engagement with desirable system change and the role of biodiversity therein. The work underdone for this dissertation and the resulting empirical findings hopefully make a small contribution to achieving the CBD’s 2050 vision for a planet where humans live in harmony with nature.

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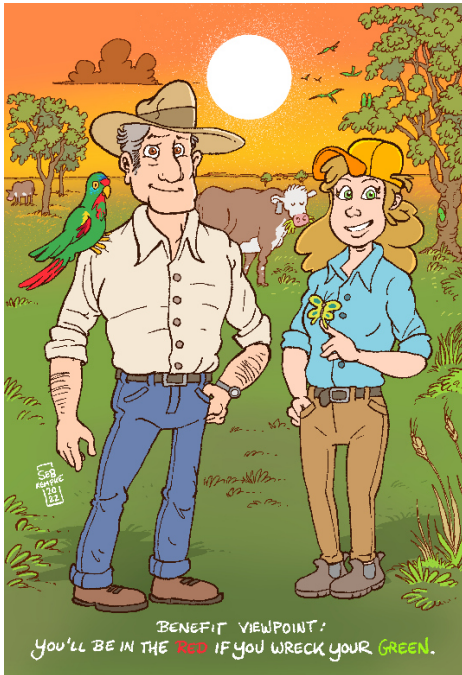
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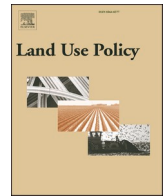


## Chapter II

### 'You can't be green if you're in the red': Local discourses on the production-biodiversity intersection in a mixed farming area in south-eastern Australia (*Discourses Paper*)







# 'You can't be green if you're in the red': Local discourses on the production-biodiversity intersection in a mixed farming area in south-eastern Australia

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## ABSTRACT

Limiting biodiversity loss is a global challenge, especially in areas where biodiversity conservation conflicts with intensifying agricultural production. The different views and preferences about how to protect biodiversity, and why it is valuable, make concerted action to improve conservation outcomes difficult. Exploring different discourses that represent shared understandings of an issue or a topic can help to understand this plurality. We focused on a mixed farming area in south-eastern Australia where intensive agricultural production is linked to an ongoing loss of biodiversity. Using the Q-methodology, we conducted 94 interviews with people who may influence biodiversity outcomes in farming landscapes to explore shared understandings of the farming-biodiversity intersection. We also sought to understand how such discourses relate to perceptions of biodiversity in agricultural contexts and if they are associated with particular stakeholder groups. We identify four discourses on the relationship between farming and biodiversity, the farmers' role and responsibility for biodiversity, and the preferred approaches to improve biodiversity outcomes. Our findings highlight how perceptions of biodiversity by agricultural stakeholders varied substantially between discourses, but that discourses were not significantly associated with stakeholder group. We discuss our findings in the context of policy development and broader governance. We consider how a balanced mix of policy instruments, including market and community-based instruments, can better engage with contrasting understandings of the production-biodiversity intersection. To improve biodiversity outcomes, it is necessary to integrate a plurality of biodiversity values and ensure a broad and balanced set of policy instruments that supports land managers as stewards of the land.

## 1. Introduction

The ongoing loss of biological diversity represents one of the key environmental challenges of the 21st century (MA, 2005; IPBES, 2019). There is ample scientific evidence highlighting the decline of biodiversity at a global level (Butchart et al., 2010) and its projected decline in the future (IPBES, 2019). However, progress towards the Convention on Biodiversity Conservation's (CBD) Aichi targets has been insufficient in averting the biodiversity crisis (Tittensor et al., 2014; Secretariat of the Convention on Biological Diversity, 2020) and existing environmental

legislation and policies are ineffective in halting the loss of biodiversity (Pe'er et al., 2014; Ward et al., 2019; Kleijn et al., 2020) and extinctions (Woinarski et al., 2017). Among the most important drivers of biodiversity loss in terrestrial ecosystems is the expansion and intensification of agriculture (Foley et al., 2011; Tilman et al., 2011; Kehoe et al., 2017). In light of an increasing world population, changes to consumption behaviours and reductions in food waste are seen as critical for global food security in addition to growing food production (Godfray et al., 2010). Therefore, developing better approaches to protect biodiversity in farming landscapes remains a key challenge (Kremen and

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Merenlender, 2018; Kleijn et al., 2020).

Different viewpoints about why biodiversity should be protected and how to avert biodiversity loss represent a key impediment to concerted actions to improve conservation outcomes in farmland. In the conservation community, the ‘new conservation’ debate highlights different arguments about the value of nature and the best approach to improve conservation outcomes (Soulé, 2013; Marvier, 2014). Fundamental questions such as the value of biodiversity and why it should be protected represent areas of disagreement among conservation practitioners (Berry et al., 2018). Indeed, there are different viewpoints in the professional conservation community about the role of humans, science and capitalism in conservation (Sandbrook et al., 2019). Vastly different approaches to conservation are also reflected by the land sharing versus land sparing debate (Green et al., 2005) and sustainable intensification (Tilman et al., 2011). Perceptions of what constitutes biodiversity, its values, and human-nature relationships vary not only among academics, but also among different social groups (e.g. Buijs et al., 2008; Hill et al., 2021). These diverse positions represent different ways of thinking about how conservation fits with economic objectives, with aspirations of people in local communities, and indeed the relationship between people and nature. Improving biodiversity conservation in farming landscapes is therefore an ecological and social challenge (Snoo et al., 2013) and conservation needs to engage with social evidence on people’s perceptions, preferences and values (Bennett, 2016).

In this paper, we explore the diversity in understanding of the intersection of biodiversity and farming by key stakeholders that influence biodiversity outcomes in farming. One way to structure and identify shared and prevalent perceptions of a topic, issue or phenomena is through discourses. A discourse represents a shared way of understanding the world (Dryzek, 2013; Hugé et al., 2013) and can reflect different perceptions of environmental problems (Barry and Proops, 1999). Discourses give meaning to, and help explain, phenomena and issues in the environmental realm. For example, discourses in global environmental politics reflect contrasting ways of conceptualising environmental problems and understanding how they can be addressed within existing institutional structures (Hajer, 2002; Dryzek, 2013). Discourses are a useful concept to draw out different constructions of biodiversity which helps understand how the issue of biodiversity loss can be addressed (Gustafsson, 2013). Engaging with discourses about biodiversity in farming is therefore important to help better understand how biodiversity is perceived in farming systems and to understand areas of consensus and conflict.

We take a place-based approach to understanding discourses because drivers of biodiversity decline and solutions are context specific (Pascual et al., 2021). Studying discourses in a defined geographical area helps elicit contextual conservation understanding and practices (Benitez-Capistros et al., 2016). Connecting with the diverse values and constructs of biodiversity at a local level is important for improving support of public policy (Fischer and Young, 2007) and its design and implementation (Siebert et al., 2006; Bardsley et al., 2019). For example, climate change research has shown that understanding prominent discourses in agricultural communities highlights barriers and opportunities for change (Fleming and Vanclay, 2010). Engaging with the multiple and often competing viewpoints on biodiversity and production objectives can increase our understanding of how to better integrate biodiversity and agricultural production. For example, Jiren et al. (2020), identified four discourses on food security and biodiversity conservation across different governance levels in Ethiopia, highlighting the need for reconciliation between these co-existing viewpoints. Therefore, better understanding of local communities’ perspectives on how biodiversity and agricultural production objectives constrain or support each other could help inform future policy development to enhance biodiversity outcomes in agricultural landscapes.

We focus on south-eastern Australia as a case study where land is being used intensively for agriculture and is linked to biodiversity decline, creating a particularly challenging context for preservation and

restoration of biodiversity (Lindenmayer et al., 2016). In Australia, commodity-focused agriculture is largely operating under a ‘get big or get out’ pressure and a “cost-price squeeze of competitive productivism” (Newsome, 2020, p. 58). At the same time, agriculture is one of the key drivers for declines in threatened species’ populations in Australia (Kearney et al., 2019). For example, of the grassy woodland ecosystems dominant in south-eastern Australia before European colonisation, only fragments remain due to land clearing such as the removal of trees and establishment of exotic pastures (Prober and Thiele, 1995). These ecosystems are now internationally recognised as an endangered ecoregion (Hoekstra et al., 2005). Australia has ratified the CBD and there is a suite of federal and state level governance arrangements and policy instruments aimed at improving biodiversity conservation. This includes voluntary, bottom-up approaches such as the Landcare model which started in the 1990s (Robins, 2018), regulatory approaches such as native vegetation legislation, and market-based instruments (MBIs), such as payments for ecosystem services (Royal, 2021). Despite some successful conservation projects for the protection of threatened species (Garnett et al., 2018), Australia’s key piece of national environmental legislation, the Environmental Protection and Biodiversity Conservation (EPBC) Act, has been ineffective in halting the loss of habitat for endangered and threatened species and communities (e.g. Ward et al., 2019). The reasons for this ineffectiveness are complex, including insufficient funding (Wintle et al., 2019), poor monitoring (Scheele et al., 2018) and ineffective laws (Ashman et al., 2022), against the backdrop of the high vulnerability of Australian ecosystems (Bergstrom et al., 2021). Further, a 2018 report on the interaction between the EPBC Act and the agricultural sector highlighted that awareness of obligations under the EPBC Act is limited, processes for designating threatened species and ecological communities are considered to be unclear, and that support to the agricultural sector to achieve environmental objectives is insufficient (Craik, 2018). Finally, climate change adds further pressure to the challenge of integrating profitable farming with successful biodiversity conservation. Biodiversity in south-eastern Australia is projected to decrease by approximately 8% by 2050–2070 solely due to climate change and notwithstanding further land use changes (Drielsma et al., 2017).

Our research aim was to explore the diversity of understandings around biodiversity conservation in farming communities in a mixed farming area in south-eastern Australia. To meet this aim, we developed the following research objectives: (1) identifying biodiversity-production discourses, (2) understanding perceptions of local biodiversity in agricultural contexts reflected by these discourses, and (3) understanding how the discourses are spread through different stakeholder groups. To this end, we drew on Q-methodology (Brown, 1980; Stephenson, 1935) as a mixed method approach which combines rank-ordering of a set of items on a topic with subsequent interviews to explore the meanings behind or rationales for the sorting. We applied our approach in a study of the Muttama Creek Catchment area in the sheep-wheat belt, an area of intensive agricultural production with only small patches of remnant native vegetation remaining. The challenges associated with biodiversity conservation in this region are common across other highly modified human environments and our findings are relevant for other dryland farming systems in Australia and globally.

## 2. Material and methods

### 2.1. Study area

We focused on the Muttama Creek Catchment area in the South-West Slopes of New South Wales (NSW), Australia. The area is characterized by relatively fertile soils, undulating hills and areas of rocky outcrops mostly on hilltops or on top of ridges. The catchment has a temperate climate with an average annual precipitation of 600–800 mm (NSW Government, DPI, 2018). Muttama Creek Catchment is a tributary of the Murrumbidgee river and covers an area of 113,700 ha. Our study area is

a mixed farming region in the sheep-wheat zone. The northern part of our study area is predominantly used for cropping (mostly wheat, canola and hay), the southern part of the study area for grazing cattle for milk and meat and sheep for wool and meat (Ryan and Olsauskas, 2018) (Fig. 1). In the Cootamundra-Gundagai Regional Council (CGRC), the local government area which covers our entire study area, the agriculture, forestry and fishing sectors together were the biggest employer in 2016, accounting for 15.2% of employees in the CGRC area (Anon, 2020). The average farm size is 954 ha (NSW Government, DPI, 2018) and livestock accounts for 64% and crops for 36% of the CGRC's AUD \$135.23 million worth of agricultural production (Anon, 2019). Muttama Creek Catchment is characterized by woodlands and open woodlands dominated by white box (*Eucalyptus albens*) but also other tree species including kurrajong (*Brachychiton populneus*), black cypress pine (*Callitris endlicheri*) and river red gum (*Eucalyptus camaldulensis*) (NSW DPIE, 2016). Since European colonisation, the area has been extensively cleared, leaving mostly remnant and fragmented areas of native vegetation, which have resulted in declining bird populations (NSW DPIE, 2016). For example, the threatened swift parrot (*Lathamus discolor*) and the endangered ecological community White Box - Yellow Box - Blakey's Red Gum Grassy Woodland and Derived Native Grassland can be found in our study area. Despite funding provided for large scale restoration of Box Gum Grassy Woodlands through the Riverina Local Land Services, no substantial improvements in threatened species have been observed (personal communication with Muttama Creek Landcare Group).

## 2.2. Q-methodology and discourses

Our aim was to explore the diversity of discourses on the farming-biodiversity intersection. To understand different discourses, we drew on Q-methodology, which engages with the subjects' own viewpoints and the meaning they attribute to a certain topic, a term coined 'operant subjectivity' (Brown, 1980). It is a mixed-method approach that follows a systematic procedure by which the same set of items on a certain topic or issue is rank-ordered by all participants, followed by a post-sorting interview which helps understand participants' sorting rationale (Watts and Stenner, 2012; McKeown and Thomas, 2013). For the rank-ordering, a grid is used which ranges from 'most agree' to 'most disagree' and which has space for all items, but with fewer spots towards the extremes. Thus, participants consider all items relative to each other based on their subjective viewpoint (Watts and Stenner, 2012). Based on

sorting and responses, participants are grouped together when they share a viewpoint on a particular topic or issue. Q-methodology has been used increasingly in environmental science and conservation research (Zabala et al., 2018) and to understand social perspectives in sustainable natural resource management (Sneegas et al., 2021). As Q-methodology aims to identify the breadth of viewpoints on a topic or issue, it can reveal discourses that are marginalised or less common, thereby highlighting areas of conflict; for example, on values that are not visible in dominant discourses (Blicharska and Grandin, 2015).

In Q-methodology, participants are treated as variables and the selection of statements is therefore vital. The set of statements used (termed a Q-set) was developed in an iterative approach based on a review of academic literature, grey literature, and discussions with key informants during a scoping trip in the study area in November 2019 (supplementary material II). Key informants were identified based on our knowledge of the study area and by contacting representatives of key organisations in the study area. These key informants were later contacted for a full interview in the next stage of the research. We identified recurring themes that emerged from these sources and developed statements that covered key aspects of the biodiversity-production debate (supplementary material III). To explore tensions between farming and biodiversity conservation perspectives, not all statements directly touched on biodiversity but also covered economic aspects such as profitability or productivity. With our initial set of statements, we conducted seven pilot interviews with key informants in the study area. The pilot interviews were pivotal to ensure that our Q-set was well-balanced between more ecological and more farming and production oriented statements, ensuring that we captured the main topics of the debate and that the wording of the statements was clear and concise (following Watts and Stenner, 2012). The Q-set was reduced and refined based on feedback from the pilot interviews, conversations with two key informants working in Landcare and discussions in the research team. Statements that proved to be unclear, ambiguous or redundant were removed. For example, the pilot interviews highlighted that terms such as resilience or ecosystem services are not part of the everyday language of land managers in our study area and were therefore not included. These steps were crucial to ensure that the Q-set was comprehensive, relevant, and understandable. Our final Q-set consisted of 36 statements (supplementary material III).

For participants in the Q-methodology, we wanted to identify local discourses by a wide range of stakeholders that influence biodiversity outcomes in our study area. We therefore did not limit our recruitment strategy for participants to only land managers or landholders. We also interviewed key government or natural resource management organisations such as Local Land Services working on this topic, agricultural consultants, farming organisations, and other people who have an influence on biodiversity management in the study area. We started with an initial list of people who we expected to have contrasting viewpoints based on our knowledge of the study area and people suggested by key informants. We then followed a snowball sampling approach (Bryman, 2016) to identify other participants with potentially different viewpoints relevant to our research by asking participants to suggest contacts who they believed had a contrasting or particularly interesting perspective. Q-methodology studies often have between 30 and 50 participants (McKeown and Thomas, 2013, see also Zabala et al., 2018). Yet, as outlined by Watts and Stenner (2012), there is no criteria for the ideal number of participants. As we wanted to identify the prevalent discourses in our study area, we interviewed a larger number of participants. We continued interviewing until key topics kept coming up repeatedly and when the same participants were referred to us repeatedly. In total, we interviewed 94 participants between 8 March and 12 June 2020. We conducted 34 of these interviews face-to-face. Due to social distancing requirements in light of COVID-19, the remainder of the interviews were conducted online using the video conferencing software Zoom and the website Q-sortware ([www.qsortware.net](http://www.qsortware.net)) or a combination of an Excel spreadsheet and an interview over the phone.

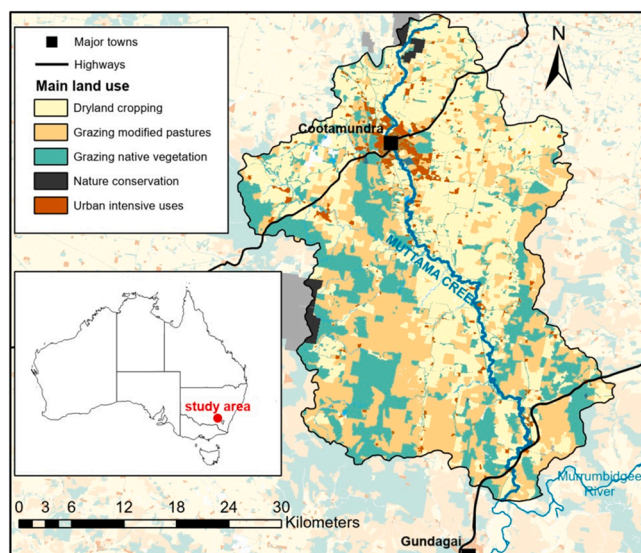


Fig. 1. Map of the Muttama Creek Catchment and the main land use. Sources: Supplementary material I.

The interviews lasted between 30 min and 1 h 45 min, with an average interview lasting approximately 55 min. Except for one person, all participants agreed to be audio-recorded. All recorded interviews were transcribed verbatim and we kept detailed notes of the interview with the participant who did not want to be recorded and of one interview where the recording did not work.

To obtain the sorting of the statements (Q-sorts), interviews followed a standard procedure. Participants were provided with a participant information sheet which was approved by the Human Ethics Committee of the Australian National University and included the purpose of the project, information on confidentiality and potential risks to participants. All participants gave informed consent either verbally for the phone and online interviews or in writing for the in-person interviews. Next, participants were presented with the statements and asked to rank them based on the sorting question ‘What should we consider to integrate farming and biodiversity in agricultural landscapes?’ from most agree (+4) to most disagree (−4) on a grid representing a quasi-normal distribution. To have a common point of reference, we asked participants to consider biodiversity to mean ‘native vegetation and wildlife’ during the interviews. The scoping trip and pilot interviews highlighted the different meanings of biodiversity to participants, for example referring only to crop diversity. However, biodiversity in the context of Australian conservation policy targets the preservation of native species. We therefore decided to use this specific definition of biodiversity for the interviews. Following the ranking of the statements, we did a post-sorting interview to understand the rationale behind the sorting (Watts and Stenner, 2012) and the broader context within which participants interpreted the statements and attributed meaning to them. Finally, we asked each participant to indicate which of the statements they agreed with, disagreed with, and felt neutral about. At the end of the interview, participants were asked to fill out a short questionnaire to provide demographic information and to state the stakeholder group they belonged to. Data obtained during the interviews were stored on a password-protected laptop and a hard disk and physical records are kept in a locked filing cabinet. Only members of the research team have access to the data and are obliged to maintain confidentiality.

We conducted a factor analysis of the Q-sorts using the PQMethod software version 2.35 (Schmolck, 2014) (Fig. 2). Factor analysis helps identify latent variables (factors) which explain patterns in the data and thus groups participants with similar sorting together (Watts and Stenner, 2012). Based on correlations of all Q-sorts, all eight factors in the unrotated factor matrix had an eigenvalue of > 1, making them eligible for further consideration. As factors seven and eight each had only one significantly loading Q-Sort in the unrotated factor matrix, we did not

consider them further (see Watts and Stenner, 2012, p. 107). For all remaining six factors, we did a principal component analysis, which provides the ‘best’ solution in terms of maximizing the variance of each subsequent factor (Brown, 1980), and a varimax rotation. Following Q-methodology’s mixed method approach, factor interpretation draws on the grouping of Q-sorts from the statistical analysis but also participants’ sorting rationales. We used the four elements of discourses by Dryzek (2013) as overarching categories guiding the coding of the transcripts and notes from the debriefing interviews (Fig. 2). Using MAXQDA version 2020.3, we coded text segments of the transcripts in an inductive, iterative approach. Codes were considered to be important for the discourses when they were recurring and repetitive themes or framings across participants loading significantly onto the factors. We decided on four factors as the quantitative and qualitative analysis together provided the most qualitatively rich and differing viewpoints (Fig. 2). Our interpretation and description of the four discourses was based on three components: 1) a model Q-sort which are the weighted averages of all Q-sorts associated with the respective discourse (factor array) (supplementary material IV); 2) the evaluation of the statements across participants who significantly loaded onto each of the factors (supplementary material V); and 3) the recurring discourse elements mentioned by participants loading on the discourses (supplementary material VI). The discourses are the outcome of the combined qualitative and quantitative analysis, but for the sake of simplicity we use the term discourse also when referring to the results of the quantitative analysis, i.e. the factors.

To understand perceptions of local biodiversity and how the discourses are distributed through stakeholder groups, we prepared a short questionnaire. Participants were asked to indicate which stakeholder group they belonged to and their perception of the condition of biodiversity in the catchment on a five-point Likert scale ranging from ‘very poor’ to ‘very good’. We also asked participants to provide demographic information regarding their gender and age. We applied Chi-squared tests (p-values based on Monte Carlo simulation) to test for an association between discourses and stakeholder groups and discourses and biodiversity assessment.

### 3. Results

We identified four discourses, which reflect different underlying assumptions about relationships between farming and biodiversity conservation and how the latter can be improved, different priorities and understandings of the role and responsibility of farmers.

The four discourses accounted for 57% of the variance and 73

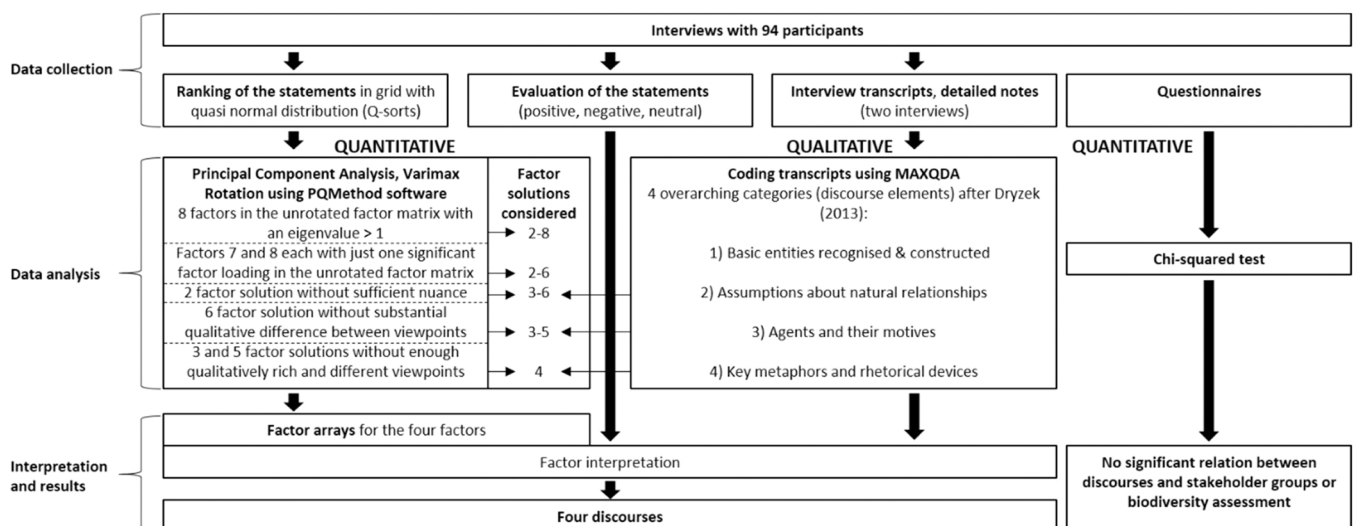


Fig. 2. Flowchart depicting the steps in the analysis and interpretation of the data.



participants (78%) loaded significantly on one of the discourses (Table 1; supplementary material VII). 17 participants loaded significantly on more than one discourse and four participants did not load significantly on any of the discourses. The mean age of our participants was 53 years and participants were predominantly male (76%) (supplementary material VIII).

Below, the four discourses are presented by referring to key statements, which are preceded by the # symbol. The old farming adage ‘You can’t be green if you’re in the red.’ reflects the thinking that unless your business is profitable, you cannot protect the environment. It was brought up by several participants during the interviews and prompted interesting responses. Therefore, the four discourses were named with reference to this adage. Illustrative quotes are selected to highlight common themes among participants associated with the discourses.

### 3.1. Discourses

Given the relatively high correlations between some discourses, there were two statements which were rank-ordered the same in all four model Q-sorts (factor arrays) (Table 2). The statement ‘Protecting groundcover is important for agricultural production.’ was ranked at +3 in all discourses. Linked to the consensus on the importance of groundcover, all discourses strongly disagreed that maintaining farming practices of previous generations would be important for farm viability (#19: -4). There was a general view that previous practices were outdated either because they were not considered to contribute to future farm viability or because they had been destructive to the environment or the landscape (e.g. excessive use of super phosphates, excessive ploughing of fields).

#### 3.1.1. Benefit discourse: you’ll be in the red if you wreck your green

37 participants with a mean age of 53 significantly loaded onto this discourse, with age ranges covering almost all age groups. Compared to all participants, the percentage of female participants was slightly higher in this group (24% vs. 30%).

According to the benefit discourse, the protection of biodiversity in agricultural landscapes is an important priority (#6, #26), especially due to the ongoing destruction of biodiversity (Tables 2 and 3). The notion of ecosystems denotes an understanding of biodiversity as being part of a bigger whole and a focus on the catchment or landscape shifts attention away from the individual farm to consider this challenge more broadly (#7, #11). Some farmers are considered to be “eco-vandals” (P39) who clear land for production without regards for the environment and there is a general issue of lack of environmental understanding among farmers.

**Table 1**  
Correlations between discourses and discourse characteristics. The table is the result of the quantitative analysis.

