CZECH AND SWEDISH INTENSIVELY UTILISED AGRICULTURAL LANDSCAPES – PARALLELS AND DIVERGENCES DURING THE LAST 300 YEARS

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Abstract

The paper presents result of the case study analysis based on the reseach undertalen in the framework of the PhD study at the Czech Univrsity of Agriculture in Prague. It was undertaken in the productive agricultural landscape in southern Sweden and in the Eastern Bohemia region of the Czech Republic between 1703 and 2006. The Lilla Uppåkra study site (321 ha) in Sweden and the Honbice study site (244 ha) in the Czech Republic are located in an open plain landscape characterized by favourable soil and climate conditions. Landscapes characterized by similar natural conditions, but developing under different national socio-economical conditions may serve as a reference which helps to better understand international landscape change relationships. Old cadastral maps (1703, 1805, 1813 and 1839) and aerial photographs (1939, 1950, 1962, 1966, 2003 and 2004) have been interpreted to describe changes in land cover and basic landscape micro-structural characteristics such as the mean size and the relative number of landscape elements, the relative length of linear objects and the index of landscape heterogeneity. Even though the methods of landscape metrics have rapidly developed, and there is a wide range of various landscape characteristics, their utilization for practical implication is limited. However, a set of quantitative characteristics that have been used in this thesis have been found as sufficient to describe landscape changes in a satisfactory manner.

Landscapes at both the sites concerned have been influenced primarily by agricultural activities with the arable land as a dominating land cover (more then 85 %). While the proportion of arable land increased until 1962 (1966), it decreased from 1962 (1966) onwards. Periods during which Patchiness (Q) and the mean size of landscape elements increased as a result of the intensification were followed by a decline and recovery. The proportion of grassland decreased from 1703 (1839) to 1962 (1966) in both countries followed by an increase after 1962 (1966) onwards. There was a higher proportion of grassland in the Lilla Uppåkra site in 1703 (27.5 compared to 4.7 % in the Czech Republic). The relative number of grassland elements increased while the mean size of polygons decreased, which refers to a higher degree of fragmentation. Increasing intensity of the animal husbandry as well as the increasing population from the beginning of the 19th century might be among underlying reasons behind the grassland loss.

Swedish agricultural history has had a shorter tradition (6,000 years) as compared with the Czech Republic (7,000 years). However, there are some common points. Even though the changes in the Swedish and Czech agricultural landscape were partly similar in their character, they had a different timing. Some changes related to the agricultural intensification due to land reforms occurred much sooner in Sweden (the turn of the 18th and 19th century) as compared with the Czech Republic (after 1918 and after 1950). On the whole, changes in the Swedish landscape as from the turn of the 18th and 19th century should be viewed as a relevant consequence of agricultural innovations and of the overall

technological revolution induced by political and socio-economical changes in Europe. In addition, the Czech landscape would have probably faced these trends even if the collectivisation had not occurred since 1950 in former Czechoslovakia. The only reservations refer to the high intensity of large-scale changes and their negative impacts on the environment and the quality of life in the Czech Republic (the diminishing ecological quality of ecosystems, landscape character damage, forest damage or severe repression of private landowners during 1950s etc.).

It might be concluded that even if some actions in the landscape may have had similar reasons behind and they could even lead to similar effects in the landscape structure, they could have been driven by different political and socio-economical driving forces. Moreover, they might have had different consequences from the social point of view (economically governed land reforms in Sweden in contrast with politically driven changes during the collectivisation including repressions in former Czechoslovakia).

It must be stressed that only a limited part of the entire landscape history has been recorded in either of the two countries (1703 – 1839 – 2006) although a wide range of relevant source materials have been used for the analysis. On the Honbice site, the first exact map dates back to 1839 (Stabile Cadastre Map) and earlier source materials cannot be used for quantitative analysis. Therefore, considerable changes before 1839 were not analysed, e.g the abolishment of large ponds in the north-west part of the study site which used to be located close to the present pond. In the thesis, only quantitative changes have been analysed and no qualitative monitoring has been made. Quantitative responses of some land cover types belonging to similar landscape types to particular landscape anthropogenic forming processes have been found largely identical or similar in both the countries regardless of whether they are located in Central Europe or south Scandinavia. The only difference is the timing and intensity of structural changes.

Key words: landscape structure, landscape metrics, Czech Republic, Sweden, GIS, European Landscape Convention

Introduction

Human society has passed through numerous unstable periods which may be named crises. In all these cases society has adapted to the new situation by changing the organisation and the economy or by applying a new technology. Changes in landscape are caused by changes in society, which together with the environment have interacted in the long-term perspective. Environmental factors, such as mainly climate and hydrology have long-term effect on the landscape. These changes can be quantified in terms of various characteristics and indices and analysed using Geographic Information Systems (Lausch et Herzog, 2002; Palmer, 2004; Pixová, 2005). All in all, landscape changes appear as ”visible responses” to natural and man-made positive or negative actions. By analysing the impacts of such actions on landscape, we may establish relationship between changes and their driving forces in order to analyse positive and negative factors from the landscape ecological stability point of view. Then, we can set up recommendations for the relevant landscape planning and management strategy in future.

Landscape is composed of many different and dynamic components. It is the result of the interaction between the natural environment and man’s activities driven by actual needs (Antrop, 1998). Landscape is characterised by dynamic and continuous change, which may be expressed by quantitative changes of landscape structural characteristics. The rate of change varies in accordance with fluctuations of natural and anthropogenic processes

(Skånes, 1996). Natural conditions represent the most important factors that set limits to the utilisation of land. However, it is rather a framework for the way in which land is finally used, as it is the farmer and his actions that "have the last word" about the way in which agricultural landscape will appear (Helström, 2002). Changes in permanent structures of the landscape will be focused on since they have positive effects on the ecological stability of the landscape. According to Skage (1993) landscape dynamics should be studied on three different levels: (1) Land as an "arena" for different activities, (2) Users who use the land thus affecting its appearance, (3) Society, institutional framework that influence actors.

Intensively utilised agricultural landscapes have become a major subject of interest of this research. In the Czech Republic, more than half of the entire country's territory (54.1 %) was used as agricultural land in 2003 of which 71.6 % was arable land. In Sweden, 7.02 % of the total land area was utilised as crop land, of which 84.4 % was arable land. While there is a large disproportion in the proportion of land used for agricultural purposes in Sweden and in the Czech Republic (7.02 % in contrast to 54.1 %), a total amount of agricultural land is similar in both countries (31 630 km2 in Sweden as compared to 42 650 km2 in the Czech Republic). While in Sweden cropland took up 5.93 % of the total country's territory, it was 38.7 % in the Czech Republic, which is similar to the portion of the County of Skåne used as arable land (more than 40 % of the total area of the County of Skåne) (Statistics Czech Republic, 2006; Statistics Sweden, 2006).

Main reason behind the choice is that the study areas represent examples of landscapes that European Landscape Convention (Weber et al., 2004) defines as an "ordinary landscape". Even if this is not characterised by any special phenomena, it is valuable and unique though because of its cultural heritage value. Analysis of landscape development may provide with objective data and methods that can help us to delimit values of such ordinary landscape, e.g. landscape memory structure (Skaloš, 2004, 2006).

Factors behind landscape change

Population pressure has become an essential condition behind all phases of expansion in settlement and cultivation within the social and natural limits of the landscape. Population thus represents an essential variable for a number of different developments, such as formation of villages (urban areas) and resource (landscape) utilisation. Decline in population has on the contrary been a cause of regression in the cultural landscape (Berglund, 1991). In Sweden as well as in the Czech Republic, the population has been almost constantly increasing, except during the Late Middle Ages. While the population in Sweden referred to more than 2 million people in 1800, it had increased up to 9 million until 2005 (9 047 752 inhabitants). In the Czech Republic, the number of inhabitants had increased from more than 4 million around 1800 up to more than 10 million in 2005 (10 234 092 inhabitants). The Czech Republic is a more populated country in contrast to Sweden in terms of population density. While it amounted to some 130 inhabitants per sq. kilometre in the Czech Republic in 2005, it was only 20 inhabitants per sq. kilometre in Sweden. However, very rough numbers are received if we deal with the whole country. In the County of Skåne as such, population density is much higher and thus closer to the Czech Republic in numbers – it was some 103 inhabitants per sq. kilometre in 2005 (Statistics Sweden, 2006; Statistics Czech Republic. 2006).

Land ownership was an important factor behind several changes in the landscape. It has been of continuing importance. Since World War II an increasing number of outside influences has reduced the role of the land owner as more outside restrictions have come into existence (Berglund, 1991). Land ownership structure in Sweden with the crown, church and manors as dominating land owners has been historically quite similar to that one

in the Czech Republic. However, while private farmers have become major ownership subjects in the studied site Lilla Uppakra, large private cooperatives own the major portion of the study site Honbice. Moreover, development of the ownership structure in the former Czechoslovakia has been very dynamic, especially after the World War II. As soon as the Communist Party took power in the former Czechoslovakia in 1948, state-owned agricultural co-operatives inspired by Russian kolkhozes became dominant agricultural land owners. After the political shift in 1989 (”Velvet Revolution”), private ownership with the later land privatisation process occurred again in the Czech Republic (Löw et Míchal, 2003; Jech, 2001).

