

HERCULES

Sustainable futures for Europe's HERitage in CULtural landscapES:
Tools for understanding, managing, and protecting landscape functions
and values

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D1.2 Systematic Review Protocol

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Executive summary

This Deliverable presents the protocols for the individual systematic reviews that will be performed in D1.3 (“Report on three individual systematic reviews”, due on month 24 of the project). Three different review protocols are presented, one on proximate causes and underlying drivers of landscape change, one on rates and pattern of landscape change, and one on the actors responsible for and impacted by landscape changes.

Table of contents

Executive summary	1
Table of contents	2
1 Introduction	3
2 The driving forces of landscape change in Europe: A systematic review of the evidence.....	4
2.1 Background.....	5
2.2 Methods	7
2.3 Data synthesis and presentation.....	13
2.4 Competing interests	14
2.5 Acknowledgements	14
2.6 References	14
3 Protocol on rates and patterns of landscape change	18
3.1 Background.....	18
3.2 Methods	19
3.3 Data synthesis and presentation.....	23
3.4 References	23
4 Protocol for a review in integrated landscape initiatives in Europe	29
4.1 Background.....	30
4.2 The concept of Integrated Landscape Initiatives (ILIs).....	32
4.3 Objectives of the review	34
4.4 Methods	35
4.4.1 Scoping exercise	36
4.4.2 Collection of initiatives	37
4.4.3 Classification and characterization of the initiatives	38
4.5 Presentation of results.....	41
4.6 References	41
4.7 ANNEX: Scoping exercise.....	42

1 Introduction

Cultural landscape changes have been examined in many case studies for different landscapes, land use systems, socio-economic, and environmental contexts throughout Europe. Despite profound conceptual and case study-level knowledge, however, a systematic synthesis of existing case studies and, along with that, a structured framework is lacking that goes beyond exemplary descriptions and abstract typologies.

To overcome this limitation, HERCULES provides a consistent conceptual framework for studying cultural landscapes that is linked to a systematic review of main fields of research in order to synthesize and build on existing knowledge. HERCULES has proposed a framework to manage and integrate different understandings of cultural landscapes (see HERCULES deliverable 1.1 “Cultural landscapes framework”) to foster the design of effective cultural landscape policies. Six major dimensions of landscapes emerged from recent progress in landscape science that we propose to consider when studying landscape change: (1) social-ecological linkages in landscapes, (2) landscape structure and land-use intensity, (3) landscape history, (4) driving forces, processes, and actors of landscape change, (5) landscape values and meanings, and (6) cultural landscape management.

To substantiate this framework, we will perform three reviews of main fields of knowledge. Especially issues of understanding the processes which change cultural landscapes, the rates of change, both short and long term, and the actors involved have gained much scientific attention. Therefore, HERCULES will perform systematic reviews on (1) the driving forces of landscape change in Europe, (2) the rates and patterns of landscape change, and (3) the actors in the field of cultural landscape change, including their perceptions. Actors take on a special role in landscape changes: actors are responsible for and impacted by landscape changes and play an important role related to the “driving forces” of landscape change; thus they are included in the first review. In addition, given the special importance of collective action to deliberately shape landscapes and to define the way forward, the third review regards the importance of actors in terms of “Integrated Landscape Initiatives”. More reviews, based on other components of the cultural landscapes framework, may follow later in the project if found relevant for the outcome of HERCULES.

The reviews will use both qualitative and quantitative techniques to identify commonalities across the large number of existing European case studies and scrutinise which factors cause different cases to behave differently. The reviews will be based on searching scientific databases as well as the internet for empirical studies on change of cultural landscapes in Europe. Study selection follows a multi-level process and includes study quality assessment. Extracted data will be synthesised through meta-analysis and qualitative review techniques.

The purpose of this deliverable is to define the procedures for the three systematic reviews. The systematic review protocol developed here will be used later in the process to perform the review of the literature on the research fields named above.

2 The driving forces of landscape change in Europe: A systematic review of the evidence

Authors

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Abstract

Background: The number of studies on the driving forces of landscape change in Europe has grown considerably. However, the understanding of the drivers of landscape change remains challenged because of the strong variation of existing case studies over disparate spatial and temporal scales and the current fragmentation and dispersal of landscape research across many domains and disciplines. Integration of this knowledge is needed as landscape is the most relevant scale to address real-world sustainability problems. The aim of this study is to provide a first systematic synthesis of the underlying drivers and proximate causes of landscape change across Europe. A systematic review of the literature on landscape change will identify and catalogue all available knowledge from a wide variety of sources. In particular, the review has the following objectives: (1) to characterize how underlying drivers and proximate causes of landscape change have been addressed in empirical case studies; (2) to identify and classify the most important drivers and causes of change in European landscapes; (3) to evaluate which types of actors are considered in landscape change studies and how their role is assessed; and (4) to examine existing biases in the scientific literature related to particular environmental, land-use, and socio-economic attributes.

Methods: This systematic review will be based on searching scientific databases as well as the internet for empirical studies on the drivers and causes of landscape change in Europe. Study selection follows a three-stage process. Stage 1: Synthesis of how different studies have addressed the drivers, causes, and actors of landscape change will be derived from the extracted information in a narrative form. The relationship between different methods, scales, and landscape contexts used in the studies will be explored through univariate statistics. Stage 2: Both single-factor and multi-factor causations of underlying drivers and proximate causes of landscape change will be identified. A cluster analysis of cases will be made to identify groups of studies that address typical combinations of drivers, causes, and contexts of landscape change. Stage 3: To identify knowledge gaps, the observed number of studies performed in a particular environmental, land-use, and socio-economic context will be compared to the expected number, given that studies would be distributed randomly.

Keywords

Driving forces; Landscape dynamics; Europe; Systematic review; Evidence-based policy; Urbanization; Agricultural intensification; Land abandonment; Greening

2.1 Background

European landscapes have been shaped and maintained by people and their activities over millennia (Farina 2000). As they have done throughout history, Europe's landscapes are undergoing rapid and fundamental changes today (Palang et al. 2004, Pinto-Correia and Kristensen 2013). Partly reflecting global trends, partly exhibiting regional particularities, multiple processes seem influential in reshaping European landscapes, though their magnitude has not been quantified yet. Among the important processes are urbanization, agricultural intensification, land abandonment and forest expansion, market expansion and liberalization/centralization of market policy, "greening" of land uses and extension of nature conservation areas, and development of renewable energy uses (Plieninger and Bieling 2012). Depending on prevailing social-ecological conditions, these trends find strongly varying regional expression, exhibiting diverse directions and speeds (Pinto-Correia and Kristensen 2013). For example, hot spots of land abandonment occur in Eastern Europe (Baumann et al. 2011), the Mediterranean parts of Europe (Sluiter and de Jong 2007) and many European upland areas (MacDonald et al. 2000). In contrast, agricultural intensification is most expressed in those European regions where biophysical and structural conditions for agriculture are favorable, e.g. in many areas of Northwestern Europe (Pinto-Correia and Kristensen 2013).

The immense magnitude and rate of these changes has given rise to concerns that landscape sustainability – the capacity of a landscape to consistently provide long-term, landscape-specific ecosystem services essential for maintaining and improving human well-being (Wu 2013) – is currently at risk (Selman 2012). Traditionally, landscape ecological research has focused on landscape patterns (mainly by performing land cover mapping, compare Newton et al. 2009), while disregarding processes of landscape change (Bürge et al. 2004). However, knowledge on drivers, processes, and outcomes of landscape change is indispensable for the design of policy responses to safeguarding landscape values through environmental and socio-economic change (Klijn 2004). Moreover, knowledge on landscape drivers is becoming more important, as policies are shifting away from their traditional sectorial foci toward integrated "landscape approaches" in natural resources management (Sayer et al. 2013). In the European context, this view has been reflected in the cross-sectoral approach of the European Landscape Convention that calls for the integration of protection, planning, and management of landscapes (Jones et al. 2007).

The driving forces concept

The driving forces-state-response model was introduced in the late 1990s as an indicator framework for environmental policy (OECD 1999). The purpose was to link in particular changes indicators of changes in the environmental state to policy responses. The European Environment Agency has refined the framework to a detailed policy evaluation framework, termed the "DPSIR Framework" (Driving force, Pressure, State, Impact and Response model) (Maxim et al. 2009). Though the driving forces concept has brought forward environmental policy analysis, the OECD framework has been criticized for being mainly a "macro model" with no or limited attention given to agents involved in environmental change (and therefore in implementing the environmental policies). Another weakness is that policy making is primarily conceptualized as problem solving activity,

that is as “response” mainly, and not as a more proactive place making activity (Oñate et al. 2000).

In the scientific arena, the concept of driving forces has most frequently been applied in the nascent land change science (Turner et al. 2007), where a distinction between underlying drivers and proximate causes of change has been made. Underlying driving forces comprise the fundamental social and natural processes (e.g. human population dynamics, agricultural policies or culturally embedded attitudes and beliefs) that underpin the proximate causes and either operate at the local level or have an indirect impact from the national or global level (Geist and Lambin 2001, Geist and Lambin 2002). They can comprise political, economic, cultural, technological, and natural factors (Brandt et al. 1999, Hersperger and Bürgi 2009). In contrast, proximate causes refer to human activities or immediate actions at the local level that change the landscape, such as agricultural expansion or extension of settlements. However, proximate causes and underlying drivers of change interact (Geist and Lambin 2002).

Some authors have stressed the need to more clearly identify the role and appropriate conceptualization of human agency in studies of driving forces (Hersperger et al. 2010, Bieling et al. 2013). The role of actors in terms of landscape change may be threefold: First, they represent the interface between underlying drivers and proximate causes, thus becoming agent of landscape change. Second, they may be affected positively or negatively by change (which in turn has consequences for their attitudes and actions). Third, it is always also the agent who is the primary policy target as policy does not change landscapes, but people do. In a European landscape context, agents can act in three roles as landscape managers: as property owners, as producers (mainly of agricultural commodities), and as citizens (Primdahl et al. 2013).

