



Research

Looking at hidden connections to explore adaptive capacity of cultural landscape systems: case studies of four landcare associations in Germany

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ABSTRACT. Adaptive capacity indicates the capacity to cope with and adapt to a disturbance in a complex social-ecological system. Cultural landscapes can be understood as such systems that are confronted with land abandonment and agricultural intensification as key disturbances. However, responses to such cultural landscape loss have not been systematically investigated so far in terms of adaptive capacity. Taking this gap as a starting point and following a context-sensitive approach, this study addresses the question: how can the adaptive capacity of cultural landscape systems for a disturbance such as land abandonment be understood? We answer this question through a comparative case study of four landcare associations in Germany. A conceptual framework that distinguishes between coping and adaptation responses and allows for the analysis of different levels of fit of responses is used. Management of abandoned agricultural land, the establishment of cultural landscape features, provision of consultation and mediation services, and machinery are implemented as coping responses by the four associations. Adaptation responses include the organization of events, public relations work, education, regional brand promotion, lobbying work, and the promotion of regional products. The interactions between the responses that have either synergetic or counterproductive effects were identified. The results of this study emphasize the fit between different responses as an important factor for understanding the adaptive capacity of cultural landscape systems in addition to investing in coping and adaptation responses in isolation. In this sense, adaptive capacity needs to be understood not only in terms of coping (short-term adaptive capacity) and adaptation responses (longer-term adaptive capacity) but also through a good fit, which reduces trade-offs between responses and thus offers a broader range of future options. We conclude by calling for a holistic analysis of different responses to a disturbance that takes account of their fit.

Key Words: *adaptive capacity; cultural landscape; integrated landscape initiative; land abandonment; landcare association; social-ecological system*

INTRODUCTION

A cultural landscape can be defined as a landscape that is shaped by tightly intertwined interactions between human beings and nature, and with this, it reflects distinctive characteristics of both nature and society in a given context (Council of Europe - Committee of Ministers 1995). Therefore, a cultural landscape can be understood as a social-ecological system (SES) that is “a bio-geo-physical unit and its associated social actors and institutions” (Glaser et al. 2012: 4) that interact with each other (Berkes and Folke 1994, Kirchhoff et al. 2012).

Cultural landscapes in developed countries are facing two challenges. On the one hand, intensified land and resource use has disconnected many linkages and substantially narrowed down functions of cultural landscapes (Jongman 2002, Selman 2012). On the other hand, the abandonment of farmlands has also drastically changed cultural landscapes over the last decades (MacDonald et al. 2000, Rey Benayas et al. 2007, Bieling et al. 2011).

The complexity and diversity of a SES make it extremely difficult for a single actor to manage them, which applies to cultural landscapes as well (Kooiman and Bavinck 2005, Berkes 2009, Prager 2012). Additionally, the negative consequences of centralized natural resource management approaches have underlined the importance of community involvement in the management process (Agrawal and Gibson 1999). This explains the key role of integrated landscape initiatives (ILIs) in cultural landscape management. Integrated landscape initiatives involve

collaboration of diverse stakeholders across sectors and contribute to sustainable landscape management by fostering multiple landscape functions such as tourism, local heritage, and food production (for an overview for Europe see Garcia-Martin et al. 2016).

To comprehend the capability of a SES to deal with a disturbance—fluctuation in the system factors or connectivity with internal and external settings—and to rearrange themselves in times of such an event (Folke et al. 2005, Engle 2011, Schoon and Cox 2012), the concept of adaptive capacity has been highlighted. Adaptive capacity allows for the understanding of a system’s ability to cope with a disturbance in consideration of its complex nature (McClanahan et al. 2008, Marshall et al. 2012). Thus, the concept of adaptive capacity is useful for studying cultural landscapes, considering the multiple social and ecological elements and interactions that compose them (Wylie 2007, Bohensky et al. 2010, Stenseke et al. 2012).

With regard to the topic of this study, two research gaps were identified: first, holistic analyses of stakeholder strategies to deal with disturbances and subsequent cultural landscape loss are missing, even though a few authors have indicated the potential existence of trade-offs between outcomes of different strategies to cope with or adapt to a disturbance (Biggs et al. 2004, Bohensky et al. 2010, Lemos et al. 2013). This study is unique in the sense that it not only focuses on each strategy and its characteristics but also on the interactions between different strategies (or their “fit”) to attain a comprehensive understanding of cultural landscapes’

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adaptive capacity. Second, only a few studies have assessed the activities of ILIs working against land abandonment and cultural landscape loss (see, e.g., Prager 2012, 2015, García-Martín et al. 2016). This situation also applies to landcare associations in Germany (Prager 2012, Schomers et al. 2015), which are the subject of this study. At the same time, this study goes beyond the previous publications (e.g., Prager 2015, Penker 2017) on landcare associations as its focus is on the in-depth analysis of their activities and their interrelations as a way to understanding the adaptive capacity of cultural landscape systems.

