ESPON

EU-LUPA
European Land Use Patterns

Applied Research 2013/1/8

VOLUME VI
The Øresund Region Case Study Report

Part C Scientific report |
Version 30/November/2012

EUROPEAN UNION
Part-financed by the European Regional Development Fund
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This report presents the final results of an Applied Research Project conducted within the framework of the ESPON 2013 Programme, partly financed by the European Regional Development Fund.

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1. INTRODUCTION TO THE REGION

The Øresund region is located on two strands of the Strait of Sund - both in Denmark and Sweden. The boundaries of the Øresund region changed in the recent years. With administrative changes, in Denmark as well as in Sweden, the area of the region increased. From 1 January 2007 the administrative division of Denmark applies to 5 regions, which replaced the division of 13 provinces (*Amts*). As part of administrative reform, the number of municipalities was reduced from 270 to 98. In Sweden, in 1997, counties of Kristianstad and Malmöhus merged to Skåne county (*Scania*). Through changes in the Øresund, region expanded its area more than twofold. It currently covers the region of Skåne on the Swedish side of the strait, the capital region of Denmark and Zealand region (islands *Sjælland, Lolland, Falster, Møn* and *Bornholm*) on the Danish side. The region has a total area of 21 203 km^2, of which 11 369 km^2 is on the Swedish side and 9 834 km^2 belongs to Denmark. With 3.7 million inhabitants the Øresund region is the largest and most densely populated metropolitan region of the Nordic countries.

The Øresund's Bridge linking Copenhagen and Malmö since 2000, is a comprehensive motorway network that connects the North of Scandinavia with Denmark and Western Europe.

This bridge also extends the regional railroad that formalizes a loop between the Danish and Swedish coasts. On the other hand, the various waterways that facilitate communication among numerous cities of the Bay extend to the Baltic Sea and the Atlantic Ocean via the North Sea, thus expanding the possibilities with the coastal countries concerned (Figure 3). The most obvious and on-going process in this area is the urban sprawl.

Figure 1 – Old regionalization of the Øresund region.

Source: http://www2.dmu.dk/rescoman/groundobs/maps/oresund.htm

Figure 2 – The area of Øresund region

http://www.tendensoresund .org/en/key-map

Figure 3 - Key traffic nodes for international passenger traffic in the Øresund region.

Source: http://www.tendensoresund.org/en/accessibility-from-a-european-perspective/Picture6.jpg/image_xlarge

The Øresund region is very interesting in the aspect of land use typologies with urban sprawl interaction, and consequently also with multifunctional activities as the following are taking place:

- Protected areas both on islands of the region, and on the Swedish mainland
- Agriculture, with Southern Sweden being the most intensive producing area of that country
- A large number of renewable energy producers both individual as well as park based windmills, on both land and sea.
- In addition, a high production of biomass for biogas, power and district heating generation. Especially on the Swedish side there are interactions and conflicts between agriculture and biomass production.
- High mobility between the Swedish and Danish sides, and with the bridge being the most important commuting tool, especially from the Swedish side. In 2010 approximately 20 000 people a day commuted across the Sund – six times more cross-border commuters compared to the year 2000.
- Coastal communities where tourism and second homes from both sides are playing a significant role.

The region is an excellent illustration of the urban sprawl problem and since the bridge was erected the implications of urbanization from one country (the Danish side) on the land use patterns in another country (the Swedish side) occur.

2. CHARACTERIZATION OF LAND USE AND LAND COVER

2.1. Definitions of land use

The terms "land cover" and "land use" are often confusing.

Land use was defined by de Bie (2000) as "a series of operations on land, carried out by humans, with the intention to obtain products and/or benefits through using land resources ". He described land resources as all aspects of land that enable, support, constrain or influence present as well as potential land use. FAO defined land use as "the total of arrangements, activities, and inputs that people undertake in a certain land cover type", the same organization in contrast defined **land cover** as "the observed physical and biological cover of the earth's land, as vegetation or man-made features." (FAO, 1997a; FAO/UNEP, 1999).

Good example, which illustrates the above definitions is “grassland” for cover term, while "rangeland" or "tennis court" refer to the use of a grass cover.

T.M. Burley suggests, that land use means to combine a land cover and land utilization. He used the concept of land cover to refer to the setting in which action (employment) takes place, i.e. the vegetation and artificial constructions covering the land surface. Second concept, land utilization, was used for the activities i.e. the employment of the land surface through the medium of land cover.[1]

The most important transformation in land use is a combination of many interactions including:

- Socio-economic and historical changes
    - Land ownership and tenure changes
    - Population growth
    - Urbanization
    - Industrialization
    - Development of technology
    - The establishment of transportation and communication networks
- Political decisions:
    - Subsidies and taxes for using the land
- Environmental conditions:
    - Climatic factors
    - Soil quality[2]

[1] Jankowski W., 1975, Land Use map ping development and the methods, Geographical Studies, Publisher PAN, Wroclaw, Warszawa, Krakow, Gdansk, No.111.

[2] Brouwer F.M., Chadwick M.J , Future land use patterns in Europe, [in]: Brouwer F.M., Thomas A.J., Chadwick M.J., 1991, Land use changes in Europe : processes of change, environmental transformations, and future patterns, Kluwer Academic Publishers, Dordrecht, Boston, London, p. 49.

2.2. Surface and structure of land use

The region has a total area of 21 203 km^2, of which 11 369 km^2 is on the Swedish side and 9 834 km^2 is on the Danish side. It is very diversified: a high population density region of Copenhagen and Malmö, forest area in the North and East of Scania, agriculture land in Southern Scania and Zealand. Additionally all region has a highly developed coastline, along which evolved the residential area, touristic and recreation zone, small business centre, and windmill farms producing renewable energy.

Kostrowicki J. observed that, the Northern region is mostly characterized by market-oriented agriculture with livestock breeding, which progressively declines with the distance from settlement of traditional agriculture.[3]

Agriculture has a large impact on the specificity of land use in Denmark. Land under arable use accounts for 90% of the utilized agricultural area in Denmark[4]. On the Danish side of Øresund region agriculture is the most significant form of land use. In the past traditional agriculture dominated, but nowadays the organic agriculture becomes more popular. A new trend is also to convert agricultural land into industrial area with highly developed transport infrastructure (like in Køpe area).

Merging information about land use in Denmark and Sweden is difficult due to the different approach to the leading statistics. Structure of land use in the Øresund region is decidedly different than in Denmark or Sweden (Figure 4). In whole Denmark there are more utilized agricultural lands (58%) and less forest areas (11%). In Sweden the situation is reversed: more than 58% of land is covered by wooded area and just 7% is used as agricultural land. The Øresund region consists of three different sub-regions: Hovestaden (the capital region of Denmark), Sjælland (Zealand) and Scania region (in Eurostat statistics the most similar region in terms of area is Sydsverige). Each of the three regions is completely different: the Copenhagen area has the highest rate of "Other" area, which is mainly urbanized land. In two remaining regions, this indicator is at the level of 1/4 of land. The Zealand region has 63% of utilized agricultural area and merely 1/10 of this region is covered by forest. The region of Scania has the highest share of wooded land (42% of area) and a high rate of agriculture land.

The region is a combination of mono-centric development (Copenhagen, Malmö) with some multicentre elements (Roskilde, Køpe, Søro).

In the 21st century the land use changes were not as significant in case of the urban area of Great Copenhagen. Most changes occurred on rural areas, which transitioned into urban ones. The changes in urban areas weren't observed in the recent years, as they mostly took place in 1970s and 1980s. Nowadays only the area of fifth zone is still developing. Vast majority of urban land was established on former agricultural land. Between 2000 and 2006 the urban land-take was much higher than between 1990 and 2000, about 340 ha per year in second period

[3] Lee J., Land resources, land use and projected land availability for alternative uses in the EC [in:] Brouwer F.M., Thomas A.J., Chadwick M.J., op.cit., p.40.

[4] Kostrowicki J., Trends in the transformation of European agriculture [in:] Brouwer F.M., Thomas A.J., Chadwick M.J., op.cit., p.2.

compared to the previous 50 ha per year[5]. Almost no urban land is transferred back to other uses. Once the land becomes urban – it remains urban.

In 1972 the zoning system in Denmark divided the land to urban, rural and recreation zones. This fragmentation was in use till the turn of the century. It protected rural areas exclusively for agriculture production, apart from one compromise being the development of communication networks.

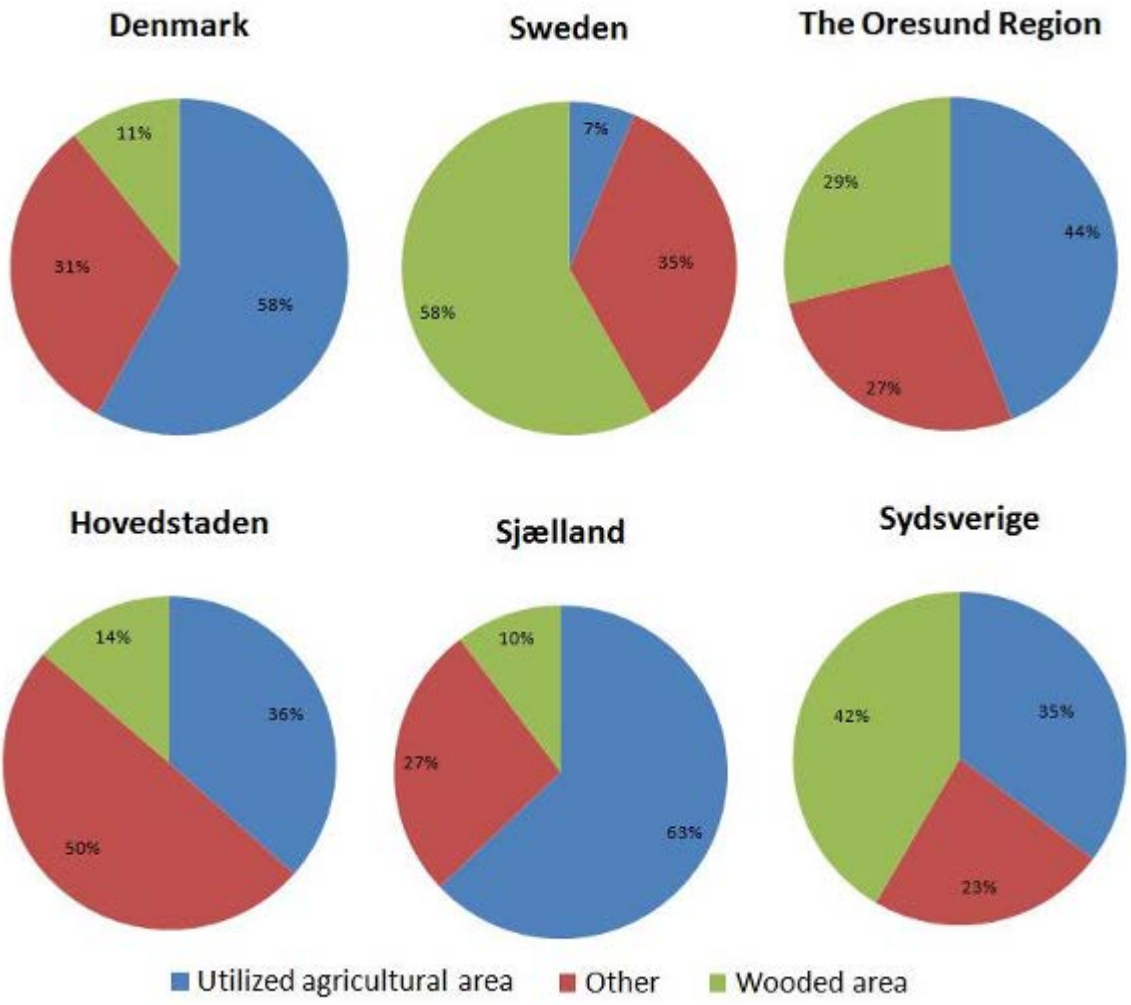


Figure 4 – Structure of land use in 2009

Source: Eurostat

Every year the number of visitors to Danish and Swedish countryside is increasing. Nordic people are highly aware of healthy and safe style of living, and they perceive contact with nature as a medicine for “lifestyle illnesses”. For this reason, preservation of natural environment values is so essential for Nordic inhabitants.

It was not simple to reconcile aspirations of both, residents and investors, but the Nordic people managed to achieve it. Most overwhelming was the rigid adherence to

[5] Zasada I , Fertner C , Piorr A, Nielsen TAS . Peri-urbanisation and multifunctional adaptation of agriculture around Copenhagen . Geografisk Tidsskrift . 2011;111(1):59-72.

the rules concerning planning and thinking about the future, not the current time and potential benefits.

It was noted that the city of Copenhagen evolves on a circular plan: first round of infrastructure and consequently the “gaps” in between are managed. When formulated "Finger Plan" as a basis to fill the emerging space, both in the city and the outskirts the green space was use. Small areas, located in or near the city were mainly used by residents for short trips, while large surfaces of green areas on the outskirts were visited during the longer vacation. When organizing the undeveloped space, a conflict between natural and urbanized areas was visible: the pressure put on recreational and agricultural area was intensified.

By analyzing Figure 5 (with old administrative division) it can be deduced that between 1985 and 2004 agriculture in Denmark was highly modified. Agricultural land area decreased or was stable in almost all Danish side of Øresund .

Figure 5 – Agricultural data for the Copenhagen and Zealand regions. Data for municipalities. Changes between 1985-2004

The darker the color the higher the rate

Source: http://landblend.files.wordpress.com/2010/03/overview_kom_data_s.jpg

Greatest changes are to be noticed in corn farming land areas: in 1985 this type of agriculture was critical, because of high number of animal’s farm. Together with an increased number of EU Member States, these farms were moving out to less developed countries, like for instance Poland. Corn farming land hence decreased. EU policy supports big farms, thus the average farm size still increases in almost all

of Denmark. Only in a few municipalities remain farms of insignificant size. This situation exists exclusively in the neighborhood of Copenhagen and in the North of the Copenhagen region, because of a specific lifestyle and recreational farming.

2.3. Land cover specificity

Land cover is the physical material at the surface of the earth.

According to Jesper Brandt, Denmark is a very urbanized country, so there are not a lot of natural, environmental elements. Researchers from Roskilde University focused on small elements of environment, like small lakes, groups of trees, rivers. They realized that these small elements are also important for landscape and for perception of space as a whole.

Researchers focused on development of small biotypes, which are shown in Figure 1 (fragmentation on general linear and area biotypes). They discovered that in 1950s and 1960s negative changes occurred. In the next decades the adverse trend was still observable. In early 1990s the situation altered to positive. But nowadays it is negative again. The most important reason is that the agriculture sector has a rather strong political support. Researchers didn't find correlation between distance from urban centre to the area where measurements were made, because Denmark is a relatively small country with a significant pressure from urban population on the countryside. People have different interest for rural area.

% of change	1954-1968	1968-1980	1981-1986	1986-1991	1991-1996
Linear biotypes	- 0.6	- 2.3	- 1.3	- 1.3	0.9
Area biotypes	- 0.5	- 0.8	- 0.8	- 0.8	0.3

Figure 6- Development of small biotypes. Changes per year.

Source: interviev with Jespar Brandt, Esbern Holmes

Corine Land Cover for Øresund region reflects the biophysical state of land. In this region main role plays the urban area, forest and arable land. Detailed land use in the region is shown in Figure 8. The core of the region is the Copenhagen area, which is the most urbanized area of Nordic countries.

The lands occupied by industry, commercial and transport are closely associated with urban areas. The highest percentage of them are located in the immediate vicinity of Copenhagen. In figure 7 there is a noticeable green ring around the city approximately 15 km from the center. Most arable lands are situated within 20-30 km from the city, in a further distance value is fixed at more than 50% of the area. With the distance from the center of Copenhagen, forest area is gradually increasing. About 70km from Copenhagen forests cover exceeds 40% of the area. It is mainly associated with dense forestation of Skåne.

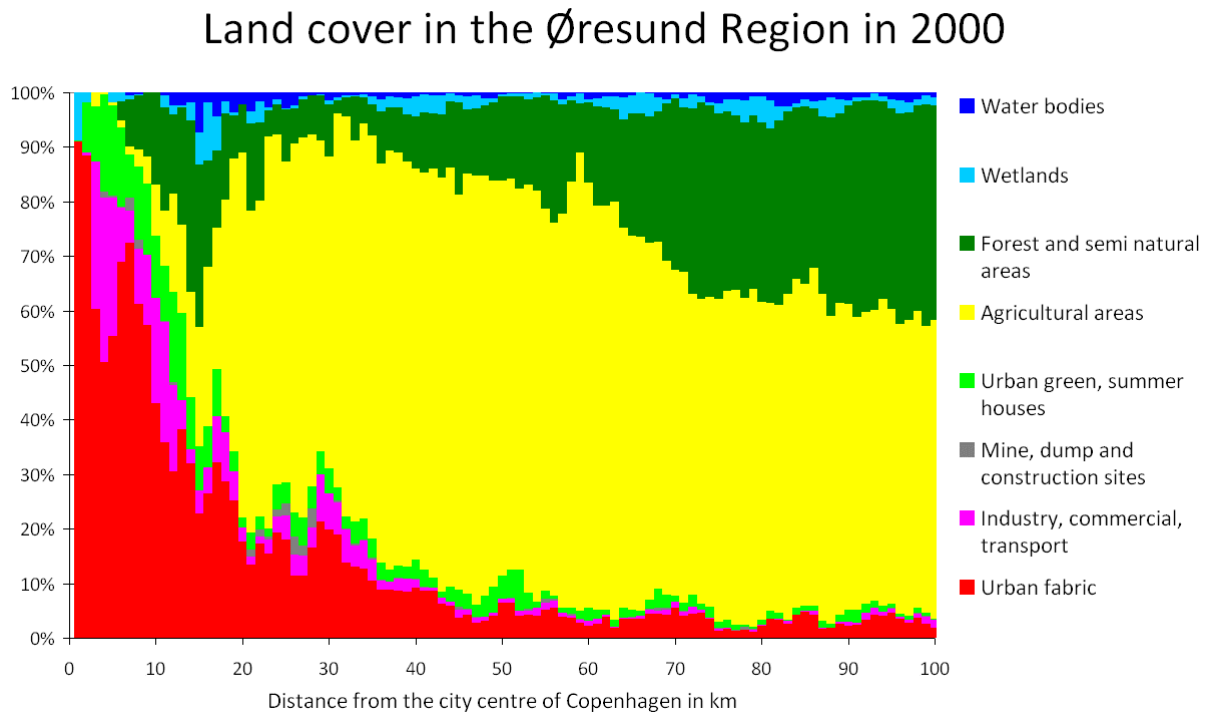


Figure 7 – Land cover in the Øresund region in 2000

Source: http://landblend.files.wordpress.com/2010/05/Øresund _lc_20001.gif

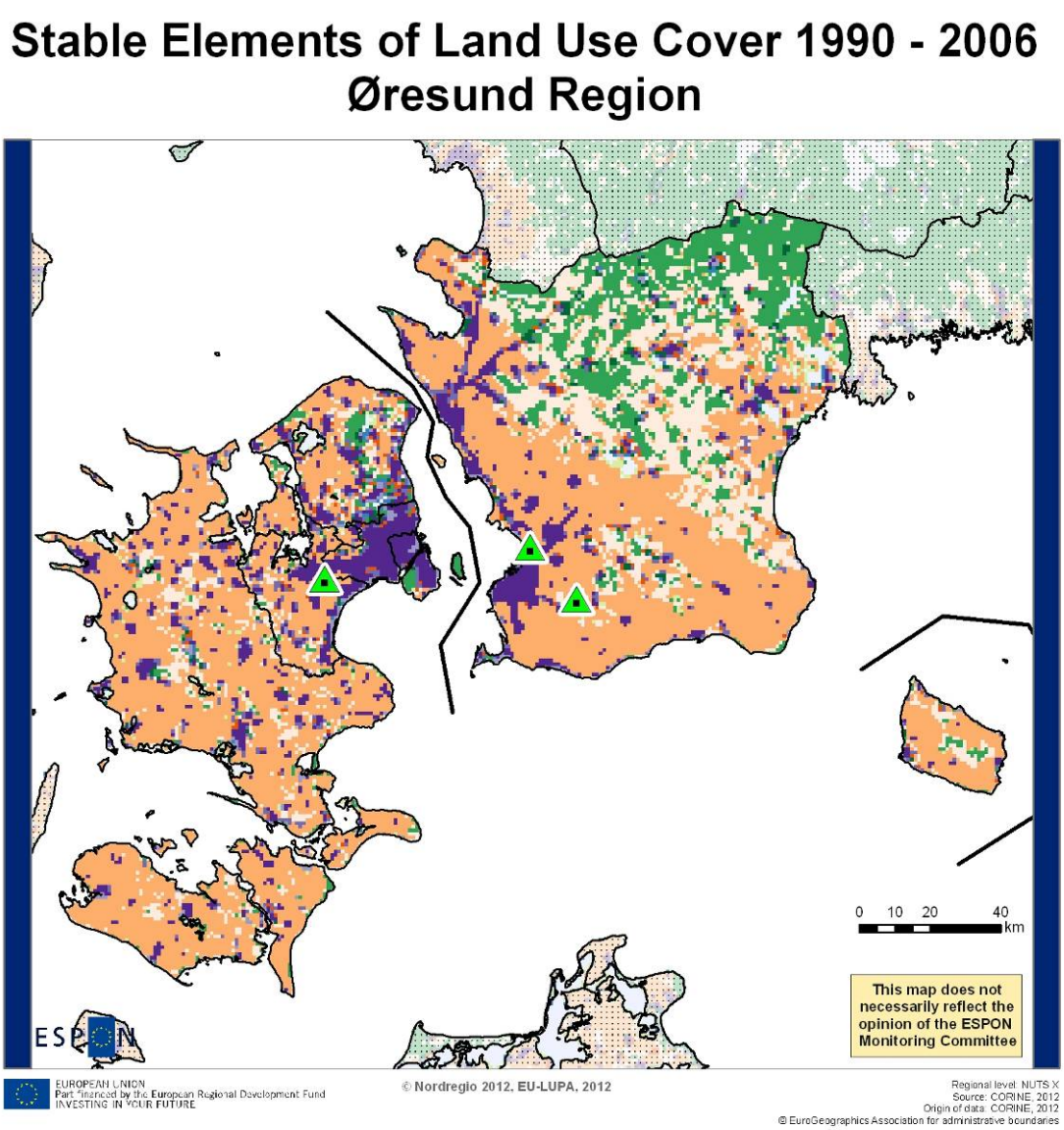


Figure 8 – Stable elements of Land Cover 1990-2006

Source: Nordregio based on Corine Land Cover

2.4. Protected areas (from environment, military, etc. points of view)

First National Park in Denmark was established in August 2008. Parks preserve the most unique and valuable natural areas and landscapes; by protecting habitats and species to offer a unique experience for visitors and contribute to sustain the natural heritage.

In Øresund region the national park of Kongernes Nordsjælland (the Kings' Northern Zealand) is located. In consist of beaches, woods, lakes and streams and is only 30 minutes away from Copenhagen. In many places, the landscape bears traces of the time when the area was the hunting grounds of the Danish kings.

Danish legislation protects especially vulnerable natural areas such as moors, marshes, lakes, meadows and sand dunes, as well as many plants, animals and their living and breeding habitats. The EU Natura 2000 programme, which protects especially valuable ecosystems of flora and fauna, is a critical element in the process of protection and preservation. Denmark is in possession of 246 Natura 2000 identified sites. Altogether, these cover 8% of the Danish countryside and about 12% of its sea area. Protected countryside covers an area six times the size of Bornholm.

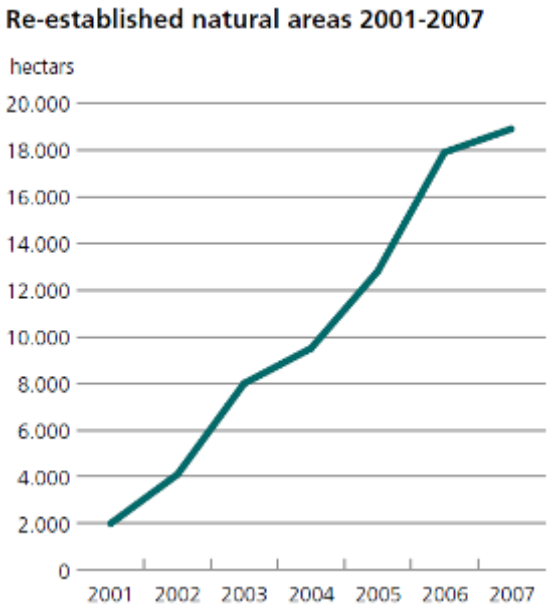


Figure 9 - The graph shows the total rise in natural areas from 2001 to 2007. This rise is a result of state re-forestation, private re-forestation and rehabilitation of natural and wetland areas in Denmark.

Source: Forest and Nature Agency 2008

On the other side of Øresund, in Scania more protected areas can be found. There are three national parks:

- *Dalby Söderskog* is a small national park situated in the municipality of Lund, near Dalby. It has an area of 0.36 km² and consists of broadleaf forest. It was established in 1918, when it was thought to be a unique remnant of primeval forest. In fact, the area has previously been used for pasture. Due to high concentration of limestone and chalk in the soil, specific conditions were provided for unique flora colonisation.

- *Stenshuvud* National Park is located on East coast of Scania with its total area of 386 hectares, including the hill Stenshuvud, which is 97 meters high. The shape of the hill is a characteristic point on the horizon, and for centuries it was a reference point for sailors on the surrounding waters . Park faces the Baltic Sea and is covered by broadleaf forest, especially hornbeam, heaths, meadows and swamps. Natural park protects varoius animal species like hazel dormouse, golden oriole, European tree frog. There are about 600 plant species present.
- *Parc nacional de Söderåsen* - the park features an especially contoured landscape with up to 90 m (300 ft) deep ravines. The valleys are covered with broadleaf forest, mostly beech.

2.5. Technical management of the land use (infrastructure, drainage systems, etc.)

The infrastructure of the Øresund region contributed to transforming of the area into a competitive business centre and it provides efficient transport accessibility, for residents, tourists and investors. The deciding factor for this was the availability of multimodal transport options (motorway, railway, airport, harbour). The Øresund region has the largest logistic hubs in Scandinavia.

a. Roads, motorways

The most important connection for the Øresund region with rest of Europe is the Great Belt Bridge, which links Zealand with the mainland. Along with the motorway E20 it connects the region with other Scandinavian countries. Southern part of Zealand is combined with the North by motorways E47 and E55. Skåne is crossed by roads E22 and E65. Trips by car comprised 62% of all to the rest of the country, Norway, Finland and the remaining regions of Denmark, but only 25% of all trips to and from the rest of Europe[6].

b. Railways

Railway connection of the greatest significance in the region is the so-called “necklace of pearls”. There are located some older and newer towns, which are connected by this railway, making this region more accessible. Second important connection is between Copenhagen and Malmö. Railways of the region could be compared to road transport, as they present similar efficiency. In Sweden railways are more important than in Denmark, because of longer travelling time and more dense truck traffic.