Since the turn of the millennium, the number of studies into the driving forces of landscape change has grown (e.g., Bicik et al. 2001, Krausmann et al. 2003, Mottet et al. 2006, Serra et al. 2008, Hersperger and Bürgi 2009, Bieling et al. 2013). However, the understanding of the drivers of landscape changes remains challenged, among other reasons by the strong variation of existing case studies over disparate spatial and temporal scales (Bürgi et al. 2004) and the current fragmentation and dispersal of landscape research across many domains and disciplines within the human, social and natural and physical sciences (ESF 2010).

Case study research at local scale is on the one hand needed to foster a “place-based culture” in landscape ecology (Fischer et al. 2011), because the landscape is the most relevant scale to address real-world sustainability problems (Crumley 2012). On the other hand, local-scale studies are highly specific in contexts, actors, main processes, scale, and resolution (Bürgi et al. 2004). But despite the unique context of most local landscapes and their drivers, application of a comparative framework can allow more generalized insight that can be transferred across places (Rindfuss et al. 2007, Kinzig 2012). Systematic review and meta-analyses techniques are particularly promising approaches to synthesize and upscale local-scale insights on environmental changes to a more general level (Rudel 2008). But while the recent years have brought significant developments in all corners of landscape research, these have hardly been synthesized, so that Pan-European perspectives on landscape change – as informed by local case studies – are heavily under-developed (ESF 2010). Systematic reviews and meta-analyses have become popular in the

environmental sciences (Pullin and Stewart 2006), but – to our knowledge – such systematic approaches to gathering the evidence on the drivers of landscape change in Europe have so far not been carried out.

Objective of the review

The aim of this study is to provide a first systematic synthesis of the underlying drivers and proximate causes of landscape change across Europe. A systematic review of the literature on landscape change will identify and catalogue all available knowledge from a wide variety of sources. In particular, our review has the following objectives: (1) to broadly characterize how underlying drivers and proximate causes of landscape change have been addressed in empirical case studies; (2) to identify and classify the most important drivers and causes of change in European landscapes, including combinations of drivers, causes, and contexts of landscape change; (3) to evaluate which types of actors are considered in landscape change studies and how their role is assessed; and (4) to examine existing biases in the scientific literature related to particular environmental, land-use, and socio-economic attributes. By this, we identify knowledge gaps that put barriers to the understanding and management of landscape change. Such evidence-based synthesis may inform current landscape-related policy processes, for example the EU Common Agricultural Policy, the EU Cohesion Policy 2014-2020, the EU 2020 Biodiversity Strategy, and the EU Green Infrastructure Strategy, as well as national policies and regional planning.

2.2 Methods

Our method will follow established guidelines for systematic review and systematic mapping (Bates et al. 2007, Centre for Evidence-Based Conservation 2010) and will be oriented along previous systematic review exercises in comparable fields (Rudel 2008, Plummer et al. 2012, Randall and James 2012, van Vliet et al. 2012, Haddaway et al. 2013, Roe et al. 2013, van Asselen et al. 2013).

Search terms

Scoping was performed to find optimal keywords and to get a first overview about the availability of suitable studies. The scoping exercise was performed in the ISI Web of Science, using the various keywords (Table 2.1).

Table 2.1. Scoping results (limited to studies in Europe)

Keyword 1	Keyword 2	Hits
“Landscape change” OR “landscape dynamics”	forces OR drivers OR causes OR determinants	160
“Landscape change”		446
“Landscape change” OR “landscape dynamics”		603
“Landscape change” OR “land use change” OR “land cover change” OR “land change”		2359

The scoping exercise revealed that many studies did not use terms such as “driving forces”, “drivers”, or “causes” in the abstracts, though they offered explanations on causes, drivers, and impacts. When extending our search to the keywords “land-use change”, “land-cover

change”, and “land change”, a large number of irrelevant papers was yielded. Therefore, we decided to perform an inclusive search strategy based on the following search string:

“Landscape change” OR “landscape dynamics”

To select only case studies from Europe, the search was refined by adding the following search terms:

Europe OR EU OR Albania OR Andorra OR Armenia OR Austria OR Azerbaijan OR Belarus OR Belgium OR “Bosnia and Herzegovina” OR Bulgaria OR Croatia OR Cyprus OR Czech* OR Denmark OR Estonia OR Finland OR France OR Georgia OR Germany OR Greece OR Hungary OR Iceland OR Ireland OR Italy OR Kazakhstan OR Latvia OR Liechtenstein OR Lithuania OR Luxembourg OR Malta OR Moldova OR Monaco OR Montenegro OR Netherlands OR Norway OR Poland OR Portugal OR Romania OR Russia OR “San Marino” OR Serbia OR Slovak* OR Slovenia OR Spain OR Sweden OR Switzerland OR Macedonia OR Turkey OR Ukraine OR “United Kingdom” OR England OR Wales OR Scotland*

The following databases will be searched for relevant documents:

- ISI Web of Science
- GEOBASE (Ovid)
- CABI: CAB Abstracts (Ovid)
- Scopus

To locate grey literature, the first 50 pdf and word documents provided by each of the following sources will be considered:

- Google Scholar
- Scirus
- Dogpile

Where search engines do not accept the search strings provided above, strings will be modified accordingly. Titles and abstracts will be stored in a single Endnote database and duplicates will be removed. Studies in English, French, Spanish, Greek, Danish, Dutch and German language will be considered.

Study inclusion criteria

Drawing back on Rudel et al. (2008) and Geist and Lambin (2004) we specify that a study has (1) to cover a landscape of clearly anthropogenic origin, (2) to be based on in-depth field investigations, (3) provide some form of measurement of landscape change processes at regional to local scale within Europe, and (4) to offer explanations about the forces driving landscape change in the study areas.

The selection of studies relevant for this review will take place in a three-stage process. First, relevance for this study will be initially assessed on the basis of study titles. Second, further selection is performed on the basis of paper abstracts. In the third stage, the content of the full papers will be assessed. In cases of doubt, studies will be included to the next phase of the selection process. Repeatability of study inclusion will be checked through a random subset of at least 10% of references whose titles and abstracts will be assessed by

another reviewer independently. Inclusion consistency will be calculated through kappa statistics (Cohen 1960). Selection criteria will be modified if kappa should be below 0.5. The criteria for inclusion into the review refer to population, intervention, comparators, and outcomes (as defined in the primary question and highlighted in Table 2.2).

Table 2.2. Definition of subject, intervention, outcomes, and comparator

Subject population	Intervention	Outcomes	Comparator
Landscapes in Europe at regional-local scales (continental scope)	Political, economic, technological, cultural, or natural driving forces	Empirical measurements of landscape change	Landscape pattern before driving forces unfolded (“before-after comparisons”)

Relevant populations

Landscapes in Europe at local to regional scales (NUTS2 and below, 1-10,000 km²). Observations of multiple landscapes that are situated in different NUTS2 units (whether in the same country or in different countries), but appear within one paper will be included separately in the dataset and considered independently.

Relevant intervention

Policy and institutional, economic, technological, cultural, or natural and spatial drivers. Policy and institutional factors comprise formal policies, but also the informal policy climate and property rights. Economic factors relate to market growth and commercialization (e.g. of agricultural commodities), economic structures, urbanization and industrialization, and other variables. Technological factors refer to the application of new technologies. Cultural factors represent public attitudes, values and beliefs as well as individual and household behavior (Geist and Lambin 2002). They also include demographic factors such as natural increment, migration, population density, population distribution, and life cycle features. Natural and spatial driving forces include climate, topography, natural disturbances, soil characteristics, and the spatial configuration of landscape patches.

Actors

Types of actors addressed (e.g., farmers, tourists); actors’ relation to landscape change (decision maker of landscape change / performer of landscape change / affected by change), role of actors (property owners / producers / citizens).

Relevant comparators

The review will consider comparisons in landscape pattern before and after particular driving forces became effective.

Relevant outcomes

Measures of causes of landscape change, for example expansion of urban areas, farmland abandonment, or increase in landscape elements.

Potential effect modifiers

Various contextual aspects are likely to exert influence on what underlying drivers and proximate causes of landscape change are identified in the empirical studies. We expect that these are, firstly, related to the chosen study approach and general research background. For example, the year in which a study has been published, the disciplines of the authors, and the data sources and methods used may all lead to different research outcomes. Secondly, we assume that outcomes will depend very much on the context of the study areas. Here, consideration of different temporal and spatial scales may lead to variation. The type of landscapes; environmental, land-use, and socio-economic characteristics of the study areas; the country in which study areas are located; and the way how study areas are delimited may show influential. Sub-group analyses will be performed to reveal how such factors determine study outcomes.

Data extraction strategy

All information will be entered in spreadsheets. Spreadsheet categories will be pretested to guarantee repeatability. We will extract the following information from the studies that meet inclusion criteria:

- *Context*: What were the characteristics of the study and the study area that may have influence on interventions and outcomes? (Tables 2.3 and 2.4)
- *Intervention*: What underlying drivers and actors were considered for specific landscape outcomes? (Table 2.5, Table 2.6)
- *Outcomes*: Which proximate causes of landscape change were observed and what direction has been measured (increase / decrease of certain land cover or landscape elements)? (Table 2.7)

Table 2.3. Contextual aspects of the landscape change literature, related to the respective study

Aspect	Classes	Description
Year		Year in which study was published
Research area		Discipline of the study, according to ISI categories
Data source	Aerial photographs, satellite images, maps, statistics, field measurements, etc.	Data source of quantitative assessment of landscape change
Method of identifying drivers	Quantitative, qualitative	
Information source on drivers	Personal interpretation, expert interviews, spatial modeling, literature review etc.	
Spatial scale of study	1-100 km ² , 100-1000 km ² , 1000-10000 km ²	Extent of study area
Time scale	Long-term (100-500 years), medium-term (20-99 years), short-term (<20 years)	Time period in which landscape change was observed
System border definition	Administrative, biophysical, other	Definition of the limits of the study area
Number of spatial scales considered		Number of different spatial scales at which the empirical landscape analysis was performed
Number of study landscapes considered		
Number of points in time considered		

