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Ulysses

Using applied research results from ESPON as a yardstick for cross-border spatial development planning

Targeted Analysis 2013/2/10

Annex VI – Case Study 4: Northern Finland - Russia Cross-Border Area (Euregio Karelia)

Report on Task 2.2 - Multi-scale performance analysis

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Nomenclature

NUTS: Abbreviation for the Nomenclature of territorial units for statistics. The NUTS classification is a hierarchical system for dividing up the economic territory of the EU for the purpose of collection, development and harmonisation of EU regional statistics.

NUTS 1: major socio-economic regions

NUTS 2: basic regions for the application of regional policies

NUTS 3: small regions for specific diagnoses

LAU: Abbreviation for the Local Administrative Units (LAUs) compatible with NUTS classification.

LAU 1: The upper LAU level (formerly NUTS level 4) is defined for most, but not all of the countries.

LAU 2: The lower LAU level (formerly NUTS level 5) consists of municipalities or equivalent units in the 27 EU Member States.

SNUTS 1-3: “Similar to NUTS” classification applied in this report for the Russian territories.

SLAU 1-2: “Similar to LAU” classification applied in this report for the Russian local administrative units.

CBA: Abbreviation for cross-border area.

Executive summary

This report represents results of the Ulysses-study task 2.2 concerning Case Study 4; the Northern Finland – Russia cross-border area (Euregio Karelia). In the given task multi-thematic analyses were performed on statistical data with the aim of analysing territorial development in the case study area.

Euregio Karelia is a cross-border region situated on the Finnish-Russian border area and it has a total area of 270,624 km² and a total population of 1324918 inhabitants. Euregio Karelia is formed out of three Finnish NUTS 3 level regions; North Karelia, Kainuu and Northern Ostrobothnia and the Republic of Karelia in the Russian Federation. (Since Russia is not a member of the European Union, it does not apply the NUTS division to its territories. A SNUTS ("Similar to NUTS") classification was created for the purposes of the Ulysses study and the Republic of Karelia was identified as SNUTS 2 level region.) The borderline dividing the Finnish and the Russian regions is an external border of the European Union and it is approximately 700 kilometres long. In contrast to EU internal borders, there exists no visa-free entry on the Finnish-Russian border, and the visa regulations are determined by EU-Russian visa agreement and the Schengen-regime. The regions collaborate across the border under the title of Euregio Karelia, which is a cooperation forum founded in 2000. The main aim of the Euregio is to develop living conditions in the region by improving economic wellbeing and social justice among the inhabitants.

This first theme of this study was demographic analysis of the cross-border area (CBA). It became evident that Northern Ostrobothnia is the only region in Euregio Karelia that has had positive total and natural population growth and positive net migration. North Karelia and Kainuu, on the contrary have suffered from negative population growth and negative migration, while in the Republic of Karelia population growth has been negative, but net migration positive. Accordingly, while the population density has been declining in three regions of Euregio Karelia, namely in North Karelia, Kainuu and the Republic of Karelia, the population density in Northern Ostrobothnia has been increasing through the whole 1990s and 2000s. Northern Ostrobothnia is also the only region in Euregio Karelia that has a larger amount of children (aged 0-14) than elderly people (65 years or more). The share of elderly population is largest in Kainuu (20,65 %) and North Karelia (19,43 %), while in the Republic of Karelia only 11,94 % of the population is 65 years or more and the working age population covers 73,33 % of the total population.

Total fertility rate of Euregio Karelia has been increasing from 1,74 in 2000 to 1,94 in 2009. In general total fertility rates have in all the NUTS 2 and NUTS 3 level regions of the Northern Finland – Russia CBA shown gradual increase during the given time period, as have the fertility rates of Finland and Russia. On NUTS 2 level, Northern Finland is the only region with the fertility rate over the replacement level. As or total dependency ratio in Euregio Karelia, it was 49,32 in 2009 that signifies that there were 49,32 persons aged 0-14 and over 64 years of age for every 100 person in the working age population. This ratio is only slightly higher than EU average (48,90) and slightly lower than Finnish average (50,33), but much greater than total dependency ratio for Russia that was 39,24 in 2009.

Demographic in-depth analysis that were performed in the study show, that there is no significant "border effect" in Euregio Karelia. In other words, population growth and density in the Finnish regions of Euregio are not related to the border distance. In the future it would be interesting to have a closer look at migration statistic on the Finnish side, since it could become evident that regions close to the border are actually attracting population from the neighbouring country.

The second topic analysed here was polycentric development, in other words the urban structure of a region. There are nine functional urban areas (FUAs) in the Northern Finland – Russia CBA (NUTS 2 level), and four of them are located in the territory of Euregio Karelia; Oulu (Northern Ostrobothnia), Joensuu (North Karelia), Kajaani (Kainuu) and Petrozavodsk (The Republic of Karelia). The largest FUA of the Northern Finland – Russia CBA was in 2006 the city of Petrozavodsk and Prionežskij municipality that surrounds the city. When we take a look at FUAs in the territory Euregio Karelia, it is possible to observe that population change has been positive between 2001 and 2006 in all the FUAs except for Kajaani (-2,9 % decrease).

The slope of rank size distribution of FUA population in the Northern Finland – Russia CBA was -0,88 in 2006. This indicates that the Northern Finland – Russia CBA has a relatively polycentric urban structure, more polycentric than the average urban structure in ESPON countries. The slope of rank size distribution of FUA GDP was -0,81 in 2006. Even if this value indicates of a polycentric cross-border area, it has to be noticed that the value did not include data for the city of Petrozavodsk and Prionežskij municipality. That would have, due to the significant differences in GDP, affected the final values. Primacy rate for the Northern Finland – Russia CBA was 0,79 in 2006. This again suggests that urban structure of the region is not dominated by one big city, but that the size of the biggest FUA (PETRO) is actually smaller than anticipated by the rank-size distribution of the FUAs.

In almost all the Finnish FUAs dominating economic activity is traditional manufacturing (incl. mining and energy production). The second most important NACE group is service sector, which in Kajaani is the leading one producing 24,9 % of total gross value added of the FUA. In general terms FUAs with lower GDP per inhabitant are located in Eastern Finland, while FUAs with higher GDP are in Northern Finland.

The next theme analysed in this study was urban-rural relations in the Northern Finland – Russia CBA. First we applied ESPON 1.1.2 and Eurostat typologies to classify the regions into rural and urban areas. ESPON 1.1.2 typology classifies all the regions of the Northern Finland – Russia CBA as regions with low urban influence and low human intervention. The Eurostat typology also considers the regions of the CBA as predominantly rural regions. Even if the regions of Euregio Karelia appear rural from the European perspective, the share of agricultural areas in the region's total area is significantly lower than European average (ESPON countries). Share of agricultural areas in the ESPON countries was 38,65 % in 2006, while the largest share of agricultural areas in the CBA was 7,91 % in Northern Ostrobothnia. Urbanisation of agricultural areas in the regions of Euregio Karelia has been below the European average (ESPON countries). Urbanisation of natural and semi-natural areas in Northern Ostrobothnia and North Karelia, on the contrary, has been stronger than in ESPON countries in average.

The share of GVA by agriculture and fishing in total GVA has decreased in all the regions between 1997 and 2008. Even if there has been an increase in the GVA by agriculture and fishing, the share of those fields of economy in the total GVA has decreased between 1997 and 2008 in all the regions of Euregio Karelia, as in Finland and the European Union. In Euregio Karelia the decrease has been strongest in Northern Ostrobothnia, where the share of agriculture and fishing in total GVA has dropped at an annual rate of -4,09 %.

Considering accessibility and connectivity of the Northern Finland – Russia CBA, in the context of ESPON space potential accessibility of the Finnish regions of Euregio Karelia by road is very low, between 6,2 (North Karelia) and 3,1 (Kainuu). This is understandable considering the remote location of the regions from the main European road infrastructure. The regions of Euregio Karelia are not easily accessed by rail either,

even if they do value slightly higher in the rail than in the road accessibility; between 10,3 (North Karelia) and 6 (Northern Ostrobothnia). Air connections to Euregio Karelia seem to make the region better accessible to the European countries than road and rail infrastructure. Accessibility by air to North Karelia valued at 55,2, to Kainuu at 50,8 and to Northern Ostrobothnia at 44,8. It is possible to argue how well these figures correspond to reality. If we look at flight traffic from and to the regions of Euregio Karelia, the busiest airport is located in Oulu, Northern Ostrobothnia.

Multimodal accessibility combines all the above analysed forms of transport and demonstrates general accessibility levels. Relatively good air accessibility of Euregio Karelia clearly affects the multimodal accessibility levels of the region. In the context of ESPON countries, North Karelia values at 48,2, Kainuu at 44,2 and Northern Ostrobothnia at 39,1. In the context of the cross-border region, North Karelia has the highest (106,78) and Northern Ostrobothnia the lowest (86,62) accessibility. Index change of standardised potential accessibility has in all the regions been negative. According to these analyses, greatest decrease of accessibility has taken place in Northern Ostrobothnia and the smallest in Kainuu.

Compared to the physical accessibility, the Northern Finland – Russia CBA ranks considerably higher with its "virtual connectivity". In 2009 75,6 % of households in the NUTS 2 region of Northern Finland had a broadband internet connection and in Eastern Finland the respective figure was 60 %. The European average in 2009 was 56 %.

Analyses on Lisbon / Europe 2020 and Gothenburg objectives included four subcategories: economy and employment, research and innovation, social cohesion and environment. The coefficient of deviation, which measures regional disparities in the GDP per capita has been increasing between 1997 and 2008 in the Northern Finland – Russia CBA from 9,2 to 16,4. The coefficient shows significantly lower disparity between the regions of the CBA than between Finnish or ESPON regions in average. It is necessary to remind that this analysis included only the Finnish regions of the Northern Finland – Russia CBA. Had the Republic of Karelia been included in the analysis, the results had been quite the opposite.

We compared NUTS 3 regions of the CBA with the leading region (Inner London West region) in terms of GDP per capita, trough index number analysis. Northern Ostrobothnia was classified as middle income region, while both North Karelia and Kainuu were identified as less developed regions. In the catching up analysis we evaluated the speed of catching-up with the leading region (Inner London West region). Northern Ostrobothnia is the only region that has been classified as a (slow) converging region, while North Karelia and Kainuu had performed as non converging regions. The strongest region of Euregio Karelia, Northern Ostrobothnia, would need 218 years to catch up with the leading region.

The leading economic sector in the North Karelia and Kainuu in 2008 was public administration and community services. Highest share of employment in all the Finnish regions of Euregio Karelia was in 2008 recorded in public administration and community services (L-P).

Total intramural R&D expenditure in Northern Finland (5,38) was higher than the Finnish average, while in Eastern Finland R&D expenditure was below the Finnish and EU average (1,61). Unemployment in Eastern and Northern Finland was slightly above the Finnish and European average in 2010. Concerning other social cohesion indicators, Eastern Finland performed generally weaker than Northern Finland.

We studied environmental performance of the Northern Finland – Russia CBA based on indicators from the European Commission's 5th Cohesion Report and ESPON Climate Project. From the 5th Cohesion Report we

selected six indicators; soil sealed area, ozone exceedance, waste water treatment, Natura 2000 areas, solar energy and wind power potential.

In North Karelia 97 km², in Kainuu 100 km² and in Northern Ostrobothnia 415 km² of soil per inhabitant was sealed in 2006. Ozone concentration exceedances were low or non-existence in Euregio Karelia. Urban waste water treatment capacity in the Northern Finland – Russia CBA is slightly above the Finnish and EU averages. The share of NATURA 2000 areas values significantly lower than the average European (EU27). Solar energy potential in the CBA is well below the leading European regions, but also well above European regions with the least solar potential. Wind energy potential, on the other hand, is above the European average in all the regions of Euregio Karelia. Sensitivities to climate change were generally low in all the regions of Euregio Karelia.

Factor analyses that complete this study on the territorial development of Northern Finland – Russia CBA validate results of the previous sections. For future development of the study it would be necessary to include more Russian data into the analyses. This applies both to data on the Republic of Karelia and Russia in general, as it would make it more accurate to examine and to view the Northern Finland – Russia CBA in the European and Russian contexts than relying almost solely on Finnish data.

What also needs to be studied in the future is how the connections in the CBA actually work. What is the role of the border in connecting / disconnecting the regions from each other? Since data is available on border traffic, we will make at least qualitative analysis on the development of the traffic across the Finnish-Russian border in Euregio Karelia.

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Chapter 1. Introduction

1.1. Research objectives

ULYSSES is a case study oriented project, the main aim of which is to use ESPON applied results as a yardstick for decentralized cross-border spatial development planning. There are four overall objectives in the ULYSSES-project:

1) To promote ESPON research results by raising awareness among involved stakeholders on the practical utility of decentralised cross-border spatial development.

2) To produce multi-thematic territorial analysis for the cross-border areas by making use of available ESPON applied research results and other local analyses / data, taking into consideration future territorial challenges.

3) To promote experience and best practices exchange in the field of cross border spatial development by applying coherent cross-border strategies.

4) To promote a further application of targeted research results in the selected cross-border areas and review general usefulness of applied research results in the context of cross border spatial development.

More specific objectives of ULYSSES are following:

a) To perform multi-scale and multi-thematic territorial analysis. To analyse territorial socioeconomic dynamics and performance of each case study region with regard to six targeted themes under analysis at different territorial scales. The objective is to identify territorial drivers and dynamics of each region.

b) To perform institutional performance analysis. To identify key institutional drivers that could allow building better baseline strategies in order to answer main challenges identified.

c) To conduct integrated analysis, where territorial dynamics and performance of the regions will be compared to their institutional performance. To relate performance analysis with policy structures and actions.

d) To produce policy recommendations. To formulate strategic guidelines to cope with identified challenges in each cross-border areas, methodological guidelines for future cross-border analysis and policy recommendations at national and EU level that encourage cross-border area territorial cooperation.

Case studies to be examined within the framework of ULYSSES are:

CS 1: Upper Rhine cross-border area along the land borders between France, Germany and Switzerland,

CS 2: Cross-border area along the entire Spanish-French land border (Pyrenees),

CS 3: Cross-border area along the land border between Greece and Bulgaria,

CS 4: Cross-border area covering parts of Northern Finland-Russian land border (Euregio Karelia),

CS 5: Cross-border area along the borders between Poland, Germany (land border) and Sweden (maritime border), and

CS 6: Extremadura/Alentejo on the border between Spain and Portugal.

Analyses in the framework of ULYSSES-project are based on data and indicators developed by previous ESPON projects. Complementary data has been collected also from Eurostat and national statistical databases. Analyses are done on different territorial scales, comparing each region to the cross border area as a whole, each region to the entire cross border area within the same country, each region to the whole cross border area in the neighbouring country and each region to confining non-border regions within the same country.

Analyses of territorial dynamics include following four themes: demography, polycentric development, urban-rural relationship and accessibility and connectivity. Territorial performance of the cross-border regions is studied from the perspective of Gothenburg and Lisbon/Europe 2020 strategies, and thus following four themes have been included in the analyses: economy and employment, research and innovation, social cohesion and environment. Finally, factor analyses are performed in order to study the relationship between territorial dynamics and territorial performance.

This report presents research results concerning ULYSSES case study number four, namely the study of Northern Finland – Russia cross-border area. First we give a general overview of the case study region, and then deliver the results of the analyses theme by theme. In the end of each chapter we draw conclusions on the theme in question, and in the end of this report we summarize the most relevant findings of the study as a whole.

1.2. General overview of the Northern Finland – Russia CBA (Euregio Karelia)

Euregio Karelia is a cross-border region situated on the Finnish-Russian border area. It is formed out of three Finnish regions; North Karelia, Kainuu and Northern Ostrobothnia and the Republic of Karelia in the Russian Federation. The borderline dividing these regions is an external border of the European Union and it is approximately 700 kilometres long. On the Finnish side the regions belonging to Euregio Karelia are located in Northern and Eastern Finland and they stretch across the whole mainland from the Finnish-Swedish maritime border to the Finnish-Russian land border. On the Russian side the Republic of Karelia is located in North-western Russia and it borders the White Sea in the North and Lake Ladoga in the South.

Figure 1. Map of Euregio Karelia

In the Ulysses project quantitative statistical analysis were made on the case study areas utilizing the NUTS classification (Nomenclature of territorial units for statistics) established by Eurostat. From the perspective of NUTS division Euregio Karelia appears as follows. On the Finnish side it includes three NUTS 3 level regions; North Karelia, Kainuu and Northern Ostrobothnia. Two of these regions, North Karelia and Kainuu belong to the NUTS 2 region of Eastern Finland, and Northern Ostrobothnia belongs to the NUTS 2 region of Northern Finland. Since part of the analysis on the case study areas have been made on NUTS 2 level, it is necessary to notice that both Eastern and Northern Finland include NUTS 3 regions that are not members of the Euregio, namely Northern and Southern Savonia in Eastern Finland and Lapland and Central Ostrobothnia in Northern Finland.

Since Russia is not a member of the European Union, it does not apply the NUTS division to its territories. Therefore a SNUTS ("Similar to NUTS") classification was created for the purposes of the Ulysses study and it follows the Russian administrative structure.[1] In the SNUTS division Russian Federation represents level 0 and the eight federal districts (federal'nye okruga) constitute level 1. The federal districts are formed out of 83 federal subjects (sub"ekty federacii) that represent level 2 in this study. The Republic of Karelia (Respublika Kareliâ) is a federal subject of the Russian Federation and, accordingly, a SNUTS 2 level region. It belongs to the Northwestern Federal District that represents SNUTS 1 level in this study. As the following Russian administrative level, the municipal raions, is more or less comparable with LAU1 level, there is no regional division in Russia which corresponds to the NUTS 3 division. Municipal regions of the Republic of Karelia were therefore aggregated into three SNUTS 3 regions; Northern part of the Republic, Southern part of the Republic and the City District of Petrozavodsk, all having around 200 000 inhabitants and thereby fulfilling the NUTS 3 level requirements set up by Eurostat.

Table 1. NUTS division of Northern Finland – Russia CBA (Euregio Karelia)

NUTS	NUTS ID	NUTS level
Finland (Suomi)	FI	NUTS 0
Mainland Finland (Manner-Suomi)	FI1	NUTS 1
Eastern Finland (Itä-Suomi)	FI13	NUTS 2
North Karelia (Pohjois-Karjala)	FI133	NUTS 3
Kainuu	FI134	NUTS 3
Northern Finland (Pohjois-Suomi)	FI1A	NUTS 2
Northern Ostrobothnia (Pohjois-Pohjanmaa)	FI1A2	NUTS 3
Russia (Russiâ)	RU	SNUTS 0
Northwestern Federal District (Severo-Zapadnyj federal'nyj okrug)	RU3	SNUTS 1
The Republic of Karelia (Respublika Kareliâ)	RU3D	SNUTS 2
City District of Petrozavodsk	RU3D1	SNUTS 3

[1] This work was carried out by following the example of ESPON Database 2013 project, where a SNUTS division was introduced to countries of the Western Balkans that were lacking the NUTS division (Serbia, Bosnia, Albania).

(Petrozavodskij gorodskoj okrug)		
Nothern part of the Republic of Karelia (Severnaâ čast' Respubliki Kareliâ)	RU3D2	SNUTS 3
Southern part of the Republic of Karelia (Ûžnaâ čast' Respubliki Kareliâ)	RU3D3	SNUTS 3

Figure 2. Map of NUTS 2 and NUTS 3 level units of the Northern Finland – Russia CBA (Including the borderlines of the case study region of Euregio Karelia)

Euregio Karelia has four administrative centres; Joensuu in North Karelia, Kajaani in Kainuu, Oulu in Northern Ostrobothnia and Petrozavodsk in the Republic of Karelia.[2] Joensuu is located 376 km North-east of Helsinki, Kajaani 474 km and Oulu 540 km North of Helsinki (as the crow flies). As the Ulysses-project studies border regions and, in this case, Northern Finland – Russia CBA, it is necessary to point out that the territory of Euregio Karelia is only partly located at the Finnish-Russian border. The distance of the administrative centres from the border well illustrate this fact. Joensuu is situated 65 km and Kajaani 120 km from the Russian border, but Oulu lies on the Western coast of Finland approx. 200 km from the border to Russia. On the Russian side, Petrozavodsk is situated 697 km North-west of Moscow and the distance to the Finnish border is approximately 200 km.

Figure 3. Map of Finland and Russia presenting the Northern Finland – Russia CBA and the NUTS 3 and SNUTS 2 level administrative centres

Euregio Karelia has a total area of 270,624 km². The Finnish NUTS 3 regions of North Karelia, Kainuu and Northern Ostrobothnia cover 90,124 km², which is 33,3 % of the CBA's total area and 23 % of the total area of Finland. The Republic of Karelia (SNUTS 2) has a total area twice as large (180,500 km²), and it covers 66,7 % of the CBA's total area, but it only 1,1 % of the total area of Russia. On NUTS 2 level the Finnish areas of Eastern and Northern Finland have a total area of 236,087 km², which is as much as 60 % of the total area of Finland.[3]

[2] When addressing Euregio Karelia from an administrative point of you, one has to point out that Euregio Karelia has been established by the respective regions in year 2000 to function as a cooperation forum and it forms no administrative entity and possesses no legislative power. On the Finnish side it is also not easy to point out administrative centres of the CBA on the basis of NUTS division, since statistical NUTS regions do not always correspond with administrative regions. Administrative centre of Mainland Finland (NUTS 1) is naturally the capital of Finland Helsinki, but NUTS 2 level regions (suuralueet) have been created from NUTS 3 regions exceptionally for statistical purposes. NUTS 3 level regions (maakunnat), provinces, are headed by regional councils that are responsible for strategy-based development of the regions and have certain statutory tasks related to regional development. Provinces can therefore be considered administrative regions. In Russia Petrozavosk is the administrative capital of the Republic of Karelia.

[3] Information concerning the total area of the Finnish regions is from Maanmittauslaitos (January 1 2011) and information concerning the Russian regions from publication "Regions of Russia 2010".

Table 2. Total area of NUTS 1, 2 and 3 level units of the CBA

NUTS	NUTS ID	NUTS level	Total Area (km²)	(%) of CBA
Finland (Suomi)	FI	NUTS 0	390,903.13	
Mainland Finland (Manner-Suomi)	FI1	NUTS 1	377,579.62	
Eastern Finland (Itä-Suomi)	FI13	NUTS 2	85,168.48	
North Karelia (Pohjois-Karjala)	FI133	NUTS 3	21,583.7	8
Kainuu	FI134	NUTS 3	24,451.6	9
Northern Finland (Pohjois-Suomi)	FI1A	NUTS 2	150,918.4	
Northern Ostrobothnia (Pohjois-Pohjanmaa)	FI1A2	NUTS 3	44,088.44	16,3
Russia (Russiâ)	RU	SNUTS 0	17098,200.00	
Northwestern Federal District (Severo-Zapadnyj federal'nyj okrug)	RU3	SNUTS 1	1687,000.00	
The Republic of Karelia (Respublika Kareliâ)	RU3D	SNUTS 2	180,500.00	66,7
City District of Petrozavodsk (Petrozavodskij gorodskoj okrug)	RU3D1	SNUTS 3	N/A	N/A
Nothern part of the Republic of Karelia (Severnaâ čast' Respubliki Kareliâ)	RU3D2	SNUTS 3	N/A	N/A
Southern part of the Republic of Karelia (Ûžnaâ čast' Respubliki Kareliâ)	RU3D3	SNUTS 3	N/A	N/A

Chapter 2. Demographic analysis of the Northern Finland – Russia CBA

Demographic decline and the ageing of population is one of the main challenges in the European Union. Even if the population in EU (27) has been growing without a break since 1960, climbing up to 502.5 million in January 2011, net migration instead of natural change has been the main determinant of population growth since the beginning of 1990s. Europeans have generally been having fewer children, and the total fertility rate that describes the average number of children that would be born to a woman over her lifetime has declined from well above the replacement ratio (2.1 live births per woman) to 1.56 in 2008.[4] Population decline is especially problematic for peripheral regions, including border regions that are often situated on the fringe of nation states, since young people tend to migrate to large urban areas, and the peripheral regions are left with the skewed age structure and the responsibility to provide services for the ageing population.[5]

The aim of this chapter is to analyse the demographic dynamics and trends in the Northern Finland – Russia CBA (Euregio Karelia). We start by describing the demographic dynamics in the area. How densely populated is the CBA? What does the age and sex structure of the CBA look like? What seem to be the temporal dynamics of the population growth? The main objective of the chapter, however, is to understand whether the border is influencing settlement patterns. Key questions to be answered are following: Is the Finnish-Russian border attracting or repulsing population? Are the border regions growing faster or slower than non-border regions? Is the population in the Northern Finland – Russia CBA ageing more rapidly than

[4] There has been a slight recovery in the TFR rates since 2003, when the ratio was as low as 1.47.
[5] Population and population change statistics 2011; Fertility statistics 2011.

the population in non-border regions? In the conclusive chapter we will discuss spatial effects of the demographic dynamics and trends.

In order to study the demographic situation and future trends in the case study area, we have identified a set of indicators. These include CBA's total population, population density, natural and total population growth, total fertility rate, old and young dependency ratios and net migration. We will also study the inter-regional and international commuting in and out of the CBA. Methods of analysing the chosen parameters are explained in each subchapter separately.

Table 3. Demographic parameters studied for the Northern Finland – Russia CBA (Euregio Karelia).

Parameter – Indicator	Period covered	Data source	NUTS level
Total population			
Total population by sex			
Total population by age			
Population density	2000-2010	Eurostat, Rosstat	NUTS 2, 3; LAU 1
Natural population growth			
Total population growth			
Total fertility rate			
Old and young dependency ratios			
Net migration			
Commuters to other countries among/by active population			
Commuters to other regions among/by active population			

2.1. Demographic dynamics

2.1.1. Total population

Euregio Karelia has a total population of 1324918 inhabitants. The Republic of Karelia and Northern Finland have the largest population with more than 600 000 inhabitants and Kainuu has the smallest population with 82634 inhabitants. With the total of 640706 inhabitants, the three Finnish regions, North Karelia, Kainuu and Northern Ostrobothnia constitute 12 % of the total population of Finland. The Republic of Karelia, on the other hand, only has 0,5 % of the total population of Russia. When compared to the total population of the European Union (EU27), which in 2010 was 501 120 688 citizens, the population of Euregio Karelia makes up 0,3 % of the EU population.

Table 4. Total population in the Northern Finland – Russia CBA.

NUTS	NUTS ID	NUTS level	Population in 2010	% of the CBA total population
Finland (Suomi)	FI	NUTS 0	5351427	
Mainland Finland (Manner-Suomi)	FI1	NUTS 1	5323693	
Eastern Finland (Itä-Suomi)	FI13	NUTS 2	652346	
North Karelia (Pohjois-Karjala)	FI133	NUTS 3	165962	12,5 %

Kainuu	FI134	NUTS 3	82634	6,2 %
Northern Finland (Pohjois-Suomi)	FI1A	NUTS 2	643989	
Northern Ostrobothnia (Pohjois-Pohjanmaa)	FI1A2	NUTS 3	392110	29,6 %
Russia (Russiâ)	RU	SNUTS 0	141914509	
Northwestern Federal District (Severo-Zapadnyj federal'nyj okrug)	RU3	SNUTS 1	13437106	
The Republic of Karelia (Respublika Kareliâ)	RU3D	SNUTS 2	684212	51,6 %
City District of Petrozavodsk (Petrozavodskij gorodskoj okrug)	RU3D1	SNUTS 3	270601	
Nothern part of the Republic of Karelia (Severnaâ čast' Respubliki Kareliâ)	RU3D2	SNUTS 3	N/A	N/A
Southern part of the Republic of Karelia (Ûžnaâ čast' Respubliki Kareliâ)	RU3D3	SNUTS 3	N/A	N/A
Total population Euregio Karelia			1324918	100%

From the perspective of sex structure, Euregio Karelia has a female majority with 690836 females that make up 52,14 % of the total population of the CBA. Female majority in Euregio Karelia derives mainly from the large female representation in the Republic of Karelia, where 54,28 % of the inhabitants are women. Russia in general has a considerable female majority and female inhabitants constitute 53,75 % of the total population. In Finland the distribution between male and female citizens is more even. Males constitute 49,05 % and females 50,95 % of the total population. In the Finnish regions of Euregio Karelia, likewise, the share of males and females is almost equal (50,04 % of the population are men and 49,96 % women). In the European Union (EU27) the distribution between male and female citizens settles between the Finnish and Russian figures and 48,82 % of the citizens are male and 51,18 % female.

