Multifunctional landscapes, definitions and applications

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Jesper Brandt og Henrik Vejre

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FORORD

Vedlagte manuskript er et udkast til en indledende artikel til en 'miniserie' om 'Multifunctional landscapes', der skal udgives på WIT-press i deres serie 'Advances in ecological Sciences', som i de seneste år har indeholdt en del landskabsøkologisk litteratur.
Miniserien er baseret på bidrag til konferencen *Multifunctional Landscapes – Interdisciplinary approaches to landscape research and management*, der blev afholdt i Roskilde 18-21 oktober 2000.
Konferencen var organiseret omkring 6 workshops, der diskuterede delproblemstillinger indenfor hovedtemaet, og som fokuserede på udarbejdelsen af et sæt rekommandationer for en videre forskningsindsats indenfor området.
Derfor præsenteres indholdsfortegnelsen til serien først. Den er foreløbig, da der foregår en peer review process, som på flere punkter godt kan ændre resultatet.
Første del af vores manuskript til den indledende artikel er et forsøg på at få præciseret de forskellige opfattelser af funktionalitet, der ligger bag 'multifunktionalitetsdiskussionen', mens sidste del er baseret på dele af den opsummering, som Jesper Brandt gav ved konferencens afslutning, nemlig det der vedrørte de spatiale sider af multifunktionalitetsbegrebet, set i et landskabsperspektiv.
Det er tanken, at vi i den afsluttende del af paperet nogen lunde systematisk skal få indarbejdet de hovedideer omkring (multi)funktionalitetsdiskussionen, der præsenteres i de indkomne papers, i denne 'systematik'. Herigennem skulle vi kunne lægge op til en afsluttende debat med redaktørerne af de 6 temaer, der indgik i konferencen, med henblik på den endelige ordlyd af de 6 sæt af rekommandationer, men på dette områder er vi, på grund af en række andre presserende opgaver, ikke nået så langt, som vi havde håbet.

Roskilde, 19 November 2001

Jesper Brandt og Henrik Vejre

Proposal for 3 WIT Press Books on 'Multifunctional landscapes' in or parallel to the series "Advances in Ecological Sciences"

Part 1: Multifunctional Landscapes: Theory, Values and History

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The landscape – from vision to definition (eds: Bärbel Tress, Gunther Tress)

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The importance of multifunctional, self-organizing biosphere landscapes for the future of our Total Human Ecosystem – a new paradigm for transdisciplinary landscape ecology

Olaf Bastian (Germany)
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Hubert Gulinck (Belgium)
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Multifunctionality, landscape values and planning

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Recreational and aesthetic values in Danish landscapes – Assessing the recreational and aesthetic value

Kevin Parris (France):
Agri-environmental Indicators for Multifunctionality in the Countryside: Measuring Changes in Agricultural Landscapes as a Tool for Policy Makers.

Ecological aspects of multifunctional landscapes in historical perspective (ed.: Kenneth Olwig)

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Ecological Aspects of Multifunctionality in Landscapes in Historical Perspective

Kenneth Olwig (Norway)
"Historical Aspects Multifunctionality in Landscapes" – opposing Views of Landscape

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Historical ecology of Dutch cultural landscapes

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Multifunctional landscapes, definitions and applications

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Abstract

Within landscape sciences, the concept of multifunctionality is attaining attention. This paper deals with definitions and applications of multifunctionality in cultural landscapes. Three definitions of functionality are suggested; ecosystem, land use related, and social functionality, respectively. Land cover may serve as an empirical entry to the description of all kinds of functionalities. Land cover may indicate delineation of ecosystem borders, and help identifying ecosystem function, land cover is an expression of human induced structures and changes, and land cover may materialize a designation in the landscape. From a spatial point of view we define three general types of multifunctionality, i. a spatial combination of separate land units with different functions related to land use, ii. different functions devoted to the same land unit, but separated in time, and iii. integration of different functions at the same unit of land at the same time.

Introduction

The concept of multifunctionality is getting increasing attention in the landscape sciences and in the ongoing debates on sustainable development, agricultural policies and international trade. In the continuing process of multilateral trade negotiations in the frame of WTO, multifunctionality of landscapes in an agricultural context has become a central issue, as several industrialized countries are claiming that the externalities of multifunctional agricultural systems should exempt these countries from the general cut back or elimination of agricultural market subsidies (Bohman et al. 1999).

