Conceptualizing and analysing the acceptability of sustainability innovations in the field of land use and landscape planning

vorgelegt von
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Landscape research, social-ecological system perspective, cultural landscapes, acceptability, acceptance, participation, theory building, innovation, social values of nature, Qualitative Comparative Analysis (QCA), qualitative interviews, qualitative content analysis

Schlagwörter

Landschaftsforschung, sozial-ökologische Systemperspektive, Kulturlandschaften, Akzeptanz, Partizipation, Theoriebildung, Innovation, naturbezogene Wertvorstellungen, Qualitative Comparative Analysis (QCA), qualitative Interviews, qualitative Inhaltsanalyse

Abstract

Acceptability studies on landscapes and land uses are an increasing and in-demand research field. In-depth knowledge of the acceptability of innovations enables the proactive management of innovation processes in landscapes. However, there are various research gaps: 1) the lack of consistent and comprehensive definitions of acceptance and acceptability, 2) the lack of a framework to analyse acceptability issues from a social-ecological system perspective, 3) the lack of a conceptual link between acceptability and landscape approaches, and 4) the knowledge gap of links between acceptability and collaboration. This thesis aims to fill these gaps by 1) conceptualizing acceptability in the above-mentioned research field, 2) analysing acceptability, 3) and conceptually and empirically linking acceptability to collaboration.

The first part of this thesis provides a comprehensive literature review, which leads to a new sociologically driven definition of acceptability (Paper 1). Acceptability is here defined as a scientific concept that examines actor-based and dynamic judgement and decision processes. The definition serves to develop an acceptability framework that is applied in empirical analyses (Papers 2 and 3) in the Spreewald region (SP). The definition and the framework integrate different dimensions of acceptability, cover its complexity and dynamics, and offer sufficient flexibility for a broad application.

Paper 2 qualitatively analyses the acceptability factors that influence the decisions of landowners and farmers related to land pools. The generally high appreciation of the cultural landscape (CL) leads not automatically to a positive acceptance of the land pool concept as possible solution to protect the CL. Reasons for diverging attitudes toward land pools are the lack of shared values among actors and different opinions about how to protect the CL. Additional acceptability influencing factors are previous experiences, level of participation, and trust in actors or institutions.

The second empirical study analyses the acceptability of local biomass heating plants and their contribution to cultural landscape management in the same case study region. Fuzzy-set qualitative comparative analysis (fsQCA) was applied to explore whether farmers would install a biomass plant and the reasons for accepting or rejecting it. Results show a currently low acceptance of biomass plants. The analysis revealed three types of farmers: proponents and potential adopters, ethically concerned opponents, and open-minded refusers. Each group has a different configuration of the following factors: ethical acceptance of and interest in technology, a

need for a new heating system, the availability of sufficient feedstock, and a perceived readiness of technology.

Both studies revealed a high diversity of factors, which advocates an 'open approach' to analysing acceptability in general. On the basis of empirical evidence, a novel approach is introduced that conceptually integrates acceptability studies into adaptive landscape co-design and management (Paper 4). By combining acceptability with established collaborative landscape approaches these two separated research strands are brought together to a new approach. This approach is called the acceptability and landscape design cycle (ALDC) approach. Four iterative steps comprise the ALDC approach: defining the preconditions for acceptability analysis, conducting the acceptability analysis, integrating the results into a landscape strategy, and re-designing and refining the innovative ideas and landscape strategy. The development of the ALDC approach was additionally inspired by a study which examines the preconditions and opportunities for initiating a collaborative landscape management in the SP (Paper 5), going beyond the explicit analysis of acceptability.

Kurzfassung

Studien zur Akzeptanz und *Acceptability* im Kontext von Landnutzung und Landschaftsmanagement sind ein wachsendes und gefragtes Forschungsfeld. Umfängliches Wissen über die *Acceptability* von Innovationen ermöglicht ein proaktives Management von Innovationsprozessen im Landschaftskontext. Diesbezüglich gibt es derzeitig verschiedene Forschungslücken: das Fehlen 1) einer konsistenten und umfassenden Definition in Abgrenzung von Akzeptanz und *Acceptability,* 2) eines geeigneten Analyserahmens aus einer sozial-ökologischen Perspektive, 3) konzeptioneller Vernetzung zwischen *Acceptability*-Analysen und landschaftsbezogenen Ansätzen, 4) von Wissen über die theoretischen und empirischen Zusammenhänge der Konzepte *Acceptability* und Kollaboration bzw. Kooperation.

Die Dissertation adressiert diese Forschungslücken, in dem sie 1) *Acceptability* im oben genannten Forschungsfeld konzeptualisiert, 2) *Acceptability*-Analysen beschrieben werden und 3) Verknüpfungen zwischen *Acceptability* und Kollaborationen aufgezeigt werden. Der erste Teil widmet sich einer systematischen Literaturanalyse, auf deren Grundlage eine soziologisch-geprägte Definition von *Acceptability* formuliert wird (Artikel 1). Acceptability ist demnach ein komplexes wissenschaftliches Konzept, welches akteursbasierte und dynamische Beurteilungsprozesse in den Blick nimmt, wobei der Begriff anders konnotiert wird als das deutsche Wort Akzeptabilität. Die Definition dient dazu, im nächsten Schritt einen geeigneten Rahmen für die empirischen *Acceptability*-Analysen zu entwickeln und anzuwenden (Artikel 2 und 3). Sowohl die Definition als auch der Analyserahmen integrieren die vielfältigen Dimensionen von Acceptability, die inhärente Komplexität und Dynamik abdeckend und genügend Flexibilität für eine breite Anwendbarkeit bietend.

Die erste empirische Studie untersucht, zu welchem Grad sogenannte Entwicklungspflegepools im Spreewald (SP) von Landeigentümern und Landnutzern akzeptiert werden und welche Faktoren dem zugrunde liegen. Die Ergebnisse zeigen, dass die generell hohe Wertschätzung für die Kulturlandschaft Spreewald nicht automatisch zu einer hohen Akzeptanz (im Sinne von Zustimmung) bezüglich der Entwicklungspflegepools, als Konzept den Spreewald zu schützen, führt. Gründe für Akzeptanz bei einigen und Ablehnung bei anderen Interviewten sind das Fehlen von gemeinsamen Wertevorstellungen und verschiedene Zielvorstellungen, mit welchen Mitteln der Spreewald geschützt werden könnte. Weitere Einflussfaktoren der *Acceptability* sind die

bisherigen Erfahrungen der Akteure, Art und Weise der Partizipation und Vertrauen gegenüber anderen.

Die zweite empirische Studie beschäftigt sich mit der *Acceptability* von lokalen Heizungsanlagen (Rundballenvergaser von Landschaftspflegematerial) und deren Beitrag zum Kulturlandschaftsmanagement im SP. Es wurde eine ‚*Fuzzy-Set Qualitative Comparative Analysis*' (fsQCA) angewandt, die aufzeigte, welche Gründen vorliegen müssen, damit regionale Landwirte sich eine solche Anlage in den nächsten 5 Jahren anschaffen würden oder nicht. Die Analyse ergab, dass die Akzeptanz für solche Heizungsanlagen derzeit noch niedrig ist. Dabei wurden drei Typen von Landwirten identifiziert: Befürworter und potentielle Nutzer, Ablehnende aus ethischen Bedenken „Heu zu verbrennen" und offene Landwirte, die aber keine Anwender in absehbarer Zukunft werden. Für jede dieser Gruppe liegt eine andere Konfiguration von folgenden Faktoren vor: ethische Akzeptanz des Verfahrens, Interesse am Verfahren und der Technologie, Bedarf eines neuen Heizungssystems, Verfügbarkeit von Heizmaterial, die wahrgenommene Reife der Technologie.

Beide Studien decken eine große Bandbreite an Faktoren auf, was grundsätzlich für die Nutzung eines ‚offenen' Rahmens zur Analyse von *Acceptability* spricht. Auf Basis der empirischen Ergebnisse wurde ein neuer Ansatz entwickelt, wie *Acceptability*-Studien in die Landschaftsentwicklung und das Landschaftsmanagement eingebunden werden können (Artikel 4). Dieser sogenannte *Acceptability and landscape design cycle* (ALDC) kombiniert die bisher voneinander getrennten Forschungsfelder 1) *Acceptability* und 2) kollaboratives Landmanagement zu einem dynamischen und sozial-ökologischen Ansatz. Die vier iterativen Schritte in ALDC sind: das Festlegen, was genau analysiert werden soll (Vorbedingungen), das Durchführen der *Acceptability*-Analyse(n) selbst, die Integration der Ergebnisse in die Landschaftsstrategie und die Anpassung der Innovationen und Landschaftsstrategie. Die Konzeptionierung des ALDC-Ansatzes wurde auch von dem fünften Artikel inspiriert, der sich mit den Voraussetzungen und Möglichkeiten auseinandersetzt, die die Einführung eines kollaborativen Landmanagement im SP bestimmen, aber keine direkte Analyse von *Acceptability* beinhaltet.

List of publications

Five scientific papers contribute to the cumulative dissertation. Hereafter, I refer to these articles using the abbreviation P1 to P5.

Paper 1 (P1):

Busse, Maria; Siebert, Rosemarie (2018): Acceptance studies in the field of land use—A critical and systematic review to advance the conceptualization of acceptance and acceptability. Land Use Policy 76, 235-245. https://doi.org/10.1016/j.landusepol.2018.05.016 (IF: 3.5)

Paper 2 (P2):

Busse, Maria; Heitepriem, Nico; Siebert, Rosemarie (2019): The acceptability of land pools for the sustainable revalorisation of wetland meadows in the Spreewald region, Germany. Sustainability 11, 4056. https://doi.org/10.3390/su11154056 (IF: 2.7)

Paper 3 (P3):

Busse, Maria; Siebert, Rosemarie; Heitepriem, Nico (2019): Acceptability of innovative biomass heating plants in a German case study – A contribution to cultural landscape management and local energy supply. Energy, Sustainability and Society 9:36. https://doi.org/10.1186/s13705-019-0215-2 (IF: 1.9)

Paper 4 (P4):

Busse, Maria; Heitepriem, Nico; Zscheischler, Jana; Siebert, Rosemarie (2019): Integration of acceptability studies into an adaptive landscape co-design and management – The acceptability and landscape design cycle (ALDC). Landscape Research (IF: 1,8) (submitted on 19.11.2019)

Paper 5 (P5):

Zscheischler, Jana; Busse, Maria; Heitepriem, Nico (2019): Challenges to build up a Collaborative Landscape Management (CLM) ‑ Lessons from a stakeholder analysis in Germany. Environmental Management 64(5), 580–592. https://doi.org/10.1007/s00267-019-01205-3 (IF: 2.4)

List of abbreviations

ALDC	Acceptability and landscape design cycle (cf. paper 4)
BR	Biosphere reserve
CLM	Collaborative landscape management (cf. paper 5)
DOI	Diffusion of innovation theory
ES	Ecosystem services
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
MA	Millennium Ecosystem Assessment
NCP	Nature's contribution to people
QCA	Qualitative comparative analysis
RQ	Research question
SDGs	Sustainable Development Goals
SP	Spreewald region
TAM	Technology acceptance model
TEEB	The Economics of Ecosystems and Biodiversity
TD	Transdisciplinary research

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1. Introduction

1.1 Background of the thesis

Landscapes are dynamic systems which underlie continuous changes, uncertainties, and often unforeseen interactions (Dramstad and Fjellstad, 2011; Sayer et al., 2013). These dynamics do not take place only in the bio-physical sphere as ecological processes but there also exist multiple interconnections between physical landscapes and human activities. In this sense, landscapes are "*areas, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors*" (Council of Europe, 2000). Several actor groups and stakeholders are involved in making specific demands related to landscape changes at different spatial scales. These demands and interests are coupled with often diverging objectives for the development of landscapes (protection of nature and biodiversity, climate protection, efficient resource use, food production, aesthetically experiencing landscapes, etc.) and to determine why nature and landscapes should be valorised (Kenter et al., 2015; Ott, 2015). As a consequence and to adequately address the complexity of landscape processes and balance multiple demands, the major strands of landscape research – natural science (especially landscape ecology) and social science and their application e.g. in landscape planning and design – must unite their areas of expertise (Antrop, 2006). Examining landscapes from a human perspective that includes human-environmental interactions is vital for understanding landscape dynamics (Ryan, 2011). Social science contributes knowledge about peoples' demands, interests, values, perceptions, attitudes, motivations, and activities to landscape research and practice-oriented approaches. This knowledge can be elicited through in-depth analyses (e.g., on acceptability) or co-produced in transdisciplinary research (TD) processes that bring scientists, practitioners (landscape planners, policy makers, etc.) and local actors (landowners, farmers, and the wider public) together. Only by gaining such social knowledge – in addition to knowledge of ecological effects and monitoring and assessing ecosystem services in landscapes – can appropriate solutions and approaches be developed that address complex social-ecological challenges and pursue a sustainable future for landscapes. Such solutions should be innovative (Antrop, 2006; Beunen and Opdam, 2011; Ryan, 2011; Sayer et al., 2013) and tailored in such a way that they capture the real-world problem in specific landscapes, as generalized scientific knowledge has only limited validity at local scales (Beunen and Opdam, 2011; Ostrom, 2007). The development of solutions also implies that one

must consider the interests and demands of local actors and stakeholders to avoid inappropriate planning, rejection or even opposition to proposed solutions. Acceptance, in its meaning as approval, is an important precondition for successfully accomplishing and implementing innovative solutions. From an innovation management and landscape approach perspective, knowledge of whether and why affected local actors and potential users accept or reject innovative ideas is strongly needed to adequately consider their interests in the development of suitable solutions (Campellone et al., 2018; Wolsink, 2018). Generating this knowledge is the research object of acceptability studies that are often labelled also as acceptance studies. In this dissertation, I use the term acceptability for the theoretical concept that seeks to understand actor-based, dynamic, and complex judgement processes which lead to decisions on acceptance, rejection or a degree between both (Busse and Siebert, 2018) (for a detailed understanding of acceptability see 2.6 and paper 1).

Ideally, people are proactively involved in the whole landscape co-design and management process, which corresponds to the new mode of integrated and collaborative landscape approaches advocated by researchers who aim to replace the predominance of so-called 'command and control' or expert-based governance arrangements (Folke et al., 2005; Olsson et al., 2004; Peat et al., 2017; Scott, 2011). 'Landscape approach' is the umbrella term for frameworks that aim to integrate policy and practice for multifunctional landscape use by balancing different stakeholder perspectives (Reed et al., 2016). Landscape approaches correspond to the social-ecological system perspective and embrace, among others, the concepts of adaptive co-management, landscape co-design, the integrated landscape approach, the collaborative landscape approach, collaborative landscape management, participatory land use planning, multi-stakeholder governance at the landscape level, etc. (Reed et al., 2016; Sayer et al., 2013). All these landscape approaches are part of the collaborative paradigm that has become a new trend in planning and public policies (Cleaver and Whaley, 2018; Pahl-Wostl et al., 2007; Reed et al., 2016). Joint characteristics and a common ground for sound landscape approaches are reflected in the ten principles outlined by Sayer et al. (2013), which include, among others, continual learning and adaptive management, the multifunctionality of landscapes, and strengthened stakeholder capacity.

Taking into account the importance of knowledge on acceptability in landscape approaches (Hitzeroth and Megerle, 2013; Schenk et al., 2007; Wolsink, 2018), it is not surprising that acceptability studies on landscapes and land uses are an increasing and in-demand research field (Busse and Siebert, 2018). Against this background, this dissertation aims to contribute to the

current discussion by conceptualizing and analysing the acceptability of sustainability innovations. The Spreewald region (SP) is chosen to empirically support the dissertation.

The SP is a historically grown cultural landscape comprising an extended network of water channels, floodplain forests, arable land, and different types of wetland meadows. This mosaic of land uses builds unique landscape scenery and provides abundant biodiversity. In particular, the small-scale wetland meadows are increasingly under threat of falling out of use for economic reasons related to efficient resource use. In the SP, land abandonment is seen as a complex sustainability problem because valuable biotopes are getting lost through natural succession. This also leads to an observable disappearance of the culturally valuable landscape mosaic, which is important for the regional identity and regional tourism. Therefore, the TD team of a project called 'ginkoo'[1] aimed to design a suitable landscape strategy, understood as a bundle of complementary innovative ideas, for the SP. This problem setting is the basis for the empirical studies in this dissertation.

1.2 State-of-the-art of acceptance and acceptability studies

In the scientific literature, the terms 'acceptance' and 'acceptability' are very often used synonymously for the same research purpose: analysing whether and why affected local actors and potential users accept or reject planning outcomes or innovations. Acceptance and acceptability studies are an application-oriented research issue that is embedded in several disciplines and research fields, such as landscape planning, agricultural and environmental research, political science, market and consumer research, and technology assessment (Lucke, 1995). Each of these disciplines and research fields use very different definitions and understandings of acceptability and acceptance. Additionally, there is no consistent application of these terms within the same field or discipline.

Current international publications on agricultural and environmental research primarily deal with technical innovations or planning projects concerning renewable energies (e.g., implementation of wind parks, photovoltaic and biogas plants) wherein acceptability by affected actor groups, the community or the local pubic is analysed (Caporale and De Lucia, 2015; Spartz et al., 2015; Eswarlal et al., 2014; Williams, 2014; Mallett, 2007; Wüstenhagen et al., 2007; Assefa and Frostell, 2007). In terms of sustainable land use, important publications include those dealing with the acceptability or adoption of soil conservation measures and agri-environmental schemes (Prager

[1] http://www.ginkoo-projekt.de/; see also acknowledgements.

and Posthumus, 2010; Sattler and Nagel, 2010; Siebert et al. 2006). Additionally, landscape planning acceptability studies have been carried out for roughly two decades. A particular focus has been on quantitatively exploring the acceptability by the local public of newly designated or already implemented large-scale protection areas such as national parks and biosphere reserves (Mose, 2009; Ruschkowski von, 2009; Sauer et al., 2005).

From application-oriented research on acceptance and acceptability, only limited conceptual-theoretical contributions have emerged. One of the few examples is the 'stage-model' (*in German 'Stufen der Akzeptanz und Inakzeptanz'*), which includes not only acceptance as positive attitudes and behaviours but also other degrees which range from active opposition, via tolerance and conditional acceptance to approval and active engagement (Ruschkowski von 2009, Sauer et al. 2005). This 'stage-model' is widely used in German-speaking countries but less so in the international context. From a perspective of political sociology, an influential theoretical approach was developed by the German sociologist Doris Lucke (1995), one that takes into account established theories of communicative action (Habermas, 1982) and value rationality and value spheres (Weber, 1922). Lucke (1995, 91) defines acceptance as the product of a mutual communication process between different actors. This definition contains an active component, as opposed to a passive perception of acceptance. Decisions are made by considering the relationship among subjects, objects and the context. A recent theoretical contribution to a better understanding of social acceptability is the definition proposed by Fournis and Fortin (2017) in which the authors differentiate the term from social acceptance. Whereas social acceptance is a degree of decision (similarly perceived by Sauer, 2005), social acceptability is understood as "*a process of collective assessment of a given project […], integrating plurality of actors (stakeholders) and spatial scales (from global to local) as well as involving the specific trajectory (past and future) of a political group or policy (community/society)*' (Fournis and Fortin, 2017, 5). Further theoretical approaches include the diffusion of innovation theory (DOI) (Rogers, 2003), the technology acceptance model (TAM) (Davis, 1989), and the typology of social acceptance (Wüstenhagen et al., 2007). In the DOI theory, Rogers (2003) describes the typical phases of a diffusion process, with acceptance as one specific phase. The diffusion process comprises the characteristics of an innovation, of the communication channels, of the social system and of the temporal dimension. Furthermore, Roger (2003) differentiates between five adopters' categories: innovators, early adopters, early and late majority, and laggards. TAM aims to predict the acceptance of information technologies by end-users. According to Davis (1989), acceptance is based on individual rational choices and two main variables: perceived ease of use and perceived

usefulness. From a more sociological-constructivist and innovation-system perspective, DOI and TAM have shortcomings related to the technology-focused and deterministic or simplistic character of stages and factors. Both theories overlook interwoven, socially constructed processes and systems and power relations (Ajibade, 2018; Lyytinen and Damsgaard, 2001; Mallett, 2007). Mallett (2007) notes that Rogers' adopter categories and communication principles neglect complex interactions, communication flows, and power-based interdependencies between actors, which are embedded in social norms and institutional settings. Wüstenhagen et al. (2007) developed a concept of social acceptance of renewable energies that differentiates three types: socio-political acceptance, market acceptance, and public acceptance. This concept is more a typology than a theory of acceptance.

Many agricultural and environmental studies apply the above approaches: Lucke's (1995) theory can be particularly found in research from German-speaking countries (e.g., Hitzeroth and Megerle, 2013; Prager and Posthumus, 2010; Ruschkowski von, 2009; Sauer et al., 2005; Schenk et al., 2007; Specht et al., 2016). Some studies are based on DOI (e.g., Hemström et al., 2014; Sattler and Nagel, 2010). Among many others, the studies by Eswarlal et al. (2014) and Williams (2014) use the typology of social acceptance by Wüstenhagen et al. (2007). One conclusion from the state-of-the-art is that process-oriented and feedback approaches have gained in importance, while input-output models are increasingly criticized.

In the body of the literature under observation, analysis of acceptability factors and argumentations is seldom operationalized by applying conceptual frameworks, as factors are mostly borrowed from other studies for use as survey items. Generally, the use and handling of factors are determined through the perspective on acceptability, the research method, and the object of analysis. In qualitative studies on acceptability, factors are often determined through data collection. In quantitative surveys, different sources of factors can be found: 1) copying factors from other empirical studies as survey items, 2) theory-driven building of factors and their use as survey items, and 3) mixed sources of factors. Examples of theory-driven factors include the following: Rogers' (2003) factors — relative advantage, compatibility, complexity, trialability, and observability — stem from a technological-innovation driven perspective. Prager and Posthumus (2010) derive their factors from sustainability dimensions by using ecological, economic, institutional, and socio-cultural factors with subfactors). Davis (1989) reduces factors to perceived ease of use and perceived usefulness. However, to some extent, linkages between factors from different perspectives can be identified. For example, a consideration of a psychological perspective that includes individual-personality-oriented factors can be observed in

all the above-mentioned studies. On a very broad level, the following factors are common sense: perception of risks, benefits, information, and implementability of innovations.

1.3 Gaps and research needs

On the basis of the state-of-the-art of the literature, four main research gaps can be identified, which motivated this dissertation.

Gap 1: Lack of consistent and comprehensive definitions of acceptance and acceptability

The state-of-the-art of the literature on acceptance and acceptability shows that there are very diverging interpretations of what these two terms mean. Some researchers see acceptance as the positive outcome of complex acceptability processes (Fournis and Fortin, 2017; Wolsink, 2018), whereas others understand (social) acceptance as the broad concept that examines whether and why actors accept or reject an innovation or project (Raven et al., 2009; Sattler and Nagel, 2010; Wüstenhagen et al., 2007). In some studies, both terms are used for similar meanings. Another lack of clarity concerning the definition of acceptance is that some researcher see acceptance as passive reaction of affected people (Anderson et al., 2012; Oppermann, 2018) whereas others define acceptance as active process or process orientation (Lucke, 1995; Sattler and Nagel, 2010; Specht et al., 2014; Wolsink, 2010). Researchers such as Anderson et al. (2012) and Wolsink (2012) include rejection in the concept of acceptance whereas others limit it exclusively to acceptance in its meaning as a positive outcome (Specht et al., 2014; Williams, 2014). In short, there is a lack of theoretical work on the understanding of acceptability in the field of land use and landscape planning. Thus, an in-depth analysis of literature is needed to gain more clarity and precision regarding the use of terminology and to offer insights to advance the conceptualization of acceptance and acceptability.

Gap 2: Lack of an acceptability framework from a social-ecological perspective

As described in the state-of-the-art, none of the acceptance or acceptability concepts are able to capture the multifaceted character of acceptability phenomena (e.g., process orientation, range of outcome degrees, range of analysis levels, multiple interactions; cf. 2.6 main concepts/ acceptability) and be deemed suitable for the diversity of acceptability phenomena in social-

ecological system research, which also includes landscape research. On the one hand, each concept concentrates on a specific dimension or element of acceptability while simultaneously neglecting other aspects. On the other hand, the focus of most concepts in the literature is on technologies (Davis, 1989; Fournis and Fortin, 2017; Rogers, 2003; Wüstenhagen et al., 2007). Therefore, there is a need to merge different approaches and to use the advantages of promising concepts to develop a suitable acceptability framework. Such a holistic framework should be applicable to a broad range of acceptability phenomena in different real-world landscape contexts (including little-known and poorly-explored phenomena) and be in line with the social-ecological system perspective (cf. 2.3 basic assumptions).

Gap 3: Lack of a conceptual link between acceptability studies and landscape approaches

Collaborative landscape approaches (Folke et al., 2005; Olsson et al., 2004; Reed et al., 2016; Sayer et al., 2013) and acceptability studies on land use and landscapes both deal with human–environmental interactions (cf. 2.3. basic assumptions), the attitudes or values of local actors, and multi-actor involvement. Generally speaking, knowledge on acceptability is required when dealing with landscape transformation through innovation processes and the governance of landscapes (Schenk et al., 2007; Wolsink, 2018). However, to date, both research strands have been widely separated from each other. Acceptability studies refer very seldom to collaborative landscape governance or management approaches. Conversely, collaborative landscape approaches might implicitly consider the importance of acceptability issues but less so the necessity of in-depth acceptability studies, as evidenced by the lack of citations from the corresponding literature. Mutual referencing and exploring of insights are an opportunity to use the benefits from both research strands. Thus, there is a need to fill the research gap by conceptually integrating acceptability in the form of an approach that guides the implementation of acceptability studies into landscape approaches.

Gap 4: Knowledge gap of the explicit relation between acceptability and collaboration

Acceptability issues appear to be implicitly important in regional studies dealing with collaboration of actors in landscape contexts. However, there is little evidence in the scientific literature of how acceptability and collaboration issues are explicitly related, e.g. in terms of

mutual influencing factors. In the literature review, no empirical study was found that examines the interaction between acceptability and collaboration at the case study level. Reed et al. (2016) and Loft et al. (2015) identified a lack of empirical studies on how to implement collaborations in landscape contexts and on the barriers to successful collaboration and the strategies to overcome them. Against this background, the knowledge gap relative to the role of acceptability in initiating and implementing collaborative arrangements should be filled by empirically examining the expectations and attitudes of actors at the case study level.

1.4 Research objectives and research questions

Considering the above research gaps, this dissertation pursues three objectives that are specified through corresponding research questions. The objectives and research questions are introduced below.

Objective 1: Conceptualizing acceptability in the field of land use and landscape planning

This objective has the following dimensions: a) defining acceptability, b) developing a framework of acceptability, and c) integrating acceptability into landscape design and management. Defining acceptability aims at filling the research gap of the inconsistent understandings of acceptance and acceptability. Developing a framework of acceptability addresses the lack of a comprehensive concept enabling one to analyse acceptability issues related to land use and landscape planning from a social-ecological system perspective. Integrating acceptability into landscape approaches seeks to fill the connectivity gap between both research strands. This first objective reflects the above mentioned outstanding importance of acceptability issues for landscape dynamics and corresponds to the manifold characteristics of landscapes as well to the principles of how landscape should be adequately analysed and managed (Sayer et al., 2013).

The corresponding research questions are:

RQ1a) How can acceptability be defined by considering the current state-of-the-art of the literature on acceptability in the field of land use and landscape planning?

RQ1b) How should a framework be conceptualized from a social-ecological research perspective that includes the most important characteristics of acceptability?

RQ1c) How can acceptability studies be integrated into landscape co-design and management?

Objective 2: Analysing acceptability using the example of SP

The second objective is to apply the developed framework and analyse the acceptability of different sustainability innovations in a specific landscape context. As this dissertation was embedded in the TD project called 'ginkoo', which included investigations in the SP, the analyses of acceptability are connected to the same region. Analysing acceptability means to examine whether and why local actors accept or reject innovative ideas. More specifically, the empirical analysis encompasses the exploration of acceptability degrees (whether acceptance or rejection or degrees between) and acceptability factors (why) by involving different innovative ideas and the various perspectives of local actors.

The second objective includes the following research questions:

RQ2a) To what degree do local actors (mainly landowners and farmers) accept sustainability innovations to revalorize wetland meadows in the SP?

RQ2b) Which factors influence the decisions of local actors and what are the linkages among factors?

Objective 3: Relate acceptability to collaborations using the SP as an example

This objective explores the relationship between acceptability issues and collaborations for collaborative landscape management. In particular, the role of acceptability degrees in relation to specific acceptability factors for initiating collaborations is examined.

The following research question specifies the third objective:

RQ3) How can the relationship between empirical acceptability issues, mainly in terms of factors and degrees, and collaborations for a collaborative landscape management be described?

1.5 Connections between papers and objectives

This dissertation comprises five papers (P1 to P5) that are strongly interconnected. Each of the papers seeks to contribute to the above-formulated research objectives. P1 and P4 primarily address the conceptualization of acceptability (objective 1). P1 aims at defining acceptability on the basis of a comprehensive and systemic literature review of the state-of-the art of acceptability studies in the field of land use and landscape planning (corresponds to RQ1a). P4 deals with

integrating complex acceptability processes into landscape design and management (corresponds to RQ1c). P2 and P3 apply a new acceptability framework based on the acceptability definition (RQ1b) and analyse acceptability degrees and factors. These two empirical papers mainly contribute to the second objective (corresponds to RQ2a and b). By explaining and using the framework of acceptability, both papers can also contribute to the first objective. P5 sheds light on the relation between acceptability and collaborative landscape management. This last paper addresses objective 3 and corresponds to RQ3. Figure 1 illustrates the interconnectivity of the five papers and their aspired contribution to the three research objectives. If the papers are able to meet the objectives and fill the corresponding gaps, how they do so is described in detail in the synthesis section. Furthermore, in that section, I discuss and reflect on the role of the five contributing publications in landscape planning and management by applying the 10 landscape approach principles as a framework (Sayer et al., 2013).

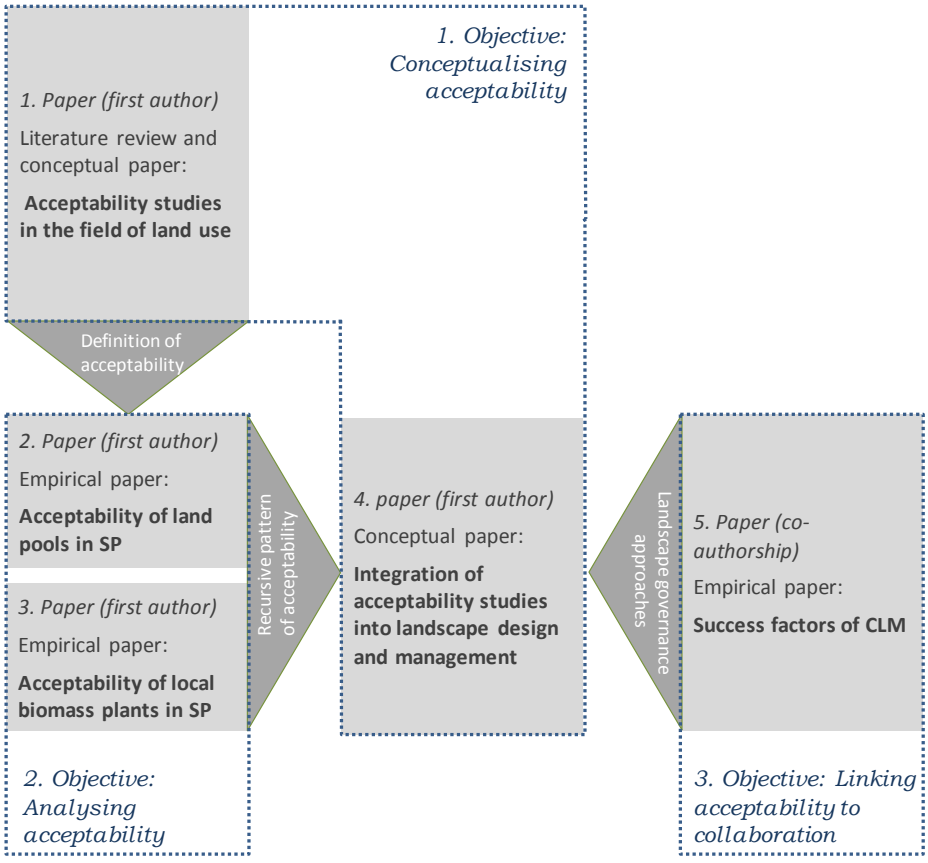

Figure 1: Contributions of the papers to the research objectives and the connections among papers

2. Research philosophy, methodology, assumptions, concepts

2.1 Disciplinary anchor of the research

The disciplinary anchor of this thesis is on landscape planning and research, with a strong focus on the sociological components within these research fields. Acceptability studies are generally associated with environmental sociology. More specifically, however, the research field of this thesis could be termed social-ecological research or even 'landscape sociology'. The latter is a relatively new research field and is still not very widespread. Greider and Garkovich (1994) define landscape sociology as the *"study of how human beings' relations with their landscapes are shaped by the social relationships in which they interact."* In line with the working group 'Landscape and environmental sociology' of the University of Melbourne, it *"focuses on everyday practices, policy and planning relating to natural resource and environmental management ..."* Given the above, this dissertation is interested in studying processes within social-ecological systems, and procedural justice to deal with current sustainability issues.

2.2 Research philosophy

Many studies strongly recommend that researchers always reveal the research philosophy[2] that underpins their work, including statements on its ontology[3] and epistemology[4] (Moon et al., 2019, 2016; Saunders et al., 2009). Doing so enables others to understand the researchers' position and assumptions and to explore the relationship between researchers and their subjects (Moon et al., 2016). Different research philosophies lead to different research assumptions and methodologies (Moon et al., 2016). Generally speaking, the research philosophy also has an influence on the choice of research design, methodology, methods, and questions (Moon et al., 2019). Thus, each philosophy requires its own research logic.

The underlying ontology of this dissertation is a constructivist position (cf. Guba and Lincoln, 2005; Patton, 2002), which means that people construct the reality of an object and their

[2] The research philosophy is the basic reference system related to how scientific knowledge is developed (Saunders et al., 2009).

[3] Research ontology refers to theories of existence. Defining the ontology means to make 'assumptions about the nature of reality' (Saunders et al. 2009, 127).

[4] Research epistemology refers to theories of human cognition. The researcher makes assumptions about how acceptable knowledge can be created and how to communicate this knowledge to others (ibid).

knowledge using their own experiences, values, and perceptions in interacting with others and the world. Thus, various and even conflicting subjective realities can coexist. These subjective realities are a product of socio-cultural and historical interpretations made by humans (cf. Moon et al. 2019, 2016). Constructivism is especially interested in understanding the construction of subjective realities and the impact of these constructions on social lives and interactions (Patton, 2002). In terms of epistemology, I conduct interpretive research to gain insights into social realities and the construction of meanings through an interpretive understanding of documented statements (empirical data in the form of audios and text documents) (Kleemann et al., 2013). Using the 'research onion' scheme (Saunders et al., 2009), figure 2 summarizes this research philosophy, research approach, methodology, research design, and the applied methods of this dissertation.

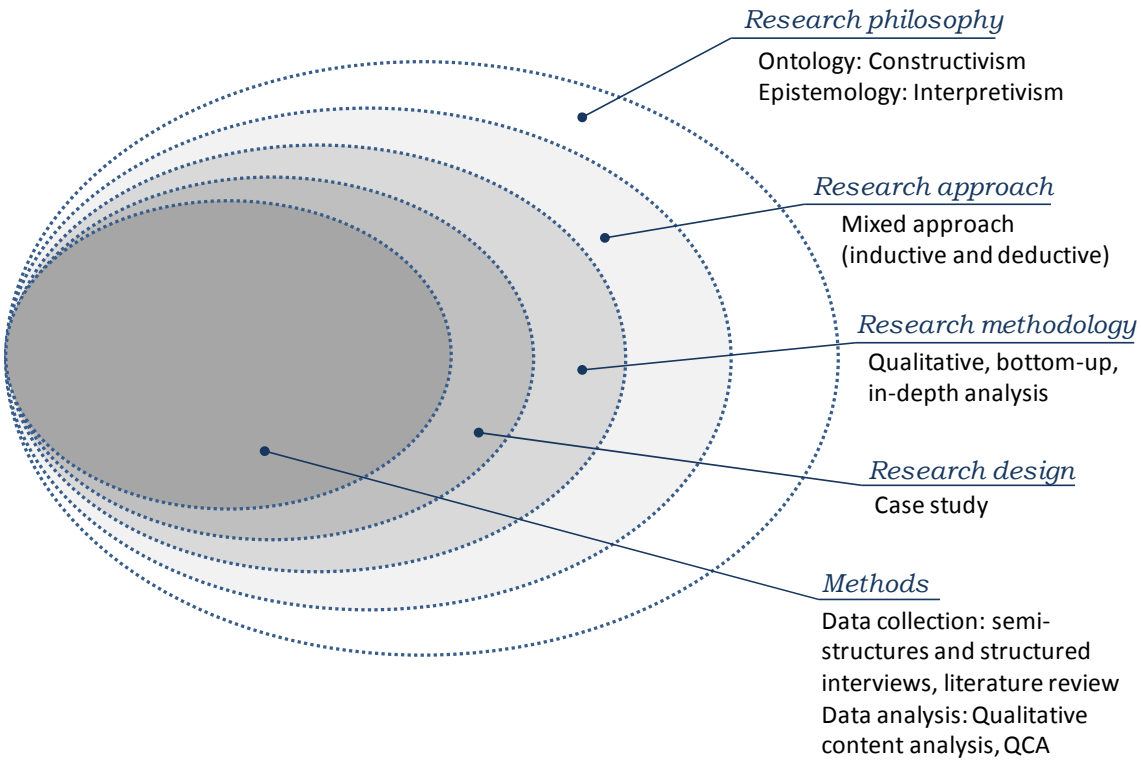

Figure 2: The 'research onion' of this dissertation (based on Saunders et al. 2009)

2.3 Methodology

As displayed in the research onion (figure 2), this dissertation uses a qualitative and bottom-up methodology. According to this research methodology, taking local problem framings and the involvement of local actors into account is crucial to scientifically addressing real-world problems in empirical studies. Only by doing so can meaningful and deep insights be obtained and adequate goals for the sustainable transformation of social-ecological systems (e.g., landscapes) be established (Reed et al., 2006). The bottom-up methodology is distinguished from the expert-led and top-down methodology. The latter is less appropriate for exploring social-ecological systems because, according to Reed et al. (2006, 407) top-down methodology is grounded in 'scientific reductionism' and aims at quantifying factors without taking into account the 'variety of resource user perspectives'. Using case studies fits perfectly into the qualitative and bottom-up methodology. This dissertation is based on a multiple and embedded case study design as it is depicted in figure 3. According to Yin (2013), case studies are adequate for in-depth investigations of a current phenomenon or problems within a real-word context. The topic of my empirical work – a sustainable solution for the wetland meadows in the SP region – is one such real-world problem.

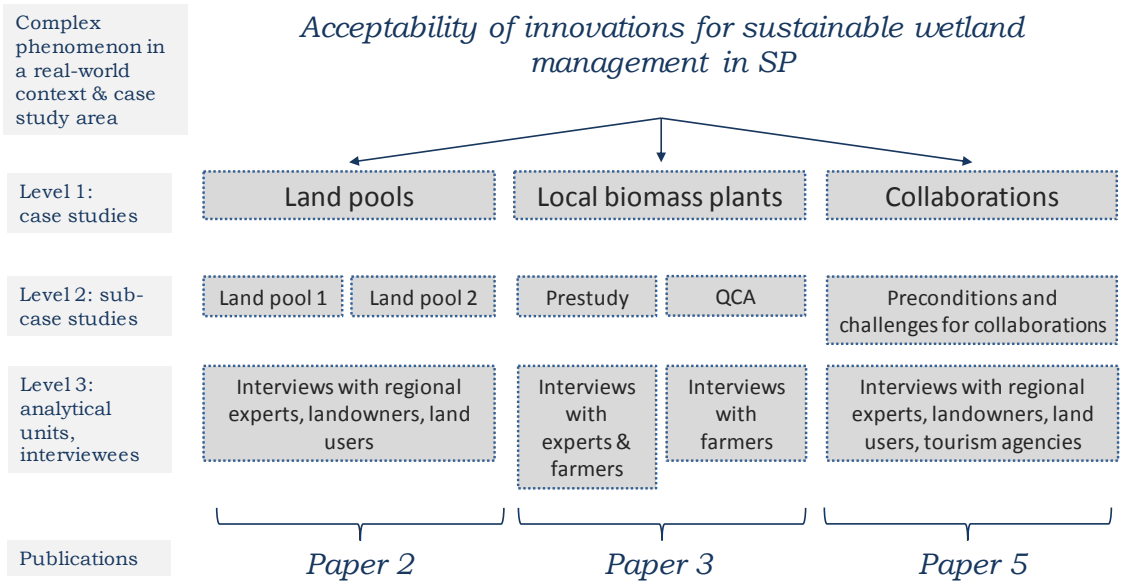

Figure 3: Multiple and embedded case study design of this dissertation (based on Yin 2013)

The research design includes three case studies within one case study area (multiple case study design). Each of these three case studies covers numerous analytical units; therefore, it is an

embedded case study design. Each interview conducted represents an analytical unit. The selection of the case studies is purposeful and strongly oriented to the problem setting in the SP. As for the 'land pools' case study, the selection of the analytical units (interviewees) targets a complete survey, which means that all involved and known landowners in the area were interviewed. In the 'local biomass plants' and 'collaborations' case studies, a thematic saturation through snowball sampling and key informants (interviews with regional experts) was used to gain information-rich cases and an improved understanding of the phenomena (Mayring, 2007; Onwuegbuzie and Leech, 2007; Patton, 2002). Thematic saturation is reached if information redundancies emerge and no new elementary information for the overall story can be added by further interviews. This research procedure includes ongoing reflection, iterative analysis and interpretation of data, and snowball sampling, which are typical in circular research designs (Hennink et al., 2011; Patton, 2002). Such a circular research design is applied in this dissertation as shown in figure 4. The qualitative data in the form of semi-structured and structured interviews is analysed by applying two qualitative oriented research methods: qualitative text analysis (Kuckartz, 2014) and qualitative comparative analysis (Ragin, 2000; Schneider and Wagemann, 2013). In line with the constructivist and interpretivist paradigm, this dissertation aims at analytic generalization, within-case comparison, and case-to-case transfer instead of predicting or extrapolating probabilities (external statistical generalization) (Onwuegbuzie and Leech, 2007; Yin, 2013). The development of the concept of acceptability corresponds to incremental-inductive theory building and experience-based conclusions (Patton, 2002). There are specific standards in qualitative research that rely on methodical rigour but follow a different logic than that in quantitative research. Whereas the logic in quantitative research is based on linear designs, qualitative research is characterized by circular and reflexive designs. The common ground on quality criteria is process-oriented and encompasses 1) disclosure of previous assumptions, 2) researcher-interviewee relations, 3) a rule-based procedure, 4) documentation, and 5) reflections and communicative validation (Kuckartz, 2014). These criteria also apply to this dissertation.

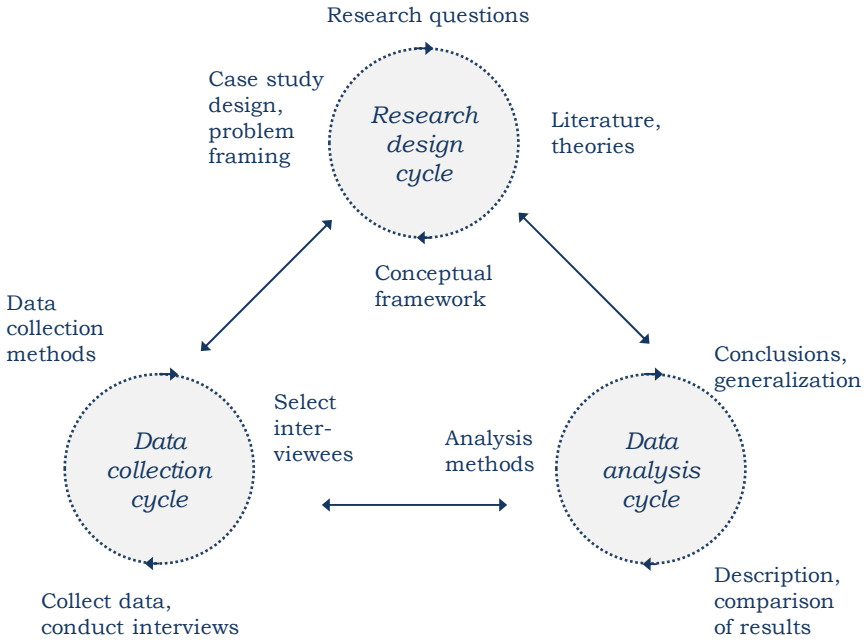

Figure 4: Circular research design of this dissertation (based on Hennink et al., 2011)

2.4 Researcher's role

This section reflects on the relationship between the researcher and the case study participants. Such a reflection can be seen as a self-assessment of the study's subjectivity. To do so is important because subjectivity is always an issue in science (Moon et al. 2016). Each researcher is connected in a complex manner to her/his research object. The philosophical position and the previous theoretical and practical knowledge (knowledge of livelihood, study area, and research topic) influence researchers in regard to their choice of methodology and research questions. Studies on the same topic or that analyse the same data source but from different disciplinary perspectives can yield very different results (Moon et al. 2019). Reporting on subjectivity is essential for high-quality research in terms of reducing bias and increasing the reliability of the research (ibid.). "*Subjectivities of the researcher are not necessarily understood as something to be controlled for in the way experimental bias may be treated. Instead, the unique value brought to the research process by the researcher (e.g., Fontana & Frey, 2005) must be recognised and explicated throughout the research, from the methodological design through to communication of the findings"* (Moon et al. 2019, 6). However, unintended bias should be avoided. With these considerations in mind, I briefly report on the subjectivity in this research. Because my previous theoretical knowledge is already revealed through the dissertation's basic assumptions, I focus on

my knowledge of the case study: my knowledge of the SP was minimal at the beginning of the research process. I had never previously conducted research in this region and knew the SP only from the literature and reports. A major advantage of this fact was that I was perceived as an external and neutral individual by the interviewees, which positively influenced the research process because the locals' opinions of me were not biased through any previous activities in the region. Consequently, the local participants were open-minded during the interviews, gave honest answers, and also mentioned critical points. In contrast, my initially minimal knowledge of the region (e.g., knowledge of very specific localities and their environmental problems) can somehow be considered a disadvantage in the research process. In time, however, this constraint has diminished because knowledge creation has increased through my own empirical work (explorative interviews) and through practical exchanges with research colleagues and regional project partners.

2.5 Basic assumptions

Revealing the basic research assumptions and hypotheses[5] makes a study's research philosophy and the researcher's previous knowledge explicit (Moon et al. 2016, Meinefeld 1997). The basic assumptions underlying this dissertation are the following:

1) According to the constructive research perspective, the concepts of landscape, nature conservation, sustainability, and the social values of nature are socially constructed (e.g., Kenter et al. 2018, Ott 2016, Antrop 2006, Greider and Garkovich 1994). These concepts are charged with symbolic and aesthetic meanings, and their perception is based on subjective and socially influenced observations and experiences (Antrop, 2006). Given this assumption, nature conservation problems can also be considered to be social problems (Moon and Blackman 2014).
2) There are multiple interactions between humans and their environment that shape cultural landscapes (e.g., Stern 1993). Thus, landscapes should be understood as social-ecological systems (Antrop, 2006; Opdam et al., 2016; Ryan, 2011; Westerink et al., 2017). The main issues in research focusing on human–environment interactions and social-ecological systems are human driving forces of environmental change, peoples' perception of landscape change,

[5] Due to the specific logic of qualitative research, the hypotheses can be more open, as in quantitative research. There is thus no restriction to 'if, then' hypotheses which aim at verifying or falsifying hypotheses. I consider basic assumptions and hypotheses as possible terms, because in P2 I used the term 'hypotheses'.

the effects of environmental degradation on the well-being of people, the effective sustainable management of multifunctional landscapes, and the dynamics of public concerns about environmental issues.

3) Acceptability in the field of land use and landscape planning is a multifaceted concept that can be adequately investigated through the lenses of social-ecological systems and environmental sociology (Lucke, 1995) because the decision making underlies social norms, peoples' social values of nature, and power relations. This assumption is in line with the environmental ethics of value dimensions in nature conservation (Ott, 2015).
4) To address and solve the complex real-world problems we face today, deliberative and collaborative processes are considered promising approaches. This advocates for a TD as a guiding research principle in which co-production of knowledge, mutual social learning, and flexible and collaborative decision making between science and practice are inherent (Dramstad and Fjellstad, 2011; Hazard et al., 2018; Zscheischler et al., 2017).
5) Westley et al. (2011) note that the capacity of humans to innovate should be used to support global sustainability issues. Similar is formulated in the SDGs. Complex problems in landscapes require innovative solutions and innovation thinking to transform them into more sustainable landscapes (Bodin, 2017; Campellone et al., 2018).

2.6 Main concepts

This section is devoted to the most important concepts used throughout the dissertation, which could not be fully explained in the papers. The following main concepts are introduced in detail:

- Acceptability (own concept)
- Sustainability innovations
- Values of nature

Acceptability from a social-ecological and constructivist perspective

This paragraph describes in detail the acceptability framework developed for this dissertation project, as it is the basis for the empirical studies. At the same time, this framework is also the result of the research I performed in this dissertation, as it addresses objective 1: 'conceptualizing acceptability'.

As noted in the state-of-the art section, there is no consensus about how to theoretically and conceptually understand acceptance and acceptability. As recommended by Fournis and Fortin

(2017), I distinguish between acceptance and acceptability to underline their scientific determination and significance instead of their meaning as everyday terms. In this sense, acceptance is the positive outcome of a judgement process towards an object. As positive affirmation acceptance is the opposite of rejection and can be differentiated from other outcomes such as tolerance or conditional acceptance.

In contrast to the term acceptance, acceptability is a multifaceted theoretical concept that seeks to reveal and understand actors' judgement processes which lead to specific decisions on acceptance, rejection or a degree between both. The multiple facets of the acceptability concept are depicted in figure 5 and described in-detail in the following. The definition of acceptability is primarily based on two of my papers (Busse et al., 2019; Busse and Siebert, 2018) and uses valuable theoretical considerations from the body of literature on acceptance and acceptability (Kollmann, 1998; Lucke, 1995; Sauer et al., 2005; Wolsink, 2010): Acceptability encompasses complex, dynamic, and multi-configurational decision processes that are made by acceptability actors. The decisions – so-called acceptability decisions – are based on values, convictions, rational considerations, and social norms that are formed in reflections with oneself and in discussions with others. There are multiple interactions (in terms of active examination and reflection) among the acceptability actor, the specific acceptability object, other actors, and the context that lead to the acceptability decisions (Lucke, 1995). These decisions can vary over time, e.g., when new insights emerge and are considered and are thus seldom static once articulated. This phenomenon can be called a 'recursive pattern of acceptability' (Ganzevles et al., 2015). I distinguish between several possible 'degrees of acceptability decisions', which can range from negative degrees, such as opposition or rejection, via intermediate degrees (tolerance, indifference, conditional acceptance) to high acceptance or even engagement (Sauer et al., 2005a; Wolsink, 2012). Inspired by Kollmann (1998), Lucke (1995), and Wolsink (2010) the concept of acceptability considers not only attitudes but also includes decisions regarding actions and long-term use or evaluation. Therefore, acceptability decisions can be made by actors and investigated by the researcher at one of three different acceptability levels: the attitude level, action level, or utilization level. At the attitude level, the actors express their judgements, which are attitudes towards an acceptability object without acting. At the action level, the subjects take action (e.g., adopting an innovation or collaborating in a landscape governance arrangement) on the basis of their attitudes and by taking practical implications into account. The utilization level refers to the monitoring and evaluation of the long-term use of an innovation. Additionally, acceptability studies can be conducted on different spatial scales (local, regional, national, international), as

explained by Fournis and Fortin (2017) and Wolsink (2010). If possible and recommendable, the interactions among these scales should also be treated in acceptability studies. The consideration of scales is part of the acceptability context, in the same manner as institutional settings and political conditions.

In this holistic framework, it is possible to conceptually frame and structure complex acceptability phenomena from a constructive perspective in social-ecological research. By corresponding to the paradigm of qualitative research, the framework supports explorative and inductive analyses in which influencing factors are not determined ahead of time. This might be suitable for cases where some factors are previously unknown or where the aim is to elicit interviewees' own arguments without being limited by a narrow set of survey items. The framework is applicable to a broad range of acceptability phenomena in different real-world landscape contexts.

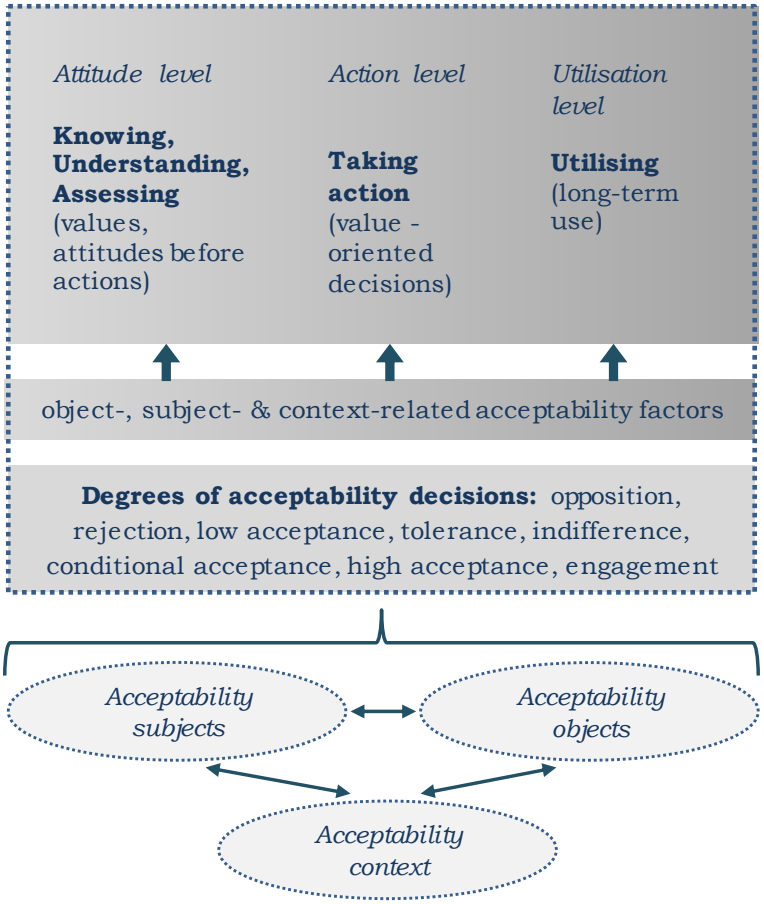

Figure 5: Conceptual framework of acceptability; my own design in accordance with (Kollmann, 1998; Lucke, 1995; Sauer et al., 2005; Wolsink, 2010). Acceptability as a concept comprises a dynamic interaction between the actors, the acceptability object, and the context. These interactions and reflections are the basis for the articulation of value-based factors that result in actors' acceptability decisions. There are several degrees of acceptability decisions that can range from opposition to engagement. Acceptability decisions are made at a specific level (attitude, action, or utilization level).

Sustainability innovations

In this dissertation, I use the term 'sustainability innovation' to describe the solutions and ideas that contribute to transforming the landscape into more sustainable systems (cf. basic assumption 5). A better understanding of the purpose of 'sustainability innovation' is crucial to explaining the term's two components: 'sustainability' and 'innovation'. Since the Bruntland Report and the iconic self-commitment of Rio 92 by the world community aiming at sustainable development, the terms 'sustainability' and 'sustainable development' are on everyone's lips and on the agenda of all spatial levels of politics (e.g., Local Agenda 21, German Sustainability Strategy, SDGs) and of most research institutions. Meanwhile, as an outcome of the ongoing debate on complex sustainability problems and challenges, there have emerged several, continuously increasing research fields, such as sustainability transformation (Weiland et al., 2017), sustainable land use (Aznar-Sánchez et al., 2019), and sustainable consumption research (Vergragt et al., 2014), culminating in the proclamation of a new discipline: 'sustainability science' (Brandt et al., 2013). The most widespread and prominent definition of sustainable development was elaborated by the World Commission on Environment and Development, which described it as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (WCED, 1987: 54). This concept integrates the social, environmental, and economic dimensions as the fundament of human–environmental interactions; and it is grounded in the postulation of intergenerational, distributive, and procedural justice (Meadowcroft, 2007). In coping with urgent and complex sustainability problems worldwide, expressed, for instance, through planetary boundaries (Rockström et al., 2009) and the call for 'sustainable development' (in terms of SDGs), innovation has played a special role because it generates renewal, reform, and transformation (Campellone et al., 2018; Elzen and Wieczorek, 2005; Klewitz and Hansen, 2014; Westley et al., 2011). Independent of their purpose, innovations are new, perceived as new, or improved products or ideas that are already implemented in a system, as opposed to inventions, which are precursors to innovation (Klewitz and Hansen, 2014). Generally, the literature distinguishes among product, process, organizational, and social innovations, as well as between disruptive innovations (radical renewals) and incremental innovations (step-by-step renewal based the improvement of existing matter) (ibid). For innovations that strive for sustainability and the transformation of social-ecological systems, several synonymous terms are used, e.g., eco-innovations (Rennings, 2000), sustainable innovations (Stock et al., 2017), and sustainable-oriented innovations (Klewitz and Hansen, 2014).

Such innovations can be advanced nature-based and technical solutions, ground-breaking types of landscape co-management, alternative financing options, new social initiatives or sophisticated process design. Elzen and Wieczorek (2005) note that to effect the transformation of current socio-technical and social-ecological systems to more sustainable ones, incremental innovations are not sufficient; instead, changes in several systems and regimes must be accomplished simultaneously in a 'co-evolution' process. The concept of 'sustainability innovation', as used in this dissertation, includes such a systemic dimension of innovations.