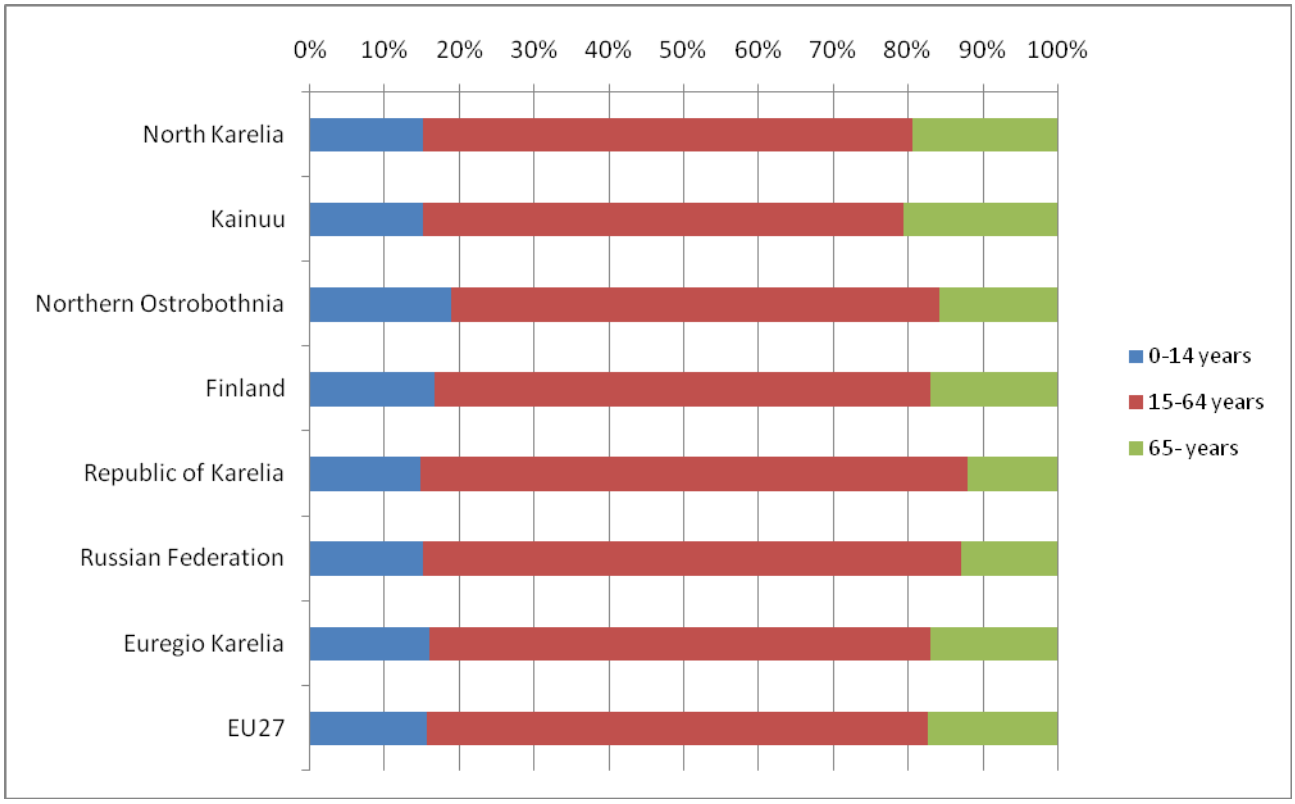
Table 5. Amount of male and female population in the Northern Finland – Russia CBA.

NUTS	Male population in 2010	Male population % of total population	Female population in 2010	Female population % of total population
Finland (Suomi)	2625067	49,05 %	2726360	50,95 %
Mainland Finland (Manner-Suomi)	2611260	49,05 %	2712433	50,95 %
Eastern Finland (Itä-Suomi)	322649	49,46 %	329697	50,54 %
North Karelia (Pohjois-Karjala)	82498	49,71 %	83464	50,29 %
Kainuu	41356	50,05 %	41278	49,95 %
Northern Finland (Pohjois-Suomi)	323149	50,18 %	320840	49,82 %
Northern Ostrobothnia (Pohjois-Pohjanmaa)	197412	50,35 %	194698	49,65 %
Russia (Russiâ)	65639380	46,25 %	76275129	53,75 %
Northwestern Federal District (Severo-Zapadnyj federal'nyj okrug)	6155504	45,81 %	7281602	54,19 %
The Republic of Karelia (Respublika Kareliâ)	312816	45,72 %	371396	54,28 %
City District of Petrozavodsk (Petrozavodskij gorodskoj okrug)	n/a	n/a	n/a	n/a

Nothern part of the Republic of Karelia (Severnaâ čast' Respubliki Kareliâ)	n/a	n/a	n/a	n/a
Southern part of the Republic of Karelia (Ûžnaâ čast' Respubliki Kareliâ)	n/a	n/a	n/a	n/a
Euregio Karelia	634082	47,86 %	690836	52,14 %

In order to study the age structure in Euregio Karelia, three age groups were considered in the analysis: 1) population between 0-14 years, 2) population between 15-64 years (working age population) and 3) population over 65 years of age. The share of 0-14 year old population in Euregio Karelia in 2010 was 15,95 %, the share of 15-64 year old population 67,08 % and the share of population over 65 years of age 16,96 %. Northern Ostrobothnia is the only region in Euregio Karelia that has a larger amount of children (aged 0-14) than elderly people (65 years or more). In contrast to the other regions, where the share of 0-14 year olds is approximately 15 %, in Northern Ostrobothnia children make up 18,94 % and citizens over 65 years of age 15,83 % of the total population. The share of elderly population is largest in Kainuu (20,65 %) and North Karelia (19,43 %), while in the Republic of Karelia only 11,94 % of the population is 65 years or more and the working age population covers 73,33 % of the total population. The small share of elderly people is very typical for Russia (national average is 12,89 %) and the oldest age group consists to a large extend of women. The share of women among the population above 65 years is 68,69 %, when in Finland female citizens represent 58,77 % of the population over 65 years of age. In the European Union the age structure of the population is similar to the Finnish one with 15,62 % of the population belonging to the youngest age group, 67,01 % of the population to the working age population and 17,38 % of the population to the eldest age group.

Figure 4. Age structure in the Northern Finland – Russia CBA.



2.1.2. Population density

Population density that expresses the amount of population per unit of measurement (here square kilometre) was 7 inhabitants per km² in Euregio Karelia in 2010. On NUTS 2 level the most densely populated area of the Northern Finland – Russia CBA was Eastern Finland with 9,3 inhabitants per km² and the most sparsely populated area was the Republic of Karelia with 3,8 inhabitants per km². On NUTS 3 level there were differences between the Finnish areas, Nothern Ostrobothnia having the highest population density with 11,1 inhabitants per km² and Kainuu the lowest density with 3,8 inhabitants per km². The figures picturing the population density in Northern Finland – Russia CBA seem low when compared to the European Union average (116 inhabitants per km² in 2008), yet they are very similar to the national averages in Finland (17,9 inhabitants per km²) and Russia (8,3 inhabitants per km²).

While the population density has been declining in three regions of Euregio Karelia, namely in North Karelia, Kainuu and the Republic of Karelia, the population density in Northern Ostrobothnia has been increasing through the whole 1990s and 2000s. When we look at the situation on LAU 1 level, it is possible to detect that the increase in population and, hence, population density has been positive only in Oulu region. If the population density in Oulu region was 34,7 inhabitants per km² in 1990 and 41 in 2000, there were 48,2 inhabitants per km² in 2010. In Oulu city (LAU 2) there were 98,9 inhabitants per km² in 2010. As mentioned above Oulu, the urban centre of Northern Ostrobothnia is located on the western border of Finland and therefore is not in direct sphere of influence of the Finnish-Russian border. As to the other administrative centres of Euregio Karelia, the most densely populated city is Petrozavodsk with 2395

inhabitants per km² (2010) and the most sparsely populated city Kainuu with 20,8 inhabitants per km² (2010). In Joensuu the population density was 30,5 inhabitants per km² in 2010.

The following figures illustrate the temporal evolution of the population density in the Northern Finland – Russia CBA (Figure 5) and the population density in the regions of Euregio Karelia (Figure 6, including NUTS 3 level regions in Finland and SNUTS 2 level region in Russia).

Figure 5. Population density in the Northern Finland – Russia CBA between years 2000 and 2010.

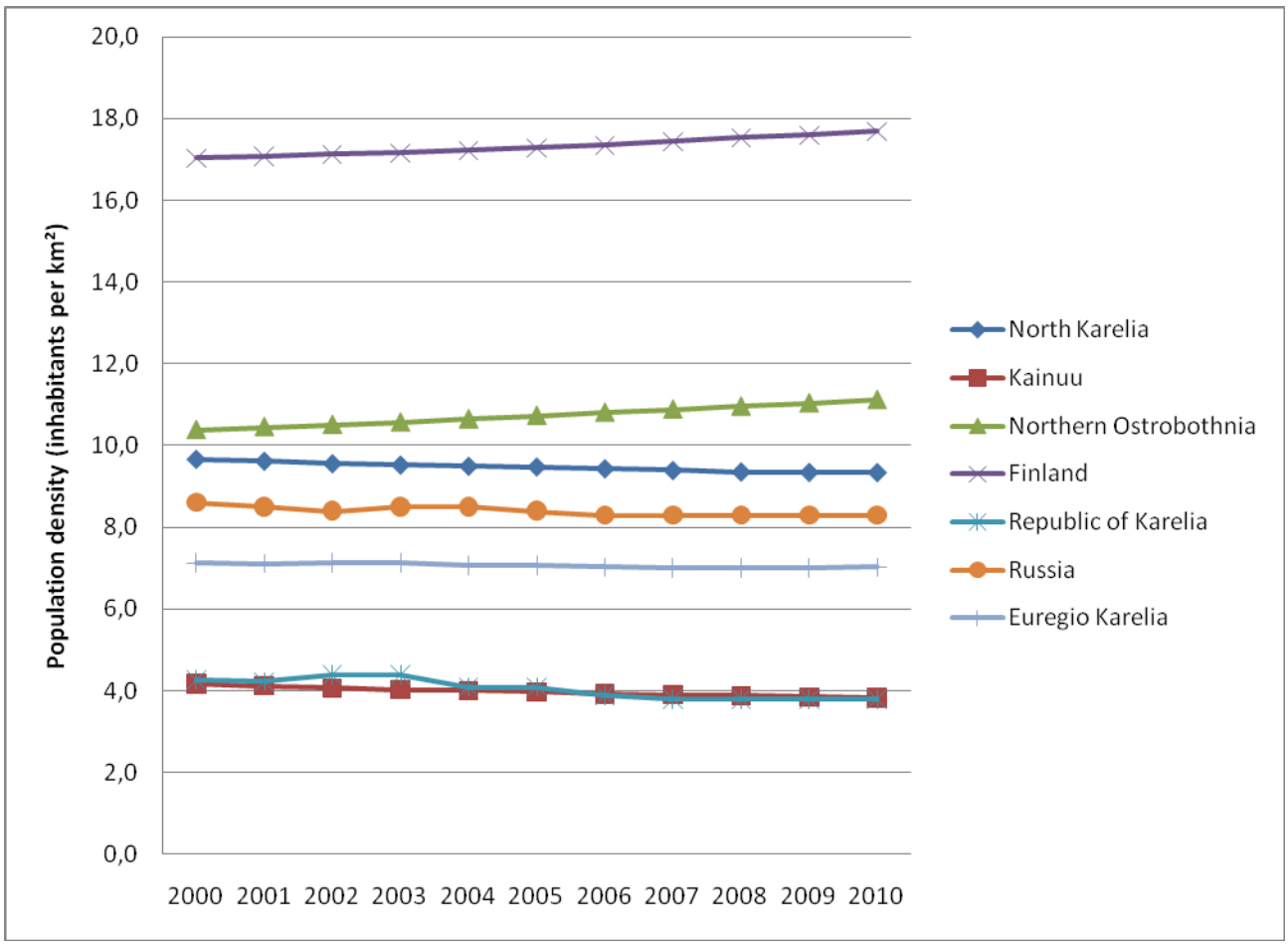


Figure 6. Population density in Euregio Karelia in 2009.

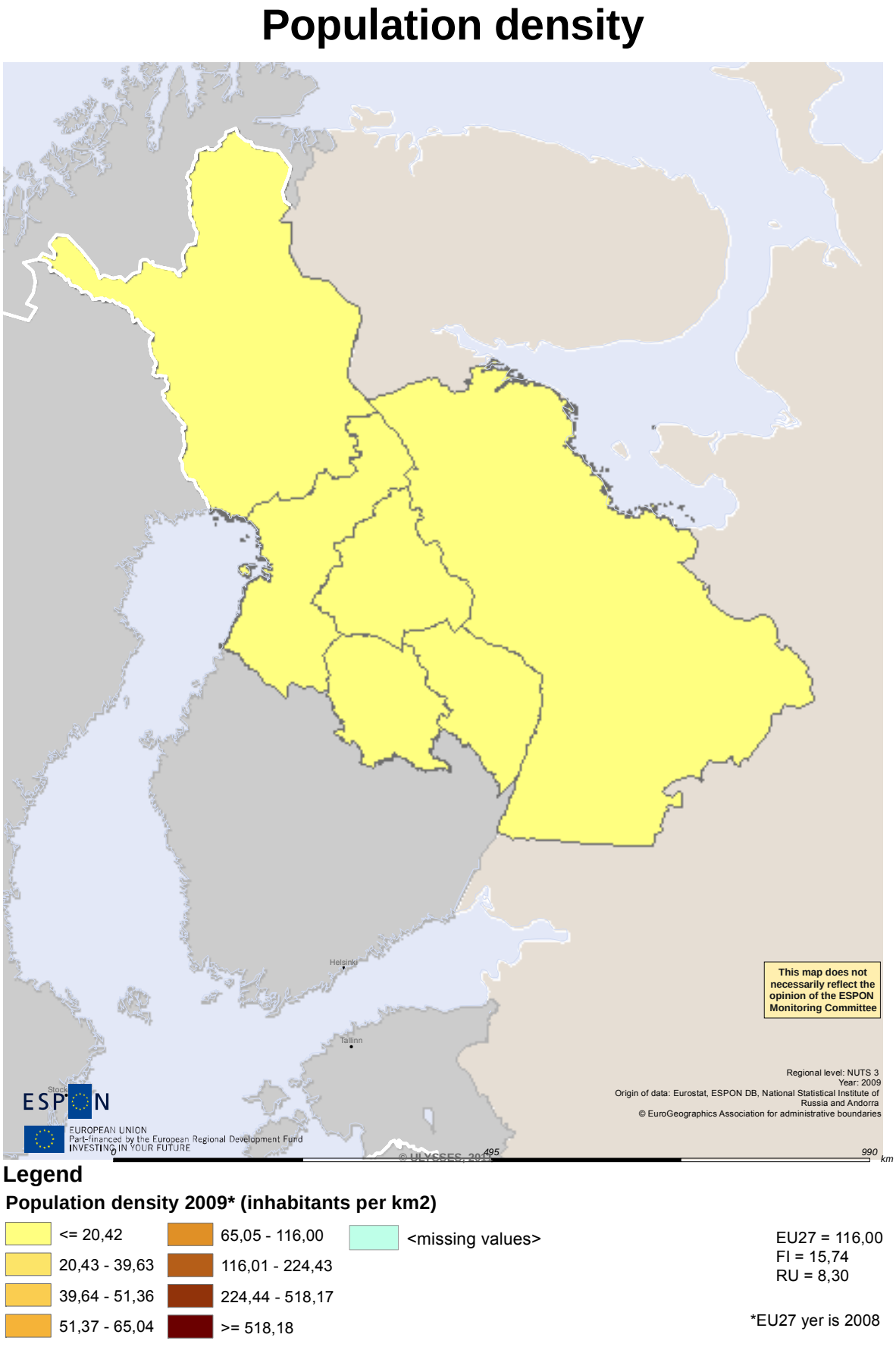
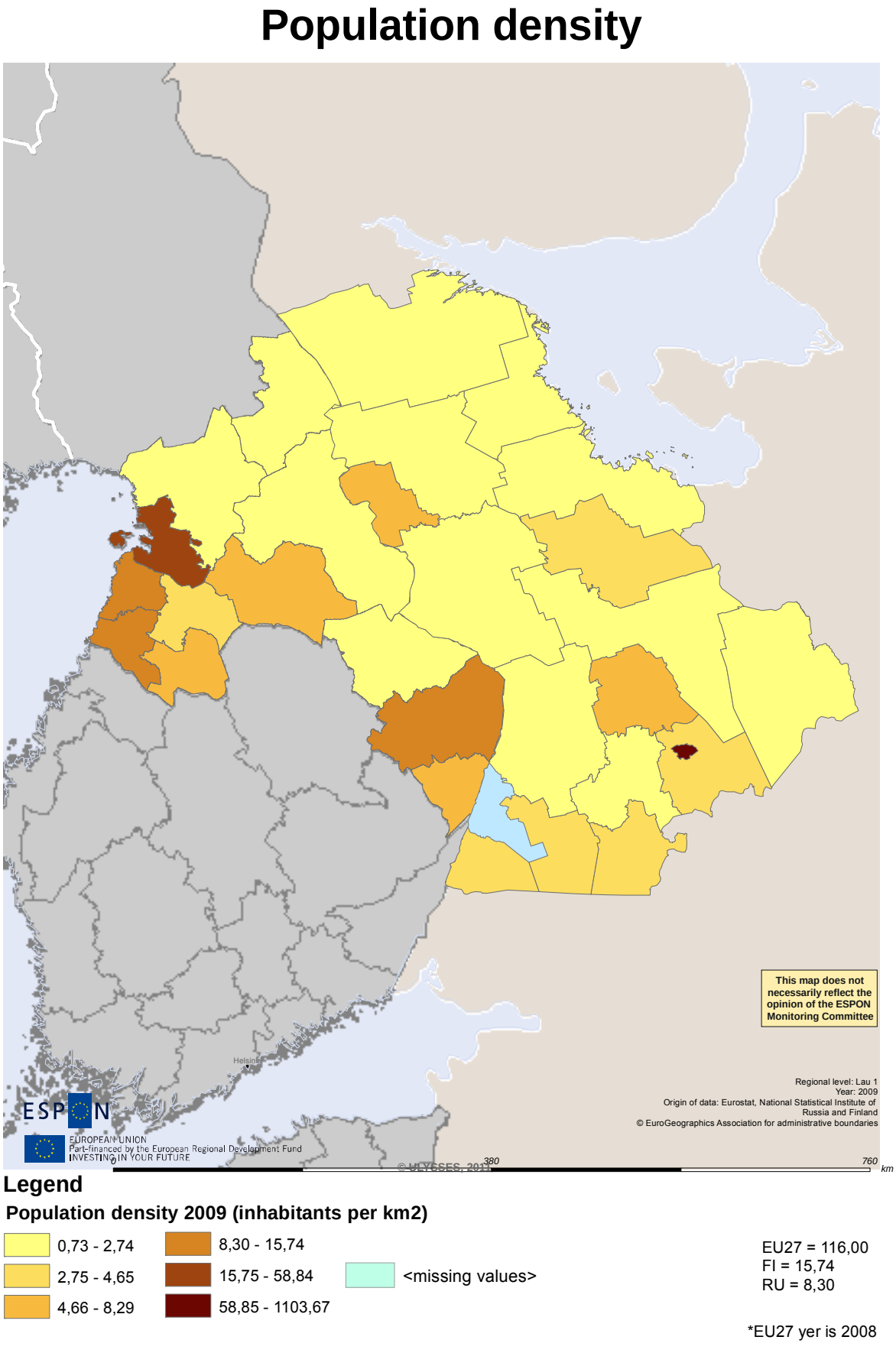


Figure 7. LAU 1 level population density in Euregio Karelia in 2009.



2.1.3. Population change

Population growth illustrates the change in an area's population over time and it is determined by four factors; births, deaths, immigrants and emigrants. Natural population change is the difference between the number of live births and deaths during a given time period. Total population change, unlike natural population change, takes into account migration. The following table presents total population change in the Northern Finland – Russia CBA between years 2001 and 2010.

Table 6. Population growth in the Northern Finland – Russia CBA 2001-2010.

NUTS	NUTS ID	Total population 2001	% of CBA population	Total population 2010	% of CBA population	Total population change 2001-2010
Finland (Suomi)	FI	5181115		5351427		170312
Mainland Finland (Manner-Suomi)	FI1	5155339		5323693		168354
Eastern Finland (Itä-Suomi)	FI13	680870		652346		-28524
North Karelia (Pohjois-Karjala)	FI133	171609	12,63 %	165962	12,53 %	-5647
Kainuu	FI134	89777	6,61 %	82634	6,24 %	-7143
Northern Finland (Pohjois-Suomi)	FI1A	628418		643989		15571
Northern Ostrobothnia (Pohjois-Pohjanmaa)	FI1A2	368598	27,13 %	392110	29,60 %	23512
Russia (Russiâ)	RU	146303611		141914509		-4389102
Northwestern Federal District (Severo-Zapadnyj federal'nyj okrug)	RU3	14198896		13437106		-761790
The Republic of Karelia (Respublika Kareliâ)	RU3D	728813	53,64 %	684212	51,64 %	-44601
City District of Petrozavodsk (Petrozavodskij gorodskoj okrug)	RU3D1	n/a		n/a	n/a	n/a
Nothern part of the Republic of Karelia (Severnaâ čast' Respubliki Kareliâ)	RU3D2	n/a		n/a	n/a	n/a
Southern part of the Republic of Karelia (Ûžnaâ čast' Respubliki Kareliâ)	RU3D3	n/a		n/a	n/a	n/a
Total population Euregio Karelia		1358797	100 %	1324918	100 %	-33879

In order to have a closer look at total population change in the Northern Finland – Russia CBA we have compared the population growth during two five-year periods, the first one including years 2001 to 2005

and the second one years 2006 to 2010. For both periods, we have calculated a growth rate according to the following formula:

$$Growth\ rate = \frac{population\ at\ the\ end\ of\ period - population\ at\ the\ beginning\ of\ period}{population\ at\ the\ beginning\ of\ period}$$

A positive growth rate indicates that the population has been increasing and a negative rate that the population has been decreasing. Euregio Karelia shows negative population growth in both periods, a 1,70 % decrease between 2001 and 2005, and a 0,55 % decrease between 2006 and 2010. During the first period Euregio Karelia lost 23096 inhabitants and during the second period 7318 inhabitants. Again, the only region with positive population growth during both periods was Northern Ostrobothnia with a 3,45 % growth between 2001 and 2005, and a 3,73 % growth between 2006 and 2010. Kainuu has during both periods suffered from the greatest population lost (-4,25 % during 2001-2005 and -3,13 % during 2006-2010) and the population has been decreasing likewise North Karelia and in the Republic of Karelia during both time periods.

When we compare the two periods it is possible to detect a general tendency in the population growth. Regions where population has been increasing between 2001 and 2005 have continued to grow between 2006 and 2010, and the population growth has been more extensive during the second period. However, the second period has been more favourable also for regions suffering from population decrease. Even if they have continued to lose inhabitants, negative population growth has been less severe than during the first time period. The difference in population growth between the first and second period has been greatest in the Republic of Karelia, where during 2001 and 2005 population growth rate was as much as -3,53 %, but during 2006 and 2010 only -1,91 %. Equally strong deceleration of negative population growth has taken place in the North-Western Federal District of Russian Federation, and Russian Federation in general. The population of European Union (EU27) has been increasing both between 2001 and 2005 (1,52 %) and between 2006 and 2010 (1,60 %).

If we look at the whole period from 2001 to 2010, Euregio Karelia has had a -0,28 % annual population decline. Annual population growth rate is an indicator that illustrates an average annual percent change in the total population during a given time period and it is calculated according to the following formula:

$$Annual\ growth\ rate = \left(\frac{population\ at\ the\ end\ of\ period}{population\ at\ the\ beginning\ of\ period}\right)^{\frac{1}{years\ in-between}} - 1$$

In the Northern Finland – Russia CBA, Kainuu has had the greatest annual change of -0,92 % and smallest annual changes in the population during the given time period have taken place in North Karelia, where the population has been declining at an -0,37 % annual rate. Northern Ostrobothnia has shown greater annual population growth (0,69 %) than Finnish regions in general. In Finland population has been increasing at an 0,36 % annual rate that has been slightly less than annual population growth of 0,39 % in the European Union (EU27).

Table 7. Population growth rates in the Northern Finland – Russia CBA.

NUTS	NUTS ID	NUTS level	Growth rate 2001-2005	Growth rate 2006-2010	Annual population growth rate 2001-2010
Finland (Suomi)	FI	NUTS 0	1,07 %	1,82 %	0,36 %
Mainland Finland (Manner-Suomi)	FI1	NUTS 1	1,06 %	1,81 %	0,36 %
Eastern Finland (Itä-Suomi)	FI13	NUTS 2	-2,03 %	-1,78 %	-0,47 %
North Karelia (Pohjois-Karjala)	FI133	NUTS 3	-1,74 %	-1,40 %	-0,37 %
Kainuu	FI134	NUTS 3	-4,25 %	-3,13 %	-0,92 %
Northern Finland (Pohjois-Suomi)	FI1A	NUTS 2	0,55 %	1,50 %	0,27 %
Northern Ostrobothnia (Pohjois-Pohjanmaa)	FI1A2	NUTS 3	3,45 %	3,73 %	0,69 %
Russia (Russiâ)	RU	SNUTS 0	-1,93 %	-0,59 %	-0,34 %
North-Western Federal District (Severo-Zapadnyj federal'nyj okrug)	RU3	SNUTS 1	-3,30 %	-1,40 %	-0,61 %
The Republic of Karelia (Respublika Kareliâ)	RU3D	SNUTS 2	-3,53 %	-1,91 %	-0,70 %
City District of Petrozavodsk (Petrozavodskij gorodskoj okrug)	RU3D1	SNUTS 3	n/a	n/a	n/a
Nothern part of the Republic of Karelia (Severnaâ čast' Respubliki Kareliâ)	RU3D2	SNUTS 3	n/a	n/a	n/a
Southern part of the Republic of Karelia (Ûžnaâ čast' Respubliki Kareliâ)	RU3D3	SNUTS 3	n/a	n/a	n/a
Total population Euregio Karelia			-1,70 %	-0,55 %	-0,28 %

Figure 8. Annual population growth rate in Euregio Karelia between 2000 and 2009.