Table 2.4. Contextual aspects of the landscape change literature, related to the respective study area (data will be taken at NUTS2 levels)

Aspect	Classes	Description / Source
Country		Country in which study area is located
NUTS2 region		Nomenclature of Territorial Units for Statistics
Landscape type	Marine, coastal, inland water, forest, dryland, island, mountain, polar, cultivated, urban, etc.	Aspects of landscapes that are under particular focus in the study (Millennium Ecosystem Assessment classification)
Urban-rural type	Predominantly urban region, predominantly rural region, intermediate regions	European Environment Agency (EEA)
Travel time to cities >50,000 inhab.		Joint Research Centre
Population density		EUROSTAT
Regional GDP		EUROSTAT
Biogeographic region	Mediterranean, Atlantic, Continental, Alpine, Boreal, etc.	European Environment Agency (EEA)
Nationally designated area	Yes / No	EEA
Less favored area	Yes / No	EEA
Percentage of arable land		EUROSTAT/CORINE
Percentage of permanent grassland		EUROSTAT/CORINE
Percentage of forests		EUROSTAT/CORINE
Percentage of built-up land		EUROSTAT/CORINE
Agricultural area type	Prime agricultural area / marginal agricultural area	EEA
Mean farm size		EUROSTAT
Intensity of agricultural labor force		Mean number of farmworkers per agricultural area (EUROSTAT)
Predominant intensity of farming	Low / high / medium intensity farming	FP6-SEAMLESS (Kempen et al. 2011)
Predominant scale of farming	Low / high / medium scale farming	FP6-SEAMLESS (Kempen et al. 2011)
Predominant type of farming	Arable / dairy / beef / other farming	FP6-SEAMLESS (Kempen et al. 2011)
Tourism capacity		Number of tourist accommodation establishments (EUROSTAT)

Table 2.5. Underlying drivers of landscape change considered in the cases (modified from Hersperger and Bürgi 2009, final classification of drivers will be performed during data analysis)

Category	Underlying driver
Political and institutional	Agricultural policy Forestry policy Spatial development policy Nature conservation policy Energy policy Transportation and infrastructure policy Economic policy Defense policy Property rights Policy climate
Economic	Structural change in agriculture and forestry Real estate market Prices/price relations for agricultural and forestry products Market growth and commercialization
Cultural	Population density Age structure of population Public attitudes, values and beliefs Migration Individual and household behavior Population numbers Population distribution Population migration Shifts in the age structure of population
Technological	Technological modernization of society Technological modernization in land management
Natural and spatial	Climate Topography Disturbances Soil characteristics Spatial configuration

Table 2.6. Actors considered in the cases

Category	Description
Types of actors addresses	Full-time farmers / Hobby farmers / Tourists / Local residents / Developers etc.
Relation to landscape change	Decision-makers of landscape change / Performers of landscape change / affected by landscape change
Roles of actors	Property owners / Producers / Citizens

Table 2.7. Proximate causes of landscape change observed in the cases (modified from van Asselen et al. 2013, final classification of drivers will be performed during data analysis)

Category	Proximate cause
Settlement / industrial development	Urban development Rural development
Infrastructure construction	Construction of roads, airport, etc. Dam/reservoir construction Establishment of wind turbines Development of photovoltaic plants / solar thermal collectors
Land consolidation	Up-scaling of parcel sizes Removal of landscape elements (e.g., hedgerows, wetlands)
Agricultural expansion / intensification	Expansion of arable land Intensification of agriculture Biofuel production
Expansion / intensification of forestry	Afforestation / plantations Timber / wood harvesting
Extraction of natural resources	Oil / gas extraction Coal extraction Extraction of minerals Peat extraction Water extraction
Agricultural extensification	Land abandonment Agricultural extensification
Nature / heritage conservation activities	Expansion of protected areas Heritage conservation activities Agri-environmental activities (e.g. planting of hedgerows)

2.3 Data synthesis and presentation

Characterization of how the study of drivers, actors and process of landscape change has been addressed in the studies will be synthesized in a narrative form. The relationship between different methods, scales and landscape contexts used in the studies will be explored through univariate statistics, e.g. through Chi-square tests (compare Nieto-Romero et al., 2014).

The identification of underlying drivers and proximate causes of landscape change will be carried out through frequency analysis across all study cases. Both single-factor and multi-factor causations will be identified (compare van Asselen et al. 2013). Further contextual information (e.g., on population density, GDP, protected area coverage) will be included at NUTS2/NUTS3 level from Pan-European data sources (EUROSTAT, European Environment Agency). The most important interactions between proximate causes, underlying driving forces, and contextual factors will be assessed through univariate statistics. In addition, a cluster analysis of cases will be computed to identify typical combinations of drivers, causes, and contexts of landscape change (compare van Vliet et al. 2012).

To identify sampling biases and knowledge gaps, the *observed* number of studies performed in a particular environmental, land-use, and socio-economic context (e.g. biogeographic region, population density, GDP, farming systems) will be compared to the *expected* number, given that studies would be distributed randomly.

2.4 Competing interests

The authors declare that they have no competing interests.

2.5 Acknowledgements

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3 Protocol on rates and patterns of landscape change

Author

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3.1 Background

Land change has contributed to reshaping European landscapes. Recent research addresses the challenges that landscape change poses on environmental and social aspects (Alcantara et al., 2013; Griffiths et al., 2013; Bernetti et al., 2013; Verburg et al., 2009), as a 700,000 km² land-cover change in Europe in a 60-year time span (1950-2010) is documented, which corresponds to changes in 15,5% of its total area (Fuchs et al., 2013). Land cover change can be defined as the conversion of one land cover category to another (Lambin et al., 2003; Meyer & Turner II, 1992). The alterations between agricultural, forest and urban land cover categories affect both ecosystems and human activities, and raise sustainability issues in multiple spatial and temporal scales (Turner II et al., 2007). Deforestation, afforestation, farmland abandonment, agricultural and urban land expansion show the dynamics of landscape and are assessed in relevant studies concerning Europe (Tomaz et al., 2013; Alcantara et al., 2013; Li et al., 2013; Griffiths et al., 2013; Seto et al., 2011). Land cover changes may lead to changes in landscape structure, pattern and functions (Lasanta & Vicente-Serrano, 2012). Another concern is the rate and magnitude of these changes and how they affect ecological processes and human activities. Rates of change can be calculated by comparing the total area of the land-cover under study between multiple time points (usually per year or decade), revealing patterns of acceleration or deceleration (Puyravaud, 2003). The scale differs among study areas, depending on the goals and methodologies used in each study.

Land-cover changes include habitat loss and fragmentation (Paudel & Yuan, 2012), biodiversity loss (Moser et al., 2002), soil degradation and carbon storage decrease (Eaton et al., 2008; Lantz et al., 2001), decline of ecosystem services (Newton et al., 2009) and flood event frequency (Solin et al., 2011). In order to quantitatively assess land changes and their impact on landscape, spatial data need to be analyzed. Remote sensing and Geographic Information Systems (GIS) provide spatial modeling, analysis tools and mapping methods to determine the extent of land-cover changes for multiple dates, investigate landscape patterns and simulate predictions about future changes (Newton et al., 2009). Relevant studies regarding Europe employ remote sensing techniques to detect changes on forest, agricultural and urban areas using satellite data or aerial photographs on different time points and look into their potential impacts. Examples include land abandonment and expansion (Bieling et al., 2013; Alcantara et al., 2013; Li et al., 2013; Eaton et al., 2008), urban expansion (Romano and Zullo, 2014; Seto et al., 2011), forest loss (Baumann et al., 2012; Solin et al., 2011).

The concept of land change is related to the driving forces concept, as land change can be also defined as a result of proximate causes and underlying drivers (Hersperger et al., 2010). Relevant studies in regards to the European region concern drivers proposed by Bürgi et al. (2004), where socioeconomic, political, technological, natural and cultural

driving forces lead to landscape changes. Land-cover change and rates are affected by environmental changes and social, economic and political transitions, as existing case studies indicate (Munteanu et al., 2014; Sklenicka et al., 2014; Alcantara et al., 2013; Biro´ et al., 2013; Kopecka et al., 2007).

Objective of the review

The objective of this study is the implementation of a Pan-European systematic review of the literature and meta-analysis on the quantification of landscape changes and rates and the analysis of patterns they present at multiple scales. The literature review will consider available sources to enumerate all relevant studies and aims to: (1) provide estimations and measurements when possible of land-cover and landscape change across Europe, (2) provide measurements of rates of persistence and change in multiple spatial scales, revealing acceleration and deceleration of rates (3) link landscape changes to the driving forces concept and (4) to examine existing biases in the scientific literature related to particular scales, rates, drivers, processes, and landscape attributes. The outcome of the study is expected to fill the gaps in landscape change literature, reveal current trends in landscape change in Europe and provide evidence to improve policy-making at a landscape level.

3.2 Methods

The method is selected according to guidelines for systematic reviews (Centre for Evidence-Based Conservation 2010) and will consider reviews and meta-analyses in relevant subjects (Seto et al, 2011; Sitzia et al, 2010; Rudel, 2008 Benayas et al, 2007).

Search terms

In order to find optimal keywords to capture all relevant land change studies, a scoping process was performed in ISI Web of Science online library, using different keywords and wildcard symbols (indicated by an “*”). A query using “land”, “change”, “rate” and “*” keywords presented a large amount of articles, most of them irrelevant to our research. Thus, the following search strings will be used:

“land cover* change* rate*” OR “land-cover change rate*”*

*“landscape * change* rate*” OR “landscape change rate*”*

To select only case studies from Europe, the search was refined by adding the following search terms:

Europe OR EU OR Albania OR Andorra OR Armenia OR Austria OR Azerbaijan OR Belarus OR Belgium OR “Bosnia and Herzegovina” OR Bulgaria OR Croatia OR Cyprus OR Czech* OR Denmark OR Estonia OR Finland OR France OR Georgia OR Germany OR Greece OR Hungary OR Iceland OR Ireland OR Italy OR Kazakhstan OR Latvia OR Liechtenstein OR Lithuania OR Luxembourg OR Malta OR Moldova OR Monaco OR Montenegro OR Netherlands OR Norway OR Poland OR Portugal OR Romania OR Russia OR “San Marino” OR Serbia OR Slovak* OR Slovenia OR Spain OR Sweden OR*

Switzerland OR Macedonia OR Turkey OR Ukraine OR “United Kingdom” OR UK OR England OR Wales OR Scotland

The following databases will be searched for relevant documents:

- ISI Web of Science
- GEOBASE
- CABI: CAB Abstracts
- Scopus

To locate grey literature, the first 50 pdf and word documents provided by each of the following sources will be considered:

- Google Scholar
- Scirus
- Dogpile

Where search engines do not accept the search strings provided above, strings will be modified accordingly. Titles and abstracts will be stored in a single Endnote database and duplicates will be removed. Studies in English, French, and Greek language will be considered. The starting time point will be the year 1945.