	Benefit Discourse	Balance Discourse	Trade-off Discourse	Payment Discourse
<b>Benefit Discourse</b>	1.00	0.48	0.30	0.13
<b>Balance Discourse</b>		1.00	0.64	0.28
<b>Trade-off Discourse</b>			1.00	0.50
<b>Payment Discourse</b>				1.00
<b>No. of defining Q-sorts</b>	37	9	23	4
<b>% of explained variance</b>	24	11	17	5
<b>Eigenvalue</b>	22.82	10.53	15.58	4.86

**Table 2**

Model Q-sorts for the four discourses (factor arrays) which are calculated based on the weighted averages of the Q-sorts associated with each of the discourses. The highest agreement (+4, +3) for each discourse is highlighted in green and the lowest agreement is highlighted in orange (-4, -3).

#	Statement	Benefit discourse	Balance discourse	Trade-off discourse	Payment discourse
1	Farmers need to be profitable first before they can protect biodiversity.	-2	-2	4	-1
2	To improve biodiversity outcomes, changes to farming practices are necessary.	4	1	-1	0
3	Agricultural innovation and technology are important for farm profitability.	-1	3	3	1
4	Farmers should provide habitat for threatened or endangered native species.	1	0	0	-1
5	Farmers can better mitigate extreme weather events by improving biodiversity.	1	-1	-3	0
6	Biodiversity has a unique value and should be preserved.	4	0	1	-2
7	Connecting habitats across boundaries is important.	2	-1	1	-1
8	Australian primary producers play an important role in global food security.	-1	4	2	0
9	Agricultural production and biodiversity conservation can be integrated without trade-offs.	-1	0	-3	-4
10	Farmers need more funds to do on-farm biodiversity conservation.	0	-3	2	4
11	Landscape-scale collaboration is necessary.	1	0	1	-2
12	The long-term growth in farm productivity is a major priority.	-2	4	2	4
13	Biodiversity on farms increases land value.	0	-2	-2	2
14	Productive areas should be utilised and only marginal or unproductive areas should be set aside for biodiversity conservation.	-3	-1	-1	-2
15	Farming families and their farm profitability are crucial for this region.	0	2	4	0
16	Farmers should be free to clear land for agricultural production.	-4	-4	-4	1
17		-1	-1	-1	-2

(continued on next page)

Table 2 (continued)

#	Statement	Benefit discourse	Balance discourse	Trade-off discourse	Payment discourse
	Local communities should take more responsibility for biodiversity protection and enhancement.				
18	There should be more consultation with farmers by government agencies.	-2	0	0	0
19	Maintaining farming practices of previous generations is important for farm viability.	-4	-4	-4	-4
20	Education and awareness-raising about the benefits of biodiversity to agriculture are necessary.	2	2	0	1
21	Protecting or enhancing biodiversity benefits farmer wellbeing.	1	-2	-1	-1
22	There should be subsidized loans to farmers for biodiversity conservation that are paid off based on future revenues.	-2	-3	-2	2
23	Farmers need more ecological knowledge to protect and enhance biodiversity on their farm.	3	1	0	1
24	Protecting groundcover is important for agricultural production.	3	3	3	3
25	Farmers are responsible for looking after the land for future generations.	2	3	2	2
26	Future generations should be able to experience healthy biodiversity on farms.	3	2	2	3
27	Protecting and planting scattered paddock trees is important.	0	1	-1	-3
28	There should be stronger policy and laws to protect and enhance biodiversity.	0	-2	-2	-3
29	Policies and laws should not limit management options by farmers.	-2	-1	-2	2
30	Farmers should get paid for protecting their biodiversity assets.	-1	-3	1	3
31	Cropping and grazing areas should be managed for production and biodiversity at the same time.	2	1	0	-2

Table 2 (continued)

#	Statement	Benefit discourse	Balance discourse	Trade-off discourse	Payment discourse
32	To buffer the ups and downs of farming, changes to farming practices are necessary.	1	2	1	-1
33	Corporate agriculture provides an economic growth opportunity for this region.	-3	-2	-3	-3
34	Farmers need to get the most production out of their land.	-3	1	0	2
35	Biodiversity benefits a farm's long-term profitability.	2	0	-2	0
36	Farm viability is a major priority.	0	2	3	1

*“Because we’ve already got limited land available for biodiversity left and allowing farmers to clear, there will always be someone prepared to clear everything and so I don’t think that there should be free rein [...]” P38*

To improve biodiversity outcomes in farming, there are two important and interconnected levers for change. Firstly, farming practices need to evolve from what previous generations have done, including for example more focus on preserving groundcover (#19, #24). Secondly, farmers’ knowledge about biodiversity or ecological literacy should be improved for example through education (#2, #20, #23).

*“[...] active knowledge is power so you’re really empowering people to make better decisions around the balancing act between the two when they have some understanding of [...] how farming and biodiversity can work together.” P67*

This indicates that the relationship between farming and biodiversity is understood as intertwined. Both production and biodiversity objectives should be considered in a sustainable balancing act (#31) and biodiversity conservation should not just focus on areas that are unsuitable for production (#14). This ties in with the belief that biodiversity benefits farming in the long run and although farm profitability and viability concerns play a role, farmers shouldn’t be focused on maximum production or prioritise profitability over biodiversity objectives (#1, #34, #35, #36). The importance of biodiversity in agriculture can be compared to a litmus test for the farm business.

*“[...] I think that farmers will get paid for protecting their biodiversity assets within their own business, the profitability of their businesses will improve so there will be a payoff there [...]” P29*

This discourse reflects a sense of commitment towards future generations and farmers are seen as (temporary) custodians of the land which includes their environmental responsibility (#4, #25, #26).

*“I think that as a landowner I feel responsible to take care of the land for the period of time that I have it in my care. And when I think about native wildlife or trees, I think it’s really important that whatever I do or we do collectively as an area here, doesn’t impact that opportunity for the future.” P83*

However, responsibility extends beyond the farmer and is shared with the wider community. Nevertheless, more involvement by the government or the community are not seen as particularly promising avenues for change (#17, #18, #28).

3.1.2. Balance discourse: you can stay out of the red and keep some green

Nine participants with a mean age of 54 were significantly associated with this discourse, no participant being over the age of 64. The highest

**Table 3**

Discursive elements after Dryzek (2013) of the four discourses. Discourse categories in bold emerged only in the respective discourse.

Dis-course	Basic entities recognised and constructed (ontology)	Assumptions about natural relationships	Agents and their motives	Key metaphors and rhetorical devices
Benefit discourse (F1)	<ul style="list-style-type: none"> <li>• <b>Change</b></li> <li>• <b>Catchment/ landscape</b></li> <li>• <b>Ecosystems</b></li> <li>• <b>Ecological/landscape literacy</b></li> <li>• <b>Education</b></li> <li>• Profitability/ viability</li> <li>• Farm as business/ operation</li> <li>• Future generations</li> <li>• Long term</li> <li>• Family farms</li> <li>• Community</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Farmers as (temporary) custodians</b></li> <li>• <b>Biodiversity as shared responsibility</b></li> <li>• <b>Corporates have a negative impact on the community</b></li> <li>• <b>Farmers have limited environmental understanding</b></li> <li>• <b>Farming and biodiversity as sustainable balancing act</b></li> <li>• Biodiversity benefits profit/ production</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Many farmers would clear without limits for production</b></li> <li>• <b>More knowledge will motivate better environmental outcomes</b></li> <li>• <b>Financial incentives motivate farmers</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Some farmers are eco vandals</b></li> <li>• <b>Biodiversity crashing, destruction</b></li> <li>• <b>Biodiversity as litmus test for business</b></li> </ul>
Balance discourse (F2)	<ul style="list-style-type: none"> <li>• <b>Balance</b></li> <li>• <b>Food production</b></li> <li>• Long-term view</li> <li>• Productive land</li> <li>• Profitability, viability</li> <li>• Productivity</li> <li>• Farming families</li> <li>• Technology</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Synergy between production and biodiversity</b></li> <li>• <b>Biodiversity benefits the landscape</b></li> <li>• <b>Farmers have a responsibility to look after the land</b></li> <li>• <b>Disconnect between farming communities and cities</b></li> <li>• Viability/profitability a prerequisite for on-farm improvements</li> <li>• Biodiversity benefits production</li> <li>• <b>There is a trade-off between production and biodiversity conservation</b></li> <li>• <b>Biodiversity has negative impacts on production/ profitability</b></li> <li>• <b>Biodiversity is not the sole responsibility of farmers</b></li> <li>• <b>Farmers have learnt from the past</b></li> <li>• <b>Competition in the agricultural sector</b></li> <li>• <b>Profit/viability as prerequisite for farming</b></li> <li>• Profit as prerequisite for protecting biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Farmers' protection of biodiversity independent of funding</b></li> <li>• <b>Farmers are there to make a profit</b></li> <li>• Farming for future generations</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Clean and green products</b></li> <li>• <b>Policy: Draconian measures</b></li> <li>• <b>Farmers: Caretakers</b></li> <li>• <b>Sense of loss: Extinction of marsupials/ mammals, trees dying</b></li> </ul>
Trade-off discourse (F3)	<ul style="list-style-type: none"> <li>• <b>Trade-off</b></li> <li>• <b>Land ownership</b></li> <li>• <b>Community fabric</b></li> <li>• <b>Farmers as (food) producers</b></li> <li>• Farm as business/ enterprise</li> <li>• Profitability, viability</li> <li>• Production, increasing productivity</li> <li>• Family farms</li> <li>• Money as limiting factor</li> <li>• Longer time frame</li> <li>• Technology</li> <li>• Productive vs. unproductive land</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Farming as learning process</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Farmers protect biodiversity when it is economically beneficial</b></li> <li>• <b>Feel good factor of biodiversity to farmers</b></li> <li>• <b>Landcare impacts on the land</b></li> <li>• <b>Farmers prioritise profit/ production</b></li> <li>• Farming for future generations</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Trade-offs: No free lunches, seesaw</b></li> <li>• <b>Financial constraints: Having the wolf at the door</b></li> <li>• <b>Using productive land for production: You can't eat koalas</b></li> <li>• <b>Focus biodiversity on unproductive land: You can't make a silk purse out of a sow's ear</b></li> </ul>
Payment discourse (F4)	<ul style="list-style-type: none"> <li>• <b>Different farming generations</b></li> <li>• <b>Biodiversity as farm expense</b></li> <li>• Money as limiting factor</li> <li>• Productivity, profitability</li> <li>• Farming families</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Farming as learning process</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>With funding, farmers can protect biodiversity</b></li> <li>• <b>Farmers' choice</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Government: People in glass houses, big brother</b></li> </ul>

proportion of women (44 %) was found in this group.

According to the balance discourse, farmers are seen as food producers who contribute to global food security (#8; Tables 2 and 3). They need to make a profit and farm productivity is important (#12, #15, #36). To achieve that aim, innovation and technology in agriculture are vital and they can also contribute to biodiversity conservation (#3). Consequently, practices of previous generations are outdated and changes to farming practices are necessary both to address the volatility of farming markets and to protect biodiversity (#2, #19, #32).

*"I think the good farmers, probably the same farmers that are using precision agriculture and innovation etc. etc. will see the value in protecting their biodiversity assets [...]" P79*

Therefore, payments to farmers or more funds are not seen as the best approach in terms of biodiversity conservation (#10, #22, #30). Rather, those farmers that want to protect biodiversity, will provide space for biodiversity independent of funding. More ecological knowledge and awareness about biodiversity benefits to farming is viewed as important, especially in view of the extinction of species and the expressed sense of loss (#20, #23).

Farmers have a responsibility to manage the land well, as caretakers,

especially for future generations (#25, #26). This ties in with the view that Australian farming produces "clean and green products" (P79), i.e. products that are good for human health and the environment.

*"We should be doing it because we're custodians of the land and we want to see the land in a better state if we keep improving it." P93*

Biodiversity and production are approached in a balanced way. Getting the most production out of the land is important while simultaneously protecting and planting trees in paddocks (#27, #34). Trees are particularly important because they have many benefits, providing inter alia improvements in salinity and serving as protection for livestock. They are important landscape features, and they should be planted to counteract their ongoing loss from agricultural landscapes. Both in cropping and grazing land uses, farmers should thus consider profitability and biodiversity (#31). Therefore, biodiversity protection and productive farming are not seen in opposition but the relationship is viewed as a synergy.

*"To keep doing it is to keep improving the productivity as well as the healthiness of the environment and the soil I think we can do it in a balanced approach." P10*

This highlights why farmers should not be free to clear land for agricultural production without regard for biodiversity concerns (#16). However, there should also not be too much government involvement in farming (#28, #29). This links to a reported feeling of disconnect between rural/farming and urban/city communities and an apprehensiveness towards measures imposed on farmers.

*“[...] I think there has been a relaxation in the last few years but certainly I think there was a pushback of some in the farming community against draconian issues.” P69*

### 3.1.3. Trade-off discourse: you have to be viable or you can't spare any green

23 participants with a mean age of 50 were significantly associated with this discourse, with ages ranging from the mid-thirties to mid-seventies. This group was characterized by the highest percentage of male participants (87%).

According to the trade-off discourse, profitability, productivity and viability are vital to maintain farm businesses into the future which provides money that can be used to protect biodiversity on the farm (#1, #12, #36; Tables 2 and 3). Farmers are seen as food producers who contribute to global food security (#8). Having to survive by farming in the competitive agricultural sector, biodiversity will be farmers last priority if they have “the wolf at the door” (P82).

*“[...] unless farming is viable and unless farmers are profitable, we are not going to be here [...] we won't be protecting any biodiversity anyway because we won't be able to maintain the operation, we'll be leaving farming.” P92*

To develop the farming enterprise, agriculture relies on innovation and technology and not on practices of previous generations (#3, #19). Regarding the farming model, farming families are preferred over corporate farming; for example, because they improve the community fabric of the region and benefit the community economically (#15, #33). Apart from being part of the community, farmers have a responsibility to look after the land and not degrade it to the detriment of future generations (#25, #26). However, it is not the sole responsibility of farmers to protect biodiversity or provide habitat for wildlife, and it comes down to being able to afford it.

*“[...] I think 'should' is the wrong word, I think farmers would provide habitat for threatened and endangered species as long as they can afford to” P32*

Although biodiversity is associated with a “feel good” factor for farmers, there is a lack of evidence or even negative impacts of biodiversity for the farming business (#5, #13, #21, #35). For example, trees take nutrients and water from adjacent fields and are an obstacle to modern farming equipment. The expression “no free lunches” (P18) reflects this view that biodiversity always comes at a cost.

*“[...] if you start to tie up more land in biodiversity you cut productive land out of production so there should be a bit of a trade-off there. Production for biodiversity.” P56*

The relationship between agricultural production and biodiversity conservation is considered to be a trade-off, i.e. both objectives are on opposite ends of a seesaw meaning that increases of on-farm biodiversity will result in losses in production (#9). As a result, if farmers believe that biodiversity will provide economic benefits to their farm business, they will protect it.

*“If it can be proved that putting larger areas of biodiversity aside can reduce our costs and make us more profitable, problem solved.” P40*

As the scarcity of money is an issue with regards to on-farm conservation, more money or paying farmers for protecting biodiversity is another suitable approach (#10, #30).

Generally, it is important to protect biodiversity and farmers should

not clear all land for production (#6, #16). However, there should not be too much government involvement or control over what farmers do on their own land (#28, #29). Although communities should not get too involved in farming, collaborative approaches focusing on the landscape more broadly are positive (#7, #11, #17). The bottom-up, voluntary nature of Landcare model is an example for how positive environmental impacts in the region can be achieved.

### 3.1.4. Payment discourse: you have to stay out of the red and get paid for the green

Four participants with a mean age of 50 significantly loaded onto this discourse, ages ranging from the mid-thirties to the mid-sixties. The gender ratio in this group reflected that of all participants, i.e. 75% male and 25% female.

According to the payment discourse, maintaining or increasing farm productivity is important for the viability of farming (#12, #34, #36; Tables 2 and 3). For protecting biodiversity, money scarcity is a key issue. Additionally, production and biodiversity conservation cannot be integrated without trade-offs (#9). Farmers therefore need more funds to protect biodiversity or should get paid for protecting their biodiversity assets (#10, #30). Having money available means that farmers can protect biodiversity. An example how this could be done is through revenue-contingent loans (#22).

*“So we should get paid to keep our natural bush.” P75*

Farming is considered as a learning process based on past experiences and there are differences between farming generations. Therefore, farming practices of previous generations are not relevant for viability anymore and technology and innovation are important (#3, #19). An example for the changes between different generations is the importance that is now placed on protecting groundcover (#24).

*“My grandfather he would have been the one that was clearing the land and my father would have been helping him as a child and then as he aged he identified that the gullies [...] have been created from poor land conservation. [...] I'm the third generation now that I've seen this come through.” P15*

This generational lens also extends to future generations which should be able to experience healthy biodiversity on farms (#26).

Moreover, farmers have the responsibility to look after their land (#25). Although biodiversity has a positive effect on the value of the land, protecting biodiversity for its intrinsic value is not so important (#6, #13). Therefore, farmers should not have a general responsibility to provide habitat on the farm or to plant scattered paddock trees (#4, #27). Biodiversity and agricultural production are considered separately where farmers should not be forced to manage land for both objectives (#31). With money being a limiting factor, biodiversity competes with other farm expenses.

*“[...] if your farm is not profitable then you're not going to outlay money on something [...] instead of like feed for your livestock, you outlay money on that sort of stuff before your biodiversity.” P08*

The freedom to make your own decisions without too many restrictions by government or “big brother” (P19) is very important (#16, #28, #29). As a result, communities should not take on more responsibility for biodiversity and farmers should not necessarily have to collaborate across the broader landscape (#11, #17). Although farmers need ecological knowledge and education, as well as awareness about the benefits of biodiversity to agriculture (#20, #23), farmers are the ones who decide what they put into action.

*“[...] and I suppose it comes down to sometimes the person who is actually on the place [farm] or who knows the land actually has the knowledge of how this should be done.” P15*

### 3.2. Perceptions of local biodiversity within agricultural contexts

Regarding the assessment of the condition of biodiversity in the catchment area, participants' responses varied substantially. Although no one ranked the condition as 'very good', 13% of participants assessed it as 'good' (supplementary material IX) and 40% as 'fair'. Biodiversity was seen to be in 'poor' condition by 28% and in 'very poor' condition by 14% of the participants. The qualitative analysis of the interviews indicated that participants associated with the benefit and balance discourses expressed a sense of environmental loss or regarded the loss of biodiversity as an issue but it did not emerge as an important topic in the other two discourses. In the statistical analysis, however, we did not find a significant relation between the discourses and the biodiversity assessment.

Although we did not ask participants to provide a definition of biodiversity, the discourses and comments made by participants during the interviews convey that participant's understanding of biodiversity sometimes differed from the definition we provided, i.e. native vegetation and wildlife. During the interviews, some participants challenged our focused definition of biodiversity as too narrow or provided definitions that differ from the wilderness-oriented definition of biodiversity we used.

*"Because when I think of biodiversity [...] I think of those things but I think of it a lot broader, in terms of diverse pasture, microbiology, you know all that type of thing leads to a biodiverse ecosystem." P27*

*"[...] it's not your type of biodiversity because it's not native plants and that sort of thing but it's my type of biodiversity, this means that in a well-managed, well-organized, in a proper rotation system, we can protect our soils and the biodiversity within the soils, look after the worms and all those sorts of things [...]" P73*

### 3.3. Discourses and stakeholder groups

Through the questionnaires, participants indicated which stakeholder group they belonged to. If they belonged to several groups, they were asked to indicate which group they felt best reflected their perspective during the interview. 71% of participants were landholders or land managers, 13% worked as agricultural consultants or for farming organisations, 10% worked for a government organisation, and 6% were in the category 'Other'. The statistical analysis did not indicate significant relations between the discourses and participants' stakeholder groups (see also supplementary material X).

## 4. Discussion

### 4.1. Summary and comparison of the discourses

Halting and reversing biodiversity loss has become a key policy priority internationally and in Australia and we sought to explore the diversity of local viewpoints on the biodiversity-production intersection. Through interviews with 94 participants, we identified four empirically-

grounded discourses that differed in three key aspects (Table 4). Our findings highlight that perceptions of how biodiversity and agriculture are connected differ substantially and influence how production and biodiversity objectives are prioritised. The role of farmers varies in the discourses, ranging from food producers to temporary custodians with implications for what responsibilities they have. Finally, we show that assumptions and beliefs regarding how biodiversity can be protected differ and include building ecological literacy, investing in technology and payments.

Our findings extend and add nuance to existing understanding of how biodiversity is framed in agricultural landscapes. Previous research on the perspectives of production and non-production landholders in Australia towards biodiversity found two opposing positions, namely a multifunctional and a uni-functional view of agricultural landscapes (Moon and Cocklin, 2011). Other distinctions have been made between more ecocentric and anthropocentric viewpoints (Braito et al., 2020). Although our four discourses cannot be directly mapped onto these existing perspectives, they reflect mostly an anthropocentric view of biodiversity. However, our findings point to a polarity between more pro-environment (benefit, balance discourses) and pro-production (trade-off, payment discourses) framings. The intrinsic value of biodiversity which is a prominent reason to preserve biodiversity among conservation practitioners (Berry et al., 2018) did not play an important role in any of the discourses.

### 4.2. Engaging with different biodiversity conceptions and values

Our results show substantial differences between the perceptions of the importance of biodiversity and the loss of biodiversity in the four discourses. Environmental policies in NSW recognize that native vegetation and wildlife are threatened by a set of interacting drivers (NSW Environment Protection Authority, 2021). However, in a major Australia-wide survey of people living in rural and regional areas, almost half of NSW farmer respondents considered declining numbers of some native animals or birds and the loss of vegetation (trees and shrubs) to be no problem or only a minor problem (46.4 % and 45.8 %, respectively) (data sourced from the 2018 Regional Wellbeing Survey, Australian Farmers, Version 1.02 January 2020). Our findings are reflective of this disconnect between key policy problems and perceptions and priorities by parts of the farming community.

These differences may be partly attributed to different levels of knowledge about the loss of biodiversity. However, they also may be explained by the plethora of meanings related to the term biodiversity (Turnhout and Purvis, 2020). Biodiversity is a multifaceted concept for which different definitions exist. They include the broad, inclusive definition of biodiversity as "variability among living organisms" in the Convention on Biological Diversity (Anon, 1992, p. 3) but also more wilderness-oriented understandings (e.g. Mace, 2014, Soulé, 2013). As a context-specific concept (Gustafsson, 2013), biodiversity has many meanings for farmers (Kelemen et al., 2013) and is associated with a range of values (Bardsley et al., 2019). Therefore, farmers' or local perspectives can differ substantially from scientific constructions of biodiversity (Soini and Aakkula, 2007; Maas et al., 2021). Our results

**Table 4**

Summary of three key aspects at the biodiversity-farming intersection reflected by the four discourses as unpacked in Section 3.1.

	Relation between farming and biodiversity	Farmers' role and responsibility	Key solution to improve biodiversity outcomes
<b>Benefit discourse</b>	Intertwined; farming depends on ecosystem health long-term	Farmers as custodians; societal/community responsibility for biodiversity	Increasing farmers' knowledge; changing farming practices
<b>Balance discourse</b>	Balanced; biodiversity benefits landscape health	Farmers as food producers & caretakers	Technology; farmers awareness of biodiversity benefits
<b>Trade-off discourse</b>	Trade-off; no evidence of biodiversity benefits to agriculture or no benefits known	Farmers as food producers; profitable business; biodiversity not sole responsibility of farmers	Profitable businesses have extra money available for biodiversity conservation; paying farmers for biodiversity conservation
<b>Payment discourse</b>	Separated; no biodiversity benefits to agriculture	Productivity; farmers' choice; responsibility to look after the land	Paying farmers for biodiversity conservation

highlight how there are differences between the discourses in terms of how biodiversity is valued and how important its protection is. In the Australian context of heavily modified landscapes, environmental protections focus on native vegetation, wildlife and ecosystems (e.g. [NSW Environment Protection Authority, 2021](#)). However, some of the interviewees challenged this definition of biodiversity as too narrow. This discrepancy in definitions highlights that conservation policies in Australia do not capture the broad spectrum of farmers' biodiversity values ([Bardsley et al., 2019](#)). We therefore add to calls to design conservation measures in agricultural landscapes that fit with local, context-specific understandings of farmers and the people who manage the land ([Hevia et al., 2021](#); [Raymond et al., 2016](#); [Selinske et al., 2017](#); [Wyborn and Evans, 2021](#)). The discourses we identified are not simply ways of communicating about a topic but represent different ways of seeing and interpreting biodiversity in farming systems (sensu [Dryzek, 2013](#)). This highlights that various approaches are needed to help reconcile production with biodiversity conservation objectives in the agricultural context.

#### 4.3. A balanced policy mix to engage with diverse local discourses

The discourses reflected different beliefs about how farmers will be motivated to protect biodiversity, including through increased ecological knowledge or payments. The need for a mix of policy instruments for biodiversity conservation has long been recognised ([Gunningham and Young, 1997](#); [Schirmer et al., 2012](#)). Whilst Australia has different types of policy instruments for conservation in place, there has been a shift away from Community-Based Natural Resource Management (CBNRM) to Market-Based Instruments (MBIs) over the past three decades ([Royal, 2021](#)). The competitive, payment-based approach of MBIs fits particularly with the production logic of the trade-off and payment discourses where land managers are willing to give up land if monetary incentives are high enough to make sense economically. However, several concerns and limitations of MBIs regarding social and environmental outcomes have been raised. [Royal \(2021\)](#) recently highlighted that MBIs can result in both ecological and social trade-offs. For example, long-term environmental benefits of MBIs are questionable due to limited funding periods ([Tennent and Lockie, 2013](#)). Our findings confirm those concerns for the discourses where motivations for conservation are predominantly economic. An overreliance on MBIs and a focus on the economic value of biodiversity brings with it the risk that biodiversity is seen as just an extra farm expense (payment discourse) and not the responsibility of farmers as temporary custodians of the land (benefit discourse). This emphasises the importance of policy instruments that support and foster responsibility for the environment as part of private landholders' stewardship ethic (c.f. [Leopold, 1991](#)). This could help reconcile the view of farmers as food producers with that of farmers as environmental stewards which is reflected in the balance discourse.

