



Research

# Working with or against multifunctional landscapes? A case study of land users' local knowledge of grassland–forest transition zones in northeastern Germany

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**ABSTRACT.** Maintaining or restoring landscape multifunctionality is essential to ensuring that landscapes provide a broad array of services. Increased multifunctionality means that there are more diverse land uses bordering each other. The areas in which land uses interact are transition zones; those between grasslands and forests could fulfill multiple purposes due to their special ecological characteristics that support the needs of diverse species. However, with their management practices, local land users often shape the characteristics of land-use transition zones, with implications for ecological processes that build the base for service provision. Local ecological knowledge of land users could give important insights into the basis of their decisions. Here, we explore how land users' and farmers' local knowledge shapes their management that contributes to the maintenance and restoration of multifunctional landscapes. We conducted 21 semistructured qualitative interviews with livestock farmers and local experts for agriculture and nature conservation using grassland–forest transition zones as a specific example for interdependent components of multifunctional landscapes. We found that local knowledge of the interviewed farmers can contribute to the maintenance or restoration of multifunctional landscapes in several ways: it provides insight into landscape functions in grassland–forest transition zones, it enables land users to use landscape function–grassland production synergies, and it provides insight into the perceived negative and positive contributions of forests to grassland production. The perceived negative contributions of forests to grassland production were an important driver for farmers' management decisions. Farmers have a holistic view of both the field and the landscape. Managing landscapes for multifunctionality is dependent on this kind of holistic knowledge to identify synergies and trade-offs in landscape functions and how they contribute to agricultural production. However, current regulations such as the institutional separation of grassland and forest and grassland area-dependent direct payments prevent farmers from acting according to their local knowledge.

**Key Words:** *actionable knowledge; collaborative landscape management; forest management; grassland management; human–wildlife coexistence; knowledge coproduction; landscape functions; local ecological knowledge; scientific ecological knowledge; stakeholder perceptions*

## INTRODUCTION

Agriculture has undergone tremendous changes in Europe during the last decades. The post-war era of production maximization was followed by another era of reckoning with pressing environmental problems associated with more intensive agriculture. This transition has pushed agricultural practices toward sustainability, accompanied by a shift in farmers' roles to encompass not just production but also landscape management (Burton 2004, Renting et al. 2009). These changes are mirrored in agricultural policies, including the European Common Agricultural Policy (CAP), which has incentivized creating multifunctional agricultural landscapes (European Commission 2020). These landscapes are supposed to serve multiple purposes, including agricultural production, maintaining or restoring habitats for biodiversity, and securing diverse natural resources (Hersperger et al. 2020).

In multifunctional agricultural landscapes, increased connectivity between habitats is needed to promote spillover of ecosystem services and their providers (Grass et al. 2019). Previous work has highlighted that seminatural habitats enhance the functional diversity of species that support ecological processes such as pollination and pest control in adjacent agricultural fields (Birkhofer et al. 2018, Martin et al. 2019, Serafini et al. 2019). However, understanding how far ecosystem services and their

providers spillover across boundaries between seminatural habitats and agricultural land-use systems that make up multifunctional agricultural landscapes is essential to disentangling agricultural management from landscape effects. Focusing on the areas within different land-use systems where spillover effects are visible could be valuable for discerning the effects of management compared to the effects of landscape structure. These areas have previously been referred to as transition zones given that they are characterized by interactions of neighboring land-use types (Schmidt et al. 2017) via ecosystem services and their providers. As an example, we highlight grassland–forest transition zones. Because of past land-use changes and forest fragmentation, these transition zones cover broad parts of European agricultural landscapes (Wade et al. 2003) and can be considered habitats of high ecological relevance (Burst et al. 2017, Erdős et al. 2019).

The characteristics of grassland–forest transition zones depend on farm and forest management, so the managing land users, in particular farmers, largely influence fundamental ecological processes in these areas. These land users are embedded in complex social-ecological systems in which a broad array of drivers affect their decisions regarding landscape changes or management (Edwards-Jones 2006, Ostrom 2007, Ahnström et al. 2009). How they perceive biophysical conditions and spatial

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structures such as grassland–forest transition zones explains their management decisions (Kaltoft 1999, Siebert et al. 2006, Bennett 2016). In particular, the perceived effects of transition zones on the productivity of managed landscapes affects the management practices that farm and forest managers choose. Indeed, increasing or retaining the land’s productivity remains a main motivation for many land users (Kristensen et al. 2016, Preissel et al. 2017).

Land users’ perceptions of their natural environment can be considered part of their local ecological knowledge that can contribute to the restoration and maintenance of multifunctional landscapes (Cebrián-Piqueras et al. 2020). For instance, there is evidence that by aligning funding requirements and regulations with farmers’ knowledge, perceptions, and values, the schemes would be adopted more widely (Marshall 2009, von Münchhausen and Häring 2012, Mettepenningen et al. 2013, Chapman et al. 2019). Local ecological knowledge also determines farmers’ and other land users’ ability to adapt their management practices to diverse local site conditions, comprising multifunctional landscapes (Berkes et al. 2000, Altieri 2004). Finally, farmers’ and land users’ local ecological knowledge has also been considered instrumental to complementing scientific ecological knowledge (Raymond et al. 2010, Tengö et al. 2014, Cebrián-Piqueras et al. 2020) because local ecological knowledge is valued for its site specificity, multiple scales, and ability to cover large time frames (Joa et al. 2018). In this sense, local ecological knowledge is especially suited to characterizing the complex nature of ecological functions within multifunctional landscapes and linking them to specific spatial structures such as transition zones. Therefore, exploring farmers’ and land users’ local ecological knowledge of transition zones is one central condition to restoring and maintaining multifunctional landscapes (Plieninger and Bieling 2013, Duncan et al. 2020).

Farmers manage some of the most species-rich ecosystems throughout Europe (Oppermann et al. 2012, Bernués et al. 2016) and, therefore, their knowledge is especially important for maintaining or restoring habitats for biodiversity and securing diverse natural resources (Plieninger and Bieling 2013). Here, we add to the literature by exploring farmers’ local ecological knowledge and how it may contribute to maintaining or restoring multifunctional landscapes in central Europe. We focus on farmers as land users who affect the multifunctionality of landscapes with their decisions and practices as a spillover from production. We specifically aim: (1) to explore farmers’ local ecological knowledge of landscape functions associated with grassland–forest transition zones, (2) to gather information on their perceived positive or negative contributions on grassland production, and (3) to explore the relationship between local ecological knowledge and management decisions affecting multifunctionality.

## **THEORETICAL BACKGROUND**

Our study is embedded in the wider literature that includes multifunctional landscape management and local ecological knowledge related to conservation and agriculture. Within the scientific literature, the multifunctional use of landscapes is often referred to as the sharing of land to produce food and resources and to conserve ecosystems and their components (Fischer et al. 2017, Grashof-Bokdam et al. 2017). To integrate these sometimes

conflicting goals, it is vital to manage them in a way that makes use of synergies and reduces trade-offs (Pretty 2018, Powers et al. 2020). We use the concept of landscape services (Termorshuizen and Opdam 2009) to identify synergies and trade-offs. We do so by organizing knowledge about ecological functions that land users associate with specific landscape structures and by identifying different values they attach to them. The concept of landscape services differs from ecosystem services (also referred to as environmental services or nature’s contribution to people) in that it accounts for the spatial dimensions of service provision. Using the landscape services concept is especially suitable for exploring ecological functions that are linked to the presence of certain spatial structures such as land use transition zones (Bastian et al. 2014, Westerink et al. 2017).

Ecological functions are the basis for service provision (Termorshuizen and Opdam 2009). They can be defined as the biotic and abiotic processes that occur within an ecosystem and may contribute to the provision of services either directly or indirectly (Garland et al. 2021). If ecosystem functions are linked to spatially explicit landscape characteristics or structures, some authors prefer the term landscape functions (Duarte et al. 2018). However, irrespective of ecosystem or landscape, functions become services when their benefits are valued by humans (Fagerholm et al. 2012). Because of the different understandings and variety of value concepts in the social sciences, we limited our use of values to considering instrumental values as factors that affect farmers’ decisions (Chan et al. 2018). Instrumental values are characterized through a process of value creation that is merely a means to an end to satisfy human needs and preferences. In our study, this idea specifically means understanding farmers’ perceptions of landscape functions as they contribute positively or negatively to grassland production (i.e., forage, or meat, in our case), highlighting their value.

We realize there are many different approaches and lenses that can be used to discern pattern–process relationships in multifunctional landscapes. We chose the structure–function–value framework to organize information and insights from farmers about transition zones. Here, we focus on the relations between spatial structure, in this case, grassland–forest transition zones, perceived landscape functions, and their perceived contributions to grassland production through the farmers’ eyes (Fig. 1). We use the term “contribution” instead of “service” because the former is more neutral and less imbued with a particular ontology. Furthermore, we can simply add “positive,” “negative,” or “ambiguous” to describe how the contribution was valued, and better distinguish perceived synergies and trade-offs. In the context of grassland–forest transition zones, it is particularly interesting to look closely at the perceived negative contributions to agricultural production instead of solely evaluating potentially beneficial landscape functions. Negative contributions of ecological functions currently seem to be understudied, although recent literature underlines the high probability of perceived negative contributions influencing land users’ behavior (Lyytimäki 2015, Blanco et al. 2019, Teixeira et al. 2019).

The interest for knowledge-related themes is increasing within sustainability science, and many authors have acknowledged the importance of land users’ knowledge for sustainable land

**Fig. 1.** Conceptual framework describing the contributions of landscape functions to grassland production dependent on a unique spatial structure (e.g., grassland–forest transition zones). Adapted from Termorshuizen and Opdam (2009).



management in the past years (Berkes and Turner 2006, Tengö et al. 2014, Šūmane et al. 2018, Apetrei et al. 2021). Local ecological knowledge is one form of knowledge that is gained through extensive personal observation of and interaction with local ecosystems (Charnley et al. 2007). It can be differentiated from traditional or solely ecological knowledge in that it is derived from more recent human–environment interactions and shared by a specific group of people (Raymond et al. 2010). The effect of local ecological knowledge on land-user decisions has been explored by several authors (Lamarque et al. 2014, Muhamad et al. 2014, Bernués et al. 2016, Dietze et al. 2019). For instance, Lamarque et al. (2014) found that even though knowledge about ecosystems and their services is considered in farmers’ decision making, it is not the main factor constituting their decisions. Similarly, Muhamad et al. (2014), who studied a rural population’s perception of ecosystem services in a forest–agricultural landscape, suggested that land-user decisions were more dependent on economic incentives than on local ecological knowledge. A literature review of factors influencing farmers’ considerations and engagement for biodiversity conservation in Europe found a range of drivers for land-user decisions stemming from individual, communal, and collective as well as from societal levels (Siebert et al. 2006). Therefore, obtaining insights into how farmers perceive and value spatial landscape structures and their functions for production will shed light on the drivers of farmers’ decisions that do or do not support multifunctional use of landscapes. Exploring local ecological knowledge could therefore be crucial to restoring and maintaining multifunctional landscapes (Hernández-Morcillo et al. 2014, Burton et al. 2020).

The presence of local ecological knowledge alone, however, does not guarantee that farmer management decisions support multifunctional landscapes (Cebrián-Piqueras et al. 2020). Agri-environmental schemes or regulations could be powerful means that support the transition from monofunctional to multifunctional landscapes. However, in Europe, attempts to preserve the diversity of species within agricultural fields, particularly via the CAP, have failed in the past (Nilsson et al. 2019, Pe’er et al. 2020). Such top-down policies and schemes have therefore not been particularly successful in fostering actor-led landscape management that enhances the provision of multiple functions or services. This result can partly be explained by the unidirectional and siloed flow of information or knowledge upon which most current agri-environmental schemes are based (Leventon et al. 2017, Recanati et al. 2019, Dik et al. 2022) Many authors, therefore, highlight the need to integrate different forms of knowledge that are put into action by local decision-makers, including farmers (Kloppenburger 1991, Raymond et al. 2010, Brunet et al. 2018).

Actionable knowledge is knowledge generated through effective collaboration of different stakeholders, leading it to be usable in practice (Stern et al. 2021). Therefore, to produce actionable knowledge, scientific and local knowledge need to be intertwined to represent diverse social, legal, organizational, and political contexts (Mach et al. 2020, Stern et al. 2021). Especially within conservation research, many authors highlight the need to integrate multiple forms and sources of knowledge to focus on the interconnectedness of social and environmental issues and to foster agricultural production alongside biodiversity conservation within multifunctional landscapes (Kloppenburger 1991, Pretty 1995, Berkes 2004). In this regard, local ecological and scientific ecological knowledge are often seen as complementary to each other because of their inherently different ontologies, and their integration potentially overcomes deficits of past conventional ecological research (Joa et al. 2018). Whereas scientific ecological knowledge usually refers to “explicit knowledge that has been derived from applying more formal methods that aim to increase rigour concerning different positions on validity and reliability” (Raymond et al. 2010:1769), local ecological knowledge is valued for its site specificity and consideration of multiple scales (Becker and Ghimire 2003). However, Raymond et al. (2010:1767) see the “different philosophical or epistemological perspectives held by researchers” as a major challenge affecting knowledge integration. To overcome this kind of challenge, the orientation toward predefined problem-focused integration processes might be helpful. In this regard, Westerink et al. (2017) showed that the concept of landscape services can be used as a boundary concept that bridges cognitively and socially constructed distinctions between categories that might be present among different stakeholders. As such, recording local actors’ knowledge is an essential starting point to obtain insights into their way of perceiving complex interactions of humans and nature and factors driving these interactions (Tengö et al. 2014, Geertsema et al. 2016), especially in multifunctional landscapes.

## METHODS

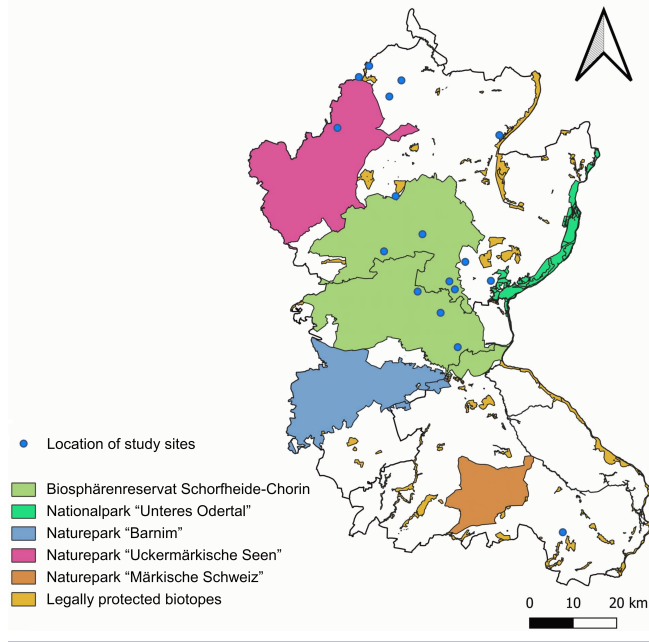
### Study sites and region

The study sites were located in the northeastern part of Brandenburg, a state in Germany, throughout three administrative districts: Uckermark, Barnim, and Märkisch-Oderland. The physical characteristics in this area differ from the rest of Brandenburg because this region was formed during the younger Weichselian glaciation, which left behind many recognizable glacial forms. For instance, the northern part is characterized by 50,000–60,000 glacial depressions (Ministerium für Umwelt, Gesundheit und Verbraucherschutz des Landes Brandenburg 2010). The structural heterogeneity of the landscape created several different biotopes and, as a result, a high diversity of species. The high occurrence of rare species and biotopes worthy of protection alongside the sparse human population of the region created the perfect preconditions to establish spacious nature reserves (Fig. 2; Ministerium für Umwelt, Gesundheit und Verbraucherschutz des Landes Brandenburg 2010).

### Land use and grassland–forest transition zones

A relatively high percentage of the arable land is managed organically in Barnim (17.8%) and Uckermark (12.0%), which can partially be explained by the large-scale nature reserves that prohibit intensive agricultural practices (Ministerium für

**Fig. 2.** Map of the three legislative districts, Barnim, Uckermark, and Märkisch-Oderland, of the German state Brandenburg. It indicates the location of the study sites and protected areas falling into the studied region, including the Biosphärenreservat Schorfheide-Chorin, Nationalpark “Unteres Odertal”, the three Natureparks “Barnim”, “Uckermärkische Seen”, “Märkische Schweiz”, and several legally protected biotopes.



ländliche Entwicklung Umwelt und Landwirtschaft 2018). Approximately 39.5% of the agricultural area in the study region is managed by agricultural businesses with livestock. These businesses comprise both specialized and mixed farm systems (Amt für Statistik Berlin-Brandenburg 2017). While the number of dairy cows has decreased considerably over previous years, increasing numbers of farms are transitioning to beef production. Nowadays, Brandenburg has the highest number of cow-calf beef production systems in Germany (Troegel and Schulz 2018). This extensive form of beef production includes cattle grazing on grassland areas throughout the summer months or sometimes the whole year and is often organic.

Approximately 27.7% of the studied area is covered by forests and 5.7% is covered by permanent pasture. Grassland–forest borders are therefore a common feature of the landscape (Amt für Statistik Berlin-Brandenburg 2019, 2020). Nevertheless, in the context of this landscape, only a few of the forest edge areas can develop naturally. Most of them are artificially created by land users and are characterized by a sharp transition between open areas such as permanent pasture or agricultural fields and forest (Ministerium für Landwirtschaft, Umwelt und Klimaschutz Brandenburg 2020). Until now, no institutional regulations deal with the management of forest edges in Brandenburg. Farmers are usually the ones managing these edges to prevent the forest from growing into their farmed area. Moreover, the forest law in Brandenburg prohibits the grazing of livestock in the forest, which

results in forest and grassland being treated as two sharply separate, distinct entities by farmers. Nevertheless, in 2020, a directive was enacted by the Ministry of Agriculture, Environment and Climate Protection in Brandenburg dealing with the protection and restoration of naturally developed forest edges. This directive highlights the importance of nature conservation efforts for the multifunctional management of landscapes.

