5 Building landscape character indicators

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5.1 Introduction

The objective of this part of the project was to examine possible methodological approaches for selecting landscape character indicators as part of a wider European concept. In order to achieve this goal, the work has:

- examined the conceptual basis of landscape indicators and the way they have been developed through recent European initiatives;
- undertaken a survey of recent policy applications that cover a landscape related issues; and
- developed a typology of landscape indicators that can be used as a framework by those concerned with describing landscape and landscape change at the European scales.

In order to provide a basis for the recommendations from this work package, an extensive review of the 'state-of the art' in relation to the use of landscape indicators in a policy context has been made. The review seeks to look at landscape indicators in the context of the general environmental, social and economic indicators that are currently being used, and to identify the key issues that must be considered as we look towards developing a core set of indicators that can be applied at European scales. The literature review was underpinned by the results of a questionnaire survey of ELCAI participants (see Annex IV for details). They were asked to report back on the current situation in their country or region, and to reflect on the appropriateness of the various conceptual approaches to indicator design.

5.2 Landscape indicators and policy: the state of the art

A review of recent literature relating to the development and application of landscape indicators suggests that there is considerable diversity both in the way landscape is conceptualised and represented in terms of an indicator or set of indicators. This review demonstrated that there is – quite naturally – a close link with the types of factors which determine LCA typologies and mappings as identified in Chapter 3:

- the physical form and functioning of the landscape (the 'biophysical');
- the human influence on the landscape form (the 'cultural');
- the human experience of the landscape (the 'perceptual and aesthetic'); and
- the opinions and expressions of stakeholders.

In essence, these factors can be divided into two main categories, namely the 'object'-driven typologies and the 'perception'-driven ones.

5.2.1 Landscape as an object

At one extreme, some studies represent landscape more as an 'object', that is in terms of the physical arrangements of various types of feature. Thus in the landscape ecological literature 'landscape' is often defined in terms of the structure and pattern of a land cover mosaic and its relationships with physical and biotic elements such as terrain, geology, soils and vegetation, and cultural factors associated with people's use and management of the land over time. Landscapes are represented as a heterogeneous area over which the patterns of association of the various elements exhibit a repeated and consistent pattern.

Examples of more 'object' based approaches are provided by policy focused applications such as EnRisk (Delbaere 2005), which has proposed several measures that can be used to identify risk zones for European landscapes. The landscape indicators proposed include:

- landscape diversity;
- landscape coherence; and
- landscape openness and closedness.

Each can be calculated by making a spatial analysis of the patterns exhibited by the various components of land cover across an area of interest. Elsewhere, other types of structural measures have been used to look at change in the fragmentation of open space on an annual basis in Belgium, and change in specific cover types, such as forest.

5.2.2 Landscapes and perception

In addition to the 'object' based approaches described above, other commentators argue that while landscapes have distinct structures, the representation of landscape also depends fundamentally upon understanding the perceptions of people. For example, 'Landscape' according to the European Landscape Convention means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors. Such definitions take the notion of landscape beyond that of something that can be described 'objectively' in terms of physical structures, for once we extend the idea to include the perceptions of people, we have to confront the fact that different people or groups may perceive the same landscape in different ways, and that even for a single person or group, perceptions may change over time. If 'landscape' is defined as 'what is in the eye of the beholder', then we enter the realm of more subjective, value-based judgements which are often more difficult to measure.

Many examples can be found to illustrate how perceptual or value-based aspects of landscape have been used to develop indicators. In the Netherlands, for example,

Hoogeveen *et al*. (2000) has reported on the outputs of the MKGR Project, which has sought to monitor the quality of the green environment. The study which reported indicators at the municipality scale, included measure of 'landscape experience'. Elsewhere, in the UK, the Countryside Agency (Countryside Agency 2005) have published the results of a recent study that has developed a new approach to mapping tranquillity in different landscapes, based on participatory appraisal techniques. This work is of particular interest because it represents a move away from the more structurally based approaches to tranquillity mapping, based on the proximity to different sources of potential disturbance, that have been criticised by a number of workers (e.g. CAG Consultants, 1998), to an analysis of based more directly on people's views about the countryside.

5.2.3 Indicator typologies

The object- and perception-based approaches described above should not be thought of as alternative and opposing approaches to indicator construction, but rather as complementary ones. Each seeks to capture a different aspect of what is universally acknowledged as being a complex idea – namely that of landscape. Faced with the diversity of approaches that exist, many have therefore sought to develop general frameworks to typologies of indicators that describe the different type of measure that can be developed.

The most widely used indicator framework is the so-called 'DPSIR' model initially proposed by OECD, which seeks to characterise indicators according to whether they are used to characterise the dynamics of some 'driver', 'pressure', 'state', ' impact' or 'response' variable (Table 5.1). Examples of indictors based on this framework are illustrated by two of the measures proposed by the European Environment Agency's as part of the IRENA Project.

