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The role of co-evolutionary development and value change debt in navigating transitioning cultural landscapes: the case of Southern Transylvania

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Cultural landscapes and their social–ecological values are threatened by changing lifestyles, policies and land-use practices, making their appropriate management a key sustainability challenge. Drawing on five years of interdisciplinary research in Transylvania, we conceptualise the notion of a ‘landscape interface’ – the intersection between the ecological and social subsystems, which through time, shapes and is shaped by the local value system. The landscape interface is a source of system continuity and stability. In Transylvania, many locals still act according to the value system associated with a disappearing landscape interface, a phenomenon we term a ‘value change debt.’ We argue that the erosion of the old value system, together with the weakening of the landscape interface, threatens sustainability – whereas reconnecting social–ecological feedback and thus strengthening the landscape interface could foster sustainability. The new conceptual perspective proposed here could foster greater understanding of cultural landscapes, including the social dimension of human–environment interactions.

Keywords: human–nature connection; landscape interface; social–ecological system; reconnecting feedback; resilience

Introduction

Cultural landscapes are among the most tangible expressions of co-evolutionary human–nature connections (e.g. Bignal and McCracken 2000; Antrop 2005) (see also Box 1). The mutual shaping of human–nature connections has created distinct ecological, socio-economic and cultural patterns (Farina 2000), including unique land uses and cultural ties with the land (Plieninger and Bieling 2013). The uniqueness and diversity of these landscapes is now valued worldwide. Cultural landscapes include, for example, the Satoyama landscapes in Japan (Iwata, Fukamachi, and Morimoto 2010), the Puszta pastoral landscape in Hungary (Chief 2006), and many other long established and persistent agricultural production systems. The importance of cultural landscapes extends beyond their conservation value. They provide a vast array of cultural and ecological services for human well-being and foster food security, traditional knowledge, sociocultural values, and native forms of sociocultural organisation.

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Box 1. Glossary of terms

Ascribed values: The importance placed on nature, for example, on an ecosystem service or on a landscape respectively (Ives and Kendal 2014). We distinguish ascribed values from held values. Ascribed values refer to second-order preferences, which exist in the objective realm of choice and action (Abson and Termansen 2011). These are influenced by held values, which refer to deeply held first-order preferences.

Cultural landscapes: Geographic areas where humans and the environment have gradually co-evolved through a variety of land uses over long periods of time (Plieninger, Höchtl, and Spek 2006). Human communities have continuously shaped their natural environment according to their needs, and in turn adapted to the natural landscape they inhabited (see e.g. Berkes, Colding, and Folke 2003; Folke *et al.* 2005). Recently converted agricultural landscapes (such as soya dominated landscapes in South America) are not considered cultural landscapes because they are not characterised by the gradual co-evolution of culture and land use.

Held values: Deeply held first-order preferences that shape and inform subsequent, second-order preferences (ascribed values). First-order preferences form the conceptual and principle basis for judgements and decision making about the world, whereas second-order preferences are the real-world choices that flow from those first-order preferences. For example, the idea of sustainability (a first-order preference) may affect consumption choices (a second-order preference). As such, first-order preferences exist in the conceptual realm of ideas and ideals, whereas second-order preferences exist in the objective realm of choice and action (Abson and Termansen 2011).

Landscape interface: A physical and cultural dynamic space resulting from the intersection and interaction between the ecological and social subsystems, fostering human-nature connections and social-ecological knowledge integration. Through time, the landscape interface shapes and is shaped by the local value system.

Landscape: A landscape is defined by the researched phenomenon. Here, we define a landscape in relation to the physical space within which rural communities live, work and interact with nature. Typically, the term describes physical spaces that range from a scale of tens of hectares to square kilometres characterised by a mosaic structure of land cover, and by the presence of unifying social or natural features (e.g. a similar governance history or topography (Forman 1995).

Motivational crowding out: A process whereby extrinsic motivators such as monetary incentives or punishments can undermine, or, under different conditions, strengthen intrinsic motivation (Frey and Jegen 2001).

Resilience thinking: A body of concepts and tools that deal with the structure and management of social-ecological systems in the face of change (e.g. Folke 2006; Gunderson and Holling 2002).

Value change debt: The time lag between changes in actors' deeply held values following changes to the landscape interface.