### Data collection

We collected data between October 2019 and February 2020 using semistructured interviews conducted face to face with farmers in northeast Brandenburg. The semistructured interview design made it possible to cover predefined topics but also provided a certain degree of flexibility in each interview (Newing et al. 2011, Young et al. 2018). The interview guide aimed to gather data on three overarching topics: (1) farmers’ perceptions of landscape functions associated with grassland–forest transition zones, (2) farmers’ evaluation of functional ecological processes according to their positive and negative contributions to grassland production, and (3) the effect of farmers’ local ecological knowledge of landscape functions on their grassland management decisions (see Appendix 1 for the full interview guide). The interviews lasted 30–120 min and were recorded. Farmers signed consent purposively chosen to fit to the grassland system and landscape context. We identified suitable farmers through databases of local research institutions and organizational structures such as the UNESCO Biosphere Reserve Schorfheide-Chorin, the Biodiversity Exploratories, or the Landcare Association Schorfheide-Chorin. We contacted 20 farmers, of which 17 agreed to be interviewed (Table 1). The diversity of farms within our sample reflects the grassland farm characteristics in Brandenburg, with a high share of organic farming, cow-calf beef production, and family farms. Four additional interviews were conducted with local experts for agriculture or nature conservation who had more general but regionally adapted scientific ecological knowledge (Table 2). The expert interviews provide a more scientific view of grassland–forest transition zones and can help to compare more local and more regional perspectives. For each expert, an individual interview guide was constructed based on their field of expertise and was closely related to the interview guide designed for the farmers.

### Data analysis

After transcribing the interviews, we analyzed them following the rules of qualitative content analysis. Qualitative analysis helps to describe and interpret complex situations with the necessary detail and depth (Newing et al. 2011). The content was structured according to Kuckartz and Rädiker (2012) and Schreier (2014), which state that a coding structure should consist of overarching deductive categories and further differentiation occurs inductively. Using the rough coding structure, the whole material was coded once using the software MaxQDA (<https://www.maxqda.com/>, Verbi, Berlin, Germany). During this process, inductive categories were developed following Mayring’s (2014) guidelines for inductive category formation. After that, code definitions and anchor examples, which help to guarantee a certain degree of conformity within the process of categorizing farmer statements, were developed before the whole material was coded again (Table 3).



**Table 1.** Characteristics of the interviewed farmers and their farms.

Farmer number	Farming system	Grassland management	Animal production system	Number of animals	Total managed area (ha)	Permanent pasture area (ha)	Legal structure or farm type
F1	Conventional	Grazed	Cow-calf beef production	110	900	70	Cooperative
F2	Organic	Grazed	Cow-calf beef production	170	1200	216	Family farm
F3	Conventional	Mowed	Dairy production	900	1400	180	Limited company
F4	Conventional	Grazed	Dairy production	70	80	20	Family farm
F5	Organic	Grazed	Cow-calf beef production	1120	783	675	Family farm
F6	Organic	Mowed	Cow-calf beef production	650	3000	300	Cooperative
F7	Organic	Mowed	Cow-calf beef production	600	1281	367	Limited company
F8	Organic	Mowed	Cow-calf beef production	150	580	300	Family farm
F9	Organic	Grazed	Sheep	500	570	200	Family farm
F10	Organic	Mowed	Fodder is sold	–	2150	110	Limited company
F11	Organic	Grazed and mowed	Cow-calf beef production	180	600	130	Family farm
F12	Organic	Mowed	Dairy production	470	170	20	Family farm
F13	Conventional and organic	Grazed	Horses	70	950	140	Family farm
F14	Organic	Grazed	Dual-purpose breed	16	10.2	10	Non-profit and educational farm
F15	Organic	Mowed	Cow-calf beef production	29	10.8	2	Family farm
F16	Organic	Mowed	Dairy production	55	160	70	Family farm
F17	Organic	Grazed	Cow-calf beef production	100	900	200	Limited company

**Table 2.** Sample of interviewed experts and their occupation.

Expert number	Occupation
E1	Contact for farmers within a local nature conservation agency
E2	Agricultural scientist and field trial supervisor
E3	Contact for farmers within a local nature conservation association
E4	Biologist and conductor of local long-term functional biodiversity research on agricultural fields

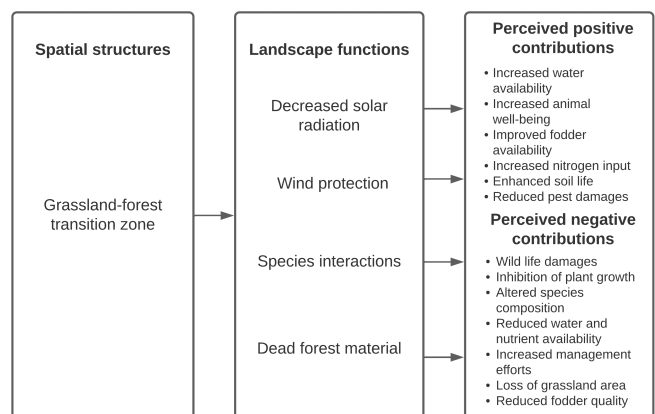
**RESULTS**

We organize our results according to the structure-function-value framework (Fig. 1). The interviewed farmers perceived four overarching landscape functions that occur within grassland–forest transition zones. Some of these functions were perceived to contribute positively or negatively to grassland production (Fig. 3). Detailed results tables, including all farmer quotations, are found in Appendix 2.

**Farmers’ perceptions of the grassland–forest transition zone and associated landscape functions**

Farmers perceived decreased solar radiation, wind protection, dead forest material, and species interactions as the most important landscape functions (Fig. 4). Indeed, many farmers mentioned that the forest changes the climatic conditions of their grassland fields close to the forest edge. The forest canopy shades the grassland area, decreasing the solar radiation reaching the

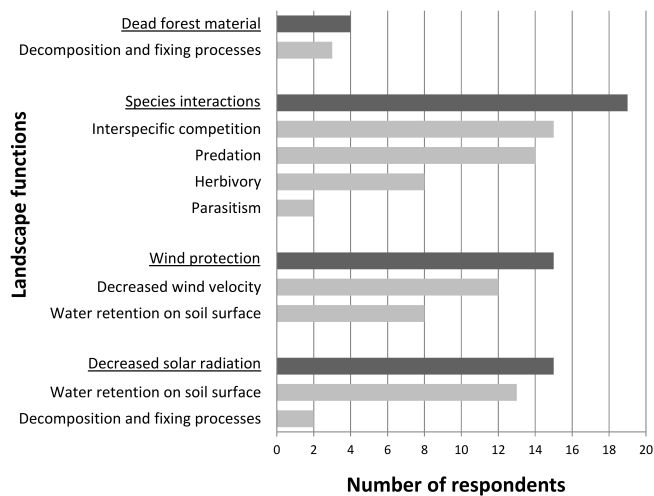
**Fig. 3.** Results structure derived from the structure-function-value framework, including the grassland–forest transition zone as a spatial structure that provides the landscape functions: decreased solar radiation, wind protection, species interactions, and dead forest material. The landscape functions are perceived by the interviewed farmers as either positive or negative contributions to grassland production. Structure-function-value framework adapted by Termorshuizen and Opdam (2009).



**Table 3.** Interview coding structure for the code dimensions of landscape functions, contributions to grassland production, and management decisions. The dimensions were further subdivided into code categories during the content structuring process. The corresponding literature includes underlying theoretical constructs as well as empirical evidence for the categories' relevance.

Code dimension	Code category	Main content	Corresponding literature
Landscape functions	Wind protection, species interactions, dead forest material, decreased solar radiation	Farmers' perceptions of functional ecological processes associated with grassland–forest transition zones	Termorshuizen and Opdam (2009), Potschin and Haines-Young (2011)
Contributions to grassland production	Positive contributions	Positive contributions of landscape functions to grassland management (e.g., increased water availability, improved animal well-being)	Zhang et al. (2007), Teixeira et al. (2019), Blanco et al. (2020)
	Negative contributions	Negative contributions of landscape functions to grassland management (e.g., decreased fodder quality, increased management efforts)	
Management decisions	Adaptive management	Adaptation of management measures toward landscape contributions	Darnhofer et al. (2010), Milestad et al. (2012)

**Fig. 4.** Numbers of respondents perceiving each landscape function, including the overarching functions comprising dead forest material, species interactions, wind protection, and decreased solar radiation, as well as further differentiations and effects.



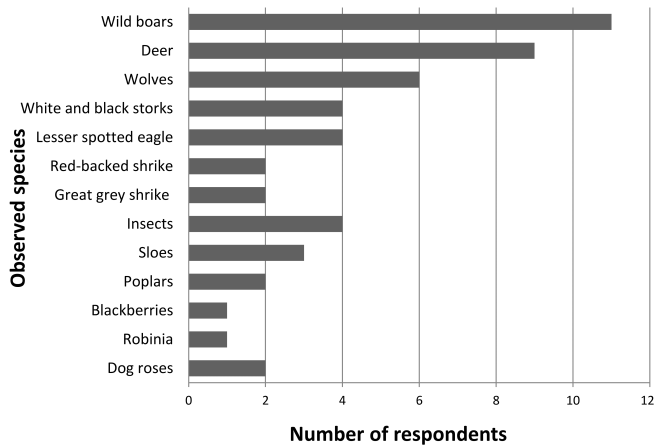
grassland, thereby creating cooler and moister conditions in the edge transition area. The wind protection function of the forest, which decreases the velocity of winds blowing over the open grassland area, was also strongly perceived by farmers. Farmers associated these functions, in particular solar radiation, with moisture retention in the grassland (Fig. 4). For example, one farmer stated “(...) if there is dew in the forest area, it is rather wet, and if you are further away, it is dry because the wind is more likely to get there” (Farmer 11). This quotation highlights the effect of wind on moisture availability in grasslands and the positive effect that forest edges may have on that aspect.

Besides climate-related effects of forests on grassland fields, farmers even more frequently mentioned the interactions of

species inhabiting the grassland–forest transition zones and the resulting effects on grasslands (Fig. 4). For instance, birds of prey that have their main habitat in the forest use the grassland while looking for small mammals or amphibians. The associated bird species were white stork (*Ciconia ciconia*), black stork (*Ciconia nigra*), lesser spotted eagle (*Clanga pomarina*), great grey shrike (*Lanius excubitor*), and red-backed shrike (*Lanius collurio*). However, wild boar (*Sus scrofa*) and several deer species (Cervidae) were most frequently associated with grassland–forest transition zones (Fig. 5); farmers attributed their presence to their use of the forest as shelter and the grassland for grubs, acorns, beechnuts, and grazing. Wolves (*Canis lupus*) were identified as predators, but farmers were more concerned about how wolves affect the behavior of deer and boar populations than of their potential threat for livestock. Indeed, farmers observed deer and boar gathering in bigger packs and their behavior becoming less predictable. In some cases, different kinds of insects that affect livestock in the adjacent grassland were also recognized as taking advantage of forests. Some farmers mentioned the insects' parasitic relationship by transmitting diseases or causing biting stress to livestock grazing in the grassland (Fig. 5). Specific insect species named concerning the forest were flies (*Brachycera*), mosquitos (Culicidae), and wood ticks (*Ixodes ricinus*). Farmers perceived interspecific species competition between forest and grassland plants (Fig. 4). Besides competition for water and nutrients, farmers also mentioned competition for space, given that shrubs and other tree species rapidly grow into the grassland area (Fig. 5). Species that were mentioned included sloes (*Prunus spinosa*), poplars (*Populus* spp.), blackberries (*Rubus* spp.), robinia (*Robinia pseudoacacia*), and dog roses (*Rosa canina*). Species interactions across several trophic levels thus shaped some ecological patterns and processes in grassland–forest transition zones, with variable contributions to grassland production.

Farmers also addressed the grassland–forest transition zone as affecting soil functions. Specifically, they mentioned that they expect foliage covering the soil during the autumn months to affect soil nitrogen in the area. However, farmers said little about the underlying processes changing the properties of soils and their connection to the forest (Fig. 4).

**Fig. 5.** Numbers of respondents perceiving each species as frequently inhabiting the transition zone between grassland and forest.



**Perceived contributions to grassland production of landscape functions associated with the grassland–forest transition zone**

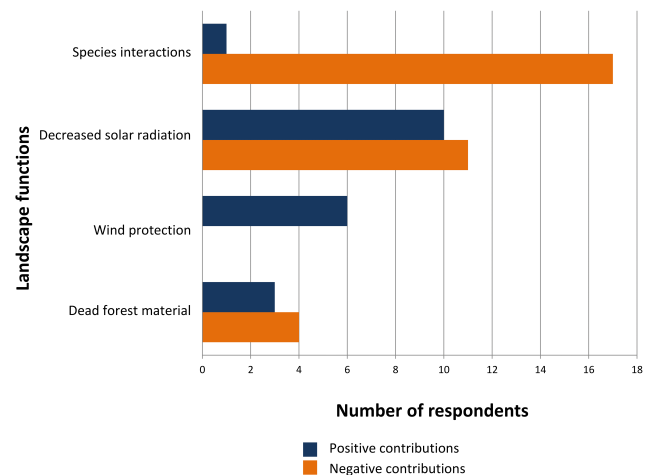
Farmers generally found that grassland production was substantially affected by the functional ecological processes that they associated with the grassland–forest transition zone. In general, farmers perceived more negative than positive contributions. They attributed most of the negative contributions to species interactions (Fig. 6). Only one expert mentioned the possibility of biological control processes that positively affect grassland yield (Fig. 7C). Other farmers and experts did not perceive this positive contribution at all or disregarded it due to low importance for grassland yields. Nevertheless, farmers frequently mentioned that the high abundance of boars and deer, whose main habitat is the forest, negatively affect grassland production (Fig. 7C). Wild boars are particularly considered a major hazard for yield stability. Farmers explained that during boars’ search for protein-rich foods, they dig up large areas of grassland, leading to substantial yield losses. This effect was confirmed by two of the experts, who mentioned the large negative effect boars can have on grasslands (Fig. 7C). For example, in reference to grassland, one expert stated: “If you imagine there are 50 wild boars in the forest and they come every day to the grassland areas and make damages, then the forest as a place of the wild boars would be disadvantageous” (Expert 2). This quotation underlines the large role that forests have as habitat for animal species that are detrimental to grassland production and shows how grassland–forest transition zones can be impractical or problematic for agriculture.

Farmers also perceived plant species occurring along the forest edge as major competitors for plant species occurring in the grassland (Fig. 7C). For instance, shrub and tree species rapidly grow into the grassland area, limiting the manageable area, causing yield losses. Furthermore, they compete with forest species for water and nutrients, and the shade thrown by forest species is perceived as restraining plant growth in the grassland–forest transition zone. Moreover, farmers often mentioned that forest vegetation restricted access to the forest edge with

machinery, and therefore, the occurrence of low yielding plant species is promoted, affecting the overall plant species composition in grasslands. For example, one farmer said that “More weeds, for example, nettles and thistles, grow at the forest border because it is not possible to manage them well there” (Farmer 1). This view of vegetation dynamics in grassland–forest boundaries was shared by one of the experts (Fig. 7C), highlighting the complexity of managing land use transition zones, where vegetation from both land-use systems overlaps.

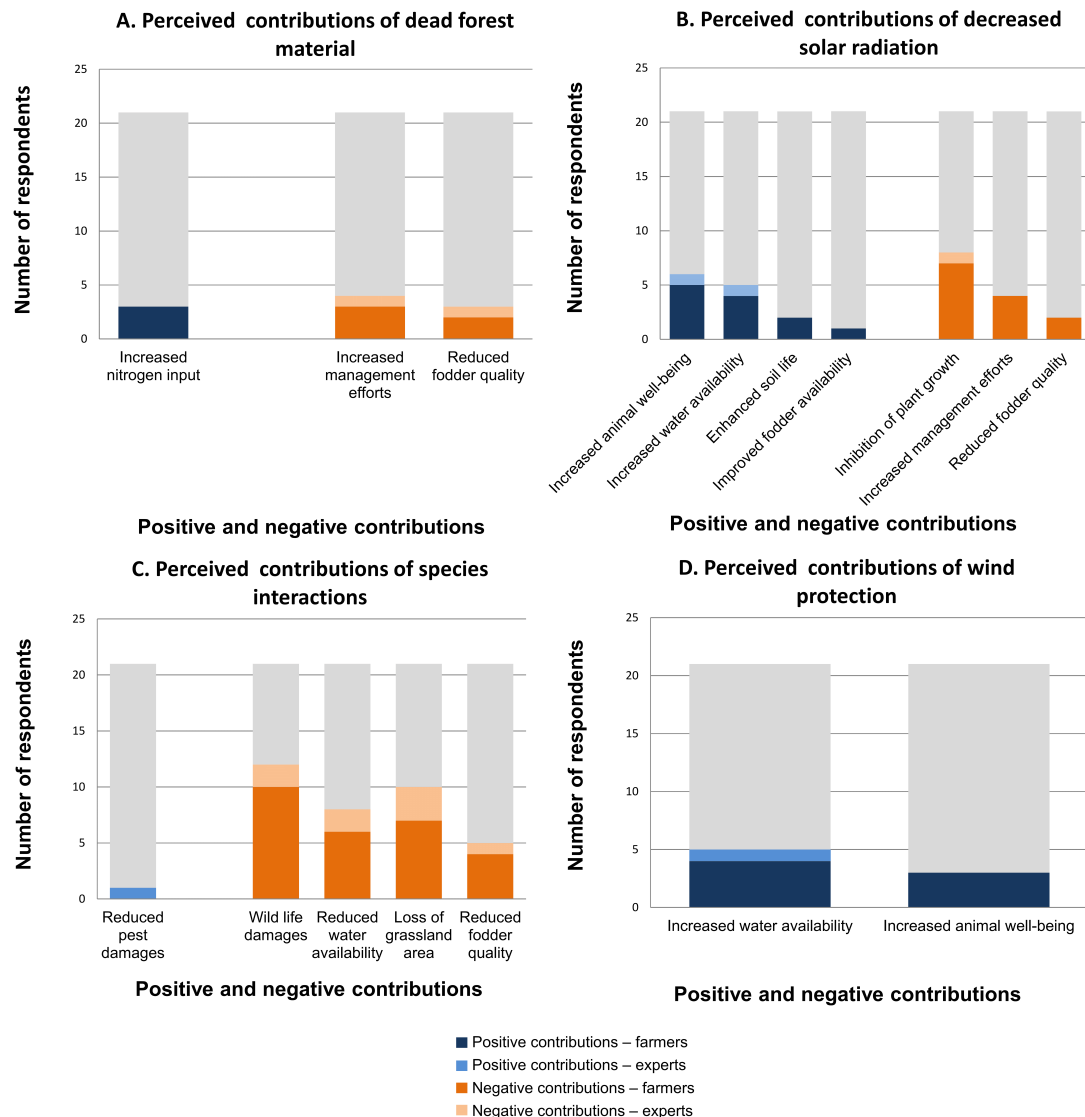
Farmers had a more ambiguous perception of the effects of decreased solar radiation on grassland productivity than did experts (Fig. 6). Most of the farmers perceived this function as negatively affecting grassland production by inhibiting the growth of grassland plants (Fig. 7B). In contrast, some farmers perceived this function as positively affecting the yield in dry years by increasing the amount of available water (Fig. 7B). However, these farmers stated that this effect is rather small compared to the water competition of grassland with forest species (Fig. 7B). One expert explained that this effect is highly contextual: “It certainly also depends on the year, like for example, last year we had, in the shaded areas, the positive effect of reduced solar radiation” (Expert 3). As with the farmers, though, the expert opinions were divided regarding this topic. Although one expert stated the possibility of higher yields in the edge areas during a drought year, the other three experts stated that there is no positive effect on grassland yields in dry years due to water competition (Fig. 7B).

