Chapter 12
Bringing It All Together – Taking Care of the Landscape

Abstract The landscape is common heritage, supports the environment we live in and affects our well-being. Several measures are proposed to take care of it. However, the responsibility and competence for landscape management, planning and protection is complex. Landowners have the most important territorial competence to make material changes. Authorities only have the spatial competence to regulate, stimulate and restrict. The landscape is a social and mental construct and users groups value it differently. The insiders and outsiders, academic experts and laymen and various stakeholders have different visions and interests. All have the right to participate in the planning process. Hence, a transdisciplinary approach is mandatory. Landscape planning works only indirectly through spatial and land use planning. Subsidiarity is a basic principle in policy but the spatial competencies of administrations at different scales are often discordant with the landscape structure. Projects planning is likely to threaten the holistic landscape integrity and makes planning at a landscape scale essential. The landscape is an omnipresent holistic entity and has intrinsic value. To allow an assessment, qualities need to be expressed in terms of instrumental values, which can be related to utility and functions, which are expressed as landscape services. Criteria are used to define policy-relevant holistic indicators to follow-up the effectiveness of the measures taken. Some principles to set goals for the landscape are formulated. To enhance, create, restore, protect and conserve the landscape, different strategies for landscape management are possible. However, it is unlikely to predict the future by simply extrapolating from the past and present into an uncertain future. Scenarios can be made considering the probable future outcomes. Exploratory landscape scenarios offer the possibility for a transdisciplinary learning process with the landscape as an integrating concept.

Keywords Integration • Planning • Management • Conservation • Landscape values • Landscape services • Transdisciplinarity • Sustainable development • Monitoring

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12.1 Speaking for the Landscape

The most innovative aspect of the European Landscape Convention is how it places the landscape in the principles of democracy, human rights and the rule of law as defended by the Council of Europe. The landscape is regarded a common good to be shared by all and several measures are proposed to take care of it. The landscape is part of our heritage and supports the environment we live in, it makes our cadre de vie. Taking care of the landscapes is an essential, but a complex and difficult task. Indeed, many simple questions arise, but the answers are not obvious. Following examples illustrate the problem.

The landscape is a common good and belongs to everyone.

- OK. But, who will take care of the landscape?
- Is it? Not in *my* landscape. . ..

There is always landscape, so what?
What is the need for landscape?
Who needs what kind of landscape?
Are you willing to pay for the landscape?
This is urbanised and not landscape. . ..

These questions illustrate different social discourses towards the management of the landscape. Basically, two discourses dominate in the 'social demand of landscape': the landscape as an always-present scene and the landscape as a living environment (Luginbühl 2012). The first one is affected by aesthetic appraisal and makes a division between 'beautiful', 'pure', 'natural' i.e. ecologically sound and 'intrinsic valuable' landscapes, and ordinary 'non-landscapes'. The second discourse relates to the landscape as the environment allowing having a good life, characterised by qualities of utility, such as freedom to use, the way of right, living, and well-being, and offering services accordingly. Clearly, taking care of the landscape depends on the type of landscape one recognises and on the social expectation of its usefulness for the actors involved.

12.2 Who Is Competent?

The landscape is there and for the people. It belongs to all. So who is then responsible and competent for landscape management, planning and protection? Hägerstrand (2001) identified different competencies in environmental politics. He considered what he called the *territorial competence* as the most important one. It is the competence (private or public) landowners possess to make material changes in the land. Authorities as civil services, administrations and agencies only possess the *spatial competence* (unless they are also landowners). Their power lies in regulating, stimulating and forbidding. Hägerstrand called these *symbolic transactions*. Spatial competence can be organised in two ways: (1) by *functional specialisation*,

Table 12.1 Examples of landscape qualities and potentials preferred by insiders and outsiders

Insiders	**Outsiders** (also often valued by insiders)
• The quality of life	• Recreation and tourism
• Local employment production	• Scenic beauty
• Facilities and services	• Biodiversity and environmental services
• Memories and associations	• Vicarious consumption of customs and traditions
• The way of life	• Architectural significance of buildings
• Symbols	• Safe food
• Living space	• Natural resources (water, timber, minerals)
• Safety, refuge, defence	• Military training and conquest

Selman (2006)

which leads to sector authorities, and (2) by *geographical integration*, i.e. assigning the authority to a specific territory, such as a nature reserve.

Big and rich landowners possess a great territorial competence and the impact this had on the development of landscapes is obvious from history. Nowadays, landscapes evolve also by non-concerted actions of numerous small landowners, creating highly fragmented and heterogeneous landscapes and causing an uncertain, chaotic future development. Antrop (1998, 2003, 2004b) called this the autonomous development.

Selman (2006) emphasised the difference between insiders and outsiders of an area in landscape planning (Table 12.1). Their evaluation of landscape qualities can be partially similar, but many differences exist as well, resulting in conflicting competencies, interests and different visions to participation.

Landscapes are dynamic and result from interacting processes that determine their structure and appearance. A basic paradigm of landscape ecology, i.e. the continuous interaction between processes and spatial patterns, is essential in planning too (Forman and Godron 1986). It means that policy and planning can steer landscape dynamics in two ways: (1) by acting upon the spatial structures or (2) upon the processes and functioning (which are going beyond pure ecological processes). The actual structures, such as land use, define the state of the landscape. To understand the dynamics, driving forces acting on the local or regional level must be identified. The DPSIR-model (*Driving forces, Pressures, Impacts, States, Responses*) applies here. The landscape is also a social and mental construct and meanings and values of different users groups will influence landscape changes as well.

Different users groups ask specific questions in a planning context (Fig. 12.1):

- Policy makers ask questions as “what if. . ..?”. They demand scenarios and alternatives from which they can choose. Scenarios and alternatives contain a lot of uncertainty and seldom become reality.
- Locals (insiders) ask questions as “will it become better or worse for us?” They are very concerned and certainty about the real changes that are going to happen is the most important.

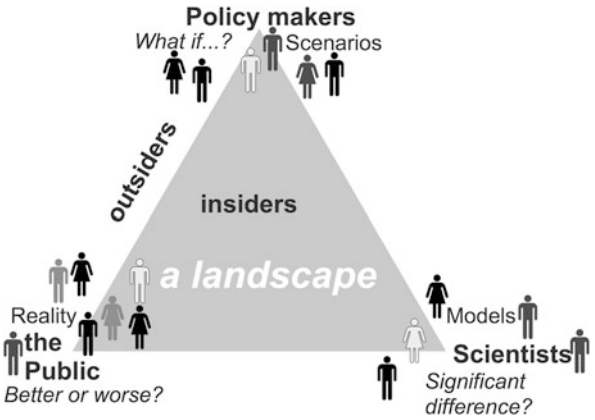

Fig. 12.1 Three fundamental questions in evaluating alternatives in landscape planning and diverse actors, insiders and outsiders

- Scientists ask questions as "is the difference significant?", referring to differences between states, scenarios or alternatives. Models are used to assess this, which can be rather abstract.

Who should participate? The European Landscape Convention states in article 5c that participation includes "the general public, local and regional authorities, and other parties with an interest in the definition and implementation of landscape policies" (Council of Europe 2000). In the Preamble, the Convention refers to the Aarhus Convention of 1998 dealing with public participation in decision-making (UN 1998) and Prieur and Durousseau (2006) argue that "the general public" should be interpreted "in the broadest sense, including individuals regardless of their place of residence". This means that insiders and outsiders have the same rights in participation as well as residents and temporary visitors.

In practice, participation is still too often a pretence and simply informing the public and awareness-raising activities are considered sufficient. According to the general measures proposed by the ELC, each Party should "establish procedures for the participation of the general public, local and regional authorities" (Art.5). However, the ELC suggests that landscape quality objectives should be based on "the aspirations of the public", but are formulated by "the competent public authorities" (Art.1c.). This makes a kind of participation 'by delegation' possible. Anyhow, the implementation of participation varies a lot between countries and situations (Jones and Stenseke 2011).

Although the ELC emphasises the importance of public participation, it is also aware of the problems involved. Thus, it is acceptable that 'competent public authorities formulate the aspirations of the public' (article 1.c), while policy can restrict itself to 'consulting the public concerned' (article 6). This places the onus on policy makers, planners and managers, who need to be properly trained and educated in landscape assessment, as is also suggested in article 6.B.

To solve the issues of landscape planning, a transdisciplinary approach and participation are mandatory (Naveh 2007; Jones and Stenseke 2011). Jones

(2007) justified the public participation in landscape planning on the basis of democracy, legitimacy, information exchange, tackling of conflicts and heterogeneity and social justice. Different types of participation can be recognised, often ordered according to the degree of active participation and transdisciplinary integration. Tress et al. (2005) discuss different forms of participation in relation to factors of success in transdisciplinary landscape planning and management. Also, different levels of participation can be recognised, which was first formulated by Arnstein (1969) as the ladder of participation for citizen engagement. In a later state, social learning was considered as a new policy paradigm in the engagement of citizens in for example natural resource management (Collins and Ison 2006). Zachrisson (2004) formulated following hierarchy in the type of citizen participation in relation to co-management of natural resources (cited by Jones and Stenseke 2011 and based on Arnstein 1969):

1. Informing.
2. Consultation.
3. Co-operation.
4. Communication.
5. Advisory committees.
6. Management boards.
7. Partnership.
8. Community control.

The involvement in taking care of the landscape can be done also in general, without any specific planning project. The European Landscape Conventions rightly stresses the importance of *awareness-raising, training and education* (Art. 6). Jones (2007) discussed different methods of awareness-raising of the public in the context of landscape planning and management, such as exhibitions, photographic documentation, signposted landscape trails and guided walks, (school) field trips, fieldwork by students and the use of media and Internet. Mobile navigation apps and Internet applications such as RouteYou could be added to the list.

12.3 Landscape Planning Is a Spin-Off from Spatial Planning

Fundamentally, 'landscape' is different from 'land' (see Chap. 3). Hägerstrand's territorial competence refers in the first place to land. The material and tangible changes are made here and become apparent in changes of the land cover and land use. This is the domain of physical and spatial planning (Fig. 12.2). Landscape planning can only be done indirectly through spatial planning by those who possess the stimulating and regulating competencies.

