Studying long-term changes in cultural landscapes: outlines of a research framework and protocol

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ABSTRACT
Applied historical landscape research often takes place under the umbrella of sustainability issues and sustainability research, but now includes both environmental sustainability and community resilience. This confronts the study of cultural landscapes with new issues and challenges such as how to utilize long-term and more recent perspectives, and to integrate economic, cultural and ecological drivers of landscape change. A key question is how to make landscape studies relevant for both contemporary landscape services and future landscape changes. We propose a new framework for study that combines insights from landscape biography, historical ecology and systems theory. It presents a ‘protocol’ for exploratory research with premises and operational principles, and argues for geodesign in connecting environmental issues, heritage practices and question-driven historical analysis. The framework and protocol are based on recent research within the European Community’s Seventh Framework project Sustainable Futures for Europe’s Heritage in Cultural Landscapes (HERCULES).

KEYWORDS
Cultural landscape; long-term change; sustainability; research protocol; HERCULES

1. Introduction
During the second half of the last century, in both Europe and North America, historical landscape research has achieved a more or less respected place in the theory and practice of land use planning. This resulted in strongly developed, often regional specific, research traditions in applied historical geography, historic landscape characterisation and historic landscape assessment. These traditions built on earlier branches of landscape research, like the local history approach in the UK, the morphogenetic schools in German and continental European geography and early experiments with participative heritage planning in Denmark (Newcomb, 1972). Although these traditions also explicitly aimed at making understandable the historical background and development of the contemporary cultural landscape (e.g. Denecke, 1982, p. 127), most applied research eventually centred on the mapping and description of characteristic historic elements, patterns and structures in the present-day agrarian landscape. In this way, applied historical landscape research contributed significantly to our knowledge of surviving ancient field systems, rural settlement forms and vegetation types, as well as to their preservation within the framework of new spatial planning interventions.

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Since the 1990s, historical landscape research increasingly takes place under the umbrella of sustainability issues and sustainability research (Bai et al., 2015; Bürgi, Silbernagel, Wu, & Kienast, 2015; Council of Europe, 2000; Janssen, Luiten, Renes, & Rouwendal, 2014; Plieninger et al., 2015; Tress, Tress, Fry, & Opdam, 2008; and Widgren, 2012). In this context, the term ‘sustainability’ is used in at least two different ways. First, from the perspective of environmental sustainability, the landscape’s cultural heritage is envisaged as an important carrier of the identity of place (genius loci), as well as the only source that directly informs present-day society and planning about land use systems in the past and their influence on landscape and ecosystems. Second, from the viewpoint of ‘resilient societies’, the heritage of rural and urban landscapes is seen as crucial for safeguarding people’s access to and engagement with their (material) past, for obvious reasons like cultural identification, the transmission of social memories, well-being, education and recreation.

Not surprisingly, involvement with both dimensions of the sustainability debate has resulted in the incorporation of applied historical landscape research in the study and design of ecosystem services and ‘landscape services’ (Plieninger et al., 2015; Termorshuizen & Opdam, 2009):

Landscapes exhibit diversified and interconnected types of values ranging, for instance, from intangible features such as spiritual values and outdoor recreation through water and climate regulation to the provision of food (...). Landscape research into such services is typically focused on how different types of landscapes provide different services, and how different parts of society value them, depending on the cultural background, scarcity, and accessibility of the services provided. (Plieninger et al., 2015, p. 5)

Such an approach was adopted in the recently completed European Community’s Seventh Framework project Sustainable Futures for Europe’s Heritage in Cultural Landscapes (HERCULES) (Plieninger et al. 2015). As a response to the European Landscape Convention’s call for transdisciplinary research that includes actors with stakes in cultural landscapes (Council of Europe, 2000), HERCULES engages public and private actors to protect and sustainably manage cultural landscapes of significant cultural, socio-economic, historical, natural and archaeological value and at local, national and Pan-European levels. The project specifically focuses on the sustainable use and future development of heritage in Europe’s cultural landscapes. Like many other recent and ongoing programmes with such a broad interdisciplinary scope and aim, the HERCULES project faced the complicated task of integrating the study of long-term changes in cultural landscapes with the research of more recent and current land use systems, ecosystems and related matters of biodiversity. Also, long-term landscape histories have to be made useful and effective for landscape services and future land use planning. With respect to this (difficult) exercise, recurring issues are:

(1) How to study the development of cultural landscapes from a long-term perspective, covering centuries or even millennia and integrating economic, cultural and ecological drivers and aspects of landscape change;
(2) How to integrate the methodological starting points and empirical results of long-term landscape histories with those of more recent land use histories and ecological research;
(3) How to make long-term landscape studies relevant for the thinking about landscape services and future landscape changes?

One of the work packages of the HERCULES project (WP2) explicitly dealt with the first issue, not only theoretically but also empirically in the form of case studies in the Netherlands (Central Netherlands river landscape and its wetlands), Sweden (the former coastal landscapes of Uppland) and Estonia (Vooremaa). In order to assess the long-term interactions between social, economic and natural drivers in these regional landscapes more accurately and systematically, the concepts of historical ecology (HE) and landscape biography (LB) were integrated with a complex systems (CS) approach (Crumley, 1994, 2015; Kolen, Hermans, & Renes, 2015; Meyer & Crumley, 2011; and Roymans, Gerritsen, Van der Heijden, Bosma, & Kolen, 2009). The ‘cultural landscape’ was defined as both a socially constituted and meaningful whole and a dynamic system that enables people to adapt to changing climatic and environmental conditions. Drawing on recent insights from landscape archaeology, geography and other disciplines, HERCULES WP2 designed an innovative framework for understanding the long-term
development and transformation of cultural landscapes (Kolen et al., 2015). Additionally, it delivered concrete methodologies for collecting and linking interdisciplinary data within such a framework (de Kleijn et al., 2016).

In this article, we briefly discuss the framework, its premises and operational principles. It furthermore aims at bringing interdisciplinary landscape projects a step further by offering input for the other two issues (2 and 3) as well. The outcome of the HERCULES project also consists of premises and principles for similar interdisciplinary landscape projects in the future. Increasingly, besides integrating the results of different landscape disciplines, the ultimate goal of these projects will reside in making long-term studies of the cultural landscape more profitable and effective for the thinking about future planning, design and sustainable landscape change. We will here present the premises and principles as potential components of a research protocol, although the term ‘protocol’ is not meant as a strait jacket. Rather we aim at exploratory methodological guidelines (cf. Crumley et al., 2014) that may be adapted, improved and refined in the process of future research by others.

However, before introducing the premises and operational principles of the integrated long-term approach developed within HERCULES WP2, it is important to understand something of the international background of studying the long-term history of cultural landscapes.

2. Studying the deep history of cultural landscapes: the ongoing divide

In recent decades, the long-term study of landscapes has seen rapid international growth. While archaeological theory and practice has been at the forefront, the disciplines of geography, anthropology, history, ecology and philosophy have also made important contributions. Our approach draws from both European and North American research traditions, which together reflect the contributions of other key disciplines.

Beginning in the 1970s, European and North American landscape studies were often divided between social science and humanities-oriented constructivist approaches (taking landscape as a social construct) and science-based essentialist approaches (seeing landscape as an external natural phenomenon), which prevented landscape researchers from developing truly interdisciplinary perspectives. Particularly in Europe, science-based and morphological approaches primarily aim at the objectified knowledge of landscape as an external phenomenon, either in terms of processes and systems or in terms of ancient landforms and relict structures (field divisions, built structures, infrastructure).

Also in the 1970s, the old holistic landscape approaches of cultural geography and local history had gradually given way to ever more advanced theories and models for spatial analysis and cross-cultural comparison that followed the quantitative and statistical paradigm that was developed within the ‘new’ human geography and the ‘new’ processual archaeology. These approaches were, however, not only essentialist, but also markedly reductionist, treating humans as little more than anonymous ‘particles’ and statistical factors.