Social values of nature compared to ecosystem services and nature's contribution to people

Since basic assumptions 1) and 3) rely on the reflection of the 'social values of nature', this is an important issue in this dissertation. In line with Kenter et al. (2015, 2018), I define 'social values' as a system of social norms and ethical assumptions that penetrates a common good (e.g., nature or landscapes) or a society. Social values are formed through social interactions among people who are socialized in a certain system of social and cultural norms (Kenter et al., 2015). Social values dynamically interplay with individual values by constituting each other. Thus, social values in a society or community can strongly influence individual values, and at the same time, individual values become socially shared and capture collective meanings through processes of socialization, including deliberation and internalization (ibid.). The relationship of people with 'nature' or landscapes is always value-based because people bring 'nature' into interconnection with human existence (Ott, 2015; Wolsink, 2018). In this dissertation, I use the term 'nature' according to the definition by German environmental ethicist Konrad Ott (2015, 2018)[6] and distinguish between three types of 'social values of nature': 1) intrinsic, 2) instrumental, and 3) eudemonistic values (figure 6).

[6] He defines 'nature' as a pluralistic concept with a broad spectrum of meanings. At one pole is the 'unspoiled wilderness', and at the opposite pole are urban spaces. Between both poles are various entities, e.g., plants, animals, soils, forests, mires, meadows (Ott, 2018). 'Nature' is the central research topic of environmental ethics and sociology and describes the non-human environment as a counterpart to human life. Both sub-disciplines deal with questions about human nature or human–environmental interactions, including the blurring of the dichotomy between human life and non-human environment or nature.

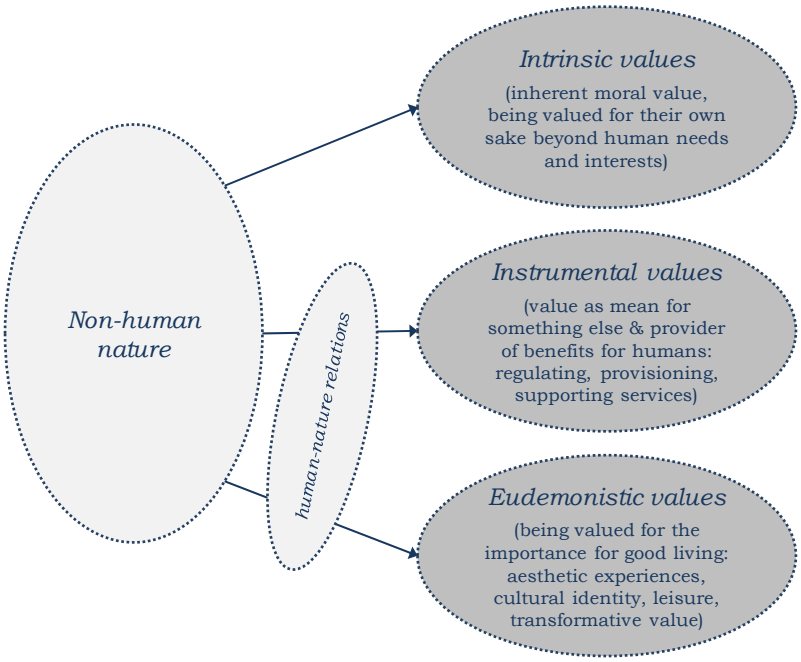

Figure 6: Categories of social values of nature (based on Ott 2015)

Generally, the social values of nature can be seen as an umbrella term that also embraces the concepts of ecosystem services (ES) and of nature's contribution to people (NCP) (De Vreese et al., 2019; Kenter, 2018). Since the influential study by Costanza et al. (1997), the reports by the Millennium Ecosystem Assessment (MA, 2005), and The Economics of Ecosystems and Biodiversity (TEEB, 2010), the ES concept has gained an increasing amount of attention and has been mainstreamed in research and policy (de Groot et al., 2010). The MA (2005) conceptualized the division into provisioning, regulating, cultural and supporting ES. Despite its seminal impact on research and policies and the growing ES community, a certain criticism has arisen among social scientists and environmental philosophers: The implementation of ES-based planning and management processes in practice has, to date, been limited because the ES concept is less familiar to people and far removed from their perceptions and values of nature (De Vreese et al., 2019; Díaz et al., 2018; Opdam et al., 2016; Westerink et al., 2017). The ES concept neglects mutual human–nature interrelations, is focused on instrumental values, cannot fully capture intrinsic and eudemonistic values, and excludes cultural diversity such as indigenous and local knowledge (Chan et al., 2016; De Vreese et al., 2019; Díaz et al., 2018; Ott, 2015). These shortcomings can result in demotivating actors from collaborating in the sustainability transformations of landscapes (De Vreese et al., 2019). Furthermore, the separation of cultural ES from regulating and provisioning ES should be rethought because all these service categories are intertwined (Chan et al., 2016; De Vreese et al., 2019; Plieninger et al., 2015). Ott (2015) and Chan

et al. (2016) also criticize that through the demand–supply divide and economic valorisation principle, ES and, especially, payments for ES are further applications of mere economic thinking about natural goods. The overall value of nature cannot be captured through economic valuation because it only calculates the costs and benefits of changes in natural goods (Ott, 2015).

One alternative concept is that of landscape services, which applies ES at the landscape scale to connect human values to landscape structures at the local level (Termorshuizen and Opdam, 2009; Westerink et al., 2017). Landscape services are more appropriate in community-based or collaborative landscape approaches than ecosystem services because landscapes are more familiar to people than the concept of ecosystems (Westerink et al., 2017) and facilitate TD collaborations (Opdam et al., 2016). However, landscape services still rely on the ES conception, and there remain many criticisms.

To overcome some of the above-mentioned shortcomings of ES by incorporating the diversity of knowledge sources (indigenous and local knowledge), by recognizing culture and insights from social sciences (instead of focusing on economics), NCP has been conceptualized (De Vreese et al., 2019; Díaz et al., 2018; Kenter, 2018). As an outcome of the current debate about which is the most suitable concept, NCP has been added to the IPBES report published in 2017 (Díaz et al., 2018). Nonetheless, Kenter (2018) remains critical, remarking that NCP, similar to ES, is grounded in instrumental values and on the idea of a one-way relationship between nature and people (Kenter, 2018). I share his criticism and prefer applying the more holistic concept of the social values of nature because *"in the end, we can only integrate values into environmental governance, not services or contributions — ultimately it is the societal importance ascribed to nature that matters"* (Kenter 2018, 40).

3. Acceptance studies in the field of land use — A critical and systematic review to advance the conceptualization of acceptance and acceptability (Paper 1)

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Acceptance studies in the field of land use—A critical and systematic review to advance the conceptualization of acceptance and acceptability

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ABSTRACT

Despite the increasing importance of studies dealing with acceptance in the field of land use, few theoretical-conceptual reflections and reviews have been published. To address this gap, this paper offers a critical and systematic review of recent literature regarding acceptance and land use. Our aim is to synthesise the contributions of these publications in order to advance scientific debate on this topic. The data set consists of 132 peer-reviewed journal articles and book chapters and is dominated by empirical papers (mostly quantitative studies) and European case studies. Renewable energy appears as the most important thematic issue, followed by sustainable land use. In these studies, many researchers did not define acceptance or apply a theory. It seems to be perceived as an everyday term with a clear meaning. However, this review reveals that there is no common understanding of acceptance; instead, the given definitions and characteristics are sometimes even contradictory. Acceptance is often considered a positive and desirable outcome of planning projects. Only a few authors understand acceptance as a complex phenomenon. As a cross-sectoral research topic, it applies theories from different disciplines and research fields (psychology, sociology, and innovation research), even though the use of these theories within disciplines is not consistent. Most empirical studies address influencing factors with the aim of explaining decisions about acceptance. However, the theoretical foundation underlying the selection of factors is often weak. Therefore, we recommend that researchers engage in a thorough reflection of notions and concepts, suitable and sound identification of influencing factors. In concluding with our own theoretical-conceptual reflections, we support the idea that acceptance and acceptability should be distinguished to gain more clarity in the use of terms. Thus, acceptability encompasses actor-based and dynamic decision processes. The decisions are products of interactions among the actors, the object, and the context. They can be assigned to a particular degree (from rejection to acceptance or engagement) and made at the attitude, action, or utilization level. Finally, we believe that further research can benefit from this advanced concept of acceptability.

1. Introduction

When developing a successful planning, decision-making, and implementation process, it seems essential to consider the acceptance of innovations, measures, or projects (e.g., Stigka et al., 2014; Hitzeroth and Megerle, 2013). Consequently, acceptance has recently become an important issue in the research field of land use and sustainability science. The increasing importance of this issue is reflected in the growing number of publications concerning acceptance and land use in recent years. These publications are mainly empirical case studies with different foci covering a broad range of subjects (Schenk et al., 2007). Each publication contributes its specific aspects and perspectives to the application-related debate about acceptance. Only a few theoretical and conceptual reflections and reviews of acceptance have been published. Existing (bibliometric) reviews focus only on energy issues and do not include other land use issues (e.g., Gaede and Rowlands, 2018; Rand and Hoen, 2017; Fournis and Fortin, 2017, p. 5). Furthermore, the terminological, ontological, and theoretical bases of studies are rarely analysed. To fill this research gap, a comprehensive and broad review of literature related to acceptance and land use is long overdue.

This paper offers a critical reflection on the current state of acceptance studies regarding land use changes that encompass a broad range of topics. It aims to reflect and synthesise publications' contributions to the theoretical-conceptual understanding of acceptance and their relation of those contributions to each other in order to advance the debate on acceptance. Therefore, we systematically reviewed scientific publications that address acceptance issues within the field of land use. We analyse and discuss their research topics and intentions, epistemological and ontological foundations and linkages (definitions, theories, and concepts), applied methods, and the role of factors in acceptance

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studies. We conclude with our own theoretical-conceptual reflections about acceptance.

In this review, we include the following questions:

- What are the main research topics and intentions?
- Is there a common understanding of acceptance? What definitions are used in publications?
- How are other frequently used concepts (acceptability, perception, attitudes, etc.) distinguished from the concept of acceptance in the literature?
- In which disciplines are acceptance studies based? Which disciplinary theories have been used to explain acceptance?
- What role do factors play in explaining the acceptance phenomena?

2. Methods

2.1. Systematic literature review

We systematically reviewed the peer-reviewed scientific literature that addresses acceptance issues within the field of land use. Systematic literature reviews seek *"comprehensively identify all relevant studies to answer a particular question, and assesses the validity (or 'soundness') of each study taking this into account when reaching conclusions"* (Petticrew and Roberts, 2006, p. 39). To deliver clear scientific communication and produce valid results, literature reviews must be systematic, explicit, transparent, and reproducible in their methods (Fink, 1998; Booth et al., 2012). Following these core principles, we designed and documented the methodological procedures that were used for this review, which we detail below.

2.2. Literature search and selection, framework for analysis

We performed an online literature search to identify publications on acceptance in the context of land use. First, we used the major digital bibliographic databases Web of Science (formerly ISI), Science Direct, and Springer Link to search for scientific peer-reviewed publications from 1995 to December 2017. We limited the literature search to English-language publications. In an advanced search, we used the following search terms in each database: "*acceptance*" AND *"land use" / "land management" / "sustainable land use."* We checked the relevance of the articles by screening the titles, abstracts, and keywords. The publications identified as relevant were added to an Excel database. The publications were analysed quantitatively in terms of absolute and relative frequencies. They were also analysed qualitatively. The quantitative analysis criteria included the article type, land use type, year of publication, case study area, and frequencies of the use of definitions and theories. Additionally, the content of used definitions, the conceptual characterization of acceptance, the use of theories, and the role of acceptance factors were qualitatively analysed to gain a deeper understanding of the theoretical-conceptual foundation of acceptance studies. When the study began, the analysis criteria were determined to provide an overview of the body of literature. After an initial analysis, the criteria were revised and refined based on the information provided in the articles.

3. Results and discussion

3.1. Description of the data set

The data set consists of 132 publications, including articles in journals and book chapters. The vast majority of them are empirical papers with their own research data (102 papers,). The remaining publications are empirical plus conceptual (9), theoretical plus conceptual or viewpoint papers (short articles on opinions) (11), or thematic reviews regarding meta-studies (10). The results reveal that the field of scientific acceptance publications is strongly dominated by empirical studies with quantitative data generation and analysis. More than half (68 papers,) of the empirical papers (111 when the empirical plus conceptual papers are included) used quantitative methods, such as surveys, experiments, and modelling. Only 19 empirical papers () used qualitative methods in terms of interviews and group discussions. In all, 18 papers () applied a mix of qualitative and quantitative methods, and 5 comparative case study analyses were carried out.

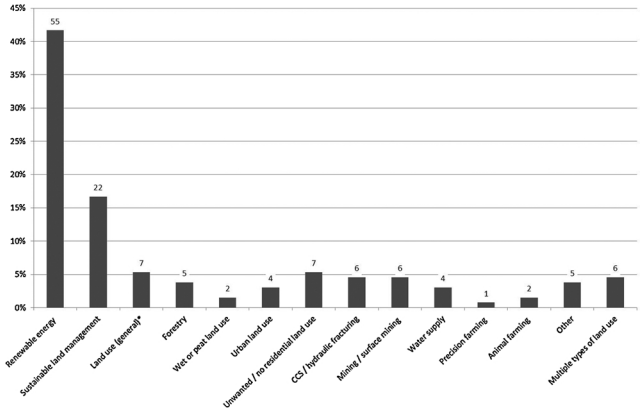

Fig. 1. Publications systemized according to thematic foci (n = 132).
* Land use (general) includes intensively used arable land, agricultural landscapes, land consolidation, and rural landscapes.

Analysing the geographical distribution of the case study areas reveals that most research was conducted in Europe (61 case studies,). Asia (19 case studies,), North America (17 case studies,), and Australia (13 case studies,) have roughly the same number of case studies. Little research data was gathered from Africa (6 case studies) or Latin America (3 case studies). The remaining studies were either intercontinental (6 case studies) or not locatable (7 case studies). We did not consider the geographic distribution of research institutions and authors.

Fig. 1 shows that the thematic focus of these studies is clearly related to renewable energy issues, such as projects wind turbines, bioenergy plantations, biofuel, biogas or geothermal power facilities, waste to energy, and photovoltaics. The second most important issue is sustainable land management, which includes research on landscape and nature conservation measures, the maintenance of ecosystem services (including biodiversity), agri-environmental schemes, soil and water conservation measures, and dry-land farming. Each of the remaining thematic categories only covers a very small number of publications (Fig. 1).

The range of specific issues within these topic categories is broad, but many of them can be subsumed under innovative technologies and land use and management practices. Regarding research intentions and priorities, the majority of publications aim to assess the degree of acceptance and to identify explanations for specific acceptance outcome in terms of fostering and inhibiting factors. These publications also seek to provide recommendations for increasing acceptance outcomes. In addition to these research intentions, some papers deal specifically with trade-offs between different land uses (e.g., Caporale and de Lucia, 2015) and affected actor groups (e.g., Tudor et al., 2015), acceptance type classifications (e.g., Wüstenhagen et al., 2007), specific links between selected acceptance factors (Wolff and Herzog, 2014), and the assessment of acceptance-enhancing measures (Anderson et al., 2012). The result of screening research intentions is congruent with the high number of empirical publications.

In the last 10 years, acceptance has received increasing attention, as depicted in the graph of chronologically ordered publication dates (Fig. 2). The vast majority of papers () have been published since 2010.

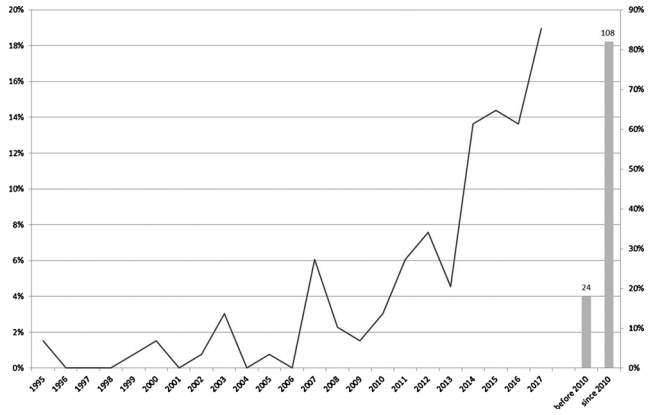

Fig. 2. Accumulated publications on acceptance over time (n = 132).

3.2. Definitions of acceptance and distinction from related terms

More than half of the analysed studies do not offer a definition of acceptance. The observation of Wüstenhagen et al. (2007, p. 2684) that "clear definitions are rarely given" in the "practical policy literature" is still true for the analysed publications in this review. For the authors of those studies, which include researchers, planners, and policy makers, the term acceptance seems to be a practical, everyday term that is commonly understood and does not require any explicit definition (e.g., Lucke, 1995; Wüstenhagen et al., 2007). This review instead reveals that there is no common understanding of acceptance (Wolsink, 2012) but that there is a rather broad diversity of definitions with regard to different dimensions (e.g., public, social), including different aspects and characteristics of acceptance. When compared, the definitions are often inconsistent with each other, and their formulation is sometimes vague. These definitions of acceptance, which sometimes overlap or even contradict each other, are summarized in Table 1 and discussed in Section 3.3. The most cited definition in the reviewed publications is that given by Wüstenhagen et al. (2007). This applies in particular to papers on renewable energy issues (Raven et al., 2009; Huber et al., 2012; Sovacool and Ratan, 2012; Chin et al., 2014; Hammami et al., 2016; Höltinger et al., 2016), as well as other issues such as carbon dioxide capture and storage (CCS) (van Os et al., 2014; Haug and Stigson, 2016) and afforestation (Williams, 2014). The definition of Wüstenhagen et al. (2007) contributes to the classification of different types of acceptance rather than to the characterization of the phenomena. These types, including socio-political acceptance, community acceptance, and market acceptance, are further explained in Subsection 3.3.2.

In our opinion, presenting one generalized and integrative definition of acceptance is challenging. The intention and usage of a concept depends on its thematic and disciplinary context. Acceptance as research area has various disciplinary relations (see also Subsection 3.4). However, we are convinced that defining the key terms and concepts is generally necessary to make one's own work comprehensible to others, to provide guidance for the logical structure of the paper and to reflect on one's own understanding of a concept. Definitions are also an elementary component of theories (Turner, 1991) and therefore a principle of good scientific practice, especially in an interdisciplinary or transdisciplinary context.

Furthermore, defining acceptance helps to distinguish acceptance from related terms and concepts. In this review, we identify and analyse the most frequently used terms and concepts related to acceptance, such as *acceptability, legitimacy, attitudes,* and *perception*.

The term *acceptability* is mentioned in only some publications (e.g., Easterling and Kunreuther et al., 1995; Fournis and Fortin, 2017; Shindler et al., 2002; Williams, 2014). By focussing on renewable energy projects, Fournis and Fortin (2017, pp. 5) offer an elaborate and comprehensive definition of *acceptability* and underscore the multifarious processes of interactions between technology and social actors on different spatial scales. They distinguish between micro-social, meso-political, and macro-economic levels. Similarly, Shindler et al. (2002) define *social acceptability* as a process recognizing its socio-political dimension. Additionally, they highlight the existence of different degrees of *acceptability*. In both publications, *acceptability* is contrasted with *social acceptance*, and the latter is seen as a positive degree of *acceptability* and a desirable outcome for planning projects. Heldt et al. (2016) understand *acceptability* as a property of an object to be accepted and *acceptance* as a result that is influenced by several factors. Dzidic and Green (2012), Easterling and Kunreuther et al. (1995), Lee et al. (2017), and Strazzera and Statzu (2017) use *acceptance* and *acceptability* for similar meanings without providing a definition of either term.

The term *legitimacy* only appears in Gross (2007) and has the same meaning as acceptance.

The term *attitude* is often used in the context of acceptance studies. Several publications explain attitudes as one aspect of acceptance without specifying this link in detail (Mann and Kögl, 2003; Gross, 2007; Mante and Gerowitt, 2007; Leitinger et al., 2010; Suškevičs and Külvik, 2010; Williams, 2011, 2014; Emmann et al., 2013; Liu et al., 2013; Stigka et al., 2014; van Os et al., 2014; Tohidyan Far and Rezaei-Moghaddam, 2017). In two of the analysed publications, public acceptance has the same meaning as public attitudes (Hitzeroth and Megerle, 2013; Enevoldsen and Sovacool, 2016). Accordingly, to Hitzeroth and Megerle (2013, p. 577): "…' acceptance' refers to a range of positive attitude parameters …" and is different than behaviour. However, Wolsink (2010, p. 303) provides a clear distinction between acceptance and attitudes: "Social acceptance is not simply a set of static attitudes of individuals; instead, it refers more broadly to social relationships and organizations, and it is dynamic as it is shaped in learning processes." A third category of studies claims to analyse attitudes but offers no clear explanation of what attitudes are in contrast to acceptance (e.g., Kamal et al., 2015; Ladenburg, 2008; Tapsuwan et al., 2011; Veidemane and Nikodemus, 2015).

Similar issues surround the term *perception*, which many authors, including Bewket (2007), Easterling and Kunreuther et al. (1995), Gross (2007), Hall et al. (2013), Hemström et al. (2014), Leitinger et al. (2010), Liu et al. (2013), Schenk et al. (2007), Tokushige et al. (2007), Toma et al. (2014), Schrader (1995), Spartz et al. (2015), Specht et al. (2016), Stringer et al. (2014), and Zhao et al. (2015), understand as a specific element of acceptance. Perception seems to be a core, broadly influential factor associated with acceptance that can be related to its different aspects, such as the perception of benefits (e.g., Specht et al., 2016), the perception of risks (e.g., Ren et al., 2016; Robinson et al., 2012; Specht et al., 2016), and the perception of specific measures (Hall et al., 2013; Toma et al., 2014). In particular, Bastian et al. (2017), Gilg (2009), Kupidura et al. (2014), and Lokocz et al. (2011) conducted studies of perceptions. These studies defined neither acceptance nor perception. Some studies view perception as a synonym for acceptance (Zoellner et al., 2008; Jones et al., 2012; Schroeder et al., 2013; Eswarlal et al., 2014). While conducting an acceptance study, Zoellner et al. (2008, pp. 4137) use a definition of perception but do not provide a definition for acceptance or describe the relationship between acceptance and perception. According to Zoellner et al. (2008, p. 4137), perception is an "active, subjective and transforming" process. This definition presents characteristics that are similar to those of acceptance in the literature (cf. following paragraph).

To sum up, in the analysed literature, the distinction between acceptance and its related concepts is largely unclear, and the use of these terms is often imprecise. Nonetheless, Fournis and Fortin (2017) make a valuable theoretical contribution by distinguishing between acceptance and acceptability.

Table 1
Definitions of "acceptance" and "acceptability" used in the literature.

Author/Year	Definitions
Anderson et al. (2012)	"*Acceptance implies passivity and as such does not necessarily reflect community approval or support.*" (p. 687)
Bewket (2007)	" … *acceptance refers to the farmers' evaluation of the introduced technologies in terms of their effectiveness in arresting soil erosion and their potential to improve land productivity, while adoption refers to the farmers' expression of commitment for a sustained utilization of the technologies as part of the local agricultural system after the external assistance is withdrawn.*" (p. 409)
Chin et al. (2014)	"… *social acceptance can be defined as a parameter to indicate public support towards an innovative technology for a sustainable development pathway*" (pp. 31). (This is an amalgamation of several definitions).
Emmann et al. (2013)	"*Farmers' investments in biogas plants can be interpreted as the outcomes of their acceptance of a new technology* (Heyder et al., 2012*).*" (pp. 373)
Engen et al., 2018, 2017 online first	"*Social acceptability is a loosely applied concept in the social sciences that describes the extent to which a group of people prefer a given situation* (Brunson, 1996)." *(pp. 27)*
Fournis and Fortin (2017)	"… *in order to distinguish social acceptance, seen as one of the possible results (. non-acceptance) of a complex process of social acceptability*" *(p. 5)* "… we define *acceptability as a process of collective assessment of a given project (understood as the specific embodiment of complex interactions between technology and society within a given socio-technical project), integrating plurality of actors (stakeholders) and spatial scales (from global to local) as well as involving the specific trajectory (past and future) of a political group or policy (community/society).*" (pp. 5)
Heldt et al. (2016)	"*While acceptability is 'an objective property'* (Lucke, 1995) *of a technique that could be 'determined in a verification procedure'* (Tschiedel, 1989)*, acceptance can be influenced by generating trust and sharing responsibilities in public participation processes.*" (pp. 1052, 1053)
Hemström et al. (2014)	"… *degree to which the public accepts (favors or opposes) intensive forestry practices can be interpreted as adoption of the idea that intensive forestry is used by a forest owner or society. This is a type of non-activist, environmentally significant behavior* (Stern, 2000) *which, whether the public accepts intensive forestry or not, has implications policy and management.*" (pp. 198)
Hitzeroth and Megerle (2013)	"… *the present work clearly distinguishes between "attitude" and "behaviour".* (pp. 576, 577) "*…' acceptance' refers to a range of positive attitude parameters adopted by subjects of acceptance (parties concerned by planning) as to an object of acceptance (planning project).*" (pp. 577)
Langer et al. (2016)	"*We focused in this study on the socio-political and community acceptance dimensions according to* Wüstenhagen et al. (2007)*. These dimensions refer to the general and local view of the public towards wind energy.*" (pp. 251)
Raven et al. (2009)	"… *societal acceptance as a process of negotiating expectations; Societal acceptance is not just about the acceptance by the general public. In our view it is important to distinguish between the acceptance by different social groups* (Wüstenhagen et al., 2007) *and acceptance on different societal levels* (Rohracher et al., 2004)." (pp. 565)
Sattler & Nagel (2010)	"…*acceptance is the result of an interrelated decision making process depending on the subject of acceptance (the farmer), the object of acceptance (the conservation measures), and the surrounding context (the frame conditions).*" (pp. 70) "… *acceptance of an innovation is the result of the interaction and mutual learning within a group of individuals or a community rather than the outcome of an one-to-one interaction between a single adopter and an innovation…*" (pp. 71)
Schumacher and Schultmann (2017)	"… *the present paper defines local acceptance as positive appraisal by direct residents (subject of acceptance) of a local biogas plant (object of acceptance) in the trinational URR (context of acceptance), including both passive approval and active support.*" (pp. 2395) (This is a conclusion of the definitions by Lucke (1995) and Wüstenhagen et al. (2007).
Shindler et al. (2002)	"*By its nature, social acceptability is a process rather than an end product" (pp. 1) "recognizing that varying degrees of acceptability likely exist.*" (pp. 3) In accordance with Brunson (1996) acceptability *is "a condition that results from a judgmental process by which individuals (1) compare the perceived reality with its known alternatives; and (2) decide whether the 'real' condition is superior, or sufficiently similar, to the most favorable alternative condition … Thus, the term 'social acceptability' could be reserved for references to some aggregate form of public consent whereby judgements are shared and articulated by an identifiable and politically relevant segment of the citizenry. As we discuss later, this distinction also is important for assessing the merits of individual evaluations (the type most associated with personal interests) versus socio-political processes for developing a broader shared agreement about what should occur for the larger community of interest."* (pp. 4)
Sonnberger and Ruddat (2017)	"… *acceptance can […] be characterized by a positive attitude of an acceptance subjecta specific acceptance object (*Upham et al., 2015*Upham et al., 2015). When this positive attitude is paralleled by supportive actions, some scholars speak of support or behavioral acceptance, rather than acceptance (*Batel et al., 2013*Batel et al., 2013; Upham et al., 2015).*" (pp. 57).
D'Souza and Yiridoe, 2014	"Williams and Mills (1986) *examined social acceptance in the context of a broad continuum, including the degree or strength of acceptance, and consideration of various social groups."* (pp.263)
Specht et al. (2016)	"*Acceptance in this context describes the process or fact of something being perceived as adequate, valid, or suitable. (*Oxford dictionary, 2015*Oxford dictionary, 2015). The opposite of acceptance would be non-acceptance or rejection, whereby rejection linked to an action can lead to active resistance or responses (*Dethloff, 2004*Dethloff, 2004;* Wüste and Schmuck, 2013*Wüste and Schmuck, 2013).*" (pp 755.)
Western et al. (2017)	"… *social acceptability is a judgement people make about whether an action, attribute, or condition is rated as superior or relatively neutral when compared with potential alternatives (*Brunson and Shindler, 2004*Brunson and Shindler, 2004)."* (pp. 531)
Williams (2011)	"*Brunson (1993, p. 9) defines acceptance as : 'a condition that results from a judgemental process by which individuals (a) compare the perceived reality with its known alternatives, and (b) decide whether the 'real' condition is superior, or sufficiently similar, to the most favourable alternative condition'.*" (pp. 56)
Wolsink (2010)	"*Social acceptance is not simply a set of static attitudes of individuals; instead it refers more broadly to social relationships and organisations, and it is dynamic as it is shaped in learning processes.*" (pp. 303)
Wolsink (2012)	"*Following definitions from psychology on the social acceptance of individuals, social acceptance of a phenomenon like the implementation of wind power is the degree to which people like or dislike the phenomenon. The concept includes all degrees, from full refusal to total adoption."* (pp. 1786)
Wüstenhagen et al. (2007)	"*We intend to contribute to the clarity of understanding by distinguishing three dimensions of social acceptance, namely socio-political acceptance, community acceptance and market acceptance.*" (pp. 2684) Explanations of these dimensions are given on pp. 12.

3.3. Characteristics and structuring features

In this section, we summarize the variety of characteristics and structuring features of acceptance in the analysed body of literature. Acceptance is a very complex phenomenon that offers different interpretations, as has already been made clear by the various distinguishing features and components mentioned above.

3.3.1. Characteristics

In the following section, we illustrate and contrapose characteristics of acceptance based on their definitions from the literature (Table 1). Due to diverging understandings in the literature, these characteristics are sometimes contradictory. In some cases, differing interpretations of statements about characteristics are also possible.

Process-orientation vs passiveness: Raven et al. (2009), Sattler and Nagel (2010), Shindler et al. (2002), Specht et al. (2016), Williams (2011), and Wolsink (2010) attribute a dynamic and process-orientated component to acceptance. In our interpretation, this means that acceptance can change in both directions (positive or negative) over time as it is proactively influenced by subjects. In contrast to this position,

Anderson et al. (2012) state that acceptance implies passiveness.

Intra-personal vs. intersubjective judgement processes: Bewket (2007), Williams (2011), and Schumacher and Schultmann (2017) describe acceptance as the outcome of an evaluation and judgement process. In our interpretation, the authors focus with this statement on intra-personal (conscious or unconscious) processes, which are not necessarily based on interactions with others. However, this process requires self-active engagement with the issue of acceptance. According to Hitzeroth and Megerle (2013), the evaluation and judgement process is limited to attitudes or personal judgements and does not include the process of acting. Thus, acceptance is not focused on behaviour, even though it is a (pro)active opinion-forming process in terms of an intersubjective or intra-personal engagement from a psychological and sociological point of view (Lucke, 1995). Following Anderson et al. (2012), a third interpretation is that the evaluation and judgement process is generally passive as only acting or behaviour can be seen as activities. In contrast to the intra-personal perspective, Raven et al. (2009), Sattler and Nagel (2010), Shindler et al. (2002), and Wolsink (2010) emphasize interactions and relationships between individuals, groups, and institutions. Thus, acceptance is intersubjective and not an isolated and silent issue. Communication and participation are important impact factors. The decision process depends on interactions with others.

Excluding vs. including rejection: Chin et al. (2014) and Williams (2014) consider acceptance to be the (public) support of an idea or a technology. Thus, acceptance only has a positive connotation as it does not have a negative side/"charge" in terms of rejection. Hitzeroth and Megerle (2013), Schumacher and Schultmann (2017), Specht et al. (2016), and Shindler et al. (2002) also share this opinion. In contrast, Anderson et al. (2012) believe that acceptance does not automatically equate to approval or support. The phenomenon also covers non-acceptance or rejection. D'Souza and Yiridoe, 2014 and Wolsink (2012) advocate for a similar understanding.

Adoption vs. acceptance: According to Bewket (2007), acceptance is not the same as adoption. Whereas acceptance refers to personal judgements concerning farming technologies, adoption is an "… expression of commitment for sustained use of the technologies …" (Bewket, 2007, pp. 409). Other authors have an opposing understanding, stating that acceptance "…. can be interpreted as adoption of the idea …" (Hemström et al., 2014, pp. 198) or as "investment of technology" (Emmann et al., 2013, pp. 373).

Finally, some authors understand acceptance only as a positive result or condition (Shindler et al., 2002; Hitzeroth and Megerle, 2013; Chin et al., 2014; Specht et al., 2016; Fournis and Fortin, 2017; Schumacher and Schultmann, 2017), whereas other authors believe it to be a complex phenomenon that is compound, many-faceted, multi-layered, and affected by various conditions (e.g., Wolsink, 2012; Wüstenhagen et al., 2007). To achieve more clarity concerning these two positions and to prevent misunderstandings, Fournis and Fortin (2017) suggest the differentiation between acceptance and acceptability.

3.3.2. Intentions of structuring acceptance

Various approaches to conceptually structuring acceptance can be found in the literature. These structuring elements are sometimes based on the abovementioned characteristics.

Types: The analysed literature offers various types of acceptance, e.g., public acceptance, social acceptance, local acceptance, community acceptance, or acceptance of specific affected groups (e.g., landowners, farmers, and tourists). The type of acceptance is mainly connected to the subject of acceptance and possibly to spatial levels. Thus, each type can be associated with certain subject groups (Wüstenhagen et al., 2007; Wolsink, 2012; as well Lucke, 1995). A review of the body of literature shows that a clear differentiation between the types of acceptance cannot be found in all cases. In some publications, different terms (e.g., community, local, social, public) have the same meaning and are used confusingly. Enevoldsen and Sovacool (2016) use the terms public and community acceptance synonymously. Achillas et al. (2011), Chin et al. (2014), Liu et al. (2013), and Stigka et al. (2014) use social and public acceptance interchangeably. Petrova (2016), Williams (2011, 2014), and Zoellner et al. (2008) apply the term public acceptance to refer to specific case study areas and not the public in general. Wüstenhagen et al. (2007) and Wolsink (2012) clearly emphasize that public acceptance, local acceptance, and social acceptance do not have equivalent meanings and cannot be used interchangeably. In their definition and conception of social acceptance, they articulate the following types of social acceptance: (1) social-political acceptance, (2) community acceptance, and (3) market acceptance. Within this typology, the subjects of acceptance and the social group also play an important role. (1) Social-political acceptance is the general acceptance of broad topics (e.g., renewable energy or nature conservation laws) without referring to a site-specific project. The social groups involved in this type include the general public, key stakeholders, or policy makers. (2) By community acceptance, Wüstenhagen et al. (2007) refer to a specific (energy) project to be implemented in a defined location. In this case, the local stakeholders and residents are the subjects of acceptance. (3) Market acceptance refers to Rogers' (2003) market adoption of innovations by customers "through a communication process between individual adopters and their environment" (Wüstenhagen et al., 2007, p. 2685). Embracing the possibility of categorizing a broad range of acceptance phenomena into differentiable types, many other authors have referred to and apply this classification (cf. 3.1; 3.4). Scherhaufer et al. (2017, pp. 864) rejects the rigorous differentiation between socio-political, market, and community acceptance by advocating for a more integrative perspective that considers interdependencies between the three types.

Dimensions: In her theoretical approach to acceptance, the German sociologist Doris Lucke (1995) developed a relation triangle as an orientation guide. It consists of three dimensions: (1) the acceptance object, (2) the acceptance subject, and (3) the acceptance context. The acceptance object is the thematic reference (1) of what should be accepted to a certain extent by a subject. This acceptance subject can be an individual or a group (2) who constantly interacts with other actors. Thus, the process of evaluations and decisions happens not only as a reflection of the thematic issue but also with regard for personal beliefs, norms, and values and in the interplay with positions of others (e.g., society and political actors). Lucke (1995) labels the object-related and subject-related framing conditions (political, institutional, legal, historical setting, etc.) as the acceptance context (3). By determining the dimensions of the given acceptance phenomenon, the researcher can structure the problem and gain more clarity regarding the boundaries of the issue. Hitzeroth and Megerle (2013), Sattler and Nagel (2010), and Schumacher and Schultmann (2017) refer to this relationship triangle, although Hitzeroth and Megerle (2013) do not explicitly mention in their definition the acceptance context as an important and double-constituted reference point in the triangle. The importance of distinguishing between object, subject, and inter-subject dimension as analytical categories is stated in van Os et al. (2014). Referring to Roo and Porter (2007), a publication about the role of actors in a fuzzy governance environment, van Os et al. (2014) adopt this distinction procedure in their acceptance study. As mentioned in the previous paragraph, Wüstenhagen et al. (2007) also emphasize the specific roles of different subjects, objects, and contexts in their typology. Lucke goes beyond a type assignment by explaining that acceptance decisions are made in the interaction between different actors by considering the conditions of the specific object and their framing conditions. Lucke focuses on mutual negotiation and communication processes, value-oriented decision making, active reflection on issues, and circumstances. Thus, the perspective of Lucke (1995) is a more sociological (and social-psychological) perspective than that of Wüstenhagen et al. (2007). Such social-psychological aspects concerning the relation between subjects, objects, and contexts can also be identified in the concepts described by Fournis and Fortin (2017) and Wolsink (2012).

Levels: Another division of the acceptance phenomena includes at least two action levels: the level of attitudes and the level of acting (Raven et al., 2009; Sattler and Nagel, 2010; Wolsink, 2010, 2012). At the non-proactive level of attitudes, the subject offers an internal judgement before acting. At the next level, the subject alters his judgement into an action, and his behaviour is an expression of his attitudes.

Degrees: Different degrees of decisions about acceptance exist on a quality axis with possible positions on the positive or negative side (cf. Sauer et al., 2005). Ranging from negative grades to positive grades, these degrees include non-acceptance (rejection), low acceptance, indifference, high acceptance, approval, proactive support, and active ownership (Wolsink, 2012; D'Souza and Yiridoe, 2014). Hitzeroth and Megerle (2013) involve the range of rejection, range of risk, and range of acceptance in their model of the evolution of attitudes. This inclusion provides the opportunity to analyse the factors underlying critical degrees, and this might be important for project success.

In summary, very few publications recognize the enormous complexity of the structuring elements regarding acceptance or acceptability. The conceptual efforts made byWolsink (2010,2012) should be mentioned as a noteworthy exception.

3.4. Disciplinary relations and theories

Acceptance is generally a cross-sectoral research topic in different disciplines or areas of applied research with their own perspectives on and understandings the issue (Lucke, 1995; Schenk et al., 2007).[1]With regard for land use changes, acceptance is mostly an application-oriented or even an interdisciplinary issue. Therefore, the analysed studies contain different disciplinary relations. These disciplinary relations are reflected in the use of theories and theoretical constructs to design the research frameworks or/and to explain acceptance phenomena. The application of the theory can vary in its extent, ranging from explicitly theory-based by testing deducted hypotheses to less strict forms of theory use (Davies et al., 2010). The disciplinary relations and the use of specific theories are obviously strongly connected to the particular research issue (especially the acceptance objects), the research interest and intention, and the academic background of the researcher. In terms of the analysed body of literature, the frameworks used for data generation and analysis are based either on single theories or a combination of several theories. Although research generally requires a sound theoretical foundation (Udo-Akang, 2012), we found 32 empirical studies that do not use any theory or concept for their empirical research. At the same time, these publications failed to apply an inductive methodology where theory building is the outcome of the empirical analysis.

Schenk et al. (2007, p. 68) state that, "Until now there has been no real theory of acceptance available." We assume that a generally valid and interdisciplinary theoretical explanatory model for a broad range of acceptance phenomena and issues is difficult to establish if acceptance cannot be assigned to a single discipline. This assumption has been confirmed by the analysed publications. In our opinion, no "real theories"[2]have been offered until now, only contributions to a theoretical understanding of acceptance phenomena in land use from different disciplinary perspectives. The most important contribution found in the body of literature is the typology of acceptance of renewable energy suggested by Wüstenhagen et al. (2007). This typology is more of a problem structuring model than a "real theory" of acceptance because it is not capable of explaining or predicting how acceptance is constituted or why individuals or groups accept or do not accept ideas, practices, or innovations. Several publications on renewable energy also reference Wüstenhagen et al. (2007) in explaining their research framework and study design (Huber et al., 2012; Sovacool and Ratan, 2012; Chin et al., 2014; Eswarlal et al., 2014; Ganzevles et al., 2015; Yuan et al., 2015; Hammami et al., 2016; Höltinger et al., 2016). Even studies focussing on others issues (but similarly structured) have adopted the typology of Wüstenhagen et al. (Williams, 2011; van Os et al., 2014; Williams, 2014; Zhao et al., 2015; Haug and Stigson, 2016).

A popular and often cited but nonetheless controversial explanation for non-acceptance or rejection of local projects (e.g., wind turbines, power plants, waste management) is the so-called "Not In My Back Yard" (NIMBY) syndrome. Originally suggested and described by Dear (1992), NIMBY has long been used by project developers and policy makers, though today, many researchers agree that it is more of "a normative label" than a serious and scientifically sound explanation (Devine-Wright, 2009; Wolsink, 2012, pp. 1797; Petrova, 2016; Wolsink, 2006). Thus, within the scientific community, NIMBY's explanatory power has been widely discarded due to its limitations given the negative attribution of human attitudes and its tendency to obscure the actual reasons for rejecting land use changes (e.g., Enevoldsen and Sovacool, 2016; Petrova, 2016; Wolsink, 2012; Wüstenhagen et al., 2007).

Fournis and Fortin (2017) have developed a new and promising concept that distinguishes the notions of acceptance and acceptability. The authors enrich the recent theoretical-conceptual debate by advocating the conscious use of these terms and proposing three analytical levels (micro-social, meso-political, and macro-economic). While this concept was developed as a result of a literature review in the field of wind energy projects, it has the potential to be applied in a broader context.

The most extensive and comprehensive sociological contribution to a theoretical understanding of acceptability comes from Lucke (1995). Beyond the acceptance subject, object, and context dimensions already mentioned in Section 3.3, Lucke addresses mutual process orientation, the concept of values, acceptance action levels, sociological acceptance types, etc. Very few aspects of Lucke's reflections on acceptance are considered in the analysed literature, and what does appear is only presented by German-speaking researchers (Hitzeroth and Megerle, 2013; Schenk et al., 2007; Schumacher and Schultmann, 2017; Specht et al., 2016).

Generally, if no established theory exists, applying theories of related subject areas is often appropriate (Schnell et al., 2013). This practice can also be observed in the case of acceptance studies. Our analysis reveals many uses of theories and theoretical constructs from other disciplines, subject areas, and research fields. However, the terms and concepts within these disciplines are not used consistently. Table 2 presents the disciplines and research fields with the embedded theories that are used to design the framework for the empirical work in the analysed acceptance studies.

A diverse array of psychological theories are used in acceptance studies. Due to the essential role that psychological processes of human thinking and acting play in acceptance decisions, psychology is unsurprisingly the most prominent discipline when considering acceptance from a theoretical perspective. Personal values, attitudes, and behaviour are psychologically constituted constructs and thus fundamental topics in psychology. None of the applied psychological theories are dominant or used particularly often.

For numerous definitions (cf. Subsection 3.2), acceptance is therefore constituted in a social space and depends on social interactions between people and social groups: so-called social acceptance. The discipline that investigates social behaviour – sociology – thus has the second most important role in acceptance research. In addition to the aforementioned theoretical contribution of Lucke (1995), theories regarding essential communication requirements (Habermas, 1997), the

[1] Beyond topics related to land use, acceptance studies are well known in (clinical) psychology, food science, technology assessment, and product marketing.

[2] Schnell et al. (2013) and Turner (1991) define a theory as a system of statements that explains a part of reality. Despite an on-going discussion of what theories are and of what they consist (Sovacool and Hess, 2017), Udo-Akang (2012) mentions the following generally established characteristics of theories: descriptive ability, explanatory power, heuristic value, testability, integration, parsimony, clarity, comprehensiveness, and delimitation.

Table 2
Theories and theoretical constructs in the literature.

(Sub)Disciplines /research areas[a]	Embedded theories or theoretical constructs	References
Acceptance of renewable energy	Typology of acceptance (Wüstenhagen et al., 2007)	Chin et al. (2014), Dermont et al. (2017), Ganzevles et al. (2015), Hammami et al. (2016), Huber et al. (2012), Eswarlal et al. (2014), Langer et al. (2016), Rand and Hoen (2017), van Os et al. (2014), Williams (2011, 2014), Sovacool and Ratan (2012), Sonnberger and Ruddat (2017), Schumacher and Schultmann (2017), Yuan et al. (2015); Zhao et al. (2015)
	From social acceptance to acceptability (Fournis and Fortin, 2017)	Fournis and Fortin (2017)
(Environmental) Psychology and Behavioural Studies	Theory of valuing environmental and natural resources (Haab and McConnell, 2003)	Caporale and de Lucia (2015)
	Cognitive and behavioural theories (without bibliographical reference)	Walter (2014)
	Theory of reasoned action (Ajzen and Fishbein, 1980)	Stigka et al. (2014), Emmann et al. (2013)
	Theory of planned behaviour (Ajzen, 1991)	Stigka et al. (2014), Price and Leviston (2014), Wolsink (2012)
	Value-Belief-Norms (Stern, 2000)	Price and Leviston (2014)
	Attitude of confidence (Adrian et al., 2005)	Tohidyan Far and Rezaei-Moghaddam (2017)
	Environmental-psychological approaches (based on various sources)	Zoellner et al., 2008
	Theory of psychological reactance (Brehm, 1966)	Schenk et al. (2007)
	Attitudes in social psychology (Rajecki, 1990)	Mann and Kögl (2003)
Sociology	"Acceptance theory" (Lucke, 1995)	Hitzeroth and Megerle (2013), Schumacher and Schultmann (2017), Specht et al. (2016), Schenk et al. (2007), indirectly: Sattler and Nagel (2010), Suškevičs and Külvik (2010)
	Theory of communicative behaviour (Habermas, 1997)	Schenk et al. (2007)
	Theory of symbolic interactions (Mead, 1968; Blumer, 1992)	Schenk et al. (2007)
	Social capital (Putnam, 2000; van Oorschot et al., 2006)	Jones et al. (2012)
	Framing theory (Goffmann, 1974)	Spartz et al. (2015)
Ethics	"frame of reference" concept (human-nature and human-animal relationships, Te Velde et al., 2002)	Boogaard et al. (2011)
Innovation research	Technology Acceptance Model - TAM (Davis, 1989)	Emmann et al. (2013), Sharifzadeh et al. (2017), Tohidyan Far and Rezaei-Moghaddam (2017)
	Diffusion of innovation (Rogers, 2003)	Sattler and Nagel (2010), Hemström et al. (2014)
	Organizational innovation adoption (Frambach and Schillewaert, 2002)	Emmann et al. (2013)

[a] Generally, academic disciplines have the following common elements: a particular object of research; a homogenous communication context; an accepted knowledge corpus; a set of research methods, concepts, and theories; and, to a certain extent, a manifestation at scientific institutions (e.g. Krishnan, 2009). Thus, acceptance and innovation research are more research areas than definable disciplines.

symbolic value building of "things" through continuously occurring interactions (Blumer, 1992 in Schenk et al., 2007), and social capital "as a multi-dimensional concept" (Jones et al., 2012, pp. 56) have been applied in the analysed literature.

A third source of important theories is innovation research. The Technology Acceptance Model (TAM) (Davis, 1989), the theory of diffusion of innovation (Rogers, 2003), and organizational innovation adoption (Frambach and Schillewaert, 2002) are models restricted to explaining the acceptance behaviour of technical innovations or/and specific products. In TAM, acceptance is synonymous with innovation adoption by users. Rogers' theory of acceptance includes one step in an idealised innovation adoption process. The main acceptance factors in both theory models are similar: relative advantage, compatibility, complexity, traceability, observability (Rogers, 2003), perceived usefulness, and perceived ease of use (Davis, 1989). Although both theories are highly appreciated by a large community of technical innovations researchers, the acceptance of technical innovations in the field of land use is rarely explained by these theories.

Considering the reviewed literature, landscape planning,[3] sustainability research, and agroeconomics are (sub)disciplines in which acceptance studies are frequently conducted but which have not created their own theories. A possible exception to this is the unacceptance-acceptance spectrum designed by Sauer et al. (2005; cited in Hitzeroth and Megerle, 2013) for a landscape planning and nature conservation study. This spectrum contributes to the definitional understanding of acceptance. However, its contribution is mainly based on theoretical considerations from environmental psychology and sociology.

The included publications reveal that theories of justice are an issue of increasing importance with disciplinary bases in social psychology, law, (political) philosophy, and ethics. Gross (2007) stated that general justice principles, including fairness regarding distribution and outcome and the fairness of processes and decision-making procedures, exist across these disciplines. Thus, justice consists of distributional and procedural justice as its two main pillars, and these two forms find expression in individual perceptions. These principles of justice are applied in the studies of Gross (2007), Walker et al. (2014), Wüstenhagen et al. (2007), and Zoellner et al. (2008). With the introduction of the concept of environmental justice, a link between justice principles and environmental planning has been established. Environmental justice stresses the importance of proactively including justice principles in environmental planning processes and environmental policies to enhance the acceptance of land use measures (Gross, 2007; Wüstenhagen et al., 2007).

In conclusion, the theoretical foundations of acceptance studies in general still remain poor and in need of further development. To wit, only one-third of the analysed literature uses a theoretical approach for their studies.

[3] In its origins, landscape planning is the planning instrument of nature conservation. In the course of its scientification, landscape planning has also become a planning discipline.

3.5. The role of factors influencing acceptance

The majority of the investigated studies mention the importance of factors influencing acceptance. These factors can be described as the specific conditions and driving forces that positively or negatively impact the degree or quality of acceptance in each case. Therefore, these factors are essential for studies that aim to analyse reasons for acceptance and go beyond describing the degrees (from low to high acceptance). Only by identifying the influencing factors is it possible to improve acceptance and successfully manage projects.

In the analysed publications, the use and handling of factors differ depending on the applied research method (quantitative or qualitative) and the researchers' individual theoretical comprehension of acceptance and/or acceptability. In this sense, Sovacool and Hess (2017, pp. 740) acknowledge that "… different theories accommodate (and may incentivize) different methods". In several studies, the sources of factors for empirical work are neither clearly nor explicitly described in the research methodology (Schrader, 1995; Janikowski et al., 2000; Luz, 2000; Mante and Gerowitt, 2007; Tumuhairwe et al., 2007; Ladenburg, 2008; Leitinger et al., 2010; Qiu et al., 2014; Ruggiero et al., 2014; Kendal et al., 2015; Ren et al., 2016). In these cases, identifying the researcher's perception of relevant factors is difficult, and the theoretical basis appears to be weak. Another factor selection strategy is the adoption and adaptation of factors used by other published case studies as a basis for their research design in order to quantitatively measure the evidence and specific manifestation of those factors (e.g., Bewket, 2007; Que et al., 2015; Robinson et al., 2012; Veidemane and Nikodemus, 2015; Williams, 2014; Yuan et al., 2015; Zhao et al., 2015). Examples of applying of theory-based factors include the studies of Achillas et al. (2011), Boogaard et al. (2011), Chin et al. (2014), Hitzeroth and Megerle (2013), Jones et al. (2012), Liu et al. (2013), Musall and Kuik (2011), Sattler and Nagel (2010), and Spartz et al. (2015). In this category, the extent to which theory guides the research differs, ranging from a rigorous adoption of predefined factors (e.g., Sattler and Nagel, 2010) to a more open interpretation and application of theories or theoretical constructs (e.g., Hitzeroth and Megerle, 2013; Musall and Kuik, 2011) and a partially theory-based factor use in which theory-based factors are just one part of the factor set (Jones et al., 2012). The studies conducted by Emmann et al. (2013), Hemström et al. (2014), Suškevičs and Külvik (2010), and Thøgersen and Noblet (2012) use a mix of theory-based factors as well as factors from other empirical studies. All of the studies in the abovementioned categories (excluding some studies with unclear factor selection sources) have the common characteristic in that they select the acceptance factors before quantitatively gathering empirical data.

Another smaller category of studies neither determined nor fixed factors before gathering empirical data. These include studies by Gross (2007), Hall et al. (2013), Hammami et al. (2016), Schenk et al. (2007), Schröter et al. (2015), and Sovacool and Ratan (2012). In these cases, factors were not the starting point, but instead the outcome of a theory-based data analysis. The theories served as analytical frameworks and explanation models to varying degrees. Factors were later discussed and compared with findings from other studies. From our point of view, the openness related to factors provides the advantage of a direct relation to a specific case. Additionally, compared to previously fixed factors, all aspects mentioned by interviewees during data collection can be considered in the analysis phase. These strong, qualitatively oriented research methods are suitable for explorative studies in which not all factors are already known.

Generally, the factors vary between cases. Thus, a simple adoption of factors to other cases bears the risk of disconnecting the empirical work from theory and excluding important acceptance factors. The question that arises is whether common/universal and transferable factors exist. Schenk et al. (2007) state that regardless of the acceptance object, there are some similar factors, but no evidence exists for the most important ones, "especially in the context of nature and landscape conservation measures" (Schenk et al., 2007, pp. 67). Indeed, after analysing the body of literature, some similar factors are apparent. For example, trust, participation, knowledge, prior experiences, and economic and visual aspects are frequently cited as influencing factors. However, researchers´ opinions and scientific evidence regarding the most important factors strongly depend on the theoretical foundations of each study.[4] Furthermore, factors in form-driving forces are rarely clearly defined entities across the range of studies and are *per se* not on the same level. More general or unspecific factors often encompass a bundle of specific factors (economical aspects, justice, communication, perceived (dis)advantages, general attitude, etc.). Due to their lack of specificity, these general factors are often used. However, factors can also be of a specific character describing a narrow issue, a particular situation, or specific circumstances (e.g., production costs, job creation, perceived procedural justice, prior experiences, or attitudes towards technology or towards the innovation initiator). In conclusion, creating a complete list of all factors and determining which are most crucial seems to require a disproportionate amount of effort and is likely to be less useful.

4. Conclusion

In this literature review, we sought to synthesise publications' contributions to the acceptance phenomena in order to advance the theoretical-conceptual debate on this topic. Therefore, we discussed its epistemological foundations and linkages and analytically revealed its weaknesses. In summary, the lack of definitions and theories of acceptance and acceptability as well as an insufficient theoretical foundation regarding the selection of explanatory factors are widespread among studies. Many consider acceptance only as a positive outcome that should be achieved when planning projects (e.g., Specht et al., 2016). Few publications acknowledge the complexity of these issues and the need for a theoretical-conceptual foundation (e.g., Fournis and Fortin, 2017).

4.1. Recommendations for further research

1) Authors of scientific publications should always clarify their understanding of acceptance or acceptability to make their work more comprehensible to others, to provide guidance for the logical structure of the paper and to reflect on their own concepts. In this sense, it is also important to distinguish acceptance from related notions and concepts (e.g., acceptability, perception, attitudes, etc.) or to include them in a meaningful way.
2) From a theoretical point of view, it is worth incorporating a broad range of degrees, including non-acceptance and rejection, into analyses. This has been recommended not only in the literature we reviewed about land use issues, but also by Kahma and Matschoss (2017) and Sovacool et al. (2017). It should be taken into account that degrees of negative acceptance can reveal important findings for the implementation of projects and the diffusion of innovations. The timely exposure of active resistance allows the consideration of alternative solutions in early stages of the process (Sovacool et al., 2017). According to Kahma and Matschoss (2017), it is improper to conclude that non-acceptance can be explained by opposite influencing factors other than acceptance. Both outcomes are based on different factors and explanations worthy of analysis (Kahma and Matschoss, 2017). Hitzeroth and Megerle (2013) suggest paying special attention to critical degrees and acceptance risks such as doubt or conditional acceptance. Knowledge about these degrees is

[4] The rational choice approaches or contingent valuation (e.g., willingness-to-pay studies) mainly focus on individual behaviour decisions based on individual perceived (economic) benefits. In these approaches, economic factors have an outsized importance. Approaches that are strongly influenced by cultural and social norms centre more on norms and value-related factors.

crucial for successful project implementation because it enables reaction to and management of potential threats.

3) As a methodological recommendation, we advocate a sound analysis of factors. Qualitative analyses in terms of explorative or in-depth studies are suitable for cases when factors are previously unknown. The use of factors from other sources (e.g., established literature) is only advisable if comparable cases exist. Such is the case for widely analysed and discussed topics, e.g., wind turbines. Hence, factors from other studies could be used to conduct own surveys, but only if the framing conditions and settings are similar.
4) Dealing with land-based issues, especially when policy makers are involved, requires careful reflection upon and spatial framing of acceptability studies. This means considering not only assigning the issue to a spatial level (local, regional, national, etc.) but also embedding the findings into a broader spatial implementation context (e.g., in regional planning and landscape development).

4.2. Redefining acceptance and acceptability

Based on the analysed literature, we conclude with our own reflections in order to advance the scientific understanding of the conceptualization of acceptance. To prevent misunderstandings related to the use of terms (as outlined above) and to thereby achieve more clarity, we advocate differentiating between acceptance and acceptability, as suggested by Fournis and Fortin (2017). This enables the recognition of acceptability as complex scientific concept and the simultaneous recognition of acceptance as positive outcome of a judgement processes and everyday term. To conclude for this review, this differentiation means that most analysed studies deal with acceptability rather than with acceptance.[5] According to our understanding, acceptability encompasses: (a) actor-based and dynamic decision processes that are supported by value-based arguments and formed in intrapersonal and intersubjective judgement processes. These decisions, so-called acceptability decisions, are (b) the products of the interactions among the acceptability actor, the specific acceptability object, other actors, and the context. Furthermore, the (c) acceptability decisions can be assigned to a particular degree (from opposition and rejection to high acceptance and engagement) and can be made on a certain level, including (d) attitude, action, or utilization. At the non-proactive level of attitudes, the subject offers an internal judgement before acting. At the next level, the subject alters his judgement into an action that is the expression of his attitudes. The utilization level refers to assessing the long-term use of an innovation. This definition of acceptability is based on theoretical reflexions from Fournis and Fortin (2017), Lucke (1995), and Wolsink (2012, 2010). Applying this understanding of acceptability offers the possibility of decoding and structuring very different (regarding issues and spatial scales) cases while considering the main characteristics and elements of acceptability. Furthermore, it supports an open, case-oriented, and explorative analysis in which not all drivers and influencing factors are already known. In summary, we believe that land use and social research can benefit from this advanced understanding of acceptability.

