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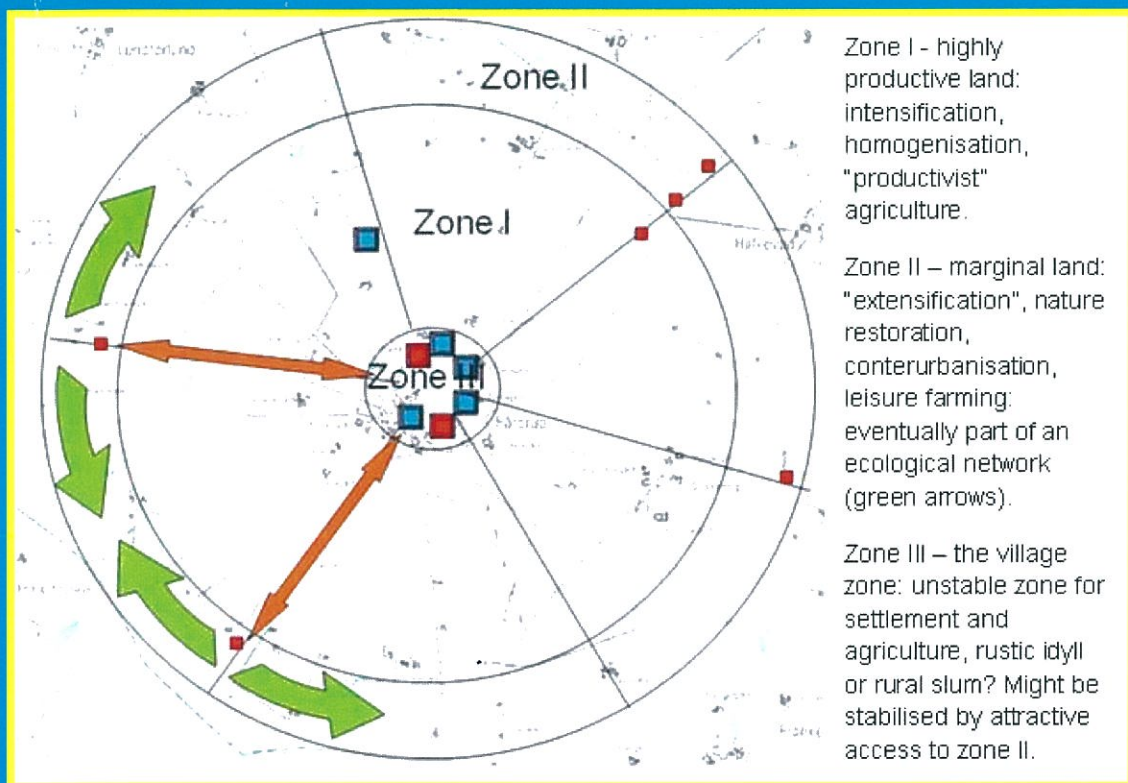
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## LANDSCAPE ECOLOGY AND PROBLEMS OF EUROPEAN CULTURAL LANDSCAPES

JESPER BRANDT

### ZUSAMMENFASSUNG

Obwohl sich Landschaftsökologen im globalen Rahmen stetig weiter untereinander vernetzen, scheinen sich aufgrund regionaler geographischer und historischer Gegebenheiten regionale Trends innerhalb dieser Fachdisziplin zu entwickeln. Die moderne Landschaftsökologie in Europa ist eine interdisziplinäre Fachrichtung, welche sich vor allem auf Basis der Thematisierung angewandter Problemstellungen, im Bezug auf die europäische Kulturlandschaft – besonders der Agrarlandschaft –, seit der Etablierung von Umweltbewegungen, entwickelt hat. Als zentrale Themenfelder sind vor allem die Auswirkungen der technologischen und strukturellen Entwicklungen innerhalb der europäischen Agrarlandschaft auf Naturraum und Habitate sowie die Verbreitungsmöglichkeiten für Wildtiere zu nennen. Weitere Problemstellungen basieren auf multifunktionalen Nutzungskonzepten ruraler Landschaften, besonders im Hinblick auf Suburbanisierungsprozesse. Eine Anzahl untereinander vergleichbarer Projekte, mit parallelen bis ähnlichen Ausprägungen innerhalb Dänemarks und weiterer europäischer Länder, werden exemplarisch herangezogen, um die Entwicklungen innerhalb der Landschaftsökologie zu verdeutlichen.