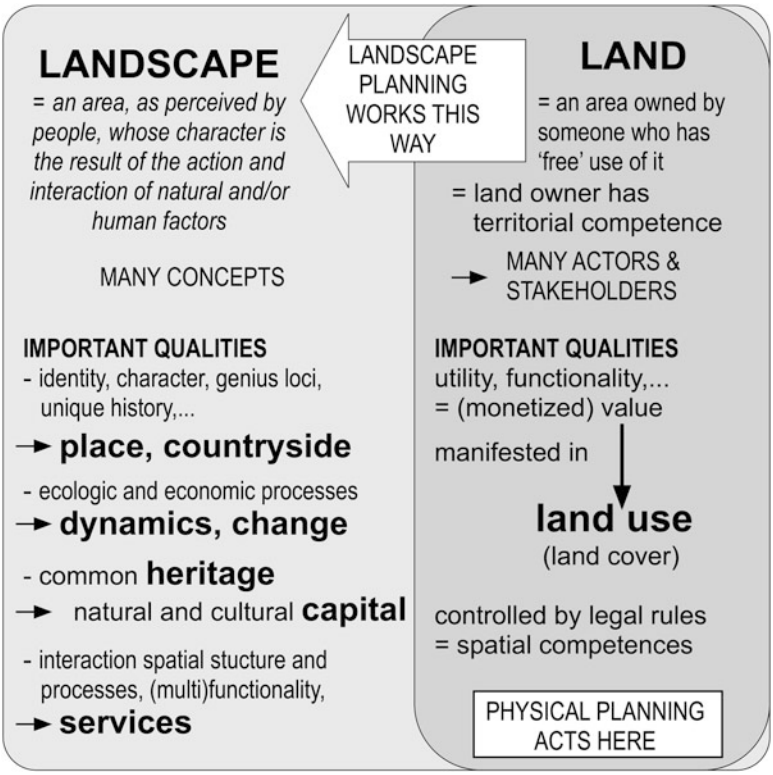

Fig. 12.2 Landscape planning can work only indirectly through spatial planning and land use planning in particular

Landowners and their tenants have the free use of their property and this defines the utility of the land that can be expressed in monetary values. Restrictions on the free use of the land are often experienced as depreciation of its value. The outsiders, 'visitors', use the landscape mainly by its scenic aspects and thus for them, accessibility and the rights of passage are important qualities. Most of the landscape values they assess are intangible and rarely expressed in monetized terms. Maintaining of these landscape qualities is the responsibility of the landowners and the public authorities together. Balancing between the use rights of the landowners and tenants on the one hand and the rights of the public on the other hand is manageable when the number of landowners and tenants to deal with is small. This is the case for the management of vast areas of governmental lands, such as nature parks or large estates. When the land property is fragmented over a large number of small landowners, each exercising their use rights and often in a non-concerted manner, the holistic landscape character is lost rapidly. This is the case in the urbanising countryside with numerous stakeholders.

Landscape and spatial planning are inevitably interconnected. All forms of spatial planning will affect the landscape. One could also say that the landscape

is a constant living test for spatial planning and allows to assess the appropriateness or inconsistency of human practices. Much about this can be learned from the study of a territory's history, in particular relating to a sustainable use of the landscape. In traditional landscapes, natural resources are treated with great care, producing highly sustainable land use of great environmental significance and creating landscapes that are generally appreciated aesthetically. Clearly, the preservation of landscape values is associated with the survival of cultural models that created these landscapes (Bloemers et al. 2010).

12.4 Planning a Complex and Highly Dynamical System

As complex and highly dynamical systems, landscapes change all the time. Without management or planning, landscape changes happen spontaneously in a more or less chaotic manner due to the non-concerted activities by numerous actors. This kind of development is called *the autonomous development* (A in Fig. 12.3). Planning and management aim to steer or control this development. Planning actions are taken to redirect the trend and outcome, e.g. to stop the development A (a in Fig. 12.3), or to make changes to realise another goal (e.g. to goal B). As soon as the plan to achieve this goal is announced, several new developments will emerge spontaneously, some expected, some unexpected and often not desired. There will be a counter-reaction (r) opposing the original plan's goal or actions exploiting unintended opportunities created by the plan (p). This will shift the planning goals in a non-desired direction. The real development B will seldom follow the originally planned direction. At a given moment in time (t), all these developments (B, a, r and p) will exist together and mark the landscape changes in some way. After some time, the decision can be made to adjust the planning goals B and the process will start all over again and finally lead to situation C. When the contextual conditions have changed, a completely new redirection of the planning goals may become necessary, e.g. towards new goals as D. Thus, landscape planning acts step by step. Although the chaotic character of the autonomous development is somewhat controlled by planning actions, it will never be completely eliminated.

12.5 Subsidiarity and Fragmentation

Many planning policies recognise *subsidiarity* as a principle to organise and divide the tasks and responsibilities. In the past, landscape planning was imposed by an elite and specialists, and policy was organised top-down from the national level. Democratisation places the responsibility with each individual landowner and resides the spatial competence at the local level (districts, municipalities) and regional level (regions, counties, provinces and departments). As a consequence,

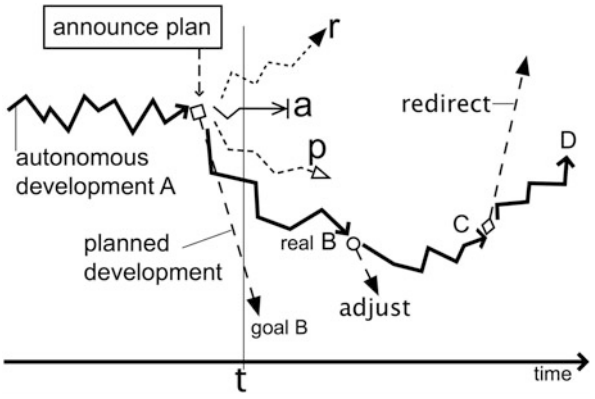

Fig. 12.3 Step-by-step rule in landscape planning (explanation see text)

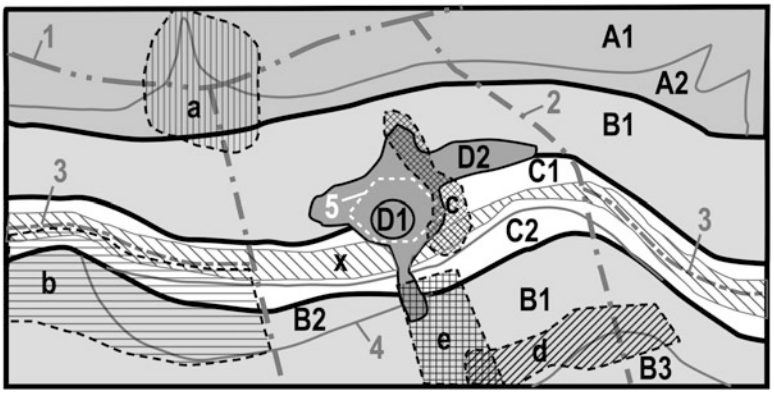

Fig. 12.4 Effect of administrative borders and subsidiary planning on the holistic landscape integrity; A, B, C, D: main landscape units, A1, A2,. . ., D1, D2: landscape types (4: the border of subunits). Administrative borders 1: international, 2: regional, 3: local, 5: administrative limits of the town D. x: regulated area at national level. Spatial planning projects: a: an international cross-border project covering three regional levels, b: a plan at local level partly interfering with a special designated area at national level x, c: a plan of urban renovation covering landscape units within the local authority of the town, d: an interregional planning project, partially transformed by a later local plan e. The hatching of the plans indicates different planning goals

people's involvement becomes more direct. Today, most competencies to change landscapes belong to landholders, local stakeholders and regional authorities. It is significant that in many countries the national and federal governments do not have any direct authority anymore in the matter, which is also the case for example at the EU level.

The spatial zoning of administrative units at different hierarchical levels overlays the spatial pattern of landscape units in a discordant way, and so do different planning projects. The fictive example in Fig. 12.4 shows that the final result will be a fragmentation of the holistic landscape integrity. This is what happens when

policy and planning do not start from the landscape in a comprehensive way and when landscape scale, planning scale and spatial competencies are not coherent. Even when applying all democratic principles of subsidiarity, legal regulations and participation, there is no guarantee that the landscape quality will benefit from the final outcome. More probablematic is that the landscape becomes more diverse and fragmented and less coherent, thus degrading its character and identity.

12.6 Planning at the Landscape Scale – Landscape as Integrating Concept

Protection for conservation purposes is the oldest form of landscape planning. Sites and their landscape surroundings became legally protected mainly for spiritual meaning as genius loci and for its beauty. The Bogd Khan Mountain in Mongolia was legally protected in 1783 by the local government of the Qing Dynasty for its beauty. It is the oldest known protected landscape and was added in 1996 to the UNESCO's World Heritage Tentative List as one of the sacred mountains in Mongolia in the cultural category, which exhibits universal natural or cultural significance, or both.

In the rapidly industrialising society of the nineteenth century, the Arcadian and sublime landscapes became the core of the romantic vision of nature. Inspired by the writings of Alexander von Humboldt, an ecological awareness emerged by many (Wulf 2015). Writers and poets, painters and photographers advocated the protection of the wilderness. Promoters of the new environmental theory such as Henry David Thoreau and John Muir, saw in the wilderness the salvation of the industrialising American society (Schama 1995). The idea emerged of designating natural areas as 'national park'. Yellowstone National Park was created in 1872 as the first "public park or pleasuring-ground for the benefit and enjoyment of the people" and "hereby reserved and withdrawn from settlement, occupancy, or sale" (The Library of Congress 1872). Near the end of the nineteenth century, legislation for the protection of nature and heritage, including the landscape, came into force in most western countries (Van Hoorick 2000).

In most cases, the approach was sector oriented, top-down and based on an expert judgment with little of no participation of the public. Today, landscape planning cannot be restricted to specific sector groups and must be integrated, dynamic, participatory and transdisciplinary. Landscape planning is applying holism for our future landscapes. Paul Selman (2006) called it planning at the landscape scale, which includes planning for and through the landscape.

These ideas are also reflected in following definitions of the European Landscape Convention (Council of Europe 2000):

– *Landscape policy* means an expression by the competent public authorities of general principles, strategies and guidelines that permit the taking of specific measures aimed at the protection, management and planning of landscapes;

- *Landscape quality objective* means, for a specific landscape, the formulation by the competent public authorities of the aspirations of the public with regard to the landscape features of their surroundings;
- *Landscape protection* means actions to conserve and maintain the significant or characteristic features of a landscape, justified by its heritage value derived from its natural configuration and/or from human activity;
- *Landscape management* means action, from a perspective of sustainable development, to ensure the regular upkeep of a landscape, so as to guide and harmonise changes which are brought about by social, economic and environmental processes;
- *Landscape planning* means strong forward-looking action to enhance, restore or create landscapes. (ELC Art.1)

These definitions must be understood within the scope of the Convention, which "applies to the entire territory [. . .] and covers natural, rural, urban and peri-urban areas. It includes land, inland water and marine areas. It concerns landscapes that might be considered outstanding as well as everyday or degraded landscapes." (ELC Art.2).

The landscape concept contains many aspects allowing such integration, e.g.:

- its holistic nature, related to perception and experience, character and identity, scale and hierarchical structure
- its dynamics: the continuous interaction between spatial structure and processes defining its functioning
- sustainability related to concepts as natural and cultural capital, multifunctionality and heritage
- the inter- and transdisciplinary approach: landscape as a social and cultural construction, and as an expression and means of communication.