Against this background, this study aims to investigate the adaptive capacity of cultural landscape systems to accommodate disturbances that have the potential to induce cultural landscape loss, such as land abandonment and agricultural intensification. A cultural landscape system encompasses a natural system that provides diverse ecosystem services (Schaich et al. 2010) ranging from agricultural products, climate regulation, and water cycling to recreational and aesthetic values (Millennium Ecosystem Assessment 2005), as well as a social system with key actors including farmers, local and regional authorities, environmental groups, associations, residents, consumers, tourists, and relevant institutions such as rules and property rights arrangements (McGinnis and Ostrom 2014). We evaluate the adaptive capacity of landscape systems by studying the associations and the actions taken by them to react to disturbances as indicators of the systems' adaptive capacity. The adaptive capacities of the associations themselves are not the objective of this study. Moreover, we aim to identify successful examples of adaptive capacity in the context of cultural landscape loss. In the end, this study may provide a useful analysis of stakeholder strategies that manifest adaptive capacity that other ILIs can refer to.

THEORETICAL FRAMEWORK

Adaptive capacity is expressed through adaptation, which denotes a measure taken or the outcome of a measure that is implemented to cope with or adapt to perilous situations (Smit and Wandel 2006, Whitney et al. 2017). Adaptive capacity in an ecological sense is the ability of an organism or a population to suit itself to its environment for survival and reproduction through the process of evolution (Futuyma 1979, Sober 1984, Brien and Holland 1992). Social adaptive capacity indicates the capacity of a person or a group of people to adapt to disturbances not only for the sake of survival and reproduction but also for the maintenance or even improvement of their quality of life (Gallopín et al. 1989, Gallopín 2006, Smit and Wandel 2006). This study is concerned with the adaptive capacity of cultural landscape systems to handle a disturbance related to cultural landscape loss. We assess the systems' adaptive capacity by examining the responses of key actor groups in the systems, landcare associations, which are implemented to deal with the disturbance. High adaptive capacity of a cultural landscape system will enable the adjustment of a system so that the system and the social-ecological benefits it generates are not severely damaged by disturbances (Adger 2006). Taking into account that the landcare associations are increasingly recognized by the authorities as important partners for cultural landscape management (e.g., Staatsministerium Baden-Württemberg 2015, Hessische Landesregierung 2017) and that a wide variety of actors across different sectors are involved in them, we consider the

associations are representative of the key actors in the system to some extent.

How is adaptive capacity expressed through stakeholder strategies, and what levels of adaptive capacity do they demonstrate? The analytical framework used in this study, adapted from Berkes and Jolly (2001), Fabricius et al. (2007), and Tuvaldal and Elmqvist (2012), infers a system's adaptive capacity from the analysis of key actors' responses. Responses indicate both intentional and unintentional actions of stakeholders to deal with a disturbance. Actors or stakeholders are those who are influenced by the changes in the characteristics of a system of interest that result from a disturbance (Tuvaldal and Elmqvist 2012). Coping responses are employed to respond to a disturbance for short-term social-ecological benefits that will diminish over a brief period of time if the response is stopped (Berkes and Jolly 2001, Fabricius et al. 2007). Here, the focus is on the continuity of the effect, not on the length of a disturbance or the continuity of the response itself. For example, if a dairy farmer buys fodder for her livestock in a dry season when fodder from her own farm is not available, it will generate an immediate effect. However, if the farmer stops buying fodder, its availability will drop more quickly in contrast to if she invested in, for example, better water supply equipment (Salmoral et al. 2020). Some coping responses may entail the degradation of certain system components, for the sake of short-term benefits. With this, such responses will deteriorate its long-term adaptive capacity by reducing or eliminating the possible options for actors to deal with a disturbance in the future (Folke et al. 2002, Fabricius et al. 2007, Tuvaldal and Elmqvist 2012). For instance, if the dairy farmer sells her animals in a dry season, it will generate an immediate income (Salmoral et al. 2020), but it is likely to have a negative impact on her longer-term livelihood. On the contrary, the aim of adaptation responses is beyond short-term benefits that can be attained from social-ecological systems and is concerned with their long-term sustainable management (Berkes and Jolly 2001, Fabricius et al. 2007). One example of adaptation responses is the establishment of a clause that grants Arctic communities the right to rearrange their hunting periods in line with climate variation (Berkes and Jolly 2001, Parry et al. 2007). Accordingly, many adaptation responses generate self-sustaining feedbacks that do not require excessive inputs from outside of the system.

Responses are not implemented in a vacuum—they can interact with and influence each other. A response can work against other responses by canceling out their effects or reversing them. This means resources that could have been used for other adaptation options might be exhausted without having their intended effect achieved. Potential trade-offs between the benefits of coping and adaptation responses have been discussed (Biggs et al. 2004, Bohensky et al. 2010, Lemos et al. 2013). Referring to this literature, when different responses are in an antagonistic relation, we call it a “bad fit.” However, a response can amplify the effect of other responses. Multiple responses can synergistically work together and facilitate each other. This indicates a “good fit.” When the potential of a response is compromised due to the lack of synergy with other responses, there is a “missing fit.”