**Schlüsselworte:** interdisziplinäre Ansätze, IALE, ländliche Räume, Habitat, Kleinstbiotope, multifunktionale Landschaften, Suburbanisierung

### SUMMARY

Parallel to a growing global cooperation among landscape ecologists, different regional trends within landscape ecology seems to arise, related to different geographical and historical conditions. Modern landscape ecology in Europe has developed as an interdisciplinary activity inspired by practical problems of European cultural – especial agricultural – landscapes since the rise of the environmental movement. Central themes have been the consequences of technological and structural changes within European agriculture for the landscape and the development of habitats and dispersal opportunities for wildlife, and a variety of landscape problems related to the trends towards multifunctional use of agricultural landscapes due to new types of land use and settlements affected by counterurbanisation processes. A number of interrelated landscape ecological projects in Denmark, with parallels to similar developments in other European countries are used as examples to illustrate the development.

**Key words:** interdisciplinarity, IALE, rural landscape, habitat, monitoring, small biotopes, countryside, multifunctional landscapes, counterurbanisation

## 1 INTRODUCTION

Within the global community of landscape ecologists very different opinions exist concerning the goals and scopes of landscape ecology. Especially the landscape ecological traditions in Europe seem to develop in other directions than in USA and other parts of 'the new world'. These variations might partly be related to differences in population density, but different perspectives on the inclusion of landscape history and social organization of land use obviously also contribute to the various opinions. However, although there indeed are differences in the science practice and especially in the social context for this practice, we should not exaggerate them, and in any case rather see them as complementary entrances to the integrated study of the landscape.

A common frame for the scientific endeavor of landscape ecologists can be found in the mission statement of the International Association for Landscape Ecology (IALE) formulated in December 1997:

*Landscape ecology is the study of spatial variation in landscapes at a variety of scales. It includes the biophysical and societal causes and consequences of landscape heterogeneity. Above all, it is broadly interdisciplinary (IALE, 1998).*

This 'definition' is however open for different interpretations.

## 2 A EUROPEAN PERSPECTIVE ON LANDSCAPE ECOLOGY

In Europe there seems to exist a growing preference for a practice-oriented problem-solving interpretation, emphasizing the cultural aspects of landscape history as important parts of both structure and dynamics within the ecology of landscapes, giving a special responsibility for the difficult interdisciplinary integration of the ecological, economic, social and cultural aspects of landscapes. Correspondingly European landscape ecologists tend to consider their science a very broad theme, characterized by the ambition of integrating a variety of different problem-oriented perspectives on the landscape into a holistic unity – although we rather seldom succeed in really to do it, since our point of departure will always be crucial for the way we organize our research and how our research is perceived by an audience. This might also give rise to a more descriptive character of the study, compared to other traditions (Brandt, 1998).

## 3 INTERDISCIPLINARITY AND THE EUROPEAN HISTORY OF LANDSCAPE ECOLOGY

Referring to the history of modern landscape ecology it has been common to underline this interdisciplinarity by referring to Carl Troll and his 'invention' of the name 'landscape ecology'. In several papers from the 50ties and 60ties he presented landscape ecology as the interdisciplinary integration of geography and biology as disciplines (Troll, 1966, Troll, 1968). However originally he was much more concrete in his almost accidental introduction of the term: First time it turns up is in a paper from 1938: *Luftbildplan und ökologische Bodenforschung*. As a concluding

remark after a detailed description of the close interrelation between all the different ways of air photo interpretation that developed since the first world war, he states that

*Luftbildforschung ist zu einem sehr hohen Grade Landschaftsökologie.*

And he adds:

*Die Luftbildforschung wirkt ausserdem in hervorragendem Masse wissenschaftsverbindend. Sie führt auf der gemeinsamen Ebene des Landschaftsbauhaushaltes so verschieden marschierende Wissenszweige wie Archäologie und Geologi, Lagerstättenforschung und Forstwissenschaft, Geomorphologie und Botanik, Bodenkunde, Landwirtschaftswissenschaft und Pflanzenökologie zusammen. ... Das gemeinsame Ziel ist das Verständnis der Raumökologie der Erdoberfläche (Troll, 1939).*

Despite this persuading characterization of the scientific integrating trends having been forced through due to the development of air photo technology, I do not consider the trends of interdisciplinarity as the most important characteristics by the emergence of landscape ecology. It might however look so from the personal viewpoint of the researcher. In general, our personal identity as scientists is very much related to the social status of our discipline. Consequently, most scientists demand very good reasons to be engaged in a close and equal cooperation with other disciplines, not to speak of an overarching transdisciplinary integrating landscape ecology, as it has been described, e.g. by Isi Zonneveld and by Zev Naveh, in their landscape ecological textbooks.