The landscape is the common ground where different perspectives meet and can serve as an integrating concept (Fig. 12.5). Both insiders and outsiders demand participation in plans concerning a specific landscape. Several disciples have different concepts and methods to study that landscape and need to co-operate at least multidisciplinary, and better in an interdisciplinary way (see Chap. 4). Economic and social sectors defend their proper interests. The policy will have to integrate these with the interests of the public and expert knowledge. Different interest groups, as trusts, are connected in networks defending specific values. Finally, the landscape is the place where regional problems can be solved in transdisciplinary cooperation.

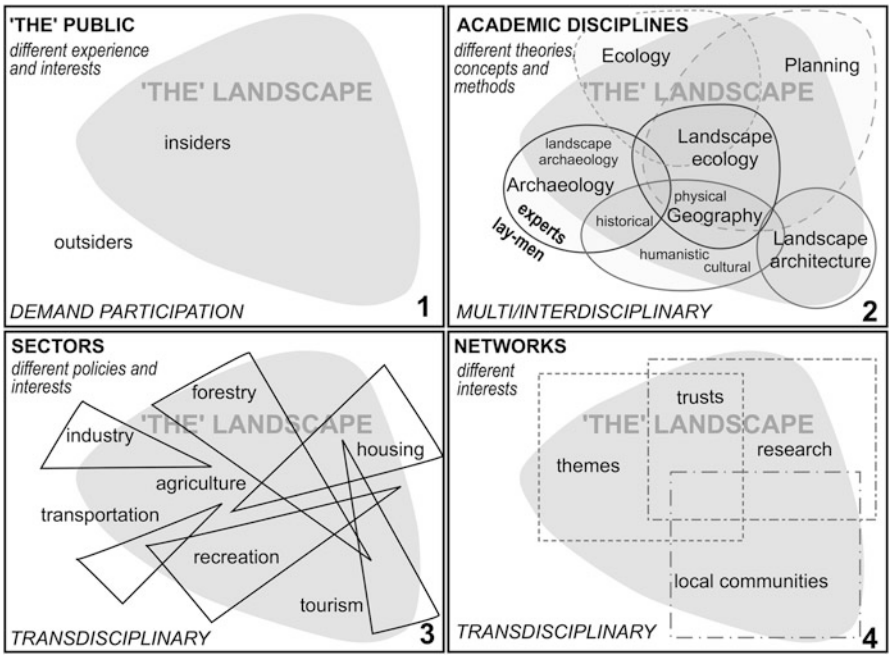

Fig. 12.5 Landscape is the common interest between the public, academic disciplines, economic sectors and social networks and can be an integrating concept

12.7 Landscape Qualities, Values and Services

12.7.1 The Intrinsic Value of Landscape and the Question of 'Right' and 'Wrong'

When land qualities can easily be expressed in monetary terms, this is not the case for most of the landscape qualities. Often these are 'soft' values related to scenery and beauty, or environmental qualities such as quietness. Many of these values have been considered as 'intrinsic' (Antrop 2012). In philosophy and ethics, *intrinsic value* is a property which an object has 'in itself', independent of its appreciation by a perceiver or its utility for some purpose, i.e. it has this value 'naturally' and it can be considered "absolute" or "universal". The debate on intrinsic and extrinsic value goes back to Plato and the ethical discussion of good and bad (Zimmerman 2010). Both are fundamental concepts in value theory (axiology), which aims to understand and explain how, why and to what degree humans value things. It belongs to the domain of philosophy and ethics but has also economic implications. An object with intrinsic value may be regarded as an end-in-itself. A value which arises from the object's utility or usefulness or its potential for creating more value is called *extrinsic or instrumental*. Extrinsic value is relational to things other than the object itself, including the environment it is situated in. Consequently, it can depend on

relations as in market mechanisms and in this case, its value can be expressed in monetary terms.

Carter (2001) gives the following definitions, of which the easiest is for instrumental value and the vaguest for intrinsic value:

- *Instrumental value* is the value which something has for someone as a means to an end which they desire.
- *Inherent value* is the value which something has for someone, but not as a means to a further end.
- *Intrinsic value* is simply the value which something has. No appeal need be made to those for whom it has value. It is simply valuable and is so independently of anyone finding it valuable.

The term inherent value is often confused with intrinsic value and sometimes seen as the first-grade instrumental value when a personal experience is of intrinsic value. For example, a beautiful landscape can have value for me (and not for someone else), but not because it enables me to do something further. This means that the intrinsic value ("beauty") can be used to define a range of instrumental values that can be realised (Nordstrom 1993).

Clearly, intrinsic value is a holistic concept. It became a fundamental concept in environmental ethics as founded by philosophers (Rolston 1988). Basically, the argument is that wild nature and healthy ecosystems have intrinsic value prior to and apart from their instrumental value as resources for humans, and should, therefore, be preserved. Ethical duties are derived from these intrinsic values. Environmental ethics applies the notions of "right" and "wrong" to human behaviour in relation to nature (Rolston 1999), and therefore provide the philosophical basis for assigning a value using different instrumental and intrinsic moral values embodied in nature and/or its component parts (Satterfield 2002).

Aldo Leopold broadened the scope of environmental ethics from individuals, species and ecosystems to the land as a holistic entity. He called it *land ethic*, which "simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land" (Leopold 1949). Its basic principle is: "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise". This encompasses the moral, ecological and aesthetic meanings and includes non-material holistic qualities such as integrity, stability and beauty.

Environmental ethics brought the notion of intrinsic value into the debate on nature conservation (Vilkka 1997), animal welfare (van der Tuuk 1999), the 'deep-ecology' movement (Nordstrom 1993), in landscape ecology (Naveh 1995) and cultural heritage (de la Torre 2002). Consequently, intrinsic value can refer to very different things and its meaning depends largely on the context it is used in. Also, related terms such as inherent value and extrinsic value need to be clarified in the context of landscape assessment, in particular when it comes to the economic evaluation of landscape in terms of benefits and services (Price 2013; Van der Heide and Heijman 2013).

12.7.2 Assigning Landscape Values: Many Decisions to Make

When assessing, protecting, conserving or managing landscapes, people use essentially instrumental values. Even for an intrinsic value such as beauty, the assessment is often expressed in terms of instrumental values relating to meaning or utility. Specific utilities or services the landscape provide are referred to a *landscape functions* (Costanza et al. 1997). Combining landscape functions in space and time resulted in concepts such as multifunctionality (Brandt and Vejre 2004a, b), and in groupings as natural and social capital (Haines-Young and Potschin 2004).

Most debates in landscape evaluation are about whether a subjective or objective approach should be used. In the 1960s, subjective was often associated with holistic and objective with quantitative. Within scientific communities, this meant varying on a scale from 'worst' to 'best' (Price 2013). Other concepts added to the confusion, such as 'precision', 'accuracy', 'uncertainty', 'representative' and 'impartial'. Most of this discussion is about the method and how to measure and express the value. Assigning values means classifying an object or spatial unit according to predefined criteria. Value is often expressed on an ordinal scale of measurement (ranking from low to high). However, many landscape features cannot be described directly in quantitative terms. For example, narratives and place names are qualities which contribute to a landscape's identity and character, but neither can be expressed in quantitative terms. The holistic nature of landscape makes it too complex to express its value with one attribute. Multiple criteria are necessary to create a profile that indicates the various aspects of its values. The component parts (elements, objects) need be evaluated individually, as well as their relations in a spatial context (configuration) and time (history, processes, functions) is necessary. (see Chap. 10).

Many questions arise when it comes to assigning values to landscapes. How to assess (measure, express) the rather abstract and intangible landscape qualities in terms of value that are useful to policymakers? They often ask for measurable indicators that allow assessing the effect and efficiency of their decisions (Botequilha Leitão et al. 2006; Botequilha Leitão and Ahern 2002; Parris 2004; Dramstad and Sogge 2003). How to formulate instrumental values for intrinsic qualities of the landscape? Also, the reverse of the problem exist: often 'official' values are vaguely formulated in legislation. How to interpret these in particular situations?

An important issue is who assigns the values. Again its is a matter of degree of transdisciplinary participation. The simplest and fastest way is by expert judgement, as is still the case in the World Heritage nomination and often only the competent public authorities participate. Even when the experts use elaborated guidelines and follow strict procedures to minimalize subjectivity, multiple approaches with eventually contradictory outcomes are possible. The alternative method is to use the public to extract values. Basically, this approach analyses public preferences, which are used by experts for assigning values. Interviews,

questionnaires and personal narratives are collected from which experts then extract landscape values. Willingness-to-pay is used to express monetized values. Questionnaires using Likert-scales allow quantitative multivariate statistical analysis to determine correlations between landscape attributes and stakeholder group responses. Experience shows that 'the public' rarely provide coherent answers, adding complexity and uncertainty to the expression of the values (Sevenant and Antrop 2010a). The fully participatory approach involves the public actively during the whole planning and assessment process. In general, this a slow and long process of intensive communication through dialogue as it is simultaneously a awareness-raising and learning process for all parties (CHeriScape 2017).

Using these values in support of decision-making turns these assessments into instrumental values. Since values are assigned by humans, they are dependent on the cultural context and time as well. They can change, which is something that often happens in periods of economic or political crisis.

12.7.3 Respect Our Common Heritage: The Past Is Important for the Future

The landscape is part of our common heritage and integrates a variety of values, both natural and cultural. For example, traditional rural and pastoral landscapes are the result of practices adapted to specific local natural conditions and cultural adaptation. They combine natural, historical and cultural values, which gives them a distinctive character and identity. Preference studies show that traditional landscapes are often valued for their aesthetic values as well. They offer a great diversity of landscape types, which often supported sustainable ecological processes. Consequently, they are important information sources of barely studied knowledge on sustainable management techniques that would be useful for the future (Austad 2000).

A distinction is often made between natural heritage (fauna, flora, natural resources and also landscapes) and cultural heritage consisting of artefacts (objects, including landscape), and intangible aspects (customs, traditions, beliefs, etc.). Lowenthal (1985) showed that artefacts contain memories and narratives important for people, and Schama (1995) gave an impressive overview of what landscapes symbolise in Western civilisation. Landscapes can be read as a history book (Claval 2005). Heritage is often unique and irreplaceable, which are two important characteristics of its intrinsic and instrumental values. However, the perception of what is valuable as heritage changes between generations and cultures.

To conserve heritage sites and landscapes, they are designated as areas with some legal protection status. To achieve this, different categories of values have been defined. These categories are broad and generic, so series of criteria are needed to assess different aspects of their composed value. Many of these criteria can be seen as indicators or predictors of qualities that cannot be measured directly.