As its name suggests, the IRENA 'landscape state indicator' is a state indicator according to the DPSIR model, based on the landscape parameters of parcel size, linear features and crop variation. It is intended that it should be used to help people understand the differences in structure of the agricultural landscape across Europe and how, potentially they change over time. In contrast the proposed 'landscape diversity indicator' is intended as a tool for measuring the impact of agricultural land use change on landscape, according to the changes in the variety of land use in a given area. In both cases it is proposed that the indicators should be calculated for area-specific, biogeographic and agro-cultural units.

Although the DPSIR model is a useful one for describing different types of indicator according to their place in some supposed chain of causation, it does not easily accommodate the different ways in which landscape is described and used, and other indicator typologies have been proposed. For example, recognition of the importance of the difference between the object- and perception-based approaches to indicator construction led ad hoc working group of the Statistical Office of the European Communities on Landscape Indicators (Eurostat 1998) to suggest that landscape indicators should be categorised on three contrasting levels, namely:

- Level 1: comprising of indicators based on statistical data relating to the occupation of the land (e.g. the proportions of agriculture, forestry, semi-natural or built-up land in an area);
- Level 2: comprising indicators based on patterns and land use/land cover trends (e.g. the degree of fragmentation, diversity, importance of linear features and trends over time); and
- Level 3: comprising indicators that seek evaluate the quality of the landscape and its impact on the perception of the observer.

The conclusions were based on the results of a questionnaire survey to Member States (see Annex IV for details). It was argued that while there was general agreement about the measures that fell within the first two levels, with those in the first being better developed than the second, for the development of indicators at Level 3, something of a 'quantum leap' in methodological development was required. It was argued that it is this level which has to be studied in greater detail in order to develop indicators which allow an objective characterisation of the landscape, taking account of the cultural diversity of the various countries.

A similar conclusion was drawn by the more recent OECD study, reported by Dramstad and Sogge (2003), which suggested a four-fold grouping of landscape indicators for assessing agricultural impacts on landscapes (Table 5.2), namely those relating to landscape structure, function, management and value.

The structural measures identified in the 2003 OECD typology study largely comprise those identified by the first two levels in the Eurostat (1998) document. The new elements of this scheme make more explicit the difference between the structural aspects of landscape and its uses or functions (such as for recreation, biodiversity or agricultural production) or its management (e.g. actions related to various policy objectives). The notion of 'value' envisaged by Dramstad and Sogge (2003) largely corresponds to the indicators at Level 3 of the Eurostat (1998) classification, in that their construction depends on the response of people. However, it is also clear that the OECD scheme takes these perceptual measures beyond elements that seek only to describe the way the landscape is experienced (e.g. in terms of 'tranquillity', 'openness' or 'naturalness') to include a monetary measure of the importance of that landscape to various types of users. As with the earlier study by the SOEC, the 2003 OECD Working Group also

TABLE 5.1. OECD 'DPSIR' Indicator Model.

- **Drivers** e.g. Policy ~ CAP
- **Pressures** e.g. Agricultural change ~ abandonment
- **State** e.g. Characteristic elements ~ woodland cover
- **Impact** e.g. Change in character ~ change in biodiversity
- **Response** e.g. Agri-environmental payments

TABLE 5.2. OECD typology of landscape indicators.

Indicator group	Examples
Structure	Woodland pattern, fragmentation
Function	Recreation, biodiversity
Management	Agri-environmental payments
Value	Willingness to pay

conclude that indicators that seek to describe or measure the value of landscapes are as yet the most poorly developed. Dramstad and Sogge note that while there has been significant advance there is still "…. a skewed distribution in terms of the indicators developed" (Dramstad and Sogge 2003. p.6), with a considerable emphasis on indicators of landscape structure rather than those covering the other aspects of landscape that are important to people.

As in the case of the differences in approach that have been generated by the object- and perception-based approaches to landscape, existence of different indicator typologies should not be viewed in terms of competing and alternative models. Rather the diversity of view reflects more the specific contexts in which different assessments are set. This shows that in many cases, practitioners did not feel it necessary to represent their indicators in terms of any particular typology, or to describe in any depth how 'landscape' as an underlying concept was understood. Moreover, while all of the assessments seek to represent 'landscape', the particular measures selected vary from study to study, and there appears to be little agreement about what might constitute a core set of indicators that capture the fundamental aspect of landscape.

Faced with the situation that there currently appears to be no common approach to the design of landscape indicators across Europe, or any agreement about any set of metrics that definitively can be taken as representing landscape, this ELCAI project has gone on to examine the question of what types of measure might be selected when we are faced with the task of monitoring the landscape implications of a given set of policies. Our results and recommendations can best be described in terms of two key ideas, namely the way in which indicators are referenced spatially or geographically, and the way in which they relate to the more general notion of 'landscape character'.