Study inclusion criteria

Studies to be considered must include (1) quantified measurements of land-cover change and landscape change (urban, agricultural or forest cover), (2) quantified measurements of land-cover and landscape change rates at regional to local scale within Europe, and (3) explanations about the forces and the rates of different forces that drive landscape change in the study areas (Rudel, 2008).

The selection of studies follows a three-stage process. First, relevant studies will be initially assessed on their study titles. Second, the paper abstracts will be considered. In the third stage, the content of the full papers will be assessed. In cases of doubt, studies will be included to the next phase of the selection process. Repeatability of study inclusion will be checked through a random subset of at least 10% of references whose titles and abstracts will be assessed by another reviewer independently. Inclusion consistency will be calculated through kappa statistics (Cohen, 1960). Selection criteria will be modified if kappa should be below 0.5. The criteria for inclusion into the review refer to population, intervention, comparators, and outcomes (as highlighted in Table 3.1).

Table 3.1. Definition of subject, intervention, outcomes, and comparator

Subject population	Intervention	Outcomes	Comparator
Landscapes in Europe at regional-local scales (continental scope)	Rates of persistence and change in multiple spatial scales	Empirical measurements of rates of landscape change and persistence	Landscape pattern before driving forces unfolded with measurement of the rate of change – persistence (“before-after comparisons”)

Relevant populations

European landscapes at local to regional scales (NUTS2 and below, 1-10,000 km²) will be considered. Observations of multiple landscapes that are situated in different NUTS2 units, but appear within one paper will be included separately in the dataset and considered independently.

Relevant outcomes

Measurements of land-cover and landscape changes and associated rates regarding urban, agricultural and forest covers. Synthesis of case-study findings to reveal national and pan-European trends on a broader scale for different periods.

Potential effect modifiers

The outcome of this study is likely to be affected by a variety of factors, most of them depending on the context of each individual case study:

- Data sources
- Methods
- Spatial and temporal scales
- Social, economic and environmental characteristics

Data extraction strategy

All information will be entered in spreadsheets. Spreadsheet categories will be pretested to guarantee repeatability. We will extract the following information from the studies that meet inclusion criteria:

- *Context*: Local characteristics of study area that may have impact on the outcome of the study. (Table 3.2, 3.3)
- *Outcomes*: Land-cover change measurements and rates. (Table 3.4)

Table 3.2. Contextual aspects of the landscape change literature, related to the respective study

Aspect	Classes	Description
Year		Year in which study was published
Research area		Discipline of the study, according to ISI categories
Data source	Aerial photographs, satellite images, maps, statistics, field measurements, etc.	Data source of quantitative assessment of landscape change rate - persistence
Method of identifying rates	Quantitative, qualitative	
Information source on rates	Personal interpretation, expert interviews, spatial modeling, literature review etc.	
Spatial scale of study	1-100 km ² , 100-1000 km ² , 1000-10000 km ²	Extent of study area
Time scale	Long-term (100-500 years), medium-term (20-99 years), short-term (<20 years)	Time period in which landscape change was observed
System border definition	Administrative, biophysical, other	Definition of the limits of the study area
Number of spatial scales considered		Number of different spatial scales at which the empirical landscape analysis was performed
Number of study landscapes considered		
Number of points in time considered		

Table 3.3. Contextual aspects of the landscape change literature, related to the respective study area

Aspect	Classes	Description / Source
Country NUTS2 region		Country in which study area is located Nomenclature of Territorial Units for Statistics
Landscape type	Marine, coastal, inland water, forest, dryland, island, mountain, polar, cultivated, urban, etc.	Aspects of landscapes that are under particular focus in the study (Millennium Ecosystem Assessment classification)
Urban-rural type	Predominantly urban region, predominantly rural region, intermediate regions	European Environment Agency (EEA)
Travel time to cities >50,000 inhab.		Joint Research Centre
Population density		EUROSTAT
Regional GDP		EUROSTAT
Biogeographic region	Mediterranean, Atlantic, Continental, Alpine, Boreal, etc.	European Environment Agency (EEA)
Nationally designated area	Yes / No	EEA
Less favored area	Yes / No	EEA
Percentage of arable land		EUROSTAT/CORINE
Percentage of permanent grassland		EUROSTAT/CORINE
Percentage of forests		EUROSTAT/CORINE
Percentage of built-up land		EUROSTAT/CORINE
Agricultural area type	Prime agricultural area / marginal agricultural area	EEA
Mean farm size		EUROSTAT
Intensity of agricultural labor force		Mean number of farmworkers per agricultural area (EUROSTAT)
Predominant intensity of farming	Low / high / medium intensity farming	FP6-SEAMLESS (Kempen et al. 2011)
Predominant scale of farming	Low / high / medium scale farming	FP6-SEAMLESS (Kempen et al. 2011)
Predominant type of farming	Arable / dairy / beef / other farming	FP6-SEAMLESS (Kempen et al. 2011)
Tourism capacity		Number of tourist accommodation establishments (EUROSTAT)

Table 3.4. Proximate causes of landscape change observed in the cases (modified from van Asselen et al. 2013, final classification of drivers will be performed during data analysis)

Category	Proximate cause
Settlement / industrial development	Urban development Rural development
Infrastructure construction	Construction of roads, airport, etc. Dam/reservoir construction Establishment of wind turbines Development of photovoltaic plants / solar thermal collectors
Land consolidation	Up-scaling of parcel sizes Removal of landscape elements (e.g., hedgerows, wetlands)
Agricultural expansion / intensification	Expansion of arable land Intensification of agriculture Biofuel production
Expansion / intensification of forestry	Afforestation / plantations Timber / wood harvesting
Extraction of natural resources	Oil / gas extraction Coal extraction Extraction of minerals Peat extraction Water extraction
Agricultural extensification	Land abandonment Agricultural extensification
Nature / heritage conservation activities	Expansion of protected areas Heritage conservation activities Agri-environmental activities (e.g. planting of hedgerows)

3.3 Data synthesis and presentation

Characterization of the rates of landscape change and persistence will be synthesized in a narrative form. The relationship between different methods, scales and landscape contexts used in the studies will be explored through univariate statistics, e.g. through Chi-square tests.

The identification of the rates of change will be carried out through frequency analysis across all study cases. Both single-factor and multi-factor causations will be identified. Further contextual information (e.g., on population density, GDP, drivers of change) will be included at NUTS2/NUTS3 level from Pan-European data sources (EUROSTAT, European Environment Agency). The most important interactions will be assessed through univariate statistics. In addition, a cluster analysis of cases will be computed to identify typical combinations.

To identify sampling biases and knowledge gaps, the observed number of studies performed in a particular environmental, land-use, and socio-economic context (e.g. biogeographic region, population density, GDP, farming systems) will be compared to the expected number, given that studies would be distributed randomly.

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4 Protocol for a review in integrated landscape initiatives in Europe

Authors

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Abstract

In the last decades the number of initiatives in Europe that foster the safeguard of the services landscape provide to human well-being has increased strongly. Although most of these initiatives would not pursue the protection of landscapes services directly, they do indirectly contribute to their preservation by enhancing the functions of the socio-ecological systems, and by involving different stakeholders and sectors. This kind of initiative has been called Integrated Landscape Initiatives (ILIs) by the Landscapes for People, Food and Nature Initiative. The characteristics of these initiatives are varied in terms of location, scale, organisation, funding, size, professionalism, services and values addressed, stakeholders, etc.

Notwithstanding the importance of the ILIs for the European cultural landscapes, very little is known about its spectrum in the continent. Their spatial distribution and the range of socio-ecological systems' services addressed by the ILIs remain uncertain. Having an overview of these initiatives in Europe could contribute to make them more effective, to enable a better management of their resources, to take advantage of their potentials and to mitigate their constraints. Moreover, the exchange of experiences and ideas could be triggered.

Bearing this in mind, the aim of this review is to provide a systematic analysis of the spectrum of the initiatives that contribute to the safeguard of landscape services in Europe. Therefore, the review has the following objectives: to find varied, well distributed and relevant examples of ILIs, to create a typology in order to analyse their characteristics, and to recognise the gaps, potentials and constrains of the ILIs existing in Europe.

The methodology proposed will be based on systematic internet searches, on the canvassing of HERCULES experts, umbrella organisations and representatives of the ILIs, and on an online survey with selected ILIs. Internet searches and the canvassing of experts and umbrella organisations will be performed to collect the initiatives. The collection of information will be based on a two stages procedure: 1) Gathering of basic information on potential ILIs in order to further contact their representatives and to delete the ones that do not qualify as ILIs, and 2) collection of detailed information on each ILI by inviting all of the representatives to participate in an online survey. The survey results will be used to develop a typology for ILIs in Europe and to exhaustively characterize them in terms of patterns, gaps, challenges and potentials.

Keywords

Landscape; landscape values; landscape services; ecosystem services; actors; ecosystem stewardship; community-based management; sustainability; human well-being; Europe

4.1 Background

Landscapes are, by definition, at the interface of nature and society. As the European Landscape Convention states, they are “the result of the action and interaction of natural and/or human factors” (Council of Europe, 2000). Landscapes express a tight interplay of physical features of the human environment with social structures and human ideas. Particularly in Europe, humans have profoundly shaped landscapes over centuries, accumulating layer by layer the history, culture and knowledge of people over time. Except for those areas where the physical conditions are too extreme, the whole territory can be considered anthropogenic landscape (Plieninger and Bieling, 2012). Therefore, UNESCO (2008) describes landscapes as the “combined works of nature and man” and sees them as illustrative of the evolution of human society.