The conference on multifunctional landscapes held in Roskilde in October 2000 demonstrated the recognition of the problems of multifunctionality of cultural landscapes, and a growing interest in applying the concept in landscape science, and not least the application of multifunctionality in landscape analysis, management and planning.

Many participants were reluctant precisely to define what they meant by multifunctional landscapes, however. This may be due to respect for the many-faceted aspects of the concept, of which a strict definition may only cover a fraction. Attempts to reach a sound definition may easily be dissolved by critical examination and evaluation by an interdisciplinary audience. As such, multifunctionality does not differ from other complex concepts from the environmental sciences, e.g. biodiversity or sustainable development. By refraining from defining the concept of multifunctional landscapes, however, we risk that multifunctionality is becoming another buzzword, deprived from any operational content. We therefore urge a discussion on multifunctionality and multifunctional landscapes that is focused on practical application in landscape sciences and landscape management.

In this paper we suggest definitions on functionality, multifunctionality and multifunctional landscapes. Central issues include the question of scale, and the employment of information on land attributes (in particular land cover) in the operationalization of functionality. Finally we discuss where, when and how to apply multifunctionality in landscapes. The various aspects of functionality are throughout demonstrated by simple cases.

The different approaches to functionality

Prior to the discussion on multifunctionality, we will focus on the core of the term - the concept of functionality. We focus on three types of functionality reflecting different approaches in the landscape sciences:

i. Functionality of ecosystems and landscape ecosystems
ii. Functionality pertaining to land use
iii. Social functionality

Initially the three types will be treated as separate concepts, but as will be demonstrated below, they are closely related.

i. Functionality of ecosystems and landscape ecosystems

According to general ecosystems theory (e.g. Odum 19xx, Kimmins 19xx), ecosystems may be described as the interaction between living and dead biomass and the abiotic frames, which in turn may be described by fluxes of energy, matter and species in both topological and chorological (spatial) context. In the definition of ecosystem function in a landscape ecological context, the spatial dimension should be emphasized.

Ecosystem function includes both system-internal fluxes and system-external fluxes. System-external fluxes include exchange of energy, matter and species with the surroundings. The *totality of fluxes* or *processes* constitutes the ecosystem *function*. In strict ecosystem sense, any human use of (as expressed by land use, see below) or impact on ecosystems may be described as regulations of inputs and outputs of matter, energy and species, hence human influence is merely a part of the ecosystem function (e.g. Zonneveld 1995). By stressing that ecosystem function is the *totality* of processes, irrespective of the type and extent of human interferences with the system, it gives little meaning to use the term *multi*functionality at the ecosystem level, as there cannot exist more than one totality of processes, i.e. more than one function. However, if ecosystems are understood as hierarchically ordered, consisting of different types of subsystems that are functionally linked, ecosystems may be considered multifunctional.

Within environmental science and planning ecosystem function is more often described from a direct or indirect anthropocentric point of view: So, de Groot (1992) defines *functions of natural environment* as the capacity of natural processes and components to provide goods and services that satisfy human needs directly and/or indirectly, and divides them into 16 types of regulation functions, 5 types of carrier function, 11 types of production functions and 5 types of information functions (se fig.

1). Of these four groups the first group, regulation functions, can be considered 'ecosystem functions'.

Ecosystem research has often been carried out with emphasis on the time dimension and corresponding ignorance of the space dimension. But in reality ecosystems will always have a spatial dimension and their hierarchical ordering will be expressed in different characteristic types of spatial structures and dynamics at different scales. Landscapes are from an ecological point of view mostly understood as conglomerates of spatial units each consisting of a different ecosystem (or when emphasis is put on the spatial aspects: ecotopes or ecochores). Though a landscape may be considered as one ecosystem with only one totality of processes, the focus on the heterogeneous composition of different ecosystems implies that landscapes generally are considered ecologically multifunctional.

Regarding the landscape as a concrete combination and unity of discrete ecological systems represent the general approach of natural sciences to functionality. Landscapes may regulate the local circulation of matter, energy and information in time and space, and simultaneously act as a habitat for different organisms. The distinction of these functions are only mental abstractions, however, as they are all part of the totality of processes.

