Chapter 4
Approaches in Landscape Research

Abstract The complexity of landscape and its multiple meanings make that it is conceptualized differently according to the approach followed: as a complex spatial system of phenomena in interaction, as a scene or image that can be described using rules of perception, and as an existential phenomenon with strong symbolic meanings and values. The bird's-eye perspective offers a synoptic and detailed view of the visible aspects of the landscape with a dynamic scale by zooming in and out. This vertical perspective is often indirect and distant from the landscape as in aerial photography and cartography. The interior perspective is the one how most people experience landscapes every day. The inner perspective creates mindscapes that influence the way we value landscapes. The transcendental perspective sees landscape as holistic phenomenon and focuses on the meta-reality generated by the composing parts, such as coherence and complexity. Scientific disciplines combine in specific ways these different approaches. Following approaches are discussed: geography, ecology, landscape ecology, history, historical ecology, archaeology, environmental psychology and landscape architecture, as well as possibilities for inter- and transdisciplinary research.

Keywords Ways of seeing • Viewpoint • Bird's-eye perspective • Interior perspective • Inner perspective • Discipline • Interdisciplinary • Transdisciplinary

4.1 Introduction

In this chapter, we discuss principles that form the basis for the different approaches in landscape research. Two important aspects are the viewpoints taken by the observer of the landscape ('ways of seeing' as Cosgrove (2002) called them) and the framework of the scientific discipline involved or the context in which the research is done.

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4.2 Ways of Seeing

Cosgrove (2002) said that "landscape denotes primarily geography as it is seen, imaged and imagined" and that the evolution of landscape meanings also depended on changing technologies in sensing and representing our environment. The viewer of the landscape chooses a specific viewpoint and selects what to see and how.

The complexity of landscape and its multiple meanings make that it is conceptualized differently according to the approach followed. Landscape can be seen as:

- a complex spatial system of objects (elements) and continuous phenomena in interaction. In this approach following concepts are used: structure, pattern, functions, ecosystem, change, dynamics. The systems theory is the most important paradigm in this approach. These concepts can be described, sometimes measured and analysed using landscape metrics and indicators.
- a scene or image that can be described using rules of perception. Basic concepts are: views, view-sheds, isovists, vistas, perspectives, but also concepts related to preference such as aesthetics, openness, naturalness, disturbance, etc. Theories of environmental perception and Gestalt-psychology are applied as well as design principles.
- an existential phenomenon with strong symbolic meanings and values. Basic concepts used in this context are: home(land), heritage, history, genius loci, character, landmarks, social construct, narratives, etc. These are approaches of arts, philosophy, humanistic geography and sociology.

According to the viewpoint of the observer, four perspectives can be recognized Fig. 4.1):

- a viewpoint from above offers a bird's-eye perspective, looking from 'outside' to the landscape in a vertical or oblique way;
- a viewpoint 'interior' in the landscape offers mainly a horizontal perspective: the way most people perceive and experience the landscape;
- an 'inner', mental perspective offers mental images (mindscapes) of the landscape and allows representations and visualisation of the landscape, such as mental maps;
- a transcendent, abstract perspective: the landscape as a holistic meta-reality.

4.2.1 The Bird's-Eye Perspective: Landscapes at a Distance

The perspective from above uses a real or virtual viewpoint distant from the actual landscape. It is the bird's-eye perspective as can be seen directly from a high position and from the air. As an indirect observation, aerial photographs and satellite imagery also give this perspective. It offers a synoptic and detailed view