#### **4 PRACTICAL SOCIAL NEEDS BEHIND INTERDISCIPLINARITY: THE CASE OF MEDICINE<sup>1</sup>**

Such good reasons are to be found primarily in the development of the possibilities to fulfill strong needs for holistic studies in the surrounding society, needs that can be so strong that they can resist or at least complement the build-in trends of on-going specialization within the classical university disciplines following the main division of knowledge within science, social science and humanities. Medicine is the classical example of an exception from the main division of sciences into faculties. A strong division of disciplines within medicine has developed, but in principle with an overall purpose related to the necessary holistic study of the health of the human being; – not just the human body, but the human totality, including both our mind and our social context: The science of Medicine is thus the study of health problems – or the health sustainability of the ‘inner environment’ of the human being.

#### **5 LANDSCAPE ECOLOGY AS THE STUDY OF THE HEALTH OF OUR EXTERNAL ENVIRONMENT**

Although the comparison certainly has some limits, I think it will stay fruitful to regard the development of landscape ecology as a delayed process parallel to the development of Medicine, but focusing on our external environment, our extended reality outside the body. The object, the holistic units, we are studying in parallel to the human being, is our landscapes.

One might argue that it is often difficult or even not possible to limit or delineate landscapes as individuals. And this is of course true. But not more true than the fact that doctors constantly run into the same problems with humans and all other creatures, who are not just individuals, but also constituted as collective social clusters, not the least in their disease patterns.

Following this line, some landscape ecologists, e.g. in Canada, has tried to cultivate this way of thinking by organizing conferences in landscape ecology under the label: Ecosystem Health and Medicine (Moss, 1994).

## 6 THE PRACTICAL PROBLEMS INSPIRING MODERN EUROPEAN LANDSCAPE ECOLOGY

When Carl Troll studied the development within air photo interpretation, the integrative trends were influenced by the many different requirements that could be fulfilled through aviation and air photo technique. The possibilities were countless, but between the two world wars they were to a high degree dominated by military and neo-colonial interests.

However, when landscape ecology revived and became generally accepted in the 80ties and 90ties, it was closely related to the involvement in a series of practical environmental problems coming at the political agenda, but having a landscape or spatial dimension that had been neglected within most disciplines during the foregoing generation due to a dominating nomothetic science ideal, in practice neglecting spatial and landscape variation, even within geography. Especially from the mid-80ties following the Brundtland report, there was a growing understanding that environmental problems were not just problems of smoke, noise and garbage, but also comprised a variety of complicated chorological connections in our landscapes, impossible to handle isolated, and with a strong social and cultural dimension. It was recognized that biodiversity problems were not just a question of the protection of species and their habitats, but had to include the dynamics of dispersal in fragmented cultural landscapes, constituting the main living landscapes of most of the populations of European wildlife. It was realized that pattern matters {Antrop, 2009 #1335}.

## 7 THE FOUNDATION OF THE INTERNATIONAL ASSOCIATION FOR LANDSCAPE ECOLOGY (IALE)

The manifestation of this social pressure for a more holistic management of not just valuable protected areas but of all types of landscapes constituted at least in Europe a main motivation for the institutional development of modern landscape ecology.

A decisive event in this development was the organization of the International Congress: Perspectives in Landscape Ecology, arranged by the Dutch society for landscape ecology, WLO, in Veldhoven in 1981. Characteristically, the subtitle was '*Contributions to research, planning and management of our environment*'. The conference was thematically organized around themes of urban problems, urban-rural relations, rural problems and problems of natural areas, reflecting the ambition to cover not just all landscape types, but especially the more intensively used cultural landscapes {Tjallingii, 1981 #908}.

It was a stimulating fact for the further development of European landscape ecology that a parallel social pressure for environmental studies at the landscape level had developed in Eastern Europe. There has been several distinctive academic traditions within landscape science in Eastern Europe and Russia, and despite traditional personal and disciplinary competition (such as between geographers and biologists in Bratislava, being sarcastically commented by the late Ernst Neef (Neef, 1977) they in fact more and more merged together in a role as medical doctors of landscapes, producing landscape diagnoses and practical landscape planning recommendations, e.g. for collective farms and regional and local authorities. Most well-known is probably the development of the landscape ecological planning method LANDEP, chaired by Milan Ruzicka and Ladislav Miklos (Ruzicka and Miklos, 1990), even recommended as an integrative tool in the formulation of § 10 of the Rio Agenda 21-document. It was certainly not an accident that The International Association for Landscape Ecology (IALE) was founded in Piestany, Slovakia, during the VIth International Symposium on Problems of Landscape Ecological Research.

