Agricultural changes in peripheral areas of the EU

Farm structure of North Karelia (Finland) during 1995-2004

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Master’s Thesis
May, 2013

Research Statement **University of Eastern Finland**

The present thesis analyses the changes in agricultural activities and land uses in North Karelia (Finland) during the period 1995-2004. This period is characterized by the accession of Finland to the European Union, and the implementation of the Common Agricultural Policy in agriculture. The analysis investigates 4659 farms in 1995, including their main activities, areas and location. The data is complemented with land uses maps, official agricultural statistics and secondary sources based in academic literature. The methods include the use of change-matrices and geostatistical approaches based on kernel methods to assess changes in the location of farm-activity cores, as well as relative locations of the farms in a core-periphery continuum. The research is an attempt to provide tools for understanding the current changes and the impact of the policy measures in a specific context characterised by *peripherality*. The results showed that there have been important changes in the farm structure of North Karelia. The overall direction of these changes was towards larger cereal areas, farms more oriented towards production, increasing farm concentration and diversification of farm activities. In addition, farms located in the periphery of the studied area are less prone to change the main activity, and include a higher diversification of activities than those located in the core economic areas. Most of the changes observed can be framed in the general features of *productivism* and *post-productivism*, with a transition between two stages in North Karelia. The present thesis can be useful for the study of the impacts of policy changes in the transformation of the agricultural landscapes, specifically in areas located in economic peripheries.

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The title of the research: *Agricultural changes in peripheral areas of the EU: Farm structure of North Karelia (Finland) during 1995-2004*
Faculty/Subject: Faculty of Social Sciences and Business Studies / Human Geography
Pages: 65
Work: Master's thesis
Time: May 2013
Key words: *land use change, policy analysis, agriculture economics, centre-periphery, productivism, post productivism, geo-statistics*
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Index

Foreword

First of all, I wish to thank my supervisor, Dr. Timo Kumpula, for his time and for giving me the opportunity of supervising this thesis. He introduced me for first time to the tools of GIS and that was a turning point in my academic skills. As well, I am also indebt to Dr Paul Fryer for his constant help and for introducing me to the approaches of social sciences, which also has made a long lasting impact in my way of seeing the world.

I would like to extend my gratitude to Prof Jarmo Kortelainen, Prof Heikki Eskelinen, Dr Minna Tanskanen, Prof Ilkka Liikanen and Dr David Gritten which have been also contributed to my interest for social sciences. Thanks must be given to Dr José Ramón González Olabarria for his help with the geospatial analyses. And of course my Human Geography colleagues Eugene Comer, Iker Urzelai, Jussi Laine, Nina Verkerk, Moritz Albrecht and many others, which whom I have enjoyed great times. Also, Dr Javier Arévalo and Cristóbal Delgado have helped me significantly to develop my skills in the field, as well as Javier López-González.

My deepest gratitude goes to my family, my parents Blas and Ángela and my sister Laura, who have been always giving me their unconditional support and love, and for my grandmothers and other relatives. I also thank all my friends at the University of Eastern Finland, for sharing all these years together like a family, as well as my colleagues in Spain. Finally, I would like to thank my loved one, Mari, who has always been by my side.

Joensuu, May 2013

Blas Mola-Yudego

1 Introduction

1.1 Background of the research

The big changes affecting all kind of agricultural production in the world and in Europe in particular, have a strong influence on the population and depopulation patterns of the rural areas. All those changes have important social and environmental consequences that must be studied and analysed.

During the last few years, the combination of a better production environment, the improved management and better varieties resulted from agriculture research, has led to a continuing growth in the productivity of European agriculture (Latesteijn, 1995), at the same time, to substantial surpluses for some commodities. Higher productivity means that the same amount of agricultural produce can be generated with less land and fewer farmers, displacing labour to some other activities.

This process has been described by some authors as a gradual shift which is unavoidable in a situation of rapid economic growth. However, it has also been pointed out that is not such smooth evolution, since farmers will only leave agriculture when their income declines drastically (Latesteijn, 1995; Strijker, 2005), due to the strong preference for being a farmer, and the lack of lucrative alternatives for their land, machines, buildings and other equipment. Considering the social aspects of this process, Strijker (2005) remarks that “the pressure on agricultural incomes, necessary for the process of sectorial transformation, often has been judged by politicians to be socially undesirable”.

This is one of the most important reasons for the development of specific policies for agriculture. In the European Union (EU) the main instrument of the agricultural policy in the period of 1960–1992 was price policy: agricultural prices were subsidised above the equilibrium level in order to support agricultural incomes (Rabbinge & Diepen 2000). The resulting intensification was not only a by-product of the agricultural policy; it was one of its objectives. Even today it is stated in the Treaty of the EU (article 33) that the first objective of the agricultural policy of the Union is “to increase agricultural productivity by promoting technical progresses”. As observed by Strijker (2005): “high product prices are an incentive for intensification of the use of the resources, including land”. And other emerging objectives related to land use will affect policy reforms as well. Social objectives, such as full employment and reasonable income; economic objectives such as high productivity and low costs; environmental objectives, such as minimization of nitrogen loss; and agricultural objectives, such as efficient use of fertilizers, can all have different consequences for land use (Latesteijn, 1995). Most of the EU country members have strongly modified their policies and targets related to agriculture during the last years, pursuing these objectives.

All these changes in policies are especially relevant in the Finnish context. In one hand, Finland is located in a peripheral area with respect to main economic markets, limiting the prospects of distribution and logistics. On the other hand, Finnish agriculture suffers for one of the hardest climatic conditions in Europe. Both factors are even more extreme in the region of North Karelia, located nearby the Russian border. Arguably, this region is particularly interesting as an extreme case of *peripherality* in agriculture, as more northern regions lack enough agricultural lands to make them subject to study, and more southern regions are wealthier and better connected to the global market flows.

In this context, the recent changes in the policy framework, in the conceptions of agriculture and in the role of farmers in the society are a relevant topic of study in this region. As Finland joined the EU in 1995, the last years offer an interesting period of study in order to indentify structural changes in the agricultural sector linked to the development of agricultural policies and global economic changes.

1.2. Agricultural modernization in Finland

The agricultural modernization in Finland can be divided in three phases (Hietala-Koivu, 2002). A first period includes the consequences of the second world war, when over 400 000 refugees from territories ceded to the Soviet Union were settled. This first period would cover 1950–1969 and resulted in agricultural intensification, including increasing use of fertilizers, pesticides and cattle breeding, which were necessary to produce more food. The effects of these were the overproduction of cereals, meat and butter. At the same time, when the baby-boom generation reached working age (late 1960s), most of these people were registered unemployed. In North Karelia (and the eastern and northern parts of Finland), many farms were not sufficiently viable and their fields were either rented out, sold, reforested or left uncultivated under the Finnish field reservation system that operated in 1969–1974 (Katajamäki, 1991).

Hietala-Koivu (2002) defines a second period from 1970–1994, that was defined by a specialization in Finnish agriculture. In this period, there was a concentration of pig, poultry and milk production, in particular, on less and less farms. In parallel, crop cultivation became largely limited to the south and west of the country, where land was more fertile, and the subsurface drains have been installed in 70–80% of the arable land in recent decades (Salaojakeskus, 1999). This meant that milk and forestry became the main sources of income for the rest of the country. Also in this period there were implemented agricultural policy measures to reduce overproduction. Specifically they included support for leaving fields fallow or reforesting them, and about 180 000 ha of field in the east and north had been reforested by 1995 (Statistics Finland, 1996).

Finally, a third period can be defined as the last two decades, and started in 1995 with the accession of Finland to the UE and the implementation of the Finnish agri-environmental programme (FAEP). This period is particularly relevant for the objectives of this thesis, as it imply the implementation of significant changes in the agricultural policy framework, which resulted mostly from decisions taken outside the Finnish context.

1.3 EU membership on agricultural and rural development

Finnish agriculture has been experiencing major structural changes during the last two decades. Finland's accession to the EU in 1995, presented a serious challenge. The support for accession was not unanimous, in parallel with all northern countries. The result of the referendum has the support for only 57% of voters (Sundberg, 1995). One of the factors that explain this was in the perception of the problematic future of the Finnish agriculture. Accession to the EU meant the adoption of the Common Agricultural Policy (CAP) rules, which translated in significant changes for Finnish farmers (table 1).

The CAP rules meant cuts in producer prices enhanced in a short period of time, and as a result, the Finnish agricultural sector had improved its competitiveness. The new price system adopted in 1994 was already similar to those in the EU (Niemi and Ahlstedt, 2005). However, the price level remained higher than those in the EU; e.g. in 1995 were approximately double. The lower prices paid meant important consequences all over the country, but especially on the specialized farms of the south and west part of the country (Hietala-Koivu, 2002). This also meant a rapid transition from a relatively closed market to an open market.

In general, Finnish agriculture was in disadvantage compared to other countries, due to unfavourable production conditions, soil and climate, as well as unfavourable farming structure (Tomsik and Rosochatecká, 2007). In general, Finnish crop yields are about one half of equivalent central European countries. Concerning the structure, Finland is a large country for European standards with a sparse population, which implies difficulties for maintaining the population in rural areas. On the one hand, there has been a decreasing labour intensity as an overall result of the decrease in the number of agricultural farms and technological development. At the same time, there has been a decline in job opportunities for more than 25% (Rosochatecká and Tomšík 2007). All in all, accession to the EU has been a serious challenge for Finnish agriculture (Rosochatecká and Tomšík 2009).

Table 1. Summary of Common Agricultural Policy legal documents affecting Finnish farmers (SCM Network, 2007).

Policy scheme	Legal documents
Single Payment Scheme	Council Regulation (EC) No 1782/2003 of 29 September 2003 establishing common rules for direct support schemes under the Common Agricultural Policy and establishing certain support schemes for farmers.
Livestock Identification & Movement	European Parliament and Council Regulation 1760/2000 (establishing a system for the identification and registration of bovine animals and repealing Council Regulation 820/97); Council Regulation 21/2004 (establishing a system for the identification and registration of ovine and caprine animals). Council Directive 92/102/EEC on the identification and registration of animals.
Welfare of Farmed Animals	Council Directive 91/630/EEC of 19 November 1991 laying down minimum standards of the protection of pigs; Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes; Council Directive 91/629/EEC of 19 November 1991 laying down minimum standards for the protection of calves; Council Directive 1999/74/EC of 19 July 1999 laying down minimum standards for the protection of laying hens.
Nitrates	Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources.
Veterinary Medicines	Council Directive 2001/82/EC (as amended by Directive 2004/28/EC) on the community code relating to veterinary medicinal products.
Pesticides	Council Directive 91/414/EEC of 15 July 1991 concerning the placing of plant protection products on the market.
Rural Development / Agri-environment schemes	Council Regulation (EC) No 1698/2005 of 20 September 2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD).
Pollution Prevention and Control	Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control.

1.4 Theoretical framework

The consequences and changes in land uses, modern agricultural regimes and rural areas have led to an increase in theoretical and conceptual work during the recent years. According to Burton & Wilson (2006) “it is fair to say that the last 15 years have seen the emergence of some of the most interesting and challenging theoretical debates about the nature, changes and future trajectories of modern agricultural regimes and rural areas from a variety of economic, social, political and environmental stances”.

One powerful concept from these debates has been the notion that modern agricultural regimes have moved from a ‘*productivism’* stage to a *‘post-productivism’* (Cloke, 1983; Cloke and Goodwin, 1992; Marsden et al., 1996), and more recently some authors have noticed changes from this productivism or post-productivism stages to the new multifunctional agricultural regimes (Marsden et al., 1996; Wilson, 2001). According to this vision, the productivist era emphasised maximum food production and the predominant role of the countryside as a site for production of food and fibre (table 2). The productivist countryside is where the traditional activity of the rural entities is based on the intensification of agricultural production, traditional food products and fiber.

In this context, the increase of the income from this business that can be achieved by centralization, intensification and specialization of production (Burton and Wilson, 2006). On the other hand, the post-productivism era reduces emphasis on food production and emphasises on the countryside as a place of consumption with high environmental sustainability. The post-productivist countryside can be referred as a newly formed activity paradigm of the rural agents, ”based on perception of rural areas as consumption spaces, formation of the countryside as the country infrastructure, where land use has production, ecological, social and aesthetic functions” (Burton and Wilson, 2006). In this sense, the decreased production of conventional food products and raw materials has been changed by commercialized and non-commercialized public goods (Vesala and Vesala, 2010). In many ways, post-productivism does not necessarily deny productivism as such, but both concepts are complementary as it increases the possibilities of the agents of various rural areas to maximize their income and the public benefit.

Table 2. Productivism versus post-productivism roles in agriculture, adapted from Burton & Wilson (2006).

Productivit roles	Post-productivist roles
Industrialising	Deindustrialising
Commercialising	Decommercialising
Intensifying	Extensifying
Specialising	Diversifying
Concentrating production	Dispersing production
Generating surplus	Consuming the countryside
Corporate involvement	Improving the environment
Mechanising	Decreasing intensity
Increasing biochemical use	Reducing biochemical use
Aiming for maximising profit	Aiming for sustainability

The firsts accounts of post-productivism in Europe became obvious in the 1970s after the first crude oil crisis and developed strong in the 1990s (Ward, 1993). Some authors (Argent 2002) distinguish productivism from post-productivism not only as the mode of agricultural system but as the opinion of the country government to agriculture and the promotion of the rural activities in general.

According to Walford (2003) the policy enacted during the implementation of the CAP, increasing protectionism and subsidies, are responsible for the changes in agriculture leading to overproduction in the EU. In this sense, the study of productivism to post-productivist development of agriculture has become very relevant, and plays an important role to frame the study of the transformation of the agricultural sector in North Karelia during the 1990s, particularly to explain some of the changes in farm structure, farm activities and location. Additionally, it must be taken into account that North Karelia is located in a double periphery: a climatic periphery characterised by hard conditions for agricultural production leading to generally lower production values, and in the periphery of the EU nearby the external border of the free-trade area. As such it is expected to follow a different dynamic with respect to agricultural transformation of the sector.

1.5 Research question and objectives

All issues regarding changes in agriculture are of a capital importance in the present national and international scenario. Especially, the EU policies are having a big impact in rural areas and can modify highly the traditional social patterns. Population distribution and the definition of the new roles of the rural agriculture-based areas will configure one of the greatest challenges of the EU, and they are worthy investigating to try to foresee the trends and propose alternatives.