In Europe and North America by the end of the 1970s, reactions appeared, first within ‘humanistic’ geography and, from the early 1980s, within the ‘new’ cultural geography. The ‘humanists’ (Meinig, 1979) defended the message that landscape was ‘in the eye of the beholder’ and, hence, visions of landscape always showed the subjective fascinations, interests and ambitions of the perceiver. This last point was followed some years later in the new cultural geography developed by Cosgrove and Daniels, who were strongly inspired by the humanistic geography, iconographical approaches in history and by Marxist perspectives on power relations in the social sciences (Cosgrove, 1984; Cosgrove & Daniels, 1988). In the early 1990s, research in the Anglo-Saxon academic world seemed to have moved increasingly towards the study of landscapes as social and symbolic constructions. This perspective was also adopted by interpretative (‘post-processual’) landscape archaeology, notably in the UK (e.g. Tilley, 1997).

On the other hand, large numbers of regional landscape studies, partly related to planning, still described and mapped landscapes in the traditional way of the ‘local history approach’ and landscape morphology. The gap between these different worlds of research seemed unbridgeable and kept
growing, hence the frustrations about over-theorising in geographical and archaeological landscape research (e.g. Fleming, 2007 and Johnson, 2007).

In the United States and Canada, response to processual archaeology was enthusiastic in some influential circles, but also generated strong resistance. This response took a variety of forms, including but not limited to gender archaeology (feminist and queer theory), political archaeology (issues of class and power), mortuary studies (the body), historical archaeology (combining physical remains and documents), the archaeology of agency (individual and group identity and decision-making) and an explicitly cultural re-engagement with environment and ecology.

Contract archaeologists and heritage managers (in the US: cultural resource managers), reflecting their own growing importance and diminished interest in theoretical battles, adopted a pragmatic approach to heritage management and historical/environmental conservation. One could argue that in North America, landscape archaeology drew on these lively initiatives and had become, in its own right, a response to processual archaeology by the early 1990s.

To conclude, there is a continuing divide between more essentialist and naturalistic approaches to landscape on the one hand and more constructivist and ‘culturalist’ approaches on the other, both in post-war European and—to a lesser extent—North American landscape research. However, whereas in Europe landscape archaeology responded to processual archaeology by re-engaging humanistic geography, history and phenomenology, landscape archaeology in North America developed within an eclectic anthropological framework that embraced influences from geography, history, ecology and environmental archaeology.

3. Towards an integrated approach

In 1996, The Danish-American geographer Kenneth Olwig tried to synthesise the essentialist and constructivist traditions, based on a thorough investigation of the origins of the landscape concept, by re-introducing the ‘substantive’ nature of landscape (Olwig, 1996, 2002). Like Olwig, WP2 of HERCULES also seeks to develop an integrated approach to the study of landscapes, combining the long-term perspective of archaeology and history with recent insights from cultural ecology, anthropology and geography. Landscape biography and historical ecology are among the prominent emerging approaches to the study of long-term landscape history and are herein combined and integrated with a complex systems approach to investigate human–environment interactions.

**Landscape Biography** aims at overcoming the divisions and boundaries in landscape research and landscape characterisation by focusing on the following issues (Kolen et al., 2015):

- The role of layered histories and long-term and path-dependent developments (the landscape as a continuously changing and effective palimpsest);
- The particular agency of engaged individuals and groups who identified/identify strongly with places and spatial practices (landscape as entanglement of life histories);
- The role of productive interactions between people and biotopes in the making of landscapes with both a high cultural diversity and biodiversity (nature as a work in progress);
- The role of memory and narrative in the transmission of landscapes (the landscape as a ‘chronicle of life and dwelling’ [cf. Adam, 1998, 54; Ingold, 2000, p. 189]).

As a historical research strategy, Landscape Biography therefore expresses a strong sense of the dynamic multilayered nature of landscapes and the active role that landscapes play in the life histories and social memory of people (cf. Ingold, 2000). This means that landscapes are not only seen as the (interim) outcomes of drivers, but also in themselves are considered drivers for social change.