In the past, there were slow connections with limited capacity, and as a result, Copenhagen and Malmö tended to develop rather independently.

[6] www.tendensoresund.org

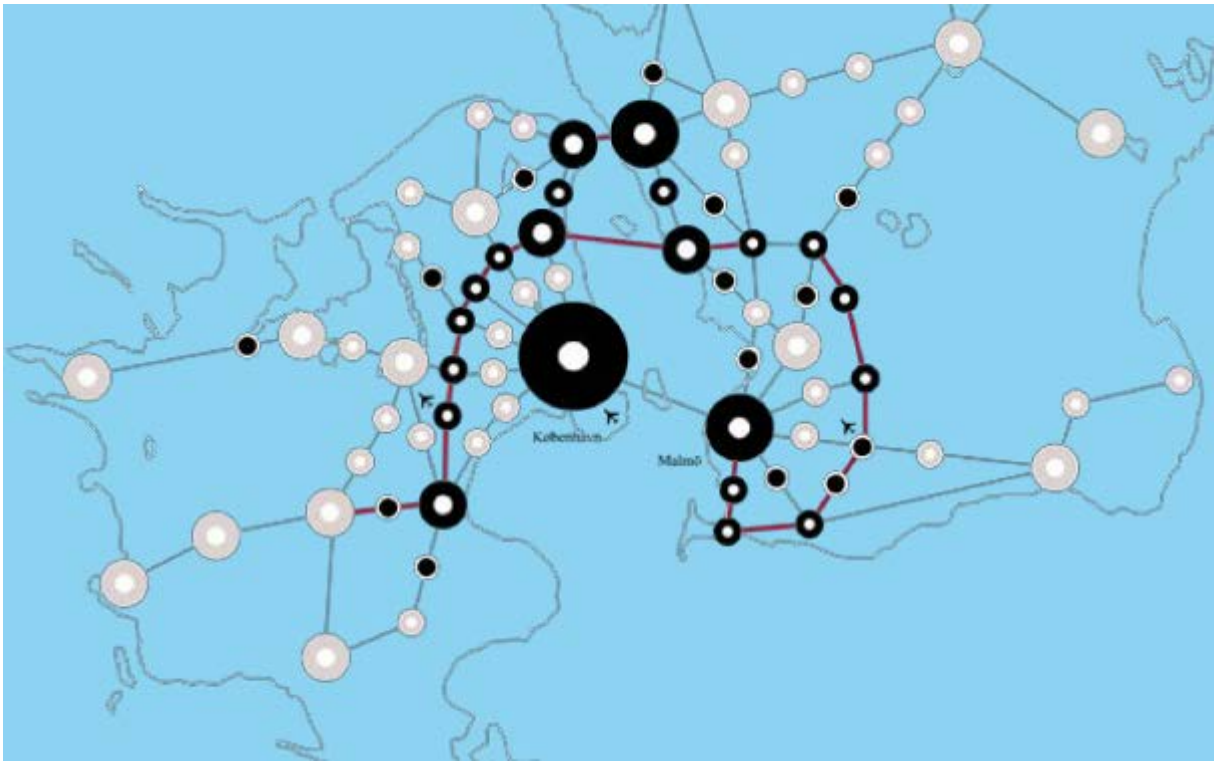


Figure 10 - New ring railroads merge the existing (station-) urban networks together across the Finger Plan and the Swedish train lines.

Source: Byplan, Nr. 4 december 2008/60. http://www.byplanlab.dk/sites/default/files/byplan0408.pdf

c. The Øresund Bridge

The Øresund Bridge was opened on 1st July 2000. 182 million people have crossed the Øresund Bridge either since then, of which 111 million by car and 71 million by train. This is comparable to all of Denmark's and Sweden's populations taking the trip across the bridge as many as thirteen times during the first nine years. The 111 million car travellers can be broken down into 48 million vehicles during the period 2000-2009.[7] The economic crisis affected Denmark and Sweden as well, and resulted in a slowdown of traffic intensity on the bridge.

Nowadays the car traffic is very dense every day: about 19 500 vehicles per 24 hours, which is a 141% increase comparing to the period 2001 – 2009.

All kinds of purposes to travel with passenger car over the Øresund Bridge increased, but the structure of travelling is changing as well. More and more people travel over the bridge for commuting purposes. During 8 years, between 2001 and 2009 this kind of travelling increased from 5% to 42%. Other kind of purposes lost on their importance (Figure 12).

[7] www.tendensoresund.org

Daily traffic across the Øresund Bridge

Category	2001	2005	2007	2008	2009	Growth 2001 – 2009
Passenger cars	7,290	12,328	16,831	17,767	17,986	147%
Motorcycles	67	82	106	96	93	39%
Vans and caravans	204	300	465	441	449	120%
Lorries	421	737	927	932	817	94%
Coaches	103	155	153	131	117	13%
Total traffic	**8,085**	**13,602**	**18,482**	**19,367**	**19,462**	**141%**
Number of individual journeys						
Cars	21,900	32,000	40,600	41,000	41,300	89%
Trains	13,500	18,100	26,600	29,400	30,400	125%
Total	**35,400**	**50,100**	**67,200**	**70,400**	**71,700**	**103%**

Figure 11 – Daily traffic across the Øresund Bridge.

Source: Ten years, the Øresund bridge and its region http://uk.oresundsbron.com/page/34

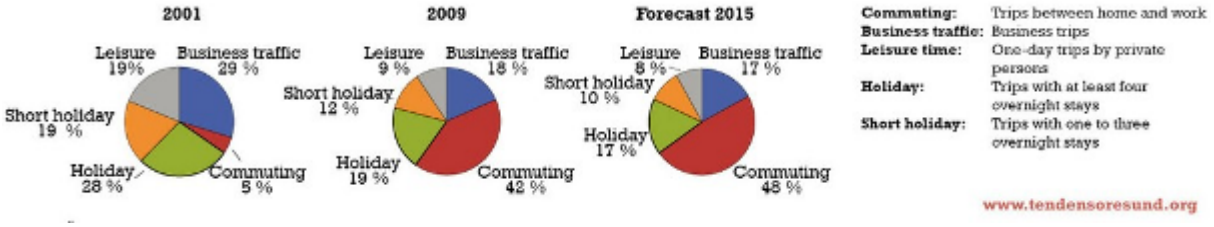


Figure 12- Purpose of travel with passenger car over the Øresund Bridge

Source: Ten years, the Øresund bridge and its region http://uk.oresundsbron.com/page/34

d. Copenhagen – Malmö Port (CMP)

This provides an excellent example of how two harbours, located on the opposite coasts and in two different countries, can create synergy effects and new cross-border cooperation involving four million consumers.

Each year the company offers efficient transport and logistics services to nearly 8000 ships. Thanks to its strategic location in the Øresund region, CMP's facilities also serve as hubs for the whole Baltic Sea region and its roughly 100 million consumers and hundreds of thousands of businesses. At its ports in Copenhagen and Malmö CMP handles a wide variety of freight, including consumer goods, transit of oil, grain, scrap metal, building materials, industrial inputs and new cars. The company also handles significant cruise and passenger traffic between different destinations in Northern Europe. In recent years CMP has also established a car distribution operation, which has become a centre for car transports to the Nordic and Baltic states and Russia. CMP's facilities are full-service ports, which offer transport and

logistics services in cruise, ferry, *RoRo* (Roll-on/roll-off) and container traffic, car imports, combi traffic, and oil and dry bulk terminals. Thanks to its specialisation in the form of different business segments, CMP is able to provide professional services, combining the right technology, infrastructure and professional expertise to meet each customer's specific requirements. This ensures high-quality execution.

e. Copenhagen Airport (Kastrup)

The Copenhagen Airport is the largest airport in Scandinavia. It is located in the Southern outskirts of Copenhagen. Having a good connection with Sweden by Øresund Bridge, it hence becomes an international port for Southern part of this country.

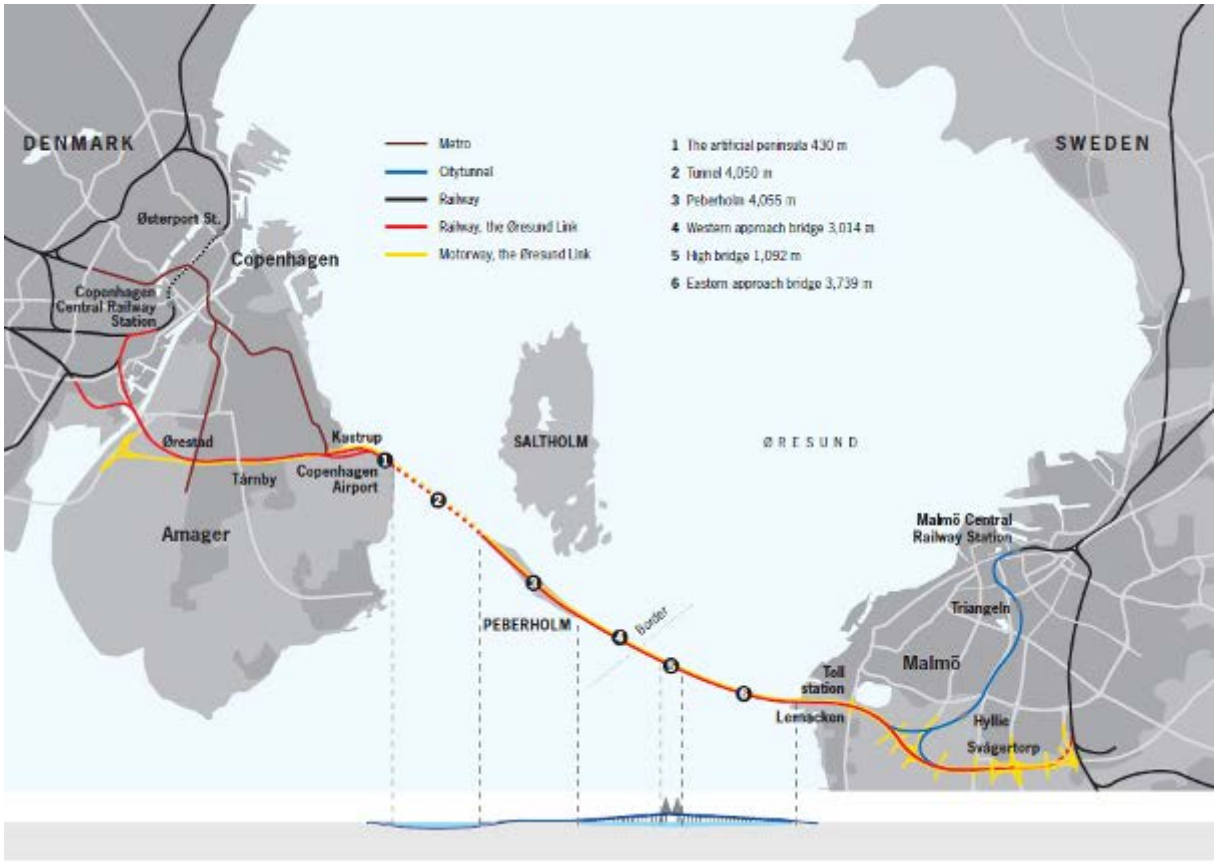


Figure 13 – The Øresund Bridge and the accompanying infrastructure

Source: Ten years, the Øresund bridge and its region http://uk.oresundsbron.com/page/34

2.6. Major trends in historical context

In the years 1960 - 1990 all over Europe, arable land decreased by about 6 million hectares. Never before the changes in land use were as significant. It should be noted that population showed flexibility in adopting to the new situation. People had to learn to manage the land.

Till 1658 Scania belong to Denmark. In that year, in Roskilde the treaty was signed, by virtue of which all Danish lands East of Øresund were ceded to the Swedish

Crown. But the historical events in administration didn't change the mentality of Øresund people. They still feel connected with Denmark.

In the historical context we shouldn't extend beyond the last century, because the sense of research might be lost.

After he Second World War, in 1947, the Danish architects and urban planners Peter Bredsdorff and Sten Eiler Rasmussen presented the Finger Plan (Figure 14). This was a development plan for Copenhagen city and its suburbs. The main core was the city and the skeletal 'fingers' pointed the future development along existing transportation infrastructure. Finger plan protected green wedges between "fingers", facilitating the access to nature, woodland and pastoral landscape. It wasn't a legislative plan, but city growth was directed in this way. In 2007 the plan was incorporated into Denmark's Planning Act. Appliance of spatial planning to the Finger Plan contributed to avoid traffic overload commonly found in other big cities.

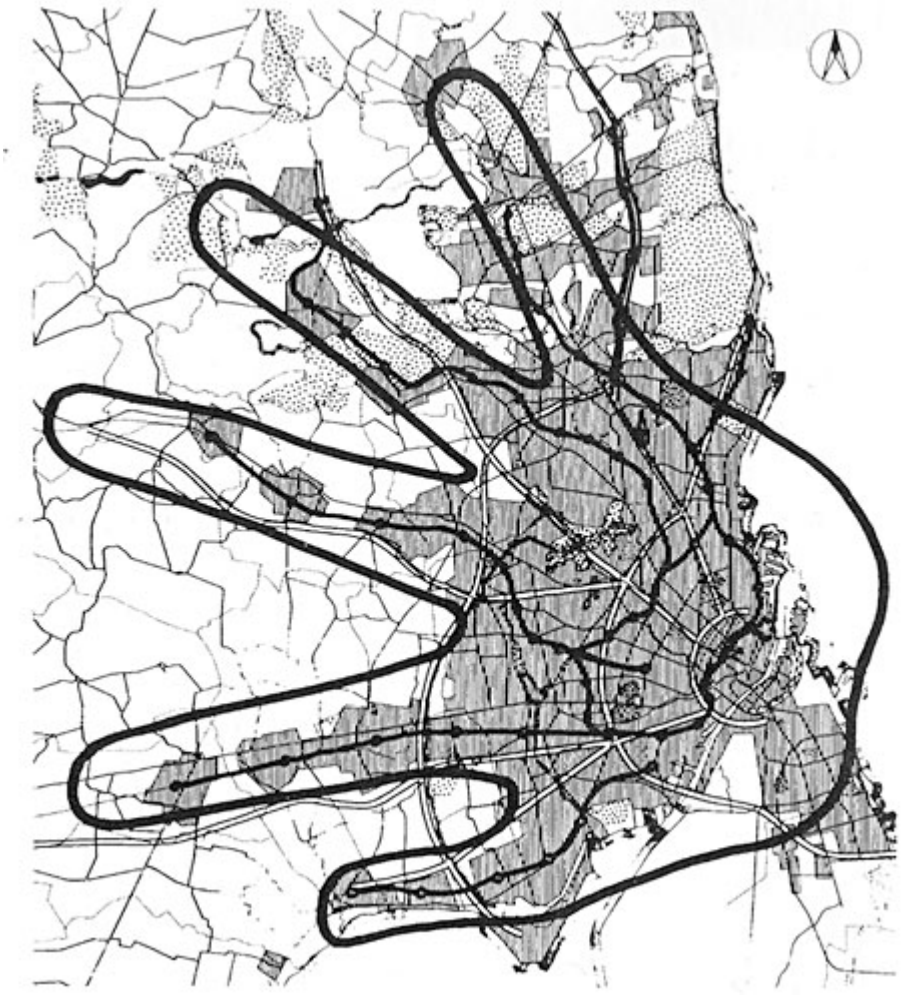


Figure 14 – Finger plan from 1947

Source: http://www.oresundstid.dk/billeder/1945-2000/16-02.jpg

There were a lot of ideas for spatial planning in Øresund region. In late 1950s there were suggestions about a great lake, which could be formed by building two bridges: on the North and on the South of the strait. Coast was to be an urbanized area, while the interior of the region was to be used for agriculture and forestry. Only the

Southern bridge was built (The Øresund Bridge), but there are still plans for another one towards the North (nowadays there is a ferry connection only).

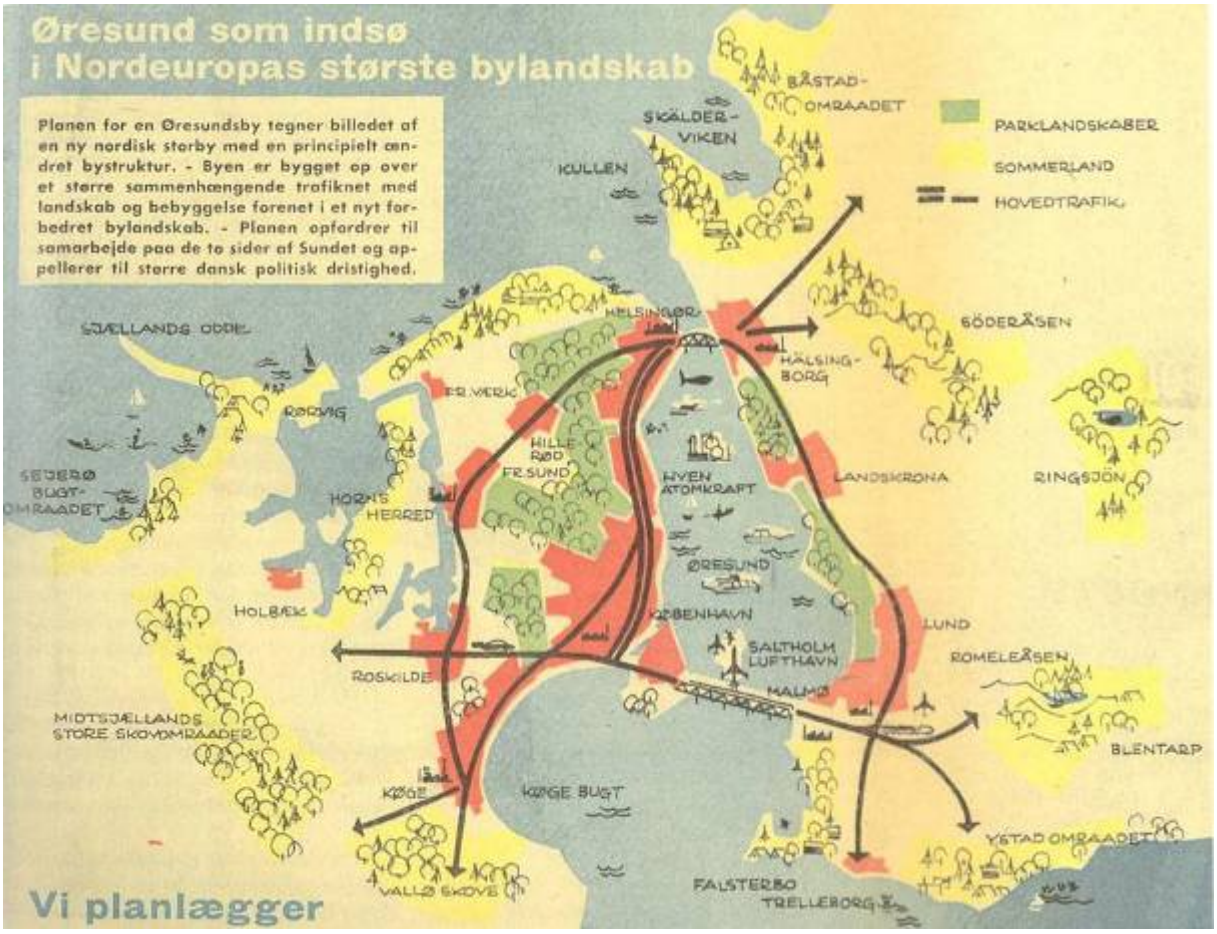


Figure 15 – The Øresund region in map from 1959 as a great lake in Nordic countries landscape.

Source: Arne Gaardmand : Dansk Byplanlægning 1938-1992, Arkitektens Forlag 1993

During the 1980s and 1990s the country's industrial base changed. In agriculture the processes of merging, mechanization and industrialization went hand in hand with a strategy that aimed at the large quantities of inexpensive devices (pork, chicken, dairy products, etc.). The industry underwent changes that resulted in increased investment in service industries, renewable energy, electronics and medical products.

In the 1990s Sweden experienced a serious crisis, which resulted in a rise in unemployment reaching the level of other EU countries and USA, and the emergence of public debt, which in the late 1990s reached 50% of GDP. This crisis was associated with the global slowdown in the economy and tax cuts by the right-wing government, while maintaining social expenditures at the same level. The implementation of numerous reforms and recovery programs failed to improve productivity and increase macroeconomic indicators

From 1 January 2007 the administrative division of Denmark applies to the 5 regions, which replaced the division of 13 provinces (Amt). As part of administrative reform also reduced the number of municipalities from 270 to 98. In Sweden, in 1997, counties of Kristianstad County and Malmöhus County merged to the Skåne County (Scania).

3. NARRATIVE OF CHANGE IN RELATION TO LAND USE

3.1. Socio-economic (demography, employment, … etc.)

The Øresund region has the highest population density in the Scandinavia region, with 3.7 million habitants. In the region of Scania live 1.2 million and on Danish side 2.5 million people. The population of the region is concentrated mostly on the Danish side, with the vast majority in the agglomeration of Copenhagen. Metropolitan regions and cities are characterized by a greater female share in total population, which could be associated with a greater access to jobs for women in these areas.

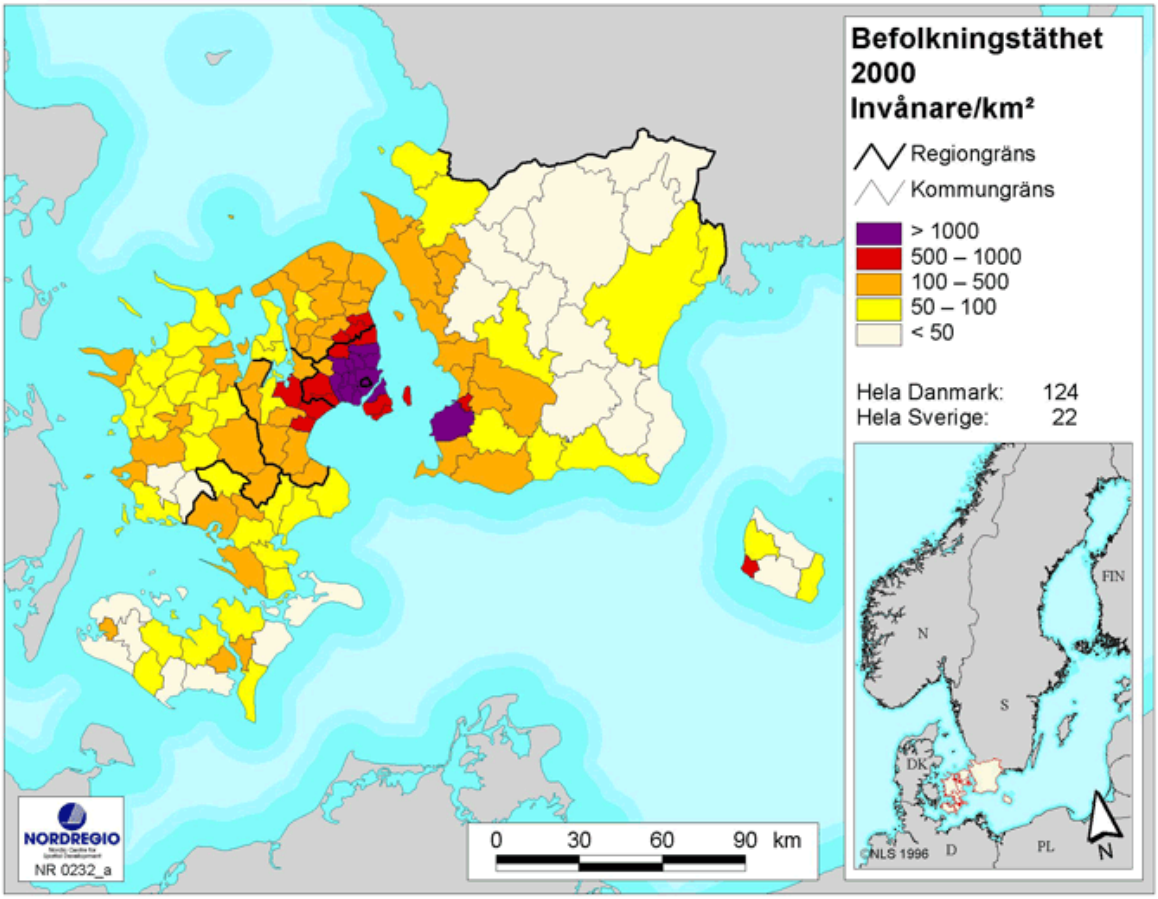


Figure 16 – The Øresund Population density in 2000

Befolkningstäthet = population density

Kommun = municipality

Invånare/km² = Population/km²

Hela Sverige/Danmark = Whole of Sweden/Denmark

Source : http://www.nordregio.se/

In the period of 2000 to 2008 population increase of the region reached 180 000 people. The total growth of the region is caused by to 40 000 more births than deaths, mainly on the Danish side. The rest of this growth is due to a surplus of immigrants. A large part of the migration flow across Øresund is concentrated in the two large cities of Copenhagen and Malmö.

The age structure in Øresund region is rather adverse from the economic point of view, as it is in all Nordic area. The most common trend is that the urban areas have a greater share of younger population in comparison to rural and sparsely populated ones. Another common trend is the extended life expectancy.

In general, the most rapid population growth regions are located in the most densely populated capital and big city regions.[8] Total fertility rate (TFR) is nowadays less than two children per woman. At the same time, low fertility is accelerating the ageing of European populations. Sweden has had a relatively high fertility in the recent decades. During the 1980s and 1990s, the annual TFR for Sweden fluctuated around the value of 1.8 children per woman.