5.2.4 Landscape indicators as spatially explicit measures

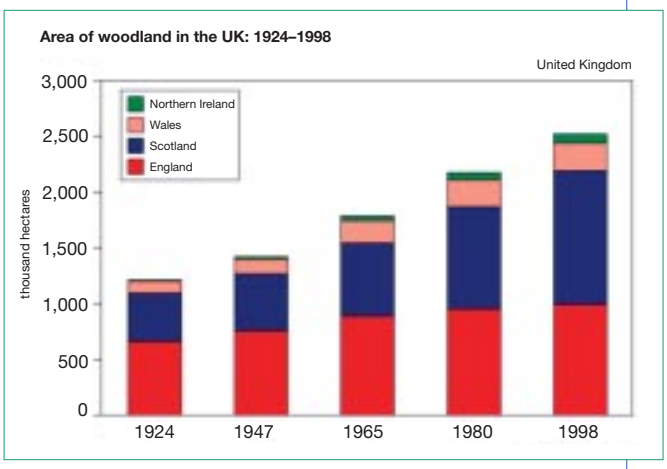
In order to help clarify the issues surrounding the development of landscape indicators, a key question that has been examined in this part of the project is the extent to which such indicators should be spatially explicit; that is the extent to which they refer to a specific set of places or areas. The reason why this question is important is that while the notion of landscape may cover many different types of theme or attribute, ultimately such measures have to be referenced to some locality or set of localities if they are to help us understand the implications of change at the landscape scale. In fact, the property of being spatially explicit seems to capture one of the most important ideas that is embodied in the landscape concept, namely that it is essentially an area in which we can recognise a repeated and consistent pattern between of various landscape elements, that can be used to distinguish these units from all others. This notion applies whether those landscape elements are based on the recognition of 'objects' (e.g. woodland blocks or linear features) or perceptual elements (e.g. tranquillity).

The importance of the link between landscape indicators and some explicit spatial framework can be illustrated by reference to Figure 5.1, which shows the change in woodland cover in the UK between 1924 and1998. The indicator is taken of the suite of indicators of sustainable development, and has been used by UK Government to monitor policies that promote increasing woodland cover (Department of the Environment 2000).

Although woodland is clearly an important landscape element and a general increase in forest cover would have important landscape implications, as it stands the measure shown in Figure 5.1 is best regarded as a general environmental indicator because it does not reference the change to any particular (i.e. explicit) landscape type. Rather, it deals with woodland change in four general administrative regions, each of which contain many different types of landscape. Thus, while such measures are helpful in monitoring policies at one scale, the implications of woodland change in different landscapes cannot easily be judged. We know, for example, that while an increase in woodland would be beneficial in some areas, where cover had been lost as a result of recent land use change, whereas large scale planting in other areas would fundamentally undermine the historical and cultural aspect of these landscapes.

In order to test the proposition that a landscape indicator must be spatially explicit, that is be designed to refer to the conditions of a particular landscape or set of landscapes, a questionnaire survey was undertaken across the members of the ELCAI consortium. The aim was to find out how many of the landscape typologies identified in the Scientific Review (Chapter 3) had been used as a spatial framework for indicator construction,

FIGURE 5.1. Example of an environmental indicator.
(Source: The Forestry Commission)



what other types of spatial framework had been employed in the design of landscape indicators, and what general agreement there was amongst practitioners that a fundamental property of landscape indicators was the way they were referenced to explicit landscape units.

The material presented in Table 5.3 notes the type of landscape measure, its geographical coverage and the spatial framework (i.e. mapping unit) used. The data were derived from the questionnaire material generated by this part of the project (see Annex IV/A) and our wider review of other studies. The insights gained were supplemented by the results of an earlier questionnaire survey made as part of Work Package 1, which asked ELCAI members to identify any indicators that had been linked to the typologies they described, and how they linked to the DPSIR and 2003 OECD typologies (Annex IV/B).

TABLE 5.3. Landscape indicators in European countries and Europewide. (Sources: **bold** = ELCAI Partner questionnaire, otherwise literature review).