## **8 WILDLIFE HABITATS IN AGRICULTURAL AREAS: A TYPICAL PROBLEM AREA IN MODERN EUROPEAN LANDSCAPE ECOLOGY**

### **8.1 THE DEVELOPMENT OF THE SMALL BIOTOPE PROJECT IN DENMARK**

The introduction of modern landscape ecology in Denmark was in line with the trends of the environmental movement of the 1970ties, inspiring scientists and planners all over Europe. It started with a general annoyance with the Danish Nature Conservancy, mainly focusing on the preservation of threatened species and exotic habitats, in a time, where a rapid technological and structural change in Danish agriculture resulted in a widespread removal of small habitats for wildlife in the countryside. Denmark is an intensively used agricultural land, and approximately 1/3 of our total area available for wildlife is situated as small humble landscape elements in and between the fields in the countryside. In the beginning we baptized them 'Interstitial Habitats' (Agger et al., 1982) but renamed them later into the more straightforward term 'small biotopes'. Our main objective was to develop a consistent and reproducible taxonomy and surveying methodology to allow for a quantitative documentation of the ongoing impoverishment, habitat fragmentation and homogenization of our agricultural landscapes.

It started as a combined master thesis project at Roskilde University with a group of students combining geography and biology, resulting in an application for a research project that was paid by the Danish Agricultural Research Foundation. A consistent typology was developed, and 13 agricultural areas of 4 km<sup>2</sup> each selected as a representative sample of agricultural landscape for the eastern part of Denmark, was surveyed in detail in 1981, including interviews with the farmers concerning the functionality of their small biotopes. Based on air photo-interpretation and historical topographical maps we also constructed a database permitting an analysis of the individual historical fate of the small biotopes up through history (Agger and Brandt, 1988).

In 1986 the survey was repeated and extended to cover all Danish Weichsel moraine landscapes as a part of an extensive national account on marginal lands, where the amount and composi-



on of small biotopes were used as an indicator for trends of intensification and extensification in land use (Brandt and Agger, 1988).

In 1991 the investigation was included in the first national program for nature survey, now covering 32 areas all over Denmark (Brandt et al., 1994).

In 1996 it was repeated again, now as empirical basis for a large interdisciplinary national research project *Man, Landscape and Biodiversity*, set up parallel to similar projects in other European countries at that time (Brandt et al., 2001a). Many European countries were facing growing problems with planning and management of agricultural areas, changing from rather mono-functional agricultural production among a culturally equalized local population towards more multifunctional land use among a growing diversity of professions and cultures being settled in many agricultural areas due to a beginning counterurbanisation process (Brandt and Vejre, 2002).

## 8.2 THE SMALL BIOTOPE SURVEY AS A PART OF THE NATIONAL NATURE MONITORING PROGRAM

From the end of the 90ties the monitoring was handed totally over to the Danish national environmental monitoring program NOVANA.

The last survey has been carried out in 2008, and it has been decided to repeat it every 6 year. But no total national survey on the development of small biotopes has yet been published since 1996.

Today the small biotope monitoring has both a unique and an exposed position in the national program, since it is the only nature monitoring activity in Denmark outside the obligatory EU natura2000-areas.

There have been several challenges in this program. One of the most interesting being the experience of the slow and surprisingly difficult, but also unavoidable transformation from a *survey*, basically representing a spatial, but static way of perceiving the landscape and its components, towards a *monitoring* system, reducing the survey to a snapshot of processes that has to be described, explained, and mastered in a concerted way within and between the landscape units. The monitoring makes it necessary to realize the landscape not as a static picture but as a steady flow. It requires not only a rigid monitoring system (in this case by producing a strict division between physiographic, functional and generic characteristics used for classification), but also an almost frightening conservatism in the registration methodology to ensure reliable results. It also necessitates an almost just as frightening constant reclassification and problematic data manipulation if the monitoring has to be reoriented towards new goals (Brandt et al., 2003).

## 8.3 TRENDS IN EUROPEAN SMALL BIOTOPES SINCE THE 70TIES.

In figure 1 is given some main results of the monitoring of small biotopes in Denmark, showing the changes (in percentage) per year of the length of linear biotopes (*hedgerows, road verges,*



*field divides, ditches, brooks, channels and rivers*) and in the surface of area biotopes less than 2 ha. (*woodlots and small plantations, solitary trees, permanent herbaceous cover, prehistoric barrows, bogs and lakes*) since 1954.