Table 12.2 Components of landscape evaluation commonly used for designating landscape as heritage

Categories of values	Assets or functions	Principles to evaluate
INTRINSIC • Natural, ecological • Historical • Archaeological • Cultural • Social • Aesthetic • Symbolic INSTRUMENTAL Potential value for: • Agriculture • Housing • Recreation • Heritage • Tourism	• Space • Information • Products (goods) • Services, amenities • Capital (natural, social...)	• Sustainability • Preserving and enhancing diversity and identity • Social benefits • Economic profit • Multifunctionality of land use through - Spatial combination - Temporal combination • Combined effects (positive, negative), synergy

After Antrop (2012)

Typical examples are the use of landscape attributes for assessing the beauty of a landscape (Sevenant and Antrop 2009) and the linking of visual and ecological landscape indicators (Fry et al. 2009; Ode et al. 2008). Criteria can be expressed in very different ways depending on their operational definition (see Chap. 10). The scale of measurement used defines the possibilities of quantification or combining criteria, as in a multicriteria evaluation for example. The scale at which the evaluation is applied is also essential. Some landscapes can be very valuable for locals, but meaningless at the scale of the UNESCO World Heritage. Table 12.2 summarises the components of landscape values that are common in regulations for designating landscapes as heritage and Table 12.3 gives an overview of some methodological issues involved.

A qualitative assessment is made by defining a priori a set of conditions and criteria to be used. A significant example is the case of the UNESCO World Heritage assessment. To be included on the World Heritage List, the proposed sites are evaluated on two conditions. First, they must be of 'exceptional', 'outstanding' or 'universal' value, which is a threshold. Second, they have to meet at least one out of ten selection criteria, which are nominal descriptions. Since the revision of the Guidelines in 2005, cultural and natural criteria have been merged into one list (Table 12.4). The criteria (i) to (vi) correspond to the cultural criteria, and (vii) to (x) to the natural ones. Their generic description contains values the committee of experts should use in their assessment.

Table 12.3 Methodological issues in landscape evaluation

Criteria concerning:	Expression of value	Scale of significance	Participation
CONTENT - Category or theme - Period or time - Time depth - Rarity - Authenticity - Information content - Coherence - Diversity/ heterogeneity -... PERCEPTION, PREFERENCE - Legibility - Identity, character - Order, variation - Contrast, transition - Atmosphere, mystery - Stewardship -... UTILITY - Accessibility - Potential use/benefit for... -...	SCALE OF MEASUREMENT • Qualitative (Attributes) - Description - Nominal categories • QUANTITATIVE (variables) - Ordinal (ranking) - Interval - Ratio • MULTIVARIATE - Multicriteria evaluation -... • MONETARY OR NOT - Willingness to pay -...	• Local • Regional • National • International • Universal (global)	• Expert judgement only - Disciplinary - Multi- or inter-disciplinary • Informing the public • Consulting the public before the evaluation • Using the public for assessing values (e.g. preference analysis by experts) • Active participation from the start (transdisciplinary)

After Antrop (2012)

12.7.4 Criteria to Assess Holistic Qualities of the Landscape

The complexity and diversity of landscape qualities and its holistic properties, in particular, resulted in many more criteria commonly used in landscape assessment. Many are vaguely defined or no precise operational definition is given as one of the common meanings in the current langue is implictly used. Following groups of criteria are often used in the description and the assessment of landscapes (Table 12.5):

- criteria describing composition or configuration: representativeness, rarity, authenticity, coherence, information value, diversity, heterogeneity,
- criteria describing the visual landscape, perception and experience: legibility, identity, character, soundness, order, naturalness, variation and contrast, atmosphere, mystery,
- criteria related to utility: accessibility, stewardship

Table 12.4 Selection criteria for the UNESCO World Heritage List since the updated of the Operational Guidelines in 2005

(i) to represent a masterpiece of human creative genius; (ii) to exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design; (iii) to bear a unique or at least exceptional testimony to a cultural tradition or to a civilisation which is living or which has disappeared; (iv) to be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history; (v) to be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change; (vi) to be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance. (The Committee considers that this criterion should preferably be used in conjunction with other criteria); (vii) to contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance; (viii) to be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features; (ix) to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, freshwater, coastal and marine ecosystems and communities of plants and animals; (x) to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

UNESCO http://whc.unesco.org/en/criteria/

Table 12.5 Main groups of landscape assessment criteria

Assessment criteria for		
The content	**Perception and experiencing**	**The use of the landscape**
• Representativeness • Rarity, uniqueness • Authenticity • Information value • Coherence • Diversity and heterogeneity	• Legibility • Recognisability • Identity • Character • Soundness • Order • Naturalness • Variation and • contrast • Atmosphere • Mystery	• Accessibility • Utility • Stewardship

Representativeness expresses the degree an element or landscape unit is representative of the category it belongs to. The more the element possesses characteristics in a legible manner, the more it is representative. Very representable examples can be used as ideal types of the category. They have an important information value, are well suited for educational purposes and can be used as a reference, an archetype or prototype. Representativeness can refer to different aspects such as the period of origin of creation, the morphology, style, or function.

Rarity expresses the frequency of occurrence of a type, element or landscape unit. When only one example exists of a category it is called unique. Rarity is only meaningful when several units of a category occur. Rarity does not refer to other qualities or values of the element, thus rare or unique does not express representativeness, etc. Rarity depends also on the completeness of the data and the scale (spatial and temporal) used in the assessment. The possibility of not yet discovered elements should be considered. Rarity is a difficult criterion to be used in landscape assessment, as it is often (and spontaneously) associated with economic scarcity, which increases (monetized) value. As ancient landscape elements often are relics, thus rare, this criterion is also associated with age and heritage. The rarity of heritage elements refers also to vulnerability, the potential for replacement and restoration. *Uniqueness* is the extreme form of rarity and often used as an argument the good or site is irreplaceable.

Authenticity refers to the degree the element or landscape unit is still original or genuine. It is the opposite of false, counterfeit, imitation, kitsch.

Information value, or for short *information*, expresses the amount of the information content that can be obtained. This is formally defined in the information theory formulated by Shannon, as the probability that the occurrence of a sign is uncertain and unknown to the receiver, i.e. the observer (Shannon and Weaver 1949). Mathematically it is expressed as *information entropy* and often expressed in bits. In landscape ecology, information entropy is used as a measure of the heterogeneity of spatial patterns. It combines the number of occurring categories (richness) or diversity) with the number of isolated spatial units (patches) defining the landscape configuration. Thus, it is related to criteria as diversity and heterogeneity and landscape complexity. These properties refer also to aesthetical qualities related to variation, order, homogeneity and disturbance (Nohl 1998, 2001). Information value is also significant for heritage values but expresses than the potential of new knowledge that could be extracted.

Coherence expresses the strength of the relations between landscape elements and components. It expresses unity between elements of diverse nature, origin and quality. It is an essential criterion expressing the holistic nature of a landscape. Loss of coherence leads to fragmentation, loss of character and ultimately loss of identity. Coherence stimulates legibility of the landscape. Different forms of coherence are recognised. According to Verhoeve and Vervloet (1992) and

Haartsen and Renes (1982) following categories are significant in the assessment of cultural landscapes:

- *Ecological coherence*: focuses upon vertical relations at one spot between land cover, land use and the natural substrate formed by geology, soils and landform;
- *Functional coherence*: relations between the elements of the landscape system guaranteeing its optimal functioning;
- *Genetic coherence*: the degree elements in the landscape have a common origin or evolved together;
- *Chronological coherence*: the degree all elements refer to the same (historical) period;
- *Spatial coherence*: de degree the elements form a holistic unit that can easily be recognised in the landscape.

Van Mansvelt (1997) considered three groups of ecological coherence in rural landscapes: the vertical (on site), the horizontal (landscape-level) and the cyclical (temporal) coherence. Phipps (1984) related this to the degree of order or chaos in the landscape. Comparing soil conditions and land cover, he made the distinction between vertical relations (ecological order) and horizontal relations (topological order) (see Chap. 8). According to Mander and Murka (2003) coherence reflects the correspondence between the potential (natural or biophysical) and actual (cultural or man-made) landscape diversity. Mander et al. (2010) used Moran's I statistic as a measure of this coherence. Similarly, Tveit et al. (2006) define coherence as a reflection of the correspondence between land use and natural conditions in an area.

Diversity and heterogeneity are two concepts that are frequently used in landscape ecology with very specific meaning. In common language and in other approaches to landscape, they have, however, different meanings. In ecology, diversity express plant and species diversity in the perspective of the paradigm that biodiversity is important for survival. With landscape ecology, the concept was spatially upscaled to habitat, ecosystem and landscape diversity. Diversity in society is used in a more or less similar way in a social aspect ('a diverse society is good') and in the landscape context, the great diversity of cultural landscapes is considered a positive quality expressing cultural identity and regional character (see Chap. 3). A decreasing diversity leads to uniformity, which is seen a negative development, hence landscape policy must focus on conserving landscape diversity.

Several measures and indices for diversity have been elaborated to express diversity quantitatively at different scale levels. In landscape ecology, diversity consists of two components: richness and evenness, which are generally referring to the compositional and structural diversity (McGarigal 2015). They are indicators of the information content and degree of order of a landscape. The common linguistic meaning of diversity in English refers to the condition of being composed of differing elements, for which synonyms as variety and heterogeneity as used. The definition of *heterogeneity* is commonly "the quality or state of being composed of many different elements or types". Antonyms are similarity and homogeneity.

Heterogeneity in landscape ecology is used in a different sense and more specific meaning, mainly as the spatial heterogeneity in patch mosaics, which is a scale-dependent landscape metric.

Legibility refers to visual perception, coherence, cognition, recognition, orientation, which are all factors used in the creation of a mental map of a place. Kevin Lynch (1960) introduced in *The Image of the City* the concept legibility, which he also called *clarity* and *imageability*. He considered legibility as one of the most important visual properties of the cityscape and defined it as "the ease with which its parts [of the cityscape] can be recognised and can be organized in a coherent pattern"(p. 2–3). The concept became rapidly popular in city planning, but also more broadly in landscape design and planning. Important is that legibility helps to orientate the observer in space using landmarks as references and a clear spatial composition and structure.

Recognition or *recognisability* expresses the ease by which an element or landscape can be classified in a predefined classification system. For example: is this landscape an openfield, a hedgerow landscape or polder landscape? Landscapes having a distinct character can easily be recognised. Recognition relates to the holistic Gestalt of the landscape. Recognition necessitates knowledge and is the first step towards identification. An open cropland can only be recognised as being an open field when ones know what this means. Although recognition is mainly cognitive it is important in the more emotional assessment of the environment as it creates a sense of familiarity.

Identity is related to the character in the sense that in order to be identifiable (certainly as being unique) the character must be clear. If the element is unique, it often gets a unique proper name. This is the case of many unique geographical regions: e.g. Brittany, the Weald and Picardy.