**Fig. 6.** Numbers of respondents who mentioned positive or negative contributions associated with four landscape functions.



The perceived effects of microclimate functions (i.e., shading, temperature, wind, and moisture-related functions) of forests on grasslands seemed to depend on whether the farms had livestock grazing on the relevant areas. Many farmers perceived the shade effect as advantageous for the well-being of their animals, which was also supported by two of the experts (Fig. 7B). Furthermore, two farmers were aware of the negative consequences of high temperatures on soil microorganisms and therefore stated that the

**Fig. 7.** Farmers' perceived positive and negative contributions of ecosystem functions to grassland production. (A) Dead forest material. (B) Decreased solar radiation. (C) Species interactions. (D) Wind protection.



shading effect could affect soil fertility and yield (Fig. 7A). “And behind the forest, the ground is shaded anyway, the temperature is not so high, and that is again positive for soil life” (Farmer 6). Thus, in a broader sense, farmers seemed to value the grassland–forest transition zone for its temperature-regulating function for species from soil microorganisms to livestock.

Shade was also considered beneficial for grassland production. The later start to vegetation growth in the shaded area was regarded as an advantage by one farmer because they needed enough fodder for their sheep throughout the whole year (Fig. 7B). The farmer stated: “(...) you have shadow areas, you also have areas where humidity is staying for a longer time, then you have corners again where the vegetation starts later. You just have to adapt your management, you can see this as an advantage, you

can see it as a disadvantage, but it depends on using the conditions with intelligence” (Farmer 9). This shows that how grassland–forest transition zones are perceived is related to how farmers use the specific conditions and functions. For example, perceived negative contributions were from the occurrence of shade-loving plants, which reduce the quality of the fodder and increase management efforts because the hay dries more slowly in shaded areas.

Farmers only associated positive contributions from the grassland–forest transition zones with the wind protection function (Fig. 6). This function affected the same areas of grassland production as the decreased solar radiation by increasing water availability on the soil surface and improving the well-being of grazing animals (Fig. 7D). Dead forest material (e.g., leaf litter)

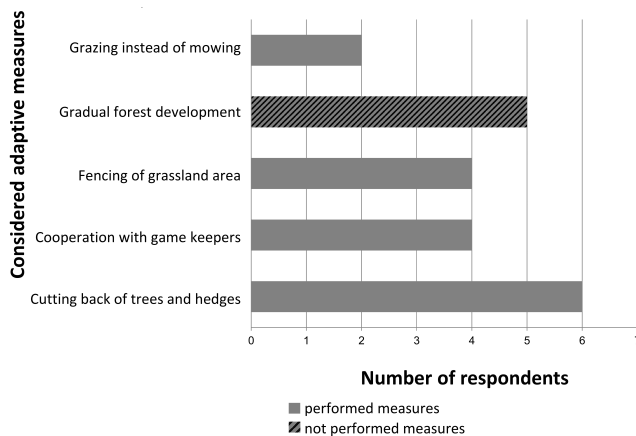


falling onto the grassland area was perceived as negatively affecting grassland production (Fig. 6). The foliage covering the soil during the autumn months was expected to affect the soil fertility in the transition zone, but the effect on yield is still expected to be rather low because the large masses of foliage negatively affect fodder quality (Fig. 7A). Dead trees also fall onto the grassland, complicating management; they increase management efforts because they can destroy fences and need to be removed from the area (Fig. 7A).

### Farmers' local ecological knowledge and management decisions regarding the grassland–forest border

Farmers' perceptions of landscape functions affected their management decisions. Farmers most frequently cut back shrubs and hedges as a response to the competition for space between forest and grassland species (Fig. 8). While most farmers were interested in a clear border to the forest and therefore mowed the edge area very clearly, some farmers had difficulties in doing so because of conflicting interests of forest owners or limited accessibility with machinery due to tree branches. Expert 1 stated that a common technique to avoid limited accessibility is the additional removal of overhanging twigs and branches. Although these practices make the forest more vulnerable, which can also affect farmers negatively (i.e., trees falling on fences), none of the farmers let the forest develop in a gradual, successional manner. Nevertheless, several farmers considered gradual forest development an option, if it were supported by sufficient funding (Fig. 8). They were aware of the wind protection function of this kind of forest edge and listed additional positive effects for grassland management: "(...) it is an advantage if I have shrubs and hedges on the edge and not this shadow function and water absorption (...)" (Farmer 3). This response demonstrates how forest edges with a successional gradient improve functions related to microclimate regulation. Farmers' decision to prevent forest succession was strongly connected to the direct payments that farmers receive by means of the CAP. Their receipt of direct payments is dependent on the size of their grassland fields, and payments are reduced if shrubs and hedges grow too rapidly into the area.

**Fig. 8.** Numbers of farmers considering various adaptive measures in reaction to perceived landscape contributions to grassland management.



Two farmers mentioned that grazing of the grassland–forest transition zone area with livestock instead of mowing could be a strategy to make better use of the area's conditions (Fig. 8). Furthermore, one of them mentioned that the limited accessibility of the forest edge by machinery can be avoided by letting livestock graze on the grassland. The animals can walk under the branches of the trees and therefore keep the edges clear more efficiently. Another farmer considered the different availability of fodder due to the shifted vegetation growth as a clear advantage if cattle are grazing in the area. Furthermore, both farmers mentioned that by letting cattle graze in the area, they can make use of the positive contributions of decreased solar radiation on the well-being of their animals. For example, one of them said: "(...) and when I decided to use it as a young cattle pasture, then it could not be any better because the animals can eat, have shade, and can also chew on the trees" (Farmer 4). This quotation shows how livestock can make use of and benefit from grassland–forest transition zones.

Additional adaptive measures were adopted in the case of wild boars and deer that come from the forest to the grassland and cause damage. One example is to prevent wildlife from entering the grassland by fencing the field. Moreover, several farmers rely on the support of hunters to avoid damage to the grassland (Fig. 8). A good relationship with hunters is therefore regarded as an important strategy by one farmer. "I'm always in favor of hunters doing the job who are on the scene. They are the contact persons for me, and I know they are outside [hunting] every night" (Farmer 8). As such, the interaction between land-use systems here, via boar foraging, is mirrored in necessary interactions between land users, which can allow both farmers and hunters to make use of grassland–forest transition zones.

### DISCUSSION

Using a conceptual framework linking structure, function, and contributions within grassland–forest transition zones, we were able to categorize farmers' local ecological knowledge and complement it with insights from experts to understand the complexity of managing and restoring multifunctional landscapes. Our study elicited five key findings. First, farmers perceive the functionality of grassland–forest transition zones as relevant for both grassland production as well as for the wider maintenance of the landscape's patterns and processes. Second, regarding farmers' perceptions and knowledge, farmers have detailed although not equally shared knowledge about ecological aspects of grassland–forest transition zones, which can be attributed to the distinct farm business contexts that were included in our sample. Third, farmers identified four overarching landscape functions within grassland–forest transition zones, including decreased solar radiation, wind protection, species interactions, and dead forest material. Three of these four functions were perceived as ambivalent, with negative and positive contributions to grassland production; only wind protection was uncontested positive. Moreover, how they valued functions in terms of the contribution to grassland production was central to their decision-making (Termorshuizen and Opdam 2009, Kristensen et al. 2016, Chapman et al. 2019). Fourth, farmers adapt their management measures to the inconveniences resulting from the transition zones; these measures are partly short term (e.g., cutting back trees and hedges), partly long term (e.g., gradual forest development), and partly in cooperation with

others (e.g., gamekeepers). Finally, in terms of multifunctional landscapes, we see a need and a potential to move from single plot considerations to more holistic assessments.

Farmers' local ecological knowledge provided a holistic picture of landscape functions that they observed in grassland–forest transition zones. In particular, their knowledge of species and species interactions in these areas highlighted the interconnectedness of biodiversity conservation and agricultural production within multifunctional landscapes (Fig. 4). While other studies focus largely on farmers' knowledge of different plant or animal species in specific production contexts (Winter et al. 2011, Valencia et al. 2015, Vogl et al. 2016), few address species occurring because of land-use interactions, which can demonstrate the link between field-level management and landscape-scale effects. Additionally, ecological studies in grassland–forest transition zones usually focus only on one or more functional groups of organisms (Lacasella et al. 2015, Mazia et al. 2016, Boesing et al. 2018). Research such as ours, involving farmers' local ecological knowledge, could help to shed light on the biodiversity, abundance, and complex interactions between species that greatly influence landscape functions, particularly in the context of multifunctionality.

Negative contributions were stronger and more frequently perceived than potentially beneficial contributions of the grassland–forest transition zones on grassland production. This phenomenon drove farmers' management decisions regarding these zones. Besides making use of synergies, farmers also frequently reported choosing management options that disturb the movement of plant and animal species between land-use systems and therefore hinder multifunctionality. For instance, a frequent response to the loss of grassland area by forest succession was the regular cutting back of shrubs and hedges. Anthropogenic forest edges that lack a gradual development of shrubs and trees might serve as dispersal barriers for species with important functional traits or promote the presence of invasive species (Fagan et al. 1999, Caitano et al. 2020). While having perceived positive effects on grassland production, cutting back shrubs and hedges prevents the restoration of habitats for local biodiversity and negatively affects the securing of diverse natural resources. Furthermore, management practices that repeatedly prevent natural forest succession and keep the edges open decrease the resilience of forest stands, especially to strong wind events (Wuyts et al. 2008). This subsequently affected farmers negatively because trees frequently fall into the grassland areas and can damage fences and increase management efforts. Forest edges that developed naturally could in turn create potential synergies between grassland production and nature conservation, which was also mentioned by certain farmers, indicating the presence of local ecological knowledge in this regard. However, in accordance with Lamarque et al. (2014) and Muhamad et al. (2014), we found that farmers' decisions were not based solely on their local ecological knowledge but also external drivers (i.e., regulations or funding schemes). In fact, institutional factors such as farmers' fear of losing area-dependent funding, the lack of institutional regulations dealing with the management of forest edges, and the separation of forest and grassland into two distinct entities by the Brandenburg forest law were major drivers of farmers' decision to cut back shrubs and hedges that grow into their grassland. If regulations did not prohibit farmers from better using, or least

experimenting with, these transition zones, perhaps more positive contributions by the grassland–forest transition zone or multifunctional landscapes could emerge. While speculative, engaging in participatory research with farmers regarding synergies and trade-offs in multifunctional landscapes could provide greater insight.

Local ecological knowledge of land users is not only central in their own decision-making but can also be helpful to support research on the complex interactions between bordering land uses. Indeed, other authors also highlight the potential of knowledge co-production for successful biodiversity monitoring and conservation efforts (Blicharska et al. 2016, Kühl et al. 2020, Chambers et al. 2021, Dawson et al. 2021). Local ecological knowledge could also play an important role in the way science–practice knowledge or information transfer occurs (Opdam 2019). Targeted information would increase farmers' awareness of positive contributions and possible synergies, which could be an entry point for landscape management-related information and advisory interventions. For instance, the production of actionable knowledge about soil functions could enable farmers to maintain a nutrient balance that prevents negative effects on the functional diversity of soil biotic species due to nutrient leakage (Ball et al. 2018, Dietze et al. 2019). Therefore, producing (or co-producing) actionable knowledge on soil functions, including the provision of nutrients and decomposition processes, is a major prerequisite for the restoration and maintenance of multifunctional landscapes. Using boundary objects such as specific landscape structures or functions can help integrate local actors' knowledge into planning processes for multifunctional landscape maintenance or restoration because discussing these boundary objects with actors reveals how they use or adapt to them, revealing their local ecological knowledge (Westerink et al. 2017). Within these planning processes, the active identification of local land users' ecological knowledge is important to facilitate decision-making adapted to local land users' values (Termorshuizen and Opdam 2009, Brunet et al. 2018). Furthermore, insights into local land users' needs and preferences can help set the right frame for the use of boundary concepts, which increases their potential to inform farmers' decision-making in favor of multifunctional landscapes (Opdam et al. 2015).

Our study underlines the difficulty in reconciling different land uses in European multifunctional landscapes. Farmers perceived the forests to have dominant effects over grassland production because it is a habitat for plant and animal species that encroach on grassland fields. As such, scaling up studies and also policies from single farmer or field scales, single types of species, or single functions or services (e.g., yield) means embracing social-ecological complexity and accounting for social and ecological spillovers (i.e., positive or negative contributions of landscape functions). This situation means that understanding social and ecological interactions between land-use systems is essential to understanding the synergies and trade-offs in multifunctional landscapes. We learned from farmers that they have holistic knowledge of both field and landscape effects and do not necessarily separate these scales when thinking about management. This result suggests that perhaps their holistic knowledge of the landscape scale was captured well in our study of grassland–forest transition zones. For example, farmers

pointed to possible synergies between livestock and forests, specifically that there would be increased positive contributions from the grassland–forest transition zones to grassland production if livestock could make use of the forest edge and graze in the forest. Given how landscape functions were perceived, we learned that farmers already work with the landscape (e.g., in grassland–forest transition zones) for certain benefits, but that they are also disadvantaged by the landscape scale, largely because of wildlife damage to grassland production, but also, institutional factors.

## CONCLUSION

We explored farmers' local ecological knowledge of landscape functions associated with grassland–forest transition zones, their positive and negative contributions to grassland production, and the relationship between local ecological knowledge and management decisions affecting multifunctionality. We found that farmers had substantial knowledge of landscape functions, species composition, and interactions concerning grassland–forest transition zones. However, only a few farmers used this knowledge to manage landscapes for multifunctionality. What farmers do with their knowledge depends on how they perceive the contributions of different landscape functions to agricultural production. Here, the perceived negative contributions of forests to grassland production were prevailing and strongly affected farmers' perceptions of the adjacent forest. This overall negative perception affected farmers' decisions in favor of management measures that do not support multifunctionality. Furthermore, current regulations such as the institutional separation of grassland and forest, and area-dependent direct payments are affecting farmers' ability to use their local ecological knowledge to manage multifunctional landscapes. Therefore, we conclude that even though the farmers' local ecological knowledge could enable them to manage landscapes for multifunctionality, factors such as negative contributions of landscape functions or institutional impacts are currently preventing them from doing so.

## FUTURE PROSPECTS

The number of farmers we interviewed was limited and represents only a small snapshot of local land users. In a next step, it may be beneficial to include the perceptions and knowledge of gamekeepers or forest managers. However, case studies based on specific local contexts give insights into the way that land users perceive and value their surrounding landscape (Quintas-Soriano et al. 2018, Teixeira et al. 2018). These kinds of case studies are needed to depict the complexity of social-ecological system interactions in full detail (Birkhofer et al. 2015). Together with studies conducted at larger scales and including a broad array of participants, they can help draw a composite picture of the drivers of land management and land-use changes that affect the ability of landscapes to provide multiple functions (Kristensen et al. 2016). We wanted to focus on farmers as land users within landscapes who influence major ecological processes through their management. Focussing only on one group of land users allowed us to dive deep into their perceptions affecting their decisions, especially the way in which they perceive their surrounding landscapes and contributions to production. However, ecological processes occur over large spatial extents and are usually not tied to human-made boundaries (Fischer et al. 2019). They are influenced by multiple land users whose

interactions have not often been explored within the scientific literature. Because cooperation beyond field borders could be another important precondition for the successful management of landscapes for multifunctionality, we propose that more research needs to be conducted on this topic in the future. By looking closely at the dynamics of land user interactions and factors affecting cooperation and cooperation barriers, a further step could be made to the management of landscapes for production while at the same time preserving biodiversity.

*Responses to this article can be read online at:*

<https://www.ecologyandsociety.org/issues/responses.php/12970>

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## Data Availability:

*The anonymized data that support the findings of this study are available on request from the corresponding author, Henrike Schümann. None of the data/code are publicly available because there exists currently no pleasant solution that allows the upload of qualitative data linked to the DOI. All data were collected via interviews, and all research participants signed consent forms allowing us to record, take notes, and/or transcribe the interviews for data for scientific publication.*

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## **Appendix 1.** Exemplary interview guides for farmers and experts

### Exemplary interview guide for farmers

#### A) General information about the farm and grassland management:

- 1) Can you tell me more about your position and your task at (farm name)?
  - a. How long have you been working here? Is it a family business, a limited liability company, or another type of business?
  - b. Do you have an agricultural education, if so what kind (university degree, apprenticeship)?
  - c. When did you first come into contact with agriculture?
2. How many hectares do you cultivate in total? How much of it is grassland?
3. Can you describe your current grassland management in more detail?
  - a. What is your grassland used for? Is it grazed or mowed?
    - i. When mowed: Is the fodder for your animals or is the fodder sold?
    - ii. If sold: as fodder, biomass or another purpose?
    - iii. If grazed: animals per ha? How often and for how long are animals on the pasture?
    - iv. Other: Is fertilization used? How often? Is the species composition changed by sowing, pesticides or biological pest control? Is it permanent grassland or rotational farming?
4. How has grassland management changed over the years?
5. Do you remember how grassland was managed before your time?
6. How have the areas changed (i.e. forest to grassland or vice versa, grassland to arable land, decrease in grassland)?
7. Do you know who manages/owns the forest? Do you have contact?
  - a. If so, could you forward the contact to me?

#### B) Impact of management on biodiversity

1. Which plant species do you observe on the grassland?
2. Which animal species do you observe on the grassland?
  - a. Are there species that are only found in the transition zone between grassland and forest?
  - b. Which species have their main habitat in forests?
  - c. Why do the species from the forest also come to the grassland?

3. Have you observed a change (loss or presence of new species) in the quantity or presence of different species in recent years?
  - a. If so, which ones?
  - b. What could be the reasons for the changes? Where do new species come from?
4. Are there species that benefit the management of your grassland or provide different services to you?

C) Influence of forest/landscape complexity on soil fertility, water balance, temperature regulation and wind protection, which ultimately affect forage yield and quality.