The use of the concept of functionality in strict ecosystem sense is problematic in the landscape sciences. It is too poorly defined and of little use in landscape sciences, and landscape sciences must develop specific definitions of function and functionality. Not least the use of functionality in cultural landscapes have demonstrated the need of alternatives to those concepts offered by ecological sciences.

ii. Functionality pertaining to land use

The definition of ecosystemfunctionality above is not influenced by the fact that most landscapes are cultural in their origin, often consisting of minor natural patches embedded in cultivated matrixes. In contrast the second approach to functionality is

strongly related to the human-ecological aspect of the landscape, generally expressed as *land use*. Land use comprises any human exploitation that has implications for ecological fluxes, i.e. ecosystem input and output. Land use may be regarded as the spatial expression of human adaptation to the natural conditions of the landscape, e.g. relief and climate soil, flora and fauna.

Landscapes are exploited or used in order to fulfill material and spiritual human needs. Of methodological reasons we will restrict land use to material processes, as these have spatial implications, which may be registered by changes in land cover. If human use does not leave traceable impacts on ecological fluxes, we should reject from using the term land use, and instead employ definitions of social functionality as described below (iii).

According to the land use approach, function is equal to land use, and the functionality refers to the set, or bundle, of processes that are specifically linked to the specific land use. Two or more sets of processes with each an assigned land use, result in two or more functions, and in this context functionality may be an appropriate term to denote the *totality of land uses* . Alternatively, multifunctionality may characterize situations with more than one land use on the same tract of land. It is obvious that land use multifunctionality requires a reductionist view on function as compared to the ecosystem approach described above (i), as the totality of processes is divided into fragments, or "bundles", of processes pertaining to the different land uses in question. A specific process could be related to more than one bundle of processes, and hence be related to more than one land use, and different processes related to one land use function? (fig x).

Landscapes will typically host several land uses, and in terms of land use - related functionality, landscapes will most often be multifunctional, but not always. One land use may completely cover large land areas despite substantial variation in geo-ecological units, and hence landscapes may be considered monofunctional. [Example]

The distinction between functionality of type (i) and (ii) may be illustrated by a few simple examples. Ecosystem function encompasses *all* processes, whereas land use encompasses all *relevant* processes. In a forest ecosystem, all internal and external fluxes are included in the ecosystem function - including processes related to

insignificant organisms, whose presence are completely irrelevant to the *land use* - forestry. The presence of a small population of birds is part of the ecosystem function, but the land use forestry is functioning irrespective of the presence of the particular bird. Flood plain agriculture may serve as another example on distinction between ecosystem function and land use. Flood plains experience regular flooding at winter and spring time, certainly the rise and fall of water is part of the ecosystem function, but it may functionally fall outside the immediate relevance for growing of crops in the summer, i.e. the land use.

It should be emphasized that ecosystems from a land use point of view may be considered multifunctional – Forman & Godron (1986) and van der Ploeg (1995) claimed that a hedgerow (which in this context must be treated as an ecosystem used by man) may possess *multiple functions* for the farmer and for the society – shade, pest reduction, wildlife, competition with crops etc. Also a land use type may be considered multifunctional – a pasture may be used for grazing, for mowing, serve as a habitat for species, etc. Often the term multiple use is used to describe different land uses at the same landscape unit.

iii. Social functionality

The third approach to functionality comprises functions that are not necessarily related to material processes per se, as required in definitions (i) and (ii), (though social functions definitely still *may* be attributed bundles of processes)evt ud . Functionality without attributed material processes may be denoted meta-functionality.

Meta-functions are often associated to aesthetic, social, economic, juridical, regulative or cadastral relations. Meta-functions are related to specific landscapes, but not necessarily associated to well defined geo-ecological units. Adding aesthetic values, or designation of land areas to specific intended purposes are examples of meta-functions, as they only exist on maps or as perceptions.

The general category of social functions may be subdivided in *perceived* and *designated* functionality. Though both entire constructions of the human mind, differences exist between designated and perceived functions. Designations in

landscapes are typically made in order to give priority for a certain land use, protection measures or other requirements that calls for a zoning of the land area, so that planners and developers can act in order to concentrate activities - .Designations in landscapes are often very well delineated objectively and retrievable from maps and GIS's. Perceived functions comprise typically mental abstractions, where information from the landscape are interpreted by the human brain and transformed into ill defined concepts of beauty, or spiritual feelings. Perceived functions are most often subjective, and difficult to delineate in concrete landscapes. The spiritual feeling may vary tremendously form person to person exposed to the same landscape, and driving through a landscape, it is hard to tell exactly when the landscape cease or begin to be beautiful. Both perceived and designated functionality require a flow of information to ad meaning to the functions. Transformation of information may be landscape information reproduced on a map or in a written or oral presentation of landscapes.