Character refers to the holistic appearance, the Gestalt, of a given area making it distinct from other (surrounding) landscapes. The concept of *landscape character* was introduced the English Landscape Character Assessment (LCA) (see Chap. 10). The European Landscape Convention made it popular and several regional and national methods were developed for landscape characterisation.

Soundness or completeness expresses the degree all elements and characteristics of a landscape type are present in the given case. These criteria are complementary to the degree of disturbance or degradation. The assessment of these criteria is holistic and made by comparing the actual case with the model of the landscape types created from all available expert knowledge.

Order expresses the degree of certainty that is experienced in a landscape, as opposed to the uncertainty associated with disorder or chaos. It is often expressed and measured by the information entropy. The order relates to many other indicators such as heterogeneity, complexity, coherence, harmony, predictability, legibility and disturbance. Consequently, it is typically a holistic characteristic of the landscape.

Naturalness refers to the degree of human impact on the landscape and is expressed on ordinal scales. Preferences studies showed that naturalness is associated with 'harmonous integration', 'organically evolved' and 'authenticity'.

Generally, a high degree of naturalness is considered positive. Visible human influence such as buildings and constructions affect naturalness negatively.

Variation is a general term related to concepts as diversity and heterogeneity. Often it refers to one theme or feature, such as landform or architecture, or one variable. Statistically, it is expressed numerically in standard deviation from the mean value and important for assessing the significance of the mean value. The maximal variation is also called *contrast*. It can be used as a threshold in the assessment, for example when the contrast of colour, shape or size of an element in its environmental context is considered unacceptable.

Atmosphere refers to the ambient feeling an observer experiences in the landscape. It a holistic quality affecting aesthetical appreciation and memorising the experience, in particular when it is a first-time experience. A complex of sensory inputs such as sounds, smells, feelings, seasonal conditions and many others, causes the atmosphere. Atmosphere is also one of the properties formulated in the theory formulated by Kaplan et al. (1998). Similarly, m*ystery* has been defined in the information theory as a property of the landscape that fascinates the visitor and stimulates exploring, referring feeling of fear as well as longing (see also Chap. 6). Openness and tranquillity are also two criteria based on perception. *Openness* is related to the visual exploration of the landscape, in particular, the viewing depth and absence of obstacles as woods and buildings. The appreciation often depends on the size of the open spaces around the observer and the nature of the obstacles (Nijhuis et al. 2011) (see also Chap. 10). *Tranquillity* is an environmental criterion based on the measurement of the ambient noise and related to defining soundscapes.

A landscape gets a more positive appreciation when its *utility* is evaluated greater, i.e. its potential use is varied and large. Multifunctionality can increase utility. Possible (free) *accessibility* to the terrain is judged adding to its utility. Controlling accessibility is an effective way helping to uphold a site. *Stewardship*, i.e. care and maintenance are important positive aspects in the aesthetical appreciation of landscapes and influences behaviour. However, its meaning and significance depend on cultural norms and traditions.

12.7.5 Shaping the Future: Landscape Quality Objectives

The European Landscape Convention (ELC) (Council of Europe 2000) defined landscape quality objective as follows "for a specific landscape, the formulation by the competent public authorities of the aspirations of the public with regard to the landscape features of their surroundings" (Article 1c). This is not really a definition of the concept, nor formulates what these aspirations and features could be. It gives rather a framework how to define these objectives. The Specific Measures of the ELC (Article 62D) specifies further "Each Party undertakes to define landscape quality objectives for the landscapes identified and assessed, after public consultation in accordance with Article 5.c." In 2006, the Council of Europe devoted a

workshop to the problem (Poullaouec-Gonidec 2006). The final conclusions were that for most of the European territories neither the debate nor the necessary agreement on their landscape quality objectives had taken place, that so far the rules specifying which authority is responsible, which criteria should be used and how the formulated landscape quality objectives should be validated, were not sufficiently developed (Zoido 2006). From the different contributions, it became clear that 'landscape quality' has been interpreted in the ELC in the sense of 'value', rather than in the more neutral meaning of 'a distinctive attribute or characteristic' or 'peculiar and essential character' as is used in most landscape typologies and classification systems. In land evaluation 'quality' has two aspects: (1) a factor for determining the suitability of the land for a certain use, and (2) a diagnostic characteristic to distinguish suitability classes (Zonneveld 1995). The English term 'quality' in the sense of 'a distinctive attribute or characteristic' is often translated into other languages solely in the meaning of 'value' expressed on a scale from better to worse.

Most obviously, aesthetical qualities of the landscape have been defined since the eighteenth century and resulted in an approach to analysing the visual landscape. Today, landscape quality is broader and includes the quality of the living environment, well-being, character and identity (see also Chap. 6). Many of these qualities are place-bound. In addition, and according to the ELC, also ordinary, everyday and even degraded landscapes have to be taken into consideration, as well as the dynamical aspect, the concept of landscape quality objective widens even more. Clearly, landscape quality is essentially relative and temporal.

The meaning of landscape quality as 'value' is also supported by the procedure proposed by the ELC: "formulation by competent public authorities of the aspirations of the public" and "for the landscapes identified and assessed". This means that landscape quality objectives can be assessed through delegation and are defined case-by-case and step-by-step, which most probably will result in fragmentation of the existing landscape as discussed before. Also, the "aspirations of the public" will have a subjective value. The "competent public authorities" will only possess 'spatial competence' and can steer by 'symbolic transactions' to use Hägerstrand's terms.

Besides 'quality', also the term 'objective' needs some clarification. In planning it refers to achieving a specific result in a predefined time perspective. Objectives need to be formulated more detailed than 'goals' so their realisation can be tested and evaluated. Goals refer to the desired and ideal situation at the end of the planning process and there is only some certainty about realising this. Goals are vaguely defined, which appropriately described by the German term *Leitbild* (Bastian 2004). In order to formulate landscape quality objectives in a transdisciplinary way, the use of explorative scenarios proved to be useful (see Sect. 12.9.5).

12.7.6 Landscape Services

'Goods and services' are considered essential for humanity (Dailey 1997; de Groot et al. 2002; Millennium Ecosystem Assessment 2005). The 'services concepts', such as ecosystem services, environmental services and landscape services, became important in policy (de Groot et al. 2010). In this set, landscape services came last and were derived from ecosystem services, which broadened thanks to the transdisciplinary approach of landscape ecology (Tremorshuizen and Opdam 2009). De Groot et al. (2002) made a typology of ecosystem functions, goods and services that became used widely. The listed services are grouped into four main categories according to their main function: provisioning, regulating, habitat and supporting, culture and amenity. Most often, landscape services are a subset of ecological processes with utility functions for humans and which can be valued in an economic way (Haines-Young and Potschin 2010). Tremorshuizen and Opdam (2009) see the concept of landscape services as a specification of 'ecosystem services' allowing to bridge the landscape ecology paradigm with sustainable development. The patterns-processes model of landscape ecology can be fit into collaborative and transdisciplinary landscape planning using a conceptual knowledge framework they called the "structure–function–value chain".

Many 'goods and services' models show 'services' as an interface between a biophysical and human world (de Groot et al. 2002, 2010; Haines-Young and Potschin 2010) (Fig. 12.6). Some aspects of the landscape are seen as a part of the biophysical world which has qualities and functions that can be beneficial for human well-being and economy through (ecosystem) services. The concept 'landscape services' needs to be broader and have to transcend the dichotomy (biophysical) land(scape) versus society (Vallés-Planells et al. 2014). As landscape encompasses both the tangible world and its socio-cultural and economic realm in the human mind, landscape services interact two-ways (Fig. 12.7). In particular, expressing the landscapes services in an economic evaluation will affect ultimately the landscape as well.

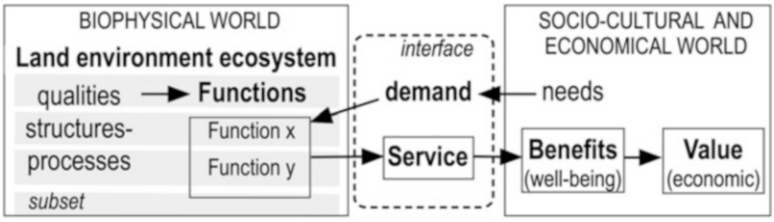

Fig. 12.6 Ecosystem services seen as an interface between the biophysical world and the socio-cultural and economic world

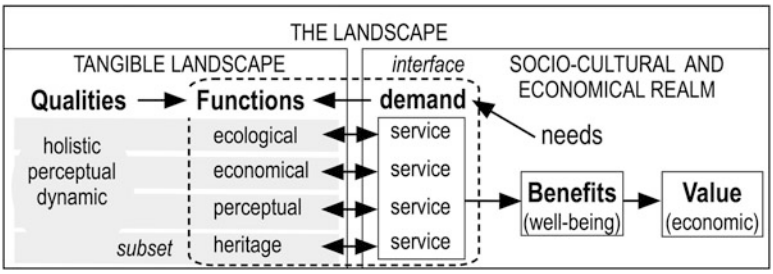

Fig. 12.7 Landscape services bridge the tangible landscape to its socio-cultural and economic realm

12.8 Principles to Set Goals for the Landscape

12.8.1 Attempt Sustainable Development

The Brundtland Report or *Our Common Future,* published in 1987 by The United Nations World Commission on Environment and Development (WCED), gives the most widely recognised definition of sustainable development: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987). The report was a basic document for discussion in the 1992 Earth Summit, the Rio Declaration and the adoption of Agenda 21. Since then, sustainability is on all policy agendas. Sustainable development ties together the carrying capacity of natural systems and the human needs. It covers domains of economics, ecology, culture and politics and it should be noticed that landscape is not mentioned explicitly in all the sub-domains.

The principle is used in the conservation of biodiversity and through landscape ecology, it was also introduced in landscape management (Potschin and Haines-Young 2006). The idea that ecosystems also provide 'goods and services' to society and can be regarded as 'natural capital' (Haines-Young 2000). This new paradigm includes besides ecosystems also landscapes. Haines-Young (2000) formulated a model for sustainable development linked to multifunctional landscapes.

Applying sustainability in landscape context is not easy as landscapes are changing continuously. Also, not only 'natural capital' should be considered, but also the 'social' and 'cultural capital' as well. Antrop (2006) identified two perspectives concerning sustainability and landscape. First, sustainability refers to the sustainable conservation of the existing landscape character and qualities. This implies that also processes, knowledge and financial means that created the landscape character and qualities must be sustained. This is a major problem in areas with traditional agriculture depending on a vanishing lifestyle of the people who created and maintained these landscapes (Vos and Stortelder 1992; Pinto-Correia et al. 2006; Emanuelsson 2009). It is also the main factor in sustaining the category 'organically evolved' and 'continuing 'cultural landscapes on the UNESCO World

Heritage list. The central question here is "who is in charge and responsible for managing the landscape?" The second perspective on sustainable landscapes focuses on the sustainable rural economy and attempts to create new landscapes to make this possible. This differs according to the human pressure on the land. In areas where activities intensify, this leads to the concept of acceptable multifunctional land use in densely populated areas where multiple interest groups compete. In areas where land abandonment is the major problem, it became clear that spontaneous re-wilding not necessarily means improvement of the natural capital, requiring also here a planned management.