Today, cultural landscapes are increasingly under threat. Five types of drivers that affect cultural landscapes have been distinguished: socioeconomic, political, technological, natural, and cultural (Plieninger *et al.* 2015). Specific phenomena such as urbanisation or globalisation (Antrop 2005) can impact on all of these drivers. Despite a

natural fluidity and continuous evolution of landscapes (Manning *et al.* 2009), the intensity of post-second world war landscape changes has been disruptive to the diversity, integrity, and identity of many of these complex systems (Plieninger and Bieling 2012). Increasing human–nature disconnection, changing lifestyles, land-use practices, cultural contexts, and policy goals place cultural landscapes under growing pressure, with consequences that are not yet fully understood. One of Europe’s most notable examples of a cultural landscape, experiencing numerous social, cultural, and economic changes, is Southern Transylvania in Central Romania (Akeroyd and Page 2006).

This synthesis paper proposes an emergent conceptual understanding of cultural landscapes between continuity and change, based on the importance of intrinsic and held values, using Southern Transylvania as a case study. Rather than presenting new empirical data, we draw on evidence from five years (2011–2016) of place-based social–ecological research that addresses the problem of sustainability in Southern Transylvania. By conceptualising Transylvanian villages as social–ecological systems (SESs) (e.g. Hanspach *et al.* 2016), we studied components of the ecological subsystems, components of the social subsystems, interrelations between the two, and direct and indirect drivers of change (Mikulcak 2015; Dorresteijn 2015; Loos 2014). In line with Plieninger and Bieling (2012), our understanding of such human-shaped environments was also influenced by a particular type of systems thinking, namely resilience thinking, which expands the focus of landscape management to dealing with uncertainty and dynamics (Box 1). In mapping the social–ecological conditions in the study area we relied on the integration of multiple ways of knowing the system (Raymond *et al.* 2010; Fischer, Sherren, and Hanspach 2014). Non-academic stakeholder participation laid the foundation for complementing our combined scientific, expert, and normative knowledge with experiential and local ones through a transdisciplinary process (Hanspach *et al.* 2014; Fischer *et al.* 2015; Nieto-Romero *et al.* 2016).

Based on our findings and experience in Transylvania, in this paper we (i) briefly describe the social and ecological subsystems of Transylvania; (ii) introduce the notion of the ‘landscape interface’; (iii) outline the threats to that interface; (iv) link the notion of the landscape interface and SES change to the idea of a ‘value change debt’; and (v) discuss the implications of the ‘landscape interface’ and ‘value change debt’ for the sustainable management of cultural landscapes.

The social and ecological subsystems of Southern Transylvania

We studied an area of 7.440 km² in Southern Transylvania (Figure 1), with a population of approximately 280,000 inhabitants (INS 2011). In this hilly landscape, land use is primarily determined by topography with forests occupying the hill tops, arable fields being located mainly in the valleys, and grasslands occurring on the slopes (Figure 1, Figure 2). Historically, this has maintained a heterogeneous mosaic of relatively similar proportions of the main land-use types. Small-scale farms of 2–3 ha are scattered in small parcels, and a high degree of manual labour and low levels of agro-chemical input persist in the valleys (e.g. Kovács-Hostyánszki *et al.* 2016; Öllerer 2013) (Figure 3). All of the above supports high rates of biodiversity, including numerous threatened species (Loos *et al.* 2015; Dorresteijn *et al.* 2013; Loos, Dorresteijn, *et al.* 2014).

At present, the region is mostly populated by ethnic Romanians, Hungarians, and Roma, along with a very small number of Transylvanian Saxons. Because of few employment opportunities much of the rural population is income-poor, with

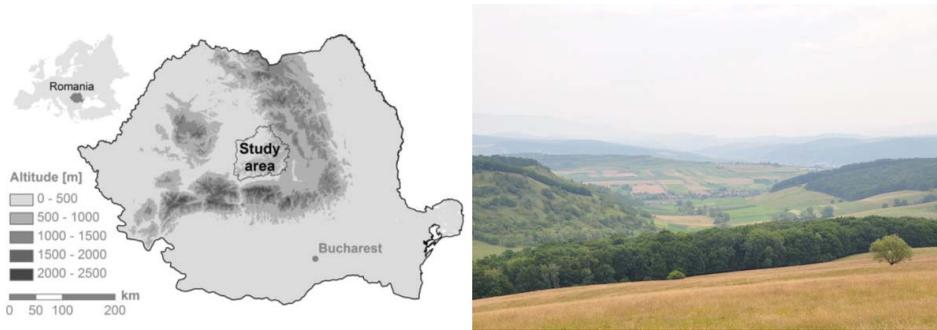


Figure 1. Map of the study area. The picture on the right shows the three main land-use types in relatively equal proportions: forests, arable fields, and grasslands. Source: the authors.