*Increased biodiversity through increased landscape complexity can provide various services.*

1. What services does the forest / a complex landscape provide to you?
2. Have these services changed in recent years?
  - a. If so, what might be the reason for this?
3. How important is landscape complexity for the grassland yield?
  - a. How would you say a landscape with a lot of complexity differs from a more homogeneous landscape, especially concerning production and biodiversity?
4. Would you classify the adjacent forest, in general, more as an advantage or disadvantage for biodiversity and yield in grassland?
  - a. If there are advantages: Do you include the advantages into your grassland management? If so, how?

D) Impact of ecosystem services on management decisions

1. Has the yield of your grassland areas changed or fluctuated significantly in recent years?
  2. What can be the reasons for these fluctuations? (i.e. drought, pest infestation, soil degradation, low forage quality)
  3. How do you stabilize their performance/ yield when the natural processes are no longer reliable?
    - a. Are you already thinking about the future? / How long-term are you planning when applying management decisions?
  4. Can the above-mentioned services keep the yield stable in the long run?
  5. What would happen if the small forest plots disappeared from the landscape?
- E) Impact of cooperation and knowledge exchange on landscape complexity

1. What difficulties arise in the attempt to make agriculture in North-East Brandenburg more ecological?

2. Do you think it is feasible to make agriculture more ecological without sacrificing yield?
  - a. What basic conditions must be in place?
3. How important is your knowledge of the elements of the landscape and their interaction for the current management of your grassland?
  - a. Where do you get your knowledge from? (literature, experience, cooperation)
  - b. Would you say your knowledge would have to gain importance to perform measures that enhance landscape complexity?
5. Would you call an increase and/or the preservation of landscape complexity a meaningful measure for the increase of the nature protection potential with constant yield (i.e. sowing of disappeared old varieties, increase of different landscape types on the same area (increase grassland forest borders), adding structural elements (trees, bushes)
  - a. What has prevented you from implementing it so far?
6. Is there currently cooperation between you and neighbouring land users? (i.e. agreements on timing, intensity measures, land-use change, species composition, adherence to limits) Within the framework of a support program or independent of it?
  - a. Do you see cooperation with other land users as a possible advantage to increase landscape complexity? In what way? (i.e. exchange of knowledge)
  - b. How would cooperation to manage the border between grassland and forest ideally look like? What does a particularly bad example of such cooperation look like to you?

Q) Do you have anything else to say about one of the topics that was not covered by our questions?

Exemplary interview guide for experts

A) General information about the occupation and the region

1. Can you tell me more about your position and your responsibilities at (name of institution)?
  - a. How long have you been working here in the region?
  - b. How does your work with the farmers look like?
  - c. How are the information events you offer perceived by the farmers?
2. What are the characteristics of agriculture in North-East Brandenburg?
  - a. What factors characterize the management of grassland in North-East Brandenburg?
  - b. How does the management of grassland in North-East Brandenburg differ from the rest of Germany?

3. What influence did historical events have on agriculture in North-East Brandenburg?

- a. How has the way grassland is managed changed over the years?
- b. How have the areas changed (i.e. grassland to forest or vice versa, grassland to field, decrease in grassland)?

B) Influence of management on biodiversity

1. Which animal and plant species are characteristic for the grassland in North-East Brandenburg?

- a. Are there species that are only found in transition zones (forest / grassland, grassland / arable, arable / forest)?
  - b. Which species have their main habitat in forests?
  - c. Why do these species migrate from forests to grassland?
2. Have you observed a change (loss or presence of new species) in the quantity or presence of different species in recent years?
- a. If so, which ones?
  - b. What could be the reasons for the changes? Where do new species come from?

3. Are there species that provide advantages in the management of grassland?

C) Influence of forest/landscape complexity on ecosystem services (i.e. soil fertility, water balance regulation, temperature regulation and wind protection) which ultimately affect forage yield and quality.

*Increased biodiversity through increased landscape complexity can provide a variety of services.*

1. What ecosystem services does the forest / a complex landscape provide for the farmer?
2. Have these services changed in recent years?
  - a. If so, what could be the reason for this?
3. How important is landscape complexity for the yield?
  - a. How would you say a landscape with a lot of complexity differs from a more homogeneous landscape, especially concerning production and biodiversity?
4. Would you classify the adjacent forest, in general, more as an advantage or disadvantage for biodiversity and yield in grassland?
  - a. What would be the best way to integrate forest benefits into grassland management?

D) Impact of ecosystem services on management decisions

1. Has the yield of farmers on their grassland changed or fluctuated significantly in recent years? If so, why?
2. How can performance/yield be stabilized in the long run if natural processes are no longer reliable?
3. What would happen if the small forest plots disappeared from the landscape?



- a. Can you see a difference between grassland bordering on forest and grassland without forest borders?

E) Impact of cooperation and knowledge exchange on landscape complexity

1 What difficulties arise in the attempt to make agriculture in the North-East Brandenburg more ecological?

2. Do you think it is feasible to make agriculture more ecological without sacrificing yield?

- a. What framework conditions must be in place to achieve this?

3. How important is knowledge of the elements of the landscape and their interaction for the current management of grassland in North-East Brandenburg?

- a. Would you say that knowledge/knowledge exchange would have to gain in importance to implement an increase in landscape complexity?

4. Are you aware of current examples of cooperation between farmers in the North-East Brandenburg?

- a. Do you see cooperation with other land users as a possible advantage to increase the complexity of the landscape? In what way? (exchange of knowledge?)

- b. How would cooperation to manage the border between grassland and forest ideally look like? What does a particularly bad example of such cooperation look like to you?

Q) Do you have anything else to say about one of the topics that were not covered by our questions?

## Appendix 2. Result tables with exemplary quotes in German and English.

**Table A1.1:** Result table for the code dimension “perception of landscape functions”.

Code dimension	Code category	Code	Quote German	Quote English
perception of landscape functions	dead organic substances	-decomposition and fixing processes	„(...) dass da ein höherer Nährstoffeintrag ist durch die Blätter die der Wald verliert und da sieht man dann, dass das Gras da etwas dunkler gefärbt ist, demzufolge kann man sagen, dass da vielleicht doch mehr Stickstoff umgesetzt wird.“ (Landwirt*in 6)	“(...) that there is a higher nutrient input through the leaves that the forest loses and then you see that the grass is a little darker in colour, so you can say that perhaps more nitrogen is converted.” (farmer 6)
			„(...) gut der Wald, die Blätter die runterfallen. Das heißt nicht, dass es der Rede wert ist.“ (Landwirt 12)	“(...) well the forest the leaves that fall there. That does not mean it's worth mentioning.” (farmer 12)
			„Ich denke mal schon, dass da teilweise schon durch das Laub was im Herbst kommt, der Humusanteil ein bisschen größer ist noch.“ (Landwirt 15)	“I think that the hummus is a little bit bigger because of the foliage which comes in autumn.” (farmer 15)
	species interactions	-interspecific competition	„Der Wald dehnt sich immer weiter aus, da die Bäume in die Fläche reinwachsen.“ (Landwirt*in 1)	“The forest expands more and more as the trees grow into the area.” (farmer 1)
			„(...) am Wald wird immer weniger Ertrag sein, weil [...] ziehen die Bäume relativ viel Wasser.“ (Landwirt*in 2)	“(...) there will be fewer yields in the forest, because [...] the trees withdraw a lot of water.” (farmer 2)
			„Also am Feldrand, wenn da Wald und Bäume ist, die Bäume holen so das Wasser weg, das da die ersten Meter da ist der Ertrag hin.“ (Landwirt*in 3)	“So, at the edge of the field, when there are forest and trees, the trees take away the water that is there for the first few meters and the yield is there.” (farmer 3)
			„Na wir haben [...] viele Buschreihen, Waldgrenzen und die Situation, dass sich die Natur sich das auch in sehr schnell in sehr hoher Meterzahl zurückholt Jahr für Jahr.“ (Landwirt*in 7)	“Well, we have [...] many rows of bushes, forest borders and the situation that nature recovers very quickly in a very high number of meters year after year.” (farmer 7)
			„Wir müssen aufpassen das uns der Wald nicht zuwächst, das heißt ich habe eine Fläche von 8 Hektar und wenn ich 3 Jahre lang nicht irgendwie mal einen Pflegeschnitt mache, dann habe ich nur noch irgendwann am Ende 7 oder 6 Hektar.“ (Landwirt*in 8)	“We must be careful that the forest does not overgrow us, i.e. I have an area of 8 hectares and if I do not make any maintenance cut for 3 years, then I have at some point only 7 or 6 hectares.” (farmer 8)
			„Wenn wir trockene Jahre haben, soweit wie die Baumkrone reicht ziehen die Bäume auch Wasser, also	“When we have dry years, as far as the treetop reaches, the trees also

wir haben da unter sehr trockenen Boden.“ (Landwirt*in 9)	draw water, so we have very dry soil underneath.” (farmer 9)
„Der Wald braucht ja auch Wasser, das sieht man aufm Acker schneller und deutlicher als aufm Grünland das unter den Bäumen nichts wächst.“ (Landwirt*in 10)	“The forest also needs water, which can be seen faster and more clearly on the field than on grassland that nothing grows under the trees.” (farmer 10)
„Wenn man nicht mähen würde [...] Eichen auch und alles eigentlich, das wäre Ruckzuck Wald, ne.“ (Landwirt*in 12)	“If you wouldn't mow [...] oaks too and everything else, it would be a forest in no time.” (farmer 12)
„Die Bäume und auch Schwarzdorn wachsen dann teilweise auch recht expansiv immer weiter ins Feld rein.“ (Landwirt*in 13)	“The trees and also blackthorn grow expansively further and further into the field.” (farmer 13)
„(...) und da kommen jetzt diese Brombeersträucher darein, die wachsen da jetzt teilweise ins Grünland rein. Also vor allen Dingen an den Rändern wo man jetzt mit den Maschinen so ungünstig rankommt noch.“ (Landwirt*in 15)	“(...) and these blackberry bushes come into it, they grow into the grassland. So especially at the edges where you have limited access with the machines.” (farmer 15)
„(...) am Rand ziehen sie [die Bäume] mehr Wasser, deswegen ist der Ertrag dort geringer.“ (Landwirt*in 16)	“(...) at the edge they [the trees] use more water, so the harvest is lower at the edge.” (farmer 16)
„Ja bezüglich Bodenfruchtbarkeit, hatte ich gesagt frisst der Wald eher die Nährstoffe weg und nimmt das Wasser eher weg.“ (Expert*in 1)	“Yes, regarding soil fertility, I said the forest tends to eat away the nutrients and take away the water.” (expert 1)
„(...) und wenn die Wurzeln der Waldkante dann in die Flächen reinreichen, wird da auch noch viel Wasser und Nährstoffe entzogen und man sieht oft, dass da auch wenig wächst.“ (Expert*in 2)	“(...) and if the roots of the edge of the forest reach into the surfaces, there is also still much water and nutrients extracted and you can see that the growth is inhibited.” (expert 2)
„Ich denke mal der Wald wird jetzt nicht wirklich wahrgenommen, als irgendwas was man einbeziehen könnte, eher das man gucken muss das es nicht in die Fläche reinwächst.“ (Expert*in 3)	“I guess the forest is not perceived as something that you could include, rather that you have to make sure that it does not grow into the area.” (expert 3)
„(...) was die Landwirte gesagt haben, wegen der Flächenausmessung, dass immer die Bäume in die Fläche wachsen, das sehen die Landwirte als Nachteil.“ (Expert*in 4)	“(...) what the farmers have said, because of the area measurement, that the trees grow into the area, the farmers see this as a disadvantage.”

-predation	<p>„(...) und darum drehen sie, jeden Kuhfladen um und gucken ob da Würmer drunter liegen.“ (Landwirt*in 2)</p> <p>„Immer Stellen wo der Wolf ist, die alten führenden Bachen die gehen weiter weg.“ (Landwirt*in 3)</p> <p>„(...) jedes Tier läuft dahin wo es Futter findet, die Wildschweine diese Engerlinge die da schlüpfen oder Regenwürmer, da wühlen die natürlich das Grünland um.“ (Landwirt*in 5)</p> <p>„Also wir haben vermehrt auch mit dem Wolf zu tun und das Verhalten des Wildes hat sich verändert.“ (Landwirt*in 7)</p> <p>„Störche, wir haben auch einen Schwarzstorch hier. Und die gehen natürlich auf die Wiesen und [...] die holen sich dann da ihr Futter.“ (Landwirt*in 8)</p> <p>„(...) unsere Störche leben ja von Amphibien letzten Endes von Fröschen und dergleichen und die machen ja diese klassische Wanderung, überwintern ja im Wald oder in Gehölzen und gehen im Sommer auf die Freifläche und das sind genau die Übergangsbereiche hier an solchen Waldrändern.“ (Landwirt*in 9)</p> <p>„Im Grünland haben sie vor 2 Jahren und vor 3 Jahren größere Schäden gemacht, also dass sie gewühlt haben nach Engerlingen im Boden.“ (Landwirt*in 11)</p> <p>„(...) Greifvögel, die sitzen dann auch oft auf den Bäumen und lauern auf Mäuse (...).“ (Landwirt*in 12)</p> <p>„Ja also im Wald, da sind die Wildschweine die in dem hohen Gras Deckung haben und tierisches Eiweiß suchen was unter der Grasnarbe sich befindet.“ (Landwirt*in 10)</p> <p>„(...), wenn die [die Wildschweine] jetzt hier wühlen, Käfer suchen,</p>	<p>(expert 4)</p> <p>“(...) and so, they turn around every cowpat and see if there are worms underneath.” (farmer 2)</p> <p>“Always places where the wolf is, the old leading sows go further away.” (farmer 3)</p> <p>“(...) every animal goes where it finds food, the wild boars, these grubs that hatch there or earthworms, of course they dig up the grassland..” (farmer 5)</p> <p>“So we are dealing more and more with wolve populations and the behavior of the game has changed.” (farmer 7)</p> <p>“Storks, we also have a black stork here. And of course they go to the meadows and [...] they get their food there.” (farmer 8)</p> <p>“(...) our storks live from amphibians, ultimately from frogs and similar, and they make this classic migration, overwinter in the forest or in woods and go in summer to the open space and these are exactly the transition areas here at such forest edges.” (farmer 9)</p> <p>“In the grassland, they made bigger damages 2 years ago and before 3 years, because they rooted for cockchafer grubs in the ground.” (farmer 11)</p> <p>“(...) birds of prey, they often sit on the trees and watch for mice (...).” (farmer 12)</p> <p>“Yes, so in the forest, there are the wild boars that have cover in the high grass and look for animal protein which is under the topsoil.” (farmer 10)</p> <p>“(...) if they [the wild boars] root here, search</p>
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	<p>Würmer suchen, dann sind die Flächen natürlich erstmal beschädigt.“ (Landwirt*in 13)</p> <p>„Klar wenn ich sage ein Schwarzstorch dieses Jahr mehrfach da, dann ist das sicherlich was Besonderes aber das sind ja auch die einzelnen Faktoren die eine Rolle spielen. Ich sagte ja, dass da der Teich beim Austrocknen war und das eine besondere Futterquelle war.“ (Landwirt*in 14)</p> <p>„(...) die [Wildschweine] suchen da Würmer und so die sie da ausbuddeln.“ (Landwirt*in 15)</p> <p>„Und wenn er [der Wolf] dann in seiner Nähe Schafe hat und erst einmal gelernt hat, wie harmlos Schafe sind, dann geht er eben auch immer wieder auf Schafe.“ (Expert*in 2)</p> <p>„(...) mir viel da zum Beispiel der Schreiadler ein der ja auch immer noch ein paar Brutvorkommen hat im Templiner Raum und für den das Grünland als Nahrungsraum ja sehr wichtig ist.“ (Expert*in 3)</p>	<p>for beetles, search for worms, and then the surfaces are damaged.” (farmer 13)</p> <p>“Sure if I say a black stork this year several times there, then it is certainly something special but these are also the individual factors that play a role. I already said that the pond was drying up and that was a special food source.” (farmer 14)</p> <p>“(...) they [the wild boars] are looking for worms to dig them up.” (farmer 15)</p> <p>“And if he [the wolf] then has sheep near him and has only once learned how harmless sheep are, then he also goes to sheep again and again.” (expert 2)</p> <p>“(...) I thought of the lesser spotted eagle, for example, which still has a few breeding sites in the Templin area and for which grassland is very important as a feeding ground.” (expert 3)</p>
-herbivory	<p>„(...) das Wild hat ja sonst den ganzen Tag Zeit die Nahrung zu sich zu nehmen. Wenn sie dann aber nur immer am aufpassen [sind] wer dich gerade verfolgt, dann kommen sie in die Fläche in der Nacht wenn es dunkel ist und dann wird Tische und Bänke gefressen.“ (Landwirt*in 2)</p> <p>„(...) weil das Wild, die essen natürlich gern da auf dem, ich hab da son bisschen Luzerne mitdrin so eine Aussaatmischung so ein bisschen gemacht, da äsen sie gerne.“ (Landwirt*in 3)</p> <p>„Da gibt es auch Wildtiere so wie Rehe und Damwild was ja auch oft vertreten ist. Ist eine gute Äsung für die. Die fressen sich auf dem Grünland satt.“ (Landwirt*in 6)</p> <p>„(...) wir haben mehr Wild auf diesen Beständen. Die wollen Freifläche und Wald haben und wir</p>	<p>“(...) usually the game has the whole day to feed. But if they are always on the watch who is chasing them, then they come into the area at night when it is dark and then tables and benches are eaten.”(farmer 2)</p> <p>“(...) because the game, of course they like to eat there on the, I've got a bit of alfalfa in there a seed mixture I made there, they like to eat there.” (farmer 3)</p> <p>“There are also wild animals such as deer and fallow deer which is also often represented. It is good for them to graze. They then feed on the grassland.” (farmer 6)</p> <p>“(...) We have more game on these stands. They want to have open space</p>

		haben Eichelmast im Wald (...).“ (Landwirt*in 7)	and forest. We have a lot of acorns in the forest (...).” (farmer 7)
		„Aber an den Randbäumen wissen wir da haben wir bei uns oft Eichen zu stehen und unter so einer Eiche, da etablieren sich Lebensräume, also sieht man an den Wildschweinen.“ (Landwirt *in 9)	“But on the edge trees we often have oak trees and under such oak trees, habitats are established, so you can see from the wild boars.” (farmer 9)
		„(...) oder das Rotwild, die da auch raufgehen um zu äsen. Rehwild ist natürlich auch auf dem Grünland.“ (Landwirt*in 10)	“(...) or the red deer, which also go there to graze. Roe deer are of course present on the grassland as well.” (farmer 10)
		„(...) die [Wildschweine] fressen je nach Saison auch, wenn denn viel Eichelmast und Kastanien und Bucheckern im Wald zu finden sind.“ (Landwirt*in 13)	“(...) the [wild boars] also eat, depending on the season, if there is a lot of acorns and chestnuts and beechnuts in the forest.” (farmer 13)
		I: „Fallen ihnen noch andere Gründe ein warum manche Arten aus dem Wald auf ihrem Grünland vorkommen?“	I: “Can you think of other reasons why some species from the forest occur on your grassland?”
		B: „Ja weil das Gras sicherlich wenn es gemäht ist und neu wieder aufwächst bzw. abgefressen worden ist, ist es ja frischer ist es ja saftiger“ (Landwirt*in 14)	B: “Yes, because the grass when it is mowed and grows up again or has been eaten off, it is fresher, it is juicier.” (farmer 14)
	-parasitism	„(...) in der Bewirtschaftung haben wir auch noch mit Mücken, Fliegen zu tun.“ (Landwirt*in 7)	“(...) in management we also have to deal with mosquitoes, flies.” (farmer 7)
		„(...) das [Holzbockvorkommen] wird sicherlich auch im Wald sein. Also es werden mehrere bestimmte Arten, Insekten dort sein, die natürlich auf ne beweideten Fläche weniger sind.“ (Landwirt*in 11)	“(...) that [occurrence of wood ticks] will certainly be in the forest. So there will be several specific species, insects, which are of course less on a grazed area.” (farmer 11)
wind protection	-decreased wind velocity	„Aber wenn man so am Waldrand ist und von der Wetterlage von der Seite der Wind kommt (...). Da ist es immer ein bisschen geschützter.“ (Landwirt*in 3)	“But if you are at the edge of the forest and the wind comes from the side (...). It's always a bit more protected there.” (farmer 3)
		„Ringsherum ist ja hier Wald eigentlich, das die Winde natürlich nicht so [stark] sind dann.“ (Landwirt*in 5)	“All around here is forest, so the winds are not so strong, of course.” (farmer 5)
		„Ja der Windschutz auch.“ (Landwirt*in 6)	“Yes, the wind protection, too.” (farmer 6)
		„(...) im Winter ist es sogar angenehmer, wenn man auch mal	“(...) in winter it is even more pleasant to have