Data collection occurred when a drought affecting south-eastern Australia from mid-2017 to early 2020 had just ended. This explains why there was a shared understanding that preserving ground cover is necessary, although with different practical implications, including using rotational grazing, the use of drought feedlots, or stubble retention. Across the discourses, we found broad agreement with the stewardship principle (taking care of the land with a responsibility towards future generations). Yet, our results highlight how understandings of what stewardship or custodianship of the land implies were different. Biodiversity is understood as a farmer's responsibility in the benefit and balance discourses suggesting that there exists higher intrinsic motivation for conservation compared to the trade-off and payment discourses. A policy mix – incorporating MBIs and CBNRM – is therefore better able to capture the broad spectrum of farmers' viewpoints and reduce the risk of motivational crowding out ([Braito et al., 2020](#)). For example, Landcare is a key example of CBNRM in Australia and has been known to foster social and human capital among land managers ([Curtis et al., 2014](#)). The divide between pro-production and biodiversity-positive

attitudes reflected through the discourses additionally suggests that biodiversity will be pursued by different strategies and practices. This does not necessarily present an issue, as for example, both land sparing and land sharing management approaches can lead to different but complementary outcomes for ecological resilience ([Abson et al., 2019](#)). In line with [Royal \(2021\)](#), our findings highlight the need for a broad and balanced set of policy instruments that engages with both intrinsic and extrinsic motivations of land managers.

In Australia, there have been calls for increased funding, policy and legislation support, and coordinated national action, to improve threatened species management ([Kearney et al., 2019](#)). Our results highlight how some of the viewpoints present a barrier for conservation uptake and implementation when conservation actions are considered a burden for farmers with no economic benefit. That there are different prioritisations and understandings of biodiversity in the discourses presents a challenge for broader scale or collaborative approaches towards biodiversity conservation and thus for improving social-ecological resilience ([Royal, 2021](#)). Our results suggest that policymakers need to better engage with, and address the diversity of viewpoints reflected in, local perceptions of what biodiversity is, how biodiversity is valued in agriculture and how it can be integrated into farming to increase uptake of conservation policy. For example, there is an urgent need to provide context-specific evidence about how biodiversity benefits farming to target those that do not see biodiversity protection as part of their responsibility as land managers.

#### 4.4. Governing biodiversity in agricultural landscapes

Our results illustrate how the discourses as shared perspectives and understandings of the production-biodiversity intersection transcend actor groups and represent ways of thinking embedded within rural communities. Such local discourses about farming and biodiversity do not emerge in a vacuum, but are influenced and shaped by the broader governance and policy context (c.f. [Runhaar et al., 2017](#)). Moreover, environmental problems are attributable not only to individual management but are also outcomes of governance ([Pahl-Wostl, 2009](#)). Australian government policy discourses have been focusing on increasing efficiency and profitability and farmers have been constructed as self-reliant individuals with increasing emphasis on private sector investments in agriculture ([O'Keeffe, 2017](#)). Additionally, the use of economic framings in environmental and conservation policy by the Australian Government has increased, which can be explained by the dominance of a neoliberal paradigm ([Kusmanoff et al., 2017](#)). Particularly the trade-off and payment discourses echo this focus on productivity and profitability, representing a productivist framing of the relationship between farming and biodiversity.

In the conservation community, framings of conservation have changed over the past few decades ([Mace, 2014](#)), leading to an integrated perspective of coupled human and environmental systems (e.g. [IPBES, 2019](#)). In contrast, only the benefit discourse views ecosystems and production systems as interlinked and with a more holistic agro-ecosystem view. The discourses and the polarization between them reflect a tension between agricultural and biodiversity objectives. In particular, the trade-off and payment discourses share the view that biodiversity is something external to the production system. Such a lack of an integrative perspective has also been observed in global environmental and sectoral policies, which thus do not fully account for the complexities of social-ecological systems ([Biermann, 2021](#)). A more integrative human-environment system perspective in the broader governance system can play a role in (re-)shaping local discourses. Moreover, it is increasingly recognised that to address ongoing biodiversity decline, there is a need to engage with the plurality of biodiversity values and perspectives ([Pascual et al., 2021](#)). The inclusion of different value and knowledge systems will also require more fundamental changes to governance systems so that biodiversity policy provides spaces for the inclusion of plural values ([Leventon et al., 2021](#)).

Despite the importance of changes to the broader governance to improve biodiversity outcomes, local and community-based activities also play a pivotal role in changing understandings about the production-biodiversity relationship. Landcare in Australia, especially in its early stages, contributed to building awareness, knowledge and understanding about environmental issues among rural landholders (Robins, 2018). Re-shaping existing or creating new discourses that have a more integrative human-environment perspective and that include plural values about biodiversity will therefore emerge from the interplay of changes to the broader governance system but also more engagement with the topic at the community-level that influence how farming communities think about the farming-biodiversity intersection.

## 5. Conclusions

We aimed to understand shared perspectives about the production-biodiversity intersection in a mixed farming area in south-eastern Australia. Identifying such discourses in farming communities can help understand opportunities and define barriers for improving biodiversity outcomes in farming, which have implications for current and future policy development. We showed that viewpoints about the importance of biodiversity protection, biodiversity benefits to farming and the meaning of stewardship differed substantially between the discourses, some of which can present a barrier for conservation policies. We also highlight how relying too much on MBIs risks reinforcing primarily economic motivations for biodiversity conservation among farmers and overlook softer policy tools such as education to increase ecological literacy in the farming community. Due to the diverse and context-specific meanings of biodiversity, engaging with local perceptions of biodiversity in agricultural contexts is important to understand which approaches can help better reconcile production and biodiversity objectives. We argued that there is a need for a well-balanced mix of different policy instruments that engages with both intrinsic and extrinsic motivations for biodiversity and fosters environmental stewardship among private land holders. As local discourses are shaped by the broader governance context around biodiversity and farming, a policy mix alone will not eliminate perceived conflicts between agricultural and biodiversity objectives and polarisation between viewpoints. Broadening the scope of values in biodiversity conservation to include local biodiversity values, will however require more fundamental changes to the way biodiversity in farming systems is governed. Finally, reshaping discourses towards understandings of linked human-environment systems will be brought about by an interplay of changes to the broader governance system and community-level engagement with biodiversity.

## Declaration of Competing Interest

None.

## Data Availability

The data that has been used is confidential.

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## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.landusepol.2022.106306](https://doi.org/10.1016/j.landusepol.2022.106306).

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## Chapter III

Using the Three Horizons approach to explore pathways towards positive futures for agricultural landscapes with rich biodiversity  
*(Three Horizons Paper)*







# Using the three horizons approach to explore pathways towards positive futures for agricultural landscapes with rich biodiversity

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## Abstract

In light of the global challenges of the Anthropocene, including biodiversity loss, there are increasing calls for positive, inspirational futures to motivate action and help steer away from current, largely unsustainable trajectories. The three horizons framework is an approach in future studies that engages with normative futures and helps develop pathways towards them. However, this approach has not been applied to explore opportunities for biodiversity conservation with farming communities. We developed a template to apply the three horizons framework in combination with storytelling to explore positive futures for agricultural landscapes with rich biodiversity. We then applied this method over two workshops with a rural community in a farming landscape of south-eastern Australia facing typical contemporary challenges of an ageing population, climate change, biodiversity loss and global market uncertainty. In the workshops, six pathways for change were developed. We unpack these narratives of change to contrast problem framings, future aspirations and mechanisms of change and discuss implications for conservation. We discuss our approach to integrating diverse perspectives and values, creating actionable knowledge and highlight the role of governance and policy to support individual and collective agency. We conclude that the three horizons approach has the potential to create actionable knowledge through locally meaningful narratives of change, and thus influence priorities and empower local action. For lasting on-ground change, leadership and effective cross-scale governance is required.

**Keywords** Biodiversity conservation · Futures methods · Narratives · Storytelling · Systems thinking · Transformation

## Introduction

The notion of the Anthropocene as a new geological era highlights the extent of human impact on the world's ecosystems (Crutzen 2002), which is irreversibly threatening

the basis upon which humanity relies (Steffen et al. 2015). Recent global projections of the impacts of human-induced climate change (IPCC 2021) and loss of biodiversity and ecosystem services (IPBES 2019) highlight the need for urgent action. However, despite increased knowledge of these unsustainable trajectories, existing approaches to protect biodiversity have largely failed to achieve global objectives such as the Aichi targets (Díaz et al. 2019). As a result, it is increasingly recognised that business-as-usual is not an option, and fundamental, system-wide changes are needed (IPBES 2019; Díaz et al. 2019). A key challenge for research on biodiversity conservation is that it involves tackling a wicked problem characterised by uncertainty and unclear and often ambivalent solutions (c.f. Rose 2018). Much debate in conservation has narrowly focused on agricultural production and disregarded societal issues such as justice and governance (Loos et al. 2014) and has not considered the issue through a systems lens. Subsequently, there are calls to make conservation

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research more transformative to address biodiversity loss (Colloff et al. 2017; Wyborn et al. 2020b). This means including different perspectives and values (Colloff et al. 2017), moving away from research that is focused exclusively on scientific knowledge and instead recognising different types of knowledge (e.g. Sterling et al. 2017) such as indigenous and local knowledge (e.g. IPBES 2019) and drawing on interdisciplinary and participatory research approaches (Rose 2018).

To counteract the often negative projections of future ecological and social decline, there have been calls to develop novel, inspirational scenarios (Bennett et al. 2016) and positive visions that inspire people to act (Raudsepp-Hearne et al. 2020; Pereira et al. 2019a, 2018). By providing directions for change, desirable futures and visions play a key role for sustainability transformations (Wiek and Iwaniec 2014). Developing such normative or positive futures requires more than the progression of change from existing drivers or trends. An ability to imagine is vital. Imagination refers to ideas about the future that cannot be captured by the senses (Moore and Milkoreit 2020). Processes that foster imagination can help to improve system understanding, co-create new solutions, fill participants with a greater sense of hope for the future, and foster a commitment to action (Pereira et al. 2019b, 2018). Imaginative futures can also help to explore and engage with different worldviews and values, as outlined by Wyborn et al. (2020a) in the context of biodiversity loss. However, future pathways developed thus far have predominantly had a global or regional focus and quantitative methods dominate (Mangnus et al. 2019). More participatory and imaginative approaches are needed to complement these efforts in ways that can enable more effective and practical local-level human agency (Pereira et al. 2019b), especially those approaches that start from bottom-up interventions (Pereira et al. 2021).

In this paper, we focus on the three horizons framework, a participatory future studies approach that helps grapple with future uncertainty and divergent perspectives and focuses attention on the role of humans to bring about positive futures (c.f. Sharpe et al. 2016). This makes it a potential tool to explore options for improving biodiversity outcomes at a local level. Three horizons structures discussions about desirable futures and ways to get to those futures along three horizons (Sharpe et al. 2016). Horizon 1 is the current system or business-as-usual, Horizon 3 is the imagined future system, and Horizon 2 represents the transition or transformation zone from Horizon 1 to Horizon 3 (Curry and Hodgson 2008; Sharpe et al. 2016). Three horizons is an approach to systems analysis where each of the three horizons represents a different condition of the system (Curry 2015) or different system patterns (Leicester 2020). These three horizons can be understood as an ‘orientating heuristic’, bringing focus and awareness to different patterns of

change and the disconnect between the current situation and desired futures.

The three horizons framework has been applied to a broad range of topics, often in combination with scenario planning. Initially developed as a practitioners’ tool, the approach has been increasingly used in research since 2006 (Curry and Hodgson 2008). It has been used to create scenarios based on existing initiatives of positive futures or ‘seeds’ (Pereira et al. 2019a, 2018; Raudsepp-Hearne et al. 2020) and to explore the role of human agency in achieving positive futures (Falardeau et al. 2019). It has also been applied to structure discussions about strategies that will lead to preferred scenarios for human–wildlife coexistence (Jiren et al. 2021). Three horizons has frequently been applied to develop bottom-up or local pathways of change, including to develop value-based local scenarios (Harmáčková et al. 2021) and to understand how regional pathways contribute to achieving the Sustainable Development Goals (Aguiar et al. 2020). To our knowledge, the utility of the three horizons framework to address biodiversity loss has not been assessed to date. We created a template that combines the three horizons framework with a storytelling approach to elicit pathways towards positive futures. We applied this method in a case study on biodiversity conservation in an agricultural landscape in south-eastern Australia.

The aim of this paper is twofold. First, we provide a step-by-step guide for how three horizons, in combination with a storytelling approach, can be applied to explore systems change towards desirable futures. Second, we assess how useful this approach is to developing locally meaningful narratives about positive futures that help identify opportunities for protecting biodiversity. To this end, we engaged a place-based community to collaborate with us to: (1) explore different perspectives on systems change towards positive futures, and (2) assess the utility of the three horizons framework for navigating towards those futures. The place was the Muttama Creek Catchment, a farming area in south-eastern Australia which faces challenges representative of the broader region in Australia and the globe, including climate change, biodiversity loss and an ageing rural population. We collaborated with the Muttama Creek Landcare Group, who was keen to develop community activities and broaden engagement with other people in the community. For our first research aim, we conducted two full day workshops over the course of two weeks. For aim two, we used questionnaires to document workshop participants’ evaluation of the utility of the three horizons framework to support futures thinking, creativity, empowerment and dealing with diverse viewpoints and complexity. We describe the workshop process and the resultant six pathway narratives that emerged from discussions. We then reflect on the approach with specific reference to how our application helped with mutual understanding across different perspectives among

the Muttama community, the social impact of this research approach, and the utility of this futures studies tool for biodiversity conservation in farming landscapes.

## Materials and methods

### Situating the three horizons framework

Futures studies offers a range of methods to enable communities to explore possible, plausible and normative futures that improve decision-making and help navigate pathways towards those futures (Bai et al. 2016; Bengston 2019). Such methods can help make people's assumptions about the future explicit and explore novel futures. For example, Jarva (2014) argues that even though the future has not materialised in the real world, "it does exist in peoples' minds as passive and active (motivational) futures" (p. 21). Scenarios, visioning and backcasting are well-known participatory methods in transformation research (Wittmayer et al. 2018) and share common characteristics with the three horizons framework.

Scenarios can be applied in a range of different ways to make predictions, for exploring a topic, or engaging with normative questions (Börjeson et al. 2006). In recent years, there has been a growing interest in normative scenarios (e.g. Aguiar et al. 2020) and application of scenario planning to explore positive futures (e.g. Falardeau et al. 2019; Iwaniec et al. 2020). Scenario planning has become a prominent tool in social–ecological systems research to study, inter alia, biodiversity questions (Oteros-Rozas et al. 2015). Despite the plethora of ways in which scenarios have been applied to date, their role to enhance human agency and create positive scenarios remain under-researched (Falardeau et al. 2019). While scenarios have been used to help build common visions, their use as a standalone exercise has limited their utility in bringing about collaborative action—both for rural communities (Nieto-Romero et al. 2016) and for biodiversity conservation (Pert et al. 2010).

Visioning is another approach in futures studies that aims to develop a normative, desirable future (Wiek and Iwaniec, 2014) and is often combined with other future studies tools that build on these visions (e.g. Hamann et al. 2020). Visions of the future can be valuable in providing motivation for change but this may not be enough to help translate the visions into human action nor enable transformative change (Iwaniec et al. 2020). In contrast to these forward-looking approaches, backcasting connects the future with the present by starting from an endpoint and working back towards the present (e.g. Inayatullah 2008; Vervoort et al. 2014), thus enabling a systemic and long-term oriented perspective to be taken (Quist 2016). In backcasting, alternative futures or visions are developed and their feasibility and

consequences for actions and planning in the present are considered (Dreborg, 1996; Quist and Vergragt, 2006).

A key challenge that remains for any futures method engaging with normativity is the inherent subjectivity related to positive or preferable futures. Achieving a 'good future' is difficult because of the normative nature of these futures and the divergent perspectives that exist (Pereira et al. 2019a). Therefore, it is increasingly recognised that there exists not just one single ideal future and one single path, but multiple desirable futures and pathways (Bai et al. 2016; Bennett et al. 2016; Scoones et al. 2020), with pathways defined as being "courses of events and actions towards the desired targets" (Aguiar et al. 2020, p. 2). The three horizons framework offers an approach to developing pathways that simultaneously considers the present and the future systems and connects the present with desirable end points in the future. In addition to being highly participatory, it takes a systems perspective and focuses on identifying how humans can bring about change.

### Case study context

The catchment area of the 100 km long Muttama Creek (1138 km<sup>2</sup>) lies in the so-called sheep–wheat belt of south-eastern Australia, i.e. where land use is a mix of cropping and livestock grazing with sheep and cattle. The study area is located in the temperate climate zone, which, due to stable weather conditions, contributes to farms having relatively high commercial property values (Olsauskas et al. 2018). The agriculture, forestry and fishery industries together are the largest employer in the Cootamundra-Gundagai Regional Council (CGRC), the local government area encompassing our study area (ABS 2022). Agriculture thus plays a vital role in the regional economy and it is largely export-oriented. The majority of land in the region is privately owned. Most of the Council's approximately 11,000 population reside in the two major towns, with the rest of the area being sparsely populated. On average, the population in the area is older than the population of the state of New South Wales and migration trends show an increase of older residents (Cootamundra-Gundagai Regional Council 2018).

Since European colonisation in the early nineteenth century, and more specifically, since the onset of industrialised agriculture, much of the original grassy woodland ecosystems has been removed through land clearing with only remnant areas of natural vegetation remaining. While the study region has experienced a decline in rainfall since 1990 (Bureau of Meteorology and CSIRO 2020), since 2020, there has been above average rainfall leading to record canola harvests and cattle prices. However, according to climate projections for the broader region, average temperatures are expected to increase and rainfall patterns are projected to change with increased rainfall in summer,

and declining rainfall for other seasons (Local Land Services 2015). These climate changes scenarios are projected to result in decreased pasture production and profitability by 2030 (Local Land Services 2015). Based on global emission scenarios and projected changes in rainfall and temperature, the broader Riverina region, which our study area is part of, could experience a decrease in farm profits by 2050 of up to 31.5% compared to the 1950–2000 period (Hughes et al. 2020).

There have been several community-led initiatives in the area addressing climate change and environmental issues. The Muttama Creek Regeneration Group was founded in 2003 to focus community effort to improve riparian health of the section of the Muttama Creek that runs through the urban areas of one of the towns in the area.<sup>1</sup> Then, in late 2018, members of the local farming community formed the Muttama Creek Landcare Group, which aims “to protect and rehabilitate the natural vegetation of the Muttama Creek and surrounds, to reduce adverse impacts of climate volatility in the area and increase biodiversity”.<sup>2</sup> Key actions of the local Council’s Rural Lands Strategy include increasing tree canopy and encouraging regenerative farming (Cootamundra-Gundagai Regional Council 2019).

## Research approach

In this section, we first outline how we selected and recruited participants for the workshops before detailing how participants were guided through the three horizons. We then highlight how we analysed the six pathways through thematic clustering and used narratives to uncover the multiple ways in which people view the future before describing how we evaluated participants’ assessment of our workshop approach.

### Participant selection and recruitment

To address our two research aims, we conducted two full-day workshops two weeks apart in April and May 2021. Through earlier research involving case study participants, we identified contrasting perspectives on the biodiversity–production intersection reflecting different perceptions of biodiversity and land use priorities (Schaal et al. 2022b). Workshop participants were thus selected to reflect the diverse viewpoints held among farming stakeholders in our study area so that desirable futures could be created to encompass this diverse

range of values and perceptions. Due to the systemic nature of the three horizons approach, we also sought to invite participants with different roles in the agricultural system. This included land managers in the area, staff from local and state government and non-government agencies (Cootamundra Gundagai Regional Council, Local Land Services, Biodiversity Conservation Trust), members of local community groups (a regional Landcare coordinator, members of the Muttama Creek Landcare Group), a teacher from the local high school, and other key organisations and individuals working in that space. We sent email invitations to over 130 people who we had either interviewed in the project previously, identified as key stakeholders, or who had been suggested to us by other interviewees. We also advertised the workshops via Facebook as well as through articles in two local newspapers (*Cootamundra Herald*, *Gundagai Independent*) and a newspaper focused on agriculture and rural topics in Australia (*The Land*). There were 28 participants at each of the workshops. 16 participants who participated in the first workshop also participated in the second one.

### Workshop process

Previous research in the study area highlighted that peoples’ perspectives on the role and importance of biodiversity conservation in farming varied substantially, from a more ecological perspective that sees biodiversity as the prerequisite for profitable farming to a pro-production perspective that questions biodiversity benefits to farming (Schaal et al. 2022b). Building on these insights, we defined the following overarching question to frame the discussions: *How will we create a future where our landscape sustains viable communities, profitable farming and a rich biodiversity?* Based on this framing, we developed key questions to guide participants through the three horizons (Fig. 1).

The workshops alternated between group discussions with changing compositions and plenary discussions. During the first workshop participants were asked to:

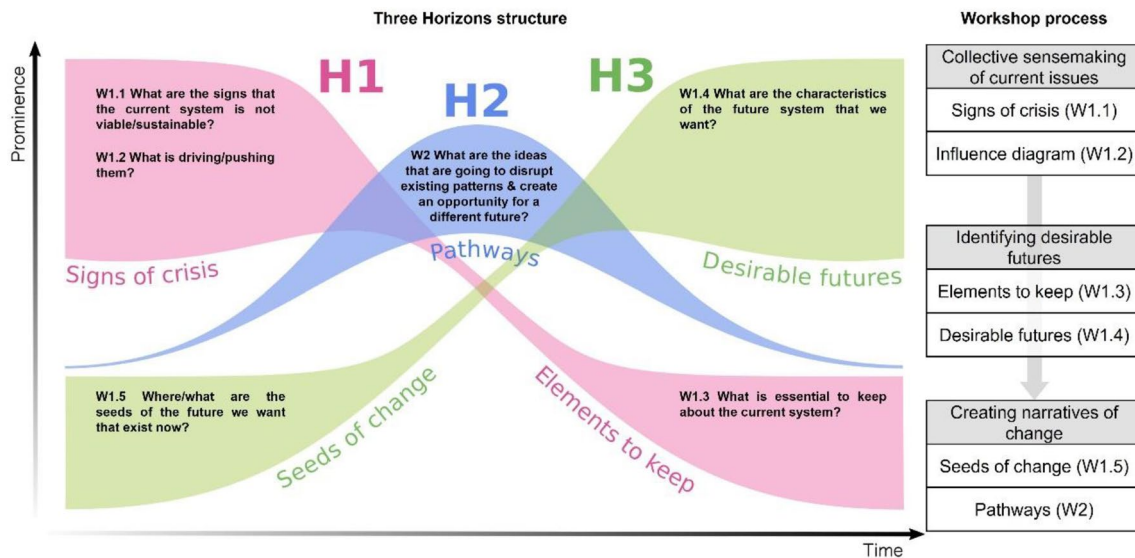
1. Identify signs that the current system is not viable in the long run (Horizon 1; Fig. 1, W1.1).
2. Identify the drivers behind these unsustainable trajectories (Fig. 1, W1.2).
3. Discuss what aspects they would like to retain from the current system (Fig. 1, W1.3).
4. Identify characteristics of a desirable future (without specifying a particular time frame) (Horizon 3; Fig. 1, W1.4).
5. Identify examples of a desirable future that exist already today (Fig. 1, W1.5).

The examples identified by participants of aspects of desired futures already existing today thus become the seeds

<sup>1</sup> <https://www.facebook.com/Muttama-Creek-Regeneration-Group-1217251158377723>, information retrieved on 28 October 2021.

<sup>2</sup> <https://www.facebook.com/muttamacreeklancare>, information retrieved on 15 October 2021.





**Fig. 1** The three horizons (H1–H3) and the questions guiding the discussions for each of the horizons during the two workshops. The letters and numbers indicate which aspects were covered during the first (W1) and second (W2) workshop and in which order (1–5)

that will help create the positive futures of tomorrow. Seeds are understood to be “initiatives (social, technological, economic, or social–ecological ways of thinking or doing) that exist, at least in prototype form [...] but are not currently dominant or prominent in the world” (Bennett et al. 2016, p. 442).

The focus of the second workshop was to develop future pathways where key issues in the current system (Horizon 1) were bridged with desirable characteristics of the future (Horizon 3) through project ideas (Horizon 2). Participants split into groups and were asked to come up with project ideas that would help move away from current issues (Horizon 1) and towards desirable system characteristics (Horizon 3). Some groups chose to stick to broad themes, e.g. addressing the issue of declining community health and capacity, whereas others focused on more narrowly defined issues, e.g. set stocking and its impacts. After this initial brainstorming, the result of which were ten different project ideas, participants grouped themselves around a particular project idea they preferred to work on more (Fig. 1, W2) by writing their name against that project idea. The total number of groups was not pre-determined, but during the selection, six groups emerged with group sizes ranging from 2 to 5 participants. A storytelling approach was then used to develop pathways using so-called storyboards. Storyboards were initially developed in the film industry and are sequences of drawings to map out the film narrative (Hart 2008). The groups were encouraged to draw on people from other groups with expertise that they needed for their pathway. Each group was asked to discuss and draw four steps of a storyboard: (1) the context or setting of their projects; (2) which enablers would help advance the project; (3) what potential barriers

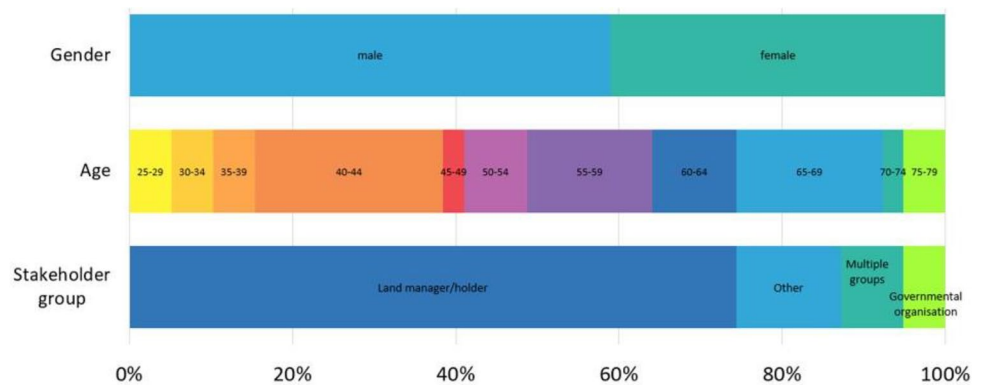
the project might face; and (4) how the successful project would look and feel like (Supplementary Material I). We decided to draw on a storytelling approach as it helps foster imagination, i.e. ideas which do not form part of “sensory and lived experience” (Moore and Milkoreit 2020, p. 9). Stories are also important to create shared understandings of dynamics in social–ecological systems (Galafassi et al. 2018).