Due to this long-lasting history of tight interconnections between people and their natural surroundings, landscapes have an “important public interest role in the cultural, ecological, environmental and social fields (...) they contribute to the formation of local cultures (...) and contribute to human wellbeing and consolidation of identity” (Council of Europe, 2000). Human well-being is linked to landscapes over a multitude of aspects which can be captured with terms like values, services, functions or benefits. Currently, the ecosystem services concept is the dominating paradigm in conceptualising and categorising these linkages. The main reference regarding ecosystem services has been the Millennium Ecosystem Assessment (MA), which defines them as “the benefits people obtain from ecosystems” (Millennium Ecosystem Assessment, 2003: 49) and distinguishes four categories: provisioning services (food, water, timber, etc.), regulating services (regulation of climate, floods, diseases, etc.), cultural services (e.g., recreational, aesthetic, and spiritual benefits), and supporting services (soil formation, photosynthesis, etc.). In 2009 a Common International Classification of Ecosystem Services (CICES) was proposed in order to establish a generally accepted definition and classification of ecosystem services, that is still being reviewed and discussed on behalf of the European Environment Agency (EEA), and whose latest version was made public in 2013 (European Environment Agency, 2013). According to CICES, ecosystem services are defined as “the contributions that ecosystems make to human well-being, and arise from the interaction of biotic and abiotic processes” (Haines-Young et al., 2009: Executive Summary); and are classified in three main categories: provisioning services, regulation / maintenance services (categories regulating and supporting in the MA classification), and cultural services.

The ecosystem services framework focuses on the functioning of ecosystems and considers human agency mainly as a driver for the alteration (and mostly degradation) of those ecosystems. Following a different and more nuanced perspective, the landscape approach explicitly includes human action as a coexisting component and thus depicts landscapes as fully integrated socio-ecological systems (Naveh, 1995; Tress and Tress, 2001). Drawing on the ecosystem services framework, but adding the human-ecological understanding of landscape research to it, Termorshuizen and Opdam (2009) developed the landscape services concept. They define landscapes as spatial human-ecological systems that deliver a wide range of functions that can be valued by humans for economic, sociocultural, and ecological reasons. In this view, landscape services are defined as landscape functions that are valued by people. Whereas functions exist regardless of humans, services are created only through people using and valuing these landscape functions (Termorshuizen and

Opdam, 2009). This differentiation puts people and their values central to the ways in which the environment contributes to human well-being. Building on the landscape services framework, Vallés-Planells et al. (2014) developed a classification of the ways in which landscapes contribute to human wellbeing. They distinguish provisioning services, regulating and maintenance services, and cultural and social life fulfilment services.

By outlining that landscapes constitute areas “as perceived by people”, the landscape definition of the European Landscape Convention points to the scientific discourse on landscapes, which considers them as consisting of both a physical-material dimension, and a cognitive dimension of cultural and subjective meanings attached to these material facts. This discourse has enhanced the role of local stakeholders and civil society in the decisions and management related to the many aspects of landscapes; contributing to its democratisation and triggering a growing awareness of the importance of safeguarding these values. As indicated in Part II.2.3.A of the Guidelines for the Implementation of the European Landscape Convention, “(...) strengthening the relationship between the population and its living surroundings underpins sustainable development (...). Moreover, participation is regarded as an instrument for strengthening the identities of populations, which recognise themselves in their surroundings” (Council of Europe, 2000).

Contributions of landscapes to human well-being are due to active management of landscapes, i.e. people engaging with the land in terms of land-use. Nevertheless, the utilisation of the land for some benefits may also be associated with the degradation of the provision of other landscape services what might jeopardise overall human well-being; hence, good practices that strengthen synergies in multiple uses and reduce trade-offs are at the core of sustainability policy. The sustainability of landscape management is fostered by government authorities through a variety of strategies like incentive schemes, conservation projects or rural development initiatives. However, top-down strategies without the active involvement of local stakeholders seldom achieve their purposes, and the action of governmental bodies alone is not enough to safeguard the necessary local-level management. Therefore, coordination, communication and cooperation between institutional levels, sectors and different stakeholders are a must for sustainable land management. Multi-stakeholder partnerships and collaborative groups play an important role in facilitating these linkages (Prager, 2012; Prager et al., 2012).

Although landscapes have always been stamped by sometimes gradual, sometime rapid reorganisations in order to adapt their uses to changing societal demands (Antrop, 2005; Dannebeck et al., 2009), the speed, scale and magnitude of current landscape change is unprecedented (Jansen et al., 2009; Millennium Ecosystem Assessment, 2005). Not only in an European context, cultural landscapes face the challenges of globalisation and its associated increasing flows of technology, investment and trade; intensification and homogenisation; urbanisation and proliferation of built infrastructure; marginalisation and abandonment; and new aims and uses like renewable power provision (Plieninger and Bieling, 2012). In response to these challenges, there is a growing movement among civil society that demands local products, is interested in local traditional knowledge and culture as connected to landscapes, is concerned about the conservation of biodiversity, longs for unique touristic destinations, demands eco-products, or (if living in the big cities) is willing to start a new life in a rural area.

Triggered by these challenges and by the demands of the civil society, there has been a rise in regional and local activities to sustain cultural landscapes and the services they provide, in the form of strategies strengthening sustainable local development, nature conservation, biodiversity protection, sustainable production, rural and natural tourism, local stewardship and merchandising of local products. These strategies are carried out by partnerships of land users, conservation activists, consumers associations, and other grassroots movements (Plieninger and Bieling, 2012). An important characteristic of this emerging initiatives are the highly participatory approaches and the great variety of voluntary actions and management activities that they foster.

4.2 The concept of Integrated Landscape Initiatives (ILIs)

In order to systematically frame these approaches and activities, we use the concept of *Integrated Landscape Initiatives (ILIs)*. The definition of ILIs to be used in this review builds on the experience and definition provided by the Landscapes for People, Food and Nature (LPFN) Initiative and in particular its review of Integrated Landscapes Initiatives performed in Africa (Milder et al., 2014), on the results of a scoping exercise (see below), and on the perspectives of experts involved in the HERCULES project.

The definition for an ILI used by Milder et al. (2014: 70) is the following:

“Project, program, platform, initiative, or set of activities that: (1) explicitly seeks to improve food production, biodiversity or ecosystem conservation, and rural livelihoods; (2) works at a landscape scale and includes deliberate planning, policy, management, or support activities at this scale; (3) involves inter-sectorial coordination or alignment of activities, policies, or investments at the level of ministries, local government entities, farmer and community organizations, NGOs, donors, and/or the private sector; and (4) is highly participatory, supporting adaptive, collaborative management within a social learning framework”

Due to the African context, where safeguarding provisioning services is a major challenge, this definition is oriented towards food production and rural livelihoods. To adapt it to the European context and to the objectives of the review we want to perform, it has been changed in the following way:

Integrated Landscape Initiatives are projects, programs, platforms, initiatives, or sets of activities that foster the provision of a broad range of landscape services and contribute to the personal and social fulfilment and well-being of the people that perceive them.

These initiatives have to comply with the following basic criteria: work at a landscape scale, involve inter-sectorial coordination, develop or support multi-stakeholder processes, be highly participatory, and work mainly on a non-profit basis.

Attending to the concepts, definitions and classifications already expounded in the background section, where landscape services are defined as *landscape functions that are valued by people*, we consider the concept of landscape services the right tool to transpose the subjective and heterogeneous values attributed to a landscape, into a common language. This way we can classify and analyse the motivations expressed by the different ILIs in a systematic way (Table 4.1).

Table 4.1. Classification of landscape services¹

Motivation of ILI in terms of landscape services addressed	Type of service	Examples
	Nature conservation, biodiversity, wildlife	Preservation of specific biotopes or species
	Localised food production	High-quality food, organic food, local varieties
	Localised renewable energy supply	Energetic use of local biomass, energy-self-sufficiency
	Rural livelihoods improvement	Availability of jobs for the local population, increase of local income
	Regulation and maintenance services: Climate, water, soil	Improvement of water quality or availability
	Natural/cultural/rural tourism	Improvement of gastronomic services, visitor centres
	Outdoor recreation for local people	Improvement of infrastructure (e.g. walking trails) and quality and accessibility of landscape features
	Aesthetic values, scenery	Enjoyment by pleasing sensations
	Cultural heritage, history, memory	Preservation of traditions or historical features
	Sense of place, local identity, personal fulfilment	Uniqueness, source of inspiration, spiritual values
	Improvement of social well-being, social fulfilment	Activities directed towards enhancing local collaboration and a shared community identity
	Other	<i>(To be specified)</i>

Integrated Landscape Initiatives include bottom-up local initiatives and grassroots movements, civil society associations (e.g., Friends of the Lake District in the United Kingdom and the Valminho Florestal in Portugal), local governments organisations (e.g., Atelier dei Paesaggi Mediterranei (ADPM) in Italy), agrarian or environmental platforms and cooperatives (e.g., Agrarische Natuurverenigingen in the Netherlands), but also initiatives fostered by regional and central governments (e.g., Observatori del Paisatge in Catalonia), international funds (e.g., Burren LIFE project in Ireland) or national and international umbrella organisations (e.g., Bund Heimat und Umwelt (BHU) in Germany and the European Landscape Network).

Nevertheless, not all of the initiatives found can be considered ILIs according to the definition specified above (for examples see Table 4.2). For instance, regarding the agrarian platforms, a good example of an ILI could be the German landscape care associations (Landschaftspflegeverbände) whose aim is to combine regional development, the provision of farmer incomes and sustainable nature resources management (Prager, 2012), whereas, for example, the English Farmer Network, which focuses on the support to local farming communities, would not be considered an ILI because it does not involve inter-sectorial coordination.