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[5] Nonetheless, in this review, we used mainly the term “acceptance” because this was the starting point for our analysis. The differentiation between “acceptance” and acceptability is one of the conclusions and should be considered in further research.

References

Achillas, C., Vlachokostas, C., Moussiopoulos, N., Banias, G., Kafetzopoulos, G., Karagiannidis, A., 2011. Social acceptance for the development of a waste-to-energy plant in an urban area. Resour. Conserv. Recycl. 55, 857–863. http://dx.doi.org/10.1016/j.resconrec.2011.04.012.

Adrian, A.M., Norwood, S.H., Mask, P.L., 2005. Producers’ perceptions and attitudes toward precision agriculture technologies. Comput. Electron. Agric. 48, 256–271. http://dx.doi.org/10.1016/j.compag.2005.04.004.

Ajzen, I., 1991. The theory of planned behaviour. Organ. Behav. Hum. Decis. 50, 179–211.

Ajzen, I., Fishbein, M., 1980. Understanding Attitudes and Predicting Social Behaviour. Prentice-Hall, Englewood Cliffs.

Anderson, C., Schirmer, J., Abjorensen, N., 2012. Exploring CCS community acceptance and public participation from a human and social capital perspective. Change 17, 687–706. http://dx.doi.org/10.1007/s11027-011-9312-z.

Bastian, C.T., Keske, C.M.H., McLeod, D.M., Hoag, D.L., 2017. Landowner and land trust agent preferences for conservation easements: implications for sustainable land uses and landscapes. Landsc. Urban Plann. 157, 1–13. http://dx.doi.org/10.1016/j.landurbplan.2016.05.030.

Batel, S., Devine-Wright, P., Tangeland, T., 2013. Social acceptance of low carbon energy and associated infrastructures: a critical discussion. Energy Policy 58, 1–5. http://dx.doi.org/10.1016/j.enpol.2013.03.018.

Bewket, W., 2007. Soil and water conservation intervention with conventional technologies in northwestern highlands of Ethiopia: acceptance and adoption by farmers. Land Use Policy 24, 404–416. http://dx.doi.org/10.1016/j.landusepol.2006.05.004.

Blumer, H., 1992. Der methodologische Standort Des Symbolischen Interaktionismus. In: Burkart, R., Hömberger, W. (Eds.), Kommunikationstheorien: ein Textbuch zur einführung. Wilhelm Braumüller Universitäts—Verlagsbuchhandlung GmbH, Wien, pp. 23–40.

Boogaard, B.K., Bock, B.B., Oosting, S.J., Wiskerke, J.S.C., van der Zijpp, A.J., 2011. Social acceptance of dairy farming: the ambivalence between the two faces of modernity. J. Agric. Environ. Ethics 24 (3), 259–282. http://dx.doi.org/10.1007/s10806-010-9256-4.

Booth, A., Papaioannou, D., Sutton, A., 2012. Systematic Approaches to a Successful Literature Review. Sage Publications, Thousand Oaks.

Brehm, J.W., 1966. A Theory of Psychological Reactance. Academic Press, New York.

Brunson, M.W., 1996. A definition of “social acceptability” in ecosystem management. In: Brunson, M.W., Kruger, L.E., Tyler, C.B., Schroeder, S.A., tech (Eds.), Defining Social Acceptability in Ecosystem Management: A Workshop Proceedings. Gen. Tech. Rep. PNW-GTR-369, pp. 7–16.

Brunson, M.W., Shindler, B.A., 2004. Geographic variation in social acceptability of wildland fuels management in the Western United States. Soc. Nat. Resour. 17, 661–678. http://dx.doi.org/10.1080/08941920490480688.

Caporale, D., de Lucia, C., 2015. Social acceptance of on-shore wind energy in Apulia Region (Southern Italy). Renew. Sustain. Energy Rev. 52, 1378–1390. http://dx.doi.org/10.1016/j.rser.2015.07.183.

Chin, H.-C., Choong, W.-W., Wan Alwi, S.R.W., Mohammed, A.H., 2014. Issues of social acceptance on biofuel development. J. Clean. Prod. 71, 30–39. http://dx.doi.org/10.1016/j.jclepro.2013.12.060.

D’Souza, C.D., Yiridoe, E.K., 2014. Social acceptance of wind energy development and planning in rural communities of Australia: a consumer analysis. Energy Policy 74, 262–270. http://dx.doi.org/10.1016/j.enpol.2014.08.035.

Davies, P., Walker, A.E., Grimshaw, J.M., 2010. A systematic review of the use of theory in the design of guideline dissemination and implementation strategies and interpretation of the results of rigorous evaluations. Implement. Sci. 5, 14. http://dx.doi.org/10.1186/1748-5908-5-14.

Davis, F.D., 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Q. 13, 319–340. http://dx.doi.org/10.2307/249008.

Dear, M., 1992. Understanding and overcoming the NIMBY syndrome. J. Am. Plann. Assoc. 58, 288–300. http://dx.doi.org/10.1080/01944369208975808.

Dermont, C., Ingold, K., Kammermann, L., Stadelmann-Steffen, I., 2017. Bringing the policy making perspective in: a political science approach to social acceptance. Energy Policy 108, 359–368. http://dx.doi.org/10.1016/j.enpol.2017.05.062.

Dethloff, C., 2004. Akzeptanz und Nicht-Akzeptanz von technischen Produktinnovationen [Acceptance and non-acceptance of technical product innovations]. Pabst Science Publ, Berlin.

Devine-Wright, P., 2009. Rethinking NIMBYism: the role of place attachment and place identity inexplaining place-protective action. J. Commun. Appl. Soc. Psychol. 19, 426–441. http://dx.doi.org/10.1002/casp.1004.

Dzidic, P., Green, M., 2012. Outdoing the Joneses: understanding community acceptance of an alternative water supply scheme and sustainable urban design. Landsc. Urban Plann. 105, 266–273. http://dx.doi.org/10.1016/j.landurbplan.2011.12.023.

Easterling, D., Kunreuther, H., 1995. A siting process to gain public acceptance. In: Easterling, D., Kunreuther, H. (Eds.), The Dilemma of Siting a High-Level Nuclear Waste Repository. Springer, Netherlands, Boston, pp. 167–192.

Emmann, C.H., Arens, L., Theuvsen, L., 2013. Individual acceptance of the biogas innovation: a structural equation model. Energy Policy 62, 372–378. http://dx.doi.org/10.1016/j.enpol.2013.07.083.

Enevoldsen, P., Sovacool, B.K., 2016. Examining the social acceptance of wind energy: practical guidelines for onshore wind project development in France. Renew. Sustain. Energy Rev. 53, 178–184. http://dx.doi.org/10.1016/j.rser.2015.08.041.

Engen, S., Runge, C., Brown, G., Fauchald, P., Nilsen, L., Hausner, V., 2018. Assessing local acceptance of protected area management using public participation GIS (PPGIS). J. Nat. Conserv. 43, 27–34. http://dx.doi.org/10.1016/j.jnc.2017.12.002.

Eswarlal, V.K., Vasudevan, G., Dey, P.K., Vasudevan, P., 2014. Role of community acceptance in sustainable bioenergy projects in India. Energy Policy 73, 333–343. http://dx.doi.org/10.1016/j.enpol.2014.04.019.
Fink, A., 1998. Conducting Research Literature Reviews: From Paper to the Internet. Sage Publications, Thousand Oaks.
Fournis, Y., Fortin, M.-J., 2017. From social "acceptance" to social "acceptability" of wind energy projects: towards a territorial perspective. J. Environ. Plann. Manage. 60, 1–21. http://dx.doi.org/10.1080/09640568.2015.1133406.
Frambach, R.T., Schillewaert, N., 2002. Organizational innovation adoption: a multi-level framework of determinants and opportunities for future research. J. Bus. Res. 55, 163–176. http://dx.doi.org/10.1016/S0148-2963(00)00152-1.
Gaede, J., Rowlands, I.H., 2018. Visualizing social acceptance research. Energy Res. Soc. Sci. 40, 142–158. http://dx.doi.org/10.1016/j.erss.2017.12.006.
Ganzevles, J., Asveld, L., Osseweijer, P., 2015. Extending bioenergy towards smart biomass use issues of social acceptance at Park Cuijk, The Netherlands. Energy Sustain. Soc. 5, 22–34. http://dx.doi.org/10.1186/s13705-015-0053-9.
Gilg, A., 2009. Perceptions about land use. Land Use Policy 26, S76–S82. http://dx.doi.org/10.1016/j.landusepol.2009.08.018.
Goffmann, E., 1974. Frame Analysis: An Essay on the Organization of Experience. Harvard University Press, Cambridge.
Gross, C., 2007. Community perspectives of wind energy in Australia: the application of a justice and community fairness framework to increase social acceptance. Energy Policy 35, 2727–2736. http://dx.doi.org/10.1016/j.enpol.2006.12.013.
Haab, T., McConnell, K.E., 2003. Valuing Environmental and Natural Resources: The Ecometrics of Non-Market Valuation. Edward Elgar Publishing, Cheltenham.
Habermas, J., 1997. Theorie des kommunikativen Handelns Band 1, Handlungsrationalität und gesellschaftliche Rationalisierung. Suhrkamp, Frankfurt am Main.
Hall, N., Ashworth, P., Devine-Wright, P., 2013. Societal acceptance of wind farms: analysis of four common themes across Australian case studies. Energy Policy 58, 200–208. http://dx.doi.org/10.1016/j.enpol.2013.03.009.
Hammami, S.M., Chtourou, S., Triki, A., 2016. Identifying the determinants of community acceptance of renewable energy technologies: the case study of a wind energy project from Tunisia. Renew. Sustain. Energy Rev. 54, 151–160. http://dx.doi.org/10.1016/j.rser.2015.09.037.
Haug, J.K., Stigson, P., 2016. Local acceptance and communication as crucial elements for realizing CCS in the Nordic region. Energy Procedia 86, 315–323. http://dx.doi.org/10.1016/j.egypro.2016.01.032.
Heldt, S., Budryte, P., Ingensiep, H.W., Teichgräber, B., Schneider, U., Danecke, M., 2016. Social pitfalls for river restoration: how public participation uncovers problems with public acceptance. Environ. Earth Sci. 75, 1053. http://dx.doi.org/10.1007/s12665-016-5787-y.
Hemström, K., Mahapatra, K., Gustavsson, L., 2014. Public perceptions and acceptance of intensive forestry in Sweden. Ambio 43, 196–206. http://dx.doi.org/10.1007/s13280-013-0411-9.
Heyder, M., Hollmann-Hespos, T., Theuvsen, L., 2012. Investments in tracking and tracing systems in the food industry: a PLS analysis. Food Policy 37, 102–113. http://dx.doi.org/10.1016/j.foodpol.2011.11.006.
Hitzeroth, M., Megerle, A., 2013. Renewable energy projects: acceptance risks and their management. Renew. Sustain. Energy Rev. 27, 576–584. http://dx.doi.org/10.1016/j.rser.2013.07.022.
Höltinger, S., Salak, B., Schauppenlehner, T., Scherhaufer, P., Schmidt, J., 2016. Austria's wind energy potential—a participatory modeling approach to assess socio-political and market acceptance. Energy Policy 98, 49–61. http://dx.doi.org/10.1016/j.enpol.2016.08.010.
Huber, S., Horbaty, R., Ellis, G., 2012. Social acceptance of wind power projects: learning from trans-national experience. In: Szarka, J., Cowell, R., Ellis, G., Strachan, P.A., Warren, C. (Eds.), Learning from Wind Power. Palgrave Macmillan, UK, Basingstoke, pp. 215–234.
Janikowski, R., Kucharski, R., Sas-Nowosielska, A., 2000. Multi-criteria and multi-perspective analysis of contaminated land management methods. Environ. Monit. Assess. 60, 89–102. http://dx.doi.org/10.1023/A:1006152212344.
Jones, N., Clark, J.R.A., Panteli, M., Proikaki, M., Dimitrakopoulos, P.G., 2012. Local social capital and the acceptance of protected Area policies: an empirical study of two Ramsar river delta ecosystems in northern Greece. J. Environ. Manage. 96, 55–63. http://dx.doi.org/10.1016/j.jenvman.2011.10.012.
Kahma, N., Matschoss, K., 2017. The rejection of innovations? Rethinking technology diffusion and the non-use of smart energy services in Finland. Energy Res. Soc. Sci. 34, 27–36. http://dx.doi.org/10.1016/j.erss.2017.05.024.
Kamal, S., Kocór, M., Grodzińska-Jurczak, M., 2015. Conservation opportunity in biodiversity conservation on regulated private lands: factors influencing landowners' attitude. Environ. Sci. Policy 54, 287–296. http://dx.doi.org/10.1016/j.envsci.2015.07.023.
Kendal, D., Ford, R.M., Anderson, N.M., Farrar, A., 2015. The VALS: a new tool to measure people's general valued attributes of landscapes. J. Environ. Manage. 163, 224–233. http://dx.doi.org/10.1016/j.jenvman.2015.08.017.
Krishnan, A. (2009). What are Academic Disciplines? Some observations on the Disciplinarity vs. Interdisciplinarity debate. National Centre for Research Methods, NCRM Working Paper Series 03.
Kupidura, A., Łuczewski, M., Home, R., Kupidura, P., 2014. Public perceptions of rural landscapes in land consolidation procedures in Poland. Land Use Policy 39, 313–319. http://dx.doi.org/10.1016/j.landusepol.2014.02.005.
Ladenburg, J., 2008. Attitudes towards on-land and offshore wind power development in Denmark; choice of development strategy. Renew. Energy 33, 111–118. http://dx.doi.org/10.1016/j.renene.2007.01.011.
Langer, K., Decker, T., Roosen, J., Menrad, K., 2016. A qualitative analysis to understand the acceptance of wind energy in Bavaria. Renew. Sustain. Energy Rev. 64, 248–259. http://dx.doi.org/10.1016/j.rser.2016.05.084.
Lee, G.-E., Loveridge, S., Joshi, S., 2017. Local acceptance and heterogeneous externalities of biorefineries. Energy Econ. 67, 328–336. http://dx.doi.org/10.1016/j.eneco.2017.08.013.
Leitinger, G., Walde, J., Bottarin, R., Tappeiner, G., Tappeiner, U., 2010. Identifying significant determinants for acceptance of nature reserves: a case study in the Stilfserjoch National Park, Italy. eco.Mont 2, 15–22.
Liu, W., Wang, C., Mol, A.P.J., 2013. Rural public acceptance of renewable energy deployment: the case of Shandong in China. Appl. Energy 102, 1187–1196. http://dx.doi.org/10.1016/j.apenergy.2012.06.057.
Lokocz, E., Ryan, R.L., Sadler, A.J., 2011. Motivations for land protection and stewardship: exploring place attachment and rural landscape character in Massachusetts. Landsc. Urban Plann. 99, 65–76. http://dx.doi.org/10.1016/j.landurbplan.2010.08.015.
Lucke, D., 1995. Akzeptanz: Legitimität in der 'Abstimmungsgesellschaft'. Leske und Buderich, Opladen.
Luz, F., 2000. Participatory landscape ecology—a basis for acceptance and implementation. Landsc. Urban Plann. 50, 157–166. http://dx.doi.org/10.1016/S0169-2046(00)00087-6.
Mann, S., Kögl, H., 2003. On the acceptance of animal production in rural communities. Land Use Policy 20, 243–252. http://dx.doi.org/10.1016/S0264-8377(03)00025-5.
Mante, J., Gerowitt, B., 2007. A survey of on-farm acceptance of low-input measures in intensive agriculture. Agron. Sustain. Dev. 27, 399–406. http://dx.doi.org/10.1051/agro:2007038.
Mead, G.H., 1968. Geist, Identität und Gesellschaft: aus der Sicht des Sozialbehaviourismus. Suhrkamp, Frankfurt.
Musall, F.D., Kuik, O., 2011. Local acceptance of renewable energy—a case study from southeast Germany. Energy Policy 39, 3252–3260. http://dx.doi.org/10.1016/j.enpol.2011.03.017.
Oxford Dictionary. Acceptance (Accessed 18 Aug 2015). http://www.oxforddictionaries.com/de/definition/englisch/acceptance.
Petrova, M.A., 2016. From NIMBY to acceptance: toward a novel framework – Vespa – for organizing and interpreting community concerns. Renew. Energy 86, 1280–1294. http://dx.doi.org/10.1016/j.renene.2015.09.047.
Petticrew, M., Roberts, H., 2006. Systematic Reviews in the Social Sciences. A Practical Guide. Blackwell Publishing, Marden.
Price, J.C., Leviston, Z., 2014. Predicting pro-environmental agricultural practices: the social, psychological and contextual influences on land management. J. Rural Stud. 34, 65–78. http://dx.doi.org/10.1016/j.jrurstud.2013.10.001.
Putnam, R.D., 2000. Bowling Alone: The Collapse and Revival of American Community. Simon & Schuster Paperbacks, New York.
Qiu, J., Shen, Z., Chen, L., Xie, H., Sun, C., Huang, Q., 2014. The stakeholder preference for best management practices in the three gorges reservoir region. Environ. Manage. 54, 1163–1174. http://dx.doi.org/10.1007/s00267-014-0324-9.
Que, S., Awuah-Offei, K., Samaranayake, V.A., 2015. Classifying critical factors that influence community acceptance of mining projects for discrete choice experiments in the United States. J. Clean. Prod. 87, 489–500. http://dx.doi.org/10.1016/j.jclepro.2014.09.084.
Rajecki, D.W., 1990. Attitudes. Sinauer, Sunderland.
Rand, J., Hoen, B., 2017. Thirty years of North American wind energy acceptance research: what have we learned? Energy Res. Soc. Sci. 29, 135–148. http://dx.doi.org/10.1016/j.erss.2017.05.019.
Raven, R.P.J.M., Mourik, R.M., Feenstra, C.F.J., Heiskanen, E., 2009. Modulating societal acceptance in new energy projects: towards a toolkit methodology for project managers. Energy 34, 564–574. http://dx.doi.org/10.1016/j.energy.2008.08.012.
Ren, X., Che, Y., Yang, K., Tao, Y., 2016. Risk perception and public acceptance toward a highly protested waste-to-energy facility. Waste Manage. 48, 528–539. http://dx.doi.org/10.1016/j.wasman.2015.10.036.
Robinson, K.G., Robinson, C.H., Raup, L.A., Markum, T.R., 2012. Public attitudes and risk perception toward land application of biosolids within the south-eastern United States. J. Environ. Manage. 98, 29–36. http://dx.doi.org/10.1016/j.jenvman.2011.12.012.
Rogers, E.M., 2003. Diffusion of Innovation, fifth ed. Free Press, New York.
Rohracher, H., Bogner, R., Späth, P., Faber, F., 2004. Improving the Public Perception of Bioenergy in the Eu. Final report.
Roo, G., Porter, G., 2007. Fuzzy Planning: The Role of Actors in a Fuzzy Governance Environment. Ashgate, Cornwall.
Ruggiero, S., Onkila, T., Kuittinen, V., 2014. Realizing the social acceptance of community renewable energy: a process-outcome analysis of stakeholder influence. Energy Res. Soc. Sci. 4, 53–63. http://dx.doi.org/10.1016/j.erss.2014.09.001.
Sattler, C., Nagel, U.J., 2010. Factors affecting farmers' acceptance of conservation measures—a case study from north-eastern Germany. Land Use Policy 27, 70–77. http://dx.doi.org/10.1016/j.landusepol.2008.02.002.
Sauer, A., Luz, F., Suda, M., Weiland, U., 2005. Steigerung der Akzeptanz von FFH-Gebieten. BfN-Skripten 144, München.
Schenk, A., Hunziker, M., Kienast, F., 2007. Factors influencing the acceptance of nature conservation measures—a qualitative study in Switzerland. J. Environ. Manage. 83, 66–79. http://dx.doi.org/10.1016/j.jenvman.2006.01.010.
Scherhaufer, P., Höltinger, S., Salak, B., Schauppenlehner, T., Schmidt, J., 2017. Patterns of acceptance and non-acceptance within energy landscapes: a case study on wind energy expansion in Austria. Energy Policy 109, 863–870. http://dx.doi.org/10.1016/j.enpol.2017.05.057.
Schnell, R., Hill, P.B., Esser, E., 2013. Methoden der empirischen Sozialforschung, tenth ed. Ouldenburg, Munich.
Schrader, C.C., 1995. Rural greenway planning: the role of streamland perception in

landowner acceptance of land management strategies. Landsc. Urban Plann. 33, 375–390. http://dx.doi.org/10.1016/0169-2046(94)02029-F.
Schroeder, L.A., Isselstein, J., Chaplin, S., Peel, S., 2013. Agri-environment schemes: farmers' acceptance and perception of potential 'payment by results' in grassland—a case study in England. Land Use Policy 32, 134–144. http://dx.doi.org/10.1016/j.landusepol.2012.10.009.
Schröter, B., Matzdorf, B., Sattler, C., Garcia Alarcon, G., 2015. Intermediaries to foster the implementation of innovative land management practice for ecosystem service provision—a new role for researchers. Ecosyst. Serv. 16, 192–200. http://dx.doi.org/10.1016/j.ecoser.2015.10.007.
Schumacher, K., Schultmann, F., 2017. Local acceptance of biogas plants: a comparative study in the trinational upper rhine region. Waste Biomass Valorization 8, 2393–2412. http://dx.doi.org/10.1007/s12649-016-9802-z.
Sharifzadeh, M.S., Damalas, C.A., Abdollahzadeh, G., Ahmadi-Gorgi, H., 2017. Predicting adoption of biological control among Iranian rice farmers: an application of the extended technology acceptance model (TAM2). Crop Prot. 96, 88–96. http://dx.doi.org/10.1016/j.cropro.2017.01.014.
Shindler, B.A., Brunson, M., Stankey, G.H., 2002. Social Acceptability of Forest Conditions and Management Practices: A Problem Analysis. Gen. Tech. Rep. PNW-GTR-537. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland.
Sonnberger, M., Ruddat, M., 2017. Local and socio-political acceptance of wind farms in Germany. Technol. Soc. 51, 56–65. http://dx.doi.org/10.1016/j.techsoc.2017.07.005.
Sovacool, B.K., Hess, D.J., 2017. Ordering theories: typologies and conceptual frameworks for sociotechnical change. Soc. Stud. Sci. 47, 703–750. http://dx.doi.org/10.1177/0306312717709363.
Sovacool, B.K., Kivimaa, P., Hielscher, S., Jenkins, K., 2017. Vulnerability and resistance in the United Kingdom's smart meter transition. Energy Policy 109, 767–781. http://dx.doi.org/10.1016/j.enpol.2017.07.037.
Sovacool, B.K., Ratan, P.L., 2012. Conceptualizing the acceptance of wind and solar electricity. Renew. Sustain. Energy Rev. 16, 5268–5279. http://dx.doi.org/10.1016/j.rser.2012.04.048.
Spartz, J.T., Rickenbach, M., Shaw, B.R., 2015. Public perceptions of bioenergy and land use change: comparing narrative frames of agriculture and forestry. Biomass Bioenergy 75, 1–10. http://dx.doi.org/10.1016/j.biombioe.2015.01.026.
Specht, K., Siebert, R., Thomaier, S., 2016. Perception and acceptance of agricultural production in and on urban buildings (ZFarming): a qualitative study from Berlin, Germany. Agric. Hum. Values 33, 753–769. http://dx.doi.org/10.1007/s10460-015-9658-z.
Stern, P.C., 2000. New environmental theories: towards a coherent theory of environmentally significant behaviour. J. Soc. Issues 50, 65–84.
Stigka, E.K., Paravantis, J.A., Mihalakakou, G.K., 2014. Social acceptance of renewable energy sources: a review of contingent valuation applications. Renew. Sustain. Energy Rev. 32, 100–106. http://dx.doi.org/10.1016/j.rser.2013.12.026.
Strazzera, E., Statzu, V., 2017. Fostering photovoltaic technologies in Mediterranean cities: consumers' demand and social acceptance. Renew. Energy 102, 361–371. http://dx.doi.org/10.1016/j.renene.2016.10.056.
Stringer, L.C., Fleskens, L., Reed, M.S., de Vente, J., Zengin, M., 2014. Participatory evaluation of monitoring and modeling of sustainable land management technologies in areas prone to land degradation. Environ. Manage. 54, 1022–1042. http://dx.doi.org/10.1007/s00267-013-0126-5.
Suškevičs, M., Külvik, M., 2010. The role of information, knowledge, and acceptance during landowner participation in the natura 2000 designations: the cases of Otepää and Kõnnumaa, Estonia. In: Jones, M., Stenseke, M. (Eds.), Therapeutic European Landscape Convention. Springer, Netherlands, pp. 275–294. http://dx.doi.org/10.1007/978-90-481-9932-7_14.
Tapsuwan, S., Leviston, Z., Tucker, D., 2011. Community values and attitudes towards land use on the Gnangara groundwater system: a sense of place study in Perth, Western Australia. Landsc. Urban Plann. 100, 24–34. http://dx.doi.org/10.1016/j.landurbplan.2010.09.006.
Te Velde, H., Aarts, N., Van Woerkum, C., 2002. Dealing with ambivalence: farmers' and consumers' perceptions of animal welfare in livestock breeding. J. Agric. Environ. Ethics 15, 203–219.
Thøgersen, J., Noblet, C., 2012. Does green consumerism increase the acceptance of wind power? Energy Policy 51, 854–862. http://dx.doi.org/10.1016/j.enpol.2012.09.044.
Tohidyan Far, S., Rezaei-Moghaddam, K., 2017. Determinants of Iranian agricultural consultants' intentions toward precision agriculture: integrating innovativeness to the technology acceptance model. J. Saudi Soc. Agric. Sci. 16, 280–286. http://dx.doi.org/10.1016/j.jssas.2015.09.003.
Tokushige, K., Akimoto, K., Tomoda, T., 2007. Public perceptions on the acceptance of geological storage of carbon dioxide and information influencing the acceptance. Int. J. Greenh. Gas Control 1, 101–112. http://dx.doi.org/10.1016/S1750-5836(07)00020-5.
Toma, L., Barnes, A., Revoredo-Giha, C., Tsitsoni, V., Glenk, K., 2014. A behavioural economics analysis of the impact of information and knowledge on CO2 capture and storage acceptance in the European union. Procedia Econ. Finance 14, 605–614. http://dx.doi.org/10.1016/S2212-5671(14)00749-7.
Tschiedel, R., 1989. Sozialverträgliche Technikgestaltung–Wissenschaftskritik für eine soziologische Sozialverträglichkeitsforschung zwischen Akzeptabilität. Westdeutscher Verlag, Opladen.
Tudor, C.A., Iojă, I.C., Rozylowicz, L., Pătru-Stupariu, I., Hersperger, A.M., 2015. Similarities and differences in the assessment of land-use associations by local people and experts. Land Use Policy 49, 341–351. http://dx.doi.org/10.1016/j.landusepol.2015.07.001.
Tumuhairwe, J.B., Rwakaikara-Silver, M.C., Muwanga, S., Natigo, S., 2007. Screening legume green manure for climatic adaptability and farmer acceptance in the semi-arid agro-ecological zone of Uganda. In: Bationo, A., Waswa, B., Kihara, J., Kimetu, J. (Eds.), Advances in Integrated Soil Fertility Management in Sub-Saharan Africa: Challenges and Opportunities. Springer, Netherlands, pp. 255–259. http://dx.doi.org/10.1007/978-1-4020-5760-1_22.
Turner, J., 1991. The Structure of Sociological Theory, fifth ed. Wadsworth Publishing Company, Belmont.
Udo-Akang, D., 2012. Theoretical constructs, concepts, and applications. Am. Int. J. Contemp. Res. 2, 89–97.
Upham, P., Oltra, C., Boso, A., 2015. Towards a cross-paradigmatic framework of the social acceptance of energy systems. Energy Res. Soc. Sci. 8, 100–112. http://dx.doi.org/10.1016/j.erss.2015.05.003.
van Oorschot, W., Gelissen, W., Arts, J., 2006. Social capital in Europe. Measurement and social and regional distribution of a multifaceted phenomenon. Acta Sociol. 49, 149–167.
van Os, H.W.A., Herber, R., Scholtens, B., 2014. Not under our back yards? A case study of social acceptance of the Northern Netherlands CCS initiative. Renew. Sustain. Energy Rev. 30, 923–942. http://dx.doi.org/10.1016/j.rser.2013.11.037.
Veidemane, K., Nikodemus, O., 2015. Coherence between marine and land use planning: public attitudes to landscapes in the context of siting a wind park along the Latvian coast of the Baltic Sea. J. Environ. Plann. Manage. 58, 949–975. http://dx.doi.org/10.1080/09640568.2014.903167.
Walker, B.J.A., Wiersma, B., Bailey, E., 2014. Community benefits, framing and the social acceptance of offshore wind farms: an experimental study in England. Energy Res. Soc. Sci. 3, 46–54. http://dx.doi.org/10.1016/j.erss.2014.07.003.
Walter, G., 2014. Determining the local acceptance of wind energy projects in Switzerland: the importance of general attitudes and project characteristics. Energy Res. Soc. Sci. 4, 78–88. http://dx.doi.org/10.1016/j.erss.2014.09.003.
Western, J.M., Cheng, A.S., Anderson, N.M., Motley, P., 2017. Examining the social acceptability of forest biomass harvesting and utilization from collaborative forest landscape restoration: a case study from western Colorado, USA. J. For. 115, 530–539. http://dx.doi.org/10.5849/JOF-2016-086.
Williams, R., Mills, S., 1986. Public Acceptance of New Technologies: An International Review. Croom Helm, London, UK, pp. 1–18.
Williams, K., 2011. Relative acceptance of traditional and non-traditional rural land uses: views of residents in two regions, southern Australia. Landsc. Urban Plann. 103, 55–63. http://dx.doi.org/10.1016/j.landurbplan.2011.05.012.
Williams, K.J.H., 2014. Public acceptance of plantation forestry: implications for policy and practice in Australian rural landscape. Land Use Policy 38, 346–354. http://dx.doi.org/10.1016/j.landusepol.2013.11.023.
Wolff, J., Herzog, H., 2014. What lessons can hydraulic fracturing teach CCS about social acceptance? Energy Procedia 63, 7024–7042. http://dx.doi.org/10.1016/j.egypro.2014.11.736.
Wolsink, M., 2006. Invalid theory impedes our understanding: a critique on the persistence of the language of NIMBY. Trans. Inst. Br. Geogr. 31, 85–91. http://dx.doi.org/10.1111/j.1475-5661.2006.00191.x.
Wolsink, M., 2010. Contested environmental policy infrastructure: socio-political acceptance of renewable energy, water, and waste facilities. Environ. Impact Asses. Rev. 30, 302–311. http://dx.doi.org/10.1016/j.eiar.2010.01.001.
Wolsink, M., 2012. Wind power: basic challenge concerning social acceptance. In: Meyers, R.A. (Ed.), Encyclopedia of Sustainability Science and Technology. Springer, New York, pp. 12218–12254. http://dx.doi.org/10.1007/978-1-4419-0851-3_88.
Wüste, A., Schmuck, P., 2013. Social acceptance of bioenergy use and the success factors of communal bioenergy projects. In: Ruppert, H., Kappas, M., Ibendorf, J. (Eds.), Sustainable Bioenergy Production–An Integrated Approach. Springer, Dordrecht, pp. 293–318.
Wüstenhagen, R., Wolsink, M., Bürer, M.J., 2007. Social acceptance of renewable energy innovation: an introduction to the concept. Energy Policy 35, 2683–2691. http://dx.doi.org/10.1016/j.enpol.2006.12.001.
Yuan, X., Zuo, J., Huisingh, D., 2015. Social acceptance of wind power: a case study of Shandong Province, China. J. Clean. Prod. 92, 168–178. http://dx.doi.org/10.1016/j.jclepro.2014.12.097.
Zhao, D.-X., He, B.-J., Johnson, C., Mou, B., 2015. Social problems of green buildings: from the humanistic needs to social acceptance. Renew. Sustain. Energy Rev. 51, 1594–1609. http://dx.doi.org/10.1016/j.rser.2015.07.072.
Zoellner, J., Schweizer-Ries, P., Wemheuer, C., 2008. Public acceptance of renewable energies: results from case studies in Germany. Energy Policy 36, 4136–4141. http://dx.doi.org/10.1016/j.enpol.2008.06.026.

4. The acceptability of land pools for the sustainable revalorisation of wetland meadows in the Spreewald region, Germany (Paper 2)

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Article

The Acceptability of Land Pools for the Sustainable Revalorisation of Wetland Meadows in the Spreewald Region, Germany

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Abstract: To successfully implement sustainability innovations, it is crucial to gain knowledge about their acceptability by potential users. This paper addresses the acceptability of land pools for the sustainable revalorization of wetland meadows using two case studies in a cultural landscape (CL) in Germany. The aim of this study is to analyse factors that influence the decisions of landowners and farmers towards these land pools. Therefore, we developed a sociologically driven framework of acceptability. We applied structured qualitative text analysis for analysing qualitative interviews. The results show that acceptability differs between the two case study areas and between interviewees. The value-based appreciation of the CL is high, but does not lead "per se" to a positive acceptance of the land pools. Reasons for this are the lack of shared values and the existence of diverging opinions about the objectives of land pools. Additional important factors are previous experiences, level of participation, and trust in actors or institutions. A recommendation is that discussion of values of nature supports the identification of shared values. A clear description of the problem and embedding the concept in a systematic strategy for regional development could enhance acceptability. For the success of similar sustainability innovations, it is essential to design a fair innovation process (transparent communication and active actors' involvement). A theoretical-conceptual conclusion is that the acceptability framework supports qualitative, in-depth and actor-centred analyses focussing on linkages between values and arguments on different levels. The framework also reveals diverse and previously unknown factors.

Keywords: attitudes; acceptance; societal relations to nature; biodiversity banking; peatland management; sustainability innovation; procedural justice; social-ecological interactions

1. Introduction

Today, extensively used wetlands of high nature value are under increasing threat of falling out of use for both economic and cultivation-related reasons. The decrease in the current use of wetlands and flooded meadows is evident for many European cultural landscapes (CL) (e.g., [1,2]). This land abandonment in cultural landscapes can dramatically reduce the functioning of the ecosystems, biodiversity, and cultural values [1,3]. To mitigate such losses, innovative solutions for reusing threated wetlands are needed.

One example of land abandonment is the issue of marginal wetland meadows in the Spreewald region (Germany). These marginal wetlands—in the sense of fragmentized and small-scale wetland meadows—are a typical element of the CL in this region, in addition to the ramified network of water

channels, floodplain forests, small-spatial wood structures and arable lands. The CL has grown over the course of centuries as a result of human agricultural production and livelihoods. Regional stakeholders of the Spreewald region are aiming for the continual use of marginal wetlands in an effort to preserve biodiversity and spatial differentiation as typical characteristics of this CL, the latter with the goal of providing an attractive landscape for tourism. Therefore, innovative solutions for the sustainable valorisation of wetlands are under development using a transdisciplinary innovation process. One possible solution consists of financing the wetlands' development and maintenance measures through a legal biodiversity offset banking instrument—so-called land pools [4]. In German, these land pools are known as "Flächen- und Maßnahmenpools". Although land pools are not a very new idea in general, they are new in this region and subject to region-specific site and instructional conditions. In Germany, land pooling has been embodied in the national law (German Federal Building Code) since the end of the 1990s. However, the federal state of Brandenburg, in which in the Spreewald region is located, enacted land pools in its Nature Protection Law (BbgNatSchG § 14) in 2004 and published a state-related regulation to concretise the law into specific handling instructions in 2009. Since then, there have been some examples of land pools in Brandenburg, but there are no examples in the Spreewald region. Due to this novelty effect, land pools can be seen as an innovative part of the previously mentioned systematic strategy.

The concept of land pools refers to a public and mainly non-commercial type of biodiversity banking. It is the main pillar of public offset instruments in Germany [4,5]. Land pools bundle potential vulnerable land plots and allocate them for landscape development and maintenance measures. These are compensation measures for impacts on nature and on the landscape (according to the German Impact Mitigation Regulation: §§ 14–18 BNatSchG, § 14 BbgNatSchG and the German Federal Building Code: spatial and temporal flexibilisation of compensation measures §§1a Abs. 3, 9 Abs. 1a, 135a Abs. 2, 200a BauGB). The official recognition and certification process of land pools is an administrative procedure; it is legally binding and should lead to long-term financing of maintenance and development measures for nature conservation. In accordance with national law (BauGB § 5 Abs. 2/10), it is recommended to include land pools in land-use plans and to develop a management plan [6]. For landowners, a land pool implies restricted property rights concerning land use, which is recorded in the land register. Other states have established similar banking instruments to compensate for impact on nature; examples include wetland mitigation banks in the United States of America [7] and a biodiversity offset supply scheme in France [4]. Each of these different banking instruments is based on specific laws and on institutional, financial, and instrumental settings.

There are some publications on biodiversity offsets and mitigation and conservation banking [4,8] but only very few international publications that deal specifically with land pools. The most prominent one is by [4], who categorise different types of biodiversity banking using an international comparative analysis. Nevertheless, there are a multitude of German publications [5,7,9]; these deal mainly with the institutional setting of land pools and their contribution to spatial planning but not with their acceptability by local actors. With the present article, we contribute to filling this research gap.

From a practice-oriented perspective, more knowledge about the acceptability of land pools is needed because acceptability elucidates the potential of implementing land pools: An acceptability analysis reveals if and why landowners and land users accept or reject land pools. Landowners and users are core actors in the regional development process of land pools. Without considering this acceptability issue, sustainability innovation projects can completely fail in the event that the affected actors reject the underlying idea. Hence, such projects cannot be successfully implemented if their acceptability is not considered first. Furthermore, by attending to acceptability, potential land use conflicts could be avoided. The aim of this paper is to analyse landowners' and farmers' attitudes towards acceptability issues of land pools in two case study areas (CS1 and CS2) of the Spreewald region. From a practice-oriented perspective, we address the following research questions:

(RQ1) Which factors (in terms of arguments and values) influence their acceptability decisions and what are the linkages between them?

(RQ2) To what degree do landowners and farmers accept land pools?

To conduct this analysis, an additional conceptual research question had to be considered:

(RQ3) How should a framework be conceptualized in order to include the most important characteristics of acceptability?

In addition to RQ1 and RQ2, we formulated the following ex-ante hypotheses on the basis of the explorative interviews (cf. Section 3.2.1).

(H1) The investigation and examination of values of nature and CL are crucial for studying the acceptability of land-use-related innovations. This assumption is in line with environmental ethics, which states that nature conservation argumentations are based on various value dimensions such as instrumental, eudemonistic, and intrinsic values (cf. [10]). (The eudemonistic values are attributed to the basic condition for the quality of human lives).

(H2) The design of the innovation processes positively or negatively influences acceptability decisions.

(H3) Acceptability decisions depend on perceptions of the development of the landscape during recent decades.

These ex-ante hypotheses can be understood as basic assumption statements that make previous knowledge explicit. This technique is recommended for qualitative research [11].

2. The Development of an Own Theoretical-Conceptual Framework

To address RQ3, we considered an in-depth literature review of existing studies dealing with acceptability or acceptance in the field of land use [12]. This review shows that the theoretical-conceptual basis of acceptance is on the one hand still weak, and on the other hand inconsistent in the use of terms. To bring more clarification, we distinguish between acceptance and acceptability as recommended by [12,13]. Therefore, we understand acceptance as one of several possible results of a judgement process, specifically as a positive result in the sense of non-rejection. In contrast, acceptability is a complex theoretical concept that looks at the process by which judgements are formed and decisions are made.

To fill the above-mentioned gap and provide a consistent theoretical-conceptual framework, we provide a detailed definition of acceptability and develop a framework that reflects its various characteristics and structuring elements. Both the definition and framework were developed from a mainly sociological perspective [14], which includes theoretical elements developed in landscape planning [15], environmental science [16], and technology assessment [17] (cf. Figure 1).

Referring to Figure 1, in our understanding, acceptability (as a theoretical concept) encompasses (a) actor-based and dynamic decision processes that are supported by value-based arguments and formed in intrapersonal and intersubjective judgement processes. These decisions—so-called acceptability decisions—are (b) the products of the interaction between the acceptability actor, the specific acceptability object, other actors, and the context. There are (c) several possible degrees of acceptability decisions (from opposition and rejection to high acceptance and engagement) on different possible (d) acceptability levels (attitude level, action level, or utilisation level).

(a) The complex acceptability decisions, made by the acceptability actors, can vary over time instead of being static once articulated.

(b) Furthermore, acceptability implies actors' active examination of the acceptability object within its context and their interactions with other actors to make a decision using rational insight and value-based internal conviction [14]. These multiple relations, described by the German sociologist Doris Lucke, are cited by some other scientific publications (e.g., [18–20]). Similar to this understanding, the processes of interactions between technology (acceptability object) and social actors on different spatial scales are underlined by [13,16].

(c) The term "degrees of acceptability decisions" describes possible positions on a quality axis [15,21], ranging from negative acceptance grades to positive acceptance grades. The acceptability decisions can express, for instance, opposition, rejection, low acceptance, tolerance, indifference, conditional acceptance, high acceptance, and engagement (proactive support) [22,23].

(d) According to [14,16,19,24], acceptability is not only about attitudes. Therefore, we distinguish among attitude level, action level, and utilisation level (cf. [17]). At the non-proactive level of attitudes, the subject offers an internal judgement before acting. At the next level, the subject alters his judgement into an action that is the expression of his attitudes. The utilisation level refers to assessing the long-term use of an innovation.

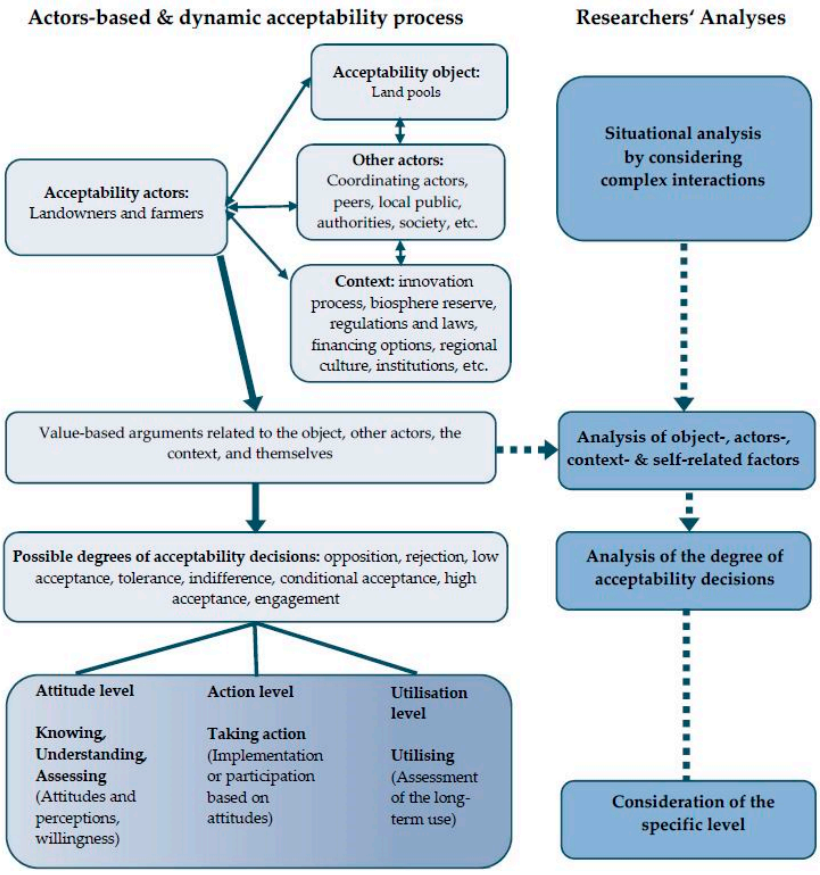

Figure 1. Conceptual framework of acceptability with adaptations to the case study land pool (own design in accordance with [14–17]). Left side: In the actor-based and dynamic acceptability process, the acceptability actors reflect on the acceptability object, the arguments of other involved actors, and the context. These interactions are the foundation for value-based arguments that lead to the actors' acceptability decision. These acceptability decisions can be assigned to a particular degree (from opposition to engagement) and can be made on a certain level (attitude, action, or utilisation level). Right side: Researchers should take into account this complexity with all mentioned components when analysing acceptability. This includes the analysis of the specific situation by considering the complex interactions, the analysis of factors (based on the stated arguments of the acceptability actor, the analysis of the particular acceptability degree, and the reflection of the level on which decisions are made.

Using our acceptability framework (Figure 1), it is possible to conceptually frame and structure complex acceptability phenomena. Furthermore, our framework advocates an open analysis, because the factors or arguments that influence acceptability decisions are not determined ahead of time. This feature corresponds to the paradigm of qualitative research. Thus, interviewees are free to argue without being limited by a rigid corset of items. All mentioned arguments can be considered in later

analyses. This approach is mainly suitable for explorative studies in which not all factors were known previously [25].

The analysis was conducted on the attitude level, which encompasses the acceptability decisions and their different degrees as preconditions for later action [14]. At the same time, the analysis shows indications on the action level. This is especially the case for the land pool CS1.

3. Case Study Areas, Materials, and Methods

3.1. Case Study Areas and the Process for Establishing Land Pools

At the beginning of our research project in 2015, two land pools (CS1 and CS2) were in the planning stage, and these served as case study areas for this acceptability study (Figure 2). The Spreewald Foundation—a non-profit foundation dedicated to the cultural landscape of the Spreewald region—acts as initiator and coordinator, and as potential manager of the land pools. In the establishment phase and functioning process of land pools, this foundation maintains relations with different actors, as depicted in Figure 3. The pool manager concludes contracts with the investor (polluter), the authorities, the landowners, the executing company (e.g., a local farmer), and the planning office in order to offer the provision of land and to plan, coordinate, document, and monitor maintenance measures.

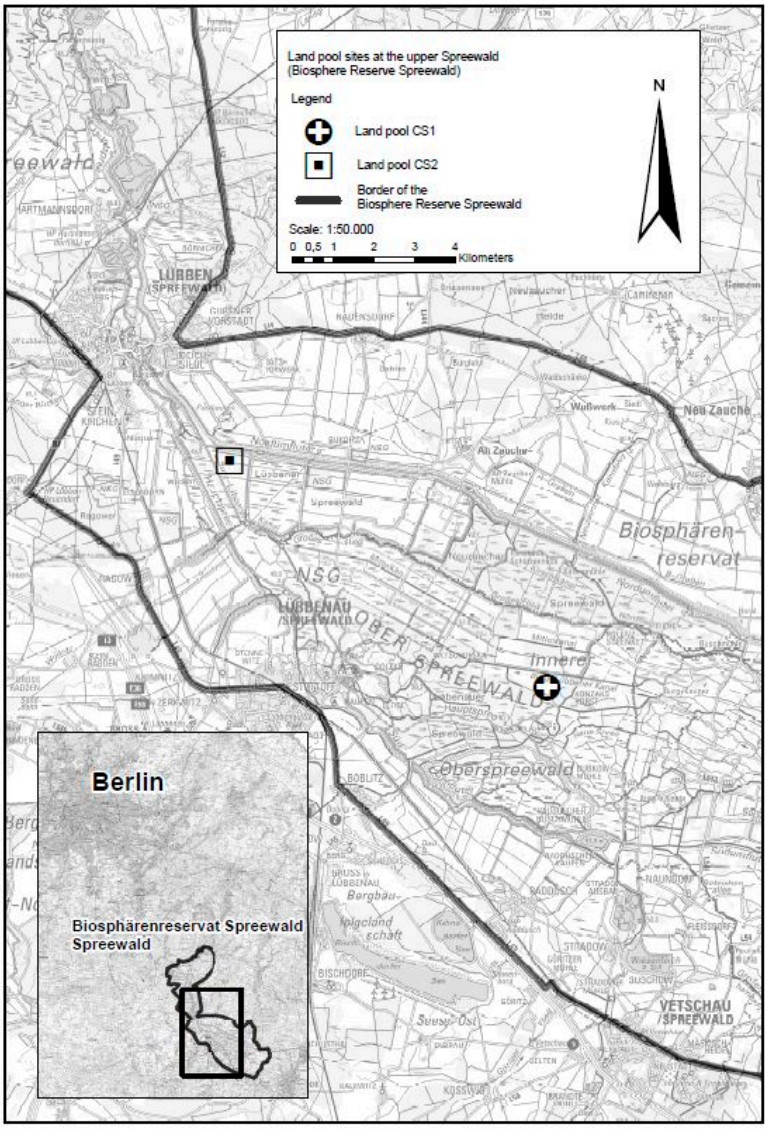

Figure 2. The location of the case study areas.

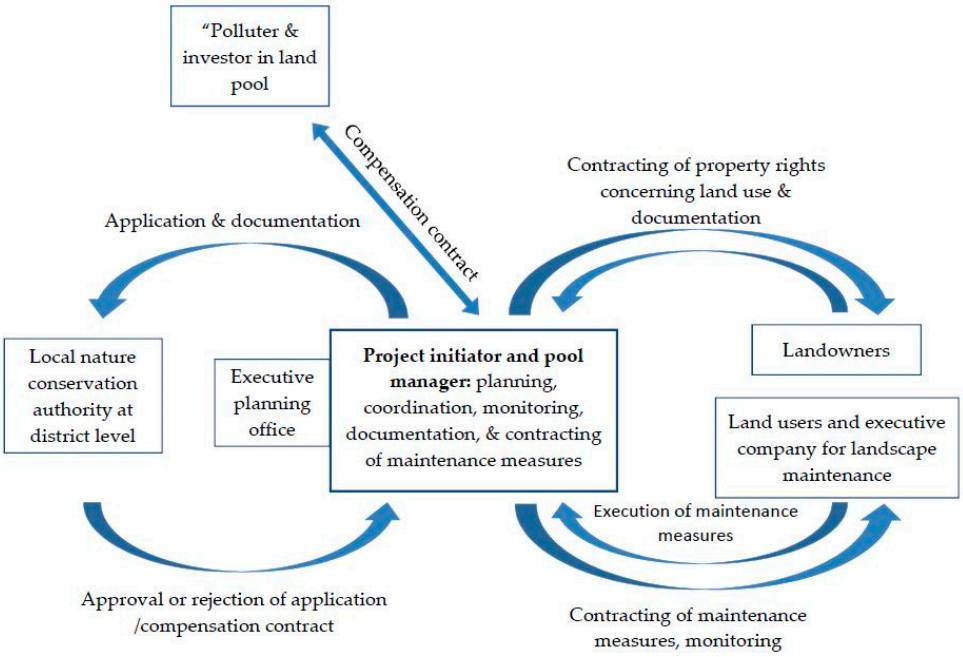

Figure 3. Functioning and requirements of establishing land pools in the Spreewald region (own design, in accordance with Stiftung Rheinische Kulturlandschaft 2017) (http://www.rheinische-kulturlandschaft.de/wp-content/uploads/2016/12/Grafik-Massnahmentraeger.jpg).

CS1 and CS2 are located in the biosphere reserve "Spreewald" (Germany) and are part of zone II, which is known as a buffer zone (or maintenance zone). At the same time, the case study areas are nature conservation sites and Habitats Directive Sites of Community Importance (Flora Fauna Habitat areas), with established use and cultivation restrictions [26]. Thus, landowners and users have restricted possibilities to act with regard to their land plots.

The CS1 encompasses an area of approximately 160 ha, of which 70 ha are wet meadows and the remaining ha are forest and woodland biotopes. The former hay meadows are currently only sporadically and partly used. Since the 1950s, more than half of that area has been recaptured by *Sambucus nigra* and *Fraxinus excelsior*, mostly by reforestation and much less by succession. The larger part of the remaining meadow land of that area is not in use anymore due to unfavourable hydrological conditions. There has been a loss of biodiversity due to natural succession, primarily of *Carex acuta* L., *Carex acutiformis Erh.*, *Phragmites australis*, *Salix cinerea*, and *Alnus glutinosa* (E-01). Through the intended re-use of those meadows by mowing, further succession to forest biotopes can be avoided and the former habitat types protected by the European Habitats Directive can be revitalized (SP1). In CS1, all landowners are private, and each of the 15 landowners owns only small plots. In 2014, on behalf of the initiator of the land pool concept, bilateral ad-hoc communication meetings between a regional consultant and each landowner took place. During these meetings, the overall conditions for lease and usage agreements were discussed with each landowner. A planned and mutual participation process—in the form of joint meetings with open discussions—was not conducted at the beginning. After these bilateral meetings, two public communication meetings were held to present the land pool concept and discuss co-operation conditions.

The CS2 has an area of 60 ha and is dominated by open landscape in the form of wetland meadows. Similar to land pool CS1, it is characterized by the existence of protected biotopes, including a natural occurrence of rare brown moss fen patches (*Amblystegiaceae*) and threatened species such as *Hierochloe odorata*. However, increasing natural succession and seasonal water logging can be observed. Various small channels cross this area. Some plots are still used by a local farming company. With seven private landowners, two foundations, two administrative entities, and a farming company, the property structure in CS2 is more heterogeneous than in CS1. In total, there are twelve landowners in

this case study area. To present the land pool concept and to openly discuss the aims of development in the local area, a joint workshop with landowners and farmers was conducted at the end of 2015. Additionally, the coordinating institution offered to visit the land plots. Landowners do not use their plots themselves for agricultural production. Some did not even know the condition of their properties at the time. Five landowners accepted this offer and participated in a joint "field visit" in spring 2016.

For both land pools, maintenance and development measures were planned and described in a management plan. The two areas can be differentiated by location and the composition of dominating habitat types within the area. CS2 is situated near the town of Lübben and at the border of the flood plain area of the river Spree. Land pool CS1 is located at the very centre of the flood plain area, near a small village.

3.2. Methods

3.2.1. Data Collection Method and Empirical Material

The research object (the acceptability of land pools for marginal wetlands) is a contemporary complex phenomenon in a real-life context, and thus some aspects of it are still unknown. Adequately addressing this initial condition, we chose a qualitative and circular research approach [25,27]) with an embedded case design [28]). The research design consists of a situational and in-depth analysis using different types of qualitative interviews (Table A1). In 2015, explorative interviews [29] with 6 regional experts [30] were conducted to capture the recent situation in the region. This situational analysis (cf. [31]) included the framing of the problem, the discussed solution strategies, and initial acceptability-related statements. With the support of the explorative interviews, we redefined the practice-oriented research questions (RQ1 and RQ2), formulated the hypotheses (H1–H3), and described the case study areas, the constellation of the actors, and the process for establishing the land pools (Section 3.1). Furthermore, these interviews served to contextualise the results of in-depth analysis concerning the acceptability seen by landowners and farmers.

To conduct the in-depth analysis, we applied the method of qualitative and problem-centred interviews [32]. By using this method, we gained a profound insight into the rich acceptability issue, revealed linkages between argumentations and values, and found causalities within the heterogeneity of acceptability patterns (cf. [25]). From 2015 to 2017, we conducted problem-centred interviews with 13 farmers and landowners in the two case study areas (CS1 and CS2). The interview participants included one representative of a nature conservation organization (who is also a regional expert), four private landowners out of 15 with land plots in CS1 (including one group interview), and nine private landowners out of twelve with land plots in CS2. Two of the latter group were also farmers (one farmer and one hunter). This qualitative research method was also necessary because of the structure of landownership (small number of analytical units) and because of the specifics of field access (only direct contact with people enabled their willingness to participate).

The interview guideline was based on the analytical framework as described in Section 2. It contained questions concerning the interviewee's relation to their land property and to the CL, concerning attitudes towards the maintenance of the CL and the acceptability of land pools, and concerning alternative solutions for marginalized wetlands. The interviews lasted between 30 minutes and one-and-a-half hours. To meet the requirements of transparency and reliability in qualitative case studies [28], we produced interview notes, which included the personal impression and circumstances of the interview situation, as well as additional information beyond the recorded interview itself. The audio-recorded interviews were transcribed. Afterwards, the transcripts were sent to interviewees, thus providing them with copies with which to confirm the interview content. This procedure follows the ethical standards of qualitative social science [33,34].

As additional material, we used the minutes of a stakeholder participation workshop related to the CS2 land pool, feedback from participants in the workshop (in the form of short questionnaire results), and an opinion statement of a local interest group regarding the recent developments in CS2.

3.2.2. Analytical Method

To analyse the problem-centred interviews, we applied the method of Qualitative Text Analysis (a variant of Qualitative Content Analysis) described in [35]; we also considered the approaches of other authors who describe Qualitative Content Analysis, such as [36,37]. Qualitative Content Analysis follows the following principles: (1) embedding the analysis in a model of communication (including the objective and the formation settings), (2) applying a rule-based and step-wise procedure scheme, (3) coding and analysing the text on the basis of categories, and (4) ensuring transparency, validity, and reliability [35,37]. Kuckartz [35] highlights the importance of feedback loops between each step of analysis by iteratively refining the research question and the categories. Guided by this approach, our method of analysis follows a circular procedure, which is consistent with our circular research approach.

Recognizing that there are diverse types of Qualitative Content Analysis [35,36], we mainly applied the structured type to conduct an interpretive thematic analysis. In this type, the use of thematic categories is common. We combined this type of category with an evaluating category that served to define the degree of acceptability decisions. By applying a mix of deductive and inductive categories, the main categories are based on the analytical framework (e.g., object-, actors-, context-, and self-related factors, acceptability degrees), whereas most sub-categories were developed out of the interview material (e.g., trust in coordinating actors, procedural justice, prior experiences, etc.). Afterwards, we used the inductively derived categories to rethink and adjust our analytical framework (cf. [36,38]). As recommended by Kuckarz and Schreier [35,36], we worked with category definitions, example codings for each category, and coding guidelines. The coding process and the analysis of the material were software-supported using MaxQDA 10 (verbi GmbH). The main messages of the codings are summarized as short texts and arranged in the profile matrix. According to Kuckartz [35], the profile matrix is a fundamental instrument of qualitative text analysis that shows main results in a complex table with entries for each analytical unit and topic. This allows further analyses in two directions—thematic analyses across interviews and analyses across different topics (cf. Section 4).