Designated or perceived multifunctionality may easily arise from the mere combination of designated functions in the same landscape or land unit - or different perceptions of the same landscape (Fig xx). The forestry example from above may still serve as example for the designated and perceived functions. The forest may be designated a *habitat* according to EU regulation - the habitat is delineated on a map and recognized by all relevant actors - without even leaving a single track in the landscape. But the forest has got a new function. Also, the perceived functionality, recognition that the forest is beautiful, or the location of important cultural carnations, does not necessarily imply physical changes.

Relation between the different functionality concepts (i), (ii) and (iii).

As mentioned above, the three approaches represent different viewpoints on functionality, partly related to different scientific traditions. Identification of links between the three approaches therefore seems essential to the communication among transdisciplinary audiences.

Some crucial *differences* between the approaches should initially be pinpointed, however. Firstly, ecosystem function encompasses all processes, whereas land use

encompasses only a fraction of these processes, as exemplified above. Thirdly, material processes are not necessarily a consequence of designated or perceived functionality. Finally it should be emphasized noted, that ecosystems (and land use?) too may be viewed as a social construction, built on a model that emphasizes certain processes.

When linking and distinguishing between (i), (ii) and (iii), the concept of land cover may be a useful tool. Land cover does not provide much information per se, but coupled with the concept of functionality, land cover becomes an important tool. Land cover may assist in operationalizing the use of all three approaches. Land cover information is probably the most often used variable in distinguishing both ecotope and land use units, and the manifestation of perceived functions in the landscape is often reflected in land cover. Often, the borders of designated functions on maps follow land cover boundaries.

Land cover is an empirical entry to the description of both ecosystem functionality, land use functionality, and in many cases also designated and/or perceived functionality. Land cover may indicate delineation of ecosystem borders, and help identifying ecosystem function, but land cover is also an expression of human induced structures and changes, i.e. land use.

Land cover may be used to characterise and/or delineate a designation, e.g. land ownership borders in form of e.g. hedges and wallsSo, land cover may be used to visualize otherwise non-visible borders. Land cover may also contribute to perceived functions. For instance aesthetic value is often a result of a specific distribution and/or combination of land cover type.

Perceptions and designations may be materialized in the landscapes, but usually only after a process of information. National parks, nature reserves, battlefield parks are examples on designated areas that did not initially posses marked boundaries, but where differentiation in management inside and outside the designated area slowly make the borders visible. In an urban development plan, a parcelling out will often result in a materialisation of borders in form of hedgerows, walls or other marked land cover differences as one of the first material consequences. In contrast, the

materialization of autonomous ecosystem processes happen irrespective of human influence.

Combining different types of functionality

A basic frustration that commonly arises when the concept of multifunctionality is discussed is that different approaches to functionality are employed in the discussions. If a land use function is combined with a meta-function - e.g. agriculture combined with aesthetic beauty, the area may be multifunctional by definition. But does it make sense to combine totally different aspects of functionality? We fear that multifunctionality will be deprived of its sense if all kinds of functionality are mingled. It is therefore of importance to settle some general agreements on operationalization of functionality and multifunctionality.

Consequences for the development of multifunctional landscape

Spatial

Operationalization of functionality and multifunctionality in landscapes

Obviously each approach to functionality comes to very different results both what the conception of functions, as well as the landscape concept are concerned. Further, problems of correspondence between the various approaches exist. If it is attempted to explicit different functions empirically, problems seem to arise for a corresponding clear conception and mapping of landscape units and vice versa: In the conceptualization and complex mapping of landscape units, certain priorities concerning landscape functions will implicitly be present, not necessarily in correspondence with the needs set by a given classification of functionalit y [fig]. But - given a landscape structure, chorological defined as a holistic entity of heterogeneous land units, and given a classification of functions - it is not difficult to encircle some central aspects of the concept of a multifunctional landscape.