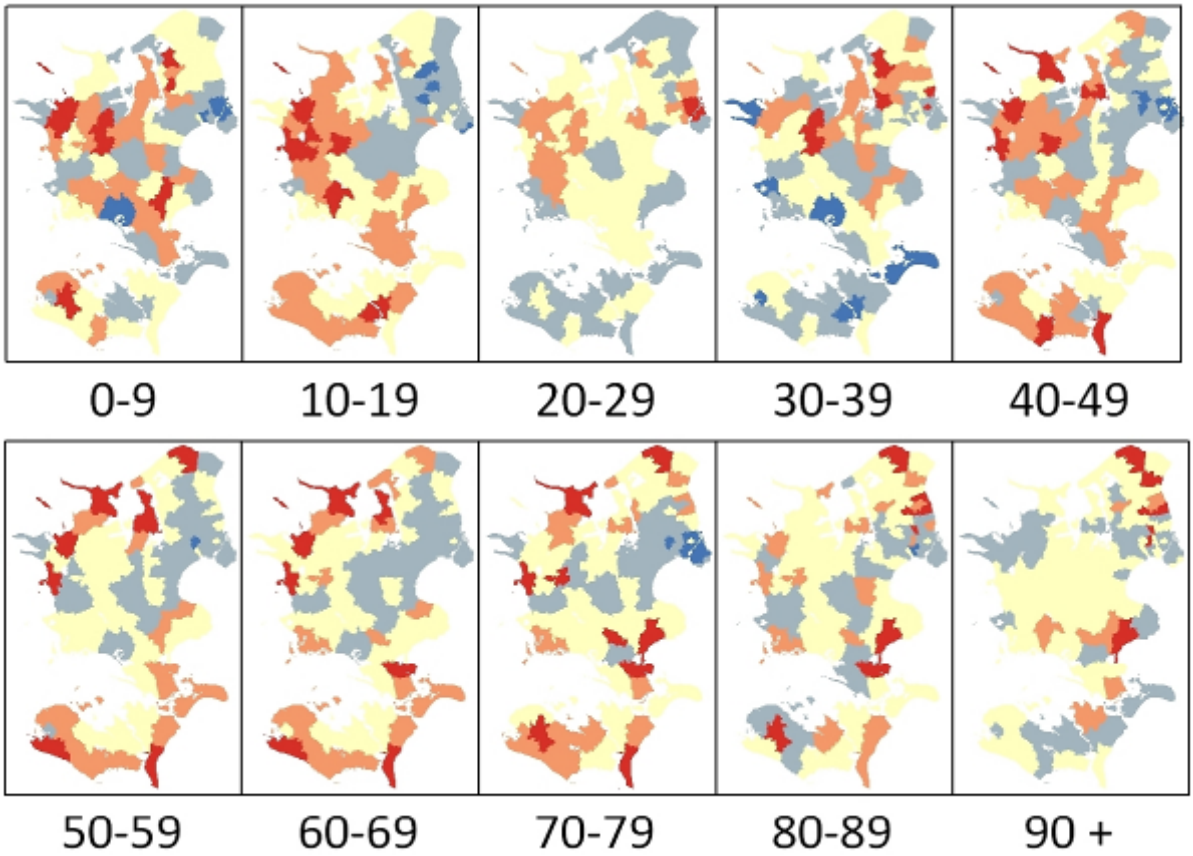


Figure 17 - In-migration by age groups in the Copenhagen region in 1996-2006

Red means high in-migration in relation to regional average,
Blue means low in-migration in relation to regional average.
Yellow means around regional average (-0.5 to 0.5 Standard deviation).

Source: Kupiszewski, M., Illeris, S., Durham, H., 2001, Internal Migration and Regional Population Dynamics in Europe: Denmark case study. Working Paper Working Paper 01/02, School of Geography, University of Leeds.

Figure 13 shows the sum of in-migrants in the years 1996 – 2006 by 10-year age groups. Not surprisingly most of 20-29 year group tend to move into the city, while 50 – 79 year old group to the coast, away from urban areas.

[8] Rauhut D., Rasmussen R., Roto J., Francke P., Östberg S., 2008, The Demographic Challenge to the Nordic Countries, Nordregio, Stockholm.

Scandinavian people tend to change their place of living several times in their lifetimes. First, when they grow up and go to university or first work– they move from homes to cities, to experience what the city life has to offer. The Second shift occurs when they form a family: young people establish themselves in the blocks or on estates of detached houses in suburban areas or in the city, depending on the income level. The next stage, in adulthood, is moving to the countryside or into urban areas (block). Together with the movement, the demand for residential areas, recreational and leisure is changing. It is worth noting that the destination places in case of all movements are concentrated within one hour of access (isochrones).

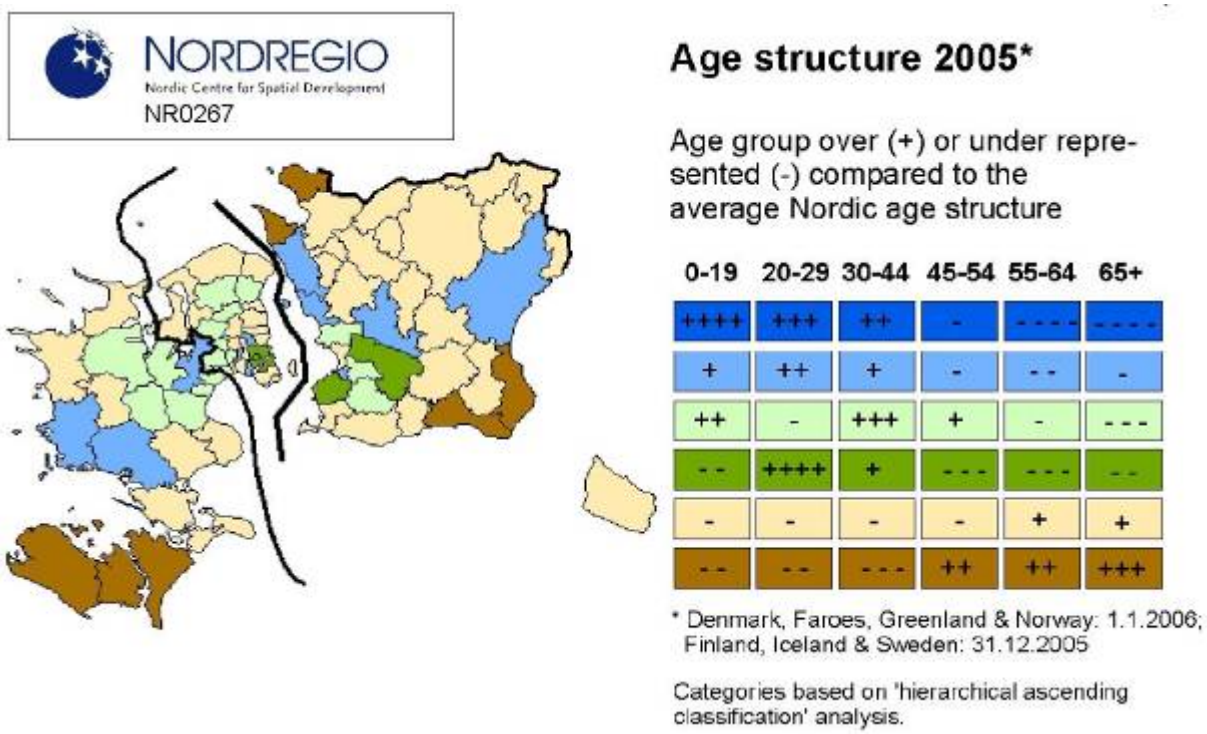


Figure 18 –Age structure in the Øresund region in 2005

Source: Rauhut D., Rasmussen R., Roto J., Francke P., Östberg S., 2008, The Demographic Challenge to the Nordic Countries, Nordregio, Stockholm.

Population of the Nordic countries is known as for the awareness of safety and healthy lifestyle. This is a reason why they excel in high life-expectancy level and low mortality.

The age structure in Øresund region is similar to structures of the both nations. On the Danish side there is a smaller share of teenagers and a greater proportion of people in age 25-44; on Swedish side there are more people aged 22-34 and a lower percentage of those in their 50. and 60. comparing to Sweden as a whole[9]. The Nordregio presents a map of age structure in 2005 in multiplies of Øresund region. The map shows age diversity in the different municipalities of the region. The most important relationship is the arrival of young people, up to the age of 44 in urban areas. In peripheral areas are dominated by people over 45 years of age. Figure 9 confirms that the majority of people aged 20-29 live in metropolitan areas and cities with Universities.

[9] Øresund Trends 2010

Comparing the rates in the Nordic countries to the EU-27 average, these are societies with a greater share of older and younger people, but in the category "young adults" are below the EU average. In 2004 in Denmark about 15% of the population was aged over 65 years.

The population forecast predicts an increase in number of habitants of the Øresund region to about 4 million people by 2029. The population rate is expected to increase more rapidly on the Swedish side, whereas the largest percentage of elderly is expected to increase on the Danish side.

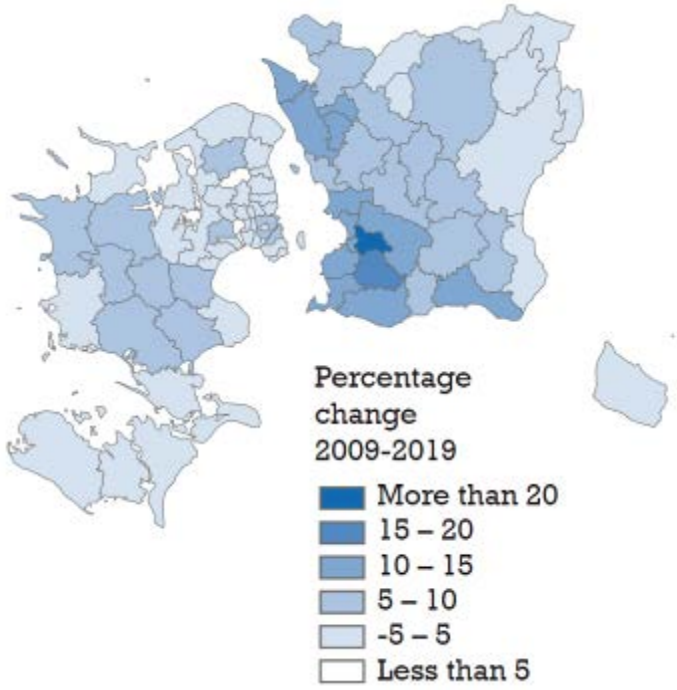


Figure 19 - Forecast of population 2009 – 2019

Source: Statistics for Denmark and Skåne region. Map: Skåne region

Most of migration is taking place inside the country: people move from the peripheral areas into the metropolitan ones. Every second person who migrates is aged between 20 and 35 years old. This situation is similar in all Nordic countries. Most of the migrants arriving in the region return to their former place of residence or come from other regions of Scandinavia. Another group are the people from neighbouring countries (e.g. Germany, Poland, Great Britain, Russia).

Net migration rate is positive for migrants from abroad, but for citizens of Denmark and Sweden it is negative. Migrants settled mainly in the metropolitan region and in large cities, additionally exacerbating the uneven population of the area.

The most important factors influencing the age structure of the region are:

- low fertility rates,
- high average life expectancy,
- the out-migration of young people.

But they do not explain the whole problem, now considered as crucial long-term changes in the economy and the social condition.

The structure of age, gender and education in the Øresund region has a huge impact on the local economy. Peripheral regions increasingly pit on the traditional manufacturing and intensive agriculture industries.

The workforce within the region is 1.8 million people, which makes it the largest recruitment base in Scandinavia. In addition, the population is highly educated and this confirms the thesis of following a strong correlation between universities, industry and public sectors.

There are 11 universities in the Øresund region with approximately 165 000 students, 6 500 Ph.D. level research students and 10 000 researches. In addition, there are around 4 000 visiting students from about 800 other universities with which the region's educational institutions cooperate.

In this region 1/3 of residents between the age of 25 and 64 has some form of post-secondary education.

However, there are strong regional differences: the capital region of Denmark has the highest percentage of people with higher education, subsequently the Region Skåne . While in the region of Zealand, this ratio is the lowest. This region has the highest percentage of population with compulsory education. The statistics do not include the population that continues learning at that level. Analysing the regions, there is a wide variation among their municipalities: from 17.5% of people with higher education in the South of Zealand and in Northern Skåne to over 40% in urban areas.

There is a tendency to increase the population with higher education and increase the number of students. In 1998 in the region 135 396 persons studied, and 10 years later, about 20 000 more. In 1998, the Øresund region had 23.4% of people with higher education, while a decade later, in 2007 that figure was already 32.6%. The highest increase in this time-frame was noted in the capital region of Denmark: 37.1% in 2007, is an increase of 13% compared to 1998.

The Øresund region has two world-class universities and three top European schools: first two are University of Copenhagen, with 43rd position in the global ranking and the Lund University.

There are over 130,000 students in the region, and more than 40% of them are in the biomedical sciences faculty, which is connected with Medicon Valley, cluster organized on both sides of Øresund .

It is worth noting that some regions, despite of offering the universities, do not record higher proportion of young people than expected. In case of Roskilde, a city that has one of the largest universities in the region, most of young people with the beginning of a higher level of education are not moving to this city, but remain living in Copenhagen, which offers more attractions for the youth. High-speed trains, public transport, determine University of Roskilde accessibility for people living in Copenhagen as it is located within the area covered by isochrones of 60 minutes.

With the opening of the Øresund Bridge the possibility for residence on one side of the Sund increased and hence the opportunity to study, work and leisure. With the opening of the bridge in 2000, the number of students increased on the opposite side of the bridge, especially in case of young Danes studying in Sweden, with an increase of over 600 in 2000 to 1400 a year later. Changes among Swedish students were not that significant, but they are considered to be long-lasting. Within 10 years, from 1998, the number of students increased from 900 to almost 1600.

Despite the economic crisis, the Øresund region recorded a growth in employment in the last decade. In 2007 in the region were employed 1.83 million people, including 18 400 commuters through the strait. Most of them lived and worked in Sweden, Denmark (17 800), in the opposite direction traveled only 600 people. Opening of the bridge intensified migration between Denmark and Sweden. In 2003, 72.7% of the region's population aged 16-64 was employed. Six years later this rate grew up to 74.9%. The employment rate differs on the sides of the strait. In the Danish part of the region in 2007, it was 77.7%, and 68.9% in Sweden. Above all, the employment rate is much higher among younger age groups in the Danish part compared to the Swedish part of the Øresund region.

In the third quarter of 2009 over 68 thousand inhabitants of the region were unemployed (3.0% of the population aged 16-64 years). In the period 2004-2009 in the Danish side of the region the unemployment rate fell from 4.2 to 2.3%, while the in Sweden from 5.2 to 4.3%. Between 2002 and 2007, the unemployment decrease reached 32%. The Danish economy helps young people to embark at the beginning of a career, thus resulting in less unemployment among youth in Denmark than in Sweden. This explains lower unemployment rate on the Danish side of the strait. Impact on the structure of employment was also determined by the "efterlønssystem“ which gives older people the chance to retire at a younger age.

The governments of Denmark and Sweden signed a bilateral agreement to avoid double taxation - as many Swedes choose to pay tax in Denmark, where these are lower. The agreement also refers to compensations for the other side, because of its lost tax revenue.

Unfortunately, the economic crisis put its impact upon the region which resulted in a decline in employment and overall decline of economy.

An increasing number of people are employed in private business sector, while the share of employment in agriculture and manufacture industry continues to decrease. The manufacturing industry (including construction) accounted for roughly 15 percent of total employment in the capital region of Denmark, which can be compared to Zealand and Skåne regions where the manufacturing industry accounted for 22% and 23% of employment respectively.

GDP per capita in the Zealand and capital region is 105 507 € and in Scania 31 560 €.

Value added (a company’s or an industry’s production minus the value of input goods) is a contribution to the Gross Domestic Product (GDP) or at the regional level, the Gross Regional Product (GRP). Regarding economic growth measured as a change in value added for an industry, three sectors particularly increased in significance in period 1993-2007 in the capital region of Denmark: transport and telecommunications, finance and the chemical and plastics industry. In Zealand and Skåne regions, the manufacturing industry still plays an important role in the economy. The most apparent disparities occur between the structure of industry in different regions: the largest concentration of business services, real estate and financial operation, transportation, travel, post and telecommunications is in the capital region, because this type of activity usually concentrates in the capital city.

Industry	Capital Region of Denmark 1993	Capital Region of Denmark 2007	Region Zealand 1993	Region Zealand 2007	Region Skåne 1993	Region Skåne 2007
Agriculture, forestry, hunting, fishery	0.5%	0.3%	3.5%	2.5%	2.8%	1.5%
Mining and quarrying	0.1%	0.0%	0.2%	0.1%	0.3%	0.1%
Food and tobacco industry	1.7%	1.0%	3.8%	2.8%	4.4%	3.1%
Textiles, clothing and leather industry	0.1%	0.1%	0.3%	0.1%	0.2%	0.1%
Wood, paper and graphic industry	2.4%	1.7%	2.0%	1.4%	3.7%	2.6%
Chemical industry, rubber and plastics	2.5%	3.8%	1.7%	3.8%	2.7%	3.6%
Industry for other non-metallic mineral products	0.3%	0.2%	0.9%	1.0%	1.0%	0.9%
Iron, metal and other manufacturing industries	4.2%	3.9%	5.9%	6.4%	7.1%	8.6%
Electricity, gas, heating and hot water supply	2.2%	1.4%	2.9%	1.3%	3.0%	3.2%
Construction	3.4%	3.6%	7.2%	7.6%	5.3%	5.5%
Wholesale and retail trade	15.0%	13.8%	9.8%	13.8%	11.2%	12.7%
Hotel and restaurant industry	2.0%	1.5%	1.6%	1.2%	1.1%	1.3%
Transport, travel, post and telecommunications	7.1%	12.7%	7.7%	5.6%	8.1%	6.9%
Financial operations	7.5%	11.1%	2.6%	3.8%	3.9%	2.1%
Real estate, business services, R&D	21.4%	21.3%	17.3%	18.4%	17.4%	23.2%
Public administration	7.2%	6.3%	6.4%	7.1%	6.6%	4.2%
Education	4.7%	4.5%	7.0%	6.7%	6.3%	5.9%
Health and medical care	11.4%	8.5%	12.3%	13.4%	11.6%	10.8%
Culture, leisure and recreation	6.4%	4.9%	4.9%	3.7%	3.2%	3.6%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Total value added	318.2	483.3	103.0	139.7	173.0	278.0

www.tendensoresund.org

Figure 20 – Industry in the Øresund region

Source: www.tendensoresund.org

The Øresund region has 99 629 people employed in the high tech service sector, which makes 5.4% of total employment of the region. This is 10th place in EU-15 if the number of employees is considered. The Eurostat Statistic show, that Øresund region has a very high specialisation Index of high tech services, one of the highest in Europe.

The Öresund region focused in pharmaceutical production and some computer-related forms of service production. Skåne has a prominent position in the manufacturing industries and in natural science as well as technological research and development. The capital region of Denmark is specialised in pharmaceutical industry, other advanced technological manufacturing and several computer industries. Zealand region has specialisation in pharmaceuticals and the production of medical equipment. The region is an economic powerhouse that accounts for 26% of the aggregate of the gross national products of Sweden and Denmark. The region invests 3.9% of its gross regional product in research and development. It is a consistent pattern that most of R&D investments take place in metropolitan areas. About ¾ of Danish expenditures on R & D derive from business sector for Øresund region: 71% for the capital region of Copenhagen, 3.1% for Zealand region. In Sweden 18% of industry's R&D investments are made in Skania region.

Example of Platforms vs. Clusters

- Platform: "Öresund Science Region": Promotes knowledge-based economic development in Öresund region (Zealand/Copgenhagen and Southern Sweden/Malmö).
- Acts as a cluster facilitator and is owned by Örsund University. Focuses on the strong sectors in the region: ICT, Logistics, Food, and Environment
- Financed by memberships and by public funding
- Clusters: Pharma and medico-cluster in Öresund region

- A market driven, geographically based cluster. Consist of about 300 companies, public institutions (ex. hospitals and universities). Medion Valley Alliance – the platform, that stimulates the cluster • Formerly a part of Öresund Science Region.

The region focused on Medicon Valley, which was modeled on the American Silicon Valley. The idea was created during the early 1990s and was supported (administratively and financially) by the European Union Interreg II Programme. The researches performed at local Universities (in Copenhagen and Lund) were the beginning of medical activities in the Øresund. There were numerous medical researchers, which brought several Nobel Prize winners and fueled the development of Medicon Valley. Nowadays, the cluster consists of universities, hospitals and companies, which take part in science market, biotech, med-tech and pharmacy researches. In 2003 Medicon Valley accounted for more than 20% of the total GDP of Denmark and Sweden combined[10]

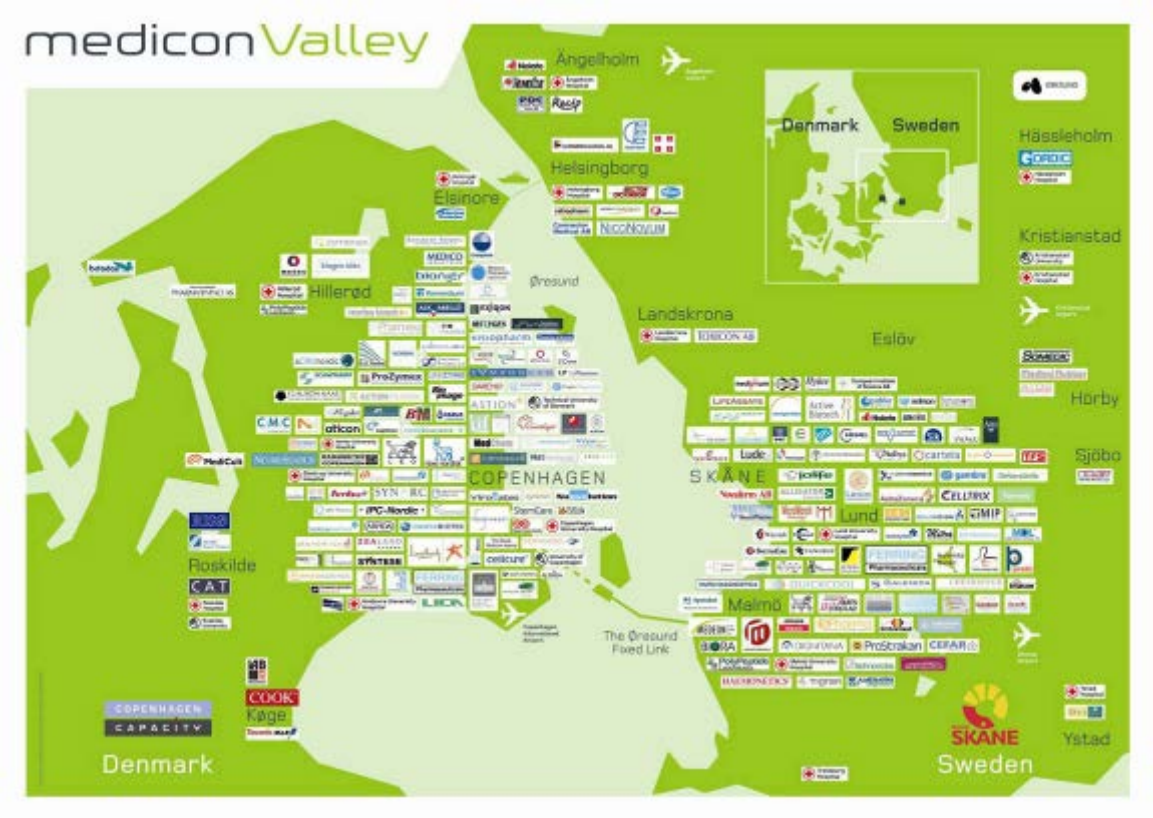


Figure 21 – Companies, universities and hospitals of the Medicon Valley in the Øresund region

Source: http://www.mva.org/media%2815,1033%29/Region_Medicon_Valley.jpg

Top R&D companies in Medicon Valley:

- Novo Nordisk (diabetes)
- H. Lundbeck (neurosciences)

[10]http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/2310/the_medicon_valley_region_academia_and_industry_join_forces_in_research_and_training

- Coloplast (medical devices)
- AstraZeneca (inflammation)
- Genmab (cancer)
- ActiveBiotech (cancer)
- NeuroSearch (neurosciences)
- TopoTarget (cancer)

The average house prices in Denmark were the highest in Copenhagen county and Frederiksborg County till 2007 (before the administrative reform), and the highest level was reached in 2006. The administrative reform in Denmark coincided with the time of global crisis and it was had impact of inhibition growth of prices in the whole region.

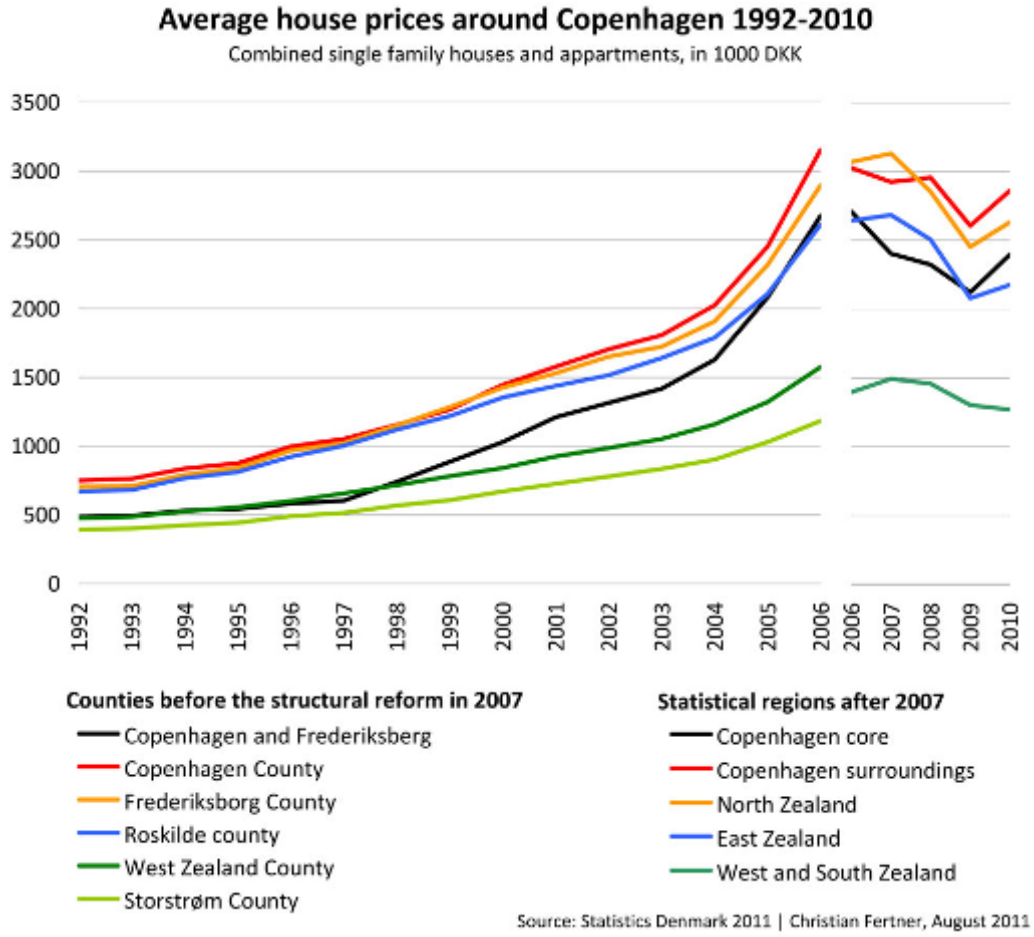


Figure 22 – Average house prices around Copenhagen

Source: http://landblend.files.wordpress.com/2011/08/house_prices.jpg

3.2. Environment (Landscape, soils, climate change… etc.)

The landscape of the Øresund region is very diversified. There are open spaces in countryside, large forest area in Skania and highly urbanised area in cities. The Øresund region is surrounded by the sea, with attractive coastline offering soothing landscape. The region attracts tourists and people for their second houses and

business. There is a temperate climate, which allows to spend time outdoors most of the year. In Øresund, golf and horseback riding are very popular forms of spending leisure time. The Danish and Swedish people care about quality of their lives but also the quality of natural environment. They support the use of renewable energy sources, of which wind is the most efficient (due to open spaces as well as frequent and strong winds from the sea). There are many wind mills in the Sund, but some inhabitants claim that they contribute to landscape deterioration.