Country	Indicator(s)	Coverage[1] and Mapping Unit	Source
Austria	Area and quality Quality of targeted habitats (edge length and density of ecological infrastructure)	Tyrol (for certain landscape types) C (Cultural Landscape Types)	
Belgium	Increase of Built-up Area and fragmentation of open	Flanders Region (?)	Flanders Environment Report
Czech Republic	Defoliation of Forests Natural condition of forest growth Historical Land use Anthropogenic transformation of landscape and its aesthetic value	C C (41 natural forest units) C (cadastral units, district, regions) C (9 basic landscape types)	
Denmark	Land Use types	C (municipalities)	
Finland	Edge density of field margins Change in openness of ls Tourism accommodation Building permits	C (counties)	NINJOS/OECD (2002, 108 ff)
France	Length of planted hedgrows per annum	Brittany (NUTS 3)	
Greece	Land Cover Land Use Land Values	C (administrative units)	NINJOS/OECD (2002, 130 ff)
Hungary	Land use change Growth of forested area	C (Hungary) C (national, regional)	
Ireland	Woodland/Forest area Visual Landscape Impact	C (county) C (viewshed basis)	Indicative Forestry Strategy Draft Wind Energy Guidelines
Netherlands	Landscape heterogeneity and connectivity Change/genesis Landscape Change of landscape type	C C C	
Norway	See Table 5.4, this report	C (counties)	
Portugal	No questionnaire provided		
Spain	No questionnaire provided		
Switzerland	Indicators based on stock and quality of area and linear landscape features	C (cantons)	http://www.umwelt-schweiz.ch/buwal/shop/files/pdf/phpNUNM56.pdf http://www.umwelt-schweiz.ch/buwal/shop/files/pdf/phpXMd08b.pdf
United Kingdom (England)	Landscape character – physiography – land cover – cultural pattern	C (159 character areas for England)	www.countrysidequality counts.org.uk
European Scale	Landscape coherance Openeness/closeness Landscape Diversity Landscape state	European Landscape Classification	EnRisk EnRisk EnRisk/IRENAw IRENA

When respondents were asked as part of the questionnaire survey (Annex IV/A, Question 1) to describe any landscape indicator that had been used on a policy context, a number of examples were identified. Table 5.3 shows, that in terms of the types of spatial unit used to represent them, it was apparent that they range from administrative units (e.g. state, region, municipality or forest district), abstract geometric units (e.g. 1km x 1km grid squares) through to units that are more clearly delimited in terms of their biophysical or socio-cultural characteristics (e.g. 'eco-districts', natural forest areas, or Landscape Character Areas). Although most of them are therefore spatially explicit, they are more like the example shown in Figure 5.1, in that they refer to areas that are unlikely to constitute a single 'landscape' type within which there is some degree of internal homogeneity or unity. Thus interpretation of the implications of change in the indicator for conditions on the ground may be difficult or ambiguous.

When asked to identify which of the indicators had been used in the context of a specific landscape typology (Annex IV/ A, Question 2), many fewer examples were provided. Belgium, Denmark and Germany, for example, reported none, even through the more general question about the use of landscape indicators in a policy context had revealed that for the first two, at least, landscape indicators had been constructed. In both cases the measures appeared to be reference to an explicit spatial framework, but one which was less clearly tied to variations in landscape structure than the other examples identified.

One of the most sophisticated uses of a landscape typology as a spatial framework for constructing a suite of landscape indicators was the '3Q' Project reported from Norway (see Table 5.4, and Annex IV/A). Here a set of landscape formed part of a larger suite of measures designed to establish a baseline that could be used to monitor landscape changes in agricultural landscapes – with the aim to establish whether agro-environmental policies have desired effects (Puschmann *et al*. 2004). The landscape units that provided the spatial context for the indicators were the set ten agricultural landscape

TABLE 5.4. Variables reported from the Norwegian 3Q monitoring programme.

Theme	Subject of interest	Reported variable
Spatial structure - landscape	Land type	Area of each type
	Fragmentation of different land types	Average size of coherent units; Total units per km^2
	Landscape diversity	Shannon's diversity index
	Landscape heterogeneity	Heterogeneity index (HIX)
	Edge types	Length of each type
	Water edges	Length of different types; Area of different land types in 10m-buffer zone
	Buildings	Number per land type; Percent on each land type
Spatial structure - agricultural land	Land type (level III)	Area of each type
	Fragmentation	Number and size of fields
	Diversity of agricultural land types	Shannon's diversity index
	Field shape	Area weighted average shape index
	Field edge types	Length
	Linear elements on agricultural land	Number; Length
	Non-crop islands in agricultural land	Number; Percent of different types
	Point objects in agricultural land	Number; Percent of different types
Biodiversity [a]	Diversity of habitats	Shannon's diversity index
	Abundance of farmland birds	Number of species, numbers of individuals
	Distribution of farmland birds	Percent of sample squares in different regions where selected species are present
	Diversity of vascular plants	Number of species, Shannon's diversity index
	Distribution of vascular plants	Percent of sample squares in different regions where selected species are present
Cultural heritage	Historical buildings	Number
	Cultural heritage features and sites	Number, land use around features of different types, visibility of features
Accessibility	Access routes	Length; Percent of different types
	Connectivity	Gamma-index
	Disturbance from roads and built-up areas	Area within 100 m distance intervals; Percent in each distance interval
	Accessible land	Area accessible for three mobility groups; Percent area accessible to the three mobility group

a The landscape metrics listed under the theme of 'spatial structure' are also used as indicators for the biodiversity theme. Bird and plant indicators were not reported in the county reports since these started as research projects rather than part of the monitoring programme. However, these indicators will be included in future reporting.

regions identified at the national scale, defined in terms of the conditions they impose on farming. These national units were formed by the aggregation of 45 landscape regions, which were themselves based in a set of 444 smaller sub-regions.