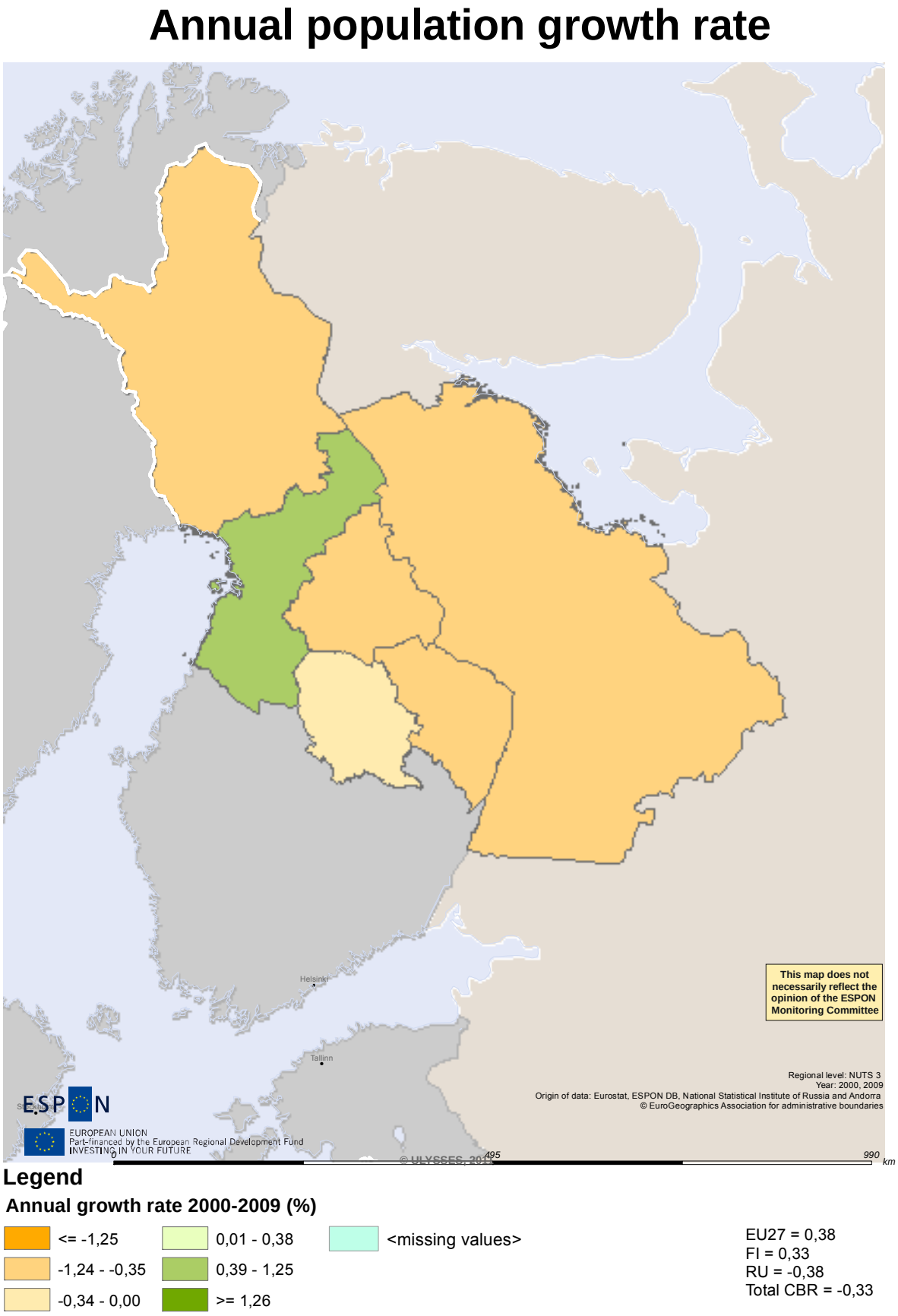
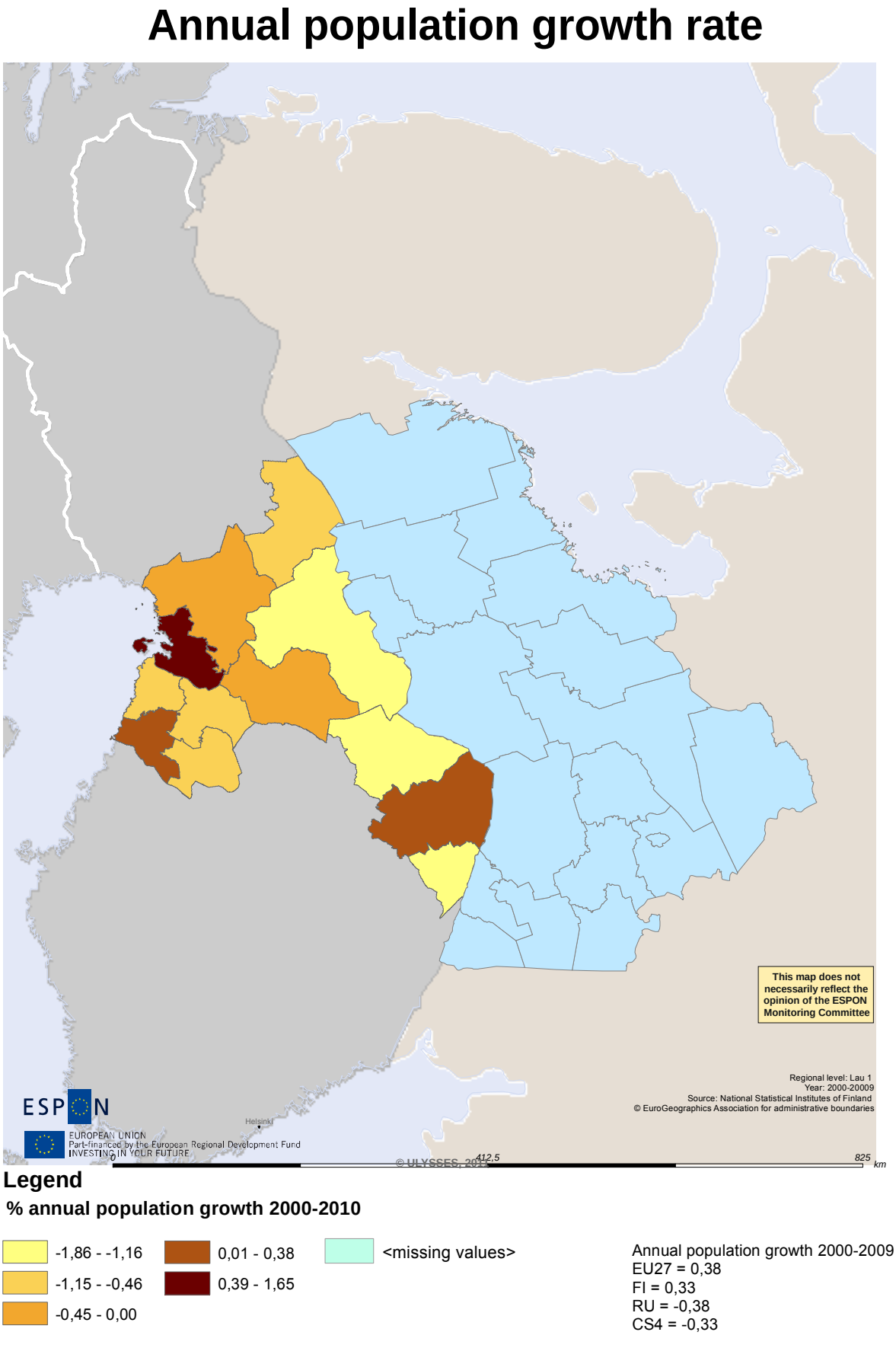


Figure 9. LAU 1 level annual population growth rate in Euregio Karelia between 2000 and 2009.



2.1.4. Natural population change and net migration

What then has been the dominating factor for population change in the Northern Finland – Russia CBA? In order to better understand the mechanisms of population change we have analysed natural increase (births – deaths) and net migration (immigrants – emigrants)[6] in the CBA between years 2001 and 2010. It occurs that natural increase has been the determinant both for positive and negative population growth in all the regions of Euregio Karelia. In Northern Ostrobothnia natural increase has been very positive with 25442 births over deaths. Even if net migration in the region has also been positive (925 immigrants over emigrants), it has been less significant from the perspective of population growth. North Karelia and Kainuu have suffered from both natural population decrease and negative net migration. In North Karelia both factors have had a similar significance on population decrease, but in Kainuu net migration has clearly been the more significant determinant. If there were 1966 deaths over births in Kainuu between 2001 and 2010, during the same time period there were 5738 emigrants over immigrants. The Republic of Karelia of all the regions has suffered from the strongest natural population decrease. During the studied time period there were 47564 deaths over births, and even if migration to the region has been positive (3912 immigrants over emigrants) it has not been able to compensate for the natural loss of population.

Table 8. Natural population increase and net migration in the Northern Finland – Russia CBA between 2001 and 2010.

NUTS	NUTS ID	NUTS level	Natural increase 2001-2010	Net migration 2001-2010
Finland (Suomi)	FI	NUTS 0	92888	101273
Mainland Finland (Manner-Suomi)	FI1	NUTS 1	92586	99344
Eastern Finland (Itä-Suomi)	FI13	NUTS 2	-13489	-16831
North Karelia (Pohjois-Karjala)	FI133	NUTS 3	-3064	-2679
Kainuu	FI134	NUTS 3	-1966	-5738
Northern Finland (Pohjois-Suomi)	FI1A	NUTS 2	27763	-9407
Northern Ostrobothnia (Pohjois-Pohjanmaa)	FI1A2	NUTS 3	25442	925
Russia (Russiâ)	RU	SNUTS 0	-6414386	3024911
North-Western Federal District (Severo-Zapadnyj federal'nyj okrug)	RU3	SNUTS 1	-938099	268469*
The Republic of Karelia (Respublika Kareliâ)	RU3D	SNUTS 2	-47564	3912*
City District of Petrozavodsk (Petrozavodskij gorodskoj okrug)	RU3D1	SNUTS 3	N/A	N/A
Nothern part of the Republic of Karelia (Severnaâ čast' Respubliki Kareliâ)	RU3D2	SNUTS 3	N/A	N/A
Southern part of the Republic of Karelia (Ûžnaâ čast' Respubliki Kareliâ)	RU3D3	SNUTS 3	N/A	N/A
Total population Euregio Karelia			-27152	-3580*

*Net migration values for the Republic of Karelia and Northwestern Federal District of Russian Federation do not include statistical adjustments.

To be able to compare natural increase and net migration figures of the regions, we have calculated crude rates for these indicators. Crude rate of natural increase illustrates the difference between births and deaths during a year to the average population and it is expressed per 1 000 inhabitants. It is calculated according to the following formula:

[6] For a national population, net migration refers to external migration (movements between countries), and is the difference between external arrivals and external departures. For a subnational population, net migration includes both external migration and internal migration (movement within a country), and is the difference between external arrivals and external departures, plus the difference between internal arrivals and internal departures.

$$Crude\ rate\ of\ natural\ increase = \frac{natural\ increase\ in\ a\ given\ year}{average\ population\ in\ that\ year}\ 1000$$

Again, it is possible to detect the positive natural growth of population in Northern Ostrobothnia that has been considerably stronger than the Finnish or European Union population increase. All the other regions of Euregio Karelia have been suffering from natural population decrease and their crude rates have been below national and EU averages.

Table 9. Crude rate of natural increase in Euregio Karelia, Finland, Russia and EU27 between 2000 and 2009.

NUTS	NUTS ID	NUTS level	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Finland (Suomi)	FI	NUTS 0	1,4	1,5	1,2	1,5	1,9	1,9	2,0	1,8	2,0	2,0
North Karelia (Pohjois-Karjala)	FI133	NUTS 3	-1,6	-1,6	-2,6	-2,0	-1,9	-1,5	-1,3	-1,6	-2,3	-1,2
Kainuu	FI134	NUTS 3	-1,7	-1,8	-2,7	-2,7	-2,0	-0,9	-3,5	-2,1	-2,7	-2,4
Northern Ostrobothnia (Pohjois-Pohjanmaa)	FI1A2	NUTS 3	5,4	5,7	6,0	6,0	6,5	7,3	7,1	7,1	7,0	7,3
Russia (Russiâ)	RU	SNUTS 0	-6,5	-6,5	-6,4	-6,1	-5,5	-5,9	-4,8	-3,3	-2,6	-1,8
The Republic of Karelia (Respublika Kareliâ)	RU3D	SNUTS 2	-7,8	-7,9	-8,6	-9,6	-8,2	-8,1	-6,9	-5,3	-5,0	-4,0
Total population Euregio Karelia			-1,4	-1,4	-2,0	-2,1	-1,4	-0,8	-1,1	-0,5	-0,8	-0,1
EU27			0,6	0,5	0,3	0,2	0,8	0,6	1,0	1,0	1,3	1,0

Crude rate of net migration, on the other hand, is the difference between immigrants and emigrants during a year (including statistical adjustments) to the average population and it is also expressed per 1 000 inhabitants. The rate is calculated according to the following formula:

$$Crude\ rate\ of\ net\ migration = \frac{net\ migration\ in\ a\ given\ year}{average\ population\ in\ that\ year}\ 1000$$

Crude rate of net migration in Euregio Karelia has been increasing between 2000 and 2009, and it has improved from -3,1 in 2000 to -1,1 in 2009, mainly due to the positive net migration trend in the region of Kainuu. In Kainuu there were 12,8 emigrants over immigrants (per 1000 inhabitants) in 2000, but only 3,9

emigrants over immigrants (per 1000 inhabitants) in 2009. Crude rate of net migration has been increasing also in Finland and in the European Union in general. The Republic of Karelia has been following the migration rates of Russia, where migration both in and out of the country have been strong during the whole 2000s, and the crude rate of net migration has been varying between -0,8 and 2,5 (not including year 2009, when the crude rate of net migration in Russia was 9,2) without having a clear pattern of improvement or decline.

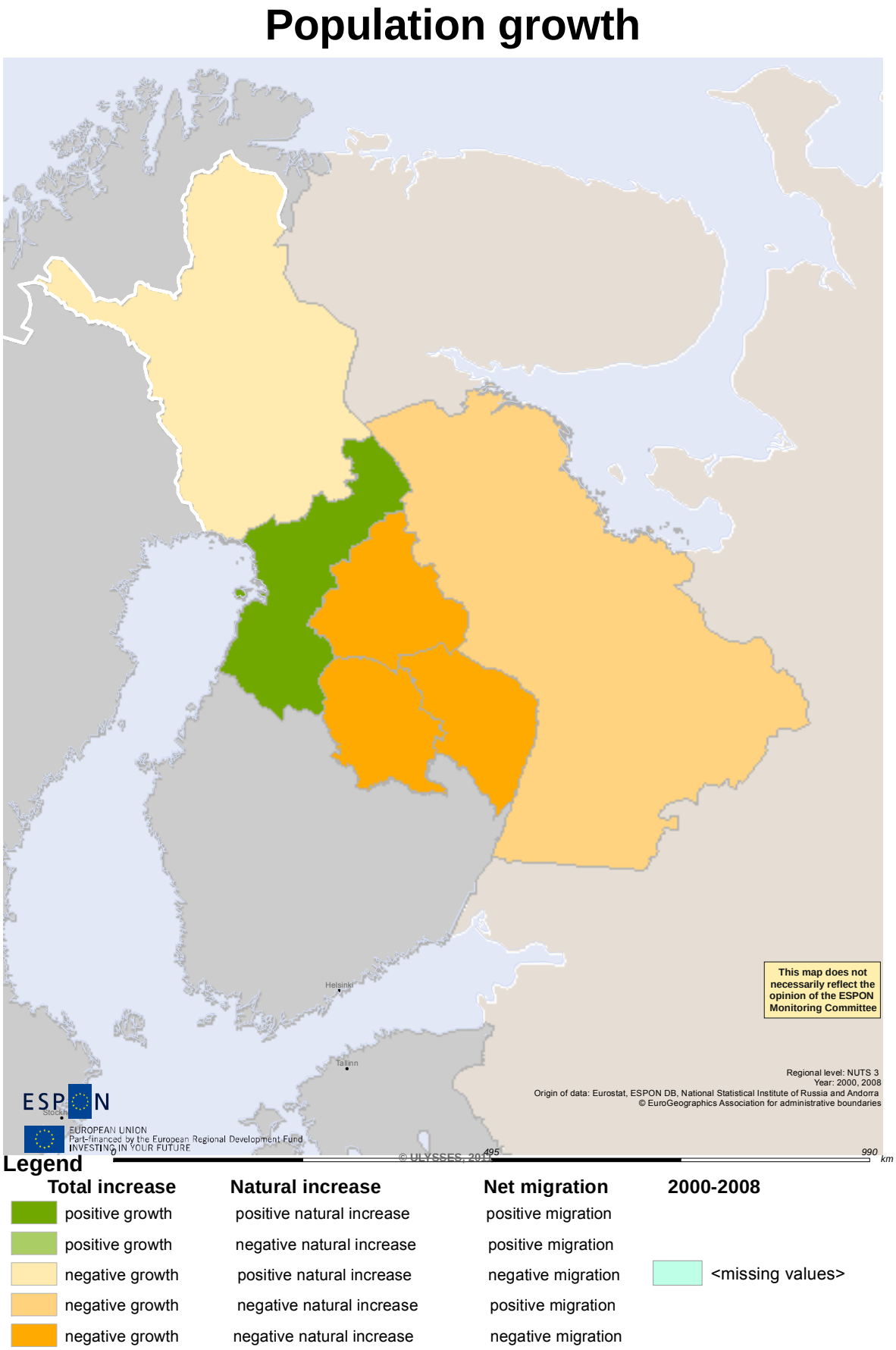
Table 10. Crude rate of net migration in Euregio Karelia, Finland, Russia and EU27 between 2000 and 2009.

NUTS	NUTS ID	NUTS level	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Finland (Suomi)	FI	NUTS 0	0,5	1,2	1,0	1,1	1,3	1,7	2,0	2,6	2,9	2,7
North Karelia (Pohjois-Karjala)	FI133	NUTS 3	-3,9	-3,1	-3,7	-1,5	-1,2	0,2	-3,5	-3,1	-1,4	0,2
Kainuu	FI134	NUTS 3	-12,8	-12,9	-9,9	-6,5	-5,0	-6,8	-7,8	-4,7	-4,8	-3,9
Northern Ostrobothnia (Pohjois-Pohjanmaa)	FI1A2	NUTS 3	2,5	1,4	-0,7	-0,8	1,4	0,8	-0,2	0,2	0,1	0,3
Russia (Russiâ)	RU	SNUTS 0	2,5	2,0	3,1	-0,8	0,7	0,9	1,1	1,8	1,8	9,2
The Republic of Karelia (Respublika Kareliâ)	RU3D	SNUTS 2	1,7	2,2	2,7	0,0	0,0	0,2	0,6	1,7	0,4	-0,8
Total population Euregio Karelia			-3,1	-3,1	-2,9	-2,2	-1,2	-1,5	-2,7	-1,5	-1,4	-1,1
EU27			1,5	1,3	3,8	4,2	4,0	3,6	3,2	3,9	3,3	1,8

*Net migration values for the Republic of Karelia do not include statistical adjustments.

In the following map we have categorized the regions of Euregio Karelia according to their demographic performance between years 2000 and 2008. As illustrated, Northern Ostrobothnia is the only region in Euregio Karelia that has during the given time period had positive natural and total population growth and positive net migration. North Karelia and Kainuu, on the contrary have suffered from negative population growth and negative migration, while in the Republic of Karelia population growth has been negative, but net migration positive.

Figure 10. Category map of population change in Euregio Karelia between years 2000 and 2008

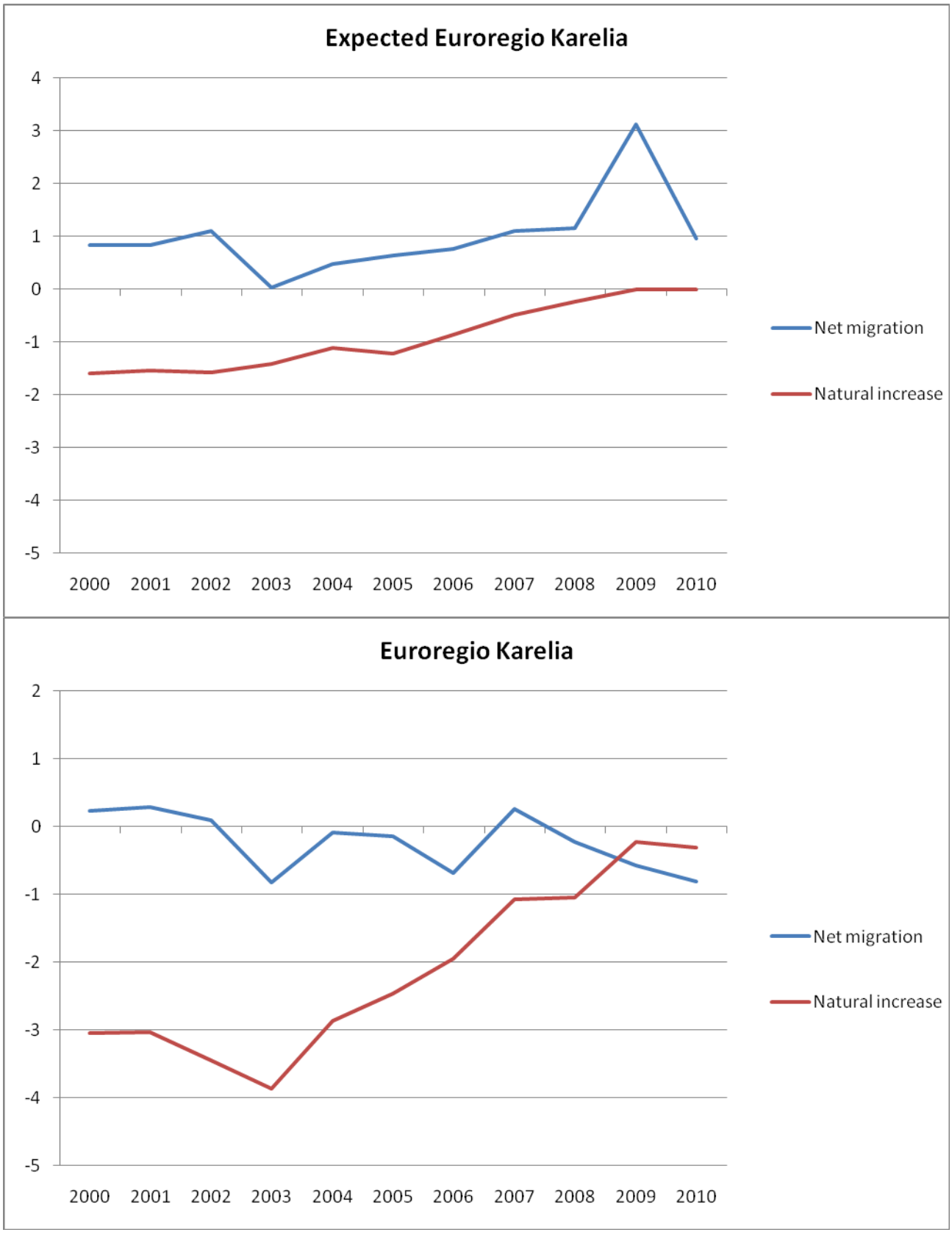


2.1.5. Population projections

Following two figures represent the expected and actual natural population change and net migration in Euregio Karelia between 2000 and 2010. Expected natural population change and net migration are synthetic figures that illustrate regions' behaviour assuming that regions would follow the patterns of their respective countries. Accordingly we have calculated Euregio Karelia's expected natural population change and net migration assuming that, first, the Finnish regions would have followed the Finnish national natural population change and net migration figures, and, second, that the Republic of Karelia would have behaved according to the Russian national avarages. In order to calculate the rates, national natural population change and net migration averages were weighted according to the regions' population.

In the figures we can observe that would the natural population growth in Euregio Karelia have followed the Finnish and Russian national averages, it would not have dropped dramatically in the beginning of 2000s. Since year 2003 the natural population change in Euregio Karelia has been positive to such an extent that it has almost reached the national averages. Net migration, on the other hand has been below the national averages through the whole last decade, and contrary to the strong positive trend on national level between 2007 and 2010, Euregio Karelia has suffered from a decline in migration rates.

Figure 11. Expected behaviour of Euregio Karelia's natural population change and net migration between years 2000 and 2010.



* Net migration values for the Republic of Karelia do not include statistical adjustments.

Figure 12. Total population change in the Northern Finland – Russia CBA between 2000 and 2001 and linear regression for population projection.

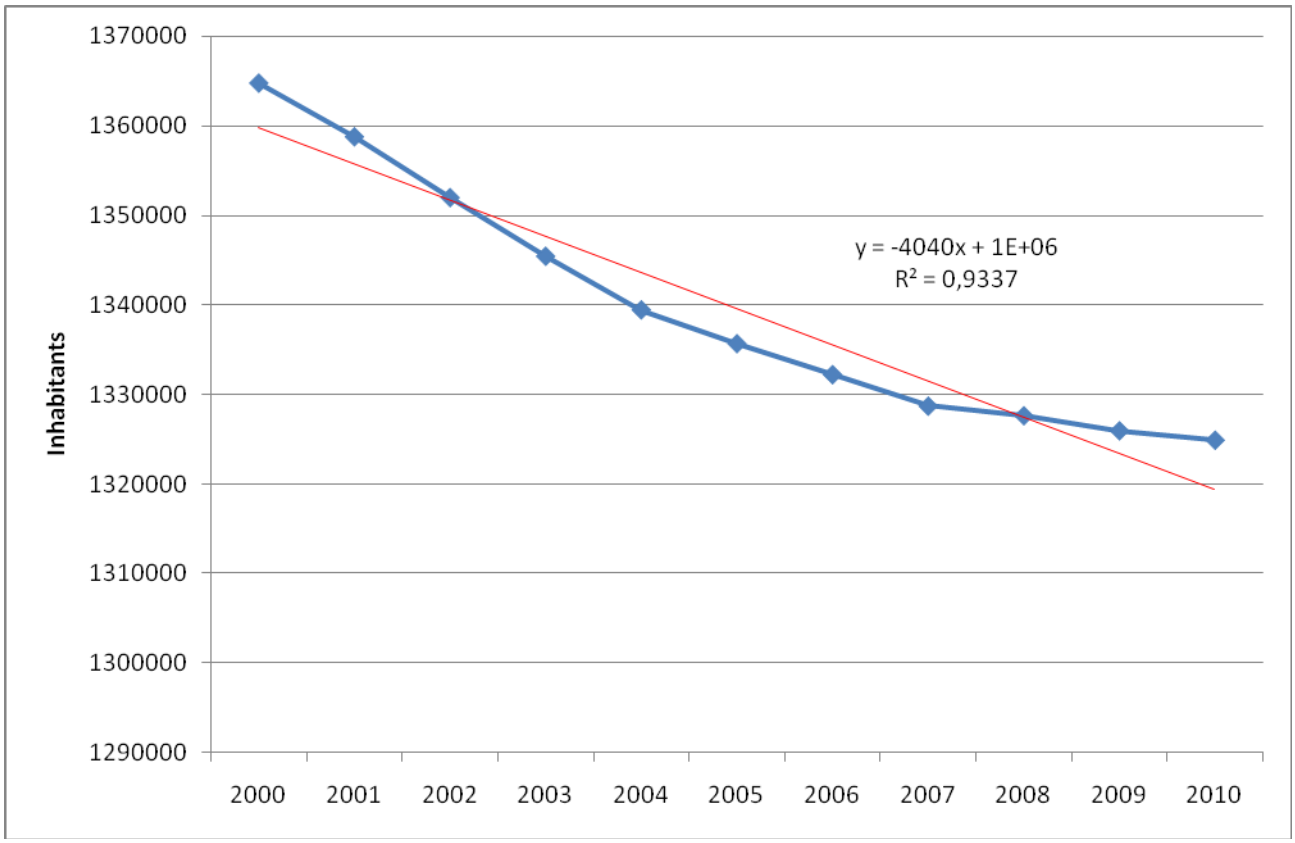


Table 8. Linear regression models and 2020 population projection for the Northern Finland – Russia CBA.

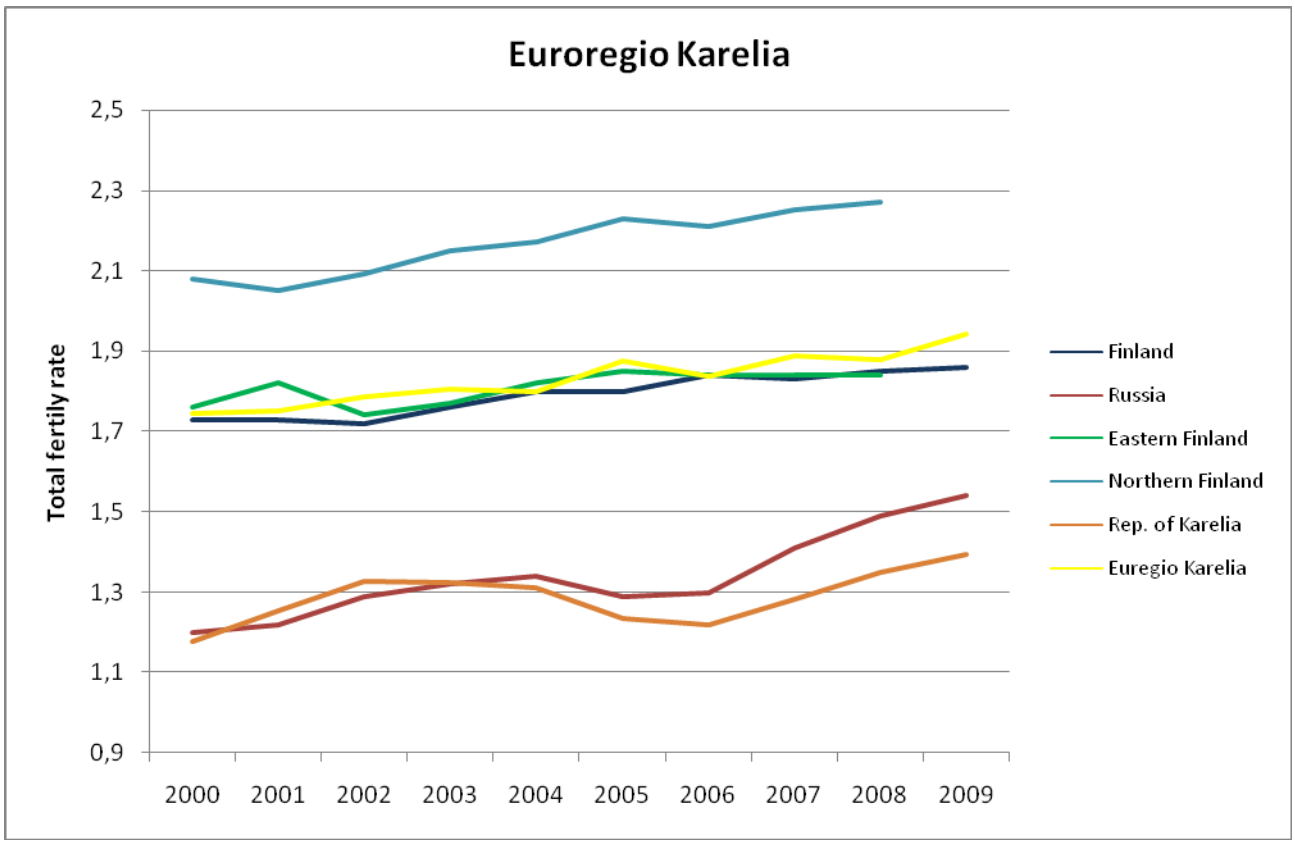
2.1.6. Total fertility rates

Total fertility rate (TFR) is an indicator that describes the average number of children that would be born to a woman over her lifetime if she were to live to the end of her child-bearing years (15-49 years) and bear children in accordance with current age-specific fertility rates. The TFR is a synthetic rate and it is not based on the fertility of any real group of women. A total fertility rate of around 2.1 live births per woman represents the so-called replacement level, which is the average number of live births per woman required to keep the population size constant if there were no inward or outward migration.