Landscape history in the Czech Republic

In the first half of the 19th century, the Industrial Revolution began in Europe. This led to the first significant impact on landscape. Up to this time, human activities had been estimated as being in balance with natural processes hence creating what we refer to as so-called “harmonic cultural landscape”. Despite rapid industrialisation at the turn of the 20th century, even during the 1930s and the 1940s, cultural landscape was still regarded as diverse and harmonic (Lipský, 2000; Sklenička, 2003)

The end of WWII is taken as a breaking point (‘turning point’) for Czech society and for the Czech landscape as well, which is true for the whole of Europe as well. Modern technologies in agriculture began to develop, along with intensification and specialisation. Changes in landscape had never been so pronounced before 1945. After the Communist Party took power in the former Czechoslovakia during the Putsch in 1948, these changes were characterised by large-scale Soviet way of farming with agricultural co-operatives (inspired by so-called Russian kolkhozes) as major agricultural land owners. Collectivisation of agriculture stands for the one of several significant actions in the history of the former Czechoslovakia after 1945, which left great marks not at least on the face of the Czech cultural landscape. It officially made its start in 1951 (Jech, 2001). That is to say that apart from political, economic and landscape-ecological consequences, Collectivisation showed also negative implications from the sociological point of view due to severe repression of private landowners. Many of them were bound with duties, imprisoned, or punished in other ways (Jech, 2001; Ptáček, 2006). The so-called “Velvet Revolution” in 1989 brought about new economic and social conditions as a framework for developing institutional framework, and affecting landscape users in the landscape arena. The period from 1948 until 1989 may be further subdivided to several phases according to several authors. For example, Sýkora (1998) distinguishes following periods: (1) Socialist Collectivisation (1950 – 1970), (2) The concentration of agricultural production (1970s – 1980s). Löw et Míchal (2003) divide landscape history in the former Czechoslovakia into following distinct periods:

- Displacement of the German population from the Sudety Region and the following resettlement by the Czech population (1945 – 1948),
- First phase of Collectivisation (1950s),
- Second phase of Collectivisation (1970s),
- Land Consolidation in cadastral areas (1970s – 1980s),
- Negative compensatory land reclamations (náhradní rekultivace),
- Designation of specifically protected areas,
- Ecological disaster of mountain forest ecosystems,

The period after 1989 might be characterised by: (a) land restitution, (b) political contention, (c) national environmental protection policy, and (d) complex land consolidation.

Landscape history in Sweden

Cultural factors were probably more important than ecological restrictions in causing landscape changes in south Scandinavia. The socio-economic correlation with territories situated outside the study site locality grew in time. During historical time the area became more influenced by central Europe - eespecially from the 16th century onwards the area became increasingly integrated with the agrarian market of Europe. Economic boom occurred in the Early middle Ages and during High Middle Ages and it is still the subject of the intensive debate whether it was due to an increase in population requiring techniques to raise productivity, or to technical development progressively leading to population growth (Berglund, 1991).

In agrarian society man started to change nature more dynamically than before. The accessibility of soil nutrients has been the critical factor in this development. The expansion of the cultural landscape has passed through periods of areal expansion followed by periods of concentration. With increasing population it has been possible to increase production by improving productivity. It was possible due to improving (a) agrarian techniques, (b) organisation and (c) land mobilisations (expansions). Soil nutrient balance was a ruling factor for the maintenance of productivity and carrying capacity of the agro-ecosystems. Loss of nutrients has always to be compensated. From the Late Bronze age, the loss of nutrients was compensated by manuring. From the dusk of agriculture until the Late Bronze age, soil nutrient balance was maintained mainly through slash-and-burn agricultural practice. From the Late Iron Age, rotation system was the further tool to prevent the nutrient reduction. Before 1700, cereal production was not on a very great scale due to bad times for agriculture during 1658 – 1700 and negative effects of the Scania war (1670 – 1678). In the first part of the 18th century, the farming economy improved and as commercial agriculture spread all over area during the 19th century, national economy forces as well as international trade have become of primary interest, also for the individual farmer. Particularly over the last 200 years, the most rapid and serious changes have taken place within the Swedish landscape. Through the last 200 years, technology gained in importance promoted by the national agricultural policy, by the introduction of agricultural societies, general scientific progress and international influence. Lately, it has been furthered by agricultural specialisation in cereal farming together with revolutions in transport. During the 19th century, new agricultural techniques (e.g. deep ploughing) together with introduction of organic and minerogenic fertilizers (marling, animal bones etc.) were applied to compensate the loss of nutrients. Then, commercial fertilizers occurred after 1900. The high loads (firstly used after 1950 with peaks during the mid 1970s) were applied to reach the highest yields in history. This has resulted in huge environmental problems, including leaching nitrogen into rivers and streams and eventually to ground waters (Berglund, 1991; Sporrong et al., 1995; Helmfried, 1994; Gustavsson et Ingelög, 1994).

Since the early 19th century the cultural landscape has faced general simplification and rationalisation in terms of land use and vegetation. The ecological result of this is a broad spectrum of environmental problems associated with (Berglund, 1991):

- Fragmentation of ecosystems;
- Decreasing landscape, habitat, and species diversity;

- Threats to species populations;
- Chemical pollution by residues of pesticides;
- Increased nutrient leaching.

Among cultivation and cropping practices, five procedures can be distinguished as having the greatest impacts on the landscape since the introduction of permanent arable (Berglund, 1991):

- Seed-bed preparation
- Nutrient additions: manure and fertilizers
- Cropping and fallow cycles
- Management of fallows
- Drainage

The period before 1945 is judged as well balanced from a biological point of view. Since WW II, the Swedish landscape has been confronted with a number of serious changes. Today's central settlement regions are the oldest cultural settlements being colonised in prehistoric times, while marginal areas were settled much later. Regions in south and mid-Sweden were colonised during the Middle Ages and inland areas in Norrland even later. Settlements in Sweden have always been strongly linked with agriculture (Berglund et al., 1991; Hägerstrand et Lohm, 1991; Rosén et Borgegård, 1999; Ihse, 1995; Skånes, 1996).

Swedish agriculture has undergone three substantial break points during its history:

- Agrarian revolution (during the 19th century);
- New impetus (after the Second World War);
- New upheaval of nowadays (expected to continue for several decades).

Reasons for studying Sweden

Relevant reasons behind choosing the comparative study site in southern Sweden can be summarized as follows:

- To study landscape changes in the Czech Republic in the European context;
- To examine two faces of modernisation;
- There are advanced methods of remote sensing in Sweden;
- There is also the a long tradition of the systematic large-scale land survey in Sweden (from 1628 onwards);
- To undertake a detailed large-scale analysis and comparison of landscape changes in Swedish and Czech productive agricultural areas as early as from 1703. It is unlike Vaněčková (2003) who made similar investigations, but in smaller scale in the limited time extent (between 1912 and 2002).

Two faces of modernisation

Sweden, especially, has become a country where a rapid modernisation has occurred. This is typical of the former Czechoslovakia too, but the modernisation appeared in different background. However, consequent changes seem to be rather similar in both countries. The end of WWII is taken as a breaking point ('turning point') for Czech society and for the Czech landscape as well, which is true for the whole of Europe as well (Johnsson, 1991). Modern technologies in agriculture began to develop, along with intensification and specialisation. Changes in landscape had never been so pronounced before 1945. After the Communist Party took power in the former Czechoslovakia during the Putsch in 1948, these changes were characterised by large-scale Soviet way of farming

with agricultural co-operatives (inspired by so-called Russian kolkhozes) as major agricultural land owners. Collectivisation of agriculture stands for the one of several significant actions in the history of the former Czechoslovakia after 1945, which left great marks not at least on the face of the Czech cultural landscape. It officially made its start in 1951 (Jech, 2001). That is to say that apart from political, economic and landscape-ecological consequences, Collectivisation showed also negative implications from the sociological point of view due to severe repression of private landowners. Many of them were bound with duties, imprisoned, or punished in other ways (Jech, 2001; Ptáček, 2006). The so-called "Velvet Revolution" in 1989 brought about new economic and social conditions as a framework for developing institutional framework, and affecting landscape users in the landscape arena. The same is not true for Sweden, where mainly economic forces were behind changes. This thesis contributes by providing information on the two different ways of modernisation after 1945 in the Czech Republic and Sweden.

Similar changes under different conditions?

Substantial agricultural reforms resulting in land consolidations occurred much sooner in Sweden (at the turn of the 18th and 19th centuries) compared with the Czech Republic (after the 1950s). Landscape changes after 1945 feature similar patterns (intensification and modernisation of agriculture, getting rid of wetland areas and dispersed vegetation, reducing density of communication infrastructure etc.) in both countries (Lipský, 1995; Ihse, 1995). However, the driving forces behind these countries are reported to be different. In Sweden, there were mainly economic driving forces behind landscape changes as compared with politically oriented large-scale Soviet system of farming characterised by agricultural co-operatives according to so-called Russian kolkhozes in the Czech Republic.

Objectives

Knowledge of the historical land use may serve as a basis to understand processes that have contributed to the creation of the present landscape. On the whole, this knowledge can be applied in the landscape planning procedure in order to reach a relevant landscape management (Lannér, 2003). The objectives are:

(1) To quantify changes in landscape structure in the Honbice (eastern Czech Republic) and Lilla Uppåkra (southern Sweden) case study sites between 1703 and 2006;

(2) To identify factors behind landscape changes of both sites;

(3) To find relationships between changes and factors behind;

(4) To identify positive and negative factors from the landscape ecological stability point of view;

(5) To identify similarities and differences between landscape changes in the Czech and Swedish case study site;

(6) To examine importance of the landscape change analysis for the landscape planning practice;

(7) To test the applicability of the proposed methods.

Material and methods

Data collection

The way in which the data is collected and finally treated has the most considerable impact on the quality of results (Tuček, 1998).