In terms of the extent to which landscape indicators are designed to be spatially explicit, it is apparent from our review that they are, although the nature of the spatial referencing system varies from study to study. Given the way in which statistical data are generated it seems inevitable that landscape indicators will continue to be constructed across sets of administrative units rather than 'real' landscape types, and it could be argued that ultimately such measures are valuable, because they have a close link to the management structures through which policies are implemented on the ground. However, to be useful these indicator frameworks must provide some understanding of the sensitivity of landscapes within the unit to change in the indicator variable if these measures are to be informative. The indicators constructed must be sufficiently sensitive or reliable to distinguish one area from another and to track their different trajectories over time. In order to explore how this might be achieved Work Package 5 went on to examine the general concept of landscape character and the potential use of indicators of landscape character.

5.2.5 Landscape indicators and indicators of landscape character

As noted elsewhere in this Report 'landscape character' is defined as a 'distinct and recognisable pattern of elements in the landscape that makes one landscape different from another….' (Swanwick and Land Use Consultants, 2002), while 'characterisation' is simply the process by which we identify and describe areas of similar character, and go on to classify and mapping them. Such ideas have been developed, stimulated as a result of an extensive body of work in the UK in the 1990s that developed in response to efforts two decades earlier, which sought to evaluate landscape.

The goal of landscape evaluation is to identify what makes one landscape 'better' or 'worse' than another. The development of rigorous evaluation techniques had, however, proved contentious in the 1980s and so workers sought to separate out tasks of classification and description from that of evaluation. The aim of landscape classification and description, it was suggested, was to identify what makes one landscape 'different' or 'distinct' from another, which was quite different from that of assigning relative values. As a result of such work, a systematic process of classification and description known as 'Landscape Character Assessment' has been developed (Swanwick and Land Use Consultants, 2002).

As part of the brief for this Work Package, we examined the conceptual basis of landscape indicators in more detail by exploring the question of what more is added to the notion of a landscape indicator by linking it to the idea of landscape character. We have asked: Are indicators of landscape character different, from landscape indicators, and if so what role might they play in wider policy applications?

Our review starts from one of the most basic tenets of the 'landscape' concept, namely that landscapes are normally defined or delimited in terms of set of repeated and consistent pattern of elements. Although the idea of 'landscape character' merely builds on this, the concept takes it further in that we attempt to make it *explicit* what these patterns are from a given perspective. This perspective is usually a socio-cultural one, although increasingly it be becoming recognised that landscape characterisation techniques can be used to provide a range of different 'views' of the landscape. This 'Historic Landscape Character Assessment' is now recognised as a distinct by complementary type of exercise to the more general Landscape Character Assessment. Urban Character Assessment appears to be emerging as another (see Swanwick and Land Use Consultants 2002).

Thus one could argue on the basis of recent developments in the literature, that while a landscape indicator is an environmental indicator that has some explicit reference to a prescribed set of landscape units, an indicator of landscape character is a measure that is not only spatially explicit, but also one that is referenced to some shared but abstract understanding of the perceived patterns that may each landscape unit 'locally distinctive'. Landscape indicators therefore tell us something about how the individual elements or features that define landscape change over space or time. Landscape character indicators are, by contrast, somewhat more holistic, in that they can help us to understand how such changes modify or transform the combined patterns of all the elements of landscape, that given an area its 'sense of place'.

In order to test this proposition, a further question was included in the survey of ELCAI partners, to understand how they viewed the idea of landscape character and its role in indicator construction (Table 5.5, and Annex IV/A, Question 3). In general it was *agreed* that the distinction between the term 'landscape indicator' and 'indicator of landscape character' was a reasonable one to make (Question 3i), although only a few examples could be identified to illustrate the construction of an indicator based on notions of character (Question 3ii). In fact, responses showed that there was considerable *disagreement* about the extent to which any single measure could be used to represent landscape character (Question 3iii). Two national applications, one from the Netherlands[4] (the NLI Project) and other from the UK[5] (Countryside Quality Counts) specifically used ideas about landscape character to explore issues of environmental quality issues. The latter specifically sought to develop an indicator of overall character that could be used at national scales.

4 www.meetnetandschap.nl
5 www.countryside-quality-counts.org.uk

TABLE 5.5. Summary of partner positions on role of landscape character concept in indicator development.