	Windschatten hat.“ (Landwirt*in 9)	wind protection from time to time.” (farmer 9)
	„Allgemein ist unsere Erfahrung auch für Ackerstandorte, das Hecken und Waldränder schon ihre Vorteile haben, weil sie so ein bisschen Windschutz geben und Schatten und sowas.“ (Landwirt*in 10)	“In general, our experience is that hedges and forest edges have their advantages, because they give a bit of wind protection and shade and so on.” (farmer 10)
	„Sie haben natürlich Windschutz das ist da (...)“ (Landwirt*in 11)	“You have of course wind protection that is there (...)” (farmer 11)
	„(...) klar ist es kühler am Waldrand so und Windschutz klar auch.“ (Landwirt*in 12)	“(...) clearly it is cooler at the edge of the forest so and wind protection is clearly also present.” (farmer 12)
	„Von der direkten Bewirtschaftung Vorteile könnten natürlich sein mit Winderosion, also das müsste ja dann doch deutlich den Wind ausbremsen.“ (Landwirt*in 13)	“From the direct management advantages could of course be wind erosion, so that it significantly slows down the wind.” (farmer 13)
	„(...) der sorgt sicherlich dafür, dass da nicht ganz so schnell, das Wasser verdunstet durch den Wind, aber wie groß der Einfluss ist.“ (Landwirt*in 15)	“(...) it certainly ensures that the water does not evaporate that quickly due to the wind, but how great the influence is.” (farmer 15)
	„Es gibt einen gefühlten Wind-, Erosionsschutz mit dem Wald in Damerow.“ (Landwirt*in 16)	“There is perceived wind, erosion protection with the forest in Damerow.” (farmer 16)
	„(...) und Windschutz klar, das definitiv, Winderosion und sonst auch der allgemeine Windschutz genauso wie für meine Tiere auch ist der Wald da ein wichtiger Punkt.“ (Landwirt*in 17)	“(...) and wind protection clear, that definitely, wind erosion and otherwise also the general wind protection also for my animals the forest is an important point.” (farmer 17)
	„Also außer Windschutz und solche Geschichten ist mir da erstmal auch nicht mehr eingefallen.“ (Expert*in 1)	“So apart from windbreaks and such stories, I can't think of anything else for the moment.” (expert 1)
-water retention on soil surface	„(...) weil der Wind der trocknet auch richtig aus wenn der Wind über die Felder fegt. Der nimmt ja sehr viel Feuchtigkeit mit und das könnte der Wald oder Waldstreifen auch verhindern.“ (Landwirt*in 5)	“(...) because the wind also dries out considerably when it sweeps over the fields. It takes a lot of moisture with it and the forest or forest strip could also prevent that.” (farmer 5)
	„Auf jeden Fall, es kann nicht so schnell austrocknen, weil der Wind bricht sozusagen und ja ist auch	“Definitely, it can not dry out so quickly, because the wind breaks, so to

decreased  
solar  
radiation      -water  
retention on  
soil surface

positiv. Wegen Wasserhaushalt auch.“ (Landwirt\*in 6)

„Ja ist natürlich gut wenn du Wald und Struktur drin hast. Also die Feuchtigkeit geht nicht so schnell raus und Winderosion ist ja, gut aufm Grünland nicht, aber ist ja aufm Acker auch ein Thema.“ (Landwirt\*in 8)

„Sehen sie ja auch wenn Tau ist oder so im Waldbereich ist es eher nass und wenn sie weiter weg sind ist dann trocken, weil dann der Wind da eher rankommt.“ (Landwirt\*in 11)

„Stimmt, der Wind trocknet weniger aus, also wenn weniger Wind ist, Schatten hilft auch dazu.“ (Landwirt\*in 12)

„(...) der sorgt sicherlich dafür, dass da nicht ganz so schnell, das Wasser verdunstet durch den Wind, aber wie groß der Einfluss ist.“ (Landwirt\*in 15)

„Sieht man ja auch sehr schön im Windschatten von solchen Waldparzellen, hat man meist länger eine Bereifung (...) und ich kann mir vorstellen, dass dort die Luftfeuchtigkeit länger gehalten wird, durch diesen Windschatteneffekt.“ (Expert\*in 1)  
„(...) auf der einen Seite weiß man, dass eben an Gehölzen sich der Wind bricht und wie gesagt dann mehr Feuchtigkeit entsteht.“ (Expert\*in 3)

„Aber ansonsten, das [die Wald-Grünland Übergangszone] ist ja ein anderer Lebensraum, so muss man es ja auch sagen. Erstens feuchter, schattiger  
+-der ist nicht ganz so warm.“ (Landwirt\*in 2)

Er beschattet, das ist schon so. Und je nachdem es bleibt länger feucht. (Landwirt\*in 4)

„Ich denke auch, dass hinterm Wald natürlich auch weniger Verdunstung ist weil oftmals der Wald auch einen

speak, and yes is also positive. Because of water balance also.” (farmer 6)

“Yes, of course, it is good if you have forest and structure in it. So the moisture does not go out so quickly and wind erosion is, well on the grassland is not, but is on the field also an issue.” (farmer 8)

“You can see when there is dew in the forest area it is rather wet and when you are further away it is dry, because then the wind is more likely to get there.” (farmer 11)

“True, the wind dries out less, so when there is less wind, shade also helps for this.” (farmer 12)

“(...) it certainly ensures that the water does not evaporate that quickly due to the wind, but how great the influence is.” (farmer 15)

“One sees also very nicely in the slipstream of such forest plots, one has usually longer hoarfrost (...) and I can imagine that there the humidity is held longer, by this wind shadow effect.” (expert 1)  
“(...) On the one hand, we know that the wind breaks on trees and, as I said, more moisture is created.” (expert 3)

“But apart from that, that's [the forest-grassland transition zone] a different habitat, you have to say. First, it's more humid, shadier and not quite as warm.” (farmer 2)

“It is casting a shadow in fact, it is. And depending on it stays wet longer.” (farmer 4)

“I also think that behind the forest is obviously also less evaporation

Schatten wirft.“ (Landwirt*in 6)	because often the forest also casts a shadow.” (farmer 6)
„(...) man hat Schattenbereiche, hat auch noch Bereiche wo länger Feuchtigkeit sich hält (...).“ (Landwirt*in 9)	“(...) you have shaded areas, you also have areas where moisture stays longer (...).” (farmer 9)
I: „Ist ihnen schon mal aufgefallen das Flächen die an Wald grenzen auch in Hinblick auf zum Beispiel Dürre, das die mehr Ertrag hatten?“	I: “Have you ever noticed that areas bordering on forest, also with regard to drought, for example, had a higher yield?”
B: „(...) Allgemein ist unsere Erfahrung auch für Ackerstandorte, das Hecken und Waldränder schon ihre Vorteile haben, weil sie so ein bisschen Windschutz geben und Schatten.“ (Landwirt*in 10)	B: “(...) In general, our experience is also for arable land, that hedges and forest edges already have their advantages, because they give a bit of wind protection and shade.” (farmer 10)
„(...) im Bereich des Waldes, [...] im Schattenbereich ist es auch eben länger schattig und kühl. Sehen sie ja auch wenn Tau ist im Waldbereich ist es eher nass (...).“ (Landwirt*in 11)	“(...) in the area of the forest, [...] in the shadow area it is longer shady and cool. You can also see when there is dew in the forest area it is rather wet (...).” (farmer 11)
„Stimmt, der Wind trocknet weniger aus, also wenn weniger Wind ist, Schatten hilft auch dazu.“ (Landwirt*in 12)	“True, the wind dries out less, so when there is less wind, shade also helps for this.” (farmer 12)
„Diese Schattenlagen wo der Wald deutlich Schatten wirft die sind dann teilweise im Winter deutlich mehr unter Frost, wenn andere Flächen schon aufgetaut sind, dann bleiben die noch schattig, führt dann teilweise auch zu anhaltender Nässe.“ (Landwirt*in 13)	“These shaded areas where the forest clearly casts shadows are then partly in winter clearly more under frost, when other areas are already thawed, then they remain still shaded, leads then partly also to persistent wetness.” (farmer 13)
„(...) die Bäume machen schon ziemlich viel Schatten und da trocknet das Heu halt schlechter.“ (Landwirt*in 15)	“(...) the trees make quite a lot of shade and there the hay dries just worse.” (farmer 15)
„Vielleicht hält er ein bisschen mehr Feuchtigkeit aber auch nur gefühlt.“ (Landwirt*in 14)	“Maybe he holds a little more moisture but only perceived.” (farmer 14)
„Naja man sieht das schon das teilweise wenn das so warm ist, wenn die Sonne nicht direkt draufknallt, dass dann schon mehr Wasser gehalten wird.“ (Landwirt*in 17)	“Well you can see that partly when it is hot, when the sun is not directly shining on it, that more water is held.” (farmer 17)
„Wo in den Schattenbereichen eine Zeitlang, der positive Effekt der verringerten Sonneneinstrahlung	“Where in the shaded areas for a while, the positive effect of the

	gewirkt hat, dass da im Schatten noch ein bisschen mehr gewachsen ist als in der prallen Sonne (...).“ (Expert*in 3)	reduced solar radiation has worked, that there in the shade has grown a bit more than in the blazing sun (...).” (expert 3)
	„Es sah mir immer feuchter aus, aber es ist vielleicht dann eben auch eher die Beschattung (...).“ (Expert*in 4)	“It always looked more humid to me, but it is perhaps then also more the shading (...).” (expert 4)
-decomposition and fixing processes	„(...) und dann geh ich mal davon aus beschatten die die Fläche besser und dann hast du da einen viel höheren Humusanteil.“ (Landwirt*in 2)	“(...) and then I assume they shade the area better and you have a much higher humus content there.” (farmer 2)
	„Und hinterm Wald ist der Boden beschattet, die Temperatur geht nicht so hoch und das ist positiv fürs Bodenleben.“ (Landwirt*in 6)	“And behind the forest, the ground is shaded, the temperature does not increase that much and that is positive for soil life.” (farmer 6)

**Table A1.2:** Result table for the code dimension “perception of landscape characteristics”.

Code dimension	Code theme	Code	Quote German	Quote English
perception of landscape characteristics	species composition	-wild boars	Und machen sie irgendwas oder verwenden sie den Wald oder kommen sie in das Grünland rein?	And do they do anything or use the forest or come into the grassland?
			„Die Wildschweine [...] sind gerne im Grünland.“ (Landwirt*in 2)	“The wild boars [...] like to be in the grassland.” (farmer 2)
			„Wildschwein ist fürs Grünland ein großer Nachteil. Und die kommen natürlich vom Rand, vom Schilfgürtel oder vom Wald (...).“ (Landwirt*in 3)	“Wild boars are a big disadvantage for the grassland. And of course they come from the edge, from the reed belt or the forest (...).” (farmer 3)
			„(...) und in diesem Schattenschlag, des Waldes ist natürlich auch der Wildschaden (...).“ (Landwirt*in 5)	“(...) and in this shade, the forest is of course also the damage caused by the game (...).” (farmer 5)
			„Fallen dir noch andere Gründe ein warum Tiere aus dem Wald auf dem Grünland dann vorkommen?“	“Can you think of any other reasons why animals from the forest can be found on grassland?”
			„(...) die Wildschweine suchen das Bodenleben, vielleicht auch heruntergefallene Bucheckern oder Eicheln (...).“ (Landwirt*in 6)	“(...) the wild boars are looking for ground life, maybe also fallen beechnuts or acorns (...).” (farmer 6)
			„(...) die wollen Freifläche und Wald haben. Wir haben Eichelmast im Wald und die kommen auch im	“(...) they want to have open fields and forests. We have acorn mast in

	Herbst raus um sich für den Winter Eiweiß zu suchen auf dem Grünland und wühlen.“ (Landwirt*in 7)	the forest and they come out in autumn to look for protein for the winter on the grassland and dig.” (farmer 7)
	„Also Wald ist auch problematisch für die Grünlandflächen, weil wir ja auch das Wild im Wald haben (...)“ (Landwirt*in 8)	“So the forest is also problematic for the grassland areas because we also have the game in the forest (...)” (farmer 8)
	„Aber an den Randbäumen wissen wir da haben wir bei uns Eichen zu stehen und unter so einer Eiche [...] da etablieren sich Lebensräume, also sieht man an den Wildschweinen.“ (Landwirt*in 9)	“But at the edge trees there we have oaks and under such an oak [...] habitats establish themselves there, you can see it at the wild boars.” (farmer 9)
	„Ja also im Wald, da sind dann die Wildschweine die in dem hohen Gras Deckung haben und quasi tierisches Eiweiß suchen.“ (Landwirt*in 10)	“Yes, in the forest, there are the wild boars that have cover in the high grass and look for animal protein.” (farmer 10)
	„(...) weil die [Wildschweine] eben über diese Waldpartien gezogen sind. Also von einem Wald übers Grünland zur nächsten Waldparzelle und dann zum Acker rüber.“ (Landwirt*in 11)	“(...) because the [wild boars] have just moved over these forest areas. So from one forest over grassland to the next forest plot and then to the field.” (farmer 11)
	„(...) wenn denn viel Eichelmast und Kastanien und sonstiges und Bucheckern im Wald zu finden sind. Aber dann suchen sie [...] im Feld, gerade im Grünland nach Würmern (...)“ (Landwirt*in 13)	“(...) if there are a lot of acorns and chestnuts and beechnuts in the forest. But then they look for worms [...] in the field, especially in grassland (...)” (farmer 13)
	„Am Waldrand sind vielleicht Wildschweine ein Thema (...)“ (Landwirt*in 16)	“Forest edge is maybe an issue for boars (...)” (farmer 16)
-deer	„Der Wald dehnt sich immer weiter aus da die Bäume in die Fläche reinwachsen. Dadurch wächst auch das Habitat für wildlebende Tiere zum Beispiel Damwild.“ (Landwirt*in 1)	“The forest continues to expand as the trees grow into the area. This also creates more habitat for wild animals, such as fallow deer.” (farmer 1)
	„Und andere Tiere?“	„And other animals?“
	„Damwild, Rotwild, Rehwild (...)“ (Landwirt*in 2)	“Fallow deer, red deer, roe deer (...)” (farmer 2)
	„Na Rehe sind da. Bisschen ab und zu mal ein Hirsch im Herbst auch.“ (Landwirt*in 5)	“Well, roe deer are there. Now and then a deer in the fall too.” (farmer 5)
	„Da gibt es dann auch Wildtiere so wie Rehe und Damwild was ja auch oft vertreten ist, ist dann halt eine gute Äsung für die.“ (Landwirt*in 6)	“There are also wild animals such as deer and fallow deer which is also often present, it is good for them to graze.” (farmer 6)