Figure 2. Overview of a Transylvanian village. The picture on the right shows the main street in a village. Many of our interviewees remarked on the poor state of infrastructure in Transylvanian villages. Source: the authors.

limited availability of non-farming jobs and dependence on subsistence farming (Gorton, Hubbard, and Hubbard 2009; Hartel *et al.* 2014). Especially young people often migrate seasonally or permanently, leading to an ageing rural population and rural depopulation (Ghişa *et al.* 2011).



Figure 3. Hay is highly valued as fodder during winter, depending on their income. Farmers still manually cut hay for their livestock. Source: the authors.

Different historical periods – the Saxon period (pre-communism), communism, post-communism, and EU membership – have all left prominent cultural and identity legacies, and have shaped the social and the ecological subsystems. Following the collapse of communism, the transition towards a market economy was marked by social, institutional, and political instability (Milcu *et al.* 2014). Low levels of trust and widespread corruption have since eroded social capital (Mikulcak *et al.* 2015; Slangen 2004). Widespread privatisation and restitution laws of collectivised land that were initially envisioned as a ‘return to a just order’ (Verdery 2003) led to important tenure changes (Nichiforel and Schanz 2009). Agricultural land trends polarised either towards land abandonment or intensification (Culbert *et al.* 2016), and deforestation increased. Finally, Romania’s accession to the European Union (EU) in 2007 led to increasing migration and further institutional, land use and tenure changes, mainly driven by the structures of the Common Agricultural Policy (CAP). In addition, large parts of the case study area were assigned protection status under the Natura 2000 network.

The overall pattern of land use in Southern Transylvania remained relatively stable throughout these changes (Culbert *et al.* 2016). Indeed, Southern Transylvania is recognised as one of Europe’s last ‘biocultural refugia’, defined by Barthel, Crumley, and Svedin (2013, 1143) as “places that not only shelter species, but also carry knowledge and experiences about practical management of biodiversity and ecosystem services.”

Understanding the landscape interface

Southern Transylvania offers fertile ground for applying a ‘human in the environment’ perspective (Folke 2006). The way the landscape developed and its current SES configuration are a result of a co-evolution of social and ecological factors (Fischer, Hartel, and Kuemmerle 2012). These internal co-evolutionary processes are characterised by relatively direct linkages between resource users and ecological dynamics (*sensu* Berkes, Colding, and Folke 2003; Folke *et al.* 2005). Examples of such linkages include the persistent reliance of Transylvanians on local ecosystem services (e.g. hay, firewood, local crops), the ways in which inhabitants have historically directly shaped this landscape (e.g. by grazing and tree farming creating wood pastures (Hartel *et al.* 2013), or their role in influencing ecosystems through mediating and altering multitrophic interactions (Dorresteijn, Schultner, *et al.* 2015). Moreover, this cultural landscape has also allowed locals to meaningfully relate to nature in non-utilitarian ways: The landscape is the daily arena for interaction, connection and proximity between elements of the social and ecological subsystems, including farmers engaging with the land (Horcea-Milcu *et al.* 2015), shepherds considering bears as their ‘neighbours’ (Dorresteijn *et al.* 2016), and old trees as valued bearers of social, cultural, spiritual, and historical heritage (Hartel *et al.* 2013). Recognising the landscape’s function as an arena for living and engaging with nature, we define the ‘landscape interface’ as a dynamic space of intersection and interaction between the ecological and social subsystems (Box 1). The notion of a landscape interface is consistent with our findings on the landscape providing a physical and cultural space for experiencing nature (Dorresteijn *et al.* 2016), accessing ecosystem services (Hartel *et al.* 2014; Horcea-Milcu *et al.* 2015), but also with our findings on landscape aspirations (Milcu *et al.* 2014). By determining decisions and power processes, the notion of a landscape interface borrows the characteristics of a meta-institution that influences decisions regarding land use and the distribution of benefits and responsibilities coming from the ecological subsystems, but

also governs the process of creating and assigning meaning, norms, and values to nature (see also Pretty *et al.* 2009).