12.8.2 Stimulate Multifunctionality Wisely

Multifunctionality is a complex concept and often refers to land use. Depending on the scale of observation and on the landscape heterogeneity, three scale levels can be distinguished: field, field system and landscape (Antrop 2006). Multifunctionality relates also to the duration of a particular land use and how successive land use forms interfere:

1. no interference: 'only passing by', e.g. hiking through agricultural land
2. minor interference: temporary use and recovering possible, e.g. a rock concert in a meadow
3. major interference with lasting effects, e.g. as a result of soil compaction or erosion
4. demanding infrastructure: the land use form becomes almost permanent and affects visually the landscape, e.g. small 'temporary' buildings along an event place.

Brandt and Vejre (2004a) identified three types of mulifunctionality depending on spatial scale and time (Fig. 12.8):

(a) spatial segregation, meaning land use zoning
(b) time segregation: succession of different land use types as in crop rotation
(c) spatial integration or real multifunctionality: different land uses at one place changing in time. Only this form of multifunctionality is independent of the scale of observation.

Multifunctionality is also scale dependent. Antrop (2004a) considererd three distinct scale levels in the multifunctional agricultural land use on the island of Lanzarote: the field level, the field-block level and the landscape level (see Fig. 5.6 (4) in Chap. 5). Multifunctionality has to be used wisely, i.e. it must affect fundamental landscape characteristics permanently. In Fig. 12.9, the polycultural land use (4) does not disturb or change the landscape type of agricultural land, for example, while urban and industrial functions (5) increase the overall multifunctionality of the landscape, but cause fragementation and change the initial landscape character and coherence.

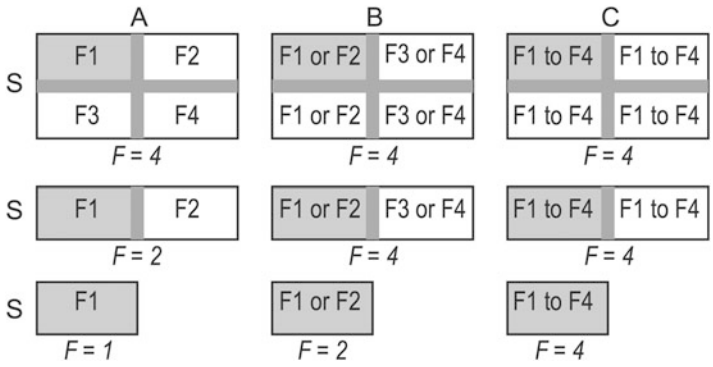

Fig. 12.8 Three types of multifunctionality depending of three scale levels and time segregation. F1-F4: functions or land use types. (**a**) multifunctionality by spatial segregation (zoning), (**b**) time segregation with successive functions at one places (as in crop rotation), (**c**) spatial integration in space and time. Also, the borders between the land use types may have an ecotone-function according to the width and fuzziness of the border; ecotones can be part of a larger ecological network having its proper functions (After Brandt and Vejre (2004a))

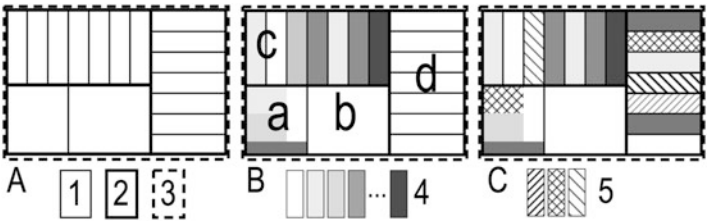

Fig. 12.9 Multifunctionality in a fictive agricultural landscape at the field level (*1*), field-block level (*2*) and landscape level (*3*). (*4*) indicates agricultural land use types and (*5*) urban and industrial ones. Case A shows a landscape with only one function al all levels. Case B shows within-field multifunctionality in (a) and in field-block (c); in field-block (d) all fields have the same function. Case C shows multifunctionality at all levels, but the urban functions (*5*) disturb irreversibly the agricultural character of the landscape

12.8.3 Reduce All Kinds of Fragmentation

Fragmentation refers to hampering processes in the landscape because subdividing spatial units become too small to function properly (Jongman 2002). It relates to the spatial configuration, connectivity and heterogeneity of the landscape. Initially, the concept is based on the island theory in ecology and the theory of meta-population, which are both important for the survival of species (Opdam 2005; Whittaker and Fernandez-Palacios 2007; Lindenmayer and Fischer 2013). Hence, fragmentation has a negative connotation. To prevent habitat fragmentation, landscape ecologists proposed planning ecological networks and building corridors and formulated some practical rules regarding spatial patterns and sizes of habitat patches (Soulé 1991; Opdam et al. 2003; Vos and Opdam 2012). Forman described different forms of fragmentation (Fig. 12.10).

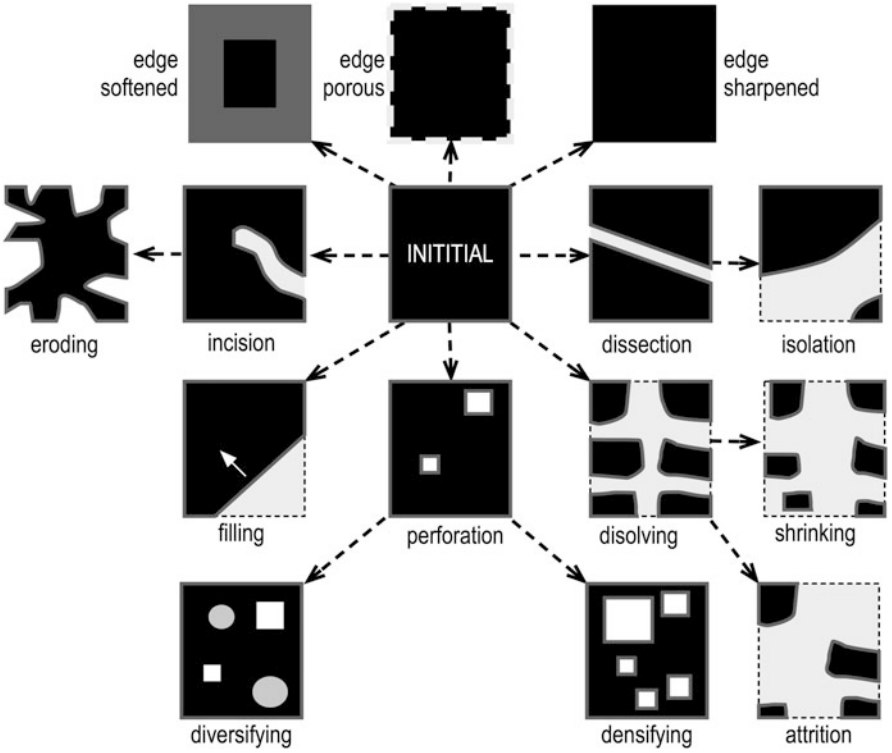

Fig. 12.10 Processes of fragmentation

The concept of fragmentation gained importance through landscape ecology and in particular in forest and nature management. It also stimulated the creation of ecological networks and greenways to reduce the negative ecological aspects of fragmentation in agricultural and urbanised landscapes. However, the principle is also valid in an economic and cultural sense. Historical and archaeological ensembles in the landscape are affected as well. Fragmentation of the landownership hampers agricultural mechanisation and also road networks can become fragmented, reducing connectivity and communication. A historical example in agriculture and land use is the fragmentation of the arable land by continuous field division due to inheritance, reducing the economic efficiency and making land consolidation necessary. Fragmentation also affects areas of high heritage value, such as designated landscapes. Finally, administrative, institutional and legal fragmentation in authorities having competencies in landscape policies contribute to tangible fragmentation of holistic landscape units (see Fig. 12.4).

12.8.4 *The Endless Feedback Loop Between Functioning and Spatial Structure*

Forman and Godron (1986) formulated a basic principle of landscape ecology as follows:

> An endless feedback loop:
> Past functioning has produced today's structure; today's structure produces today's functioning; today's functioning will produce future structure.

This principle is not only valid for ecosystems but also for all functional aspects of the landscape, including the ones in planning, management, conservation and design. A first consequence is that elements and structures that are not functional anymore will gradually become obsolete and disappear and after some time be replaced by new structures that are adapted to the new functional needs (Fig. 12.11). Typical examples are heritage elements that are abandoned and become ruins. Even when they have been designated and have a protected status, this will not prevent their dereliction when no new functions can be found to make them useful again. Similar things happen with derelict land.

A second consequence is that there are always two options to take action (Fig. 12.12). One can act upon the spatial structure by modifying it by introducing

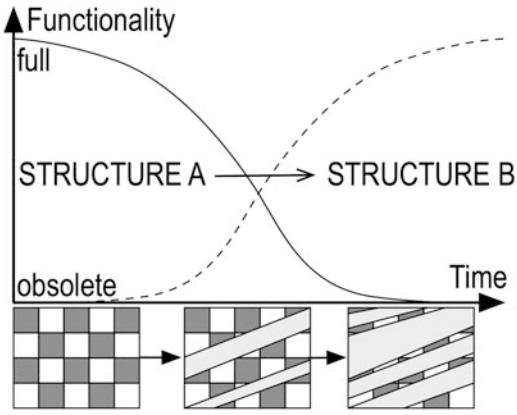

Fig. 12.11 When a spatial structure is not adapted anymore to the changing functional needs, it will become obsolete and be replaced by a new one

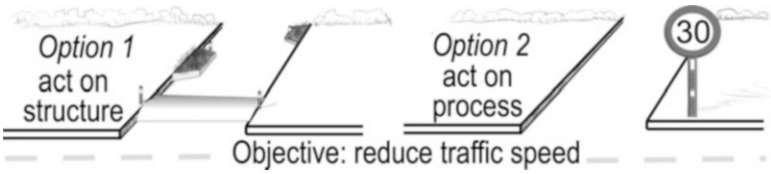

Fig. 12.12 The interaction between spatial structure and functioning offers the planner two options to realise a certain objective: (*1*) adapt the spatial structure to force a change in the functioning, or (*2*) changing the functioning itself, in this case by regulating behaviour by setting speed limits

new patterns, land use or elements, or one can control the processes directly. In both cases, the functioning of the landscape will change.