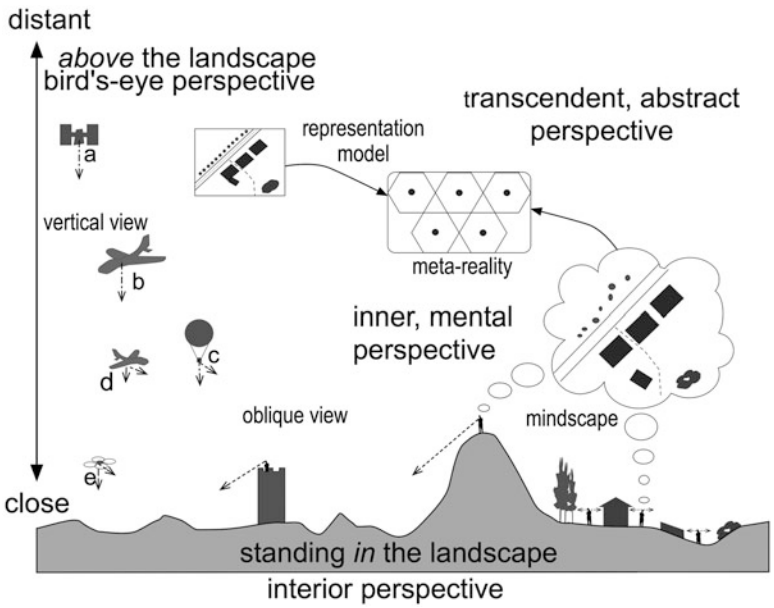

Fig. 4.1 Viewpoints and perspectives

of the visible aspects of the landscape with a dynamic scale by zooming in and out. The scale defines the extent of the view and the degree of detail (the 'grain') observed. The vertical perspective is commonly used in cartography. Maps show a conceptualised representation of the landscape according to mapmaker's rules.

This perspective clearly shows spatial patterns and the context of distinct elements. Often also the hierarchical structure and composition are revealed as well as the coherence and relations between the constituent parts. The information content is usually very high and allows the formulation of hypotheses about processes that are active in the landscape, about its history and the land use.

However, this perspective is literally distant, since the information used is mainly visual and the observer has no direct contact with the landscape. Knowledge about the landscape is derived from the interpretation of spatial patterns.

Humans instinctively looked for high viewpoints offering bird's-eye perspectives over the landscape. Mountaintops and towers gave an oblique perspective over a vast area, allowing orientation and cognitive mapping. These were the viewpoints of the early mapmakers. Since the development of photography, it is also possible to register more objectively this synoptic view. In 1858, Gaspard Felix Tournachon alias Nadar took the first aerial photograph from a balloon near Paris. Aerial photography offered unexpected views of the landscape and revealed patterns and features that were unknown until then. The benefit of the new technology was obvious and soon the most diverse devices were created to bring cameras in the air: balloons, kites, pigeons and airplanes. Aerial photographs taken from the Western front during the First World War demonstrated the potential for military

Fig. 4.2 Aerial photograph of Boekhoute (Belgium) in 1944. Settlement pattern and field systems are represented in detail. The inundation enhances the micro-relief and shows the different elevation between the polders (Photo Aerial Air Force)

reconnaissance and map making (Stichelbaut and Chielens 2014). Thus, the new technology developed rapidly, in particular during the wars (Fig. 4.2). Stereoscopic photogrammetry became the basis for a new approach in cartography and photo-interpretation using stereovision for military intelligence and scientific research. Orthophotographs are geometrically rectified and became a new type of map, commonly used as base layers in Geographical Information Systems (GIS) (Fig. 4.3a).

Aerial photographs offer a detailed and synoptic and simultaneous view of many landscape components such as land use, vegetation, settlements, field systems and landform emphasising their relations and coherence. This made Carl Troll say: "aerial photography is in a high degree landscape ecology" (Troll 1939). Aerial imagery allows also the detection of phenomena that cannot be observed easily