There is a high dynamic in these mostly man-made landscape elements that comes and goes as an integrated part of the dynamics of the agricultural structure and technology. Especially the period of heavy industrialisation of the crop production during the 1970ties resulted in a rapid decrease in all types of biotopes. This period was replaced by a period of general stabilisation during the 80ties and 90ties which however covered an increasing regional and local variation in trends.

<b>The net rate of changes per year of linear and area biotopes in 5 test areas in Western Denmark (20 km<sup>2</sup>) 1954-1996</b>					
	1954-68	1968-81	1981-86	1986-91	1991-96
Nb. of years in each period	14	13	5	5	5
<b>Linear biotopes (% change)</b>					
% of length, per year	- 0.6	- 2.3	- 1.3	-1.3	0.9
% of area, per year			-2.9		2.5
<b>Area biotopes (% change)</b>					
% of number, per year	- 0.5	- 0.8	-0.8	-0.8	0.3
% of area, per year			3.0		1.7

**Fig.1:** The net rate of changes per year of linear and area biotopes in 5 test areas in Western Denmark (20 km<sup>2</sup>) 1954-1996. Linear biotopes comprises e.g. hedgerows, road verges, field divides, ditches, brooks, channels and rivers. Area biotopes comprises forests, woodlots and small plantations, solitary trees, permanent herbaceous cover, prehistoric barrows, bogs and lakes.

Thus, at the empirical level there seems to be a support for the thesis about a transition from a 'productivist' phase of agriculture towards a more diverse multifunctional phase (Wilson, 2001) and the influence of this transition on the development of the agricultural landscape. This change in trends in the mid-80ties has been observed parallel in Great Britain, The Netherlands and other European countries (Brandt et al., 2002).

The attention called by these parallel observations in other European countries were certainly important from the very beginning of the small biotope studies.

The Veldhoven-congress in 1981 and the following IALE-Congresses in Piastany (1982), Roskilde (1986), Münster (1988), Roskilde (1991) and Toulouse (1995) documented how the same ideas, parallel methodologies and empirical investigations among what sometimes were called the hedgerow-peoples, was developing in many other countries. The problems with the industrialization of the rural areas, opposed to a growing interest in vernacular, daily landscapes, were more or less the same (Brandt et al., 2002).

## 8.4 THE EUROPEAN BIOHAB PROJECT

One of the consequences of this parallel development was the initiation of a variety of research projects based on cooperation among European IALE-members. A central one was the BioHab project, producing a handbook for surveillance and monitoring of European habitats. The main challenge in BioHab was to construct a both consistent and flexible monitoring system that could allow for both a European wide monitoring of General Habitat categories, and at the same time permitting the inclusion of specific regional and local types of natural and cultural habitat categories. The system was tested in a number of different European landscapes, which showed how a national monitoring could be integrated in the General Habitat Classification and other types of classification, e.g. EUNIS or the plant life form, according to Raunkiaer (Bloch-Petersen et al., 2006, Bunce et al., 2007). That Christian Raunkiaer's plant life forms from 1907 were chosen as the main theoretical foundation for the monitoring of General Habitat Categories was for Danish landscape ecologists an interesting peculiarity, since this part of the Danish botanists work has never been appreciated among Danish botanists who in general have been very species-oriented and skeptical towards landscape ecology as a transdisciplinary activity. As a reminder, the following central quotation by Raunkiaer in a Danish paper from 1907 was placed at the frontpage of the resulting Handbook:

*'Here then Plant Geography as a botanical science gives place to Plant Geography as geographical science. We shall consider vegetation as an expression of the climate, and life forms of plants as a means of determining the biological characteristics of the different climates', (Raunkiaer, 1934).*

## 8.5 URBANISATION AND DEVELOPMENT IN AGRICULTURAL LANDSCAPES

In the empirical material of the small biotope monitoring in Denmark a growing mass of regional and local variations was recognizable, thus documenting a growing diversifications of trends in the development. The study of this growing trends of a spontaneous division or segregation of rural areas into continuous intensive productivist agriculture and areas with growing multifunctional land use more and more dominated by urban functions and trends of both counterurbanisation and rural decay, has been in focus of our research during the later years. This reflects obviously processes that has to be studied as an urbanization of the countryside, both at a regional and on a local scale. Basically the question is raised: Is it possible to relate the local landscape structure and dynamics of this transition period to an urban-rural continuum? It is interesting to note that this question was indirectly in focus of the agenda already at the congress in Veldhoven in 1981 (Brandt et al., 2001b).