In this study, high adaptive capacity encompasses the capacity to exploit coping and adaptation responses to a disturbance (Berkes and Jolly 2001, Keskkitalo 2012) that do not limit future adaptation

Table 1. Distinction of coping responses and adaptation responses, adapted from Berkes and Jolly (2001), Fabricius et al. (2007), and Tuvendal and Elmqvist (2012)

	Coping responses	Adaptation responses
Timeframe	Short-term	Long-term
Aim	Immediate social-ecological benefits	Sustainable management for continuous social-ecological benefits
Mechanism	Dependent on external support	Self-sustaining
Possible negative effects to current system properties	Long-term properties of the current system may be deteriorated for the sake of an instant benefit	No negative effects involved

options (Folke et al. 2002). We consider both coping and adaptation responses in order to recognize the dynamic nature of adaptation, which may, for instance, reshape pre-existing coping responses to better deal with new situations through adaptation (Adger et al. 2004, Berkhout et al. 2006, Keskkitalo 2012). Accordingly, attention is not only given to each response of the landcare associations but also to the interactions among the responses. Transformation responses that involve a shift in core system identity are not within the scope of this study (Tuvendal and Elmqvist 2012). Table 1 provides the distinctions between coping and adaptation responses that are used in the study.

METHODS

Study Design

This study adopted an embedded comparative multiple case study design following Yin (1989) and uses four landcare associations in Germany as its cases. A qualitative research methodology is employed in the study considering the complex nature of a SES and the contexts in which it is embedded that should be taken into consideration together (Mason 2002).

Four landcare associations that have experienced cultural landscape loss were recruited according to the snowball method. All four associations considered land abandonment to be the primary disturbance that had induced cultural landscape loss. This enabled the comparison of responses from different associations that work with similar disturbances. The cases were selected to cover four different federal states in order to take different policy schemes into account. The number of cases (see also Creswell 2007) allowed for an in-depth analysis and meaningful comparison of different variables (Smith and Osborn 2009, Robinson 2014).

Stakeholder Interviews

Interviews were used as the principal data collection method as a detailed understanding of participants in the subject can be acquired through this method (Boyce and Neale 2006, Turner 2010). The interviewees are actors in the associations' responses, and with this, they can provide comprehensive information (Robinson 2014). At the same time, the interviewees represent one of the main actor groups (e.g., farmers, local authority, nature conservation groups, and restaurant owners) to allow the collection of opinions from diverse points of view. The main actor groups were identified and the interviewees were selected by the managing directors of the associations, responding to the question "please name main actor groups in your association and members who can represent these groups." The main interview questions dealt with the characteristics of cultural landscapes, the

challenges in managing cultural landscapes, the reasons for and responses to the challenges, and the rationales of the responses. A list of interview questions is provided in Append. 1. Fifteen respondents (two to five interviewees per association) participated in the interviews from July to December 2018. In the case of the Landcare Association Neumarkt, its managing director and one restaurant owner participated in the interview, whereas managing directors, local politicians, nature conservationists, and farmers took part in the interviews of the other three associations. The interviews were audio-recorded with the interviewees' consent and later transcribed word for word except for filter sounds and filler words (Boyce and Neale 2006, Mayring 2014). As German is not the native language of the main author, the transcription was done with the help of a translator.

Data Analysis

This study used qualitative content analysis to obtain valid and reliable findings in highly contextual situations on the basis of a systematic process. The study drew on a deductive approach, with the initial coding scheme and the categories being revised during the analysis. The distinctive aspects of coping and adaptation responses and fit between responses presented in the theoretical framework chapter were used as the basic coding categories. Analysis was performed with a focus on the subject matter of the materials, using the analysis software QDA Miner (Prasad 2008, Mayring 2014). The coding scheme is included in Append. 2.

Limitations

The adaptive capacity of this study does not capture the temporal scale of cultural landscape systems that constantly change (Trimble and Berkes 2015). Also, our basis of inference is limited to the human interventions of the landcare associations. As the study is based on a qualitative study design, statistical representation of the causal relationship between responses and adaptive capacity is not possible (Yin 1989). The identification of main stakeholder groups and interviewees was done by the managing directors of the associations, which may have been biased.

Landcare Associations and Their Context

One important cause of cultural landscape loss in Germany is the abandonment of marginal farming areas. Although the agriculturally used area in Germany diminished by 2.1% from 1991 to 2019 (Statistisches Bundesamt 2020), permanent pastures and meadows sharply decreased by 10.8% for the same period (Umweltbundesamt 2020). According to a study conducted by the European Commission, 493,400 ha of land will be abandoned in Germany during 2015–2030, i.e., 2.7% of the utilized agricultural area in the country. The absolute figure is the fifth

Table 2. Characteristics of the landcare associations

	Middle Black Forest Landcare Association	Rheingau-Taunus Landcare Association	Neumarkt Landcare Association	Uckermark-Schorfheide Landcare Association
Federal state	Baden-Württemberg	Hesse	Bavaria	Brandenburg
County	Rottweil, Ortenaukreis	Rheingau-Taunus	Neumarkt in der Oberpfalz	Uckermark, Barnim
Before the German reunification	Federal Republic of Germany	Federal Republic of Germany	Federal Republic of Germany	German Democratic Republic
Foundation year	2006	1991	1995	1992
Members	8 municipalities 11 associations 42 individuals	10 municipalities 15 associations and individuals	19 municipalities 35 associations 80 individuals ^[1]	4 municipalities 5 associations 20 enterprises 20 individuals ^[2]
Characteristics of cultural landscape	Mosaic pattern of forests, pastures and farmland ^[3]	Many vineyards in Rheingau, and a mixture of meadows, forests, valleys, and low mountain range in Taunus ^[4]	Medium-sized mountains with a combination of forests, pastures, and cropland ^[5]	Vast forest areas, lakes, wetlands, and grasslands with high biodiversity ^[6]

^[1] Landschaftspflegeverband Neumarkt i.d.OPf. e.V. n.d.