To broaden the ways in which people in the area can engage with the workshop outcomes, we invited an interpretive artist to join the workshops and to create artworks inspired by the discussions. Arts represent an alternative mode of engagement with a topic, which can help communicate and illustrate research findings, and complement them through critical, creative or engaging outputs (Saratsi et al. 2019).

### Thematic clustering

After obtaining oral consent from participants, we recorded all sessions where participants presented outcomes from small group work to the large group and subsequent discussions involving all participants. We also kept all written workshop outcomes produced by the individual groups. All recorded workshop discussions were transcribed verbatim. We took an inductive approach to clustering the written workshop outcomes into key themes. The Horizon 1 themes (W1.1) were clustered around aspects from the group presentations that were delivered during the workshop. Themes derived for other workshop outcomes (W1.3–1.5) were grouped together by the authors after the first workshop by drawing on the workshop transcripts to inform our

**Fig. 2** Participants' demographics regarding gender, age and stakeholder group ( $n = 39$ )



understanding of their meanings. In the two weeks between the two workshops, we summarised outcomes and key insights from the first workshop into a report that was sent to all participants of both workshops. At the beginning of the second workshop, we briefly presented the outcomes from the first workshop and asked participants to add themes or drivers that they felt were missing. After the second workshop, we wrote up storylines the groups had presented using workshop recordings, and gave each a name based on the descriptions and expressions used by participants during their presentations. We then sent summaries of workshop outcomes to all participants for feedback. We also presented them at several meetings of the Muttama Creek Landcare Group to report back on the workshop and obtain feedback on the outcomes. These steps were vital to understand whether our interpretations of the storylines and labels were reflective of the groups' understandings.

### Narratives of change

Our first research aim was to articulate how the three horizons framework, in combination with a storytelling approach, can be applied to explore different perspectives on systems change towards positive futures. For this, we were interested in understanding the narratives of change produced through the storytelling approach as a reflection of different perspectives on systems change. Narratives provide both a useful way to communicate imaginary futures (Beckert 2016) and to engage with multiple imaginations of the future (Wyborn et al. 2020b). From a constructivist perspective, Leach et al. (2010) argue that for the same issue there are multiple co-existing narratives framing the system and its dynamics differently, each reflecting different values and goals through which problem and solutions are variously identified. In a narrative, different events are put into a sequence, starting with a beginning, e.g. a particular problem; the middle, in which certain events subsequently unfold; leading to the end, where certain outcomes are identified (Roe 1994). Narratives thus not only frame a problem

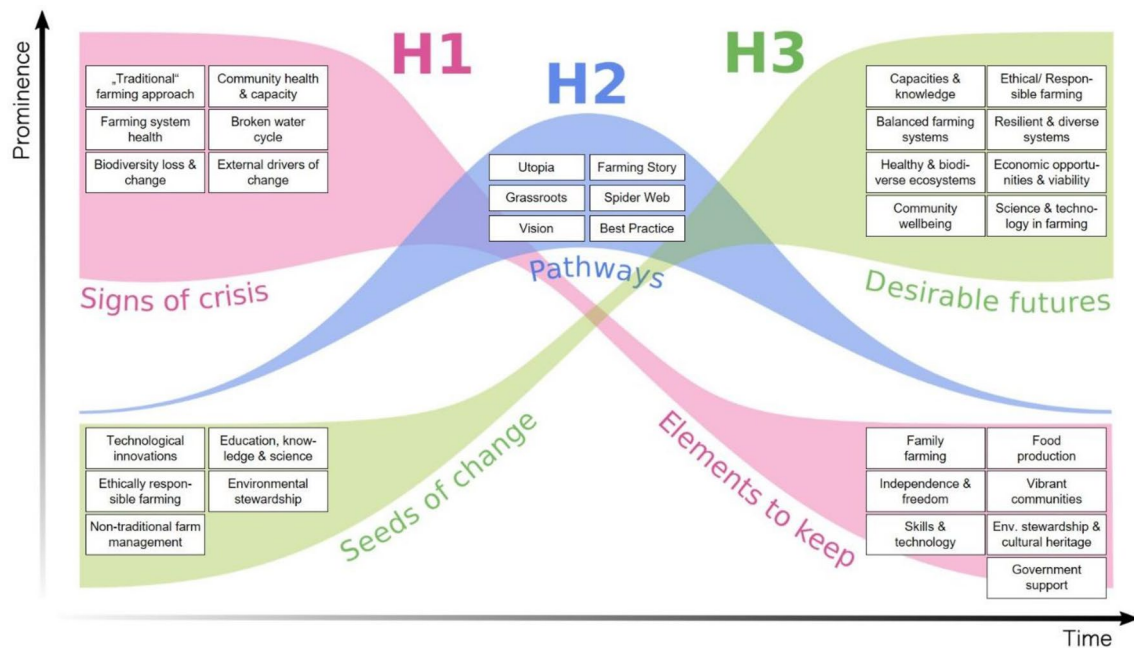
in a certain way, but also who is responsible to address the problem and how. They give structure to future imaginaries (Pigott 2018) by, for example, considering three key elements: a rationale, relevant actors, and a plot (Wittmayer et al. 2019). We understand narratives here as storylines that start with a perceived problem which is addressed through a set of activities and developments leading to a desired future.

### Participant evaluation

Our second research aim was to assess the utility of the three horizons approach for navigating towards those futures. For this, we were interested in understanding participants' assessment of the workshops regarding five recurring topics in the current literature on futures studies: (1) dealing with complexity (e.g. Bengston 2019); (2) providing space for creativity and imagination (e.g. Wyborn et al. 2020b); (3) dealing with a diversity of goals and perspectives (e.g. Pereira et al. 2019a); (4) empowering participants and agency (e.g. Sharpe et al. 2016); and (5) fostering future thinking or literacy (e.g. Pereira et al. 2018, 2019b). At the end of each workshop, we asked participants to complete a questionnaire where they were asked to rank a question regarding each of these five key futures studies aspects on a five-point Likert scale from 'strongly disagree' to 'strongly agree'. We received 39 questionnaires; 18 from participants at the first workshop and 21 from the second. The questionnaire also served to obtain participant demographic details: 59% of the respondents were male, they were predominantly land managers or landholders (74%), and they covered a range of different age groups, with over half of the respondents 55 years or older (Fig. 2).

### Results

During the workshops, participants discussed a range of interconnected issues with the current system and expressed diverse aspirations for the future. Based on these



**Fig. 3** The three horizons (H1–H3) and the main themes that emerged from the discussions about each of the horizons

discussions, participants in groups then developed six storyboards in which innovations, technologies or new ways of thinking and doing provided the impetus for moving away from a non-viable system towards positive futures. The resultant pathways combine six cross-cutting themes that emerged during the workshops: technology, knowledge, community, responsibility, environment, and farming systems. Each pathway represents a unique combination of these themes, highlighting the diversity of future aspirations and perspectives.

In the following, we present our findings in the order in which the three horizons were discussed during the workshops.

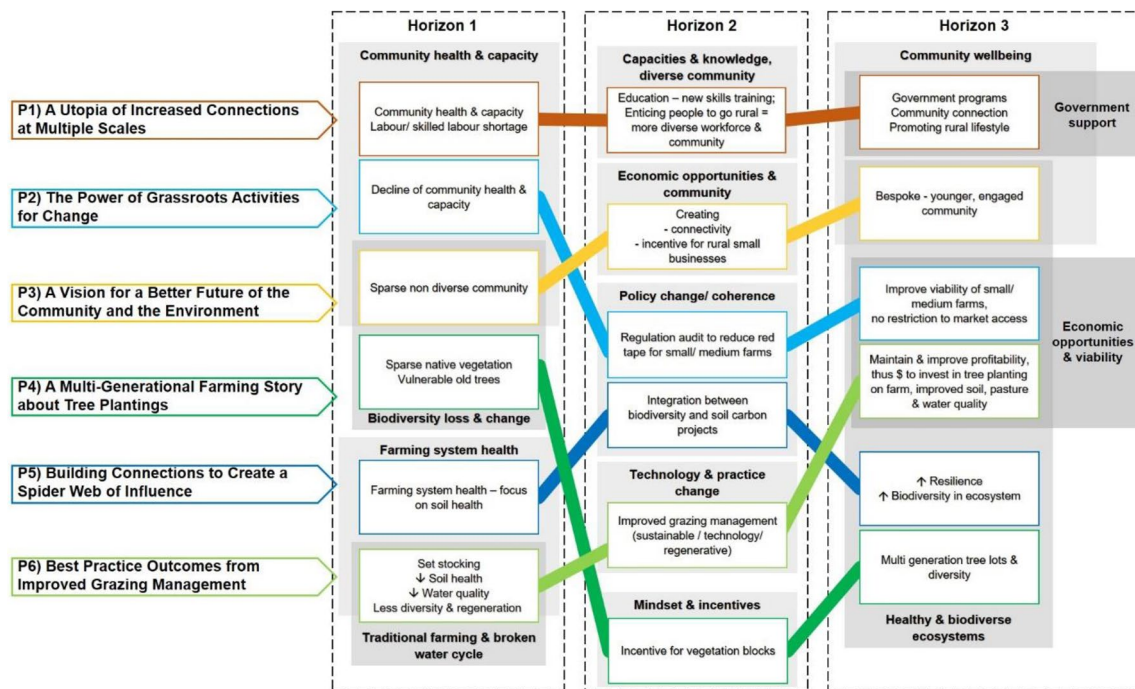
### Horizon 1

Participants in small group discussions identified different aspects that they felt were indicative of how the current system will not remain viable in the future (Fig. 3, ‘Signs of crisis’). The most prominent theme across the groups were issues related to “traditional” or more conventional farming approaches that were seen as lacking agility or having an over-reliance on chemical inputs. Biodiversity loss was also perceived to be a key issue, examples being the loss of birds or big old trees from the landscape. Another biophysical concern related to the water cycle, in particular poor water quality in the catchment area and increased run-off after heavy rainfall. Several groups mentioned issues related to farming system health, specifying a decline in soil quality, loss of crop diversity and invasive weeds. Similarly, participants

perceived a decline of individual and community health and capacity, including an ageing population in rural areas and mental health issues driven by burn out. Finally, examples of external system drivers beyond the immediate control of participants included climate change, increasing natural disasters and increasing consumer awareness about impacts of farming practices.

The discussion on drivers of change identified by participants focused on two critical signs that the system is untenable in the long run: traditional farming practices and a broken water cycle (Supplementary Material II). Workshop participants were divided into six groups, each of which selected one key issue and discussed driving forces that lead to these negative outcomes (Fig. 1, W1.2). This short exercise exploring direct and indirect drivers for these two situations highlighted the complexity of the issues involved by showing how the two issues are interrelated and how different drivers influence those issues in different ways. The influence diagram created by the researchers after the workshops (Supplementary Material II) showed how interconnected the different drivers are in participants’ understanding across social, governance and management, economic, technological and biophysical aspects.

Participants felt that there were several aspects that should be retained from the current system (Fig. 3, ‘Elements to keep’). This included the skills of farming communities in handling technology and their openness to adopt new technologies. Maintaining environmental stewardship and cultural heritage was a specific reference to farmers’ desires to take care of the environment, biodiversity and



**Fig. 4** Overview of the six pathways (P1–P6) that participants developed during the second workshop. The figure shows how the signs of a non-viable system (Horizon 1), innovative ideas, new ways of doing or technology (Horizon 2) and desirable characteristics of the future

(Horizon 3) are connected. Grey boxes are main themes identified through thematic clustering. The coloured boxes were written down by the groups prior to developing the pathways resulting in minor textual differences compared to the final narratives

cultural heritage on their farms. Participants wanted to maintain food production which includes farmers' rights and ability to produce food, especially locally. Family farming was seen as important given its association with inter-generational management and a stewardship commitment to the land. Vibrant communities should be preserved, e.g. by maintaining the regional population or government support through legislation and funding. Participants also wanted the government to maintain their role in providing funding for local land management outcomes to enhance community well-being and to put in place good biosecurity legislation. At the same time, participants also valued independence from government, i.e. the right to farm and the freedom to choose the way of farming within community expectations. Finally, other aspects to be retained were the equality of women in farming and the farming lifestyle.

### Horizon 3

Participants identified a broad range of aspects that characterise positive futures (Fig. 3, 'Desirable futures'). This includes science and technology in farming, e.g. that farming systems should be based on science or use renewable energy to reduce reliance on fossil fuels. Capacities and

knowledge should include anticipatory capacity of the community to plan for change and real time education and knowledge. Regarding ethical or responsible farming, participants wanted to see traceability and accountability in farming. Participants also discussed a range of properties that related to ecosystems and farming systems. Healthy and biodiverse ecosystems were desirable to participants and included healthy and biodiverse aquatic ecosystems and increasing soil carbon levels and soil health. Balanced farming systems meant that there should be a balance between production and natural systems and a better match of inputs and outputs in farming. Desirable system properties were their resilience and the diversity of people, enterprises and ecosystems therein. Community well-being meant that there should be a better standard of living for all in the communities. Economic opportunities and financial viability encompassed stabilised markets, ecotourism and an economic value for biodiversity. Finally, other desirable aspects were well-resourced government support staff and farming being seen as a good industry to be involved in despite a challenging climate.

Some of the aspirations towards the future can already be found in the present system (Fig. 3, 'Seeds of change'), including technological innovations such as hydroponics and

**Table 1** Barriers (B) and enablers (E) identified by the groups prior to developing the storylines

		P1	P2	P3	P4	P5	P6
		<i>Utopia</i>	<i>Grass- roots</i>	<i>Vision</i>	<i>Farming Story</i>	<i>Spider Web</i>	<i>Best Practice*</i>
Governance & Policy	<b>B</b>		X	X	X	X	
	<b>E</b>		X	X	X	X	X
Individuals & mindsets	<b>B</b>	X		X	X	X	X
	<b>E</b>				X	X	
Markets & industry	<b>B</b>	X	X	X	X		
	<b>E</b>	X		X		X	
Education & knowledge	<b>B</b>	X	X				
	<b>E</b>	X	X		X		X
Collaboration & connections	<b>B</b>	X					
	<b>E</b>			X	X		
Farming systems	<b>B</b>	X				X	
	<b>E</b>				X		
Technology	<b>B</b>						X
	<b>E</b>	X			X		X

The areas shaded in yellow indicate that the groups mentioned aspects that relate to an overarching factor both being a barrier and an enabler

\*This group did not produce a written output of the barriers and enablers discussed. They were instead derived by the researchers afterwards based on the presentation of the storyline

glass houses, electric fences, virtual animal tags or robotic services. Education, knowledge and science related aspects that exist today were access to agriculture in the education system and research into practice change. Ethically responsible farming included honesty in labelling, animal welfare and humane practices but also technology-assisted paddock-to-plate traceability. Participants expressed a desire that environmental stewardship be put into practice and that landholders are rewarded for doing so. Non-traditional farm management related to cell or rotational grazing instead of set stocking, cover crops and support for carbon and solar

farming. Other aspects included agritourism and equal participation of women in farm management.

## Horizon 2

In total, there were six groups with each choosing an issue or set of issues in the current system (Horizon 1) that they wanted to address and associated future aspirations that they wanted to move towards (Horizon 3). Through storytelling, they charted pathways into positive futures (Fig. 3, 'Pathways'; Fig. 4). Here, we briefly outline the narratives (see full narratives in Box 1 and Supplementary Material III):

*Utopia* pathway: In this pathway, the key issues recognised are disconnects at different levels, especially locally, but also between rural and urban areas, and decreasing community health due to fewer people in the communities. The group recognised that improving education to create a more diverse and skilled workforce was the key to overcoming this challenge to a large extent. Positive change is also expected to happen through making stronger connections between producers and consumers through technology. This includes social media, paddock-to-plate marketing, which brings food from farmers directly to consumers, and agritourism. Such connections are expected to increase understanding of the agricultural landscape among urban residents, while strengthening local food production.

*Grassroots* pathway: In this pathway, the key issues addressed are decreasing community health and capacity. The group felt that a key lever for change involves making the regulatory framework more conducive to supporting viability of small and medium-sized farms. Change at the local level is seen to happen through bottom-up means such as grassroots initiatives or ‘kitchen table’ conversations. The group recognised mixed farms and bringing family members back to the farm as enablers for change that lead to improved viability for small and medium-sized farms and enhance capacity for ethical, semi-intensive agriculture. These developments over time are believed to improve the health of the Muttama Creek and the landscape.

*Visions* pathway: In this pathway, two intertwined issues are considered: decreasing community health and well-being, particularly a lack of diversity of people; and partly depleted ecosystems. The group saw change coming from increasing connectivity (between farmers and consumers and with the land), networking, support for micro projects, more incentives for small rural businesses and farm diversification. This is expected to lead to a bespoke, young and energised community where people live in harmony with the land, farmers are paid for conservation, sustainable practices and net zero carbon emissions.

*Farming Story* pathway: In this pathway, the key issue concerns unhealthy and non-diverse ecosystems, e.g. sparse native woody vegetation. The group focused on change that started with just one farmer with the right mindset and incentives at the community-level through Landcare and improved environmental education. As a result, the farmer was expected to start on-farm improvements through revegetation, tree plantings and fencing off the creek. Over several generations, ecosystem and livestock health were believed to improve by planting multi-generational tree lots. Eventually the group expected this to have a trickle-down effect on the rest of the community.

## Horizon 1



## Horizon 2



## Horizon 3



**Fig. 5** Artworks created by a local artist based on the workshop discussions. They represent each of the three horizons. Artist: Julia Roche. Photos: Jack of Hearts/Jackie Cooper

**Spider Web pathway:** In this pathway, the key issue addressed is a disconnect between the federal and state system regarding soil carbon and biodiversity projects. The group believed that better collaboration and integration between state and federal level governments—supported by government representatives in the communities and farmers championing changes—would help increase community buy-in. This was expected to lead to more resilient and bio-diverse ecosystems (Box 1).

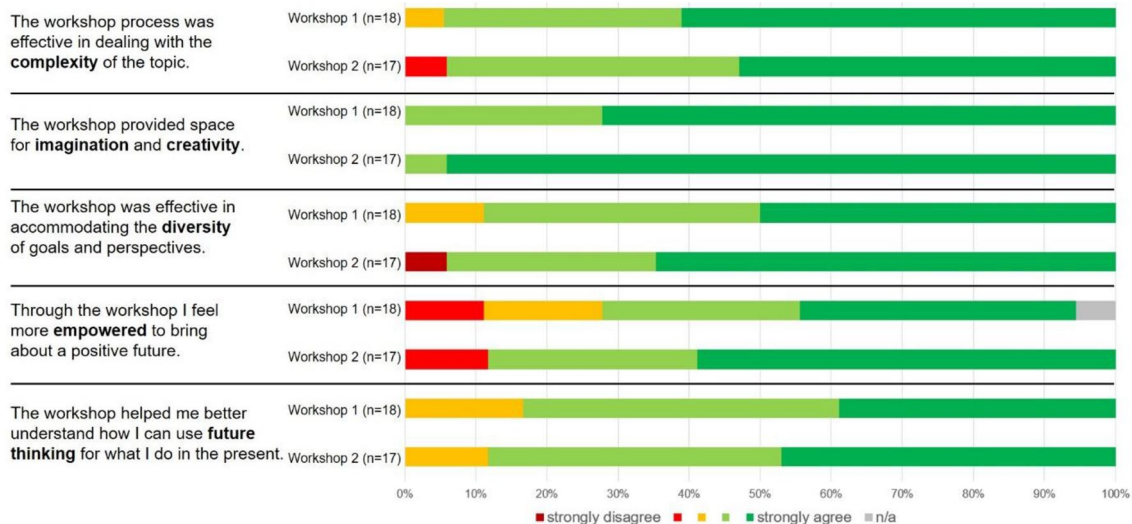
**Best Practice pathway:** In this pathway, the key issues recognised were reduced soil health, water quality and loss of biodiversity as interlinked problems. The group felt that widespread implementation of practices that already exist on a small scale such as rotational grazing together with virtual fencing and other technological innovations, e.g. using drones for feed calculations, would help bring about change. Participants expected this to help improve farm viability, which would also lead to better environmental outcomes.

Prior to and while they were developing the storylines, the groups considered aspects that would inhibit or support the realisation of their pathways. When discussing barriers and enablers, the most prominent across all six pathways was the aspect related to the governance and policy context (Table 1, Supplementary Material IV).

Based on the workshop discussions following the guiding questions, the local artist created abstract artworks representing each of the three horizons (Fig. 5).

### Participants' assessment of the three horizons workshop process

Overall, participants' assessment of the workshops regarding the five key futures studies aspects were very positive (Fig. 6). The second workshop involving the pathways narratives was ranked more positively than the first workshop, except for the complexity dimension. On average, 64% of the responses were in the 'strongly agree' section for workshop 2, compared to 52% for workshop 1. The empowerment dimension generally received the most negative responses, i.e. 11% and 12% of the responses in the 'strongly disagree' section for the first and second workshop respectively. The creativity dimension received the overall most positive assessment with 72% and 94% of participants selecting the 'strongly agree' response for workshops 1 and 2, respectively. The future thinking dimension received the lowest percentage of 'strongly agree' responses for both workshops.



**Fig. 6** Participants' assessment of the two workshops based on five key topics in futures studies on a five-point Likert scale from strongly disagree to strongly agree. For more detail see Supplementary Material V

**Box 1 Example of a storyline and the corresponding storyboard. See Supplementary Material III for the other five storylines.**

**(P5) Building Connections to Create a Spider Web of Influence.**

The key issue that this pathway addresses is the disconnect between the federal and state systems (*top left in the drawing*), with specific reference to the federally funded soil carbon projects and projects funded by state government such as the Biodiversity Conservation Trust. In particular, when there are in-perpetuity agreements for land on a property set aside for biodiversity conservation, that property is excluded from soil carbon projects.

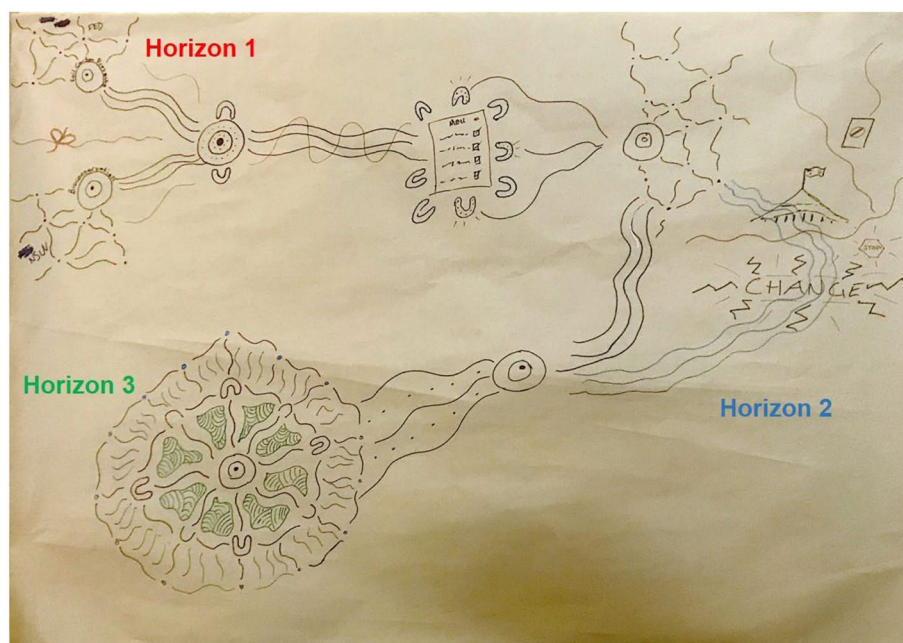
As a result of this lack of coherence, legislation blocks synergies between projects and creates red tape. People's mindsets, especially a fear of change, stand in the way of creating better connections between biodiversity and soil carbon projects (*top right*). For example, many landholders feel that moving away from traditional to more sustainable farming practices and embracing long-term projects, e.g. biodiversity conservation and soil carbon projects, is a huge and risky commitment.

"... the fear of engaging and the fear of the unknown is a big thing to overcome."

Synergies between the projects regarding biodiversity, food production and farmers' income exist. However, for these synergies to emerge, federal and state agencies need to collaborate and help create a spider web of influence. This in turn helps to improve connection with research and funding opportunities. Government agency representatives located in the community are important for influencing the direction of change. Farmers who are passionate about these synergies and champion them can increase buy-in from the rest of the community by demonstrating that it is worthwhile to do these projects on their property. Soil carbon markets provide another opportunity for changes to farming practices.

"... we need to get everyone around the table trying to figure out a way that [the federal and state systems] can work together."

Eventually, these changes lead to a healthy and sustainable environment (*bottom left*)



*This storyboard uses Indigenous symbolism and was drawn by a Wiradjuri workshop participant*



## Discussion

Combining the three horizons framework with a storytelling approach helped elicit six pathways towards future visions and explore anticipated changes, including to biodiversity in the local area. The three horizons approach provides a structured way to talk about different dynamics that give rise to different futures, while storytelling helped participants connect their ideas into narratives of change. Our approach to explore futures can be classified as imaginative, participatory and qualitative (c.f. Bengston 2019) and contributes to a growing body of literature on local or regional pathways and actions towards positive futures (Bennett et al. 2016; Pereira et al. 2018; Mangnus et al. 2019). While futures methods to develop pathways often focus on a limited or pre-defined number of visions (e.g. Mangnus et al. 2019; Raudsepp-Hearne et al. 2020), the flexibility of our approach offered the opportunity for a broader range of different pathways to emerge. Moreover, in contrast to vision-driven approaches such as backcasting, the three horizons framework is focused on exploring systems dynamics by considering perceptions of current issues, future aspirations, and innovations simultaneously. In the following, we first contrast the six narratives before discussing implications for conservation in farming landscapes. We then present our reflections on benefits and limitations of our approach in terms of plural values and perspectives in conservation research, creating actionable knowledge and the role of policy and governance.