In this context, the research presented is an attempt to analyse the changes in the farm structure and production activities in the region of North Karelia and to provide tools for understanding the current changes and the impact of the political measures.

The research is presented in three main objectives:

1st: To analyse the evolution in the farms' activities. Have there been changes in the farm structure in North Karelia during the studied period?

2nd: To explain such changes in a theoretical framework. What has been the impact of the EU agricultural policies?

3rd: To supply with methodological tools for studying the spatial changes of farm activities in North Karelia, and particularly about their location regarding *peripherality*.

2. Research material

2.1 Studied area

Finland is the northernmost countries in the EU, located between the 60th and 70th parallels (Häkkilä, 2002). The present area of the country is 338 100 km^2, with a population of 5.4 million (Statistics Finland, 2013), making it a large country with low population density. Today, Finnish population is mostly concentrated in densely built areas, which cover less than 3% of the total area of the country (Statistical Yearbook of Finland, 2000) and it is regarded one of the most rural areas in Europe.

Concerning agriculture, only 8% percent of the country is arable land (Statistics Finland, 2013). This makes Finland one of the countries with less human influence on the landscape, especially in the north and east of the country, as the population centres are located mostly in the south and western coast, considered the most fertile agricultural lands, and the rest is cover by forest lands (Häkkilä 1984). In fact, the north and the east present a landscape dominated by forest, with limited settlements and farmland, which are mostly located on river banks or lake shores (Häkkilä, 1984). The total agricultural area is about 2.2 Mha and about 8% of this area is regarded as set-aside in 2010 (Statistics Finland, 2010).

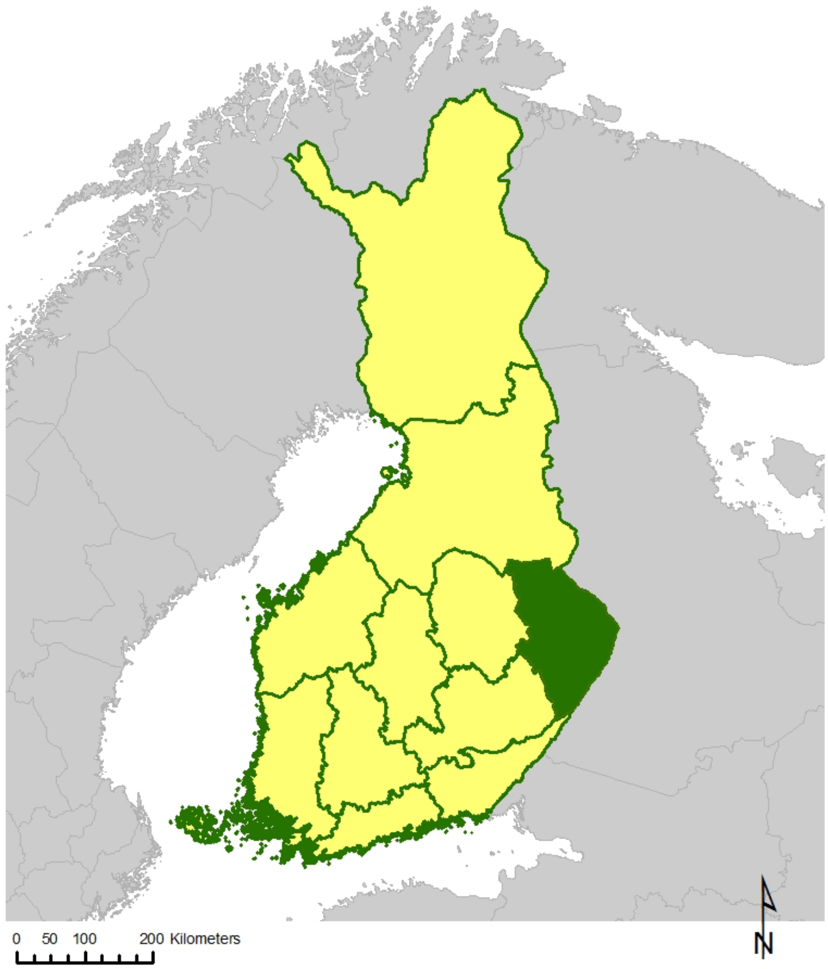


Figure 1. Location of the studied area: North Karelia (Finnish: *Pohjois-Karjala*).

In general, agriculture and forestry are dominant in rural Finland. The fact that Finland presents a relatively strong agricultural and forest sector is rather exceptional considering the country's geographical location. The explanation of this corresponds to the Gulf Stream, that raises the temperature by about 3–4 °C, compared to similar latitudes in Russia or Alaska (Kettunen 1997). Despite of that, there is a clear gradient of climatic variation along and across the country, which extends 1 100 kilometres from south to north. Whereas in the south the growing season is 170–180 days and over 1 300 degree days, in the north the growing season is only 100 days, and presents only about 500 degree days (Alalammi, 1987, WorldClim database).

The area subject of study is the region of North Karelia (Finnish: *Pohjois-Karjala*), located in eastern Finland (figure 1). Administratively, the region was considered a province (*lääni*) from 1960 to 1997. In 1997 was merged to nearby provinces to conform the province of Eastern Finland. North Karelia is somehow south Finland, presenting a growing season of about 150 days and 1050 degree days, (Alalammi, 1987). The annual precipitation is 601 mm, half of which falls as snow. A similar to the latitudinal gradient, but less intense, is found between the west (close to the sea) and the east (continental) parts of the country. North Karelia shares therefore many features of continental climate, with hot summers and cold winters.

Concerning the agricultural productivity of the region, averages for oats and barley for the period 2000-2005 (Matilda, 2010) were around 2.7 t/ha in North Karelia, which is lower than the national average, around 3.2 t/ha and 3.3 t/ha, respectively. The values for the south of Finland (*Uusimaa* region) would be 3.3 t/ha and 3.5 t/ha, respectively. Averages in Central Sweden would be closer to 4 t/ha in both cases, and in Denmark around 5 t/ha.

2.2 Farm activities

In this study, the farm and land uses were defined according to the Finnish Agricultural Yearbooks. According to the traditional definition used in Finland, a farm is a homestead of at least 1 ha. This definition was used in official statistics starting at the 1969 agricultural census and it is somehow still in use. However, during the latest decades, some farms have become abandoned or uncultivated, although they are still included in the farm register. Therefore, since 1990, the official statistics included an additional (not excluding) concept referred to *active farm*. In this sense, an *active farm* is defined as a delimited land portion with at least 1 ha of utilized agricultural area or with livestock equaling at least one animal unit (see definitions at Statistics Finland, 2003).

The main farm activities were coded and grouped as “husbandry”, including: Dairy cattle husbandry (*Lypsykarjatalous*, c1), Cattle raising (*Lihanautaojen kasvatus*, c2), Other cattle husbandry (*Muu nautakarjatalous*, c3), Pig production (*Porsastuotanto*, c4), Other pig husbandry (*Muu sikatalous*, c6), Meat hogs raising (*Lihasikojen kasvatus*, c5), Egg production (*Kananmunien tuotanto*, c7), Domestic fowl meat production (*Siipikarjalihan tuotanto*, c8), Other domestic fowl husbandry (*Muu siipikarjatalous*, c9), Sheep production (*Lammastalous*, c10), Goat production (*Vuohitalous*, c11), Horse production (*Hevostalous*, c12). The group for “cereal” production included: Cereal culture (*Viljan viljely*, c13). Other cultivations included: Special plant production (*Erikoiskasvituotanto*, c14), Gradening outside (*Puutarh. viljely avomaalla*, c15), Greenhouse cultivation (*Kasvihuoneviljely*, c16), Other non specified cultivation (*Muu kasvituotanto*, c17) and Organic production (*Luomutuotanto*, c18).

Concerning Forestry (*Metsätalous*, c19), it must be taken into account that forest is an integral part of the Finnish farm and nearly all farms have a forest holding, and in many cases it accounts for a larger area than the fields (Häkkilä 1991). In the year 1998, Finnish farms had an average of 16.3 hectares of arable land and 44.3 hectares of forest land (Statistics Finland, 2000). In the dataset available, Forestry (c19) is only coded when is grown as a cultivation, mostly on arable land, and forest lands are therefore not included. In this sense, changes relating to forest lands are based on the Corine land uses map as defined by the European Environment Agency (2000). Finally, No Production (c23) refers to those fields either abandoned or set aside. The location of all farms analysed is provided in figure 2.

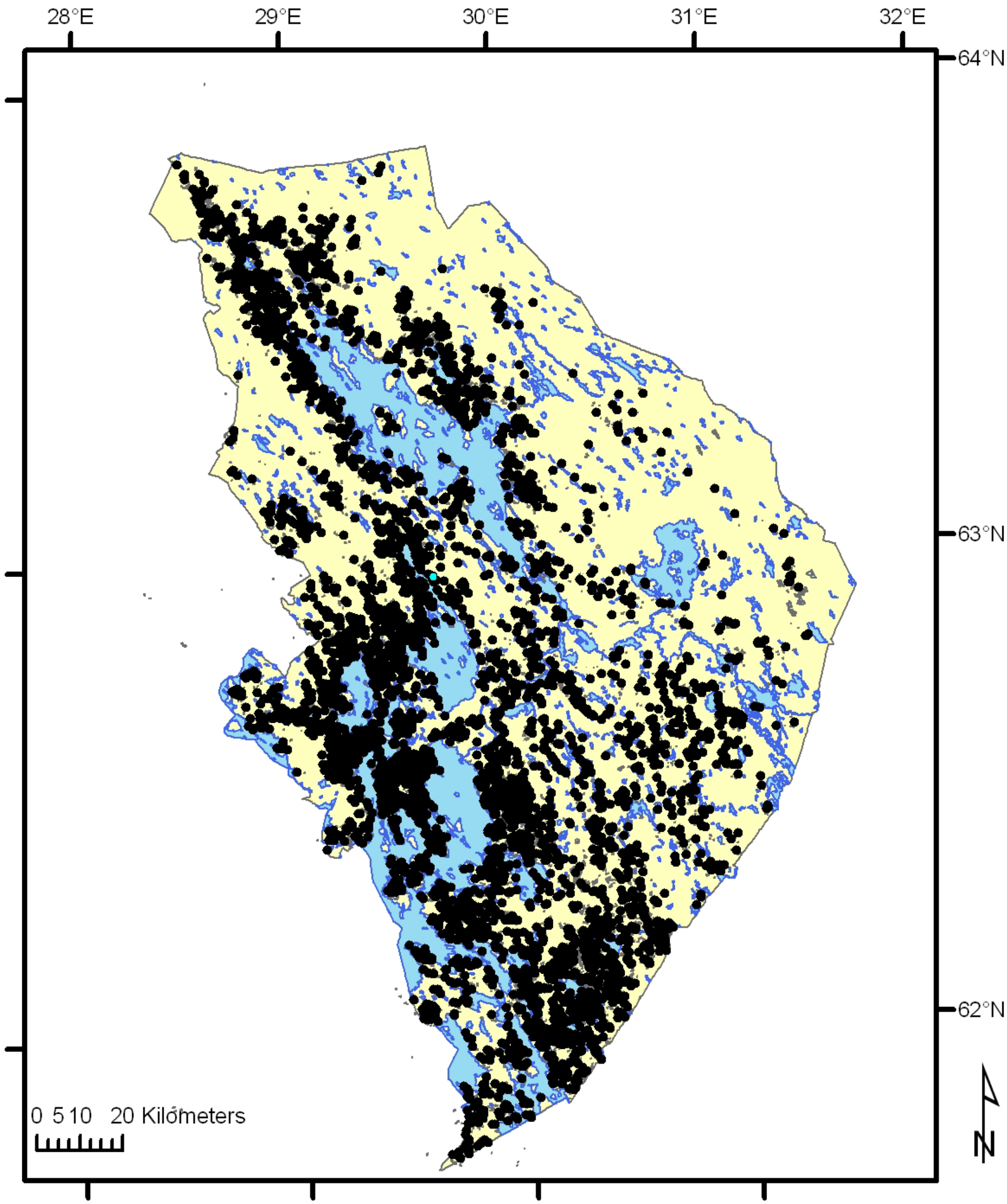


Figure 2. Location of the analysed farms in North Karelia (Finland) during the period 1995-2004.

2.3 Achievement of data

The indicators of main production at North Karelian farms were provided by the Karelian Board of Agriculture, regarding the main production during the period 1995-2004. The data included the geo-referenced position of the farms, the size of the fields, data regarding ownership, the production activity of each field by year, and the estimated main production activity of the farm as well as a database with information about the changes along time. This set of data has been re-organised to be able of treat it statistically.

The CORINE Land Cover project for Finland, from the European Environmental Agency (EEA), provided by the Image & Corine Land Cover 2010 and 2000 database has been obtained to analyse the land uses in North Karelia and its the geographic distribution (as well as other layers such lakes, urban settlements, industrial areas…).

Regarding the distribution of population and density (Finland), it has been used the maps provided by GRID-Arendal: Population Density for Baltic Sea drainage basin region (Langaas, 1993 and Sweitzer et al, 1996). Several other maps provided by the department have been used to set the political boundaries (municipalities). Additionaly, public resources with national statistics at different leves (Statistics Finland, Eurostat…) have been used to elaborate the database required for the research. For instance, the identification of the economic cores was based on data of GDP/capita as defined by the World Bank (2008). The information for the distribution of global settlements was extracted from the Settlement Points database (CIESIN 2004). A summary of the main datasets used is provided in table 3.

Table 3. Main datasets and sources used in this study

Data	Source
Land uses map 2010 (Finland)	CORINE Land Cover project for Finland, from the European Environmental Agency (EEA), provided by the Image & Corine Land Cover 2010 (I&CLC2010)
Land uses map 2000 (Finland)	CORINE Land Cover project for Finland, from the European Environmental Agency (EEA), provided by the Image & Corine Land Cover 2000 (I&CLC2000)
Location and size of North Karelian farms	*Karelian Board of Agriculture*
Activities by field and year	*Karelian Board of Agriculture*
Main activity by farm and year	*Karelian Board of Agriculture*
Farm statistics	Ministery of Agriculture and Forestry Yearbooks, Matilda, Statistics Finland
Population density	GRID-Arendal: Population Density for Baltic Sea
Location of urban centres, population	Global Rural-Urban Mapping Project (GRUMP): Settlement Points. Palisades, NY: CIESIN, Columbia University. (CIESIN 2004)
Productivity and prices	Statistics Finland / Eurostat
GDP capita	World Bank (2008)
Farmers identities in Finland	Vesala and Vesala (2010)
Main agricultural potential (Finland)	Berkel and Verburg (2011).