4. Results

In the results section, we reveal the aggregated results of our interview analyses.

Section 4.1 is dedicated to RQ1. In this part, we describe the different factors which influence the acceptability of the land pools. The second subsection of the results (Section 4.2) responds to RQ2. In this part, we compare the acceptability degrees of the two case study areas—CS1 and CS2. In Section 4.3, we illustrate the linkages of different factors in detail and the line of argumentation using one interview as example. Furthermore, all results are summarised in the two profile matrices (Supplementary Materials: Tables S1 and S2). In these profile matrices, we show the results for each analysed interview and case study area in a comprehensive manner.

4.1. Factors Influencing the Acceptability of Land Pools

Regarding the research question about the factors influencing the acceptability and connectivity of factors (RQ1), the analysis revealed a complex acceptability pattern of land pools (Figure 4). Often, the argumentations about the particular topics (appreciation of CL and wetlands, attitudes toward maintenance of wetlands, etc.) were built upon each other. Therefore, these topics cannot be described in complete isolation from one another.

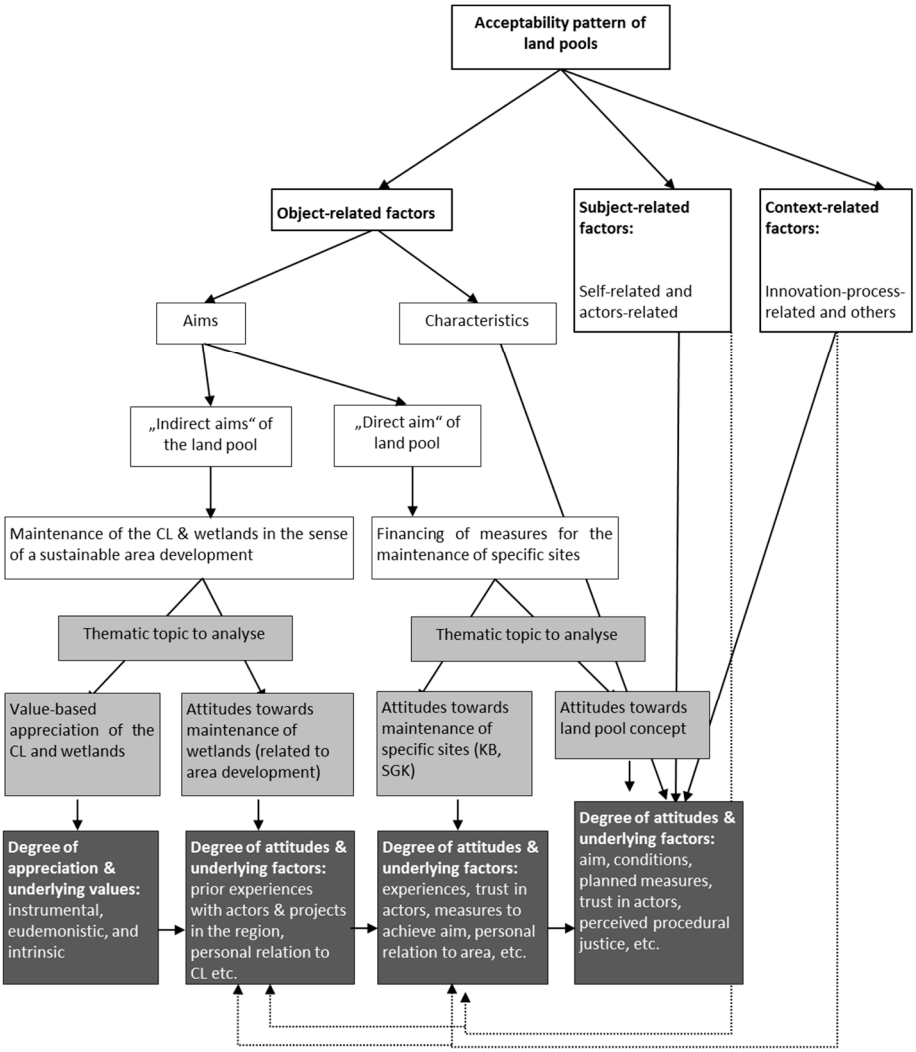

Figure 4. The analytical acceptability pattern of land pools in CS1 and CS2. The figure shows the analysed topics (middle grey boxes in the centre) and the respective outcome aspects that include the specific degrees and underlying factors (dark grey boxes at the bottom). The topics derive from deductively built factors (object-, subject-, and context-related factors) and inductively built aims (direct aim and indirect aim) and factors (e.g., perceived procedural justice). Generally, this analytical acceptability pattern is a preparatory result stage that can be used to better understand the structure of the specific results.

4.1.1. Values of the CL and Wetlands

In accordance with the framework (Figure 1) and our hypothesis 1 (H1), we paid special attention to the perceived values of the CL and the wetlands because the attitudes towards land pools depend on value-based judgements and decisions (cf. Figure 4). In general, the appreciation of the CL is high or very high, but this does not lead per se to a positive acceptance of the land pool (cf. profile matrices in Supplementary Materials). To illustrate this fact, we give examples. The initiators of the land pool use mainly biodiversity conservation arguments, but they are less shaped by eudemonistic or intrinsic values. Most interviewed landowners and users argue based on economic values, namely that the CL should be maintained for agricultural use. Additionally, they cited eudemonistic values such as the importance of regional and cultural identity, the beauty of the landscape or its recreational value (cf. quotation CS2-03 and CS2-08). In some cases, nature conservation arguments were mentioned as well. To summarize, there are no shared values among landowners, users and the initiators of the land pools per se. The degree of appreciation of the CL depends on the perceived importance of maintaining the wetlands in general.

> The wet meadows are *"what really represent the Spreewald. It* [the maintenance of the wetlands] *is very important for us. What now happens, here in the Spreewald . . . It has grown wild, I say. It has become overgrown. I did not know the Spreewald like that in earlier times. . . . "* (CS2-03)

> The maintenance of the wetlands is important *"because they are parts of the cultural landscape, aren't they? And certainly they were used too intensively in the past . . . But I say, to leave nature to itself until there is only swampland . . . That is not the Spreewald. There should be strict nature reserve zones—that is O.K. But the cultural landscape itself is more important for me: That there is a cow from time to time, or that the farmer can use its plots in a reasonable way."* (CS2-08)

4.1.2. Attitudes towards the Maintenance of the Wetlands

To understand the acceptability of land pools, it is important to consider their "direct aims" and "indirect aims" (Figure 4). The "direct aim" of land pools is the financing of measures for the maintenance of specific wetlands. According to the initiators, the main "indirect aim" of establishing land pools is the maintenance of the wetlands as part of the CL and of the sustainable development of the area. Thus, the land pool concept is only one of the possible options for achieving the "indirect aim". In line with this thinking, some interviewees prefer other solutions to finance the maintenance of wetlands. As preferred solutions, they mentioned, for instance, cooperation with local tourism providers to develop voluntary financing instruments for tourists or the thermal use of landscape material by establishing decentralized heat-generating power stations.

As shown in Supplementary Materials, attitudes towards the maintenance of the wetlands and of the wetlands (CS1 and CS2) are much better than attitudes towards the land pool concept. One reason for this is the criticism of some interviewees that the focus is only on wetlands and not on the CL as a whole. They argue that wetlands are an important part of the CL, but they are only one part. Thus, other issues, such as the management of the water body and forests, are underexposed. The current water management was sometimes cited as misleading, poorly implemented, and influenced by the interests of "environmentalists". This mismanagement of water is seen as a type of "creeping land expropriation" because it leads to high groundwater levels, which consequently makes the wetlands useless and worthless for farmers (cf. quotation CS1-02). According to those concerned interviewees, this situation could be used by "environmentalists" to declare worthless wetlands as "strict nature reserve areas" for the protection of wilderness. This discussion of aims shows that the desired and necessary conditions for the area's development—in contrast to the area's current state—influenced the interview partners in their judgements of the land pools.

> *" . . . that these areas are put under water to pass them completely to nature conservation—that means zone 1, absolutely no trespassing—and that the nature conservationists just perform a creeping expropriation, from behind. They say that they cannot do anything. Guilty is that person or another one or certain circumstances. But that is not true. Our problem is that we become just expropriated—in a manner. Maybe it is so. Anyway, this feeling is there . . . "* (CS1-04)

Generally, the attitudes towards the maintenance of wetlands are influenced by the stated values of the CL and by prior experience with actors and projects in the region with regard to sustainable development of the area.

> *"Well, when there is something new, almost always they talk to us very late or only very seldom. That is just a mistake, too. They should ask us right from the beginning: Is this possible at all?"* (CS1-03)

The critical view on the maintenance of case study areas is associated with the medium or strong personal connection of the interviewees to their land. Interviewees with a strong connection to the area see themselves as competent to discuss and decide about the area's development. They show lower degrees of acceptability. In contrast, the three interviewees with a weak personal connection to the area reported a high degree of decision acceptability with regard to the maintenance of the specific wetland.

4.1.3. Attitudes towards Land Pools

The land pool concept implies interventions in the property rights on land. This issue was mentioned as an important object-related factor. A considerable number of landowners sharply criticized the fact that they have to renounce their land use rights over the course of the next 25 years or longer, recorded with an entry in the land register). For them, this requirement is a criterion to strictly reject land pools. They stated that they would never agree to such a restriction, and they feel that this would mean they would lose agency with regard to their land.

> *"And if a land pool deals with an entry in the land register that will be the end for me. I will not accept an entry in the land register. I'm not sure how the political situation will change in the next 25 years . . . ".* (CS1-03)

Beyond objective-related factors, other crucial factors are innovation process-related and actor-related arguments. Concerning the innovation process, perceived procedural justice was cited as important by the majority of interviewees. In this context, interviewees mentioned that own participation, having a voice in the process, and the possibilities of influencing the process are crucial to the success of the project. Actor-related factors are trust in actors and previous experiences with these actors. For instance, the initiators and coordinators underestimated the influence of the way they had acted during previous nature conservation projects. Furthermore, they could hardly imagine that their way of acting could be perceived as controversial by local actors or that it would probably lead to rejection of the land pools. Otherwise, prior positive experiences with the initiators of land pools resulted in high acceptance of the land pool concept, as shown by one interview.

4.2. Comparison of the Acceptability Degrees of CS1 and CS2

This subsection mainly contributes to answering the research question about expressed acceptability decisions (RQ2). The degree of acceptability decisions differs between the two case study areas. Within each area are landowners expressing high acceptance and low acceptance, in the form of conditional acceptance or rejection of the land pools. The case study without the stakeholder involvement process (CS1) was seen more critically than was the CS2 land pool establishment process, which was based on an integrated participation process. Thus, the perceived design and procedure of the innovation process are crucial to acceptability decisions. However, different roles additionally to being landowner (e.g., hunting or farming) did not reveal a different argumentation pattern.

Concerning the CS1 land pool, one private landowner sees the land pool idea very positively, while the other three landowners interviewed rate it much more negatively. The main objective-related factor for rejection is the "restriction on property rights". Distributive justice arguments were also mentioned in terms of questioning whether the selected area was the most suitable for maintaining the CL. For three interviewees, the maintenance of meadows close to the village was more important than in remote areas. These interviewees have strong personal connections in terms of deep rootedness in the village and its land use history. Consequently, the CL has a high value for their cultural and regional identity.

> *"Why will it [the land pool] be in the area of CS1, where there is only a little tourism? Why will it not be done around L. [the village]? There are enough [suitable] plots".* (CS1-01)

Concerning the case of CS2, the degree of acceptability decisions varies from rejection to high acceptance/engagement in similar proportions. Three interviewees strongly accepted the land pools concept. One of them even stated the wish to engage in establishing the land pool, while three interviewees decided on "rejection/conditional acceptance". The degree "doubt/conditional acceptance" was expressed by two interview partners. Only one subject tended toward "conditional acceptance/high acceptance". The distributive justice arguments played only a marginal role in acceptability decisions.

4.3. Linkages between Different Farctors—An Example Case

In this subsection, we present an example of a "single-case analysis" to describe the linkages between different factors to illustrate the line of argumentation (Figure A1). This analysis mainly contributes to RQ1. We selected this case (a landowner from CS2, interview CS2-03) for a detailed description because it reveals complex acceptability patterns and rich information. Furthermore, it includes many aspects and arguments that were mentioned by other interviewees as well. Generally, this in-depth description serves to better understand the complexity of argumentation patterns and to derive suitable acceptance enhancement measures.

In interview CS2-03, the strong appreciation of the CL was explained by a multitude of value arguments. According to the interviewee, the landscape contributes to the regional-cultural identity and local recreation. These are so-called eudemonistic values, because they are attributed to the basic condition of quality of life. The wet meadows are *"what really represents the Spreewald"*. Thus, the maintenance of the wetlands is essential to this interview partner. The currently *"overgrown"* landscape *"has only little to do with the Spreewald I still knew from my childhood. At that time the meadows were cut. There were some haystacks . . . ".*

The argument in favour of the agricultural use of wet meadows is connected with public instrumental values of nature (important for the region, tourism, and nature conservation). The degree to which the conservation of typical wetland species is also intrinsically motivated was not clearly indicated in the interview. The previous value argumentations and the statement on own "ownership obligation" make clear that the interviewee completely agrees with the aim of maintaining wetlands. However, he does not agree with how wetlands are currently treated. The 'conditional acceptance' towards the wetlands and CS2 reflects doubts regarding the intentions and competences of some regional actors. The interviewee reported having a relatively strong connection to the CS2 area. Some previous negative experiences with the course and the outcome of a regional nature conservation project led to a lack of trust in regional actors. According to the interviewee, project coordinators focused only on species and biotope conservation and did not sufficiently include the interests and expertise of laypersons. The perception that they lacked an adequate voice caused landowners to feel they had no agency with regard to the landscape development process. Thus, the interview partner states that future innovation should be designed as a fair process. He demanded the same for the process of establishing land pools in CS2. All affected actors should be involved early and in a "real way" by having a voice and an influence on the outcome of the process. If these conditions are met, this interviewee will strongly accept the land pool concept. The efforts regarding the current process design are perceived as fair and promising, and there is partial trust in the coordinating actors. Additionally, some objective-related factors positively influence this acceptability decision: The interviewee has very positive attitudes towards the aims of re-use and maintenance of CS2 and sees the required restriction of property rights as unproblematic.

5. Discussion

As already mentioned in the introduction, internationally published studies about the acceptability of land pools do not exist, making it impossible to compare factors at this specific level. Therefore, we can only generally discuss our results in relation to studies dealing with land use issues and their acceptability. Thus, the following section focuses on the presence of various factors and their relation to other factors that determine acceptability. We pay special attention to the discussion of our ex-ante hypotheses.

Hypothesis 1. *The ex-ante hypothesis "Acceptability decisions are influenced by social norms and values of nature" is supported by the study's findings. The stated values of nature have a special impact on the assessment of the overarching aim—the maintenance of wetlands (cf. [1]). They also influence opinions about the suitability of area selection and of measures to achieve the aim of wetland maintenance.*

In the acceptability and acceptance literature, the importance of values as influencing factors is mentioned. Generally, values are socially constructed and depend on socio-cultural affiliations [18]. Individual value expressions are based on socio-cultural values, which are subsequently interpreted through own experiences [39,40]. Referring to the ecosystem service debate, Kenter [39] provides a framework of shared and social values that differentiates between "shared group values" and "shared community values". The author argues that shared values between the actors of an innovation process ("shared group values") are needed to create a common basis for the success of the sustainability innovation. This can be better supported by an open discussion of actors' values instead of monetarily quantifying values, as is often done in such projects. In the present case study, the value statements show that at the time the interviews were conducted, no shared group values within the innovation process participants had previously existed. However, shared community values were identified among CS1 interviewees, for instance, in their preference for maintaining meadows close to the village rather than remote meadows. This value-based argument was shared by local residents, who were connected through their shared experiences and practices. Adding to the findings of Kenter [39], Chan et al. [41] claim the increased importance of the socio-cultural dimension of nature values in environmental policies. In particular, these authors recommend the recognition of eudemonistic values as part of relational values (understood as the mutual relation between nature and humans).

Hypothesis 2. *Concerning this hypothesis, the study shows evidence that the design of innovation processes influences acceptability decisions in both directions. The case study with an integrated participation process based on the principles of transparency and actors' involvement was better accepted than the process based on individual consultation. The innovation-process-related factors, such as having a voice, early involvement of all actors, and the possibility of influencing the outcome and process, can be summarized as a superior analytical factor—so-called "procedural justice" [42]. Eswarlal et al. [43] discuss similar justice criteria for bioenergy projects: control over the project, information availability, and communication and relationships. Procedural justice is widely discussed in the literature, mainly in studies about renewable energy projects. In accordance with Aitken [44], Petrova [45] (p. 1283) emphasizes that a fair process design would lead to higher acceptance "even if an outcome is not considered fair to all participants". Procedural justice concerns are often linked to trust in actors [46,47]. Referring to "public acceptance" of wind energy projects, Walter [46] states that the characteristics of a project developer have an influence on decisions about acceptance or non-acceptance. Generally, trust—as an influencing factor—is considered in numerous publications [18,24,42,48,49].*

Hypothesis 3. *Our study showed that prior negative experiences of landowners negatively influenced acceptability decisions. The interviewees mentioned their experiences with a long-term nature conservation project and with the designation process of the biosphere reserve. Due to these negative experiences, the interviewees lost confidence in regional nature conservation actors. The finding that prior experiences are related to trust is supported by the literature on acceptability [50–52]. "People also need to have confidence in the institutions concerned" [53] (p. 67). In conclusion, the factor "trust" connects our H2 and H3.*

By applying a qualitative research approach, the study revealed additional results beyond those related to the hypotheses. In the following, we discuss two specific points: (a) the "expropriation frame", and (b) the meaning of degrees of acceptability decisions.

a. Some interviewees connected the focus of cultural landscape protection on wetlands to water mismanagement as an instrument of expropriation. We interpret the argumentation that "water mismanagement is creeping or cold expropriation" as an "expropriation frame"). According to the concept of framing [54–57], the "expropriation frame" is an imagined and selective narrative of the reality that is grounded in individual experiences, knowledge and perceptions of those farmers and landowners. By intersubjectively constructing this frame, the farmers and landowners make sense of the complex situation as the basis of their argumentation and actions. The situation's dissemination and reproduction (as part of the framing process) allow building a

shared narrative and an alliance against other positions. This frame is attributed to the economic and cultural value of the landscape as a counterpart to the "pure" nature conservationist, environmentalist and climate protectionist positions. The mis-management of water and the intended rise of water levels are regarded as the leading problems in the region that need to be solved. The process of framing and the use of frames are common in problematic situations between agriculture and environment in general and in wetland areas in particular [55]. The "expropriation frame" is not specific to the Spreewald region; it has also been identified in other German regions, as seen in articles in the local press and in regional public debates (e.g., [58–60]). Generally, the suspicion that land will be indirectly expropriated is connected with the sense of losing control or agency. The same emotion or reaction was triggered by the implication that land pools would restrict property rights. From a behavioural perspective in psychology, both reaction processes can be explained by Brehm's theory of Psychological Reactance (cf. [53]), which states that the elimination or limitation of choices often causes opposition or non-acceptance.

b. The analysis showed that acceptability decisions can vary over time and are thus influenced by various conditions (e.g., process conditions and objective-related conditions, such as the form of contracts or the set of maintenance measures). Sometimes, one single distinctive degree of acceptability could not be identified. In some cases, the degree of "conditional acceptance" was related to "high acceptance". In other cases, it was related to "rejection", meaning that these interviewees reached a temporary decision on the level of attitudes. At the same time, they stated that a future decision about taking action would depend on whether their suggested conditions were to be adopted or not. This attitude is also related to the interviewees' expectations regarding the initiator of land pools.

Hitzeroth and Megerle [18] discuss a similar point. They [18] (p. 577) argue that degrees of "conditional acceptance" and "indecisiveness" are strongly connected to personal expectations and attached conditions. These degrees can be very critical and unstable. They are called "turnaround moments" [18] (p. 578) in the acceptability process because, without positive intervention, such acceptability degrees potentially shift into non-acceptance or opposition. Thus, these unstable degrees belong to the "range of risks" [18] (p. 578)). Generally, the form and meaning of degrees of acceptability decisions are not extensively discussed, and they are therefore a relatively new topic.

6. Conclusions

The results of this acceptability study allow us to draw conclusions on two levels—at the level of the case study and the level of the conceptual framework. The case study level showed that the discussion and disclosure of the values of all involved actors supports the identification of shared values and the mutual understanding of the value arguments. The importance of wetland maintenance is still not clearly understood or rated as important by affected actors. A clear description of the complex problem—using maps and embedding the concept of land pools in a systematic strategy for regional development—could enhance acceptance. Furthermore, to support the success of land pools, it might be beneficial to restore trust through transparent and open communication as well through early and active involvement of all affected actors in terms of a fair design of the innovation process. For those activities, additional resources are necessary. If possible, the land pool concept as official requirement should be modified in accordance with local and official framing conditions. For the case study presented here, that requires changing current contracts about restricted property rights into softer solutions. With landowners who tended to reject land pools due to property rights, toleration agreements can be made.

The conclusion regarding the conceptual framework corresponds to the research question concerning the conceptualisation of acceptability (RQ3). The framework was helpful for structuring the presented acceptability phenomenon, and it supports an in-depth analysis that includes the linkages between values and arguments on different levels. Additionally, it revealed a broad range of arguments and factors that would not have been identified with previously fixed factors, as are commonly used in

standardized surveys. Our case study showed that when analysing acceptability, the consideration of all types of actors is important (focus on interaction) and that process-related factors should be underlined as crucial in the dimension of the acceptance context. In the design of further acceptability studies, it might be helpful to understand that sometimes the degree of acceptability decisions cannot be clearly classified by one distinctive degree and can change over time depending on future events in the innovation process. To refine the acceptability model, further research in terms of additional studies is required; such research could apply our framework to other contexts.

Supplementary Materials: The following are available online at http://www.mdpi.com/2071-1050/11/15/4056/s1, Table S1: Profile matrix of CS1., Table S2: Profile matrix of CS2.

Author Contributions: Conceptualization, M.B.; methodology, M.B. and R.S.; validation, N.H. and R.S.; formal analysis, M.B.; investigation, M.B. and N.H.; resources, M.B.; data curation, M.B.; writing—original draft preparation, M.B.; writing—review and editing, N.H. and R.S.; visualization, M.B. and N.H.; supervision, R.S.; project administration, R.S.; funding acquisition, R.S.

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Appendix A

Table A1. Conducted interviews and analytical units.

No. of Analytical Unit	Type of Actor/Interview Code No.	Function/Area Context	Type of Interview
1	Initiator of land pools (nature conservation administration & member of non-profit foundation) (*E-01*)	Regional expert; without link to a specific area	explorative
2	Regional actor in private nature conversation (*E-02*)	Regional expert; link to CS2 and other areas	explorative
3	Representative of regional administration of nature conservation (*E-03*)	Regional expert; without link to a specific area	explorative
4	Administrator of regional nature conservation measures (*local water authority*) & representative of official landowner (*E-04 = CS2-09*)	Regional expert; link to CS2 and to other areas	explorative and problem-centred (identical to No. 19)
5	Agricultural consultant, Partner in the innovation process (*E-05*)	Regional expert; acquiring land plots for land pools, without link to a specific area	explorative
6	Representative of the regional farmers' association (*E-06*)	Regional expert; without link to a specific area	explorative
7	Private landowner (*CS1-01*)	Link to CS1	problem-centred
8	Private landowner (*CS1-02*)	Link to CS1	problem-centred
9	Private landowner (*CS1-03*)	Link to CS1	problem-centred
10	Private landowner (*CS1-04*)	Link to CS1 and other areas	problem-centred
11	Private landowner (*CS2-01*)	Link to CS2; actor in nature conservation	problem-centred
12	Private landowner (*CS2-02*)	Link to CS2	problem-centred
13	Private landowner (*CS2-03*)	Link to CS2	problem-centred
14	Private landowner and farmer (*CS2-04*)	Link to CS2	problem-centred
15	Private landowner (*CS2-05*)	Link to CS2	problem-centred
16	Private landowner (*CS2-06*)	Link to CS2	problem-centred
17	Private landowner (*CS2-07*)	Link to CS2	problem-centred
18	Private landowner, land user (hunter) (*CS2-08*)	Link to CS2	problem-centred
19	Representative of official landowner (*CS2-09*) &administrator of regional nature conservation measures (*local water authority*)	Regional expert, Link to CS2 and to other areas	explorative and problem-centred (identical to No. 4)

Appendix B

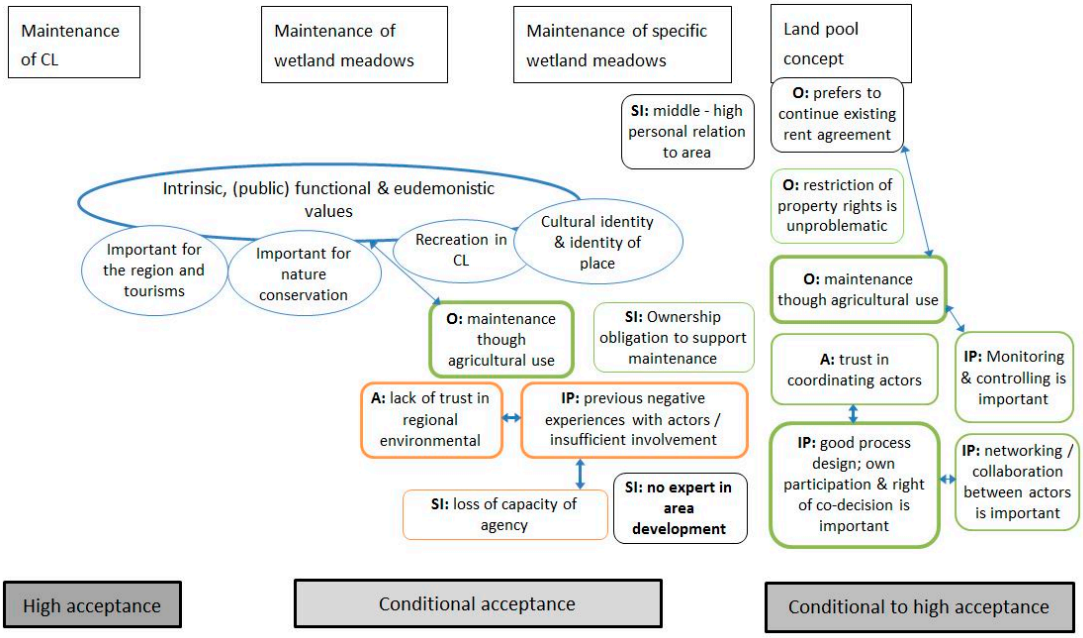

Figure A1. The visualization of an acceptability pattern of one interview (CS2-03).

References

1. McGinlay, J.; Gowing, D.J.G.; Budds, J. The Threat of Abandonment in Socio-Ecological Landscapes: Farmers' Motivations and Perspectives on High Nature Value Grassland Conservation. *Environ. Sci. Policy* **2017**, *69*, 39–49. [CrossRef]
2. Biggs, R.; Westley, F.; Carpenter, S. Navigating the Back Loop: Fostering Social Innovation and Transformation in Ecosystem Management. *Ecol. Soc.* **2010**, *15*, 9. [CrossRef]
3. Beilin, R.; Lindborg, R.; Stenseke, M.; Pereira, H.M.; Llausàs, A.; Slätmo, E.; Cerqueira, Y.; Navarro, L.; Rodrigues, P.; Reichelt, N.; et al. Analysing How Drivers of Agricultural Land Abandonment Affect Biodiversity and Cultural Landscapes Using Case Studies from Scandinavia, Iberia and Oceania. *Land Use Policy* **2014**, *36*, 60–72. [CrossRef]
4. Froger, G.; Menard, S.; Méral, P. Towards a Comparative and Critical Analysis of Biodiversity Banks. *Ecosyst. Serv.* **2015**, *15*, 152–161. [CrossRef]
5. Herberg, A.; Köppel, J.; Ohlenburg, H. Moderierte Informations-Und Kommunikationsplattform "Flächen-Und Maßnahmenpools". Abschlussdokumentation Zur Moderierten Informations-Und Kommunikationsplattform. 2006. Available online: https://www.dbu.de/OPAC/ab/DBU-Abschlussbericht-AZ-22803.pdf (accessed on 27 July 2019).
6. BDLA. *Flächenpool Und Ökokonten. Chancen Für Umweltbewusste Konsumenten*; BDLA: Berlin, Germany, 1999.
7. Geißler, G.; Köppel, J. Wetland Mitigation Und Conservation Banking. Upside down–Weiterentwicklung von US-Amerikanischen Konzepten Zur naturhaushaltlichen Kompensation. *Naturschutz und Landschaftsplanung* **2012**, *44*, 364–370.
8. Mann, C. Strategies for Sustainable Policy Design: Constructive Assessment of Biodiversity Offsets and Banking. *Ecosyst. Serv.* **2015**, *16*, 266–274. [CrossRef]
9. Jessel, B. Naturschutzfachliches Flächenmanagement durch regionale Flächenpools. *Raumforsch. Raumordn.* **2006**, *64*, 391–404. [CrossRef]
10. Ott, K. *Zur Dimension Des Naturschutzes in Einer Theorie Starker Nachhaltigkeit*; Beiträge Zur Theorie und Praxis starker Nachhaltigkeit; Metropolis Verlag: Marburg, Germany, 2015; Volume 8.
11. Meinefeld, W. Ex-Ante Hypothesen in Der Qualitativen Sozialforschung: Zwischen "fehl Am Platz" Und "unverzichtbar". *Z. Fur Soz.* **2016**, *26*, 22–34. [CrossRef]

12. Busse, M.; Siebert, R. Acceptance Studies in the Field of Land Use—A Critical and Systematic Review to Advance the Conceptualization of Acceptance and Acceptability. *Land Use Policy* **2018**, *76*, 235–245. [CrossRef]
13. Fournis, Y.; Fortin, M.-J. From Social 'Acceptance' to Social 'Acceptability' of Wind Energy Projects: Towards a Territorial Perspective. *J. Environ. Plan. Man.* **2017**, *60*, 1–21. [CrossRef]
14. Lucke, D. *Akzeptanz. Legitimität in der "Abstimmungsgesellschaft"*, 2nd ed.; Leske + Budrich Verlag: Opladen, Germany, 1995.
15. Sauer, A.; Luz, F.; Suda, M.; Weiland, U. Steigerung der Akzeptanz von FFH-Gebieten. *BfN-Skripte* **2005**, *144*, 200.
16. Wolsink, M. Contested Environmental Policy Infrastructure: Socio-Political Acceptance of Renewable Energy, Water, and Waste Facilities. *Environ. Impact Assess. Rev.* **2010**, *30*, 302–311. [CrossRef]
17. Kollmann, T. *Akzeptanz Innovativer Nutzungsgüter und-Systeme: Konsequenzen Für Die Einführung von Telekommunikations- und Multimediasystemen*; Gabler: Wiesbaden, Germany, 1998.
18. Hitzeroth, M.; Megerle, A. Renewable Energy Projects: Acceptance Risks and Their Management. *Renew. Sust. Energy* **2013**, *27*, 576–584. [CrossRef]
19. Sattler, C.; Nagel, U.J. Factors Affecting Farmers' Acceptance of Conservation Measures—A Case Study from North-Eastern Germany. *Land Use Policy* **2010**, *27*, 70–77. [CrossRef]
20. Von Ruschkowski, E. Ursachen Und Lösungsansätze Für Akzeptanzprobleme von Großschutzgebieten Am Beispiel von Zwei Fallstudien Im Nationalpark Harz Und Im Yosemite National Park. Ph.D. Thesis, Leibniz University, Hannover, Germany, 2009.
21. Hofinger, G. *Denken Über Umwelt Und Natur*; Beltz: Weinheim, Germany, 2001.
22. D'Souza, C.; Yiridoe, E.K. Social Acceptance of Wind Energy Development and Planning in Rural Communities of Australia: A Consumer Analysis. *Energy Policy* **2014**, *74*, 262–270. [CrossRef]
23. Wolsink, M. Wind Power: Basic Challenge Concerning Social Acceptance. In *Encyclopedia of Sustainability Science and Technology*; Springer: New York, NY, USA, 2012; pp. 12218–12254. [CrossRef]
24. Raven, R.P.J.M.; Mourik, R.M.; Feenstra, C.F.J.; Heiskanen, E. Modulating Societal Acceptance in New Energy Projects: Towards a Toolkit Methodology for Project Managers. *Energy* **2009**, *34*, 564–574. [CrossRef]
25. Patton, M.Q. *Qualitative Research and Evaluation Methods. Integrating Theory and Practice*, 4th ed.; SAGE Publications Ltd.: Thousand Oaks, CA, USA, 2019.
26. Begerock, C. Potentialanalyse und Maßnahmenkonzeption für Lebensraumtypen 6440 und 6410 im NSG Kockrowsberg (BR Spreewald). Bachelor Thesis, University of Potsdam, Potsdam, Germany, 2011.
27. Witt, H. Strategies in Qualitative and Quantitative Research. *Forum Qual. Soc. Res.* **2001**, *2*. [CrossRef]
28. Yin, R.K. *Case Study Research and Applications*, 6th ed.; SAGE Publications Ltd.: Los Angeles, CA, USA, 2019.
29. Honer, A. Das explorative Interview: Zur Rekonstruktion der Relevanzen von Expertinnen und anderen Leuten. *Schweiz. Z. fur Soz.* **1994**, *20*, 623–640.
30. Meuser, M.; Nagel, U. Das Experteninterview—konzeptionelle Grundlagen und methodische Anlage. In *Methoden der Vergleichenden Politik-und Sozialwissenschaft: Neue Entwicklungen und Anwendungen*; Pickel, S., Pickel, G., Lauth, H.-J., Jahn, D., Eds.; VS Verlag für Sozialwissenschaften: Wiesbaden, Germany, 2009; pp. 465–479. [CrossRef]
31. Clarke, A.E.; Friese, C. Grounded Theorizing Using Situational Analysis. In *The SAGE Handbook of Grounded Theory*; SAGE Publications Ltd.: London, UK, 2007; pp. 362–397. [CrossRef]
32. Witzel, A. The Problem-centered Interview. *Forum Qual. Soc. Res.* **2000**, *1*. [CrossRef]
33. Mero-Jaffe, I. 'Is That What I Said?' Interview Transcript Approval by Participants: An Aspect of Ethics in Qualitative Research. *Int. J. Qual. Meth.* **2011**, *10*, 231–247. [CrossRef]
34. European Commission; Directorate General for Research. *European Textbook on Ethics in Research*; Publications Office: Luxembourg, 2010.
35. Kuckartz, U. *Qualitative Text Analysis: A Guide to Methods, Practice & Using Software-SAGE Research Methods*; SAGE Publications Ltd.: London, UK, 2014.
36. Schreier, M. *Qualitative Content Analysis in Practice*; SAGE Publications Ltd.: London, UK, 2012.
37. Mayring, P. Qualitative Content Analysis: Theoretical Foundation, Basic Procedures and Software Solution. 2014. Available online: https://www.ssoar.info/ssoar/handle/document/39517 (accessed on 25 July 2019).
38. Corbin, J.M.; Strauss, A. Grounded Theory Research: Procedures, Canons, and Evaluative Criteria. *Qual. Sociol.* **1990**, *13*, 3–21. [CrossRef]
39. Kenter, J.O.; O'Brien, L.; Hockley, N.; Ravenscroft, N.; Fazey, I.; Irvine, K.N.; Reed, M.S.; Christie, M.; Brady, E.; Bryce, R.; et al. What Are Shared and Social Values of Ecosystems? *Ecol. Econom.* **2015**, *111*, 86–99. [CrossRef]

40. Bieling, C. Cultural Ecosystem Services as Revealed through Short Stories from Residents of the Swabian Alb (Germany). *Ecosyst. Serv.* **2014**, *8*, 207–215. [CrossRef]
41. Chan, K.M.A.; Balvanera, P.; Benessaiah, K.; Chapman, M.; Díaz, S.; Gómez-Baggethun, E.; Gould, R.; Hannahs, N.; Jax, K.; Klain, S.; et al. Opinion: Why Protect Nature? Rethinking Values and the Environment. *Proc. Natl. Acad. Sci. USA* **2016**, *113*, 1462–1465. [CrossRef] [PubMed]
42. Wüstenhagen, R.; Wolsink, M.; Bürer, M.J. Social Acceptance of Renewable Energy Innovation: An Introduction to the Concept. *Energy Policy* **2007**, *35*, 2683–2691. [CrossRef]
43. Eswarlal, V.K.; Vasudevan, G.; Dey, P.K.; Vasudevan, P. Role of Community Acceptance in Sustainable Bioenergy Projects in India. *Energy Policy* **2014**, *73*, 333–343. [CrossRef]
44. Aitken, M. Wind Power and Community Benefits: Challenges and Opportunities. *Energy Policy* **2010**, *38*, 6066–6075. [CrossRef]
45. Petrova, M.A. From NIMBY to Acceptance: Toward a Novel Framework—VESPA—For Organizing and Interpreting Community Concerns. *Renew. Energy* **2016**, *86*, 1280–1294. [CrossRef]
46. Walter, G. Determining the Local Acceptance of Wind Energy Projects in Switzerland: The Importance of General Attitudes and Project Characteristics. *Energy Res. Soc. Sci.* **2014**, *4*, 78–88. [CrossRef]
47. Maguire, L.A.; Lind, E.A. Public Participation in Environmental Decisions: Stakeholders, Authorities and Procedural Justice. *Int. J. Glob. Environ. Iss.* **2003**, *3*, 133–148. [CrossRef]
48. Hall, N.; Ashworth, P.; Devine-Wright, P. Societal Acceptance of Wind Farms: Analysis of Four Common Themes across Australian Case Studies. *Energy Policy* **2013**, *58*, 200–208. [CrossRef]
49. Ganzevles, J.; Asveld, L.; Osseweijer, P. Extending Bioenergy towards Smart Biomass Use Issues of Social Acceptance at Park Cuijk, The Netherlands. *Energy Sust. Soc.* **2015**, *5*, 22. [CrossRef]
50. Lisec, A.; Primožič, T.; Ferlan, M.; Šumrada, R.; Drobne, S. Land Owners' Perception of Land Consolidation and Their Satisfaction with the Results–Slovenian Experiences. *Land Use Policy* **2014**, *38*, 550–563. [CrossRef]
51. Veidemane, K.; Nikodemus, O. Coherence between Marine and Land Use Planning: Public Attitudes to Landscapes in the Context of Siting a Wind Park along the Latvian Coast of the Baltic Sea. *J. Environ. Plan. Man.* **2015**, *58*, 949–975. [CrossRef]
52. Mann, S.; Kögl, H. On the Acceptance of Animal Production in Rural Communities. *Land Use Policy* **2003**, *20*, 243–252. [CrossRef]
53. Schenk, A.; Hunziker, M.; Kienast, F. Factors Influencing the Acceptance of Nature Conservation Measures—A Qualitative Study in Switzerland. *J. Environ. Manag.* **2007**, *83*, 66–79. [CrossRef] [PubMed]
54. Foucault, M. *The Order of Things: An Archaeology of the Human Sciences*; Pantheon Books: New York, NY, USA, 1971.
55. Hulshof, M.; Vos, J. Diverging Realities: How Framing, Values and Water Management Are Interwoven in the Albufera de Valencia Wetland in Spain. *Water Int.* **2016**, *41*, 107–124. [CrossRef]
56. Feindt, P.H.; Oels, A. Does Discourse Matter? Discourse Analysis in Environmental Policy Making. *J. Environ. Pol. Plan.* **2005**, *7*, 161–173. [CrossRef]
57. Goffman, E. *Frame Analysis: An Essay on the Organization of Experience*; Harper & Row: New York, NY, USA, 1974.
58. Wir Müssen Uns Wehren. MK—Kreiszeitung. 14 November 2014. Available online: https://www.kreiszeitung.de/lokales/verden/ottersberg-ort29239/besorgte-bauern-buerger-infoabend-moorplaenen-landes-4445810.html (accessed on 27 July 2019).
59. NWZ–Nord-Westzeitung. Landvolk Köterende "Das Ist Schleichende Enteignung". 11 November 2014. Available online: https://www.nwzonline.de/wesermarsch/wirtschaft/das-ist-schleichende-enteignung_a_20,0,300120966.html (accessed on 27 July 2019).
60. ML Niedersachsen—Niedersächsisches Ministerium für Ernährung, Landwirtschaft und Verbraucherschutz. Keine Einschränkung Der Landwirtschaft Durch Schutz Vor Torfabbau. 5 November 2014. Available online: https://www.ml.niedersachsen.de/startseite/aktuelles/pressemitteilungen/keine-einschraenkung-der-landwirtschaft-durch-schutz-vor-torfabbau-129040.html (accessed on 27 July 2019).

5. Acceptability of innovative biomass heating plants in a German case study – A contribution to cultural landscape management and local energy supply (Paper 3)

The authors of paper 3 are Maria Busse, Rosemarie Siebert, and Nico Heitepriem. This paper was published in Energy, Sustainability and Society 9:36 (2019).

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ORIGINAL ARTICLE Open Access

Acceptability of innovative biomass heating plants in a German case study—a contribution to cultural landscape management and local energy supply

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Abstract

Background: To prevent negative effects on the cultural landscape through land abandonment or agricultural intensification, innovative solutions towards more sustainable land use are required. Local bioenergy systems using agricultural co-products are perceived as one solution to threatened cultural landscapes with small-scale meadows. The aim of this paper is to analyse the acceptability of biomass heating plants in the Spreewald region (Germany) and their contribution to cultural landscape management.

Methods: We asked 17 farmers about the likelihood that they would install a biomass plant on their farms and about their reasons for accepting or rejecting it. A fuzzy set qualitative comparative analysis was applied.

Results: The analysis showed that acceptance is relatively low. We identified three types of farmers: proponents and potential adopters, ethically concerned opponents, and open-minded refusers. Biomass plants were likely to be accepted if farmers stated an ethical acceptance of and interest in technology, a need for a new heating system, the availability of sufficient feedstock, and a perceived unproblematic readiness of technology—all these factors had to exist in combination. On the other hand, farmers rejected a biomass plant if one of the following factors existed: ethical concerns about "burning hay", satisfaction with their current oven, low availability of feedstock, or a perceived low readiness of technology. Other factors were the existence of procedural justice, trust in coordinating actors, and a demonstration plant.

Conclusions: The discussion shows that the specific results have to be contextualised within the innovation process for sustainable landscape management. This may be achieved by integrating the acceptability study into an adaptive landscape design. This relies on mutable acceptability decisions, reflexive learning processes, and iterative feedback loops in innovation processes. Our paper advances knowledge about (1) how to prevent land abandonment and simultaneously promote regional energy and (2) the acceptability in the field of land use and landscape management.

Keywords: Fuzzy set qualitative comparative analysis (fsQCA); Bioenergy; Energy transitions; Co-products; Biomass conversion; Gasification; Land abandonment; Wetlands; Integrative landscape design

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Highlights

- Local biomass plants could prevent land abandonment in cultural landscapes.
- Local biomass plants could promote regional energy supply.
- QCA revealed three farmer types regarding their of biomass plants.
- Low acceptance of biomass plants at the farm level due to various conditions.
- Need to integrate acceptability studies into adaptive landscape design.

Background

Currently, most cultural landscapes worldwide are mainly confronted with land use changes and, therefore, with two opposing problems: intensification of agricultural production or land abandonment [1–3]. Whereas some cultural landscapes are threatened by cost-efficient and intensive agriculture, in other landscapes, the importance of agricultural production is shrinking. The land abandonment scenario mainly takes place in cultural landscapes that have diverse and small structures and that are often difficult to access, such as mountain regions [1], upland pastures [4], and terraced landscapes or wetlands [5]. The cultivation of such landscapes is perceived as no longer economically viable due to its cost intensity [6–8]. Both problematic situations—land abandonment and agricultural intensification—can dramatically decrease the functioning of the ecosystem, biodiversity, and cultural values [2, 7–10].

At the same time, in the last decades, there has been a rising demand for bioenergy from landscapes [6, 7]. Bioenergy, especially that from energy crop production, is directly linked to agricultural intensification and risks causing the abovementioned ecological and social impairments [11]. Thus, in the meanwhile, bioenergy is viewed more critically and is under pressure to prove its long-term benefits for a sustainable development of agricultural landscapes and for renewable energy transitions [6, 12, 13]. A challenge is to harmonise bioenergy production with other uses, such as food production, by considering its trade-offs. The trade-offs of bioenergy production are addressed by various Sustainable Development Goals (SDGs 2, 7, 13, 15) and, for instance, are expressed in the "food-fuel debate" [11, 14, 15]. To prevent and counter the negative effects of land abandonment and agricultural intensification through bioenergy production, innovative solutions towards more sustainable land use are required. These solutions have to be site-specific and adapted to the setting of each landscape. Bioenergy[1] systems that use residuals, "surplus" grassland biomass, and agricultural co-products have the potential to address such risks [6, 7, 13]. They are perceived as one solution for formally used cultural landscapes that are composed of grasslands or meadows and are now increasingly under threat of falling out of use. Hence, this innovative use of residuals for bioenergy production can potentially contribute to both suitable cultural landscape management and a decentralised energy supply. In particular, decentralisation is an important topic in recent energy transition debates all over the world [16]. The regional level is seen as decisive for the success of national energy transitions, such as the "German Energiewende" [17, 18]. Furthermore, the exploitation of biomass has some advantages in moving forward renewable energies, such as the better possibilities of energy storage and the opportunity of economic development for rural areas [19].

The issue of using biomass from residuals is of rising interest in science. In the scientific literature, the current research focus is on technological aspects, such as efficiency and reducing emissions of conversion technologies [20]. Some research exists on the residual feedstock characteristic for the gasification process [21] and for producing biogas [22]. A sustainability assessment of different bioenergy technologies (including gasification of landscape material) has been conducted by Grunwald and Rösch [6]. Socio-economic studies deal mainly with feedstock availability and the willingness to supply straw for bioenergy production [23, 24] and the acceptability aspects of biofuel and biogas production [25–27]. However, there is a research gap concerning knowledge about the acceptability and socio-technological interactions of local biomass plants using agricultural residuals. The issue of acceptability should be addressed as early as possible in the innovation process. Only in cases where local actors accept the innovative idea as a solution to land abandonment and want to implement this technology is it worth continued promotion of the innovation process. As high acceptance is a success factor for implementation in general, analysis of acceptability and the identification of potentials or implications for further adoption at the local level must be done. Furthermore, it is worth gaining knowledge about the potential contribution of local bioenergy plants to maintaining cultural landscapes and promoting energy transitions.

The present case study aims to contribute to this research gap by investigating the potential of bioenergy from residuals as part of the solution to unused wetland meadows in the cultural landscape of the Spreewald region (Germany). The specific aim of this paper is to analyse the acceptability of biomass heating plants by farmers of the case study region. In this context, farmers are crucial actors because one of their possible roles is to implement a biomass plant on their farms. Our guiding research questions are as follows:

[1]Bioenergy is renewable energy made from materials derived from biological and, thus, non-fossil sources ([14], cf. [15]).

RQ1: Which conditions (other than the need for financial support) influence the decisions of local farmers to accept or reject on-farm biomass plants?

RQ2: Which pathways lead to acceptance, and which lead to rejection?

RQ3: What conclusions can be drawn for regional landscape design and management?

Theoretical framework

Theories typically used when dealing with the acceptability of (technical) innovations are the Diffusion of innovation (DOI) theory by Rogers 1995 and the Technology acceptance model (TAM) by Davis [28] (cf. [25]). From a more sociological and innovation-system perspective, both theories have their shortcomings concerning the extent to which they are technology-driven, the deterministic character of their stages and factors, and their neglect of interwoven socially constructed processes and systems [29, 30]. Mallett [30] critically points out that Rogers' adopter categories (innovators, early adopters, early and late majority, and laggards) and communication principles are described in a reductionist manner, ignoring complex and multiple interactions and communication flows between actors, social norms, or institutional settings. Thus, there is a need for a framework that considers acceptability as a complex phenomenon that includes openness for different explanatory factors and links to socio-technical systems. Due to this, we apply the sociological-driven, process-oriented, and open understanding of acceptability as suggested by Busse and Siebert [25]. The authors define acceptability as a bundle of complex, non-static but mutable decision processes regarding a certain object made by different involved actors. These processes are characterised by the use of value-based arguments and by different acceptability degrees—ranging from rejection to high acceptance or even engagement. According to this understanding, acceptability and acceptance are not synonyms. Acceptance is a positive outcome of a decision process. Within this process, an active reflection on the issue within its context and interaction with others and social norms are required [25]. Acceptability studies should involve context factors, such as institutional settings and fairness of the process, system thinking, and the consideration of socio-technical regimes [16]. The present paper focuses on the acceptability decisions that are made by farmers at an early stage in the innovation process (cf. the next section on the case study description). Thus, we observe only one (but important) piece of a puzzle—the complex acceptability phenomenon.

Considering the concept of social acceptance by Wüstenhagen et al. [31], our analysis is mainly covered by the type "market acceptance", which is defined as the "process of market adoption of an innovation". At the same time, market acceptance is more than a mere market-based assessment by farmers. Due to its relation to visions of landscape development and conservation, market acceptance also contains elements of "community acceptance", where opinions and judgements of local stakeholders and end users on site-specific renewable energy projects and institutional settings play a major role [16, 31]. Regarding the acceptability degrees, we want to pay special attention to temporary and inconclusive decisions, the so-called doubt or conditional acceptance [32], and to "rejection" or "non-use" of innovations [25, 33]. When analysing acceptability, most researchers focus only on the positive outcome—acceptance—while neglecting the negative degrees. "It is taken as given that novel technologies diffuse from innovators to the mass market – a transfer in which non-use is thought to disappear over time" [33]. However, we can learn a lot from motivations or conditions that cause rejection.

Case study description and methods

Case study description

The Spreewald region is located in Eastern Germany (see Fig. 1). This historically grown cultural landscape is characterised by an extended network of natural streams (the main river Spree and its side arms) and artificial water channels. The small-scale cultural landscape is composed of different types of wetland meadows and forests and arable farmland. The case study area is part of the Biosphere Reserve Spreewald. As mentioned in the introduction, the Spreewald is affected by land abandonment, especially the small-scale wetland meadows, which are increasingly under threat of falling out of use due to economic, cultivation-related, and water management reasons. Some parts of the wetlands are already overgrown with sedges (*Carex acuta L.*, *Carex acutiformis Erh.*), common reed (*Phragmites australis*), grey willow (*Salix cinerea*), black alder (*Alnus glutinosa*), and other common species.

Land abandonment can be seen as problematic for at least three reasons: (1) formerly sustainable used wetland meadows are increasingly abandoned; 2) the biodiversity of these wetlands, of which preservation is (in parts) legally binding, is decreasing (e.g. species and habitats protected by the European Habitats Directive); and (3) the typical character of the open landscape and, therefore, a particularly important part of the regional cultural heritage and identity is threatened.

For these reasons, regional key actors (mainly, the non-profit foundation for the cultural landscapes in the Spreewald region—Bürgerstiftung Kulturlandschaft Spreewald—and the Biosphere Reserve Spreewald authority) recently aimed to develop an innovative strategy to reuse and maintain the wetland meadows. One

Fig. 1 Location of the Biosphere Reserve Spreewald in Germany. The biosphere reserve is the core of the Spreewald region

part of this landscape strategy encompasses the idea to use biomass from wetland meadows to generate heat at the local level. The idea of using the wetlands' biomass is not a new one in this region. For 20 years, the region has addressed wetland abandonment by experimenting with biogas production without great success. One reason was that the biomass from the wetlands is very heterogeneous and has a high lignin content resulting in a low biogas yield. This failure caused scepticism and resignation among the involved regional actors (Expert 1–3, Additional file 1). For a few years, gasification technology has been brought into play. Gasification, like combustion and pyrolysis, is a thermos-chemical conversion technology applied to biomass [34] (Fig. 2). Since 2016, a pilot biomass plant (generating 200 kW) has operated on a farm in the Spreewald to test the technology and practical procedures (Fig. 3). The latter includes the production and logistics of the feedstock, operational integration of heat production into the daily work on the farm, efficiency, cost calculation, emissions, and co-products (ashes). The implementation of this demonstration plant was a collaborative achievement by a transdisciplinary project that started in 2014. The project is the collaboration between regional key actors from different sectors (nature conservation, tourism, agriculture, and civic society) and social and agricultural scientists.

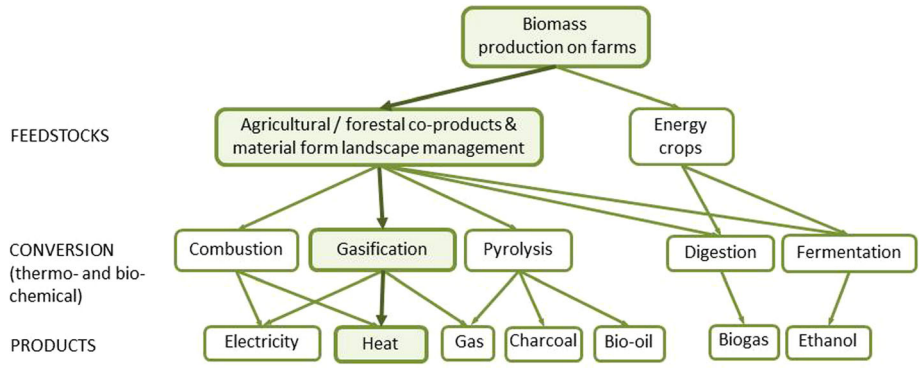

Fig. 2 Bioenergy systematisation (adopted by McKendry [34] and Arbolino et al. [19]). Fields and arrows in bold are relevant for the present case study

The technology used follows a two-step gasification process (Fig. 3). First, in the hay carburettor chamber, the biomass from wetlands is gasified. In a second step, the after-burner heat exchanger converts gas into thermal energy. Such plants are available in different sizes (from approximately 50- to 10,000-kW plants) and types. The advantages of this technology are its high-level efficiency and low rate of emissions. The different steps carried out by farmers for generating and using the heat produced by such biomass plants are illustrated in Fig. 4. The technology is quite new and not yet broadly applied to biomass from marginal landscapes in practice.

Methods

The acceptability of biomass heating plants by local farmers is a complex research issue embedded in a real-life context and carries many unknown aspects. Addressing adequately this initial condition, we chose a qualitative research approach [35] with an embedded case design [36]. The main part of the research design consists of qualitative comparative analysis (QCA) [37–39]. With QCA, we were able to unravel configurational patterns for acceptance and rejection and to create a typology of farmer groups [38]. An additional reason for choosing QCA was that it is a suitable method for middle-sized datasets with approximately 10 to 50 cases [37].

Fig. 3 Pilot project of the biomass gasification plant in the Spreewald region

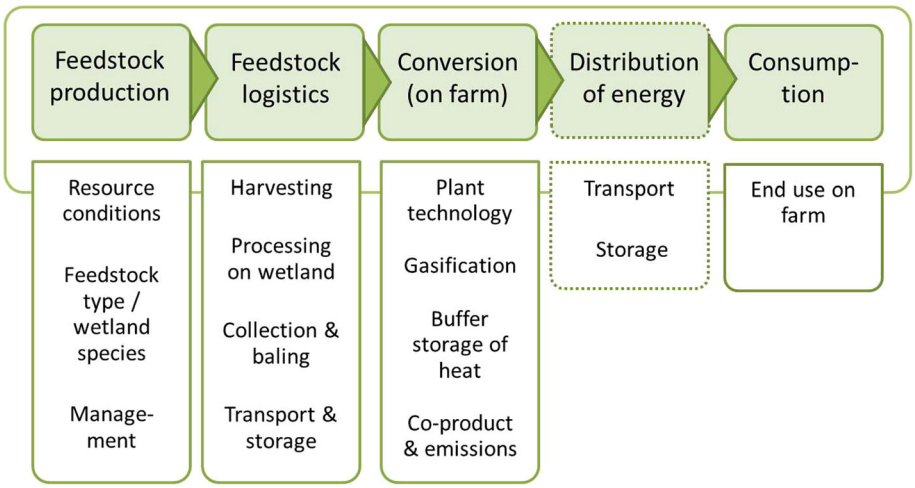

Fig. 4 Bioenergy supply system with production stages of generating and using heat from on-farm biomass. Distribution is only required in the case of collective or community power plants (adopted by Dale et al. [14])

Generally, in QCAs, values are classified into the so-called sets, which will be placed in relation to each other. QCA is a set-theoretic technique that aims at revealing configurational pathways that lead to the specific phenomenon—the so-called outcome. The pathways consist of singular conditions or a pattern of conditions. Thus, causal relations for phenomena can be described using the concepts of equifinality[2] and asymmetry[3]. We applied the fuzzy set QCA variant (fsQCA), with which "differences in the degree of set membership can be captured" [38]. FsQCA is recommended for analysis because it contains more information than dichotomous crisp sets [38]. The identification of necessary and sufficient conditions from a set of variables is crucial for QCAs. To better comprehend our results, it is important to understand these basic elements of each QCA. Necessary conditions are defined by the following statement: Wherever a certain outcome is present, condition A is also present. For example, a necessary condition means that all interviewees who accepted an idea (positive outcome) also had to have an interest in this topic (condition A). Condition B is a sufficient condition if wherever condition B is present, a certain outcome is also present. For instance, all interviewees who had ethical concerns (condition B) also rejected the idea (negative outcome). At the same time, other sufficient conditions can also lead to rejection [38].

[2]Equifinality in set theory means multiple conditions (or a combination thereof) co-exist to describe the same outcome [37].
[3]Asymmetry in set theory means that explanations for a positive outcome cannot be derived automatically from the explanation for the negative outcome [37].