	<p>„Beim größten anfangen haben wir Damwild, Rehwild, Schwarzwild (...).“ (Landwirt*in 7)</p> <p>„(...) oder das Rotwild, die da auch raufgehen um zu äsen. Rehwild ist natürlich auch aufm Grünland.“ (Landwirt*in 10)</p> <p>„Aber ansonsten sind die Randbereiche - gerade so Niederwild und auch Hochwild, das Rotwild und auch Kraniche und Hasen, sieht man auch.“ (Landwirt*in 13)</p> <p>„(...) und Rehe die ziehen sich auf unsere Flächen.“ (Landwirt*in 14)</p> <p>„Beobachtet hab ich da bisher bloß Rehe (...).“ (Landwirt*in 15)</p>	<p>“Start with the biggest we have fallow deer, roe deer, wild boar (...).” (farmer 7)</p> <p>“(...) or the red deer, which also go there to graze. Roe deer are of course also on the grassland.” (farmer 10)</p> <p>“But otherwise the peripheral areas - just so small game and also big game, the red deer and also cranes and hares, you can also see.” (farmer 13)</p> <p>“(...) and deer move to our areas.” (farmer 14)</p> <p>“So far I have only observed deer (...).” (farmer 15)</p>
-white and black storks	<p>„Schreiadler haben wir schon immer gehabt, Schwarzstorch haben wir schon immer gehabt. Also ich sag mal dadurch das es sehr abgelegen ist. Wir haben auch relativ naturnahe Vorkommen.“ (Landwirt*in 2)</p> <p>„Störche, wir haben auch einen Schwarzstorch hier. Und die gehen natürlich auf die Wiesen und [...] die holen sich dann da ihr Futter.“ (Landwirt*in 8)</p> <p>„Und Störche ja da und hier.“ (Landwirt*in 12)</p> <p>„(...)Schwarzstorch haben wir zweimal gesehen dies Jahr.“ (Landwirt*in 14)</p>	<p>“Lesser Spotted Eagle was always there, Black Stork was always there. Since it is very remote we also have relatively natural habitats.” (farmer 2)</p> <p>“Storks, we also have a black stork here. And of course they go to the meadows and [...] they get their food there.” (farmer 8)</p> <p>“And storks here and there.” (farmer 12)</p> <p>“(...) we have seen black stork twice this year.” (farmer 14)</p>
-lesser spotted eagle	<p>„Schreiadler haben wir schon immer gehabt, Schwarzstorch haben wir schon immer gehabt. Also ich sag mal dadurch das es sehr abgelegen ist. Wir haben auch relativ naturnahe Vorkommen.“ (Landwirt*in 2)</p> <p>„(...) ich hab hier auch einen Schreiadler neben dem Ackerbereich im Wald (...).“ (Landwirt*in 11)</p> <p>„(...) der Schreiadler, der ja auch immer noch Brutvorkommen hat im Templiner Raum und für den das Grünland als Nahrungsraum ja sehr wichtig ist (...).“ (Expert*in 3)</p> <p>„(...) für die Region der Schreiadler, auch wenn er nicht häufig ist aber er kommt hier vor.“ (Expert*in 4)</p>	<p>“lesser spotted eagle was always there, black stork was always there. Since it is very remote we also have relatively natural habitats.” (farmer 2)</p> <p>“(...) there is also a lesser spotted eagle next to the field area in the forest (...).” (farmer 11)</p> <p>“(...) the lesser spotted eagle, which also still has breeding occurrences in the Templin area and for which the grassland is very important as food area (...).” (expert 3)</p> <p>“(...) for this region the lesser spotted eagle, although it is not common</p>

		it is found here.” (expert 4)
-great grey shrike and red backed shrike	<p>„Wir haben hier auch den Raubwürger und Neuntöter [die] solche Randbereiche ja auch gerne nutzen.“ (Landwirt*in 13)</p> <p>„(...) Arten die Wechselgänger sind, also die vor allem die Grenzregionen, die Übergangsregionen Wald-Grünland, da haben wir praktisch diese: Raubwürger, Neuntöter (...)“ (Expert*in 1)</p>	<p>“We have here also the great grey shrike and red-backed shrike [which] like to use such edge areas.” (farmer 13)</p> <p>“(…) Species that are changelings, i.e. mainly the transitional regions between forest and grassland, we practically have these: great grey shrike, red-backed shrike (...)” (expert 1)</p>
-insects	<p>„Zum Beispiel Blattlausbefall ist überall, da diese in Bäumen überwintern.“ (Landwirt*in 1)</p> <p>„(...) also von Insekten her geh ich ganz schwer davon aus, dass da mehr sind an der Waldkante, weil ein ganz anderes Klima da herrscht.“ (Landwirt*in 2)</p> <p>(...) die Arten die sie dem Wald zuordnen würden, wären dann vor allem das Wild und sonst noch irgendwas anderes?</p> <p>„Wir haben eine ganze Reihe von Insekten (...)“ (Landwirt*in 7)</p> <p>„(...) das wird sicherlich auch im Wald sein. Also es werden mehrere bestimmte Arten, Insekten dort sein, die natürlich auf einer beweideten Fläche weniger sind.“ (Landwirt*in 11)</p>	<p>“For example, aphid infestation is everywhere, as they spend the winter in trees.” (farmer 1)</p> <p>“(…) so insects I am quite sure that there are more of them at the edge of the forest because there is a completely different climate.” (farmer 2)</p> <p>(...) the species you would assign to the forest, would be mainly game and anything else?</p> <p>“We have a whole range of insects (...)” (farmer 7)</p> <p>“(…) that will certainly be in the forest. So there will be several specific species, insects, which are of course less on a grazed area.” (farmer 11)</p>
-sloes	<p>„Sind ja dann Hecken, also Schlehen meistens die dann da im Übergangsbereich sind.“ (Landwirt*in 5)</p> <p>„(...) wo auch ordentlich Schlehen [...] reingewachsen sind.“ (Landwirt*in 13)</p> <p>„Wir haben ab und zu mal solche Heckenrosen und die Schlehe kommt auch ab und zu.“ (Landwirt*in 14)</p>	<p>“There are hedges, mostly sloes, which are in the transition area.” (farmer 5)</p> <p>“(…) where also sloes [...] have grown into.” (farmer 13)</p> <p>“From time to time we have dog roses and the sloe also comes from time to time.” (farmer 14)</p>
-poplars	<p>„Wenn man nicht mähen würde, Sämlinge und durch Wurzeln. Bei Pappeln ist es so schlimm (...)“ (Landwirt*in 12)</p> <p>“(…) und Pappeln wachsen immer weiter ins Feld rein.“ (Landwirt*in 13)</p>	<p>“If one would not mow, seedlings and by roots. With poplars it is so bad (...)” (farmer 12)</p> <p>“(…) and poplars grow further and further into the field.” (farmer 13)</p>
-black-berries	<p>„(...) und da kommen jetzt diese Brombeersträucher darein, die</p>	<p>“(…) and now these blackberry bushes grow</p>

		wachsen da jetzt teilweise ins Grünland rein.“ (Landwirt*in 15)	into it, they are now partly growing into the grassland.” (farmer 15)
-robinias		„Wenn wir dann Grünlandverbesserung machen wollen, sind die Samen von der Robinie mit drin und die keimen dann und dann haben wir auf einmal einen neuen Robinienwald da.“ (Landwirt*in 5)	“If we want to improve the grassland, the seeds of the robinia are mixed in and they germinate and then all of a sudden we have a new robinia forest.” (farmer 5)
-dog roses		„Oder Hagebutten oder so was die vermehren sich da natürlich.“ (Landwirt*in 5) „Wir haben ab und zu mal solche Heckenrosen und die Schlehe kommt auch ab und zu.“ (Landwirt*in 14)	“Or dog roses they multiply there, of course.” (farmer 5) “From time to time we have dog roses and the sloe also comes from time to time.” (farmer 14)

**Table A1.3:** Result table for the code dimension “contribution to grassland production”.

Code dimension	Code theme	Code	Quote German	Quote English
contribution to grassland production	contributions of dead forest material	<u>positive contributions</u>		
		-increased nitrogen input	„(...) dass da ein höherer Nährstoffeintrag ist durch die Blätter die der Wald verliert und da sieht man dann, dass das Gras da etwas dunkler gefärbt ist, demzufolge kann man sagen, dass da vielleicht doch mehr Stickstoff umgesetzt wird.“ (Landwirt*in 6)	“(…) that there is a higher nutrient input through the leaves that the forest loses and then you see that the grass is a little darker in colour, so you can say that perhaps more nitrogen is converted.” (farmer 6)
			„(...) gut der Wald, die Blätter die runterfallen. Das heißt nicht, dass es der Rede wert ist.“ (Landwirt 12)	“(…) well the forest the leaves that fall there. That does not mean it's worth mentioning.” (farmer 12)
			„Ich denke mal schon, dass da teilweise schon durch das Laub was im Herbst kommt, der Humusanteil ein bisschen größer ist noch.“ (Landwirt 15)	“I think that the hummus is a little bit bigger because of the foliage which comes in autumn.” (farmer 15)
		<u>negative contributions</u>		
		-increased management efforts	„Da im Wald keine Bewirtschaftung stattfindet, weil die Besitzer Naturschutz als keine Bewirtschaftung verstehen, fallen öfter Bäume ins Grünland rein. [...] Wir müssen für die Waldkantenpflege sorgen.“ (Landwirt*in 1)	„Since there is no management in the forest, because the owners understand nature conservation as no management, trees fall into the grassland more often. [...] We have to take care of the forest edges.” (farmer 1)
			„(...) das am Rand trockene Bäume stehen, die drohen auf die Wiese zu kippen das man die schon von vorneherein gezielt absägt, so dass das Grünland	„(...) that dry trees stand at the edge, which threaten to fall on the grassland are sawn off purposefully, so that the



	<p>Tiere die natürlich dann schnell warm werden und das ist in der Nähe vom Wald deutlich angenehmer.“ (Landwirt*in 17)</p>	<p>black animals that get very, very warm very quickly and that is much more comfortable near the forest.” (farmer 17)</p>
	<p>„Naja der Wald puffert mit Sicherheit Temperaturen. Er spendet Schatten, bzw. bei sehr kalten Winden, vielleicht dann auch Windschatten, gegenüber Kälte. Das ist dann interessant, wenn da Tiere auf der Fläche stehen, die suchen oft Schutz dann im Waldbereich.“ (Expert*in 2)</p>	<p>“Well, the forest certainly buffers temperatures. It provides shade, or in very cold winds, perhaps even slipstream, against the cold. This is interesting if there are animals in the area, they often seek protection in the forest.” (expert 2)</p>
-increased water availability	<p>„Ich denke schon, also die Schutzwirkung durch Wind und Wasserhaltevermögen wird sicherlich ein bisschen verbessert, wenn da auch Wald, Waldstreifen oder Wald [sind].“ (Landwirt*in 5)</p>	<p>“I think so, so the protective effect by wind and water holding capacity is certainly improved a bit if there [are] also forest, forest strips or forest.” (farmer 5)</p>
	<p>„Ich denke mal für die Artenvielfalt und den Ertrag ist der Wald schon ein Vorteil, das ist so in Dürreperioden, dann wird es vor Sonne und vor Wind geschützt und es trocknet nicht so aus.“ (Landwirt*in 6)</p>	<p>“I think for biodiversity and yield the forest is indeed an advantage, that is the case in drought periods, it is protected from sun and from wind and it does not dry out so much.” (farmer 6)</p>
	<p>„(...) und der Ertrag denn doch deutlich besser ist, weil es ja ein reines Wasserproblem war und wenn dann so ein Meter Wasser gespeichert bleibt und nicht verdunstet, das vorteilhafter ist.“ (Landwirt*in 13)</p>	<p>“(…) and the yield is then significantly higher, because it was a pure water problem and if a meter of water remains stored and does not evaporate, it is more advantageous.” (farmer 13)</p>
	<p>„Naja man sieht das schon das teilweise wenn das so warm ist, wenn die Sonne nicht direkt draufknallt, dass dann schon mehr Wasser gehalten wird. Im Anfangsstadium [...], da hat das Grünland schon eher ein Defizit direkt am Wald, aber das holt es auf jeden Fall eigentlich wieder auf.“ (Landwirt*in 17)</p>	<p>“Well you can see that partly when it is so warm, when the sun is not directly shining on it, that more water is held there. In the early stages [...], the grassland has more of a deficit right next to the forest, but it actually makes up for it in any case.” (farmer 17)</p>
	<p>„Es hängt sicherlich auch davon ab, was hat man für ein Jahr, so wie letztes Jahr wieder. Wo in den Schattenbereichen eine Zeitlang, der positive Effekt der verringerten Sonneneinstrahlung gewirkt hat, dass da im Schatten</p>	<p>“It certainly also depends on the kind of year you have, like last year again. Where in the shaded areas for a while, the positive effect of reduced solar radiation has worked, that</p>

	noch ein bisschen mehr gewachsen ist als in der prallen Sonne.“ (Expert*in 3)	there in the shade has grown a bit more than in the blazing sun.” (expert 3)
-enhanced soil life	„(...) und dann geh ich mal davon aus beschatten die die Fläche besser und dann hast du da einen viel höheren Humusanteil.“ (Landwirt*in 2) „Und hinterm Wald ist der Boden beschattet, die Temperatur geht nicht so hoch und das ist positiv fürs Bodenleben.“ (Landwirt*in 6)	“(...) and then I assume they shade the area better and you have a much higher humus content there.” (farmer 2) “And behind the forest, the ground is shaded, the temperature does not increase that much and that is positive for soil life.” (farmer 6)
-improved fodder availability	„Hat natürlich im Sommer Vorteile, hat auch noch Bereiche wo länger Feuchtigkeit gehalten wird und Ecken wo die Vegetation später ansetzt.“ (Landwirt*in 9)	“There are advantages in summer, there are areas where moisture is kept longer and corners where the vegetation starts to grow later.” (farmer 9)
<u>negative contributions</u>		
-inhibition of plant growth	„(...) am Wald wird immer weniger Ertrag sein, weil zum einen ist es ein bisschen schattiger (...).“ (Landwirt*in 2)  „Schatten ist nicht immer gut, weil manche Pflanzen brauchen das Sonnenlicht um zu assimilieren.“ (Landwirt*in 6) „(...) dann hat man noch Probleme mit Schattenbildung, also das der Ertrag da geringer ist.“ (Landwirt*in 8) „(...) durch den Schatten, ist ja auch weniger Vegetation im angrenzenden Bereich.“ (Landwirt*in 11) „Die Verschattung dann von der Seite, lässt auch nicht viel wachsen.“ (Landwirt*in 14) „(...) die Bäume machen schon ziemlich viel Schatten und [...] ist noch relativ wenig, Masse da an Grünfutter, also wächst da halt doch schlechter.“ (Landwirt*in 15) „Im Anfangsstadium, da sieht man das schon, da hat das Grünland schon eher ein Defizit direkt am Wald (...).“ (Landwirt*in 17) „(...) die haben starke Beschattung, das ist also für die Gräser ungünstig.“ (Expert*in 2)	“(...) there will be always fewer yields at the forest, because on the one hand it is a bit shadier (...).” (farmer 2)  “Shade is not always good because some plants need sunlight to assimilate.” (farmer 6) “(...) then you still have problems with shadow creation, so that the yield is lower.” (farmer 8) “(...) due to the shadow, there is less vegetation in the adjacent area.” (farmer 11) “The shading from the side does not allow much to grow.” (farmer 14) “(...) the trees make quite a lot of shade and [...] it is still relatively little mass of green fodder, so it does not grow well.” (farmer 15) “In the initial stage, you can already see that the grassland has a deficit directly at the forest (...).” (farmer 17) “(...) they are strongly exposed to shade, so this is unfavourable for the grasses.” (expert 2)
-increased	„(...) weil man ja oft Schatten hat	“(...) because you often



	management efforts	<p>hintern Wald und da trocknet es nicht so gut ab.“ (Landwirt*in 6)</p> <p>„(...) da ist immer Schatten, da trocknet natürlich das Heu immer schlecht.“ (Landwirt*in 12)</p> <p>„Diese Schattenlagen die sind dann teilweise im Winter deutlich mehr unter Frost, wenn andere Flächen schon aufgetaut sind.“ (Landwirt*in 13)</p> <p>„(...) für die Ernte ist es erstmal ungünstig, weil es eben Schatten bildet und das Heu dann eben schlechter trocknet in dem Bereich.“ (Landwirt*in 15)</p>	<p>have shade behind the forest and it does not dry off so well.” (farmer 6)</p> <p>“(...) there is always shade, of course, the hay always dries badly.” (farmer 12)</p> <p>“These shadow-areas are in the winter more under frost, if other surfaces are already thawed.” (farmer 13)</p> <p>“(...) for the harvest it is unfavourable at first because it forms shade and the hay dries less well in the area.” (farmer 15)</p>
	-reduced fodder quality	<p>„Das kann man nur mulchen und weg damit, das ist nicht mehr Futter ne, absolut nicht.“ (Landwirt*in 3)</p> <p>„Ja in Wald nähe sind meistens doch eben Moose ein bisschen mehr. Dass da durch die Schattenwirkung auf jeden Fall auch der Ertrag dann schlechter ist.“ (Landwirt*in 5)</p>	<p>“You can only mulch it and get rid of it, it is no longer fodder, absolutely not.” (farmer 3)</p> <p>“Yes, near the forest there are usually more mosses. Because of the shadow effect the yield is worse.” (farmer 5)</p>
contributions of species interactions	<u>positive contributions</u>		
	-reduced pest damages	<p>„(...) aber wenn [...] andere Strukturen drum herum sind, dann ist die Wahrscheinlichkeit höher das da auch irgendwelche Tiere sind die Schädlinge fressen können.“ (Expert*in 4)</p>	<p>“(...) but if [...] there are other structures around it, then the probability is higher that there are also some animals that can eat pests.” (expert 4)</p>
	<u>negative contributions</u>		
	-wild life damages	<p>„Jetzt ist es aber so, dass wir wochenweise kein Wild haben und wochenweise so viel Wild haben, die dann so stark zu Schaden gehen, dass man sich kaum vor wehren kann.“ (Landwirt*in 2)</p> <p>„Wildschwein ist schon fürs Grünland ein großer Nachteil. Und die kommen natürlich vom Rand, von Schilfgürtel oder vom Wald.“ (Landwirt*in 3)</p> <p>„Schwarzwild gibt es hier, [...] die dann da im Schlagschatten des Waldes, alles umwühlen.“ (Landwirt*in 5)</p> <p>„Die Wildschweine suchen das Bodenleben, vielleicht auch heruntergefallene Bucheckern oder Eicheln.“ (Landwirt*in 6)</p>	<p>“But now it is the case that we do not have any game for weeks and then another week we have so much game causing so much damage that we can hardly defend ourselves against it.” (farmer 2)</p> <p>“Wild boar is a big disadvantage for the grassland. And of course, they come from the edge, from the reed belt or the forest.” (farmer 3)</p> <p>“There are wild boars here, [...] which then root around everything in the shadow of the forest.” (farmer 5)</p> <p>“The wild boars look for the terrestrial life, maybe also fallen beechnuts or acorns.” (farmer 6)</p>