3 Methods applied

3.1. Geographic kernel methods

This study analyses the structure of the farms and its activities in North Karelia, including two dimensions: geographical and temporal. The geographic analysis aims to identify and quantify areas where an activity is mostly performed and the temporal deal with the changes (and factors related) that this activity has presented across the timeframe of study. In this sense, the objectives require valid methodologies that can address adequately both dimensions and its interactions.

Geospatial *kernel* methods are a valid method to identify and analyse geographic clusters. Statistically speaking, this approach is a non-parametric method for the estimation of the spatial distribution of probabilities based on a pool of observed events. For a given spatial region, a continuous grid is first created, and the probability of occurrence of a specific event for all the points of the grid is calculated. This calculation is made according to the observed events, creating a density function based on the frequency of the events studied. The function of density is subsequently calculated for all the points on the grid, which results in a continuous distribution of the density of frequency for all the territory studied (figure 3).

In this study, the kernel function used i is based on a normal bi-variate distribution curve, where the variables analysed are the Universal Transverse Mercator (UTM) coordinates of the events studied (e.g. farms with a specific activity, economic centres, etc…). They must follow the equation:

$$K(x,y) = \frac{1}{2\pi n h^2} \sum_{i=1}^{n} \exp\left(- \frac{(x - x_i)^2 + (y - y_i)^2}{2h^2} \right) \qquad \text{Eq 1}$$

where *K(x,y)* is the estimated density function for the point *(x,y)*, *h* is the bandwidth radius (i.e. smoothing parameter) which affects the dispersion of the density function, *x* and *y* are the coordinates of a point inside the studied area, and x_i and y_i are the coordinates of the *n* observed events. In some cases, this function can be weighted by adding a value to the numerator. This can be particularly useful when the events subject of study present a magnitude, e.g.: the study of farms might weight the position of a farm with a given activity by the total size in use with that activity, or population patterns might weight the location of cities or villages by its population, in order to correct the estimates. In these cases, large farms or large cities present a higher pulling effect on the continuous grid, and offer a more realistic picture of concentration.

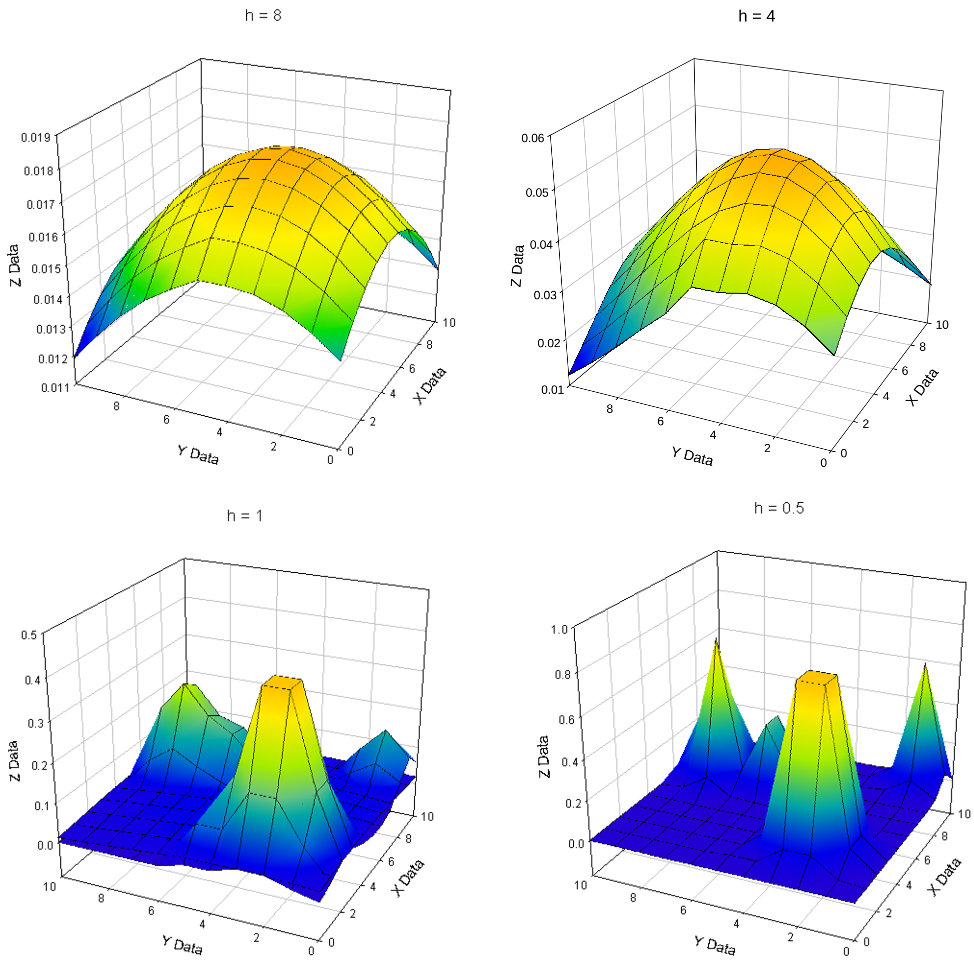
Another key element of the equation is the bandwidth radius *h*, which acts as a smoothing factor. The smoothing factor (*h*) will determine the level of aggregation of the data in the density function, and significantly affects the final outcome (Silverman, 1986; Worton, 1995). Although there is not a broadly accepted methodology to determine the optimal smoothing factor (Silverman, 1986, Brunsdon, 1995), a common method is an *ad hoc* choice, referring *h* to a parameter (Worton, 1995). In this study, the parameter of reference was always calculated according to the following equation (Worton, 1989):

$$h_{ref} = n^{-1/6} \sqrt{\frac{\mathrm{var}_x + \mathrm{var}_y}{2}} \qquad \text{Eq 2}$$

where h_{ref} is the reference value used to calibrate *h*, *n* is the number of events and var_x and var_y are the estimated standardised variances of the x and y coordinates, respectively. The final calculations are based on variable kernels, where the smoothing parameter is not fixed along the locations, being lower in areas with low concentration of events. By this means, studied events in bordering areas are not over-represented.

The values of reference where calculated for several time intervals. Different values of *h* where applied and compared, with the final version being based on a smoothing parameter of 40% of the reference value h_{ref} (Eq 2). The kernel estimations were based on the HRE (Home Range Extension) package in ArcGis v 9.0 developed by the Centre for Northern Forest Ecosystem Research (CNFER) (Rodgers and Carr, 1998).

a)



b)

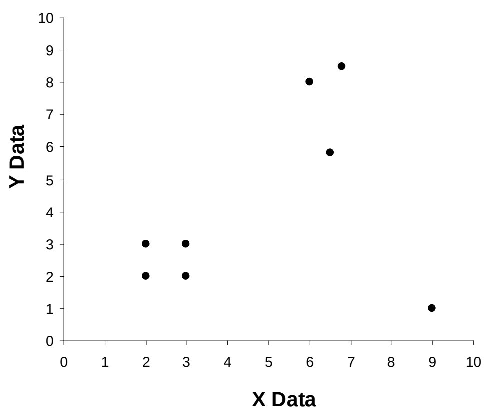


Figure 3. Illustration of kernel estimates for different values of bandwidth radius (h ref = 0.5, 1, 4, 8) (a) for the same set of coordinates x-y (b). In this study, the events to be studied are farms with a particular activity.

After the kernels are calculated it is necessary to analyse the resulting estimates. Therefore, a method for analysis, and also to represent the estimates in a graphical way, is the used of raster maps with standardised isopleths. Isopleths in this study are based on percent volume contours (PVC), in order to compare areas with high density of events in the different periods of study. The PVCs define the volumes under the utilisation distribution, and thus represent a defined percentage of occurrence (or concentration) of a given event in the smallest possible area. For instance, the isopleths containing the 10th percentile area shows the areas with the highest concentration of an event (e.g. the 10% of the total population, for the smallest area possible, which in this case is interpreted as the highest density of population), and it is considered the *core area*. On the other hand, the 90th percentile area represents the lowest density, since it contains almost the total number of events studied. The resulting maps were presented using a 150 x 150 grid cells resolution.

3.2 Identifying agricultural cores

A similar method was implemented aiming at identifying agricultural cores, ie. areas that concentrate most of the agricultural production given a single activity. In this case, the PVC areas are used to map the location where the activity is concentrated, and changes in the PVC shape and location along time necessary imply changes in the farm activities' geography.

For this study, the PVCs were calculated given a kernel function for all farms with cereal production, in order to assess changes in one of the most spread farm activity. The kernels and PVC were calculated for the years 1995 and 2004, to evaluate overall changes in along the time of study. Therefore, the areas under a 10% PVC refers to those areas with the highest concentration of cereal production as main farm activity, as they encapsulate 10% of the total area planted with cereal in the smallest continuous area. At the same time, 90% of the PVC defines an area with cereal production, as it covers almost all cereal production area in a continuum.

3.3. Economic cores and periphery

The region was analysed and described according to its position with respect to the economic cores across time. Therefore, a methodology was proposed in order to map the geography of the economic cores in Finland, also based on kernel methods. The main assumption was that local concentrations of cities can serve as a proxy for economic cores, taking into account their population and wealth expressed as the country's GDP. In addition, as the main focus of study was North Karelia, a region located in a border area, cities of nearby Russia were also included in the calculations. The estimates were based using the Settlement Points database (CIESIN, 2004). Therefore, for every settlement, the population of the settlements for a given year was multiplied by the GDP per capita of the country for that year (Finland and Russia).

Once the city network was established and weighted, it was subject to an aggregation method using a kernel function. This approach resulted in a continuous map of regional economic concentration, and in order to standardise these areas, percent volume contours (PVCs) were used. The PVCs are basically areas that concentrate given percentages of the total values in the smallest area possible. Analogously in this case, a 10% PVC refers to the areas with the highest concentration of wealth, as they encapsulate 10% of the total GDP in the smallest continuous areas. At the same time, 90% of the PVC defines an area with a low concentration, as it covers almost the whole geography of the country. The PVCs where calculated for the year 1985 and 2005 in order to observe changes in the location of wealth in Finland, and whether there was a pattern of concentration. Also, a main objective of this was to observe the overall situation of North Karelia with respect to the location of the economic cores of the country.

3.4. Assessing transformations in agriculture and land uses

The overall changes in farm activities and in land uses were evaluated by using change-matrices, in which the percentage of farms that change are compared to the initial farms supporting that activity. The reference year was the first year of the study period or the first year with data available. The farm activities were compared between 2004 and 1995, and in the case of land uses, between the years 2006 and 2000.

The changes in the farm activities and its location and the scores that define core-periphery were then analysed. For this, the average centre-periphery values were calculated, and analysed using *t-test* and *Anova*, assuming a normal distribution in the location (based at the same time in the kernel calculations). Other simple statistic techniques include linear regression, based on ordinary least squares. The statistical analyses were performed using SPSS v 13 (2004).

4. Analysis and results

4.1. Description of the farm structure

A total of 4659 farms have been studied in the area of North Karelia during the period 1995-2004. The farms were clustered in four main activities: oriented towards cereal production, oriented towards husbandry in a broad sense, oriented towards gardening, oriented towards forestry (figure 4). The farms were located in the agricultural lands of the area, mostly around the lakes and rivers. There were more farms located in the central south and west areas, than nearby the Russian border.

The farms oriented towards cereal production and husbandry were clearly dominating, whereas fewer numbers were oriented toward gardening or forestry (understood as a farm activity). Those farms oriented towards cereal production tended to be located in the central-western areas of North Karelia, whereas husbandry oriented farms tended to be scattered across the territory. In the case of gardening activities, some clusters were identified in the south and eastern areas. Forestry activities on farms were dispersed and scarce, and they were mostly located in the south and easternmost areas.

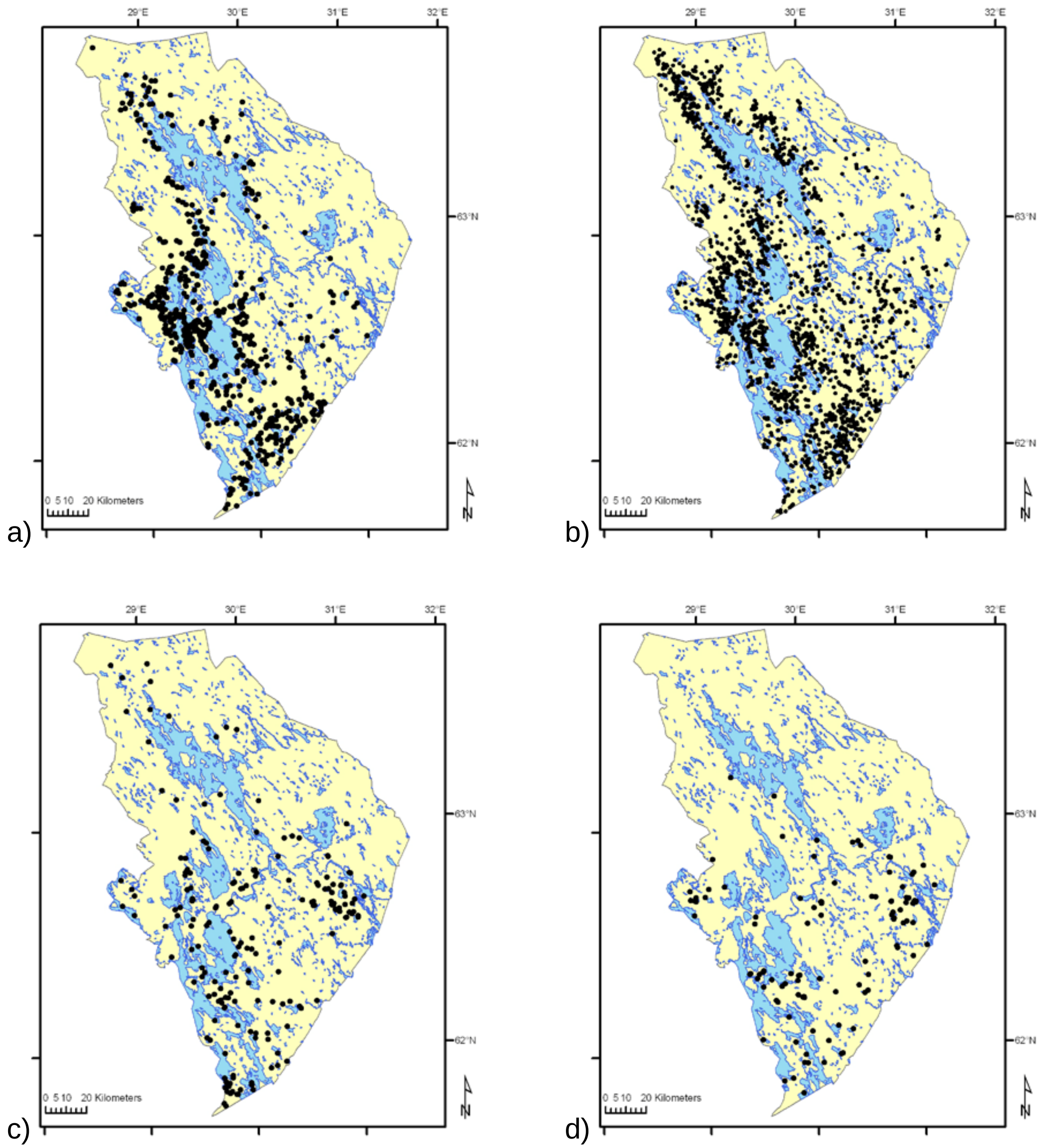


Figure 4. Main uses of the farms in 2004: a) oriented towards cereal production, b) oriented towards husbandry, c) oriented towards gardening, d) oriented to forestry.