Question	Austria	Belgium	Czech Republic	Denmark (I)	Denmark (II)	Germany (I)	Germany (II)	Hungary	Ireland	Netherlands	Norway	Switzerland	UK
i) Is the distinction between landscape indicators and indicators of landscape characters suggested above one that you would agree with?	Yes(Q)	Yes	–	Yes	Yes	Yes	Yes	Yes(Q)	Yes	Yes(Q)	Yes	Yes	Yes
ii) Given the definition of landscape character outlined above, can you identify any specific examples of the construction and/or use of such an indicator at local, national, regional or European scales?	No	No	No	No	No	No	Yes	Yes	No	No	No	Yes	Yes
iii) Given that landscape character is defined in terms of the perceptions of people, do you feel that there is scope for constructing a map of landscape character as opposed to landscape types the European scale?	Yes(Q)	No	No(Q)	No	No(Q)	No(Q)	Yes(Q)	No	No	No	No	Yes(Q)	Yes
iv) Would such a map have scientific or policy relevance at the European Scale?	No	No	Yes(Q)	Yes	Yes(Q)	Yes(Q)	Yes(Q)	No	Yes(Q)	Yes(Q)	Yes(Q)	Yes	Yes
v) From your experience of using the various landscape typologies reviewed by WP1, do you feel that their application is limited in any way by the fact that the units are unrelated to people's perceptions of what makes or distinguishes a landscape?	No(Q)	No	Yes(Q)	No	Yes(Q)	Yes(Q)	No(Q)	_	Yes(Q)	Yes(Q)	Yes(Q)	Yes(Q)	Yes
vi) From your experience of using the various landscape typologies reviewed by WP1, do you feel that their application is limited in any way by the fact that the units are unrelated to people's perceptions of what makes or distinguishes a landscape?	Yes	Yes	Yes	No	No(Q)	No	Yes	Yes	Yes(Q)	Yes(Q)	No(Q)	Yes	Yes

Q = qualified (in a sense that there were reservations)

From the analysis of the survey results it was clear that for many the question of whether variations in landscape character could be mapped was often conflated by respondents with the issue of whether indicators of change in overall character or important aspects of character could be constructed. While many agreed that mapping could be achieved, fewer though that holistic indicators could be built.

The dilemma between the requirements of mapping and indicator construction is perhaps best illustrated and explained by reference to the Countryside Quality Counts Project in the UK, in which an indicator of change in landscape character was constructed (Haines-Young *et al*. 2004). In this application, the overriding policy issue was to identify where landscape change was occurring at national scales (England) and determine whether these changes mattered. The study used a map of Countryside Character Areas to provide the spatial framework for indicator construction, and their associated descriptions to understand the context in which change in the key elements that defined character could be judged. Thus by looking at how individual elements of landscape, such as woodland, boundary features, agricultural land cover, settlement and development, semi-natural habitats, historic elements and river and coastal features were changing over time, those character areas where the existing character of the countryside was being modified or transformed in a significant way could be identify.

The key message from the UK study for ELCAI, is that the existence of a systematic characterisation of the landscapes provided the contextual information that was required in order to interpret the significance of the changes shown by a given landscape indicator, in terms of what made those specific landscape distinctive from other areas.

Thus despite differences of opinion amongst ELCAI partners, the distinction between landscape indicators and indicators of landscape character appears to be a useful one, because it emphasises the importance of understanding the landscape context in which the significance of changes in an indicator can be judged. Landscape characterisation is an important adjunct to the development of landscape indicators because it provides an assessment framework within which the implications of change at the landscape level can be judged. In other words it allows us to meet the challenge

set down by the Eurostat (1998) to develop indicators at their 'level 3', namely to attempt 'an objective characterisation of the landscape, taking account of the cultural diversity of the various countries'.

The importance of developing the kinds of contextual understanding that landscape characterisation provides was in fact recognised in the survey of ELCAI partners. As summary Table 5.5 shows (see also Annex IV/A, Question 3), most felt that, despite some qualifications, a mapping of landscape character at European scales would have policy relevance. For example, the respondent from Belgium argued that a map of landscape character at European scales would 'highlight the huge variety of landscapes throughout Europe'. In addition, it was also suggested that it would 'serve as a spatial reference for region specific policies (CAP and rural development)' and help us understand 'regional 'identity' as the starting base for sustainable development'. The response from the Netherlands argued that a 'landscape character map can be used to combine region specific scientific thresholds (e.g. environmental) and policy targets.'

When asked (Table 5.5, question iv, and see also Annex IV/A) if the development of indicators of landscape character would help to overcome some of the problems associated with the use of the more bio-physically based landscape typologies identified in Work Package 1 the majority of ELCAI respondents felt that they could be helpful, although fewer thought it could be done at European scales. The exploratory study of Hunziker and Kienast (1999) has shown, however, that pattern indices derived from the analysis of photographs can be used as a tool for mapping people's assessment of natural beauty in a test region in Central Europe – thus some rapid assessment might be possible.