^[2] Landschaftspflegeverband Uckermark-Schorfheide e.V. n.d.b

^[3] Kaerlein et al. 2012, Bieling and Konold 2014

^[4] Rheingau-Taunus-Kreis n.d.

^[5] Regierung der Oberpfalz 2010

^[6] Ministry of Environment Health and Consumer Protection of the Federal State of Brandenburg 2013

highest among European Union (EU) member states (Perpiña Castillo et al. 2018). Mountainous areas with many high nature value farmlands will particularly be under direct threat in the future (Keenleyside and Tucker 2010).

Landcare associations (Landschaftspflegeverbände, Landschaftsentwicklungsverbände, or Landschaftserhaltungsverbände) are examples of ILIs in Germany that address this issue. Created in the 1980s, landcare associations aim to accomplish the following objectives. First, the associations intend to implement and facilitate sustainable natural resource management in cultural landscapes, including biological resources such as indigenous species and their habitats. Second, the associations aim to support farmers so that they can acquire revenue by managing cultural landscapes and selling local products, thereby boosting regional development. Lastly, they attempt to make the public, especially future generations, aware of the significance of cultural landscape management. One notable characteristic of the landcare associations is that during their decision-making processes, stakeholder groups with different interests—often farmers, nature conservation groups, and community residents—have an equal voice (Prager and Vanclay 2010, Prager 2012, Bluemlein 2009). The characteristics of the four landcare associations are presented in Table 2. For their locations, see Fig. 1.

RESULTS

Recognized Disturbances

The most significant disturbance related to cultural landscape loss in these four cases was extreme agricultural extensification and land abandonment, followed by intensification of farming in three associations. In addition, the expansion of residential districts and public infrastructure was mentioned by two respondents in two different landcare associations. In the future, generational shifts and changes in climate patterns are expected to provoke more severe land abandonment in some cases.

Fig. 1. Management areas of the Uckermark-Schorfheide (in the north-east part of Germany), Neumarkt, Middle Black Forest, and Rheingau-Taunus landcare associations, clockwise.



Many cultural landscapes in the four cases had unfavorable natural conditions, such as steep slopes or low soil fertility, which often require more labor input than advantaged areas for producing similar yields, if that is possible at all. Such areas with inherently low productivity have been highly influenced by the intense price competition in the global agricultural market. The respondents perceived that agricultural policy had not fully recognized the disadvantaged farming conditions embedded in the cultural landscapes. At the same time, farming has lost its

Table 3. Responses of the Middle Black Forest, Rheingau-Taunus, Neumarkt, and Uckermark-Schorfheide landcare associations to disturbances related to cultural landscape loss

	Middle Black Forest Landcare Association	Rheingau-Taunus Landcare Association	Neumarkt Landcare Association	Uckermark-Schorfheide Landcare Association
Coping responses	Land exchange mediation	Land exchange mediation	Consultation	Consultation
	Consultation	Consultation	Management/restoration of high nature value areas	Management of high nature value areas
	Infrastructure provision	Infrastructure provision	Creation of cultural landscape features	Creation of cultural landscape features
	Management/restoration of high nature value areas	Management/restoration of high nature value areas		Species protection
	Creation of cultural landscape features	Creation of cultural landscape features		
Adaptation responses	Event organization	Event organization	Event organization	Event organization
	Public relations work	Public relations work	Public relations work	Public relations work
	Education	Education	Education	Education
	Lobbying activities	Lobbying activities	Regional product promotion	Lobbying activities
	Regional product promotion	Tourism development	Tourism development	Regional product promotion Tourism development

attractiveness as an occupation because other opportunities for making a living in these neighborhoods have appeared. People's attachment to their natural surroundings has weakened, and price has become central to their consumption behaviors. Also, a lack of infrastructure necessary for agriculture and living was highlighted in the case of the Middle Black Forest Landcare Association due to its remote location. High performance livestock breeds replaced indigenous ones that could ingest fiber-rich fodder, and this played a role in the abandonment of extensive grasslands in the case of the Neumarkt Landcare Association (Hümmer 1974, Poschlod and Wallisdeevries 2002, Bender et al. 2005).

Agricultural intensification was often closely connected with land abandonment. If a farmer abandons her steep or rocky field, she has to use the remaining flat ground more intensively to be able to compete with other producers. Also, the corresponding agricultural policy had not properly incentivized farmers to manage cultural landscape elements such as flower strips in their farmlands, which led to intensified use of the given areas. Changes in farmers' and land managers' mindsets about nature, which can be framed as the instrumental perspective on nature, resulted in a strongly profit-driven way of farming and damage to cultural landscape elements (*personal communication, environmental conservationist in the Uckermark-Schorfheide Landcare Association, 13 December 2018*).