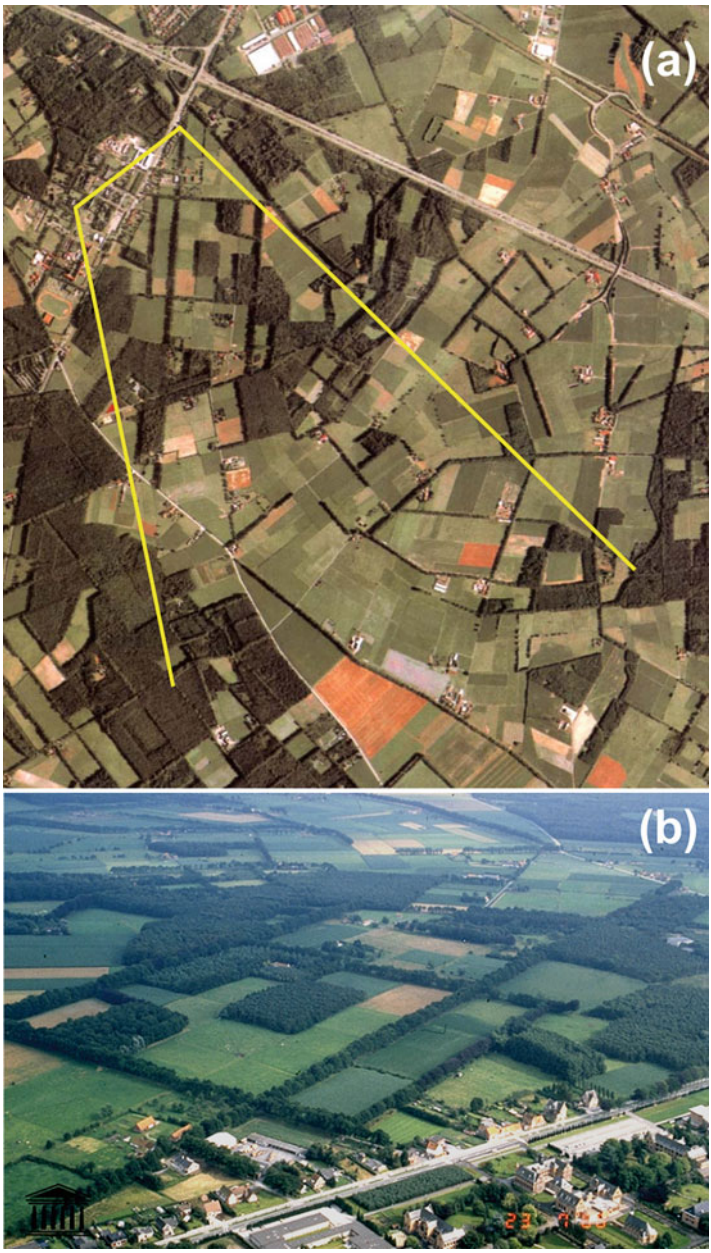

Fig. 4.3 Orthophotograph (**a**) and oblique aerial photo (**b**) of the Sint Pietersveld in Flanders (Belgium). Elements and objects are more easily identified on oblique than on vertical photographs. Both show spatial patterns and coherence between the elements. However, oblique photographs are distorted and loose detail with the decreasing scale towards the background, making them less practical to make measurements and perform quantitative analyses. (Copyright (**a**) Eurosense; (**b**) Ghent University and J. Semey 1989)

Fig. 4.4 Archaeological soil and crop marks on an oblique aerial photograph in Aartrijke (Belgium). Soil and crop marks are ephemeral phenomena that can be detected from a bird's-eye perspective. They are caused by differences in soil moisture, soil depth and stoniness that influence the growth of the vegetation. Also, micro-relief can be detected from this viewpoint in particular when the sun elevation is low (Copyright Ghent University, photo 54.525 J. Semey 1990)

from a ground position, such as soil and crop marks, which are indicative for archaeology and micro changes in soil conditions and drainage and indications of pollution. Aerial photography became a basic tool in the study of landscape, in physical, historical, rural and regional geography, in land evaluation, as well as in archaeological prospecting.

For surveying, often large-scale oblique photographs are used offering great detail (Fig. 4.3b). Their registration is very flexible and fast, allowing interactively testing the best exposure conditions and using them for monitoring and making repeat photography of specific features. Applications as these are particularly important in archaeological surveying (Dassié 1978), as demonstrated by the intensive surveying in Britain by O. Crawford (1960), in Germany by Irwin Scollar (1975), in Picardie (France) by Roger Agache (1978) and many others. Archaeological prospecting using aerial photography proved very fruitful, as for example demonstrated by the work of Jacques Semey who took more than 70,000 pictures in 20 years over Flanders, revealing more than 650 unknown archaeological sites (Ampe et al. 1996; De Reu et al. 2010) (Fig. 4.4).

However, the extent covered by one oblique photograph is limited and distortions of the geometry and illumination conditions are important. For mapping purposes, systematic stereoscopic vertical photographs are preferred. These often

range from scales between 1:10,000 and 1:50,000. The vertical perspective demands some training in photo-interpretation to recognise objects accurately and understand the features shown, certainly when special films, such as false colour infrared are used. Stereovision enhances the holistic view of the landscape, especially microtopography, due to the vertical exaggeration.