Data collection

In 2015 and 2016, nine explorative interviews were conducted to identify important conditions influencing acceptability of biomass plants by farmers. This step was also necessary to familiarise ourselves with the issue. Among the interviewees are three regional experts and six regional farmers. The latter group includes the farmer who built the regional pilot plant. Additionally, two expert group discussions with regional experts (including the pilot plant owner), the innovator (oven constructer), and scientists were held in 2016. The group discussions allowed us to understand the advantages and disadvantages of implementing the technology in the Spreewald region and to identify conditions influencing acceptability from an expert perspective. Both interview results and insight from the group discussions were used to design a standardised questionnaire with the aim of performing surveys for the fsQCA. The questionnaire contained general information about the farms and production characteristics and questions about the likelihood of implementing a biomass plant on the farm (outcome question for the QCA), the conditions that influenced the farmers' decisions (e.g. ethical aspects, costs, technological and operational aspects, fairness and communication), alternative solutions, and the farmers' interest in maintaining the cultural landscape (Additional file 2). We formulated mainly closed questions with prefixed items (using a 4-point Likert scale). Additionally, the possibility of adding detailed statements was given.

In spring 2018, 17 face-to-face interviews with farmers of the Spreewald region were conducted using the previously described questionnaire. During the interview, the first author of this paper filled in the questionnaire (according to the farmer's answers) and wrote down the

Table 1 Membership scores for outcome of interest and variables (similar to 4-point scale in questionnaire)

Membership scores	Outcome of interest	Items
0	Extremely unlikely implementation, rejection	I completely disagree.
0.3	Unlikely implementation	I mostly disagree.
0.5	Neither acceptance nor rejection*	Neither agree nor disagree*.
0.7	Rather likely implementation	I mostly agree.
1	Very likely implementation, acceptance	I completely agree.

*Items are not used in the questionnaire but have to be defined as qualitative anchor according to the QCA rules

farmers' additional statements. In most cases, interviewees gave permission to record the interviews. Directly after the interviews, notes about the interview situation were taken and further information was gathered to support the information value of the interviews. Thus, a transcription of the interviews from the second phase of interviews in 2018 was not necessary (Additional file 1: interview list).

Data processing and analysis

Data processing encompassed the development of a codebook based on the questionnaire and survey data entry into an Excel database. A comparison with the recorded audio file of each interview was made to clarify vagueness or any misunderstanding in the survey data. This step of back-checking guarantees that farmers' self-judgements on the Likert scale represents a realist picture of their attitudes. Thus, it serves as qualitative validation of the coded items. Defining the outcome of interest, the potential influencing variables, and the qualitative anchors for identifying the membership scores (for outcome and variables) is obligatory when using the QCA method [38]. The qualitative anchors and membership scores were predefined through 4-point Likert scales in the questionnaire (Table 1). Due to including the farmers' self-judgement regarding outcome of interest and variables, a calibration of raw data by the researchers was not necessary. The farmers' self-judgements were taken as QCA membership scores.

The questionnaire contained a very large number of possible variables for the QCA (see Additional file 2), but only five variables were finally used for the analysis. These selected variables are displayed in Table 2. The process of reducing variables is in line with the methodological literature.[4] The decision fell on these five variables because they were determined to be the most important for farmers when making a judgement about their attitude.[5] Afterwards, the selection of variables was back-checked with our knowledge that went beyond the QCA data (mainly from the group discussion because there is no information from literature available).[6] The "need for financial support" was excluded from the analysis of necessary and sufficient conditions for acceptance and rejection. All interviewees stated that they would need financial support regardless they accept or reject the implementation of a biomass plant. Thus, the influence of this condition is negligible for analysis outcome. This phenomenon is called "trivial condition" which should be excluded from interpretation [38]. However, the "need for financial support" can be seen as a basic and essential precondition.

The fuzzy set data were analysed using the software fsQCA 2.5 by Charles Ragin. Comprehending QCA and reproducing our results are crucial to knowing the basic operations of Boolean and fuzzy algebra and quality check instruments for QCAs as they are displayed in Table 3.

As usual in QCAs, first, we analysed the necessary conditions for the positive outcome (= acceptance) and negative outcome (= rejection). Afterwards, the sufficient conditions were identified. For the analysis of sufficient conditions, we displayed our empirical evidence in the so-called truth tables (Additional files 4 and 6), as recommended by Schneider and Wagemann [38]. Generally, truth tables contain all logically possible combinations of variables and their respective outcome values observed in the analysed cases. Each row stands for one combination of variables.

[4]Schneider and Wagemann [38] recommend a moderate number of variables for QCAs to decrease the number of possible condition combinations and to avoid a long list of logical remainders. They state (p. 276f) that approximately 3–5 variables in a study with 20–40 cases are suitable. For the reduction process, we iteratively balanced between empirical insights and our prior theoretical knowledge. As recommended by Schneider and Wagemann [38], we created a macro-variable ("Ethical acceptance") as a reduction strategy.

[5]The interview material showed that questions about other variables could not be easily answered by farmers at this stage, with their knowledge regarding the technology and the consequences for implementation. These variables become important for farmers who are already willing to implement a biomass plant and think in detail about implementation consequences.

[6]Theoretical knowledge from literature could not be used to select conditions because there are no published studies about the acceptability of local biomass plants (using gasification of hay) by farmers. It is a very new issue. Factors influencing acceptability from somewhat related topics are not useful because factors vary from case to case (and research question to research question). Therefore, we used this explorative procedure.

Table 2 Variables included in fsQCA

Variables	Variable name*	Variable sources
Ethical acceptance	ETHICS/ethics	Macro variable, mean of four sub-variables: (1) acceptance of using biomass for generating heat and (2) its usefulness, (3) relevance for local energy supply, and (4) relevance for maintaining regional wetlands
General interest in specific carburettor technology	INTEREST/interest	Survey data directly used
Insufficient readiness of technology as perceived implementation barrier	READYBARRIER/ readybarrier	New built variable using data from variable "interest in technology" and "perceived readiness of technology" (code plan: Additional file 3)
Satisfaction with current heating system on farm	SATISF/satisf	Survey data directly used
No availability of material (feedstock)	NOMAT/nomat	Survey data directly used

*For explanation see Table 3

Consulting the truth tables, we decided on logical remainders (rows with no empirical evidence) and excluded them from minimisation. In the minimisation process, row information is summarised to extract the final solution term of sufficient conditions by applying fuzzy algebra [38].

Results

To gather the outcome values for the QCA, the farmers were asked how likely they were to install a biomass heating plant on their farm within the next 5 years. This information served us as proxy for identifying the acceptability decision degrees (acceptance or rejection).

Among the 17 interviewed farmers, 13 stated that it is "extremely unlikely" or "unlikely" that they will implement such a biomass plant on their farms. Only four farmers responded that implementation is "rather likely" or "very likely" (see Fig. 5).

Clustering the cases according to the outcome (acceptance or rejection) and underlying conditions, we found three types of farmers:

A) Proponents and potential adopters
B) Ethically concerned opponents
C) Open-minded refusers

In the following, these farmer types will be described in detail.

Acceptance cases—"type A" farmer

The "type A" farmers can be labelled as proponents of the technology and potential adopters. The underlying conditions show that none of the conditions is a relevant necessary condition for acceptance. Table 4 displays that three single conditions (ETHICS, INTEREST, readybarrier) and all combinations of conditions passed the consistency test, in which a consistency threshold above 0.9 is recommended by Schneider and Wagemann [38].

Table 3 Basic operations in Boolean/fuzzy algebra and definitions of quality check instruments, according to [38]

Operations and terms	Definition
*	Logical AND
+	Logical OR
Outcome in upper-case letters (Y)	Positive outcome (= acceptance)
Outcome in lower-case letters (y)	Negative outcome (= rejection)
Condition in upper-case letters (e.g. INTEREST)	Condition is present.
Condition in lower-case letters (e.g. interest)	Condition is absent.
Consistency of necessary or sufficient condition	Degree of data being in line with statement of necessity or sufficiency.
Coverage of necessary condition	Relevance measure of necessary condition; coverage within the set of all cases.
Raw coverage of sufficient conditions	Degree to which outcome is covered by a statement.
Unique coverage of sufficient conditions	Degree to which outcome is UNIQUELY covered by a statement.
Solution coverage	Degree to which outcome is covered by the all pathways/entire solution term.
Logical remainder	A possible logical combination without empirical evidence.
Conservative solution term	Solution term without assumption about logical remainders.

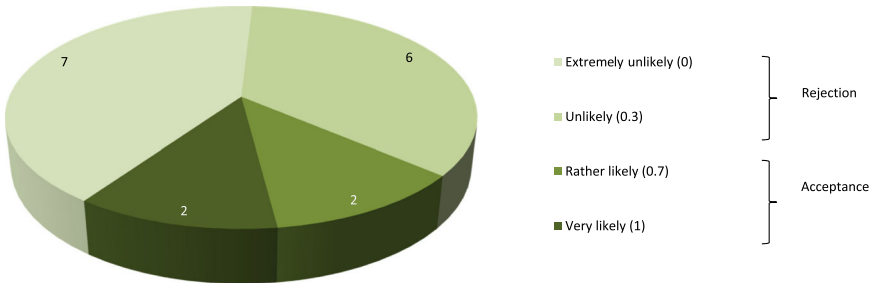

Fig. 5 Likelihood of implementing a biomass plant on farm as proxy for acceptability decision degree

However, none of the tested necessary conditions shows a higher coverage value than 0.5.

The results of the analysis of sufficient conditions show that only when all five tested conditions are met in a single case does a farmer state that he is likely to implement a biomass plant on his farm. A farmer in this group (1) ethically accepts the idea to use a biomass plant for the maintenance of wetland meadows and supplying local energy, (2) is generally interested in the technology, (3) does not perceive the low readiness of the technology as a barrier, (4) is not satisfied with the current heating system on his farm, and (5) has feedstock for the biomass plant available on his farm. These sufficient conditions for acceptance can be described by the following conservative solution term[7] (based on the truth table in Additional file 4):

ETHICS*INTEREST*readybarrier*satisf*nomat

(Conservative solution term, solution coverage 0.769; solution consistency 0.816; cases with > 0.5 memberships in solution term: farmer 1, farmer 3, farmer 4, and farmer 12)

As mentioned before, being in need of financial support is a basic and essential precondition for farmers who stated acceptance. Additional factors are having the necessary machinery for and possibility of storing the feedstock (pressed into bales and covered), process-oriented factors that are connected to procedural justice (relational trust or having a demonstration plant) and not preferring another solution to the "wetland problem". Farmers who preferred to accept the biomass plants stated that maintenance of the cultural landscape is important or very important. As reasons for the positive attitude towards the cultural landscape, the value of the cultural landscape for agricultural use and its value as a cultural heritage are mentioned by these farmers. One farm has 550 ha of arable land and grasslands. In this case, wetland meadow use consists of mowing and grazing. The second farm has 1250 ha arable land only, and wetland meadow use consists only of mowing because this farmer does not have grazing animals.

[7]The parsimonious solution term (the at least complex solution term) for acceptance is "satisf*nomat" (solution coverage 0.769, solution consistency 0.818). The intermediate solution term for acceptance that included easy counterfactuals is "ETHICS*readybarrier*satisf*nomat" (solution coverage 0.769, solution consistency 0.816).

Table 4 Necessary conditions for acceptance (Y)

Conditions tested	Consistency	Coverage
ETHICS	1.000	0.371
INTEREST	1.000	0.481
readybarrier	0.942	0.418
satisf	0.826	0.589
nomat	0.826	0.544
ETHICS+INTEREST	1.000	0.368
ETHICS+readybarrier	1.000	0.322
INTEREST+readybarrier	1.000	0.406
ETHICS+INTEREST+satisf	1.000	0.361
ETHICS+INTEREST+readybarrier	1.000	0.322
ETHICS+INTEREST+nomat	1.000	0.363

Rejection cases: "type B" and "type C" farmers

Using the QCA results and the additional qualitative statements of the farmers, the rejection cases can be divided into two groups. "Type B" farmers are labelled as opponents due to ethical concerns. "Type C" farmers are generally open-minded towards the technology but refuse due to other conditions. Before describing each type separately, QCA results encompassing both groups are provided. The foundation for grouping the rejection farmers is the analysis of conditions. The analysis of necessary and sufficient conditions can only be made for all rejection cases. No necessary conditions could be found because consistency values are below 0.75 (see Additional file 5). All conditions passed neither the consistency nor the coverage test.

The result of the analysis of sufficient conditions is displayed in Table 5[8].

All five assumptions in Table 5 contribute to unique coverage for the outcome "rejection". The displayed assumptions (considering all of them) can be reduced to the following intermediate solution term:

(Solution coverage 0.822; solution consistency 1.00)

Type B farmers		Type C farmers
ethics∗interest∗readybarrier∗SATISF∗NOMAT	+	**ETHICS∗(READYBARRIER+SATISF+NOMAT)**

"Type B" farmers: ethically concerned refusers

"Type B" farmers have very strong ethical concerns about burning wetland material. The following quotation underlines this pathway (ethics*interest*readybarrier* SATISF*NOMAT):

> "Thermal use of hay? Never! Hay is fodder! It must not be burnt! … That really hurts me. This can only stem from farmers who do not have animals. … I´m not interested in this technology at all." (farmer 18).

Additional conditions that influence rejection are farmers' preference for other solutions to the "wetland problem" and a lack of trust in regional actors. Using biomass from meadows as forage for suckler cows and better water management were perceived as adequate solutions.

> "Meadows should be used for feeding animals. Generally, the water regulation is currently bad. It is mismanagement on the part of the regional water association. And the conservationists do a bad job. This is also problematic for the species protection. We don't have storks anymore" (farmer 13).

All "Type B" farmers stated that the wetlands should be maintained because they are essential for agriculture, a part of their cultural heritage, and an important habitat for flora and fauna.

"Type C" farmers: open-minded refusers

"Type C" farmers ethically accept the technology but stated at least one restricting condition why they reject the innovation (ETHICS *[NOMAT+SATISF+READYBARRIER]). Farmers in this group each reported different restrictions regarding the implementation of a biomass plant (see Table 6).

A few "type C" farmers mentioned conditions for the use of wetlands' biomass:

> "It is only OK if it doesn't bring the mere cultivation of energy crops and if there is sufficient feedstock available that can't be used for other purposes. Its use for animals has priority" (farmer 9).

Additional conditions that influence rejection by "type C" farmers are the lack of knowledge concerning airing expenses, perceived high operational costs, and difficulty of integrating the procedure into daily work on the farm. Like "type B" members, some "type C" farmers stated that better water management in the Spreewald region is needed (farmers 7–8 and 13–15). Furthermore, during the interview, farmers were asked about their willingness to supply feedstock instead of installing a plant. Four "type C" farmers stated that they would sell their feedstock to an operator of a biomass plant (farmers 2, 11, 14, and 15). Five farmers would neither provide their feedstock nor install a plant (farmers 6, 10, 13, 16, and 17). Regarding the characterisation of these farmers, the sizes of cultivated land varied from very small farms with approximately 5 ha to medium-sized farms with 800 to 1500 ha. Farm production orientation is mainly towards forage crops. The wetland meadow use consists only of mowing and grazing. Additionally, farmers in this group recognised the importance of maintaining wetlands.

Discussion and further implications

In this section, we discuss our results in relation to the literature about acceptability, bioenergy, and transition management to derive case-related and general implications.

Because acceptability decisions are often temporary, they can vary over time as a result of certain influences. Whether acceptability decisions will change in a positive direction (higher acceptance) or in a negative direction (less acceptance) depends on activities and interventions during the innovation process. This idea is what Hitzeroth and Megerle [32] call sensitive "turnaround moments". With the knowledge of why farmers accept or reject the innovations, innovation process can be steered

[8]The parsimonious solution term for rejection is "SATISF*NOMAT" (solution coverage 0.923, solution consistency 0.900). The intermediate solution term for rejection that included easy counterfactuals is "interest + ETHICS*(SATISF + NOMAT) + ETHICS*readybarrier*(SATISF + NOMAT)" (solution coverage 0.856, solution consistency 0.980).

Table 5 Analysis of sufficient conditions for rejection (y) (based on the Quine-McCluskey algorithms, without logical remainders, on basis of truth table in Additional file 6)

Assumptions	Cases	Raw coverage	Unique coverage	Consistency
ethics*interest*readybarrier*SATISFY*NOMAT	Farmers 13 and 17	0.203	0.163	1.000
ETHICS*interest*READYBARRIER*NOMAT	Farmers 6, 10, and 16	0.305	0.127	1.000
ETHICS*INTEREST*SATISF*nomat	Farmers 5, 7, and 14	0.228	0.152	1.000
ETHICS*INTEREST*satisf*NOMAT	Farmers 8 and 9	0.144	0.033	1.000
ETHICS*INTEREST*readybarrier*NOMAT	Farmers 2, 9, 11, and 15	0.338	0.101	1.000

Solution coverage 0.822; solution consistency 1.000

through introducing acceptance building measures. In the present case study, it is of special interest whether the implementation of biomass heating plants at the farm level is still a promising innovation pathway or whether a different path should be taken.

Our study revealed the following factors for rejecting biomass heating plants at the farm level: (a) ethical concerns, (b) satisfaction with the current oven, (c) low availability of feedstock on the farm, and (d) perceived low readiness of technology.

a) Ethical concerns are a strong barrier that implies that farmers categorically reject biomass plants as a solution to the rising abandonment of small-scale wetlands. The opinions of these farmers are established (fixed) and are difficult to change during the innovation process. Therefore, it is not reasonable to insist on their acceptance in the future. When ethical concerns and values will not be adequately addressed in the innovation process, conflicts may occur [40]. To avoid conflicts and manage disagreements, it is recommended to involve concerned actors continuously in the discussion and reflection about the overall aims of the innovation and a landscape development strategy (e.g. suitable solutions to maintaining the small-scale wetlands and the whole cultural landscape).

Table 6 Quotations illustrating ethical acceptance and restricting conditions of "type C" farmers

Restricting condition	Quotation
NOMAT	"In my case, I don't have enough feedstock on my farm for my own oven" (farmer 8).
SATISF	"I don't need a new heating system. My current fuel-and-wood oven works very well" (farmer 2).
READYBARRIER	"This technology is suitable to maintain wetland and supply local energy if it's economically feasible. But I think the low readiness of this technology might cause a lot of costs and problems" (farmer 15).

These quotations stem from the interviews in which farmers could make detailed statements in addition to the standardised questionnaire

Moderate ethical concerns (such as those expressed by farmers who agreed with the use of landscape material for bioenergy under certain circumstances) advocate for a smart use or cascade use of such biomass [41, 42]. Smart use includes prioritising the application of biomass. Biomass should be used first to feed animals and only second to produce bioenergy. For the latter use, only biomass with low nutritional value (called co-product) is used. An example of cascade use in our case study is to apply the ash (residues of gasification) onto the field. This procedure helps to close the local resource cycle. The aforementioned ethical concerns are somehow related to the food and fuel debate, which is commonly brought up in the context of biogas production in Germany [26]. In both cases, the preferred use of biomass is for food or, alternatively, feed. This issue is backed by the traditional farmers' self-conception as "producers of food" rather than "producers of energy". European studies from Poland and the Czech Republic revealed that farmers ethically favour food production over growing biomass for energy production [24, 43]. With focus on the landscape scale, Werling et al. [15] argue for multi-functional landscapes by growing perennial bioenergy plants on marginal plots to avoid conflicts with food production. Perennial bioenergy plants increase landscape diversity and support other ecosystem services [15].

b) If farmers are satisfied with their current heating system, it is very unlikely that they will implement a biomass plant on their own farms in the coming years. This finding does not necessarily imply that biomass plants are per se an inadequate solution to the "wetland problem". An alternative option could be shifting the implementation of biomass plants from the single-farm level (as we have done in the present analysis) to the community level. This shift in the innovation process is also a starting point for a "new" acceptability study.

c) The low availability of own feedstock was identified as another barrier to acceptance by farmers. This is in line with the statement of Scarlat et al. [42], who

point out that the success of establishing bioenergy systems depends on (among other things) the availability of biomass. To overcome this barrier, a biomass plant at the community level could be a promising solution. Feedstock for a community-based biomass plant can be jointly supplied by various farms from the region. In the interviews, some farmers stated that they would provide their feedstock for a regional biomass plant. One farmer even added that he would appreciate discussing with colleagues the option of jointly mapping suitable plots for producing feedstock.

d) Advances in technology are seen as a key issue in implementing effective and efficient bioenergy systems [42]. The gasification technology that is the basis of biomass heating production in the Spreewald case study is still relatively new. Due to the currently low readiness of this technology, more time for experimentation and technology development is needed. From a socio-technological perspective, additional constraints are the lack of financial support from the government, regulatory limitations (e.g. emission protection law), and the limited availability of the technology. These are typical challenges in socio-technological niches and their management [44, 45]. To overcome such constraints and to create a "market niche", adequate funding schemes, new shared rules (e.g. revision of existing laws), and routines within the "socio-technical regime" are required [44]. Generally, for single farmers and small companies, it is more difficult to apply for investment subsidies than it is for bigger entities. Therefore, it might be promising to install a biomass plant at the community level. Wolsink [16] and Cavicchi [46] point out that the present (bio) energy system, with its often hierarchical, top-down, large-scale, market-oriented, and lobby-oriented character, should be restructured. However, a rethinking of the current energy strategy is overdue. For instance, top-down pathways, such as installation of wind turbines in rural areas, can cause rejection by communities and even regional conflicts [16, 17]. Gailing and Röhring [47] propose pushing a change from a mere "installation site" management for renewable energy into collaborative "regional action areas" where local actors are engaged. This is in line with the concept of decentralised "micro-grid energy systems". Such micro-grid systems should be integrated into landscape planning and management that defines available and suitable space for renewable energy focuses in co-production with all actors (including local residents) [16].

In addition to the already discussed influencing factors, our study revealed further factors that potentially support enhancing acceptance: (e) valorisation of wetlands by farmers and (f) trust and co-operation between actors (justice).

e) As the results show, all interviewed farmers stated that wetland meadows are worth maintaining because they are a pivotal part of the cultural landscape. Values of the cultural landscape are seen in its agricultural use, in its beauty, and in itself as a holder of cultural heritage and as a habitat for flora and fauna. This finding is in line with recent case studies. It is widespread that farmers place great meaning in the agricultural value of meadows [4]. Other studies point out that the cultural values of landscape (in general) are often appreciated by farmers, residents, and other regional actors [1, 24]. A survey of Polish farmers determined that most interviewed farmers preferred to conserve their cultural heritage than to exploit farmland exclusively for income from energy crops [24]. Our case study shows how both aims—bioenergy production and protection of cultural landscapes—can potentially be combined by implementing local biomass heating plants. The cultural values of the landscape that are shared by many local actors are a powerful social capital and a good starting point to jointly create a shared vision for cultural landscape protection [1, 48].

f) Our study shows that relational trust, procedural fairness, and justice play a role in proponents' ("type A" farmers') acceptability decisions. Relational trust is about truthfulness, mutual appreciation, and creating shared values among involved actors [4, 49, 50]. The importance of these issues is revealed in a Scottish case study about landscape maintenance for grasslands with high nature values: The farmers' motivation was limited to cooperating in maintenance measures in case the relation between farmers and coordinators (conservationists is this case) was weak or unbalanced [4]. Regular contact; joint meetings on values, aims, conceptions, and solutions; and having a demonstration plant may help build trust [48]. Demonstration plants also foster technology development on a niche level and mutual and reflexive learning.

Finally, the influencing factor "need of financial support" as an essential precondition for acceptance has to be discussed. In the interviews, the farmers stated that an on-farm biomass plant requires a major investment. Farmers would need financial support from funding programmes for undertaking such investment. Applying for funding requires a lot of effort, and at the same time, the outcome of the application is

uncertain. The investment costs can hardly be compensated by future income or energy price savings when producing energy from wetland biomass. The contribution of this bioenergy process chain to farmers' income is relatively low regardless of whether the energy is directly produced and used on-farm or the biomass is supplied to the market [7]. The profit margin in the biogas process chain is much higher if biogas and heat are used [7]. However, the biomass from the Spreewald wetlands is less favourable than other feedstocks for biogas production.

The discussion points above indicate how to integrate the results of the specific acceptability study in a wider context of landscape design and management. As we have shown, such integration builds on mutable acceptability decisions [41], reflexive and iterative learning processes (e.g. [44, 51, 52]), innovation system thinking with feedback loops [44, 48], and adaptive landscape design [48]. Reflecting results is always crucial because acceptability studies are often only a piece of the puzzle of a broader picture. Thus, this is not only important for the present case study; the results also have a general implication for cases with place-based innovations embedded in cultural landscapes. Especially considering that some studies neglect or underestimate such a process of temporal-spatial contextualisation [53, 54], this seems to be a valuable recommendation.

Conclusion

The paper analysed farmers' acceptability of local biomass heating plants in the Spreewald region (Germany) and its contribution to cultural landscape management. Fuzzy QCA was a suitable method for revealing complex patterns of acceptability and for identifying different farmer types regarding the attitudes towards biomass plants. Our analysis revealed that acceptance of biomass plants at the farm level is relatively low. Contextualising degrees of acceptability and their underlying factors supports revising and adapting the innovation pathway. For the Spreewald case study, a biomass plant at the community level seems to be a promising solution. However, the acceptability of such a community-based biomass plant and further conditions should be investigated before implementing this idea. This finding directly indicates the importance of integrating each acceptability study into a broader picture. For this purpose, we propose integrating acceptability studies into an adaptive landscape design, if appropriate. To refine such an integration procedure, further research is needed by applying the procedure to additional cases and other contexts. In conclusion, our paper provides a scientific contribution in two ways. First, knowledge has been gained regarding how a local biomass plant can help reduce land abandonment in cultural landscapes with small-scale meadows. Second, we advanced the state of the art in acceptability studies.

Additional files

Additional file 1: List of interviews table. (DOCX 24 kb)

Additional file 2: Questionnaire for interviewing farmers regarding their acceptance of local heating plants. (PDF 96 kb)

Additional file 3: READY-BARRIER" (the mean of variable "interest in technology" and "perceived readiness" including also relevant qualitative statements). (DOCX 24 kb)

Additional file 4: Truth table for positive outcome (= acceptance) without logical remainders. (DOCX 25 kb)

Additional file 5: Analysis of Necessary Conditions for negative outcome (=rejection). (DOCX 24 kb)

Additional file 6: Truth table for negative outcome (= rejection) without logical remainders. (DOCX 25 kb)

Abbreviations

DOI: Diffusion of innovation theory; fsQCA: Fuzzy set qualitative comparative analysis; QCA: Qualitative comparative analysis; SDGs: Sustainable Development Goals; TAM: Technology acceptance model

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Authors' contributions

MB devised the main conceptual ideas; collected, processed, and analysed the data; and wrote major parts of the paper. RS contributed to the methodological design, supervised the data collection, revised the manuscript, and made the suggestions for improvements. NH contributed to the case study description, revised the manuscript, and made the suggestions for improvement. NH gave feedback on the study design and data interpretation, and provided access to the interviewees. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets generated and analysed during the current study are not publicly available due protecting confidentiality of sensitive information but are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

Before interviews were conducted, an interview consent form was provided to all participants. Each participant signed a consent letter in order to participate in the interview. Ethics approval is not applicable.

Consent for publication

The authors consent to publication.

Competing interests

The authors declare that they have no competing interests.

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References

1. Plieninger T, Bieling C, Ohnesorge B, Schaich H, Schleyer C, Wolff F (2013) Exploring futures of ecosystem services in cultural landscapes through participatory scenario development in the Swabian Alb, Germany. Ecol Soc 18. https://doi.org/10.5751/ES-05802-180339
2. Plieninger T, Höchtl F, Spek T (2006) Traditional land-use and nature conservation in European rural landscapes. Environ Sci Policy 9:317–321. https://doi.org/10.1016/j.envsci.2006.03.001
3. Schulp CJE, Levers C, Kuemmerle T, Tieskens KF, Verburg PH (2019) Mapping and modelling past and future land use change in Europe's cultural landscapes. Land Use Policy 80:332–344. https://doi.org/10.1016/j.landusepol.2018.04.030
4. McGinlay J, Gowing DJG, Budds J (2017) The threat of abandonment in socio-ecological landscapes: farmers' motivations and perspectives on high nature value grassland conservation. Environ Sci Policy 69:39–49. https://doi.org/10.1016/j.envsci.2016.12.007
5. Biggs R, Westley F, Carpenter S (2010) Navigating the Back Loop: Fostering social innovation and transformation in ecosystem management. Ecol Soc 15. https://doi.org/10.5751/ES-03411-150209
6. Grunwald A, Rösch C (2011) Sustainability assessment of energy technologies: towards an integrative framework. Energy Sustain Soc 1(3). https://doi.org/10.1186/2192-0567-1-3
7. Rösch C, Skarka J, Raab K, Stelzer V (2009) Energy production from grassland – assessing the sustainability of different process chains under German conditions. Biomass Bioenerg 33:689–700. https://doi.org/10.1016/j.biombioe.2008.10.008
8. Levers C, Schneider M, Prishchepov AV, Estel S, Kuemmerle T (2018) Spatial variation in determinants of agricultural land abandonment in Europe. Sci Total Environ 644:95–111. https://doi.org/10.1016/j.scitotenv.2018.06.326
9. van der Zanden EH, Verburg PH, Schulp CJE, Verkerk PJ (2017) Trade-offs of European agricultural abandonment. Land Use Policy 62:290–301. https://doi.org/10.1016/j.landusepol.2017.01.003
10. Beilin R, Lindborg R, Stenseke M, Pereira HM, Llausàs A, Slätmo E, Cerqueira Y, Navarro L, Rodrigues P, Reichelt N, Munro N, Queiroz C (2014) Analysing how drivers of agricultural land abandonment affect biodiversity and cultural landscapes using case studies from Scandinavia, Iberia and Oceania. Land Use Policy 36:60–72. https://doi.org/10.1016/j.landusepol.2013.07.003
11. Dauber J, Miyake S (2016) To integrate or to segregate food crop and energy crop cultivation at the landscape scale? Perspectives on biodiversity conservation in agriculture in Europe. Energy Sustain Soc 6. https://doi.org/10.1186/s13705-016-0089-5
12. McGovern G, Klenke T (2018) Towards a driver framework for regional bioenergy pathways. J Clean Prod 185:610–618. https://doi.org/10.1016/j.jclepro.2018.02.251
13. INRENA, IEA, FAO (2017) Bioenergy for Sustainable Development. https://www.ieabioenergy.com/publications/bioenergy-for-sustainable-development. Accessed 24 Oct 2018.
14. Dale VH, Kline KL, Buford MA, Volk TA, Tattersall Smith C, Stupak I (2016) Incorporating bioenergy into sustainable landscape designs. Renew and Sust Energ Rev 56:1158–1171. https://doi.org/10.1016/j.rser.2015.12.038
15. Werling BP, Pennington D, Landis DA Biodiversity services and bioenergy landscapes. Extension Bulletin, Michigan State University 3164:1–12
16. Wolsink M (2018) Co-production in distributed generation: renewable energy and creating space for fitting infrastructure within landscapes. Landscape Res 43:542–561. https://doi.org/10.1080/01426397.2017.1358360
17. Becker S, Naumann M (2017) Energy democracy: mapping the debate on energy alternatives. Geogr Compass 11:e12321. https://doi.org/10.1111/gec3.12321
18. Gawel E, Lehmann P, Korte K, Strunz S, Bovet J, Köck W, Massier P, Löschel A, Schober D, Ohlhorst D, Tews K, Schreurs M, Reeg M, Wassermann S (2014) The future of the energy transition in Germany. Energy Sustain Soc 4. https://doi.org/10.1186/s13705-014-0015-7
19. Arbolino R, De Simone L, Yigitcanlar T, Ioppolo G (2018) Facilitating solid biomass production planning: insights from a comparative analysis of Italian and German marginalized areas. J Clean Prod 181:819–828. https://doi.org/10.1016/j.jclepro.2018.01.154
20. Sahota S, Shah G, Ghosh P, Kapoor R, Sengupta S, Singh P, Vijay V, Sahay A, Vijay VK, Thakur IS (2018) Review of trends in biogas upgradation technologies and future perspectives. Bioresource Technol Rep 1:79–88. https://doi.org/10.1016/j.biteb.2018.01.002
21. Judex JW, Wellinger M, Ludwig C, Biollaz SMA (2012) Gasification of hay in a bench scale fluidised bed reactor with emphasis on the suitability for gas turbines. Biomass Bioenerg 46:739–749. https://doi.org/10.1016/j.biombioe.2012.06.006
22. Achinas S, Achinas V, Euverink GJW (2017) A technological overview of biogas production from biowaste. Engineering 3:299–307. https://doi.org/10.1016/J.ENG.2017.03.002
23. Townsend TJ, Sparkes DL, Ramsden SJ, Glithero NJ, Wilson P (2018) Wheat straw availability for bioenergy in England. Energ Policy 122:349–357. https://doi.org/10.1016/j.enpol.2018.07.053
24. Zyadin A, Natarajan K, Igliński B, Iglińska A, Kaczmarek A, Kajdanek J, Pappinen A, Pelkonen P (2017) Farmers' willingness to supply biomass for energy generation: evidence from South and Central Poland. Biofuels 8:421–430. https://doi.org/10.1080/17597269.2016.1225647
25. Busse M, Siebert R (2018) Acceptance studies in the field of land use—a critical and systematic review to advance the conceptualization of acceptance and acceptability. Land Use Policy 76:235–245. https://doi.org/10.1016/j.landusepol.2018.05.016
26. Schumacher K, Schultmann F (2017) Local acceptance of biogas plants: a comparative study in the trinational upper Rhine region. Waste Biomass Valori 8:2393–2412. https://doi.org/10.1007/s12649-016-9802-z
27. Chin H-C, Choong W-W, Wan Alwi SR, Mohammed AH (2014) Issues of social acceptance on biofuel development. J Clean Prod 71:30–39. https://doi.org/10.1016/j.jclepro.2013.12.060
28. Davis FD (1989) Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly 13:319. https://doi.org/10.2307/249008
29. Lyytinen K, Damsgaard J (2001) What's wrong with the diffusion of innovation theory? In: Ardis MA, Marcolin BL (eds) Diffusing software product and process innovations. Springer US, Boston, MA, pp 173–190
30. Mallett A (2007) Social acceptance of renewable energy innovations: the role of technology cooperation in urban Mexico. Energy Policy 35:2790–2798. https://doi.org/10.1016/j.enpol.2006.12.008
31. Wüstenhagen R, Wolsink M, Bürer MJ (2007) Social acceptance of renewable energy innovation: an introduction to the concept. Energy Policy 35:2683–2691. https://doi.org/10.1016/j.enpol.2006.12.001
32. Hitzeroth M, Megerle A (2013) Renewable energy projects: acceptance risks and their management. Renew Sust Energ 27:576–584
33. Kahma N, Matschoss K (2017) The rejection of innovations? Rethinking technology diffusion and the non-use of smart energy services in Finland. Energy Re Soc Sci 34:27–36. https://doi.org/10.1016/j.erss.2017.05.024
34. McKendry P (2002) Energy production from biomass (part 2): conversion technologies. Bioresource Technol 83:47–54. https://doi.org/10.1016/S0960-8524(01)00119-5
35. Patton MQ (2019) Qualitative research and evaluation methods. Integrating theory and practice, fourth edition. SAGE Publications Ltd, Thousand Oaks
36. Yin RK (2019) Case study research and applications, 6th edn. SAGE Publications Ltd, Los Angeles
37. Ragin CC (2000) Fuzzy-set social science. University of Chicago Press, Chicago
38. Schneider CQ, Wagemann C (2012) Set-theoretic methods for the social sciences: a guide to qualitative comparative analysis. Cambridge University Press, Cambridge
39. Meyer C, Chen C, Matzdorf B (2018) Qualitative comparative institutional analysis of environmental governance: implications from research on payments for ecosystem services. Ecosystem Services 34:169–180. https://doi.org/10.1016/j.ecoser.2018.07.008
40. Gamborg C, Anker HT, Sandøe P (2014) Ethical and legal challenges in bioenergy governance: coping with value disagreement and regulatory complexity. Energ Policy 69:326–333. https://doi.org/10.1016/j.enpol.2014.02.013
41. Ganzevles J, Asveld L, Osseweijer P (2015) Extending bioenergy towards smart biomass use Issues of social acceptance at Park Cuijk, The Netherlands. Energ Sust Soc 5:22. https://doi.org/10.1186/s13705-015-0053-9
42. Scarlat N, Dallemand J-F, Monforti-Ferrario F, Nita V (2015) The role of biomass and bioenergy in a future bioeconomy: policies and facts. Environ Develop 15:3–34. https://doi.org/10.1016/j.envdev.2015.03.006
43. Frantál B, Prousek A (2016) It's not right, but we do it. Exploring why and how Czech farmers become renewable energy producers. Biomass Bioenerg 87:26–34. https://doi.org/10.1016/j.biombioe.2016.02.007
44. Schot J, Geels FW (2008) Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy. Techno Anal Strateg 20:537–554. https://doi.org/10.1080/09537320802292651

45. Geels FW, Schot J (2007) Typology of sociotechnical transition pathways. Res Policy 36:399–417. https://doi.org/10.1016/j.respol.2007.01.003
46. Cavicchi B (2018) The burden of sustainability: limits to sustainable bioenergy development in Norway. Energ Policy 119:585–599. https://doi.org/10.1016/j.enpol.2018.05.015
47. Gailing L, Röhring A (2014) Was ist dezentral an der Energiewende? Infrastrukturen erneuerbarer Energien als Herausforderungen und Chancen für ländliche Räume. Raumforschung und Raumordnung 73:31–43
48. Campellone RM, Chouinard KM, Fisichelli NA, Gallo JA, Lujan JR, McCormick RJ, Miewald TA, Murry BA, John Pierce D, Shively DR (2018) The iCASS platform: nine principles for landscape conservation design. Landscape Urban Plan 176:64–74. https://doi.org/10.1016/j.landurbplan.2018.04.008
49. Eswarlal VK, Vasudevan G, Dey PK, Vasudevan P (2014) Role of community acceptance in sustainable bioenergy projects in India. Energ Policy 73:333–343. https://doi.org/10.1016/j.enpol.2014.04.019
50. Gross C (2007) Community perspectives of wind energy in Australia: the application of a justice and community fairness framework to increase social acceptance. Energ Policy 35:2727–2736. https://doi.org/10.1016/j.enpol.2006.12.013
51. Moser SC (2016) Can science on transformation transform science? Lessons from co-design. Curr Opin Env Sust 20:106–115. https://doi.org/10.1016/j.cosust.2016.10.007
52. Pahl-Wostl C (2009) A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. Global Environ Chang 19:354–365. https://doi.org/10.1016/j.gloenvcha.2009.06.001
53. Schroeder LA, Isselstein J, Chaplin S, Peel S (2013) Agri-environment schemes: farmers' acceptance and perception of potential 'Payment by Results' in grassland—A case study in England. Land Use Policy 32:134–144. https://doi.org/10.1016/j.landusepol.2012.10.009
54. Veidemane K, Nikodemus O (2015) Coherence between marine and land use planning: public attitudes to landscapes in the context of siting a wind park along the Latvian coast of the Baltic Sea. J Environ Plann Man 58:949–975. https://doi.org/10.1080/09640568.2014.903167

Publisher's Note

6. Integration of acceptability studies into an adaptive landscape co-design and management — The acceptability and landscape design cycle (ALDC) (Paper 4)

This is an Author's Original Manuscript of an article submitted to Taylor & Francis, Landscape Research in 2019. The authors are Maria Busse, Nico Heitepriem, Jana Zscheischler, and Rosemarie Siebert.

Integration of acceptability studies into an adaptive landscape co-design and management – The acceptability and landscape design cycle (ALDC)

Acceptability studies of place-based innovations and landscape approaches address both actors' perceptions and values on landscapes and aim to sustainability transformation. Acceptability studies often neglect complex and on-going processes. Landscape approaches rarely consider in-depth acceptability studies as elementary in landscape co-design and management. For the sustainable transformation of landscapes, it might be fruitful to combine aspects from both research strands. The paper introduces the 'acceptability and landscape design cycle'; a new approach that integrates acceptability studies into adaptive landscape co-design and management. It is composed of four iterative phases: 1) defining the preconditions for acceptability analysis, (2) conducting the acceptability analysis, (3) integrating the results into the landscape strategy, and (4) re-designing and refining the landscape strategy. We illustrate the application of these phases by the case study Spreewald. The conceptual paper provides practical implementation guidelines and contributes to a better understanding of the dynamic characteristic of acceptability decisions.

Keywords: recursive pattern of acceptability; acceptance; landscape co-design; adaptive co-management; social learning, iterative innovation processes; collaborative decision-making:

Introduction

Complex problems in landscapes require accepted and place-based innovations for the sustainable transformation of these landscapes (Bodin, 2017; Westley et al., 2011). Place-based innovations refer to a certain space. They can range from novel technical solutions to new forms of landscape governance. The acceptance of such innovations by users or affected actors is seen as an important precondition for the successful implementation of innovations (Busse & Siebert, 2018). Only by gaining and reflecting in-depth knowledge if actors accept or reject innovations and why they do it innovation processes and landscapes can be strategically and adequately managed. From the perspective of deliberative policy making in social-ecological research and landscape planning, steering innovation requires the involvement of affected and other related actors in the innovation process because it is presumed to be helpful in enhancing acceptance (Pahl-Wostl, 2009). Thus, participation and collaboration is claimed to legitimize innovations or the innovation process by addressing transparency, integrating knowledge, jointly discussing and creating solutions, and preventing conflict (Johansson, Sandström, & Lundmark, 2018). Considering this importance of acceptability, it is comprehensible that acceptability studies in the field of land use have become of increasing interest in academia during recent decades (Busse & Siebert, 2018).

Studies on acceptability in the field of land use are often stand-alone and 'snapshots' conducted in one specific moment in the innovation process. This neglects acceptability as an on-going process and the embeddedness in landscape development processes (e.g., Kamal, Kocór, & Grodzińska-Jurczak, 2015; Leitinger, Walde, Bottarin, Tappeiner, & Tappeiner, 2010; Pleger, Lutz, & Sager, 2018; Schenk, Hunziker, & Kienast, 2007). However, acceptability studies are in most cases part of a broader project or a complex social-ecological structure. Our experiences in recent research projects have taught us that integrating acceptability results into a broader context and into landscape development processes are crucial steps. Important issues in this sense are 1) the change of acceptability decisions in the course of landscape development and innovation processes; 2) the role of complex actors' constellation in landscapes for the acceptability of place-based innovations; 3) the spatial distribution within a landscape of acceptability decisions

on innovations within the specific landscape; and 4) the spatial complementarity of innovations. More theoretically expressed the integration of acceptability studies should be understood as an on-going adaptive process since innovations are also developed in non-linear processes, where social-ecological interdependencies within landscapes are shaped by continuous change. In social-ecological research, several landscape approaches exist that address adaptive co-design or co-management (Folke, Hahn, Olsson, & Norberg, 2005; Olsson, Folke, & Berkes, 2004; J. Reed, Van Vianen, Deakin, Barlow, & Sunderland, 2016; Sayer et al., 2013). Implicitly acceptability plays somehow a role in these landscape approaches by mentioning the importance of collaborations between actors, flexible decision making, or shared responsibility. Nonetheless, the landscape approaches do not explicitly refer to the acceptability literature and do not consider in-depth acceptability studies as elementary in landscape co-design and management. There was no single study found that integrates the analysis of acceptability into landscape approaches. As a matter of fact, a considerable amount of important studies concerning the governance of social-ecological systems and landscape approaches does not even mention the terms 'acceptance' or 'acceptability' (e.g., Berkes, 2009; Bodin, 2017; Duff et al., 2009; Folke et al., 2010, 2005; Opdam et al., 2013)

Vice versa, also in acceptability studies, landscape co-design or adaptive co-management play mostly an indirect role. Relevant literature on landscape approaches (Folke et al., 2005; Olsson et al., 2004; J. Reed et al., 2016; Sayer et al., 2013) is not cited in any recent acceptability study. Yet, both research strands are completely disconnected and co-exist without inspiring each other. Consequently, there are two separate research strands that deal with similar issues: actors' perceptions and values in landscapes and the sustainable transformation of landscapes. There is a need to bring these two research strands conceptually together to make use of insights from both of them (cf. figure 1). Doing so would be fruitful for the sustainable transformation of landscapes and for the advance of the debate in landscape planning and research. Corresponding to this, Primdahl, Pinto-Correia, & Pedroli (2019) stated that to better understand, identify, and assess future development options of landscapes new analytical tools and pro-active landscape governance approaches are required which involve a broad range of regional actors.

We specify this requirement by claiming an approach that offers guidance through concrete steps of integrating acceptability studies into landscape development processes. Such an approach has not yet been provided in the scientific literature.

Addressing this need, the aim of this conceptual paper is to introduce a new approach to integrate acceptability studies in adaptive landscape co-design and management. This approach is called the 'acceptability and landscape design cycle' (ALDC). It is mainly suitable for place-based innovations, which contribute to the sustainable transformation of landscapes. The approach was inductively developed from our lessons learnt from the case study Spreewald and is based on the empirical acceptability studies that has been published recently (Busse, Heitepriem, & Siebert, 2019; Busse, Siebert, & Heitepriem, 2019). We describe the different phases of the ALDC approach and illustrate this using the above mentioned case study.

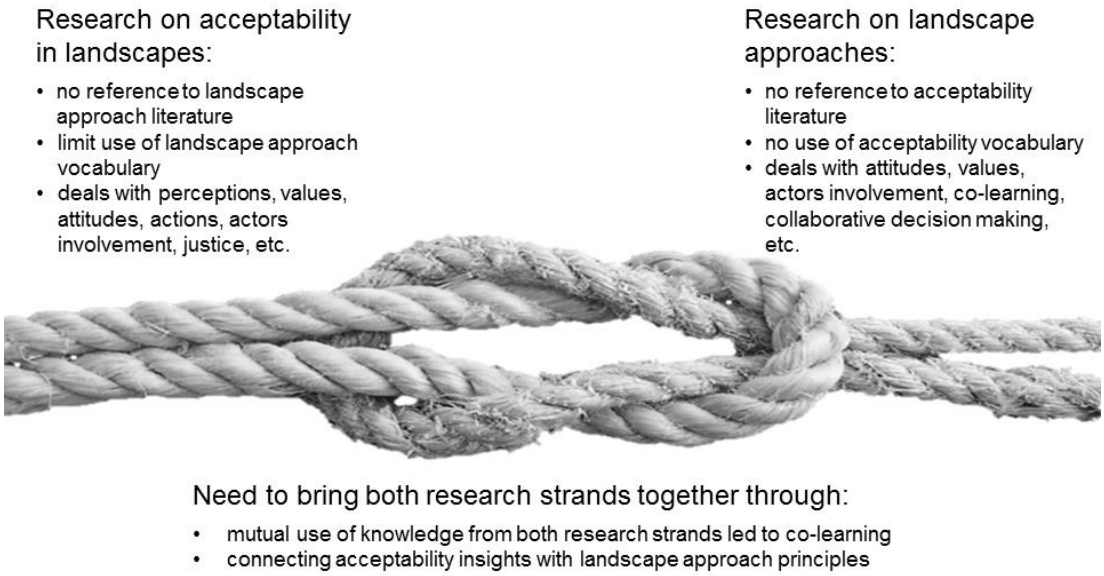

Figure 1. Disconnection of acceptability studies and landscape approaches and the need to combine both

Main concepts that influences the new approach

We base the ALDC approach on three main concepts that are described in the following: 1) acceptability and the need for recognizing recursive pattern of acceptability), 2) innovations and the need for innovation system thinking in

landscape research 3) landscape approaches and the need for adaptive co-design and co-management.

Acceptability and the need of recognizing recursive pattern of acceptability

There is no common understanding among landscape researchers what acceptance and acceptability means (Busse & Siebert, 2018). We define acceptability as a multifaceted concept that investigates a bundle of complex and dynamic decision processes performed by different involved actors (Busse & Siebert, 2018; Fournis & Fortin, 2017; Lucke, 1995). These acceptability decisions are based on value-based arguments and on interactions with others and the acceptability context (social norms, institutional-political settings, scale interactions) (Lucke, 1995). Acceptability studies examine the degree of these actors' decisions — ranging from pro-active engagement, and acceptance via doubt and conditional acceptance to rejection or even opposition — and their underlying acceptability factors (Busse & Siebert, 2018; Sauer, Luz, Suda, & Weiland, 2005). Hitzeroth and Megerle (2013) emphasize 'turnaround moments' between conditional acceptance and opposition as critical for innovative projects that should be recognized and handled by project managers. Furthermore, acceptability decisions can be analysed for and assigned to specific level by differentiating between attitude level (analysis of attitudes before taking actions), action level (analysis of adopting innovations or participating in collaborations), and utilization level (long-term evaluation concerning the use of innovations). In addition to these levels, acceptability studies can be performed on different spatial scales as it is underlined by Fournis and Fortin (2017) and Wolsink (2010).

Normally, acceptability decisions are gathered and analysed at one specific moment in the innovation process. In reality, decisions are often temporary and can vary over time through changing conditions. Therefore, acceptability studies can be understood as a 'snapshot' analysis of the more complex and on-going process. We can assume that another 'snapshot' at a different moment would lead to different results. To capture real-world problems, these dynamics – so called 'recursive pattern of acceptability' (Ganzevles, Asveld, & Osseweijer, 2015) should be adequately addressed in acceptability studies. Even if some studies already implicitly recognise

such 'recursive pattern' they are not a substantial part of these studies due to constrains regarding methodology and complexity or project timelines. Unfortunately, Ganzevles Asveld, & Osseweijer (2015) or other researchers do not describe in detail how to cope with the 'recursive pattern of acceptability'. Until now, it has been an underexposed but necessary topic in scientific debates and literature. Taking 'recursive pattern of acceptability' into account or emphasising it is new and so far rather uncommon.

Landscape approaches and the need for adaptive co-design and co-management

Landscape approach is an umbrella term for frameworks which aim at integrating policy and practice for the multifunctional landscape use by balancing different stakeholder perspectives (J. Reed et al., 2016). Landscape approaches correspond with a social-ecological system perspective, and embrace the concepts of adaptive co-management, landscape co-design, collaborative landscape management, etc. (J. Reed et al., 2016; Sayer et al., 2013). Regardless the diversity of terms some commonly shared principles in landscape approaches has been identified by Sayer et al. (2013) such as the principles of continual learning and adaptive management, multifunctionality, shared responsibilities, participatory monitoring, and strengthen actors' capacities. These principles reflect the needed shift from command and control to co-management as suggested by many landscape researchers (Cleaver & Whaley, 2018; Pahl-Wostl, 2009).

Among the different landscape approaches two are of major importance for the ALDC: a) landscape co-design and b) adaptive co-management.

(1) Traditionally, landscape design is often understood as part of landscape architecture or land art and is less connected with landscape conservation or sustainability. Opdam et al. (2018) advocate for expanding this view by broadening the definition of design to further sustainable landscape development. In line with this, Nassauer and Opdam (2008, 635) define '[landscape] design as intentional change of landscape pattern, for the purpose of sustainably providing ecosystem services while recognizably

meeting societal needs and respecting societal values. Design is both a product, landscape pattern changed by intention, and the activity of deciding what that pattern could be'. Additionally, design can be a bridging concept for scientists and practitioners to implement knowledge on landscape use, landscape processes, and societal values in their decision making (Nassauer & Opdam, 2008). It has the potential to integrate various disciplines and to merge concepts of scale, spatial heterogeneity, sustainability, socio-cultural acceptability, and creativity (Swaffield, 2013). Applications of landscape co-design can be found in different contexts, e.g., pest control in agricultural landscapes (Steingröver, Geertsema, & van Wingerden, 2010), bioenergy landscapes (Dale et al., 2016), and landscape conservation design (Campellone et al., 2018). There are similarities but also slight differences between landscape design and landscape management. Design promotes creative thinking in intentional landscape change processes at specific moments and proposes sustainable landscape strategies, whereas management indicates how the design can be continuously implemented (Swaffield, 2013).

(2) Adaptive co-management refers to the flexible and on-going community-based management of landscapes and specific situations, which allows for constant adaptation or adjustment and is executed by institutional arrangements at different levels to maintain system resilience (Olsson et al., 2004). Scientific knowledge and local non-scientific knowledge concerning social-ecological systems should be integrated in adaptive co-management practice by creating space for joint evaluation, monitoring, and adaption (Peat, Moon, Dyer, Johnson, & Nichols, 2017). Thus, adaptive co-management links dynamic social learning with collaborative management practices and flexible decision making (Olsson et al., 2004). The core elements of such management are the facilitation of actors' networks and the coordination of multiple interests (Cleaver & Whaley, 2018; Olsson et al., 2004). Sharing power among organizations and flexible institutional arrangements are also important for being capable of reacting to changes and uncertainties (Cleaver & Whaley, 2018). However, a suitable approach for practically implementing adaptive co-management is lacking.

Innovations and the need for innovation system thinking in landscape research

To analyse social-ecological systems (e.g., landscapes) and their sustainable transformation, Westley et al. (2011) and Campellone et al. (2018) advocate for a holistic system perspective that considers the complex interactions. The sustainable transformation process calls for innovations, which safeguard the ecological and social integrity to prevent unintended side effects and trade-offs (Campellone et al., 2018).

Top-down and centralized solutions are not flexible enough to respond to the dynamic, non-linear, and highly uncertain problems we face (ibid). Therefore, it is crucial to foster bottom-up innovations, enable social co-learning for building up social capital and co-produced knowledge, and encourage experimentation with new approaches at the local level to innovate in a timely and effective manner (Campellone et al., 2018; Westley et al., 2011). In this context, landscapes are a powerful medium for collaborative experimentation and innovation (Opdam, Luque, Nassauer, Verburg, & Wu, 2018). Intended transitions in ecosystem management are also a type of social innovation. Social innovations are new processes, forms of governance or organizational arrangements that fundamentally change routines, rules or beliefs in social systems and can be developed, implemented, and adopted by a broad range of actors. Currently, innovation and transition researchers assume can take different transition pathways depending on diverse conditions at different innovation management levels (e.g., timing, readiness of the innovation, and societal and political pressure) (Geels & Schot, 2007; Westley et al., 2011). Generally, innovation system thinking is already often considered in acceptability studies and landscape approaches.

Integration of acceptability studies into adaptive landscape co-design and management—The ALDC approach

The purpose of the ALDC is to conceptualize how acceptability studies can be integrated into adaptive landscape co-design and management. Through this integration, acceptability is adapted to the complex realities of landscape

development. The approach is helpful for creating and implementing accepted, practice-oriented, and suitable innovations and landscape strategies that consider the values, attitudes, and behaviour of actors. Due to the division into phases, the ALDC offers guidance as to which steps and procedures this aim can be achieved.

The need for recognizing the recursive pattern of acceptability (Busse & Siebert, 2018; Ganzevles et al., 2015) is the central anchor of our approach. Bringing this into a concept has not been done so far. For the development of the phases of the ALDC, we refer to procedures that are mainly common ground in landscape approaches but which so far are not well integrated in a process description: the situation analysis, co-design of options, implementation, reflection and adaptation. Furthermore, the development of framework is methodologically based on with incremental-inductive theory building and experience-based conclusion that have been drawn from our work in the case study Spreewald. The ALDC comprises four sequential phases: 1) preconditions of acceptability, 2) analysis of acceptability 3) integration of acceptability results, and 4) re-define and re-design of the landscape strategy. Once the four phases have been passed through the iterative cycle, they can be started again until a final landscape strategy has been developed. This procedure can be assigned to the concept of landscape co-design (Swaffield, 2013). We are aware that this phase-based approach shows an ideal typical sequence of events which cannot fully reflect the complex reality where processes include more feedback loops. Nonetheless, the conceptualisation supports understanding the dynamics of acceptability phenomena and landscape co-design processes.

In the following, we describe the phases of the ALDC approach and briefly illustrate its practical implementation with the case study Spreewald.

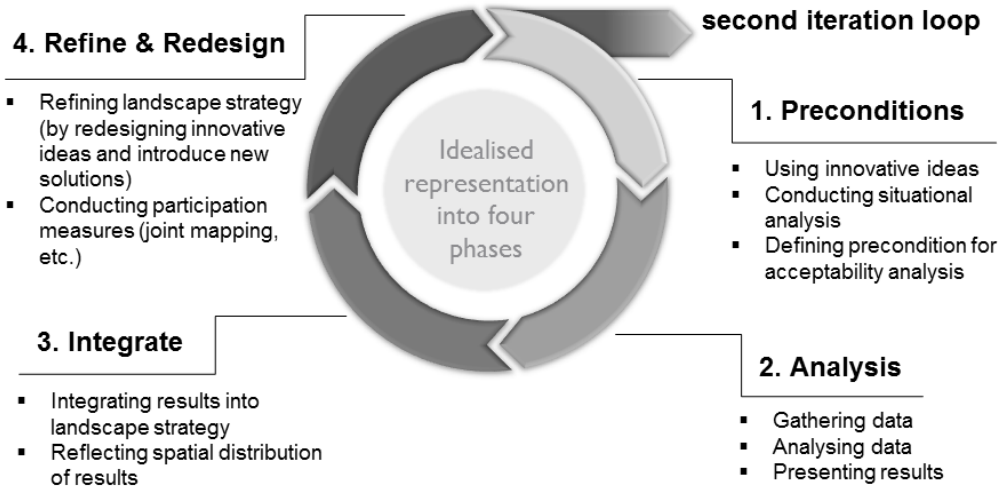

Figure 2: Acceptability and landscape design cycle (ALDC)

First phase: Preconditions of acceptability analysis

Defining the specific preconditions and conducting a situational analysis are crucial steps before gathering data for the acceptability analysis. Defining preconditions for the acceptability analysis includes the reflection on the specific acceptability object, affected actors and context conditions (Busse & Siebert, 2018). Normally acceptability phenomena can be very complex and nested, especially when dealing with the protection of cultural landscapes (e.g., Plieninger et al., 2013) or the design of bioenergy landscapes (e.g., Dale et al., 2016). Thus, a comprehensive reflection is needed to define the acceptability object as precisely as possible. Only doing so, enables to conduct a sound and in-depth acceptability analysis. The acceptability object is often the innovative idea itself (e.g., a new governance form). However, often several ideas are under consideration for aiming the sustainable transformation. Differentiating between the overall objective of the sustainable transformation (e.g., maintaining a cultural landscape) and the specific objective of the innovative idea (e.g., successfully introducing a new governance form to maintain this landscape) helps to identify the acceptability object. Additionally, an actor analysis to identify and explore the relationships between actors can be useful for defining the most relevant actors. Such a situational analysis is important for making explicit assumptions and being precise in choosing adequate research methods, analysing, and reflecting on the gathered data.