**Historical Ecology** is a practical framework of concepts and methods for studying the past and future of the relationship between people and their environment (Balée, 1998; Balée & Erickson, 2006; Crumley, 1994, 2012; Hornborg & Crumley, 2007; and Meyer & Crumley, 2011). While Historical Ecology may be applied to spatial and temporal frames at any resolution, it finds particularly rich sources of data at the
‘landscape’ scale, where human activity and cognition interact with biophysical systems, and where archaeological, historical, ethnographic, environmental and other records are plentiful.

The term Historical Ecology draws attention to a definition of ecology that includes humans as a component of all ecosystems and to a definition of history that goes beyond the written record to encompass both the history of the Earth system and the social and physical past of our species. Historical Ecology provides tools to construct an evidence-validated, open-ended narrative of the evolution and transformation of specific landscapes, based on records of human activity and changing environments at many scales. Historical Ecology offers insights, models and ideas for a sustainable future of contemporary landscapes based upon this comprehensive understanding of their past.

Complex systems are self-organising and exhibit what are known as ‘emergent properties’, which cannot be deduced from the individual natural or cultural components of the system. Perspectives on complex systems (cf. Van der Leeuw and McGlade 1997; Bentley & Maschner, 2003) combine the principles of complex systems theory with the concept of interacting agents. Corresponding methodologies for modelling allow researchers to study whether developments inevitably lead in a certain direction (path dependence) and whether different scenarios will produce similar outcomes (equifinality) (Kohler et al., 2007; Wilkinson et al., 2007). These methodologies are suitable for exploring long-term developments in cultural landscapes, allowing the testing of different hypotheses of the development and of the cultural heritage embedded in these landscapes. They may also lead to insights on how micro-scale processes give rise to macro-scale phenomena, which is of great interest to landscape archaeology, where we can usually only observe the macro-scale results of micro-scale actions in the past.

Together, these frameworks encompass the range of variation that is currently found in international landscape studies. While the frameworks largely overlap, Landscape Biography focuses on the regional scale of analysis and is more explicitly phenomenological and aimed at heritage studies, while historical–ecological approaches are multi-scalar and are more comprehensive and explicitly but not exclusively empirical. Both frameworks embrace the researchers, stakeholders, planners and managers of landscapes. With spatially dynamic models specifically designed for the interdisciplinary study of landscape change, HERCULES WP2 intends to provide landscape researchers with new tools to understand long-term developments in cultural landscapes by more effectively linking archaeological, historical, geographical, ecological and social data (de Kleijn et al., 2016).

Within the HERCULES project, the combined historical–ecological and biographical approach of the landscape was tested in two case study landscapes: the river delta landscape of the Netherlands and Uppland in Sweden (de Kleijn et al., 2016). In both cases, the research was assisted by dynamic modelling techniques. As these two case studies still predominantly focused on the long-term interactions between geomorphological, ecological and economic changes, a third comparative case study was devoted to the role of cultural transformations and associated shifts in spatial perceptions on long-term landscape change. In both the northeastern part of the Netherlands and the region of Vooremaa in Estonia, two regions that roughly share physical-geographical characteristics, the impact of the religious transformations on the ordering and use of the landscape was studied as well. This perspective contained the relationships between religion, social organisation, land ownership and the regional infrastructure. The third comparative study showed that cultural transformations occasionally had a significant impact on long-term landscape change, leading to different path-dependent developments under different social and economic conditions. Hence, landscape studies should avoid a one-sided ecological or economic approach and consider other factors and actors as well.

Together, the case studies of HERCULES WP2 addressed the question of how to study long-term developments in landscapes in a more systematic way and from an interdisciplinary viewpoint (issue 1 of the introduction). In order to tackle the other issues (2 and 3) as well, which related to the integration of long-term histories with the study of more recent, current and future landscape changes, the project started to define the outlines of a ‘protocol’ for studying long-term landscape change. This protocol is to be used heuristically and improved empirically in coming years. The main building blocks, consisting of premises and operational principles, will be briefly outlined below.
4. Understanding long-term changes in cultural landscapes: premises

As a source of information and ‘historic lab’ for experiences and best practices in specific human–environment interactions: (historic) land use and (optimal) biodiversity, ancient anthropogenic water systems and water management issues, land use forms that mitigate land degradation and erosion (desertification).