### Comparison of the pathways

The six narratives reveal a diversity of problem framings, future aspirations, and mechanisms of change to move towards positive futures. The pathways addressed issues related to community health, farming systems and landscape health, and lack of policy coherence. Conservation objectives were embedded in the broader context of rural development, allowing us to consider community needs that are not always considered in approaches that focus only on agriculture or nature conservation. In most of the six narratives, change came from a combination of elements within the control of the community and from outside the focal system. Farmers were key actors for change in most of the pathways (*Grassroots*, *Vision*, *Farming Story* and *Best Practice* pathways). The community or community organisations also played a vital role in many of the pathways either to bring about or to support changes (*Utopia*, *Grassroots* and *Farming Story* pathways). Institutional changes were vital for the *Spider Webs* pathway and to a lesser extent in providing incentives in the *Best Practice* pathway. In the

latter, technology was a key driver of change for realising a positive future.

The pathways also relied on different types of innovations for system change. We understand innovation here broadly as “the (re)integration of new or existing information in innovative ways” (McKenzie 2013, p. 83). This means that whilst something might be an established practice elsewhere, it can count as new in a particular location. The *Best Practice* pathway focused particularly on technological innovations. In contrast, the *Farming Story* and the *Utopia* pathways pursued a different avenue by focusing on education. Environmental education and awareness-raising help mobilise human resources and enable innovations for transformative change (Pereira et al. 2021). The *Vision* pathway provided the most comprehensive account of strategies to establish alternative food systems such as direct marketing, diversified production or producing on a smaller scale. In sum, our narrative approach to pathways highlights different system framings and values (c.f. Leach et al. 2010) as well as different priorities and perceptions of key problems and solutions proposed to overcome these challenges (see also Krauß 2020).

### Implications for biodiversity conservation in farming landscapes

The six pathways represent different understandings of the relationship between farming and biodiversity. For example, in the *Best Practice* pathway, local stakeholders imagined that improved profitability would provide the means to protect on-farm biodiversity through use of new technologies combined with changed practices. In contrast, the *Vision* pathway focuses on a changed relationship with nature, i.e. living in harmony with the land, which IPBES (2019) refers to as an element of a good quality of life. Prominent academic debates about conservation in agriculture, such as land sparing versus land sharing (Green et al. 2005) or the prospect of sustainable intensification (Loos et al. 2014; Tilman et al. 2011), did not play a major role in the pathways. Instead, the approach of storytelling helped workshop participants identify a variety of ways to protect biodiversity in their south-eastern Australian farming landscape context, such as rotational grazing or planting tree plots.

IPBES (2019) suggests five levers for transformative change to avoid the destruction of nature, some of which the five pathways refer to. With regard to incentives and capacity building (lever 1), the *Farming Story* and *Vision* pathways focused on environmental education, e.g. about the benefits of tree plantings, and education through community-based organisations. With regard to cross-sectoral cooperation (lever 2), the *Spider Webs* pathway pointed to the need for integration of biodiversity and soil carbon projects across administrative levels. This lack of integration

between agricultural and conservation policies in Australia has been identified elsewhere (e.g. Bardsley et al. 2019). Our findings highlight how this lack of coherence is perceived to be a barrier for change on the ground. Carbon credits as a form of environmental policy (lever 5) were brought up as enablers for change by two groups. Research shows that in addition to storing carbon in the soil, vegetation projects can improve biodiversity outcomes if they are well designed (Standish and Prober 2020). Our findings highlight a willingness among farmers to engage in carbon farming and tree planting and suggest an underexplored potential for synergies.

### Dealing with a diversity of perspectives and values

Our application of the three horizons approach is specifically designed to include a range of different perspectives and problem framings. Guided by the overarching workshop question, participants could explore the plethora of topics relevant for their community, thus opening up their thinking to various issues, visions and innovations which was vital for the subsequent development of different pathways. Although the overarching question for the workshops was framed around community well-being, profitable farming, and rich biodiversity, the number or exact nature of narratives was not pre-defined. As researchers, we designed the guiding questions, the structure of the storytelling and clustered emerging topics. However, the workshop process was highly participatory, giving participants the freedom to explore a vast array of different change dynamics. Pereira et al. (2018) argue that imagination, a diversity of viewpoints and storytelling are important for creating spaces for transformative thinking. The questionnaire responses in our case suggested that the workshops were successful in fostering creativity and imagination and offered participants a useful process to think about the future. We found that combining three horizons with a storytelling approach provided a space to discuss current issues, sketch multiple visions and elicit pathways towards them. Peoples' imagination is influenced by how the social and natural world are experienced by individuals (Moore and Milkoreit 2020) and groups of participants that worked on the pathways were self-selected. The narratives of change elicited through the storytelling exercise thus revealed shared ways to identify meanings about key issues and how those can be overcome (c.f. Veland et al. 2018).

Feedback provided by participants through the questionnaires suggests that dealing with complexity and integrating different perspectives fully into the discussion remained challenging. An option to further explore tensions and trade-offs between different perspectives in the transitional space between the first and the third horizons could be through tools such as dilemma thinking (Sharpe et al.

2016). Moreover, our workshop approach could be extended by exploring areas of convergence and divergence across the different pathways (e.g. Harmáčková et al. 2021) to identify how the different pathways mutually reinforce or hinder each other. Whilst this might have helped to better address value conflicts, we do not want to suggest that the pathways are mutually exclusive or that any one pathway necessarily negatively impacts on another pathway. The pathways can be pursued simultaneously and there is potential for synergies among them. Our template could be extended to include a session to further test and explore the pathways, and their different aspects could be recombined or integrated into new emergent pathways. This could have been achieved by exploring common aspects between the pathways (e.g. Raudsepp-Hearne et al. 2020), thus highlighting similar change rationales and shared values. For example, there are areas of overlap regarding increasing more direct selling to consumers, more networking and support for community-based organisations.

The pathways explored by our participants highlight system dynamics that are mostly within the control of individuals or the community in the focal system. In the pathways, some of the identified drivers are beyond the control of individuals, e.g. increasing policy coherence in the *Spider Webs* pathways, but in most pathways individuals or the community play a key role for change, e.g. in the *Vision* and *Farming Story* pathways. The storyboards and narratives that the groups presented reflect shared expectations, goals and values pertaining to the future. This can help create agency and collective action (Galafassi et al. 2018; Charli-Joseph et al. 2018) and such collective sensemaking is important to prepare for change in social–ecological systems (Moore et al. 2014; Olsson et al. 2006). For example, narratives can be a powerful tool to engage other people if the narrative, and thus how problems and solutions are framed, resonate with other peoples' experiences and understandings (c.f. Wittmayer et al. 2019). To ensure that workshop outcomes provide a resource for future action, they were documented in detailed workshop reports and form part of a printed project booklet with policy recommendations (Schaal et al. 2022a). The booklet includes the artworks created by the local artist and thus offers an additional means of engagement with the three horizons. The structured yet highly participatory nature of the workshop approach described in this paper makes it a suitable approach to meet calls to include plural values of biodiversity (c.f. Pascual et al. 2021).

### Creating actionable knowledge

Actionable knowledge—i.e. “knowledge that enables action, or intervention, in concrete situations” (Bartels 2012, p. 435)—plays an important role not only in transformation research (Wittmayer et al. 2018), but also in conservation

on privately owned land (Cortés Capano et al. 2019). Such knowledge provides insights into the different options available and supports decision-making about actions (Hölscher et al. 2021). Our use of storytelling to articulate desired future pathways created actionable knowledge driven by inspiration and positive thinking. This positivity enabled discussions about concrete activities during the workshops and feedback from participants and from the Landcare Group afterwards highlighted that the pathways could be used for strategic planning and as design criteria for future community projects. We are also aware that the Landcare Group has applied for funds to pursue actions that were discussed at the workshop, and subsequently further developed. Additionally, the six project narratives propose concrete interventions and innovative approaches at the individual and collective level. However, establishing consequential links between research and social impact is challenging (e.g. Hölscher et al. 2021). Since the conclusion of the workshops, we have not evaluated which on the ground actions are a direct result of the two workshops. Nevertheless, discussions with people from the study area during and after the workshops suggested that the workshops and the three-year research project in which they were embedded increased awareness about the topic of biodiversity in farming landscapes among people in the area and that the workshop process is a stepping stone for future on the ground activities.

Despite contributing to increased awareness about the topic, the questionnaire responses related to empowerment and future thinking point to limitations of our approach in terms of future literacy, i.e. “the capability of offering insights on how to approach unforeseeable challenges by using the future to innovate in the present” (Pereira et al. 2019b, p. 9). Whilst developing a future vision is important to prepare for change, navigating the transition requires selecting which innovation or activities should be taken up (Moore et al. 2014). Effective leadership is an important element for conservation action (Sterling et al. 2017) and it helps preparing for and delivering change (Olsson et al. 2006). Discussions during and after the workshops confirmed that leadership, e.g. by governmental agencies, and provision of financial resources are critical for bringing about the changes described by the pathways. However, our research team’s resources were limited because the workshops were part of a research project with pre-defined aims and a set timeframe. Such time-limited project contexts present challenges in terms of trust building, inclusion of all relevant stakeholders, and reflection that enables ongoing learning and delivery of the project’s longer-term desired outcomes (Allan 2012; Papp et al. 2022). Our experiences in applying the three horizons framework with storytelling indicates that while it was very useful to explore a range of (management) options at the local level, it does not produce strategies and actions as directly as backcasting does

(c.f. Hichert et al. 2021). The workshops and their outcomes do, however, offer multiple points to engage with change, allowing different people depending on their values, skills and agency to decide where and how they will engage. For example, this might be experimenting with innovative ideas, nurturing existing seeds of change or just maintaining good aspects that should not be lost. This highlights that the approach described in this paper is particularly useful for scoping and eliciting different context-specific opportunities for systems change.

Researchers applying our three horizons storytelling workshop template in other contexts could devote extra time to identifying next steps and assign responsibilities for implementation of the project ideas. The three horizons framework focuses on how transitions can be managed (Sharpe et al. 2016). To further increase the operationalization of the pathways, researchers applying our suggested workshop guide could include an additional workshop session for developing sequences of activities, identifying how those are linked to the levers of change, and assigning responsibilities which could support the community in developing a theory of change (see also Colloff et al. 2021). In our case, increasing this action-oriented planning focus would either have been at the expense of existing workshop achievements or require increased time commitment from the project team and participants. We instead encouraged the action agenda to be developed by organisations who had sent representatives to the workshops. Indeed, our experiences from the application of the three horizons approach suggests two key criteria for selection of participants. Stakeholders should not only be selected to represent a broad range of perspectives on the topic. More strategically, local change agents, community leaders and actors that can institutionalise the workshop outcomes should be invited to help increase the potential for post-workshop pursuit of actions inspired by the future visioning activities. Embedding the workshop process and the research project in a longer-term project or local program and institutionalising the workshop outcomes, e.g. with the local Council, could be important aspects to ensure that the three horizons workshops serve as stepping stones for a longer-term agenda of community change and not a one-off exercise.

### The role of governance and policy context

Aspects relating to governance and policy were seen as both barriers and enablers of change across almost all pathways. The governance context can enable sustainability transformations by, for example, supporting the emergence of markets for innovations, but can also provide a barrier for transformation, e.g. because regulations influence what is more or less profitable (Pereira et al. 2021). Though barriers and enablers were discussed at

the second workshop, a session identifying innovations that help transition to the third horizon and innovations that lead back to the first horizon respectively—so called H2+ and H2− (Sharpe et al. 2016)—could have helped further identify drivers strengthening the current system and hindering system change, a reflective exercise that would have strengthened action planning. The pathway narratives reflect different problem framings and propose subsequent solutions to address those issues. Governance processes influence which narrative(s), i.e. pathway(s), become(s) dominant by framing the system, the goals and problems in a certain way (e.g. Leach et al. 2010). For example, Pigott (2018) analysed imaginaries about socio-ecological transformations in Welsh government policy and highlighted how the concept of resilience, framing of time and notions of crisis provide opportunities and obstacles for buy-in from local people and opportunities for alternative imaginaries to occur. The three horizons approach can be viewed as an enabling approach in sustainability transformations in that it helps communities develop pathways into positive futures and thus engage with collective action (c.f. Scoones et al. 2020). However, as Scoones et al. (2020) note, such approaches may fail to integrate structural or political obstacles to transformations. This points to challenges related to cross-scale governance to bring about change. In our study, cross-scale governance mechanisms and advocacy to influence funding policy and funding priorities may be required to see substantial actions on the ground. Such actions could create incentives and reduce the risk for individual farmers.

## Conclusions

In view of the projections of future ecological and social decline, novel, inspirational and positive futures are urgently needed to provide direction for change and help build momentum for collective action. We showed how combining three horizons with a storytelling approach can be used to create pathway narratives towards positive futures that bring about improved biodiversity outcomes. We applied our approach with a farming community in south-eastern Australia. We unpacked the resulting narratives of change to show differences in how problems are framed, how desirable futures are imagined and how technological, institutional, and social changes can lead to desired outcomes. Across the pathways, a recurring theme involved disconnects in the system, with the pathways highlighting ways to (re-) build connections. This referred to connections between farmers and consumers, between rural and urban areas, with the land and the landscape, and between different policies.

Though the pathways narratives are specific to the south-eastern Australian farming context, they highlight opportunities

for improving conservation outcomes in farming landscapes, such as carbon offsetting mechanisms and environmental education. By fostering collective sensemaking about key issues and desirable futures, our research approach may help the rural community in our study area to prepare for change. Moreover, the workshop process and the resulting six narratives of change created actionable knowledge about the options that individuals and the community have available to shape the future they want. However, the pathways also showed inhibitors for innovation and change, in particular local leadership and the policy and governance context.

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**Data availability** The transcripts of the workshops analysed for this article are not publicly available due to participants being promised confidentiality as part of their informed consent. When all information that could identify individuals or their organisation is removed from these transcripts, they no longer have much value as research data due to the context-specific nature of the information. The questionnaire data is available in the Supplementary Material.

## Declarations

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical statement** The research was approved by the Human Research Ethics Committee of the Australian National University protocol number 2019\_913. All workshop participants were familiar with and provided oral consent confirming that they were sufficiently informed about the content of the research, were willing to participate in the project, agreed with further use of workshop materials for research purposes, and agreed to be audio-recorded.

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# Chapter IV

## Exploring cultural landscape narratives to understand challenges for collaboration and their implications for governance *(Landscape Narratives Paper)*



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## **Exploring cultural landscape narratives to understand challenges for collaboration and their implications for governance**

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### **Abstract**

Ongoing land use change, including both land abandonment and agricultural intensification and expansion, not only present a threat for biodiversity and ecosystem health but also for the persistence of cultural landscapes. However, farmland abandonment and the resulting loss of traditional cultural landscapes is an under-researched topic in the literature. Our work in a transdisciplinary action research project in the Spreewald Biosphere Reserve suggested that challenges to preserve the cultural landscape are rooted in diverging landscape understandings and future aspirations. Dealing with and integrating different perceptions and viewpoints is a key challenge in landscape governance. Narratives as storylines about a topic or an issue have a structural and temporal dimension and can help understand land-use conflicts and different viewpoints. We adopted a social constructivist perspective on landscape to engage with meanings and perceptions (including values) that constitute landscape to diverse stakeholders. To understand these differences in meaning, we drew on Q-methodology and conducted 38 interviews with key stakeholders. We elicited three co-existing and partly overlapping landscape narratives. These differ with regard to meanings of the term cultural landscape, including how stakeholders characterise the landscape, how they appreciate it, and what they perceive as threats. We show how such differences in meanings and values attributed to the landscape translate to different problem framings and future aspirations and thus present a barrier for collaborative management and governance. We highlight how participatory vision development could help address narrative tensions and argue that a more integrative perspective would better include cultural aspects.

### **Keywords**

biodiversity; biosphere reserve; plurality; Spreewald; values

### **1. Introduction**

Land use changes are among the most important drivers of ecosystem degradation and biodiversity loss (IPBES, 2019). These changes not only threaten the persistence of ecosystems but also that of cultural landscapes and thus the many ways in which people relate to and value them. Both land abandonment and agricultural expansion and intensification are drivers of landscape changes in Europe (Plieninger et al., 2016), which are accompanied by a range of interacting drivers such as climate change or political changes shaping cultural landscapes (Bürgi et al., 2017a). Using the example of semi-natural habitats, Herzon et al. (2022) highlight that interconnected societal processes, including less attention in research and decreasing public experience of these habitats, contribute to the decrease of the area under appropriate management. Although land abandonment has been identified as a key driver for landscape change, farmland abandonment and the concomitant loss of traditional cultural landscapes is an under-researched topic in the literature (Zscheischler et al., 2019). The term cultural landscapes

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refers to the co-evolution of humans and nature and the broad range of material and non-material values that people associate with them (Bürge et al., 2017b; Schaich et al., 2010) - emphasising subjectivity and plurality for understanding landscapes (Stenseke, 2018) and thus the myriad of ways in which humans interpret and ascribe meaning to landscapes (e.g. Sandström and Hedfors, 2018). For example, van Putten et al. (2020) recently showed how landscape associations vary between different languages. Cultural landscapes therefore present a particularly interesting type of landscape to explore challenges around differences in perceptions of landscape change processes.

Our research aim was to explore different meanings associated with a cultural landscape through a narrative lens and understand how those create challenges for landscape management and governance. This research aim emerged from the transdisciplinary action research project *ginkoo* in the Spreewald Biosphere Reserve (BR) in eastern Germany. *ginkoo* explored options for coordinated landscape management and maintenance to preserve the wet meadows, which are typical of the Spreewald area, but which are threatened to disappear due to land abandonment (Schäfer and König, 2018). Findings from the transdisciplinary project suggested that navigating the process to co-develop and co-implement innovations to address this challenge were rooted in diverging imaginations of the sustainable future development of the cultural landscape. In workshops with different stakeholders in the area, a question that kept coming up repeatedly either explicitly or implicitly was ‘What cultural landscape are we talking about?’. This question pointed to differences in what cultural landscape meant to different people and resulting challenges to establish collaborative management of the cultural landscape and co-creation of different innovative approaches to address land abandonment. This current paper therefore presents results from research that sought to explore these differences.

Different meanings ascribed to and understandings of environmental problems present an important governance challenge (c.f. Ingold et al., 2019). Görg (2007) defined landscape governance as “deal[ing] with the interconnections between socially constructed spaces (the politics of scale) and “natural” conditions of places” (p. 954). Thus, landscape governance is concerned with perceptions of problems related to biophysical aspects in particular locations (c.f. Buizer et al., 2016). Such landscape perceptions are influenced by peoples’ experiences with them (van Putten et al., 2020). For example, perspectives on landscape development are influenced by different interests (Barnaud and Couix, 2020, Frei et al., 2020) and landscapes are valued by different people for various reasons – instrumentally, intrinsically or relationally (Bieling et al., 2020). Thus, how landscapes are perceived influences management decisions as well as how inhabitants of the landscapes take up these decisions. Further, landscapes are not stagnant but constantly evolving and thus perceptions of landscape can change. How people think about current changes of a landscape and the future is influenced by how they perceive past changes (Soliva, 2007). Moreover, significant landscape changes can alter how people relate to and value them (Riechers et al., 2020), which is even more relevant for cultural landscapes.

Narratives provide a conceptual lens to identify different perceptions of issues and to reveal underlying beliefs, preferences and values. Central to narratives is a sequence of events or actions (Roe, 1994) and thus a temporal dimension (Bryman, 2016; Soliva, 2007). Narratives are about something, e.g. an issue, phenomena or topic, such as land abandonment (Frei et al.,

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2020; Soliva, 2007). Narrative research has examined tensions and conflict around current and future landscape development. For example, Stanley (2021) contrasted narratives about cemeteries' material-symbolic meaning in Icelandic culture and contrasted them with an imagined futures narrative by an external consulting firm. Similarly, Masterson et al. (2019) highlight how different narratives in a study area in South Africa draw on different place meanings and how the full breadth of meaning is not incorporated into dominant conservation narratives. Tensions between narratives were also highlighted by Köpsel et al. (2017) who contrasted a policy narrative with different local landscape narratives about Cornwall. Contrasting landscape narratives can also help understand conflicts around future land use and development priorities (Plieninger et al., 2018). These examples highlight how a narrative lens provides a nuanced understanding of conflicts related to different meanings and perceived changes and trade-offs related to land use and development. Thus, narratives do not only constrain but also enable thinking (Veland et al., 2018) and what is perceived to be the right course of action or management (e.g. Köpsel et al., 2017).

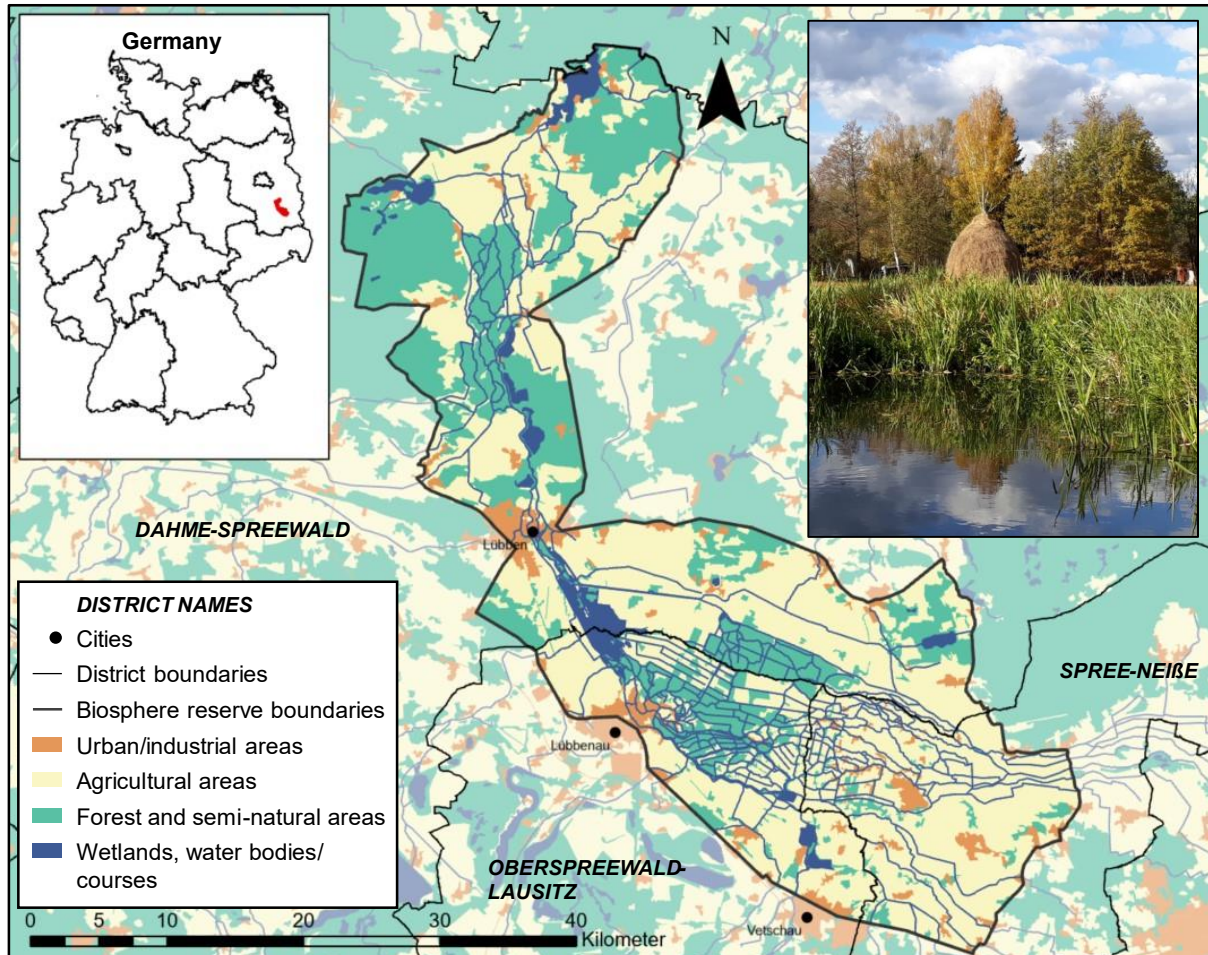
In this paper, we took a social constructivist approach that considers constructions of landscape in relation to physical or material elements of the environment, the interpretation of which differs between different people or groups (c.f. Gailing, 2012; Köpsel et al., 2017). The materialities of landscape, e.g., landscape elements, thus provide the 'raw material' to which meanings are ascribed (Stedman, 2016). We understand narratives not as tools of communication to achieve a certain objective but as shared interpretations and meanings assigned to the notion of cultural landscape. To address our research aim, we sought to explore how the Spreewald cultural landscape is conceptualised by local actors and how this relates to perceptions of threats and landscape values. To this end, we used a mixed methods approach, namely Q-methodology (Watts and Stenner, 2012). We interviewed 38 stakeholders from different sectors, including agriculture, nature conservation and tourism in the Spreewald. We identified three cultural landscape narratives which differ with respect to problem framings, landscape meanings and values. We highlight how this creates narrative tensions resulting in both a lack of a shared problem framing and future imaginations which create a barrier for management and governance. Findings from this research are also relevant for other cultural landscapes where stakeholders seek ways to collaboratively preserve traditional cultural landscapes.

## **2. Material and Methods**

### ***2.1. The study area and the transdisciplinary project context***

The Spreewald area is located approximately 100 km southeast of Berlin in the Federal State of Brandenburg in Germany (Fig. 1). It was awarded the status as Biosphere Reserve in 1990 just after the German unification. The Spreewald is characterised by an interplay of an extensive network of the river Spree, small and fragmented agricultural areas and (floodplain) forest. Extensive, small-scale farming in the area resulted, for example, in species-rich wet meadows. Due to their ecological significance, three habitat types are protected under the European Union's Habitat Directive in the Spreewald. Further, the Sorbs, a Slavic tribe, settled in and cultivated the Spreewald as early as the 6<sup>th</sup> century. Their language, customs and influence on

e.g. architecture are today considered cultural heritage. Thus, the Spreewald is known for both its biological diversity but also high cultural significance which forms the basis for the regional identity (Schäfer and König, 2018). Today, the Spreewald is particularly known for gherkins cultivated there, which received the status as protected geographical indication, but also horseradish. With over 800,000 visitors in 2019, tourism is a key sector in the regional economy.