The co-evolving interactions among biophysical and sociocultural structures within the Transylvanian ‘landscape interface’ have deeply imprinted a value system on locals in relation to the landscapes they inhabit. During historical changes, the reality of local people revolved around applying nature-based survival strategies and adapting to the validated normative pathways of achieving a farming-based livelihood as a source of social acceptance (Verdery 2003; Câmpeanu and Fazey 2014). Moreover, our research suggested the landscape interface acted as a space of social–ecological interaction that nurtures and is nurtured not only by human agency and knowledge, but ultimately by value creation processes. During this historical co-evolution, values were emergent from the system, feeding back into practices, institutions and attitudes, maintaining the system from within. We posit that these values have been self-reinforcing, in spite of rapidly changing political and economic ‘contexts.’ The landscape interface was feeding the value system and in turn, the value system was reflected in the landscape. For example, according to a narrative analysis on the benefits from nature in Transylvania, the social norm of maintaining cultivated land mirrored a land ethic irrespective of livelihood returns (Horcea-Milcu *et al.* 2015). It emerged as a manifestation of a deeply rooted agrarian identity of locals as land stewards despite seemingly decreasing returns from small-scale agriculture (see also Raymond *et al.* 2015). The normative pathway of not abandoning agricultural land, and the values attributed to a maintained landscape (Milcu *et al.* 2014; see also Rogge, Nevens, and Gulinck 2007), stem from the generation spanning experiences of local people gathered in the long course of engaging with the landscape. Unlike decisions for farming-based livelihoods founded on social validation and external motivation, these intrinsic, held values transcend contexts and prevent less sustainable pathway deviations (see also van den Born 2017).

Small-scale farmers emerged as key actors of the landscape interface, and illustrate the above processes of feedback and reinforcing practices. Ecological studies typically underline the benefits of small-scale farming for biodiversity, while the maintenance of high nature value (HNV) farmland is a priority of the EU policy for biodiversity conservation (Sutcliffe *et al.* 2014). Indeed, in Transylvania, the richness and diversity of nature is supported by the small-scale mosaic of cultivated land, and the diversity of land uses (Hanspach *et al.* 2015; Babai and Molnár 2014; Loos, Kuussaari, *et al.* 2014). The creators of this mosaic are the small-scale farmers, who are characterised by tight interactions with, but also by a distinct type of attachment to, the landscape (in line with Bieling *et al.* 2014). Findings point to small-scale farmers not only as investors of resources in order to co-produce (Raymond 2017) and mobilise ecosystem services – understood here as the appropriation of ecosystem structures and functions through investments of different capitals (Spangenberg, von Haaren, and Settele 2014; Horcea-Milcu *et al.* 2015) –, but as the actual agents of the landscape interface, endowed with the human capacity and traditional knowledge to maintain it (Figure 3). Crucially, the high levels of biodiversity in Transylvania at present are not the result of externally imposed policy instruments, or an overriding desire to conserve that biodiversity (see also Babai and Molnár 2014) – rather, they are the outcome of the goals, values and meanings emergent from generations of use and experiences of nature at the landscape interface. To be maintained or continue to evolve (rather than vanish), existing value systems in settings such as Transylvania thus depend on the continuation of such interactions with ecosystems.

Threats to Transylvania's landscape interface

Today, many co-occurring sociocultural, demographic, economic, institutional, and policy pressures are potentially fragmenting Transylvania's SESs, threatening its landscapes, and affecting locals' connection to nature (Milcu *et al.* 2014). According to our social studies, local people perceive and incriminate indirect drivers of change (Box 1) for the main problems in the area; the past and present political regimes, depopulation, aging, but also new lifestyle aspirations, were considered to explain the lack of jobs, low community spirit and poor education (Mikulcak *et al.* 2015; Hanspach *et al.* 2014). Also, the economic realities of the global market versus the environmental goals set by the EU (e.g. EC 1992) create demanding and often contradictory challenges for the management of Transylvanian cultural landscapes. Numerous other social-ecological studies stress the importance of indirect drivers of change for the SES dynamics (Carpenter *et al.* 2006; Forbes *et al.* 2009; Kittinger *et al.* 2012).

The current threats to the stability and resilience of the Transylvanian cultural landscapes may trigger the breakdown of the gradual evolution of held values at the landscape interface. Notably, today's threats to the stability of the Transylvania's cultural landscape differ from past threats in at least three aspects.

First, current threats are primarily external, acting on the system through top-down management, heavily relying on either coercion (e.g. laws, state imposed regulations) or extrinsic rewards (e.g. subsidies, grants), with little or no regard for the intrinsic values that co-evolved within the landscape interface. Cultural landscapes have become more connected to, and embedded within, larger systems (national and global markets and institutions). The goals and values in managing the landscape thus originate no longer only (or even primarily) within the landscape, but are increasingly imposed from outside. Externally imposed development pathways can cause tensions, for example, between people's aspirations for economic prosperity and the conservation of natural and cultural heritage (Young *et al.* 2007). Externally induced landscape management that ignores the landscape interface and local value system thus risks undermining the co-evolutionary processes between people and the landscape, which underpin the stability and sustainability of cultural landscapes.