By integrating Landscape Biography, Historical Ecology and Complex Systems Theory, we wish to realise a trans-temporal approach to landscape, by treating epochs, periods and other temporal divisions as ripe for research and not firewalls that protect temporal specialties. Such a trans-temporal approach has several advantages. Particularly important for planning and heritage, the coupled human-environment system can be analysed with regard to effective management strategies under specific (local, regional) cultural and environmental conditions and the results used to formulate future scenarios.

Thus, a major issue is how to practically envision future landscapes. Many designers, planners and heritage managers are employed to plan and manage entire towns or regions, taking into account the complexity of changing environments. In addition to the trans-temporal approach, we wish to contribute to landscape research by including future-oriented and management aspects and by enhancing the role of long-term thinking and analysis in geodesign, urban planning, landscape design and stakeholder involvement (Lee, Dias, & Scholten, 2014). Moreover, traditional historic landscape assessments are poorly matched with the needs of planners, policy makers and public interest groups. Such knowledge communities actively contribute to the further development of landscapes and regions and include their heritage (Fairclough & Grau Moller, 2008; Janssen et al., 2014; and Kolen et al., 2015). We wish to introduce these important knowledge communities to new possibilities for understanding complex interactive processes over the long term through clarification of the powerful roles of narrative, social memory and practical experience (from the past and the present) in collaboration and design.

In our view, in order to tackle these challenges, integrated and multidisciplinary approaches to long-term changes in cultural landscapes should start from the following 15 premises, or at least from a combination of a significant number thereof:

(1) The Earth system and human societies are, together, the most complex system we know. As an integral part of these, landscapes are densely connected networks with several features that set them apart from simpler systems such as internal combustion engines. The ‘behaviour’ of some elements in landscapes cannot be predicted (termed nonlinearity), but they emerge in the course of time. This perspective follows on understandings of the human condition.

(2) A complex systems approach offers a useful focus for the study of biophysical systems that include humans. Now that the Anthropocene has arrived, humans are essentially everywhere on Earth. The goal of ‘long-term studies’ is to combine knowledge of past human societies with knowledge of past biophysical conditions and use their analysis to model sustainable future possibilities for heritage management.

(3) Diversity plays a critical role in ensuring resilience to systemic shocks, not just of living organisms (biodiversity) but also in the design properties, organisation, practical execution and perception of (changes in) human land use systems. Together, these have shaped landscapes over time.

(4) Much of what we know about such systems cannot be based on extrapolation from present conditions. Landscapes are remarkably historical: initial conditions of the landscape system are a predictor of later states. Past decisions shape and constrain subsequent ones, and small differences are disproportionately the cause of later circumstances. This is called path dependence. Thus, physical infrastructure, social practices and other conditions can impede necessary system-wide change.

(5) A region’s linked human and environmental history contains information about how it responds to rapid changes and extremes. For example, knowledge of past climate extremes allows managers to anticipate changes in the landscape (e.g. sea level rise, rapid changes in water systems, the impact on particular species or clever innovations people found in the past).
(6) Knowledge of past management strategies for landscapes can help avoid earlier mistakes or, in the case of good results to a particular strategy, offer viable alternatives to a similar contemporary challenge. These ‘old-and-new’ solutions stimulate ‘tinkering’ to arrive at hybrid innovations and stimulate sustainable current development. They have many advantages: use of low-cost, low-impact, locally available materials, the strength of local inventiveness and bricolage, a local and motivated workforce and a source of local pride, which strengthens the community.