**Fig. 1.** Map of the Spreewald Biosphere Reserve in eastern Germany showing the extensive river network of the Spree and the characteristic mix of the river with agricultural and forest areas. The photo shows a wet meadow and a hay stack, a symbol of traditional land management in the area. Data sources: supplementary material I

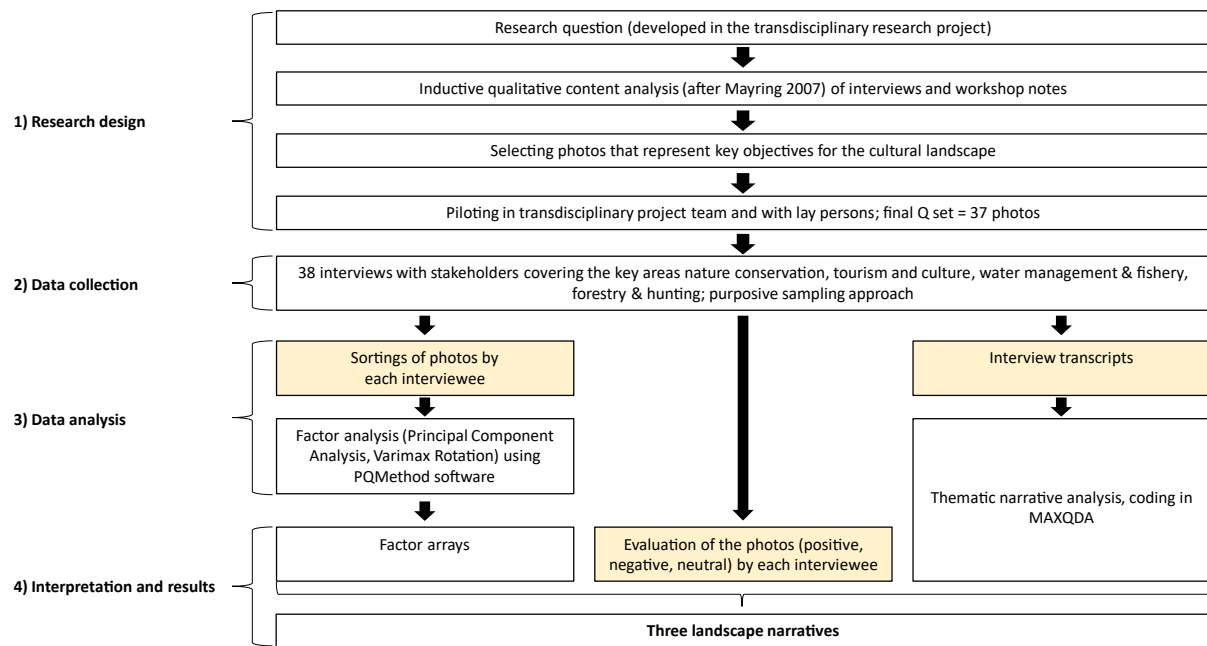
The research aim for this particular study came out of a transdisciplinary research project in the Spreewald BR (ginkoo). The ginkoo project focused on how management of innovation processes can be improved among coordinating actors to support sustainable land use (König et al., n.d.). The traditional, extensive management that created the cultural landscape is no longer economically viable which leads to land abandonment and subsequent natural reforestation and the loss of wetland biodiversity. Three innovative approaches were tested as part of ginkoo: a biodiversity offset instrument (land pools) (Busse et al., 2019), the thermal use of biomass from landscape maintenance, and financing landscape management directly through the touristic sector, e.g. via donations (König et al., n.d.).

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## ***2.2. Photo-based Q-methodology***

We used Q-methodology as a way to understand landscape narratives in a structured, holistic and qualitatively rich way (c.f. Watts and Stenner, 2012). In Q-methodology, a set of representative items are selected from a particular subject area or topic of interest and participants rank the items relative to each other, e.g. from what they most agree with to what they most disagree with, based on a sorting question (Brown, 1980; McKeown and Thomas, 2013; Watts and Stenner, 2012). All participants were asked to place the items in the same fixed symmetrical sorting layout, with a decreasing number of items permitted towards the two extremes of the layout, forcing participants to prioritise items. Through the activity of sorting, participants express their own (subjective) point of view relative to the focus topic (Brown, 1980). Following the sorting, an interview with each participant serves to understand the personal interpretation of the items and rationale for the sorting in more depth. Central to Q-methodology is its holistic nature (Watts and Stenner, 2012), whereby the entire sorting of items by each participant (Q-sort) is considered because all items are ranked relative to each other based on each participant's viewpoint. In the analysis stage, researchers search for patterns in the Q-sorts thus identifying prevalent social perspectives or discourses (Watts and Stenner, 2012).

We used a photo-based Q methodology according to the steps outlined in Fig. 2. Our focus was on identifying different landscape narratives and how different landscape elements, i.e. landscape materialities, are interpreted within those narratives. Photographs are useful in eliciting values, beliefs and attitudes towards a topic and engaging with different meanings (Prosser and Schwartz, 1998). We therefore decided to use photos as items as a way to elicit participants' subjective interpretations of the items, rather than the more common statement or text-based approaches. Photos have been used for example to understand perceptions of abandoned farmland in landscapes (Benjamin et al., 2007) and landscape aspirations among rural communities (Milcu et al., 2014). In our case, the photographs were used (1) as prompts to get participants to discuss different aspects of the landscape but also (2) as data in that they were numbered and the ranking of statements was the basis for our quantitative analysis (c.f. Bryman, 2016).



**Fig. 2.** Steps in the Q-method approach. The three types of data collected as part of the interviews are highlighted in yellow.

### 2.3. Interview process

To explore different conceptualisations of the Spreewald cultural landscape and related perceptions of threats and landscape values, we first sought to identify the ‘concourse of communication’, i.e. the range of perspectives on the topic (McKeown and Thomas, 2013). To select photo motifs, we focused on identifying different objectives regarding the development of the cultural landscape. We did an inductive qualitative content analysis (after Mayring, 2015) of 18 interviews with key informants that had been conducted at early stages of the project, minutes of three project workshops between 2016 and 2018, and two interviews with tourism organisations. Based on the identified objectives and intensive discussions among the co-authors, we made an initial selection of photos featuring motifs that represented the different objectives. To identify different viewpoints, we decided to include photos that we expected to provoke strong qualitative reactions among participants, e.g. a rape seed field. We also developed a framework for the items that covered the key topics and to ensure that it was balanced between different types of land use, ecosystems and cultural elements. We discussed and piloted the interviews with another member of the ginkoo team who had been part of the project from the beginning and two lay persons. We incorporated their feedback and the final Q-set consisted of 37 photos (supplementary material II).

To answer our research question, we selected participants that play a role in shaping and influencing landscape development and whose perspectives therefore matter for the topic (c.f. West et al., 2016). Landscape development of the Spreewald is influenced by a range of different formal institutions focusing on different areas including tourism, rural development and nature conservation (Gailing, 2012). We selected participants purposively based on an initial contact list developed in the ginkoo project team and expanded our list through a snowball sampling approach (c.f. Bryman, 2016). We included participants from the key areas

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agriculture, forestry and hunting, water management and fishery, nature conservation, tourism and culture and from different types of organisations (governmental, private, non-governmental organisations) (supplementary material III).

Before each interview started, participants were provided with a project summary outlining the study objectives. After an introduction to the research project and an explanation of the interview process, participants had the opportunity to ask questions and they subsequently signed a consent form agreeing to participate in the research and to be audio-recorded. All the interviews were conducted following the same interview guide (supplementary material IV). First, participants were asked to outline their role, responsibilities and the key objectives of their organisation regarding the Spreewald. Second, participants were given the photos in random order and asked to rank them on a grid representing a quasi-normal distribution based on the sorting question ‘What should the Spreewald cultural landscape look like?’ from most positive (+4) to most negative (-4). We did not use photo labels or explained the photos to participants because they ascribe meaning to the items (c.f. Watts and Stenner, 2012). We answered questions about the photos’ contents as briefly as possible. Third, depending on the participants’ preference, we interviewed them during or after the sorting of the photos to understand the meanings attributed to the photos and the overarching rationale behind the sorting (Watts and Stenner, 2012). Fourth, we asked participants to categorise photos into those they perceived to be positive, neutral and negative. At the end of the interviews, participants were asked to fill out a short questionnaire to obtain demographic information regarding age and gender.

In total, we conducted 38 interviews, which took place between February and March 2019 and each lasted approximately one hour. In one case, two employees from the same organisation decided to do an interview together. Over half of the participants were 55 years or older. Approximately a third of participants were associated with the areas of water management and fishery and agriculture and another third of participants were associated with multiple areas of expertise. All recorded interviews were subsequently transcribed verbatim. The transcripts and the respective Q-sorts were sent to the participants with the possibility to rephrase anything that participants felt might be misinterpreted by the researchers or to add explanations.

#### ***2.4. Narratives and data analysis***

We took a convergent mixed method approach to analyse the three types of data we had collected: 1) ranking of the photos in the grid that participants were presented with, 2) evaluation of the photos (negative, neutral, positive) and 3) transcripts of the interviews.

We first wrote memos for all the photos based on our recollection of the different meanings and interpretations of the items to understand which photos stood out and why, e.g. because of contrasting interpretations between participants. After familiarisation with the transcripts, we wrote brief case summaries for the interviews based on key terms such as wilderness or land management and summarised different understandings of cultural landscape. We analysed the Q-sorts statistically. Factor analysis is a method of data reduction helping to identify patterns in the data and thus latent or underlying variables (factors) (Watts and Stenner, 2012). We analysed the Q-sorts using the PQMethod software version 2.35 (Schmolck, 2014). Whilst each Q-sort reflects a unique perspective, factor analysis identifies groups of participants who share



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a perspective based on similar rankings of the photos (e.g. Brown, 1980). All eight factors in the unrotated factor matrix had an eigenvalue of  $> 1$ . Factors 4-8 all had only one or no significant factor loading in the unrotated factor matrix, which is one criteria for not considering them further (see Watts and Stenner, 2012). For the remaining three and two factor solutions, a principal component analysis and varimax rotation were applied to identify a ‘best’ or preferred solution (Brown, 1980). Simultaneously, we conducted a thematic narrative analysis which focuses on the content, i.e. what is said, and not e.g. to whom something is said (Riessman, 2008). Therefore, we coded text segments under themes relating to the broad categories of land use, threats and negative aspects, characteristics and general aspects using MAXQDA version 2020.4.1 in an inductive-deductive approach.

We compared the two and three factor solutions with the case summaries and preliminary coding of the data to understand how well the qualitative and quantitative analysis complemented each other. We decided on a three factor solution due to the subjective meaning of the extracted factors (c.f. Watts and Stenner, 2012). This ensured that each of the factors represented a distinct perspective. Our interpretation of the narratives was based on three elements: a model Q-sort for each narrative (so-called factor array), the assessment of the photos (supplementary material V) and the themes that were identified in the transcripts. To put the themes into context, the factor arrays helped us understand particularly salient photos in the narratives and the assessment helped us uncover areas of (dis-)agreement over the interpretation of the photos. This was supplemented by the case summaries which helped us to avoid dissecting the interviews based on the themes and remain focused on how the themes are embedded within and relate to the overall landscape interpretations. Based on the photo interpretations and meanings, themes and assessments of photos, we identified key landscape values for each landscape narrative. We understand values here broadly to refer to the importance or appreciation of the landscape thus including intrinsic, instrumental and relational values (Chan et al., 2016). This notion of values thus includes biophysical aspects (e.g. forest) but also place meanings (e.g. home) and landscape aesthetics (e.g. tidiness) (c.f. Raymond et al., 2016).

Preliminary findings were presented at a workshop in the study area in October 2019. Workshop participants were asked to provide feedback on the findings and align themselves with one of the three perspectives. Some of the people we interviewed also participated in this workshop. How they aligned themselves with the narratives, without any knowledge of which narratives their Q-sort was associated with, as well as their questions and feedback on the findings were vital for the further interpretation and distinction between the narratives.

### **3. Results**

We identified three landscape narratives which represent different perceptions of what the landscape is and what it should look like. The three narratives accounted for 61% of the variance and the Q-sorts of 26 people loaded significantly onto the narratives (Table 1).

**Table 1.** Correlations between the narratives. For more details see the factor matrix (supplementary material VI).

	<b>Nature narrative</b>	<b>People narrative</b>	<b>Land use narrative</b>
Nature narrative	1.00	0.46	0.08
People narrative		1.00	0.35
Land use narrative			1.00
<b>Number of defining Q sorts</b>	11	12	3
<b>% of explained variance</b>	29	25	7

In the following, the three narratives are presented by referring to the photo numbers, which are preceded by the # symbol. The names of the three narratives are based on expressions used by participants associated with the narratives.

### ***3.1. Nature narrative: Cultural landscape as landscape close to natural***

The *nature narrative* recognised that the cultural landscape was created and shaped by humans, and the landscape was conceptualised as the connection between the traditional use of the landscape and nature, understood by participants as areas and elements showing little or no human intervention. Despite human influence on the landscape, the protection of nature in terms of species and habitats was an important goal (Fig. 3).

*„It is certain that the cultural landscape was planted at some point but it also has a high degree of closeness to nature, this symbiosis between protection and utilization goals so to speak.“ (I26)*

The two photos showing birds (white stork, kingfisher) had the highest ranking and reflected this symbiosis (#7 & #30: +4) (Fig. 4). The kingfisher was seen as a symbol or “indicator” (I21) of a generally good ecological condition of the landscape and the white stork as a synanthropic bird reflected how humans and nature co-exist and are compatible through traditional land use.

*„[...] and the stork for me is also such a symbol of how nature and humans can be reconciled with each other [...]“ (I25)*

Traditional land use played a central role in this narrative and related to two key aspects: First, small scale agricultural production and extensive management were seen as reflecting a careful use of the land (#19 & #33: +3, #13 & #28: +2). Second, management also referred to forestry and hunting as a way to create “beautiful forests” (I19). However, participants associated with this narrative did acknowledge that small-scale, traditional agriculture is an ideal and that it is threatened because it is not economically viable. Related to the appreciation of traditional land management were elements that represent ways of traditional living in the landscape such as the haystack (#34: +3, #8: +1, #+6: 0). The marketing of regional products, including through organic farming labels (#36: +1, #22: 0), was considered an important economic aspect. Despite a preference for the production and sale of local products, two participants noted that the

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production of gherkins takes place outside the Biosphere Reserve, which explained the lower ranking of this motif (#4: -1).

Nature, in the sense of untouched areas, was considered to be important in and of itself, in addition to its value as a habitat. Participants considered natural and wilderness areas, i.e. motifs appearing less organised and displaying little or no human intervention, (including flora, fauna and wildlife) as essential parts of the landscape. This explains why photos displaying natural areas or dead wood were considered to be positive (#16: +2, #9 & #21: +1). For example, views towards the beaver were generally positive, and it was mostly viewed as belonging to the landscape (#12: 0). Sustaining biological diversity, referring primarily to species diversity, in the landscape is important, and this was mentioned in particular in relation to wet meadows which were seen as a key characteristic of the Biosphere Reserve (# 27: +2).

*“[...] the species-rich wet meadows are, so to speak, THE symbol of the Spreewald cultural landscape.” (I26)*

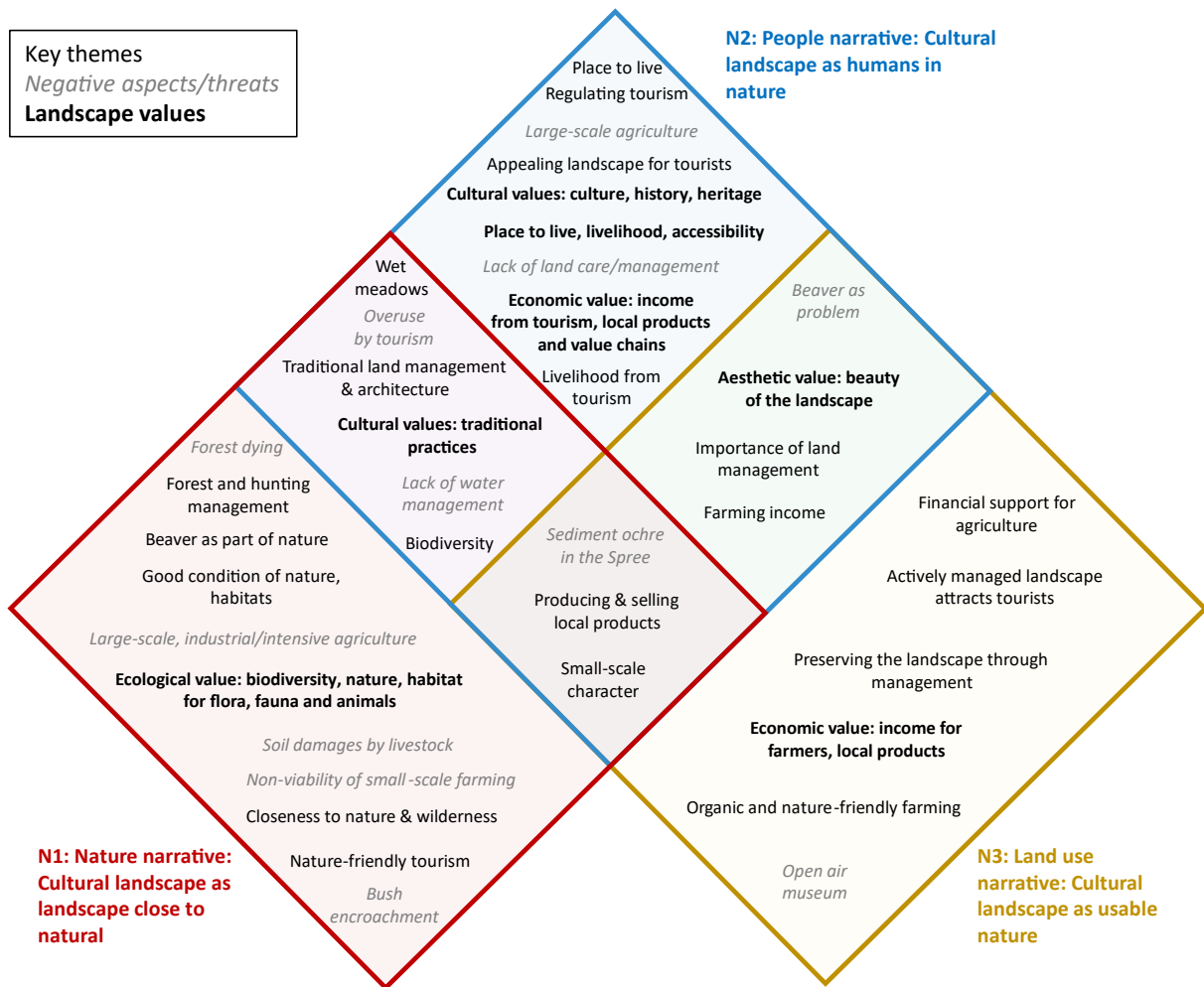
Some participants argued that it is because of nature that tourists come to the Spreewald. Notions of “nature-friendly tourism” (I25) or “nature-oriented tourism” (I27) highlighted that tourism needs to be compatible with the protection of areas with little or no human intervention. With regard to threats or negative aspects, this narrative reflected a strong apprehension towards large-scale, intensive agriculture which was perceived to be a threat to the typical landscape (#5: -4, #11 & #18: -3, #15 & #23: -2). The intensive use also related to intensive livestock management and the damage to the soil from large numbers of animals on wet meadows (#1: -1).

*“[...] that is really my image of the enemy as far as the Spreewald is concerned: heavy tractor, super heavy technology, with thick, big tires, making everything flat, huge areas if you see the straw rolls in the background, a disaster.” (I24)*

The lack of water management and maintenance of the streams was seen as something negative (#14: -2). However, participants agreed that not all streams need to be cleared of dead wood but they should be well-maintained. Whilst natural areas and areas of wilderness in the cultural landscape are important, no management at all was not considered to be positive which is why bush encroachment as a result of land abandonment was perceived to be a problem.

Forest dying was another theme that appeared prominently in this narrative. This related to flooding of areas during the summer months and infections of trees with *Phytophthora alni* pathogens. These two aspects are key issues for alder trees but also ash trees. A picture that appeared to be displaying signs of unhealthy trees was therefore assessed predominantly negative (#31: -1). Finally, participants considered sediment ocre in the Spree (#25: -4) and mass tourism (#3: -3) to be threats, particularly with regards to habitat protection.

*“[...] the invasion of bipeds in the Spreewald, or in such close to natural areas in the long run and in this mass will sooner or later bring it down.” (I23)*



**Fig. 3.** Venn diagram displaying the three narratives with related themes, negative aspects and landscape values. The phrases originate from the qualitative analysis.

### 3.2. People narrative: Cultural landscape as humans in nature

In the *people narrative*, humans and their use and interaction with nature created the cultural landscape which continues to be the basis for life and production. Nature was valued for the way people relate to their environment. The cultural landscape was viewed as a place to live and important for peoples' livelihood by making an income from agriculture but especially from tourism (Fig. 3).

*“Spreewald cultural landscape is a colourful bouquet of demands and the Spreewald cultural landscape, without humans, is not a cultural landscape.” (I05)*

Traditional management of the landscape is important in this narrative as it reflects the historical context in which the landscape was created. Therefore, the hay stack and gherkins stood out particularly due to their symbolic meanings (#4 & #33: +4) (Fig. 5). This reflected an appreciation of the hard work that humans put into creating and sustaining the cultural landscape (#28: +1).

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*“The hay stack is THE symbol of the Spreewald cultural landscape and served our previous generations to keep livestock in the Spreewald [...]” (I09)*

Land care and management of the landscape were perceived to be essential components to preserve the cultural landscape (#7: +3, #1: +2; #5, #13, #23 & #18: 0). The small-scale character of the landscape was appreciated but participants did acknowledge that traditional, small-scale agriculture is not economic under the current conditions.

*“A farmer who limits himself to transporting his hay and straw on barges cannot work in a way that earns him money.” (I13)*

This narrative reflected a strong appreciation for the cultural heritage of the landscape. This included the typical architectural style of the houses but also traditional handicraft techniques and lived culture by e.g. wearing traditional costumes (#34: +3, #8 & #6: +2).

*“But at the end of the day, I think it's important to focus on originality and to continue to live these traditions as they were created in the past.” (I01)*

Apart from these cultural elements, participants also appreciated biodiversity in the Spreewald, which in this narrative was mostly associated with the presence of different species and wet meadows (#27: +2, #30: +1).

Another key element in this narrative were humans and people still living in the landscape. This was tied to the role of infrastructure which allows inhabitants, tourists and land managers to access the fragmented landscape (#35: +1; #24: 0). Thus, language and local knowledge were intricately linked to landscape understandings.

*“[...] an old Spreewald saying is that the soul of the Spreewald lies at the bottom of the stream.” (I09)*

In this narrative, local products and local value chains were seen as an opportunity to create an income (#22: +1). This included organic farming as a means to produce products that can be sold at a higher price (#36: +3). Moreover, the economics of tourism in the landscape were considered to be important because tourism is a key source of income in the Spreewald (#37: 0, #3: -1). Additionally, tourists appreciate and experience the nice landscape.

*“Of course, there should also be romanticism in the Spreewald and it should also be developed for tourism, because the people there also need sources of income.” (I13)*

However, this narrative reflected an ambivalent relationship with tourism. On the one hand, it is an important economic factor but on the other hand, mass tourism or “Walt Disney (World)” (I05, I33) were believed to lead to conflict between tourism and conservation but also e.g. between canoers and boatmen. In particular, participants mentioned the increased volume of paddle boats. Therefore, participants were strongly in favour of regulating and channelling tourism.

*“but the canoes, the damage they cause at the riverbanks and so forth, that is a catastrophe. [...] There are days when you hardly see the water for the canoes.” (I02)*

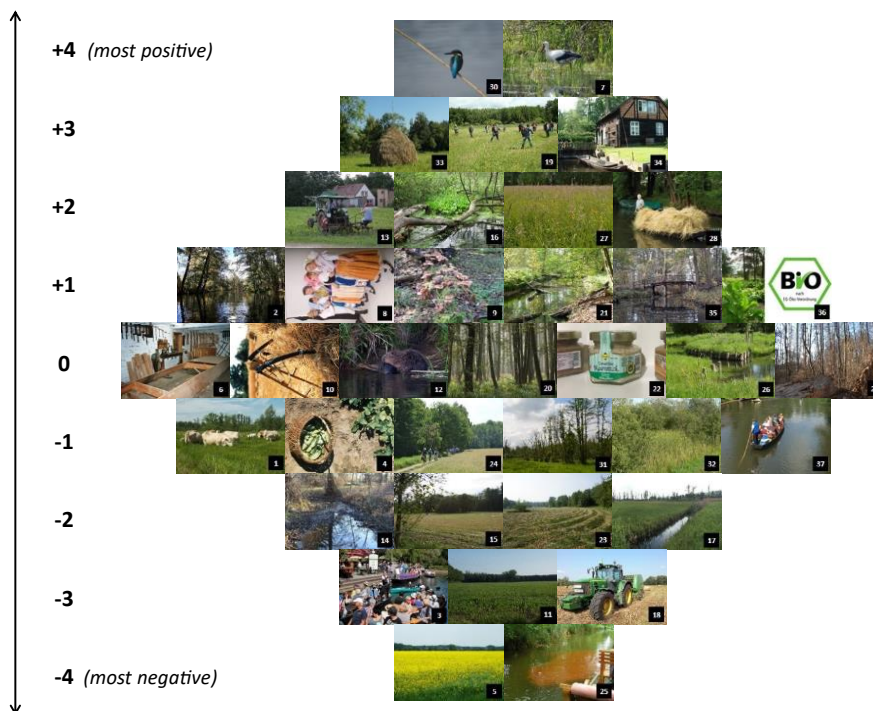
Threats to the cultural landscape related to iron ore in the Spree (#25: -4) and the beaver due to its damage to the landscape (#12: -2). Two other negative aspects related to land use and management: Large scale farming was considered negative and not a fit for the Spreewald. However, the loss of land care or agriculture was seen as a problem as it changes the appearance

and character of the Spreewald. Therefore, too much wilderness in the sense of unmanaged areas in the landscape was seen as something negative (#9 & #29: -2, #16 & #32: -3).