### 8.5.1 IN SEARCH FOR AN URBAN-RURAL CONTINUUM OF LANDSCAPE IMPACT

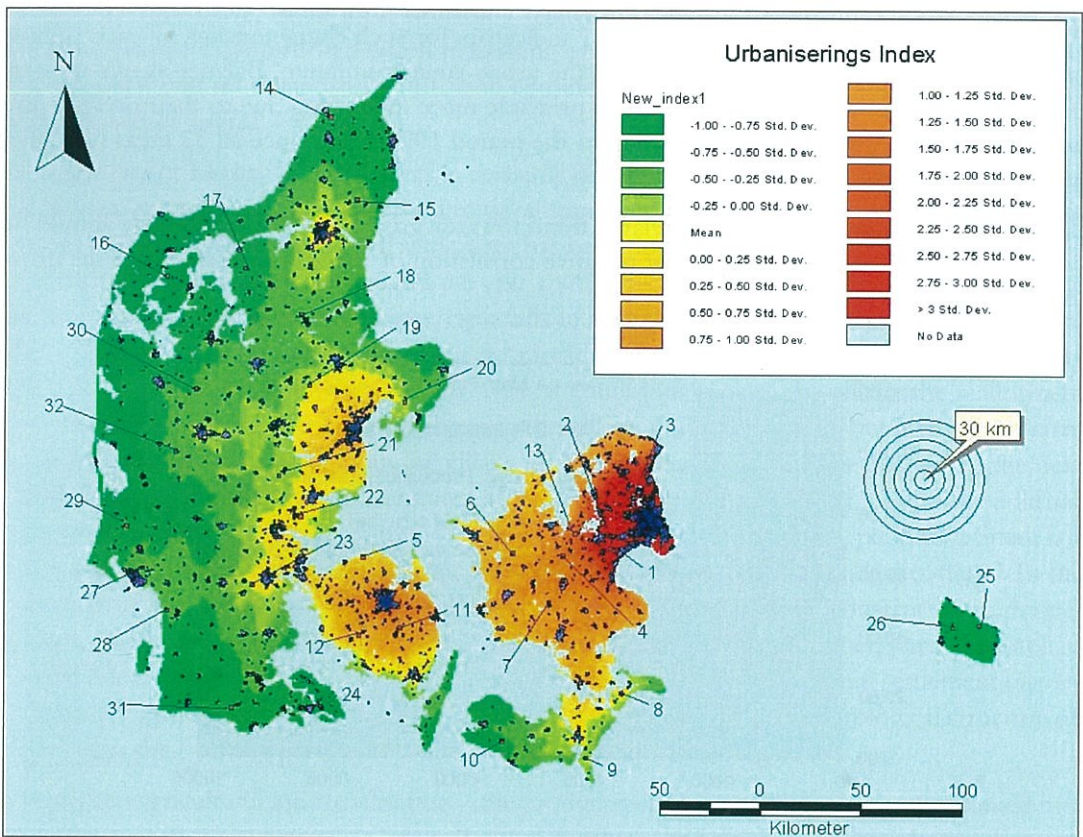
Based on our monitoring we tried to fit our 32 4-sq.km. test areas into a spatial model for 'urban pressure' in Denmark to test if different relevant landscape parameters could be linked to the ranking of the test areas within an urban-rural continuum.

By urban pressure is meant the sum of potential urban influence from all urban areas to a given rural location. The potential urban influence was considered to be distance-dependant, based on a gravity-principle. Further we constructed a model for the potential urban influence based on the square root of the weighted distance to an urban-area-related expression of population size.

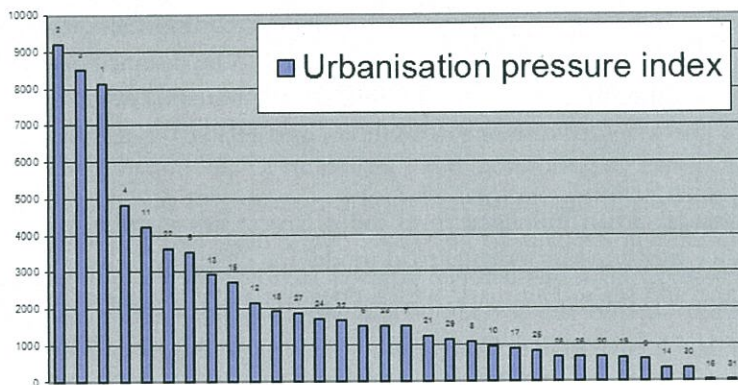
The nation-wide potential urban influence from the 4 largest urban areas in Denmark was calculated with distance measured by a digital road model for Denmark. This was done due to the distribution of land and sea in Denmark, which does not allow the use of a simple spatial diffusion model.