(7) Knowing a landscape’s history can be likened to using completed experiments undertaken in the laboratory of the past. Many (pre)historic forms of land use have proven not to be sustainable, but it is true that their persistence is, at least in part, witness to their utility and may be a source of inspiration for reuse, revitalisation and redesign. Examples are smart irrigation and water retention systems that could now be reactivated or reintroduced in desert landscapes or upstream parts of river landscapes, at least when the present-day social organisation of land use and water management is able to incorporate these ‘innovations’.

(8) Landscape change occurs and is affected by forces at all spatial scales, from local to global.

(9) The holistic form of historical ecology (Crumley, 2015) that we employ is theoretically and methodically strong, embracing the contribution of many different knowledge communities and types of data, working with diverse stakeholders and to project future scenarios for regions.

(10) For all these reasons, historical ecology and landscape biography study long-term transformations in landscapes from prehistory to the present, viewing landscape as a dynamic and complex interplay between social and economic developments, culturally informed perceptions of the environment, the history of institutions and political formations and ecological dynamics (Crumley, 1994, 2015; Kolen et al., 2015; Meyer & Crumley, 2011; and Roymans et al., 2009). It is important to realise that the disciplines contributing to this exercise, like landscape archaeology, historical geography, historical anthropology and palaeoecology, explore quite different data sets covering different time-intervals and aspects of landscape change. These data sets, and the methods used to analyse and interpret them, must be related and integrated in more systematic ways in order to synthesise long-term changes.

(11) Together, historical ecology and landscape biography can link social memories to the long term, connecting the micro-histories of places with broad-scale developments and integrating experience and process. One of the routes to this end is by the study of how, in different mnemonic, religious and social systems, memories, values and ideas concretely interact with the material world (e.g. Küchler, 2002).

(12) An explicit question of landscape research should be to investigate the power of existing landscapes on people and their spatial practices, as well as the dynamic way in which people have dealt with their environment through time. A more intimate and emotional approach to landscape summons inhabitants’ deep feelings and values.

(13) Landscapes have their own temporalties and rhythms, in relation to but distinctive from individual life cycles and community histories. Landscapes have the potential to ‘absorb’ and transmit aspects of personal life histories and to string them together into long chains of reference and local testimonies of human–land relationships.

(14) As a result of this, landscape issues often highlight the importance of social memory and the means to construct ‘a chronicle of life and dwelling’ (Ingold, 2000: 189). To engage today with past landscapes, we must be able to tell stories that reconnect heritage visitors to the thoughts and emotions of previous inhabitants. Additionally, landscape biographies can make people aware of similarities and differences (otherness) in the perceptions, emotions and thoughts of people, both in the past and in the present. In this way, heritage landscapes can be promoted as tools of tolerance, openness and pluralism.
The past is also always present in the landscape of ‘today’. All landscapes incorporate ‘the powerful fact that life must be lived amidst that which was made before’ (Meinig, 1979: 44). Thus, landscape biography and historical ecology view landscapes as palimpsests that are transforming continuously, both through conscious interaction by people with the material past in the environment and through less conscious forms of agency.

5. Operational principles

In addition to the premises listed above, the team of HERCULES WP 2 defined a set of 10 operational principles (Crumley et al., 2014) that may guide the design of landscape research along these lines (Meyer & Crumley, 2011:122). These principles include:

(i) A commitment to begin with a research design constructed by all collaborating scholars and evaluated/supported by relevant stakeholders who jointly decide central questions, elucidate desired outcomes and plan the data gathering, data merging and interpretive phases of the project (cf. ‘Geodesign’; Steinitz, 2012; and Lee et al., 2014)
(ii) A commitment to work with combinations of quantitative and qualitative data;
(iii) A commitment to integrate both academic and non-academic knowledge in a fashion that privileges neither and attempts to translate each to the other;
(iv) A commitment to employ data collected using ‘best practice’ protocols for each relevant discipline when available;
(v) A willingness to keep independent from one another these various lines of evidence until such time as discipline-based data gathering are considered sufficient, but also to keep researchers themselves in constant dialogue;
(vi) A willingness to see conclusions about the history of a region constantly modified or reversed by new, evidence-based interpretation;
(vii) A recognition that changes in knowledge about a region may, in the end, result in planned, designed or unforeseen physical effects in the region;
(viii) A recognition that evidential gaps (spatial, temporal or thematic) raise questions about the appropriate extent of extrapolation, leading to questions of scale and reliability;
(ix) A recognition that designers’ decisions about temporal and spatial parameters must be tied both to desired outcomes and to available information about historical and ongoing processes of change (cf. Kolen, de Kleijn, & van Manen, 2014); and
(x) A recognition that ‘baselines’ in landscape reconstruction are important but have the potential to introduce errors into later interpretations.