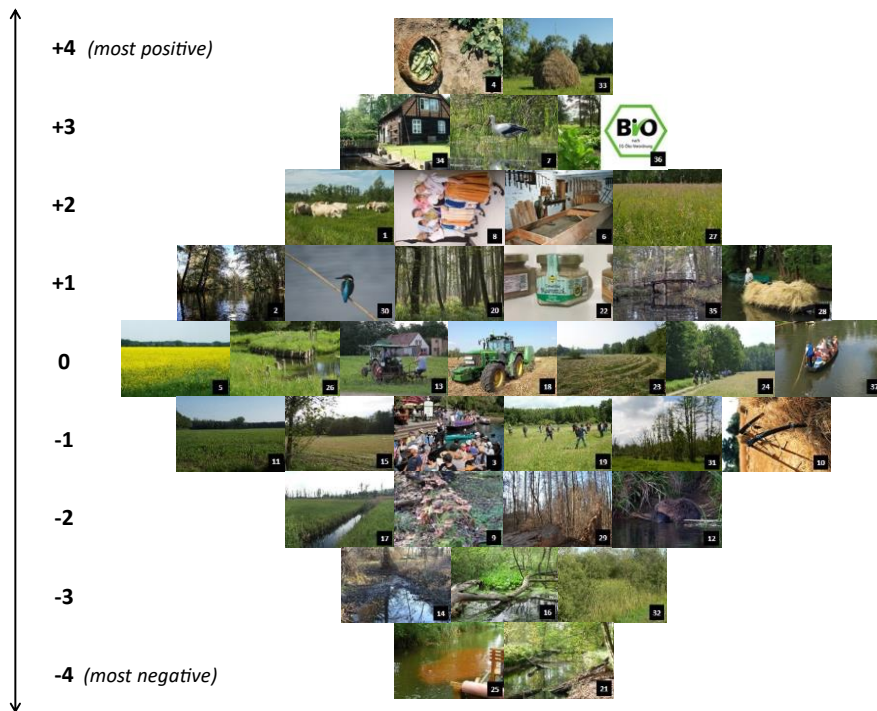
*“What I consider to be negative is the shrubbery and bush encroachment in the Spreewald. We have the typical bay willows which are growing bigger and bigger and we lose agricultural areas.” (I33)*

Connected to that, the lack of water management was considered a key issue (#14: -3, #21: -4) due to the reduction in the use of streams by humans but also negative impacts from muddy streams on wildlife and trees dying from too much water.

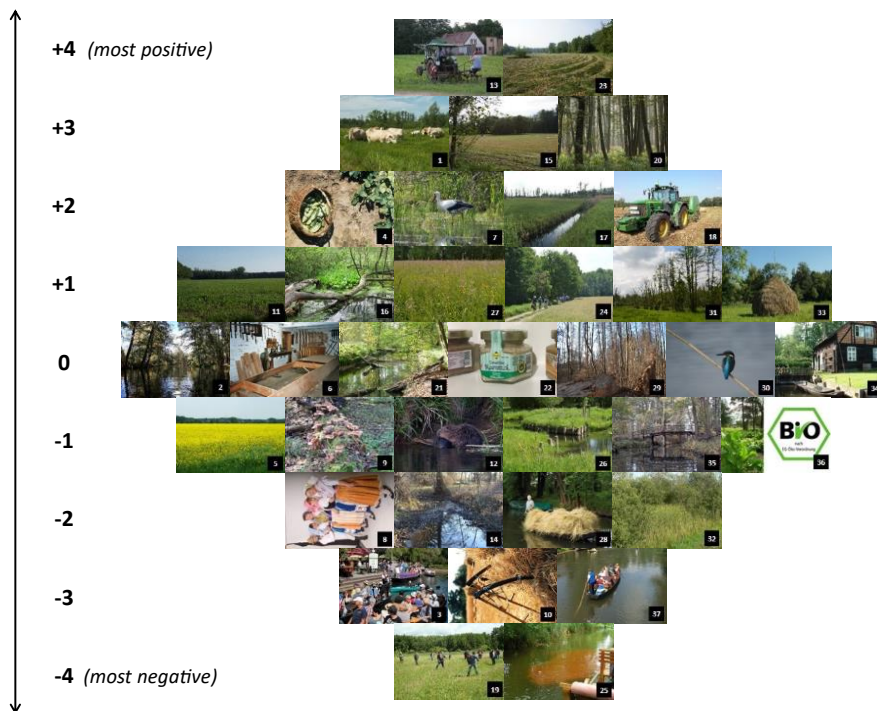
## Nature narrative



## People narrative



## Land use narrative



**Fig. 4-6.** Model Q sorts for the three narratives. The ranking of the photos is based on the weighted averages of the Q sorts associated with the narratives. Photo credit: supplementary material VII

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### 3.3. Land use narrative: Cultural landscape as usable nature

In the land use narrative, the cultural landscape was created through human use of the landscape and management continues to sustain the Spreewald. The use of the land in a nature-friendly way was central to this narrative (Fig. 3).

*“This is a cultural landscape, it is used in the front [of the photo]. This is the harmony with nature” (I14)*

The importance of land use was reflected by the prioritization of photos that show motifs relating to agriculture and land use (#13 & #23: +4, #1 & #15: +3; #18: +2; #11 & #17: +1) (Fig. 6). In this context, participants mentioned small-scale farming as characteristic of the landscape. There were two main arguments why land use is important. First, agricultural land use was considered to be pivotal to sustain the cultural landscape. If agricultural management stopped, the cultural landscape would change and lose its characteristics. For example, participants whose Q-sorts significantly loaded onto this narrative explained that the period after the designation as Biosphere Reserve highlighted that land use instead of a protectionist approach is needed to sustain the cultural landscape.

*“[...] without (land) management it won't work [...] And management, I see that actually embedded in this whole concept.” (I32)*

Second, people actively managing the landscape and therefore the appealing or “tidy landscape” (I14) attract tourists to come visit the area.

*“[...] tourists don't want to see a meadow that hasn't been mowed for five years when they pass by on the barge but they want to see a person who lives in the Spreewald and farms there.” (I30)*

This narrative was about achieving a harmony or reconciliation of agriculture and nature. Nature here referred to the presence of non-agricultural areas have their place in the cultural landscape (#7: +2). This explains why photos showing motifs with no human presence or intervention in the landscape were assessed positively (#20: +3, #16: +1; #21: 0). Organic farming was considered to be the status quo in the Spreewald. One participant argued that European Union organic farming regulations were not strict enough (#36: -1) compared to the much stricter organic farming practices in the Spreewald area.

*“We have hardly any farmer in the Spreewald who practices conventional agriculture, in fact no one at all. We all farm ecologically, extensive, we abstain from fertilizer as far as possible, without pesticides in the Spreewald and it works.” (I30)*

Economic aspects related to land use were prominent themes in this narrative. It was considered vital that those who manage the landscape, in particular forestry and agriculture, can make an income from their activities (Fig. 3). Two approaches were mentioned in that regard. First, subsidising or financing farmers who have to manage land under difficult circumstances in the Spreewald. Second, branding, marketing and selling of products coming from the area present an opportunity to make an income (#4: +2, #22: 0).

*“[...] on the one hand everything that has to do with nature, which I consider to be very positive, and everything that I associate with sustainable management [...] if I want to preserve nature, I need revenues and I can only get that from the economy.” (I32)*



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Photos representing traditional land management practices were mainly described as “show” (I14), not reflecting current land management and thus generally ranked low (#19: -4, #10: -3, #28: -2). The sentiment that the landscape should be actively managed was expressed most strongly by one participant’s opposition to an “open air museum” (I14). Whilst participants were not against preserving cultural traditions, those did not occupy a very prominent role in this narrative (#33: +1, #6 & #34: 0, #8: -2).

Perceived threats in this narrative were iron ochre in the Spree (#25: -4) and damages as a result of beaver activities, e.g. flooding due to water blockages, (#12: -1). Whilst the beaver was not seen as negative per se, some people had negative attitudes towards how the beaver is treated.

“[...] I am not against the beaver but I am against how it is spoilt.” (I30)

### **3.4. Consensus photos**

Five of the photos were consensus items, i.e. which had similar rankings across all narratives (c.f. Watts and Stenner, 2012; see also supplementary material VIII). Sediment ocre in the river Spree (#25) was considered to be negative across all three narratives. The photo displaying a river (#2) is general in nature and did not evoke any particularly strong positive or negative associations. The horseradish jar (#22) was mostly interpreted as representing local products and value chains which was something that was important in all narratives. The white stork (#7) as a synanthropic bird was interpreted as representing the management of the land by humans, and at the same time it was perceived to represent the presence of nature, explaining its overall positive ranking. The flowering meadows (#27) were mostly interpreted to represent biodiversity and were also appreciated due to their aesthetic value. Finally, cyclists in the landscape (#24) were not perceived to cause any particular damage to the landscape such as canoers and were therefore considered mostly favourably.

## **4. Discussion**

Our findings highlight how the cultural landscape of Spreewald BR is interpreted differently in the three narratives regarding what it means, what characterizes it, how it is threatened but also appreciated. This reflects different underlying understandings of human-nature relationships. The *nature narrative* can be understood as a more ecocentric viewpoint where nature is valued for its own sake independent of human use (intrinsic value). Both the *people* and *land use narratives* represent more anthropocentric viewpoints where humans and how they interact with the landscape are the focus of attention (instrumental and relational values). The beaver provides a good example for this difference because it was described as an “amazing builder” (I23) in the *nature narrative* and a “problem animal” (I32) in the *land use narrative*. Despite the context-specific nature of our narratives, there are some similarities with other landscape narratives in the literature. The *nature narrative* is comparable to other pro-nature narratives that value biodiversity, wildlife and vegetation (e.g. Frei et al., 2020, Plieninger et al., 2018, Barnaud and Couix, 2020). For example, Köpsel et al. (2017) identified a ‘natural landscape’ narrative that constructs the landscape in relation to elements of nature. This is similar in concept to closeness to nature in the *nature narrative*. Analogous to the *people* and *land use narratives*, other narratives conceptualise the landscape primarily as a place where people live (e.g. Köpsel et al., 2017), where human intervention through sustainable use or management is

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vital (e.g. Plieninger et al., 2018) or where management needs to be sustained (Frei et al., 2020). Apart from highlighting different human-nature relationships, the narratives also construct the landscape around different core values (Fig. 3). Existing classifications of landscape values in the literature highlight the myriad of ways in which landscapes are appreciated by people (e.g. Raymond et al., 2016, Garcia-Martin et al., 2017, Plieninger et al., 2018). Our findings highlight three archetypal ways of viewing and relating to the cultural landscape based on different landscape meanings and values.

The narratives we identified highlight differing landscape conceptualisations and problem framings that need to be addressed in governance approaches to the area. Other examples from the literature show how the process of land abandonment is interpreted differently depending on the viewpoint and interests. For example, it might be perceived negatively by farmers (Benjamin et al., 2007) but more positively from a conservationist's perspective (Frei et al., 2020). In the *nature narrative*, bush encroachment as a result of land abandonment was perceived as a threat because it changes the ecosystems and threatens the diversity of species. In the *people narrative*, however, the lack of land management or use was perceived negatively based mostly on the aesthetic value of the landscape. Thus, our findings explain why land abandonment in our case study is not considered an issue by everyone (c.f. Schäfer and König, 2018) which results in challenges for collaboration to tackle this 'issue'.

Understanding how place meanings vary among narratives can help elucidate commonalities but also conflicts (Masterson et al., 2019). Such 'narrative tensions' (c.f. Veland et al., 2018) became visible through our narrative approach and point to challenges for effective management. For example, wet meadows were highlighted in the *nature narrative* due to their meaning as places with high biological diversity and thus natural value. In the *people narrative*, the haystack was interpreted as a symbol for the historical links between people and nature and thus the value of traditional practices. In contrast, the *land use narrative* focused on utilisation of the landscape and opposed the preservation of the landscape in the form of a museum for consumption by tourists (c.f. Sandell, 2016). Whilst the innovation approaches to protect wet meadows developed in our transdisciplinary project resonate with some of the narratives, e.g. land pools with the *land use narrative*, they do not resolve or explicitly address any of the underlying narrative tensions. A next step could thus be to relate narratives and physical landscape elements with the innovative approaches as a means to handle 'narrative tensions'. Increased participation in innovation approaches might provide an opportunity to incorporate different priorities and viewpoints, e.g. how and where to target income from tourism for managing wet meadows.

Our findings also highlight that there are different underlying normative assumptions about how the cultural landscape should develop. Bieling et al. (2020) highlighted how ethical arguments based on different values can result in competing framings of landscape stewardship. They argue that the diversity of values which leads to different objectives and future pathways needs to be made visible and communicated. This suggests that there is a need to bring the different narratives in conversation especially around the key questions of how the landscape is currently valued and how the cultural landscape of the future is envisioned. Developing a joint vision can help provide direction for decision-making, actions and behaviours (Wiek and Iwaniec, 2014). For example, scenarios in landscape planning help diverse stakeholders to explore plausible

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changes and agree on common objectives (Albert et al., 2019). They can be helpful to develop a shared vision for the future and to explore opportunities and barriers for collective action towards that vision (Nieto-Romero et al., 2016). Moreover, exploring future visions and pathways towards them in a participatory manner can help empower rural communities to take action (Schaal et al., 2023). Developing a joint vision for the cultural landscape and exploring opportunities for change could thus help with collective sensemaking about the issue of land abandonment and resulting loss of biodiversity-rich wet meadows and provide direction for change. This could help local communities identify levers for change, including for the governance and management of the cultural landscape.

The different perceptions of landscape reflected through the narratives also point to a disconnect between physical and socio-cultural aspects of landscape. For example, a landscape that shows low-impact or no human influence was valued in the *nature narrative*. The *land use narrative* reflected an economic point of view and appreciated visible human influence on the landscape. In contrast, landscape was perceived as place to live and valued for its cultural traditions and history in the *people narrative*. Cultural elements referring to Sorbic minority language and traditions played a dominant role only in the *people narrative*. The BR Spreewald is an example of integrated landscape management, promoting multifunctional land use and selling regional products under the common label ‘Spreewald’ (Mann and Plieninger, 2017). However, our findings point to the lack of integration of cultural heritage. Both natural and cultural diversity were adopted as goals of UNESCO Biosphere Reserves in the 1990s (UNESCO, 1996). However, we found that whilst notions of both linguistic and cultural on the one hand and biological diversity on the other hand emerged during the interviews, they remain somewhat fragmented among the narratives and are not conceptualised as co-evolving. Based on synthesized insights from Biosphere Reserves across the globe, Reed and Price (2020) recently argued that increased emphasis on the concept of biocultural diversity could help shift perceptions away from seeing biosphere reserves as protected areas, an association often evoked by the term ‘reserve’. Biosphere reserves are model regions for sustainable development (e.g. Reed and Price, 2020) and practitioners interpret the concept of biosphere reserve differently, connected to the institutional context and activities in the respective biosphere reserves (Schultz et al., 2018). This highlights the opportunity for broadening the term diversity as part of the Biosphere Reserve to include both biological diversity and cultural heritage. However, whilst for example the importance of plural values of biodiversity is increasingly recognized in biodiversity research (Pascual et al., 2021), such value plurality is limited by current policy frameworks. In particular, in the current governance system sectoral policies prevail and environmental policy tends to conceptualise nature and humans as two separate entities (Biermann, 2021). Based on findings from this research, we argue that better integration of socio-cultural aspects into existing landscape management initiatives would be important in the governance of cultural landscapes.

## 5. Conclusions

Cultural landscapes are changing due to a range of different, interacting drivers (e.g. Bürgi et al., 2017a), making their management and the preservation of their biological and cultural values urgent priorities. Our study highlighted substantial differences in how a cultural

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landscape is perceived and valued by different stakeholders. The three identified narratives represent archetypal ways of viewing and relating to the cultural landscape. The *nature, people* and *land use narratives* reflect different meanings of the cultural landscape, landscape values and perceived threats. This leads to different land use and development priorities, differing problem perceptions and imaginations about the cultural landscape of the future. We show how this creates challenges for collaborative management and for developing innovative approaches to address the impacts of farmland abandonment. Our findings point to the need to develop differentiated visions of future development in a participatory approach as a way to bring different landscape narratives in conversation and to provide direction for future planning and management. In a future step, the narratives and physical landscape elements could be related to innovation approaches that were developed as part of the research project to allow for better engagement with tensions between the narratives. Our study also reveals a fragmentation of biological and sociocultural aspects among the narratives and we suggest better integration among these notions of diversity which can be informed and supported by realist contributions on spatial distribution of bio-physical characteristics of cultural landscapes. Insights from this case study are particularly relevant for researchers and policy makers involved in cultural landscape development and protected areas, especially Biosphere Reserves.

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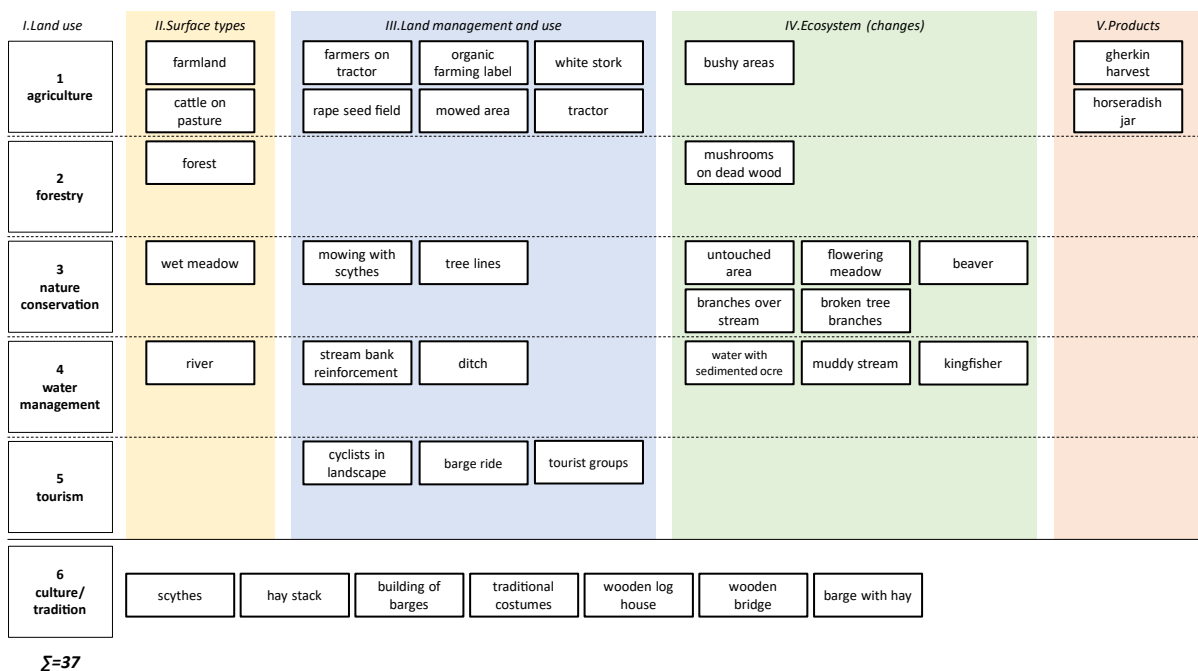
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## SUPPLEMENTARY MATERIAL

### I) Data sources of the map created with ArcGIS version 10.6.1

Description	Source
Districts boundaries	GeoBasis-DE/LGB, 2019
Biosphere reserve boundaries	Landesamt für Umwelt Brandenburg
Land cover data	GeoBasis-DE / BKG (2020)
Watercourses	WasserBLIcK/BfG und Zuständige Behörden der Länder, 22.10.2021
German federal state boundaries	GeoBasis-DE / BKG 2018

### II) Q-items framework



### III) Participants' organisational affiliation (own translation)

*Please note: There are fewer organisations listed than there were participants because in some cases two employees of the same organization were interviewed due to their different areas of expertise.*

Gov=governmental organization; NonGov=non-governmental organization; Priv=private sector

forestry and hunting		
Oberförsterei Lieberose	forest district office Lieberose	Gov
Landeswaldoberförsterei Lübben	State Company for Forestry Brandenburg	Gov
Jagdverband Lübben e.V.	hunting association Lübben	NonGov



<b>tourism and culture</b>		
Amt Burg, Sachgebiet Tourismus	Amt Burg, area of tourism	Gov
Spreewald-Natur-Camping "Am Schlosspark"	-	Priv
Spreewald Touristinformation Lübbenau e.V.	Lübbenau tourism agency	NonGov
Spreewälder Kulturstiftung e.V.	Spreewald culture foundation	NonGov
Selbstständige_r Touristiker_in	self-employed tourism specialist	Priv
<b>agriculture</b>		
Agrargenossenschaft "Spreetal" eG	agricultural cooperative "Spreetal"	Priv
Kreisbauernverband des Spree-Neiße Kreises e.V.	local farmers' association of the Spree-Neiße district	NonGov
Bauernverband Südbrandenburg e.V.	farmers' association of South Brandenburg	NonGov
Fachbereich Landwirtschaft, Veterinär- u. Lebensmittelüberwachung, Landkreis Spree-Neiße	area of agriculture, veterinary and food supervision, Spree-Neiße district	Gov
Amt für Veterinärwesen, Lebensmittelüberwachung und Landwirtschaft, Landkreis Oberspreewald-Lausitz	state office for veterinary services, food control and agriculture, district of Oberspreewald-Lausitz	Gov
Amt für Veterinärwesen, Verbraucherschutz und Landwirtschaft, Landkreis Dahme-Spreewald	state office for veterinary services, consumer protection and agriculture, Dahme-Spreewald district	Gov
Lokaler agrartouristischer Landwirtschaftsbetrieb	local agrotourism farm	Priv
<b>nature conservation</b>		
NABU Kreisverband Spreewald e.V.	Nature and Biodiversity Conservation Union, Spreewald area	NonGov
Untere Naturschutzbehörde, Landkreis Dahme-Spreewald	lower nature conservation authority, Dahme-Spreewald district	Gov
Aktionsbündis Klare Spree e.V.	action group clear Spree	NonGov
<b>water management and fishery</b>		
Gemeinschaft wendisch / sorbischer Spreewaldfischer Burg und Umgebung e.V.	association of wendish and sorbish Spreewald fishermen in Burg and surroundings	NonGov
Wasser- und Bodenverband "Oberland Calau"	water and soil association "Oberland Calau"	Gov
Wasser- und Bodenverband "Nördlicher Spreewald"	water and soil association "Northern Spreewald"	Gov
Landesamt für Umwelt, Abteilung Wasserwirtschaft	state office for the environment, area of water management	Gov
Untere Wasserbehörde, Landkreis Dahme-Spreewald	lower water authority, Dahme-Spreewald district	Gov
<b>multiple/overarching</b>		
Landesamt für Ländliche Entwicklung, Landwirtschaft und Flurneuordnung	state office for rural development, agriculture and reorganisation of land	Gov
Bürgerstiftung Kulturlandschaft Spreewald	citizen foundation Spreewald cultural landscape	NonGov

Stadt Lübbenau	City of Lübbenau	Gov
Verwaltung Biosphärenreservat Spreewald	administration of the Spreewald biosphere reserve	Gov
Landschaftspflegeverband Spree-Neiße e.V.	Spree-Neiße land care association	NonGov
Untere Naturschutz-, Jagd- und Fischereibehörde, Landkreis Spree-Neiße	lower nature conservation, hunting and fishery authority, Spree-Neiße district	Gov
Untere Jagd- und Fischereibehörde, Landkreis Dahme-Spreewald	lower hunting and fishing authority, Dahme-Spreewald district	Gov
Spreewaldverein e.V.	Spreewald association	NonGov
Fischereigenossenschaft Lübben	fisheries cooperative Lübben	Priv
Tourismusverein Lübben und Umgebung e.V.	tourist association Lübben and surroundings	NonGov
Verein zur Erhaltung und Förderung des Spreewalddorfes Lehde e.V.	association for preserving and supporting the Spreewald village of Lehde	NonGov

#### IV) Interview guide (translated from German)

##### A) PRE-SORTING INTERVIEW

I) Introduction to the project, research and informed consent

II) General

1. Please briefly explain your role and the tasks of your organisation regarding the Spreewald.
2. What are the main objectives that your organisation has regarding Spreewald?

##### B) Q-SORTING PROCESS

Spreading the grid, the photos and 'condition of instruction'. Point out that participants should rank the photos based on the perspective of their organization. Explaining the process:

*The participant puts the photos in the grid according to the instructions. The interviewer provides assistance or further explanations if needed.*

After all the photos were put in the grid, the photo numbers were written down in a small copy of the grid, and the interviewer highlights which of the Q-items were actually considered to be negative or positive.

##### C) POST-SORTING INTERVIEW

III) Q-Sort explanations

1. Do you feel that the grid reflects your perspective on what the Spreewald cultural landscape should look?
2. Was there anything that you did not understand?
3. Could you please provide an explanation about the photos placed at the extreme ends of the grid?
4. Were there any photos that were particularly important, critical or outstanding?
5. Was anything missing, and if so, where would you have placed it?
6. What if the two photos placed under 'most positive' were the only ones?
7. What if the two photos placed under 'most negative' were the only ones?

IV) Optional:

1. In how far could the before-mentioned objectives be (partially) reached?

2. Are there any incompatibilities/conflicts between your objectives? Are there any incompatibilities between your objectives and those of other actors?
3. What do you consider to be the biggest barriers to reaching your objectives?
4. What do you consider to be enablers for reaching your objectives?

V) Demographic questions about gender and age group

VI) Final questions

1. Is there anything else about the topic of the interview that you would like to tell me?
2. Are there any other interview partners who have a substantial influence on the development of the Spreewald cultural landscape whom you could recommend for an interview?