Total fertility rate of Euregio Karelia has been increasing from 1,74 in 2000 to 1,94 in 2009. In general total fertility rates have in all the NUTS 2 and NUTS 3 level regions of the Northern Finland – Russia CBA shown gradual increase during the given time period, as have the fertility rates of Finland and Russia. On NUTS 2 level, Northern Finland is the only region with the fertility rate over the replacement level. In 2000 TFR in Northern Finland was 2,08, but in 2008 already 2, 27. Lowest fertility rates of the CBA have been recorded in the Republic of Karelia, where TFR was 1,18 in 2000 and 1,39 in 2009. These figures did during the first half of the decade follow average fertility rates in Russia, but since 2004 TFR of the Republic of Karelia has

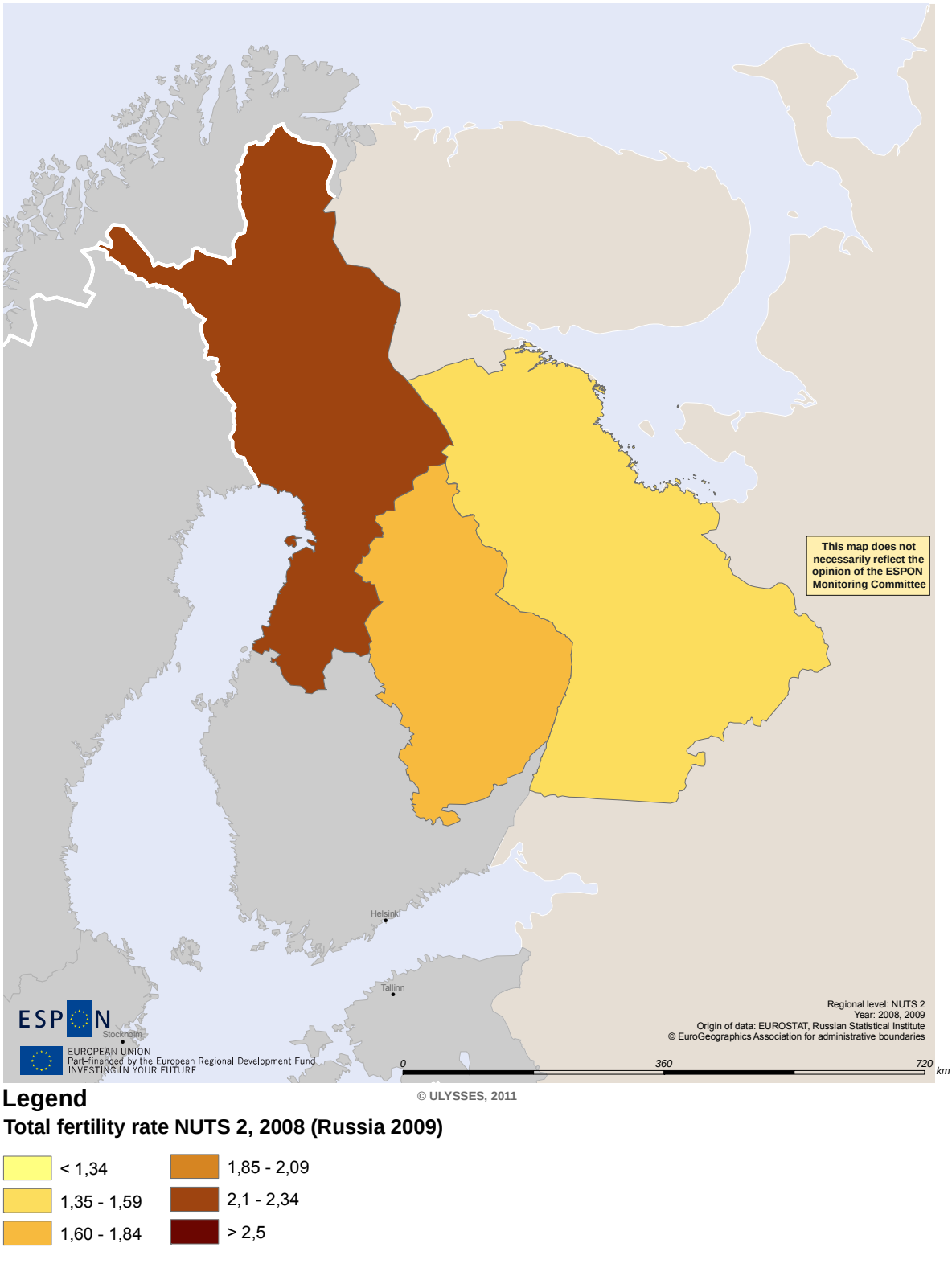
been significantly below the national average (1,54 in 2009). The Republic of Karelia is thus the only region of the Northern Finland – Russia CBA with total fertility rate below EU average (1,6 in 2008).

Figure 13. Evolution of total fertility rates in the Northern Finland – Russia CBA between 2000 and 2009.



* Total fertility rates for year 2009 are missing for the NUTS 2 regions of Eastern and Northern Finland.

Figure 14. Map of total fertility rates in the Northern Finland – Russia CBA in 2008 (Russia 20 609).



2.1.7. Dependency ratios

Dependency ratios are indicators that are used to study the level of pressure on productive population supporting the young and/or old population. These ratios are expressed as the number of dependents to the working age population. Accordingly, young age dependency ratio is the amount of 0-14 olds for every 100 person in the working age population, and old age dependency ratio is the number of people over 64 years of age for every 100 person in the working age population. Total dependency ratio is the combination of young and old age dependency ratios. Dependency ratios can be calculated according to the following formulas:

$$Young\ age\ dependency\ ratio = \frac{Number\ of\ people\ aged\ 0-14}{Number\ of\ people\ aged\ 15-64}\ 100$$

$$Old\ age\ dependency\ ratio = \frac{Number\ of\ people\ over\ 64\ years\ of\ age}{Number\ of\ people\ aged\ 15-64}\ 100$$

$$Total\ dependency\ ratio = \frac{Number\ of\ people\ aged\ 0-14 + Number\ of\ people\ over\ 64\ years}{Number\ of\ people\ aged\ 15-64}\ 100$$

In 2009 total dependency ratio for Euregio Karelia was 49,32 that signifies that there were 49,32 persons aged 0-14 and over 64 years of age for every 100 person in the working age population. This ratio is only slightly higher than EU average (48,90) and slightly lower than Finnish avarage (50,33), but much greater than total dependency ratio for Russia that was 39,24 in 2009. In the Republic of Karelia there were even less "dependents" for the working age population (36,48 per 100 persons aged 15-64) that is mostly due to low fertility and low life expectancy in the region. Accordingly, young age dependency ratio was 19,74 and old age dependency ratio 16,73 for the Republic of Karelia in 2009.

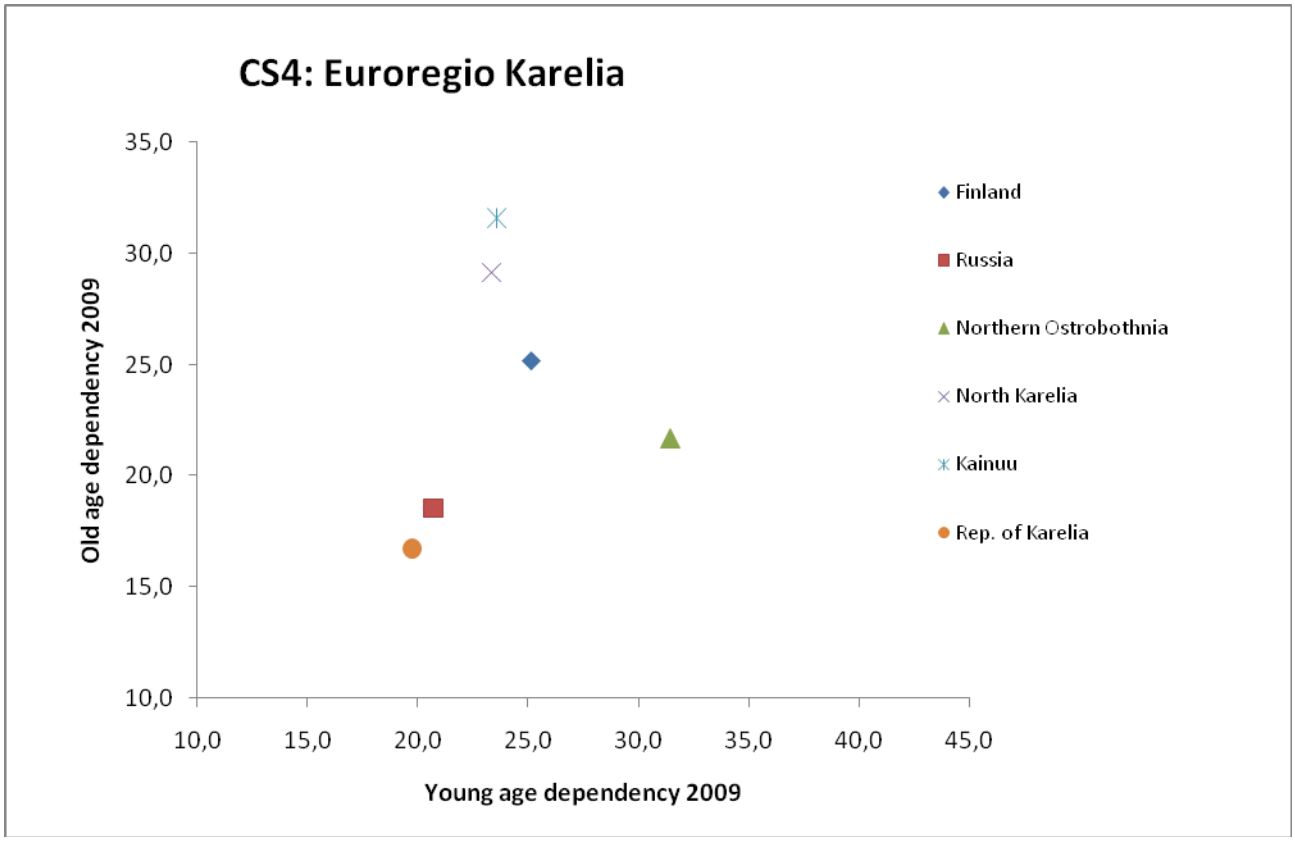
North Karelia and Kainuu show similar young age dependency ratios with EU27 average, but old age dependency ratios in the regions were a great deal higher than national or EU27 average. If mean old age dependency ratio in Finland was 25,18 in 2009 and 25,61 in the European Union, the respective value for North Karelia was 29,14 and for Kainuu 31,61. This signifies that while there is less need to take care of children less than 15 years of age, there is a high pressure on the working age population over taking care of elderly people. In Northern Ostrobothnia, on the contrary, young age dependency rate is much higher than old age dependency ratio (31,43 versus 21,68) that results of high fertility in the region and a growing number of people in the working age.

Table 11. Dependency ratios in the Northern Finland – Russia CBA in 2009.

NUTS	NUTS ID	NUTS level	Young age dependency 2009	Old age dependency 2009	Total dependency 2009
Finland (Suomi)	FI	NUTS 0	25,15	25,18	50,33
North Karelia (Pohjois-Karjala)	FI133	NUTS 3	23,35	29,14	52,49
Kainuu	FI134	NUTS 3	23,58	31,61	55,20

Northern Ostrobothnia (Pohjois-Pohjanmaa)	FI1A2	NUTS 3	31,43	21,68	53,11
Russia (Russiâ)	RU	SNUTS 0	20,70	18,54	39,24
The Republic of Karelia (Respublika Kareliâ)	RU3D	SNUTS 2	19,74	16,73	36,48
Total population Euregio Karelia			24,53	24,79	49,32
EU27			23,28	25,61	48,90

Figure 15. Scatter chart of young and old age dependency ratios in the Northern Finland – Russia CBA in 2009.



2.2. Influence of the border on settlement patterns

In order to study whether the border has affected settlement patterns in the regions of Euregio Karelia we performed in-depth analysis on certain demographic indicators. First, we examined the relationship between border distance and population change.[7] Analyses were performed on LAU 1 level and three different indicators were considered in the analysis, namely annual population growth (between 2001 and 2010), population density and distance to the border as the crow flies (air distance). The so called "border effect" was calculated according to the following formula:

[7] At this point analysis is performed only for the Finnish LAU 1 regions of Euregio Karelia. Regions of the Republic of Karelia will be included in the final report after the needed SLAU 1 data has been received from Kareliâstat.

$$Growth\ Rate = A + a_{db}db + a_{d}d + \varepsilon$$

Db is the distance to the border from a region's centre point and d is the density of a given region.

Values for the chosen indicators were standardized by subtracting the mean value from the original value and dividing the received value by the standard deviation value. The following table presents the examined LAU 1 regions and both original and standardized values that were applied in the analysis.

Table 12. Unstandardized and standardized annual population change, border distance and population density in the Finnish LAU 1 regions of Euregio Karelia.

		Unstandardized			Standardized		
LAU	LAU ID	Annual population growth 2000–2010	Border distance (km)	Population density 2000 (inhabitants /km2)	Annual population growth 2000–2010	Border distance (km)	Population density 2000 (inhabitants /km2)
Joensuu	122	0,14	57,20	12,59	0,76	-0,80	0,16
Middle Karelia	124	-1,48	26,15	6,71	-0,94	-1,16	-0,29
Pielisen Karelia	125	-1,67	36,50	3,25	-1,13	-1,04	-0,55
Kehys-Kainuu	181	-1,86	34,95	1,91	-1,33	-1,06	-0,65
Kajaani	182	-0,45	109,47	6,69	0,14	-0,20	-0,29
Oulu	171	1,65	184,27	49,97	2,33	0,66	2,99
Oulunkaari	173	-0,33	135,64	2,19	0,27	0,10	-0,63
Raahe	174	-0,48	231,34	13,87	0,11	1,19	0,26
Haapavesi-Siikalatva	175	-1,12	191,87	4,22	-0,56	0,74	-0,48
Nivala-Haapajõrvi	176	-0,66	217,29	8,17	-0,08	1,03	-0,18
Ylivieska	177	0,12	259,95	13,82	0,73	1,52	0,25
Koillismaa	178	-0,87	41,10	2,70	-0,29	-0,99	-0,59
					Annual population growth	Border distance	Population density
			Mean value		-0,58	127,14	10,51
			Standard deviation value*		0,96	87,21	13,19

*Standard deviation shows how much variation there is from the average (mean value).

The analysis show that there is no significant "border effect" as the p-value for border distance is above the significant level of 0,05. In other words, population growth and density in the Finnish regions of Euregio are not related to the border distance.

Table 13. Regression statistics picturing the "border effect" in the LAU 1 level regions of Euregio Karelia.

Regression Statistics	
Multiple R	0,871786
R Square	0,760012
Adjusted R Square	0,706681
Standard Error	0,541589
Observations	12

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	-1,6E-16	0,156343	-1E-15	1	-0,35367	0,353673	-0,35367	0,353673
Border distance (km)	0,225147	0,176383	1,276468	0,233742	-0,17386	0,624154	-0,17386	0,624154
Density 2000 (inhabitants/km2)	0,761392	0,176383	4,316692	0,001943	0,362385	1,160398	0,362385	1,160398

Second analysis that we performed projected demographic potential in Euregio Karelia. To analyse this indicator on a regional level, population and distances between centre points of all LAU 1 regions of Euregio Karelia, as well as NUTS 3 regions in the rest of Finland and SNUTS 2 regions in Russia were considered.[8] The demographic potential of a given point "i" relative to "j" was obtained through the following formula:

$$V_j = \sum_j \frac{P_j}{d_{ij}}$$

V_j = potential in j
P_j = population in j
d_{ij} = distance between j e i

Region's own potential was included in the study by dividing a region's population by one fourth of its perimeter. This value was calculated through the area of the region and not its actual perimeter. The purpose of studying demographic potential was not to measure actual population perspectives, but rather to reflect on population potential of a region considering its location.

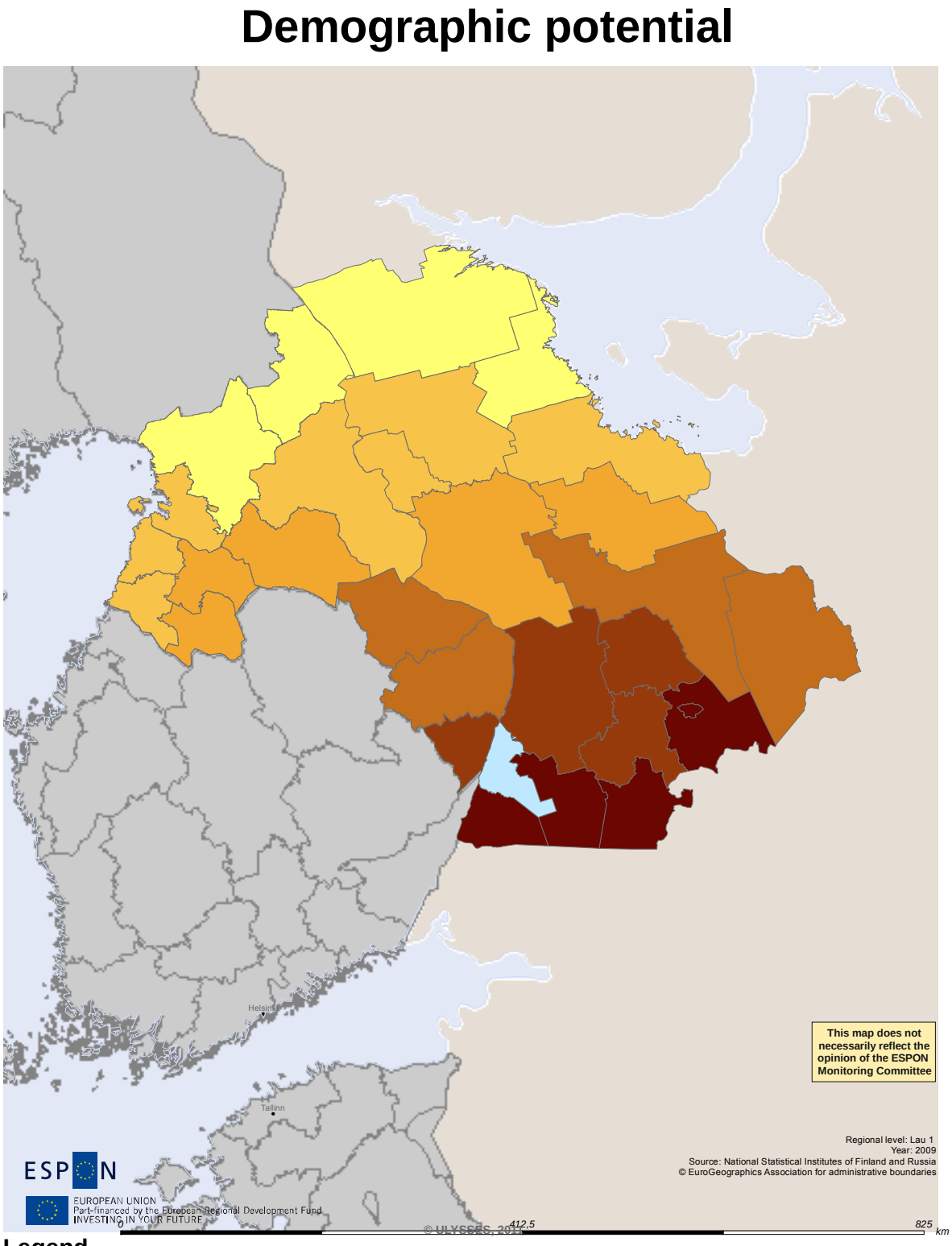
According to the analysis the highest demographic potential in Euregio Karelia is in the region of Oloneckij rajon in the Republic of Karelia located by Lake Ladoga. In order to calculate demographic potential index values for the LAU 1 regions of Euregio Karelia, the demographic potential of Oloneckij rajon was defined 100. Next all the other regions were indexed to the score of Oloneckij rajon.

[8] Considering the huge distances in Russia, only the closest SNUTS 2 regions were included in the calculation, namely those of Moskva, Sankt-Peterburg, Vladimirskaâ oblast', Arhangelskaâ oblast', Neneckij avtonomnyj okrug, Belgorodskaâ oblast', Brânskaâ oblast', Vologodskaâ oblast', Voronežskaâ oblast', Ivanovskaâ oblast', Kaliningradskaâ oblast', Tverskaâ oblast', Kalužskaâ oblast', Kostromskaâ oblast', Kurskaâ oblast', Murmanskaâ oblast', Lipeckaâ oblast', Leningradskaâ oblast', Moskovskaâ oblast', Novgorodskaâ oblast', Orlovskaâ oblast', Pskovskaâ oblast', Râzanskaâ oblast', Smolenskaâ oblast', Tambovskaâ oblast', Tul'skaâ oblast', Âroslavskaâ oblast' and Respublika Komi.

Table 14. Demographic potential values in the LAU 1 level regions of Euregio Karelia (year 2009).

LAU ID	LAU	Potential 2009	Potential Index
122	Joensuu	84616,19	76,12
182	Kajaani	69463,42	62,49
181	Kehys-Kainuu	66427,58	59,76
178	Koillismaa	58250,17	52,40
124	Middle Karelia	93047,16	83,70
176	Nivala-Haapajõrvi	71812,13	64,60
171	Oulu	64638,42	58,15
173	Oulunkaari	61290,69	55,14
125	Pielisen Karelia	77675,49	69,87
174	Raahe	66029,96	59,40
175	Siikalatva	69479,81	62,50
177	Ylivieska	67609,55	60,82
RU3D24	Kemskij rajon	62381,26	56,12
RU3D32	Kondopozhskij rajon	88008,38	79,17
RU3D33	Lakhdenpokhskij rajon	108850,1	97,92
RU3D25	Loukhskij rajon	58366,05	52,50
RU3D22	Belomorskij rajon	68122,01	61,28
RU3D23	Kaleval'skij rajon	63781,77	57,38
RU3D31	Sortaval'skij rajon	100673,6	90,56
RU3D26	Medvezh'egorskij rajon	80662,31	72,56
RU3D27	Muezerskij rajon	73361,04	65,99
RU3D34	Oloneckij rajon	111164	100,00
RU3D35	Pitkjarantskij rajon	108741	97,82
RU3D36	Prionezhskij rajon	102393,3	92,11
RU3D37	Prjazhinskij rajon	99284,55	89,31
RU3D38	Pudozhskij rajon	85336,43	76,77
RU3D28	Segezhskij rajon	73088,96	65,75
RU3D39	Suojarvskij rajon	89043,18	80,10
RU3D11	Petrozavodskij gorodskoj okrug	110860,6	99,73
RU3D21	Kostomukshskij gorodskoj okrug	66063,82	59,43

Figure 16. Demographic potential in the LAU 1 regions of Euregio Karelia (year 2009).



2.3. Chapter conclusions

Demographic analyses of the Northern Finland – Russia CBA show that demographically strong regions have been increasing their population, while weaker regions keep losing their inhabitants. Northern Ostrobothnia is the only region in Euregio Karelia that has had positive population growth and positive net migration. North Karelia and Kainuu, on the contrary have suffered from negative population growth and negative migration, while in the Republic of Karelia population growth has been negative, but net migration positive. Accordingly, while the population density has been declining in three regions of Euregio Karelia, namely in North Karelia, Kainuu and the Republic of Karelia, the population density in Northern Ostrobothnia has been increasing through the whole 1990s and 2000s. Northern Ostrobothnia is also the only region in Euregio Karelia that has a larger amount of children (aged 0-14) than elderly people (65 years or more). The share of elderly population is largest in Kainuu (20,65 %) and North Karelia (19,43 %), while in the Republic of Karelia only 11,94 % of the population is 65 years or more and the working age population covers 73,33 % of the total population.

Total fertility rate of Euregio Karelia has been increasing from 1,74 in 2000 to 1,94 in 2009. In general total fertility rates have in all the NUTS 2 and NUTS 3 level regions of the Northern Finland – Russia CBA shown gradual increase during the given time period, as have the fertility rates of Finland and Russia. On NUTS 2 level, Northern Finland is the only region with the fertility rate over the replacement level. As or total dependency ratio in Euregio Karelia, it was 49,32 in 2009 that signifies that there were 49,32 persons aged 0-14 and over 64 years of age for every 100 person in the working age population. This ratio is only slightly higher than EU average (48,90) and slightly lower than Finnish avarage (50,33), but much greater than total dependency ratio for Russia that was 39,24 in 2009.

Demographic in-depth analysis that were performed in the study show, that there is no significant “border effect” in Euregio Karelia. In other words, population growth and density in the Finnish regions of Euregio are not related to the border distance. In the future it would be interesting to have a closer look at migration statistic on the Finnish side, since it could become evident that regions close to the border are actually attracting population from the neighbouring country.

Chapter 3. Polycentric development in the Northern Finland – Russia CBA

The concept of polycentric development has gained widespread currency in planning and territorial development strategies, and today it plays a fundamental role in European regional policy and European Spatial Development Perspective (ESDP). According to ESDP pursuit of polycentricity helps to avoid further economic and demographic concentration in the core area of the EU. Balanced and sustainable development of local entities and regions creates real locational advantage of the EU vis-à-vis other large economic regions in the world.[9] The newly published Territorial Agenda of the European Union 2020

[9] ESDP 1999.

promotes polycentric development also at regional, macro-regional and cross-border levels. The report states that small and medium-sized towns can play a crucial role at regional development.[10]

Finland as a member of the European Union has adopted the goals of polycentricity into national and regional planning, and according to the Regional Development Strategy of the country the development of a spatially well-balanced regional structure is of high priority for Finland.[11] Even if the regional policy of Russian Federation does not recognize the concept of polycentricity, it also aims at balanced socio-economic development of its Federal Subjects.[12] During the last five years Ministry of Regional Development has been preparing a spatial planning programme that employs multipolar development as a key concept and aims at creating 15-17 city agglomerations that would besides Moscow, Saint Petersburg and Kazan function as growth centres of the country.[13] On regional level the concept of polycentricity has recently gained some ground in Russia as there has been discussion about polycentric development of the two largest cities Moscow and Saint Petersburg.[14]

The aim of this chapter is to study polycentric development, in other words, structure of city network in the Northern Finland – Russia CBA. First, we present functional urban areas (FUAs) of the CBA and provide information of their area (km²), population, population change and compactness. Second, we perform several analyses in order to detect whether the urban structure of the Northern Finland – Russia CBA is polycentric. We also examine whether the amount and size of urban centres in the region deviates from the rank-size distribution of urban centres in the European Union (EU27). Finally we have a look at functional specialization of the urban areas.

Indicators selected for the analysis are following:

Table 15. Indicators included in the study of polycentric development in the Northern Finland – Russia CBA.

Variable name	Geographical scale	Source	Time frame	Observations
Morphological and Functional Urban Areas		ESPON 1.4.3	2001; 2006	Some data has been gathered for the FUA mostly based on the values of the NUTS 3 which they overlap (GDP, unemployment, etc.)
Population	NUTS 0,2	EUROSTAT	2000-2006	
Slope rank size distribution GDP				
Primacy rate GDP				
Slope rank size distribution population				
Primacy rate population				
% population in FUA				

[10] Territorial agenda 2020.
[11] Suomen aluekehittämisstrategia 2013.
[12] Koncepciâ soveršenstvovaniâ regional´noj politiki v Rossijskoj Federacii.
[13] Strategičeskoe planirovanie v regionah i gorodah Rossii 2010.
[14] Pro Estate Events 9.9.2011; Zavtra 3.8.2011.

% effective FUA pop change 01-06				
Compactness 2001 (MUApop/FUA pop)				
Gini coefficient thiessen polygons (%)				

Methodology that we applied for studying polycentricity originates from ESPON 1.1.1 -project.[15] The given project considers two different aspects of polycentric development. The first one is morphological (the distribution of urban areas in a given territory) and the second one relational (networks of flows and cooperation between urban areas at different scales). Both of these aspects are closely linked, since relations between cities are crucial for polycentricity; nodes without connections between each other would not form a polycentric system. We have, however, limited our study to the morphological aspect of polycentricity. Analysis on how different urban agglomerations interact with their surroundings and each other could not, due to the lack of data, have been performed soundly on a broad scale.