12.8.5 Interesting Diversity, Safe Order and a Distinct Character and Identity

A landscape's symbolic meanings are often expressed in memories, narratives, knowledge, beliefs and affection and are often intangible and temporarily. They may be operationally valued as inherent values, as aesthetics and as preferences (see Chap. 6). Sensory qualities and mental experiences can be evaluated using a series of measurable attributes, which allow to predict correlated preference values (Sevenant and Antrop 2010b). For example, in general, a perceptively attractive landscape is found to be characterised by:

– a clear identity (holistically assessed)
– good legibility and orientation
– repeating typical elements; no disturbing elements
– a complex series of visual relations
– the possibility of (free) movement without fundamentally changing the character of the landscape
– a safe order with a little exciting disorder (variation and mystery, but no chaos).

The holistic nature of landscape offers some ideas for taking care of the landscape. Following non-exhaustive list of some holistic principles can be useful in planning, managing and designing landscapes:

Holistic aspects:

- The whole is more than the sum of the parts
- Each element gets its significance from its context
- Many small elements can be big
- Safe order with a little disorder makes it exciting
- Spatial structure and processes interact continuously and define the functioning
- Landmarks are essential not to get lost in space
- Enhance identity and character, linked to a (historical) narrative
- Not all landscapes are easily makeable
- Let many participate

Values

- Regard for the existing landscape
- The landscape is a collective good and heritage to care for
- A readable narrative of the landscape defines its identity
- Look for the genius loci

Functions and services

- What is not functional anymore, will disappear
- Use multifunctionality wisely
- Accessibility is a key to controlling change
- Apply principles of sustainability and precaution
  - Don't forget maintenance
  - Maximalize integration, renovation and reconversion
  - Reuse existing infrastructure/adapt for new functions and services
- Look further than a few generations
- Know and understand what you change or remove
- Nice and special places attract and become threatened
- Guarantee and improve readability: clear overview and structures, useful vistas and landmarks

12.9 Some Methodological Issues of the Planning Process

12.9.1 Top-Down and/or Bottom–Up?

Tress et al. (2006) and Selman (2006) gave reviews of methods and models in landscape planning. A central issue is whether the planning process should be top-down or bottom up. According to democratic principles as public's participation and subsidiarity, the answer seems simple: top-down is something from the past.

Adams and Steinitz (2000) proposed a research framework is built around following observations:

- to decide to make changes, one must know and compare the alternatives.
- to compare alternatives, one must predict their impact using simulations.
- to simulate changes, changes must be specified and defined.
- to specify potential changes, one must evaluate the current situation.
- to evaluate a landscape, one must understand its dynamic, i.e. know how it functions and what processes are active.
- to understand how the landscapes functions, one needs a representation model of the landscape.

These observations result – bottom-up – in six questions each addressing a specific goal and using a specific model (Table 12.6). Questions 1 to 4 deal with data and information, questions 2 to 5 with information and theory of prediction, and questions 3 to 6 with knowledge, cultural meaning and values. The planning process addresses at least once all these questions successively. In most cases, several rounds will be needed as to proceed to a next step each of the questions

Table 12.6 The Framework Method for landscape planning according to Adams and Steinitz (2000): six basic questions and models

Question	Model
1. How to describe the state of the landscape, spatially and temporally?	Representation models
2. How is the landscape functioning? What are the functional and structural relations between the elements	Process models
3. Is the functioning good? This can be assessed for different aspects, such as aesthetics, rentability, preference, flows of matter and energy, etc.	Evaluation models
4. How, where and when can the landscape be changed?	Change models, which must include (i) prediction of the current trends (autonomous development), and (ii) the impact of plans and actions
5. What differences caused by these changes can be predicted?	Impact models
6. Is landscape change necessary? How to evaluate the alternatives?	Decision models

demands a positive answer. If not, feedback is necessary and previous steps must be repeated. At each step participation of the stakeholders is possible. The implementation of the plan can only start when all questions are answered satisfactorily.

12.9.2 Visualisation and the Immersion in Virtual Landscapes

We are living in an era of visual communication (Lange 2001). Visual representations of the landscape based on photomontage and digital or virtual environments are commonly used as stimuli in preference research and as communication tools in design, environmental impact assessment and planning (Lange 2011). The purpose is mainly to communicate with the public or potential clients in the context of interdisciplinary research or transdisciplinary planning.

The last two decades, most of the research focused on the technical aspects of the creation of virtual environments and representations as realistic as possible (Appleton and Lovett 2003; Lange 2001). Today, visualisations offer realistic representations of the landscape allow the immersion in a virtual world. They can be interactive and allow a virtual walk-through and changing weather conditions. However, it is mainly a visual experience and movement is restricted to the observer. The whole dynamic and sensorial aspects of the landscape are not experienced (Lange 2011). However, technology develops fast and new possibilities emerge with mobile augmented reality, allowing to have a real walk in the landscape simultaneously seeing the effects of the proposed plan (Lange 2011).

Landscape visualisations are illusions and can also create virtual landscapes of the past, present and future.

Since 2005, when Google Earth was released as "A 3D Interface of the Planet", the popularity of viewing landscapes in fairly realistic three-dimensional representations increased rapidly (Sheppard and Cizek 2009) and stimulated the development of participatory mapping (Brown and Kyttä 2014). The tools in Google Earth, such as SketchUp and Streetview, offer unprecedented opportunities to access geographical data from everywhere, to make quick analyses and share landscape views over the Internet. Sheppard and Cizek (2009) give an overview of the benefits and of the risks of using such 'virtual globes' in planning and policy-making. They identified three key benefits: (1) equitable access to visual information, (2) an increased interest and engagement in viewing and manipulating this kind of information, and (3) freedom to view places or features from any viewpoint, which makes the information more representative. The accessibility of digital maps (e.g. OpenStreetMap) and imagery and user-friendly visualisation tools made that the general public became important as producers of landscape visualisations. This fundamentally changed the relationship between expert-producers and the public, stakeholders and commissioners. The democratisation of visualisation tools raised new risks and ethical questions. The main problem is that imagery of this kind can be considered being real and true and consequently judgements derived from it cannot be wrong (Pettit et al. 2011; Sheppard and Cizek 2009). There is a risk that the framing and the display of the visualisation can become more important than its content. Also, it is not to exclude that manipulations result in biased and even fake information. This all makes validation of the visualisation output necessary. Sheppard and Cizek (2009) proposed following criteria to evaluate landscape visualisations:

- *Accuracy* in the appearance of the virtual landscape at an appropriate level of abstraction/realism for the intended purpose;
- *Representativeness*: typical and significant views and conditions of the landscape should be represented;
- *Visual clarity*: the content, composition and details of the representation should be clearly explained;
- *Interest*: the visualisation should engage the audience;
- *Legitimacy* refers to the arguments and motivations of the choices made to create the visualisation in a demonstrable way;
- *Access to the visual information* should be easy for the public in various ways;
- *Framing and presentation* refer to the availability of clear contextual information (labels, mapping criteria, legend, etc.) in a neutral fashion to help to understand the visualisation.

12.9.3 Participatory Mapping: Bringing Knowledge of Locals and Experts Together

In Chap. 10 some possibilities of mapping the mindscapes have been discussed. *Participatory mapping* in various forms became popular in transdisciplinary landscape studies. Corbett (2009) gave an overview of the methods (see Chap. 10). Essentially, participative mapping allows to integrate local knowledge, which is mostly qualitative, and the expertise of researchers resulting in common, sometimes also quantified and georeferenced knowledge readily to be shared (Craig et al. 2002). Often locals have difficulties in reading abstract representations as maps and detailed aerial photos proved to be helpful (Bergen et al. 1998; Muhar 2001; Bishop and Lange 2005).

With the development of portable GIS-functionality, the integration became more efficient allowing a broader data integration and structuring in geographical information systems. Thus, *participatory geographical information systems* (PGIS) and *public participation GIS* (PPGIS) developed (Brown and Reed 2011). Brown and Kyttä (2014) discussed the key issues and research priorities of Participatory GIS (PGIS), Public Participation GIS (PPGIS) and Volunteered Geographical Information (VGI), which all aim to capture and use non-expert spatial information. Sieber (2006) made a literature review of PPGIS, and Sheppard and Cizek (2009) formulated criteria to evaluate them.

Successful applications are found in the transdisciplinary assessment of natural resources in rural communities (Corbett 2009; Fagerholm and Käyhkö 2009), in land use planning (Brown and Raymond 2007), in forest planning (Brown and Reed 2009) and national park planning (Brown and Weber 2014), landscape characterisation and strategy making (Primdahl and Kristensen 2016) and in archaeological surveying for heritage protection (Plets 2013).

12.9.4 Making a Diagnosis of the Actual Landscape

Landscape diagnosis is based on a holistic analysis of the landscape under consideration. The term landscape *diagnosis* – inspired by the medical diagnosis – was introduced in Germany in the 1950s (Bastian 2001). Similarly, Zev Naveh (2007) advocated that landscape research should become more proactive to face the challenges for future.

Landscape planning and management happen at regional or local scale and demand up-to-date and detailed information about the landscape. Although the main types and characteristics of the landscape are generally known, as are the main trends of the ongoing changes, this knowledge is very fragmented and incomplete, and detail and accuracy vary from place to place. Therefore, every project starts with a diagnosis of the landscape under study, and consists of three aspects:

1. identifying: knowing what is the actual situation and ongoing processes
2. assessment: defining the significance and meaning
3. monitoring: follow-up the processes of change

The European Landscape Convention stimulated the making of landscape inventories in Europe (see Chap. 10). Three main types of landscape inventories are currently used: the landscape atlas based on a GIS-cartographic database, the landscape biography or catalogue in the format of an illustrated monograph and databases of geolocalised photographs taken over a period of time, useful in a landscape observatory to monitor changes. Most are available in paper format and in digital form, occasionally as a web-based interactive database.

Although using different methods and techniques, most of the inventories combine in some degree the three aspects of identifying, assessment and monitoring in the final document produced. The atlas, catalogue or biography is used as the basic document in all planning projects and in some cases they have a legal status.

12.9.5 Choosing the Type of Management

The European Landscape Convention formulates in its definitions implicitly four types of landscape management: protection (conservation), restoration, enhancement and creation. Many factors determine the choice between these alternatives. To help the selection Wood and Handley (2001) recognised two dimensions to be evaluated: character and condition, which they relate to dysfunction and obsolescence. A landscape with a distinct character or clear identity and a good condition, i.e. being used and functional deserves the protection of these qualities. In the case of a landscape without any character and a poor condition of functioning, creation of a new one might be appropriate. In the scope of public's participation, population density can be considered as an additional dimension. Protection and creation of new landscapes are likely to be easier in less populated areas (Fig. 12.13).