With small-scale imagery from satellites, synoptic views are possible at regional to even global scales. The first generation satellite images were made for intelligence purposes during the Cold War. An interesting series were the stereoscopic Corona photographs made by the U.S. Air Force for strategic reconnaissance from 1959 to 1972, covering the USSR, China, the Middle East and other strategic areas. The program was declassified in 1995 and the imagery became available for scientific and civil use, revealing its significance in landscape archaeological surveying, as the high resolution (approx. 2 m), stereoscopic photographs show areas which were not yet mapped in detail at that time.

From 1967 on electronic imagery from earth observation satellites became available for civil and scientific use. The spatial resolution of the first generation imagery was insufficient to recognise individual objects and landscape elements. However, the digital format of raster images stimulated the development of multispectral image classification and spatial filtering techniques as well as digital mapping and the development of raster-GIS. Successive improvements in the remote sensing technology from the 1980s on allowed producing images showing landscape structures in more detail, and from the 1990s on satellite imagery could compete with the resolution of aerial photographs (Jensen 2000). Simultaneously, image processing and classification expanded into the world of personal desktop computing and gradually cheap image coverage became available to all. Systems as Google Earth and Bing Maps nowadays offer detailed bird's-eye images from different sources, scales and periods available to all and offer in combination with digital terrain models also oblique 3D-views from any viewpoint possible.

4.2.2 The 'Interior' Perspective: Being in the Landscape – Lookouts and Composite Landscapes

Standing in the landscape offers the observer a horizontal perspective and this is the way most people experience landscapes every day. The position and movement of the observer are important variables in understanding the views. Elevated positions offer panoramic lookouts of the landscape in an oblique view (Fig. 4.5). On flat terrain, amidst vegetation and buildings, only small parts of the landscape can be seen and a mental representation of the whole landscape has to be constructed from assembling views at different positions. This mental map allows orientation in space and gradually allows understanding relationships and patterns that compose the landscape (Fig. 4.6).

Fig. 4.5 Lookout view from the hill Rodeberg (Belgium). Hilltops and towers offer an overview of the landscape revealing some spatial arrangement and elements that can be identified easily. Topography, buildings and vegetation block the view and much of the landscape structure remains hidden (Photo M. Antrop 2005)

Fig. 4.6 The observer, standing in the landscape on flat ground and surrounded by objects that mask the view has to combine mentally views from different positions in order to understand the spatial configuration and the relations between the elements (Drongen, Belgium, Open Street Map; photos M. Antrop)

Standing in the landscape, the observer experiences his surroundings with all senses. Even if the visual perception dominates, the resulting image becomes 'coloured' by the other senses. In the landscape, it makes a difference when one is looking at nice scenery with a bad smelling waste dump or noisy motorway behind the observer or not. This is a holistic experience that is difficult to register using photography. Hence the discussion about the bias in using landscape photographs as 'objective' registration of the landscape and as the sole stimuli in preference studies.

Experiencing landscape directly by standing in and moving through it is the way we come to evaluate it as ordinary, picturesque, spectacular or sublime. It is the perspective of everyone, but also of the poet, painter, photographer and publicity maker who use the landscape in their expressions.

4.2.3 The Inner Perspective: Mindscapes and Visualisations

The inner perspective projects mental representations and memories upon the landscapes we observe and also influence the way we visualise landscapes in representations such as drawings, paintings and models. Growing up, we develop mental mapping for orienting ourselves in our environment and to help us interpreting and understanding the surroundings. This is a vital survival skill, which gradually develops our 'mental map' composed of several mindscapes according to our experience and the landscapes we visited.

The reality is not the physical landscape we observe, but its mental interpretation. We tend to focus on what we already know, on what is familiar and on what is important in terms of safety and prospect. Thus we focus on fixed landmarks for orientation, identify characteristic elements, detect risks and disturbances, and look for relations and coherence. Recognition and understanding depends on the legibility of the landscape. *Landscape reading* is determined by observer's properties as education, social status, etc. These are studied in landscape experience and preference research (Sevenant 2010).

Mindscapes represent also ideal landscapes, integrating our knowledge, memories and feelings associated with places and regions. They define the image we have of our 'homeland' and 'home' or 'domestic landscape', as well as the *genius loci* (spirit) of a place (Fig. 4.7).