Data applied in this study has been developed by ESPON 1.4.3 -project and all the analyses are based on the concept of Functional Urban Area (FUA), generated in ESPON 1.1.1 -project. Functional Urban Areas consist of a core municipality and municipalities surrounding the core. The concept is an important prerequisite for studying urban trends, because it reflects the actual role played by cities in regional development. In also has the ability to exceed administrative boundaries, since smaller administrative regions are combined according to their functional orientation and not following the traditional hierarchical classification of regions. [16] In ESPON 1.4.3 FUAs were defined by aggregating LAU 2 level regions from different NUTS 3 or 2 level regions.

In our study we have included FUAs that have at least 60 % of their area overlapping with the area of the cross-border region, and FUAs, whose Morphological Urban Area (MUA), that is the core municipality, is located within the limits of the cross-border area. The analyses on polycentricity have been made on the scale of the whole CBA, because the study of urban structure is not meaningful on low geographical scales based on the possible small amount of FUAs. Only part of the analysis could be made on the Russian side of the CBA, since ESPON 1.4.3 did not cover Russian territory and therefore no data was available.

3.1. Functional Urban Areas

Functional Urban Areas of the Northern Finland – Russia CBA are presented in the following table and map. The table provides information on the area (km²), population, population change and compactness of the FUAs. The map pictures the location of FUAs and their MUAs (core regions presented in violet colour). The Northern Finland – Russia CBA has been studied here on NUTS 2 level, and therefore cities outside the actual territory of Euregio Karelia have been included in the study. FUAs located in Euregio Karelia are Oulu (Northern Ostrobothnia), Joensuu (North Karelia), Kajaani (Kainuu) and Petrozavodsk (The Republic of Karelia).

[15] ESPON 1.1.1.
[16] Antikainen 2005.

The largest FUA of the Northern Finland – Russia CBA was in 2006 the City of Petrozavodsk and Prionežskij municipality that surrounds the city. This FUA, identified here as PETRO, is the only Functional Urban Area on the Russian side of the CBA that fulfils the requirements set up by ESPON 1.4.3 for FUAs. According to the project MUAs should have a core with more than 650 inhabitants per km² (NUTS 5 level unit) or with more than 20 000 inhabitants if they have a clear concentrated morphological core. In total FUAs should have a minimum population of 50 000 inhabitants.[17] There were 265100 inhabitants in Petrozavodsk in 2006 and 23100 in Prionežskij municipality. [18] The largest FUA on the Finnish side of the Northern Finland – Russia CBA in 2006 was Oulu with 221325 inhabitants and the smallest Kokkola with 50434 inhabitants. If we look only at FUAs located on the territory of Euregio Karelia the smallest FUA is Kajaani with 55802 inhabitants.

Petrozavodsk is also the second most compact FUA in the CBA. MUA population forms 92 % of the total population of PETRO FUA. The most compact FUA according to this analysis is Rovaniemi in Northern Finland (NUTS 2), but if we look at the distribution of population in the FUA the situation in reality is actually quite the opposite. The high value for compactness results from the fact that January 1 2006 the rural municipality of Rovaniemi, surrounding the city of Rovaniemi merged to the city. Hence the population that used to live outside MUA is now considered MUA population, even if it continues to inhabit territories outside the actual urban centre of the FUA.

When we take a look at FUAs in the regions of Euregio Karelia, it is possible to observe that population growth between 2001 and 2006 has been positive in all the FUAs except for Kajaani (-2,9 % decrease). Oulu and Joensuu have had an almost 9 % population growth. Population in PETRO FUA was growing between 2001 and 2003 and after a decline between 2004 and 2005 population has again been increasing steadily, reaching 293800 inhabitants in 2010.

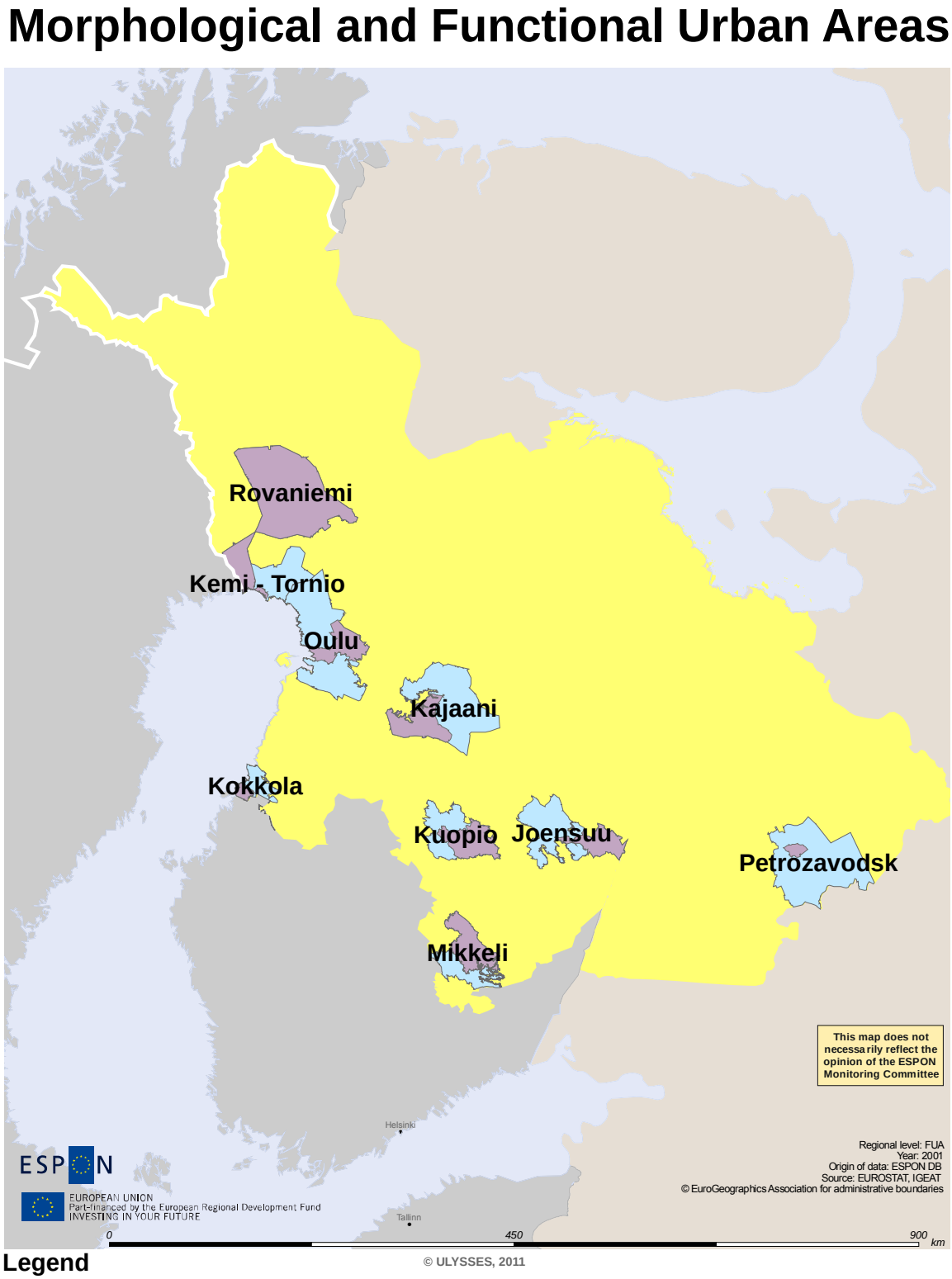
Table 16. FUAs of the Northern Finland – Russia CBA.

FUA ID	FUA	FUA area (km²)	FUA population 2001	FUA population 2006	Population change 2001-2006 (%)	Compactness 2001 (MUA population / FUA population)
FI10438	Oulu	6946,20	203293	221325	8,9	61
FI10434	Kuopio	3401,13	113758	118305	4	76
FI10427	Joensuu	4315,80	87419	95062	8,7	59
FI10430	Kemi-Tornio	4314,15	69539	67861	-2,4	33
FI10441	Rovaniemi	8016,79	35427	57849	63,3*	100
FI10429	Kajaani	6740,19	57451	55802	-2,9	63
FI10437	Mikkeli	3239,13	54560	54220	-0,6	86
FI10431	Kokkola	1828,11	49933	50434	1	71
PETRO	Petrozavodsk + Prionežskij municipal'nyj rajon	4555,31	288200**	288200	0	92

*The Rural Municipality of Rovaniemi merged to the City of Rovaniemi in 2006.
**January 1 2006 SLAU 1 region of Vepsskaâ nacional'naâ volost' joined Prionežskij municipal'nyj rajon. Here the population of both of these regions in included in the FUA population.

[17] ESPON 1.4.3.
[18] No data was available for SLAU 2 level regions of the municipality of Prionežskij municipal'nyj rajon. Data is therefore for the whole SLAU 1 level region of Prionežskij municipal'nyj rajon.

Figure 17. FUAs and MUAs of the Northern Finland – Russia CBA.



Morphological Urban Areas and Functional Urban Areas, according to the ESPON 1.4.3 (established from data from 2001)

3.2. Morphological analysis of FUAs

It is characteristic for a polycentric urban system that no city dominates over other cities in demographic or economic sense. In other words, a polycentric urban system lacks hierarchy, and cities are relatively similar of size. We have analysed the hierarchy of city systems in the countries participating in ESPON programme by calculating the slope of rank size distribution of the FUAs, and later we will perform the same analysis for the Northern Finland – Russia CBA. In order to calculate slope of rank size distribution, FUAs of a given territory are ranked from largest to smallest according to the amount of population. After that following equation is computed:

$$LN\,(population) = a + b\,LN\,(rank)$$

*LN is a function that returns the natural logarithm of a value.

This function is a so called rank-size equation in the Lotka form. If estimated relation holds, the size distribution of FUAs follows a statistical log-linear distribution. The slope of equation (β) indicates the level of hierarchy and thus the level of polycentricity in a region; the lower the absolute value of β, the higher the level of polycentricity.

Figure 18 presents rank size distribution of population in the Functional Urban Areas of ESPON countries. All the FUAs of ESPON countries have been ranked from largest to smallest, and related to each other according to their size (blue marks). The black line in the chart is the statistical log-linear line that presents a hypothetical homogeneous distribution of FUAs. A relatively flat line (low absolute value of β) implicates of a polycentric urban system, whereas a steep line stands for a more monocentric system, where a one city dominates over others.[19] The slope of equation for ESPON countries (β) for year 2006 was -1,0521, which signifies that urban system in the European Union (+ Norway and Switzerland) is in fact relatively polycentric. (ESPON β-value is very close to -1, which corresponds to regularity known as Zipf's law.) When we have a look at the hypothetical log-linear line, it is possible to observe that urban system of ESPON countries lacks hierarchy even at the upper end of the rank size distribution. The largest city should, according to the log-linear line, have a population much higher than the approximate 13 million that the largest FUA in the ESPON space, London, actually has.

Rank size distribution can be calculated also for gross domestic product in the FUAs. Figure 19 presents how the ESPON FUAs have ranked according to GDP. Here the slope of the log-linear line is steeper (-1,3608) than in the population chart because of greater differences in GDP between the leading FUAs (London and Paris) and the FUAs with the lowest GDP. The steep drop in the lower end of the distribution line is caused by a group of approximately two hundred FUAs with GDP less than 400 M€. GDP for London FUA was 589028 M€ in 2006 and for Paris 520533 M€.

[19] ESPON 1.1.1.

Figure 18. Rank size distribution of the population in Functional Urban Areas of ESPON countries (2006).

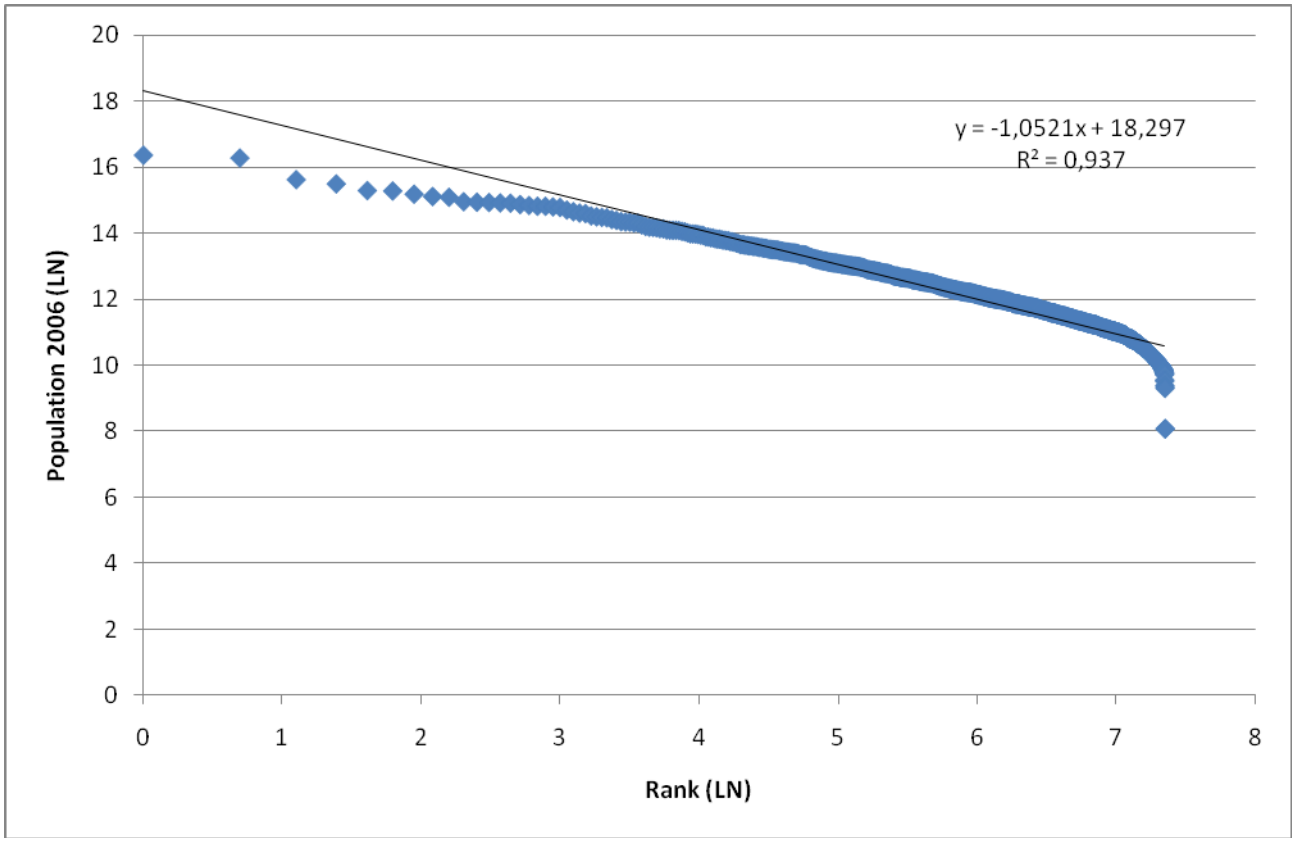
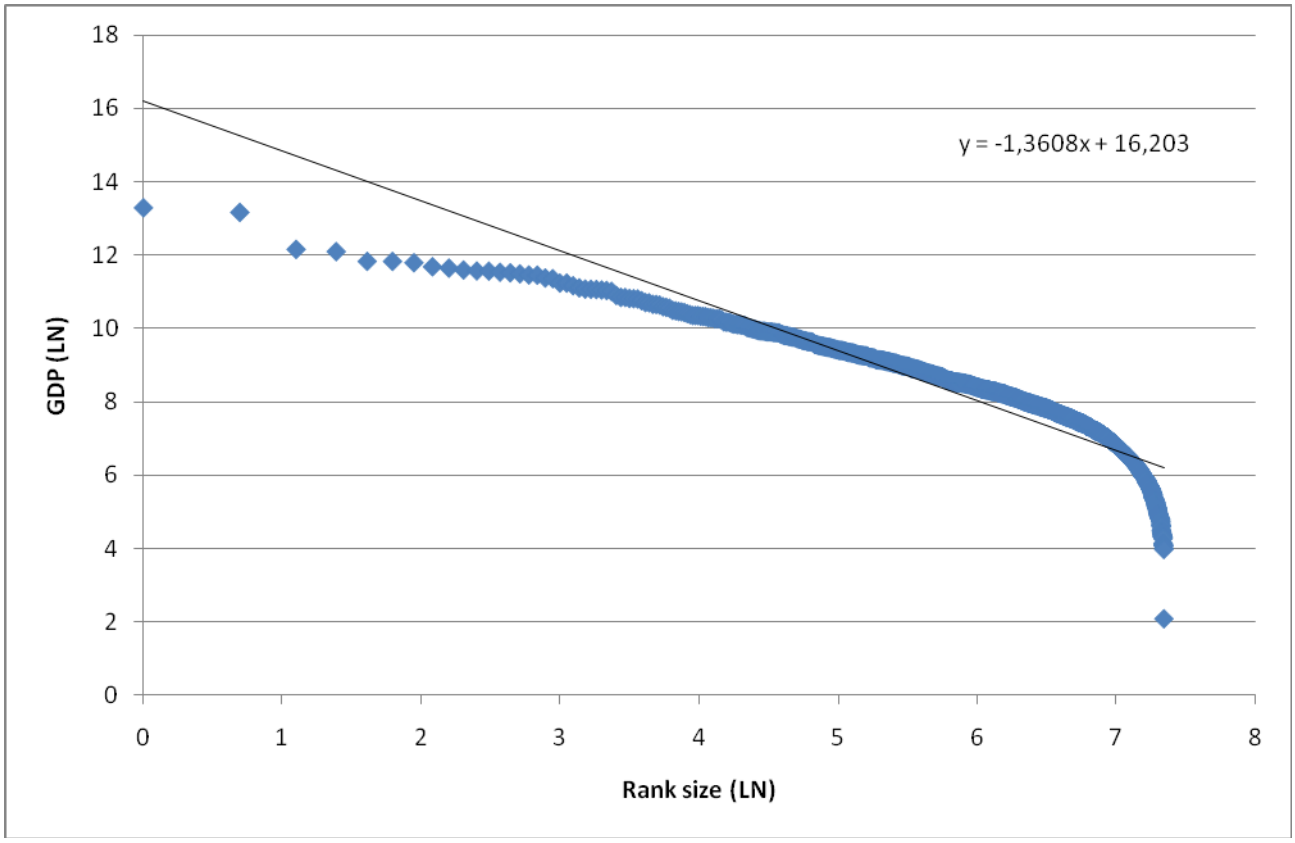


Figure 19. Rank size distribution of GDP in Functional Urban Areas in ESPON countries (2006).



The slope of rank size distribution of FUA population in the Northern Finland – Russia CBA was -0,94 in 2001. In 2006 the slope of rank size distribution valued at -0,88 that could indicate of a move towards a more polycentric urban system. The change is, however, more related to the merger of Rovaniemi rural municipality and city, and hence the increase in population in the smallest FUA of the CBA. Nevertheless the Northern Finland – Russia CBA has a relatively polycentric urban structure, more polycentric than the average urban structure in ESPON countries.

As GDP data was missing for PETRO FUA, the rank size distribution of FUA GDP only applies for the Finnish cities of the CBA. The slope of rank size distribution of FUA GDP was -0,81 in 2006. Even if this value indicates of a polycentric cross-border area, it is possible to observe great differences between the leading FUA Oulu, where GDP was 6362 M€ and Rovaniemi, where GDP was 970 M€ in 2006.

Figure 20. Rank size distribution of the population of Functional Urban Areas in the Northern Finland – Russia CBA (2006).

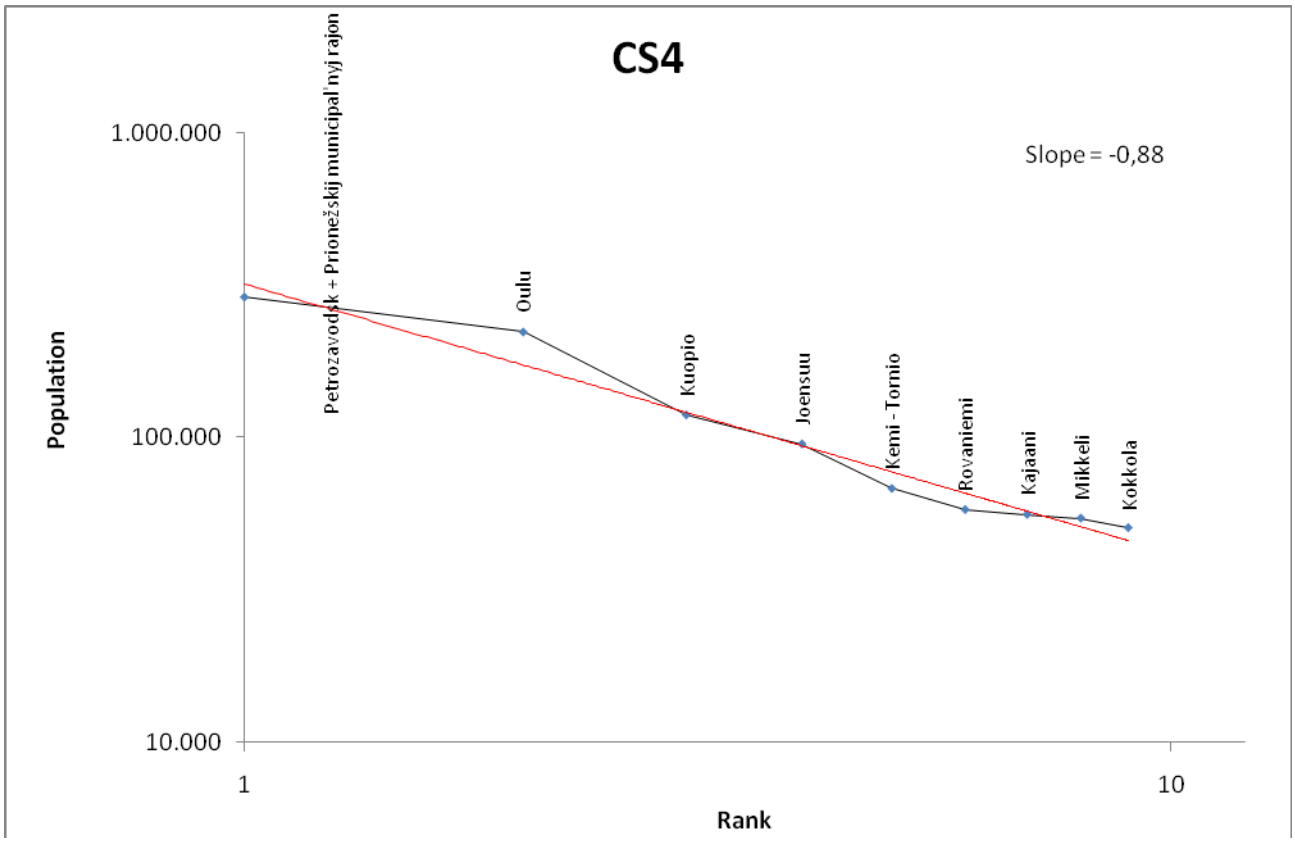
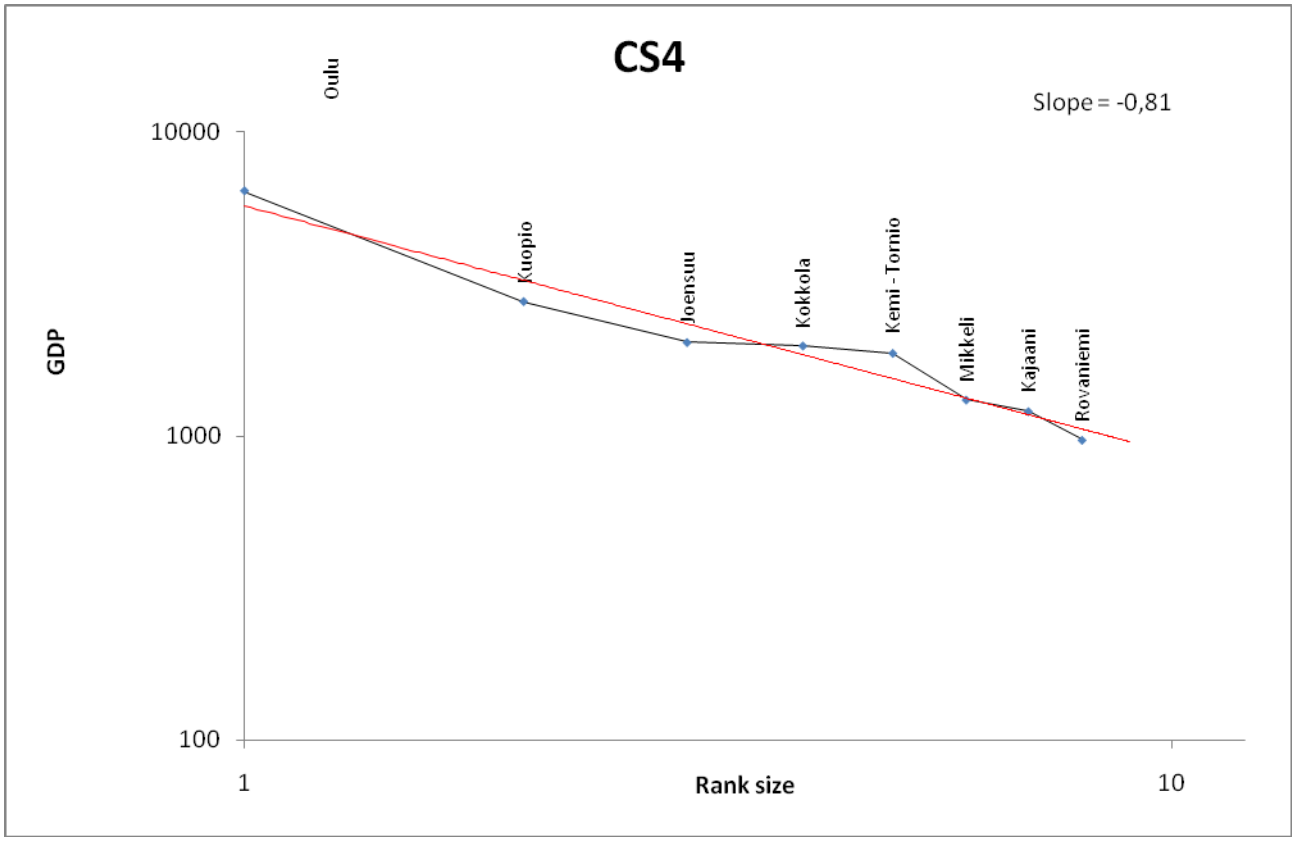


Figure 21. Rank size distribution of GDP in Functional Urban Areas in the Northern Finland – Russia CBA (2006).