Second, current threats differ from the past in terms of their extent, number, diversity and complex combined action. For example, policies are now fragmented, causing inconsistencies or misfits between them. Most policies are partial, targeting specific aspects of either the social or ecological subsystems, such as provisioning ecosystem services (in Pillar I of the CAP), conservation of single taxon (e.g. *Crex crex* Dorresteijn, Teixeira, *et al.* 2015), or certain landscape elements (e.g. boundary strips of farming parcels according to Agri-environment Measure 10 of the National Rural Development Program 2014–2020 specifying the rural development measures contained in Pillar II of the EU CAP). Literature shows that economic incentives (e.g. Agri-environment schemes) may be ineffective in highly heterogeneous or optimised landscapes (Pe'er *et al.* 2014; Batary, Matthiesen, and Tschardtke 2010). A potential (but hitherto unrecognised) reason for this is that such policies are insensitive to key system characteristics of the landscape interface (e.g. how traditional land use creates heterogeneity) that have led to a certain value or benefit (e.g. biodiversity) (Dorresteijn, Loos, *et al.* 2015). By trying to protect isolated elements through narrowly defined policy prescriptions, while ignoring links and feedback, top-down management is overlooking human-nature connections and local value systems, which together ensure the survival of many of the elements being targeted by policy in the first place. For example, we found

that payment schemes for bear damage inadvertently undermine tolerance towards human-bear coexistence (Dorresteijn *et al.* 2016).

Third, current threats are essentially money-driven. Heavily regulated agricultural subsidies, overwhelmingly mentioned by locals, are causing small-scale farmers to give up farming, or change their practices so as to maximise cash benefits (Horcea-Milcu *et al.* 2015). However, financial incentives can only be effective in the short term, because, as demonstrated by our social research on farmers (Horcea-Milcu 2015, but see also, e.g. Van Zanten *et al.* 2014), landscape interactions were not primarily driven by economic motivations (see also van den Born 2017; Yuki 2017). Similarly, prior to compensation payments, people in Transylvania tolerated bears not for their economic benefits, but because of the non-use (cultural) values ascribed to them. We consider the focus on financial incentives and extrinsic resources, a standard conservation approach in Europe (Plieninger and Bieling 2013) to be temporary, all the more in Transylvania, monetary incentives may also have negative biological consequences such as excessive pasture cleaning (Sutcliffe *et al.* 2015). Moreover, strictly economic stimuli may not align with the traditional ecological knowledge and practices; for example, imposed mowing dates were perceived as disadvantageous for hay quality (as also found by Babai and Molnár [2014] in the Gyimes area of Transylvania), but also for biodiversity (Dorresteijn, Teixeira, *et al.* 2015). Finally, the implementation of coercive or financial instruments gets distorted in countries with governance weakened by phenomena such as elite capture (Mikulcak 2015). For example, compensation payments for wildlife damage inadvertently fostered corruption (Dorresteijn *et al.* 2016).

The ‘value change debt’ in cultural landscapes

Despite numerous threats to the stability of the Southern Transylvanian cultural landscape, many people still act and behave towards nature according to their old value system regardless of not having the ‘right habitat’ (context) for their values anymore (Horcea-Milcu *et al.* 2015; Câmpeanu and Fazey 2014). The importance of intrinsic, held values (Box 1) is increasingly being recognised within ecosystem services and social-ecological frameworks (e.g. Díaz *et al.* 2015; Muhar 2017) or within conservation approaches (Manfredo, Teel, and Dietsch 2016). Intrinsic, held values (both of individuals and communities) often underpin or influence outcomes in SESs. For example, a widely shared ethic of not abandoning agricultural land, and the values attributed to a maintained landscape have the potential to reverse or at least dampen system dynamics leading to inequity patterns among ecosystem service beneficiaries in Transylvania (Horcea-Milcu 2015). The old ‘agrarian’ value system, based on the connection to the land emergent from the landscape interface, still influences the current SESs and maintains the human–nature connections within the landscape interface. Similarly, our research on human-bear coexistence showed that values related to historical proximity to nature via interactions at the landscape interface could, to a certain extent, reverse or counterbalance the recently introduced, formal wildlife management schemes that tend to imply a different relationship with large carnivores (Dorresteijn *et al.* 2014; Roellig *et al.* 2014).