The aesthetic, existential and symbolic properties and preferences were mainly studied in spectacular and sublime landscapes and from an artistic perspective. Applications are found in landscaping estate gardens and parks. Early studies of the rural and ordinary landscape rarely focused on these aspects. Only since the second half of the twentieth century they became studied in a humanistic and sociological approach. New concepts were introduced as well such as (*sense of*) *place* and *placenessness*, *non-places* (*non-lieux*) and *quality of space*. The relations between language and linguistics, and between landscape and place became more important. Kenneth Olwig (1996, 2002) and Denis Cosgrove (1984, 1993) demonstrated how the

Fig. 4.7 The spirit of place: water sources were always considered mysterious. Such vital places were marked by placing chapels and special trees nearby (Stambruges, Belgium) (Photo M. Antrop 2005). Many of these trees are fetish-trees, still venerated as shown by the ex-votos

landscape, as a concept and a representation, was intentionally used politically in shaping territories according to ideology and to develop national identities and stimulate nationalism. An extreme example is given by the planning and landscaping rules for creating 'ideal German' landscapes in Nazi-Germany.

Our mindscape also influences the way landscapes are represented in maps and 2D or 3D computer visualisations. People became familiar with cartographic representations of water in shades of blue according to the depth, lowlands in green, hilly uplands in a range of yellow-orange and mountains in brown and white for the tops. Recognising landforms on hill-shaded relief maps with virtual illumination from the northwest, according to mapmaker's conventions, causes no problems.

4.2.4 Landscape as Meta-Reality: The Transcendental Perspective

Landscape is holistic, meaning that the whole is more than the sum of the composing parts. How to grasp that 'more than the sum'? That is what the transcendental

approach to landscape attempts to do. The focus is not on the composing parts, but on the meta-reality they generate. One is looking for characteristics beyond the visible and physical landscape. How can the coherence between the composing elements be described and measured? What do landscape diversity and heterogeneity mean? To study these meta-properties, two approaches are possible: a philosophical-psychological approach and a parametric-reductionist approach.

The philosophical-psychological approach is based on the Gestalt-theory and hierarchical system thinking. Complex landscape entities that function autonomously in some degree are seen as the building blocks of the landscape. They are referred to as holons (Naveh and Lieberman 1994, Antrop 2004), black boxes ('Pandora boxes') (Zonneveld 2005) or ecodevices (Van Wirdum 1981). Although they possess some freedom in their functioning, they interact with each other and are embedded in a multi-scale hierarchical system. Zev Naveh called it the Total Human Ecosystem or THE (Naveh 2000).

The second approach is parametric and reductionist. Meta-properties, such as diversity and coherence, are formally defined, as well as the parameters to describe and measure these. The analysis uses statistics, models and thematic mapping for visualising the meta-properties. Therefore, new geostatistics, landscape metrics and indicators were developed. Special tools, such as Fragstats, became very popular in the analysis of spatial patterns (McGarigal and Marks 1995; Li and Wu 2007).

4.3 Disciplines

4.3.1 Geography and Historical Geography

Landscape was a core subject of study in geography during its early development as an empirical science. Landscape was seen as the synthesis of the interaction between the natural environment and human society and characterised by unique geographical regions. It resulted in the study of land use zoning and vegetation patterns, of agrarian systems and settlement patterns, of hydrographical and transportation networks, etc. The spatial diversity was explained by the variation in ecological and cultural factors and in a dynamical perspective covering the geological evolution and history. It implied integrating sciences as geology, soil science, botany, hydrology and geomorphology as well as demography, anthropology, economy, politics and history. As such, geography was interdisciplinary 'avant la lettre'.

Important methodological developments were initiated in geography and later used by most disciplines involved in landscape studies. Important contributions from geography were found in field surveying, cartography and map analysis in various forms, air photo and image interpretation, early development of spatial analysis, modelling and geostatistics, and the conceptualisation of geographical

information systems (GIS). Many of these are common tools in other disciplines, which also enhanced continued the methodological development.

Historical geography studies the evolution of (mainly cultural) landscapes using maps and plans, written sources and iconographic material. Also, structures, elements and place names (toponyms) in the contemporary landscapes that witness from the past are studied (Van Slembrouck et al. 2005). Early studies focus mainly on the agrarian landscape. The actual landscape is seen as a palimpsest – an analogy introduced by O.G.S. Crawford – a sheet of vellum used over and over again for writing texts, each time erasing the older ones, but leaving some fragments between the new text (Turner 2013).