Case study Spreewald: Preconditions

This region is characterized by a complex mosaic landscape of water channels, forests, wetland meadows, and arable land, which comprises historical land-cultivation forms. For visitors and locals it represents a cultural landscape of high value not only referring to economic income (e.g., for the tourism sector) but also as a place with a uniqueness with respect to biodiversity, the beauty of the landscape and cultural heritage. The often small-scaled wetland meadows with mineral and peat soil grasslands are elements of high natural value. However, the abandonment of many of these wetland meadows is seen as a crucial problem throughout this region as it causes drastic biodiversity losses and changes the landscape scenery.

The reasons for the non-use are manifold: farmers miss a successor, they have no use for hay anymore, the moving process becomes more complicated, and they feel the cutbacks in public funding. This means that historical economic cycles are no longer working and that adornment processes continue. In search of more sustainable transformation pathways, the region focuses on three innovative ideas: land pools, on-farm biomass plants to generate heat, and new collaborations with the tourism sector to solve the 'wetland problem'. The overall innovation objective is to develop a landscape strategy that is composed of synergetic and accepted innovative solutions, which serve to meet the sustainable transformation goal. This sustainable transformation is aimed at preserving the wetland meadows as part of the regional cultural landscape and introduce new management options for these wetlands. Therein, the acceptability objects are the three innovative ideas, with farmers, landowners and tourism agencies as the acceptability subjects. The main context factors that frame the acceptability are the designation of the landscape as UNESCO Biosphere Reserve Spreewald in 1990; national and federal laws concerning nature conservation, impact regulation mitigation, and emission protection; as well as agricultural and innovation funding programmes.

Second phase: Analysis of acceptability

The second phase refers to studying the acceptability which includes identifying acceptability degrees and influencing factors. It is crucial for this phase to understand

that acceptability is a complex phenomenon, whereas acceptance is the positive outcome of an acceptability analysis. The acceptability analysis should consider power arrangements, trust among actors, and procedural justice within the innovation process (Ganzevles et al., 2015; Gross, 2007; Schenk et al., 2007). Additionally, the underlying values of nature (Kenter et al., 2015; Ott, 2015) and the landscape that influence decisions should be taken into account (Ganzevles et al., 2015; Kenter et al., 2015; Ott, 2015; Schenk et al., 2007). There are different methods of studying acceptability; mainly quantitative and qualitative methods – each have their advantages. The selection of a suitable method depends on the research epistemology and research question behind the analysis. For instance, explorative and qualitative analyses are suitable for gaining in-depth knowledge, exploring unknown acceptability phenomena, and identifying unexpected factors. Quantitative methods can cover a larger number of participants and allow empirical generalization.

Case study Spreewald: Analyses of acceptability

Within the case study, two acceptability studies have been published recently: (1) one on the land pool concept in two areas (Busse, Heitepriem, et al., 2019) and (2) the other on on-farm biomass plants (Busse, Siebert, et al., 2019). To understand the case study and the contribution to the ALDC both acceptability analyses will be described briefly.

Land pools are a type of biodiversity banking, where various small land plots (with the agreement of the landowners) are pooled to finance the maintenance measures for this area. In 13 semi-structured interviews, landowners were asked if and why they would agree to give their land to the land pool. The interviews were analysed by using the qualitative text analysis (Kuckartz, 2014). All interviewees stated that the maintenance of wetland meadows is very important because they are part of the cultural landscape and heritage and provide places for recreation and hunting as well as income for the tourism sector. In both example areas, landowners were found who accepted, showed conditional acceptance, or rejected land pools. There are diverse factors that influence acceptability decisions. A 'KO criterion' for rejection was the restriction of the user rights. The importance of a fairly organized innovation process was stated by all respondents. They wanted to be involved at an

early stage and have a voice in the innovation process. This is directly connected to trust. If landowners trust in the coordinating actors, it is more likely that the innovation process will be perceived as fair. Furthermore, trust goes hand in hand with previous experiences with those actors. Some interviewees stated that they lost trust in the coordinating actors because they had not been sufficiently involved in previous projects (e.g., long-term nature conservation project or designation phase of the biosphere reserve in 1990) (Busse, Heitepriem, et al., 2019).

In a second study, 17 small and large farmers were asked if they were interested in installing a biomass plant on their farm within the next five years. Fuzzy set qualitative comparative analysis (Ragin, 2000) showed that the acceptance was relatively low, and identified three types of farmers: potential adopters, ethically concerned opponents, and open-minded refusers. Biomass plants were likely to be accepted if farmers stated an ethical acceptance of and interest in technology, a need for a new heating system, the availability of sufficient feedstock, and a perceived the readiness level of technology as unproblematic. Farmers rejected a biomass plant if one of the following factors existed: ethical concerns about 'burning hay', satisfaction with their current oven, the low availability of feedstock, or a perceived low readiness for technology. Other factors were procedural justice, trust, and a demonstration plant (Busse, Siebert, et al., 2019).

Third phase: Integration of acceptability results

The third phase is aimed at integrating the results of the acceptability into the broader context by assessing their relevance for the overall landscape strategy. Such an integration based on the critical reflection of results is a crucial part of the ongoing innovation process (Campellone et al., 2018; Ganzevles et al., 2015). In this phase, it should be considered that acceptability decisions assign a certain moment in the innovation process and can vary over time (Busse and Siebert 2018). This 'recursive pattern of acceptability' implies that acceptability studies have been renewed or conducted 'in waves' (cf. Ganzevles et al. 2015). Knowledge on low or conditional acceptance and negative attitudes or behaviour towards an innovation can be very useful for the innovation process (Hitzeroth & Megerle, 2013; Kahma & Matschoss, 2017). In this phase, the key issues to cope with are: How are acceptability results

seen in the broader context and linked to other innovative ideas with the aim of reaching the sustainability goal? How are acceptability decisions on innovations spatially distributed in the specific landscape? Are there spatially complementary or competing innovations to achieve the aim of sustainable transformation? It is recommendable to address these issues in joint discussions with the regional actors and map the results. Hence, focusing on landscapes and not only on implementation sites or farm level is important because most ecosystem services and social-ecological interactions have effects on a larger scale (Werling, Pennington, & Landis, n.d.; Wolsink, 2018). Generally, the results can be contextualized with an innovation system approach in which different innovation conditions and innovation pathways play a role (Geels & Schot, 2007), and innovations encourage the resolution of wicked societal problems (Campellone et al., 2018).

Case study Spreewald: Integration of results

The reflection of the results from the acceptability study provides regional actors with insights how to integrate different innovative ideas into the landscape strategy and official management plans and which actor groups should be considered in the further planning or innovation process (e.g., for the 'Habitats Directive MP'). The results of the acceptability studies helped to unveil the potentials and limits of the different innovations to support the aimed sustainability goal to revalorise the regional wetlands. The analyses results showed that some landowners are not willing to add their properties into the collaborative land pool project. Thus, land pools cannot be completely established in the two designated and suitable identified areas. After a mapping it was clear that these two areas cover only a small share (ca. 180 ha) of all meadows that are facing the threat of falling out of use (ca. 1500 ha). Although maintenance measures are applied in a part of one of the proposed areas in 2018, establishing land pools in other areas currently seems unrealistic. Due to such limited acceptance and reduced spatial relevance, we conclude that the land pools will be of lower importance in the near future. Concerning the acceptance of biomass plants at the farm level, the results show that this is not a promising solution to save large parts of the wetlands 'in danger'. According to the current state of knowledge, both innovative ideas are not sufficient for achieving the sustainability goal to sustainably transform the current wetland state. The concepts of land pools

and biomass plants could either be modified or supplemented with other innovative ideas (e.g., collaborations with the tourism sector for financing maintenance measures) for a thriving transformative process. To prepare the next phase of identifying, collecting and integrating complementary innovative ideas for the landscape strategy actors must be well informed about the acceptability outcomes of different innovative ideas in advance. To share the studies' results, the existing communication network of the regional firms and institutions has been utilized. Usually, the information has been forwarded in an aggregated form (short papers, manuscripts, handbooks, leaflets, etc.) Additionally, collaborative governance instruments should also be applied to include critical acceptability aspects.

Fourth phase: Refinement and re-design of the landscape design

The main issue of the fourth phase involves revising the landscape strategy by co-designing actions. Re-thinking and amending the different innovation pathways should be aimed at maximizing synergies and minimizing trade-offs (Campellone et al., 2018). This step is grounded in reflexive and iterative learning processes that are powerful to support changes (Geels & Schot, 2007; Pahl-Wostl, 2009). Learning processes are most fruitful if different actors (e.g., farmers, landowners or land residents) with various ideas and opinions are involved (Campellone et al., 2018). Thus, farmers, landowners or local people should not be seen as mere recipients of innovations but also being involved in the design process (M. S. Reed, 2008). In this phase, the participation process and co-design measure take place to create shared values and visions or to reach an agreement. The inclusion of relevant actors and co-design can potentially manage disagreement and avoid conflicts by finding shared visions (Kenter et al., 2015). Generally, participation is a long-term process for mutual trust, good relationships, and learning from each other to discuss potential solutions (M. S. Reed, 2008). An appropriate measure can be a joint mapping as a form of interactive spatial design. Another measure can be to prioritize alternative pathways if several innovative ideas are under consideration to solve the problem. The revision of a landscape strategy can also be continued after implementing and testing innovative solutions and after conducting an ex-post acceptability study (long-term level). This shows that the ALDC approach includes not only the design of the landscape strategy but also the iterative and step-by-step implementation of

suitable options.

Case study Spreewald: Refinement and re-design

As a precondition, all regional actors that have a stake in the operationalization of sustainable land management practices are responsible to breathe life into landscape strategy. To make intelligent decisions on which set of innovative ideas could be the best to reach the regional development objectives, it has turned out as being recommendable to develop a joint vision of how the future landscape should look. Therefore, broader studies (e.g., Zscheischler, Busse, & Heitepriem, 2019) and a actors' workshop has been conducted about identifying (1) shared objectives among different actors and (2) suitable areas for implementing landscape maintenance measures. Zscheischler, Busse & Heitepriem (2019) show that there are some opportunities for initiating and establishing a collaborative landscape management, but also challenges. Opportunities include that most regional actor groups have shared problem awareness and some interactions between actors already exist. Challenges are the tense social relationships among some actors, a lack of trust in the regional coordination, and a moderate collaborative capacity of the local actors.

However, which innovative ideas gain momentum often depends on various other aspects, such as legislation, subsidies, institutional power and the market. Turning, again, the gaze towards the three innovative ideas (land pools, biomass plants, collaboration with tourism), we can summarize the following points for the refinement phase: if the applied maintenance measures in the land pool show positive effects on biodiversity and landscape scenery, this could serve as a demonstration project to convince new proponents. Our study revealed that more often farmers are interested in providing their hay instead of installing their own biomass plant. This brings about the opportunity to build a community-based biomass plant. One step in this direction consists of jointly mapping the potential land plots for providing feedstock with the interested farmers. Recently, with actors in the tourism sector, which instruments or incentives could be promising to finance maintenance measures by tourists or tourism agencies have been discussed in a workshop. On basis of the discussion results a visitor donation box promoted

through local tourism agencies has been introduced. Further studies should be conducted e.g., on the acceptability of such tourism instruments and a community-based biomass plant. Additionally, and step by step, new ideas should be jointly developed. Applying our online tool box on acceptability can support regional processes on the run, avoid trade-offs before they emerge, and provide acceptance enhancement measures.

Discussion and Conclusion

In this conceptual paper, we introduced a novel approach, the ALDC, which seeks to integrate the acceptability studies of sustainable and place-based innovations into a landscape co-design. It encompasses four sequential phases: 1) situational analysis and defining the preconditions for acceptability analysis, (2) conducting the acceptability analysis, (3) integrating the results into the landscape strategy, and (4) re-designing and refining the landscape strategy. The approach has been briefly illustrated with the German case study Spreewald. Although the ALDC has been developed from our experiences from the Spreewald, the purpose is to be open for other applicability options aiming at a more general approach that offers application possibilities and transferability to similar cases. Thus, the approach is suitable for many place-based projects. It can be used to analyse sustainable transformation regarding cultural landscapes that face land abandonment, such as terraced landscapes (Kizos, Koulouri, Vakoufaris, & Psarrou, 2010), highland grasslands (McGinlay, Gowing, & Budds, 2017)or mountain landscapes (Latocha, Reczyńska, Gradowski, & Świerkosz, 2019). This kind of land abandonment is widespread in Europe and can decrease the functioning of the ecosystem, biodiversity, and cultural values (Plieninger et al., 2013). The ALDC is also appropriate for bioenergy projects in landscapes concerning smart biomass use or wind parks (Dale et al., 2016; Wolsink, 2018), nature conservation projects or projects that address the linking of urban and rural spaces. We would appreciate further tests of the ALDC and its application to other cases, which is needed to evaluate its suitability, adaptability and generalizability. Further application of the ALDC would also contribute to a refinement of the novel approach.

It must be considered that the use of the ALDC has some further implications. In

place-based innovation processes, a coordinating landscape manager who is accepted by locals and can coordinate the landscape design process is needed. The financing of such a coordinating landscape manager is often an obstacle. One option could be co-financing on equal terms by regional decision makers (administration, nature conservation and agricultural associations). The long-term process of landscape design also includes the conduction of (several) acceptability studies. To perform this task, sufficient and even important constantly available resources are required because it is an on-going process, in which investigations of acceptability and other design, planning and management steps are time-consuming and involve high costs. Furthermore, the landscape manager needs to have excellent skills in coordinating such a complex process. As an example, she or he should have professional expertise in biophysical, technical, and socio-ecological issues. Usually, in such complex fields of work, personal social skills with respect to communication, teamwork, and negotiation can be even more important. Experiences in legal landscape planning procedures and interest in deliberative procedures are requested. In view of the high requirements, it might be recommendable to support the application of the ALDC by transdisciplinary research projects which incorporate different scientific disciplines, the practitioners (especially the coordinating landscape manager), and local-regional actors as collaborating partners (Kernecker, Busse, & Zscheischler, 2019; Zscheischler et al., 2019).

Recommendations and information on how to conduct and reflect in detail an acceptability study as central part of the ALDC can be found in the tool box developed by the authors (www.akzeptanz-strategisch-steigern.de). This tool box offers assistance for defining the preconditions of the study and provides information on suitable methods for the analysis itself and how to interpret or use the results for the further process design. Additionally, acceptance enhancement measures and recommendations for process quality improvements are suggested.

Finally, the present work offers several benefits and new insights for the scientific community. It contributes to the better understanding of the dynamic characteristic of acceptability decisions or so-called ‘recursive patterns of acceptability’ (Ganzevles et al., 2015). Such pattern phenomena can be observed in many cases and need to be recognized in scientific studies and practice projects (Busse & Siebert, 2018;

Ganzevles et al., 2015). The paper seeks not only a theoretical understanding but also to provide practical implementation guidelines. This is done by introducing the ALDC approach to integrate acceptability studies into landscape design and by describing the different phases in such a process. Furthermore, the approach brings two different research strands together: (1) the acceptability studies in the field of place-based innovations for a sustainable transformation of landscapes and (2) landscape co-design and adaptive co-management approaches. Such a link is thus far still missing. Therefore, the paper contributes to scientific knowledge integration.

References

Berkes, F. (2009). Evolution of co-management: Role of knowledge generation, bridging organizations and social learning. *Journal of Environmental Management*, *90*(5), 1692–1702.

Bodin, Ö. (2017). Collaborative environmental governance: Achieving collective action in social-ecological systems. *Science*, *357*(6352), eaan1114.

Busse, M., Heitepriem, N., & Siebert, R. (2019). The Acceptability of Land Pools for the Sustainable Revalorisation of Wetland Meadows in the Spreewald Region, Germany. *Sustainability*, *11*(15), 4056.

Busse, M., & Siebert, R. (2018). Acceptance studies in the field of land use—A critical and systematic review to advance the conceptualization of acceptance and acceptability. *Land Use Policy*, *76*, 235–245.

Busse, M., Siebert, R., & Heitepriem, N. (2019). Acceptability of innovative biomass heating plants in a German case study—a contribution to cultural landscape management and local energy supply. *Energy, Sustainability and Society*, *9*(1), 36.

Campellone, R. M., Chouinard, K. M., Fisichelli, N. A., Gallo, J. A., Lujan, J. R., McCormick, R. J., … Shively, D. R. (2018). The iCASS Platform: Nine principles for landscape conservation design. *Landscape and Urban Planning*, 176, 64–74.

Cleaver, F., & Whaley, L. (2018). Understanding process, power, and meaning in adaptive governance: a critical institutional reading. *Ecology and Society 23(2).*

Dale, V. H., Kline, K. L., Buford, M. A., Volk, T. A., Tattersall Smith, C., & Stupak, I. (2016). Incorporating bioenergy into sustainable landscape designs. *Renewable and Sustainable Energy Reviews*, 56, 1158–1171.

Duff, G., Garnett, D., Jacklyn, P., Landsberg, J., Ludwig, J., Morrison, J., … Whitehead, P. (2009). A collaborative design to adaptively manage for landscape sustainability in north Australia: lessons from a decade of cooperative research. *Landscape Ecology*, *24*(8), 1135–1143.

Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T., & Rockström, J. (2010). Resilience Thinking: Integrating Resilience, Adaptability and Transformability. *Ecology and Society*, *15*(4).

Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources*, *30*(1), 441–473.

Fournis, Y., & Fortin, M.-J. (2017). From social 'acceptance' to social 'acceptability' of wind energy projects: towards a territorial perspective. *Journal of Environmental Planning and Management*, *60*(1), 1–21.

Ganzevles, J., Asveld, L., & Osseweijer, P. (2015). Extending bioenergy towards smart biomass use Issues of social acceptance at Park Cuijk, The Netherlands. *Energy, Sustainability and Society*, *5*(1), 22.

Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy*, *36*(3), 399–417.

Gross, C. (2007). Community perspectives of wind energy in Australia: The application of a justice and community fairness framework to increase social acceptance. *Energy Policy*, *35*(5), 2727–2736.

Hitzeroth, M., & Megerle, A. (2013). Renewable Energy Projects: Acceptance Risks and Their Management. *Renewable and Sustainable Energy Reviews*, *27*, 576–584.

Johansson, J., Sandström, C., & Lundmark, T. (2018). Inspired by structured decision making: a collaborative approach to the governance of multiple forest values. *Ecology and Society*, *23*(4).

Kahma, N., & Matschoss, K. (2017). The rejection of innovations? Rethinking technology diffusion and the non-use of smart energy services in Finland. *Energy Research & Social Science*, *34*, 27–36.

Kamal, S., Kocór, M., & Grodzińska-Jurczak, M. (2015). Conservation opportunity in biodiversity conservation on regulated private lands: Factors influencing landowners' attitude. *Environmental Science & Policy*, *54*, 287–296.

Kenter, J. O., O'Brien, L., Hockley, N., Ravenscroft, N., Fazey, I., Irvine, K. N., … Williams, S. (2015). What are shared and social values of ecosystems? *Ecological Economics*, *111*, 86–99.

Kernecker, M., Busse, M., & Zscheischler, J. (2019). Avert collapse of research co-production systems. *Nature*, *573*(7775), 495–495.

Kizos, T., Koulouri, M., Vakoufaris, H., & Psarrou, M. (2010). Preserving Characteristics of the Agricultural Landscape through Agri-Environmental Policies: The Case of Cultivation Terraces in Greece. *Landscape Research*, *35*(6), 577–593.

Kuckartz, U. (2014). *Qualitative Text Analysis: A Guide to Methods, Practice & Using Software - SAGE Research Methods*.

Latocha, A., Reczyńska, K., Gradowski, T., & Świerkosz, K. (2019). Landscape memory in abandoned areas—physical and ecological perspectives (Central European mountains case study). *Landscape Research*, *44*(5), 600–613.

Leitinger, G., Walde, J., Bottarin, R., Tappeiner, G., & Tappeiner, U. (2010). Identifying significant determinants for acceptance of nature reserves: A case study in the Stilfserjoch National Park, Italy. *Eco.Mont*, *2*(1), 15–22.

Lucke, D. (1995). *Akzeptanz. Legitimität in der "Abstimmungsgesellschaft"*. Opladen: Leske+Budrich.

McGinlay, J., Gowing, D. J. G., & Budds, J. (2017). The threat of abandonment in socio-ecological landscapes: Farmers' motivations and perspectives on high nature value grassland conservation. *Environmental Science & Policy*, *69*, 39–49.

Nassauer, J. I., & Opdam, P. (2008). Design in science: extending the landscape ecology paradigm. *Landscape Ecology*, *23*(6), 633–644.

Olsson, P., Folke, C., & Berkes, F. (2004). Adaptive Comanagement for Building Resilience in Social-Ecological Systems. *Environmental Management*, *34*(1).

Opdam, P., Luque, S., Nassauer, J., Verburg, P. H., & Wu, J. (2018). How can landscape ecology contribute to sustainability science? *Landscape Ecology*, *33*(1), 1–7.

Opdam, P., Nassauer, J. I., Wang, Z., Albert, C., Bentrup, G., Castella, J.-C., … Swaffield, S. (2013). Science for action at the local landscape scale. *Landscape Ecology*, *28*(8), 1439–1445.

Ott, K. (2015). *Zur Dimension des Naturschutzes in einer Theorie starker Nachhaltigkeit*. Metropolis.

Pahl-Wostl, C. (2009). A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change*, *19*(3), 354–365.

Peat, M., Moon, K., Dyer, F., Johnson, W., & Nichols, S. J. (2017). Creating institutional flexibility for adaptive water management: insights from two management agencies. *Journal of Environmental Management*, *202*, 188–197.

Pleger, L. E., Lutz, P., & Sager, F. (2018). Public acceptance of incentive-based spatial planning policies: A framing experiment. *Land Use Policy*, *73*, 225–238.

Plieninger, T., Bieling, C., Ohnesorge, B., Schaich, H., Schleyer, C., & Wolff, F. (2013). Exploring Futures of Ecosystem Services in Cultural Landscapes through Participatory Scenario Development in the Swabian Alb, Germany. *Ecology and Society*, *18*(3).

Primdahl, J., Pinto-Correia, T., & Pedroli, B. (2019). European Landscapes in Transition: Implications for Policy Integration and Landscape Governance. *EuroChoices*.

Ragin, C. C. (2000). *Fuzzy-set social science*. Chicago: University of Chicago Press.

Reed, J., Van Vianen, J., Deakin, E. L., Barlow, J., & Sunderland, T. (2016). Integrated landscape approaches to managing social and environmental issues in the tropics: learning from the past to guide the future. *Global Change Biology*, *22*(7), 2540–2554.

Reed, M. S. (2008). Stakeholder participation for environmental management: A literature review. *Biological Conservation*, *141*(10), 2417–2431.

Sauer, A., Luz, F., Suda, M., & Weiland, U. (2005). Steigerung der Akzeptanz von FFH-Gebieten. *BfN-Skripte*, *144*, 200.

Sayer, J., Sunderland, T., Ghazoul, J., Pfund, J.-L., Sheil, D., Meijaard, E., … Buck, L. E. (2013). Ten principles for a landscape approach to reconciling

agriculture, conservation, and other competing land uses. *PNAS,110*(21), 8349–8356.

Schenk, A., Hunziker, M., & Kienast, F. (2007). Factors influencing the acceptance of nature conservation measures—A qualitative study in Switzerland. *Journal of Environmental Management*, *83*(1), 66–79.

Schneider, C. Q., & Wagemann, C. (2013). *Set-theoretic methods for the social sciences: a guide to qualitative comparative analysis*. Cambrigde: University Press.

Steingröver, E. G., Geertsema, W., & van Wingerden, W. K. R. E. (2010). Designing agricultural landscapes for natural pest control: a transdisciplinary approach in the Hoeksche Waard (The Netherlands). *Landscape Ecology*, *25*(6), 825–838.

Swaffield, S. (2013). Empowering landscape ecology-connecting science to governance through design values. *Landscape Ecology*, *28*(6), 1193–1201.

Werling, B. P., Pennington, D., & Landis, D. A. (n.d.). Biodiversity Services and Bioenergy Landscapes. *Extension Bulletin, Michigan State University*, *3164*, 1–12.

Westley, F., Olsson, P., Folke, C., Homer-Dixon, T., Vredenburg, H., Loorbach, D., … van der Leeuw, S. (2011). Tipping Toward Sustainability: Emerging Pathways of Transformation. *AMBIO*, *40*(7), 762–780.

Wolsink, M. (2010). Contested environmental policy infrastructure: Socio-political acceptance of renewable energy, water, and waste facilities. *Environmental Impact Assessment Review*, *30*(5), 302–311.

Wolsink, M. (2018). Co-production in distributed generation: renewable energy and creating space for fitting infrastructure within landscapes. *Landscape Research*, *43*(4), 542–561.

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7. Challenges to build up a Collaborative Landscape Management (CLM) — Lessons from a stakeholder analysis in Germany (Paper 5)

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Challenges to Build up a Collaborative Landscape Management (CLM)—Lessons from a Stakeholder Analysis in Germany

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Abstract
Traditional cultural landscapes are of special value not only for reasons of nature conservation and high species diversity but also because they intersect with the identity of local communities, support recreation and tourism, and preserve cultural heritage. Structural changes in rural areas threaten these unique sceneries and environments in Europe and worldwide. As a result, the question of how to maintain and manage cultural landscapes where economic benefits are not assured has become a priority in science and in practice. Considering this context, community-based collaborative landscape management (CLM) can be considered an innovative and promising approach. This paper presents results from a stakeholder analysis examining the preconditions and opportunities for initiating a CLM in the biosphere reserve known as 'Spreewald'. The results indicate that due to the type of problem (landscape change)—which is characterised by complexity, beneficial linkages to a multitude of actor groups, and broad problem awareness—CLM appears to be feasible. However, other preconditions related to social relationships among actor groups, questions of legitimate coordination and the collaborative capacity of the community are not met, thus reducing the likelihood of success. To address these challenges, we discuss the potential of transdisciplinary processes (TD) to assist local communities in establishing such a collaborative problem-solving and management approach. We show that TD is highly valuable and supportive during this critical stage of emerging collaboration.

Keywords Integrated landscape approach · Transdisciplinary research · Tourism · Nature conservation · Cultural landscape · Land use conflict

Introduction

Landscapes in European rural areas are experiencing 'massive and rapid changes' due to demographical, technological, cultural, and economic developments (Verburg et al. 2006; Antrop 2006; Agnoletti 2014). The resulting structural changes lead to widespread farmland abandonment and particularly threaten traditional cultural landscapes, which are regarded as being in a state of 'profound transition' (Van Eetvelde and Antrop 2004, Agnoletti 2014). These typical landscapes are often characterised by unique agricultural systems that developed under low-intensity agriculture practices highly adapted to site-specific requirements. Today, these low-intensity agricultural practices have become economically inefficient.

Still, worldwide, traditional cultural landscapes are unique sceneries and environments; they often have high biodiversity (species diversity) that results in high value for nature conservation (e.g., Luoto et al. 2003; Plieninger et al. 2006; Beilin et al. 2014). In addition, both local communities and tourists often have a strong sense of identification with these landscapes (Antrop 1997). Moreover, Agnoletti (2014) emphasises that the cultural heritage values of Europe's historical landscapes may reach far beyond local interests as these landscapes are cultural products documenting 'past civilisations' and representing 'the genius of their builders' (p.67). Against this backdrop, the issue of how to maintain

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and manage cultural landscapes, when cultivation is no longer profitable, has become a priority question among scientists, policy makers and practitioners in the field of land use science (Hernández-Morcillo et al. 2017).

It has been recognised that the conservation of cultural landscapes is hampered by the lack of adequate policies that put an emphasis on the protection of cultural heritage (e.g. typical housing, landscape structure). Even if many cultural landscapes are part of protected areas, dominant conservation goals often favour renaturalisation and 'degradation of historical landscapes' (Agnoletti 2014). In addition, maintenance measures to conserve landscape scenery and biodiversity are time-consuming and expensive. Thus far, a huge funding gap has prevented the adequate financing of nature conservation and the minimisation of biodiversity loss (Parker et al. 2012).

In this context, there is an urgent demand for new solutions and innovations to help manage landscapes sustainably. However, questions also arise concerning the normative objectives that are guiding the development and management of such landscapes: is the mere conservation and archiving of traditional landscapes reasonable? How can such landscapes be developed in a way that maintains their specific characteristics and sites with high natural value and at the same time provides just and equal benefits for different concerned actors?

As land(scape) use issues are characterised by complex actor-constellations, conflicting interests and demands as well as many sustainability problems, there is a need for integrated solutions that combine ecological, economic and social benefits. In this context, several authors emphasise the roles and opportunities of collective action and collaborative community initiatives for sustainable landscape management (e.g., Enengel et al. 2011, Prager et al. 2012, Hernández-Morcillo et al. 2017, Leach et al. 1999, García-Martín et al. 2016, Scherr et al. 2013). Frequently mentioned benefits of such approaches include the following: tackling challenges and opportunities for landscape stewardship more effectively and pro-actively compared with single actors (Scherr et al. 2013); the emergence of creative solutions (Fadeeva 2005); sharing and mobilising resources (Cong et al. 2014); negotiating and harmonising conflicting objectives; building capacity and social capital, resulting in mutual appreciation and support (Prager et al. 2012, 2015); increased knowledge exchange and communication; and engagement with the landscape and countryside (Franks and McGloin 2007). In sum, collaborative approaches are widely acknowledged to support landscape management because they are adaptive and can be tailored to site-specific conditions. In addition, they improve legitimacy and effectiveness in decision-making (e.g., Berkes 2002, Enengel et al. 2011, Olsson et al. 2004, Loft et al. 2015) and can reduce institutional misfit.

However, collaborative approaches to landscape management also face a series of challenges, such as 'the dilemma between individual and collective benefits', 'trade-offs between different objectives' (Prager 2015, p. 62) and unbalanced power relations (Almeida et al. 2018). Collaboration creates higher transaction costs, which can be unequally distributed (Enengel et al. 2011, Prager 2015). Collaboration is also dependent on the willingness of actors to contribute to and invest time in a project (Höppner et al. 2008, Enengel et al. 2011, Prager 2015, Almeida et al. 2018). Furthermore, the need for suitable organisational structures, the prerequisite of building trust and social capital, and whether a group has the maturity required to collaborate are emphasised as important factors for successful collaboration (e.g., Evans et al. 2011, Trimble and Berkes 2013, Almeida et al. 2018).

The principles of community management (collective action or co-operation) are well described in the context of common pool resources (e.g., Ostrom 1990; Cox et al. 2010) and are confirmed by a multitude of case studies (e.g., Evans et al. 2011, Faehnle and Tyrväinen 2013, Sattler et al. 2015, Almeida et al. 2018). However, it is also acknowledged that site-specific settings can differ widely due to specific local constellations of actors and institutional functions. Accordingly, existing approaches are very diverse (e.g., Sattler et al. 2015, Ostrom 2001, Pahl-Wostl 2009). Thus, there is a multitude of case studies that not only consider very different types of natural resource systems such as fisheries, water, and forests but also focus on many different aspects of collaboration (e.g., Ostrom 1990, Cox et al. 2010).

Most case studies address established resource use systems but do not answer the question of how these 'regimes' have evolved. Bürgi et al. (2017) found that there are 'only very few documented examples of practical implementation'. The preconditions of collaborative resource management and the processes by which these collaborative approaches emerged have rarely been studied (Berkes 1997, Plummer and Fitzgibbon 2004). In the context of collaboration, one can assume that social relationships and mechanisms play a major role. Although the importance of this topic has been emphasised for a long time (Pinkerton 1989), there has been limited attention to the interrelations between the involved actors. In addition, while most studies address the risk and management challenges of resource overexploitation, traditional cultural landscapes are often affected by the abandonment of land use. Yet, the intertwined issues of farmland abandonment and loss of traditional cultural landscapes have not received much attention. In our literature review, we found only a few examples of studies focusing on this topic, including case studies from wetland abandonment in Sweden (Biggs et al. 2010), the biosphere reserve of the Swabian Alb in Germany

(Plieninger et al. 2013), and traditional grasslands in Great Britain (McGinlay et al. 2017).

Still, empirical evidence is needed 'to identify key challenges, opportunities, and lessons learnt' (Loft et al. 2015, p. 150). A critical question remains open: why do some collaborations succeed while others fail? We assume that the way local actors shape their exchange relations plays a decisive, but so far neglected, role. As shown by the meta-analysis of Evans et al. (2011), more emphasis has been placed on questions of institutional settings than on social mechanisms and human dimensions.

To address this research gap, this paper presents the results of a case study of a traditional cultural landscape in North-eastern Germany. The area of focus is the Spreewald region, which is very popular for its unique landscape and cultural heritage.

The objective of this study is to better understand how we can build up collaborative landscape management (CLM) that successfully develops and maintains traditional cultural landscapes. Therefore, we sought to gain insights into the motives and roles of actors, their interactions, and their influence on the initiation of a collaborative management approach. We address the following research questions:

RQ1: How do local actors shape their exchange relations as preconditions for the establishment of a CLM programme?

RQ2: What are the specific requirements of initiating a CLM in the investigated case, and how can a transdisciplinary approach support the process?

RQ3: Which general conclusions can be drawn for similar cases at the intersection of agriculture, nature conservation and tourism?

There is no commonly agreed definition of CLM. Our understanding is widely congruent with the concept of integrated landscape management as described by Bürgi et al. (2017).The authors operationalise it as a continual and adaptive process of joint learning between multiple stakeholders who co-design and test solutions towards a sustainable landscape development.

Research Design and Methods

Case Selection and Access

The study is part of the transdisciplinary research project *ginkoo*, which aims at developing knowledge and instruments to support the management of sustainable land use innovations. Because transdisciplinary research starts with the description of a complex real-world problem, the case of the Spreewald's traditional landscape was included in *ginkoo* after local actors stressed the problem of land abandonment and the accompanying loss of the traditional landscape and its biodiversity. The project period is five years (2014–2019). The science–practice collaboration was organised by a dual coordination structure: one regional coordinator who is employed at the biosphere reserve and located directly in the region and one scientific coordinator located at Humboldt University in Berlin. Regular meetings, workshops and established communication routines provided particularly good access to the case study field.

Case Study Design

The research design is based on an iterative research strategy that uses a deductive-inductive approach. We applied the principles of case study research presented by Yin (2018) and the transdisciplinary case study approach (Stauffacher et al. 2006). In close cooperation with actors from science and practice, we began with a comprehensive analysis of the situation following the methodological steps of Clarke (2005). To identify key actor groups and interviewees we conducted initial explorative interviews and applied the 'snowball principle' (Reed et al. 2009). Subsequently, we developed an analytical framework derived from a literature review on the pre-conditions of collaboration and co-management of natural resources. The resulting deductive categories roughly guided our data collection and analysis as sensitising concepts. During the process of analysis, we were interested in identifying additional inductive categories, which were derived from the material following the principles of open coding.

Analytical Framework (Preconditions for Successful Collaboration and Co-management)

As outlined above, empirical generalisations with regard to the management of land and natural resources are difficult due to high context-specificities, a large number of interacting variables and variances among different cases (e.g., Ostrom 2001, Cox et al. 2010). In the scientific literature on collaboration and the collaborative management of natural resources, one finds a multitude of principles and factors that influence the success of collaboration (Almeida et al. 2018, Dania et al. 2018, Evans et al. 2011).

Some frameworks consider collaborations as passing through different stages of 'maturity' (e.g., Jamal and Getz 1995, Nölting and Schäfer 2016), where different factors play a more or less important role at different times. However, most case studies address established resource use systems. Less empirical evidence is available on factors that are especially important in the initial phase of a CLM programme. Assuming that the cooperation under investigation is in the initiation phase, we focus on analysing the preconditions of a successful collaboration. In addition, we

start from the assumption that collaborations are socially embedded and highly dependent on actor-specific relationships, communication, and mutual trust (Pinkerton 1989).

We identified the following frequently mentioned categories that can be used to describe and analyse actor relationships during the initial phase when collaboration is being established (Gray 1985, 1989, Jamal and Getz 1995, Plummer and Fitzgibbon 2004): (i) actors and groups of interests; (ii) problem awareness; (iii) problem definition; (iv) actors' interrelations; (v) main interest and value-based objectives; (vi) existing networks and willingness to cooperate; and (vii) needed resources to convene and enable collaboration.

Data Collection and Analysis

The results are based on the analysis of empirical data from different sources. We conducted and transcribed semi-structured interviews with 25 representatives (farmers, small land owners, nature conservationists, tourism providers, and a political representative), collected and screened articles from the local newspaper, used reports and protocols from workshops and websites, and participated in numerous events such as workshops, informal talks, and local field trips. The interviews, documents (protocols and reports) and field notes were analysed and interpreted following the guides to qualitative content analysis of Mayring (2014) and Kuckartz (2012). Data processing was performed using the software MaxQDA. Interviews were coded and case summaries authored, and subsequently cross case conclusions were drafted (following the recommendations of Yin 2018 and Kuckartz 2012). Table 1 provides an overview of the interviewees. Quotations (Q) that prove and illustrate results of our analyses can be found in the Supplement. References on Quotations are numbered and complemented by the acronym of the interviewees' actor group (Qn_Acronym).

Table 1 Overview of interviewees

Actor group	Number of interviewees	Acronym
Member of biosphere reserve	2	BR
Tourism expert	1	TE
Farmers' association (representative)	2	FA
Nature conservationist	2	NC
Farmer	7	F
Local politician	1	P
Tourism provider	2	TP
Land owner	8	LO

Results of the Case Study: The Historical Cultural Landscape of Spreewald (RQ1)

Case Study Background and Setting

The Spreewald region, located southeast of Germany's capital Berlin (see Fig. 1), is a flood plain characterised by its distinctive cultural landscape, which consists of a broad network of water channels, open marshes (including water hammering wetlands), floodplain forests and small-scale woody plant elements (water channel margins and hatches). These conditions result in high habitat and species diversity.

Increasingly, the wetlands typical of the region can no longer be cultivated and managed profitably. Due to the high moisture and small scale, many meadows require a manual mowing. In addition, many sites are only accessible by boat. As a result, more and more land is being abandoned, and there is a serious threat that it will be released from utilisation in the future. In many areas, the process of natural succession (growth of sedges and reeds, as well as reforestation) has started, and the biosphere reserve estimates that ~1500 to 2000 ha are already affected.

Hence, the traditional landscape is about to lose its typical half-open scenery, with unfavourable consequences for biodiversity conservation and landscape-aesthetic aspects, both of which are important for regional identity and tourism.

Due to the lack of financial resources for sustainable landscape management and the preservation of the open landscape, local actors from nature conservation, agriculture and tourism are looking for innovative solutions to support the maintenance of the typical historical cultural landscape. Thus, interviews and talks revealed that several collaborative innovation processes had been initiated in the years before this study was launched. These processes aimed to maintain the cultivation of the cultural landscape through actions such as the thermal use of hay, the use of donor instruments to involve tourists, and land pooling for more effective conservation measures.

The declared aim is to merge several partial solutions and local initiatives into an integrated, innovative and systemic strategy and maintenance concept for the traditional cultural landscape of the Spreewald region. This goal presupposes collective action and collaboration between key actors.

Actors and Groups of Interest

At the time of analysis, the idea of a collaborative integrated landscape management that involves local actors was still in its infancy. To support this idea, the civic foundation 'Cultural Landscape Spreewald' was formed in 2007. Initialised by different societal actors from the public but also from the private sector the aim of the citizen foundation

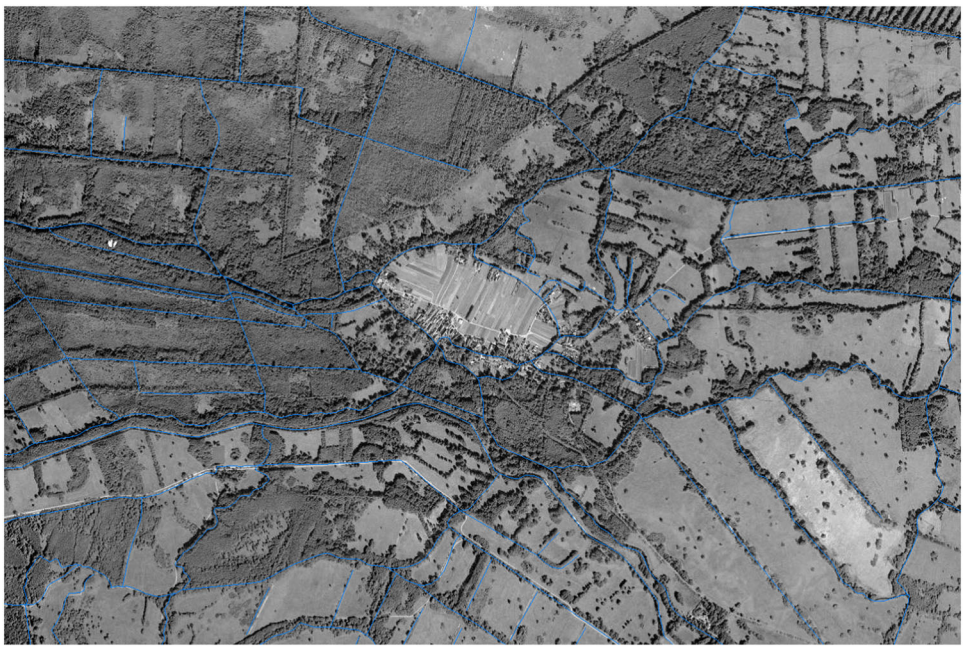

Fig. 1 Satellite image of a typical part of the case study region (known as Spreewald biosphere reserve) located in Northeast Germany close to capital Berlin. The region is characterised by a small-scale structured agricultural landscape

is to preserve the very unique landscape in the Spreewald regions with all its typical landscape elements. Amongst the founders one can find a range of regional municipalities, private associations like the regional tourism association as well as local firms and individuals. As shown in Table 2, we identified four main actor groups which are of special relevance for the development of a CLM: the biosphere reserve management, farmers and land users, tourism providers, and local residents (including small landowners who do not use their land).

A major promoter of the civic foundation was the biosphere reserve management. The biosphere reserve has the overarching goal of harmonising biodiversity conservation and regional human activities. In addition, several local actors are affected by land use abandonment due to their different main interests. Local farmers are losing income, and landowners potentially cannot recover their running costs (taxes). Local residents stated a high commitment to and interest in preserving the typical landscape because it significantly contributes to regional identity. Furthermore, the tourism sector is one of the main beneficiaries of the region's attractive landscape scenery, as there is strong potential for more than 1.8 million overnights per year.

Awareness of the Problem and Its Definition (from the Perspective of Different Actor Groups)

The interview analysis shows that all actors are aware of the problem of gradual change to the landscape. Different actors report that they have been observing this transformation over a period of three decades and that it began to be more pressing with the shift from the socialist planned economy to a market economy in eastern Germany. As a result of that shift, many farmers abandoned their businesses and agricultural plots started to run wild.

Despite a common awareness of a 'crisis', the way in which the perceived problem is defined still differs (see Table 2). From the perspective of the nature conservationists, the most important and urgent problem is the loss of areas with high nature value (especially the threat to protected species). The conservationists' major aim is the protection of nature and biodiversity; they argue that these attributes are cross-sectorally valuable for conservation as well as for tourism conducted from a cultural history perspective. In short, nature and biodiversity together constitute a 'unique selling point for the region'. Interviewed nature conservationists emphasise that in this case, the aim is not land use restriction, but, on the contrary, the preservation of land use.

In this regard, the conservationists' concerns intersect with the main concern of farmers, who define the problem as a loss of agricultural land. The farmers' aim is to maintain the agricultural sites and the opportunity to cultivate them, which is irretrievably lost, or—from an economic point of view—hardly recoverable, once the land is abandoned. The farmers consider it their responsibility to take care of their property. However, even if they emphasise their needs for economically rentable land use and for cost recovery, they also state that they do not want to become mere caretakers of the landscape without the production of food and fodder; instead they want to continue as cultivating farmers. They fear that in the future, the problematic sites might be managed by only one distant, non-regional enterprise. However, the farmers are not unanimous in their

Table 2 Identified actors and groups of interest (results from the interviews)

	Biosphere & nature conservation	Farmers	Tourism providers	Local residents & small land owners and users (often mute actors)
Problem awareness[a]	High	High	Moderate/partly high	High/partly unknown
Problem definition[a]	Loss of areas with high biodiversity value (protected species)	Loss of income and agricultural land	Loss of attractive scenery	Loss of attractive scenery
Main interest and (value-based) objectives[a]	Biodiversity & nature conservation	Income and cost recovery	Attractive scenery as a basis for tourism	Maintenance of cultural landscape and heritage
Willingness to cooperate[a]	High (initiating and driving)	Mainly scepticism and conflict; mistrust	Hesitation/rejection (free-rider problem)	Mainly scepticism, in some cases high
Needed resources to enable collaboration[a]	Time, manpower, facilitation skills	Time, manpower, capacity to collaborate	Direct or indirect payments, broker skills	Time, property rights (in case of landowners), capacity to collaborate
Additional side-benefits[b]	Communication: information on processes in the BR; increased acceptance and importance, trust-building	Conservation of cultural landscape, farmers' image (biodiversity and nature conservation)	Marketing effects (image of 'responsible tourism')	Cultural identity; economic strengthening of region, recreation

[a]Based on analytical framework (see 2.3)

[b]Inductively derived

opinions: one farmer who advocates organic farming regards structural transformation in rural areas as the main problem. From his point of view, small farmers are increasingly replaced by large agriculture holdings that have no interest in soil and nature or in landscape conservation.

Representatives from the tourism sector report that the Spreewald, based on its appearance today, is perceived as the economic basis of tourism (Q1_TP, see Supplementary Data). The protection and conservation of landscape scenery is perceived as a central issue, with the landscape and the experience of nature, it provides, being crucial. Thus, tourism providers observe the transformation of the landscape with deep concern (Q2_TE).

How Do Local Actors Shape Their Relations (Interdependencies in Terms of Mutual Expectations and Perspectives)?

Interviews reveal a high potential for conflicts between nature conservation and land use interests. The management of the biosphere reserve is largely perceived as a threat responsible for land use restrictions and inadequate water management. Thus, a multitude of prejudices and a pessimistic attitude towards the biosphere reserve have been reported. For example, one interviewee (TE) illustrated his opinion by recalling the paradox that a ferry operator reported to him: some fauna species have nearly died out since the biosphere reserve was established in the region.

In an interview, one farmer also expressed great disappointment with the biosphere, which is accused of placing nature conservation above everything else (Q3_F1).

The representative of the biosphere confirms that he does indeed face this negative atmosphere. He describes situations with local actors as 'combats' that are characterised by strong aggressiveness and defensiveness. This is attributed to frustration resulting from radical social change after the end of the German Democratic Republic (GDR) (Q4_F2). Discussions are also very emotional and sometimes also irrational or non-objective, and it is common to blame the BR as a 'scapegoat' (='Sündenbock') (Q5_BR, Q6_F2).

In this context, it is also documented that land use restrictions and current water management led to perceptions of paternalism. Remarkably, the theme of 'conflict' was prevalent throughout the interview with the biosphere reserve representative, even though that theme was not introduced in the form of a question.

Another perspective relates to the farmers. Nature conservationists and some small farmers criticise the advancing structural change, which entails a loss of small-scale farmers and an increasing concentration of land owned by only a few large agricultural companies. These changes are resulting in a lack of responsibility for the environment.

Tourism providers view farmers with indifference; their dependency on farmers' contributions to landscape maintenance remains largely unconsidered. In this context, the role of knowledge exchange, mutual understanding and communication is emphasised (BR; TE; NC; TP). In contrast, interviews with farmers and nature conservationists consistently reveal expectations that tourism should advocate for and financially support the maintenance of the cultural landscape. However, a tourism expert notes that, contrary to what is commonly believed, tourism is often characterised by low revenue (Q7_TE).

What Are the Different Actors' Value-based Objectives for Landscape Development?

When asked about the 'typical Spreewald' landscape, the interviewees find it difficult to define this concept concretely (BR, TE, P, F) because cultural landscapes are always in a state of change and are heavily influenced by anthropogenic use. However, actors had different ideas regarding the development of the cultural landscape. Interviewees attribute these differences to different actor demands, which also change over time and generations.

From a touristic perspective, the typical 'museum landscape' with haystacks and thatched roofs is increasingly less in-demand, while 'wilderness' and 'pure nature' are in higher demand. This change in landscape preferences on the part of tourism is concerning to the BR representative, who fears a loss and undermining of the distinctive nature of the landscape and the region (Q8_BR).

While representatives from nature conservation emphasise the maintenance and preservation of biotopes and species with high nature value, the tourism expert notes that tourism providers and nature conservationists differ in their notions of and perspectives on the cultural landscape. From the conservation point of view, the preservation of the open landscape with the typical wet meadows and the associated typical species composition is essential. In contrast, tourism providers describe a 'narrow landscape' consisting of river and forest as a typical Spreewald landscape (Q9_TE). Overall, the tourists and the tourism providers are primarily interested in an attractive landscape, in which details played a minor role' (Q10_TE).

At the same time, the interviews also reflect a critical questioning of the archiving of a mere 'museum landscape' (represented by the artificial building of haystacks), which refers to a long-gone, fragmented style of meadow management. This perspective is also shared by some locals who do not want to be part of a 'real life museum'.

While tourism representatives, BR representatives and conservationists have different ideas for the development or preservation of the landscape, the interview with the representative of the farmers does not reveal any specific conception of the landscape. Rather, the focus is on the management of the land and water resources as well as their consequent economic uses. This focus is also the basis for a concept of sustainability that emphasises the preservation of land use. Against this background, keeping the landscape open and preserving arable land through adequate water management are mentioned as important goals. This objective is shared by many small landowners, who prefer a 'tidy' landscape composed of well-cut meadows with tree-lined boundaries—an image that they remember from their childhood (Q14_LO).

Willingness and Opportunities to Cooperate

At the time of the investigation, some forms of collaborative innovation had already been initiated, aimed at preserving the typical Spreewald cultural landscape. However, these were limited to bilateral and isolated cooperations, and they had a rather random and fragmented character (thermal utilisation of biomass, tourism co-products, tree sponsorships, wet meadow shares, etc.). From the point of view of the BR, these efforts will not be sufficient to protect the specific wet meadows permanently. Therefore, an integrated development concept is advocated, which combines the different sub-solutions and strives for an inter-sectoral and strategic collaboration among tourism, agriculture, small landowners, and nature conservation. With regard to the question of opportunities for cooperation and the willingness to participate in innovation processes, the interviews reveal the following:

The actors consider direct cooperation between agriculture and tourism (as a spin-off enterprise) to be rather difficult to achieve because the agricultural structure in the Spreewald is no longer characterised by small agricultural enterprises (TE) and is increasingly dominated by large agricultural companies. These large farms, which at the same time represent a low level of actor diversity in the agricultural sector, are perceived to lack identity and solidarity with the region. From the perspective of some other actors, their pure focus on profit maximisation neglects issues of nature conservation and land conservation (F, NC).

For a while, there was some discussion of introducing a tourist tax for landscape conservation. However, it turned out that such a general levy would not be accepted by the tourism industry. Attempts to introduce a 'Spreewald tax' similar to a visitors' tax have already failed in the past. Instead, as a tourism provider stressed, landowners must maintain their own land plots and bear the responsibility for doing so (Q11_TP).

There is also concern on the part of tourism providers that a general tax may result in the artificial preservation of a pure 'museum landscape'. Tourism providers also note the

'free rider problem', where some pay while others only benefit (TP, FA). Furthermore, tourism providers have expressed the criticism that the BR initiated many 'good ideas' such as tourism co-products but did not involve tourism providers. As a result, co-products are not perceived as adequate (TP).

Trust is noted as an essential prerequisite for cooperation. However, trust is simultaneously described by the actors as being severely damaged and difficult to restore: '… *there we come across granite in the Spreewald*'(Q12_P). Above all, the BR is perceived by many actors as threatening and patronising. Here, reference is repeatedly made to the process by which the Spreewald biosphere reserve was designated in the 1990s. The region's local residents, small landowners, and farmers are frustrated that they had no voice in this designation process. Similar frustrating experiences are recalled with regard to a major regional nature conservation project, which was carried out between 2004 and 2014 (LO).

According to some interviewees, another barrier not only to cooperation but also to the willingness to try new things is seen in the mentality of the actors, who (as a result of their socialisation in the GDR) have very little entrepreneurial spirit. New ideas and projects are often initiated by people from outside. A lack of 'sense of community' is noted.

Resources to Enable Collaboration

Table 2 shows that time, manpower, and facilitation skills are important required resources to coordinate and enable collaboration. Although central tasks of biosphere reserve management are to organise processes that help to preserve and develop the cultural landscape and to harmonise nature conservation with socio-economic demands, the BR management employee of the Spreewald region states that the BR does not have enough financial and human resources to establish and maintain laborious collaborative processes (BR). Moreover, the other actors do not consider BR management to be a trustworthy and legitimate moderator. Rather, the role of BR management is described as that of an outsider in the community (Q13_TE).

Interviews also revealed a two-sided problem: an ageing population and the corresponding lack of a critical mass of engaged and innovative actors with the necessary skills and capacities to collaborate. Moreover, critical actors had only very limited time to contribute; and sometimes they lacked the capacity and trust to collaborate.

Discussion: Lessons Learnt

The results show that attempts to establish collaborative approaches intended to preserve the typical cultural landscape in the Spreewald region date back almost 30 years. Even if some initiatives were established successfully (e.g., 'meadows share', thermal use of hay, tree sponsorships), these projects are still very small and have not had a noticeable impact on landscape change. It is widely acknowledged by local actors from all actor groups that the typical cultural landscape of the Spreewald region is undergoing extreme transformation and is increasingly being lost. As a result, the BR argues that an integrated and inter-sectoral collaboration that includes all relevant and concerned actor groups is needed to develop sufficient and effective power. At the time of this case study, such an integrated initiative was still at the initial stage, despite long-standing attempts and many past efforts on the part of BR.

How do the Results Relate to Other Case Studies on Collaborative Approaches? (RQ 3)

In addition to identifying a number of implications for ways to improve CLM projects (see 4.2), we found that most aspects that are frequently reported in the scientific literature on collaborative approaches also played an important role in the analysed case study (for an overview see Table 3).

Shared values are especially important when actors' dependencies differ

One important point is that the awareness that a landscape change with negative implications was occurring led to a perceived 'crisis' and 'awareness of a problem,' which together served as a starting point for initiating a CLM project (e.g., Gray 1989, Plummer and Fitzgibbon 2004, Folke et al. 2005, Biggs et al. 2010). However, we also found that even when problem awareness is high, the ways in which the problem is defined and framed can vary (Sotirov et al. 2017). These different perspectives can be related to different types of dependency on the ethical values of the landscape (Kenter et al. 2015, Cooper et al. 2016). While farmers are immediately economically dependent on plots and their cultivation, tourism providers tend to have larger tolerances for change. In their business, they depend on visitors' overall impression of the landscape. Thus, the impacts of landscape change on the incomes of tourism providers remain unclear. This uncertainty might partially explain why tourism providers do not recognise their mutual dependency with farmers, while farmers, in contrast, have high expectations of the tourism sector. We argue that even if some scholars regard the 'coincidence of values' as an important precondition (e.g., Gray 1985, Jamal and Getz 1995), at least in cases where dependency on common resources differs, successful collaboration actually requires the deliberative formation of

Table 3 Preconditions for the development of a Collaborative Landscape Management (CLM) programme identified in the case study and related to evidence from literature

Deductive categories	Sub- categories	Evidence in literature
Actors and groups of interest	• Interests in issue/motivation • Diversity of actors • Commitment • Power and influence	e.g., Nölting and Schäfer 2016, Gray 1989, Almeida et al. 2018, Dania et al. 2018
Problem awareness and definition	• Perceived crisis • Urgency and importance • Responsibilities (ownership)	e.g., Gray 1989, Plummer and Fitzgibbon 2004, Folke et al. 2005, Biggs et al. 2010, Sotirov et al. 2017
Value-based objectives	• Targeted cultural landscape • Concept of sustainability • Coincidence of or shared values	e.g., Gray 1985, Jamal and Getz 1995, Kenter et al. 2015
Actor's interrelations	• Perceived interdependency • Mutual expectations and appreciation • Trust • Communication (knowledge exchange, mutual understanding)	e.g., Hulshof and Vos 2016, McGinlay et al. 2017, Gray 2004, Almeida et al. 2018
Willingness to collaborate	• Acceptability of solutions • Free-rider problem • Sense of community • Past experiences and frames • Victim identity	e.g., Trimble and Berkes 2013, Hazard et al. 2018, Goffman 1974, Gray 2004
Resources	• Neutral leadership/moderator • Time • Personal resources (diverse and innovative actors) • Financing • Skills, competencies	e.g., McCarthy et al. 2004, Fleeger and Becker 2008, Beckley et al. 2008, Cheng and Sturtevant 2012

'shared values' (Kenter et al. 2015). Such deliberative learning processes could enhance the 'recognised mutual dependency' amongst actors and reduce doubts about the outcome of the collaboration by providing 'an opportunity to collectively wrestle with difficult questions, particularly when there are risks, uncertainties, and winners and losers' (Kenter et al. 2015, 97). Still, unequal power relations and low appreciation of others' motivations may hamper the mutual recognition of values (Hulshof and Vos 2016, McGinlay et al. 2017).

Negative past experiences and frames are strong barriers to CLM

Another strong barrier is related to the 'past experiences' of the actors. The results have shown that past experiences in the case under examination were shaped by the radical social transformations after the end of the GDR. These transformations not only required adaptation to a completely different economic system but also resulted in perceived individual disadvantages. In this context, the radical social change was concurrent with the designation of ~10% of the former GDR as a protected area (see Wegener 2016). The results revealed that 'historical mistrust' and 'victim identity' linked to a lack of participation in former (landscape) development were prevalent amongst local actors (Gray, 2004). Mistrust is generally seen as a major barrier to establishing collaboration (Almeida et al. 2018). Gray (2004) has shown that the frames of decisive role actors (often resulting from mistrust) have enormous influence on the success or failure of collaborative processes. According to the concept of framing (Goffman, 1974), frames can be understood as inter-subjectively constructed and selective but nevertheless coherent narratives used to make sense of a complex situation. Grounded in individual or collective experiences, knowledge, and perceptions, the framing process is the basis of actors' argumentations and actions. As reflected in our results, such frames (e.g., mistrust concerning water management practices and regulations) and stereotypes (e.g., nature conservationists as paternalists) appear to be prevalent. Similar results were reported by Hulshof and Vos (2016), who analysed the role of frames as 'diverging realities' in Spanish water management.