The loss of cultural landscapes caused by public infrastructure expansion (e.g., highways) was stressed by the Landcare Association of Uckermark-Schorfheide. High policy priority for economic development after the reunification of Germany accelerated the construction of public infrastructure at the cost of cultural landscapes.

Responses of the Four Landcare Associations to Cultural Landscape Loss

In this section, responses used by the four landscape associations are described. The responses are not exhaustive—they are the ones the interviewees pointed to as crucial. The responses of the four associations are summarized in Table 3.

Coping responses

The management of high nature value areas and the establishment of features such as flower strips or hedges in areas that are shaped by high-intensity agriculture were implemented as coping responses by all four landcare associations. These two responses were mostly supported through subsidies for contractual nature conservation and compensation and substitution measures. Financial contributions from municipalities and districts were used for this purpose to a lesser extent. The majority of the four associations' capacity was invested in planning and implementing such responses. When a governmental authority or a company was required to provide a reimbursement based on its negative impact on cultural landscapes, the associations implemented such projects in practical terms. According to the compensation or substitution measures (*Ausgleichsmaßnahmen* or *Ersatzmaßnahmen*) in Germany, entities that modify the use or structure of landscapes and nature by making interventions are obliged to offset the impact by restoring the function and appearance of the landscape either by providing an equivalent value for the landscape or via financial reimbursement (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety 2009). In the case of contractual nature conservation, farmers obtain the payments for managing cultural landscapes through contracts with authorities such as district offices, regional councils, or the federal state ministry (Landesrecht Baden-Württemberg 2008, 2015, Bayerische Staatsministerium für Umwelt und Verbraucherschutz 2015, Land Brandenburg Ministerium für Ländliche Entwicklung, Umwelt und Landwirtschaft 2019, Hessisches Ministerium für Umwelt, Klimaschutz, Landwirtschaft und Verbraucherschutz 2020). The introduction of the regulations provided a favorable environment for the landcare associations to exploit coping responses such as high nature value area management and the creation of cultural landscape features, including flower strips and hedges.

The Middle Black Forest and Neumarkt landcare associations concentrated on the facilitation of contractual nature conservation—from looking for farmers who would take over abandoned land or incorporate cultural landscape elements in their farming areas to assisting in contracting and implementation of contracts. Conversely, for the Rheingau-Taunus and

Uckermark-Schorfheide associations, the projects initiated by compensation and substitution measures were one of their priorities. The Rheingau-Taunus Landcare Association managed large-scale projects, which dealt with the restoration of orchard meadows, vineyards, forest valleys, and dry-stone walls that were not agriculturally used any longer but contained ecologically valuable species and habitats (Weideverein Taurus e.V. n.d.; Bürgerstiftung Unser Land!: Rheingau und Taunus, unpublished manuscript, 2016). The Uckermark-Schorfheide Landcare Association facilitated the management of dry grasslands or wetlands, which are often located in nature protection areas (e.g., Natura 2000), and implemented hedge and bush planting projects. Decreases in funding for contractual nature conservation in Brandenburg State occasionally discouraged the association and its members from enacting a corresponding coping response.

In addition to the abovementioned responses, the Middle Black Forest and Rheingau-Taunus landcare associations mediated transactions of parcels that were not currently used or were not going to be used in the future for agricultural purposes. The two associations also assisted with the provision of equipment and machinery to farmers and citizens who were willing to take care of cultural landscapes. For instance, the Middle Black Forest Landcare Association was actively involved in the application for financial support from the government and the EU for pasture fencing and its installation so that farmers could continue their business and even take over fields that are abandoned by others (Ministerium für Umwelt, Klima und Energiewirtschaft Baden-Württemberg 2018). Although pasture fencing has become increasingly important for farmers due to the increasing pressure of predators on grazing livestock, its high cost has been a barrier that endangers the profitability of their businesses. The Rheingau-Taunus Landcare Association rented machinery and farming equipment at a cheap rate to citizens who voluntarily engaged in landcare activities. The Uckermark-Schorfheide Landcare Association was in charge of projects for endangered species protection. For example, the association managed a regional project to protect red kites (*Milvus milvus*) by creating flower strips and wild herb fields where they can find prey (Landschaftspflegeverband Uckermark-Schorfheide e.V. n.d.c, Deutsche Wildtierstiftung 2016). All four associations provided consultancy services for landscape management and associated paperwork.

Adaptation responses

The adaptation responses of the four case associations include the organization of events, public relations work, education, lobbying activities, promotion of regional products, and tourism development. Events were organized both for farmers and the broader public. One example is the grassland championship hosted by the Middle Black Forest and Rheingau-Taunus landcare associations that rewards good grassland management practices. Public relations activities, e.g., information stands at regional events, newsletters, and flyers were used to communicate and promote cultural landscapes and the associations' activities. For education activities, the Uckermark-Schorfheide Association held workshops for those farmers and gardeners who are interested in cultural landscape management. Although the association's members were aware of the imperative need, environmental education could not be more actively implemented due to a decline in financial support from the authorities. The associations invited politicians and government officials to talks