Historical geography uses two approaches to study landscapes. The first focuses on the reconstruction of the landscape in a given period, the other focuses on trajectories of change, also referred as landscape paths. A complete integrated history of the landscape in a certain region results in a *landscape biography* (Kolen 2005). Classifying and mapping the actual landscape according to its historical dimension is achieved in a *Historic Landscape Characterisation* (HLC) (Rippon 2004).

When the study starts from relicts in the actual landscape and gradually tries to reconstruct past situations, a *retrospective method* is used (Rippon 2012). When all information is used to reconstruct as complete as possible a given period, the method is called *retrogressive*. When making a landscape biography, the reconstruction of past landscapes and their genesis is also linked to the study of practices and technology used in agriculture and forestry, and also the political, social and economic context is taken into consideration.

4.3.2 Landscape Ecology

Ecological thinking in the study of the landscape existed already before ecology was established as a discipline (Claval 2005). The concept of landscape has been introduced in ecology rather late (Décamps and Décamps 2004). Initially, the landscape was seen in ecology as one of the scale levels in the increasing complexity of the organisation of ecosystems.

Basically, the concept of landscape necessitates an observer. Different observers see and conceive different landscapes. This applies to humans, but also to all living species. The landscape of a cow in a pasture is fundamentally different from that of a bird. Landscape ecology took this organism-centred perspective as a basis for its definition of landscape (Wiens 1976). Consequently, the landscape consists of a heterogeneous mosaic of habitats that are functionally important to a given species. The landscape is a spatial configuration of beneficial and hostile patches for the organism. For an organism the landscape extends as its home range, and thus covers different areas according to the mobility of the species concerned. This defines the scale the landscape is studied at and consists of two parameters: the *extent*

(corresponding to the home range) and the *grain* or the degree of detail (resolution) needed to describe all significant features.

Although these concepts are principally valid, when *Homo sapiens sapiens* is the species studied, they become more complex. The extent of the human home range is now global, his technology allows him to transform and more or less control his environment. The historical development of the cultural landscape shows this increasing complexity from a simple landscape ecological model to a global *Total Human Ecosystem* (THE) (Naveh 2007). Anyhow, landscape ecological principles are needed in the human perspective of the landscape. Michael Moss (1999) formulated it as follows:

> To me, landscape ecology is simply about the study of landscapes and of the need to derive understanding about landscapes in order to enhance our abilities to manage them more effectively. Landscape ecology is not the only field to focus on the landscape but it has emerged in the last few decades because, quite clearly, existing approaches that sought to address a whole range of landscape scale environmental issues were proving to be inadequate.

Landscape ecology conceives the space of a landscape as a mosaic composed of landscape elements, which configure a spatial structure, characterised by a series of meta-properties such as diversity, heterogeneity and order. The patch-corridor-matrix model is used essentially (Forman and Godron 1986). This conceptual model initiated new theoretical and methodological approaches in the study of landscapes. The spatial aspect became integrated in the classical systems theory used in ecology. The central paradigm is that the spatial structure of the landscape interacts continuously with ecological processes that shape it. Techniques of spatial analysis and geostatistics from geography were used and developed, creating a proper quantitative approach to the study of structural characteristics of the landscape by means of landscape metrics and landscape indicators.

Landscape ecology contributed to new insight and applications in nature conservation and landscape restoration and had an important impact on spatial and environmental planning. Typical examples are the introduction of ecological networks and green infrastructure (Ahern 1995; Baudry and Merriam 1988). Paul Opdam (2005) demonstrated how the island theory from ecology and the theory on meta-populations became introduced in interdisciplinary spatial planning of ecological networks. Landscape ecological concepts proved to be useful also in the study of palaeo-landscapes and the development of cultural landscapes since the Neolithic. Early human settlements can be seen as patches in a vast matrix of wilderness. Contemporary landscapes often form an urban matrix with some fragmented patches of agricultural land, woodland and nature, as well as different types of corridors. The patch-matrix model even applies on landscape preference: the smaller patches are regarded as valuable entities and receive more attention that the vast matrix of ‘ordinary’ landscape around. Protection of the remaining open rural space against ‘development’ uses arguments against fragmentation. Corridors define our mobility and different superimposed networks of transportation corridors developed.

4.3.3 Historical Ecology

Historical ecology studies past ecological conditions, processes and practices to understand the occurrence and distribution of species, as well as human actions in relation to the environment. Results indicate that many of now lost practices were highly sustainable.