For pragmatic reasons a more simple diffusion model with a spatial influence of up to 30 km was used for all other urban areas, defined as areas with urban zone planning status, and finally the urban pressure from these two models were added.

Fig. 2 shows a map of the resulting distribution of urban pressure on rural areas in Denmark. The 32 four-square-kilometre grids of rural area used in the national monitoring of agricultural landscapes are indicated as well.



**Fig.2:** Distribution of urbanisation-pressure-indices for 32 rural monitoring areas in Denmark.

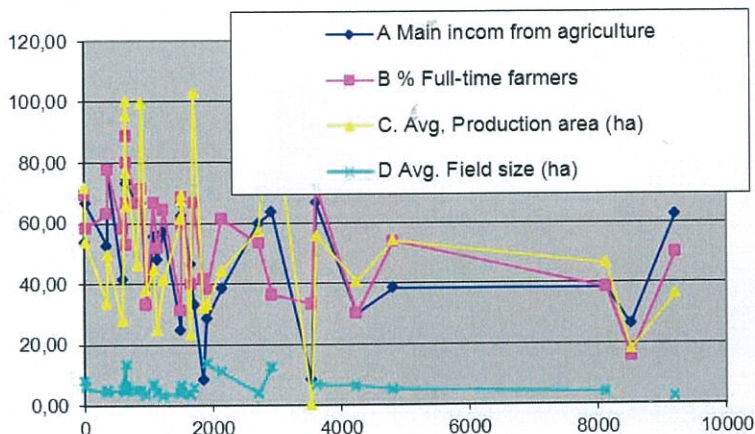


**Fig.3:** The position of the 32 rural areas on the urbanization pressure surface of Denmark (see fig.2). As shown in fig. 3 some of our test areas have been placed in the urban fringe of larger cities with a very high index of urbanization pressure.

If the rural-urban continuum is reflected in physical, social and cultural characteristics, it should be possible to test such a continuum empirically on a variety of indicators.

We tried to relate the value of a number of indicators for such characteristics of each sample area to the position of the 32 areas within the urban-rural continuum. Balance sheets were all from 1996, figures of change which are in principle more interesting due to their possible use as indicators of dynamics, were referring to the period 1991-1996, since all 32 areas had been monitored in both of these years.

In principle, a counterurbanisation-related trend towards growing multifunctionality should be indicated by a recognizable positive or negative correlation of relevant indicators and the urbanization pressure index.



**Fig.4:** Different indicators within each of the 32 test areas, along an urban-rural continuum: A: % of farmers with main income from agriculture. B: % full time farmers. C: Average production area pr. Holding (in hectares. D: Average field size (in hectares)



As shown in fig. 4, a very weak correlation could be seen for some general indicators of scale and intensity of agriculture, such as the percentage of farmers with main income from agriculture, the percentage of full time farmers, the average production area per holdings and the average field size. But looking at small biotopes or seminatural areas that might be expected to develop a certain positive correlation with urbanisation pressure, there was no connection.

Neither indicators of stock and change in build-up areas within the 32 rural landscapes did show any clear relation to an urbanization pressure index.

When interpreting these data, the reservation should of course be made, that the data have been produced for other purposes than the one used here. Probably more detailed analysis of the data as well as use of alternative models for the urban pressure could reveal a connection.

But it seems reasonable to conclude that there is no empirical evidence for any simple model of local landscape implication of a general urban-rural continuum – at a regional scale.

### 8.5.2 ALTERNATIVE MODELS OF URBAN INFLUENCE ON RURAL LANDSCAPE DEVELOPMENT

Obviously alternative, more local landscape related models for understanding the spatial implementation of counterurbanisation in existing agricultural landscapes are necessary. It seems also justified that more landscape historical entrances to the landscape ecological analysis than hitherto will be useful.