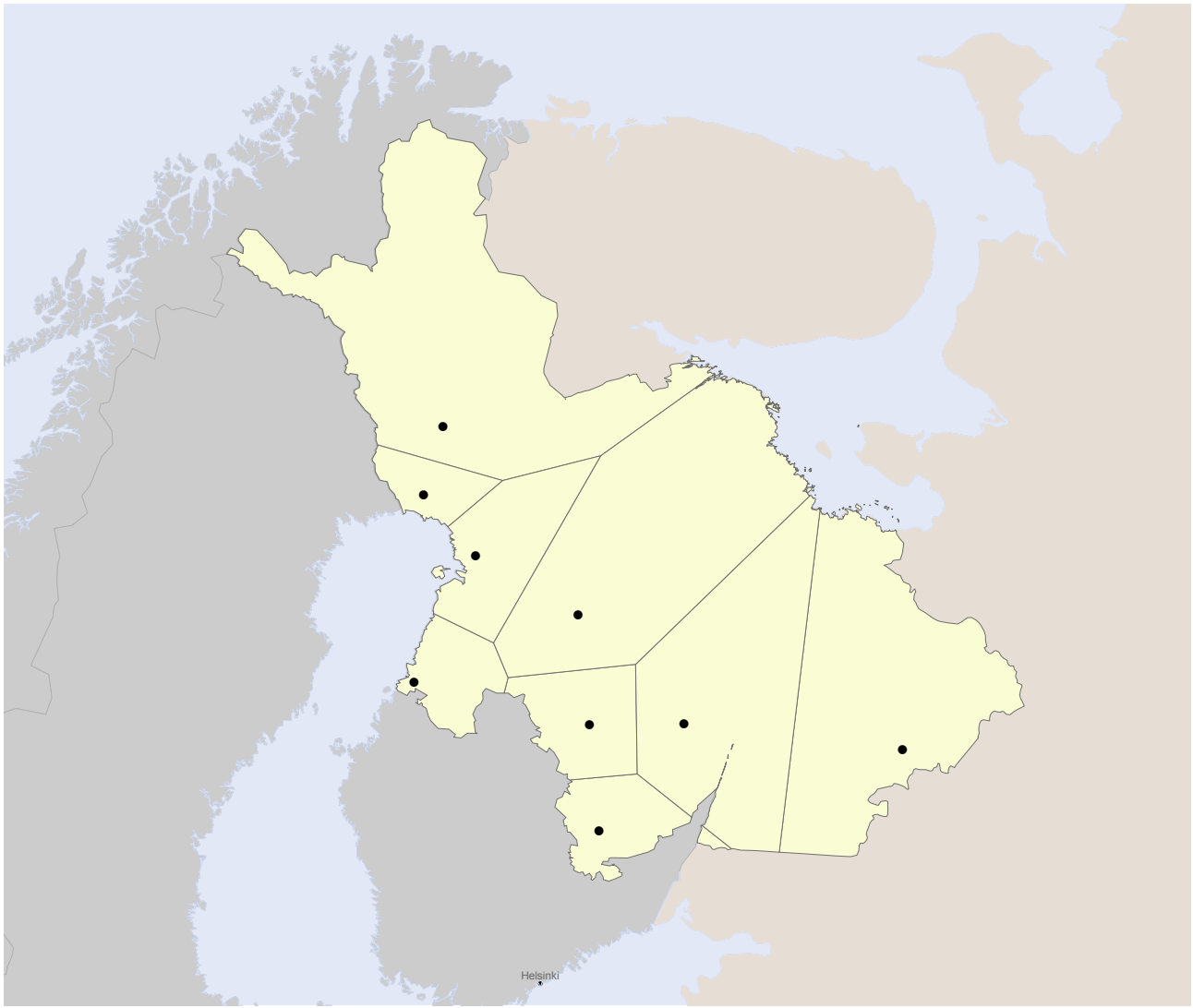
While the slope of rank size distribution considers all FUAs in a region, primacy rate excludes the largest FUA from the analysis. It is an indicator that measures how much the size of the largest FUA deviates from the regression line of the rank-size distribution of the FUAs in a given region. If the primacy rate values above 1, the population of the main FUA is above the expected value, and, on the contrary, if the primacy rate is below 1, the largest FUA is smaller than what would be expected by the regression line of the rank-size distribution of FUAs. High primacy rate thus indicates of a monocentric urban structure with one dominating FUA, and low primacy rate of a polycentric urban structure.

Primacy rate for the Northern Finland – Russia CBA was 0,79 in 2006. This again suggests that urban structure of the region is not dominated by one big city, but that the size of the biggest FUA (PETRO) is actually smaller than anticipated by the rank-size distribution of the FUAs. Primacy rate for Finland was 2,05 and 0,14 for ESPON countries in 2006. The value for Finland is caused by the large size of Helsinki FUA compared to the size of other FUAs in the country. The Finnish GDP primacy rate was also high and valued at 2,17 in 2006, indicating of accumulation of production in the capital region of the country. The distribution of GDP among the FUAs in Northern and Eastern Finland was more balanced and valued at 1,34. (PETRO FUA was excluded from the analysis due to the lack of data.)

The gini coefficient of the FUA Thiessen polygons is an indicator that measures how the FUAs are spaced throughout a given region. Values close to 100 % indicate of great inequalities in the FUA distribution while

values below 100 % imply that FUAs are more evenly spaced.[20] The gini coefficient for thiessen polygons in Northern Finland – Russia CBA valued at 41,7 %, which again indicates of a polycentric urban structure. As stated in ESPON 1.4.3 Final Report this measure implicitly evaluates overall distribution of the population. However, it has a problem of attributing same weight to all different FUAs and it does not reflect the actual influence of a city. It should, therefore, be essentially understood as a way to evaluate whether the minimum amount of services that an urban agglomeration can provide is accessible throughout the region.

Figure 22. FUA Thiessen polygons for the Northern Finland – Russia CBA (year).

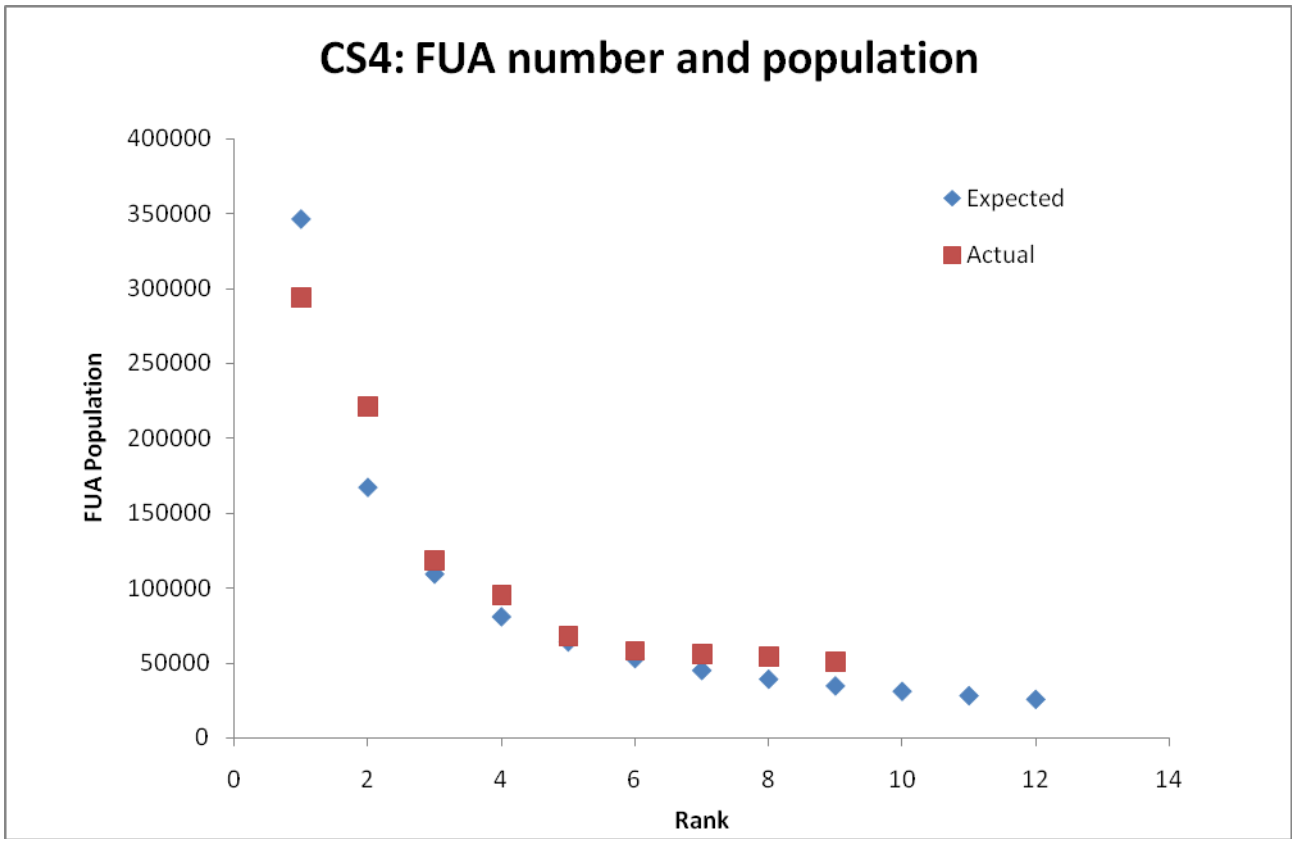


Finally, we have compared rank size distribution of FUAs in the Northern Finland – Russia CBA to the overall distribution of FUAs in ESPON countries (EU27 + CH + NO). For this exercise, rank-size coefficients were estimated considering all FUAs in ESPON countries. The actual rank-size distribution of the FUAs was thereafter compared with what would be expected if the regions would follow the European distribution.

[20] For this indicator, polygons were produced based on ESPON 1.4.3 FUA layer (made available by the ESPON DB 2013) so that the limits of the polygons were established exactly midways between two FUAs. On national level, gini coefficients were produced considering the border as a limit.

This analysis demonstrates the expected amount and size of a FUA in a region according to its total population. As the following figure illustrates, rank-size distribution of FUAs in the Northern Finland – Russia CBA follows the so called "European distribution" of FUAs relatively well. It does lack hierarchy to some extend (leading FUA with a considerable size) and the amount of FUAs is smaller, but the slope of FUA distribution is very similar to the expected distribution.

Figure 23. Rank size distribution of the Functional Urban Areas of the Northern Finland – Russia CBA to the overall distribution of FUAs in ESPON countries (2006).



Following table summarizes morphological analyses of FUAs and presents the Northern Finland – Russia CBA in the context of Finnish FUAs and FUAs of the ESPON countries. If we compare the average size of FUAs in the CBA, it is approximately two thirds of the average size of FUAs in Finland and about half the size of FUAs in ESPON countries. What is also worth mentioning, is the fact that only 51,1 % of the CBA's total population lives in FUAs, while 73,7 % of Finnish population and 74,8 % of ESPON space population inhabits FUAs.

Table 17. Morpholocigal indicators for the Northern Finland – Russia CBA (2006).

CS4	CBA	FI	RF	ESPON
Slope of rank size distribution (population)	-0,88	-0,97	N/A	-1,06

Slope of rank size distribution (GDP)*	-0,81	-1,14	N/A	-1,36
Primacy rate (population)	0,79	2,05	N/A	0,14
Primacy rate (GDP)*	1,34	2,17	N/A	0,05
Number of FUAs	9	22	N/A	1552
Average FUA population	112785,6	175985,2	N/A	245298,6
Minimum FUA population	44737	47918	N/A	3216
Maximum FUA population	294212	1440824	N/A	12972492
% of population in FUAs	51,1	73,7	N/A	74,8
% effective FUA population change 2001-2006	51,2	4,8	N/A	3,0
Compactness 2001 (MUA population / FUA population)	65,4	70,6	N/A	64,9
Gini coefficient thiessen polygons	41,7	47,96	N/A	-

*Values do not include PETRO FUA.

3.3. Functional analyses of FUAs

We have selected a group of socio-economic indicators in order to study functional specialization of FUAs in the Northern Finland – Russia CBA. Since data is not available for these indicators on FUA level, we have made estimations according to the values of NUTS 3 regions that given FUAs are part of. [21] Selected indicators include unemployment rates, GDP per inhabitant and value added by NACE that are presented in table 18. [22] In almost all the Finnish FUAs dominating economic activity is traditional manufacturing (incl. mining and energy production). The second most important NACE group is service sector, which in Kajaani is the leading one producing 24,9 % of total gross value added of the FUA. Figure 24 presents the share of different NACE sectors in the cross value added of the FUAs, and figure 25 GDP per inhabitant in the FUAs of the CBA. The map well illustrates the lower GDP per inhabitant in FUAs located in Eastern Finland, compared to FUAs located in the NUTS 2 region of Northern Finland (except for the Northern most FUA Rovaniemi with the lowest GDP per inhabitant of all the FUAs).

[21] As the values are estimates they have to be interpreted with some care.

[22] NACE (Statistical classification of economic activities) version applied here is 1.1.
A = Agriculture, hunting and forestry, B = Fishing
C = Mining and quarrying, D = Manufacturing, E = Electricity, gas and water supply
F = Construction
G = Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods, H = Hotels and restaurants, I = Transport, storage and communications
J = Financial intermediation, K = Real estate, renting and business activities
L = Public administration and defence; compulsory social security, M = Education, N = Health and social work, O = Other community, social and personal services activities, P = Activities of private households as employers and undifferentiated production activities of private households
Q = Extraterritorial organisations and bodies

Table 18. Functional indicators for the Northern Finland – Russia CBA (2006).

	Gross Value Added						GDP per inhabitant (1000 euros)	Unemployment rate
	Agriculture, forestry and fishing (AB)	Mining, manufacturing and energy (CDE)	Construction (F)	Trade and transport (GHI)	Finance and business services (J-K)	Other services (L-P)		
Petrozavodsk + Prionežskij municipal'nyj rajon	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Oulu	3,3	31,2	7,3	16,9	18,1	23,1	29	9,8
Kuopio	5,8	23,2	6,7	18,8	18,5	27,1	23	9,8
Joensuu	6,9	25,9	7	18,3	16,1	25,7	21	10,4
Kemi - Tornio	6,6	28	6,3	18,9	15,4	24,9	28	12,4
Rovaniemi	6,6	28	6,3	18,9	15,4	24,9	17	12,4
Kajaani	10,4	20,5	6,7	16,1	16,6	29,8	22	17,1
Mikkeli	10,1	20,3	6,6	18,4	16,8	27,8	24	11,5
Kokkola	5	34,8	6,2	18,7	14	21,3	39	8,7

Figure 24. Share of different NACE sectors in the value added of FUAs in the Northern Finland – Russia CBA (year 2006).

Share of NACE in the value added of FUA

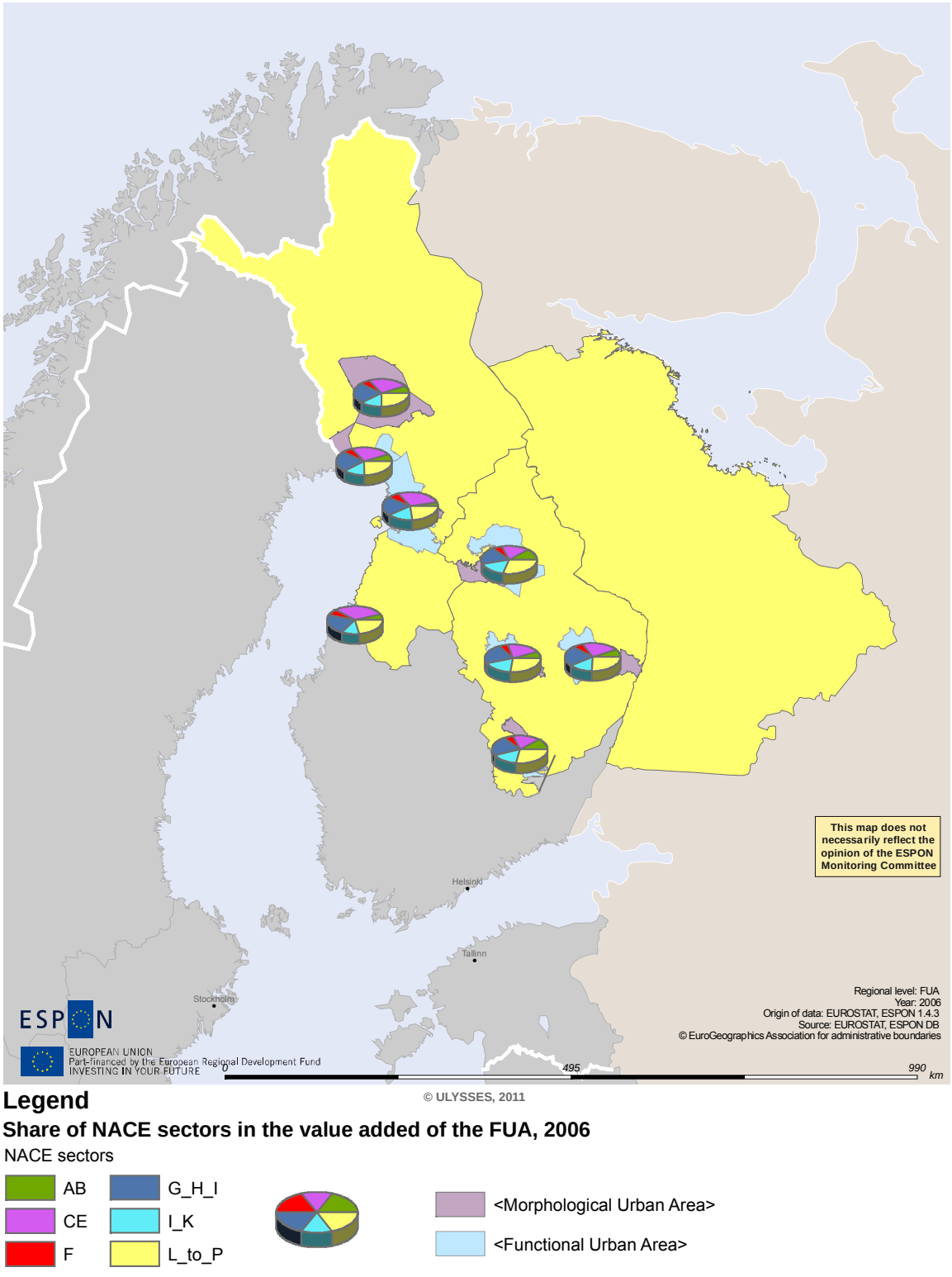
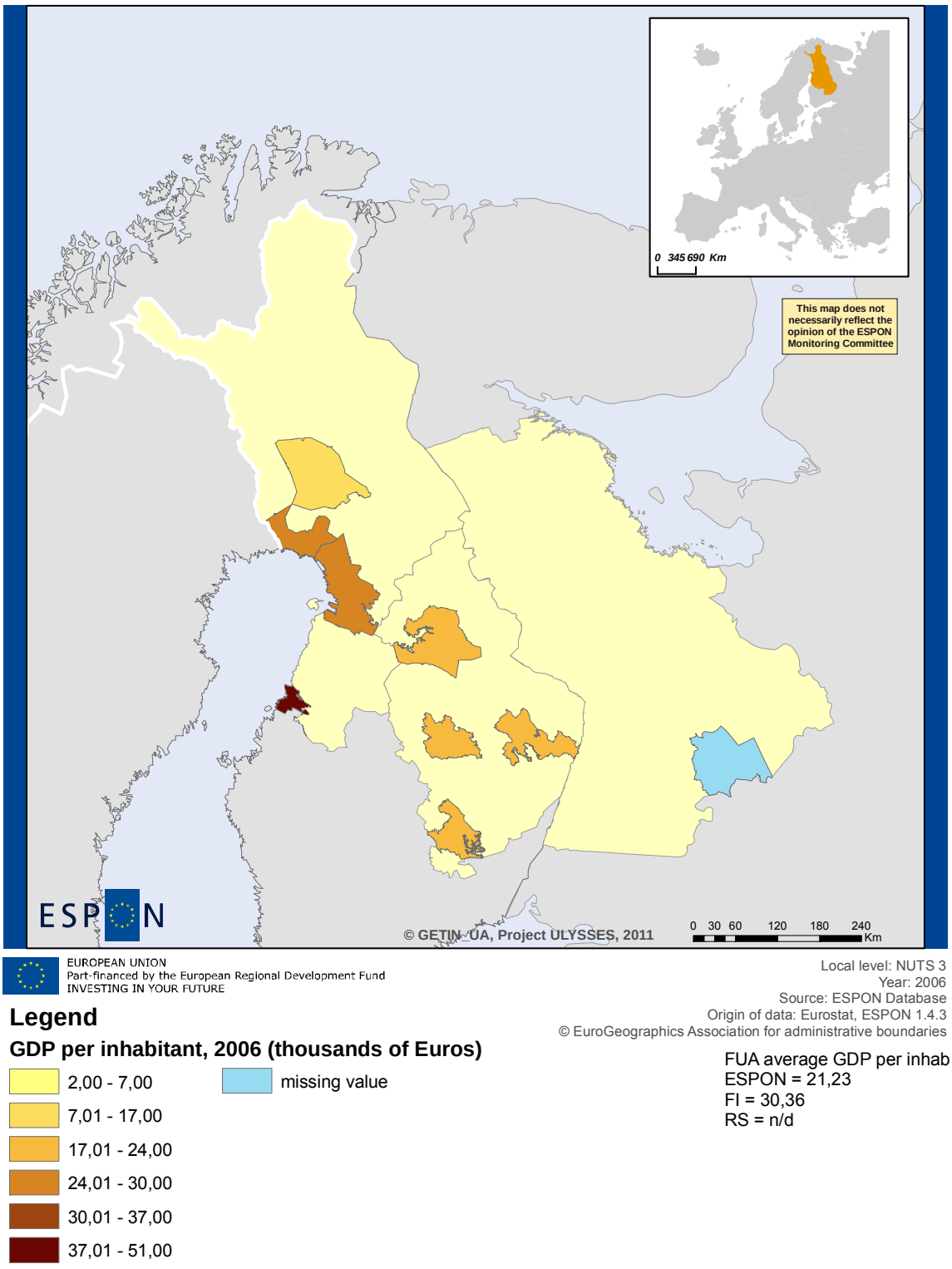


Figure 25. GDP per inhabitant in the FUAs of Northern Finland – Russia CBA (year 2006).



3.4. Chapter conclusions

When we take a look at FUAs in the territory Euregio Karelia, it is possible to observe that population change has been positive between 2001 and 2006 in all the FUAs except for Kajaani (-2,9 % decrease). The largest FUA of the Northern Finland – Russia CBA was in 2006 the city of Petrozavodsk and Prionežskij municipality that surrounds the city.

Analysis performed above show that the urban structure in the Northern Finland – Russia CBA is polycentric. The slope of rank size distribution of FUA population in the CBA was -0,88 in 2006. This indicates that the Northern Finland – Russia CBA has a relatively polycentric urban structure, more polycentric than the average urban structure in ESPON countries. The slope of rank size distribution of FUA GDP was -0,81 in 2006. Even if this value indicates of a polycentric cross-border area, it has to be noticed that the value did not include data for the city of Petrozavodsk and Prionežskij municipality. That would have, due to the significant differences in GDP, affected the final values. Primacy rate for the Northern Finland – Russia CBA was 0,79 in 2006. This again suggests that urban structure of the region is not dominated by one big city, but that the size of the biggest FUA (PETRO) is actually smaller than anticipated by the rank-size distribution of the FUAs.

In almost all the Finnish FUAs dominating economic activity is traditional manufacturing (incl. mining and energy production). The second most important NACE group is service sector, which in Kajaani is the leading one producing 24,9 % of total gross value added of the FUA. In general terms FUAs with lower GDP per inhabitant are located in Eastern Finland, while FUAs with higher GDP are in Northern Finland.

Chapter 4. Urban-rural relationship in the Northern Finland – Russia CBA

Urban-rural relationship is another key concept of European spatial policy. Active relations between urban areas and surrounding rural regions are considered a means to achieve sustainable development and territorial cohesion. Recent studies (including ESPON 1.1.2 “Urban-rural relations in Europe”) have shown that urban-rural linkages are now moving beyond single one-way exchanges towards a dynamic web of interdependencies, which shape the development of both cities and countryside. New technologies are a good example of new elements that influence the pattern and character of flows between rural and urban areas.[23] Hence there are visible and invisible flows of people, capital, goods, information and technology between urban and rural areas. It is the recognition of the complexity of urban-rural relationships that has gained political attention both at national and European levels. European Spatial Development Perspective (ESDP) speaks about going beyond traditional co-operation and building successful long-term partnerships

[23] Kūle 2010.

between urban and rural areas.[24] According to the Territorial Agenda 2020 urban-rural partnerships should include integrated governance and planning aspects.[25]

To be able to study urban and rural areas, ESPON 1.1.2 project makes a distinction between structural and functional properties of a region. Structural properties include established land-use patterns, settlement structure and the distribution of population, while functional properties refer to the factual use of the physical environment (various forms of production, consumption and communication). Following this distinction the project defines urban-rural relations as follows: structural relations of urban and rural areas are determined by the way the physical environment is constituted and shaped, while functional relations between urban and rural areas are determined by the way the physical environment is utilised.[26]

In our analyses we have examined both dimensions of urban-rural relations, however, with a limited selection of parameters. First we take a look at land use patterns in the Northern Finland – Russia CBA, and then analyse how the traditional rural fields of economic activity; agriculture, forestry and fishing have developed in the CBA.

We have faced some limitations regarding the data. Although it is possible to get land cover data on a very low geographical scale from the Corine Land Cover, indicators such as employment and economical patterns are only available at NUTS 3 level. Typologies established by ESPON and Eurostat are also available only at broad scale, and it is not possible to link the indicators with rural or urban areas at any significant scale. We have therefore focused on these typologies on NUTS 3 level and highlighted differences between them regarding land use patterns as well as socioeconomic indicators. Besides the ESPON typology on urban and rural regions, data for land types has been included in the analysis. What comes to evaluating interaction (flows of people and goods or computer mediated communication) between urban and rural areas, there is no data available on EUROSTAT or ESPON.

Table 19. Urban-rural relationship parameters studied for the Northern Finland – Russia CBA.

Variable name	Geographical scale	Source	Time frame	Observations
Change of urban fabric	NUTS 3	Corine Land Cover	2000–2006	
Agricultural areas	NUTS 3	ESPON DB	1990; 2000; 2006	
Urban-rural typology	NUTS 3	ESPON DB/ Eurostat		
Urbanization of natural areas	NUTS 3	Corine Land Cover	2000–2006	
Gross value added in forestry and fishing	NUTS 3	Eurostat	1997–2008	
Employment in forestry and fishing	NUTS 3	Eurostat, Russian Federal State Statistics Service	1997–2008	Years missing for some countries

[24] ESDP 1999.
[25] Territorial Agenda 2011.
[26] ESPON 1.1.2.

4.1. Land use patterns

Different typologies have been established in order to classify regions to urban and rural territories. The typology that was developed in ESPON 1.1.2 project is based on tree indicators; land cover, population density and the presence/absence of a FUA. Based on different combinations of these indicators, NUTS 3 regions are classified in the project as having high or low human influence (population densities) and urban intervention (land cover).

Eurostat uses an urban-rural typology that is a revision of OECD typology and classifies regions according to the three following steps:

1. Clusters of urban grid cells are created with a minimum population density of 300 inhabitants per km² and a minimum population of 5 000 inhabitants. All the cells outside these urban clusters are considered rural.

2. NUTS 3 regions of less than 500 km2 are grouped with one or more neighbours solely for classification purposes. All NUTS 3 regions in a grouping are classified in the same way.

3. NUTS 3 regions are classified based on the share of population in rural grid cells. More than 50 % of the total population in rural grid cells = predominantly rural, between 20 % and 50 % in rural grid cells = intermediate and less than 20 % = predominantly urban.

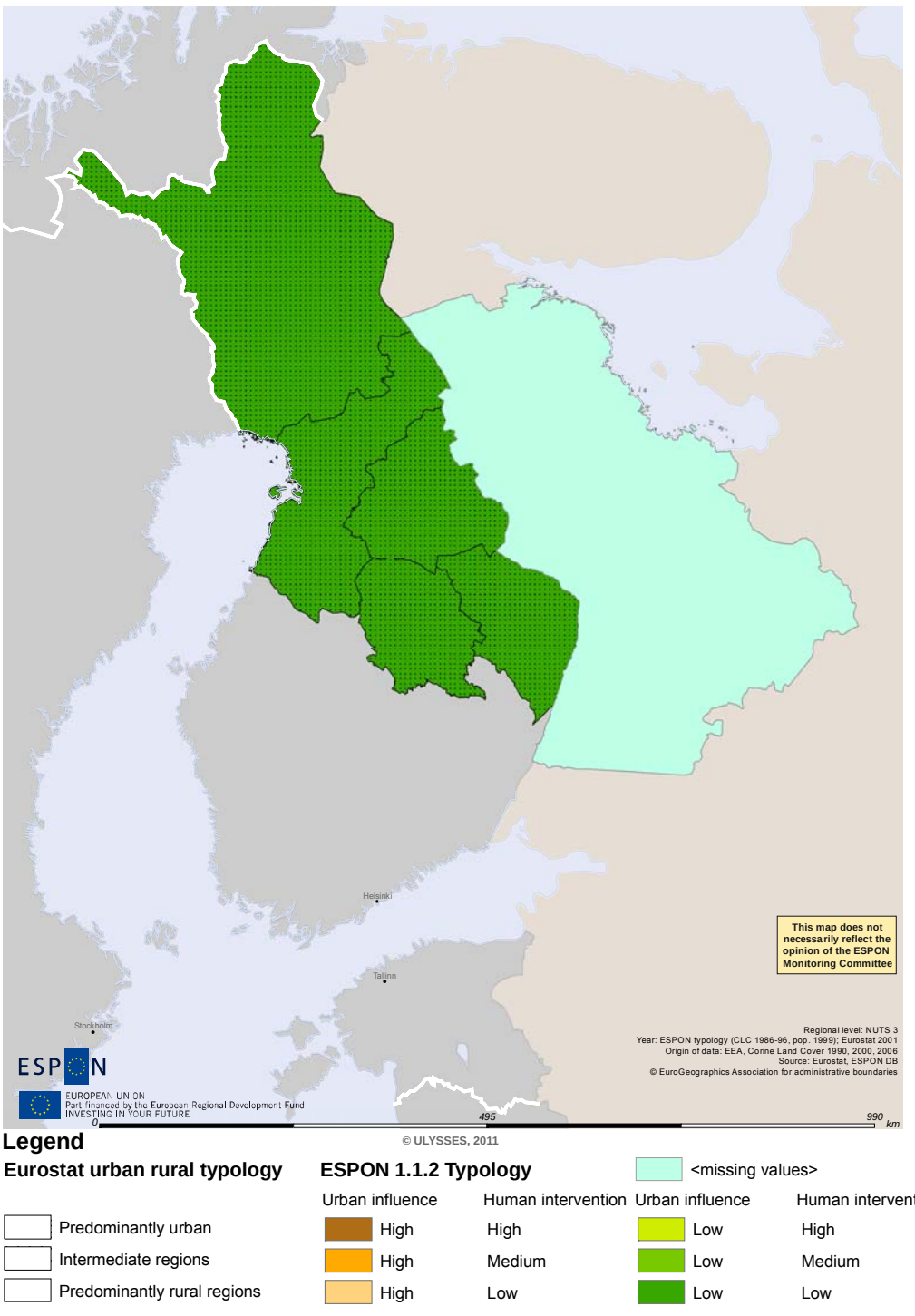
Further, some regions that are predominantly rural are considered intermediate in the presence of a city with more than 200 000 inhabitants, and intermediate regions located next to cities of over 500 000 inhabitants are considered urban.[27]

Following map presents the regions of Euregio Karelia based on these two typologies. ESPON 1.1.2 typology classifies all the regions of the CBA as regions with low urban influence and low human intervention. The Eurostat typology also considers the regions of the CBA as predominantly rural regions.