Combinations of functions within the same spatial unit – whether it is spatially well defined or diffuse - may result in a landscape regarded as multifunctional. The assignment of more than one function is very often linked to a certain scaling in space or time. If a land unit appear monofunctional, it is often just a question of scaling - or patience! If larger and larger landscapes are included in the surveys, we are likely to

encompass more than one function eventually. Further, after some time the farmer may grow a different crop, or divide the field into two units, again giving rise to multifunctionality. This has probably fed the impression that all landscapes are always multifunctional (Gulinck, this volume).

From a spatial point of view it is possible to define at least three different general types of multifunctionality:

A. Multifunctionality as a spatial combination of separate land units with different functions related to land use (spatial segregation).

B. Multifunctionality as different functions devoted to the same land unit, but separated in time, typically in certain cycles (time segregation).

C. Multifunctionality as integration of different functions at the same unit of land (or overlapping units of land), at the same time (spatial integration or "real multifunctionality").

The multifunctionality of type A - spatial segregation - dissolves itself as the scale is becoming finer since only one function - and that is monofunctionality - exist at the most detailed landscape level. The multifunctionality of type C - spatial integration - will remain constant irrespectively of the geographical scale of observation.

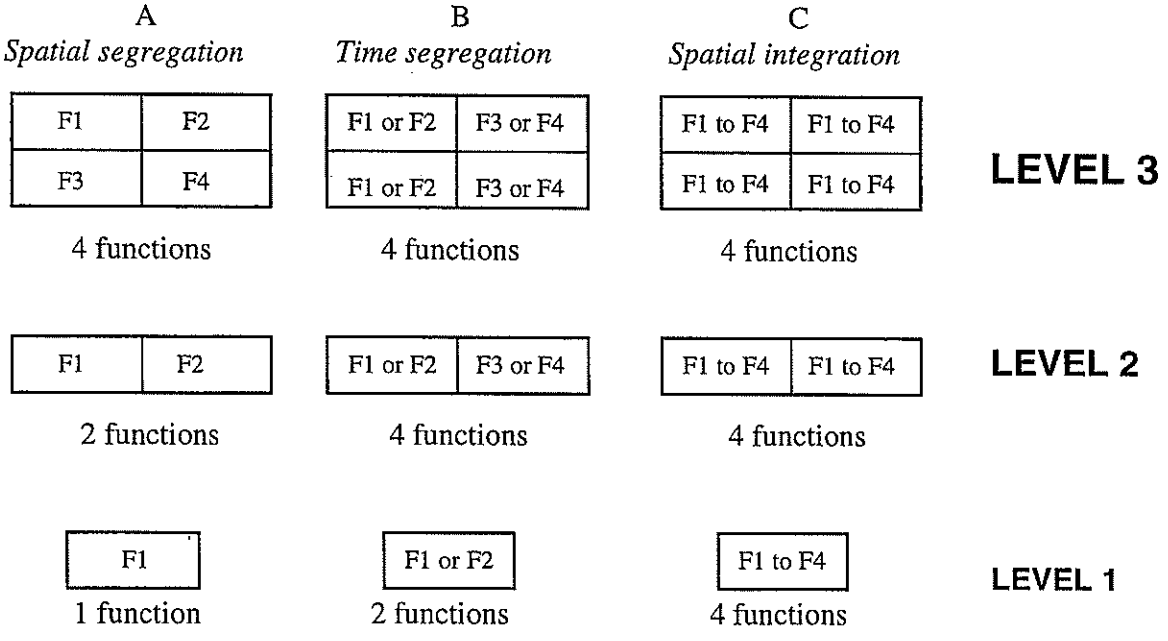


Figure 2. Three types of multifunctionality measured at different spatial levels. A: By spatial segregation. B: By time segregation. C. By spatial integration.

The type C multifunctionality is characterized by a true integration of different functions in time and space, whereas type A or B often will be a result of links or conflicts between the functions that only may be used or solved by a spatial (A) or time (B) segregation of the various functions.

Due to chorological connections between land units with different functions, interaction between different functional units will however exist in all three types of multifunctionality, and a clear distinction between them will probably be difficult in practice. Even in the extreme case of a strict spatial segregation of land use a 'real' multifunctionality at the detailed level will be present around the functional boundaries, often as a conflict, which make the chorological structure or landscape heterogeneity to an important aspect of the landscape multifunctionality, as shown in the different spatial organization of two functions in a landscape in fig. 2a-c : Although a certain spatial segregation of functions is given in all cases, it is clear that the need of a true multifunctionality around the borders increases with the amount of borderline between the two functions. The two functions have to be better adapted to each other in the right example as in the left . (interaction between F1 og F2 bliver en ny funktionskvalitet – jesper: ecotone functionalitet) So, an ecotone, as a border or transition between two different ecosystems can be considered a device for a spatial handling of multifunctionality.