However, this value system is not fixed. Inspired in part by the notion of an ‘extinction debt’, which is the time delay following habitat loss or degradation when local extinction of species can occur (Tilman *et al.* 1994; Kuussaari *et al.* 2009), we define a ‘value change debt’ as the time lag between changes in actors’ deeply held values following changes to the landscape interface (Box 1). In other words, we suggest that the current

values individuals and communities hold are shaped by a past landscape interface and associated experiences that no longer exist as such. The notion of a value change debt can help explain locals' high behavioural inertia. We hypothesise that this historically dependent value system plays a fundamental and stabilising role in cultural landscapes. This stabilising effect of a value change debt could also be seen as a factor that contributes to social–ecological resilience, at least temporarily (Folke 2006; Plieninger and Bieling 2012). Such intrinsic, held values appear to be both relatively slow to change and relatively stable (Ives and Kendal 2014; Manfredo, Teel, and Dietsch 2016). Contrary to situations where rigid values or path dependencies are seen as an obstacle towards achieving sustainability in social–ecological landscapes (Zurlini *et al.* 2015), in the case of Southern Transylvania we found that such values were a buffer against aforementioned threats to the identity of the landscape.

In Transylvania – and probably many other cultural landscapes – we argue that the main holders of the ‘stabilizing’ value system are small-scale farmers. They are not simply land managers functionally connected to the landscape. Rather, functional linkages exist alongside cultural and non-utilitarian linkages. Cultural ties to the land are a type of slow social variable shaping how the social subsystem interacts with the ecological one (Chapin *et al.* 2006). During our empirical work, small-scale farmers talked about the normativity of cultivating the land, hence interacting with it, as something that is linked to their identity and way of life. Our interviews with small-scale farmers depicted them as the ones closing the loop between ecosystems and people (see also Raymond *et al.* 2013). They are the ones maintaining a balanced cycle of (labour and resource) investments in and returns from nature (in their words: “spinning around the stock [land]”) (Horcea-Milcu *et al.* 2015). Small-scale farmers appear as stewards of the landscape that provides them with ecosystem services and economic opportunities, as well as custodians of the value system that has helped to create and maintain the landscape.

While noting the importance of small-scale farmers, we also identified a set of contextual factors that may seriously impede their agency as stewards of these landscapes in the future – including institutional constraints, elite capture, and a tendency to go along with existing injustices (Horcea-Milcu *et al.* 2015). Given the important role of small-scale farmers, their increasingly weak agency in cultural landscapes may pose a key challenge to sustainability. Indeed, a closer look at the small-scale farmer(s) in addition to small-scale farming may be the missing link in understanding and managing many traditional SES that are prone to change. Greater focus should be placed on understanding the values held by small-scale farmers and on how external policies and planning influence these historically co-evolved values. To this end, Ives and Kendal (2014) provide useful guidelines for the acknowledgement of social values in ecosystem management. However, to date, relatively little is known about how current policies and practices will alter the landscape interface and what the flow-on effects will be on local value systems.

The intrinsic, held values maintaining the cultural landscape face the risk of being eroded (Chapin *et al.* 2006) or in economic terms, ‘crowded out’ by exogenous factors (Frey and Jegen 2001; Kosoy and Corbera 2010; Muradian *et al.* 2010; Rode, Gómez-Baggethun, and Krause 2015) – including large-scale institutional arrangements (e.g. monetary incentives, regulatory instruments), but also values that were historically extrinsic to the landscape (e.g. those associated with market economies). For example, conflicts around the access to pastures in many Transylvanian villages are rooted in the distribution of pasture subsidies available from both of the EU CAP Pillars I and II (i.e.

direct payments as well as agri-environment schemes). These subsidies provide a strong extrinsic motivation to local farmers, which is increasingly crowding out the traditional norm of (sustainably) maintaining the land. Thus, there is a risk of the landscape interface shifting from being the arena where values are shared and enacted, by those who experience, live in and manage the landscape, to being simply the recipient of multiple, potentially conflicting goals and values inflicted on increasingly disenfranchised locals. Within the reflexive, internally self-sustaining social–ecological dynamics, intrinsic, held values are altered and replaced by contingent external ‘energy sources’ used to maintain desired properties according to goals set outside the system.

In Transylvania, the ongoing closure (or, in ecological terms ‘relaxation’) of the value change debt is becoming increasingly obvious. One of the most obvious changes is that locals increasingly value ecosystem services that generate cash rather than provide direct benefits (e.g. food) (Horcea-Milcu *et al.* 2015; see also Yuki 2017). This trend, coupled with individualism, weakens the institutions upholding the old value system, which was traditionally mandated to watch over common natural resources (Sutcliffe, Paulini, and Jones 2013; Loos *et al.* 2016). In other words, the resilience of the cultural landscape is being lost by a weakening of traditional connections (Plieninger and Bieling 2012), not only in a tangible, but also in a normative sense.