The distribution of species today also indicates past situations. The study of seeds and pollen found in filled ditches and ponds and peat deposits enables the dating and reconstruction of the vegetation types in past landscapes, as well as crops used by humans. Understanding long-term processes such as grazing helps explain the succession of landscape types (Vera 2000). Oliver Rackham (1990, 2004) demonstrated the importance of studying ancient trees in the reconstruction of past landscapes.

4.3.4 Archaeology

Since approximately two decades archaeologists developed a specialisation called landscape archaeology or geo-archaeology (Aston and Rowley 1974; Turner 2013). Branton (2009) speaks of historical archaeology as the archaeology of places. It is the result from the input of approaches, theories and concepts of several disciplines from natural sciences in archaeological research. A wide variety of methods and techniques is used from soil science, geology, geomorphology, geophysical prospecting, dating techniques, pollen analysis, aerial photography and remote sensing, spatial analysis and GIS. This demands an interdisciplinary approach at the scale of the landscape. Landscape archaeology focuses upon the reconstruction of palaeo-landscapes and the relations that ancient civilisations developed regarding the use of the natural resources in their environment. Landscape archaeology is very similar to settlement archaeology and ecological archaeology, but focuses on landscape modelling in a dynamic perspective.

Landscape archaeologists introduced concepts as time depth of the landscape, landscape paths or trajectories. They also developed methods for *Historic Landscape Characterisation* (HLC) (Clark et al. 2004), which aim to integrate landscape archaeology, historical geography and historical ecology for applications in heritage protection and spatial planning. Also, they focus on the management of change in the perspective of archaeological conservation (Fairclough and Rippon 2002).

4.3.5 Environmental Psychology

Since the second part of the twentieth century, psychologists showed a growing interest in the relations between the environmental conditions and the development

of the human personality and behaviour. In the beginnings, the focus was on the ways people perceived their surroundings, and how meanings and values were formed. The environment proved to be important in understanding processes of learning and behaviour. For example, following biophysical environmental factors were identified to influence health conditions and stress: weather, noise, upheaval and pollution. Also factors defining the social environmental proved to be important: population density, accessibility, mobility, territoriality, defining public, private and personal space, and finally aesthetics. All these are represented or reflected in the landscape.

Theories and methods from social sciences were used to study the relations between landscape properties, environmental factors and psychological and social indicators. Methods consist of surveys, interviews and experiments. Common is the use of photographs or video of a landscape and measuring the physiological response. Applications of these studies are mainly found in physical (urban) planning and design.

4.3.6 Landscape Architecture

Landscape architecture emerged from the garden architecture of palaces in close relationship with arts, architecture and urban design. Landscape architecture developed outside academic sciences as a profession where the creativity of the designer and the originality of the design prevailed (Bell 1999). The *American Society of Landscape Architects (ASLA),* founded in 1899, is the oldest association to deal with the landscape in a professional manner.

The importance of landscape architecture grew with the political impact of large development projects and land reforms. As an expressive form of art in garden design, landscape architecture became also important as an instrument in ideological and political propaganda (Olwig 2002). The final shaping of new constructions and infrastructure and their integration in the landscape has become a main task for architects and landscape architects today.

4.3.7 Economics

Price (2013a) reminds that implicit applications of economics to landscape date already from when land became a commodity as a natural resource. Also, when landscapes were transformed and created for aesthetic purposes, such as in landscape gardening, economical considerations about costs were important. The formal discipline of landscape economics derived from the growing demand of landscape as a common aesthetic good by the broad public (Price 2013a). The book *Landscape Economics* by Colin Price (1978) can been seen as the start of this new research field.

The economic evaluation of landscape builds upon the practice of monetary valuation of the environment and concepts as ecosystem functions and services and natural capital (Costanza et al. 1997). The ecological complexity is translated into a series of ecological functions (regulation, habitat production and information), which provide goods and services that are valued by humans (de Groot et al. 2002). Antrop et al. (2013) proposed a framework to link landscape qualities, functions, values to specific (multifunctional) land uses. Methods developed for the valuation of natural and environmental goods and services were applied on landscapes as well. However, besides instrumental values of material and ecological components of the landscape, landscapes are characterized by intangible values, such as aesthetic and cultural values. Aesthetic value in particular is regarded a non-instrumental value (van der Heide and Heijman 2013). The difference between instrumental and non-instrumental values is the basis of the discussion between objectivity and subjectivity in landscape evaluation (Price 2013b).