Another example refers to initiatives that work towards the touristic promotion of the land. Only those that combine the touristic promotion with other areas of landscape management and protection would be considered ILIs. Such is the example of the Falkland Centre for Stewardship, that dedicates a big effort to promote the beauties of their land through its website, but whose focus is on the stewardship of the place by involving partners and

¹ To develop a classification of landscape services that may be addressed by ILIs, we built on a twofold approach. First, in a deductive approach, we considered existing typologies in the field: The ecosystem services framework as proposed in the Millennium Ecosystem Assessment (2003), the current refinement of this basic outline as provided by CICES Version 4.3 (European Environment Agency, 2013) and the landscape services concept (Termorshuizen and Opdam, 2009; Vallés-Planells et al. 2014). Second, in an inductive approach, we scanned the ILIs identified within the scoping exercises for how they express the landscape services / values that are in the center of the respective initiative. The integration of both approaches resulted in the landscape services typology used in this review.

volunteers towards the sustainable land use, supporting multi-stakeholder processes and being highly participatory. On the contrary, initiatives as the Czech UNESCO Heritage for example, which is an association of Czech districts to promote the World Heritage monuments present in their land, could not be included as an ILI.

Table 4.2. Examples of initiatives that can or cannot be considered ILIs (those who, in sum, qualify as ILIs are highlighted)

Initiative	Foster the provision of a broad range of landscape services	Work at a landscape scale	Involve inter-sectorial coordination	Support multi-stakeholder processes	Are highly participatory	Work mainly on a non-profit basis
Land-schafts-pflege-verband Harz (Germany)	YES. Nature conservation, localised food production, rural livelihoods, outdoor recreation for local people, etc.	YES. Involve different land uses: Mines, grassland, meadows, pastures and moorland	YES. Farming, local products promotion, and nature conservation	YES. Individuals, farmers, companies, associations, and the rural district and municipality of Harz	YES. Cooperation processes, partnerships, participatory events (guided walks) and publications	YES
Distel-verein (Austria)	YES. Nature conservation, localised food production, rural livelihoods, etc.	YES. Involve different land uses	YES. Farming, hunting, and nature conservation	YES. Hunters, farmers and ecologists	YES. Cooperation processes and associations, enquiries, and discussions	YES
The Farmer Network (UK)	NO. Localised food production	NO. Focuses on farming business	NO. Farming	NO. Farmers	YES. But only for the farming community	YES
Falkland Centre for Stewardship (UK)	YES. Nature conservation, localised food production, rural livelihoods, tourism, outdoor recreation, cultural heritage, local identity, fulfilment, and other	YES. Involve different land uses	YES. Land promotion, conservation, farming, food production, heritage management, awareness raising, etc.	YES. Local community, volunteers, visitors, and farmers	YES. Volunteering, active involvement of the local community through different events (guided walks, picnics, storytelling, etc.) and invitations (courses, farming plots renting, etc.)	YES
Friends of the Lake District (UK)	YES. Nature conservation, tourism, outdoor recreation, cultural heritage, local identity, fulfilment, and other	YES. Involve different land uses	YES. Sustainable landscape development, conservation, awareness raising, and land promotion	YES. Local community, volunteers, visitors, landowners, and farmers	YES. Volunteering, becoming a member, public consultation, and education activities	YES
Czech UNESCO Heritage (Czech Republic)	NO. Cultural tourism and heritage	NO. Focuses on monuments	NO. Touristic promotion	NO. Visitors	NO	YES
The Landscape Architects Association of Romania (Romania)	NO. Cultural and aesthetic values	NO. Punctual interventions on parks and urban spaces	NO. Landscape architecture	NO. Landscape architects	NO	YES

4.3 Objectives of the review

The aim of this review is to provide an overview and typology of existing Integrated Landscape Initiatives (ILIs) across Europe. This is achieved by a systematic review of the

available information in the internet and of the knowledge of experts representing major organizations and networks in the field as well as by an online survey of representatives of ILIs. Our review has the following specific objectives:

1. to provide an overview of existing ILIs in Europe, including information on their aims, organizational structure, functioning and context
2. to develop a typology to characterize ILIs in Europe
3. to identify patterns regarding success and problems of the respective types of ILIs in different settings

By this, we aim at providing systematic insights on the functioning, potentials and constraints for ILIs in a Pan-European perspective. This may inform current landscape-related policy processes, for example the EU Common Agricultural Policy as well as national policies and regional planning. It will be particularly helpful in the context of achieving a transition towards sustainability, where ILIs play a crucial role as change agents preparing and guiding change processes and disseminating knowledge on how to pursue desired pathways into a sustainable future.

Having as a reference the European Landscape Convention, which invites both the European Union and any other European state which is not a member of the Council of Europe, to accede to the Convention (Council of Europe, 2000), the area targeted by this review encompasses the whole geographical area of Europe.

4.4 Methods

The methodology presented here follows the model set by the LPFN Initiative that is working on a global review of Integrated Landscape Initiatives, continent by continent. Currently the only finished continental review has been performed in Africa (Milder et al., 2014) and Latin America (Estrada-Carmona et al., in press), and there is another in progress in Asia. The proposed review will be conducted in cooperation with LPFN and will be endorsed by LPFN as European continental review.

For the review on Africa, the LPFN authors conducted a systematic assessment to inventory and analyse the ILIs in sub-Saharan Africa. The methodology carried out for this review consisted of the creation of a database of initiatives, an internet survey to one representative of each initiative, and finally, the statistical analysis of the survey data to provide a synthesis of the characteristics, patterns, outcomes and experiences of this integrated landscape initiatives in the region (Milder et al., 2014).

In the African case, 284 potential ILIs were identified and contacted, 105 responded to the survey, and after screening, 87 ILIs were included in the final analysis. In Latin America, a similar review identified 382 candidate initiatives, 173 of which responded to the survey request and 104 remained in the final sample after screening of the surveys. The European spectrum, with thousands of initiatives that meet the definition of an ILI, is much more abundant and diversified and hence, our review will not try to inventory all the existing initiatives but to identify and characterize different types of ILIs. Therefore, the method proposed in this document consists of: 1) the creation of a database of initiatives, 2) the collection of detailed information on the ILIs through online surveys, 3) the systematic assessment of this information in order to develop a typology of ILIs and to provide a

detailed characterisation of each type, and finally, 4) a synthesis of the European spectrum of Integrated Landscape Initiatives.

The review is structured in three steps:

1. Scoping exercise using the web browser Google Chrome to find key terms to be used for the search of initiatives,
2. Collection of the initiatives and basic information on them through internet keyword searches and through the canvassing of people from the HERCULES project and major organisations in the field,
3. Systematic gathering of detailed information through online surveys on each ILI collected in order to classify them in types and to characterize these types in depth, resulting in a synthesis of the spectrum of ILIs in Europe in order to bridge the information gap regarding patterns, typical problems and challenges, and to increase knowledge on the geographical distribution and on the landscape services addressed.

4.4.1 Scoping exercise

The aim of the scoping exercise is to obtain the baseline information to develop a methodology for the collection of the major number of initiatives possibly qualifying as ILIs. Therefore, the core of this exercise was the acquisition of suitable keywords to use in the internet searches that should lead to the initiatives.

The scoping exercise was performed by using the Google Chrome search engine. Boolean operators were used in the cases where the words entered form an expression that should not be broken (such as: “landscape values”, “landscape services” and “landscape dynamics”). To leave the scoping exercise as impartial as possible, no operators were used to narrow the search to the European countries. Nevertheless, the Boolean operators “-edu”, “-ca”, “-nz”, “-au”, “-us” were introduced to exclude the entries from the United States of America, Canada, Australia and New Zealand.

The scoping exercise consisted of four parts:

1. Systematic collection of ILIs’ umbrella organisations. This was done by performing a first Google search with the key term “landscape Europe”.
2. Scan of the umbrella organisations in order to find relevant keywords. The keywords were obtained: from the titles of the initiatives, from the description of their aims and activities, and from the names and titles of the partners, members or links provided on the websites (Annex, Table 4.A1). The key terms obtained from this exercise were sorted by the number of times they had appeared, and compared and completed with a list of terms relevant for the HERCULES project (Annex, Table 4.A2). Key terms that got less than two appearances in the scoping exercise and were not included in the list of key terms related to the HERCULES project were deleted.
3. Systematic selection of the valid key terms. In order to find out which key terms are valid for the review of ILIs, a Google search was performed with every key term identified. The 100 first results of each search were analysed. All the relevant entries of these 100 results were annotated. To select the relevant results the following criteria were applied: should belong to or work within Europe; should not be an article, a journal or a blog; should not be focused on landscape design; should not include only

touristic information; should not belong to academic courses, conferences, seminars, etc.; and should not belong to a private company that receives money for their services. When all the key terms had been searched, only the words that led to at least 10 relevant entries were considered valid (Annex, Table 4.A3).

4. Systematic compilation of a table with all the words, expressions and Boolean operators that will be used in the Google search for the collection of ILIs (Annex, Table 4.A4).

4.4.2 Collection of initiatives

Once the keywords to use in the Google search and the criteria to select the results are set, the following steps will be performed.

1. Collection of potential initiatives
 - The bulk of initiatives will be collected through internet keyword searches by introducing the expressions and operators selected through the scoping exercise. The internet search will be performed using Google, as it is the most common search engine. In order to avoid any external conditioning, the Google user account should be logged out when performing the search and English language will be selected in the Google search settings².
 - Initiatives will also be collected by the canvassing of the members of the HERCULES project.
 - In addition, representatives of the umbrella organisations collected through the first part of the scoping exercise will also be canvassed: Landscape Europe, Council of Europe, European Landscape Network, UNISCAPE, CIVILSCAPE, Permanent European Conference for the Study of the Rural Landscape (PECSRL), The Leibniz Centre for Agricultural Landscape Research (ZALF), International Association for Landscape Ecology (IALE) Europe, International Federation of Landscape Architects (IFLA), European Landscape Contractors Association (ELCA), Future-Oriented Integrated Management of European Forest Landscapes (INTEGRAL), European Council of Landscape Architecture Schools (ECLAS), and European Cultural Landscapes (ECL). This list was completed with the initiatives: Landscape Research Group, RECEP-ENELC, International Scientific Committee on Cultural Landscapes (ISCCL), and Landscapes for People, Food and Nature.
 - Initiatives linked to EU institutions and funds and to other already known initiatives will be included as well.
2. Collection of basic information on each candidate initiative in a database

Each time a new initiative is found, it will be added to an Excel table provided, in which the required basic information will be filled in (Table 4.3). The information collected in the table is the basis for pursuing the following tasks: 1) dismiss the

² In order to evaluate the bias that a search using the English language might cause, some Google search exercises have been performed applying selected keywords in different languages. The searches performed using either the name of the country and/or the key term in the original language had not offered new relevant results that were not found through the search with all the words in English. Consequently it has been considered not necessary to use the original language to find relevant entries. Were there a bias that has not been detected within the scoping exercise, it will be compensated with the canvassing of the members of the HERCULES project and of umbrella organisations (as outlined below).

initiatives that cannot be considered ILIs, and 2) provide contact information regarding the initiative.