4.2. Changes in farm activities

There were dramatic changes in the farm activities during the period studied. In total, 2554 farms change their main activity, resulting in maps where there are almost as many farms changing activities than keeping the same than in 1995 (figure 5).

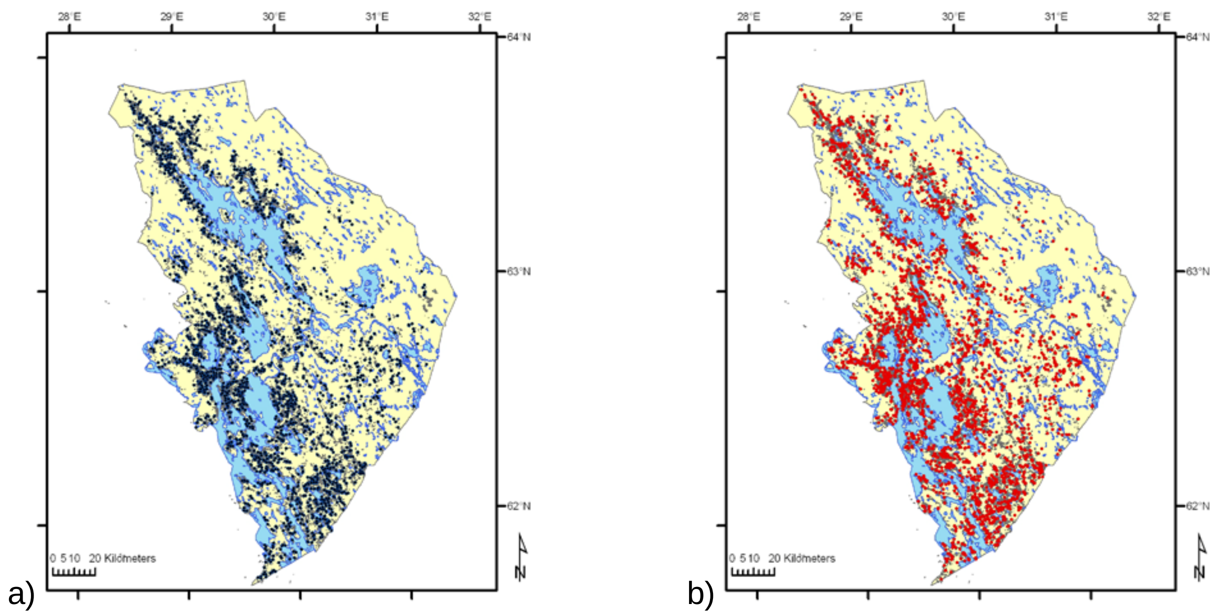


Figure 5. Changes in the farm orientation in Karelia (Finland). a) Farms which main orientation remains the same during 1995-2004 (N=2105), b) Farms which main orientation is changed (N=2554).

In general, the overall direction of these changes was towards larger cereal areas (figure 6). Most of the farms with cereal production in 1995 maintained this activity (73%), and also incorporated many farms from milk production and cattle. Milk production was clearly in reduction in the area, as fewer farms maintained this activity for the period of study. Even more extreme was the cattle situation, as very few farms maintained this activity, with most of them moving towards cereal.

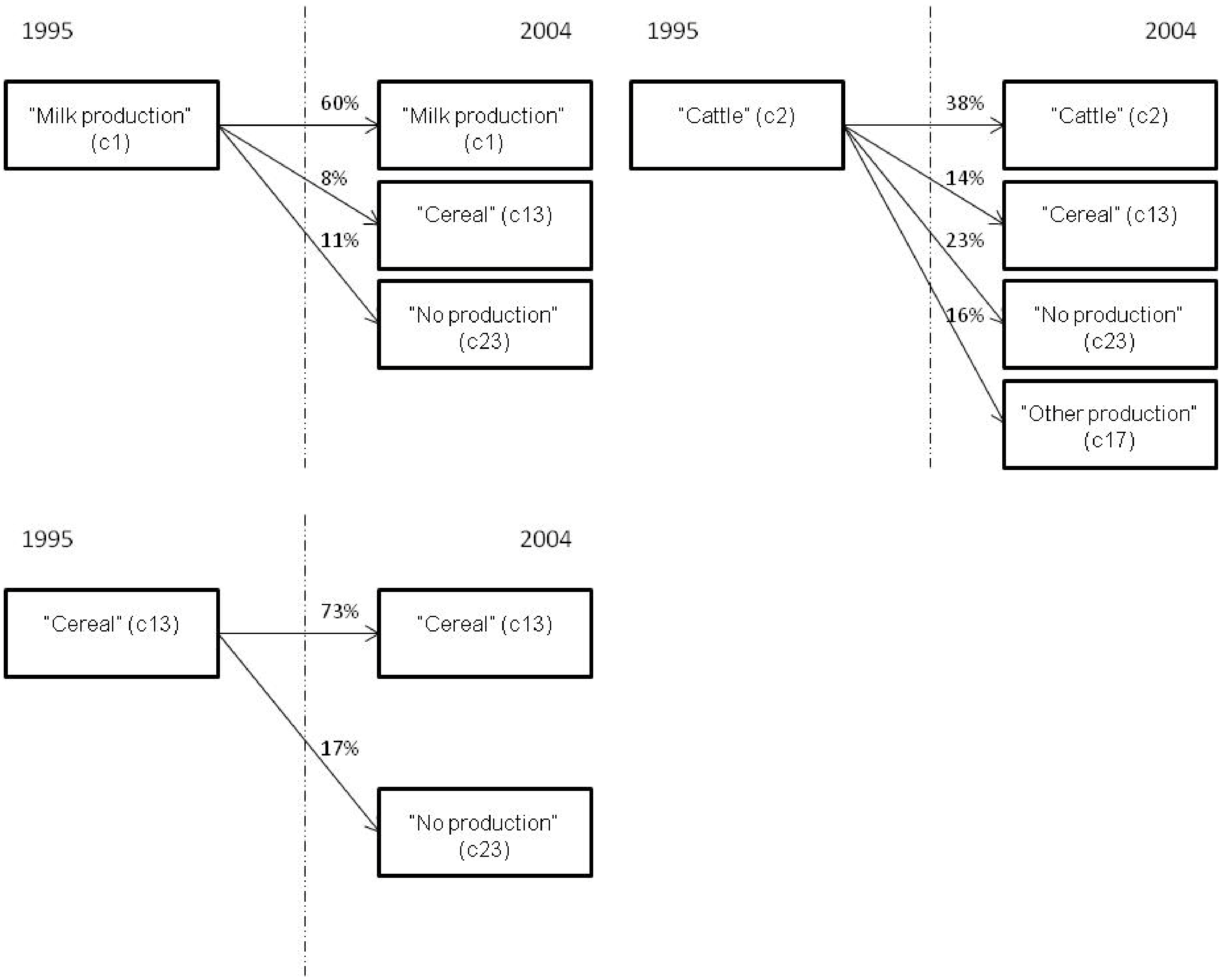
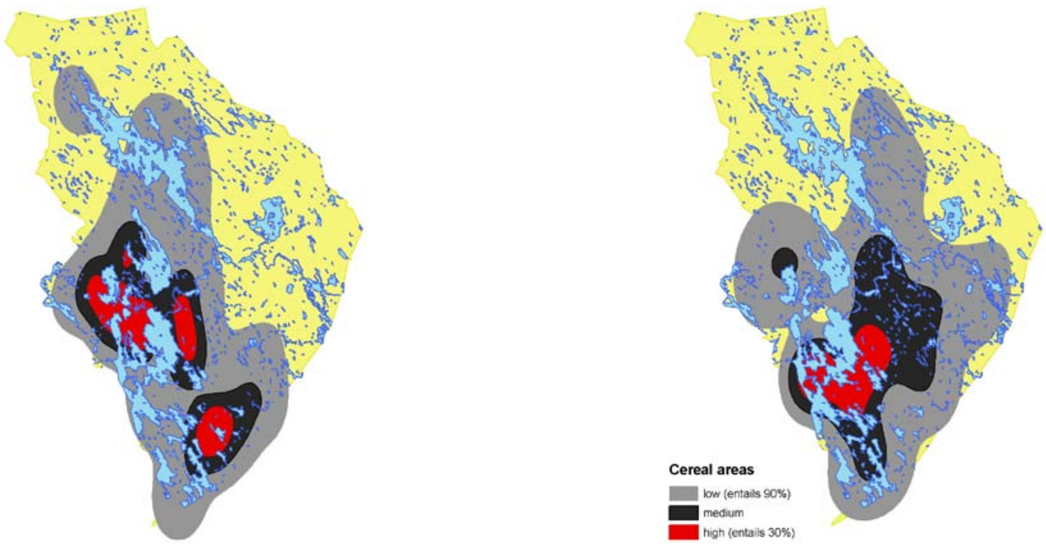


Figure 6. Direction of the changes of the main farm activities between 1995 and 2004, for selected activities in North Karelia (Finland).



a) b)

Figure 7. Cereal core areas in North Karelia (Finland) in 1995 (a) and 2004 (b). High entails 30% of the total land planted with cereal in the smallest continuous geographic area for a given year (i.e. “cereal core areas”. Medium entails 60% of the total land planted with cereal. Low entails 90% of the total land planted with cereal (i.e. “cereal extent”).

Concerning the geographical location of these new cereal areas (figure 7), there was a geographic concentration around the south of the region, and the core area concentrated around. In fact, the two main cores identified during the 1995 period, merged into a bigger one, covering a larger area and concentration share.

Finally, there was at the same time a clear diversification of the farm activities, measured in absolute number of different activities by farm (including the main activity, as defined). In this sense, an average farm in North Karelia was producing about seven additional activities in 2005 than in 1994 (figure 8). Many of this activities concern only small fields or represented a very small share of the main production, but nevertheless the results show a clear trend of diversification of the farm activities in the region compared to the middle 1990s.

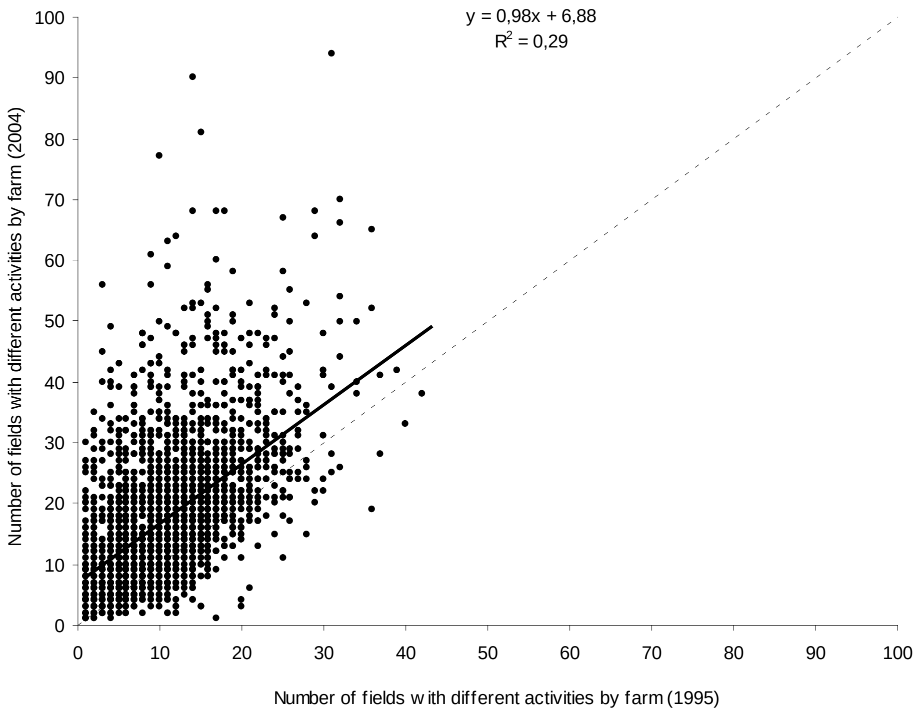


Figure 8. Changes in the number of field with different activities by farm during the period 2004 compared to 1995. The dotted line represents no change, whereas dots above this line represent farms diversifying their production activities.