There are policies in Denmark concerning expansions within forest areas, which means that as much land as possible will be converted into forest areas. The forested lands in Denmark occupy 10-15% of total territory and the intentions are to increase their share within the period 5 to 10 years. The forest areas are expanding, one of the aims to be achieved is to obtain a combination of managed forest areas, not only the monoculture of pine forest. Some of them are open to public access, others are very old forests under strict supervision.

There are two types of forests in Denmark: national forest, managed by state accessible for the citizens and private forests. Private forest owners complain for strict regulations. People can own the forest, but it will be still open for public access. The restriction concerns what be done in the forest, many of the forest areas are kept for hunting purposes. Permits for hunting are deliberately expensive in order to discourage potential hunters. According to Rasmus Ole Rasmussen due to environmental regulations Denmark back from 1960s. the amount of pollution given out is known. There are strict regulations on filters, land management and water surplices protection. The most significant threat is the agriculture, because farmers due to a widespread use of chemical fertilizers. There are in Denmark numerous organic farms, thus there is no necessity to use chemicals. Farmers however are aimed at production with less human labor involved which brings more profit. Many of these farms are moving to less developed countries, because it's cheaper to buy large areas and start this non-environmentally friendly and unhealthy production. Intensive agriculture moved from Øresund region to Jutland, for instance. It's interesting what happened to Denmark's agriculture in the last 30 years, because when Denmark joined the EU, people from Holland moved to Denmark and started their production. When Poland joined the EU, some farmers from Denmark moved there. This trend is because the land is cheaper and law regulations are less demanding in less developed countries.

The aim is to limit the amount of pollution from wood burning stoves. The Danish Ministry of the Environment has set up a grant scheme of more than DKK 7 million for the development, testing and demonstrating the technologies that can contribute to reducing pollution from wood burning stoves in private homes.

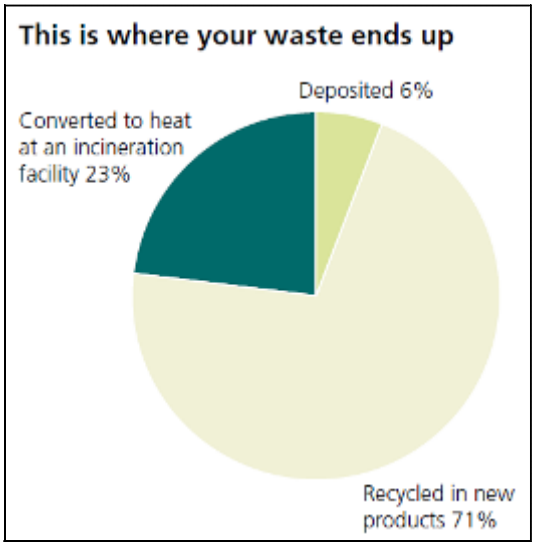


Figure 23 - Danes produce over 15 million tonnes of waste per year.

Source: The Environmental Protection Agency, ISIAG, Waste Statistics 2006

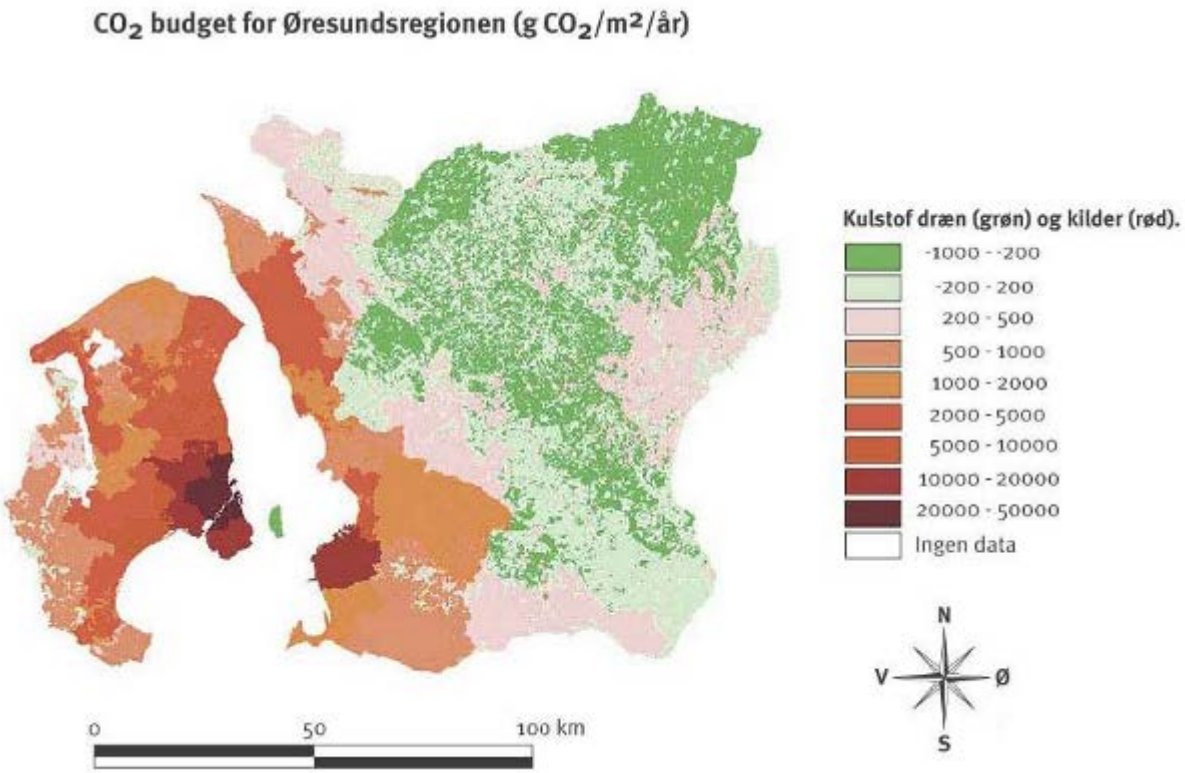


Figure 24 - The geographical distribution of CO2 accounts in the Øresund region.

Source: Henrik Sogaard, Department of Geography. http://www.klimadebat.dk/co2-budget-for-oeresundsregionen-geoviden-nr-2-2006-r17.php

3.3. Government and policy

To maintain a high level of cooperation on both sides of the strait, Øresund Committee has formulated the Regional Development Strategy. According this document, the Øresund region is in 2020 expected to be:

- "a front-runner in environmentally friendly transport and a laboratory for green technology;
- a centre for clean-tech solutions and sustainable urban development so that we can host an Öresund region EXPO in 2022;
- a single, attractive, obstacle-free labor market where individuals with a variety of educational backgrounds and skills have unrestricted access to all of the region's workplaces, irrespective of whether their skills have been acquired in Sweden, Denmark or elsewhere;
- a model for how to make the best possible use of the resources that workers with a non-Scandinavian background can bring to the labor market;
- a place where opportunities, regulations and frameworks are communicated through *Öresund Direkt*;
- a model region in terms of digital integration through the use of high quality broadband;
- a region with a diverse cultural offering that meets high criteria in terms of quality;
- a region that invests in cultural activities produced for, with and by children and young people;
- a host for international events and a popular tourist destination;
- a cohesive, competitive educational market that trains the best candidates and attracts students and researchers from other countries;
- a hub of innovation, with entrepreneurs and synergies between educational institutions and trade and industry;
- a region whose residents are able both to make use of all that the region offers and to explore its potential".

The Øresund region is situated at the contact area of two countries. Regional planning law was changed in Denmark with the administrational reform in 2007. There were 13 *Amts* and 271 municipalities before. Now administrative units are enlarged and merged into 5 regions and 98 municipalities. Most of them has over 20 thousand inhabitants nowadays. In Skåne region, 15 out of 33 municipalities have over 20 thousand inhabitants and 31 over 10 thousand inhabitants.

3.4. Localization (accessibility, core-periphery, urban-rural continuum)

Conclusions concerning scenarios of urbanisation in Europe, developed in the EU-FP6 project PLUREL[11] show that peri-urban areas (area between urban settlement areas and their rural hinterland) – opposite to urban or rural areas – will experience the highest growth rates of urbanization. These areas are under a high development pressure of urbanization, which can e.g. lead to the degradation of natural landscapes nearby cities. While most urban areas are now growing at a slower rate

[11] Peri-urbanization in Europe. Towards a European Policy to Sustain Urban-Rural Futures. PLUREL Synthesis Report. 2011

(at 0.5-0.6% per year), housing development in peri-urban areas is growing at four times this rate.

In the case of Øresund it can be expected that regions around Copenhagen and Malmö will have the fastest increase in artificial surface of peri-urban areas compared to urban or rural areas. The highest pressure on peri-urban areas is around big cities, which will certainly be a challenge for regional green structure plans like the Fingerplan. On the other hand, e.g. in Western Jutland the highest urbanization is expected in urban or rural areas, not in peri-urban areas.

3.5. Conclusions in the context of land use

In Malmö some patterns similar to the Copenhagen region evolved; in particular with infrastructure connecting smaller towns in the region with built-up areas developed along the roads and railways. However, the establishment of the bridge between Denmark and Sweden from Copenhagen to Malmö negated the relative isolation and the Øresund region was established

As only limited land resources were available in the core urban areas most of the changes and the intensifications took place in second-tier urban areas; typically in places situated within 30 to 60 kilometres from the Copenhagen and Malmö centers. The intensifications is a result of farmland to artificial surface conversion.

Similar patterns are found on the Swedish side, but intensification is also a significant component in some of the older towns due to expansion of economic activities between the two countries, which has been directly facilitated through the development of the bridge. This has led to internal changes in the urban category, typically through construction of new dwellings to accommodate the increasing number of Danish citizens now residing on the Swedish side of the border. Finally, the forest internal conversions on the Swedish side are indications of changes from commercial forestry towards the use of forest areas in connection with leisure activities and future expansion of the urban structure.

A striking feature – and a quality of the typology in relation to the example – is the subdivision of the urban/artificial category in different components characterized by the land cover associations, which clearly show intensity and direction of urban sprawl. The direction of the sprawl is shown by urban categories associated with different land use activities such as agriculture (in Denmark and Sweden) and forestry (in Sweden) connecting a “string of pearls” of former smaller urban areas into growing centers and new nodes in the network.

Exploring the collaboration among the key players in the "functional foods" industry a based in Skåne, a province known as “the breadbasket” of Sweden. The functional foods business is a new Scandinavian field of cooperation that combines biotechnology with the traditional food industry, and it has grown up from a great collaborative spirit involving government, industry and academia. This tripartite cooperation extends far beyond functional food, and has created some unique programs and educational opportunities across the life sciences.

4. ANALYSIS OF LAND USE CHANGES

4.1. Dynamics and directions of land use and land cover changes

The Øresund region is strongly diversified in terms of land use structure. Three regions can be distinguished. These are:

a) transformed terrains of Copenhagen and Malmö surroundings, with importance of services, industry, housing and transport land use functions. This zone is extended along main traffic routes and along coastal lines, in accordance with the famous 5 fingers plan of Copenhagen agglomeration;

b) agricultural and recreational - Central, Southern and Western Zealand;

c) most of Swedish part of Øresund region with strong importance of forestry and recreation, lesser importance of agriculture.

Trends of land use changing observed in the mentioned sub-regions can be approximately identified with trends observed in three NUTS 2 in the Øresund region: capital region, Zealand and Southern Sweden[12].

Dynamics and direction of land use changes depend mostly on the belonging to the one of these zones. Although general trends of land use changes can be also observed.

The Øresund region distinguishes permanent decrease of arable land area in each of its parts. Due to strong influence of Copenhagen and Malmö on the land prices during the last 20 years, agricultural lands are retreating further away from agglomeration. Attractiveness of terrains nearby long coastal line of the region as second houses area is an important factor of arable land decreasing as well.

Nevertheless, rural character of agricultural areas is relatively efficiently protected by the law regulations and spatial planning. Changes concern functional structure for the benefit of functions more exposed to leisure time services. These changes don't concern landscape in a significant manner. Therefore the decreasing of agricultural land in the agricultural areas is much slower. However share of arable land itself decreases relatively fast, what was usual for all Denmark. Between 2006 and 2009 the dynamics of decrease amounted average 1% yearly, while in Denmark it was 0.9% and in Sweden 0.4%. Decline in Denmark was especially severe in absolute values, because arable land counts there for 55.8% of total area and the decrease meant falling down by 1.6 p.p. General dropping of share of arable land area in the region is influenced mainly by the process observed in Danish part. During the period 2006-2009 share of arable land, in the Zealand region decreased by 1.2% per year and in the capital region even by 2.6% yearly. The dynamics in the capital region is much higher, but due to area of the regions disproportion, declining means lost of 7 400 ha in the capital region and 16 500 ha in the rest of Zealand. In Southern Sweden dynamics of decline counted by average 0.4% per year (fig. 25). Disproportion between dynamics observed in Southern Sweden and in Zealand is even more significant, when it's expressed in absolute values, because during this period share of arable land declined in Southern Sweden from 34.6% to 34.2% (by 0.4 p.p.) and in Zealand from 63.4% to 61.2% (by 2.2 p.p.). Permanent but low

[12] Sydsverige (NUTS 2) composed of 2 counties: Skåne (79% of total area) and Blekinge (21% of total area). Only Skåne belongs to Oresund Region.

dynamics of this process is observed in Southern Sweden at least during the last 20 years. The mean value of decreasing dynamics during the period 1990-2010 was still only 0.4% per year (fig. 26). An important impact on this situation can have also the national policy, which results from strategic importance of the Southern Sweden for Swedish agriculture, where utilized agricultural land takes only 7.5% (arable land 6.4%) of total area, and in Southern Sweden (3.4% of total area) there is 16.4% of total Swedish utilized agricultural land area (18.2% of total Swedish arable land area).

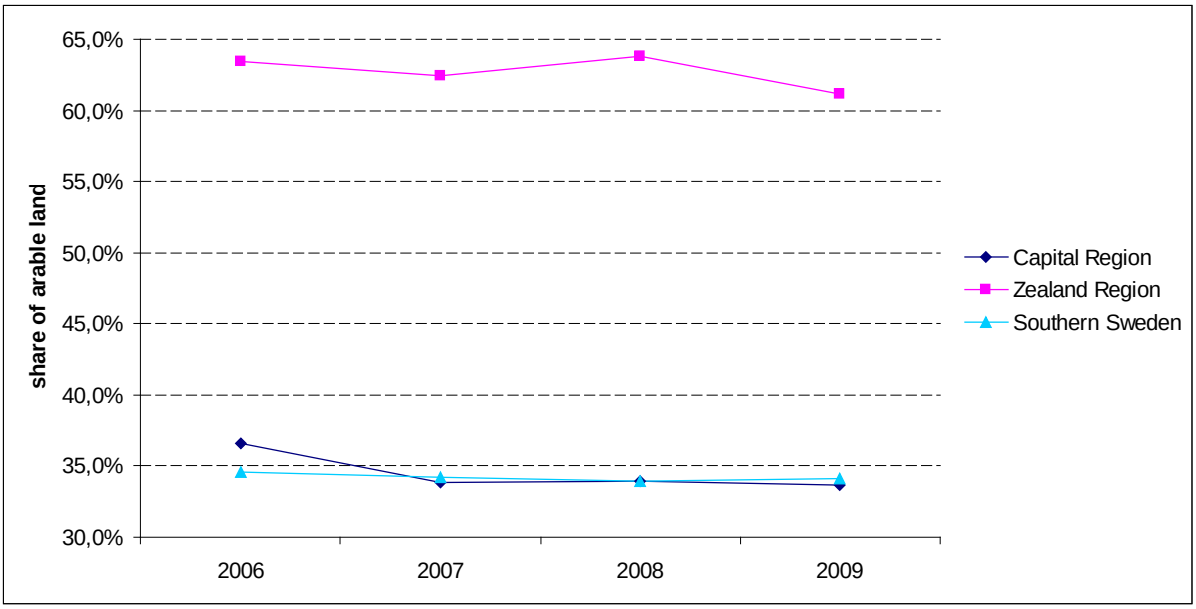


Figure 25 Share of arable land area change in Southern Sweden and in Danish parts of Øresund region

Source: own elaboration, based on Eurostat data base

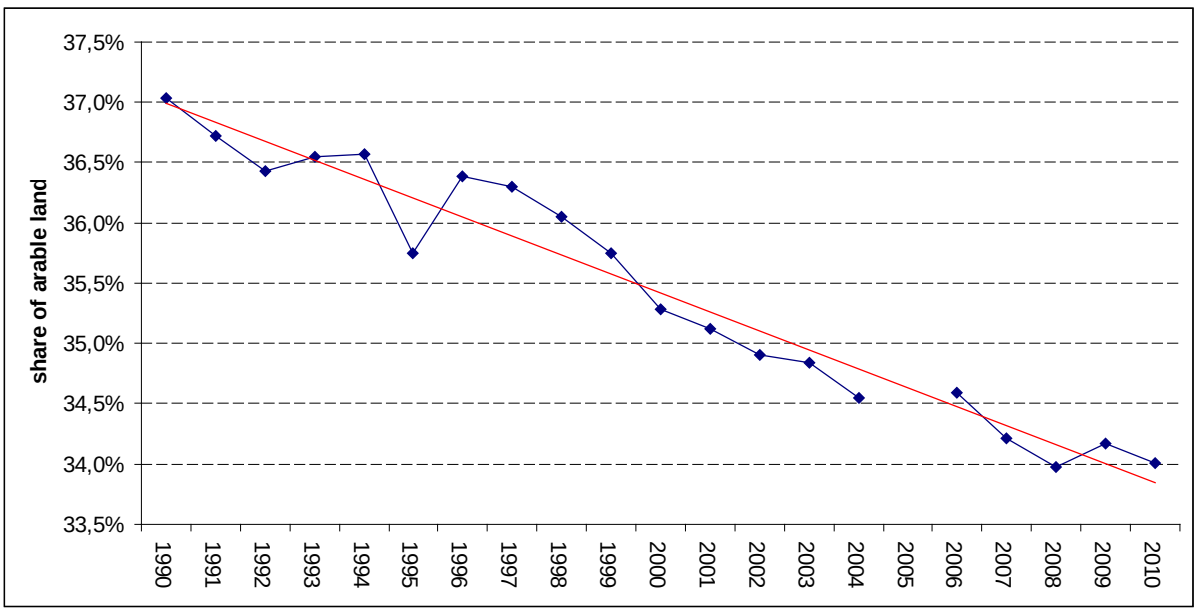


Figure 26 Share of arable land area change in Southern Sweden

Source: own elaboration, based on Eurostat data base

Apart of the intensity of pigs breeding in Denmark, which is growing up (fig. 27), concentrating and becoming more commercial, in both countries a broad trend of animal breeding reduction is observed (fig. 28).

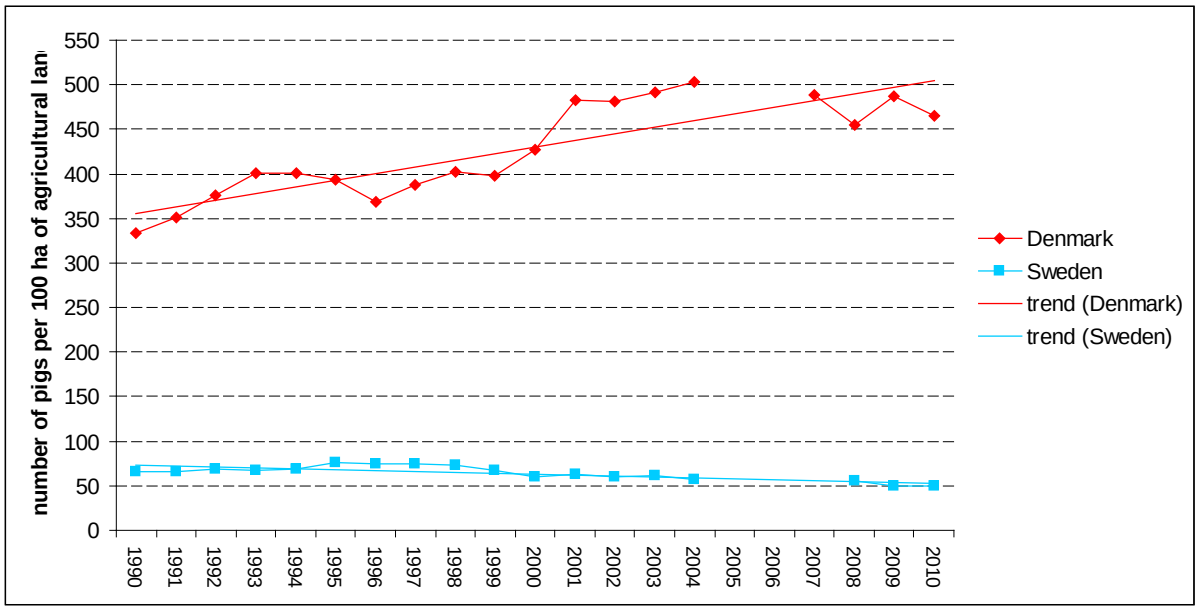


Figure 27 Number of pigs per 100 ha of agricultural land change in Denmark and Sweden

Source: own elaboration, based on Eurostat data base

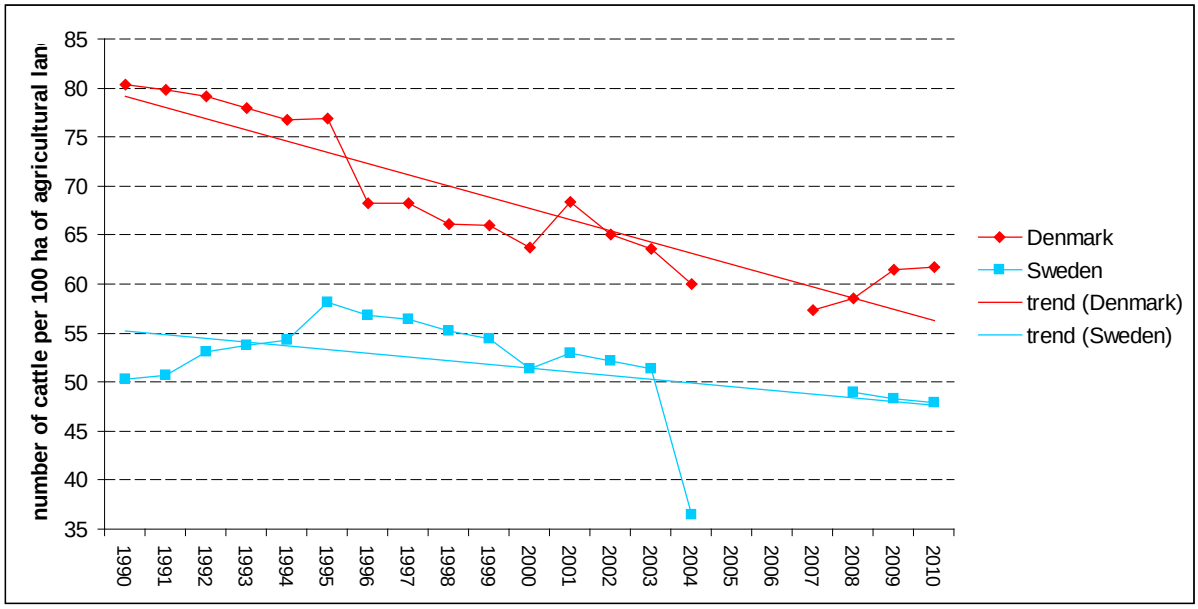


Figure 28 Number of cattle per 100 ha of agricultural land in Denmark and Sweden

Source: own elaboration, based on Eurostat data base

This negative tendency does not however influence the crops structure and the share of fodder cultivation area in the Øresund region. In Danish side there is a significant

increase of fodder cultivation area share observed in the last years. Between 2006 and 2009 the percentage of fodder cultivated land increased in the Zealand region from 3.2 to 4.3% (by 11.4% per year) and in the capital region from 5.3 to 6.4% (by 6.6% per year), where an increase was equally important in the absolute values sense (by 1.1 p.p.) due to a higher share generally. It should be stressed out that in the Swedish side the share of fodder from arable land area is even higher and there is a trend of increasing observed as well (fig. 29). Moreover, due to relatively large total area of the region and a high share of fodder cultivated land, almost the same area of it grew up in that period in Southern Sweden where increase counted 9000 ha., while in Danish side it was all together 11.7 thousand ha. This growth in a wider time perspective isn't that rapid, but the analysis of that trend since 1990 confirmed a permanent increase by 0.9% yearly (fig. 30). Permanent growth of fodder from arable land production during the period of reducing agricultural land and arable land itself is influencing the dynamic raise of fodder production significance in the land use structure since 1990.