and events so that the opinions of the associations and their members could be further disseminated. All four associations were, to a different extent, engaged in the promotion of regional products from the cultural landscape. The Neumarkt Landcare Association put a strong emphasis on it compared with the other associations. Its regional brand "Juradistl" was launched in 2004 in Neumarkt County and three neighboring counties (Amberg-Sulzbach, Regensburg, and Schwandorf). The product range of Juradistl included lamb, beef, apple spritzer, and honey products that have direct associations with the cultural landscapes. These products were produced, slaughtered or processed, and distributed via restaurants and shops in the region. The association was in charge of marketing and quality assurance of the products (Thumann 2019). The Landcare Association of Rheingau-Taunus was responsible for the implementation of the LEADER (Liaison Entre Actions de Développement de l'Économie Rurale) program—a rural development scheme in the EU—in the Taunus region, which consisted of many tourism development projects initiated by communities or private citizens (see <http://regionalmanagement-taunus.de/projekte-in-umsetzung/>) (European Communities 2006). Apart from the management of the LEADER program, the association itself also created tourist attractions (e.g., trekking trails). The Neumarkt association developed natural attractions, such as its landscape cinema and walking trails. As well, the association provided guided tours in which tourists could gain culinary experience from cooking classes in addition to excursions in cultural landscapes.

Characteristics of the Responses

The coping responses had the characteristic of "fixing the consequences" of the disturbance. Therefore, the benefits of these responses had a shorter time span than that of adaptation responses. For example, if the funding from the compensation and substitution measure ceases, the abandoned grasslands managed through the measure will likely be overgrown by shrubs and trees unless the associations find another means to continue their management. Nevertheless, the time span of the effects varied for different coping responses. So-called "first aid management"—one-time cutting of grass and bushes on abandoned land, which needs to be followed by further actions such as continuous grazing—had a very short time span. Therefore, some associations implemented this type of management only if they found farmers who would continue farming on that land through other means, for instance, contractual nature conservation (e.g., the Middle Black Forest and Neumarkt landcare associations) after they learned a lesson from their past attempts. The observed coping responses did not seem to have a negative effect on the system in the future in return for their short-term benefit. Nonetheless, if the associations exclusively rely on coping responses, their long-term adaptation is less likely to be successful compared with those that carry out adaptation responses. The nature of short-term responses was understood as such:

"We just, we are kind of healing the symptoms [...]"
(Regional official of a municipality in Rheingau-Taunus county, personal communication 11 September 2018)

The limitations of coping responses were acknowledged by the interviewees from all four associations. The respondents were

aware that excessive dependence on coping responses will not be enough to successfully manage the cultural landscapes in the long term. However, this does not mean that coping responses are totally fruitless, as all four associations deliberately carried them out and invested the majority of their resources in them.

The adaptation responses that were observed in the cases were planned and implemented with a longer-term perspective and were targeted at the causes of the disturbance mentioned by the respondents—the agri-food market, mental models of consumers, or relationship between humans and nature. The necessity of long-term responses was acknowledged by the respondents, as is reflected in the following statement:

“It is very challenging and demanding to change the mindset of people [...], but this is a kind of very intensive long-term work, and now is probably the best time for a change.” (Regional official of a municipality in Rheingau-Taunus county, personal communication, 11 September 2018).

In contrast to many coping responses that require continuous financial resources from the government or other actors, the objective of the adaptation responses is to manage the cultural landscapes in a self-sustaining way that does not excessively rely on public support in the long run. Such responses were often generated as a result of lessons learned from coping responses. For example, interviewees of the Middle Black Forest Landcare Association expressed that after many attempts (e.g., biochar production), they understood that for the management of grasslands revitalizing traditional regional agriculture is the ultimate solution, and long-term adaptation responses are necessary to make it work. Environmental education appeared in the later phase of the association’s development, showing that the lessons learned were reflected in its response portfolio. The response portfolio of the Neumarkt Landcare Association showed a similar pattern. Along this line, the managing director explained:

“It is useless if we only concentrate on cutting shrubs and trees and do not find herders. Herders cannot do the work because they don’t earn enough money for their products, so it makes no sense. [...] Again if you don’t provide environmental education to pupils, you won’t have consumers of Juradistl products. And if you don’t make this investment, you won’t be successful in a few years.” (Managing director of the Neumarkt Landcare Association, personal communication, 19 November 2018).

Fit of the Responses

Responses that have a good fit with each other were found. One example is the management and restoration of high nature value areas and education activities. The Middle Black Forest and Uckermark-Schorfheide landcare associations offered opportunities to participate in cultural landscape management to pupils and citizens in cooperation with their member municipalities, schools, or a volunteer organization (Landschaftspflegeverband Uckermark-Schorfheide e.V. n.d.a). By combining the two responses, i.e., involving pupils in landcare activities, the associations could save resources for landscape management and expect a higher educational effect, although this involved some coordination work. As meadow management was implemented

in consideration of endangered species in the Uckermark-Schorfheide Landcare Association, it supported their species protection activities. The first aid management (one-time management of abandoned land) and contracted management of high nature value areas demonstrated a good fit, in that the latter ensured the prolonged effect of the former. All associations, but especially the Rheingau-Taunus and Neumarkt associations, carried out the management of high nature value areas and promotion of tourism and regional products in connection with each other. In that way, the associations could achieve multiple goals with fewer resources, compared with when they were separately organized. It also enabled them to offer a broader range of experiences to tourists, which results in multiple social-ecological benefits. The managing directors of the Rheingau-Taunus Landcare Association emphasized the connection between practical landscape management (e.g., managing grasslands or abandoned vineyards) and responses to support agriculture in the long term (e.g., education):

“So, you always have to think about the way you extend the whole story, how can a farmer sell his products, and where can he sell his products? How can you gain the interest of the public? It is always connected. [...] It is like a puzzle, you always have to put the pieces together.” (Managing director of the Rheingau-Taunus Landcare Association, personal communication, 11 September 2018).