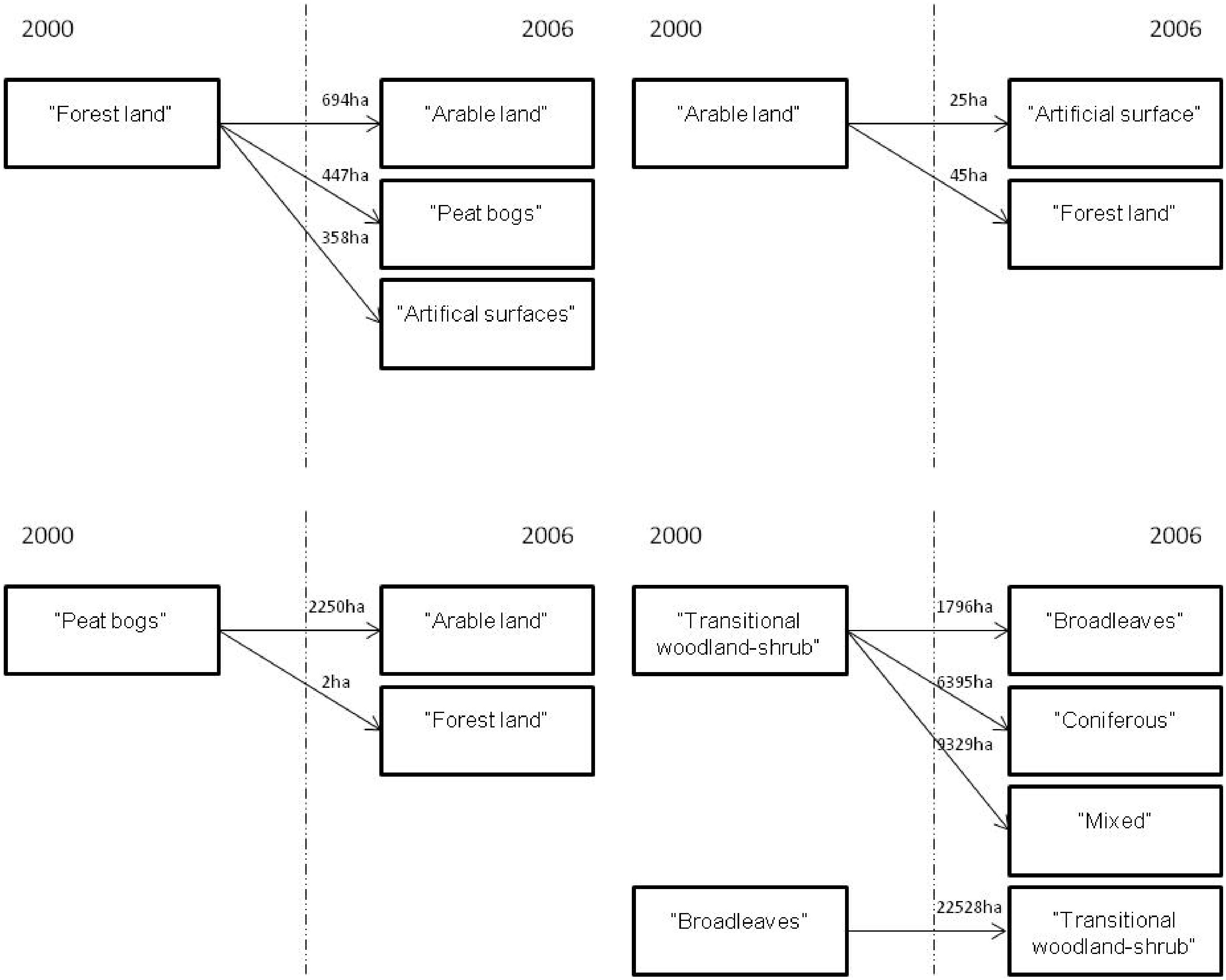


Figure 9. Direction of the land use changes in North Karelia (Finland).

Finally, regarding other land uses than farm activities, the overall direction of the changes was towards an increment of available arable land, especially from peat bogs and forest land, although these changes only affected c 3000 ha. Other changes affected the composition of the forest lands, particularly from broadleaves forests to a transitional woodland-shrub formation, affecting over 22 000 ha in merely 6 years (figure 9).

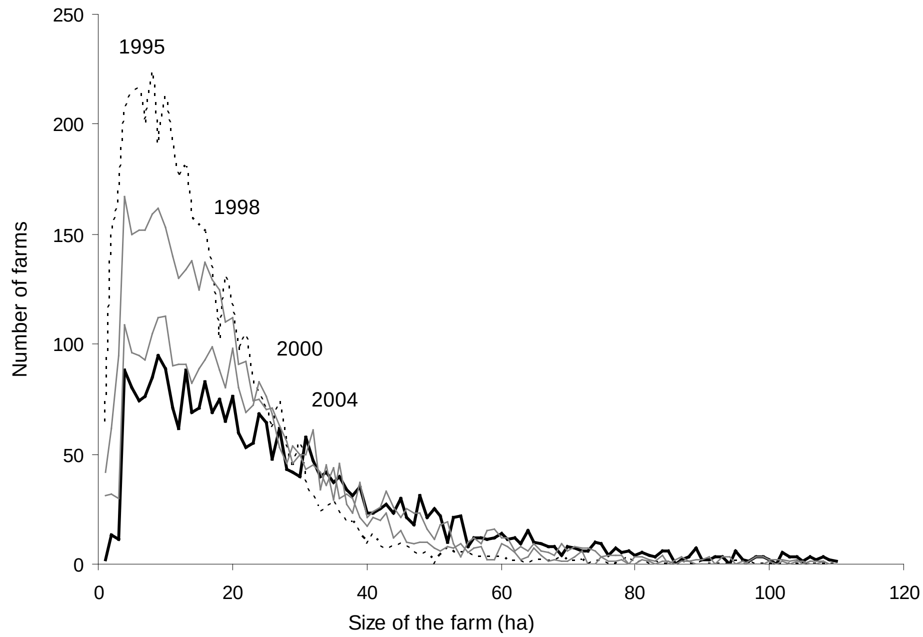
4.3. Changes in size: farm concentration

During the period studied there was a strong trend towards farm concentration (figure 10). Whereas in 1995 the largest share of farms picked their size at around 10 ha, this was no longer hold in the subsequent years. For instance, in 1995 over 41% of the farms were 10 ha or smaller, whereas this percentage was 33%, 25% and 21% for the years 1998, 2000 and 2004, respectively. At the same time, in 1994 only 24.5% of the farms were 20 ha or larger, whereas this percentage was increased to 33%, 47% and over 53% in the same years. It must be taken into account that, as a consequence of the enlargement of the farm's size, and the lack of significant changes in land uses concerning forest to agriculture, the overall number of farms was also reduced along time.

This feature is not only presented as an enlargement of the farm area, but also as an increase in the average size of the fields. Whereas in 1995 an average field in the region of North Karelia was below 1.6 ha, by 2004 the average field covered over 1.8 ha, a total increment of over 12% in 10 years.

The farm concentration trend observed in North Karelia is parallel to national changes (figure 11). By applying the same size categories available in national statistics to the data gathered in North Karelia it can be made an effective comparison: in both cases there has been a reduction of those farms smaller than 10 ha, and at the same time there has been a significant increment of those over 50 ha. The pattern is more pronounced in North Karelia than in the rest of the country for small farms, as the rate of their reduction has been more drastic. Also, the rate of creation of large farms (those over 50 ha) has been faster in North Karelia, increasing from close to merely 2% to near 15% in very short time.

a)



b)

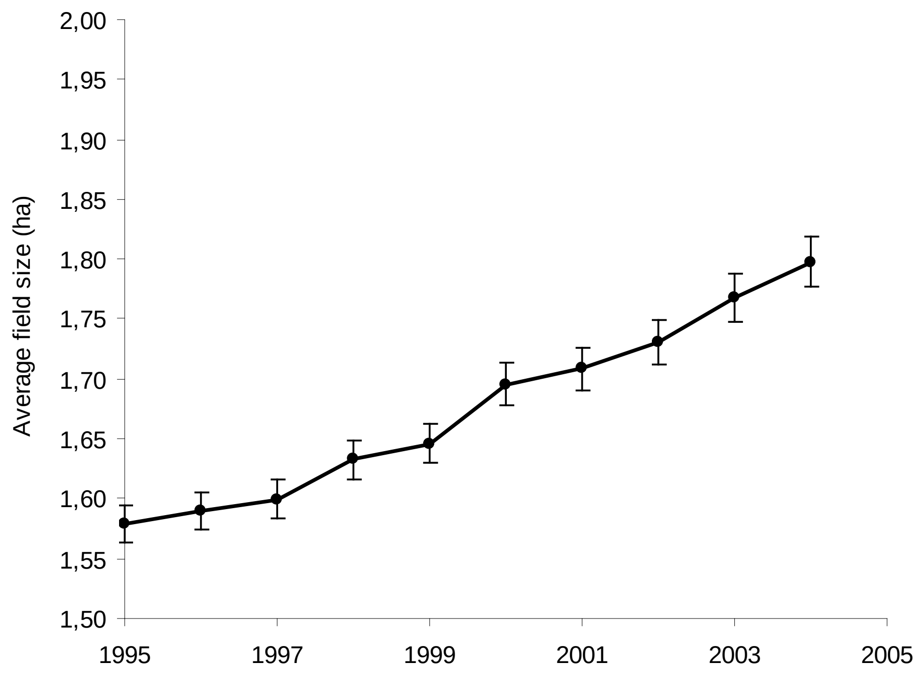
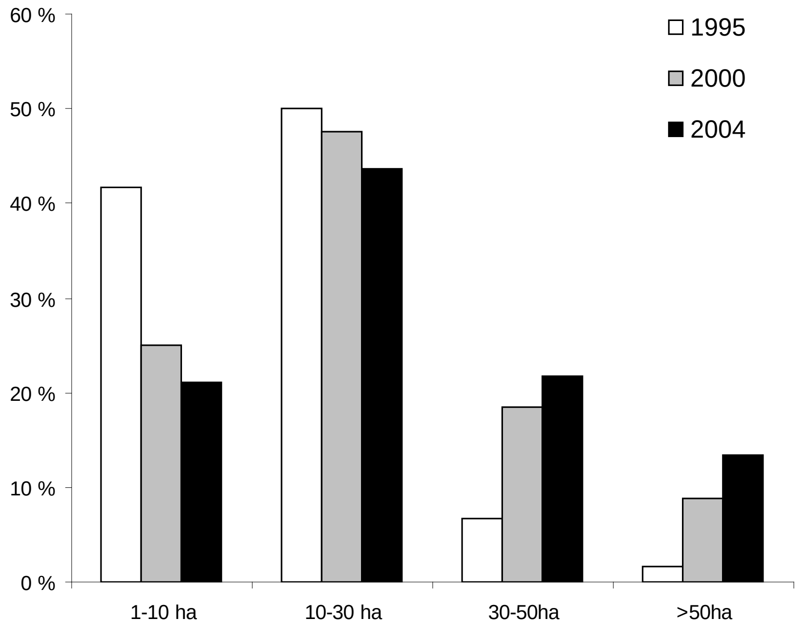


Figure 10. Concentration pattern of farms in North Karelia (Finland). a) histograms of number of farms for a given size. b) average field size along time. Bars represent the calculated standard errors for each year.

a) North Karelia



b) Finland

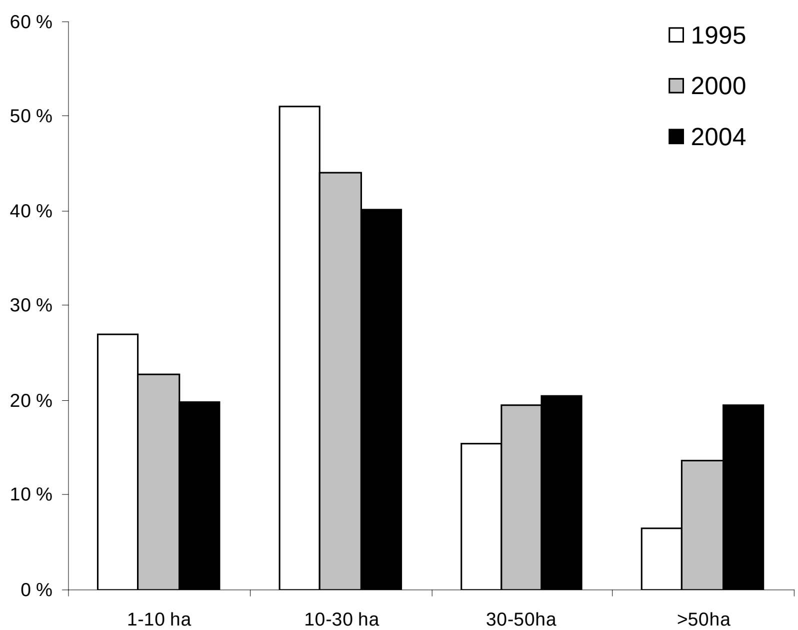


Figure 11. Farm concentration trend in North Karelia (a) and national average for Finland (b). Axis represent percentages of total number of farms for a given size.

Even with those drastic changes, the shares of large farms still remain lower for North Karelia than for the rest of Finland; although in both cases the most representative farms are those between 10 and 30 ha in size.

4.4 Changes in productivity

Concerning productivity, there have been significant increments during the last three decades, particularly in cereal. The analysis showed that whereas one ha in Finland produced an average of 2.5 t per ha annually, by the 2010s the production was c 3.5 t. The trend was significant for barley and wheat production, with coefficients of determination of 0.30 and 0.26, respectively. The increment rates were 30.5 kg and 31.1 kg annually, also respectively.

It must be noted that as these increments have resulted in over 900 kg of productivity in three decades (36% increment respect the 1980s values), this means that the same production levels can be hold in 2010 with c 70% of the land, leaving 30% for other purposes or to increase overall production.

At the same time, there has been a steady reduction of the cereal priced for the same period of time, decreasing around 2.7% and 3.8% annually for barely and wheat, respectively (R^2 in this case is 0.87 and 0.89, also respectively). The prices in 2005 were only 80% and 62.5% of those in 1995, respectively (figure 12).