Official statistics

Statistical data for the whole country, for the County of Pardubice and a former District of Chrudim has been analysed and used as a background in the discussion chapter. There is a unique database of historic statistical data on land use covering almost the entire territory of the Czech Republic. This database was established during 1990s at the Faculty of Science of Charles University in Prague. These data sets relate to four time horizons, which might be taken as breaking points in the country's and landscape history (1845, 1948, 1990 and 2000). Data is available for app. 9 000 administrative units (Bičík, 2004). This data was closely analysed by Skaloš (2005) for the case study site of Stíčany (159 ha) located nearby in the same landscape type. Thus, statistical data on the area of main land cover types for the whole country and for the county of Skåne have been analysed and used as a background in the discussion chapter. However, data series on land use have had a shorter tradition compared to the Czech Republic (from 1870 for the whole country and from the beginning of the 20th century for a county of Skåne). Since any data from the municipality or parish level is not centralised and unified as it is in the Czech Republic, only data for the country and county level has been used (Statistics Sweden, 2006; Vaněčková, 2003).

Graphical source data

Old maps

Stabile Cadastre Maps from 1839 (original scale of 1: 2880) fall within the map series produced during 1825 – 1843 for taxation purposes (Semotánová, 1988, 2002; Trpák et Trpáková, 2002; Sklenička, 2003). They are unique since they show the landscape character at the turning point between the rural and industrial transition. As they are geodetically objective, characteristics that are interpreted from them can be quantified in GIS.

Since Sweden is characterised by a long tradition of land survey, first geodetically objective maps occurred as early as in the 17th century (Sporrong et Wennström, 1990; Skånes, 1996). In this work, following maps have been used to analyse landscape changes.

Geometriska kratan from 1703 (original scale 1: 4000) shows the real situation of the 18th century open field landscape in the south Sweden. This map records a landscape character before land reforms. It is a large-scale map, which is an outcome of the landscape survey whose main objective was to registry land for a revenue collection. Consequently, this map gives detailed information on a different quality and character of particular land covers. It records arable land, different types of grassland, built-up areas, and so-called common land in the centre of the village. It is marked with red to reddish colour with dots. This is the village green where cattle were kept during night. The land over the village green consisted normally of grass, some trees and a well (Sporrong, 2006). A landscape mosaic is highly diversified consisting of a large number of holdings.

Storskiftet kartan from 1805-1806 (original scale 1: 4000) gives information on the same land cover types as it does the previous map. It provides with the picture of the landscape after the first phase of the "Storskiftet" land reform, which was completed in 1805 (consolidation of fields into few large ones without breaking the village structure).

Enskiftet kartan from 1813 (1817) – shows considerable affects of the "Enskiftet" reform during which even farmhouses were moved out of the village centres with large field blocks attached to them. There is a big uncertainty about the "measure of reality" in the data presentation on the Enskiftet map from 1813. It is because this map may record rather the state, which was supposed to achieve within land reforms instead of what was finally done in the landscape.

Ekonomiska kartan from 1910 is a large medium scale map (1: 20 000) recording the landscape during time when many statistical indices characterises landscape ecological quality to reach the most negative values, e.g. the proportion of grassland is the far lowest in the history.

Aerial photographs

The Czech Republic owns an extensive series of aerial photographs that represent a result of the systematic monitoring of the country's territory from 1936 onwards. The first aerial photographs were taken in 1936, and then they were actualised in 5-7 year intervals. In this study, aerial photographs from 1950, 1966 and 2003 for the Honbice study site have been utilised. Sweden has had a long tradition of remote sensing from 1930s onwards. The first aerial photographs were taken in 1939, later on actualised in ten-year intervals. In this study, aerial photographs from 1939, 1962 and 2004 have been used.

Mapping of the present state of landscape

Since mistakes might occur concerning interpretation of aerial photographs, the present state of the landscape has been mapped in situ in order to obtain actual information on the real state of relevant landscape structure characteristics. However, methods developed by Vondrušková et al. (1994) were avoided since the field mapping classification system had to comply with the whole study classification system. Field mapping in situ was undertaken in October 2006 within the borders of the Honbice study site. To receive more realistic image over the study site landscape, several pictures were taken.

Data verification

In order to verify information read from graphic source materials, following procedures have been applied:

- Terrain inspection in situ;
- Interpretation of additional graphic source data that was not originally used in the study (e.g. Register of the Real Estate Map from 1966 – "mapa Evidence nemovitostí");
- Study of text references dealing with the history of the village or surrounding landscape;
- Study of archival materials (undertaken within 2002 – 2007 at the State District Archive in Chrudim)
- Use of the statistical data on land use has been used as an additional reference material;
- Interviews with farmers and witnesses (undertaken in October 2003 and November 2006 in Sweden, and in January 2007 in the Czech Republic at the Honbice Municipality Office).

Data processing

Old maps and aerial photos transformed into the WGS 84 Grid System since a common based reference frame had to be applied. Transformed data was digitised using GIS software TopoL XT 8.0 and ArcView 3.2, and 9.1. For each data layer, polygons that could be visually distinguishable were vectorised. Then, a correction of the polygon minimum size was done in order to avoid statistical discrepancies. In this study, polygons smaller than 10 m^2 were excluded. Then, each polygon was classified according to the classification scheme as mentioned bellow.

Analysis of data

Time delimitation

Changes in the study site landscape have been investigated during 1703, 1839 and 2006 respecting the rise of the first geodetically exact map of Stabile Cadastre in 1839. Then, a field mapping in situ of the present state of landscape was undertaken in 2006.

Analysed landscape elements

Built-up and other areas, communications, arable land, gardens, grassland, water areas, non-forest wood species category, permanent landscape structures (PLS), small biotope-((natural or semi-natural up to 0.5 hectares).

Quantitative characteristics

Landscape macrostructure

- Area (P) in hectares or as a proportion in %;
- Coefficient of ecological stability (CES) according to Míchal et al. (1985) and Miklós (1986);
- Proportional change (in percentage compared to the value from previous year). This characteristic was calculated for each of above mentioned characteristics;
- Change intensity (in units per one year). This characteristic describes changes in ha or number of elements per one year, thus giving information on the speed of change.

Landscape microstructure

- Total number of elements – n (No);
- Relative frequency of landscape elements (fragmentation) – Q ($No.ha^{-1}$) was calculated as a rate between the numbers of particular land cover elements to the area of the land cover;
- Patch density (Qp) ($No.ha^{-1}$) was calculated as a rate between the numbers of particular land cover elements to the total area of the study site;
- Average size of elements – P mean (ha);
- Maximum size of polygon – P max (ha).

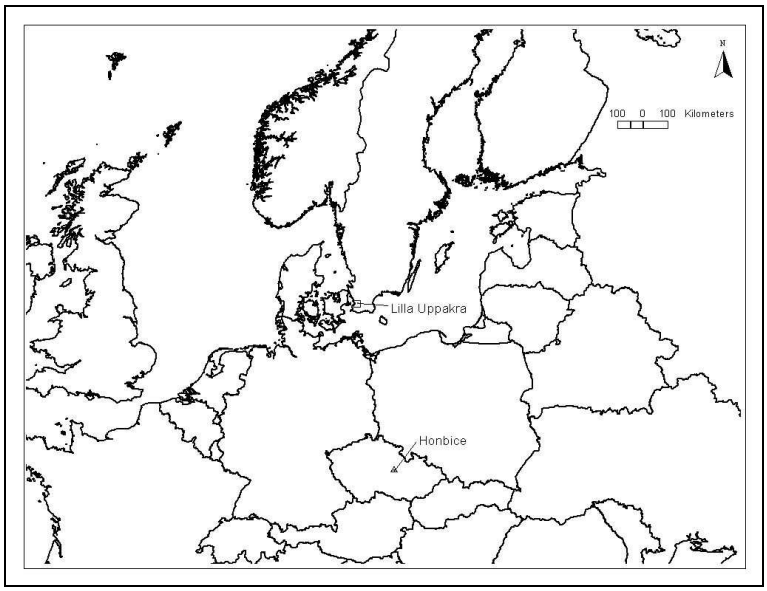
Characteristics of interaction

- Relative length of linear objects of ecotones – l ($km.ha^{-1}$)
- Index of landscape heterogeneity (V) refers to the territorial heterogeneity of the concrete ecosystem of the local importance). It was calculated according to (Mimra, 1993).

Study areas

The study site Honbice (244 ha) is located approximately 7 km to the south-east of the former District City of Chrudim, or 15 km of the county city of Pardubice (Fig. 1). Altitude ranges from 257.7 m (Ležák River) to 300.9 metres above sea level (terrain elevation to the south-west of the study site). The study site was delimited in accordance with cadastral boundaries. Study site Lilla Uppåkra (321 ha) is located in the southernmost part of Sweden, some 10 km to the north-east of the city of Malmö (Fig. 1). The site belongs administratively to Skåne County, one of 21 counties (län) that are a part of the local government (Elg, 1990). Elevation within the studied site ranges from 20 to 30 metres above the sea level.

Fig. 1: Localisation of case study locations in Europe



Results and discussion

Landscape macrostructure

Arable land has occupied a slight larger proportion of the study site Honbice (on average 89.9 %) as compared to Lilla Uppåkra (86.5 %) during 1703 – 2006. While the proportion of arable land reached its peak in Lilla Uppåkra in 1910 and 1962 (92.1 %, 92 %, i.e. 296, 294 ha), it happened in 1966 in Honbice (97 %, 221 ha). In Lilla Uppåkra, these results resemble with official statistical data as well as with information found in references (Hägerstrand et Lohm, 1991; Bernes, 1994; Rosén et Borgegård, 1999). A minimal degree at which landscapes of both sites were ploughed occurred in 1703 in Lilla Uppåkra and in 1839 in Honbice. The proportion of arable land is very similar in both sites at present (89.35 % in Lilla Uppåkra as compared with 89.42 % in Honbice) (Tab. 1, 2, Fig. 2).