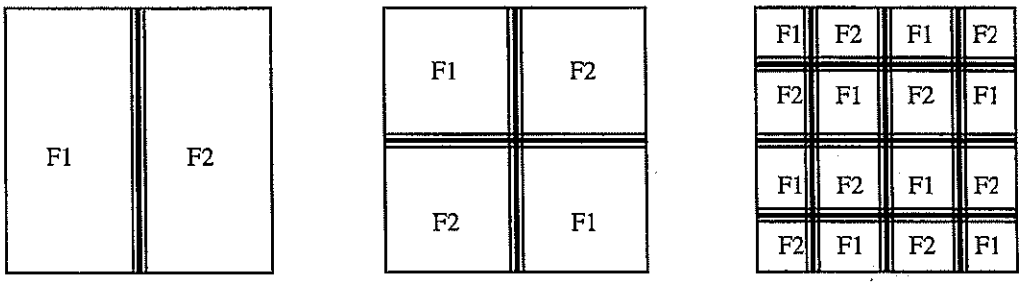
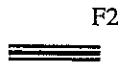


Figure 3. The influence of landscape heterogeneity on the degree of landscape multifunctionality.
F1 Function 1



I. Why study multifunctional landscapes ?

With the present deep interest in multifunctional landscapes, and the different approaches to the subject, it seems relevant to scrutinize the motives behind this interest. Clarification as to the motives for studying multifunctional landscapes may bring us closer to an operationalization of the concept, and the distinction between the types of functionality and multifunctionality.

The contemporary perspectives of multifunctional landscapes is at least partly rooted in the conception that some of our present environmental problems are related to intensive types of land use that are based on a land use segregation strategy. The segregation strategy has developed landscapes that are considered monotonous and monofunctional. This seems neither to be in accordance with the spatial structure of the land surface nor of the surrounding natural ecosystems. Further, monofunctional land use does not reflect the multifaceted character of the human demand on the environment. The general urge to stimulate multiple use of rural areas is a common reaction to environmental problems (e.g. Agger 1996)

Since the Enlightenment, there has been a move towards spatial segregation of land use functions in the landscapes of western culture. Within the era of industrialization of the agricultural and silvicultural production, monofunctional land use has in general been considered the most economically efficient land use development strategy. Although this strategy seemed economically efficient, the strategy has resulted in a growing amount of diseconomies in form of environmental problems, including problems for the functionality of the natural landscapes and ecosystems. These detrimental effects can be linked to a stage in the development of technology, where the ability to transform the environment in general has increased dramatically, but where the ability to adapt the technology to the variations in ecological conditions only recently has been developed. A part of this somewhat 'clumsy' technology has been related to the social and organizational aspects of the land use. Land use zoning has at a certain

stage of development proved to be an efficient tool to prevent e.g. urban sprawl in general, but not to regulate land use at the local landscape level.

The functional segregation in rural landscapes has apparently implied problems for the ecological functioning of the landscape, problems that has often not been economical and socially manifested, due to the segregation strategy, keeping affected groups or interests away or outside influence. Therefore it seems appropriate to adopt a land use strategy that focus on a shift from functional segregation towards functional integration.

II. Aims and strategies of multifunctional landscapes

a. Multifunctionality in intensively used landscapes

Development of multifunctional landscapes may be seen as a general strategy that systematically tries to overcome the negative consequences of the segregation of functions. The success of such strategy will depend on technological and social abilities and will among actors of the landscape to adapt different land use functions to the local landscape ecological conditions instead of adapting the landscape conditions to specific types of land use technologies, and to tailor different functions to each other instead of separating them.

The planning and realization of multifunctional landscapes imply that each type of land use must be managed within certain limits, and modified to suit competing land uses and their claims on the landscape resources. To put many different claims on the landscape do not necessarily overburden its potential, in fact multifunctionality should do the contrary. Supposedly, a multifunctional land use strategy will speed up technological changes and open a way to a more multifaceted social and hopefully also local control with the total landscape system.