6. Geodesign as a framework for landscape research

As indicated by operational principle [i], recently developed formats for landscape design and environmental planning often form excellent possibilities to realise some of the research premises discussed above (cf. van der Brink, Bruns, Tobi, & Bell, 2016). This especially applies to formats that enable and facilitate exchanges between fundamental landscape research and participatory planning and policymaking. As these sectors generally use different temporal frameworks and have different goals, it is essential to periodically link the interim outcomes of long-standing academic research to the time-schedules and cycles of environmental decision-making and spatial planning and vice versa. In ‘geodesign’, this is realised by the bringing together of researchers with different disciplinary backgrounds and stakeholders with different interests, preferably in transdisciplinary settings (van der Valk, 2010). The participants can be supported by advanced decision-making procedures (Steinitz, 2012) and high-quality facilities for linking geo-information, such as knowledge hubs and spatial data infrastructures (Lee et al., 2014). Within these settings, geodesign seeks to structure the planning and
design process according to a series of steps, which should be taken in an iterative manner. In the process, it aims to foster a fruitful integration of local knowledge and values (‘people of the place’) and expert knowledge (‘geographical sciences’) with the creativity of the landscape architect (‘design professionals’), facilitated by geospatial tools (‘information technologies’).

So far, geodesign has been primarily informed by quantitative knowledge of short-term processes. However, recent technological innovations in GIS, Spatial Data Infrastructures and linked data mean that an increasing range of data on long-term landscape change can be integrated and visualised in accessible ways as well. Based on such technologies, tools can be developed capable of further bridging the gap between the study of landscape change, cultural heritage and planning. Biographical and historical–ecological approaches can contribute to this, without uncritically justifying all changes that are proposed by politicians, planners and designers. The aim must be to bring insights in historical processes, environmental heritage and social memory to the relevant actors, so that vulnerable landscapes can be transformed into diverse, socially vital and resilient landscapes (Burgers et al., 2014). Building on this potential, HERCULES WP2 has generated some exploratory research on the use of long-term perspectives in geodesign. This has been done both on a theoretical level for one of the case study landscapes, that is, the Dutch river area (Kolen et al., 2014), and for a specific micro-region in this area, that is, Amstelland (De Kleijn in prep.).

7. Landscapes of the ‘long now’

Taking the above set of premises, operational principles and frameworks as its methodological starting point, our ‘protocol’ does not produce a single paradigm but rather offers a toolbox of concepts and competencies (cf. Crumley, 2015; de Kleijn, van Manen, Kolen, & Scholten, 2014; Kolen et al., 2015; and Meyer & Crumley, 2011). Instead of engaging in fruitless discussions of which model or theory is preferable, the premises we offer can be seen as meta-theoretical guidelines for research projects that tackle long-term changes in cultural landscapes. Gunn (1994) convincingly explained that landscapes do not just survive, but must be maintained. He emphasises the importance of what he calls ‘capturing’: the long-term transmission of cultural information about the environment, in addition to the more short-term intergenerational exchange of information, knowledge and memories. ‘Capturing’ is of crucial value for the human guidance of landscape change, including the ecosystem services and cultural heritage that are involved in this process. Similarly, the protocol developed in Work Package 2 of HERCULES is meant as a modest contribution to the study of landscape as a lens on the ‘long now’ dimension of human societies and their relationships with the environment. This entails and promotes the viewing of landscapes as both the interim outcomes (and archives) of long-term change and human intervention in the Earth system and as productive settings for future solutions to current environmental issues.

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