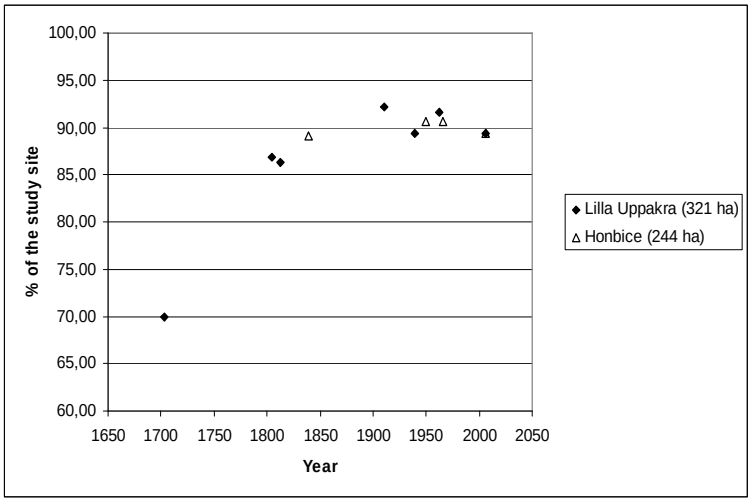
Tab.1: Land cover development in the Honbice study site (244 ha)

	Honbice study site (244 ha)										
	Land cover categories										
	Area in %										
Year	Arable land	Built -up	Other	Comm.	Gardens	Grassland	Water areas	Non-forest veg. village	Scattered veg. comm.	Scattered veg. landscape	PLS
1839	89.06	0.50	1.06	2.71	-	4.70		1.97	-	0.00	4.70
1950	90.62	1.10	0.82	1.73	0.10	1.82	0.05	2.31	1.03	0.42	3.32
1966	90.67	1.20	1.25	1.23	0.14	1.49	0.03	2.71	0.74	0.54	2.81
2006	89.42	1.13	1.79	0.91	0.72	3.03	0.08	1.12	1.01	0.79	4.90

Tab 2: Land cover changes in Lilla Uppåkra (321 ha)

	Lilla Uppåkra (321 ha)										
	Land cover categories										
	Area in %										
Year	Arable land	Built-up	Other	Comm.	Gardens	Grassland	Water areas	Non-forest village	Scattered comm.	Scattered landscape	PLS
1703	69.90	0.63	0.00	1.53	0.41	27.53	0.00	0.00	0.00	0.00	27.53
1805	86.85	0.13	0.05	1.49	0.35	11.11	0.02	0.00	0.00	0.00	11.13
1813	86.26	0.16	0.05	1.93	0.32	11.26	0.02	0.00	0.00	0.00	11.28
1910	92.10	1.40	0.28	4.33	1.18	0.53	0.02	0.00	0.00	0.16	0.70
1939	89.43	0.92	0.77	1.11	0.44	4.81	0.01	1.60	0.61	0.29	5.73
1962	91.56	0.69	0.78	1.91	0.49	3.20	0.01	0.91	0.36	0.10	3.66
2006	89.35	0.70	1.65	1.86	0.81	3.90	0.00	1.54	0.15	0.06	4.10

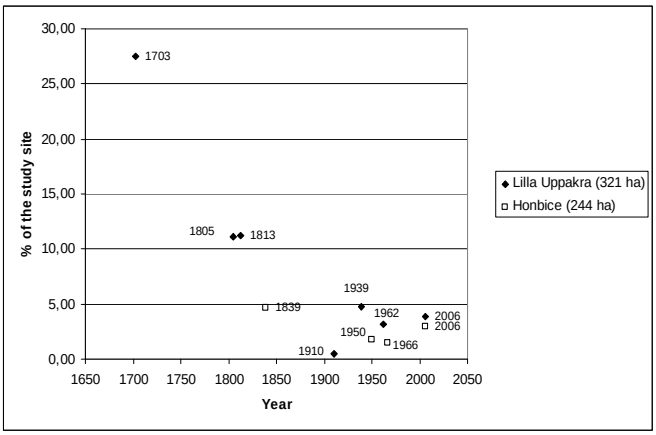
Fig. 2 : Proportional changes of arable land – comparison between Honbice and Lilla Uppåkra study sites



Grassland

The proportion of grassland has shrunk as it has been ploughed due to a need for more arable land owing to the intensification of wood production and decreasing intensification of animal husbandry (Ihse, 1995; Lipský, 1995). Average proportion of grassland during 1703 – 2006 has referred to 2.8 %, which is three times fewer in Honbice than in Lilla Uppåkra. The smallest proportion was observed in Lilla Uppåkra in 1910 (0.5 %), with the second minimum in 1962 (3.20 %). In Honbice, the minimum amounted to 1.49 % in 1966. Proportional increase of grassland after 1966 has been observed in both study sites (Fig. 3).

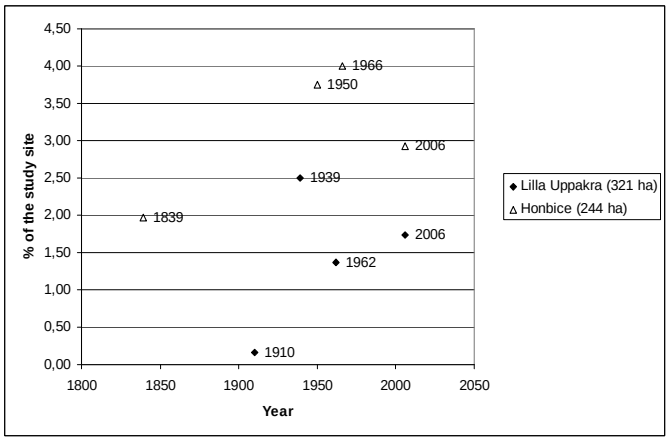
Fig. 3: . Proportional development of grassland – comparison between Honbice and Lilla Uppåkra study site



Non-forest wood species

Analysis of the total category of non-forest wood species is rather tricky as it consists of several subcategories characterised by a different dynamics. Then, particular subcategories have become a subject of the interest (Fig. 4).

Fig. 4 : Proportional development of the entire category of non-forest wood species – comparison between Honbice and Lilla Uppåkra study site



Scattered vegetation in the open landscape

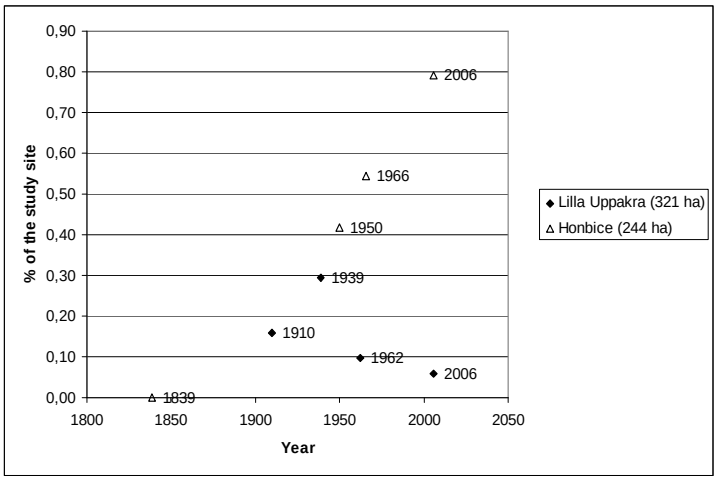
It has developed differently in both sites. It has occupied 0.44 % on average in the Honbice site while it has been 0.15 % in Lilla Uppåkra. This category has proportionally increased in the Honbice site (from 0 % in 1839 to 0.8 % in 2006), which might be viewed as a surprising fact respecting overall withdrawal of landscape greenery in the intensively utilised agricultural landscape. This succession can be explained by two factors:

(1) Scattered vegetation has developed on sites located on steep land in the west part of the study site where the intensive agricultural techniques are limited, thus allowing such greenery to develop;

(2) It could be explained as a consequence of purposeful anthropogenic plantation activities on steep slopes in the west part of the territory. Dr. Stach, a liberal person who lived in the Honbice village during the first part of the 20th century organised this planting activity in 1930s (Urbánek, 2007).

It is not the case of the Lilla Uppåkra site, where there are no such convenient conditions and most of the landscape-scattered vegetation has been cut down from 1939 onwards. A slight increase between 1910 and 1939 in Lilla Uppåkra could be a consequence of the inconsistency of different source data (Fig. 5).