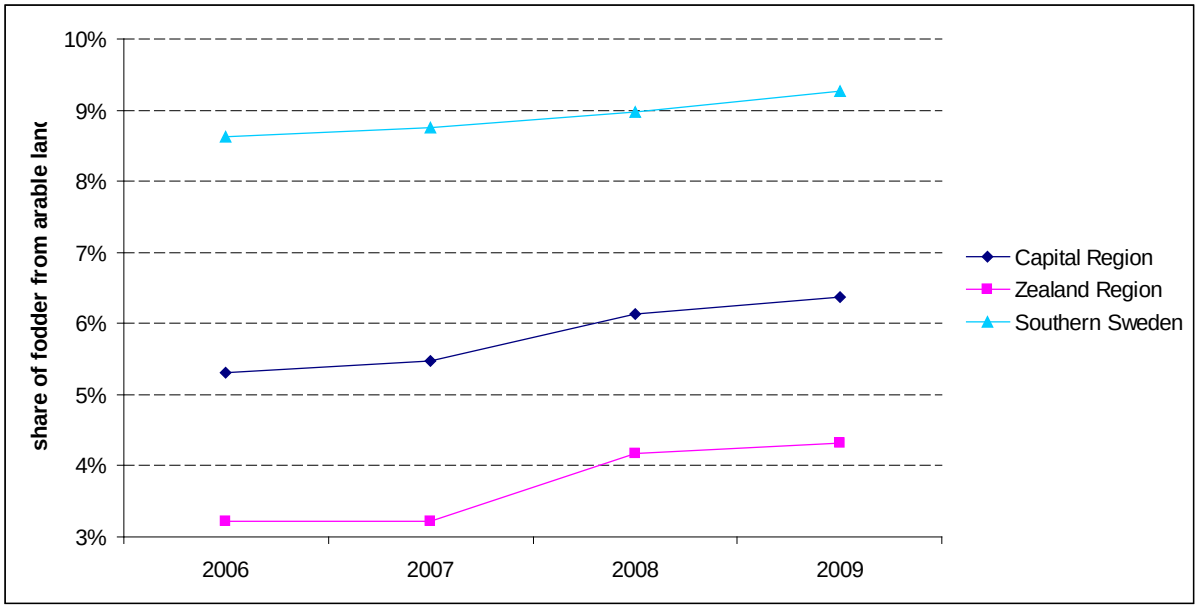


Figure 29 Share of fodder from arable land area change in Southern Sweden and in Danish parts of Øresund region

Source: own elaboration, based on Eurostat data base

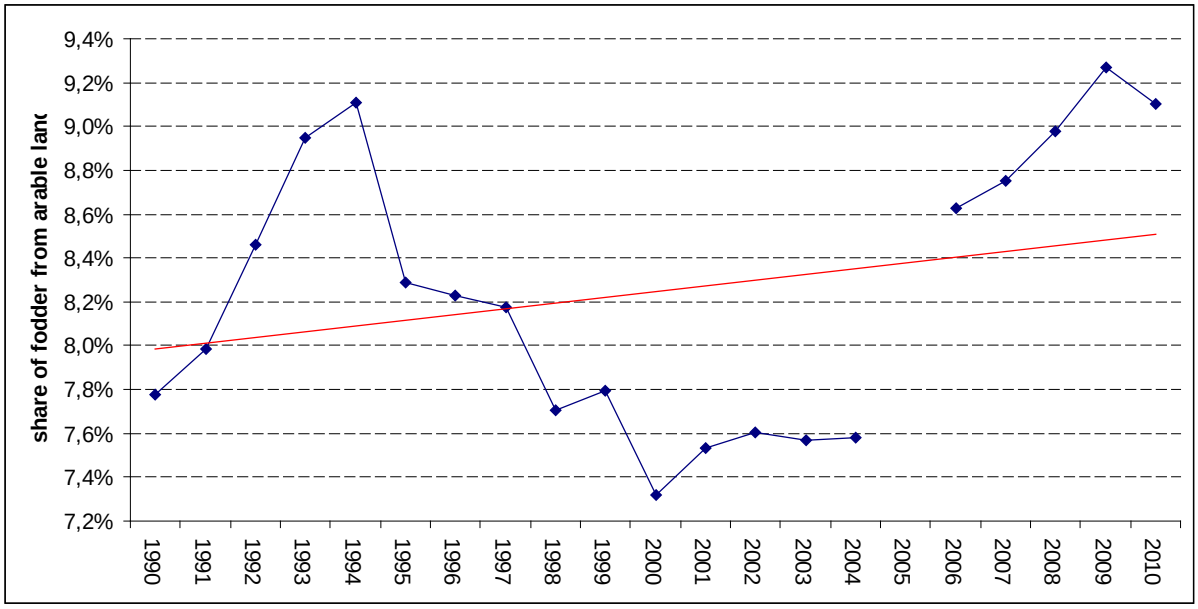


Figure 30 Share of fodder from arable land area change in Southern Sweden

Source: own elaboration, based on Eurostat data base

In the respect of fodder from arable land production, the Øresund region has a contrary importance from Danish and Swedish points of view. Southern Sweden (3.4% of total area of Sweden) takes 11.2% of arable land cultivated for fodder purposes in Sweden. High share in this case results from important role of indigenous agriculture in general. This is caused by relatively favourable natural conditions and a high share of arable land itself. In Zealand (22.8 % of total area of Denmark) there is only 8.6% of arable land cultivated for fodder purposes in Denmark. It is strictly linked with the role of animal production in agriculture of Zealand region and the rest of Denmark. Generally, animal production, especially pork production, is a strong branch of agricultural activity in Denmark. Number of pigs per 100 ha of agricultural land is very high there, in 2009 it was 487.8 as average. Role of pork production on Zealand Island is also very significant, but a lesser extent. A number of pigs per 100 ha of agricultural land in 2009 counted 278.9 in the Zealand region and 254.3 in the capital region. In respect of cattle number per 100 ha of agricultural land regardless of high rate in Denmark (61.4), Zealand region is distinct for low values (31.7 in capital region and 18.1 in the rest of Zealand). The numbers above show, that the significance of animal production in agriculture of Denmark implies high share of fodder from arable land area there, but at the same time much lower, than in the rest of Denmark.

Simultaneously to the arable land area decrease, there is a decline of permanent grasslands area observed. In the Øresund region between 2007 and 2009 permanent grasslands area fell from 113 to 104.7 thousand ha (from 4.7 to 4.5% of total area). Area of this kind of land use decreased most dynamically in the capital region, from 2006 to 2009 from 14 to 11.4 thousand ha (from 5.5 to 4.5%), with the average decline of 6.2% per year. The main reason for that is due to occupying permanent grasslands with the lowest agricultural quality and a strong pressure of more intensive kinds of land use in this area. On the other hand, the area of permanent grasslands on the rest of Zealand increased in this period from 27.6 to

31.7 thousand ha (from 3.8 to 4.4%), average by 5% yearly. It was fully compensated with an excess lost of permanent grasslands noticed in the capital region. This resulted in agriculture extension and conversion of weaker agricultural land for multifunctional use, in most cases well adapted to sport and recreation. In Swedish part of the Øresund region a decrease of permanent grasslands of significantly low dynamics was observed in the last years. Between 2007 and 2010 the area of permanent grasslands declined from 69.4 to 68.5 thousand ha (from 5 to 4.9%), with average rate of 0.4% per year. However, this trend has changed. During the 1990s. a period of dynamic decrease was observed. Share of permanent grassland in Southern Sweden between 1990 and 1998 decreased from 6.5% to 4.2%, but in 1996 it was as low as 3.9%. In the first half of the last decade this rate slightly increased again and there is a period of relative stabilization at the level a little below 5% observed in the last years (fig. 31). The importance of permanent grasslands area of Southern Sweden for the Swedish agriculture can be expressed by the fact, that 15.3% of them is situated there.

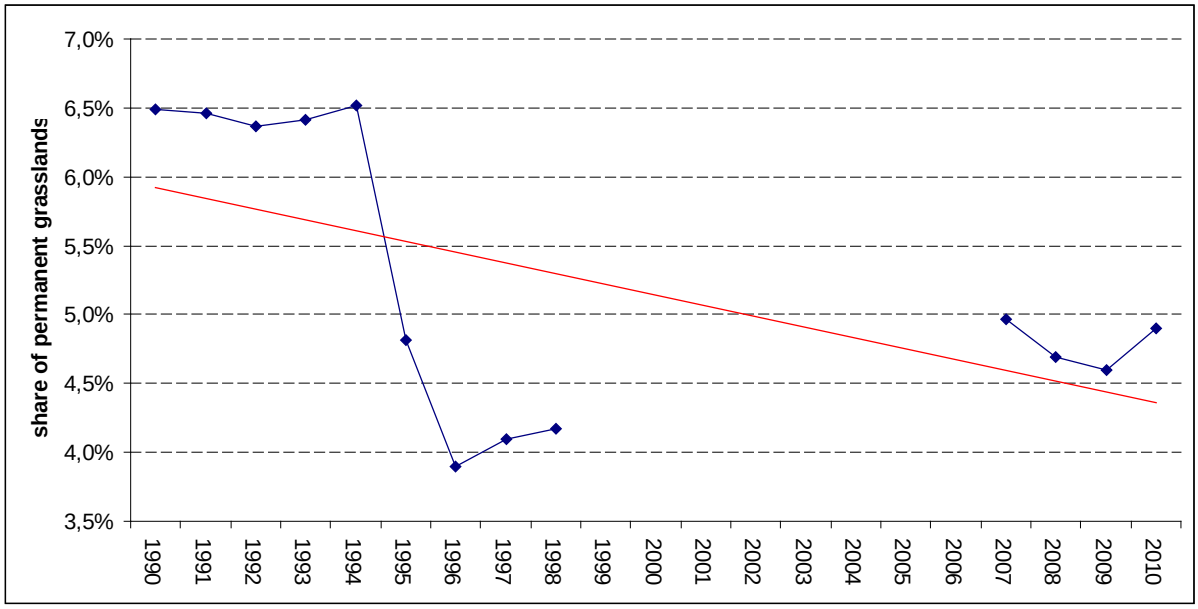


Figure 31 Share of permanent grasslands area change in Southern Sweden

Source: own elaboration, based on Eurostat data base

In the case of permanent crops area, there is a strong decreasing trend observed in the Øresund region. Between 2007 and 2009 share of permanent crops area declined by 4.4% per year, while in Sweden the decrease was at the rate of 3.2% and in Denmark it reached a decline of 10.5% per year. This tendency in the region was mainly caused by the impact of land use changes in the capital region, where in period 2006 to 2007 the area of permanent crops fell down from 600 to 500 ha (5.6% yearly). Converting the agricultural land for other functions is observed there even in the case of such intensive form of agriculture as orchards or vegetables cultivation. This lost of 100 ha was fully compensated by an increase of permanent crops area in the rest of Zealand. But this lost noticed in the Swedish part, was almost as significant. However, such a dynamic decrease of permanent crops area did not significantly influence the general land use structure in the region, because this element takes little share due to climatic conditions. Nevertheless, such rapid

changes can contribute to disappearing of permanent crops in the land use structure of the region in longer time perspective. The stability of this trend can be examined on the example of Southern Sweden, where the area of permanent crops is permanently decreasing at least since 1990 to 2010 and declined during this period from 2.7 to 1.9 thousand ha (by 30%). It must be emphasised that the dynamics of this process was 1.5% per year, while it even grew up to 1.7% yearly in the period of 2007 to 2010. In comparison, in the capital region this dynamics is much higher and counts for 5.6% yearly. However, the impact of land use changes in the Øresund region in the Swedish case is more significant from national point of view, because due to climatic conditions 65.5% of Swedish permanent crops area concentrates in Southern Sweden.

Decreasing of utilized agricultural land area in the Øresund region is observed, what was proven by the analysis of basic elements of structure changes. This is an effect of economic importance of agriculture in the Øresund region. However, the dynamics of agriculture land area declining is slow in comparison to general trends in both, Denmark and Sweden. Between 2007 and 2009 share of utilized agricultural land fell down in the region from 45.9 to 45.3% (by 0.6% yearly), while in Denmark from 62.5 to 61.2% (by 1% yearly) and in Sweden from 7.7 to 7.5% (by 1.3% yearly). It must be noticed, that due to large disproportion in the share of agricultural land area between these two countries, a much lower dynamics observed in the Øresund region still means far greater decline in absolute values, because in Sweden the dynamics of 1.3% per year contributed to the lost of only 0.2 p.p. in the share of land use structure. Although low dynamics of utilized agricultural land share and the decreasing dynamics in most of the Øresund region was low in fact, e.g. between 2006 and 2009 in the Zealand region from 67.6 to 66% (by 0.8% yearly) or between 2007 and 2010 in Southern Sweden from 36.2 to 36% (by 0.2% yearly), in the capital region the situation was extremely opposite. From 2006 to 2009 the share of utilized agricultural land decreased there from 42 to 38.2% (by 3% yearly). Nevertheless, in the capital region between 2006 and 2009 the lost of utilized agricultural land area counted for 9600 ha and was smaller than the lost noticed in the rest of Zealand (12100 ha). On the basis of Southern Sweden case, in can be analyzed that during last years the trend of utilized agricultural area declining slowed down. Its area since 1990 was decreasing at the rate of 0.9% per year, so with definitely higher dynamics than after 2007 (fig. 32).

Permanent transformation of less valuable agricultural land into non-agricultural forms of land use in Denmark and Sweden caused a general decline of fallow lands and green manures area. In Southern Sweden, an agricultural region, it used to be a small-scale process during the last decades (by 7.2% yearly since 1999), but it is already not any longer even here (fig. 33). In the period 2006-2009 this process accelerated here to decline by 26.6% per year, but it was still not as rapid compared to the Danish part of the Øresund region. In Zealand it was slightly slower than in the capital region (by 31.2% yearly), but it’s still a more significant scale than in Southern Sweden (fig. 34). Nevertheless, in much greater Swedish part of the Øresund region, where the share of fallow land was much higher, reduce of its area contributed to a more important change (by 25.9 thousand ha, while in the capital region the decrease was by 5.8 thousand ha).

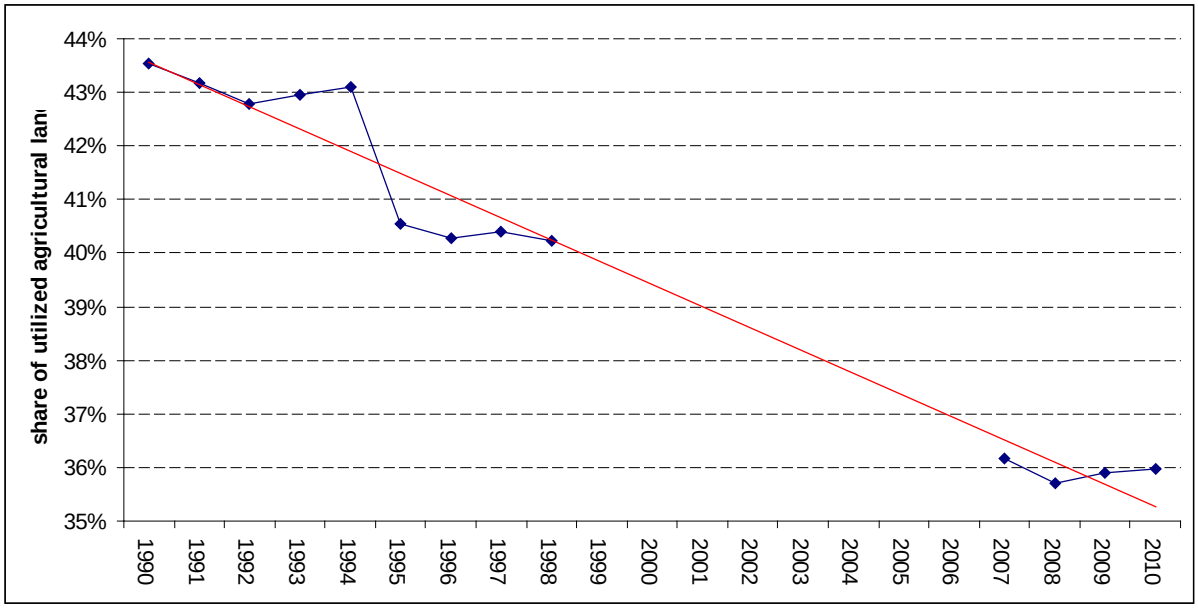


Figure 32 Share of utilized agricultural land change in Southern Sweden

Source: own elaboration, based on Eurostat data base

Figure 33 Share of fallow land and green manures in total area change in Southern Sweden and in Danish parts of Øresund region

Source: own elaboration, based on Eurostat data base

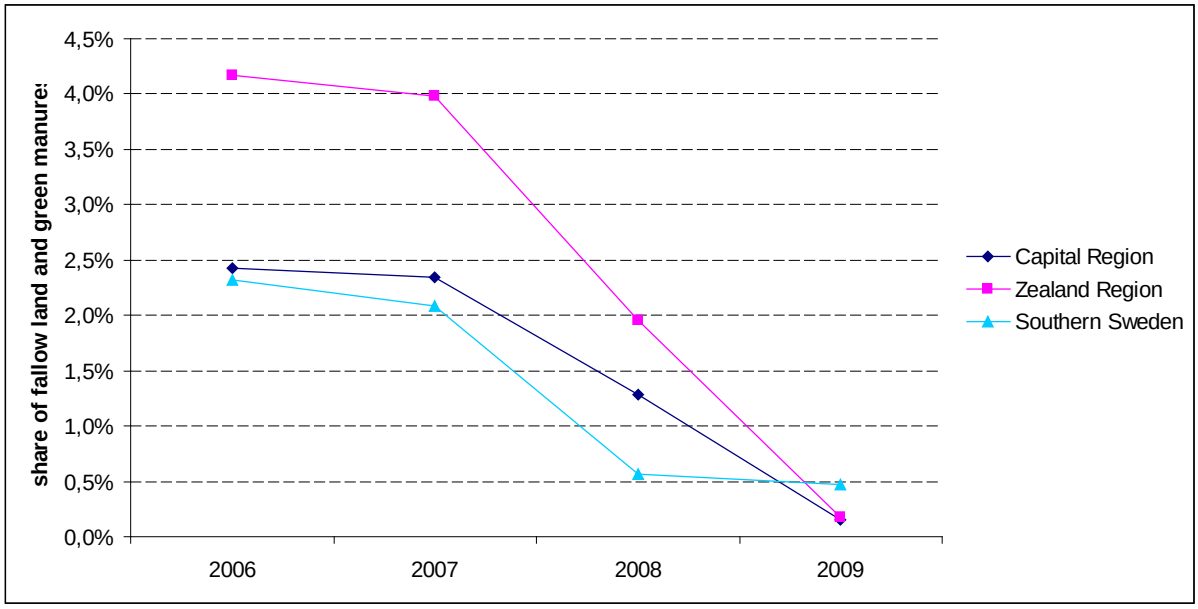


Figure 34 Share of fallow land and green manures in total area change in Southern Sweden

Source: own elaboration, based on Eurostat data base

As we can see on figure 35 and 35a the most important changes in Oresund space are related to suburban sprawl, infrastructure development and forest growth, transformation and management.

In the Øresund region a dynamic increase of forests area is worth to be analyzed as well. However, this process is not observed in all of Denmark. In Sweden as a whole, afforestation is not as significant compared to Skåne region. Between 2007 and 2009 in the Øresund region share of forests area increased from 27.5 to 29.7% (by 4% a year), while in Sweden from 57.3 to 58.2% (by 0.8% yearly). In fact, the only part of the region, where forests area is increasing, is the Swedish side, on which there are the territories of its definitely highest share. From 2007 to 2010 percentage of forested area increased there from 38.6 to 42.3% (by 3.3% yearly). Process of afforestation is observed in the wider time perspective as well, although somehow less intensive. In the period 1990-2010 share of forests area in Southern Sweden increased from 38.8 to 42.3% (by 0.5% yearly). This indicates, that before 2007 the trend of Swedish side afforestation wasn't so distinct. Intensity of this process is strictly related to transition of rural areas into multifunctional land use in the last years, especially for recreational purposes. This is mostly driven by the needs of developing agglomeration inhabitants. Such areas are usually multifunctional, because as they provide a wood source or residential area apart from mentioned functions.

According to land use typology (fig. 36) there are some results from Corine Land Cover for the years 1990-2006. The capital of Denmark and areas adjacent to city are characterised by low intensification in analysed period, because in that years there was a permanent land use of this area. In area located in distance from the centre of Copenhagen we can observe a medium-scaled intensification due to some urban sprawl combined mainly with forest conversion. This is a correct conclusion because of urban sprawl in the very external ring in Copenhagen and also urban sprawl in places located within the isochrones of 1hour way to Copenhagen. Areas

dismissed from capital are characterised by a medium intensification, with a combination of urban sprawl and forest or agricultural changes.

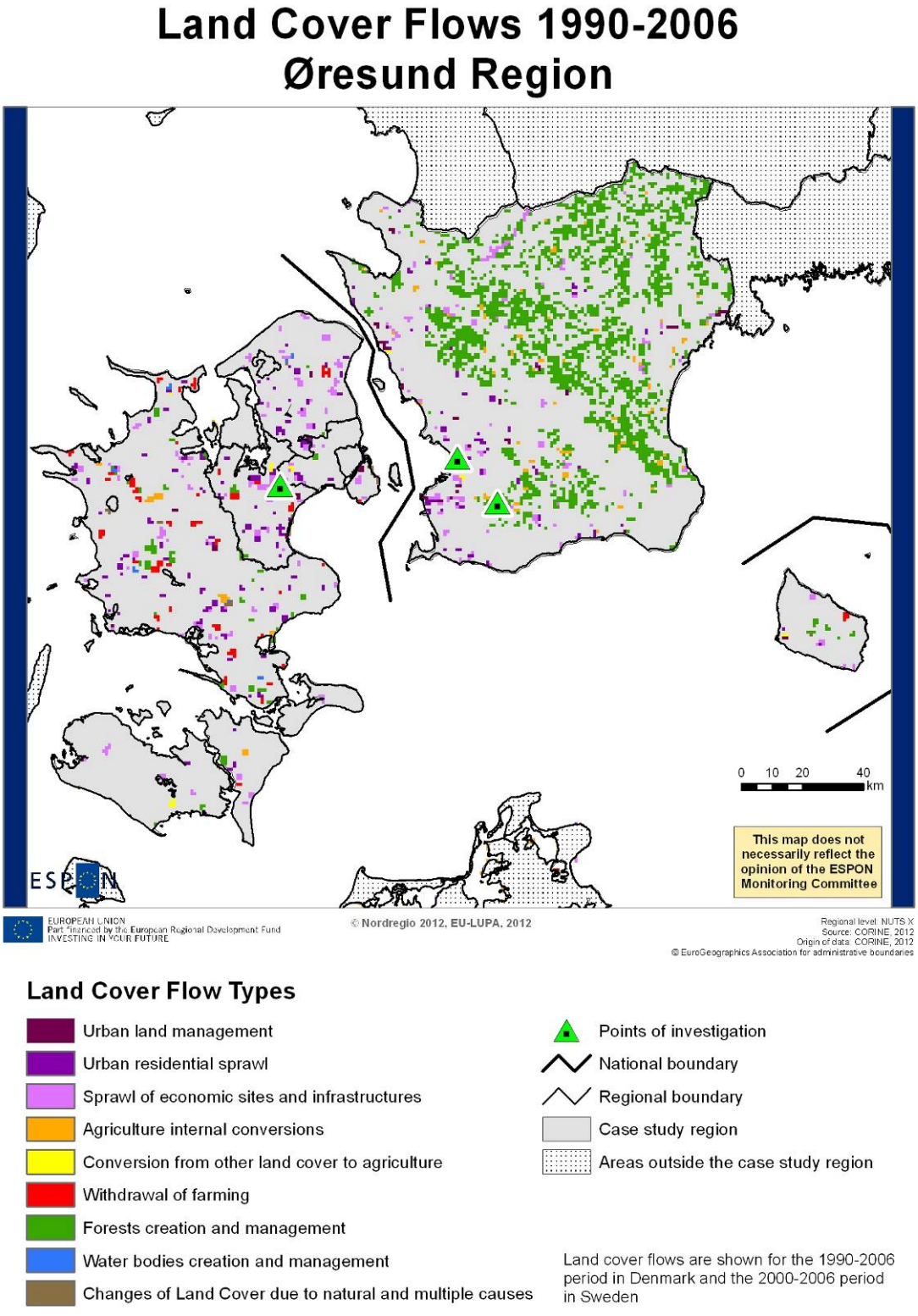
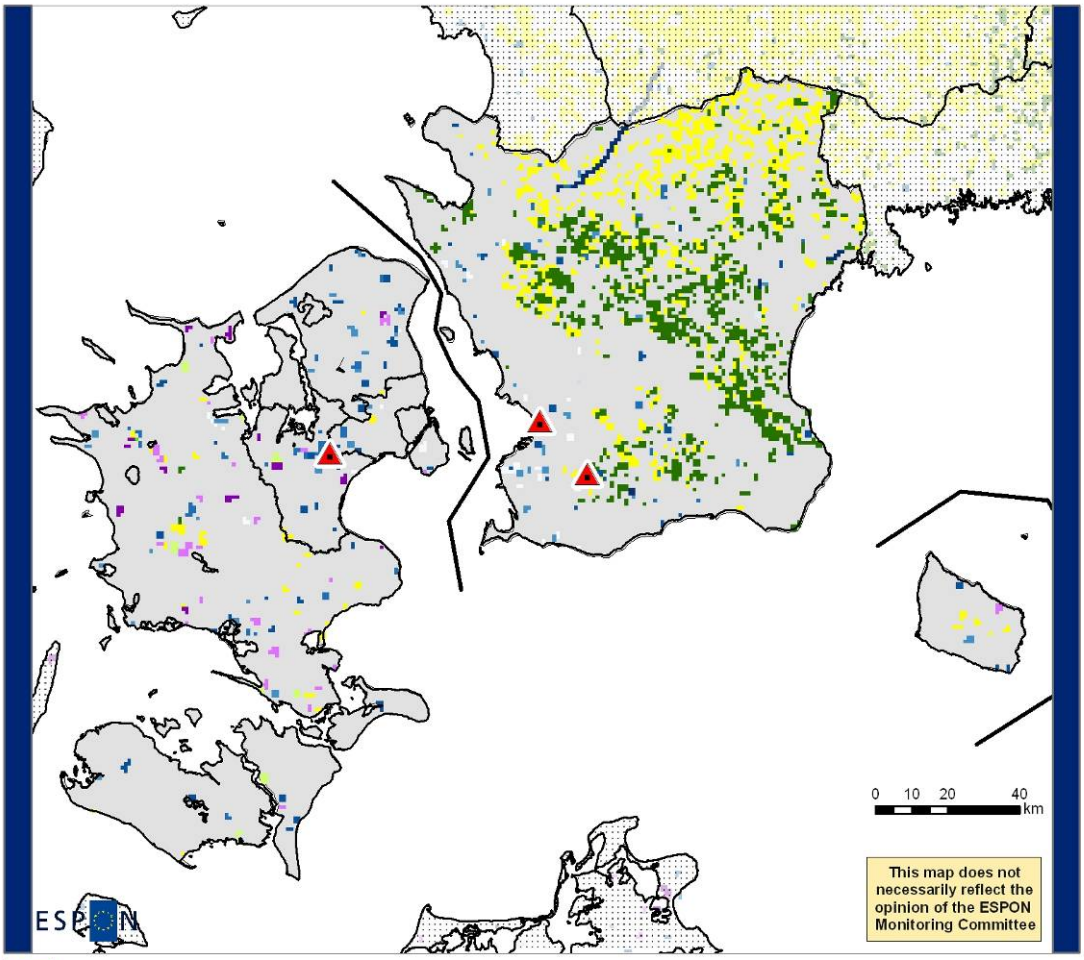


Figure 35 – Land Cover Flows 1990-2006

Source: Nordregio based on Corine Land Cover

Second Level Land Cover Flows 1990-2006
Øresund Region

Sprawl of Economic Sites and Infrastructures,
Withdrawal of Farming, Forests Creation and Management



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Regional level: NUTS X
Source: CORINE, 2012
Origin of data: CORINE, 2012

Land Cover Flow Types

- Construction
- Sprawl of airports
- Sprawl of dumpsites
- Sprawl of harbours
- Sprawl of industrial & commercial sites
- Sprawl of mines and quarrying areas
- Sprawl of sport and leisure facilities
- Sprawl of transport networks
- Withdrawal of farming with woodland creation
- Withdrawal of farming without significant woodland creation
- Conversion from transitional woodland to forest
- Forest creation, afforestation
- Forests internal conversions
- Recent fellings, new plantation and other transition
- Points of investigation
- National boundary
- Regional boundary
- Case study region
- Areas outside the region

Land cover flows are shown for the 1990-2006 period in Denmark and the 2000-2006 period in Sweden

Figure 35a – Second Level Land Cover Flows 1990-2006

Source: Nordregio based on Corine Land Cover

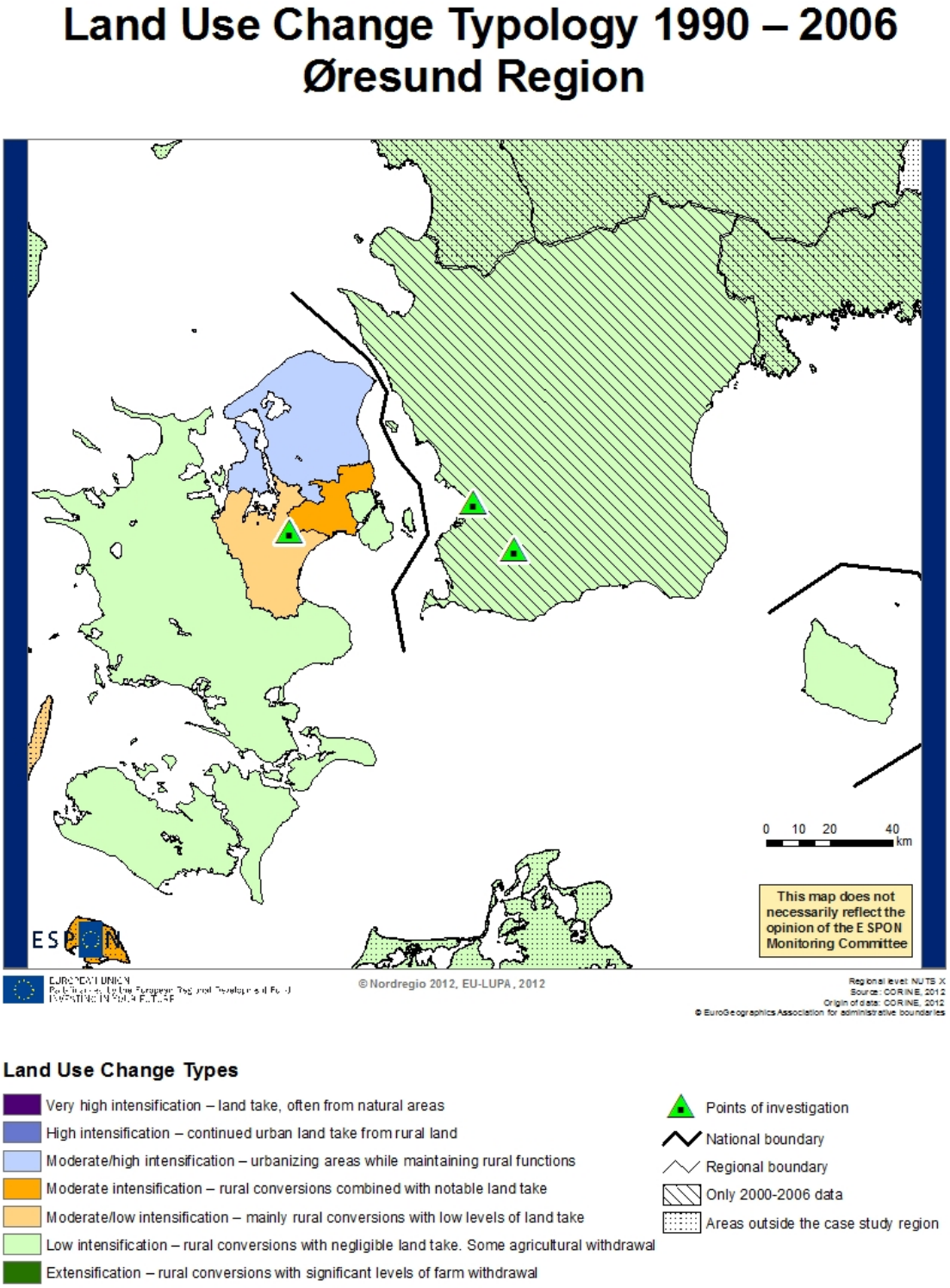

Figure 36 - Land Change Typology 1990-2006
Source: Nordregio based on Corine Land Cover

4.2. Trends, actors and drivers of the changes (micro and macro scale)

Like other parts of the Western world, the Øresund region is in a structural transition. However, there are considerable differences within the region regarding the extent of

this transition. Between 1993 and 2007 the share of value added from agriculture, forestry, hunting and fishery declined from 0.5 to 0.3% in the capital region, from 3.5 to 2.5% in Zealand region and from 2.8 to 1.5% in Skåne region. In that period the reduction of employees number in the first economic sector was of comparable scale. In the capital region there was a decline from 0.9 to 0.6%, in Zealand region from 6 to 3.7% and in Skåne region from 3.1 to 2% (*Øresund Trends 2010*).