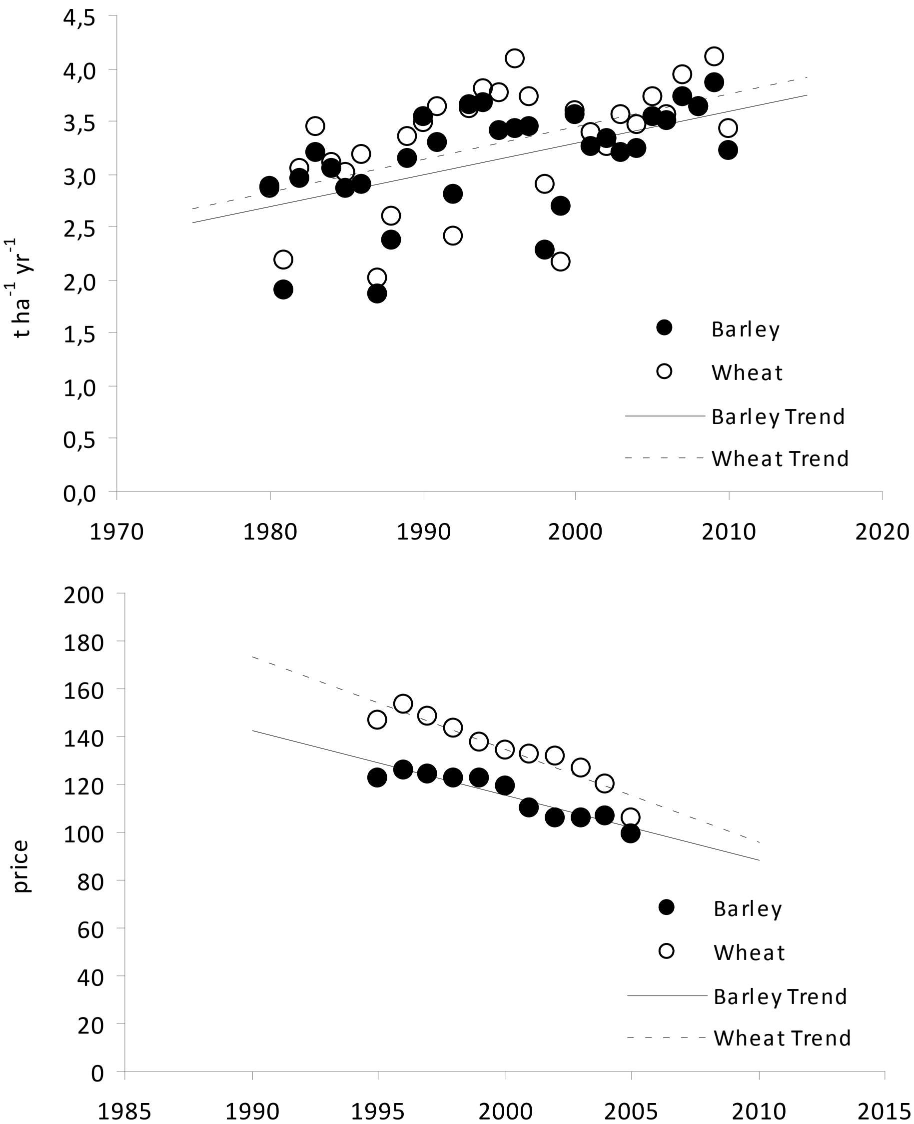


Figure 12. Changes in the field productivity and prices for barley and wheat in Finland. For the prices, the reference value (100) is 2005.

4.5 Changes in the policy framework

The most important external change identified is certainly the implementation of the CAP reforms. Quantitatively, the CAP translated into a share increment from 13% to 27% of the share of agricultural support in Finland during the period studied, the LFA from 13% to 23% and the national support schemes were reduced by half (table 4). The overall support also dropped from 2063 to 1880 M EUR for the same period of time.

Table 4. Changes in the agricultural support in Finland for the period studied, in million EUR (extracted from Tomsik and Rosochatecká, 2007: 451). CAP: common agricultural policy, LFA: Less Favoured Area

Support body	**1995 (M EUR)**	**2005 (M EUR)**
CAP Support	273	515
LFA Support	273	423
Environmental Support	239	322
National Support	1278	620

4.6 Changes in relative core position: periphication

There were also important changes concerning the relative position of North Karelia regarding the economic cores of the region (figure 13). The area with the highest concentration of socio-economic cores as defined in this thesis (a relation of the population of the urban centres weighted by the GDP per capita) was displaced to the south and west of the country during the period 1985 to 2005, due to changes in the population structure of the country. The exception would be the city of Oulu and its nearby area, which seemed to experience some expansion.

In fact, the analysis reveal that at least 60% of the economic wealth (and therefore the economic activities, and to a certain extend the decision making and the policy making) it is concentrated in less than a third of the country. Whereas in 1985, the isopleths for the 60% of economic wealth included the city of Joensuu, the line estimated for 2005 did not include the city, due to the displacement of population and GDP to the south, making the area of North Karelia to become slightly more peripheral from the economic cores.

Although the isopleths can provide with a graphical insight of the displacement of the cores, the calculations included a continuum of core-periphery that could be transformed into an index. This index was calculated for each farm (figure 14), showing the relative position of each of the farms analysed versus the core-periphery gradient.

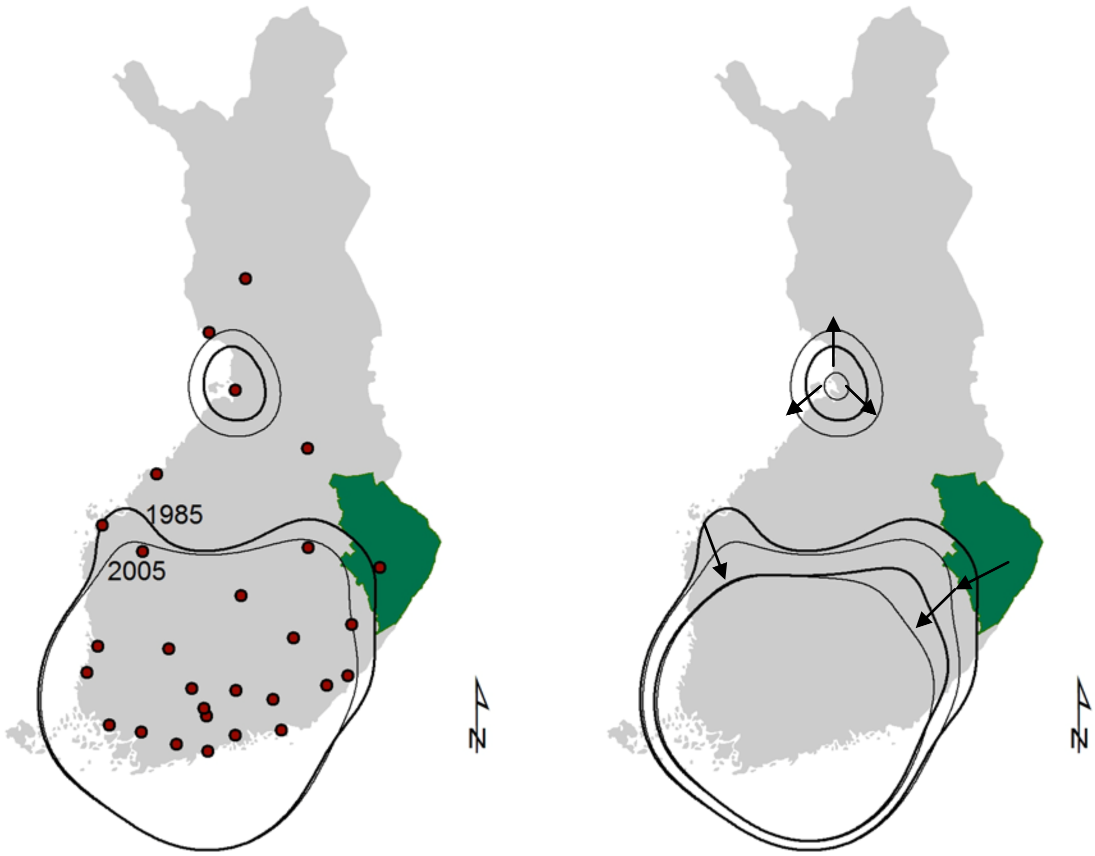


Figure 13. Illustration of the estimated displacement of the economic cores in Finland between 1985 and 2005. The lines represent isopleths encircling the same amount of economic activity for a given year. Left: Isopleths for 1985 (dark line) and 2005 (thin line) for c 60% of the economic activity in Finland. Points represent major urban centres. Right: Arrows illustrate the direction of the change of the economic cores, and lines represent isopleths for c 60% and c 50% of economic activity.

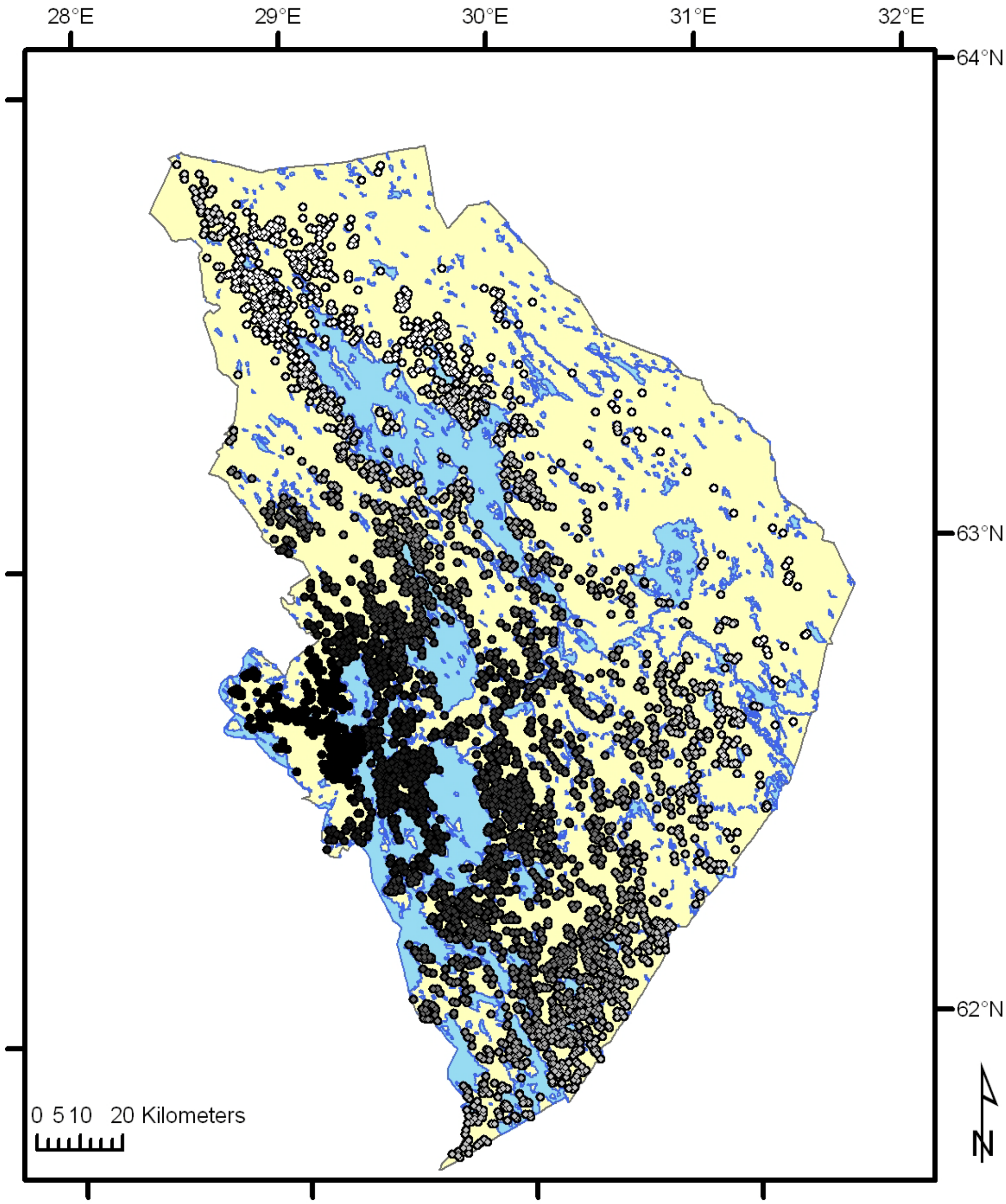


Figure 14. Representation of a core-periphery index for each farm, based on the standardised kernel values calculated for Finland and nearby regions. Darker colours indicate farms closer to socio-economic centres, whereas lighter colours indicate economic periphery. Farms nearby the Joensuu area had the highest scores, although other cities in nearby areas also modified the index. Those farms located in the northern areas of North Karelia or near the Russian border had the lowest values.

The results show that those farms more centrally located regarding the economic cores had been changing their main activity during the period of study (figure 15). On the other hand, farms located in periphery areas showed fewer tendencies to change the activities, and in many cases their main production structure remained the same than in 1995.

By activity, cereal production tended to be located closer to the economic cores, whereas milk production and cattle where located in peripheral areas of North Karelia. There were no significant differences between the averages for these main activities in 2004 with respect 1995 (figure 15).