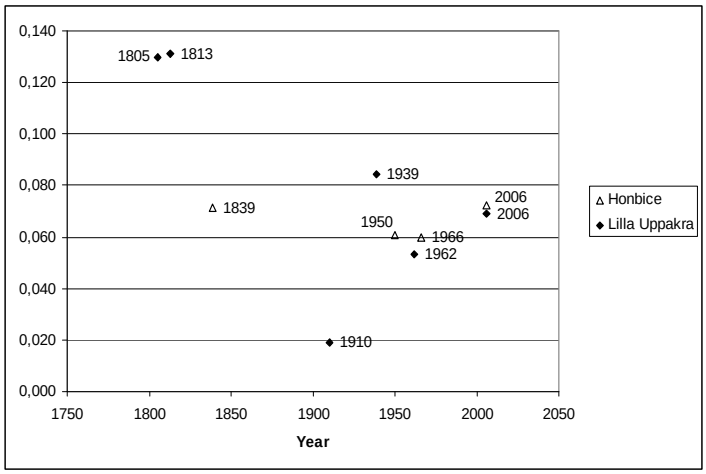
Fig. 5 : Development of scattered vegetation in open landscape – comparison between Honbice and Lilla Uppåkra study site



The coefficient of ecological stability (Míchal et al., 1985)

It has been more dynamic in Lilla Uppåkra as against the Honbice site. The average value of the coefficient of ecological stability between 1703 and 2006 has been higher in Lilla Uppåkra (0.125) than in Honbice (0.066) as there was a higher portion of grasslands in Lilla Uppåkra in 1703 (27.5 %) than in Honbice in 1839 (4.7 %). The coefficient of ecological stability is almost identical both, in Lilla Uppåkra and Honbice in 2006. In Lilla Uppåkra, the coefficient of ecological stability had been decreasing until 1910 when it reached the minimum (0.019) because of ploughing of grasslands. Again, it decreased again after 1939 because of a decreasing area of fallow land (Fig. 6).

Fig. 6 : Coefficient of ecological stability (Míchal et al., 1985) – comparison between Honbice and Lilla Uppåkra study site



Permanent landscape structures

The average size of the mean plot size for permanent landscape structures has been a lightly smaller in Honbice (300 m^2) than in Lilla Uppåkra (700 m^2) during 1703 – 2006. Changes in the mean size of polygons for permanent landscape structures have reflected two processes in Sweden: (1) consolidation of agricultural land plots between 1703 and 1813, and (2) fragmentation after 1813. In the Honbice study site, the only fragmentation process has influenced the mean size of permanent landscape structures after 1950. From 1939 (1950) to 1962 (1966), the mean size have decreased in both sites. Then the increase in the mean size of the permanent landscape structure plots has been common for both study sites (Fig. 7).

Fig. 7: Changes in the mean size of PLS elements – comparison between Honbice and Lilla Uppåkra study site

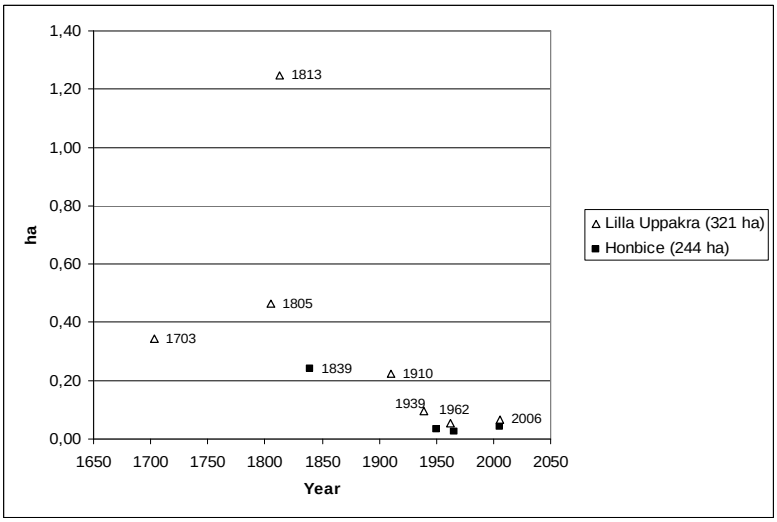


Fig. 8.: Land cover in Lilla Uppåkra 1703

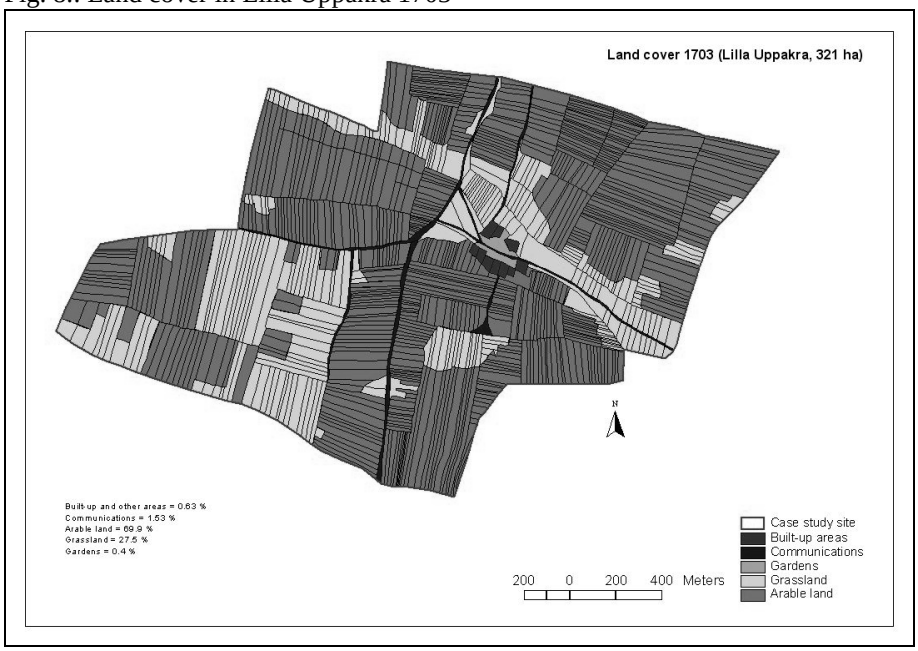
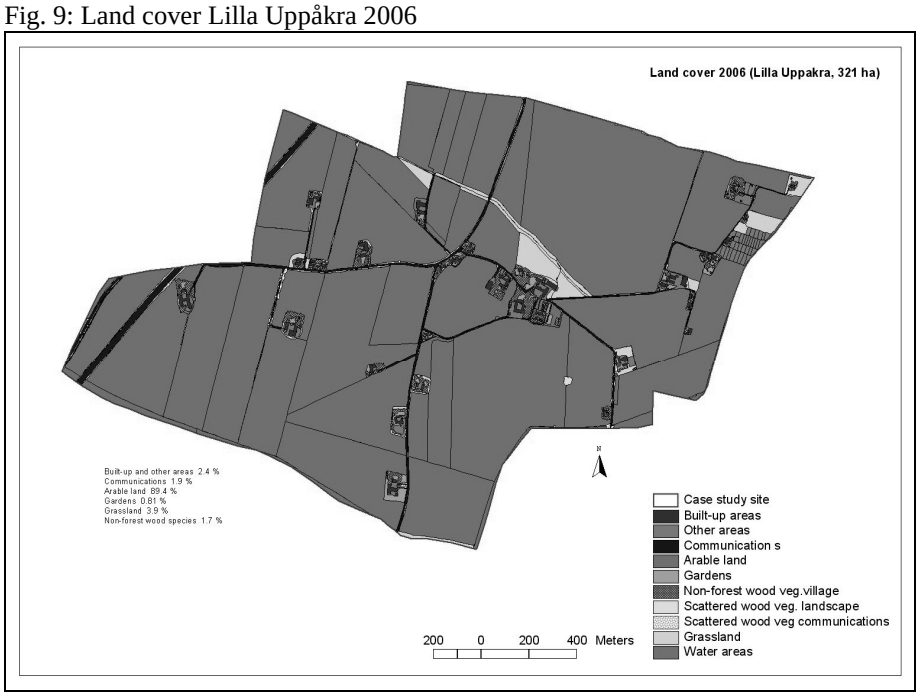