Financial and institutional support is critical for initiating CLM

Also critical when trying to establish and manage collaboration well over time are financial and institutional constraints (Biggs et al. 2010, García-Martín et al. 2016). Institutional support, which makes possible the everyday tasks of an institution (e.g., personnel management, finance,

planning), is one key factor that enables the coordinator of a collaboration to function effectively (Biggs et al. 2010). In the Spreewald case, not all actors recognised that such coordination tasks need adequate and permanent resources. Thus, it is crucial 'to educate and train society about the importance of collaborative management of landscapes' (García-Martín et al. 2016, 52) and consequently to provide sufficient time and funding for such management.

Critical Needs and Outcomes of Collaborative Landscape Management (RQ 2)

We identified a number of critical shortcomings that can potentially explain the 'unsuccessfulness' of past attempts. In addition, we will show how these challenges can be effectively tackled by applying a transdisciplinary process.

There is a lack of an integrated and joint problem definition

The results show that all actor groups could potentially benefit from collaboration aiming at landscape preservation and development. Even if actors' demands differ (see Table 2), they are all connected with and can be addressed through landscape preservation. All interviewed actors reported a strong interest in the cultural landscape.

In accordance with Gray (2004), we interpret this as a circumstance that increases the likelihood of a successful collaboration. There is not only a widespread perception that landscape change is inducing a crisis but also a recognition that the problem cannot be solved by a single actor (group) (Faehnle and Tyrväinen 2013, Scherr et al. 2013, García-Martín et al. 2016, Head et al. 2016, Almeida et al. 2018).

Although we found a common fundamental awareness of the problem amongst all parties, the way in which the problem is defined by different actors and actor groups varies. The findings also indicate differences in underlying normative goals and values. The awareness of mutual dependency and expectations is partly misaligned and rather low.

A comprehensive and joint framing of the problem, which can lead to a systemic understanding (systems knowledge) involving all relevant actors from different actor groups, still has not taken place. However, this type of framing is widely reported as a central success principle in collaborative multi-actor processes (e.g., Lang et al. 2012, Trimble and Berkes 2013, García-Martín et al. 2016, Foley et al. 2017).

A joint vision for future landscape development is needed

This divergence in problem framing corresponds with the lack of a commonly shared vision of future landscape development. All parties had serious difficulties describing what constitutes the typical cultural landscape of the Spreewald region. Cultural landscapes and their preservation as well as development are strongly connected to ethical values and normative goals. Thus, a discussion of common goals appears to be recommendable to integrate all relevant perspectives and to provide knowledge and legitimacy for future action (Plummer and Fitzgibbon 2004, Scherr et al. 2013). Other case studies have also shown that collaborative goal setting and co-design processes led to increased problem awareness (Biggs et al. 2010), shared knowledge (also values) and a generally stronger appreciation of the cultural landscape (Biggs et al. 2010, Plieninger et al. 2013). One part of such a collaborative goal-setting process can be a 'reframing of perspectives' in terms of changing negative, blaming frames into a common value-based frame of integrative landscape management (cf. Biggs et al. 2010).

The successful initiation of a CLM critically depends on an as legitimately perceived coordinator

A crucial issue that came up in the course of the transdisciplinary process is the question of who can act as an adequate moderator and/or coordinator. Normally, it is a central task of biosphere reserve management to organise processes that preserve and develop the cultural landscape and to harmonise nature conservation with socio-economic demands. However, due to a reported lack of financial resources, the BR is unable to take on this role effectively in this case. The results also show heavy mistrust towards the BR, as it is seen as placing nature conservation above other aims. Thus, BR management is not perceived as a 'legitimate convenor'. As is known from earlier studies and meta-analyses, the initiator of a collaborative innovation process has 'a critical impact on its success or failure' (Gray 1989). In the case under examination, the recognition of mutual dependency is still rather low, and values are not congruent; thus, a 'neutral third party' is regarded as the most appropriate coordinator (ibid.). Even if the civic foundation known as 'Cultural Landscape Spreewald' might be an appropriate coordinator in the future, at the time of analysis this choice was critically questioned because that organisation's member structure reflected rather 'old established networks' of the region, including BR. Thus, the risk was quite high that some actors would question the legitimacy of the community foundation and withdraw from the collaborative process.

Developing 'collaborative capacity' amongst key actors is a central success factor

As a central success factor for developing collaborative resource management and sustaining organisational structures,

processes, and strategies, many scholars have emphasised the importance of the 'collaborative capacity of a community' (e.g., Jamal and Getz 1995, McCarthy et al. 2004, Fleeger and Becker 2008, Beckley et al. 2008, Cheng and Sturtevant 2012). Beckley et al. (2008) define 'collaborative capacity' as 'the collective ability of a group to combine various forms of capital with institutional and relational contexts to produce desired outcomes'. One central indicator is a 'civic culture' expressed by local citizens who 'meet, discuss, exchange, and accomplish tasks in the public sphere'(ibid.).

The results have shown that collaborative capacity—especially with regard to social capital—can still be improved in the case study region. Trust-promoting activities are required, as are competencies in conflict management, improvements in communication skills, knowledge exchange, social learning, mutual understanding and appreciation, etc. (Cheng and Sturtevant 2012, García-Martín et al. 2016, McGinlay et al. 2017, Almeida et al. 2018). Additionally, structures, rules and strategies for CLM still need to be developed in the Spreewald region.

Co-production and co-innovation processes can improve outcomes and success

As the results have shown, there is already a series of different partial solutions based on cooperation (e.g., 'meadows share', thermal use of cut landscape material, tree sponsorships). These solutions were primarily initiated and developed by the BR and the community foundation. Even if these efforts are widely appreciated, results have also indicated that simple 'obvious' solutions might not have the necessary acceptance to be applied by a larger number of actors (Busse et al. 2019). To cite an example from the case study, farmers are highly interested in maintaining land use and avoiding land abandonment. However, the mere cost transfer as provided by sponsorships ('meadow share') turns them into 'landscape caretakers', which contradicts their self-image as producers of agricultural commodities. Another example is the development of tourism co-products (meaning products that can be sold and promoted by tourism providers, returns are used to finance landscape management), which were perceived as inadequate from the perspective of the tourism providers. Given these findings, we argue that co-innovation processes that involve all relevant actors from the beginning may also increase effectiveness and ultimately improve the outcomes and success of CLM projects. Such co-innovation processes can also be beneficial when applying the design principles of transdisciplinary co-design and co-production (e.g., Lang et al. 2012, Trimble and Berkes 2013, Hazard et al. 2018).

In sum, collaborative approaches such as transdisciplinary (TD) processes can constitute a fundamental basis for CLM, as they support the initiation of institution-building and improve relationships between actors, stimulate co-operation and enhance community empowerment (e.g., Trimble and Berkes 2013, Gruber 2010). TD processes provide a platform for communication, negotiation, planning, and conflict resolution (Zscheischler et al. 2018) that substantially supports the development of a commonly shared vision. In addition, a transdisciplinary research project facilitated by external, ideally 'neutral' scientists, can serve as an effective 'interim solution' (cf. Kauffman and Arico 2014, Scholz et al. 2017). The search for and the building-up of a legitimate coordinator for the future management of the landscape is thus a central outcome of the transdisciplinary process. In addition, transdisciplinary projects can bring in financial resources and additional (wo) manpower through third-party funding to initiate collaboration, balance the lack of resources, and provide leeway for experiments.

Conclusion

Traditional cultural landscapes are of great interest to a multitude of actor groups. However, these landscapes are at risk of being lost as a result of structural changes in rural areas and consequent land abandonment. It has been recognised that we lack adequate policies to manage the conservation of cultural landscapes. Thus, the question of how to maintain and manage cultural landscapes where economic benefits are not assured has become a priority. In this context, several scholars have emphasised the role and potentials of collective action and collaborative community approaches to sustainable land(scape) management.

The aim of this paper was to better understand how such a CLM could be built up. Based on a case study from Northeast Germany, we place a special emphasis on the social relationships and social mechanisms that exist among actors.

Our results have shown that in the analysed case study, all actor groups could potentially benefit from the initiation of a CLM project. The findings also reveal that (in addition to institutional and structural aspects) human dimensions such as actors' relationships and social mechanisms play a major—but so far neglected—role.

Our analysis supports the results of other case studies dealing with the pre-conditions of co-management (see Table 2). Thus, the pre-conditions for co-management of resources (e.g., fishery, water, forest) appear to be largely transferable to the issue of landscapes. In addition, we found that (i) shared values are especially important when actors have different dependencies on natural resources, (ii) negative past experiences and framings are strong barriers to CLM, and (iii) financial and institutional support is critical for initiating CLM.

Finally, we note that transdisciplinary processes can support the initiation of a CLM, strengthen actor interrelations, and lower identified barriers.

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References

Agnoletti M (2014) Rural landscape, nature conservation and culture: some notes on research trends and management approaches from a (southern) European perspective. Landsc Urban Plan 126:66–73

Almeida J, Costa C, Nunes da Silva F (2018) Collaborative approach for tourism conflict management: a Portuguese case study. Land Use Policy 75:166–179

Antrop M (1997) The concept of traditional landscapes as a base for landscape evaluation and planning. the example of Flanders Region. Landsc Urban Plan 38(1-2):105–117

Antrop M (2006) Sustainable landscapes: contradiction, fiction or utopia? Landsc Urban Plan 75(3-4):187–197

Beckley TM, Martz D, Nadeau S, Wall E, Reimer B (2008) Multiple capacities, multiple outcomes: delving deeper into the meaning of community capacity. Journal of Rural and Community Development 3:56–75

Beilin R, Lindborg R, Stenseke M, Pereira HM, Llausàs A, Slätmo E, Munro N (2014) Analysing how drivers of agricultural land abandonment affect biodiversity and cultural landscapes using case studies from Scandinavia, Iberia and Oceania. Land Use Policy 36:60–72

Berkes F (1997) New and not-so-new directions in the use of the commons: co-management. The Common Property Resource Digest 42(1):5–7

Berkes F (2002) Cross-scale institutional linkages: perspectives from the bottom up. In E. Ostrom, T. Dietz, N. Dolsak, P. C. Stern, S. Stonich, & E. U. Weber (eds), The drama of the commons. p. 293–321. National Academy Press: Washington, D.C.

Biggs R, Westley FR, Carpenter SR (2010) Navigating the back loop: fostering social innovation and transformation in ecosystem management. Ecol Soc 15(2):9

Bürgi M, Ali P, Chowdhury A, Heinimann A, Hett C, Kienast F, Verburg PH (2017) Integrated landscape approach: closing the gap between theory and application. Sustainability 9(8):1371

Busse M, Heitepriem N, Siebert R (2019) The acceptability of land pools for the sustainable revalorisation of wetland meadows in the Spreewald Region, Germany. Sustainability 11(15):4056

Cheng AS, Sturtevant VE (2012) A framework for assessing collaborative capacity in community-based public forest management. Environ Manag 49(3):675–689

Clarke A (2005) Situational analysis: grounded theory after the postmodern turn. Sage Publications, London

Cong RG, Smith HG, Olsson O, Brady M (2014) Managing ecosystem services for agriculture: will landscape-scale management pay? Ecol Econ 99:53–62

Cooper N, Brady E, Steen H, Bryce R (2016) Aesthetic and spiritual values of ecosystems: recognising the ontological and axiological plurality of cultural ecosystem 'services'. Ecosyst Serv 21:218–229

Cox M, Arnold G, Tomás SV (2010) A review of design principles for community-based natural resource management. Ecol Soc 15(4):38

Dania WAP, Xing K, Amer Y (2018) Collaboration behavioural factors for sustainable agri-food supply chains: a systematic review. J Clean Prod 186:851–864

Enengel B, Penker M, Muhar A, Williams R (2011) Benefits, efforts and risks of participants in landscape co-management: an analytical framework and results from two case studies in Austria. J Environ Manag 92(4):1256–1267

Evans L, Cherrett N, Pemsl D (2011) Assessing the impact of fisheries co-management interventions in developing countries: a meta-analysis. J Environ Manag 92(8):1938–1949

Fadeeva Z (2005) Promise of sustainability collaboration—potential fulfilled? J Clean Prod 13(2):165–174

Faehnle M, Liisa Tyrväinen L (2013) A framework for evaluating and designing collaborative planning. Land Use Policy 34:332–341

Fleeger WE, Becker ML (2008) Creating and sustaining community capacity for ecosystem-based management: is local government the key? J Environ Manag 88(4):1396–1405

Foley RW, Wiek A, Kay B, Rushforth R (2017) Ideal and reality of multi-stakeholder collaboration on sustainability problems: a case study on a large-scale industrial contamination in Phoenix, Arizona. Sustainability Science 12(1):123–136

Folke C, Hahn T, Olsson P, Norberg J (2005) Adaptive governance of social-ecological systems. Annu Rev Environ Resour 30:441–473

Franks JR, McGloin A (2007) Environmental co-operatives as instruments for delivering across-farm environmental and rural policy objectives: lessons for the UK. J Rural Stud 23(4):472–489

García-Martín M, Bieling C, Hart A, Plieninger T (2016) Integrated landscape initiatives in Europe: multi-sector collaborationin multi-functional landscapes. Land Use Policy 58:43–53

Gray B (1985) Conditions Facilitating Interorganizational Collaboration. Human Relations 38(10):911–936

Gray B (1989) Conditions facilitating interorganizational collaboration. Hum Relat 38(10):911–936

Gray B (2004) Strong opposition: frame-based resistance to collaboration. J Community Appl Soc Psychol 14(3):166–176

Goffman E (1974) Frame Analysis: An Essay on the Organization of the Experience. Harper Colophon, New York

Gruber JS (2010) Key principles of community-based natural resource management: a synthesis and interpretation of identified effective approaches for managing the commons. Environ Manag 45 (1):52–66

Hazard L, Steyaert P, Martin G, Couix N, Navas M-L, Duru M, Labatut J (2018) Mutual learning between researchers and farmers during implementation of scientific principles for sustainable development: the case of biodiversity-based agriculture. Sustain Sci 13(2):517–530

Head BW, Ross H, Bellamy J (2016) Managing wicked natural resource problems: the collaborative challenge at regional scales in Australia. Landsc Urban Plan 154:81–92

Hernández-Morcillo M, Bieling C, Bürgi M, Lieskovský J, Palang H, Printsmann A, Schulp CJE, Verburg PH, Plieninger T (2017).

Priority questions for the science, policy and practice of cultural landscapes in Europe. Landscape ecology, 32(11):2083–2096
Höppner C, Frick J, Buchecker M (2008) What drives people's willingness to discuss local landscape development? Landsc Res 33 (5):605–622
Hulshof M, Vos J (2016) Diverging realities: how framing, values and water management are interwoven in the Albufera de Valencia wetland in Spain. Water Int 41(1):107–124
Jamal TB, Getz D (1995) Collaboration theory and community tourism planning. Ann Tour Res 22(1):186–204
Kauffman J, Arico S (2014) New directions in sustainability science: promoting integration and cooperation. Sustainability Sci 9:413–418
Kenter JO, O'Brien L, Hockley N, Ravenscroft N, Fazey I, Irvine KN, Williams S (2015) What are shared and social values of ecosystems? Ecol Econ 111:86–99
Kuckartz U (2012). Qualitative text analysis: a guide to methods, practice and using software.Sage Publication, London
Lang DJ, Wiek A, Bergmann M, Stauffacher M, Martens P, Moll P, Swilling M, Thomas CJ (2012) Transdisciplinary research in sustainability science: practice, principles, and challenges. Sustainability Science 7(S1):25–43
Leach M, Mearns R, Scoones I (1999) Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management. World Development 27(2):225–247
Loft L, Mann C, Hansjürgens B (2015) Challenges in ecosystem services governance: multi-levels, multi-actors, multi-rationalities. Ecosyst Serv 16:150–157
Luoto M, Pykälä J, Kuussaari M (2003) Decline of landscape-scale habitat and species diversity after the end of cattle grazing. J Nat Conserv 11(3):171–178
Mayring P (2014). Qualitative content analysis: theoretical foundation, basic procedures and software solution. Beltz: Klagenfurt
McCarthy N, Dutilly-Diané C, Drabo B (2004) Cooperation, collective action and natural resources management in Burkina Faso. Agric Syst 82(3):233–255
McGinlay J, Gowing DJG, Budds J (2017) The threat of abandonment in socio-ecological landscapes: farmers' motivations and perspectives on high nature value grassland conservation. Environ Sci Policy 69:39–49
Nölting B, Schäfer M (2016). Cooperation management as a distinct function in innovation processes for alternative food production and consumption—potentials and limitations. Paper for the 12th European IFSA Symposium 'Social and technological transformation of farming systems: Diverging and converging pathways', 12th–16th July 2016, Harper Adams University. http://ifsa.boku.ac.at/cms/fileadmin/IFSA2016/IFSA2016_WS18_Noelting.pdf. Accessed 21 June 2018
Olsson P, Folke C, Hahn T (2004) Social-ecological transformation for ecosystem management: the development of adaptive co-management of a wetland landscape in southern Sweden. Ecol Soc 9(4):2
Ostrom E (1990) Governing the commons: the evolution of institutions for collective action. Cambridge University Press, Cambridge, UK
Ostrom E (2001) An institutional approach to the study of self-organization and self governance in CPR situations. Oxford University Press, New Delhi
Pahl-Wostl C (2009) A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. Glob Environ Change 19(3):354–365
Parker C, Cranford M, Oakes N, Leggett M ed., 2012. The little biodiversity finance book, Global Can-opy Programme; Oxford.
Plieninger T, Höchtl F, Spek T (2006) Traditional land-use and nature conservation in European rural landscapes. Environ Sci policy 9 (4):317–321
Plieninger T, Bieling C, Ohnesorge B, Schaich H, Schleyer C, Wolff F (2013) Exploring futures of ecosystem services in cultural landscapes through participatory scenario development in the Swabian Alb, Germany. Ecol Soc 18(3):39
Plummer R, Fitzgibbon J (2004) Co-management of natural resources: a proposed framework. Environ Manag 33(6):876–885
Pinkerton, E (Ed.). (1989). Co-operative management of local fisheries: new directions for improved management and community development. UBC Press
Prager K, Reed M, Scott A (2012) Encouraging collaboration for the provision of ecosystem services at a landscape scale—rethinking agri-environmental payments. Land use policy 29(1):244–249
Prager K (2015) Agri-environmental collaboratives for landscape management in Europe. Environ Sustain 12:59–66
Reed MS, Graves A, Dandy N, Posthumus H, Hubacek K, Morris J, Prell C, Quinn C, Stringer LC (2009) Who's in and why? A typology of stakeholder analysis methods for natural resource management. J Environ Manag 90(5):1933–1949
Sattler C, Schröter B, Jericó-Daminello C, Sessin-Dilascio K, Meyer C, Matzdorf B, Giersch G (2015) Understanding governance structures in community management of ecosystems and natural resources: The Marujá case study in Brazil. Ecosyst Serv 16:182–191
Scherr, SJ, Shames, S, Friedman, R (2013). Defining integrated landscape management for policy makers. *Ecoagriculture Policy Focus*, 10
Scholz R (2017) The Normative Dimension in Transdisciplinarity, Transition Management, and Transformation Sciences: New Roles of Science and Universities in Sustainable Transitioning. Sustainability 9(6):991
Sotirov, M, Blum, M, Storch, S, Selter, A, Schraml, U (2017). Do forest policy actors learn through forward-thinking? Conflict and cooperation relating to the past, present and futures of sustainable forest management in Germany. *For Policy Econ*, 85:256–268
Stauffacher M, Walter AI, Lang DJ, Wiek A, Scholz RW (2006) Learning to research environmental problems from a functional socio-cultural constructivism perspective: the transdisciplinary case study approach. Int J Sustain High Educ 7(3):252–275
Trimble M, Berkes F (2013) Participatory research towards co-management: lessons from artisanal fisheries in coastal Uruguay. J Environ Manag 128:768–778
Van Eetvelde V, Antrop M (2004) Analyzing structural and functional changes of traditional landscapes—two examples from Southern France. Landsc urban Plan 67(1):79–95
Verburg PH, Schulp CJE, Witte N, Veldkamp A (2006) Downscaling of land use change scenarios to assess the dynamics of European landscapes. Agric, Ecosyst. Agric Ecosyst Environ 114(1):39–56
Wegener U (2016) Die Verwirklichung des ostdeutschen Nationalparkprogramms aus der Sicht eines Aufbauleiters – eine Nachlese nach 26 Jahren. Studienarchiv Umweltgeschichte 21:35–42
Yin RK (2018). Case study research: design and methods. 6 edn., Sage Publication, London
Zscheischler J, Rogga S, Lange A (2018) The success of transdisciplinary research for sustainable land use: individual perceptions and assessments. Sustainability science, 13(4):1061–1074

8. Synthesis: Discussion and concluding remarks

8.1 The contribution of the papers to the research objectives

As mentioned in section 1.5 and illustrated in figure 1, each paper seeks to contribute in a particular way to the objectives of this dissertation. Hereafter, summaries of the papers are presented and their contributions to the objectives are explained in more detail.

Paper 1: Acceptance studies in the field of land use – A critical and systematic review to advance the conceptualization of acceptance and acceptability.

This paper offers a systematic review of recent publications on acceptance and acceptability in the context of different land uses. To this end, we analysed peer-reviewed journal articles and book chapters (n=132). The bulk of the literature is dominated by acceptability studies about renewable energy issues, followed by sustainable land use. Acceptability is a cross-sectoral and multidisciplinary research field with disciplinary anchors in psychology, sociology, behavioural economics, and innovation research. Analysis shows that many researchers do not define acceptance or apply a theory. The review also reveals that there is no common understanding of acceptance; instead, the definitions and characteristics provided are sometimes even contradictory. Additionally, the theoretical foundation underlying the selection of factors is often weak. In conclusion, we identified certain limits in adequately defining and conceptualizing acceptance and/or acceptability in the reviewed land use studies. Therefore, I generally recommend that researchers thoroughly reflect on and reveal the sources of their applied notions, concepts and influencing factors.

Contribution to objectives: In accordance with Fournis and Fortin (2017) and my own considerations, the paper underlines that acceptance and acceptability be distinguished to clarify the use of both terms. The main outcome of the review is a new definition that defines acceptability as a scientific concept that looks at actor-based and dynamic judgement and decision processes in which decisions result from interactions with other actors on the basis of social norms and from reflections about the object and context. These decisions can be assigned to a degree of acceptability ranging from rejection to high acceptance or even engagement.

Additionally, the decisions are made at a particular level: the attitude, action, or utilization level. By providing this conceptual definition of acceptability, this paper contributes to the first research objective, which aims at conceptualizing the term 'acceptability'. Thus, the knowledge gap of a consistent and comprehensive definition of acceptance and acceptability can be filled. Furthermore, the review findings and the definition establish the most important foundation for developing the novel framework of acceptability.

Paper 2: The acceptability of land pools for the sustainable revalorisation of wetland meadows in the Spreewald region, Germany

This study qualitatively analysed the acceptability factors that influence the decisions of landowners and farmers related to land pools in the Spreewald region. Therefore, we developed and applied a sociologically driven framework of acceptability. The interview transcripts were interpreted using qualitative text analysis (Kuckartz, 2014). The results show that the value-based appreciation of the landscape is high but does not lead per se to a positive acceptance. The reasons include the lack of shared values and the existence of diverging opinions about the objectives of land pools. Additional factors are previous experiences, the level and quality of participation, and trust in actors. In conclusion, this study mainly focuses on the socially related acceptability factors. The theoretical conclusions are that 1) the novel acceptability framework supports qualitative, in-depth and actor-centred analyses and that 2) it reveals diverse and previously unknown factors. Hence, the framework differs from concepts of acceptability with predefined factors, such as DOI or TAM, or frameworks from behavioural economics (e.g., willingness to pay).

Contribution to objectives: This paper contributes to research objectives 1 and 2. Using the definition of acceptability from P1 and expanding it to include an analytical framework advances the conceptualization of acceptability (objective 1) and fills the gap of lacking a framework from a social-ecological perspective. The novel framework was applied to analyse the acceptability factors and the degrees in a specific context. This empirical part of the paper assists objective 2 by 'analysing acceptability factors and degrees'. The paper shows their suitable application to explorative and qualitative social research from a theoretical perspective and from a practical perspective to social landscape research or innovation research in landscapes. Objective 3 is marginally addressed by mentioning that acceptability requires the collaboration of different stakeholders in the region.

Paper 3: Acceptability of innovative biomass heating plants in a German case study – A contribution to CLM and local energy supply

This paper analyses the acceptability of local biomass heating plants and their contribution to collaborative landscape management (CLM). Fuzzy set qualitative comparative analysis (fsQCA), in line with Ragin (2000) and Schneider and Wagemann (2013), was applied to explore whether farmers would install a biomass plant in the near future and the reasons for accepting or rejecting it. We identified three types of farmers: proponents and potential adopters, ethically concerned opponents, and open-minded refusers. Acceptance is likely if farmers ethically accept biomass plants, are interested in the technology, need a new heating system, have sufficient feedstock to feed the biomass plant, and perceive the readiness level of the technology as unproblematic. Farmers are likely to reject it biomass plants if one of the following factors arises: ethical concerns about 'burning hay', satisfaction with the current oven, low availability of feedstock, or if the technology is perceived as immature. Factors of minor importance include compliance with procedural justice, trust in coordinating actors, and having a demonstration plant. The paper advances knowledge of how to prevent land abandonment by simultaneously promoting regional energy and of the acceptability in landscape approaches by indicating the need to integrate the results into landscape co-design and management.

Contribution to objectives: All three research objectives and the corresponding research gaps (1 – 3) are addressed in P3. The paper uses the acceptability framework introduced in P2. P3 illustrates the application of the framework in a different case study (local biomass plants) but referring to the same case study region: the cultural landscape SP. Thus, P3 builds upon P2 theoretically and practically. Further theoretical insights are provided through the recommendations to integrate such 'snapshot analyses' into the broader context of landscape co-design and management and to understand acceptability as a 'recursive pattern' (cf. Ganzevles et al., 2015). In doing so, P3 paves the way for the second conceptual paper (P4). With regard to objective 2, 'analysing acceptability factors and degrees', this paper shows that the framework is suitable for revealing not only social and ethically driven acceptability factors (e.g., ethical refusal to burn hay) but also factors associated with technology (e.g., perceived low readiness of technology) or farm characteristics (e.g., availability of biomass for the biomass plant).

Paper 4: Integrating acceptability studies into an adaptive landscape co-design and management – The acceptability and landscape design cycle (ALDC)

The paper introduces the novel ALDC approach that combines acceptability studies with adaptive landscape co-design. The approach serves to develop place-based innovations. P4 describes the four iterative phases of the ALDC: 1) defining the preconditions for acceptability analysis, (2) conducting an acceptability analysis, (3) integrating the results into the landscape strategy, and (4) re-designing and refining the landscape strategy. These phases are illustrated using the SP case study. The approach fits place-based innovations for the sustainable transformation of landscapes. P4 offers guidelines for the practical implementation of the ALDC and contributes to a better understanding of the dynamic characteristic of acceptability decisions.

Contribution to objectives: By introducing the ALDC approach, this paper contributes to the first research objective, 'conceptualizing acceptability', and to filling research gap 3, 'lack of a conceptual link between acceptability and landscape approaches'. The novelty of this framework is that P4 links the concept of acceptability to landscape approaches. These two research strands have, to date, been separated from each other and do not refer to each other, although both deal with the actors' perceptions and values of landscapes in striving for the sustainable transformation of landscapes. The benefit of the ALDC is that it utilizes insights from acceptability studies and landscape approaches: The research on acceptability in the SP case study contributes to the ALDC by providing a sociological perspective on the issue and advances the idea of the 'recursive pattern of acceptability' proposed by Ganzevles et al. (2015). Furthermore, acceptability studies underline the necessity of considering acceptability phenomena in landscape approaches. Landscape and social-ecological system research provide rich approaches, such as the landscape co-design concept (Campellone et al., 2018; Swaffield, 2013; Nassauer and Opdam, 2008) and adaptive co-management. These approaches guide the ALDC by emphasizing the importance of adaptivity, social learning, and flexible decision-making.

Paper 5: Challenges to build up a collaborative landscape management (CLM) - Lessons from a stakeholder analysis in Germany

The paper is based on the idea that collaborative landscape management (CLM) can be an adequate response to the issue of landscape change through land abandonment in European cultural landscapes. The aim of P5 was to examine the preconditions and opportunities for

initiating and establishing a CLM in the SP. To achieve this, insights from a stakeholder analysis were used. On the one hand, the results show that building a CLM seems to be feasible. Positive influencing factors include the following: many of the different actors and actor groups in the region have shared problem awareness; several linkages between actors already exist; and the type of problem (landscape change) is suitable for CLM. On the other hand, tense social relationships among actor groups, insufficiently legitimized coordination through a lack of trust, and the collaborative capacity of the community (manpower, time, and abilities) reduce the chances of success. Lastly, the paper reveals that TD projects can facilitate initiating a CLM, as this stage is critical in the elaboration process of CLM.

Contribution to objectives: This paper mainly contributes to research objective 3, 'linking acceptability to collaboration' as well, to some extent, to objective 2, 'analysing acceptability factors and degrees'. Acceptability issues are intertwined in numerous ways with collaborations in landscape contexts: A) direct acceptability factors for CLM, B) indirect acceptability factors for CLM, C) pro-activeness of acceptability and collaboration, and D) conceptual link between CLM and the ALDC. By specifying the interactions between acceptability and collaboration, P5 contributes to closing the respective knowledge gap.

A) P5 underlines that trust in the coordinating institutions, shared values among actors, and past experience are important issues in building up a CLM. These issues are direct acceptability factors that influence the willingness of actors to cooperate in a CLM. These same factors were also identified as crucial for land pools (P2), but as less important in the case of local biomass plants (P3). In conclusion, as they are a precondition for a CLM, they can also influence the acceptability of the innovations themselves.

B) Additionally, there are indirect acceptability factors that constitute the acceptability of a CLM: Innovative ideas under consideration to transform the respective landscape into a more sustainable one and the pursued landscape strategy should also be accepted by involved actors to achieve a successful CLM, as these ideas, and the landscape strategy underlying their balanced composition, are the rationale behind building a CLM.

C) A collaborative design of the innovative ideas and the strategy can be beneficial for a CLM and enhance the acceptance of the innovation (Hazard et al., 2018; Trimble and Berkes, 2013). To pro-actively support and shape an idea is also the highest degree of the possible acceptability outcomes, so-called 'engagement'. Generally, collaborations in a CLM aim at the active involvement of actors in terms of partnership, empowerment, and active decision making (Reed,

2008). Thus, both collaborations and acceptability have a pro-active component in their conceptualization.

D) CLM and the associated innovation process must be flexible enough to screen out or adjust innovative ideas that are not widely accepted (cf. P4). Furthermore, P5 applies the idea that CLM is a suitable approach to coping with the current challenges of complex social-ecological systems (Folke et al., 2005; Opdam et al., 2018; Sayer et al., 2013). This concept is linked to the ALDC approach and therefore to objective 1, 'conceptualizing acceptability', as both approaches deal with collaboration among different actors, mutual social learning processes, and flexible decision making. Whereas, CLM focuses on long-term collaboration to transform and manage landscapes, the ALDC emphasizes the role of acceptability in the co-design phase of a suitable landscape strategy that must be implemented and managed later on.

In sum, my analysis of how the papers contribute to specific research objectives found even more interconnections between the insights of the papers and their contributions to the objectives of this dissertation than it was described in 1.5. This means all the papers (excepting P1) contribute to more than only one research objective.

8.2 Discussion on the landscape approach principles

This section is devoted to analysing how the papers of this dissertation contribute to the current state of landscape approaches and their practical implementation. As mentioned in the introduction, the state-of-the-art in landscape research deals with approaches that emphasise a social-ecological system perspective, stakeholder participation, and the adaptive capacity, multifunctionality, and resilience of landscapes. Such main guidelines for sound landscape approaches are reflected in the ten principles described by Sayer et al. (2013). The principles are a synthesis of widely recognized and common-sense aspects among researchers and practitioners related to how landscapes should be adequately analysed and managed. I use these landscape approach principles (Sayer et al., 2013) as a framework for the analysis in this section. The analysis identifies whether the dissertation can underpin the landscape approach principles with empirical evidence and new conceptual considerations. Furthermore, the analysis reveals whether this dissertation can contribute to conceptual and operational improvement of the landscape approach principles. I discuss how each of the five papers fit into the different principles and make suggestions for the advancement of the principles. Each principle will be presented in detail. An overview of the analysis is illustrated in figure 7.

Principle 1 – Continual learning and adaptive management

Sayer et al. (2013) note that landscapes are characterized by continual change. The dynamics in a landscape – in terms of ecology, land use, and social changes – often have unpredictable causes and effects (Folke et al., 2005; Olsson et al., 2004). Nevertheless, the outcome of such dynamics should be used as a driver of social learning about landscapes. Advances in knowledge generation must be continuously considered in landscape approaches (Berkes, 2009). Thus, the capacity to adapt new aspects in landscape approaches and to react flexibly is a central factor in adaptive management (Folke et al., 2005; Sayer et al., 2013).

The results of this dissertation fit well into the first landscape principle. This dissertation primarily deals with social changes, such as the changes in attitudes or perceptions of actors induced through knowledge generation about landscape processes and the possibilities of coping with complex landscape problems. The review paper (P1) shows that acceptability decisions are often non-linear and can change over time, e.g. during the course of the innovation process or after implementing the innovation. This time-related dynamic of acceptability decisions is termed as 'recursive pattern of acceptability' by Ganzevles et al. (2015). Changing their decisions over time means that people reflect on their decisions based on interactions with other people by discussing and negotiating issues, by mutually energizing themselves, and by demonstrating achievements. These interactions lead to social co-learning processes. Generally, co-learning as an aspect of social learning is the basis of adaptive landscape approaches (Bodin, 2017; Folke et al., 2005; Reed et al., 2010). P4 proposes a new ALDC framework that combines acceptability issues with landscape co-design and adaptive management. In particular, social learning takes place in the fourth step of the ALDC: the refinement and re-design phase. In this step, the landscape design will be revised by re-thinking and amending the different innovation pathways. This can only be accomplished through reflexive and iterative learning processes among involved actors. Each actor contributes her or his ideas and opinions to the landscape co-design. Thus, principle 1 is an important pillar of this novel framework. Similar to landscape co-design, CLM (P5) relies on the principle of social learning. Only if actors are willing to learn from each other, to have a mutual understanding, and to build social capital can they be capable of initiating a CLM. The case study papers (P2 and P3) illustrate acceptability analyses of innovative ideas at a specific moment in the innovation process; thus, they are so-called 'snapshot analyses'. A central conclusion in both papers is that the results should be integrated into landscape co-design and management in two ways: 1) time-related contextualization throughout the innovation process and 2) spatial

allocation and fitting of results in comparison to other innovative ideas regarding the same landscape. Each empirical paper indicates further steps for practical integration needed to promote landscape design in the SP region. I generally conclude that continual learning of social actors can be reached through recurring and updating acceptability analyses at a later stage of the project.

Principle 2 – Common concern entry

This principle describes the advantage of seeking a shared vision regarding problem awareness, risk perception or landscape concern for the design of a landscape strategy. Building such a shared vision should take place at an early stage of the design process. Therefore, it is labelled as a 'common concern entry' by Sayer et al. (2013). A 'common concern entry' for landscape approaches can be achieved by a trustful negotiation process that is based on involving the different local actors' and their specific perceptions and values.

Acceptability analyses at attitude level have the objective to gain knowledge about the perceptions, attitudes, and values of actors. P1 notes that the analysis of acceptability generally generates knowledge about the degree of acceptability (e.g., rejection, tolerance, high acceptance) and the underlying factors for these decision outcomes. From a practice-oriented perspective, the coincidence of shared problem awareness (P2 and P3) can be seen as a factor that positively enhances decisions, hence promoting acceptance. Only if the acceptability subjects (landowners and farmers) perceive wetland abandonment as a sustainability problem or shared landscape concern will they even consider innovative problem solutions. However, P2 and P3 also showed that the acceptance of the overarching objective – in this case, the maintenance of wetland meadows – does not automatically imply that the innovations are accepted as well. An additional important aspect of the 'common concern entry' is the active creation of shared values. P2 concludes that land pools would be more accepted if local actors (coordinators of the innovation process and the users of the innovation) trust each other and if shared values can be identified. Focusing on another innovative idea to cope with the wetland problem in the SP, P3 reveals that acceptability decisions about local biomass plants are influenced by social and ethical values related to why and how to preserve a landscape. If the actors, who initiate and develop the pilot type of an innovation and other potential users do not share the same values, their acceptance is often low. These shared values are the basis for the creation of a joint vision for the purpose of the landscape strategy. These aspects are addressed in a more conceptual manner in P4 and P5. In P4, I integrated the creation of shared values in the ALDC concept. P5 indicates that

shared problem awareness or a coincidence of values comprise a good starting point for building up a successful CLM, which is not only valid for the SP case study but also for other landscape contexts (e.g., Biggs et al., 2010).

Sayer et al. (2013) point out that trust emerges when shared values and objectives exist among actors. Whereas, I conclude that to build up shared values, actors must trust each other and that shared values must be jointly identified, as opposed to the coincidence of values (cf. Kenter et al. 2015). To identify actors' values and objectives acceptability analysis is a suitable methodological approach.

Principle 3 – Multiple scales

The third principle refers to interactions among different spatial scales when dealing with landscapes. Constraints that hamper the inclusion of multiple scales include the lack of connectivity between spatial scales regarding analyses and outcomes or the challenge of linking local concerns to macroscale drivers (Sayer et al., 2013).

Taking synergies and trade-offs at different spatial scales into account, their effect on other spatial scales is an important issue in improving interventions on landscapes (Sayer et al., 2013). This should also be reflected in acceptability studies in landscape contexts. For instance, Fournis and Fortin (2017) emphasize that the definition of the applied scale plays a certain role in analysing the social acceptability of renewable energies. This aspect has been included in the definition of acceptability (P1). Normally, acceptability analyses *could* be conducted at more than one scale but *are* finally conducted at a predefined and spatially explicit scale. Thus, the interactions with other scales are often limited in extent. Investigating cross-scale interactions might be important when investigating the implementation of sustainable innovations and their ecological, economic, political, and social consequences on other scales or regions (Allen, 2007; Biggs et al., 2010). P2 and P3 deal mainly with a specific landscape at the regional level. Nonetheless, mentioning the issues of legislation, funding, or knowledge exchange, and showing the global relevance of cultural landscape abandonment underlines the link to the national and international scales. The interaction between regional and local scales is applied in the analysis of land pools by investigating the acceptability of two case study areas within the SP (cf. P2). In addition, P4 and P5 are oriented to local-regional scale interactions.

Principle 4 – Multifunctionality

Multifunctionality in landscapes means that landscapes have and are intended for diverse uses, purposes, and functions which have to be reflected concerning their compatibility. The various dimensions include the following: production functions (agricultural use, renewable energy production, etc.), ecological functions (e.g., regulation and habitat functions), and socio-cultural functions, such as recreation or touristic use and its use for infrastructure and settlements (Mander and Uuemaa, 2015). Multifunctionality often provokes trade-offs between diverging uses (Sayer et al., 2013).

The issue of the different functionalities of landscapes is addressed in the concept of acceptability by recognizing the existence of the multiple objects and subjects for which acceptability studies can be carried out (P1). Aiming at multifunctionality can be beneficial but also a source of conflict among actors. Thus, acceptability studies are often conducted to identify such conflicting interests. The empirical papers (P2, P3, and P5) deal with the harmonization of agricultural use, touristic use, recreational use, nature protection use and the local energy supply. In particular, the social values of landscapes, such as cultural identity and cultural heritage, are considered. These values are mostly connected to a landscape's 'traditional uses' (e.g., agricultural use). Generally, multifunctionality is a key issue in the ALDC approach and CLM. The purpose of both landscape approaches is also to create synergies of uses and minimize trade-offs. Analyses of spatial synergies and trade-offs of landscape functions or services are often mapped by probabilistic and clustering approaches (Turner et al., 2014; Ungaro et al., 2014), but the basis for this mapping is seldom jointly discussed, as proposed in the ALDC and CLM.

Principle 5 – Multiple stakeholders

The fifth principle is strongly connected to the last principle in that the recognition of multifunctionality is based on the fact that in landscapes the concerns of a diversity of actors and stakeholders become important. The different actors and actor groups might have diverging interests, preferences, and demands regarding landscapes uses. Therefore, they should be included and recognized in the landscape design (Sayer et al., 2013). However, the authors do not describe how to identify the different attitudes. I suggest that conducting acceptability analyses would be a suitable a methodological approach to achieve this.

The definition of acceptability – presented in paper 1 – is inspired by recognizing different actors and stakeholders as possible acceptability subjects. The acceptability subject must be precisely defined for a suitable analysis to be conducted. P2 deals with the acceptability of land pools by landowners and land users (farmers and hunters). Actors concerned with nature conservation are considered because of their role as initiators of land pools in the region. In contrast, P3 focuses primarily on farmers' attitudes and demands regarding wetland use, and less on their interactions with other actors. Nevertheless, opinions always comprise a continuous consideration of the social context, which includes the attitudes and actions of other people and groups. The papers dealing with collaborative landscape approaches (P4 and P5) rely and build on the idea of including multiple actors. Diverging interests and demands related to the same landscape require joint efforts, communication, negotiation, and consensus-building to cope with landscape problems (Olsson et al., 2004; Reed, 2008). Doing so can improve the legitimacy of decision making (Johansson et al., 2018).

Principle 6 – Negotiated & transparent change logic

This principle is characterized by the concepts of trust, procedural justice, and transparency (Sayer et al., 2013). Whereas, the 'common concern entry' (principle 2) might be the starting point of landscape design, principle 6 relies on the continual negotiation of the 'change logic' (objectives, measures, innovations, etc.) during the whole process. The term 'processes' includes innovation processes in landscape contexts, development of landscape designs, and implementation processes of landscape management strategies.

The literature review on acceptability studies (P1) revealed that trust, procedural justice, and transparency are important acceptability factors but often go unheeded in many acceptability studies. In the case study on land pools (P2), interviewees noted the need for trust in coordinating actors and a fair and transparent innovation process. In P3, the farmers named trust as an influencing factor but not as one of the most important factors. Similar to P2 and P3, the paper on CLM shows that trust is an essential precondition for collaborations. Advocating 'negotiated and transparent change logic' is the main driver behind the ALDC approach. P4 notes that trust, transparency, and fairness are crucial guidelines in the ALDC approach. They can be identified as acceptability factors and are also vital to the refinement and re-design step of landscape design. However, such a transparent process based on equal footing bears the opportunity to build up shared values.

Principle 7 – Clarification of rights and responsibilities

This principle refers to the fair rules related to resource uses to prevent or resolve conflicts. In the landscape approach, all rights and responsibilities should be clarified and, in due course, accepted by all stakeholders (Sayer et al., 2013). Such bottom-up or community-based initiatives aim at replacing the less suitable command-and-control concepts (Cleaver and Whaley, 2018; Pahl-Wostl et al., 2007). The new mode of shared responsibilities must involve capacity-building and facilitation.

Principle 7 was not included in the definition of acceptability (P1) because that definition aims at explaining the complex characteristics of acceptability and not at connecting acceptability to landscape governance. Nonetheless, the purpose of dealing with acceptability is often grounded in fostering bottom-up initiatives. Generally, conducting acceptability studies is of interest if project coordinators aim at including the opinions, preferences, and attitudes of other actors with a stake in the landscape. P2 and P3 introduce two bottom-up innovations. In the case of land pools (P2), the project 'ginkoo' attempted to find an alternative to the common model of official land pools, as the latter is command-control-oriented. Normally, the state government forms a formal administration union (in German, the so-called '*Zweckverband*') and buys the land from private landowners to establish a certified land pool. In the case of SP, the procedure was different. The land pool manager is the civic Spreewald foundation ('*Bürgerstiftung Kulturlandschaft Spreewald'*), an informal institution. The idea is to involve the landowners as collaborators who will retain their ownership rights but provide the pool manager with user rights to their land. Thus, the wetlands are jointly managed and could be maintained by a local farmer. The implementation of local biomass plants is also a bottom-up initiative (P3). The demonstration plants could be installed through the joint efforts of the BR administration, the Spreewald foundation, a regional agricultural advisor, the builder of the biomass plant and the farmer. An acceptability analysis revealed a low acceptance among local farmers of the implementation of private biomass plants on their farms within the next few years. The conclusion in P3 was that an alternative to on-farm biomass plants could be a plant at the community level. In this context, some of the farmers interviewed said they would be willing to collaborate by supplying their landscape material to such a community-based biomass plant. The idea of fostering different bottom-up initiatives (e.g., land pools and biomass plants) and combining them with a landscape strategy jointly developed by various regional actors was the underlying basis for the ALDC approach (P4). The ALDC assumes that not only in the specific context of the SP but also for other

landscapes, when coping with a complex landscape or social-ecological problem one must consider various innovative ideas and spread the responsibility over various shoulders. P5 takes up this idea and expands it to include the collaboration of regional tourist agencies. Tourism directly benefits from the beauty and diversity of the SP landscape. However, thus far tourism agencies have not been involved in financing wetland maintenance measures. In several regional workshops with providers of touristic services, opportunities for collaboration were discussed and tourist donations selected as the most suitable financing instrument in the SP. As P5 notes, initiating collaboration among different actors requires further efforts. The lesson learned from the case study can be transferred to other landscapes where establishing a CLM is targeted.

Principle 8 – Participatory and user-friendly monitoring

Participatory monitoring refers to the constant monitoring of landscape changes and demands on the landscape while ensuring fair knowledge access, joint knowledge generation, continuous knowledge integration, and mutual learning. Sayer et al. (2013, 4) emphasize that when actors "*have agreed on desirable actions and outcomes, they will share an interest in assessing progress*." This statement illustrates the direct link to acceptability studies and acceptability enhancement measures. P1 identified participation in terms of continuous knowledge integration as an often-unheeded acceptability factor to which more attention should be paid. In terms of land pools (P2), all study participants claimed the need for transparent and accessible knowledge. In contrast, in P3 this aspect was stated by farmers as being an influencing factor but not as one of the most important acceptability factors. In the ALDC approach (P4), fair participation is a key issue that could potentially lead to long-term CLM actions between formerly separated actors (P5). An additional aspect in the context of this principle is that acceptability studies can be used as monitoring practice for identifying changes in landscape interests and demands, as proposed in the ALDC approach.

Principle 9 – Resilience

Sayer et al. (2013, 4) define resilience as the capacity to reduce the vulnerabilities of landscapes and to "*recover from their manifestations*". In contrast, Folke et al. (2010) emphasize that resilience is more about change adaptation and absorbing disturbances by simultaneously maintaining key functions in landscapes without necessarily persisting in the original state. Regardless of these different definitions and interpretations, the resilience of landscapes can be

improved by the active recognition of threats and vulnerabilities to be dealt with (Sayer et al., 2013). Ensuring the resilience of social-ecological systems, especially of landscapes, is one rationale behind implementing sustainability innovations, for instance, in terms of adaptive and collaborative approaches. Analysing the acceptability of such sustainability innovations is therefore necessary to promote resilience. Although resilience is not explicitly mentioned in P1 to P3 or in P5, it is an indirectly relevant issue. In the ALDC approach (P4), resilience is incorporated by referring to adaptive co-management (Olsson et al., 2004).

Principle 10 – Strengthened stakeholder capacity

The last principle is dedicated to the abilities and skills of actors to collaborate in landscape approaches. 'Strengthened stakeholder capacity' involves building social capital, providing exchange platforms (e.g., in form of civic organizations and deliberative processes), and having sufficient time and financing resources. As the literature review (P1) revealed, acceptability analyses are often conducted to strategically introduce acceptance enhancement measures. Enhancing acceptance through participation and deliberative processes is deemed important. However, which abilities are necessary to effectively involve actors is not an issue in P1. The need for sufficient resources for participation and collaboration is mentioned as necessary in the concluding section of P2. Similarly, P3 names this as an aspect of the further innovation process of biomass plants in the SP. Capacity-building and fostering abilities are widely discussed in the CLM paper (P5) as key issues. It is suggested facilitating 'stakeholder capacity' through the TD processes. The challenge of providing resources to coordinate innovation processes is addressed in terms of the ALDC approach (P4). The resource needs of other actors are generally considered but are not emphasized in this paper.

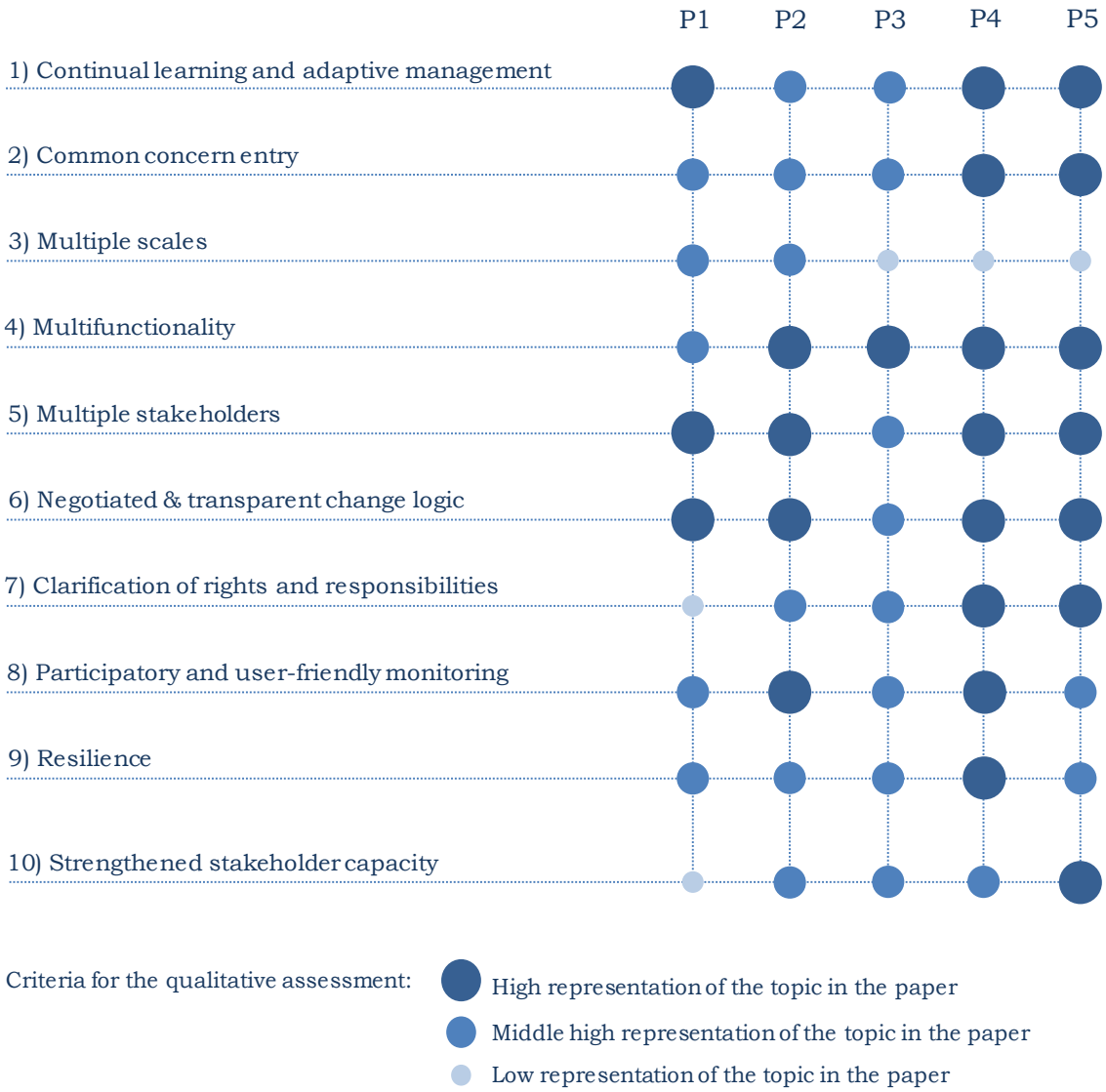

Figure 7: Overview of the contributions of the papers to landscape approach principles (based on Sayer et al., 2013)

Integrating acceptability analyses into the landscape approach principles

The landscape approach principles are best represented in the ALDC approach (see figure 7). This finding is not surprising because the ALDC approach reveals the link between studying acceptability and landscape co-design and management. Generally, acceptability analyses are in great demand to scan the objectives of and opportunities in landscape approaches. Moreover, landscape approach principles are strongly focused on the interactions between human activities and the environment. Such a perspective on landscape approaches is in line with the substance of this dissertation. Both the dissertation and the landscape approach principles are founded on the assumption that landscapes are social-ecological systems.

Despite acceptability plays implicitly a role in the landscape approach principles, acceptability analyses are not an explicit part of these principles. I interpret this as a shortcoming of the landscape approaches because in-depth knowledge about the acceptability of sustainability innovations by local actors are the precondition for identifying shared visions, developing suitable landscape designs, and implementing them successfully on the long run. To overcome this shortcoming acceptability analyses should be included into the principles which are directly dedicated to stakeholder involvement and participation: common concern entry point, multiple stakeholders, negotiated and transparent change logic, participatory and user-friendly monitoring, strengthen stakeholder capacity. Especially in the principle 'multiple stakeholders' acceptability studies are a key aspect. Sayer et al. (2013) state that it is needed to identify and recognize the concerns and aspirations of the different stakeholders. However, the authors do not describe how to achieve this. Conducting acceptability analyses are a suitable methodological approach to identify stakeholders' attitudes, concerns, values, perceptions, and motivations to derive adequate acceptability enhancement measures beyond fair participation in the process. In the remaining stakeholder-related principles should be mentioned that trust among stakeholders, transparent communication and actions and procedural justice are acceptability factors that are ideally derived from an in-depth acceptability analysis instead of be generally anticipated as important. Generally, Sayer et al. (2013) offer only a few indications by which methods the landscape approach principles can be operationalized and implemented. The findings of this dissertation, especially the ALDC approach and CLM, provide conceptual inspiration how to operationalize the landscape approach principles.

In conclusion, the previous discussion shows not only that the landscape approach principles are recognized in the papers but also that the papers contribute to the advancement of the principles themselves.

8.3 Contribution to landscape planning and research

The review article (P1) showed that acceptability studies on landscapes and land use is an increasing and very sought-after research field. However, an article reviewing existing definitions, studies, and applied concepts has, to date, been missing. The first paper in this dissertation provides not only such an analysis but also a holistic definition of acceptability. This definition integrates many different perspectives, the complexity of acceptability, and offers sufficient flexibility for broad application. The possibility of widely applying the definition is necessary

because acceptability analyses per se are used in manifold contexts. Specifying the definition to only some issues (e.g., to renewable energy or sustainable agriculture alone), as it was often done before (cf. Wüstenhagen et al., 2007; Fournis and Fortin 2017), would have meant less transferability. The definition served to develop an acceptability framework that was introduced in the empirical papers (P2 and P3). This framework – also extensively presented in section 2.6 of the framing text – was used to guide the acceptability analyses. The empirical papers offer examples of the range of possible applications. Although the case study region used and the regional problem framing in its overall conditions is the same, there are differences between acceptability factors and degrees related to both analysed innovations. Acceptability factors and acceptability degrees depend on the objects, subjects, and specific contexts analysed (cf. Lucke, 1995). In conclusion, such a revealed diversity of factors in apparently similar case studies generally advocates an 'open approach' – an approach that does not fix factors previously – to analysing acceptability (P1).

Furthermore, conceptualizing acceptability from a sociological landscape perspective is unique, and has not been done before by other researchers. The ALDC approach combines a sociological understanding of acceptability (including the 'recursive pattern of acceptability') with collaborative landscape approaches. Two currently trendy and widely applied research branches have merged to provide a novel approach that opens new applications for 1) landscape planning and management practice and 2) research on landscapes. 1) Using the ALDC facilitates the elaboration of accepted designs and management concepts for specific landscapes. Suitable strategies and instruments for the current and complex challenges in landscapes can be compiled (e.g., expressed in the SDGs). Additionally, the ALDC approach complies with the widespread calls to implement more democratically based discussion processes into landscape planning and to facilitate bottom-up, community-based, and context-sensitive decision making (Marschall, 2018; Scott, 2011). The approach contributes to creating strategies on a regional or landscape level by providing adapted innovative solutions for particular sections or areas in landscapes and by connecting these to a spatial network. 2) The ALDC approach provides the past-due conceptualization of acceptability as a response to the practical demands of adequate approaches and to the research gap of separated literature strands. By contributing to a better understanding of human–environmental interactions, the ALDC promotes the understanding of landscapes as social-ecological systems and advances the state-of-the-art of the landscape approach principles. As outlined before, not only the ALDC approach but also all the other conceptual parts of this

dissertation (the new definition, the acceptability analysis approach) offer through their broad application potential to a wide range of topics further research opportunities.

8.4 Further research needs and opportunities

Although this dissertation contributes to several objectives and challenges in science and practice, there are also some issues that could not be explored in detail during the dissertation project. Therefore, I now discuss further research needs to address the limitations of this work, and outline future research opportunities that can be derived from this dissertation.

The case study papers are focused on a single region: the SP. Such a singular focus could be interpreted as a kind of research limitation. However, because this dissertation is directly linked to the 'ginkoo' research project, expanding research to other regions was not viable. To consolidate the acceptability framework and to iteratively refine the ALDC approach, further research in other case study regions should be performed. This could reveal the types of landscape concerns and spatial scales for which the conceptualization of acceptability would be suitable and transferable.