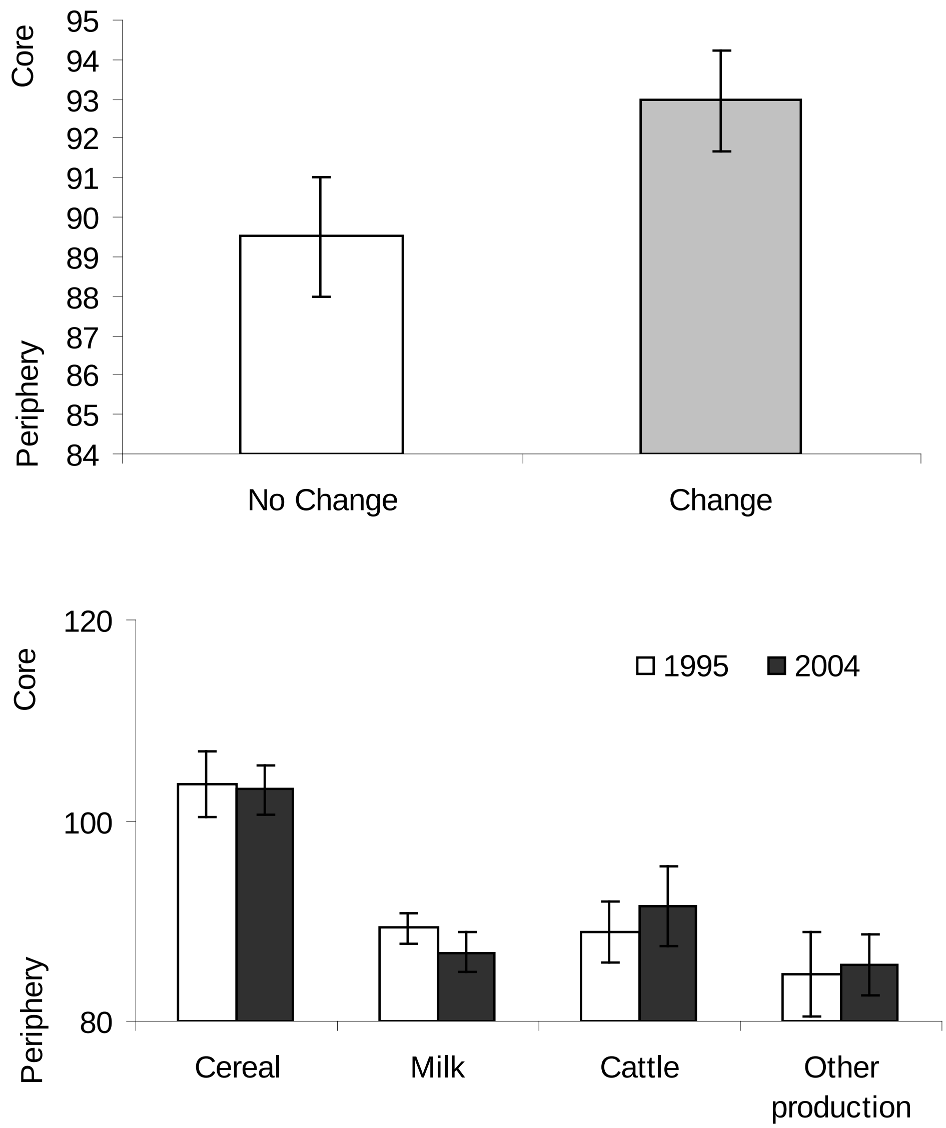
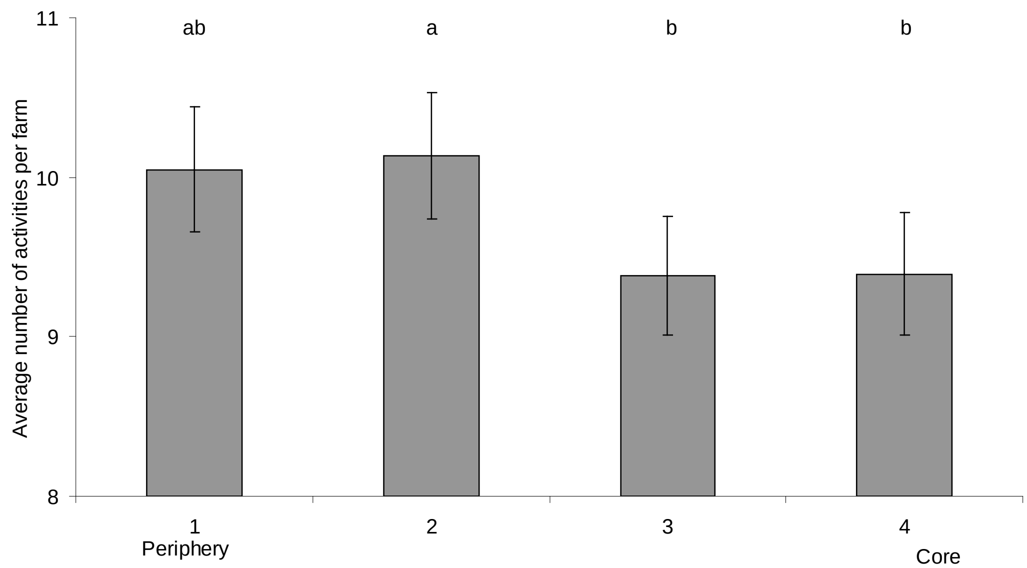


Figure 15. Average location of the farms according to their proximity to socio-economic cores. No change: farms which main activity has not been changed for the period 1995-2004. Change: Farms which main activity has been changed for the same period. The scale of the axis refers to an aggregation parameter that reflects proximity to population settlements based on a weighted probability of occurrence using a kernel method. Bars represent two times the standard error of the estimated means.

1995



2004

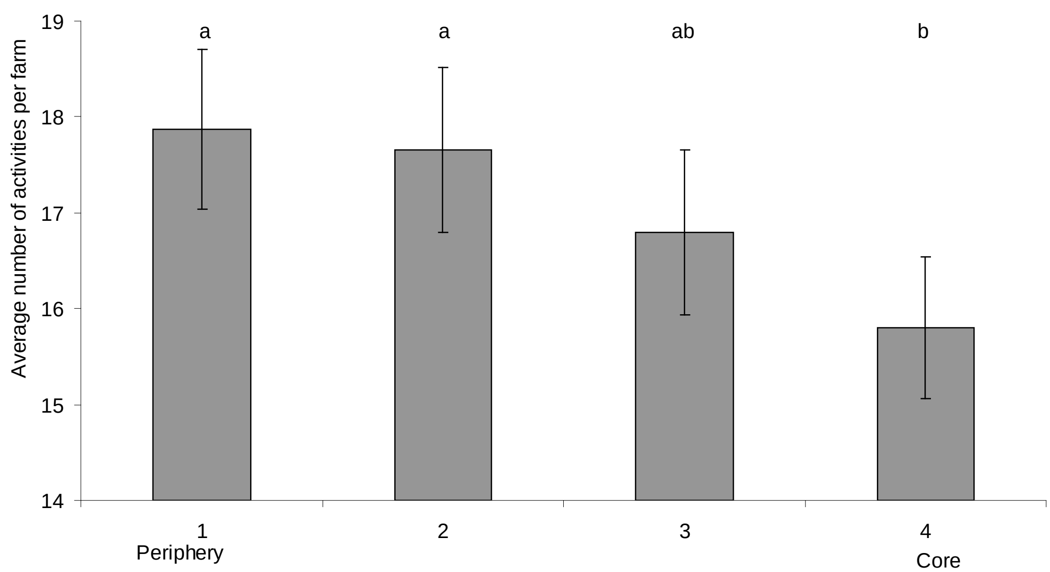


Figure 16. Average number of activities per farm related to non-husbandry production in North Karelia (Finland). Tiles 1-4 correspond to a Core-Periphery index related to the location of the farm with respect to socio-economic concentration in Finland. Letters indicate the grouping value resulting from a *Tukey* test.

5 Discussion

This study focused on the changes of farm structure and activities in North Karelia during the period 1995-2004, which was subject to major policy changes in agriculture due to the accession of Finland to the EU. As such, the research presented is an attempt to provide tools for understanding the current changes in the agricultural sector, the impact of the political measures and its consequences.

There have been recently many studies about changes in land uses (see as a recent examples Ostwald, & Chen, 2005; Strijker, 2005). The approach taken in this research is somehow differing from earlier research as aims to introduce geo-spatial methods to explain and locate the changes, and to frame them into the policy framework changes. The dataset used for this study relies heavily in empirical data, thus providing with a strong basis for analysis. The methods of analyses showed changes in both of activities as well as in the geographic location of those activities and regarding the periphery indices created.

The approach has its limitations, as the data is limited to a specific region, and it is therefore difficult to extrapolate certain results to other areas in Europe or elsewhere. In addition, the analysis and results could be complemented in future and more ambitious studies including questionnaires addressed to farmers in order to assess their main motivations, as a means to identify new factors that could better explain the features identified in the results. Given the limitations in available resources of a thesis, this information was gathered from secondary sources in the literature, providing an acceptable basis for expanding the results.

Besides these limitations, the methods and analyses performed are valid and novel tools of analysis that can be reproduced in other regions, when enough data is available, and future studies can be oriented to confirm its utility and to improve them.

5.1 Reduction of farms and concentration patterns

One of the most obvious results is that the number of farms in North Karelia has fallen significantly, and at the same time farms have been enlarged in size, in a process of concerntration. In fact, national statistics show that the number of farms is still decreasing fast over the whole country. In fact, the total number of farms has been falling by c 3% in the annual average since Finland’s accession to the EU (Tomšík and Rosochatecká, 2007), from c. 100 000 in 1995 to less than 70 000 in 2005 (Matilda, 2006). The overall changes in Finland are in line with the results from North Karelia: Nationally, the number of milk farms has been falling by 7% a year and an overall reduction to the total number of less than 40 000 farms is expected by 2020 (Tomšík And Rosochatecká, 2007). Therefore, the number of milk farms should fall to 6 000 by 2020, which is a drastic reduction if we compare to 35 000 before Finland joined the EU, and the 16 500 milk farms in 2005. In parallel with the drop in number of farms, milk production was falling in the first years in the EU, and although it increase since 1997, in the recent years, the production of milk turned to a decline.

The results show that the EU membership has resulted in higher concentration, which also agrees with other author’s analysis at national level (Tomšík And Rosochatecká, 2007). The decline in total numbers of farms concerned mainly small farms, whereas the number of farms over 50 ha of cultivated area has doubled during the EU membership period. Also the national values show a general concentration, as the average size of Finnish farm increased from 22.8 ha in 1995 to 33.3 ha in 2005 (Niemi and Ahlstedt, 2005). The total cultivated area has increased during the Finnish membership in the EU and it has grown by more than 77 000 ha between 1995 and 2004 to 2.22 million ha, which represents an annual growth rate of 3.6%. Tomšík and Rosochatecká (2007) argue that the main reason for this increase lies in introducing the new CAP rules, which made the cultivation of less productive parcels more attractive due to area payments.

At the same time, the extreme northern conditions have always been a reason for the high level of production costs, and the competitiveness of Karelian farms on the single market became troublesome. Some authors estimated that the production cost per kg milk stayed at 0.59 EUR/kg in 2004 which was about 20% less than in the 1990s (Tomšík and Rosochatecká 2007), and the average production cost of cereals reached 0.46 EUR/kg in 2004 which was similar to the 1995's levels. This is linked to the concentration patterns observed, as explain the decline in milk production cost as a results of the growing farm size and increasing milk yields. In their database show that small farms with less than 10 cows produced milk for 0.88 EUR/kg in 2004, whereas farms with over 50 cows produced for 0.49 EUR/kg given the fixed cost at small farms.

5.2 Diversification patterns

The CAP can also explain some of the directions that took the main activities, influencing the structure of production. For instance, nationwide the wheat area has almost doubled during the EU membership, which is also reflected in the results analysed for North Karelia. On the other hand, the area of root crops dropped although it was compensated by higher yields achieved.

The results showed a clear trend of diversification of farm activities along time, which agrees with similar trends in other parts of Europe. In fact, diversification of activities belongs traditionally to the common approaches to agriculture. In North Karelia, the fluctuation of yields have traditionally motivated that local farmers should secure their income from various sources, thus reducing the risks attached to a single activity by spreading the chances in a pool of alternatives. The trend observed, however, shows an increment of the diversification activities increasing since the 90's, also observed by Hietala-Koivu (2002). Also, Vesala and Vesala (2010) have observed a strong diversification in the Finnish farms, especially among crop farms (in their study accounted for 40% of all diversified farms at year 2005), whereas dairy farms were less diversified.

In line with the results, at national level more than one third of the diversified farms practise at least two non-agricultural activities as some of the new farmers' activities are oriented on services; one of the most typical activities is contracting machines (Farming and Food in Finland, 2006). In this sense, the development of rural areas is influenced positively by growing importance of other (non-agricultural) small rural enterprises. Their number grew by 2% in the period 1997–2002 and approximately one fifth of workers employed in small rural enterprises are active in processing industry (Tomšík and Rosochatecká, 2007, Tomšík and Rosochatecká, 2009). This diversification in the form of various economic activities is an important element of stability for Karelian rural areas.

The concentration and diversification patterns, explained by the implementation of the CAP but at the same time part of a process of modernisation of agriculture with more mechanized practices has contributed to the cultivation of larger parcels of land, which can be managed more easily than more irregular shaped smaller ones. The increasing numbers of tractors per hectare of field area, the increasing area of arable land per farm and the decreasing numbers of farms have been used descriptively as socio-economic measures of agricultural modernization (Hietala-Koivu, 2002). At the same time, the observed changes in agricultural activities have also consequences in the landscape. It must be observed that landscape in North Karelia have been mainly formed as a consequence of agricultural practices and the changes observed translate in changes in the landscape at different scales, and it will be an interesting focus of future research to examine the interconnections and consequences in terms of human-scale and natural diversity.

It must be taken into account that at the same time, the new incentives provided by the CAP policies and reforms can offer new opportunities to the Finnish farmers and particularly in North Karelia (Tomšík and Rosochatecká 2007). For instance, Finland’s implementation of the EU agri-environmental mandate is the Finnish AgriEnvironmental Program (FAEP). The program is nationwide with a main focus is on reducing nutrient loss from agricultural land and it is considered the primary solution to the country’s considerable problems with surface water pollution from agriculture. The FAEP has been one solution for keeping farming economically viable and at the same time promoting more environmentally friendly agriculture. At national level, almost 90% of the active have opted to participate in the programme (Laukkanen and Nauges, 2012).

Also, the results of the CAP, concerning the decoupling of the payments, can bring certain advantages because of the high production costs (Tomšík and Rosochatecká, 2007). A potential reduction in production would slow down price decrease and farmers continuing in agricultural production would find more space on the market. However, the authors emphasize that no radical changes are expected in the above described trend in agricultural production. Decoupled payments could change slightly the structure of agricultural production as they could encourage the shift from livestock production to crop production or to set-aside, eventually to production of plants offering new income opportunities, a trend that is observed in the results for North Karelia.

5.3 Location patterns

Farm activities and in general agricultural practices an obvious geographical component, as they do not appear randomly, based not just on forest area, but also variables linked to the physical, social and political context. Given a broad enough sample, it is possible to identify areas with a higher occurrence of certain activities, which can be defined as conflict hotspots, and link them to changes in the policy framework.