A general situation of land use structure change in the recent years is influenced not only by the agricultural economic situation, but also by a strong pressure of new investments of agglomeration development. The significance of rural landscape becomes more crucial, as it is protected by some of municipalities and national law regulations. Such protection became the other side of main front of changes actors. Among the others, the regulations of immigration to Denmark should me mentioned, as these are very restrictive in comparison to Sweden.

Needs of new housing area are the leading ones. Their basis lies within Copenhagen and Malmö surroundings with labour market opportunities. In further localities, the purposes of housing pressure is changing gradually in favour of landscape, preserving the traditional rural and coastal landscape. These areas are most valuable. However rural landscape was well protected during the past decades by general plan of Copenhagen development, called “five fingers plan”. The plan assumed new investments along the coastal line and the main transport corridors. Between these there are agricultural areas. The most effective administrational barrier to protect it, is to forbid new settlement building in rural areas. Despite of it, agriculture is retreating gradually further from Copenhagen and Malmö to Jutland and to the new EU-member states under the economic pressure.

Apart from rural landscape preservation by law and increasing value of plots intended for housing, another growing power is the knowledge industry and research activities, which are moving to rural areas to work in more natural landscape and clean conditions. They are interested in preserving such conditions on rural areas and have sufficient arguments as the sector develops. An example of such localization of an institution on rural areas is the new Nokia technological centre nearby Copenhagen.

Changes in the agricultural land use rely on intensification pressure, especially in the pork production. In the rural areas, especially relatively close to Copenhagen and Malmö, the important support of the landscape protection from agricultural production intensification has an economic basis. It relies on increase of value of properties situated in traditional rural landscape. That is why multi-functionality of such areas is introduced effectively. The functional changes of land use in rural areas are far stronger than changes in land cover structure. However they are gradually appearing in the agricultural land area reducing as well.

4.3. Contemporary and potential conflicts

The most important contemporary and the most likely future spatial conflict is related to the intensification of pork production, which has an impact on preservation of traditional rural landscape in the region and is lowering the land prices in the municipality. This conflict is related especially to the trends observed in Danish agriculture. It can be solved by moving part of Danish farms conducting intensive pork production to the new UE-member states in the future. Agricultural land prices

difference is conductive to it, so this process will appear probably just after buying the land by foreigners allowed in new member states.

There is no real threat of conflicts related to new transport or industrial areas developing. In the framework of new transport investments a huge external corridors are planned rather than new routes through the region. The only possible strategic future transport investment in the region is the new bridge between Denmark and Sweden. The possible two new external gates from the region are the tunnel under Fehrman Belt straits from Zealand to Germany in 2018 and a direct bridge between Zealand and Jutland Peninsula in Aarhus surroundings in further future. Such new transport areas can appear in the capital region to attend raising number of daily commuters. New industrial areas will be rather rare as well, because the number of employees in manufacturing industry including construction is decreasing. This sector accounted for approximately 15% of total employment in the capital region, 22% in Zealand region and 23% in Skåne (*Øresund Trends 2010*). Even if the manufacturing industry were to decrease in all three areas, the reduction would be the greatest in the capital region. In all three parts, business services and wholesale and retail trade are outstanding.

4.5. Scenarios

Instead of traditional industry, high-tech sector is developing very fast. It demands very often clean environmental conditions, like e.g. computer related operations, medical and surgical equipment production, social science, consultancy regarding machinery or optical instruments and photographic equipment. The scenario of future development focused on high-tech manufacturing industry and service production is most likely, what can be supported by 2.6% of Danish and 3.9% of Øresund region GDP deducted to the R&D expanses (by OECD, 2007).

The process described above will be probably followed by further retreating of agriculture from the centre of the Øresund region and possible moving some of the big intensive farms with animal production to other countries. These will be forced to adapt by changing circumstances and growing needs of unpolluted environment for high-tech activities development and live in the region. To prevent it, gradual shifting from agriculture for leisure activities function of the land use in rural areas will take place. Different situation will take place in the areas of the Øresund region further away from development core. They can change the land use in connection with needs of energetic plants cultivation. Shifting from intensive pork production to the bio-energy production can be the most important direction of land use changes in agricultural areas.

Less likely, but possible scenario to be taken into consideration is that the agriculture in Denmark and Sweden, like in all Western Europe, will be forced by the international situation to face with an increased demand for supply than today. In this pessimistic scenario agriculture will come back to intensification of food production, which will be unfavourable to landscape and land use structure in the Øresund region. This scenario can mostly influence the land use changes in Swedish part of Øresund region, which has a great importance for the Swedish agriculture.

5. MULTIFUNCTIONALITY OF LAND USE

5.1. Functional differentiations

The Øresund region has a clear functional spatial pattern. In the centres of Copenhagen and Malmö agglomerations services dominate. In the surrounding of these cities centres there is a zone of settlement with housing areas and transport corridors. Close to transport hubs very often the areas of industrial activities are situated. Transport corridors with settlements are located also along transport corridors towards North and South along the coast line, in other three directions West from the city centre in Copenhagen case, according to “five fingers plan” and in the other two directions East from the city centre in Malmö case. Along the coastal line, but further from the agglomerations there is second houses area, the broader, the better accessible city centre is. In some towns of this zone, like Kalundborg, Koge, Helsingborg, Helsingor, Trelleborg, Ystad or Ronne on Bornholm Island, there are also relatively important international transport hubs with commercial ports or intermodal terminals. These are centres of logistics, trade and other services related to the function of such town. The most of Zealand area has a rather agricultural character with strong multifunctional land use for leisure activities, recreation and sport. Bornholm Island distinguishes strong role of tourism apart from traditional agriculture. Swedish interior has an agricultural function as well, but more extensive and with significant impact of multifunctional rural areas and, especially forestry.

5.2. Current multiple uses of land

Current state of land use is strongly diversified on all the region surface. A common example of multifunctional land use is joining of agricultural producing with functions of horseback riding area and wind power station. Also active environmental protection in national park favours multifunctional land use, like landscape protection joined with among others agricultural and forestry production or recreational activities. The coastal residential area joins prevailing housing function with recreation, tourism, energy production and small businesses, which do not require large area. Many of smaller farms nearby Copenhagen agglomeration are organic due to a big demand for healthy food in the region. Multifunctional land use became very effective in economic sense as well.

An example of industrial areas land use change last decades is I/S Hedeland, where a huge gravel and clay mining area on the outskirts of the capital region was converted in a big extent into leisure activities with all infrastructure and of very diverse forms. It was possible as a result of gradual buying land from companies by organization of three communes and two counties for that aim. In this area of artificial landscape there are among others: golf club, horseback riding paths, race track, amphitheatre, old railway, ski lift or wine yards.

5.3. Potentiality of multiple uses of land

Probably due to economic circumstances the number of functions will be still increasing. Popularity and demand for organic farming in the neighbourhood of Copenhagen agglomeration and future possibilities of moving large-scale market oriented farms to other countries with lower land prices and less restrictive

environmental protection will be helpful in introducing multifunctionality into rural areas as well. Function of agriculture will change to good quality food production source, not an economic activity only. Moreover, organic farming is easy to combine with leisure activities and rural tourism development, what is economically effective as well. This trend is observed currently.

The next very strong driver of future multifunctionality introducing will be the demand of joining agriculture and environmental protection with energy production, which will become more expensive. That is why introducing wind power stations in new areas and combining it with the other functions of land use will become necessary. Approximately 25% of Danish electricity is produced by windmills. The government policy is to double energy production from renewable energy sources during the next 20 years. However it will have a negative impact upon multifunctional land use, because the windmills limit recreational or residential function and disturb environmental protection in the surroundings. It drives to a current process of retreating windmills to sea surface, but in the future it may become insufficient.

Another aspect is the change of agricultural land cover caused by energy production demands. Even currently biomass plants are becoming more important as the energy source, especially the willow. Such land cover means nominally a multifunctionality increase as adds energy production to traditional rural functions, but due to growing densely and creating non-interesting landscape it limits other functions introducing. Less problematic for the landscape and multifunctionality is rapeseeds cultivation for bio-fuel.

We can expect a dynamic development of high-tech industry and research centres in rural areas as well. It will become necessary due to both better conditions to such activities compared to the city centre and land prices differences. Organic farming helps rural municipality to attract such enterprises.

6. POLICY CONTEXT OF LAND MANAGEMANT

6.1. Land use in the regional/local documents

Regional planning law and responsibilities division has changed in Denmark with the administrational reform in 2007. There were 13 Amts and 271 municipalities before. Now the administrative units are enlarged and joined into 5 regions and 98 municipalities. Most of municipalities has over 20 thousand inhabitants nowadays. In Skåne among 33 municipalities 15 has over 20 thousand inhabitants and 31 over 10 thousand inhabitants.

In previous administrative system the Danish municipalities were too small to shape land use within. Then responsibility for land management was at country and regional level. There were 12 regional plans, 271 municipal plans and about 1300 local plans. In new structure, the national planning is strengthened, there are 5 Regional spatial development plans and responsibility is moved down, to municipalities, which were enlarged. Especially rural ones are responsible for spatial planning to a greater extent, because they do nor require permission on higher level for land use changes conducting, so they are able to perform a more complex planning. Impact of administrative change will be seen in the next 10 to 15 years.

In Sweden, the national law includes regulations that limit the rights of the municipalities, which have responsibility for the physical planning. National law regulates issues like areas of national interest or along shorelines of lakes and rivers. The central agencies provide advice for municipal planning. The county administrative board has to consult with the municipalities their plans and do the monitoring of handling national interest in municipal planning. They are also first appeal instance and can revoke municipal plan. Municipalities have planning monopoly, so called "*planmonopolet*". They produce comprehensive plans, detailed comprehensive plans, detailed development plans, area regulations and give building permission. Plans elaborated in municipalities can be revoke at national level.

In 2007 in Denmark there was a reform, both in terms of administration and development planning.

At the previous stage used the National Strategy and the 12 Regional Plans, 271 Plans and 1300 Municipal Premises Plans. After 2007, the authorities use the Strengthened National Plan, 5 Regional Spatial Development Plans, 98 Municipal Plans and as before 1300 Local Plans. The transition period to amend is the years 2006-2009.

Documents:

1) Øresund region

To maintain a high level of cooperation on both sides of the strait, Øresund Committee has formulated the Regional Development Strategy, which has horizon till 2020. The strategy includes 4 main aims:

- Knowledge and innovation,
- Culture and events,
- A diverse, yet cohesive labour market,
- Accessibility and mobility.

The Øresund region should be working on six fronts:

- using Öresund Direkt as a channel for providing an overview of the existing opportunities, regulations and frameworks;
- creating a strategy so that the knowledge resources represented within the region can be efficiently and effectively utilized to stimulate growth;
- initiating a process that enables children and young people to acquire knowledge of the cultural heritage and opportunities that arise on both sides of the Sound;
- improving opportunities for creative enterprises, art and knowledge based companies to work together on both sides of the Sound;
- improving the dialogue between Sweden and Denmark concerning investments in roads, railways, ports and airports;
- developing clean-tech solutions and promoting sustainable urban development to pave the way towards hosting a regional EXPO in 2022.

2) Copenhagen Region

a. Finger Plan for Greater Copenhagen

In 1947 two Danish architects Peter Bredsdorff and Sten Eiler Rasmussen presented the Finger plan for the development of Copenhagen. As the central city followed an existing compact city centre of the 1940s, and the fingers pointing along existing and future cities, he draped on infrastructural corridors radiated in five directions from the centre. The urban landscapes proper of Copenhagen comprise densely built parts in the city centre and in the local centres along the major traffic route. It should be noted that spatial models for urban development can be greatly influenced by the conditions of differences in natural environment (e.g. hills or wetlands) that impose constraints on urban development.

For 60 years, the "Finger Plan" was the basis for urban development, infrastructure and landscaping for the entire metropolitan area, and this influence is visible in space, and the landscape nowadays.

The plan in great detail indicated the direction in which space should be utilized within the "fingers" or in terms of land development, recreation and infrastructure. The authors devoted less attention to sites of "between the fingers", just defining them as green areas, consisting of farmland, forest areas, lakes and the Øresund coastline (the North and Helsingør, and to the South towards the town of Køge.

7. CONCLUSION

The major land use change in the Øresund region during the last 25 years was recreation and residential area increase. This was an effect of urban sprawl, suburbanization, summer houses building expansion as a result of living standard improvement and transformation of rural areas for leisure activities with a lesser agricultural production function. General framework of regional spatial plans, especially in the capital region, were relatively effective in protecting the environmental (green) corridors, but to a less extent regarding traditional rural landscape of Danish rural areas preservation. However, due to the urban sprawl and agglomeration functions pressure, the agriculture was gradually retreating to more peripheral areas and to Jutland.

Simultaneously, industry transition to high-tech branches occurred, what brings today an impact on clean environment and well-organised landscape in agglomeration surroundings. In respect of transport infrastructure investments, the railway and bicycle transport networks development is currently a priority. Road investments are and will be taking place in the Copenhagen suburbs.

Energy production demands is another new driving force of land use changes within the region. The spatial conflict of wind power plants with other functions is a barrier in introducing them into the rural landscape, but concerning the future energy prices increase, it seems to be necessary as well as a broader introduction of plants cultivated for energy production purposes like willow *(salix)*.

The 1990s and 2000s were the period of transition of the Øresund region from traditional forms of agriculture, industry and transport to more corresponding to the modern challenges. It reflects in contemporary land use changes and this process will probably accelerate due to some inertia after demands change last years.

Field studies seem to be a proper method as an attempt of typology verification. Although the conclusions and observations should be selected according to the scale of typology itself. Thus general assessment of the typology is rather positive, because specific and the most extreme land use changes have been proven during the investigation. A few mistakes detected should be treated rather as difficulties of typology verification method, not the defect of the typology itself.

Nevertheless, one extremely important conclusion considering typology and its general assumption needs to be stressed. All investigations are taking into consideration land use changes in spatial dimension, expressed as an area of land use changes, even if they are described by the functional change. In some cases, like e.g. square 2. (see appendix 1), it could be misleading, because the importance of functional changes of land use cannot be measured by the area of changes.

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- Ten years, the Øresund bridge and its region http://uk.oresundsbron.com/page/34

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European Land Use Patterns

Appendix 1

Verification of land use changes typology in practice

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Land use changes discovered by Corine Land Cover pictures analysis were verified in practice by field study of three cases in the Øresund Region. Verifications were carried out by the sample of three squares 1 km x 1 km, where the changes were the most intensive in the region, but were processing in different directions:

- square 1. is situated in the south-western edge of the Greater Copenhagen Region, approximately 4 km south-east from Roskilde (town of about 45 thousand inhabitants) and about 40 km to the west from Copenhagen. It is situated inside Hedeland – former 15 km^2 area of gravel and clay mining, today leisure activities area. The square is distinguished for very strong intensification of land use.
- square 2. is situated 1,5 km from the seashore, to the north of Lomma (town of about 8.5 thousand inhabitants, approximately 5 km to the north of Malmo). The square is distinguished for very strong extensification of land use.
- square 3. is situated about 2 km to the north of Svedala (town of about 9 thousand inhabitants, approximately 13 km to the south-east of Malmo). The square distinguishes forest intensification.

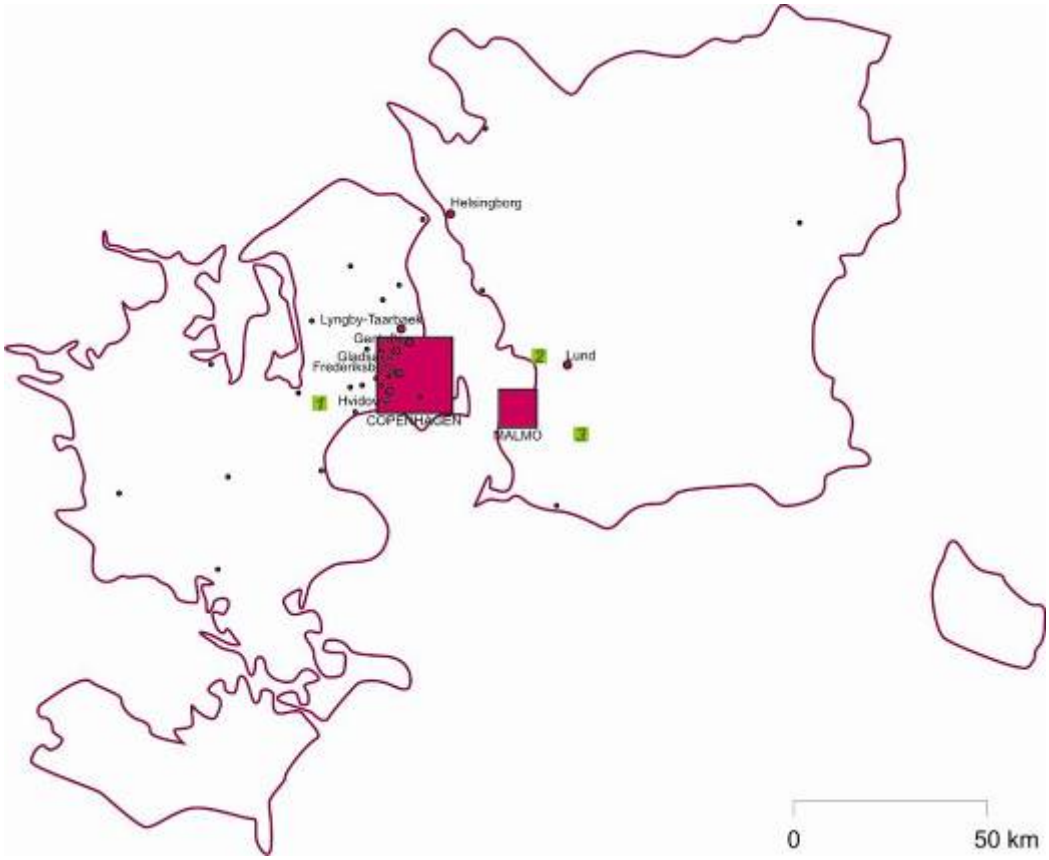


Figure 37a – Map of the Øresund Region and points of typology verification.

Source: own materials

Square 1.

The geographical coordinates

N 55°37.062’

E 12°09.899’

The land use changes in the square are associated to the function of Hedeland. Since around 1900 it was a clay and gravel mining area. In 1978 it was declared by 5 administrative units (3 communes: Hoje-Taastrup, Roskilde and Greve, 2 counties: Copenhagen and Roskilde) as 1500 ha of sport, recreation and culture area. Today these functions are existing thanks to, among others: artificial slope for skiing, tourist railway, mini railway, horseback riding routes, golf course, race-track, amphitheatre. On the basis of the interviews with inhabitants and operators of institutions situated in the area, it can be deducted, that the only land use change with significant spatial scale inside the square 1. is related to the new “Nature power fitness-bane” building. The other vast artificial areas changes took place in the 1990s. and before. Intensification of land use in the framework of the agricultural activities relay on the vineyards cultivation area increase on the southern artificial slopes, thanks to specific local microclimate.

In this case general direction of land use changes is properly recognized on the basis of Corine Land Cover images. Although the intensity of land use changes is far weaker than in the 1990s. or before, when new functions of former industrial Hedeland area were planned and introduced. Due to that contemporary processes are reflected in the land use changes typology correctly, however they do not fit to the type in typology in the dimension of their dynamics. The reason is the age of the last Corine Land Cover image from 2006, which was taken into consideration. Typology of land use changes itself illustrates processes correctly in this case.

Figure 38a - Part of Hedeland is still utilized as a mine

Source: own materials

Figure 39a – Part of Hedeland with the amphitheater and lake.

Source: own materials

Figure 40a- Golf Club

Source: own materials

Figure 41a - Nature power fitness-bane

Source: own materials

Figure 42a - Nature power fitness-bane

Source: own materials

Figure 43a – The pathway for horses

Source: own materials

Square 2.

The geographical coordinates

N 55°41.068

E 013°05.313’

The major contemporary land use changes are related to the spatial conflict between environmental and transport purposes of land use. The analyzed area has a nature reserve *Ostra Dammen* inside, which protects pond wildlife. On the other hand there is a motorway junction Copenhagen-Malmo-Goteborg-Oslo about 0.5 km to the east. There is an important bus stop for numerous daily commuters of Malmo and Lund, a transfer point for suburban buses. There are several new buildings related to the transport services, e.g. petrol station. There are new investments started as well, like McDonald’s restaurant building. Under new investments and increased traffic pressure, wildlife reserve was fenced and information tables were placed.

New investments seem to be built up between 2000 and 2006, so probably in majority they influenced intensification of land use in this period. The estimated age of many new buildings is confirmed by analysis of the Google Earth images since 2005. Extensification of land use detected on the basis of Corine Land Cover images from 2000 and 2006 analysis under the influence of changes within agricultural land use, which still dominates. However the functional importance of these changes is weaker than the importance of changes related to new investments described above.

Figure 44a – The nature reserve Ostra Dammen

Source: own materials

Figure 45a - The fence of the reserve, located along a busy road

Source: own materials

Figure 46a – The bus stop located near the reserve Ostra Dammen.

Source: own materials

Figure 47a - Service buildings located on the opposite side of the road, near the nature reserve

Source: own materials

Square 3.

The geographical coordinates

N 55°32.374’

E 013°16.271’

The land use changes in this case can reflect processes in the Skåne rural interior, the most densely forested area in the Øresund Region. The square surrounds Yddingesjon lake, (approximately 3 km^2), and is situated on the southern-west of the Holmeja village. This case was chosen due to land use changes in the framework of forests detected. The character of this square indicates a strong role of recreational purposes of land use during the last decades. There are many kilometers of horseback riding paths and old Bokskogens Golfklubb in the area. The most important new investment is big horseback riding arena. The forest takes relatively small area in the square. Inhabitants indicated, that the most important land use changes last time have taken place just to the east of the square, where the forest was partly cut down due to tree disease a few years ago.

In this case the type of land use changes reflects the reality, but shifting of the square was recognized. Changes of land use inside the forest were detected a few hundred meters to the west in real life. However in the scale of the whole elaboration and for the general conclusions from the land use changes in EU such mistake cannot change anything. This has no significant impact on the assess of the quality and accuracy of typology itself as well.