Fig. 9: Land cover Lilla Uppåkra 2006



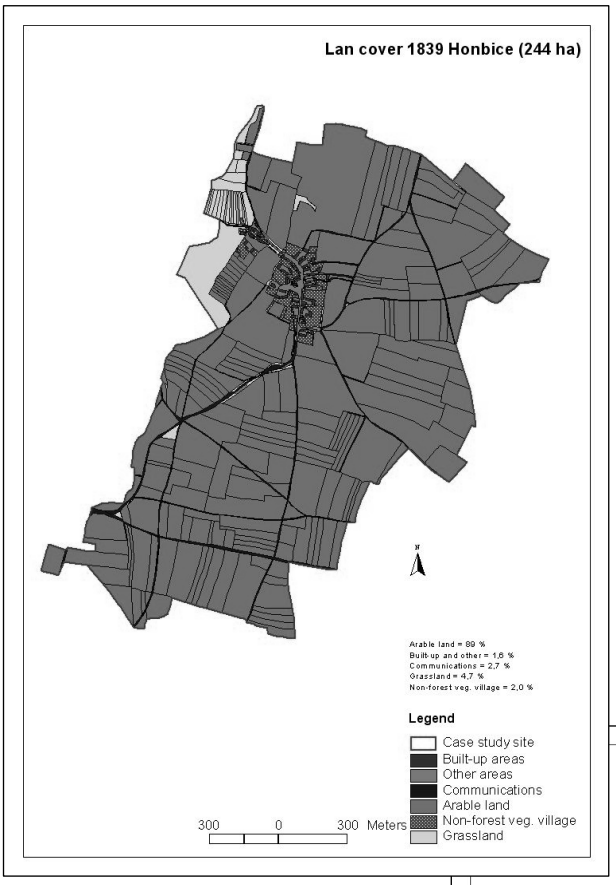


Fig. 10.: Land cover Honbice 1839

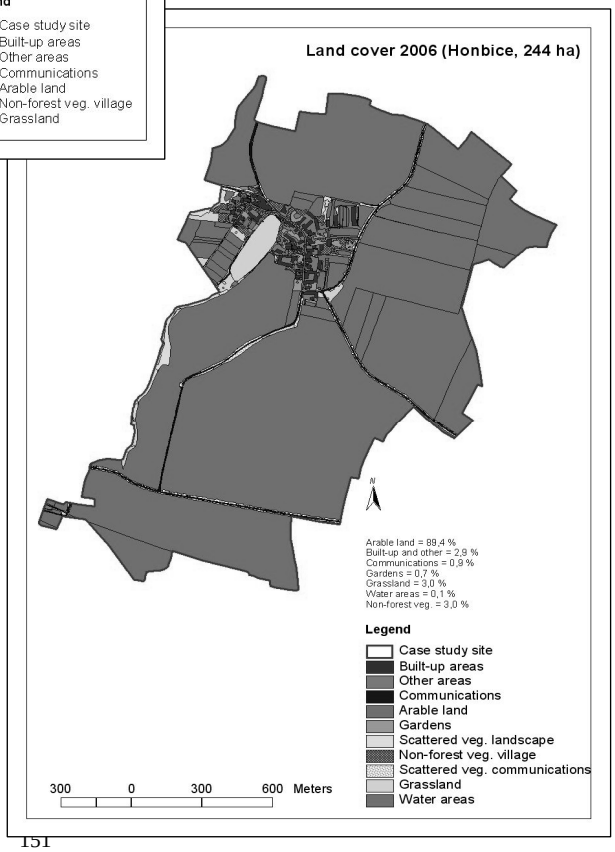
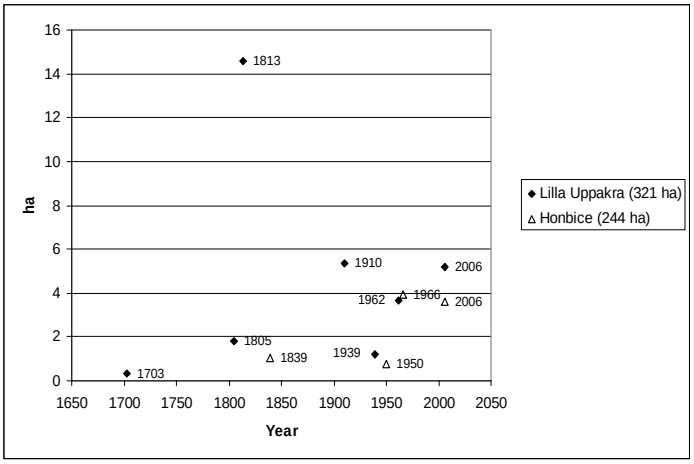


Fig. 11: Land cover Honbice 2006

Landscape microstructure

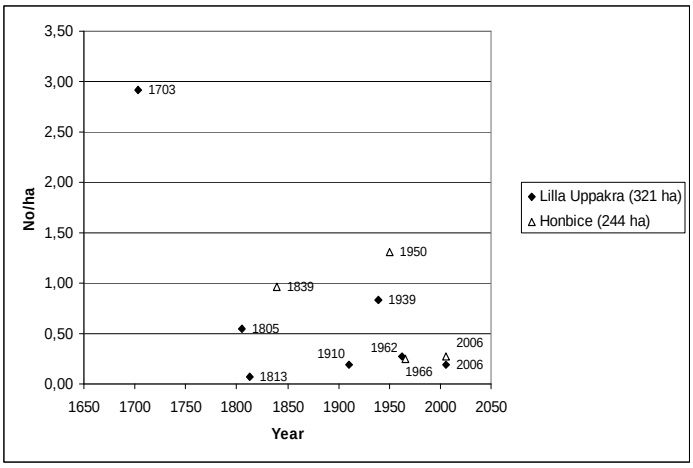
Arable land. Mean (P mean) and maximum size of landscape elements (P max). Changes in the mean size of arable land fields reflect affects of the agricultural land intensification. On average, the mean size of arable land fields has been two times larger in Lilla Uppåkra (4.60 ha) compared to Honbice (2.33 ha). While the maximum mean size was reached in 1813 in Lilla Uppåkra (14.6 ha), it was in 1966 (4 ha) in the Honbice site. Maximum values of the mean arable field size are results of the agriculture intensification. It occurred at the beginning of the 19th century in Lilla Uppåkra as well as in the Honbice site. However, consolidation of arable land fields began as late as in 1950s in the former Czechoslovakia. From 1939 (1950) until 1962 (1966), the mean size of fields increased in both sites. Then, while it has slightly decreases in the Honbice site (4 – 3.6 ha), it keeps increasing tendency on the Lilla Uppåkra study site (3.7 – 5.2). This may implicate more intensified character of agriculture in Sweden at present in contrast to the Czech counterpart (Fig. 12).

Fig. 12: Mean size of arable land fields – comparison between Honbice and Lilla Uppåkra study site



Relative frequency of arable fields (Q). The average size of the relative frequency of arable fields has been similar between Lilla Uppåkra and Honbice study site during 1703 – 2006, just a little higher in Lilla Uppåkra (0.72 No.ha^{-1}) compared to Honbice (0.70 No.ha^{-1}). The maximum degree of the arable land fragmentation was reached in 1703 in Sweden (2.9 No.ha^{-1}) in contrast to Honbice in 1950 (1.31 No.ha^{-1}). From this year respectively, this value has decreased as an affect the agricultural intensification. The increase between 1813 and 1939 was caused by a different character of source data from 1813 and 1939. After 1962, it has increased in the Honbice site because of the decreasing intensity of agricultural land use (Fig. 13).

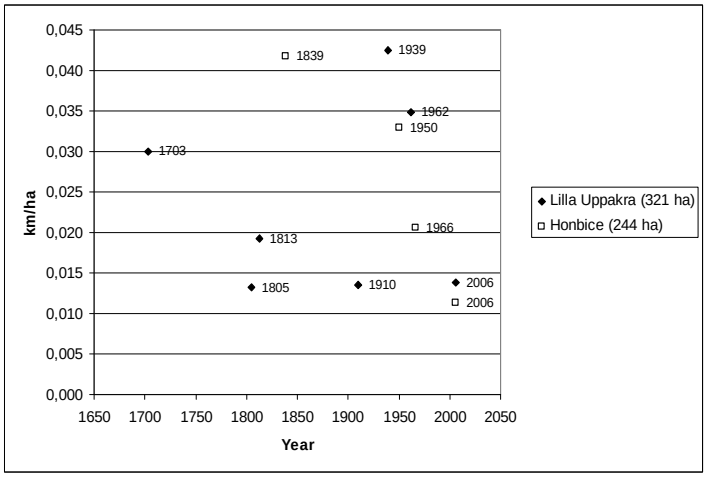
Fig. 13: Relative number of arable land fields (Q) – comparison between Honbice and Lilla Uppåkra study site



Linear features

The relative length of the linear objects in landscape can more truly respond to changes in landscape microstructure in contrast to the area or proportion of communications. On average, relative length of communications between 1703 and 2006 has been almost identical at both localities (0.030 km.ha^{-1} in Lilla Uppåkra, 0.026 km.ha^{-1} in Honbice). While this characteristic reflects only a decrease in the density of rural roads in Honbice (no new main roads have been constructed in the locality), it is not true for Lilla Uppåkra since a brand new motorway was constructed in 1954 connecting Malmö with Lund. From 1703 to 1813, impacts of new redistribution of land plots in relation to land reforms been also observed. Then, a rapid decrease in the density of communication network has occurred in both localities from 1939 (1950) (Fig. 14).

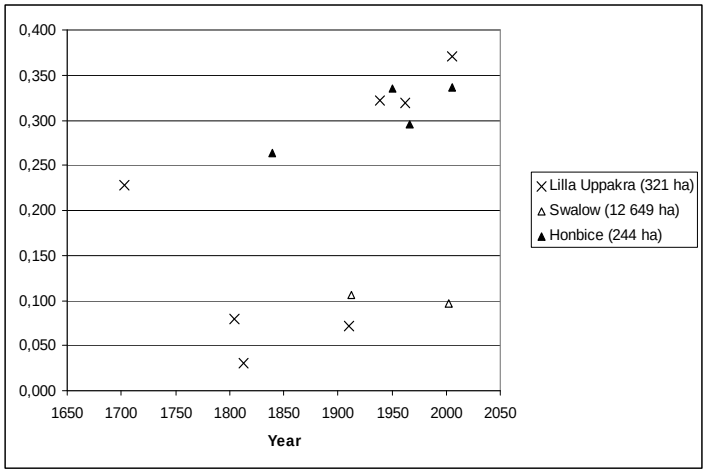
Fig. 14: Changes in the relative length of rural roads – comparison between Honbice and Lilla Uppåkra study site



Landscape heterogenity

The increase of the landscape heterogeneity index in both countries between 1962 (1966) and 2006 might have been caused by the increase in the number of landscape elements in the urban area. In the following research, the landscape heterogeneity index should be therefore quantified for the landscape excluding urban areas that probably falsify final results (Fig. 15).

Fig. 15: Index of landscape heterogeneity – comparison between Lilla Uppåkra, Honbice and Svalöv (Vaněčková, 2003).



Summary of factors behind landscape changes in the Lilla Uppåkra site

In this chapter, factors behind landscape changes in the study sites Honbice and Lilla Uppåkra have been summarized based on results of the study. Even though the summary was to provide systematic and logical information, it might be found as largely schematic and generalised.