Table 4.3. Basic information on initiatives.

Initiative	Name
Institution	Main / Collaborators / Supporters
Context	International / European / National / Regional / Local
Location	Country, place
Date	Start; End; State of the project or activity (beginning / in process / ending / permanent); Continuation of a previous initiative
Basic criteria	Foster provision of landscape values; Landscape scale; Intersectorial coordination; Highly participatory; Non-profit basis
Contact details	URL; Contact person; Contact person's email, telephone and address Contact time

3. Elimination of entries that do not comply with the characteristics of an ILI

Initiatives that do not comply with the five basic criteria that define an ILI will be dismissed. These basic criteria are: foster the provision of a broad range of landscape services, work at a landscape scale, involve inter-sectorial coordination, develop or support multi-stakeholder processes, be highly participatory, and work mainly on a non-profit basis.

Further criteria, developed throughout the scoping exercise, to be applied for the elimination of entries are: No journals or blogs will be included, university departments would only be considered if there is a research group taking part or leading a project with practical application on the land (that develops activities), and public administrations will not be included as ILIs but the institutions related with them dealing with landscape issues might be (heritage councils, landscape observatories...).

4.4.3 Classification and characterization of the initiatives

After collecting all initiatives to be studied in this review, an online survey will be sent to each ILI's representative in order to:

1. Classify the ILIs collected in types

The initiatives collected will be sorted in types, attending to its organisational character and structure, context, area of work (sectors involved), landscape services addressed, stakeholders, etc., with the help of the information obtained through the online surveys. The initiatives will be classified taking into account the criteria displayed in the tables below. In principle, no statistical analysis will be performed, unless in the course of the review the data collected prove suitable for such analysis.

2. Research on the characteristics of the types of ILIs identified

We will deliver a good description of each type of ILI based on the information provided by the ILIs' representatives through the online survey.

The information we want to obtain from each one of the ILIs in order to classify them and exhaustively characterize the types, is presented in the Tables 4.3 (basic information), 4.4 (context) and 4.5 (characterization).

Table 4.4. Context of the Integrated Landscape Initiatives.

Basic aspects of the Classes landscape		Description
Urban-rural type	Predominantly urban region / Predominantly rural region / Intermediate region	Urban-rural region according to EUROSTAT typology
Landscape type	Marine / Coastal / Inland water / Forest / Dry land / Island / Mountain / Polar / Cultivated / Urban / etc.	Millennium Ecosystem Assessment classification
Land use characteristics	Agricultural (open fieldscapes, enclosed fieldscapes, modernised fieldscapes, grazing, wood pasture, terraced landscape, drained land, irrigated land, arboriculture and viticulture) / Forestry / Mining / Industry (traditional manufactures, big industry)	Agricultural classification following Pungetti and Kruse (2010)
Population		Number of people living in the landscape. Data taken from EUROSTAT
Population density		Data taken from EUROSTAT
Regional GDP		Data taken from EUROSTAT
Protected area	Yes / No	Data taken from EEA
Less favoured area	Yes / No	Data taken from EEA
Agricultural area type	Prime agricultural area / Marginal agricultural area	Data taken from EEA

Table 4.5. Characteristics of the Integrated Landscape Initiatives.

Aspects of the landscape initiative	Classes	Description
Initiative's scope	International / European / National / Regional / Local	
Country		Country in which the initiative is located
Place		Locality where the initiative acts
Initiative's dates	Start; End; State of the project or activity (beginning / in process / ending / permanent); Continuation of a previous initiative	
Initiative's time scale	Long-term (>10 years) / Medium-term (5-10 years) / Short-term (<5 years)	Time period in which the ILI is active
Initiative's organisational character	NGO / Private / Public	
Initiative's funds	European funds / National funds / Private contributions / Memberships / Initiative's activities	Origin of the funds obtained by the initiative for its performance and to achieve its objectives
Initiative's origin	Endogenous / Exogenous	It has been established based on the initiative of local people, or due to an exogenous incentive (e.g., law, regulation, subsidy) (Prager, 2012)
Initiative's governance structure	<i>(Classes possibly to be developed out of data)</i>	Internal organisation of the initiative
Initiative's size	<i>(Classes possibly to be developed out of data)</i>	Size of the group. Number of people involved in the decision making and their implementation of activities
Initiative's aim / motivation	<i>(Classes possibly to be developed out of data)</i>	Objectives of the initiative described in its Website. Challenges and problems with an impact on the landscape services that the initiatives wants to solve
Landscape services targeted	Nature conservation / Localised food production / Localised renewable energy supply / Rural livelihoods improvement / Regulation and maintenance services / Tourism / Aesthetic values / Cultural heritage, history, memory / Sense of place, local identity, personal fulfilment / Social well-being and fulfilment / Other	Landscape services to which the initiative contributes
Sectors involved	Heritage protection / Culture and Traditions / Tourism and recreation / Local development / Agriculture / Nature conservation / Human livelihoods / Research / Institutional planning and coordination	Sectors of activity involved in the ILI
Initiative's stakeholders	Local farmers / Associations / Local or district government / NGOs / Research centre / etc. <i>(classes to be refined and developed out of the data)</i>	Groups involved in the design and implementation of the initiative (Milder et al., 2014)
Initiative's degree of professionalisation (Prager, 2012)	Experts and professionals / Volunteers	The members of the initiative might be experts on land management, local development, nature conservation, environmental issues, agricultural sciences, etc., and/or volunteers, land owners, local farmers, etc.
Initiative's participation, diffusion and awareness-raising processes	Target population; Consultation processes / Engagement processes / Diffusion processes / Raise of awareness	Sectors of population reached through the participation processes; participation techniques employed; purposes of the participation processes; ways of disseminating the activities, achievements and experience; effort put into awareness-raising
Initiative's activities and investments	Investments in agriculture / Investments in natural conservation / Investments in livelihoods and human well-being / Investments in multi-sectorial coordination and planning / Investments in local stewardship / Others	Actions performed or supported by the initiative in the course of its existence (Milder et al., 2014)

Table 4.5 continued. Characteristics of the Integrated Landscape Initiatives.

Aspects of the landscape initiative	Classes	Description
Initiative's outcomes	(Classes possibly to be developed out of data)	Monitored and perceived results of the initiative in its target area and activity.
Initiative's success	Most successful aspects; Less successful aspects (Classes possibly to be developed out of data)	
Initiative's problems, challenges and constraints	(Classes possibly to be developed out of data)	Problems, challenges and constraints the initiative faces
Initiative's collaboration	Partners / Members / Networks / etc.	

4.5 Presentation of results

The results of the review on Integrated Landscape Initiatives in Europe will be made available for an international audience. For this, the methodology followed to identify, collect, classify and characterize the ILIs presented in this document will be published, together with the synthesis of the spectrum of ILIs in Europe, in an international journal (e.g., *Landscape and Urban Planning*, *Land Use Policy*, *Environmental Management*).

Further dissemination will be achieved through the Knowledge Hub for Good Landscape Practice of the HERCULES project. The Knowledge Hub is understood as a toolkit for communication and crowdsourcing, and will share and distribute the results of the HERCULES project among stakeholders and the general public. Hence, the list of the ILIs identified and collected through the present review will become part of it.

4.6 References

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4.7 ANNEX: Scoping exercise

In this Annex we present the detailed procedure followed to perform the scoping exercise that led to the key terms to use in the collection of initiatives through Google searches. The whole scoping exercise consisted of the following four scoping exercises:

First scoping exercise: The first step was finding the Integrated Landscape Initiatives' umbrella organisations, which should lead us to other ILIs and to a first collection of key terms (second scoping exercise). This was done by performing a first Google search with the key term *landscape Europe*. Only the organisations that are international and whose main aim is related with landscape issues were considered.

The umbrella organisations found through the first scoping exercise have been: Landscape Europe, The Leibniz Centre for Agricultural Landscape Research (ZALF), European Landscape Network, Council of Europe, International Association for Landscape Ecology (IALE) Europe, International Federation of Landscape Architects (IFLA), European Landscape Contractors Association (ELCA), UNISCAPE, Permanent European Conference for the Study of the Rural Landscape (PECSRL), CIVILSCAPE, Future-Oriented Integrated Management of European Forest Landscapes (INTEGRAL), European Council of Landscape Architecture Schools (ECLAS), and European Cultural Landscapes (ECL). This list was completed with the initiatives: Landscape Research Group, RECEPT-ENELC, International Scientific Committee on Cultural Landscapes (ISCCL), and Landscapes for People, Food and Nature.

Umbrella organisations whose main field is not landscape, even though they might embrace it as one of their research interests, won't be included in the review as Integrated Landscape Initiatives. Nevertheless, they are a valuable source of ILIs, and the projects related to them that do focus on landscape issues will be included.

Second scoping exercise: The second exercise consisted of scanning the umbrella organisations in order to find relevant keywords. The keywords were obtained: from the titles of the initiatives, from the description of their aims and activities, and from the names and titles of the partners, members or links provided on the websites. An excel table was created where each umbrella organisation had two fields, one for key terms found in the description of the organisation and their aims, and one for the key terms found in the names of the links, partners or members (Table 4.A1).