As seen in the analysis presented in section 3.2, this dissertation primarily deals with local and regional scales, which was appropriate to satisfy the objective of implementing place-based sustainability innovations. Examining scale interactions, especially the importance of local–regional results for national or even global scales, could be a next step.

The empirical works applied the developed framework to explore the acceptability at the attitude level. Given their theoretical potential, analyses could also be conducted at the action level and long-term use level. The progress status of the innovation process in the SP is still in its infancy. Thus, innovation has been only tested but not widely implemented in practice. Dependence on the practical progress in the case study region made it impossible to analyse the action and long-term use levels. Future research should analyse acceptability degrees and factors after implementing of the innovations (land pools and biomass plants). A suitable research question could be the following: How acceptability degrees and factors differ among attitude level, action level, and long-term use level? These insights could be used to continue the iterative cycle of redesigning and refining the landscape co-design, and thus to update the ALDC process, in the SP.

In its current state, the ALDC approach focuses on socio-cultural issues. Although ecological knowledge is the driving force behind the ALDC – through the recognition of a nature conservation concern in the landscape – explicit ecological knowledge is not in itself an issue

within the approach. To become a comprehensive social-ecological approach, a greater ecological orientation could be added to the ALDC. In this respect, two interesting research questions are the following: At which steps of the ALDC is ecological knowledge needed and/or favourable? Which techniques could suitably integrate such knowledge?

The ALDC is essentially a bottom-up approach that is not legally binding. The ALDC can potentially complement the current landscape planning system with legally necessary top-down approaches and institutions. Such a complementation can be achieved by including a broader diversity of actors (landowners, tourism providers, local recreational visitors, etc.) and additional concerns that are not necessarily covered by formal procedures. It might be interesting to explore how the ALDC approach fits into the formal landscape planning system, and how the informal actors' involvement (in terms of the ALDC approach) can be linked to the formal actors' involvement procedure in landscape planning (multi-stage process: public statement, consultation, display, and discussion).

In general, balancing the costs and benefits of landscape interventions is recommended. Indeed, going through the entire ALDC takes a long time and consumes resources. On the one hand, investigating whether the ALDC procedure (including acceptability analyses and conducted acceptance enhancement actions) is efficient is difficult to measure. Having an example of a successful and efficient application of the ALDC could facilitate the dissemination of this approach in practice. On the other hand, landscape planners and managers must also consider the long-term costs of non-acceptance or even opposition as outcomes of a missing or 'false' participation or of a hasty implementation of plans. Thus, in the long run, the ALDC might be more efficient than initially assumed because social inclusion and fairness are paying off. Landscape is of special importance for most locals. The empirical work presented in this dissertation is in line with the statement by Scott (2011, 2754) that "*landscapes have the power to inspire, captivate and mobilize people, providing the arena within which land use change and development are negotiated and contested*". Therefore, locals often wish to participate in landscape developments and decisions. By combining acceptability issues with collaborative landscape approaches, the ALDC and CLM provide opportunities to meet this demand.

9. References

Ajibade, P., 2018. Technology acceptance model limitations and criticisms: Exploring the practical applications and use in technology-related studies, mixed-method, and qualitative Researches. Library Philosophy and Practice.

Allen, C.D., 2007. Interactions across spatial scales among forest Dieback, Fire, and Erosion in Northern New Mexico Landscapes. Ecosystems 10, 797–808. https://doi.org/10.1007/s10021-007-9057-4

Anderson, C., Schirmer, J., Abjorensen, N., 2012. Exploring CCS community acceptance and public participation from a human and social capital perspective. Mitigation and Adaptation Strategies for Global Change 17, 687–706. https://doi.org/10.1007/s11027-011-9312-z

Antrop, M., 2006. From holistic landscape synthesis to transdisciplinary landscape management, in: Tess, B., Fry, G., Opdam, P., Tress, G. (Eds.), From Landscape Research to Landscape Planning. Springer, Dordrecht, pp. 27–50.

Assefa, G., Frostell, B., 2007. Social sustainability and social acceptance in technology assessment: A case study of energy technologies. Technology in Society 29, 63–78. https://doi.org/10.1016/j.techsoc.2006.10.007

Aznar-Sánchez, J.A., Piquer-Rodríguez, M., Velasco-Muñoz, J.F., Manzano-Agugliaro, F., 2019. Worldwide research trends on sustainable land use in agriculture. Land Use Policy 87, 104069. https://doi.org/10.1016/j.landusepol.2019.104069

Berkes, F., 2009. Evolution of co-management: Role of knowledge generation, bridging organizations and social learning. Journal of Environmental Management 90, 1692–1702. https://doi.org/10.1016/j.jenvman.2008.12.001

Beunen, R., Opdam, P., 2011. When landscape planning becomes landscape governance, what happens to the science? Landscape and Urban Planning 100, 324–326. https://doi.org/10.1016/j.landurbplan.2011.01.018

Biggs, R., Westley, F.R., Carpenter, S.R., 2010. Navigating the Back Loop: Fostering Social Innovation and Transformation in Ecosystem Management. Ecology and Society 15. https://doi.org/10.5751/ES-03411-150209

Bodin, Ö., 2017. Collaborative environmental governance: Achieving collective action in social-ecological systems. Science 357, eaan1114. https://doi.org/10.1126/science.aan1114

Brandt, P., Ernst, A., Gralla, F., Luederitz, C., Lang, D.J., Newig, J., Reinert, F., Abson, D.J., von Wehrden, H., 2013. A review of transdisciplinary research in sustainability science. Ecological Economics 92, 1–15. https://doi.org/10.1016/j.ecolecon.2013.04.008

Busse, M., Heitepriem, N., Siebert, R., 2019. The Acceptability of Land Pools for the Sustainable Revalorisation of Wetland Meadows in the Spreewald Region, Germany. Sustainability 11, 4056. https://doi.org/10.3390/su11154056

Busse, M., Siebert, R., 2018. Acceptance studies in the field of land use—A critical and systematic review to advance the conceptualization of acceptance and acceptability. Land Use Policy 76, 235–245. https://doi.org/10.1016/j.landusepol.2018.05.016

Campellone, R.M., Chouinard, K.M., Fisichelli, N.A., Gallo, J.A., Lujan, J.R., McCormick, R.J., Miewald, T.A., Murry, B.A., John Pierce, D., Shively, D.R., 2018. The iCASS Platform: Nine principles for landscape conservation design. Landscape and Urban Planning 176, 64–74. https://doi.org/10.1016/j.landurbplan.2018.04.008

Caporale, D., De Lucia, C., 2015. Social acceptance of on-shore wind energy in Apulia Region (Southern Italy). Renewable and Sustainable Energy Reviews 52, 1378–1390. https://doi.org/10.1016/j.rser.2015.07.183

Chan, K.M.A., Balvanera, P., Benessaiah, K., Chapman, M., Díaz, S., Gómez-Baggethun, E., Gould, R., Hannahs, N., Jax, K., Klain, S., Luck, G.W., Martín-López, B., Muraca, B., Norton, B., Ott, K., Pascual, U., Satterfield, T., Tadaki, M., Taggart, J., Turner, N., 2016. Opinion: Why protect nature? Rethinking values and the environment. Proceedings of the National Academy of Sciences 113, 1462–1465. https://doi.org/10.1073/pnas.1525002113

Cleaver, F., Whaley, L., 2018. Understanding process, power, and meaning in adaptive governance: a critical institutional reading. Ecology and Society 23. https://doi.org/10.5751/ES-10212-230249

Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Paruelo, J., Raskin, R.G., Sutton, P., van den Belt, M., 1997. The value of the world's ecosystem services and natural capital. Nature 387, 253–260. https://doi.org/10.1038/387253a0

Council of Europe, 2000. European Landscape Convention, European Treaty Series - No. 176. Council of Europe, Florence.

Davis, F.D., 1989. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. MIS Quarterly 13, 319. https://doi.org/10.2307/249008

De Groot, R.S., Alkemade, R., Braat, L., Hein, L., Willemen, L., 2010. Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making. Ecological Complexity 7, 260–272. https://doi.org/10.1016/j.ecocom.2009.10.006

De Vreese, R., Van Herzele, A., Dendoncker, N., Fontaine, C.M., Leys, M., 2019. Are stakeholders' social representations of nature and landscape compatible with the ecosystem service concept? Ecosystem Services 37, 100911. https://doi.org/10.1016/j.ecoser.2019.100911

Díaz, S., Pascual, U., Stenseke, M., Martín-López, B., Watson, R.T., Molnár, Z., Hill, R., Chan, K.M.A., Baste, I.A., Brauman, K.A., Polasky, S., Church, A., Lonsdale, M., Larigauderie, A., Leadley, P.W., van Oudenhoven, A.P.E., van der Plaat, F., Schröter, M., Lavorel, S., Aumeeruddy-Thomas, Y., Bukvareva, E., Davies, K., Demissew, S., Erpul, G., Failler, P., Guerra, C.A., Hewitt, C.L., Keune, H., Lindley, S., Shirayama, Y., 2018. Assessing nature's contributions to people. Science 359, 270–272. https://doi.org/10.1126/science.aap8826

Dramstad, W.E., Fjellstad, W.J., 2011. Landscapes: Bridging the gaps between science, policy and people. Landscape and Urban Planning 100, 330–332. https://doi.org/10.1016/j.landurbplan.2011.02.003

Elzen, B., Wieczorek, A., 2005. Transitions towards sustainability through system innovation. Technological Forecasting and Social Change 72, 651–661. https://doi.org/10.1016/j.techfore.2005.04.002

Eswarlal, V.K., Vasudevan, G., Dey, P.K., Vasudevan, P., 2014. Role of community acceptance in sustainable bioenergy projects in India. Energy Policy 73, 333–343. https://doi.org/10.1016/j.enpol.2014.04.019

Folke, C., S. R. Carpenter, B. Walker, M. Scheffer, T. Chapin, Rockström, J. 2010. Resilience thinking: integrating resilience, adaptability and transformability. Ecology and Society 15(4): 20. https://doi.org/10.5751/ES-03610-150420

Folke, C., Hahn, T., Olsson, P., Norberg, J., 2005. Adaptive governance of social-ecological systems. Annual Review of Environment and Resources 30, 441–473. https://doi.org/10.1146/annurev.energy.30.050504.144511

Fournis, Y., Fortin, M.-J., 2017. From social 'acceptance' to social 'acceptability' of wind energy projects: towards a territorial perspective. Journal of Environmental Planning and Management 60, 1–21. https://doi.org/10.1080/09640568.2015.1133406

Ganzevles, J., Asveld, L., Osseweijer, P., 2015. Extending bioenergy towards smart biomass use Issues of social acceptance at Park Cuijk, The Netherlands. Energy, Sustainability and Society 5, 22. https://doi.org/10.1186/s13705-015-0053-9

Greider, T., Garkovich, L., 1994. Landscapes: The Social Construction of Nature and the Environment. Rural Sociology 59, 1–24. https://doi.org/10.1111/j.1549-0831.1994.tb00519.x

Guba, E.G., Lincoln, Y.S., 2005. Guba, E. G., & Lincoln, Y. S. (2005). Paradigmatic Controversies, Contradictions, and Emerging Confluences. In N. K. Denzin & Y. S. Lincoln (Eds.), (pp. 191-215)., in: Denzin, N.K., Lincoln, Y.S. (Eds.), The Sage Handbook of Qualitative Research. SAGE Publications, Thousand Oaks, pp. 191–215.

Habermas, J., 1982. Theorie des kommunikativen Handelns:, 10. Aufl. ed, Theorie des kommunikativen Handelns. Suhrkamp, Frankfurt/Main.

Hazard, L., Steyaert, P., Martin, G., Couix, N., Navas, M.-L., Duru, M., Lauvie, A., Labatut, J., 2018. Mutual learning between researchers and farmers during implementation of scientific principles for sustainable development: the case of biodiversity-based agriculture. Sustainability Science 13, 517–530. https://doi.org/10.1007/s11625-017-0440-6

Hemström, K., Mahapatra, K., Gustavsson, L., 2014. Public Perceptions and Acceptance of Intensive Forestry in Sweden. AMBIO 43, 196–206. https://doi.org/10.1007/s13280-013-0411-9

Hennink, M.M., Hutter, I., Bailey, A., 2011. Qualitative research methods. SAGE Publications, Thousand Oaks.

Hitzeroth, M., Megerle, A., 2013. Renewable Energy Projects: Acceptance Risks and Their Management. Renewable and Sustainable Energy 27, 576–584.

Johansson, J., Sandström, C., Lundmark, T., 2018. Inspired by structured decision making: a collaborative approach to the governance of multiple forest values. Ecology and Society 23. https://doi.org/10.5751/ES-10347-230416

Kenter, J.O., 2018. IPBES: Don't throw out the baby whilst keeping the bathwater; Put people's values central, not nature's contributions. Ecosystem Services 33, 40–43. https://doi.org/10.1016/j.ecoser.2018.08.002

Kenter, J.O., O'Brien, L., Hockley, N., Ravenscroft, N., Fazey, I., Irvine, K.N., Reed, M.S., Christie, M., Brady, E., Bryce, R., Church, A., Cooper, N., Davies, A., Evely, A., Everard, M., Fish, R., Fisher, J.A., Jobstvogt, N., Molloy, C., Orchard-Webb, J., Ranger, S., Ryan, M., Watson, V., Williams, S., 2015. What are shared and social values of ecosystems? Ecological Economics 111, 86–99. https://doi.org/10.1016/j.ecolecon.2015.01.006

Kleemann, F., Krähnke, U., Matuschek, I., 2013. Interpretative Sozialforschung: eine Einführung in die Praxis des Interpretierens, 2. ed, Lehrbuch. Springer VS, Wiesbaden.

Klewitz, J., Hansen, E.G., 2014. Sustainability-oriented innovation of SMEs: a systematic review. Journal of Cleaner Production 65, 57–75. https://doi.org/10.1016/j.jclepro.2013.07.017

Kollmann, T., 1998. Akzeptanz innovativer Nutzungsgüter und -systeme: Konsequenzen für die Einführung von Telekommunikations- und Multimediasystemen. Gabler, Wiesbaden.

Kuckartz, U., 2014. Qualitative Text Analysis: A Guide to Methods, Practice & Using Software - SAGE Research Methods. SAGE Publications, Thousand Oaks.

Loft, L., Mann, C., Hansjürgens, B., 2015. Challenges in ecosystem services governance: Multi-levels, multi-actors, multi-rationalities. Ecosystem Services 16, 150–157. https://doi.org/10.1016/j.ecoser.2015.11.002

Lucke, D., 1995. Akzeptanz. Legitimität in der "Abstimmungsgesellschaft," 2. Auflage. ed. Leske + Budrich Verlag, Opladen.

Lyytinen, K., Damsgaard, J., 2001. What's Wrong with the Diffusion of Innovation Theory?, in: Ardis, M.A., Marcolin, B.L. (Eds.), Diffusing Software Product and Process Innovations. Springer US, Boston, MA, pp. 173–190. https://doi.org/10.1007/978-0-387-35404-0_11

MA, 2005. Ecosystems and human well-being. Synthesis. Millennium Ecosystem Assessment, Washington, DC.

Mallett, A., 2007a. Social acceptance of renewable energy innovations: The role of technology cooperation in urban Mexico. Energy Policy 35, 2790–2798. https://doi.org/10.1016/j.enpol.2006.12.008

Mander, Ü., Uuemaa, E., 2015. Landscape Planning, in: Encyclopedia of Ecology. Elsevier, pp. 532–544. https://doi.org/10.1016/B978-0-12-409548-9.09478-1

Marschall, I., 2018. 40 Jahre Landschaftsplanung im BNatSchG – Ideen und Entwicklungen Landschaftsplanung als konzeptionelles Instrument – Meilensteine, in: Marschall, I. (Ed.), Landschaftsplanung im Prozess und Dialog, BfN-Skripte. Bonn - Bad Godesberg.

Mayring, P., 2007. Generalisierung in qualitativer Forschung. Forum Qualitative Sozialforschung / Forum: Qualitative Social Research 8, 26.

Meadowcroft, J., 2007. National sustainable development strategies: features, challenges and reflexivity. European Environment 17, 152–163. https://doi.org/10.1002/eet.450

Meinefeld, W. 1997. Ex-ante Hypothesen in der Qualitativen Sozialforschung: zwischen „fehl am Platz" und „unverzichtbar". Zeitschrift für Soziologie 26(1), 22–34.

Moon, K., Blackman, D.A., Adams, V.M., Colvin, R.M., Davila, F., Evans, M.C., Januchowski-Hartley, S.R., Bennett, N.J., Dickinson, H., Sandbrook, C., Sherren, K., St. John, F.A.V., van Kerkhoff, L., Wyborn, C., 2019. Expanding the role of social science in conservation through an

engagement with philosophy, methodology, and methods. Methods in Ecology and Evolution 10, 294–302. https://doi.org/10.1111/2041-210X.13126

Moon, K., Brewer, T.D., Januchowski-Hartley, S.R., Adams, V.M., Blackman, D.A., 2016. A guideline to improve qualitative social science publishing in ecology and conservation journals. Ecology and Society 21. https://doi.org/10.5751/ES-08663-210317

Mose, I. (Ed.), 2009. Wahrnehmung und Akzeptanz von Großschutzgebieten, Wahrnehmungsgeographische Studien. BIS-Verl. der Carl-von-Ossietzky-Universität, Oldenburg.

Nassauer, J.I., Opdam, P., 2008. Design in science: extending the landscape ecology paradigm. Landscape Ecology 23, 633–644. https://doi.org/10.1007/s10980-008-9226-7

Olsson, P., Folke, C., Berkes, F., 2004. Adaptive Comanagement for Building Resilience in Social-Ecological Systems. Environmental Management 34 (1):75–90. https://doi.org/10.1007/s00267-003-0101-7

Onwuegbuzie, A.J., Leech, N.L., 2007. Sampling Designs in Qualitative Research: Making the Sampling Process More Public. The Qualitative Report 12, 238–254.

Opdam, P., Coninx, I., Dewulf, A., Steingröver, E., Vos, C., van der Wal, M., 2016. Does information on landscape benefits influence collective action in landscape governance? Current Opinion in Environmental Sustainability 18, 107–114. https://doi.org/10.1016/j.cosust.2015.12.006

Opdam, P., Luque, S., Nassauer, J., Verburg, P.H., Wu, J., 2018. How can landscape ecology contribute to sustainability science? Landscape Ecology 33, 1–7. https://doi.org/10.1007/s10980-018-0610-7

Oppermann, B., 2018. Vom Hörsaal in den Tanzsaal ins Internet - Zur Genese der dialogorientierten Landschaftsplanung, in: Marschall, I. (Ed.), 40 Jahre Landschaftsplanung Im BNatSchG – Ideen Und Entwicklungen Landschaftsplanung Als Konzeptionelles Instrument – Meilensteine, BfN-Skripte. Bonn - Bad Godesberg.

Ostrom, E., 2007. A diagnostic approach for going beyond panaceas. Proceedings of the National Academy of Sciences 104, 15181–15187. https://doi.org/10.1073/pnas.0702288104

Ott, K., 2018. Naturschutztheorie. Dossier Bioehtik.

Ott, K., 2015. Zur Dimension des Naturschutzes in einer Theorie starker Nachhaltigkeit, Beiträge zur Theorie und Praxis starker Nachhaltigkeit. Metropolis Verlag, Marburg.

Pahl-Wostl, C., Craps, M., Dewulf, A., Mostert, E., Tabara, D., Taillieu, T., 2007. Social Learning and Water Resources Management. Ecology and Society 12. https://doi.org/10.5751/ES-02037-120205

Patton, M.Q., 2002. Qualitative research and evaluation methods, 3 ed. SAGE Publications, Thousand Oaks.

Peat, M., Moon, K., Dyer, F., Johnson, W., Nichols, S.J., 2017. Creating institutional flexibility for adaptive water management: insights from two management agencies. Journal of Environmental Management 202, 188–197. https://doi.org/10.1016/j.jenvman.2017.06.059

Plieninger, T., Bieling, C., Fagerholm, N., Byg, A., Hartel, T., Hurley, P., López-Santiago, C.A., Nagabhatla, N., Oteros-Rozas, E., Raymond, C.M., van der Horst, D., Huntsinger, L., 2015. The role of cultural ecosystem services in landscape management and planning. Current Opinion in Environmental Sustainability 14, 28–33. https://doi.org/10.1016/j.cosust.2015.02.006

Prager, K., Posthumus, H., 2010. Adopting sustainable soil management – the role of socio-economic factors. Presented at the 16th Annual International Sustainable Development Research Conference, Hong Kong.

Ragin, C.C., 2000. Fuzzy-set social science. University of Chicago Press, Chicago.

Raven, R.P.J.M., Mourik, R.M., Feenstra, C.F.J., Heiskanen, E., 2009. Modulating societal acceptance in new energy projects : towards a toolkit methodology for project managers. Energy 34, 564–574. https://doi.org/10.1016/j.energy.2008.08.012

Reed, J., Van Vianen, J., Deakin, E.L., Barlow, J., Sunderland, T., 2016. Integrated landscape approaches to managing social and environmental issues in the tropics: learning from the past to guide the future. Global Change Biology 22, 2540–2554. https://doi.org/10.1111/gcb.13284

Reed, M.S., 2008. Stakeholder participation for environmental management: A literature review. Biological Conservation 141, 2417–2431. https://doi.org/10.1016/j.biocon.2008.07.014

Reed, M.S., Evely, A.C., Cundill, G., Fazey, I., Glass, J., Laing, A., Newig, J., Parrish, B., Prell, C., Raymond, C., Stringer, L.C., 2010. What is Social Learning? Ecology and Society 15. https://doi.org/10.5751/ES-03564-1504r01

Reed, M.S., Fraser, E.D.G., Dougill, A.J., 2006. An adaptive learning process for developing and applying sustainability indicators with local communities. Ecological Economics 59, 406–418. https://doi.org/10.1016/j.ecolecon.2005.11.008

Rennings, K., 2000. Redefining innovation — eco-innovation research and the contribution from ecological economics. Ecological Economics 32, 319–332. https://doi.org/10.1016/S0921-8009(99)00112-3

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F.S., Lambin, E.F., Lenton, T.M., Scheffer, M., Folke, C., Schellnhuber, H.J., Nykvist, B., de Wit, C.A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P.K., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R.W., Fabry, V.J., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P., Foley, J.A., 2009. A safe operating space for humanity. Nature 461, 472–475. https://doi.org/10.1038/461472a

Rogers, E.M., 2003. Diffusion of Innovations, 5th ed. Free Press, New York.

Ruschkowski von, E., 2009. Ursachen und Lösungsansätze für Akzeptanzprobleme von Großschutzgebieten (Disseration). Gottfried Wilhelm Leibniz Universität Hannover, Hannover.

Ryan, R.L., 2011. The social landscape of planning: Integrating social and perceptual research with spatial planning information. Landscape and Urban Planning 100, 361–363. https://doi.org/10.1016/j.landurbplan.2011.01.015

Sattler, C., Nagel, U.J., 2010. Factors affecting farmers' acceptance of conservation measures—A case study from north-eastern Germany. Land Use Policy 27, 70–77. https://doi.org/10.1016/j.landusepol.2008.02.002

Sauer, A., Luz, F., Suda, M., Weiland, U., 2005. Steigerung der Akzeptanz von FFH-Gebieten (No. 144), BfN-Skripten. Bundesamt für Naturschutz, Bonn - Bad Godesberg.

Saunders, M.N., Lewis, P., Thornhill, A., Bristow, A., 2009. Understanding research philosophy and approaches to theory development, in: Saunders, M.N., Lewis, P., Thornhill, A. (Eds.), Research Methods for Business Students. Pearson Education, Harlow, pp. 122–161.

Sayer, J., Sunderland, T., Ghazoul, J., Pfund, J.-L., Sheil, D., Meijaard, E., Venter, M., Boedhihartono, A.K., Day, M., Garcia, C., van Oosten, C., Buck, L.E., 2013. Ten principles for a landscape approach to reconciling agriculture, conservation, and other competing land uses. Proceedings of the National Academy of Sciences 110, 8349–8356. https://doi.org/10.1073/pnas.1210595110

Schenk, A., Hunziker, M., Kienast, F., 2007. Factors influencing the acceptance of nature conservation measures—A qualitative study in Switzerland. Journal of Environmental Management 83, 66–79. https://doi.org/10.1016/j.jenvman.2006.01.010

Schneider, C.Q., Wagemann, C., 2013. Set-theoretic methods for the social sciences: a guide to qualitative comparative analysis, Strategies for social inquiry. Cambridge University Press, Cambrigde.

Scott, A., 2011. Beyond the conventional: Meeting the challenges of landscape governance within the European Landscape Convention? Journal of Environmental Management 92, 2754–2762. https://doi.org/10.1016/j.jenvman.2011.06.017

Spartz, J.T., Rickenbach, M., Shaw, B.R., 2015. Public perceptions of bioenergy and land use change: Comparing narrative frames of agriculture and forestry. Biomass and Bioenergy 75, 1–10. https://doi.org/10.1016/j.biombioe.2015.01.026

Specht, K., Siebert, R., Hartmann, I., Freisinger, U.B., Sawicka, M., Werner, A., Thomaier, S., Henckel, D., Walk, H., Dierich, A., 2014. Urban agriculture of the future: an overview of sustainability aspects of food production in and on buildings. Agriculture and Human Values 31, 33–51. https://doi.org/10.1007/s10460-013-9448-4

Specht, K., Weith, T., Swoboda, K., Siebert, R., 2016. Socially acceptable urban agriculture businesses. Agronomy for Sustainable Development 36. https://doi.org/10.1007/s13593-016-0355-0

Stock, T., Obenaus, M., Slaymaker, A., Seliger, G., 2017. A Model for the Development of Sustainable Innovations for the Early Phase of the Innovation Process. Procedia Manufacturing 8, 215–222. https://doi.org/10.1016/j.promfg.2017.02.027

Swaffield, S., 2013. Empowering landscape ecology-connecting science to governance through design values. Landscape Ecology 28, 1193–1201. https://doi.org/10.1007/s10980-012-9765-9

TEEB, 2010. Mainstreaming the economics of nature: a synthesis of the approach, conclusions and recommendations of TEEB, The economics of ecosystems & biodiversity. UNEP, Geneva.

Termorshuizen, J.W., Opdam, P., 2009. Landscape services as a bridge between landscape ecology and sustainable development. Landscape Ecology 24, 1037–1052. https://doi.org/10.1007/s10980-008-9314-8

Trimble, M., Berkes, F., 2013. Participatory research towards co-management: Lessons from artisanal fisheries in coastal Uruguay. Journal of Environmental Management 128, 768–778. https://doi.org/10.1016/j.jenvman.2013.06.032

Turner, K.G., Odgaard, M.V., Bøcher, P.K., Dalgaard, T., Svenning, J.-C., 2014. Bundling ecosystem services in Denmark: Trade-offs and synergies in a cultural landscape. Landscape and Urban Planning 125, 89–104. https://doi.org/10.1016/j.landurbplan.2014.02.007

Ungaro, F., Zasada, I., Piorr, A., 2014. Mapping landscape services, spatial synergies and trade-offs. A case study using variogram models and geostatistical simulations in an agrarian

landscape in North-East Germany. Ecological Indicators 46, 367–378. https://doi.org/10.1016/j.ecolind.2014.06.039

Vergragt, P., Akenji, L., Dewick, P., 2014. Sustainable production, consumption, and livelihoods: global and regional research perspectives. Journal of Cleaner Production, Special Volume: Sustainable Production, Consumption and Livelihoods: Global and Regional Research Perspectives 63, 1–12. https://doi.org/10.1016/j.jclepro.2013.09.028

WCED, 1987. Report of the World Commission on Environment and Development. Our common future. World Commission on Environment and Development.

Weber, M., 1922. Wirtschaft und Gesellschaft: 3. Abteilung des Grundrisses der Sozialökonomik. Mohr, Thübingen.

Weiland, S., Bleicher, A., Polzin, C., Rauschmayer, F., Rode, J., 2017. The nature of experiments for sustainability transformations: A search for common ground. Journal of Cleaner Production 169, 30–38. https://doi.org/10.1016/j.jclepro.2017.06.182

Westerink, J., Opdam, P., van Rooij, S., Steingröver, E., 2017. Landscape services as boundary concept in landscape governance: Building social capital in collaboration and adapting the landscape. Land Use Policy 60, 408–418. https://doi.org/10.1016/j.landusepol.2016.11.006

Westley, F., Olsson, P., Folke, C., Homer-Dixon, T., Vredenburg, H., Loorbach, D., Thompson, J., Nilsson, M., Lambin, E., Sendzimir, J., Banerjee, B., Galaz, V., van der Leeuw, S., 2011. Tipping Toward Sustainability: Emerging Pathways of Transformation. AMBIO 40, 762–780. https://doi.org/10.1007/s13280-011-0186-9

Williams, K.J.H., 2014. Public acceptance of plantation forestry: Implications for policy and practice in Australian rural landscape. Land Use Policy 38, 346–354. https://doi.org/10.1016/j.landusepol.2013.11.023

Wolsink, M., 2018. Co-production in distributed generation: renewable energy and creating space for fitting infrastructure within landscapes. Landscape Research 43, 542–561. https://doi.org/10.1080/01426397.2017.1358360

Wolsink, M., 2012. Wind power: basic challenge concerning social acceptance, in: Encyclopedia of Sustainability Science and Technology. Springer, New York, pp. 12218–12254. https://doi.org/10.1007/SpringerReference_301324

Wolsink, M., 2010. Contested environmental policy infrastructure: Socio-political acceptance of renewable energy, water, and waste facilities. Environmental Impact Assessment Review 30, 302–311. https://doi.org/10.1016/j.eiar.2010.01.001

Wüstenhagen, R., Wolsink, M., Bürer, M.J., 2007. Social acceptance of renewable energy innovation: An introduction to the concept. Energy Policy 35, 2683–2691. https://doi.org/10.1016/j.enpol.2006.12.001

Yin, R.K., 2013. Case study research: design and methods, Fifth ed. SAGE Publications, Thousand Oaks.

Zscheischler, J., Rogga, S., Busse, M., 2017. The Adoption and Implementation of Transdisciplinary Research in the Field of Land-Use Science—A Comparative Case Study. Sustainability 9, 1926. https://doi.org/10.3390/su9111926

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11. Contribution statements

Paper 1: Busse, Maria; Siebert, Rosemarie (2018): Acceptance studies in the field of land use—A critical and systematic review to advance the conceptualization of acceptance and acceptability. Land Use Policy 76, 235-245.

My contribution to paper 1: very substantial contribution to conceptualization (concept of paper, sole contribution: definition of acceptability); sole contribution to data collection, analysis of data, data curation, and writing the paper

Paper 2: Busse, Maria; Heitepriem, Nico; Siebert, Rosemarie (2019): The acceptability of land pools for the sustainable revalorisation of wetland meadows in the Spreewald region, Germany. Sustainability 11, 4056.

My contribution to paper 2: sole contribution to conceptualization (concept of paper, framework), methodology (interview guideline, analysis of data and data curation), and writing the paper; very substantial contribution to data collection and visualization

Paper 3: Busse, Maria; Siebert, Rosemarie; Heitepriem, Nico (2019): Acceptability of innovative biomass heating plants in a German case study – A contribution to cultural landscape management and local energy supply. Energy, Sustainability and Society, 9:36.

My contribution to paper 3: very substantial contribution to conceptualization (concept of paper, framework), and writing the manuscript; sole contribution to methodology (interview guideline, data collection, analysis of data, and data curation)

Paper 4: Busse, Maria; Heitepriem, Nico; Zscheischler, Jana; Siebert, Rosemarie (2019): Integration of acceptability studies into an adaptive landscape co-design and management – The acceptability and landscape design cycle (ALDC).

My contribution to paper 4: very substantial contribution to conceptualization (concept of paper, approach), methodology, and writing the manuscript

Paper 5: Zscheischler, Jana; Busse, Maria; Heitepriem, Nico (2019): Challenges to build up a Collaborative Landscape Management (CLM) ‑ Lessons from a stakeholder analysis in Germany. Environmental Management 64, 580-592.

My contribution to paper 5: contribution to conceptualization (concept of paper), methodology (analysis and validation of data), and writing the manuscript; very substantial contribution to data collection

12. Declarations

Erklärungen gemäß §5, Abs. 1 der Promotionsordnung

Hiermit erkläre ich, dass mir die geltende PromO der TU Berlin vom 23. Oktober 2006, zuletzt geändert mit der Änderungssatzung vom 15. Januar 2014, bekannt ist.

Hiermit erkläre ich, dass ich alle Vorveröffentlichungen im Rahmen der Dissertation, die Co-Autorinnen bzw. Co-Autoren sowie die Eigenanteile (substantieller Beitrag) gemäß §2 (4) PromO im Anhang angegeben habe.

Hiermit erkläre ich, dass ich alle Anträge auf Anmeldung einer Promotionsabsicht oder Eröffnung eines Verfahrens unter 2. bzw. 4. angegeben habe.

Hiermit erkläre ich an Eides statt, dass ich die Dissertation selbstständig verfasst habe. Alle benutzen Quellen und Hilfsmittel sind aufgeführt und die Angaben zu den Eigenanteilen bei Co-Autorenschaft sind zutreffend.

Datum, Unterschrift der Antragstellerin bzw. des Antragstellers

13. Supplement materials

Supplement A

Supplement A corresponds to the publication ‘The Acceptability of Land Pools for the Sustainable Revalorisation of Wetland Meadows in the Spreewald Region, Germany’ (Paper 2).

Each column of table S1 and S2 presents an overview of all the important statements made per interview across the different topics. These topics are based on the interview guideline. To allocate statements to deductive analytical categories (e.g., subject-related factors, object-related factors, and innovation-process-related factors), the analytical framework of acceptability was used.

Table S1. Profile matrix of CS1.

Attitudes	**CS1-01**	**CS1-02**	**CS1-03**	**CS1-04**
Cultural landscape (stated values)	Importance for region & agricultural use **(public instrumental values)**	Importance for regional-cultural identity **(eudemonistic value)**, importance for region, agricultural use, species conservation **(mix of instrumental, intrinsic & eudemonistic values)**	Importance for regional-cultural identity **(eudemonistic value)**, importance for region, agricultural use, species conservation **(mix of instrumental, intrinsic & eudemonistic values)**	Beauty of CL, recreation (**eudemonistic values**), important for region, agricultural use and tourism (**instrumental values**), abundant landscape, mosaic of different elements
Degree of appreciation	**High**	**High**	**High**	**High**
Maintenance of wet meadows	**Values:** see above; **O:** wetland as important part of CL, maintenance through agricultural use **(++); SI:** own engagement through mowing the grass **(+); SA:** trust in coordinating actors **(-)**	**Values:** see above; **O:** maintenance is important **(++),** unbalanced focus on wetlands **(-)**, currently no fair payments for maintenance **(-)**, need for maintenance programme with monitoring **(-)**, **SI:** high personal relation to wetlands **(++)**; **SA:** lack of trust in coordinating actors **(-),** negative prior experiences **(-); IP:** need for involvement of additional actors **(-)**	**Values:** see above; **O:** maintenance is important, maintenance through use **(++)**, unbalanced focus on wetlands **(-)**, currently no fair payments for maintenance **(-)**; **SI:** high personal relation to wetlands **(++)**; **SA:** lack of trust in coordinating actors **(-),** negative prior experiences **(-)**; **IP:** need for involvement of additional actors **(-)**, procedural justice **(-)**	**Values:** (agricultural) use of wetlands most important (instrumental value); **O:** aim generally positive **(+)**, unbalanced focus on wetlands, need for include water management **(-)**; **SI:** no expert of the region; **SA:** negative prior experiences, lack of trust in nature conservational actors, water mismanagement = expropriation **(-)**, **IP:** need for involve land owners **(-),**procedural justice **(-)**
Degree of acceptability	**High acceptance / engagement**	**Conditional acceptance / engagement**	**High acceptance/ conditional acceptance**	**High acceptance /conditional acceptance**
Maintenance of specific wet meadow (CS1)	**O:** Biased focus on SKG, selection of area **(--); SI:** low relation to SKG, but high relation to other areas; **A:** trust in coordinating actors **(--)**	no specific statements for SGK, **SI:** low relation to SKG, but high relation to other areas;	**O:** biased focus on SGK, selection of areas **(-)**, **O:** need for permanent guarantee of maintenance measures **(-);SI:** low relation to SKG, but high relation to other areas;	**O:** positive to maintain SGK **(+)**, area is generally problematic for use **(+)**, **SI:** personal benefit, relief of owner **(+)**
Degree of acceptability	**Low acceptance /rejection**		**Conditional acceptance / rejection**	**High**

Land pool (CS1)	**O:** No clear identification with objective, organisation of maintenance measures **(--);** entry in the land register, security interests in immovable property = problematic **(---)**; **SA:** lack of trust in coordinating actors **(--)**; **IP:** procedural justice **(--)**	**O:** No clear identification with objective, organisation of maintenance measures **(--)**, entry in the land register, security interests in immovable property = problematic **(--)**, prefers another solution **(-)**	**O:** No clear identification with objective **(--)**, entry in the land register, security interests in immovable property = problematic **(---)**, **SI:** loss of capacity of agency **(-)**	**O:** no clear identification with objective **(-)**, good solution for SGK **(+)**, maintenance measures will conducted **(+)**, fixing the land use, entry in land register = unproblematic **(+)**, financial relief **(+)**, stay in property **(+); SA:** scepticism concerning coordinating actors **(-)**, currently trust relation is given **(+); IP:** need for involvement of all actors early in the process
Degree of acceptability	**Rejection / conditional acceptance**	**Rejection / conditional acceptance**	**Rejection**	**Conditional acceptance / high acceptance**

Table S2. Profile matrix of CS2

Attitudes	**CS2-01**	**CS2-02**	**CS2-03**	**CS2-04**	**CS2-05**	**CS2-06**	**CS2-07**	**CS2-08**	**CS2-09**
Values concerning the maintenance of the CL	Importance for biodiversity, region & tourism **(mix of instrumental, intrinsic & eudemonistic values)**	Importance for nature conservation, regional-cultural identity & region **(mix of intrinsic, eudemonistic & instrumental values)**	Recreation; importance for regional-cultural identity **(eudemonistic values)**; importance for region, tourism, nature conservation **(mix of instrumental, intrinsic & eudemonistic values)**	Economic value of landscape (**individual & public instrumental values)**	Economic value of landscape, importance of property saving (**individual & public instrumental values)**	Importance for regional-cultural identity **(eudemonistic value)**, importance for region & nature conservation **(mix of instrumental, intrinsic & eudemonistic values)**	Importance for region and biodiversity conservation **(mix of intrinsic, eudemonistic & instrumental values)**	Beauty, recreation **(eudemonistic values)**, importance for region & agricultural use (**public instrumental values)**	Importance for biodiversity conservation & for region & tourism **(mix of instrumental, intrinsic & eudemonistic values)**
Degree of appreciation	**High**	**High**	**High**	**Conditional acceptance**	**Tolerance / conditional a.**	**High**	**High**	**High**	**High / engagement**

Maintenance of wetlands	**Values:** see above; **O:** unbalanced focus on wetlands **(--)**; **IP:** additional actors need to be involved **(-); SA:** lack of trust in coordinating actors **(-)**	**Values:** see above; especially: importance for nature conservation (intrinsic value)	**Values:** see above; **O:** meadows as part of CL **(+)**, Similar arguments as concerning specific site	**Values:** see above**,** importance of property saving; **O:** agricultural use of wet meadows important **(+)**;**SA:** lack of trust **(-)**; negative prior experience **(-); P:** additional actors need to be involved **(-)**	**Values:** see above; **O:** other elements of CL more important **(-) ; SA:** lack of trust **(-)**; negative prior experience **(-); IP:** lack of transparency; participation **(--)**;	**Values:** see above; **O:** maintenance of wet meadows very important (**++**)	**Values:** see above; **O:** objective **(+)**, maintenance for region & biodiversity **(++)**; **SI:** ownership obligation **(+)**	**Values:** see above, maintenance trough agricultural use, **O:** meadows as part of CL **(+)**, no clear identification with the objective **(-)**,	**Values:** see above, maintenance trough use; **O:** meadows as part of CL **(++),** objective **(+)**; **SA:** positive experience **(++)**, trust in coordinating actors **(++)**
Degree of acceptability	**Rejection /conditional a.**	**High acceptance**	**Conditional acceptance**	**Conditional acceptance**	**Indifference**	**High acceptance**	**High acceptance**	**Indifference / conditional a.**	**High / engagement**
Maintenance of specific wetland (CS2)	**SI:** high personal relation, self-identified expert of area development; **O:** unbalanced focus on wetlands **(--)**, biased focus on KB **(--)**;**SA:** lack of trust in coordinating actors **(-)**;	**SI:** low personal relation to area; ownership obligation **(+)** **IP:** positive prior experiences **(+)**	**SI:** middle - high personal relation to area; loss of capacity of agency **(-),** ownership obligation **(+)**; **O:** agricultural use of wet meadows important **(++)**, unbalanced species conservation **(-)**; **SA:** lack of trust in actors **(-)**; **IP:** previous experiences **(-)**;	**Individual functional value:** importance of property saving; **SI:** very high relation to area (use); **O:** agricultural use of wet meadows important **(+)**,**SA:** lack of trust in coordinating actors**(-)**, previous experiences **(-);** water mismanagement = expropriation **(-)**,	**Individual functional value:** importance of property saving; **SI:** low –middle relation to area	**Public functional value & intrinsic values:** see above; **Individual functional value:** importance of property saving; **SI:** low relation to area, low capacity of agency **(-)**;	Same arguments as described in "maintenance of wet meadows"; no differentiation between wet meadows in general and specific site; **SI:** low personal relation to area	**Eudemonistic values:** hunting, beauty, wellbeing; **public instrumental values:** importance for nature conservation; **SI:** high relation to area **(-)**; **O:** no clear identification with the objective **(--)**, **IP:** procedural justice **(+)**	**SI:** high personal relation to area; **SA:** positive experience **(++)**, trust in coordinating actors **(++)**; **O:** objective **(++)**
Degree of acceptability	**Rejection /conditional a.**	**High acceptance**	**Conditional acceptance**	**Conditional acceptance**	**Indifference**	**High acceptance**	**High acceptance**	**Indifference / conditional a.**	**High / engagement**

Land pool (CS2)	**O:** prefers another solution **(-),** financing through compensation payments **(-)**;**SI:** loss of capacity of agency **(-)**; **SA:** lack of trust in coordinating actors **(--)**;**IP:** participation, procedural justice is important **(+)**	**O:** security interests in immovable property = unproblematic **(+)**, stay in family **(+);** **SA:** trust in coordinating actors **(+)**; **IP:** participation, procedural justice **(+)**	**O:** maintenance through use **(+++)**, security interests in immovable property = unproblematic **(+)**; **SA:** trust in coordinating actors **(+)**;**IP:** participation, procedural justice **(+++)**	**O:** lack of information **(-)**, low financial compensation **(--)**, prefers another solution **(--)**; planning security is important; **SA:** lack of trust **(-)**, negative prior experiences **(-)**;**IP:** participation, procedural justice **(+)**	**O:** security interests in immovable property = problematic **(-)**; **SI:** loss of capacity of agency **(-)**; **SA:** lack of trust **(-)**, negative prior experiences **(-)**;	**O:** security interests in immovable property = problematic **(-),** preference of existing tenancy agreement **(-)**; **IP:** participation, procedural justice **(+)**	**O:** maintenance through use **(+)**, conservation of biodiversity **(++)**, cost-benefit analysis necessary; **IP:** procedural justice **(+)**	**O:** security interests in immovable property = problematic **(---)**, no clear identification with the objective **(--)**; **SA:** trust in coordinating actors **(+)**; **SI:** loss of capacity of agency **(---)**; **IP:** procedural justice **(++)**;	**O:** objective **(++),** **O:** security interests in immovable property = unproblematic **(+)**, planned measures **(+)**, sufficient information **(+)**; **SA:** positive experience **(++)**, trust in coordinating actors **(++)**; **SI:** professional interest **(++)**, perceived personal benefit through involvement **(+)**; **IP:** importance of own participation **(+)**
Degree of acceptability	**Rejection**	**High acceptance**	**Conditional a. / high a.**	**Rejection / conditional a.**	**Doubt / conditional a.**	**Doubt / conditional a.**	**High acceptance**	**Rejection / conditional a.**	**High & engagement**

Legend:
SI = subject-related factors are individual-related factors or self-regarding
SA = subject-related factors (related to other actors)
O = object-related factors (regarded to the characteristics of an innovation from the perspective of the interviewed person (e.g., costs, objective, form)
IP = innovation-process-related factors
(+) = positive, (++) = very positive, (+++) extraordinary positive
(-) = negative, (--) = very negative, (---) KO criteria
The intensity/degree of the factor is based on the specific argumentation in the interviews (qualitative evaluation, verbal statement of the interviewee if it is an important and less important argument) and on the stated frequency of the factor during the interview.

Supplement B

Supplement B contains the additional files 1 to 6, which correspond to the publication 'Acceptability of innovative biomass heating plants in a German case study—a contribution to cultural landscape management and local energy supply' (Paper 3).

Additional file 1: List of interviews

Interview ID	Original ID	Actors group	Interview phase	Included in QCA
Farmer1 - 17	SPTV01 - 17	Farmers	Main phase (2018)	Yes
Farmer18 - 23	SP3, SP10-SP13, SPKB04	Farmers	Explorative phase (2015 /2016)	No
Expert1	SP01	Promoter of integrated cultural land management	Explorative phase (2015)	No No
Expert2	SP04	Regional conservationist	Explorative phase (2015)	No
Expert3	SP07	Regional advisory agent	Explorative phase (2015)	No

Additional file 2: Questionnaire for interviewing farmers regarding their acceptance of local heating plants

PART 1: General Information

1) Is agriculture you main or a sideline occupation?			
□ main occupation		□ sideline occupation	
2) What is your farm's legal structure?			
□ sole proprietorship		□ partnership (e.g., partnerships under civil law)	
□ legal entity (e.g. plc, limited liability company, registered cooperative)		□ another structure, namely _____	
3) Are you, as the farm's manager, also its owner?			
□ yes		□ no	
4) How many years of experience do you have in farming?			
_____ years			
5) Age			
□ < 30 years	□ 31 – 45 years	□ 45 - 60 years	□ > 60 years
6) Gender			
□ male		□ female	

7) How large is the agricultural area that you cultivate?	
_____ ha	_____ ha thereof are permanent grassland
8) Where is your permanent grassland located?	
□ Oberspreewald	□ Unterspreewald
9) How many hectares of your permanent grassland are on lease?	
_____ ha	
10) What is your farm's main focus of production?	
□ forage and fodder crops > 2/3	□ mixed farming (livestock farming > 1/3, but ≤ 2/3)
□ crop farming (> 2/3)	□ mixed farming (crop farming > 1/3, but ≤ 2/3)
□ horticulture (> 2/3)	□ another focus, namely: _____
11) How is the permanent grassland currently used?	
□ exclusively pasture	□ exclusively mowing
□ pasture and mowing	□ no usage on approx. _____ ha, because _____
12) In which zone of the Biosphere Reserve is your permanent grassland located?	
□ mainly (> 2/3) in zone 2	□ mainly (> 2/3) in zone 3 or 4
□ another distribution, namely _____	
13) What is your livestock's composition?	
□ dairy cattle (incl. progeny); number: _____	□ mother cows (incl. calves); number: _____
□ beef cattle, number: _____	□ I do not keep any animals.
□ others:_____, number: ____	
14) Please indicate how many ha of grassland are unproblematic, temporarily, and permanently problematic.	
_____ ha are unproblematic	_____ ha are temporarily problematic (only usable in some years)
____ ha are problematic (rarely or not at all usable)	
15) Why are those areas problematic?	
□ too wet in years with average precipitation	□ many single or fragmented areas that are geographically dispersed
□ difficult to access, e.g. only by boat	□ for other reasons, namely _____
16) Which funding schemes and agri-environmental (AE) measures do you participate in?	
□ nature conservation contracts (Vertragsnaturschutz)	□ meadow protection programme of the Spreewald (Spreewaldwiesenprogramm)
□ peatland protection by damming (EAFRD)	□ Natura 2000 payments (EAFRD)
□ others, namely _____ on _____ ha	

PART 2: Biomass heating plants (Energy production from landscape conservation material)

17) Will you need a new heating plant within the next 5 years?	
□ yes	□ no
□ Yes, but I will not install a new plant because _____	
18) Which facilities on your farm are to be heated?	
□ stables	□ residential buildings
□ farm buildings (except stables)	□ drying plant for cereals
□ holiday home / room rental	□ other, namely: _____
19) How many kW should a heating plant on your farm be able to generate?	
□ < 50 kW	□ 51 – 100 KW)
□ 101 – 250 KW	□ > 250 KW
20) How did you first hear about thermal utilization?	
□ through the local pilot plant	□ through the scheduled local information event
□ through acquaintances in the region, namely:	□ through others, namely:
□ I do not know it.	

21) How likely do you think it is that you will use thermal utilization of landscape conservation materials on your farm in (within?) the next 5 years? (read out the categories)	
□ impossible	□ rather unlikely
□ rather likely	□ very likely
□ it is hard to tell, no answer	

Please indicate to what extent you agree with the following statements.

22) Attitude towards landscape and the usage of landscape conservation materials:

	I completely agree.	I mostly agree.	I mostly disagree.	I disagree.	n. s. / I do not know
I generally think it is okay to use mowed material not only as fodder or bedding, but also to produce energy.	☐	☐	☐	☐	☐
Heat production from mowed material is a convenient opportunity (among others) to keep the regional meadows cultivated and to restart cultivating abandoned land.	☐	☐	☐	☐	☐
It is reasonable to use the mowed material, which will accrue anyways, for heat production.	☐	☐	☐	☐	☐
I think it is good that mowed material is a local source of energy that can be used on-site by companies.	☐	☐	☐	☐	☐

23) Attitude towards technology and the its stage of development:					
	I completely agree.	I mostly agree	I mostly disagree.	I disagree.	n. s. / I do not know
I am generally very interested in the technology for "energy production with mowed material".	☐	☐	☐	☐	☐
To my knowledge, the technology seems to be well advanced.	☐	☐	☐	☐	☐

24) Attitude towards the expenditure:					
	I completely agree.	I mostly agree.	I mostly disagree.	I disagree.	n. s. / I do not know.
I consider the investment costs of a "hay gasifier" to be too high compared to wood heating systems.	☐	☐	☐	☐	☐
I would depend on subsidies for the investment costs.	☐	☐	☐	☐	☐
The operating costs of a heating plant seem to be difficult to estimate compared to wood heating systems.	☐	☐	☐	☐	☐

25) Current requirements:					
	I completely agree.	I mostly agree	I mostly disagree.	I disagree.	n. s. / I do not know.
I am satisfied with my current heating plant. It fulfills my requirements for the next years.	☐	☐	☐	☐	☐
(Only for "I disagree": I will need a new heating plant, but I already decided to use another type of heating.)	☐	☐	☐	☐	☐
I DO NOT have any meadows that are available for energy production (requirements: late cut, at least once a year).	☐	☐	☐	☐	☐
I only want to be a producer and distributor for "energy hay", but I do not want to acquire an oven.	☐	☐	☐	☐	☐

26) Planning and implementation:					
	I completely agree.	I mostly agree.	I mostly disagree.	I disagree.	n. s. / I do not know.
I already have components of my current heating plant (rooms, chimney, boiler etc.) that I could use.	☐	☐	☐	☐	☐
The planning effort of such a plant seems to be acceptable compared to a wood heating system.	☐	☐	☐	☐	☐
(Only to be asked for plants with 250 kW:) I would accept the effort of a procedure according to the Federal Immission Control Act.	☐	☐	☐	☐	☐

27) In ongoing operation:					
	I completely agree.	**I mostly agree.**	**I mostly disagree.**	**I disagree.**	**n. s. / I do not know.**
It is good and important that the areas will still be supported by agricultural subsidy schemes.	☐	☐	☐	☐	☐
I think it is good that by using mowed material for heating, I can influence my own heating costs.	☐	☐	☐	☐	☐
I own the necessary technology for harvesting and transport.	☐	☐	☐	☐	☐
I do have storage options for the mowed material (a covering of fleece or roofing).	☐	☐	☐	☐	☐
I can easily integrate the additional work tasks into my operational processes.	☐	☐	☐	☐	☐

28) Development process and communication in the region:					
	I completely agree.	**I mostly agree.**	**I mostly disagree.**	**I disagree.**	**n. s. / I do not know**
The existence of a pilot plant is important and useful.	☐	☐	☐	☐	☐
The exchange of information and views on heating plants with other farmers, consultants, etc. is important for me.	☐	☐	☐	☐	☐
It is important that the information and persons involved are trustworthy.	☐	☐	☐	☐	☐
It is important to me that I can gain a good insight into the status of the pilot project and that I can participate in the discussion.	☐	☐	☐	☐	☐

29) Are there further reasons that led to your decision, which have not been listed here?	
□ Yes, namely: _____	□ No
30) Do you favor another solution for your problematic wet meadows?	
□ Yes, namely: _____	□ No
31) Is there anything else you would like to add?	
□ Yes, namely: _____	□ No

32) You have told me that you consider it to be … *[insert the answer to question 21]***, that you will install a heating plant on your farm within the next 5 years. After answering the previous questions, would you still indicate the same likelihood?**	
□ Yes	□ No, I would now give the following estimation:
□ impossible	□ rather unlikely
□ rather likely	□ very likely

33) Do you think the technology is worth discussing and recommendable?		
□ yes	□ no	□ I cannot answer this yet.
34) Do you already discuss this technology with colleagues and acquaintances?		
□ yes	□ no, not yet	□ I do not know, not specified
35) Do you think that "thermal utilization" will spread in the region in the future?		
□ yes	□ no	□ I do not know, not specified
36) Is there anything you would like to tell us for the further development and implementation of local biomass heating plants?		
37) Do you have any additional comments on this interview?		

PART 3: Attitude towards the conservation of the open cultural landscape of the Spreewald region

38) How important is it to you that wet meadows as an element of the typical cultural landscape of the Spreewald region are preserved?		
□ very important	□ important	□ not very important
□ not at all important	□ not specified	□ I do not know

39) Please indicate whether you agree or disagree with the following statements on regional wet meadows.			
Cultivation of wet meadows should be continued.	□ Yes	□ No	□ I do not know. /n. s.
They are scenic.	□ Yes	□ No	□ I do not know. /n. s.
They help me to recreate and to relax.	□ Yes	□ No	□ I do not know. /n. s.
They are important for tourism and economy in the region.	□ Yes	□ No	□ I do not know. /n. s.
They are an important feature of the region and of our cultural heritage.	□ Yes	□ No	□ I do not know. /n. s.
They are an important habitat for plants and animals.	□ Yes	□ No	□ I do not know. /n. s.
Other:			

Additional file 3: READY-BARRIER" (the mean of variable "interest in technology" and "perceived readiness" including also relevant qualitative statements)

Combination of variables	Coding of variable "READY-BARRIER"	Explanation
INTEREST (1); READY (0,3)	0	No real barrier
INTEREST (0,7); READY (0,3)	0,3	Low barrier
INTEREST (0,3); READY (0,3)	0,7	High barrier
INTEREST (0); READY (0)	0	No real barrier; "no interest" is a more important barrier
INTEREST (0); READY (99)	0	No real barrier; "no interest" is a more important barrier
INTEREST (0,7); READY (0)	0,7	High barrier; in all cases with this combination (Farmer 7, 8, 20), qualitative statements underline this assumption, e.g.: "*… has teething problems … is a risk because unpredictable problems can occur"* (Farmer7)
INTEREST (0,3); READY (0)	1	Very high barrier
INTEREST (0,7); READY (99)	0,3	Low barrier
INTEREST (1); READY (99)	0	No real barrier

Additional file 4: Truth table for positive outcome (= acceptance) without logical remainders

Ethics	Interest	Ready-barrier	Satisf	Nomat	Number of cases	Raw consist.	PRI consist.	SYM consist.
1	**1**	**0**	**0**	**0**	**4**	**0.816**	**0.756**	**0.903**
1	1	0	1	1	3	0.222	0.000	0.000
1	1	0	1	0	2	0.261	0.000	0.000
1	0	1	1	1	2	0.391	0.000	0.000
0	0	0	1	1	2	0.125	0.000	0.000
1	1	1	1	0	1	0.375	0.000	0.000
1	1	1	0	1	1	0.462	0.000	0.000
1	1	0	0	1	1	0.563	0.000	0.000
1	0	1	0	1	1	0.462	0.000	0.000
Lines in bold are relevant for further minimization (development of conservative solution term by excluding assumptions on logical remainders)								

Additional file 5: Analysis of Necessary Conditions for negative outcome (=rejection)

Conditions tested	Consistency	Coverage
ETHICS	0.788	0.664
ethics	0.254	1.000
INTEREST	0.627	0.680
interest	0.525	1.000
READY-BARRIER	0.423	0.943
ready-barrier	0.703	0.709
SATISF	0.745	0.907
satisf	0.279	0.452
NOMAT	0.694	0.901
nomat	0.355	0.531

Additional file 6: Truth table for negative outcome (= rejection) without logical remainders

Ethics	Interest	Ready-barrier	Satisf	Nomat	Number of cases	Raw consist.	PRI consist.	SYM consist.
1	1	0	0	0	6	0.306	0.081	0.096
1	**1**	**0**	**1**	**1**	**3**	**1.000**	**1.000**	**1.000**
1	**1**	**0**	**1**	**0**	**2**	**1.000**	**1.000**	**1.000**
1	**0**	**1**	**1**	**1**	**2**	**1.000**	**1.000**	**1.000**
0	**0**	**0**	**1**	**1**	**2**	**1.000**	**1.000**	**1.000**
1	**1**	**1**	**1**	**0**	**1**	**1.000**	**1.000**	**1.000**
1	**1**	**1**	**0**	**1**	**1**	**1.000**	**1.000**	**1.000**
1	**1**	**0**	**0**	**1**	**1**	**1.000**	**1.000**	**1.000**
1	**0**	**1**	**0**	**1**	**1**	**1.000**	**1.000**	**1.000**
Lines in bold are relevant for further minimization (development of conservative solution term by excluding assumptions on logical remainders)								