In the case of Southern Transylvania, we therefore envision a looming tipping point (or threshold), at which the current threats to the stability of the cultural landscapes may interact to create a perfect storm of pressures that could trigger the complete breakdown of the historically reinforcing co-evolution feedback mechanisms (i.e. a regime shift; *sensu* Folke 2006). When these links break, landscape distinctiveness and functionality will be lost, giving way to simplification and homogenisation brought about by uniformising external pressures (Selman and Knight 2006; Pretty *et al.* 2009). With this, the landscape interface will change, and the associated value system will shift to a state in which the cultural landscape *per se* is no longer seen as a source of human well-being. Consistent with the described co-evolution of values and landscapes (section ii), and Gunderson and Holling’s (2002) assertion that only a few key variables drive complex SESs, a shift in values will entail irreversible landscape change. To avoid such change, below, we suggest four starting points for future management.

Maintaining cultural landscapes

Our synthetic understanding of Southern Transylvania’s cultural landscape emphasised disruptive threats to its stability, such as exogenous indirect drivers of change, coercive measures, partial policies and undermining financial instruments. We also discussed stabilising factors, namely the ‘landscape interface’ and the ‘value change debt’ reflecting the old value system into the present. To counteract existing threats, here, we propose that stabilising factors deserve more active consideration.

First, we argue for greater appreciation and support of the social values and norms arising from generations of experiences of living in cultural landscapes. We also argue for the role of intrinsic, held values as intervention points of sustainability initiatives in the region (see also Abson *et al.* 2016). Targeting these intrinsic, held values might be more efficient at maintaining cultural landscapes than focussing on specific outcomes (e.g. presence of a certain species). Care should be taken regarding how external goals and their associated values support, inhibit or shape the shared values that have co-evolved at the landscape interface (see also Babai *et al.* 2015). This requires policies that support and enable goal setting and matching, visions and values from within the

landscape. Rewarding behaviours arising from the old value system (e.g. communal cleaning of the pasture) may also reinforce its importance.

Second, strengthening the landscape interface relies on reconnecting the social and ecological subsystems. Scientists have identified disconnection from nature as a root cause for today's societal sustainability challenges (Abson *et al.* 2016). Building on and reactivating the landscape interface could counteract the 'extinction' of experiencing nature (Miller 2005) and the resulting decoupling of the social subsystems from the ecological subsystems. According to the iterative understanding acquired through our interdisciplinary work, the landscape appeared as a favourable space for facilitating and reinforcing human–nature connections. Similarly, when responding to external shocks and increasing pressures, building on the capacity of the landscape to nurture human–nature connections and fight disconnection may create better premises for the SES to reorganise in ways that allow it to continue to function. Existing literature provides a series of powerful metaphors with regards to a reconnection agenda: creating new functional links between biodiversity, livelihoods, and culture (Xu, Lebel, and Sturgeon 2009), creating 'virtuous circles' between natural, cultural, and economic assets (Plieninger and Bieling 2013; Selman and Knight 2006), seeking profitable but genuine means to re-couple the ecological subsystems with transformed social subsystems (Fischer, Hartel, and Kuemmerle 2012). In addition, the growing academic discourse about relational values may support an agenda of reconnecting the inhabitants of cultural landscapes to their natural environment (Chan *et al.* 2016; Abson *et al.* 2016).

Third, our findings indicate that integrative landscape-based management and conservation strategies considering not only the scale of a landscape, but its heterogeneous social–ecological composition and configuration of functional and normative elements may ensure a more effective management for sustainability (Dorresteijn, Loos, *et al.* 2015 in agreement with Reed *et al.* 2016; Sayer *et al.* 2013; Van Zanten *et al.* 2014). A landscape-based management would also counteract the uncoordinated and often contradictory effect of narrowly defined sectoral policies or institutional mismatches (Mikulcak 2015) by promoting more holistic ones that target the links between the social and ecological subsystems. Moreover, the insight that value changes may not occur simultaneously with landscape changes, allows us to better align the management of cultural landscapes with the value systems of inhabitants.

Fourth, harnessing the potential of stabilising factors means not only maintaining these factors as such, but also fostering connections between them. We identify two essential missing links between stabilising factors: (1) the link between the landscape interface and the value system; and (2) the feeding back of practices taking place at the landscape interface to challenge and inform externally imposed, top-down policies.