Figure 48a - Woodland and recreation area

Source: own materials

Figure 49a - Horseback riding arena

Source: own materials

Figure 50a – Yddingesjon lake

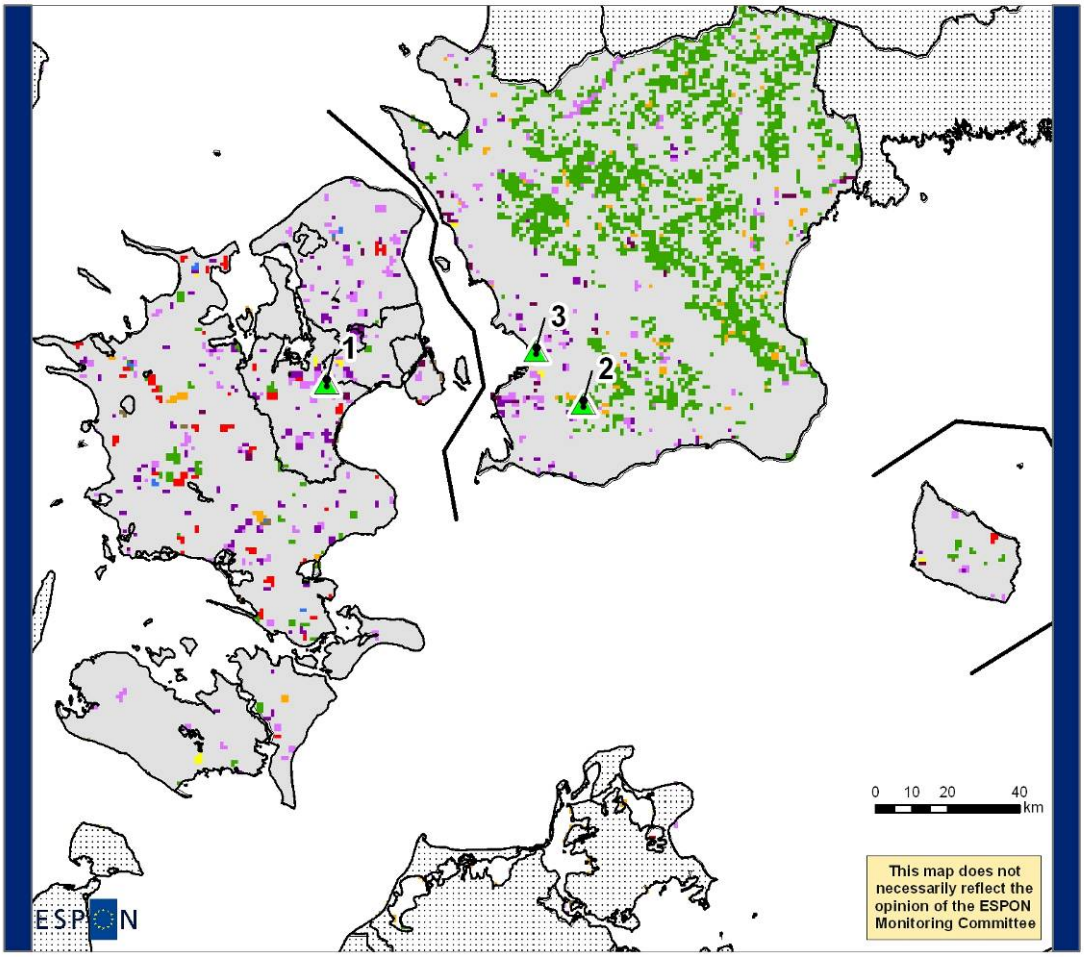
Source: own materials

Conclusions:

Field studies seem to be a proper method as an attempt of typology verification. Although the conclusions and observations should be selected according to the scale of typology itself. That is the reason why general assessment of the typology is rather positive. Specific and the most extreme land use changes have been proven during the investigation. A few mistakes detected should be treated rather as difficulties of typology verification method, not the defect of the typology itself. Some mistakes are simply the result of the lack of new data.

Nevertheless, one extremely important conclusion considering typology and its general assumption needs to be stressed. All investigations are taking into consideration land use changes in spatial dimension, expressed as an area of land use changes, even if they are described by the functional change. In some cases, like e.g. square 2., it could be misleading, because the importance of functional changes of land use cannot be measured by the area of changes.

Points of Investigation in Case Studies
Øresund Region



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INVESTING IN YOUR FUTURE

Regional level: NUTS X
Source: CORINE, 2012
Origin of data: CORINE, 2012

Land Cover Flow Types

- Urban land management
- Urban residential sprawl
- Sprawl of economic sites and infrastructures
- Agriculture internal conversions
- Conversion from other land cover to agriculture
- Withdrawal of farming
- Forests creation and management
- Water bodies creation and management
- Changes of Land Cover due to natural and multiple causes
- Case study region
- Areas outside the case study region

- Points of investigation
- National boundary
- Regional boundary

ID	Land cover flow	Land use type	Coordinates (WGS84)	
1	Urban land management	Suburban residential and economic areas	55°37'01"N	12°09'43"E
2	Forests creation and management	Rural forest	55°32'28"N	13°17'15"E
3	Urban residential sprawl	Urban cores and metropolitan areas	55°40'39"N	13°05'24"E

Land cover flows are shown for the 1990-2006 period in Denmark and the 2000-2006 period in Sweden

Figure 53 – Points of investigation

Source: Nordregio

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Appendix 2

Field study – interviews questionnaires

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Region: The Øresund Region

Place: University in Roskilde

Person interviewed: Rasmus Ole Rasmussen

Interviewer: Mariola Ferenc, Marcin Mazur

Date: 24.10.2011

I. Socio-economic factors of land use change

1. **Could you describe the main demographic processes in the region: migrations, birth rate, etc.? What is their impact on land use?**

First of all, the Øresund region is a growth pole in general, when you look at the Nordic countries. We should be aware, that a lot of issues, which we are talking about, like the development, we should regard Denmark together with the other Nordic countries. It's because we had more than a hundred years of cooperation. It means that things happening in Denmark will be depending on what is happening in other Nordic countries. Presently the universities offering studies in the Øresund region, especially in the Copenhagen Region are very attractive for the students from other Nordic countries. The major challenge for the Øresund Region is to keep the young people in a region. Having a bridge is also a country growth pole for both parts of Øresund.

Peace between Sweden and Denmark was back in the 16th century, and so for several hundred years Scania is a part of Sweden. Before that, it was a part of Denmark. Nationally and historically it is a problem for the Danish, but for Scanians even more. There is a liberation movement in the Scania Region, the political party, which wants to make Scania a part of Denmark again. It is a popular trend among Scania's people, because the demographic linkage is very strong. Economically, there is some truth also, because this region is closer to Copenhagen than to Stockholm. There is 500 km from Malmo, the capital city of the Scania region to Stockholm. The region is a peripheral one in case of Sweden. It has been very natural to devote a lot of economic activities exercised in the Danish side, because an interaction is much easier. In Denmark, in Copenhagen, the labour force from the Swedish side is much more wanted than from the Danish side because the Swedes are often much more polite to the costumers. When you go to *The Fields*, which is the largest shopping mall in the Copenhagen area, most of the shops employed people from Sweden, more than from Danish side, because the Danish are more rude.

In the growth pole there is more young people, but when you look in details in region you will see also the ageing parts. You will find a central region, with Copenhagen, where mostly young people live. But an important issue is the distance, because if you make transportation isochrones of one hour from Copenhagen they would cover the whole region. You will be able to come from any part of the region.

In the Øresund region it is not so important where you were born, because people change their place of living a few times in their lives. Migration patterns in Denmark, in general, much more depend on where you are in your life cycle. When you are a young person, you are looking for a flat in the center of town, when you established

yourself as a family you want to move to the suburbs, you want the kids enjoy the environment, live in a small community. And then, when the children move from home the older people choose to settle in places like Roskilde or other medium size towns but still with this one hour transport to Copenhagen area. It's not necessary to live close to your family, because of good transport infrastructure. Family structure isn't important for migration issues, because Denmark is such a small country.

Movement is very high, and again it's about life phases. It is very important for where you choose to settle, much more than if it takes 20 minutes to work or half an hour or an hour. If you find a nice place that suits a phase of your life, you choose it.

2. **What are the main processes and trends of settlement? What is the impact of new settlements on land use and spatial organization? Is there a lot of new built-up areas? What are the forms: contiguous development, linear patterns, scattered development**?

New settlements have a huge impact on movements in all Zealand and are more wanted by people coming from other regions. The southern part of Zealand isn't being settled by young people and labour force, because they haven't got work there.

Also a part of Jutland it is threatened by depopulation. The problem with Odense is that the travel to Copenhagen by train takes 1 hour and 10 minutes. So Odense is a region, which loses population, while Aarhus, situated opposite, is the second largest town in Jutland. It is attractive for people in the Jutland region.

You will find some people who go to Copenhagen, get education and come back to hometowns, but movements are generally from west to east direction.

Women are more mobile than men; they tend to look for education opportunities. They are moving to the Copenhagen area and bigger towns.

All the areas around Copenhagen, Odense and Aarhus are the places with domination of women, especially young. The peripheral area is dominated by men, basically men, who depend on traditional economic activities, while in urban area you can find new economic activities.

But also a good connection with core development can be a threat. If you build a bridge from land to island, it will make an outflow of population. Very often when you build infrastructure you expect that it will help a peripheral region but in fact it is in many cases the opposite way.

In Denmark the legal setting is that you divide between urban and rural regulation of the land use. In practice you cannot go to rural area and start building a town; you need to have municipal governments agreement and also regional governments approve and sometimes the state approve to start build a house in rural area. Because it is supposed to be rural, farming areas, not residential areas. But during the last twenty years the flexibility has increased, 20 years ago it was very difficult to get permission to establish a new town in rural areas. You were supposed to focus on development within what has already been designated for given activities. It is easier now and this has a huge impact on settlements. All Copenhagen area is becoming the region with new settlements and larger concentration of population.

Not in central Copenhagen, because this area becomes a business district. But all the suburbs around Copenhagen and then along the transport routes, where Roskilde is situated.

The settlements are rather linear, but that is a strict regulation. The Copenhagen area has been very well know for the “Finger Plan”, because if you put palm on Copenhagen, you will see that all transport lines are like fingers and green areas are in-between. It is still attempted to maintain that structure, that you have green wedges going into town areas.

The Zealand is an island, so the area is limited. The bridge connections make “fingers” longer, but also we have limitations in the traveling isochrones.

3. **What are the main processes, directions of changes in the field of agriculture (extensification or intensification, changes of fields spatial structure and crops structure)?**

Areas around cities used to be intensification areas, but nowadays it’s changing.

Good infrastructure and small surface of the region caused, that farmers can locate their farms in the periphery and wake up early in the morning and go to the city with their fresh products. They are not depending that much on being close to the town. Instead some of the agriculture areas around Copenhagen have become investment areas, so investors buy them and expect that within ten years the government will convert these areas from agriculture areas to building areas and they can gain a lot of profits. And not having many expenses in having the area – they can just leave it with no agriculture productions.

When you see how permission was distributed during the last 20-30 years it is a very sensible investment. Investors just need to have money and can wait 10 years for the profit.

The next reason why the areas are not used for agriculture production is the European Union agriculture policy: UE paid for not producing in some areas.

The third parameter, also important, are new activities such as horseback riding which has become extremely popular for children. Everybody can buy a farm, which was highly productive twenty years ago, a dynamic production farm producing pork for instance. The production stopped (the neighbors are also happy about it, because their life quantity increased) and new owner bought 20 horses and established a horseback riding school.

Intensive agriculture area has changed, Jutland has become an area of more intensive agriculture production, while Copenhagen area has become more extensive. This area is gaining a more multifunctional profile: an area with organic production of vegetables and fruits, which are very highly priced, with a horseback riding and sometimes windmills; the net profit will be higher than when the land was used for intensive producing.

The farming houses are not disappearing because they are very much wanted as residential houses for people working in towns. 15 years ago there was 200 000 farms, today it is less than 50 000 in Denmark. There is a constant decrease in the number of professional farms. On the other hand, there is a significant increase in the number of organic farms, which are usually very small. Organic products are very much wanted in Denmark. Especially organic milk: most of the intensive production of

milk takes place in Jutland, especially in southern part of Jutland. In the Zealand Region there are a lot of small milk farms, which sell it as organic. Milk is the most wanted organic product.

There have been a lot of changes in crops structure in the Øresund Region, what we can see in the landscape. 20 years ago in Zealand all the small lakes and hedges tended to disappear. There are a lot of investments in areas for not producing agriculture products but to gain profits in case of converted agriculture areas into residential ones.

4. **Are there such processes like: changing agricultural function of areas into other functions? Building-up areas of fertile soils? Increasing/decreasing the share of uncultivated land? Please describe briefly the processes concerning changes of agricultural land use.**

According to the soil map of the Øresund region, up to the north of the Copenhagen area there are poor soils, the central part of Zealand has fairly good soils and in the south there are excellent soils, but the best soils are treated most extensively. It is simply because people are moving out from these areas. People there have the monopoly of producing sugar beats for sugar production. Historically they have close connection to Poland because when the sugar industries developed after 1900 there was a huge immigration of Poles. Now there is a high population outflow and a lot of economic problems: the ageing of population, relatively high unemployment. People who no longer can afford an apartment in the Copenhagen region tend to move to this area, because there they can get an old farm house for almost nothing. And this creates a lot of social problems: especially drug addiction.

Uncultivated land area is still increasing. You can see on the maps that intense agriculture lands were converted into more extensive ones. There are new functions being developed including other than agricultural purposes such as horse riding for instance.

5. **What are the main processes in the field of industry and technical infrastructure (new plants, industry centers, roads, railways etc.)? How would you assess its influence on land use?**

Industry on this area, especially black industry is of little importance. Mostly industries in Denmark have a knowledge component included. In general, the majority of traditional, black industries have collapsed totally.

Denmark does not have much ore material like iron, lead and coal because almost all area was created by the ice in the ice age, except for one island. Instead, Denmark is rich in gravel and sand used in construction industries. Roskilde area has been one of a major producer of these materials for constructing Copenhagen buildings, but now they are created as residential and recreation areas (like Hedeland). 20-40 years ago producing gravel materials was an important issue. Nowadays, sand is mostly obtained directly form the seabed.

The transport infrastructure is developing, but the two path road from Zealand to Copenhagen has become a bottleneck. Every morning there is a traffic jam about 10 km ahead of Roskilde up to 5 km past Roskilde, people often spend 3-4 hours driving. It’s faster to go by train. There is a constant pressure on expanding the transportation network.

The new government has the idea to introduce payment for entering Copenhagen by car, it's expected that this will reduce the traffic jam and facilitate the transfer of people from cars to train and public transport system.

6. **What are the main processes in the field of tourism and services? Is there any development of tourism infrastructure (new hotels, holiday centers, swimming pools, tourist roads)? How intensive is the development in the spatial context (spatial extent of new areas used for tourism purposes etc.)?**

The Øresund region has a lot of coastal areas which are very popular, both for residential and tourism purposes.

Moving north along the coastline from Copenhagen, there are mostly huge houses, where the well-off people live. The whole coastline is covered by residential areas, as the distance from Copenhagen increases the cheaper the houses, but still relatively expensive.

This is a multifunctional region, due to the Danish law regulations that ensure public access to all areas. Therefore the coastline is considered as a public area. This means, that you can buy the house, which is situated next to the sea, but you cannot prevent visitors, who go along the coast. You cannot monopolize these areas.

The coastal areas are also attractive for business, which does not require a large area. Previously some of these areas introduced windmills, and it was very popular, people invested in windmills, which produce electricity. Nowadays residents and tourists have objections about the noise and disturbed landscape.

In the region it is easier to get a permission to build a residential house than to build a hotel.

The ex-hub areas were converted into residential areas, and this trend is in every town. The coastal transport does not function any more. The Copenhagen harbor area was also converted into residential area.

It's interesting because the region shows a combination of residential areas, knowledge based industries, tourist places and cultural activities.

7. **How would you describe and summarize the general conditions of economy in your region and its impact on land use? Please refer also to employment issues.**

It depends on how you define land use; people working in agriculture think of land use being what is grown on the fields, what kind of plants, but due to its multifunctionality the land use is much broader. Very often what is growing on the field is a secondary issue.

A lot of knowledge industries and research activities are moving to rural areas because people want to work in nice green conditions, Nokia for instance has a big technological center near Copenhagen, but in a green area. The consequence of land use is that the productive part has nothing to do with land cover. That's why

economy plays a huge role in land use, not because it is important what's grown but it is important what's taking place in the area.

Land use has therefore different dimensions.

II. Environmental issues

1. **Could you describe the main changes of natural areas in the last five decades (changes of forested areas, biodiversity, water conditions)? Has the spatial extent and condition of areas of high nature value changed in the last five decades?**

There are policies in Denmark concerning expansion in forest area, which means that as much land as possible will be converted into forest areas. The wooded areas in Denmark take 10-15% of land cover and the intentions are to increase them up to 20-25% in 5-10 years.

There are protected areas in Denmark, where you are not allowed to do some things, e.g. dig up orchids.

One of the major issues in protecting areas in Denmark today is not to protect areas by preventing people to access them, but to maintain a diversity of activities, which they can perform in these places.

The first national park in Denmark was in Greenland, because it was far away and easy to establish a national park. Creating the national parks hasn't had a big impact on land use. Some of these protected areas were more open to public access. According to the Danish law, all areas should be of public access; nobody can prevent people from going on some area.

The National Park of Zealand was established 5 years ago. There is generally no tradition to have national parks in Denmark. Only some spots of most valuable land were under protection. All the new national parks are multifunctional. This required maintaining agriculture, forestry, recreation and wide spectrum of activities. The idea is not only to protect nature but also to protect culture and the landscape. That is the major difference comparing to other countries, where environment is protected in a more passive way.

When you use national park for different activities you will have a higher biodiversity than when you will leave it to be monopolized.

The forest areas are increasing, one of the ideas is to have a combination of managed forest areas, but not just the pine forest. Some of them are managed for public access, others are very old forests, where no interference to the ecosystem is allowed.

There are two types of forest in Denmark: the national forests, managed by state for every citizen and private forests. Private forest owners have to complain for certain regulations. You can own the forest, but it will be still open for public access. There is a restriction what you can do in the forest, many of the forest areas are kept for hunting purposes. People pay a lot of money to have these permits for hunting. This is another function of forest areas.

There are some privately owned forests, which are strictly commercial, but typically not for pines, because Denmark is not able to compete with prices of producing pine trees in Poland or Sweden. In Denmark there are mostly beech and oak forests.

The coastal area in the Swedish part is similar to the Danish, because of open field, residential areas. The forest areas in Scania are much more popular for tourism purposes. A lot of Danish people have their summer houses in the Swedish side of Øresund in the forest. It's been popular for many years, about 50, that Danish people buy abandoned houses in forested areas.

2. **Please assess the main contemporary and future threats for natural areas (especially protected areas) in the region. How are they related to land use changes?**

Due to environmental regulations we had in Denmark back in the 1960s., we know how much pollution would be potentially emitted. There are strict regulations on filters, what you can do on land, how to protect water supplies. The biggest threat is agriculture, because farmers claim they are living in the nature and protect it, but they actually overuse fertilizers. They don't need to do that, we have in Denmark many organic farms, that prove that it isn't necessary to use chemicals. They do it because large production with less human labor involved pays better. Many of this terrible farms are now moving to Poland, because it's cheaper to buy large areas and start this unhealthy production.

Intensive agriculture is moving from the Øresund region to Jutland, for example. It's interesting what has happened to Danish agriculture in the last 30 years, because when Denmark joined the EU, people from Holland moved to Denmark and started production. And when Poland joined the EU, farmers from Denmark moved there. This trend is caused by the fact that land is cheaper and law regulations are less demanding in the new member states.

3. **Were there any natural disasters in the region in the last two decades which influenced the land use and land cover (floods, fires)?**

Flooding is interesting, because we often are thinking that climate change and sea levels will be increasing. There was some flooding in urban areas which has become an important issue. In many cases climate change is used as an excuse for flooding. We have a huge area covered with roads, buildings, the area where water can infiltrate is decreasing. People created these disasters. Even in the central part of Copenhagen there was a flood, a problem with a metro system, when there is too much rain in a relatively short time. But again, it has to do with sewerage system, which has not been improved or developed for years.

III. Multi-functionality

1. **Please name the socio-economic and environmental functions of land use in the region.**

The major socio-economic and environmental functions of land use:

- residential,
- agriculture (organic, intensive),
- recreation,
- industry with knowledge component,
- tourism,
- national park with many functions like agriculture, forestry, recreations and large spectrum of activities,
- transport,
- business centre,
- production of energy from renewable sources.

2. Multifunctional land use - which of the functions in your region co-exist?

They do not only co-exist, the farm owners create multifunctional land use: they produce on the farms, they have horseback riding activities, and some of them invest in windmills.

Also in national park we can find not just protecting function, but also agriculture, forestry, recreations and wide range of activities.

The coastal residential area performs also recreation and tourism functions. Small businesses can be found there as well.

3. Which of the functions are the most important in the context of land use?

In the Øresund region the residential function is the most important in the context of land use and to a great extent determines the overall land cover. It's important in the static land use; some regulations existent for 50 to 200 years so if you build a house, university or a shopping centre it will be there for the next hundreds years. So in that sense a static situation is created.

To some extent also forested areas, because the forest grows slowly and it is a long term investment.

4. Is the number of functions of land use increasing or decreasing?

The number of functions is increasing. The law in Denmark distinguishes between urban and rural areas; money from taxes, which you pay in urban areas is much more than in rural areas, so people who are using land for producing purposes want to keep them rural. But people who are looking for residential area are allowed to build in rural area and need to convert it into urban area. There are different interests in rural area.

5. **To what extent is the land in your region used in a multifunctional way?**

It's a very high extent, because of increasing number of functions. In rural areas the number of functions increases in a dynamic way, because farmers don't use land only for agriculture production, but also for recreation and energy production. The coastal areas are used for tourism, energy production, business and settlement (especially second houses). The protected areas are used for environment protection, maintaining the biodiversity, but also for recreation and agriculture. Urban areas have more and more green spaces, which are used for shorter visits, but also there are a lot of organic farms.

6. **What kind of functions co-existence is:**

a) the most effective?

Energy production, agriculture production, leisure time activities, like horseback riding but also using farm as a place for recreation, where you can spend two weeks, kids can pet the animals and enjoy the environment. Organic farming.

b) the most desirable?

Combination of living, working and enjoying environment seems to be in the case of Denmark a very efficient way.

c) the most common?

In the suburbs of Roskilde for example: residential area and also knowledge base, economic activities, research centers, producing pharmaceuticals. Very much depending on people, who come here and work in knowledge, live in residential area and between green spaces: a new forest was established.

d) the most difficult?

Preventing the intensive agriculture: abandoning the overuse of fertilizers. It has a huge impact on living conditions of the area, on ground water (because all drinking water in Denmark is from ground water). The poisons, which are used today don't have the impact now, but in 25-50 years time. Probably, the most dangerous for the environment is when too many economic activities involve soil interference.

7. **Which of the functions of land use are the most important for the future regional development?**

Energy production is the most important issue to replace the oil and coal industry. The major production of electricity in Denmark is based on coal. The country used to import coal from Poland, but now Denmark imports it from Australia. And only around 25% of electricity today is produced by windmills. The government policy is to double the production of energy from renewable sources in the next 20 years.

IV. Spatial conflicts

1. **Are there any conflicts related to land use? (As space is limited different actors compete to obtain the possibly largest area or their needs. For example: inhabitants strive to build houses, a businessman wants to put a plant or**

warehouse, there is a need to build somewhere sewage plant, administration of protected area tries to enlarge the area and so on).

A major point in this connection is that the spatial planning in Denmark is more focused on interaction between different types of land use. The changes in land use planning, which have been going on for the last 20 years. The idea is that you cannot do sector planning, you cannot do planning for agriculture or planning for residential areas separately, but you need to do complex planning.

2. **What are the "competing" actors and functions (environmental, agricultural, industrial, settlement etc.)?**

It depends on where in the region you are. Because people, who have the nice, big houses around coastline, are not interested in getting too many people visiting their neighborhood. That is one kind of conflict. Another conflict concerns the noise generated from the windmills. Thus, some recreation activities are in conflict with energy production. One of the consequences is moving the windmills further into the sea, but there are also people objecting for seeing windmills in the distance.

3. **Which of the actors are the most dynamic and successful in obtaining new land?**

It depends totally on what government is in power, because when you go back to the 1960s., the social democratic government started introducing these environmental laws, which protect the environment and at the same time supporting renewable energy development.

During the last 10 years the coalition government has been destroying a lot of the accomplished operations. For two months there is new social democratic government who claims, that they want to maintain the environmental protection not by privatizing it, but instead making a public access to environmental areas.

There was the municipality reform a few years before, when 2400 municipalities were converted into 98. Municipalities became larger and instead a lot of rights were given to determine how the land should be used. It's interesting to observe how this reform will have an impact on the land use.

4. **What are the most likely conflicts related to land use in the future and what could be their impact on land use?**

Besides windmills the biomass is the most important renewable energy source in Denmark presently.

All larger towns have a distributing system where a combination of traditional coal fired plants but also biomass plants become more important. The most efficiently willow (*Salix viminalis*) is a common crop for producing biomass. The willow needs to grow 3-5 years before it is high enough and most people do not consider it as a very interesting land cover. The rape field is an efficient way of producing oil, biofuel, but at the same time, in March, when it is white and yellow it might create a pleasant

scenery, but for the rest of the year it is not an interesting view. A very important law introduced by the previous government was that you cannot keep land uncovered from vegetation. When you harvest the rape seed you let the rape grow, to have a constant land cover. Whole idea would be to make sure that you make use of ecological nutrition and soils are available as well. This law protects the environment from erosion, from draining too much nutrition to the rivers, but again it is a question of how boring the landscapes are.

When you are driving across the multifunctional landscape you know that you are in a different zone and you enjoy the environment.

V. Government and policy

1. **Please assess the state and regional law concerning spatial management and planning in your region. Are legal rules effective in sustainable and rational land management?**

With the previous structure of the communes, their areas were too small to take the responsibility for managing the land, therefore all the planning was made at a higher level. But now it is in the municipalities hands, so basically we don't really know what happens until 10-15 years from now and what the impact will be resulting from this new structure. An important consequence of passing responsibilities down to the municipalities level will be that they have a close interaction with the population in these areas.

2. **Is the local and regional administration effective in land management and in preventing and solving conflicts related to land use? (Please describe and assess the issue and give some examples. Summarize the role of local and regional administration in management of land use).**

The local and regional administration is effective in land management and in preventing and solving conflicts related to land use. It goes back to the all legislations of development from the 1960s.; protection of the small rivers, small biotypes or complex landscape components has been relatively effective.

3. **Is there any monitoring of land cover changes in the region? (Please describe briefly).**

The general monitoring system exists. You need to report to the municipality the major changes in order to establish a forest area. It needs to be included in the municipal plan and accepted by the municipality. If you want to start a forest activity or you want to establish new houses it needs to be not only in front of municipality, but municipality needs to accept it as be a part of municipal's plan. It is effective in creating spatial planning.

VI. Localization (depending on the region)

1. **How the land use changes are resulting from vicinity of state border (how the state border influences land use in your region)?**

From the islands situated south of Zealand and from southern part of the region, the travel to Copenhagen takes 1 hour and 20 minutes by car, it's too much. This is a barrier not determined by the bridge between the islands, but mostly by the transport distance. The same thing happens on the Swedish side. Areas becoming more multifunctional are those within the isochrones of one hour travel from Malmo or Copenhagen.

Bridge between Denmark and Sweden makes more influence on land use than the border. We should be aware that for a hundred years the cooperation between the Nordic countries sets very few limits on what you can do in another Nordic country. You can travel between countries without passport, with legal papers you can buy a house everywhere, the languages and culture are similar, so it easy to move between countries.

Before the bridge was built, the time to travel by boat to the other side of Øresund took approximately one hour.