	<p>„Das Wild verschafft uns grundsätzlich Nachteile, weil es eben auch Grünland aufwühlt Grünland kaputt macht.“ (Landwirt*in 7)</p> <p>„Wald ist auch problematisch für die Grünlandflächen, weil wir ja auch das Wild im Wald haben, also Wildschäden.“ (Landwirt*in 8)</p> <p>„Also die Wildschweine die sind eher von Nachteil, wenn die aus dem Wald aufs Grünland kommen.“ (Landwirt*in 10)</p> <p>„Im Grünland haben sie vor 2 Jahren und vor 3 Jahren größere Schäden gemacht, also dass sie gewühlt haben nach Engerlingen im Boden.“ (Landwirt*in 11)</p> <p>„(...), wenn die [die Wildschweine] jetzt hier wühlen, Käfer suchen, Würmer suchen, dann sind die Flächen natürlich erstmal beschädigt.“ (Landwirt*in 13)</p> <p>„(...) die [Wildschweine] suchen da Würmer und so die sie da ausbuddeln.“ (Landwirt*in 15)</p> <p>„(...) Wald, beherbergt Wild insbesondere auch Wildschweine, die dann die Grasnarbe zerstören können.“ (Expert*in 1)</p> <p>„(...), dass die Wildschweine aus dem Wald wo sie eigentlich leben dann auf die Grünlandflächen wechseln und das ist natürlich dann schwierig.“ (Expert*in 2)</p>	<p>“The game provides us disadvantages because it ploughs up grassland and destroys grassland.” (farmer 7)</p> <p>“Forest is also problematic for grassland areas because we also have the game in the forest, i.e. game damage.” (farmer 8)</p> <p>“So, the wild boars are more of a disadvantage when they come from the forest to the grassland.” (farmer 10)</p> <p>“In the grassland, they made bigger damages 2 years ago and before 3 years, because they rooted for cockchafer grubs in the ground.” (farmer 11)</p> <p>“(...) if they [the wild boars] root here, search for beetles, search for worms, and then the surfaces are damaged.” (farmer 13)</p> <p>“(...) they [the wild boars] are looking for worms to dig them up.” (farmer 15)</p> <p>“(...) forest, is home to game, wild boars in particular, which can destroy the grass.” (expert 1)</p> <p>“(...) that the wild pigs from the forest where they live then change to the grassland areas and that is of course then difficult.” (expert 2)</p>
-reduced water and nutrient availability	<p>„Für den Ertrag ist der Wald negativ, da er Wasser zieht.“ (Landwirt*in 1)</p> <p>„(...) am Wald wird immer weniger Ertrag sein, weil [...] ziehen die Bäume relativ viel Wasser.“ (Landwirt*in 2)</p> <p>„Also am Feldrand, wenn da Wald und Bäume ist, die Bäume holen so das Wasser weg, das da die ersten Meter da ist der Ertrag hin.“ (Landwirt*in 3)</p>	<p>“For the yield, the forest is negative because it withdraws water.” (farmer 1)</p> <p>“(...) there will be fewer yields in the forest, because [...] the trees withdraw a lot of water.” (farmer 2)</p> <p>“So, at the edge of the field, when there are forest and trees, the trees take away the water that is there for the first few meters and the yield is there.” (farmer 3)</p>

	<p>„Wenn wir trockene Jahre haben, soweit wie die Baumkrone reicht ziehen die Bäume auch Wasser, also wir haben da unter sehr trockenen Boden.“ (Landwirt*in 9)</p> <p>„Der Wald braucht ja auch Wasser, das sieht man aufm Acker schneller und deutlicher als aufm Grünland das unter den Bäumen nichts wächst.“ (Landwirt*in 10)</p> <p>„(...) am Rand ziehen sie [die Bäume] mehr Wasser, deswegen ist der Ertrag dort geringer.“ (Landwirt*in 16)</p> <p>„Ja bezüglich Bodenfruchtbarkeit, hatte ich gesagt frisst der Wald eher die Nährstoffe weg und nimmt das Wasser eher weg.“ (Expert*in 1)</p> <p>„(...) und wenn die Wurzeln der Waldkante dann in die Flächen reinreichen, wird da auch noch viel Wasser und Nährstoffe entzogen und man sieht oft, dass da auch wenig wächst.“ (Expert*in 2)</p>	<p>“When we have dry years, as far as the treetop reaches, the trees also draw water, so we have very dry soil underneath.” (farmer 9)</p> <p>“The forest also needs water, which can be seen faster and more clearly on the field than on grassland that nothing grows under the trees.” (farmer 10)</p> <p>“(…) at the edge they [the trees] use more water, so the harvest is lower at the edge.” (farmer 16)</p> <p>“Yes, regarding soil fertility, I said the forest tends to eat away the nutrients and take away the water.” (expert 1)</p> <p>“(…) and if the roots of the edge of the forest reach into the surfaces, there is also still much water and nutrients extracted and you can see that the growth is inhibited.” (expert 2)</p>
-loss of grassland area	<p>„Der Wald dehnt sich immer weiter aus, da die Bäume in die Fläche reinwachsen.“ (Landwirt*in 1)</p> <p>„Und wenn man das einfach wild wachsen lässt, dann kommt die nächste Vermessung und auf einmal hat man einen halben Hektar weniger, weil die ja Luftbilder von oben machen.“ (Landwirt*in 3)</p> <p>„Na wir haben [...] viele Buschreihen, Waldgrenzen und die Situation, dass sich die Natur sich das auch in sehr schnell in sehr hoher Meterzahl zurückholt Jahr für Jahr.“ (Landwirt*in 7)</p> <p>„Wir müssen aufpassen das uns der Wald nicht zuwächst, das heißt ich habe eine Fläche von 8 Hektar und wenn ich 3 Jahre lang nicht irgendwie mal einen Pflegeschnitt mache, dann habe ich nur noch irgendwann am Ende 7 oder 6 Hektar.“ (Landwirt*in 8)</p> <p>„Wenn man nicht mähen würde [...] Eichen auch und alles</p>	<p>“The forest expands more and more as the trees grow into the area.” (farmer 1)</p> <p>“And if you just let it grow rampantly, the next measurement comes and all of a sudden you have half a hectare less because they take aerial photos from above.” (farmer 3)</p> <p>“Well, we have [...] many rows of bushes, forest borders and the situation that nature recovers very quickly in a very high number of meters year after year.” (farmer 7)</p> <p>“We must be careful that the forest does not overgrow us, i.e. I have an area of 8 hectares and if I do not make any maintenance cut for 3 years, then I have at some point only 7 or 6 hectares.” (farmer 8)</p> <p>“If you wouldn't mow [...] oaks too and everything</p>

	eigentlich, das wäre Ruckzuck Wald, ne.“ (Landwirt*in 12)	else, it would be a forest in no time.” (farmer 12)
	„Die Bäume und auch Schwarzdorn wachsen dann teilweise auch recht expansiv immer weiter ins Feld rein.“ (Landwirt*in 13)	“The trees and also blackthorn grow expansively further and further into the field.” (farmer 13)
	„(...) und da kommen jetzt diese Brombeersträucher darein, die wachsen da jetzt teilweise ins Grünland rein. Also vor allen Dingen an den Rändern wo man jetzt mit den Maschinen so ungünstig rankommt noch.“ (Landwirt*in 15)	“(…) and these blackberry bushes come into it, they grow into the grassland. So especially at the edges where you have limited access with the machines.” (farmer 15)
	„Dazu kommt noch der Flächennachweis. Jeder beantragte m <sup>2</sup> ist Geld wert, das heißt die [Landwirte] sind bedacht, alle Säume und jeden Waldrand sauber auszumähen.“ (Expert*in 1)	“In addition, there is, of course, the area proof. Each requested m <sup>2</sup> is worth money that means that they [the farmers] are concerned to mow out all borders and each edge of the forest cleanly.” (expert 1)
	„Ich denke mal der Wald wird jetzt nicht wirklich wahrgenommen, als irgendwas was man einbeziehen könnte, eher das man gucken muss das es nicht in die Fläche reinwächst.“ (Expert*in 3)	“I guess the forest is not perceived as something that you could include, rather that you have to make sure that it does not grow into the area.” (expert 3)
	„(...) was die Landwirte gesagt haben, wegen der Flächenausmessung, dass immer die Bäume in die Fläche wachsen, das sehen die Landwirte als Nachteil.“ (Expert*in 4)	“(…) what the farmers have said, because of the area measurement, that the trees grow into the area, the farmers see this as a disadvantage.” (expert 4)
-reduced fodder quality	„An der Waldgrenze wächst mehr Unkraut (Brennnesseln, Disteln), da dort nicht gut bewirtschaftet werden kann.“ (Landwirt*in 1)	“More weeds (nettles, thistles) grow at the forest border, because it is not possible to manage them well there.” (farmer 1)
	„(...), wenn die Bäume immer wieder rüberwachsen, dann bleibt man automatisch mit den Traktoren und Kabinen ein bisschen weiter ab, aber wenn man das ein Jahr mal gar nicht pflegt dann verwildert alles.“ (Landwirt*in 3)	“(…) if the trees are overhanging then you stay away with the tractors a little bit further, but if you don't take care of that for a year, then everything has gone overgrown.” (farmer 3)
	„Oder dass man, wenn die Bäume rüber ragen, gar nicht mit den Maschinen alles weg mähen kann.“ (Landwirt*in 8)	“Or that you can't mow it all away with the machines when the trees are overhanging.” (farmer 8)
	„Es gibt eine Übergangszone zwischen Wald und dem Anfang	“There is a transition zone between forest and the

		des Grünlands in der andere Arten wachsen, weil das mähen viel verändert.“ (Landwirt*in 16)	beginning of the Grassland, which has a different plant composition, because mowing is changing a lot.” (farmer 16)
		„Typische Arten sind dann Brennessel vielleicht, Disteln je nachdem wie der Landwirt das pflegt [den Waldrand].“ (Expert*in 2)	“Typical species are stinging nettle, thistles depending on how the farmer takes care of it [the edge of the forest].” (expert 2)
wind protection	<u>positive contributions</u> -water retention on soil surface	„Ich denke schon, also die Schutzwirkung durch Wind und Wasserhaltevermögen wird sicherlich ein bisschen verbessert, wenn da auch Wald, Waldstreifen oder Wald [sind].“ (Landwirt*in 5)	“I think so, so the protective effect by wind and water holding capacity is certainly improved a bit if there [are] also forest, forest strips or forest.” (farmer 5)
		„Ich denke mal für die Artenvielfalt und den Ertrag ist der Wald schon ein Vorteil, das ist so in Dürreperioden, dann wird es vor Sonne und vor Wind geschützt und es trocknet nicht so aus.“ (Landwirt*in 6)	“I think for biodiversity and yield the forest is indeed an advantage, that is the case in drought periods, it is protected from sun and from wind and it does not dry out so much.” (farmer 6)
		„(...) und der Ertrag denn doch deutlich besser ist, weil es ja ein reines Wasserproblem war und wenn dann so ein Meter Wasser gespeichert bleibt und nicht verdunstet, das vorteilhafter ist.“ (Landwirt*in 13)	“(…) and the yield is then significantly higher, because it was a pure water problem and if a meter of water remains stored and does not evaporate, it is more advantageous.” (farmer 13)
		„Naja man sieht das schon das teilweise wenn das so warm ist, wenn die Sonne nicht direkt draufknallt, dass dann schon mehr Wasser gehalten wird. Im Anfangsstadium [...], da hat das Grünland schon eher ein Defizit direkt am Wald, aber das holt es auf jeden Fall eigentlich wieder auf.“ (Landwirt*in 17)	“Well you can see that partly when it is so warm, when the sun is not directly shining on it, that more water is held there. In the early stages [...], the grassland has more of a deficit right next to the forest, but it actually makes up for it in any case.” (farmer 17)
		„Es hängt sicherlich auch davon ab, was hat man für ein Jahr, so wie letztes Jahr wieder. Wo in den Schattenbereichen eine Zeitlang, der positive Effekt der verringerten Sonneneinstrahlung gewirkt hat, dass da im Schatten noch ein bisschen mehr gewachsen ist als in der prallen	“It certainly also depends on the kind of year you have, like last year again. Where in the shaded areas for a while, the positive effect of reduced solar radiation has worked, that there in the shade has grown a bit more than in

		Sonne.“ (Expert*in 3)	the blazing sun.” (expert 3)
-increased animal well-being		„Also die Beweidung für die Rinder ist ja auch schön, wenn ein bisschen Wald ist und nicht nur kahle Fläche, die haben bisschen Sonnenschutz bisschen Windschutz.“ (Landwirt*in 5)	“The grazing for the cattle is also nice if there is a bit of forest and not only bare land, they have a bit of sun protection and a bit of wind protection.” (farmer 5)
		„Im Winter ist es sogar angenehmer, wenn man auch mal Windschatten hat. Denn auch Tiere mögen nicht voll im Wind stehen.“ (Landwirt*in 9)	“In winter it is even more pleasant to have slipstream. Because also animals do not like to stand fully in the wind.” (farmer 9)
		„(...) sonst auch der allgemeine Windschutz genauso wie für meine Tiere auch ist der Wald da ein wichtiger Punkt.“ (Landwirt*in 17)	“(…) also regarding the general wind protection the forest is an important point for my animals.” (farmer 17)

**Table A1.4:** Result table for the code dimension “impact on management decisions”.

Code dimension	Code theme	Code	Quote German	Quote English
impact on management decisions	adaptive management	<u>adaptive measures</u>		
		-grazing instead of mowing	„Sie müssen einfach sagen, wie intensiv wirtschaftete ich damit? Und wenn ich sage das nehme ich als Jungviehweide, dann kann ich ja nichts besseres haben, weil die Tiere fressen bisschen, haben Schatten knabbern noch am Baum rum.“ (Landwirt*in 4)	“You simply have to ask how intensively am I working with it? And when I decide to take it as a young cattle pasture, then I can't have anything better, because the animals eat a little, have shade and can also chew on the trees.” (farmer 4)
			„(...) gerade Tiere, man hat Schattenbereiche, hat auch noch Bereiche wo länger Feuchtigkeit sich abblarrt, hat dann wieder Ecken wo die Vegetation später ansetzt. Man muss sich der mit der Bewirtschaftung nur anpassen (...).“ (Landwirt*in 9)	“(…) especially animals, you have shadow areas, you also have areas where moisture is staying off for a longer time, then you have corners again where the vegetation starts later. You just have to adapt to the management (...).” (farmer 9)
		-gradual forest development	„Einen Sukzessionswald erachte ich als sinnvoll, damit der Wind nicht im Wald gestaut wird.“ (Landwirt*in 1)	“I consider a succession forest to be useful so that the wind is not dammed up in the forest.” (farmer 1)
			„(...) dann ist es natürlich schön wenn man jetzt von hohen Wald, will ich mal sagen so einen kleinen Streifen immer flacher wird. Das man nur noch so eine kleine Hecke am Ende hätte.“ (Landwirt*in 3)	“(…) then it is naturally beautiful when it develops from high forest to smaller kinds of vegetation. That you would have only small hedges at the end.” (farmer 3)



	<p>„(...) und der Übergang soll ja eben auch weich sein, das es eben keine Kante ist, da geht ja dann Wind auch rein, Sturm, Erosion, Windbruch.“ (Landwirt*in 5)</p> <p>„Man könnte den Waldrand viel sinnvoller gestalten in dem Hecken oder stufenweiser Aufbau stattfinden würde. Und hier und da noch ein paar Bäume etablieren würde die halbhoch sind.“ (Landwirt*in 9)</p> <p>„Die Waldbesitzer wollen ja so einen Sukzessionswald. Das das dann langsam ansteigt, um den Wind zu brechen (...).“ (Landwirt*in 13)</p>	<p>“(...) and the transition should also be soft, that it is not a sharp edge, because the wind goes in, storm, erosion, windbreak.” (farmer 5)</p> <p>“The edge of the forest could be made much more practical with hedges or step-by-step construction. And if here and there a few more trees would be established that are half high.” (farmer 9)</p> <p>“The forest owners want a succession forest. That it rises slowly to break the wind (...).” (farmer 13)</p>
-fencing of the grassland area	<p>„Wir haben auch teilweise schon Grünlandflächen mit einem kleinen Zaun eingezäunt, weil sie es [Reduzierung der Wildschweinpopulation] nicht hingekriegt haben.“ (Landwirt*in 8)</p> <p>„Wir müssen täglich die Zäune kontrollieren sind also auch für die Weidesicherheit verantwortlich.“ (Landwirt*in 9)</p> <p>„Eine ideale Kooperation wäre, der Waldbesitzer würde seinen Wald einzäunen, so dass die Tiere aus dem Wald nicht mehr aufs Grünland können.“ (Landwirt*in 10)</p>	<p>“We have also partly fenced in grassland areas with a small fence because they did not manage to do so [control of wild boar population].” (farmer 8)</p> <p>“We have to check the fences daily, so we are also responsible for the security of the pasture.”(farmer 9)</p> <p>“An ideal cooperation would be, the forest owner would fence in his forest so that the animals from the forest can no longer go onto the grassland.” (farmer 10)</p>
-cooperation with game keepers	<p>„(...) Rehwild geht durch unseren Zaun durch, das soll zwar ein wolfssicherer Zaun sein aber wie gesagt Rehwild geht durch, dann wird sicherlich der Wolf auch durchgehen.“ (Landwirt*in 14)</p> <p>„Obwohl wir eigentlich intensiv schießen. Ich bin ja auch im Kreistag und wir haben vom Kreis her beschlossen [...] jedes Schwein was wir extra schießen gibt es Geld für.“ (Landwirt*in 3)</p> <p>„Aber in manchen Jahren können die wirkliche jede Nacht rausgehen die Jäger und können es [Wildschweinschäden] trotzdem nicht verhindern.“ (Landwirt*in 8)</p>	<p>“(...) Roe deer goes through our fence, this is supposed to be a wolf-proof fence but as I said roe deer goes through, then surely the wolf will also go through.” (farmer 14)</p> <p>“Although we actually shoot intensively. I am also in the county council and we decided from the county [...] every pig we shoot extra is paid for.” (farmer 3)</p> <p>“But in some years the hunters can go out every night and still can't prevent it [boar damages].” (farmer 8)</p>