5.3. Landscape indicators and indicators of landscape character at European scales: prospects and recommendations

This Work Package has examined the conceptual basis of landscape indicators and their recent development in Europe through an analysis of the 'state of the art' based on a literature review and a survey of ELCAI partners. Two broad conclusions can be drawn from this work that provide the basis for our recommendations about how landscape indicators and indicators of landscape character and be used as policy tools at the European scale.

The first conclusion that can be drawn from this part of the project is that although there is a considerable diversity of approach, landscape indicators can be developed at local, national, regional and continental scales that have policy relevance. These measures can properly be described as 'landscape indicators' because that they can be linked to spatial frameworks that give them meaning in terms of the way they describe the biophysical and socio-economic pattern and process that distinguish one place from another. For future work, we therefore recommend that when policy applications require that the landscape dimension is included, the design of the indicator is based on consideration of *two* factors, namely:

i) *what aspect of landscape is to be assessed*, that is does it relate to the structural, functional, management or value aspects of landscape, or does it describe the drivers or pressures of landscape change, states, impacts or policy responses; and
ii) *what relationships exist between the indicator and the spatial framework across which variations over time and space are assessed?* These spatial units should have some explicit relevance to landscapes in that they should allow us to understand how the indicator relates to the distinctive properties of specific and prescribed areas at whatever scale is relevant to the policy question at hand.

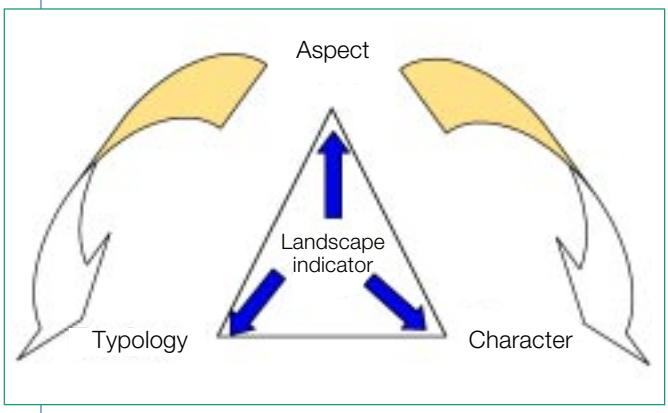
Based on the analysis of current approaches, the most informative type of landscape indicator are therefore those which are *spatially explicit*, in that they inform us about the properties of landscape units that have some biophysical and/or socio-economic integrity. *Thus the link between the indicators discussed here and the various landscape typologies reviewed in the Scientific Review (Chapter 3) is an important and fundamental one.* Our survey has shown that although some progress has been made in using these typologies as frameworks for indicator construction, much more can be done to exploit what these classifications can tell us about landscape, and to provide a *context* in which the changes depicted by our landscape indicators can be understood.

The second key conclusion that emerges from this study concerns the need to establish the contextual framework in which landscape indicators are interpreted. Our work has shown that although there are different interpretations of the concept of landscape character, there is general agreement amongst practitioners that holistic understandings of what makes one landscape distinct from another, and which gives these landscape their 'sense of place', are useful. Thus the link between indicator construction and Landscape Character Assessment emerges as a second consideration that when policy applications require that the landscape is taken into account. Figure 5.2 therefore summarises the fundamental conceptual dependencies that emerge in the construction of landscape indicators.

In this study we have found that although some have attempted to construct indicators of landscape character that seek to capture the more holistic properties of landscape, conceptual frameworks are not sufficiently well developed at present to attempt this at European scales. However, considerable progress could be made if existing landscape classifications and typologies at European scales could be augmented through a process of character assessment so that the properties of the spatial units used to represent the indicators are better understood. Landscape characterisation could provide a systematic approach to the construction of the contextual framework in which landscape indicators gain meaning 'on the ground'.

Given the current 'state of the art', a feasible approach to the construction of landscape indicators at the

FIGURE 5.2. Dependencies between landscape metrics, landscape typologies and Landscape Character Assessment.



European scale can be identified by reference to the final set of survey results collected as part of this work package.

ELCAI partners were asked (Annex IV/A, Question 4) to review the rationale for the three landscape ENRISK indicators (openness, coherence and diversity) and two IRENA indicators (state and diversity), together with the practicalities of developing them the European scales, and in particular the opportunity offered by the spatial framework of the European Landscape Classification (LANMAP2, see Work Package 4 for full description).