Several strategies may be suggested to apply additional functions in landscapes. By mimicking the functions of traditional rural landscapes, we may adopt a strategy of employing local landscapes in production of both food, energy, fibres and the additional supplies to the postindustrial societies needs for recreation, habitats and aesthetic beauty. If these outputs were expected by our local landscapes, they would

surely be more diverse in structure and function. We should stress the importance of local landscapes, as strategies probably function better if locally formulated and supported.

b. Multifunctionality and areas of special interests

It should be stressed that multifunctionality should not be applied uncritical to all landscapes. Multifunctionality is primarily an alternative strategy to land use segregation in intensively used landscapes, which for the vast majority of the population is the everyday landscape. It is certainly not that relevant in extensively used landscapes and areas of special interest, such as nature protection areas, whether they have been set up to protect a high local biodiversity or maybe just a single species. Harms et al. (1995) illustrated the problem of choosing between segregation and integration strategies in nature management, by applying four different development strategies to the same landscape, each pertaining to an animal species, that would benefit from the strategy. The strategies were based on integration and zoning (Godwit), on developing networks (Otter), on segregation (Elk), and on segregation while selecting optimal sites (Harrier), and demonstrated that multifunctionality and multiple use should not be used as value – added concepts.

III. Spontaneous development of new multifunctionality

In the pre-industrial and industrial societies, the cultural landscape is primarily a result of the productive transformation of nature. Cultural landscapes may primarily be viewed as an by-product of production, and definitely not a goal in itself. Certainly reproduction traits are present in the landscape too, such as dwellings, gardens, parks, historical sites, and all sorts of nature areas. But production areas are dominant in the landscape, and economic progress has been based on the expansion and intensification of the areas for material production, whereas the aspect of reproduction and recreation has been relatively absent through industrialization of the countryside and urbanisation of the urban fringe.

Several trends during the last 30 years have changed this production - oriented driving force of the development of our cultural landscapes dramatically: The spatial range for reproduction activities has increased enormously due to the development within transport technology and economy. A pressure for urbanization and urban sprawl of the countryside has been the result. The former social homogeneity of rural areas is dissolved. The rise in material wealth has released an economic and political demand on land-related reproduction activities putting pressure on land-resources in rural areas. Finally, an increase in agricultural production partly above the demands, paired with a global liberalization of the agricultural market has lowered the demand for agricultural land use in many parts of the world.

As a result, a shift not only towards a multiple use, but also towards a growing pressure on non-production considerations in the planning and management of cultural landscapes is happening. The material production as a base for the shaping of the cultural landscape is apparently weakening. And the growing population heterogeneity of rural areas promotes the pressure for a multifunctional land use.

The strategy for the development of multifunctional landscapes should be based on these trends, and secure the development of sustained multiple use in regions exposed to this post-industrialization landscape development, typically in peri-urban regions.

IV. Conclusion

Multifunctional landscapes can be seen as one of many strategies for a transformation towards a sustainable development at the landscape level. We are probably already in the course of this transformation, but we have only very few tools for a documentation of the trend, however, and we do not know how to evaluate the consequences.

In the discussion, it may implicitly be understood that multifunctionality is a good thing, and that the monofunctionality of the 20th century is an inherited burden that we must leave behind. Often multifunctionality is considered absolutely positive (e.g. Vos and Meekes 19xx) and seen in a historical perspective we can support this viewpoint when applying to production landscapes. But we also believe that multifunctionality

should be operationalized into a generally neutral term, and that a thorough discussion of functional values is necessary in order to circumvent futile discussions in the future. A few things should be emphasized:

1. Externalities produced by agriculture and forestry, which adds to the multifunctional character of these sectors, may be both positive and negative. In employing strategies for multifunctional land uses, we should encourage the positive externalities and evade the negative, and be aware that negative externalities may occur.

2. There is a widespread idea that traditional rural landscapes of for instance Europe were multifunctional. The multifunctional landscapes that we have lost were often landscapes in which institutional violence and suppression along with strong social inequalities were a mere fact of life. The negative impacts on the environment were apparently lesser than today, but the future planners should be aware that the landscapes we denote monofunctional happened to develop not only along with the process of democratization and development of the welfare societies of the western world, but just as much as a necessary reaction to serious landscape ecological problems of former types of multifunctional land use (Kjærgaard, 1991, Fritzbøger, 19xx). In the spirit of Zev Navehs idea (Naveh 2000) of the total human environment, we should consider landscapes as a mirror of our activities. Socio-economic structures are not always capable of managing multifunctional landscapes in a sustainable manner.