12.10 A Strong Forward-Looking Action to Enhance, Restore or Create Landscapes

12.10.1 Dealing with the Uncertain Future

The European landscape Convention defines landscape planning as a "strong forward-looking action to enhance, restore or create landscapes" (Art. 1). This suggests a process to achieve a new and desired condition of the existing landscape in a future for which the time horizon needs to be decided. During the Veldhoven meeting (Tsjallingii and de Veer 1982) there was a debate about how far in the future we have to make predictions and plan landscape actions? Most agreed it was

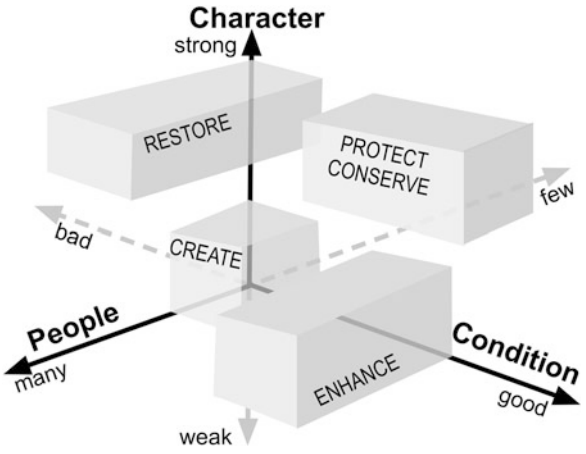

Fig. 12.13 Four strategies for landscape management based on character, condition and people

a matter of long-term vision and action. However, it wasn't obvious to agree on a time period for 'long-term'. Scholars working in fundamental research argued that this period had to be at least one generation, e.g. 30 years. Ies Zonneveld argued that maybe the amortisation time of investments of projects could be more realistic. Practitioners argued that often the duration of political mandates was significant and that visions and financial means changed with each election.

Many stakeholder's interests and visions interact and make the 'natural' changes even more chaotic. As discussed in previous sections, landscape planning works indirectly through land use planning and is only steering stepwise the autonomous development. Zev Naveh (2005) concluded that "we cannot predict the future of our landscapes and their rapid sometimes even chaotic changes by simply extrapolating from the past and present into an uncertain future."

Clearly, modelling actual processes will not allow making meaningful predictions. Continuity from the present into the future in the search for a single 'optimal' or 'desired' option risk choosing the "exactly right answer for the wrong question." (Potschin and Haines-Young 2006). Dealing with the future implies considering uncertainty. Steinitz (2003) defined different futures as:

- Preferable: that what one *wants to* happen based on value judgements
- Probable: that what is *likely to* happen based on current trends, i.e. prediction
- Plausible: that what *could* happen based on current knowledge
- Possible: that what *might* happen based on future knowledge

To this list, we should add random, low-probability, very-high-impact and disruptive events that are beyond control, such as calamities of all kinds (see Chap. 7 and Fig. 12.14). There is no way to predict deterministically the future. To plan for one optimal solution is unlikely, but many alternatives are plausible. In strategic planning, scenarios are used to compare and evaluate these alternatives to help decision-making. Making scenarios for long-term planning of landscape futures needs to be based on integrating systems thinking and must be dynamic.

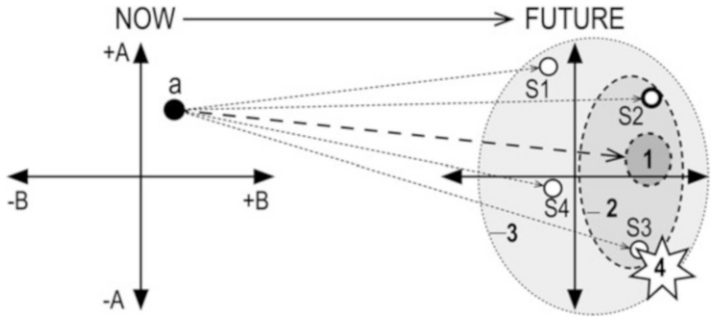

Fig. 12.14 Scenarios and uncertainty about the future: the landscape (a) located in a feature space defined by the minimum (−) and maximum values (+) of two indicators A and B. S1 to S4 are four possible scenarios for the future; S2 is the most preferred one. The uncertainty of the future increases from 1 to 4: 1 most probable (trend), 2 plausible, 3 possible and 4 unexpected events (calamity)

Indicators can be used to define the limits of the landscape tolerance over time according to the landscape quality objectives set (Potschin and Haines-Young 2006). Scenarios for different interest groups can be plotted in the feature space defined by these indicators to be compared and assessed. Figure 12.14 shows the conceptual model. Two indicators A and B are used to plot the actual status of the landscape (a) as well as the position of the expected outcomes of the scenarios S1 to S4. Indicators A and B could express the variation between a strong and weak character, between intensive or extensive land use, between continuity and discontinuity and degree of protection, for example. Different scenarios with have outcomes situated in different types of future according, which indicates their feasibility.

12.10.2 Uncertainty, Risk, Hazard and the Precautionary Principle

Uncertainty is a complex concept, rather like peeling the layers of an onion, revealing successive forms of uncertainty (Harding 1998). The outcome is that whilst we can reduce the uncertainty of one kind by applying more science, we will never totally remove uncertainty. Brian Wynne (1992) described the basic factors of uncertainty as follows:

- *Risk* refers to a combination of the probability or frequency of occurrence of a hazard and we are aware of potential consequences;
- *Uncertainty*: “we know the important system parameters but not the probability distributions”, i.e. “we don’t know the odds”;
- *Ignorance*: “we don’t know what we don’t know”;

- *Indeterminacy*: the scientific assessment of uncertainty and risk is conditional depending on the a priori assumptions made hoping they are valid;
- *Hazard* refers to an event causing damage, which can vary in magnitude and have effects that are temporarily, i.e. reversible, or irreversible causing permanent loss.

Uncertainty and risk are most formally and clearly defined in statistical analysis, in particular in relation to the probability of occurrence of errors of type I or II in statistical tests and in working with fuzzy sets. These concepts become more complex when dealing with spatial data and geographical analysis. Much of the discussion of uncertainty and risk assessment is now related to the application of GIS and spatial analysis. Uncertainty is related to many different things such as data quality, theory and conceptualisation, modelling and decision-making.

Antrop (2004b) relates uncertainty in planning to the successive and cumulative steps involved in the processing geographic data. First, uncertainty comes from the conceptualisation of the real world. Conceptualising reality depends upon many factors such as culture, ways of seeing and language. Is the reality conceived as natural objects or units, or by a more abstract representation? Do insiders and outsiders have the same conception? Much has to do with the possibility of a physical delineation or bordering of units and the classification of continuous phenomena with vague borders and complex fuzzy transitions into discrete categories. The second source of uncertainty comes from the selection of the geographical data to be used, their formal definition, the level of measurement and classification chosen. In GIS, this implies also the choice of the data model; representing reality by objects, vector or raster structures; reducing real things into points, lines and polygons. Techniques and methods of data collection, sampling and description contribute to this aspect of uncertainty. The third source of uncertainty relates to all manipulations of the information during data processing, analysis and classification and the formulation of indicators. The choice of (legend) categories and their operational definition is part of this. Here the treatment of specific properties of the data is important, such as dealing with fuzzy borders, spatial autocorrelation and size and scale dependency. Overlaying and combining data and modelling imply complex patterns of error propagation. Geostatistics offers a theoretical basis for analysing this, in particular concerning the principle of reproducibility of the results to guarantee scientific objectivity. The next source of uncertainty resides in the representation the results. This encompasses reporting and all kinds of visualisation (graphics, maps). This is essential for the participatory process and communication with the public. Finally, the participation process and the input by the public add uncertainty in the sense that the final outcome can be totally unexpected and even contradictory to the initial goals.

12.10.3 Scenarios for Future Landscapes

12.10.3.1 Normative Scenarios

Nassauer and Corry (2004) preferred using *normative scenarios*, which visualise how the future landscape should look like when all requirements of the goals are met. The idea of such prospective scenarios is based on the basic paradigm of landscape ecology that spatial patterns reflect the ecological functioning of a landscape. This allows modelling spatial compositions and configurations to optimise ecological functions, e.g. by creating ecological corridors and networks (Opdam et al. 2001). The concept of a normative scenario is related to the German concept of *Leitbilder* (Bastian 2004; Potschin and Haines-Young 2010).

Explorative Scenarios

Foresight, i.e. getting an idea about the plausible futures, is not adequate as the actors are part of the forces changing the future. Thus, defining landscape quality objectives becomes also a collective process of learning, communication and social interaction. The use of *explorative landscape scenarios* has been proposed in this context (Loupa Ramos 2010). A nice example of explorative landscape scenarios is given in the case study in Mértola. It is a rural municipality located in the south-eastern periphery of Portugal threatened by land abandonment and depopulation, which would affect the natural and cultural qualities of the landscape. The method of explorative landscape scenarios was used to formulate landscape quality objectives through a process of participatory learning between two groups: one of 'experts' and 'competent authorities' and one of the local stakeholders with very different interests. The method was qualitative and transdisciplinary and the main goal was to find a sustainable future for the community. The outcome was not only an evaluation of the proposed scenarios but also a common basis to continue. The next step is to make a 'normative' approach in identifying the adequate decisions, policies and instruments capable of realising the chosen future. This example shows how the landscape can be the integrating concept in a holistic approach.

Figure 12.15 summarises the results the explorative landscape scenarios in the case of Mértola. The discussions between the participants, based on photorealistic simulations of future landscapes, resulted in four scenarios, which were classified according to two dimensions of uncertainty, i.e. 'continuity' and 'state of protection'. The participatory process estimated also mutual understanding in the choices being made. There was an agreement between 'expert' and 'locals' that scenario 1 was most likely with a high degree of 'continuity' based on local qualities and 'without protection', i.e. market-based. Scenario 3 was considered unfavourable by both groups. For scenarios 2 and 4 were plausible for both groups but with different preferences and arguments.

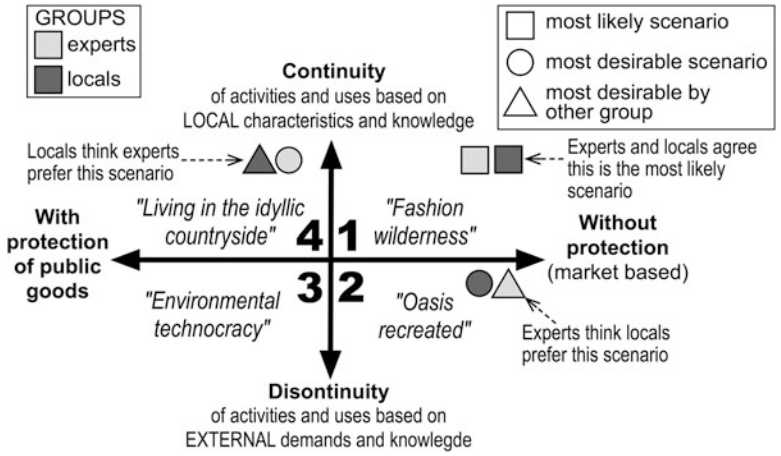

Fig. 12.15 Comparing the assessment based on two dimensions of uncertainty (continuity and protection) of four explorative landscape scenarios by experts and local stakeholders (After Loupa Ramos (2010))

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