	<p>„Aber ich hab da mal die Jäger auch ein bisschen drauf angesetzt, weil die [Wildschweine] eben über diese Waldpartien gezogen sind.“ (Landwirt*in 11)</p> <p>„Wir haben hier selbst auf dem Hof aber auch zwei Jäger, die sind sehr engagiert und gucken da auch manchmal ein bisschen aufs Schwarzwild.“ (Landwirt*in 17)</p> <p>„(...) und irgendwann im Winter, die Feldränder, wenn das ein bisschen besser gemacht wird. Dann mulchen wir einmal rundherum, das das dann ein bisschen sauberer ist.“ (Landwirt*in 3)</p> <p>„Und die [Sträucher] fressen die Rinder nicht und deshalb muss man mechanisch nachhelfen.“ (Landwirt*in 5)</p> <p>„Die Maßnahmen die wir haben an der Waldgrenze sind dann dieser Heckenrückschnitt, den dürfen wir eh nur im begrenzten Zeitraum machen.“ (Landwirt*in 7)</p> <p>„(...) und wenn ich 3 Jahre lang nicht irgendwie mal einen Pflegeschnitt mache, dann hab ich nurnoch irgendwann am Ende 7 oder 6 Hektar.“ (Landwirt*in 8)</p> <p>„Ich mach alle paar Jahre so Heckenschnittmaßnahmen um den Zuwachs wieder zurückzuschneiden.“ (Landwirt*in 13)</p> <p>„(...) im Herbst hätten wir jetzt wenigstens nochmal abmähen müssen oder mulchen müssen das da drunter ist.“ (Landwirt*in 15)</p>	<p>“But I asked the hunters to take care of it because the [wild boars] just moved over these parts of the forest.” (farmer 11)</p> <p>“We have two hunters here on the farm, who are very dedicated and sometimes look closely at the wild boar population.” (farmer 17)</p> <p>“(…) and sometime in winter, the field edges, when this is done a little better. Then we mulch all around, so that it is a bit cleaner.” (farmer 3)</p> <p>“And the cattle do not eat the [shrubs], so you have to help mechanically.”(farmer 5)</p> <p>“The measures we have at the forest border are this hedge clearing, which we are only allowed to do for a defined period anyway.” (farmer 7)</p> <p>“(…) and if I don't do a maintenance cut for 3 years, then I'll only have 7 or 6 hectares at the end.” (farmer 8)</p> <p>“I do hedge trimming every few years to cut back the plant growth.” (farmer 13)</p> <p>“(…) in autumn we should have at least cut or mulched the grass underneath.” (farmer 15)</p>
<p><u>barriers towards adaptation</u></p> <p>-area dependent funding</p>	<p>„Und wenn man das einfach Wild wachsen lässt, dann kommt die nächste Vermessung und auf einmal hat man einen halben Hektar weniger, weil die machen ja Luftbilder von oben.“ (Landwirt*in 3)</p> <p>„Die machen ja Luftbilder und dann wird die Fläche kleiner oder verbuscht oder so. Dann haben wir ein Problem es geht uns aus der landwirtschaftlichen</p>	<p>“And if you just let it grow wild, then the next survey comes and all of a sudden you have half a hectare less, because they take aerial photos from above.” (farmer 3)</p> <p>“They take aerial photos and then the area becomes smaller or covered with bushes or something. Then we have a problem - the</p>

	<p>Fläche raus, erstmal ertragsmäßig und zweitens auch fördertechisch.“ (Landwirt*in 5)</p> <p>„Beim Vermessen der Fläche merkt man es ja. Also an anderer Stelle haben wir das dann und wenn eine Kontrolle kommt. Die Fläche ist kleiner.“ (Landwirt*in 8)</p> <p>„Ja gut das alles wächst und die Felder werden immer kleiner. Bei Kontrollen die die Flächen nachmessen [...] bekommt man da auch irgendwie Probleme und weniger Geld.“ (Landwirt*in 13)</p> <p>„Dazu kommt natürlich auch noch der Flächennachweis. Jeder beantragte m<sup>2</sup> ist Geld wert, das heißt das die [die Landwirte] dann schon bedacht sind, alle Säume und jeden Waldrand sauber auszumähen“ (Expert*in 1)</p> <p>„Ne da geht es ja leider auch um die hektarbezogenen Fördermittel. Es geht ja gar nicht um die Struktur.“ (Expert*in 4)</p> <p>„(...) das [Etablierung von Strukturelementen] kann der Staat doch auch weiter fördern und machen [...]. Der will alles aber die Taschen sind zu und das ist das Schlimme.“ (Landwirt*in 3)</p> <p>„(...) wenn es gewünscht ist und bezahlt wird, dann halten wir natürlich auch Ziegen. Warum nicht? Ist alles möglich.“ (Landwirt*in 5)</p> <p>„Also das [Kooperation für mehr Landschaftskomplexität] wird auch in dem Moment funktionieren, wo es dafür einen finanziellen Ausgleich gibt, werden das alle machen.“ (Landwirt*in 8)</p> <p>„(...) und umso klein strukturierter das wird oder abwechslungsreicher das wird, umso höher sind da Bewirtschaftungskosten, das ist im Moment alles nicht möglich so wie zu Zeit die Erlöse aufm Weltmarkt sind.“ (Landwirt*in</p>	<p>agricultural land is getting smaller, firstly in terms of yield and secondly in terms of subsidies.” (farmer 5)</p> <p>“When you measure the area, you notice it. So we have this in another place then and when a control comes. The area is smaller.” (farmer 8)</p> <p>“Yes, well all this is growing and the fields are getting smaller and smaller. At controls that measure the areas and so [...] one gets problems and less money.” (farmer 13)</p> <p>“In addition, there is also the proof of area. Each m<sup>2</sup> applied for is worth money, which means that they [the farmers] are concerned to mow out all hems and every edge of the forest clean. (expert 1)</p> <p>“It concerns unfortunately also the hectare-based subsidies. it does not concern the structure at all.” (expert 4)</p> <p>“(...) the state can also continue to subsidize and do this [establishment of structural elements] [...]. The state wants everything but the pockets are closed and that is the worst thing.” (farmer 3)</p> <p>“(...) if it is desired and will be paid, then, of course, we also keep goats. Why not? Everything is possible.” (farmer 5)</p> <p>“So the [cooperation for more landscape complexity] will also work at the moment when there is financial compensation, everyone will do it.” (farmer 8)</p> <p>“(...) and the smaller the structure or the more diversified it becomes, the higher are the operating costs. None of this is possible, considering the current revenues on the world market.” (farmer 10)</p>
-insufficient funding		

		10) „Aber man muss denn auch zum Schluss immer auch sehen, wird es bezahlt oder nicht. So blöd es immer klingt, es geht ja nicht um reichwerden sondern ums Überleben.“ (Landwirt*in 12)	“But you always have to see in the end, whether it's paid or not. As stupid as it always sounds, it is not about getting rich but about survival.” (farmer 12)
		„Klar wenn man das dann auch vergolten kriegt, also im Prinzip in Euro würden wir das machen.“ (Landwirt 14)	“Sure, if you get compensated, in Euro we would do that.” (farmer 14)
		„(...) weil ihnen entweder der Aufwand zu hoch ist, bzw. der Fördersatz nicht lukrativ genug ist.“ (Expert*in 1)	“(…) because either the effort is too high for them or the subsidy rate is not lucrative enough.” (expert 1)
		„Das größte Hindernis für mehr ökologische Maßnahmen sind eben finanzielle Gründe. Also entweder muss es bezahlt werden. Oder es darf für den Landwirt keine Kosten verursachen.“ (Expert*in 2)	“The biggest obstacle to more ecological measures is financial reasons. So either it must be paid for or it must not generate any costs for the farmer.” (expert 2)
cooperative management	<u>exchange with forest owner</u> -no overlaps of management	Oder müssen sie mit den Waldbesitzern da auch irgendwas machen vereinbaren?	Or do you have to agree on something with the forest owners?
		„Nein. [...] Also man muss immer so sagen Wald wird ja ganz anders bewirtschaftet.“ (Landwirt*in 2)	“No. [...] Well, you have to keep in mind that forests are managed quite differently.” (farmer 2)
		„Weniger, weil mit Wald haben wir eigentlich nichts zu tun.“ (Landwirt*in 5)	“Not so much, because we have nothing to do with forests.” (farmer 5)
		„(...) die Forstwirte wirtschaften Wald und wir das Land. Wir haben da eigentlich keinerlei Verbindung. Ich wüsste jetzt auch nicht über welche Dinge man sich da absprechen sollte (...)“ (Landwirt*in 7)	“(…) the foresters manage the forest and we manage the land. We have no connection whatsoever. I would not know about which things to agree upon (...)” (farmer 7)
		Und mit den Forstbetrieben oder Forsteigentümer haben sie was zu tun?	And what do they have to do with the forest operators or forest owners?
		„Ja eigentlich nicht so [...]. Also wir kennen uns, aber haben da wenig Berührungspunkte.“ (Landwirt*in 8)	“Not really [...]. Well, we know each other, but we don't have much in common.” (farmer 8)
		„Also die Forst hat schon das sagen ja. Da ist nicht viel zu besprechen.“ (Landwirt*in 12)	“So the forest authorities are mainly in charge. There is not much to discuss.” (farmer 12)
	-sporadic overlaps of management	„Wir haben einen Schlag im Wald da ist solch eine Waldgemeinschaft. Da sag ich	“We have a field in the forest, there is a forest community. I always tell

	<p>immer Bescheid ihr müsst mal wieder ein bisschen [Waldrandpflege betreiben] und dann machen sie das auch.“ (Landwirt*in 3)</p> <p>„In Kontakt sind wir. Es gibt ja immer mal irgendwelche Feldrandpflege-maßnahmen oder so die dort anstehen. Ja das wird abgesprochen und mehr aber auch nicht.“ (Landwirt*in 6)</p> <p>„(...) wenn ein Baum gefällt werden soll und er fällt aufs Grünland oder wenn Tiere mal ausbrechen für sowas hat man immer Kontakt.“ (Landwirt*in 7)</p> <p>„(...) da müssten wir uns auch mit dem Waldeigentümer dann in Verbindung setzen. Weil wir schneiden dann ja im Prinzip an seinem Wald rum.“ (Landwirt*in 8)</p> <p>„Ja zum Teil, wenn man sagt man macht paar Pflegemaßnahmen, dass der Wald nicht immer mehr in die Felder reinwächst.“ (Landwirt*in 13)</p> <p>„Ein Sukzessionswald ist sinnvoll, damit der Wind nicht im Wald gestaut wird.“ (Landwirt*in 1)</p> <p>„(...) und der Übergang soll ja eben auch weich sein, das es eben keine Kante ist, da geht ja dann Wind auch rein, Sturm, Erosion, Windbruch.“ (Landwirt*in 5)</p> <p>„Aber die [die Waldbesitzer] sehen dann auch der Waldrand schützt und da ist ja auch was dran. Die innen stehenden Bäume, wenn man zu schnell aufmacht dann kriegen die Brandstellen.“ (Landwirt*in 9)</p> <p>„Die Waldbesitzer wollen ja eigentlich auch so einen Sukzessionswald.“ (Landwirt*in 13)</p>	<p>them that they need to do something [forest edge maintenance] and then they do it.” (farmer 3)</p> <p>“We are in contact. There are always some field edge maintenance measures that are necessary. Yes, that is what we have agreed upon and nothing more.” (farmer 6)</p> <p>“(…) if a tree is to be felled and it falls on grassland or if animals break out for such things you always have contact.” (farmer 7)</p> <p>“(…) there we would have to contact the forest owner as well. Because then we are basically cutting away his forest.” (farmer 8)</p> <p>“Yes, partly, if you think of doing some maintenance measures to prevent the forest from growing more and more into the fields.” (farmer 13)</p> <p>“A succession forest makes sense so that the wind is not dammed up in the forest.” (farmer 1)</p> <p>“(…) and the transition should also be soft, that it is not a sharp edge, the wind goes in, storm, erosion, windbreak.” (farmer 5)</p> <p>“But then they [the forest owners] think that the edge of the forest protects and there is a point to it. The inner trees, if you open up too fast, they will get burned.” (farmer 9)</p> <p>“The forest owners want such a succession forest.” (farmer 13)</p>
-acknowledgement of forest owners interests	<p>„(...) sicherlich muss man auch mal ein bisschen pflegen die Felldränder, das die Felder nicht zuwachsen. Aber wenn man es im gesunden Gleichgewicht macht, denk ich mal das wir da alle mit leben können, auch die</p>	<p>“(…) surely you have to take care of the edges of the fields, so that they don't become overgrown. But if you do it in a healthy balance, I think that we all can live with it, also the</p>
-finding of compromising solutions		

	<p>Waldbesitzer und wir als Landwirte.“ (Landwirt*in 6)</p> <p>„Da gibt es eben manche die sagen radikal, ich mach das [Entfernung von Strukturelementen] bis zur Flurstücks-grenze. Oder man versucht dann so ein bisschen seine Gegebenheiten anzupassen, das wird hier eigentlich versucht.“ (Landwirt*in 13)</p>	<p>forest owners and we as farmers.” (farmer 6)</p> <p>“There are some people who say radically, I do it [removal of encroaching shrubs] up to the parcel boundary. Or you try to adapt your conditions a little bit, that’s what is tried here.” (farmer 13)</p>
	<p><u>regulations regarding the forest border</u></p>	
-no determined forest edge	<p>„Es ist schwierig eine klare Waldgrenze zu ziehen, da was das angeht unterschiedliche Ansichten vorliegen.“ (Landwirt*in 1)</p> <p>„Wir haben als Landwirte oft das Ärgernis das die Bäume eigentlich nur auf die Fläche fallen, dieser Waldrand aber kaum bewirtschaftet oder gepflegt wird.“ (Landwirt*in 9)</p> <p>„Ne das [festgelegte Waldgrenze] gibt es nicht. Da gibt es höchstens eben diese Luftbilder, die abfotografiert werden, auch für diese Agrarantragsstellung.“ (Landwirt*in 13)</p> <p>„Da stehen noch ein paar alte Zaunpfähle, wo das mal früher eingezäunt war, aber die beachtet eigentlich kaum einer. Interessiert sich auch keiner für, wo da jetzt die Grenze ist.“ (Landwirt*in 15)</p> <p>„(...) Das [Festlegung der Waldgrenze] hat so nicht funktioniert, aber was man eben ausgehandelt hat, ist das der Wald eben nicht weiter in die Fläche wachsen darf. Das führte dazu das man jetzt keinen Waldrandaufbau sowie man das aus dem Bilderbuch kennt mit Saum und Strauch und dann Waldtraufzonen hat.“ (Expert*in 1)</p>	<p>“It is difficult to draw a clear forest border, as there are different views on this.” (farmer 1)</p> <p>“As farmers, we often have the annoyance that the trees only fall on the surface, but the edge of the forest is hardly managed or maintained.” (farmer 9)</p> <p>“There is no [defined forest border]. There are just these aerial photographs, which are taken, also for this agricultural grant application.” (farmer 13)</p> <p>“There are still some old fence posts where it used to be fenced in, but hardly anyone pays attention to them. And nobody is interested in where the border is now.” (farmer 15)</p> <p>“(…) The [definition of the forest border] did not work that way, but what was negotiated is that the forest is not allowed to grow further into the area. This has led to the fact that there is now no forest edge construction as we know it from the picture book with hem and bushes and then forest eaves.” (expert 1)</p>
-unclear responsibilities	<p>„Der Waldbesitzer sollte die Randpflege übernehmen, das ist jedoch nicht klar und deswegen machen sie es nicht. Das ergibt Konfliktpotential.“ (Landwirt*in 1)</p> <p>„(...) der Waldeigentümer hat</p>	<p>“The forest owner should take over the edge maintenance, but this is not clear and therefore they do not do it. This results in conflict potential.” (farmer 1)</p> <p>“(…) the forest owner also</p>



	<p>auch dafür zu sorgen, dass die [Bäume] nicht rüberwachsen. Aber das ist immer die Streitpunkt, der macht dann nichts und wir sind drauf angewiesen, weil unsere Fläche kleiner wird.“ (Landwirt*in 5)</p> <p>„Ne also eigentlich wär das ja auch Zuständigkeit der Forstbesitzer, den Wald im Zaun zu halten. Aber das macht man im eigenen Interesse dann selbst weil ja da doch nichts kommt.“ (Landwirt*in 13)</p>	<p>has to make sure that the [trees] do not grow over. But that is always the point of controversy, they do nothing and we are dependent on it because our area becomes smaller.” (farmer 5)</p> <p>“No, actually that would be the responsibility of the forest owners to keep the forest in the fence. But you do that in your interest because after all nothing happens.” (farmer 13)</p>
	<u>barriers to cooperation with forest owners</u>	
-limited usability of forest	<p>„Ich denke mal der Wald wird nicht wirklich wahrgenommen, als irgendwas was man einbeziehen könnte. Eher man muss gucken das es nicht in die Fläche reinwächst.“ (Expert*in 3)</p>	<p>“I guess the forest is not perceived as something you could include. It is more like you have to make sure it does not grow into the area.” (expert 3)</p>
-land ownership problems	<p>„(...) man müsste entweder zu Lasten des Waldeigentümers ein paar Baumreihen zurück nehmen, um dann eben Waldrand aufzubauen oder man müsste vom Landwirt Fläche wegnehmen. So ist jetzt erstmal die Regelung. Oder der Burgfrieden.“ (Expert*in 1)</p>	<p>“(...) you would either have to take back a few rows of trees at the expense of the forest owner to build up the forest edge or you would have to take the area away from the farmer. So this is the regulation for now. Or the truce.” (expert 1)</p>
-area dependent funding	<p>„Und wenn man das einfach Wild wachsen lässt, dann kommt die nächste Vermessung und auf einmal hat man einen halben Hektar weniger, weil die machen ja Luftbilder von oben.“ (Landwirt*in 3)</p> <p>„Die machen ja Luftbilder und dann wird die Fläche kleiner oder verbuscht oder so. Dann haben wir ein Problem es geht uns aus der landwirtschaftlichen Fläche raus, erstmal ertragsmäßig und zweitens auch förderlich auch.“ (Landwirt*in 5)</p> <p>„Beim Vermessen der Fläche merkt man es ja. Also an anderer Stelle haben wir das dann und wenn eine Kontrolle kommt. Die Fläche ist kleiner.“ (Landwirt*in 8)</p> <p>„Ja gut das alles wächst und die Felder werden immer kleiner. Bei Kontrollen die die Flächen</p>	<p>“And if you just let it grow wild, then the next survey comes and all of a sudden you have half a hectare less, because they take aerial photos from above.” (farmer 3)</p> <p>“They take aerial photos and then the area becomes smaller or covered with bushes or something. Then we have a problem - the agricultural land is getting smaller, firstly in terms of yield and secondly in terms of subsidies.” (farmer 5)</p> <p>“When you measure the area, you notice it. So we have this in another place then and when a control comes. The area is smaller.” (farmer 8)</p> <p>“Yes, well all this is growing and the fields are getting smaller and smaller.</p>

nachmessen [...] bekommt man da auch irgendwie Probleme und weniger Geld.“

(Landwirt\*in 13)

„Dazu kommt natürlich auch noch der Flächennachweise. Jeder beantragte m<sup>2</sup> ist Geld wert, das heißt das die [die Landwirte] dann schon bedacht sind, alle Säume und jeden Waldrand sauber auszumähen.“

(Expert\*in 1)

„Ne da geht es ja leider auch um die hektarbezogenen Fördermittel. Es geht ja gar nicht um die Struktur.“

(Expert\*in 4)

At controls that measure the areas [...] you get problems and less money.”

(farmer 13)

“In addition, there is also the proof of area. Each m<sup>2</sup> applied for is worth money, which means that they [the farmers] are concerned to mow out all hems and every edge of the forest clean.” (expert 1)

“It concerns unfortunately also the hectare-based subsidies. It does not concern the structure at all.” (expert 4)

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