The settlement history of rural areas is certainly different from region to region. Often it has to be seen in a national context related to development in rural regulation history. The contemporary history of the Danish rural settlement has been dominated by a profound reallocation of all Danish villages carried out around the year 1800. This was done in different ways, according to the local conditions. In some cases, especially in a very heterogeneous physical environment, the village was dissolved and the farms were spread over the territory of the association of owners. In areas of relatively homogeneous natural conditions around the village the reallocation was organised as a 'star reallocation', keeping the village settlement intact, but giving each farm a slice of land spreading out from the village to the marginal areas near the borders to the next village. The good soils were concentrated around the village, dominated by middle-sized farms, surrounded by marginal areas, with more wet or sandy soils dominating the periphery. Small farmers and rural workers were typically located in the periphery, living in modest cottages. In the first half of the 20th century, a new generation of small holdings were constructed in the periphery, partly to ensure a class of agricultural workers for the village farmer, partly planned as smallholders or state tenants, inspired by Georgist philosophy. Thus, the rural settlement history produced a rather close connection between the geo-ecological or geo-chorological structure of the village, the land use pattern and the social ownership stratification.

During the agricultural industrialisation – the productivist phase of agriculture – continued melioration as well as a substantial input of cheap fertilisers and pesticides raised the productivity of much of the marginal area to a level comparable with the good quality soils around the village. But in the long run the smallholders could not survive as full-time farmers due to their small



Consequently, in the coming years we will probably experience a marked social segregation in the counterurbanisation of the Danish villages, giving rise to a settlement differentiation that correspond to the wellknown social segregation of urban areas.

## 8.6 CONSEQUENCES OF DIVERGING TRENDS IN THE DEVELOPMENT OF RURAL LANDSCAPES

The landscape ecological consequences of this development can be serious:

From a management point of view it might be tempting to let these trends of landscape segregation follow up by a new zonal planning that involve a parts of the countryside in a new urban sphere of interests, and a new restricted rural zone, where the productivist agriculture can regain a higher priority in relation to other types of land use.

But such a zoning can prove to be very problematic from a landscape ecological point of view, while it divides the responsibility and the management of the total landscape into territorially conflicting units: The geographical result of the segregation implies that the potentially high productive soils will experience an intensification, decoupled from the surrounding low productive marginal areas that will be left back with an isolated responsibility for especially the biodiversity and other important parts of the cultural landscape, that they will have to manage non-agriculturally. It will probably be with high costs, and high public support to ensure biodiversity and other environmental interests, since it will develop without the close connection both to the surrounding high productive agricultural area and to science and development within the professional agricultural sector. The trends of segregation can also show up to be problematic for the supply of drinking water, while the intensified use of the naturally well-drained soils often will be situated near the top of the groundwater cones.



**Fig.6:** The village Fårdrup on SW Zealand, showing three zones of development within the two house/owner associations of the parish Fårdrup. See fig. 6 for explanation.



Thus, many landscape ecological arguments could be put forward to support an alternative strategy. This could be in form of a united management of the landscape supported by an integrated agricultural research on the development of profitable ways of land use that include the marginal and semicultural areas in a way that can deliver both a reasonable profit and fulfill landscape differentiated land use conditions, related to the protection of the biodiversity and geo-ecological functionality of these areas.

Fig. 6 shows a star-reallotted village on Zeeland, where the three zones can very easily be distinguished. It is also clear how the presence of small biotopes differentiates within the different zones.

## 9 CONCLUSION

Landscape ecology has developed through cooperation within a variety of disciplines and professions with different interests in the study of the structure, dynamics and development of landscapes. Despite continuing programmatic calls for integration, modern landscape ecology still shows many different faces, reflecting the influence of the different disciplines and professions. The most important integrating factor seems to be the influence from planning and management related to environmental and land use problems. This however obviously gives rise to different regional trends in the development of landscape ecology due to different geographical and historical settings. Modern landscape ecology in Europe has developed as an interdisciplinary activity inspired by practical problems of European cultural – especial agricultural – landscapes since the rise of the environmental movement. Central themes have been the consequences of technological and structural changes within European agriculture for the landscape and the development of habitats and dispersal opportunities for wildlife, and a variety of landscape problems related to the trends towards multifunctional use of agricultural landscapes due to new types of land use and settlements affected by counterurbanisation processes.

Growing political and economical integration on these fields within the European Union as well as within the Council of Europe (e.g. related to the adoption and implementation of the European Landscape Convention) has increased the need for a closer cooperation within landscape ecology at the European level. This has been an important background for the foundation of a European chapter of the International Association for Landscape Ecology (IALE-Europe) in Salzburg in July 2009.

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