SNUTS 3 regions of the Republic of Karelia have not been included in the analysis due to the lack of data. If we, however take a look at the regions from the perspective of the Eurostat typology (with more simple classification) and the population and population density data, we could conclude that City District of Petrozavodsk (Petrozavodskij gorodskoj okrug) would be predominantly urban, the Southern part of the Republic of Karelia (Ûžnaâ čast' Respubliki Kareliâ) intermediate and the Nothern part of the Republic of Karelia (Severnaâ čast' Respubliki Kareliâ) a predominantly rural region.

[27] A revised urban-rural typology 2010.

Figure 26. Northern Finland – Russia CBA according to ESPON 1.1.2. and Eurostat urban rural typologies.



Even if the regions of Euregio Karelia appear rural from the European perspective, the share of agricultural areas in the regions values significantly lower than European average (ESPON countries). Share of agricultural areas in the ESPON countries was 38,65 % in 2006, while the largest share of agricultural areas in the CBA was 7,91 % in Northern Ostrobothnia. The lowest share of agricultural areas was in Kainuu (1,75

%) and in the Republic of Karelia (0,24 %). The values are not directly comparable because the data for the Republic of Karelia considers only areas under cultivation and does not include fallow areas. The small share of agricultural land in these two regions is related to the large share of forests. In Kainuu forests cover 90 % of the region's territory, which is the largest share of forests in whole Finland.[28] The share of agricultural areas has been increasing in all the Finnish regions of Euregio Karelia between 2000 and 2006, while in the Republic of Karelia the share of areas under cultivation has been decreasing. This is a common trend in Russia, where the share of areas under cultivation has decreased at an annual rate of -275 51 between 1990 and 2006.

The following table presents agricultural areas in the regions of Euregio Karelia, Finland, Russia and ESPON countries. Land cover data that is used here and in the following analyses has been categorized according to the Corine Land Cover (CLC). CLC has five main categories of land use; (1) artificial, (2) agricultural, (3) forests and semi-natural areas, (4) wetlands and (5) water bodies. Agricultural areas include arable land, permanent crops, pastures and heterogeneous agricultural land.

Table 20. Agricultural areas (category 2 of the Corine Land Cover) in the Northern Finland – Russia CBA.

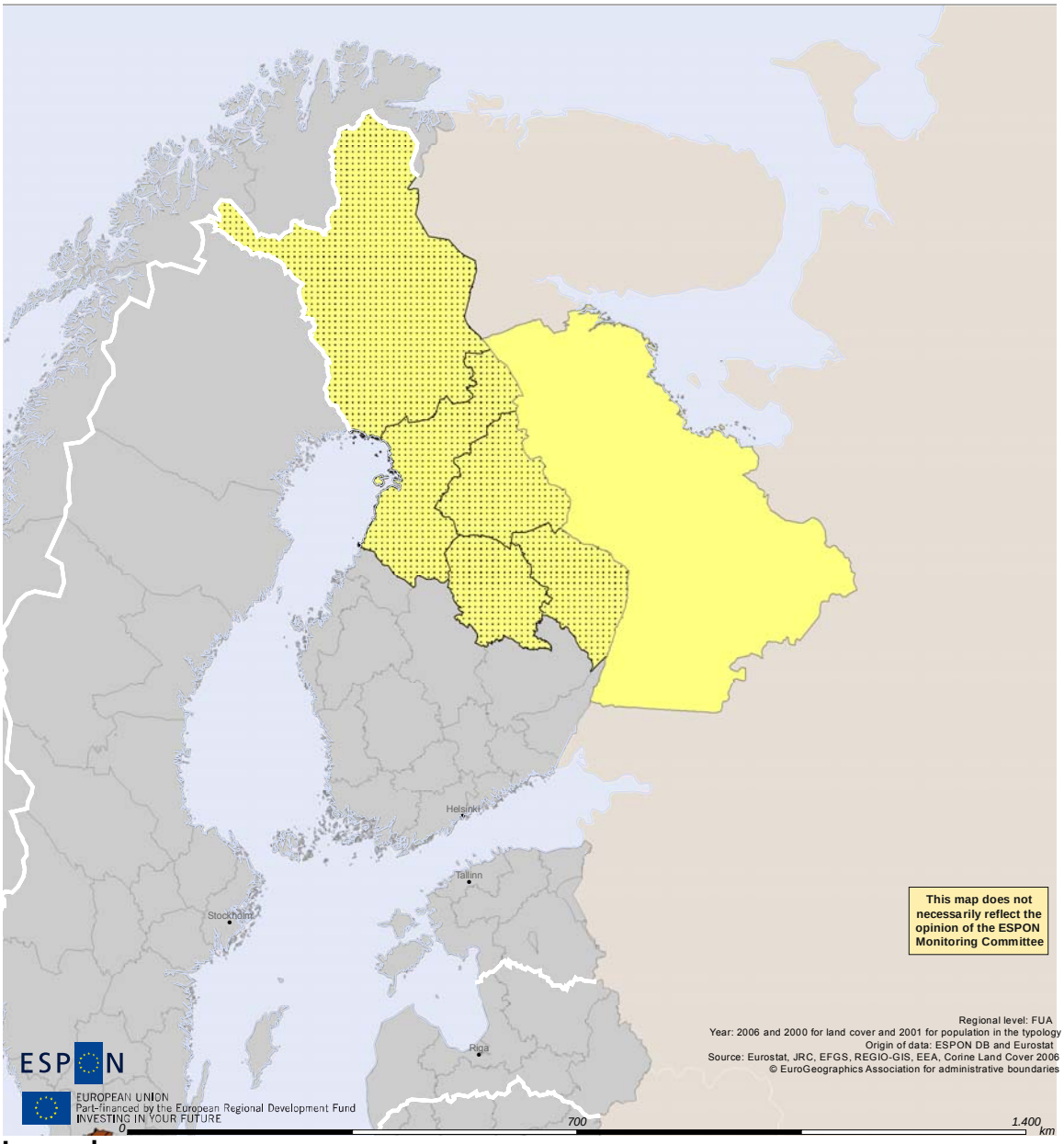
		Agricultural areas (ha)						
NUTS	NUTS ID	Total 1990	Total 2000	Total 2006	Share of total area 2006 (%)	Net formation of land cover 1990–2006	Net formation of land cover by total area 1990–2006 (per 10000)	Annual growth rate 1990–2006 (per 1000)
ESPON space	EU27 + CH + NO	182685050,0	205227723,0	184577384,0	38,65	1892334,0	39,621	6,44
Finland	FI	0,0	2941221,0	2959725,0	8,78	18504,0**	5,49**	10,46**
Russia	RU	117705160,0	84669640,0	75276990,0	4,40	-42428170,0	-248,14	-275,51
North Karelia (Pohjois-Karjala)	FI133	0,0	121366,0	122299,0	5,67	933,0**	4,32**	12,77**
Kainuu	FI134	0,0	41501,0	42861,0	1,75	1360,0**	5,56**	53,89**
Northern Ostrobothnia (Pohjois-Pohjanmaa)	FI1A2	0,0	278190,0	293772,0	7,91	15582,0**	41,98**	91,25**
The Republic of Karelia (Respublika Kareliâ)*	RU3D	82830,0	64820,0	45130,0	0,24	-37700,0	-19,65	-372,42

*Areas under cultivation
**Data for 2000–2006
Source: ESPON Database
Methodology: Tabulate area between CLC2000 level 3 and NUTS 2006 (levels 1,2,3) and aggregation at CLC2000 level 1.

[28] Statistics Finland 2011.

Figure 27. Share of agricultural areas in the Northern Finland – Russia CBA in 2006.

Share of agricultural areas



Urbanisation of agricultural areas in the regions of Euregio Karelia has been below the European average (ESPON countries). Between 2000 and 2006 127745,51 ha of agricultural area in the ESPON countries was urbanised, that is 2,67 ha urbanised land per 10000 ha of agricultural land. In Euregio Karelia largest areas of agricultural land were urbanised in Northern Ostrobothnia (0,36 ha per 10000 ha of agricultural land), while in Kainuu only 0,01 ha per 10000 ha of agricultural land was urbanised. Urbanisation of natural and semi-natural areas in Northern Ostrobothnia and North Karelia was stronger than in ESPON countries in average. If 0,34 ha of natural and semi-natural areas were urbanised in ESPON countries between 2000 and 2006, the share was 1,10 in Northern Ostrobothnia and 0,83 in North Karelia. The Finnish average for the given period was 0,75. Urbanisation in the Finnish regions of Euregio Karelia (and in Finland in general) has hence affected natural and semi-natural areas, while in ESPON countries urbanisation has decreased the share of agricultural land.

The following table presents changes in the urban fabric of the regions of Euregio Karelia, Finland and ESPON countries between 2000 and 2006. [29] As for the following two maps, they illustrate urbanisation of agricultural, and natural and semi-natural areas in the Northern Finland – Russia CBA between 2000 and 2006.

Table 21. Urban fabric (categories 111 and 112 of the Corine Land Cover) in the Northern Finland – Russia CBA.

		Urban fabric (ha) (2000–2006)							
NUTS	NUTS ID	Formation of new land cover	Consumption of land cover	Net formation of land cover	Net formation of land cover by total area (per 10000)	Urbanisation of agricultural areas (2000–2006)	Urbanisation of agricultural areas by total area (per 10000)	Urbanisation of natural and semi-natural areas	Urbanisation of natural and semi-natural areas by total area (per 10000)
ESPON space	EU27 + CH + NO	191290,05	1447,96	189842,09	3,97	127745,51	2,67	16003,73	0,34
Finland	FI	3417,26	27,08	3390,18	1,01	803,13	0,24	2528,67	0,75
Russia	RU	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
North Karelia (Pohjois-Karjala)	FI133	205,68	0,00	205,68	0,95	25,72	0,12	179,96	0,83
Kainuu	FI134	11,30	0,00	11,30	0,05	1,35	0,01	9,95	0,04
Northern Ostrobothnia	FI1A2	565,59	0,00	565,59	1,52	132,85	0,36	406,55	1,10

[29] Urban fabric belongs to the 1st CLC category of artificial surfaces. Two subcategories of urban fabric have been included in the table. These are 1.1.1 that corresponds to continuous urban fabric and 1.1.2 that corresponds to discontinuous urban fabric.

(Pohjois-Pohjanmaa)									
The Republic of Karelia (Respublika Kareliâ)	RUD3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Source: EEA Corine Land Cover

Methodology: Intersection of CLC land cover changes with level 3 and NUTS 2006 (levels 1,2,3) and aggregation at CLC2000-2006 level 2.

Figure 28. Urbanisation of agricultural areas in Northern Finland – Russia CBA between 2000 and 2006.

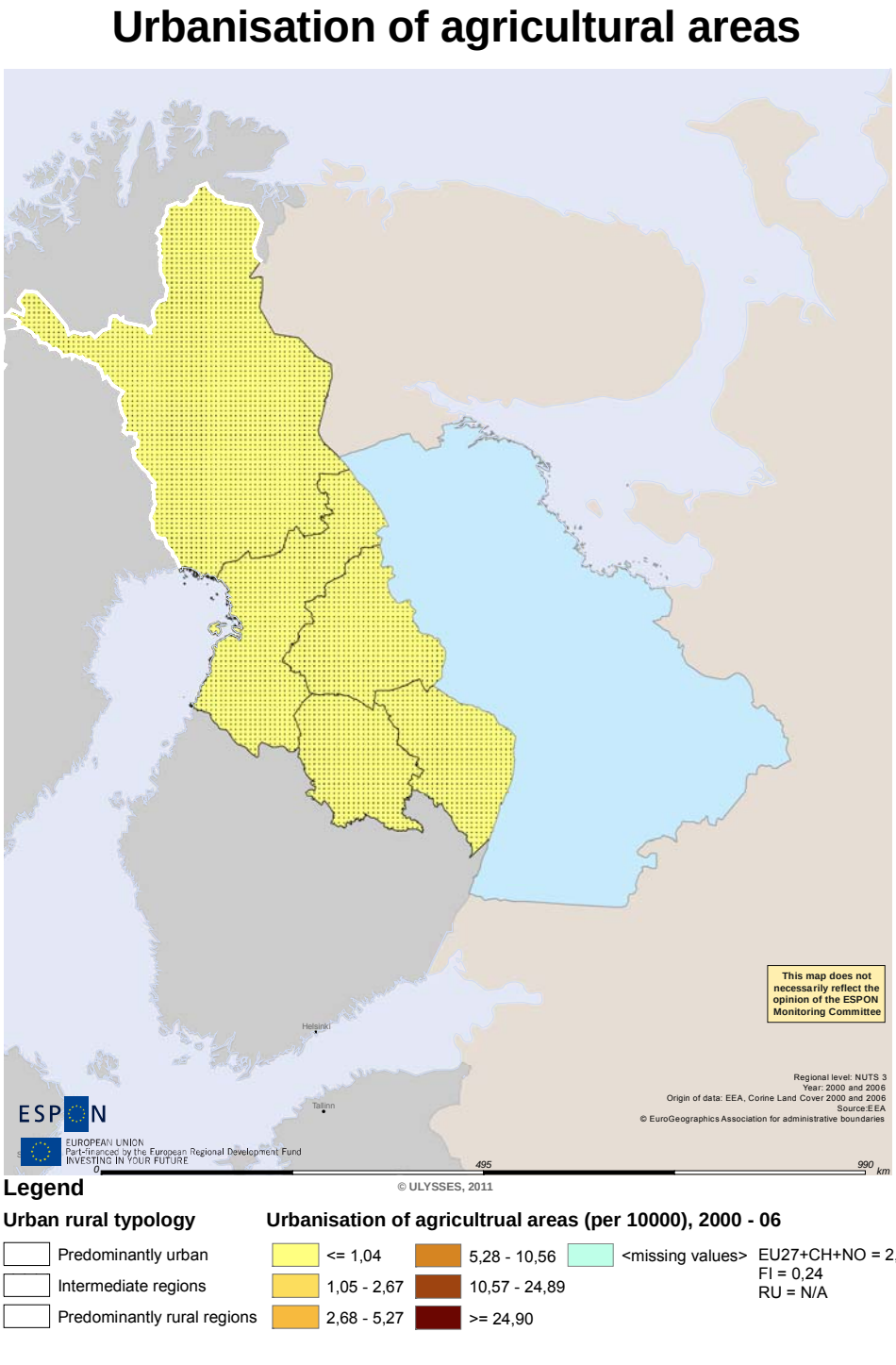
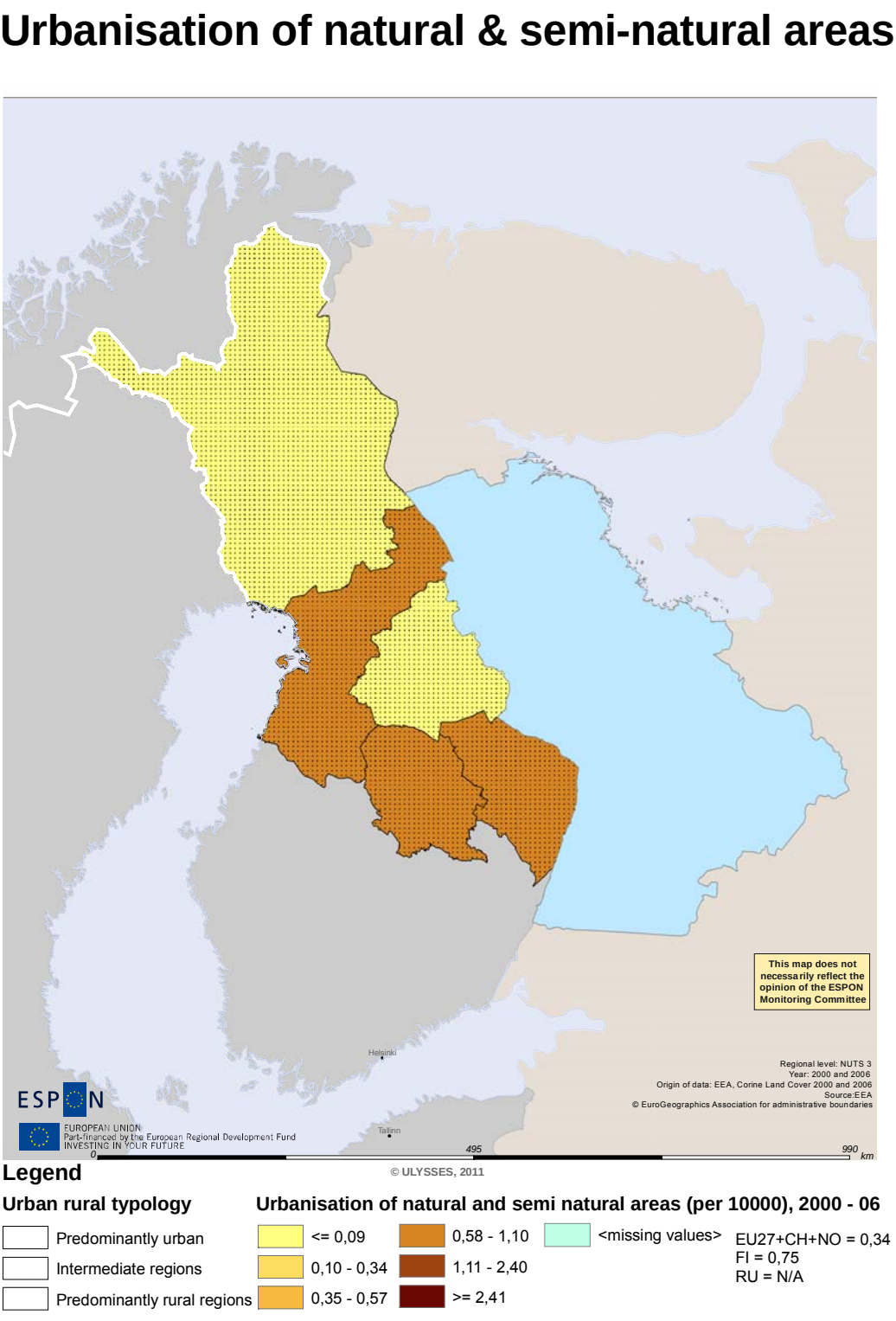


Figure 29. Urbanisation of natural and semi-natural areas in the Northern Finland – Russia CBA between 2000 and 2006.



Artificial areas include in the CLC classification (1.1) urban fabric, (1.2) industrial, commercial and transport units, (1.3) mine, dump and constructions sites and (1.4) artificial non-agricultural vegetated areas (green urban areas and sports and leisure facilities). Between 2000 and 2006 the share of artificial areas in the

ESPON countries was 10,63 ha per 10000 ha of land. In the Finland the share of artificial areas was significantly lower (3,23) and in the regions of Euregio Karelia even lower than the Finnish average. The largest share of artificial areas was in Northern Ostrobothnia (2,67) and the smallest in Kainuu (0,26). Compared to the ESPON average the changes in artificial land cover in the regions of Euregio Karelia have been moderate. Between 2000 and 2006 in ESPON countries in average 9,25 ha per 1000 ha of agricultural land, and 2,49 ha per 10000 ha of natural and semi-natural land was converted into artificial land. In Northern Ostrobothnia, where the biggest changes took place in the regions of Euregio Karelia, only 0,36 ha per 10000 ha of agricultural and 2,34 ha of natural and seminatural areas were converted into artificial areas.

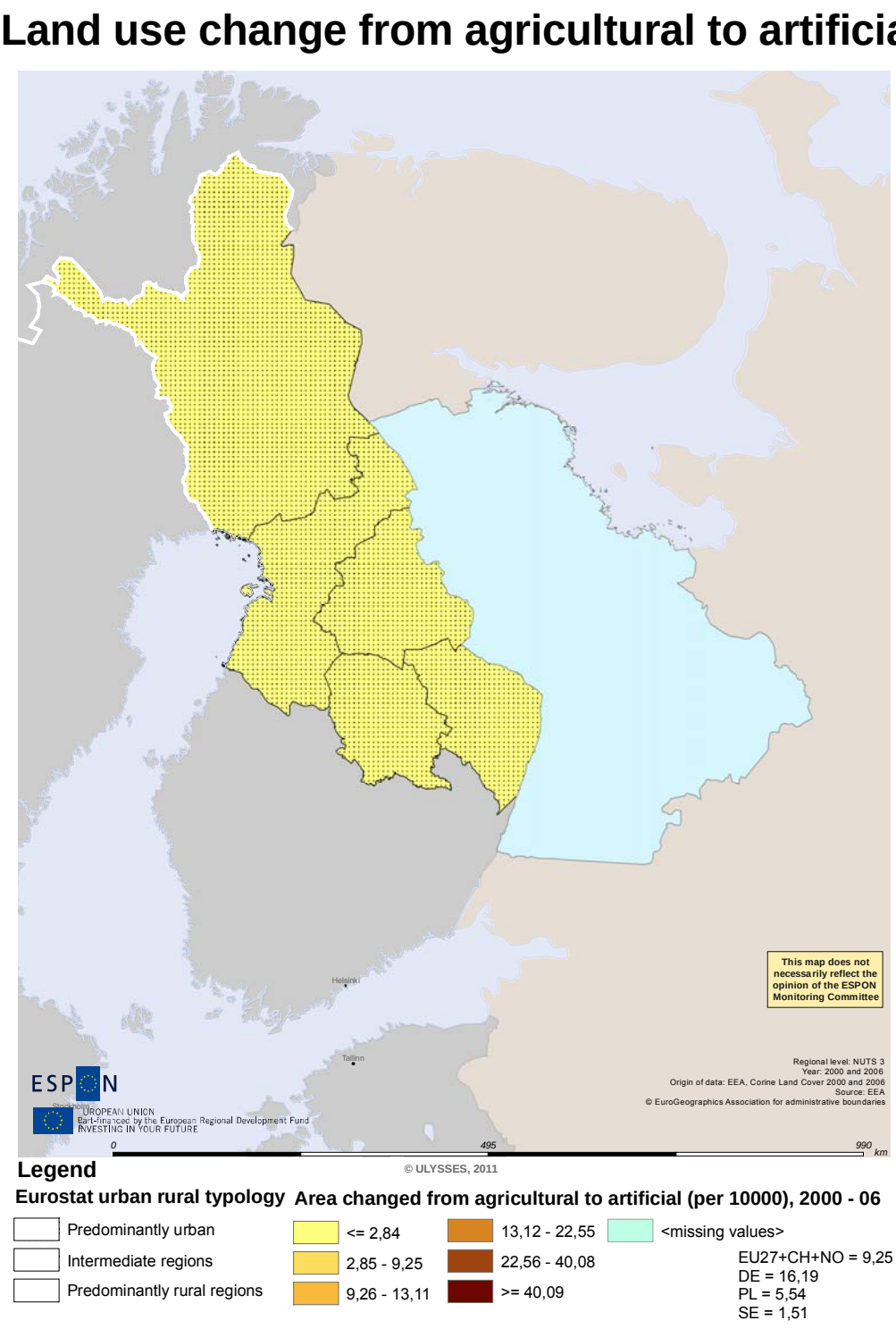
Table 22. Artificial surfaces (category 1 of the Corine Land Cover) in the Northern Finland – Russia CBA.

		Artificial Surfaces (ha) (2000–2006)							
NUTS	NUTS ID	Formation of new land cover	Consumption of land cover	Net formation of land cover	Share of net formation of land cover (per 10000)	Agricultural to artificial areas (2000–2006)	Agricultural to artificial areas by total area (per 10000)	Natural and semi-natural to artificial areas	Natural and semi-natural to artificial areas by total area (per 10000)
ESPON space	EU27 + CH + NO	667087,81	159607,44	507480,37	10,63	441994,68	9,25	118710,43	2,49
Finland	FI	12211,36	1325,65	10885,71	3,23	2069,14	0,61	8843,11	2,62
Russia	RU	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
North Karelia (Pohjois-Karjala)	FI133	422,68	38,98	383,70	1,78	25,72	0,12	357,99	1,66
Kainuu	FI134	85,61	21,28	64,33	0,26	1,35	0,01	62,98	0,26
Northern Ostrobothnia (Pohjois-Pohjanmaa)	FI1A2	1054,33	62,13	992,19	2,67	132,85	0,36	869,62	2,34
The Republic of Karelia (Respublika Kareliâ)	RUD3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Source: EEA Corine Land Cover

Methodology: Intersection of CLC land cover changes with level 3 and NUTS 2006 (levels 1,2,3) and aggregation at CLC2000-2006 level 2.

Figure 30. Land use change from agricultural to artificial areas in the Northern Finland – Russia CBA between 2000 and 2006.



4.2. Gross value added and employment in agriculture and fishing

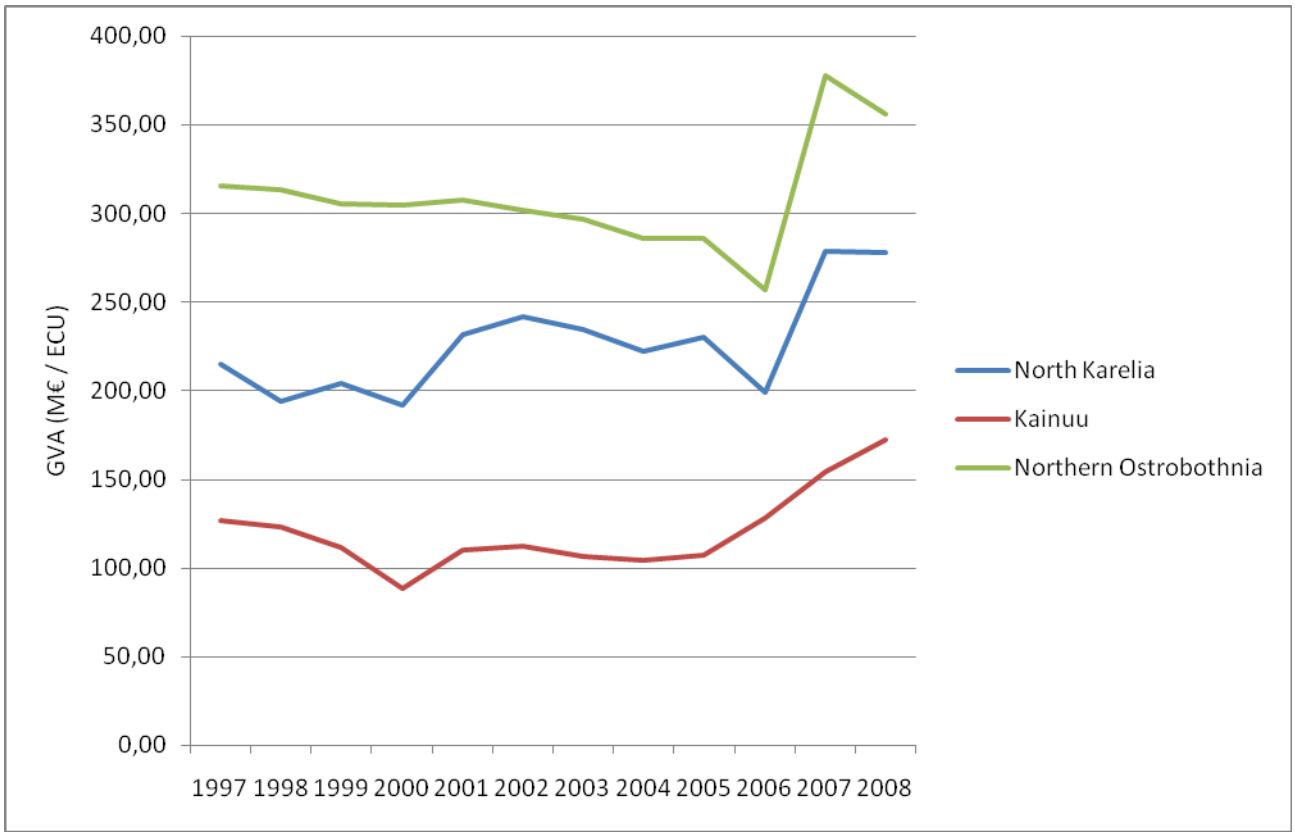
Gross Value Added (GVA) is a measure in economics of the value of goods and services produced in an area. The value of goods and services consumed as intermediate consumption is reduced from CVA. Table 23 presents GVA produced by agriculture, hunting, forestry and fishing (NACE classes A-B, hereafter referred to as agriculture and fishing) in the regions of Euregio Karelia, Finland and European Union (EU27) between 1997 and 2008. There has been a common trend in all the studied regions of a slight decrease in GVA in the first half of the 2010 decade, and a slight recovery of GVA during two last years of the studied period.