Methodologically, this study proposes the use of kernel analysis as a valid method to examine the spatial component of the changes, and to parametrize quantitatively the location according to the core-periphery dichotomy. In this sense, the application of kernel methods proposed can provide with valid indices of *periphication* for every area, including every single farm. It must be stressed that cores and peripheries are not so much defined by national or other territorial boundaries but by their position in the world economy networks. In this sense, although to a different scale, McCann and Gunn (1998) state that the core is referred to as the heartland, while the periphery is the hinterland, taken as a global as well as local perspective.

The methodology suggested is a valid ground to analyse changes in the core-periphery areas as well as for its quantification for further analyses. Cores means those regions that are in leading positions in a region or the world economy and whose high levels of production and consumption rely on mainly imported natural resources. On the other hand peripheries are those spaces which are integrated in trade and markets at a regional and global scale through their dependence on primary products and low value added exports (Hayter et al. 2003; Barton et al. 2008). In Finland, cores are located mainly in the south and west parts of the country, leaving North Karelia in a location of relative periphery. The method and analysis reflects the socio-demographic changes experience in Finland during the period analysed, and the results show that this relative position of periphery has been enhanced in recent years.

Also, the use of kernels has applications when identifying the location of farm activities, regardless of their position in the core-periphery spectrum. Therefore, with a given set of locations, it is possible to estimate the spatial distribution of probabilities of occurrence, which permits showing the relative likelihood that a change in a farm activity will be associated with that area, based on the location of previous activities or changes. By this means is possible to map core areas for certain activities, and the changes along time, linked as in this case, to changes in the policy framework that at the same time reflect a certain socio-economic pattern.

Kernel analysis has been used previously in hotspot and core area identification, including in medicine, regarding outbreaks of illnesses (e.g. Moreno et al. 2008), crime analysis, regarding areas with high levels of burglary (e.g. Savoie 2008), and armed conflict (Braithwaite 2005), in agriculture, regarding changes in land uses concerning plantations (Mola-Yudego and Gonzalez Olabarria, 2010), in forest governance, concerning forest conflicts (Gritten and Mola-Yudego 2011, Mola-Yudego and Gritten, 2010) and in geographical core-periphery analysis (Gritten et al, 2012) in a similar way as presented in this thesis. Similar approaches have been used in social sciences and economy to quantify real state prices and for mapping its changes (Fotteringham et al, 2002).

Statistically, one of the most important parameters when defining the density distribution is the bandwidth or smoothing factor (Silverman, 1986; Worton, 1995). The result of choosing a high smoothing factor is that tends to find general trends, with the loss of an important part of the information. On the contrary, a low smoothing factor can reveal more detailed changes, although it can also identify as aggregation points randomly distributed. It is generally accepted that a smoothing factor must be defined according to the nature of the study, and different methodologies have been proposed (Worton, 1989) although no general rules have been broadly adopted (Silverman, 1986). In this thesis, the kernel methods area applied to define a *peripherality* index in one hand, and the relative concentration of farm activities in the space. In both cases, several reasons point to a medium level of smoothness

Statistically, one of the advantages of the method for the problem studied is that does not assume a defined distribution, and it is rather flexible and easy to apply, allowing the definition of the ranges where a specific farm activity is located and its relative concentration. However, the method as applied presents certain limitations: there is an obvious border effect that affects the distribution of probabilities. This effect has been corrected by including data, when available, from Russia and nearby countries, which makes the core-periphery indices more reliable. Concerning the concentration of farm activities, this effect could not be corrected as there was no data available from nearby areas. In addition, some of the curves would have to be corrected for potential distortions due to latitude, or size of the farms. But, even with some technical limitations, the method allows a more thorough geographic analysis, and it can be viewed as a new contribution to existing methods for interpretation of spatial changes in agriculture. Finally, farms are naturally located on agricultural land, which it is not evenly distributed in the area, and locations with a patched distribution of agricultural land can also be revealed as kernel aggregations due to an edge effect. In both cases, these features could be compensated by a middle level of smoothing factor that would reduce the effect of such factors of noise.

The results of the method show that, in parallel to the farm concentration patterns observed, there is a geographical dimension when comes to certain farm activities, particularly cereal production, clustered in the core socio-economic areas of North Karelia. These areas are located nearby the urban centres of the region, the land is moderately fertile, the areas are well connected either by a good network of roads, railroad or fluvial lines, and thus offer good opportunities to connect to national or global markets.

The results also show that farms located in these areas are more prone to change the main activity, and are comparatively larger in size and with less diversified production. As mentioned, the increment of land areas oriented to cereal production can be viewed as a direct result of the policy incentives, and to a certain extend, this spatial concentration is a reflect of a *productivist* stage, with areas concentrating more economically profitable activities in the core, leaving a periphery with less intensive agriculture. This is not a unique trend, as in fact, it can be said that the polarization between a more intensive and more extensive land uses along the space is the main trend of landscapes changes (Antrop, 2005; Bender et al., 2005). This can be also a consequence of the CAP productivist orientation, which according to some authors, has incremented the marginalization process in those rural areas less productive (Crowley, 2003), leading to further decline (Zomeni et al, 2008).

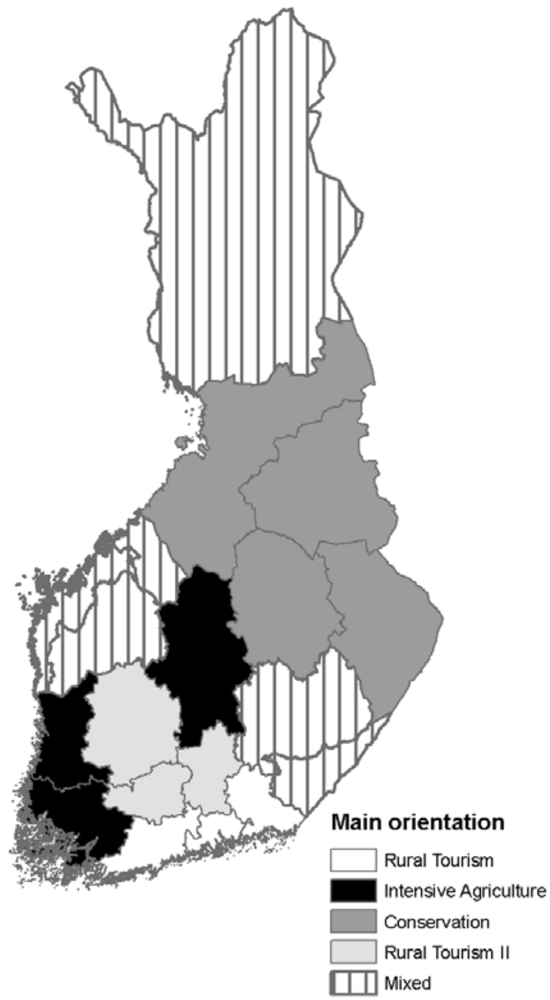


Figure 17. Main orientation of the Finnish regions. Extracted and processed data based in Berkel and Verburg (2011). Scores have been grouped and only the main result is presented.

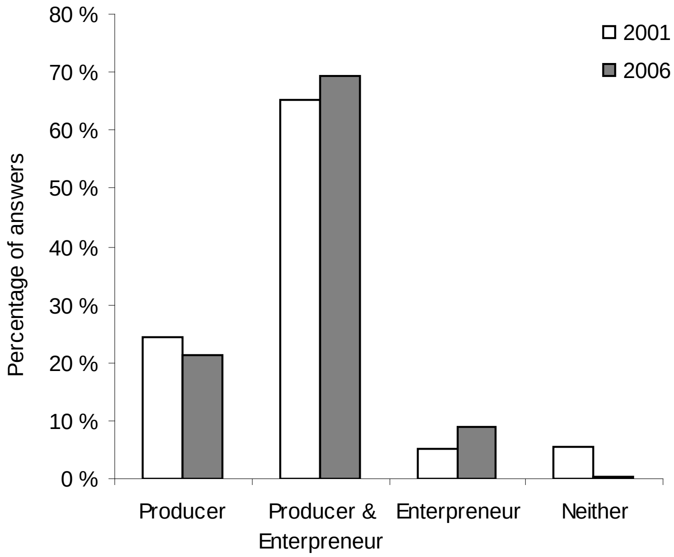
At the same time, the results show not only changes in the location of activities, but also in the relative position of North Karelia. According to the data analysed, the relative position of North Karelia is defined as a moderate relative periphery, and moves towards a *periphication*. Some authors have been studying the spatial distribution of the potential for rural development across Europe, by using the concept of territorial capital to consider spatial characteristics in assessing the capacity for rural development (Berkel and Verburg, 2011).

The result of this analysis point out the main role of North Karelia as a “conservation” area (figure 17) in clear contrast with areas oriented towards more industrial activities like intensive production or tourism in Finland, which also helps to explain the changes observed in the results.

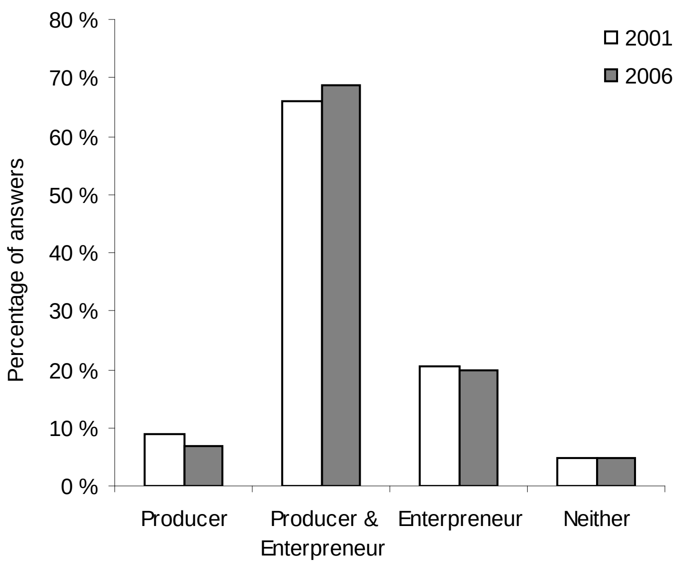
5.4 Farmers identity

The changes of the farms activities and the location of those, as well as the relative position of North Karelia, reflect deeper translations in the farmers’ identities, with lower numbers of them identifying themselves as producers, and increasing numbers as a mixed identity producer-entrepreneur (figure 18), as was found in the study of Vesala and Vesala (2010) on farmers identities at national level.

In that study it was found that dairy farmers in Finland have in general the strongest producer identity (figure 18), whereas cereal farmers would have the lowest (Vesala and vesala, 2010), which arguably agree with the observed trends in this thesis. As the number of dairy farms is clearly in decline in North Karelia, it can be speculated a transitional change in the farmers identities towars a more enterpreneurial attitude. The overall results reflected that ”Finnish farmers do not experience ‘‘*entrepreneurship’’* or ‘‘*entrepreneur’’* as something distant to themselves and not fitting in with their world of ideas” (Vesala and Vesala, 2010: 29), since the majority of them conceive themselves as enterpreneurs and producers, especially diversified farmers.



a)



b)

Figure 18. Identity of the Finnish farmers along the period 2001-2006. a) conventional farmers, b) diversified farmers (extracted from Vesala and Vesala, 2010).

Although Vesala and Vesala (2010) did not cover a longer time frame that would allow the identification of consistent trends in the identity from producer to entrepreneur, and there were important biases in the selection of the farmers for the study (especially concerning the farm size), it seems plausible that the overall farmer's identity in North Karelia is in transition, in parallel to the changes of the farm structure and the views of the CAP on farmer's role in the society, which would explain some of the features identified in the results of this thesis, and agree with the results of other authors (Burton and Wilson, 2006).

5.6 Productivist to post-productivist North Karelia?

Some of the features observed in the farm structure and production in North Karelia reflect a productivist stage, with increasing production levels, farm concentration, expansion and concentration of productive crops in core economic areas. At the same time, some of the features reflect initial stages of post-productivism, with increasing diversification of the farm activities, more entrepreneurial farmers, alternative farm activities than the conventional ones, and overall and radical changes in the farm activities in parallel with the new needs established by the policy framework at EU level.

Some authors have stressed that post-productivism is not only the reaction onto productivism, but instead "new tendencies as well and new content: new goals, methods, structure, and thinking" (Treinys et al, 2004). The new trends in consumption show a demand for food quality offered by rural areas. As Treinys et al (2004) put it, "in post-productivism the aim is to get satisfaction from the whole process of product or service consumption". Under this frame, the ongoing process of the restructuring of agriculture has been described as a shift from production oriented, productivistic agriculture to post-productivistic farms characterized by the abandonment of intensive production leading to overproduction, an emphasis on environmental protection and maintenance of the vitality of the rural areas (Burton and Wilson, 2006; Mather et al., 2006; Wilson, 2001). The combination of these factors may explain some of the trends of *periphication* of karelian agriculture as well as the increasing diversification aiming to find new market niches (or subsidy possibilities) for those lands less productive and less connected to the main markets. In this sense, both features of productivism and post-productivism are co-.existing in the time to a certain extend, although not exactly spatially, with a productivistic core and a post-productivistic periphery in North Karelia. In fact, this is in line with other authors pointing out that “the benefit of multifunctional activities in rural areas can be best disclosed by coordinating productivist and post-productivist activities, thus both these phenomena do not reject each other but rationally supplement each other” (Treinys et al, 2004).

6 Conclusions

The research presented is an attempt to analyse the changes in the farm structure and production activities in the region of North Karelia and to provide tools for understanding the current changes and the impact of the political measures. Some of the features observed in the farm structure and production in North Karelia reflect a productivist stage, with increasing production levels, farm concentration, expansion and concentration of productive crops in core economic areas. At the same time, some of the features of the farm activities reflect initial stages of post-productivism, with increasing diversification of the farm activities, more entrepreneurial farmers, alternative farm activities than the conventional ones, and overall and radical changes in the farm activities in parallel with the new needs established by the policy framework at EU level.

Most of both features seem to co-exist in the same period, although there is a spatial differentiation. Those farms located in the economic cores of the region seem to be more prone to change, and their activities are more concentrated and oriented towards production. Farms located in the periphery show reverse trends, are less prone to change the main activities and those are more diversified. At the same time, North Karelia as such seems to move towards increasing *peripherality*.

The results obtained by this research can result in tools to evaluate and quantify with precision, changes in land uses from country to farm scope, and can be useful for further economic and legislative considerations.

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