Tab. 3.: Main factors behind landscape changes in the Honbice study site

Primary factors	**Secondary factors**	**Tertiary factors**	**Consequences for landscape**	**Evaluation from nature and landscape conservation perspective**	**Timing**
Population growth, political and socio-economical changes until 1950	Extensification and rationalisation of agriculture	Introduction of shifting cultivation practice	Increasing area of arable land	Negative	18th and 19th century
		Abandonment of the fallow land practice	Decreasing area of grassland	Negative	
		Rationalisation of animal husbandry	Decreasing number of small biotopes	Negative	
			Introduction of new crops	Negative	
			Decreasing diversity of agricultural crops	Negative	

		Attempts at first land reforms (not completed)	Decreasing mean size of arable land fields (only locally, limited)	Positive	after 1918
	Sporadic and purposeful nature conservation practices	Plantation activities	Increasing area of scattered vegetation in landscape	Positive	1930s
Population, political and socio-economical changes after WWII (1950 - 1989)	Socialist collectivisation characterised by the intensification and specialisation of agriculture	Introduction of machinery	Increasing area of arable land	Negative	1950 – 1970
		Large scale use of artificial fertilizers	Increasing mean size of arable land fields	Negative	
		Large scale use of pesticides	Decreasing area of grassland	Negative	
			Fragmentation of grasslands	Negative/Positive	
			Recession of small biotopes	Negative	
			Increasing area of built-up and other areas	Negative	
			Decreasing length of rural roads	Negative	
	Concentration of agricultural production	Construction and situating of large farm buildings and complexes in the landscape	Landscape character damage - decreasing aesthetical potential of landscape	Negative	1970 - 1989
			Increasing area of built-up and other areas	Negative	
Political changes after 1989 ("Velvet" revolution)	New legislation (e.g. Act No. 114/1992 on nature and landscape protection)	Agricultural subsidies	Decreasing area of arable land	Positive	1990-2004
	Property restitutions	Changes in the ownership structure	Decreasing mean size of arable land fields	Positive	
	Land consolidations	Reorganisation of land plots	Recovery of grassland	Positive	
	Entry to the European Union	Revision of national legislation	Increasing landscape heterogeneity	Positive	2004
		Agricultural subsidies	Maintaining of grassland thanks to agricultural subsidies	Positive	

Tab. 4 : Factors behind landscape changes in the Lilla Uppåkra site

Primary factors	**Secondary factors**	**Tertiary factors**	**Its consequences for landscape**	**Evaluation from nature conservation perspective**	**Timing**
Population growth and political and socio-economical changes until 1945	Extensification and rationalisation of agriculture	Introduction of shifting cultivation practice	Increasing area of arable land	Negative	18th and 19th century
		Abandonment of the fallow land practice	Decreasing area of grassland	Negative	
		Rationalisation of animal husbandry	Decreasing number of small biotopes	Negative	
			Introduction of new crops	Negative	
			Decreasing diversity of agricultural crops	Negative	
		Land reforms	Increasing mean size of arable land fields	Negative	Turn of the 18th and 19th century
			Diminishing area of grassland	Negative	
			Decreasing number of small biotopes	Negative	
			Decreasing Index of landscape heterogeneity	Negative	
			Decreasing area of built-up and other areas	Positive	
			Dissolution of the settlement structure - removal of farmhouses out of the village to the landscape	Positive	
			Increasing length of main roads	Negative	
			Decreasing length of rural roads	Negative	
Population growth and political and socio-economical changes after from 1945 - 1995	Intensification and specialisation of agriculture	Introduction of machinery and large scale use of pesticides and artificial fertilizers	Increasing area of arable land	Negative	1945 - 1989
			Increasing mean size of arable land fields	Negative	
			Decreasing area of grassland	Negative	
			Fragmentation of grasslands	Negative/Positive	
			Recession of small biotopes	Negative	
			Increasing area of built-up and other areas	Negative	
			Increasing length of main roads	Negative	
			Decreasing length of rural roads	Negative	
	The parliamentary decision on food policy concerning deregulation of the Swedish agriculture	Governmental financial support available to reduce grain surplus and enhance the diversity of agricultural landscape	The large area of cropland being set aside for other purposes than growing crops, e.g. Grassland	Positive	1990 - 1995

	New legislation (e.g. Nature conservation Act from 1991)		Decreasing area of arable land	Positive	
			Decreasing mean size of arable land fields	Positive	
			Recovery of grassland	Positive	
			Still existing remnants of small biotopes	Positive	
			Increasing landscape heterogeneity	Positive	
Population growth and political and socio-economical changes from 1995	Entry to the European Union	Revision of national legislation	Maintaining of grassland thanks to agricultural subsidies	Positive	From 1995
		Agricultural subsidies			
	Environmental Code 1999 (including Nature conservation Act 1991)		The same as mentioned at the Nature conservation Act from 1991	Positive	

Conclusions

1) Intensively utilised agricultural landscapes have become a major subject of the interest in this study. The main reason behind the choice was that they are representatives of landscapes that the landscape European Landscape Convention defines as an “ordinary landscape”. Even if it this is not characterised by any special phenomena, it is valuable and unique at least because of its cultural heritage value. Analysis of landscape development may provide with data that can help to delimit values of such ordinary landscapes, e.g. landscape memory structure. The main task for the future seems to be an identification of such values as well as finding ways for their implementation in the landscape planning practices. Methods of landscape change analysis may then provide instruments that help to delimit and quantify such landscape values;

2) Methods applied in this study have shown to be relevant procedures that we can use to analyse and assess changes in the cultural landscape. However, their accuracy is higly limited by the quality of the source data and by the way they are processed, e.g. in Geographic information systems (GIS). Then, even though we dispose of the unique old Military map from 1785, we can not objectively analyse landscape changes from 1785 onwards due to geodethical inaccuracy of this map. What is more, its processing in GIS gives unsuffcient results;

3) It must be emphasized that only a limited part of the entire landscape history has been recorded in both countries (1703 – 1839 – 2006) although a wide range of relevant source materials have been used for the analysis. In the Honbice site, as the first exact map dates back to 1839 (Stabile Cadastre Map) and earlier source materials can not be used for the quantitative analysis. Therefore, considerable changes before 1839 were not analysed, i.e. abolishment of large ponds in the north-west part of the study site that used to be located close to the present pond) (Appendix III Fig. 1).

4) Old maps and aerial photographs stand for the relevant source data that enables us to trace back quantitatively landscape history quantitatively. However, satisfying results based on the data interpretation can be obtained only providing that different methods for a verification of interpreted data are applied, e.g. the terrain inspection in situ, interpretation of additional graphic source data, the study of text references dealing with the history of the village or surrounding landscape, the use of the statistical data on land use, and has been used as an additional reference material, interviews with farmers and witnesses;.

5) Even though methods of landscape metrics have rapidly developed, and there is a wide range of various landscape characteristics, their use for practical implication is limited. However, a set of quantitative characteristics that have been used in this study have been found as sufficient to describe landscape change in a satisfactory manner.

6) In the study, only quantitative changes have been analysed and no qualitative monitoring has been done. For example, it was only stated that the area of grassland or scattered vegetation in the landscape had increased, but no information on changes in the species composition or other qualitative characteristics was given;

7) Quantitative responses of some land cover types belonging to similar landscape types to particular landscape anthropogenic forming processes have been found largely identical or similar. Comparable landscape types show identical structural responds to some landscape anthropogenic forming processes (i.e. land reforms, land consolidations, agricultural extensification, intensification and specialisation) regardless whether they are located in Central Europe or south Scandinavia. What only differs is timing and intensity of structural changes. These landscape anthropogenic forming processes include e.g. land reforms, land consolidations, agricultural extensification, intensification and specialisation;

8) On the whole, changes in the Swedish landscape from the turn of the 18th and 19th century should be viewed as a relevant, rather fast and effective consequence of agricultural innovations and overall technological revolution induced by political and socio-economical changes in Europe. In addition, the Czech landscape would have probably faced these trends even if the Collectivisation had not occurred from 1950 onwards in the former Czechoslovakia. The only reservations refer to the high intensity of large-scale changes and their negative impacts on the environment and the quality of life in the Czech Republic (decreasing ecological quality of ecosystems, including a deteriorating of biological and landscape diversity, also the increasing air pollution and water contamination, soil erosion, landscape character damage, forest damage or severe repression of private landowners in 1950s etc.

9) apart other aspects, this study confirms that natural conditions as well as political and socio-aconomic background stand for the most important factors behind landscape changes.

Positive trends such as the increasing proportion of grasslands or slowing down the removal of small biotopes might have been an effect of several factors.

In Sweden, they were:

- New conservation legislation adopted by the Parliament (Environmental Code from 1999, which replaced former particular acts, e.g. the Nature Conservancy Act)
- Governmental financial support available to reduce grain surplus and enhance the diversity of agricultural landscape (up to 1993, this supported had been granted for a total area of 2 576 ha);
- Agricultural subsidies available to support environmental aspects of the agricultural land use (after the entry to the EU in 1995);
- The parliamentary decision on food policy from 1990 concerning deregulation of the Swedish agriculture. It resulted in a large area of cropland being set aside for other purposes than growing crops.

In the Czech Republic, they were:

- The change in the political system in 1989 (Velvet revolution), which led to the creation of suitable background for legislative and institutional transformation;
- Restitutions of the real estate properties;
- New conservation legislation adopted by the Parliament (mainly the Act No. 114/1992 from 1992 on nature and landscape protection etc.)
- New subsidies to agriculture before and after the entry to the EU in 2004).