3. There are monofunctional landscapes in the sense of land use and social functionality – that should remain monofunctional. Nature reserves, national parks with restricted admission should in many casesnot be subjected to multifunctional strategies. We should not encourage new functions in any landscape, and we should not maximize multifunctionality just for the sake of it.

Different aspects.

Strategies for the development of multifunctional landscapes

The conference in Roskilde provided useful thoughts on the concepts and strategies on multifunctional landscape and many more are embedded in these volumes. Several of the contributions to this volume deal with the concepts of function, functionality and multifunctionality. The wide variety of definitions and approaches clearly demonstrates that the scientific community has not reached a paradigm on these issues. However, it is possible to aggregate various viewpoints to create a certain common ground for the discussions to come, and we strongly encourage this discussion to continue.

Not least the several views on definitions are interesting. Gulinck (this volume) promote the obvious view that multifunctional landscapes are a pleonasm, as a landscape per definition is multifunctional. We agree, but as an operational concept, the term is now so widespread that rather than attempting to ignore it as a pleonasm, we should develop it to make practical sense. At least we should be able to graduate the concept. Gulinck further stresses that function is ambivalent, as natural, social, economical and political processes are all included in landscape function, much in accordance with Haines-Young and Potschin (this volume). They state that multifunctionality in landscapes expresses the coexistence of different spheres, i.e. ecology, economy, culture, history and aesthetics in the same tract of land, further they emphasize that multifunctionality certainly involves the interaction between landscape and man, and that multifunctionality arises according to the way we value different outputs from an area. The idea of bringing values into the assessment of multifunctionality is shared with other authors of this volume, e.g. Palang et al., and Antrop. The latter stresses that function implies a causal relationship between elements in the landscape or between the landscape and its users. Palang et al. state that one piece of land at the same time can have multiple functions – and multiple values! Finally, Navehs classification of functions according to their mode of energy transformation, in particular in relation to the agricultural sector, should be mentioned. Naveh suggests solar-powered biosphere, fossil-fuel power, and agri-industrial as appropriate functional classes.

The need for relating multifunctionality and values is emphasized by several authors. Haines-Young and Potchin put emphasis on the dependence of

multifunctionality on values, and state that multifunctional landscapes cannot be understood without reference to some value system, as multifunctionality is not a property of ecological systems per se, but a result of interaction and linkage between society and environment. In accordance, Navehs views are also concentrated on the landscape system as a part of the total human ecosystem. Palang et al. (this volume) note that values tend to change over time, and that a piece of land both may possess multiple functions and multiple values. Also Antrop (this volume) treat the question of value, by suggesting that adjacent functions may enhance or diminish the context value or even the intrinsic value of the land, and stresses that the consideration of multifunctional landscapes imply the consideration of valuing them for a specific functional use.

The future management of landscape must include some kind of multifunctionality in the approach. The traditional subsistence agriculture was multifunctional in character with its use of the land for food, energy, residence and water. This was dissolved by the industrialization of farming. A so-called neo-rural approach for landscape management may be an appropriate strategy, as suggested by Gulinck. The view of the 20th century as a monofunctional gap is interesting. Staljansen et al. points out that the whole land evaluation tradition were production – oriented and as such disregarding the multifunctional character of the land in promoting agricultural intensification and hence support the view of Gulinck. The responsibility rests on several groups, but in particular it is a task of spatial planning to assign function and future forms of function and use to land. In particularly in landscapes dominated by intensive productive use there is an urgent need for integrated landscape research to support such a spatial planning. A good example is the contribution of Cristea et al. on multidisciplinary assessment of the landscape around the city of Cljuj-Napoca in Romania, expected to face severe problems of urban sprawl and intensive land use in the near future.

Conclusion and outlook

How can we describe and analyse the development of landscape functionality, and how can we judge its influence on the landscape system and its sustainability?

This is the main agenda, given by our society, for further research in multifunctional landscapes.

Figure 1. Functions of natural environment (de Groot, 1992).

Figure 2.Three types of multifunctionality, A, B and C, measured at three different spatial levels, 1, 2 and 3. A: By spatial segretation. B: By time segregation. C. By spatial integration.

Figure 3: The influence of landscape heterogeneity on the degree of landscape multifunctionality.

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