VII) Closing

V) Q-item assessment

Q-items	nature narrative			people narrative			land use narrative			
	neg	neu	pos	neg	neu	pos	neg	neu	pos	no ass.
1 cattle on pasture	27%	27%	45%	8%	8%	83%	0%	0%	100%	
2 river	9%	18%	73%	17%	8%	75%	0%	0%	100%	
3 tourist groups	91%	9%	0%	50%	8%	42%	0%	0%	100%	
4 gherkin harvest	18%	18%	64%	0%	0%	100%	0%	0%	100%	
5 rape seed field	100%	0%	0%	17%	25%	58%	33%	0%	67%	
6 building of barges	0%	27%	73%	0%	17%	83%	0%	0%	100%	
7 white stork	0%	9%	91%	0%	0%	100%	0%	0%	100%	
8 traditional costumes	0%	9%	91%	0%	8%	92%	0%	0%	100%	
9 mushrooms on dead wood	0%	27%	73%	42%	33%	25%	0%	0%	100%	
10 scythes	0%	27%	73%	0%	25%	75%	0%	0%	67%	33%
11 farm land	100%	0%	0%	33%	25%	42%	0%	0%	100%	
12 beaver	9%	18%	73%	67%	17%	17%	33%	0%	67%	
13 farmers on tractor	18%	9%	73%	8%	17%	75%	0%	0%	100%	
14 muddy stream	36%	27%	36%	92%	8%	0%	33%	0%	67%	
15 wet meadow	55%	18%	27%	25%	42%	33%	0%	0%	100%	
16 branches over stream	0%	9%	91%	67%	25%	8%	0%	0%	100%	
17 ditch	64%	18%	18%	50%	17%	33%	0%	0%	100%	
18 tractor	64%	18%	18%	17%	25%	58%	0%	0%	100%	
19 mowing with scythes	0%	9%	91%	25%	17%	58%	0%	0%	67%	33%
20 forest	9%	9%	82%	0%	8%	92%	0%	0%	100%	
21 untouched area	0%	9%	91%	75%	25%	0%	0%	0%	100%	
22 horseradish jar	0%	18%	82%	0%	8%	92%	0%	0%	100%	
23 mowed area	55%	18%	27%	17%	25%	58%	0%	0%	100%	
24 cyclists in landscape	18%	9%	73%	0%	25%	75%	0%	0%	100%	
25 water with sedimented ocre	91%	0%	9%	92%	8%	0%	67%	0%	33%	
26 stream bank reinforcement	9%	36%	55%	17%	0%	83%	0%	0%	100%	
27 flowering meadow	0%	18%	82%	0%	0%	100%	0%	0%	100%	
28 barge with hay	0%	9%	91%	0%	17%	83%	0%	0%	67%	33%
29 broken tree branches	9%	18%	73%	50%	33%	17%	0%	0%	100%	
30 kingfisher	0%	9%	91%	0%	8%	92%	0%	0%	100%	
31 tree lines	55%	9%	36%	33%	8%	58%	0%	0%	100%	
32 bushy areas	27%	27%	45%	75%	17%	8%	0%	0%	67%	33%
33 hay stack	0%	9%	91%	0%	0%	100%	0%	0%	100%	
34 wooden log house	0%	18%	82%	0%	8%	92%	0%	0%	100%	
35 wooden bridge	0%	36%	64%	0%	17%	83%	0%	0%	100%	
36 organic farming label	9%	9%	82%	0%	8%	92%	33%	0%	67%	
37 barge ride	0%	36%	64%	8%	25%	67%	0%	0%	100%	

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## VI) Factor matrix

Following Watts and Stenner (2012), we flagged all factors that had a significant loading on one factor, i.e.  $\pm 0.42$  or above. Q sorts were considered statistically significant at the 0.01 level if the factor loading was at or above  $\pm 0.42$  [standard error  $(1/\sqrt{37}) \times 2.58$ ].

X indicating a factor defining sort. \* indicating a confounded sort

I01	0.25	0.50X	0.33
I02	-0.02	0.72X	0.19
I03	0.17	0.66X	0.13
I04*	0.55	0.58	0.09
I05	0.40	0.47X	-0.14
I06	0.19	0.80X	0.08
I07	0.75X	0.32	0.07
I08*	0.63	0.42	0.23
I09	0.41	0.71X	0.04
I11*	0.44	0.52	0.11
I12	0.69X	0.04	0.13
I13	-0.09	0.74X	0.22
I14	-0.07	0.17	0.74X
I15*	-0.25	0.62	-0.44
I16	0.78X	0.13	-0.02
I17*	0.54	0.35	0.44
I18	0.41	0.72X	0.03
I19	0.80X	0.27	0.00
I20	0.66X	0.39	-0.10
I21	0.77X	0.06	0.18
I22*	0.61	0.52	-0.08
I23	0.57X	-0.39	0.41
I24	0.85X	0.07	-0.03
I25	0.76X	0.19	0.08
I26	0.77X	0.20	0.28
I27	0.76X	0.13	-0.14
I28	0.26	0.57X	0.25
I29*	0.68	0.54	0.15
I30	-0.35	0.33	0.55X
I31*	0.71	0.50	0.02
I32	0.28	0.16	0.59X
I33	0.29	0.69X	0.24
I34*	0.55	0.43	0.35
I35*	0.68	0.47	0.11
I36*	0.42	0.52	0.12
I37	0.22	0.82X	-0.01
I38	0.35	0.73X	0.14

## VII) Photo credit

Photo number(s)	Source
#11, #14, #17, #27, #22 (photo was cropped), #24, #29, #31,	Nico Heitepriem
#1, #4, #15, #20, #23, #26, #28, #33	Michael Petschick
#6, #9, #13 (licence plate number has been edited out), #19, #21, #25, #32, #34, #36, #16	Biosphere Reserve Spreewald
#2, #35, #37	Tamara Schaal
#7, #30	Frank Kuba
#3, #12	Tom Noah
#18 (licence plate number has been edited out)	Andreas Göbel
#8	Spreewald-Touristinformation Lübbenau e.V.
#10	Andreas Traube
#5	Stefan Fussan, Licence CC BY-SA 3.0 <a href="https://creativecommons.org/licenses/by-sa/3.0/">https://creativecommons.org/licenses/by-sa/3.0/</a> ; no alterations made; <a href="https://de.wikivoyage.org/wiki/Peitzer_Land#/media/File:Rapsfelder_bei_Drehnow_0030.jpg">https://de.wikivoyage.org/wiki/ Peitzer_Land#/media/File:Rapsfelder_bei_Drehnow_0030.jpg</a>

## VIII) Consensus statements

To make the item rankings more easily comparable across the factors, during factor analysis the total weighted scores for the items are converted into a normalized factor score (Z-score) (Watts and Stenner, 2012). Consensus statements are items whose Z-scores show no significant difference between any two factors when tested at the 0.01 level (Brown 1980).

Items 2, 7, 22, 24, 25 and 27 were non-significant at  $p > 0.01$  and the items with an \* are non-significant at  $p > 0.05$ .

Consensus statements are highlighted in yellow.

Statement	Factor 1		Factor 2		Factor 3	
	Z-score	Factor array	Z-score	Factor array	Z-score	Factor array
#1	-0.476	-1	0.989	2	1.524	3
#2	0.597	1	0.527	1	-0.131	0
#3	-1.856	-3	-0.755	-1	-1.114	-3
#4	-0.118	-1	1.417	4	1.085	2
#5	-1.927	-4	-0.036	0	-0.548	-1
#6	0.211	0	0.920	2	-0.343	0
#7*	1.455	4	1.333	3	1.113	2
#8	0.632	1	0.922	2	-0.796	-2
#9	0.485	1	-0.981	-2	-0.633	-1
#10	0.179	0	-0.153	-1	-1.716	-3
#11	-1.699	-3	-0.437	-1	0.625	1

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#12	0.224	0	-1.315	-2	-0.477	-1
#13	0.937	2	0.384	0	1.573	4
#14	-0.852	-2	-1.782	-3	-0.958	-2
#15	-1.015	-2	-0.569	-1	1.261	3
#16	0.876	2	-1.486	-3	0.484	1
#17	-1.219	-2	-0.817	-2	1.030	2
#18	-1.402	-3	0.000	0	0.971	2
#19	0.954	3	-0.347	-1	-1.737	-4
#20	0.390	0	0.509	1	1.269	3
#21	0.548	1	-1.842	-4	0.010	0
#22*	0.243	0	0.570	1	-0.025	0
#23	-0.953	-2	0.047	0	1.552	4
#24*	-0.002	-1	0.391	0	0.286	1
#25*	-2.119	-4	-1.884	-4	-2.210	-4
#26	0.030	0	0.472	0	-0.457	-1
#27*	0.850	2	0.904	2	0.944	1
#28	0.822	2	0.625	1	-0.790	-2
#29	0.335	0	-1.203	-2	-0.125	0
#30	1.721	4	0.878	1	0.214	0
#31	-0.779	-1	-0.437	-1	0.788	1
#32	-0.478	-1	-1.323	-3	-0.938	-2
#33	1.378	3	1.637	4	0.803	1
#34	1.011	3	1.242	3	-0.315	0
#35	0.527	1	0.566	1	-0.633	-1
#36	0.544	1	1.149	3	-0.598	-1
#37	-0.053	-1	-0.111	0	-0.987	-3

Brown, S.R., 1980. Political subjectivity: Applications of Q methodology in political science. Yale University Press, New Haven, 355 pp.

Watts, S., Stenner, P., 2012. Doing Q methodological research: Theory, method and interpretation. SAGE, London, 238 pp.

# Appendices

## Appendix 1: List of interviews

*Please note: Alle interviews were assigned a random number before analysis, which was used for the interview acronyms.*

### a) Muttama Creek Catchment case study

Interview acronym	Interview mode	Date of the interview	Data obtained & duration of recording where applicable	Interviewer
P01	online / via phone	30.03.2020	Audiorecording, 00:55:42	Tamara Schaal
P02	face-to-face	08.03.2020	Audiorecording, 00:42:14	Tamara Schaal
P03	online / via phone	29.04.2020	Audiorecording, 01:06:11	Annie Jacobs
P04	online / via phone	28.05.2020	Audiorecording, 00:59:31	Annie Jacobs
P05	face-to-face	17.03.2020	Audiorecording, 01:02:09	Annie Jacobs
P06	face-to-face	13.03.2020	Audiorecording, 00:52:02	Tamara Schaal
P07	face-to-face	10.03.2020	Audiorecording, 01:07:15	Annie Jacobs
P08	face-to-face	19.03.2020	Audiorecording, 00:23:27	Tamara Schaal
P09	online / via phone	27.03.2020	Audiorecording, 00:49:21	Tamara Schaal
P10	online / via phone	07.05.2020	Audiorecording, 00:55:59	Tamara Schaal
P11	online / via phone	26.03.2020	Audiorecording, 00:52:33	Annie Jacobs
P12	online / via phone	20.04.2020	Audiorecording, 00:58:15	Annie Jacobs
P13	face-to-face	13.03.2020	Audiorecording, 01:02:59	Annie Jacobs
P14	face-to-face	15.03.2020	Audiorecording, 00:30:21	Tamara Schaal
P15	online / via phone	07.05.2020	Audiorecording, 00:55:16	Annie Jacobs
P16	online / via phone	15.04.2020	Audiorecording, 01:02:44	Annie Jacobs
P17	online / via phone	23.04.2020	Audiorecording, 00:53:25	Tamara Schaal
P18	online / via phone	23.04.2020	Audiorecording, 00:57:48	Annie Jacobs
P19	face-to-face	13.03.2020	Written notes	Annie Jacobs
P20	face-to-face	09.03.2020	Audiorecording, 00:37:59	Annie Jacobs
P21	online / via phone	21.04.2020	Audiorecording, 00:43:46	Tamara Schaal
P22	online / via phone	05.06.2020	Audiorecording, 01:05:35	Annie Jacobs
P23	online / via phone	07.04.2020	Audiorecordings, 00:20:25 & 00:31:40	Tamara Schaal
P24	online / via phone	16.04.2020	Audiorecording, 00:37:50	Tamara Schaal
P25	online / via phone	11.04.2020	Audiorecording, 00:55:47	Annie Jacobs
P26	online / via phone	30.03.2020	Audiorecording, 00:43:45	Annie Jacobs
P27	face-to-face	13.03.2020	Audiorecording, 00:41:35	Tamara Schaal
P28	face-to-face	09.03.2020	Audiorecording, 00:44:51	Tamara Schaal
P29	online / via phone	06.05.2020	Audiorecording, 00:33:32	Tamara Schaal
P30	online / via phone	25.05.2020	Audiorecordings, 00:22:49 & 00:17:31 & 00:06:28	Annie Jacobs
P31	face-to-face	17.03.2020	Audiorecording, 00:44:02	Tamara Schaal
P32	face-to-face	18.03.2020	Audiorecording, 00:40:33	Tamara Schaal
P33	online / via phone	04.05.2020	Audiorecording, 01:06:09	Annie Jacobs
P34	online / via phone	02.04.2020	Audiorecording, 00:50:47	Tamara Schaal

P35	online / via phone	22.05.2020	Audiorecording, 01:15:42	Tamara Schaal
P36	online / via phone	08.05.2020	Audiorecording, 01:11:08	Annie Jacobs
P37	online / via phone	02.04.2020	Audiorecording, 00:51:24	Annie Jacobs
P38	online / via phone	26.03.2020	Audiorecording, 00:34:23	Tamara Schaal
P39	online / via phone	15.04.2020	Audiorecording, 00:36:31	Annie Jacobs
P40	online / via phone	16.04.2020	Audiorecording, 01:34:28	Annie Jacobs
P41	online / via phone	29.04.2020	Audiorecording, 00:44:06	Tamara Schaal
P42	online / via phone	28.05.2020	Audiorecording, 00:55:56	Tamara Schaal
P43	online / via phone	12.05.2020	Audiorecording, 00:55:29	Tamara Schaal
P44	online / via phone	20.04.2020	Audiorecording, 00:50:38	Tamara Schaal
P45	online / via phone	23.04.2020	Audiorecording, 00:55:35	Annie Jacobs
P46	online / via phone	15.04.2020	Audiorecording, 00:41:41	Tamara Schaal
P47	face-to-face	29.05.2020	Audiorecordings, 00:19:43 & 00:19:36	Annie Jacobs
P48	online / via phone	30.03.2020	Audiorecording, 01:02:35	Annie Jacobs
P49	online / via phone	12.06.2020	Audiorecording, 00:52:51	Annie Jacobs
P50	face-to-face	06.03.2020	Audiorecording, 00:45:53	Tamara Schaal
P51	online / via phone	29.04.2020	Audiorecording, 00:52:30	Annie Jacobs
P52	face-to-face	19.03.2020	Audiorecording, 00:51:51	Tamara Schaal
P53	face-to-face	16.03.2020	Audiorecording, 00:58:59	Annie Jacobs
P54	online / via phone	18.05.2020	Audiorecording, 00:48:21	Tamara Schaal
P55	face-to-face	13.03.2020	Audiorecording, 00:58:36	Tamara Schaal
P56	online / via phone	07.05.2020	Audiorecording, 01:11:54	Annie Jacobs
P57	online / via phone	28.04.2020	Audiorecording, 01:07:40	Annie Jacobs
P58	face-to-face	19.03.2020	Audiorecording, 00:38:59	Annie Jacobs
P59	online / via phone	02.04.2020	Audiorecording, 00:47:12	Tamara Schaal
P60	face-to-face	08.03.2020	Audiorecording, 00:37:13	Tamara Schaal
P61	online / via phone	16.04.2020	Audiorecording, 00:51:36	Annie Jacobs
P62	online / via phone	08.04.2020	Audiorecording, 00:41:32	Tamara Schaal
P63	face-to-face	10.03.2020	Audiorecording, 01:10:52	Tamara Schaal
P64	online / via phone	03.04.2020	Audiorecording, 00:46:35	Annie Jacobs
P65	face-to-face	05.03.2020	Audiorecording, 00:53:55	Tamara Schaal
P66	face-to-face	16.03.2020	Audiorecording, 00:46:52	Annie Jacobs
P67	online / via phone	11.06.2020	Audiorecording, 00:55:11	Annie Jacobs
P68	face-to-face	05.03.2020	Audiorecording, 00:50:41	Tamara Schaal
P69	online / via phone	02.04.2020 29.05.2020	Audiorecordings, 00:04:03 & 00:40:41 <i>(The interview was partly conducted again due to incomplete recording during the initial interview.)</i>	Annie Jacobs
P70	online / via phone	28.03.2020	Audiorecordings, 00:56:11 & 00:41:54	Annie Jacobs
P71	online / via phone	14.05.2020	Audiorecording, 00:52:28	Tamara Schaal
P72	face-to-face	29.05.2020	Audiorecordings, 00:04:23 & 00:50:42	Annie Jacobs
P73	online / via phone	27.04.2020	Audiorecording, 01:34:10	Tamara Schaal
P74	face-to-face	19.03.2020	Audiorecording, 00:38:59	Annie Jacobs
P75	online / via phone	18.04.2020	Audiorecording, 00:53:10	Annie Jacobs



P76	face-to-face	08.03.2020	Audiorecording, 00:37:59	Annie Jacobs
P77	online / via phone	17.04.2020	Audiorecording, 00:34:07	Tamara Schaal
P78	face-to-face	16.03.2020	Audiorecording, 00:32:35	Tamara Schaal
P79	online / via phone	11.05.2020	Audiorecording, 00:48:29	Tamara Schaal
P80	online / via phone	02.04.2020	Audiorecording, 00:35:23	Tamara Schaal
P81	face-to-face	08.03.2020	Audiorecording, 00:37:59	Annie Jacobs
P82	online / via phone	02.05.2020	Audiorecording, 00:34:29	Annie Jacobs
P83	face-to-face	14.03.2020	Audiorecording, 00:46:33	Tamara Schaal
P84	face-to-face	12.03.2020	Audiorecording, 00:50:59	Annie Jacobs
P85	face-to-face	18.03.2020	Audiorecording, 00:37:28	Tamara Schaal
P86	online / via phone	26.04.2020	Written notes ( <i>The recording quality was too poor.</i> )	Annie Jacobs
P87	online / via phone	28.05.2020	Audiorecording, 00:35:09	Annie Jacobs
P88	online / via phone	26.04.2020	Audiorecording, 00:50:22	Annie Jacobs
P89	face-to-face	16.03.2020	Audiorecording, 00:37:59	Annie Jacobs
P90	face-to-face	06.03.2020	Audiorecording, 00:29:17	Tamara Schaal
P91	online / via phone	30.04.2020	Audiorecording, 00:49:15	Annie Jacobs
P92	online / via phone	29.04.2020	Audiorecording, 00:30:06	Annie Jacobs
P93	online / via phone	07.05.2020	Audiorecording, 00:55:15	Tamara Schaal
P94	online / via phone	03.04.2020	Audiorecording, 00:49:18	Annie Jacobs

Σ 78:07:32

**Total number of interviews: 94 (50 conducted by Annie Jacobs, 44 conducted by Tamara Schaal)**

#### **b) Biosphere Reserve Spreewald case study**

<b>Interview acronym</b>	<b>Interview mode</b>	<b>Date of the interview</b>	<b>Data obtained and duration of audiorecording</b>	<b>Interviewer</b>
I01	face-to-face	18.03.2019	Audiorecording, 00:28:12	Tamara Schaal
I02	face-to-face	29.03.2019	Audiorecording, 00:31:41	Tamara Schaal
I03	face-to-face	06.03.2019	Audiorecording, 00:33:13	Tamara Schaal
I04	face-to-face	13.03.2019	Audiorecording, 00:33:35	Tamara Schaal
I05	face-to-face	28.02.2019	Audiorecording, 00:34:27	Tamara Schaal
I06	face-to-face	25.02.2019	Audiorecording, 00:34:34	Tamara Schaal
I07	face-to-face	12.03.2019	Audiorecording, 00:34:40	Tamara Schaal
I08	face-to-face	12.03.2019	Audiorecording, 00:35:36	Tamara Schaal
I09	face-to-face	22.03.2019	Audiorecording, 00:35:40	Tamara Schaal
I10	face-to-face	04.03.2019	Audiorecording, 00:35:49	Tamara Schaal
I11	face-to-face	26.02.2019	Audiorecording, 00:36:08	Tamara Schaal
I12	face-to-face	14.03.2019	Audiorecording, 00:41:59	Tamara Schaal
I13	face-to-face	20.03.2019	Audiorecording, 00:42:19	Tamara Schaal
I14	face-to-face	13.03.2019	Audiorecording, 00:42:24	Tamara Schaal
I15	face-to-face	27.02.2019	Audiorecording, 00:46:44	Tamara Schaal
I16	face-to-face	05.03.2019	Audiorecording, 00:47:58	Tamara Schaal
I17	face-to-face	21.02.2019	Audiorecording, 00:48:10	Tamara Schaal

I18	face-to-face	06.03.2019	Audiorecording, 00:48:20	Tamara Schaal
I19	face-to-face	29.03.2019	Audiorecording, 00:48:22	Tamara Schaal
I20	face-to-face	04.03.2019	Audiorecording, 00:49:42	Tamara Schaal
I21	face-to-face	06.03.2019	Audiorecording, 00:50:11	Tamara Schaal
I22	face-to-face	26.02.2019	Audiorecording, 00:50:49	Tamara Schaal
I23	face-to-face	22.03.2019	Audiorecording, 00:52:54	Tamara Schaal
I24	face-to-face	29.03.2019	Audiorecording, 00:52:58	Tamara Schaal
I25	face-to-face	26.03.2019	Audiorecording, 00:55:36	Tamara Schaal
I26	face-to-face	01.03.2019	Audiorecording, 00:56:21	Tamara Schaal
I27	face-to-face	18.03.2019	Audiorecording, 00:57:29	Tamara Schaal
I28	face-to-face	11.03.2019	Audiorecording, 00:58:29	Tamara Schaal
I29	face-to-face	15.03.2019	Audiorecording, 01:00:22	Tamara Schaal
I30	face-to-face	19.03.2019	Audiorecording, 01:01:02	Tamara Schaal
I31	face-to-face	20.03.2019	Audiorecording, 01:01:48	Tamara Schaal
I32	face-to-face	27.02.2019	Audiorecording, 01:02:01	Tamara Schaal
I33	face-to-face	25.02.2019	Audiorecording, 01:02:12	Tamara Schaal
I34	face-to-face	19.03.2019	Audiorecording, 01:06:39	Tamara Schaal
I35	face-to-face	28.02.2019	Audiorecording, 01:09:09	Tamara Schaal
I36	face-to-face	01.03.2019	Audiorecording, 01:15:19	Tamara Schaal
I37	face-to-face	20.02.2019	Audiorecording, 01:18:36	Tamara Schaal
I38	face-to-face	21.02.2019	Audiorecording, 01:28:05	Tamara Schaal

Σ 31:49:33

**Total number of interviews: 38 (all conducted by Tamara Schaal)**

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## Appendix 2: Overview of articles included in the doctoral thesis

in accordance with the Guideline for cumulative dissertations enacted at the Faculty of Sustainability in January 2012

### Papers included

- [4] Schaal T., Jacobs A., Leventon J., Scheele B.C., Lindenmayer D., Hanspach J. (2022) ‘You can’t be green if you’re in the red’: Local discourses on the production-biodiversity intersection in a mixed farming area in south-eastern Australia. *Land Use Policy* 121(3): 106306. doi: doi.org/10.1016/j.landusepol.2022.106306.
- [5] Schaal T., Mitchell M., Scheele B.C., Ryan P., Hanspach J. (2023) Using the three horizons approach to explore pathways towards positive futures for agricultural landscapes with rich biodiversity. *Sustainability Science* (18): 1271-1289. doi: doi.org/10.1007/s11625-022-01275-z.
- [6] Schaal T., König B., Riechers M., Heitepriem N., Leventon J. Exploring cultural landscape narratives to understand challenges for collaboration and their implications for governance. Under review with *Ecosystems and People*.

**Author's contribution to the articles and publication status**

Article No.	Short title	Contributions of all authors	Author status	Weighting factor	Publication status	Conference contribution
[1]	<i>Discourses Paper</i>	Conceptualisation: <b>TS, AJ, JL, BCS, DL, JH</b> ; Methodology: <b>TS, AJ, JL, BCS, JH</b> ; Investigation: <b>TS, AJ</b> ; Data curation: <b>TS</b> ; Formal analysis: <b>TS, AJ, JL, JH</b> ; Writing – Original Draft: <b>TS, AJ, JL, BCS, DL, JH</b> ; Writing – Review & Editing: <b>TS, AJ, JL, BCS, DL, JH</b> ; Project administration: <b>TS, AJ, JH</b> ; Supervision, project administration and funding acquisition: <b>JH</b>	Co-author with predominant contribution	1.0	Published in Land Use Policy (IF 2021: 6.189)	-
[2]	<i>Three Horizons Paper</i>	Conceptualisation and methodology: <b>TS, MM, BCS, PR, JH</b> ; Investigation: <b>MM, BCS, PR</b> ; Formal analysis: <b>TS, MM, BCS, PR, JH</b> ; Writing - original draft preparation: <b>TS, JH</b> ; Writing - review and editing: <b>TS, MM, BCS, PR, JH</b> ; Funding acquisition: <b>JH</b> ; Supervision: <b>JH</b>	Co-author with predominant contribution	1.0	Published in Sustainability Science (IF 2021: 7.196)	<i>ICCB 2021*</i>
[3]	<i>Landscape Narratives Paper</i>	Conceptualization and methodology: <b>TS, BK, MR, NH, JL</b> ; Investigation, formal analysis and data curation: <b>TS</b> ; Writing – Original Draft: <b>TS, BK, MR, NH, JL</b> ; Writing – Review & Editing: <b>TS, BK, MR, NH, JL</b> ; Funding acquisition: <b>BK</b> ; Supervision: <b>JL</b>	Co-author with predominant contribution	1.0	Under review with Ecosystems and People	Science and Research in, for and with Biosphere Reserves 2022
<b>Σ</b>				<b>3.0</b>		

## Explanatory notes

AJ = Annie Jacobs; BCS = Ben C. Scheele; BK = Bettina König; DL = David Lindenmayer; JH = Jan Hanspach; JL = Julia Leventon; MM = Michael Mitchell; MR = Maraja Riechers; NH = Nico Heitepriem; PR = Paul Ryan; TS = Tamara Schaal

### *Publication status*

IF = Web of Science – 2021 Journal Impact Factor

### *Specific contribution and weighting factor*

according to § 12 and § 14 of the guideline for cumulative dissertations

<b>Author status</b>	<b>Weighting factor</b>
Single author = own contribution amounts to 100%.	1.0
Co-author with predominant contribution = own contribution is greater than the individual share of all other co-authors and is at least 35%.	1.0
Co-author with equal contribution = (1) own contribution is as high as the share of other co-authors, (2) no other co-author has a contribution higher than the own contribution, and (3) the own contribution is at least 25%.	1.0
Co-author with important contribution = own contribution is at least 25%, but is insufficient to qualify as single authorship, predominant or equal contribution.	0.5
Co-author with small contribution = own contribution is less than 20%.	0

### *Conference contributions*

International Congress for Conservation Biology (ICCB), virtually, 13-17 December 2021; <https://conbio.org/mini-sites/iccb-2021/program/session-types/>

Science and Research in, for and with Biosphere Reserves, Schorfheide-Chorin Biosphere Reserve (Germany), 16-20 May 2022, <https://www.biospherereserves.institute/research-conference>

\* The paper was accepted for presentation, but the session was later cancelled, and the paper was not presented.

## **Declaration (according to § 16 of the guideline for cumulative dissertations)**

I avouch that all information given in this appendix is true in each instance and overall.