4.4 Inter- and Transdisciplinary Approaches

Landscape encompasses most of the societal sectors, such as agriculture, forestry, nature and heritage conservation, urban and spatial planning, recreation and tourism. Special landscapes can be protected as monument, and land use is controlled by environmental and planning legislation. Most landscape related issues cover several sectors and demand research input from several disciplines. No sector-oriented or singular disciplinary approach proved to be adequate and efficient to deal with landscape issues. Stimulated by the Aarhus Convention, adopted by the European Commission in 1998, the of democratic participation in policy became important, and necessitated more input from the 'public', the (local) population and (potential) users in all landscape matters. Therefore, a transdisciplinary approach in landscape research is necessary (Naveh 2007) and essential for the further development of disciplines (Wu and Hobbs 2007). Tress et al. (2005a, b) analysed the integration of scientific disciplines and non-academicians in landscape studies and proposed clear definitions for the different approaches. In a (single) *disciplinary approach* the landscape is studied from the specific problems and goals of one discipline. Other aspects of the landscape are disregarded. In a *multidisciplinary approach,* several disciplines study simultaneously the same landscape and have a common research theme, but still keep their specific approaches. Different aspects of the landscape are studied, but not yet integrated. The final report looks like a collection of chapters each devoted to one discipline. In *interdisciplinary research,* a central common problem and research goal is studied simultaneously and interactively by several disciplines. Each discipline only offers a contribution that is significant for the common goal. The chapters in the final report will refer to partial aspects of the problem and the steps to solve it. Interdisciplinary research implies that a

common language is developed and understood by all participating disciplines and from the start communication and co-operation is essential to integrate all new knowledge. However, interdisciplinary research only involves scientists or experts. In *transdisicplinary research* also policy makers, administrators and laypeople participate. Tress et al. (2005a) call inter- and transdisciplinary research also integrative research (Fig. 4.8). The differences between the different degrees of disciplinary integration should become clear in the work organization and the report structure (Fig. 4.9).

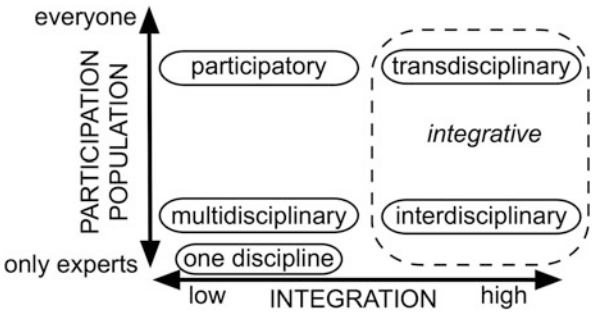

Fig. 4.8 Level of integration and participation in landscape related research (After Tress et al. 2005b)

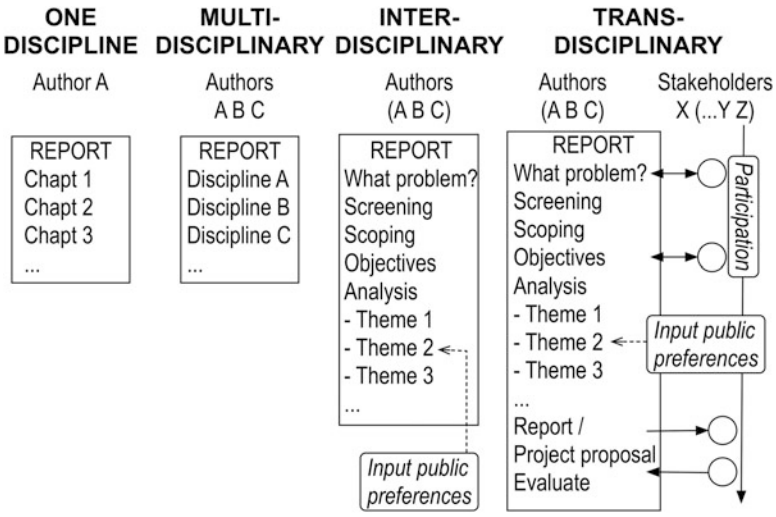

Fig. 4.9 Work organization and report structure in different degrees of integrated landscape research

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