Reconnecting the landscape interface to the value system, in practice, translates into community stewardship (Chief 2006; Plieninger *et al.* 2015) including the maintenance or development of informal institutions that display some of the characteristics that were traditionally used in Transylvania to manage common resources (e.g. *Nachbarschaft*) (Hartel *et al.* 2016, see also Rodgers 2017). Stewardship essentially describes the operationalisation of moral concerns in relation to social–ecological interlinkages (e.g. Leopold and Udall 1966). Effective landscape management oriented towards community engagement with the landscape could better substitute external input, upon which the system is increasingly dependent and which comes in the form of coercive external top down policies with a series of perverse or unintended side effects. Fighting coerciveness and relieving negative institutional pressure can be achieved by avoiding blanket institutional instruments and tailoring landscape management according to local

conditions. For example, policies should account for specific barriers to rural development (Mikulcak 2015; Nieto-Romero *et al.* 2016) and equity implications (Horcea-Milcu *et al.* 2015). Instead of dealing with the externalities of the policies by overregulating, we suggest an attentive monitoring of the outside pressure, while improving cooperation among stakeholders and strengthening bridging organisations (Mikulcak *et al.* 2013). Interventions that support and empower small-scale farmers and their motivation regardless of their productivity may come closer to more engaged forms of stewardship.

Finally, land-use practices and value systems co-evolving at the landscape interface need to both find productive and mutually beneficial links to the larger SES within which they are embedded, and inform the top-down (external) policy interventions. Bottom-up initiatives have the potential to bridge regulatory gaps and foster appropriate top-down bottom-up policy mixes (Lambin *et al.* 2014). This complementary bottom-up reconnection lends itself to community empowerment and participation. Regardless of the economic or institutional context, strong proactive communities are better situated to deal with the uncertainties caused by endogenous or exogenous drivers of change (Hanspach *et al.* 2014). Communities are key in advancing social values in the policy agenda (Lambin *et al.* 2014) and help develop governance systems inclusive of human–nature connections. For example, the community’s capacity to self-organise was shown to mitigate inequities in ecosystem services distribution and adverse trends set by institutional contexts in Transylvania. Cross-cutting our research findings, social capital was emphasised as an enabling factor in the social–ecological dynamics. An increase in social capital was attributed with the capacity to break the vicious cycle between dysfunctional local economy, poverty and social conflicts (Mikulcak *et al.* 2015). In the light of the anticipated heterogeneity of aspirations and livelihood strategies involving a greater or lesser reliance on ecosystem services (Milcu *et al.* 2014) strong communities are needed to democratically negotiate diverging interests and build a shared vision for the future management of these valued cultural landscapes.

Conclusion

In this synthesis we introduced two new notions that are closely linked to one another – the ‘landscape interface’ and the ‘value change debt.’ We define the ‘landscape interface’ as the physical and cultural dynamic spaces resulting from the intersection and interaction between the ecological and social subsystems, which shape and are shaped by the local value system. By ‘value change debt’ we understand the time lag between changes in actors’ deeply held values following changes to the landscape interface. Both the landscape interface and the value change debt are normative, acknowledging potentially important, but so far under-recognised, system properties of cultural landscapes. We believe that greater consideration of the co-evolution of SESs with value systems could provide a complementary approach for understanding and managing change in highly valued, and threatened cultural landscapes. Similarly to the explanatory power of institutional concepts, such as path dependency for deconstructing cultural landscape development (Plieninger and Bieling 2012), research that deals with assessing the contribution of value systems in maintaining the social–ecological resilience adopts a more socially refined perspective on landscapes between continuity and change.

For example, Southern Transylvania is subject to a balancing act between disruptive threats to the stability of its landscapes and stabilising factors such as the landscape interface and the intrinsic value change debt. Although acknowledged, the exact effect

and nature of their role (as intervention points) in the dynamic and resilience of this cultural landscape requires further social–ecological study, potentially explored with the help of relational values. The landscape interface and the intrinsic, held values strengthen or at least favour the sustainability of the Transylvanian cultural landscape, and hence may contribute to the challenge of sustainability science in understanding and managing such valued, yet threatened, landscapes. Capitalising on stabilising factors implies identifying and revitalising missing social–ecological feedback based on the landscape interface and the intrinsic value change debt. This reconnecting feedback, operationalised through community landscape stewardship and community empowerment, may balance the general dynamics of the SESs and allow landscapes and people to continue growing together instead of growing apart.

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