Table 4.A1. Examples for the results of the scan of the umbrella organisations' websites

Institution	Key terms found in the description	Key terms found in the names of the links, members and partners
Landscape Europe	landscape assessment, landscape planning, landscape management, sustainable landscapes	landscape institute, landscape ecology, landscape research
UNISCAPE	European landscape, landscape research, landscape education, landscape protection	landscape cultural heritage, European landscape
Permanent European Conference for the Study of the Rural Landscape (PECSRL)	rural landscape, landscape research, European landscapes, landscape management	landscape institute, landscape management, landscape ecology, landscape research

The key terms obtained from this exercise were sorted by the number of times they had appeared, and compared and complemented with a list of terms relevant for the HERCULES project (Table 4.A2). Key terms that got less than two appearances in the scoping exercise and were not included in the list of key terms related to the HERCULES project were deleted.

Table 4.A2. Key terms found through the second scoping exercise organised by number of appearances.

Key terms found through the scanning of the umbrella organisations' websites	Number of appearances			On the list of terms related to the HERCULES PROJECT
	In the description and objectives	In the name of the links, partners or members	In total	
European landscape	10	5	15	yes
landscape research	6	4	10	yes
cultural landscape	4	3	7	yes
landscape management	6	1	7	yes
landscape architecture	1	5	6	no
landscape ecology	1	4	5	yes
landscape protection	3	2	5	yes
agricultural landscape	2	2	4	yes
landscape education	3	1	4	yes
landscape institute	1	3	4	yes
landscape and heritage	2	1	3	yes
landscape awareness	3	-	3	yes
landscape contractors	1	2	3	no
rural landscape	2	1	3	yes
environment landscape	-	2	2	no
landscape observatory	-	2	2	yes
landscape policies	2	-	2	no
landscape preservation	1	1	2	yes
regional landscape	-	2	2	no
changing landscapes	-	1	1	no
every day landscapes	1	-	1	no
degraded landscapes	1	-	1	no
forest landscape	1	-	1	no
historic landscape	-	1	1	yes
landscape assessment	1	-	1	no
landscape association	-	1	1	yes
landscape food	1	-	1	yes
landscape foundation	-	1	1	no
landscape identification	1	-	1	no
landscape knowledge	-	1	1	no
landscape monitoring	1	-	1	no
landscape nature	1	-	1	no
landscape partnership	-	1	1	no
landscape people	1	-	1	no
landscape platform	-	1	1	yes
landscape practitioners	1	-	1	no
landscape restoration	1	-	1	no
landscape study	1	-	1	no
landscape systems	-	1	1	no
landscape values	1	-	1	yes
sustainable landscapes	1	-	1	no

Key terms listed as related to the HERCULES project that did not appeared through the scanning of the umbrella organisations' websites are: local landscape, farming landscape,

landscape dynamics, landscape project, landscape initiative, landscape stewardship, landscape participation, landscape resilience, landscape persistence, landscape trust, landscape platform, landscape organization, landscape program, landscape stakeholders, and landscape services.

The number of different key terms resulting from the merge of the second scoping exercise (42) and of the list of relevant terms (35) is 57. From these 57, 20 were on both lists. 17 of the 37 remaining terms that were not on both lists were deleted because they had less than 2 appearances in the scoping exercise. Therefore, the total number of key terms to be examined in the next scoping exercise has been 40.

Third scoping exercise: In order to find out which key terms are valid for the review of ILIs, a Google search was performed with every term, and the 100 first results of each search analysed. All the relevant entries of these 100 results were annotated. To select the relevant results, the following criteria were applied: should belong to or work within Europe; should not be an article, a journal or a blog; should not be focused on landscape design; should not include only touristic information; should not belong to academic courses, conferences, seminars, etc.; and should not belong to a private company that receives money for their services. When all the key terms had been searched, only the words that led to a minimum number of relevant entries were considered valid (Table 4.A3).

In this third scoping exercise 40 key terms were examined one by one, and only 15 were considered valid. The criterion to determine which key terms were valid was that only the ones that led to at least a 10% of relevant entries (out of the 100 scanned) should be accepted.

Table 4.A3. Examples for the key terms analysed through the third scoping exercise.

Key term	Examples for initiatives found	Validity
landscape research	Landscape Research Group, Grupo de Investigacion Paisaje Cultural, Carbon Landscapes Research Group, The Landscape Research Centre, The Leibniz Centre for Agricultural Landscape Research (ZALF) and the six institutes under it, The Swiss Federal Institute for Forest, Snow and Landscape Research (WSL), Yalburt Yaylasi Archaeological Landscape Research Project, The Danish Forest and Landscape Research Institute (DFLRI), The Nordic Landscape Research Network (NLRN)	VALID
landscape management	Chair for Landscape Management Uni Freiburg, Landscape Management research group University Potsdam	NOT VALID
cultural landscape	International Council on Monuments and Sites (ICOMOS), International Scientific Committee on Cultural Landscapes (ISCCL), International Federation of Landscape Architects (IFLA), Database on Cultural Landscapes and Cultural Landscape Ecosystems in Europe (CULTBASE), PAN European Thematic Network on Cultural Landscapes and their Ecosystems (2002-2005), Natural England, Pathways to Cultural Landscapes, Cultural Landscape and Urban Environment (CLUE), Cultural Landscape Explorer Utrecht, Grupo de Investigacion del Paisaje Cultural, English Heritage	VALID
landscape architecture	Landscape Architecture Group (linked to Wageningen UR), European Council of Landscape Architecture Schools (ECLAS), European Landscape Architecture Student Association (ELASA), Landscape Institute, International Federation of Landscape Architects (IFLA)	NOT VALID

During this third scoping exercise we were able to set new detailed criteria for the collection of ILIs: No journals or blogs will be analysed or included; university departments would only be considered if there is a research group taking part or leading a project with practical application on the land (that develops activities); public administrations will not be included as ILIs but the institutions related with them that deal with landscape issues might be (heritage councils...); private companies that profit from their work in landscape design or management will not be taken into account; landscape architecture initiatives will only be included if they transcend the design approach and involve inter-sectorial coordination; and finally, websites whose only aim is to provide touristic information of a site will be dismissed.

The methodology followed till this point has proven to be successful since, from the 15 key terms considered valid (to be applied in the collection of initiatives), only two (landscape dynamics and farming landscape) were not found through the second scoping exercise and had to be added from the list of terms related with the HERCULES project.

Fourth scoping exercise: In this exercise all the information collected through the previous scoping exercises was used to compile a table with all the words, expressions and Boolean operators that will be used in the Google searches for the collection of ILIs. It consisted in the detection of the best expressions and Boolean operators to define, limit and deepen the internet searches. This was based on a two stages procedure: 1) a brief research on internet key search words (such as AND, OR, WITH, etc.) and 2) the scan of all relevant possible options through Google searches combining them with some of the key terms found through the previous scoping exercises and examining the results. The result is summed up in Table 4.A4.

The position operator WITH is used when we want to reach landscape initiatives related to the keyword but that do not necessarily have to include the exact expression we introduce in the search; that way, the words introduced in the search will be in the same sentence but not necessarily adjacent. The quotation marks are used when we want to find landscape initiatives that use the exact expression we introduce in the Google search; that is why in some of the cases, the same expression has to be introduced both in singular and plural. The OR operator is introduced between all expressions to specify that the results do not have to include all the alternative expressions but one of them. To increase the number of initiatives from non-English speaking countries, the search will be completed by adding the name of each country included in the research area. The Boolean operators *-edu*, *-ca*, *-nz*, *-au*, *-us* will be applied to limit the entries from the United States of America, Canada, Australia and New Zealand.

Table 4.A4. Fourth scoping exercise - words, expressions and operators to be used in the keyword Google searches.

Key word	Expression	Linking operator	List of countries	Limiting operator
European	European landscape / European landscapes / landscapes of Europe / landscape of Europe	" " OR " "		
regional	regional landscape / regional landscapes / landscape region / landscape regions	" " OR " "	Europe OR EU OR Albania OR Andorra OR Armenia OR	
cultural	cultural landscape / cultural landscapes	" " OR " "	Austria OR Azerbaijan OR Belarus OR	
rural	rural landscape / rural landscapes	" " OR " "	Belgium OR Bosnia OR Bulgaria OR Croatia OR Cyprus OR Czech OR Denmark OR	
agricultural	agricultural landscape / agricultural landscapes / landscape and agriculture /agriculture and landscape	" " OR " "	Estonia OR Finland OR France OR Georgia OR Germany OR Greece OR Hungary OR	
farming	farming landscape / farming landscapes / farming and landscape / landscape and farming	" " OR " "	Iceland OR Ireland OR Italy OR Kazakhstan OR Kosovo OR Latvia	
environment	environment landscape	WITH	Lithuania OR Luxembourg OR Malta OR Moldova OR Monaco OR Montenegro OR	- edu, - ca, - nz, - au, - us
heritage	landscape heritage / landscape and heritage / heritage and landscape	" " OR " "	Netherlands OR Norway OR Poland OR Portugal OR Romania OR Russia OR "San Marino" OR Serbia OR Slovakia OR Slovenia OR Spain OR Sweden OR Switzerland OR	
ecology	landscape ecology / ecology of landscape / ecology of landscapes / ecology of the landscape	" " OR " "	Macedonia OR Turkey OR Ukraine OR "United Kingdom" OR England OR Wales OR Scotland	
research	landscape research / research on landscape / research into landscape / research into the landscape	" " OR " "		
protection	landscape protection / protection of landscape / protection of the landscape	" " OR " "		
policy	landscape policy / landscape policies	" " OR " "		
awareness	landscape awareness	WITH		
dynamics	landscape dynamics / dynamics of landscape / dynamics of the landscape	" " OR " "		
history	landscape history / history of landscape / history of the landscape / historic landscape / historic landscapes / history of (the) adj. landscape(s)	" " OR " "		

The search cannot be performed for the whole bunch of countries at the same time. They have to be divided in four lots. This means that four searches per keyword will have to be performed. The word in red marks where a new lot begins.