Respondents generally felt (Table 5.6) that as landscape indicators at the European scale, the rationale for the ENRISK indicators was more secure than those of IRENA, and that, despite some qualifications, it was feasible to develop such measures at European scales, given the availability of CORINE land cover change data. Linking these finding with those of the other sections of the survey it is clear that while such an exercise is technically feasible interpretation of the significance of change in the ENRISK indicators by the spatial units of LANMAP2, would be difficult, unless the latter were supplemented by some kind of broad character assessment that described what coherence, openness and diversity mean for each of the major landscape types. For example, the respondent from Switzerland argued that while the 'coherence' indicator was a useful one, it would be problematic to use in the absence of a sophisticated perception study that helped us understand what is mean by 'natural'.

The landscape classification represented by LANMAP2 is presently based on four parameters, namely climate, topography, parent material and land cover. Work Package 4 concludes that it would be valuable to extend the range of parameters used to include soil types, precipitation and the natural potential vegetation. The implication of this result is that in the medium term the typology will remain essentially one based on biophysical parameters. In the absence of a stronger cultural component, it is therefore unclear to what extent such typologies are able to fully represent real landscapes if we view them in terms of the European Convention as areas '… perceived by people, whose character is the result of the action and interaction of natural and/or human factors'. *The development of a more explicit cultural dimension to these typologies is, we recommend, a high priority for future work.*

A focus on biophysical parameters as the basis for constructing pan-European landscape typologies is inevitable, given the range of data that are available at these scales. These typologies can still be used as a framework for indicator construction and interpretation, however, if Landscape Character Assessment techniques are used to describe more fully the features that make them distinctive and therefore the context in which a particular set of landscape indicators must be viewed. Recent work, such as the study on *European Transfrontier Landscapes* (Wascher and Pérez-Soba, 2004), illustrates how that this can be done.

The *Transfrontier Landscapes* study was selective in that it identified a set of case study areas through which the

TABLE 5.6. Review of ENRISK and IRENA indicators made by ELCAI partners. Q = qualified (in a sense that there were reservations)

	Enrisk 1 (coherence)		Enrisk 2 (openness)		Enrisk 3 (diversity)		IRENA 32 (state)		IRENA 35 (diversity)	
Country	rationale	feasability	rationale	feasability	rationale	feasability	rationale	feasability	rationale	feasability
Austria	Yes (Q)	Yes (Q)	Yes	Yes	Yes (Q)	Yes	Yes	Yes	Yes (Q)	Yes
Belgium	Yes		Yes (Q)	Yes (Q)	Yes (Q)	Yes (Q)	No		Yes	
Czech Republic	Yes (Q)	Yes	Yes	Yes (Q)	Yes	No (Q)				
Denmark (I)										
Denmark (II)										
Germany (I)	No	No	Yes	Yes	Yes	No	Yes	No	Yes	No
Germany (II)	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes	No
Hungary	Yes (Q)	No	Yes	Yes	Yes (Q)	Yes	No (Q)	Yes	Yes	No
Ireland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Netherlands	Yes	Yes	Yes	Yes	Yes	Yes				
Norway										
Switzerland	Yes	Yes	Yes	Yes	Yes	Yes	Yes (Q)	Yes	Yes	Yes
UK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No

particular issues affecting transfrontier landscape could be considered. The work was nevertheless general, in the sense that the delimitation of these areas was based on the pan-European classification of LANMAP2. The information contained in this map was however, enriched by developing for the case study areas, a rich body of landscape contextual information that enabled their individual and distinctive characters to the understood. Through such characterisations one could begin to develop an understanding about where issues related to changes in, say, openness or coherence, might be significant, and thus develop the kind of framework in which more general landscape indicators could be designed.

Thus, in order to take forward the process of developing landscape indicators at European scales we recommend that existing biophysical typologies, such as LANMAP2, are used as a framework for making a European Landscape Character Assessment. The character assessment should focus on specific landscape parameters that are presently measurable at these scales (e.g. openness, coherence etc.) and describe how these parameters relate to what gives these units their local or regional distinctiveness. The assessment should specify, for example, where openness is an important property of landscapes, and where its loss would be detrimental to character, or where changes in landscape diversity would undermine traditional land use patterns.

5.4 Conclusions

This study has shown that in conceptual terms, landscape indicators can be thought of as distinct types of metric, providing they are referenced to a spatial framework that maps tracts of land that share a set of common set of structural or functional characteristics. Thus decisions about what landscape parameter to identify as an indicator and the spatial framework over which it is to be mapped are fundamentally linked. Our study has also shown that it is now possible to construct simple indicators that capture properties such as openness and diversity at pan-European scales, and to represent them spatially through Europe-wide landscape classifications, such as LANMAP2. However, our work also suggests that the application of such indicators as policy tools can be increased if these typologies were enhanced by making a character assessment of the major landscape types that they identify. Such character assessments provide the contextual information in which indicator trajectories can be interpreted.