In the peak of the traffic, the theoretical isochrones of one hour are reduced in the surface covered. People tend to get flexible hours at work and some leave homes at 5 am and go to work earlier, preventing all the traffic. In all parts of Zealand there is excellent public transportation, but people still choose to go by car, even if it takes them double the time.

2. How land use changes are resulting from vicinity of the sea coast (how the coastal location influences land use in your region)?

The coastal areas are mostly used for touristic and recreational purposes. The coast north to Copenhagen is very popular for residential and small business areas. In these areas the green energy form windmills is produced.

VII. Land use in general

1. **Please describe and summarize the major processes and trends of land use changes in the region over the last 50 years.**

Unique recreation areas as a part of residential areas have been increasing in the last 25 years. Opening up the law for urban and rural areas.

More power is given to municipalities, because they don't need go to higher administrative level to get permission concerning changes in rural areas. Now they can do a more complex planning.

2. **In a typology elaborated on the basis of statistic data, your region is characterized by multifunctionality, intensive land use changes. Is it a proper type for your region? Please explain.**

It’s relatively close to a realistic situation. It’s important to observe how the urban areas are moving into different types of rural areas: farm lands and forests. There is a different impact and ways of interaction with former land cover patterns. In the areas where there are adverse changes to land use, residential area is moving to a more open space. The Nordic countries promote local recreation areas and numerous leisure areas. The good example is Hedeland, the old gravel mine, which is now a popular recreation area.

Region: The Øresund Region

Place: University in Roskilde

Person interviewed: Jespar Brandt, Esbern Holmes

Interviewer: Mariola Ferenc, Marcin Mazur

Date: 24.10.2011

I. Socio-economic factors of land use change

1. **Could you describe the main demographic processes in the region: migrations, birth rate etc.? What is their impact on land use?**

Women migration from rural areas to cities is the principal process but it does not have an evident impact on land use changes.

2. **What are the main processes and trends of settlement? What is the impact of new settlements on land use and spatial organization? Is there a lot of new built-up areas? What are the forms: contiguous development, linear patterns, scattered development?**

The Finger Plan was created in 1947 and until the 1980s. the Copenhagen region was growing accordingly with this strategy resembling a palm. From the 1990s. the urbanization was still high in the fifth zone.

The region is a combination of a mono-centric development, like Copenhagen with some small multi-centric elements (such as Roskilde). Copenhagen is the most densely populated.

In the 20th century the land use changes were not significant in the urban area of the Great Copenhagen. They were much more clear in rural areas, which became urban. The changes in urban area were observed to a slight extent because the major changes took place in the 1970s and 1980s. Nowadays only the area of fifth zone is still developing.

The area between Copenhagen and Roskilde is the largest urban area; 15 years ago the university of Roskilde wasn't situated in the urban area – now it is – so it is the largest urbanization project in whole Denmark. The transformation of agriculture land into urban land took place.

A new trend is to convert agricultural land into industrial areas or transport infrastructure (like in Kobe, which is in Finger Plan).

In 1972 the zoning system in Denmark divided the land into urban, rural and recreation zones. These zones were strictly kept until 10-15 years ago. This system assumed that there are no urban areas in agriculture zones. It was just a compromise for communication networks. It protects rural areas for agriculture production. For many years it was strictly followed, until the mid 1990s.

There was a big pressure for urbanization in rural areas. The legislation was so strict, that you could have a farm only when you lived on this farm. All the strict regulations were broken in the last years, so today it is easier to a non-farmer to buy a farm. And when you go to these open space areas, with attractive landscapes between villages, you see that many people might be farmers in the former times, but many of them

also have a second job, like car repair for instance. Formally it is an agriculture land, but there is a functional shift in many of these areas. People might be part time farmers but they use buildings for many purposes. You have to get a special permission to build in open lands, for other than farming purposes. You cannot see relation between development in population and development in occupational structure. All the changes caused modification in legislation, but we cannot see them in landscapes.

Because of the changes many animal farms were moving out the agriculture area in Zealand. Many buildings are available for new solutions now.

The functional structure was changing stronger than the landscape or land use.

3. **What are the main processes, directions of changes in the field of agriculture (extensification or intensification, changes of fields spatial structure and crops structure)?**

The principal trend is that the animal farms are moving out. There are very few farms with strict specialization, which started in 1970, when the Danish agriculture was diverse. But after that time there were a lot of specialization farms (pig farms, milk production).

Due to the principles of sustainable development, you must have certain square meters of land for each animal unit. Because there are many farmers with a non animal production, the animal farmers can use their land to register the animals.

4. **Are there such processes like: changing agricultural function of areas into other functions? Building-up areas on fertile soils? Increasing/decreasing the share of untilled land? Please describe briefly the processes concerning changes of agricultural land use.**

The average size of farms is increasing, but you still can find a lot of small agriculture farms, especially with owners, who are part time farmers. This is because of taxation system, because if your house is registered as a farm house, you pay less tax.

A lot of part time farmers, who have about 50 acres of land or less, keep their farms just because of that reason.

In Denmark there are quite a lot of small farms, the medium sized ones were in many cases merged to create large farms.

The most dynamically producing group are the pig farmers, who buy land, not always in one piece, but often the fields are divided in many areas. There are a lot of villages, where two or three farmers take care of all the fields in this area. They rent them from small farmers.

There are some traditional pig farms, which started production 100 or 200 years ago.

5. **What are the main processes in the field of industry and technical infrastructure (new plants, industry centers, roads, railways etc.)? How would you assess their influence on land use?**

Not asked – experts do not have knowledge in this area.

6. **What are the main processes in the field of tourism and services? Is there any development of tourism infrastructure (new hotels, holiday centers, swimming pools, tourist roads)? How intensive is the development in the spatial context (spatial extent of new areas used for tourism purposes etc.)**

Not asked – experts do not have knowledge in this area.

7. **How would you describe and summarize the general conditions of economy in your region and its impact on land use? Please refer also to employment issues**.

Not asked – experts do not have knowledge in this area.

II. Environmental issues

1. **Could you describe the main changes of natural areas in the last five decades (changes of forested areas, biodiversity, water conditions)? Has the spatial extent and condition of areas of high nature value changed for the last five decades?**

Denmark is a highly urbanized country, so there are not a lot of natural, environment elements. This is why researchers focus on small elements, like small lakes, trees, rivers. They realized that these small elements are so important for landscape, for the perception of space.

They monitored about 32 places (about 2x2km) and checked the results in details. The results showed, that especially in the 1960s and 1970s due to very rapid spatial development many of these small biotypes simply disappeared.

In the 1980s and 1990s they saw stabilization of the processes in general, also the stabilization of biotypes. In some areas there was an increase of biotypes, in others they disappeared. It was clear, that with the process of intensification of agriculture the agricultural landscape becomes more monotonous.

Multifunctionality of agriculture, has begun in the 1980s, the farms are increasingly specialized in numerous non-farming activities such as services (tourism, leisure time).

In the south of the region agriculture was also the social problem, because due to intense women migration farmers had difficulties in finding wives. You might be a farmer with huge agricultural production, you have a nice place to live, you have place for recreation. There might be other types of income for framer until that time it was mostly production. Some of the big farms make about 20% of income from hunting. They don't pay tax for it.

In the 1980s and 1990s the stabilization was also due to the fact that farmers realized that the landscape was important for them for other purposes.

The last national inventory was in 1996.

Monitoring was continued within the national monitoring system (Novena) being a part of NATURA 2000 program.

Small biotypes in the agricultural landscape are included in this monitoring system formally for political reason, because it's only monitoring outside the NATURA 2000.

The monitoring has been set in all those areas in 2006. But the result has never been published. The reason is lack of money or priority of Nature 2000 program.

According to the results in the last 10 years the trend of taking away all small biotypes is still intensifying. Agriculture in the 1990s was more or less taking in

consideration types of land use. This changed after 2001, also because of political reasons, agriculture sector focused on the production again.

With the results of land use there are some clear correlations between agriculture interest and other, e.g. recreation interest. This tendency is a matter of scale and regional development. There is a trend that agriculture sector would like to have a new establishment of region organization, where we can have real agriculture development and leave the rest for nature or for urban development.

Some theories about local development:

Development of small biotypes is shown in figure 53b, fragmentation on general linear and area biotypes.

In the 1950s and 1960 there were some negative changes. In the next decades it was still a negative trend. The situation has begun to change in the 1990s. But nowadays it is negative again. The most important reason is that the agriculture sector has a rather strong political support.

If you go to on the very detailed level of land use you can see a relation between development of land use of these small elements, very detailed land cover development and the urbanization. In Denmark most people live in the Copenhagen area, so there is a pressure of different interest on countryside. We couldn't find any clear correlation between the distance from urban centers to the area where we make investigations.

% of change	1954-1968	1968-1980	1981-1986	1986-1991	1991-1996
Linear biotypes	- 0,6	- 2,3	- 1,3	- 1,3	0,9
Area biotypes	- 0,5	- 0,8	- 0,8	- 0,8	0,3

Figure 51b – Development of small biotypes. Changes per year.

In the beginning of the 19th century there were big farms that were placed on better soils. Most of the farms in historical time belonged to one man. In many cases farmers kept their farms in the villages but they had some land outside the village. It was mostly private land, instead of having a collective farming.

If you see at the border to the village you had in general more extensively used land, which we can analyze also from the socio-economic point of view; the small farmer came up in this periphery. This was also a peripheral area from environmental point of view, because it was wetlands, and the major farms were located in the centre of village, on good soils.

Today these farms are large farms, most of this land is vast fields and most of the small biotypes, bounds and channels disappear. There are fields around the village, but in periphery are locating all small farms which have very often been sold to people from cities or maintained the farming function to generate an extra income in addition to a part time job in a city.

Urbanization in this area is also common; because people from towns buy farms and houses here, have horses and perform other kinds of leisure activities.

Spatial segregation: lands with better soils are used for large fields, agriculture land and in the periphery there is very diverse land use and land cover. In general, more

and more people also settled on these areas. And suddenly you will have a lower population in areas with big farms. The problem is what happens in the village. Because there might have been 10 farms in the village and 2 or 3 of them could be left, some could be bought be people from towns. In one case one of the farmers has a pig farm, so it could be not a very attractive place. This is the process of differentiation of the villages.

The example: area has been divided into zones: land use in the periphery is differentiated, there is a high intensification of agriculture in this zone.

In small or larger scales problems can look different, you can even say in one scale that there was no change in the area whereas in the other you can see a lot of changes.

Region: The Øresund Region

Place: Hedeland I/S

Person interviewed: Erik Juhl, director of planning company, landscape architect

Interviewer: Mariola Ferenc, Marcin Mazur

Date: 24.10.2011

Some 100 years ago the land owners began extracting gravel and clay in Hedeland. From the beginning of the 1950s the suburbs of Copenhagen grew southwards and westwards and the plant side increased. Processes in the 1960s and in 1970s around were very rapidly destroying several hundred hectares of the finest farmland and transforming it into a distorted and uninviting landscape. Gravel extraction, dumping grounds, lorry driving and environmental problems had to be controlled. Between 8 and 12 m below the ground surface clay was exploited as well. An increasing awareness of the necessity for improvement led to idea of joining forces in order to reverse the unfortunate trend of affairs and, concurrently with the extraction, form a recycled and reshaped, new landscape – not for agricultural use but for recreational purposes. A large and unique landscape for leisure activities for all the people moving into the areas south and west of Copenhagen.

I/S Hedeland is a publicly owned partnership with 5 partners: the municipalities of Grave, Roskilde and Høje-Taastrup and, in the near past, former counties of Roskilde and Copenhagen. Partnership and cooperation between municipalities in Denmark is common. The partnership was founded in 1978, and its main task is, through purchasing of land, to plan, construct and run the 1500 hectares of excavation area to preserve it and lead recreational function. The surroundings were cleaned up from pesticides and fertilizers used in agriculture in the past. There is no industry and agriculture using pesticides and fertilizers anymore here, to preserve clean ground water from infiltration of chemicals. These activities are forbidden and the situation is controlled very strictly. After buying the land there was a lot of planning works for diversified forms of recreational land use provided by private company from Copenhagen with 25 planners and landscape architects. Planners took into consideration for instance the neighborhood of noisy activities of Roskilde Airport nearby or opportunities of plants preservation in some areas. Until now some 700 ha of the total area have been taken over by the partnership, and approximately 100 millions DKK have been invested in the project. The settings for different leisure activities are planned by I/S Hedeland, but their construction and current running do not receive grants from the partnership.

Reshaping the landscape required transporting about 1 million cubic meters of ground per year. Nowadays Hedeland holds a large number of distinctive features, including a 50 meters high skiing hill at 80 meters above sea level with the pond below filled by fresh water level from limestone about 32 m above sea level. Between 6 and 8 million cubic meters of fresh water yearly is pumped to Copenhagen from here. There are wine terraces with about 3000 of even 25 years old vineyards and amphitheatre created for such purposes as for instance Copenhagen being European Capital of Culture in 1996 and hosting every year a huge opera for 4 thousands of people, which is one of the most famous attractions of Hedeland. Visitors can choose between numerous leisure activities, like e.g. walk paths, 10 ha

of power track with equipment for different exercises, angling, motocross track, race-track, golf course or horseback riding. There are playgrounds for children of different age here as well. There is also car driving test center. During the winter time it's also possible to ski here. Sand and gravel were used to connect the whole area by 40 km horseback riding paths and 15 km of internal roads. Railways serving mining and brickyard, which was functioning before the World War II, are used for sightseeing now. The yearly budget of landscape planning counts 800 000 €. Buying the new land from contractors costs from 50 to 80 000 DKK per hectare.

In some areas in the vicinity of roads with network infrastructure, land is designated for houses development or leisure activities. Industrial functions, for instance gravel mining, are allowed after preparing detailed plan including specific information about transportation, noise level, amount of dust, time of mining, the number of cubic meters exploited yearly and many others and after obtaining the municipality permission for such activity. The investor needs to have a landscape scheme taking into account the changes. Before starting, a deposit of 200 000 DKK per hectare is demanded. Such strictly protected landscape and forbidding some kind of activities in the neighborhood of development core is difficult, but it is slightly easier thanks to equalizing the municipalities budgets, so suburban municipalities developing settlements, residential areas and industry, very often return the money to less well-off municipalities. It's also easier and cheaper to prepare recreational area in case of postindustrial terrains, than on the typically agricultural areas.

Gravel digging in the past provided the basis for an interesting flora and fauna habitation in the area. There are more than 365 species of wild plants, including six unconditionally preserved species of orchids. It's possible because of providing the area with approximately 2 million cubic meters of clay from outside in the past, what is not allowed anymore due to danger of bringing polluted ground and spoil the ground water. Many wild flowers also contribute to attracting several species of butterflies. Numerous species of birds, non-migratory as well as migratory, use Hedeland as their foraging and breeding habitat The lakes and canals of Hedeland hold a large population of aquatic insects, amphibians and species of fish, and on the lake shores a large number of wild ducks and waders can be seen. In some areas 500 ha of forests are introduced.

Region: The Øresund Region

Place: Soro, Region Zealand authority, section of regional development

Person interviewed: Lars Tomlinson, Anne Brehmer

Interviewer: Mariola Ferenc, Marcin Mazur

Date: 26.10.2011

Regional planning structure is divided into national level, regional level and local level. Since 1998 in Denmark there are 14 counties, which were merged in 2006 into 5 administrative regions. The overall number of 273 municipalities decreased by enlarging their areas and giving them some legislation of the former counties. The Zealand region is one of the five administrative regions. It takes the majority of Zealand island, excluding the Copenhagen Capital Region, and a couple of smaller islands. surrounding it. The Zealand region has a transitional character, because it connects southern part of Sweden (Skåne region) with Fyn island and northern Germany.

The major task of regions is the health sector. In Zealand region it takes about 95% of the total regional budget of 2.1 billion €. The Zealand region employs approximately 15 000 people, but only about 400 of them work in administration. The rest are mainly employees of hospitals. However, other important task of regions are regional development, cleaning of contaminated soils and transportation system. In Zealand region about 40 people are employed in the regional development section. This section, including transportation, has a budget of about 70 million €. In the transportation system the principal challenge is to organize an intercommunal bus and train lines, which are desired apart from state lines. In Zealand there are 30 regional bus lines and 4 train lines nowadays. This task budget is approximately 40 million €.

Regional development is supported by the regional strategy. Before administrative reform there was a restricted aerial functional planning. After the reform such way of detailed planning is shifted to municipalities, and regions create holistic comprehensive strategies including common vision of urban and rural development and interregional as well as international connections. This planning structure is more polycentric, although regional level lacks the adequate tools to apply regional vision of development in restricted way. The act includes environmental, cultural, economic, educational and infrastructural issues as well. However the strategy is a short text document and it doesn't include any maps of delimitated areas of specific functions. The municipal strategies of development and restricted aerial plans are linked to this complex regional strategy. However also the regional strategy is linked with the strategies of Denmark, Sweden, Germany and Poland. The former planning system was easier to apply, but it's better to have a holistic planning system with all linkages between different units at various levels. However after four years of practice this new system becomes easier. The growth and sustainable development is impossible without a common and holistic way of thinking about development of e.g. education system, labour market and business development.

Region: The Øresund Region

Place: Soro, Zealand region authority, regional development section

Person interviewed: Jesper Reumert

Interviewer: Mariola Ferenc, Marcin Mazur

Date: 26.10.2011

The Zealand region has a transitional character. Communication with neighboring regions is facilitated thanks to the bridges. Bridges to Skåne and to Fyn island already exist and a new bridge to Sweden in the northern part of Zealand, bridge by Fehrmann Belt and, eventually, bridge to Aarhus in western Denmark are planned. This helps in mobility, solves many commuting difficulties and enlarges the potential of the region. Nowadays, debates concerning advantages and disadvantages of investment in possible direct connection to Jutland Peninsula are taking place.

Other important challenges for the region are to improve the relatively low education level of inhabitants and to create new business clusters. Currently, the Zealand region has comparatively low number of economic clusters and a low level of innovation in relation to its neighbors. It hasn't got the main core of development, but a lot of small towns with no important tensions. The challenge for regional development is to show common goals and encourage municipalities to work together. The functional center of the region is Copenhagen, where many daily commuters work. Another important challenge is also to equalize the imbalance, because northern part of island and areas close to Copenhagen have much a better situation with economy, education, health care and venture capital.

The most important strengths of the region are the potential to develop the green industry and green energy production. The new link between Copenhagen and northern Germany will give some development possibilities as well. First of all accessibility to Copenhagen with all facilities and labour market by cars and by trains for all inhabitants of the island will increase. Apart of it, the region thanks to the countryside, natural environment and the seacoast is an attractive residential area. Although Zealand region has a rural character, due to neighborhood of Copenhagen here are mostly untypical rural areas. People living here are in a great extent the daily commuters and only part time farmers. Another opportunity is the promoting of bio-energy based on algae, hydropower and wind power stations.

To achieve the goals of the regional development, growth forum and regional council have been set up. The growth forum consists of representation of research institutions and education sector, municipalities, both sides of labour market and partners from regional council, so both publically elected politicians and members of commercial institutions. This unit creates every four years the holistic strategy for business development and every year an action plan, which is more specific and operational. The budget of funding the activities counts about 20 million € yearly, with about 9 million from regional development funds and 11 million from the EU structural fund, among the others from INTERREG. The goal is to search for linkage between regional general strategy and strategy for business development, which is more specific and has sources of financial support to apply. To do this, the most important

is the building of facilities for dialogue concerning plans and networking, what is hard to measure and evaluate, like all human capital.

A significant part of the regional planning activities is devoted to the role of transport networks going through the region. Most of the municipalities of Zealand region have the highest commuting ratio in Denmark, much higher than the municipalities from the Greater Copenhagen agglomeration itself. The region gives an opportunity to live in a cheaper house with good facilities and relatively comfortable transport infrastructure to daily commuting by train or by car. The next biggest cities in Denmark, Aarhus and Aalborg, have a far smaller zone of intensive daily commuting areas. The potential daily commuting to Copenhagen labour market is well illustrated by measurements of mobility on the Øresund Bridge. Since 2001 daily number of people crossing it increased from 4 thousand to almost 20 thousand. The highest increase took place in mobility by trains. On the basis of this case there are predictions about changes of transborder mobility and labour market potential after building a linkage to northern Germany. However, the predictions are so simple because new connection will become a link between two rural areas, not between two growth poles. That means, the profits will be in long terms and more risky. There is also a danger that this would be only a convenient linkage for transit between Skåne and Copenhagen, and even Oslo and Stockholm with all Norway and Sweden, on one side and Hamburg and Berlin on the other, which will cause stagnation for the towns located in the vicinity of current routes. E.g. Oslo has an idea to be a one-day city, which means that it has 8 hours road and train accessibility to European metropolis, like Berlin. This can be done only through collaboration with the Øresund Region. First strategy of the regional development was stronger influenced by politicians of the Øresund Committee. The newer version is expressing a broader look at the regional development and further perspective. This transport corridor is going to be developed until 2018, and hopefully will be resulting in considerable stimulation of regional growth. 7 700 cars and 3 800 passengers of trains are expected on this link every day. However it will used in a significant part reclaimed as sea low terrains and are not expected to have much influence on land use structure and the landscape directly. On the other side, in Jutland the towns are concentrating along main motorways for decades, where are attractive localizations for many companies. Such indirect impact on land use changes can be expected in the case of Fehrman Belt transport corridor. In 2007 the ferries transported over the Fehrman Belt approximately 6 200 vehicles every day. After new investment, thanks to the Øresund Bridge and Fehrman Belt, Region Zealand will become a STRING Region at the crossing of routes, what will strengthen its growth. It’s an example of using the belonging to Øresund Region as a potential to development, but seeing another opportunities connected with neighboring of Germany as well. However generating growth in the long-term sense is more uncertain than generating movement, because it equally depends on accessibility and business structure. For instance it’s a chance for development of food enterprises and tourism, so for rural areas, but e-learning for better educated population and staying of young people in rural areas are desired.

There is also one project from INTERREG fund processing, together with the Greater Copenhagen and Skåne Region. It lasts 2 years and its budget counts about 35 million DKK. It analyses potential growth caused by connecting Helsingør and Helsingborg by a new bridge, which could release overcrowded Øresund Bridge. The conclusion is, that this investment should be followed by connection of eastern and western Denmark through Kattegat. It’s currently under political discussion.

During all big projects in the region, the positive short-term impact on enterprises is observed at the construction time. The long-term effect is more desired, but harder to achieve as well. Its importance is even bigger when we are focusing on sustainable development with the share of green energy production. Therefore there are many initiatives focused on green technologies here. The purpose is to create Cleantech Cluster in Copenhagen, which demands developing the Region of Zealand to be one of the world's leading clean-tech areas. Copenhagen Cleantech Cluster is a network organization bringing together cleantech players across sectors. The network is open for all players involved in the cleantech industry, from supplier to support, research or business development. Thus, the cluster represents cleantech environments across industries and value chains. The cluster is assisting with knowledge, contacts, help to start a business and market it in Denmark and abroad, for workers in cleantech in research institutions and companies and for people thinking about starting a business. A partners are: Copenhagen Capacity, Riso DTU, DI, Copenhagen University, municipalities of Roskilde, Lolland, Kalundborg, Frederikssund and Albertslund, CAT Science Park, Danish Hydraulic Institute, Oland A/S, SEAS NVE, NCC, Siemens Denmark, Better Place Denmark, DONG Energy, Novozymes, HAldor Topsoe, Copenhagen Resource Institute, Ernst & Young, Vestas, Business Link Zealand, Business Link Greater Copenhagen, GEUS, EnergyMap.dk and Symbion Science Park. The Cluster is financed by the Zealand region, Greater Copenhagen region, the EU Structural Funds and a large number of companies, organizations and knowledge institutions.

The purpose of the Zealand Energy Cluster is to bring together climate forces in the Zealand region and the 17 municipalities in order to create smart energy solutions. The Energy Cluster Center will generate the municipal lift in climate competencies giving municipalities better tools to combat adverse climate change and create new business opportunities. The Energy Cluster Center Zealand is launching clusters within energy and energy saving solutions and serves as a center for creative forces that develop insight, knowledge and inspiration for green energy options. The project teams climate experts from the Zealand region, the 17 municipalities, businesses, education and research institutions and other stakeholders. Through dialogue, activities and exchange of experience the clusters are developing new ideas for the future intelligent climate solutions. Energy Cluster Center Zealand aims to disseminate results from projects in the 17 municipalities and the Zealand region, so anyone who has interest in developing new energy solutions should be interested in it. The partners are: Kalundborg Municipality, Lolland Municipality and the Municipality of Roskilde (on behalf of the 17 municipalities in the Zealand region), Regional Growth Forum Zealand and the Zealand region. It is financed by the Zealand region, Kalundborg Municipality, Lolland Municipality and Roskilde Municipality.

Biofuel Initiatives in the Zealand region aiming to increase the use of bio-resources for energy purposes in the region and facilitate bioenergy projects. The project has established a project organization to identify the potential for biofuel production development. It is a project managed for specific projects with the focus on assessing business potential of the various projects, including feasibility studies. Biofuel Initiatives present plans and suggestions regarding the use of the region's biomass resources for energy purposes. The partners are: Roskilde University RUC, Riso DTU and the Green Center. The project is financed by the Zealand region and the project partners.

Renewable Energy Technology engineering is aiming to develop a short, high level course in the field of renewable energy engineering techniques. The project has produces a paper on a new course in renewable energy engineering. The course aims at the combination of renewable sources of energy and the planning involved in implementing such schemes. During the course the students will acquire basic knowledge of planning and implementing schemes including a variety of renewable sources of energy. The practical part of the course will, if approved, take place on the Community Test Facility of renewable energies on the island of Lolland. The partners are: Centre for Electric Technology DTU, Roskilde University, Los Angeles County (California, USA), International Wind Academy Lolland and DONG Energy. The project is financed by the Zealand region and the Danish Ministry of Education.

Bio-composites is to investigate natural fibers and bio-resins and the related process technology for manufacturing off the so called bio-composite material and thereby extend the knowledge base for a commercial use of these materials. Bio-composite is a practical research project where the results are also published in the form of specific components. Bio-composites have investigated an innovative material technology where textiles of flax fibers have been combined with polymers made from biomass to a composite material. The project has worked together with industrial designers to show the visual possibilities for bio-composites. This project is helpful for producers of e.g. furniture or other shell structure parts that can be replaced with bio-composites, making the product more sustainable. Designers who are interested in working with the latest green technology can also contact bio-composites. The partners of the project are: Riso DTU, Regional Growth Forum Zealand and industrial designer Martin Larsen and textile designer Karina Nielsen Rios from Biennale for Crafts and Design. The project is financed by the Zealand region.

Predicting the future of agricultural production demand is difficult now, so it’s hard to say how the idea of creating a green region will be influencing the land use structure.

The Zealand region is very focused on the following issues: to improve the level of education, to enforce labour market and to create a green region of high technologies, which are not harmful to the natural environment.

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The ESPON 2013 Programme is part-financed by the European Regional Development Fund, the EU Member States and the Partner States Iceland, Liechtenstein, Norway and Switzerland. It shall support policy development in relation to the aim of territorial cohesion and a harmonious development of the European territory.

ISBN 978-2-919777-19-8