Relatively fewer indications of missing fit and bad fit were evident in the interviews. The first attempts of first aid management, implemented by the Middle Black Forest and the Neumarkt landcare associations, which were not followed by activities of farmers to take over the management for a longer time, are clear examples of a missing fit. In these cases, the effect of the response only lasted for a very short time. The flower strips management of the Uckermark-Schorfheide Landcare Association manifested a bad fit with species protection activities, which were implemented by other organizations because the flower strips created by the association members were damaged by the growing population of beavers that were under protection. From this experience, the actors of the association realized that it is necessary to consider various factors that can potentially influence the effect of a response.

Concerning cultural landscape management, the funds for project implementation and the employment of personnel were some of the most critical factors for all four associations. Clearly, the interviewees were aware of high risk and trade-offs regarding this—applying for funds requires a lot of work, and if not successful, it is an investment with no outcome and lost opportunities to dedicate human resources to other, potentially more beneficial activities.

DISCUSSION

Coping and Adaptation Responses, and Adaptive Capacity

The characteristics of both coping and adaptation responses identified in the case studies correspond to our analytical framework except for the potential negative effect of coping responses. Such an effect that restricts opportunities for potential adaptation was not found in the cases we investigated. Also, considering the motivations for carrying out coping responses, it

is difficult to say that coping responses are adopted solely due to a lack of capacity to formulate and implement adaptation responses, as stated by Fabricius et al. (2007). Not only adaptation responses, but also some coping responses included changes in the current system characteristics, contradicting Berkes and Jolly (2001) and Fabricius et al. (2007). For example, management of high nature value areas through contractual nature conservation as well as compensation and substitution measures induced changes in both formal and informal institutions of the system: changes in regulations along with the common understanding of landscape management and its benefits. The deviations from the previous literature should be understood in the context of this study. Here, the disturbance has been ongoing for decades, and it is relatively well recognized by the authorities in a developed nation that is able to provide supporting organizations and programs. Also, the actors are not individuals but organizations that have a stronger power to induce such changes in the system characteristics. Learning processes were identified in both coping and adaptation responses, confirming that learning is not the exclusive characteristic of adaptation responses (Adger et al. 2004). The majority of all four associations' resources were spent on the planning and implementation of coping responses, manifesting a relatively short-term adaptive capacity. A possible hindrance to the short-term adaptive capacity is found in the case of the Uckermark-Schorfheide Landcare Association that is induced by a decrease in public funding for certain coping responses that are considered important by association members (e.g., financial support for contractual nature conservation). However, whether the downward trend will continue or become widespread for other funding opportunities was not very clear to the interviewees.

One feature that distinguishes adaptation responses from coping responses, the self-enforcing mechanism, can play out differently in different contexts. In the cases of this study, the stakeholders considered the longevity of the government support uncertain, with some actors experiencing a decrease in government funding. Therefore, the interviewees were wary of relying too much on government support, and a self-sustaining cultural landscape system would not include government support as a key component in their eyes. However, actors can focus on other functions of cultural landscapes that have been neglected and spread risks of price and yield fluctuation by receiving such support. Also, in the context where the public goods and ecosystem services of agriculture are well recognized and the durability of support program is ensured, the support may not be a temporary expedient. Where insufficient acknowledgment of agriculture's role in public goods and ecosystem service provision is strongly problematized, government support may be one way to address the causes of a problem. Therefore, public support should not be automatically equated with an unstable instrument that only deals with the symptoms of an issue. In terms of long-term adaptive capacity, the activities of the Neumarkt Landcare Association, which has stabilized its regional brand and is directly involved in brand management, and the Rheingau-Taunus Association's tourism development are noteworthy. Although the managing directors and stakeholders are conscious of the importance of a long-term perspective, adaptation responses are less actively implemented by all four associations in our study, as available funding opportunities (mostly in terms

of nature conservation and compensation measures) are focused on coping responses. This implies that the potential long-term adaptive capacity of the association is not fully harnessed.

Fit between Responses and Adaptive Capacity

By considering a fit between responses, the associations could save resources in comparison with responses that are implemented separately and without taking interactions into account. Also, a good fit between responses amplified or prolonged their individual impact. Consequently, an adaptive capacity that does not limit future adaptation options (Folke et al. 2002) is enhanced by a good fit between responses, as the associations can use the saved resources for other responses. Stakeholder interviews and the changes in response portfolios of the associations reveal that the responses are devised and implemented in consideration of their relation to other responses to a large extent. The remark of the deputy managing director of the Rheingau-Taunus Landcare Association, which emphasized a "story", where both coping and adaptation responses are interconnected, shows such understanding. Contrarily, if a response is carried out without any consideration of its relation to other responses, it is likely to have a limited impact and, in the worst case, can restrict possible future options to deal with a disturbance. This finding confirms not only previous studies that noted the trade-offs between the benefits of coping responses and adaptation responses (Biggs et al. 2004, Bohensky et al. 2010, Lemos et al. 2013) but also highlights the importance of considering interactions of different responses, regardless of their nature: coping or adaptation.