Similarities and differences in the Czech and Swedish landscape history

Parallels

- Some land cover types in the Swedish and Czech intensively utilised case study sites respond similarly to land reforms; regardless if it they were large land reforms of the turn of 18th and 19th century in Sweden or if they were a part of the Socialist Collectivisation from 1950s in the former Czechoslovakia. There is only a difference in timing and intensity of changes between Sweden and the Czech Republic;
- Grasslands shrunk between 1703 (1839) and 1962 (1966) in both case study landscapes;
- Proportional decrease of grasslands as well as its intensity was the highest during the period until 1703 (1839) until 1939 (1950);
- The increase in the area of grassland and its recovery has been observed since 1962 (1966) in both sites;
- Fragmentation and the reduction of natural habitats until 1962 (1966) was common for both sites;
- Decreasing length of rural roads has become the common feature in both study sites;
- In both sites, an above-average proportion of the territory has been occupied by arable land (over 80 %);
- The proportion of built-up and other areas as well as gardens has increased in both sites (with the only exception in Sweden during 1703 – 1805).

Differences

A larger portion of the Lilla Uppåkra study site was covered by grassland in 1703 (27.5 %) as compared to the Honbice site (4.7 % in 1839);

- In Lilla Uppåkra, the highest proportion of arable land was observed in 1910 (official statistics refer to the maximum proportion of arable land in 1920s) in contrast to the Honbice study site (1966);
- While large-scale land reforms took place in Sweden as early as at the turn of the 18th and 19th century, it firstly occurred after 1918 and then after 1951 in the former Czechoslovakia;
- Swedish land reforms from the turn of the 18th and 19th century should be viewed rather as the land consolidation process (pozemkové úpravy) in the Czech Republic. It is because they meant only reorganisation of plots without changing the ownership structure, which is typical for land reforms;
- Built-up and other areas were characterised by a different dynamics as compared to the Honbice study site due to land reforms that caused the split of villages;
- Basic infrastructure was renewed and newly constructed sooner in the Lilla Uppåkra study site (after 1805) owing to earlier land reforms.

References

ANTROP, M. 1998. Landscape change: Plan or chaos? Landscape and Urban Planning, 41, 155-161.

BERGLUND, B.E. ED. 1991. The cultural landscape during 6000 years in southern Sweden – the Ystad project. Ecological Bulletins. No. 41.

BIČÍK, I. 2004: Dlouhodobé změny využití krajiny České republiky. Život. Prostr., XXXVIII, 2: 81- 85.

ELG, M. 1990. Sweden – a long country. In: Sporrong, U. & Wennström, H. - F., eds. (1990): Maps and Mapping, National Atlas of Sweden. SNA, Stockholm.

GUSTAVSSON, R., INGELÖG, T. 1994. Det nya landskapet – kunskaper och ideer om naturvård, skogsodling och

planering i kulturbygd. Författarna och Skogsstyrelsens förlag, Jönköping.

HELMFRIED, S. 1994. Landscape and Settlements. National Atlas of Sweden, SNA, Stockholm.

HÄGERSTRAND, T., LOHM, U. 1991. Sweden. In: Turner, B.L. ed., 1991.The Earth As Transformed by Human Action. Global and Regional Changes in the Biosphere over the Past 300 Years. Cambridge University Press with Clark University, Cambridge.

IHSE, M. 1995. Swedish agricultural landscapes– patterns and changes during the last 50 years, studied by aerial photos. Landscape and Urban Planning, 31: 21-37.

JECH, K. 2001. Soumrak selského stavu 1945 – 1960. Sešity Ústavu pro soudobé dějiny AV ČR. 2001/35.

JOHNSON, P. 1991. Dějiny 20. století. Rozmluvy, Praha.

LANNÉR, J. 2003. A Long-term Study of Historical Maps, Tree Densities, Tree Regeneration and Grazing Dynamics at Hallands Väderö. Licentite thesis. Department of Landscape Planning Alnarp, Swedish University of Agricultural Sciences.

LAUSCH, A., HERZOG, F. 2002. Applicability of landscape metrics for the monitoring of landscape chnage: issues of scale, resolution and interpretability. Ecological Indicators 2: 3-15.

LIPSKÝ, Z. 1995. The changing face of the Czech rural landscape. Landscape and Urban Planning 31 (1995): 39-45.

LIPSKÝ, Z. 2000. Sledování změn v kulturní krajině. Ústav aplikované ekologie ČZU, Kostelec nad Černými Lesy.

LÖW, J., MÍCHAL, I. 2003. Krajinný ráz. Lesnická práce, Kostelec nad Černými lesy.

MÍCHAL, I. ET AL. 1985. Ekologický generel ČSR. Terplan Praha a GgÚ ČSAV, Brno.

MIKLÓS, L. 1986. Stabilita krajiny v ekologickom genreli SSR. Životné prostredie, XX: 2:87-93.

MIMRA, M. 1993. Hodnocení prostorové heterogenity. Kandidátská disertační práce. VŠZ, Praha.

PALMER, F. 2004. Using metrics to predict scenic perception in a changing landscape: Dennis, Massachusetts. Landscape an Urban Planning 69: 201-218.

PIXOVÁ, K. 2005. Quantitative methods for landscape structure analysis and its utilisation in landscape planning in the Czech Republic. Doctoral Thesis. Forestry and Environmental Faculty, Czech University of Agriculture Prague.

PTÁČEK, J. 2006. Perzekuce občanů okresu Chrudim v letech 1948 – 1989. Kofederace politických vězňů, pobočka 19, Chrudim.

ROSÉN, E., BORGEGÅRD, S.O., 1999. The open cultural landscape. In: Håkan, R., Snoeijs, P., Diekman, M., 1999. Swedish plant geography, Acta phytogeographica Suecica 84 (Edititsvenska växtgeografiska Sällskapet), Uppsala, p. 113-134.

SEMOTÁNOVÁ, E. 1988. Staré mapy a plány jako významný pramen pro tvorbu a ochranu životního prostředí. Historická ekologie, 1: 213-227.

SEMOTÁNOVÁ, E. 2002. Studium krajiny a srovnávací kartografické prameny. In: Němec, J. (ed.). Krajina 2002 - od poznání k integraci, sborník z konference. MŽP, Ústí nad Labem.

SKALOŠ, J. 2004. Landscape Memory As a Concept For Implementation of the European Lands+ape Convention in the Czech Republic (Retrospective Study Based on Analysis of Old Maps and Aerial Photographs in the Eastern Czech Republic from 1785 until 1992). Sustain Life, Secure Survival II – Socially and Environmentally Responsible Agribusiness, International Conference. Prague, 22-25 September 2004.

SKALOŠ, J. 2005. Analyzing land use changes of intensively utilized agricultural landscape – an example from the Eastern Czech Republic. In: Křiváčková, O., Pecharová, M., Frelich, J. (eds.). 2005. Ekotrend 2005, Renewal and function of anthropogenic impacted landscape. Proceeding of International scientific meeting. The University of South Bohemia in České Budějovice, Faculty of Agriculture. 30.8. – 1.9. 2005.

SKALOŠ, J. 2006. Patterns and changes of intensively utilised agricultural landscape in the Czech Republic between 1937 and 2002, aerial photography analysis. Ekológia (Bratislava), Vol. 21, Suppl. 3, p. 232-248.

SKLENIČKA, P. 2003. Základy krajinného plánování. Naděžda Skleničková, Praha.

SKÅNES, H., 1996. *Landscape change and grassland dynamics – Retrospective studies based on aerial photographs and old cadastral maps during 200 years in south Sweden. The Department of Physical Geography Stockholm University. Dissertation series, no 8.*

SPORRONG, U., WENNSTRÖM, H. - F. (EDS.). 1990. *National Atlas of Sweden - Maps and Mapping. SNA Publishing, Stockholm. Sporrong, U., Ekstam, U., Samuelsson, K. (eds.). 1995. Swedish Landscapes. Swedish Environmental Protection Agency, Stockholm.*

SPORRONG. U. 2006. *Personal communication.*

TRPÁK, P., TRPÁKOVÁ, I. 2002. Analýza funkčnosti krajiny na základě specifických vyhodnocení indikačních skic map a svazků stabilního katastru. In: Němec, J. (ed.). Krajina 2002 - od poznání k integraci, sborník z konference. MŽP, Ústí nad Labem

TUČEK, J. 1998. GIS – geografické informační systémy. Principy a praxe. Computer Press, Praha.

URBÁNEK, F. 2007. Personal interview with František Urbánek – a native inhabitant from Honbice. January 29, Honbice Municipality Office.

VANĚČKOVÁ, T. 2003. Srovnání vývoje zemědělských krajin jižního Švédska, diplomová práce. Depon in: Česká zemědělská univerzita, Lesnická fakulta, Praha.

VONDRUŠKOVÁ, H. ET AL. 1994. Metodika mapování krajiny. ČÚOP, MŽP, Praha.

WEBER, M. ET AL. 2004. Zajištění realizace Evropské úmluvy o krajině v další činnosti MŽP. Výstup projektu VaV 640/6/02 Zajištění realizace Evropské úmluvy o krajině v další činnosti MŽP. VÚKOZ Průhonice, ČZU Praha-ÚAE Kostelec nad Černými lesy, Löw a spol. Brno. Depon in: knihovna VÚKOZ Průhonice.

Other

STATISTICS SWEDEN, 2006. Agriculture, forestry and fishery – use of agricultural land, statistical database, SCB (www.scb.se).

STATISTICS, CZECH REPUBLIC. 2002. A database of statistical data for Czech Republic. Czech Statistical Office (www.czso.cz).