Rationales of the Responses

Why do the associations adopt coping responses? First, because the stakeholders believe that the disturbance will cause immediate harm to the SESs, e.g., in terms of ecological functions and well-being of people. Second, the stakeholders are aware that coping responses will not have a severely negative effect on their systems in the future in the sense of a price for achieving a short-term benefit by investing and with this binding human or financial resources. In addition, coping responses such as high nature value area management through contractual nature conservation and compensation and substitution measures seem to be the most feasible options for the associations, considering the amount of funds available and the likelihood of receiving them, even though they involve a variety of bureaucratic burdens. Lastly, some associations ensured the longevity of the responses' effects to some degree through learning processes. Adaptation responses are initiated by the stakeholders' understanding that longer-term strategies to target the fundamental causes of the disturbance are needed. Financial resources are crucial in planning and implementing adaptation responses as well but are more scarcely available than for coping responses, which explains why the associations could invest in adaptation responses only to a much more limited extent. The rationale for considering a good fit of responses is based on the perception that cultural landscape management requires multiple actions that are closely connected to each other. Although it was not explicitly mentioned by the associations' members, the answers implied that they are well aware of budget constraints and strive to achieve a maximum return on investing limited resources (e.g., financial resources), which is one motivation for planning and implementing responses that have a good fit and create synergies.

To sum up what shapes the response portfolios of the associations, we found that the degrees of perceived necessity (awareness that certain actions are necessary), feasibility (in terms of resources available), effectiveness, and efficiency are crucial factors for deciding for a certain response.

CONCLUSION

We assessed the adaptive capacity of cultural landscape systems through the coping responses, adaptation responses, and the fit between responses of four landcare associations. The associations invested the majority of their capacity in coping responses, which manifest relatively short-term adaptive capacity, compared with adaptation responses. We found that a good fit of responses is articulated through efficient use of resources, and magnification and prolongation of other responses' effect, which demonstrates adaptive capacity that opens up future options. Therefore, the findings advance the assessment of a SES's adaptive capacity by taking "hidden connections" between responses into consideration, which goes a step further from looking at individual responses from an isolated perspective. In addition, the findings contribute to the understanding of ILIs' responses to cultural landscape loss and their characteristics in Europe. For ILI managers and related stakeholders, our analysis may serve as a benchmark for the implementation and evaluation of their responses and fit.

The findings of this study raise a few points that call for attention. First of all, policies that facilitate the planning and implementation of adaptation responses that have a good fit with already implemented responses deserve further investigation and consideration by policy makers. Thus, this requires a shift of the current strong focus on coping responses to new ways to incentivize adaptation responses and responses with a good fit for a more efficient and balanced exploitation of responses. Second, capacity building for close cooperation among relevant parties who have stakes in different responses and mediation of potential conflicts (which, however, was not apparent in the four cases we investigated) may be highly beneficial for ILIs that attempt to identify and harness synergetic effects between different responses. Third, assessing a SES that is continuously dependent on public funding as unsustainable needs to be scrutinized by examining it in several contexts. Under stable economic conditions, continuous government/taxpayer support for landcare activities may be available, as experienced in some European countries over several decades, which then may lead to the conclusion that this is a relatively sustainable mechanism—which, however, may be totally different in other contexts. In addition to this, measures to raise public awareness for the public goods provided by agriculture and to adequately value them should be strengthened.

Responses to this article can be read online at:
<https://www.ecologyandsociety.org/issues/responses.php/12470>

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Data Availability:

The data that support the findings of this study are available on request from the corresponding author, H.P. The data/code are not publicly available because they contain information that could compromise the privacy of research participants, due to confidentiality of the data.

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APPENDIX 1. List of interview questions

What are the characteristics of the cultural landscape and agricultural practices in the region?

What challenges have the cultural landscapes in the region been exposed to so far?

What caused the mentioned challenges?

What are the activities that the Landcare Association employs to deal with the challenges?

How are the activities carried out in practice?

What are the motivations behind the activities?

Have the activities changed over time? If so, what are the reasons?

What facilitates or hinders the successful planning and implementation of the activities?

APPENDIX 2. Coding scheme

Category	Description	Example
Time frame	Time frame of response's expected effect	"[...] this is a kind of very intensive long-term work [...]"
Aim	Desired result of response	"We need the intact, functioning agriculture."
Mechanism	Self-sustaining mechanism of response and its effect	"I hope that the state has the possibility to give enough money [...] but I would say it won't be all the time the same."
Possible negative effect to the current system properties	Potential negative effect to the system characteristics that response may generate	Not found in the study cases
Interaction with other responses	Influence of response on other responses or future opportunities	"[...] because for me integrated projects are the best approach to improve various things."