Table 23. Gross value added by agriculture and fishing in the Northern Finland – Russia CBA between 1997 and 2008.

		GVA by agriculture and fishing (millions of euro/ECU)								
NUTS	NUTS ID	1997	1998	1999	2000	2001	2002	2003	2004	20
EU27	EU27	196578,60	194025,70	190538,70	195587,10	205609,80	198864,60	194881,10	204970,50	18
Finland	FI	3857,20	3483,50	3675,00	4027,00	3980,00	3988,00	3869,00	3806,00	37
Russia	RU	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/
North Karelia (Pohjois-Karjala)	FI133	214,90	194,30	204,50	192,00	232,10	241,80	234,70	222,10	23
Kainuu	FI134	126,30	123,20	111,10	88,20	110,00	112,40	106,30	104,40	10
Northern Ostrobothnia (Pohjois-Pohjanmaa)	FI1A2	315,40	313,20	305,80	305,00	307,60	301,70	296,90	285,70	28
The Republic of Karelia (Respublika Kareliâ)	RUD3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/

Source: Eurostat

Figure 31. Gross value added by agriculture and fishing in the Finnish regions of Euregio Karelia between 1997 and 2008.



The share of GVA by agriculture and fishing in total GVA has, however, decreased in all the regions between 1997 and 2008. Table 24 well demonstrates the fact that even if there has been an increase in the GVA by agriculture and fishing, the share of those fields of economy in the total GVA has decreased between 1997 and 2008 in all the regions of Euregio Karelia, and in Finland and the European Union. In Euregio Karelia the decrease has been strongest in Northern Ostrobothnia, where the share of agriculture and fishing in total GVA has dropped at an annual rate of -4,09 %.

Table 24. GVA by agriculture and fishing, and share of GVA by agriculture and fishing in total GVA in the Northern Finland – Russia CBA.

		GVA by agriculture and fishing (millions of euro/ECU)		GVA by agriculture and fishing, share of total GVA (%)		Annual growth rate GVA by agriculture and fishing 1997-2008	Annual growth rate of share of GVA by agriculture and fishing 1997-2008
NUTS	NUTS ID	1997	2008	1997	2008		
EU27	EU27	196578,6	171307,5	2,82	1,75	1,26	-4,23
Finland	FI	3857,2	4641	4,12	2,87	1,70	-3,22
Russia	RU	N/A	N/A	N/A	N/A	N/A	N/A

North Karelia (Pohjois-Karjala)	FI133	214,9	278,3	9,41	7,64	2,38	-1,87
Kainuu	FI134	126,3	172,2	10,08	9,57	2,86	-0,48
Northern Ostrobothnia (Pohjois-Pohjanmaa)	FI1A2	315,4	356,3	5,35	3,38	1,11	-4,09
The Republic of Karelia (Respublika Kareliâ)	RUD3	N/A	N/A	N/A	N/A	N/A	N/A

Source: Eurostat

Figure 32. Share of GVA by agriculture and fishing in total GVA in the Northern Finland – Russia CBA (2008).

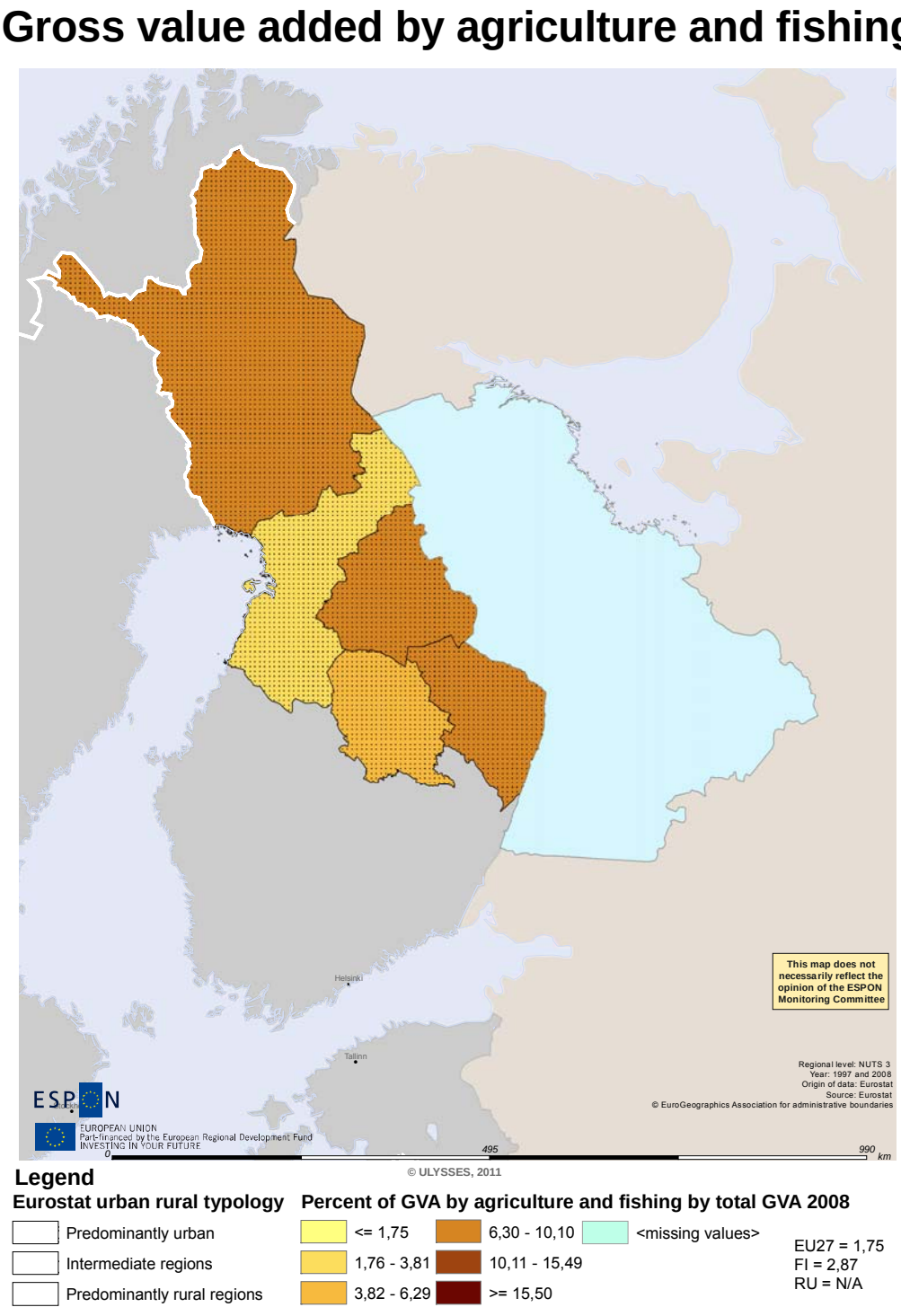
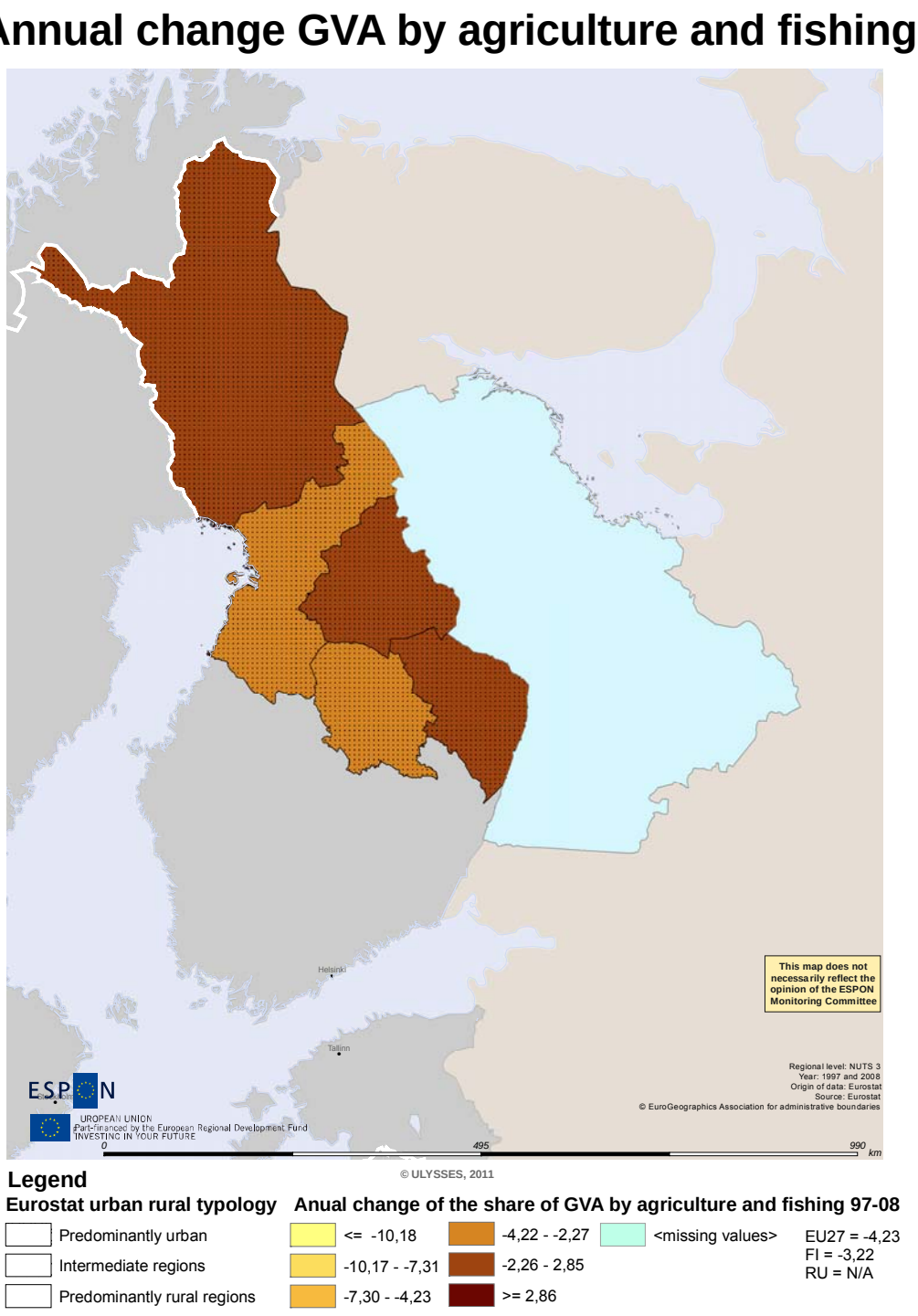


Figure 33. Annual growth rate of the share of GVA by agriculture and fishing in total GVA in the Northern Finland – Russia CBA between 1997 and 2008.



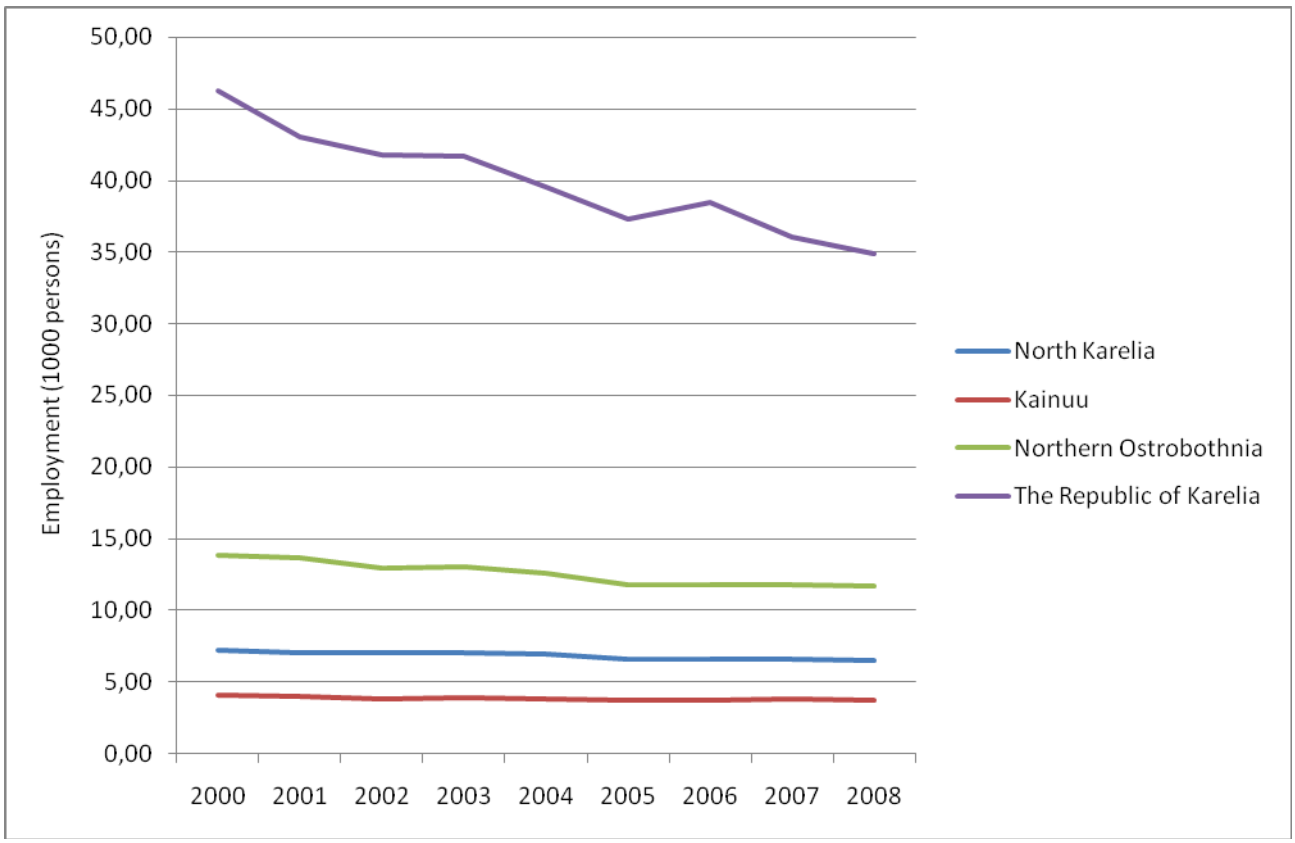
Employment statistics for agriculture and fishing show a gradual decrease in the European Union, Finland and Russia between 2000 and 2008. The trend has prevailed also in all the regions of Euregio Karelia. Table 25 presents employment statistics for the given period, and figure 34 temporal evolution of employment in agriculture and fishing in the regions of Euregio Karelia between 2000 and 2008.

Table 25. Employment in agriculture and fishing in the Northern Finland – Russia CBA between 2000 and 2008.

		Employment in agriculture and fishing (thousands of persons)								
NUTS	NUTS ID	2000	2001	2002	2003	2004	2005	2006	2007	2008
EU27*	EU27	17112,90	15846,30	14540,40	14368,70	13880,20	13686,60	13111,90	12875,70	11706,90
Finland	FI	136,90	131,50	125,90	124,90	123,40	123,20	122,80	123,00	121,90
Russia	RU	9134,43	8642,49	8349,19	7911,90	7542,85	7519,50	7287,73	7070,12	6816,66
North Karelia (Pohjois-Karjala)	FI133	7,20	7,00	7,00	7,00	6,90	6,60	6,60	6,60	6,50
Kainuu	FI134	4,10	4,00	3,80	3,90	3,80	3,70	3,70	3,80	3,70
Nothern Ostrobothnia (Pohjois-Pohjanmaa)	FI1A2	13,80	13,60	12,90	13,00	12,60	11,80	11,80	11,80	11,70
The Republic of Karelia (Respublika Kareliâ)	RU3D	46,22	42,99	41,79	41,67	39,51	37,27	38,42	36,00	34,88

*NL not included in 2000; UK not included in 2000 and 2001
Source: Eurostat and Russian Federal State Statistics Service

Figure 34. Employment in agriculture and fishing in the regions of Euregio Karelia between 2000 and 2008.



Decrease in employment in agriculture and fishing has naturally reduced the share of employment in general employment statistics. The share of employment in agriculture and fishing has thus dropped in all the studied regions. In Euregio Karelia the greatest decrease has taken place in the Republic of Karelia, where the share of employment in agriculture and fishing has decreased at an annual rate of -3,71 %. Kainuu on the other hand has shown smallest changes in the employment in agriculture and fishing; while the share of employment in the field was 11,99 in 2000, it was 10,34 in 2008. When we compare the regions of Euregio Karelia to the Finland, Russia and European Union, it is possible to observe that both the Finnish regions and the Republic of Karelia show larger shares of employment in agriculture and fishing than national or European averages.

Table 26. Employment in agriculture and fishing, and share of employment in agriculture and fishing in total employment in the Northern Finland – Russia CBA.

		Employment in agriculture and fishing (thousands of persons)		Share of employment in agriculture and fishing by total employed (%)		Annual growth rate of employment in agriculture and fishing 2000-2008	Annual growth rate of share of employment in agriculture and fishing 2000-2008
NUTS	NUTS ID	2000	2008	2000	2008		
EU27*	EU27	17701,10	11706,90	8,41	5,87	-5,04	-4,39
Finland	FI	136,9	121,9	5,97	4,83	-1,44	-2,62
Russia	RU	9134,43	6816,66	14,16	9,96	-3,59	-4,31
North Karelia (Pohjois-Karjala)	FI133	7,2	6,5	11,32	9,72	-1,27	-1,89
Kainuu	FI134	4,1	3,7	11,99	10,34	-1,27	-1,84
Northern Ostrobothnia (Pohjois-Pohjanmaa)	FI1A2	13,8	11,7	9,33	7,12	-2,04	-3,32
The Republic of Karelia (Respublika Kareliâ)	RU3D	46,216	34,876	13,47	9,95	-3,46	-3,71

*For NL and UK no data was available for 2000 and therefore data from 2001 (NL) and 2002 (UK) was used.
Source: Eurostat and Russian Federal State Statistics Service

Figure 35. Share of employment in agriculture and fishing in total employment in the Northern Finland – Russia CBA (2008).

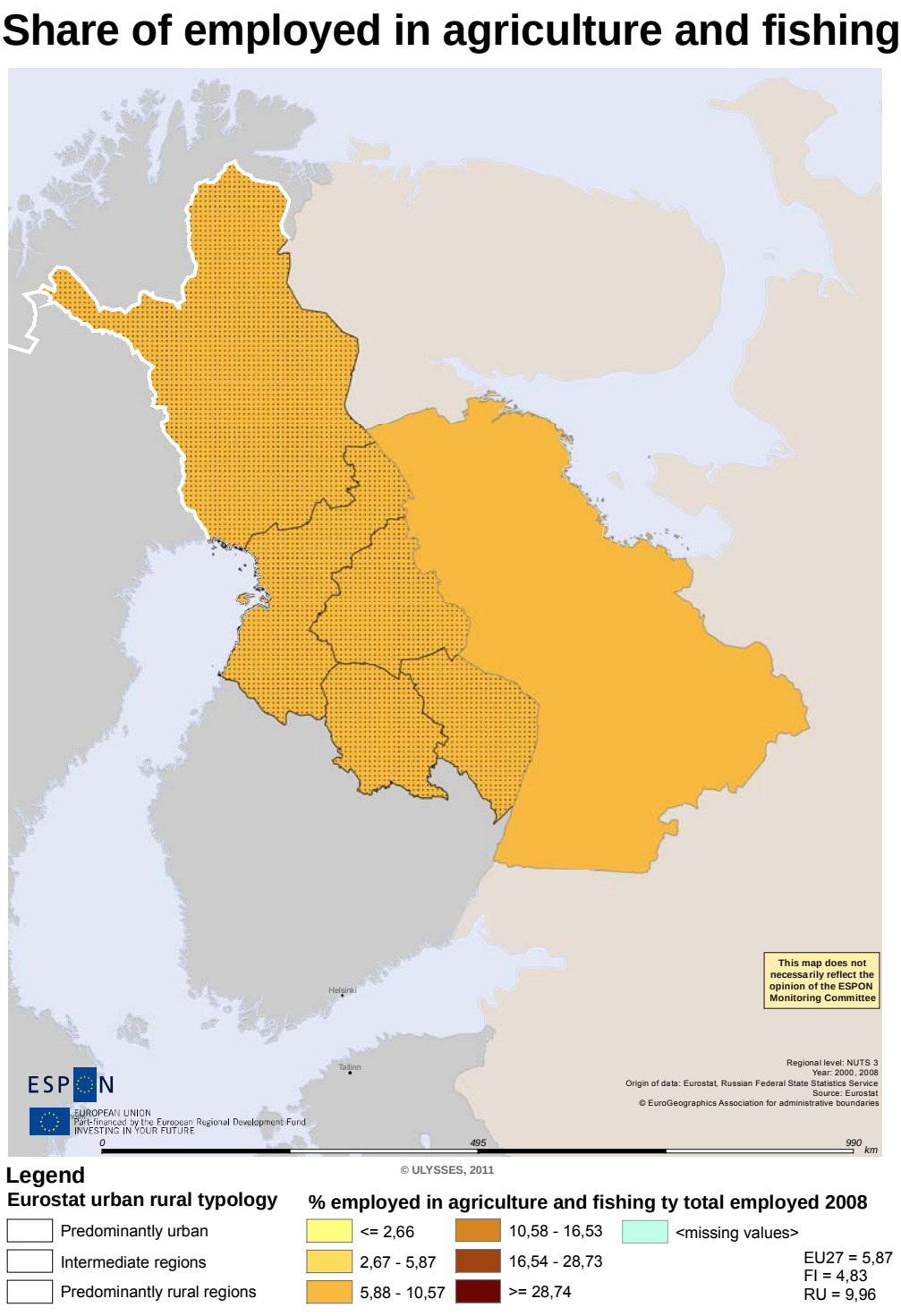
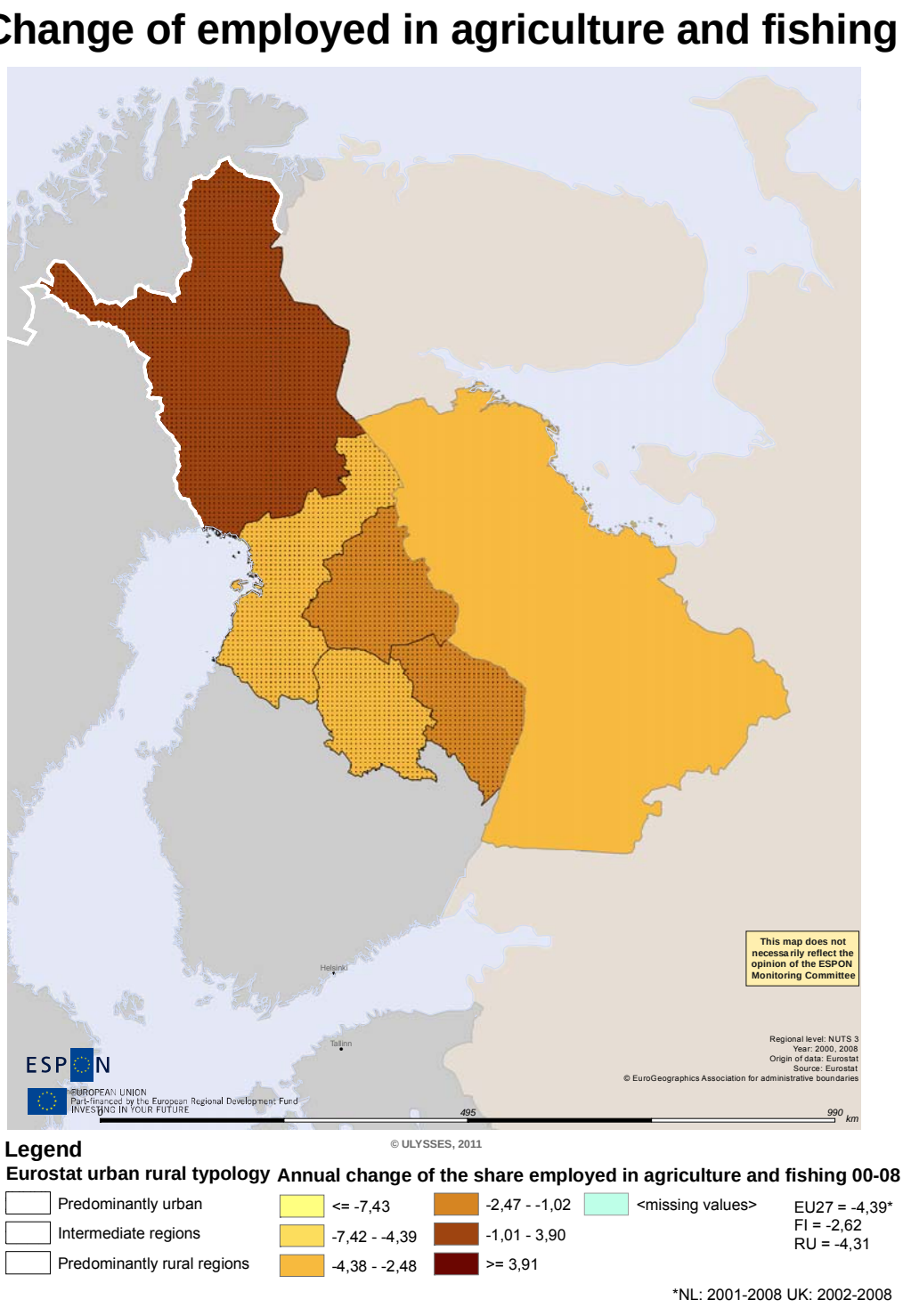


Figure 36. Annual growth rate of the share of employment in agriculture and fishing in the Northern Finland – Russia CBA between 2000 and 2008.



4.3. Chapter conclusions

In the analyses above we classified the regions of Northern Finland – Russia CBA according to ESPON 1.1.2 and Eurostat typologies. ESPON 1.1.2 typology considers all the regions of the CBA as regions with low

urban influence and low human intervention. The Eurostat typology also considers the regions of the CBA as predominantly rural regions.

Even if the regions of Euregio Karelia appear rural from the European perspective, the share of agricultural areas in the region's total area is significantly lower than European average (ESPON countries). Share of agricultural areas in the ESPON countries was 38,65 % in 2006, while the largest share of agricultural areas in the CBA was 7,91 % in Northern Ostrobothnia. Urbanisation of agricultural areas in the regions of Euregio Karelia has been below the European average (ESPON countries). Urbanisation of natural and semi-natural areas in Northern Ostrobothnia and North Karelia, on the contrary, has been stronger than in ESPON countries in average.

The share of GVA by agriculture and fishing in total GVA has decreased in all the regions between 1997 and 2008. Even if there has been an increase in the GVA by agriculture and fishing, the share of those fields of economy in the total GVA has decreased between 1997 and 2008 in all the regions of Euregio Karelia, and in Finland and the European Union. In Euregio Karelia the decrease has been strongest in Northern Ostrobothnia, where the share of agriculture and fishing in total GVA has dropped at an annual rate of -4,09 %.

Chapter 5. Accessibility and connectivity in the Northern Finland – Russia CBA

Accessibility of a region is determined by two factors, its geographical location and infrastructure. While the geographical location cannot be changed, improving connectivity can. European Spatial Development Perspective (ESDP) states that good accessibility of European regions improves not only their competitive position but also the competitiveness of Europe as a whole. Accessibility is accordingly a key policy aim of the European Union, since accessibility of a region determines the extent to which it can participate in economic growth. According to ESDP accessibility in certain parts of Europe is poor, which can make these areas less attractive for many types of investment. Islands and border regions often belong to this type of territories and they have to find specific solutions in order to succeed.[30]

Territorial Agenda 2020, on the other hand, states that fair and affordable accessibility to services of general interest, information, knowledge and mobility are essential for territorial cohesion. Providing services and minimising infrastructure barriers can improve sustainable and harmonious territorial development of the European Union. According to the agenda it is of major importance to secure access to road, rail, water-based and air transport, and to other infrastructure facilities such as broadband and Trans-European energy networks.[31]

The aim of this chapter is to evaluate accessibility and connectivity levels of the Northern Finland – Russia CBA. What is the accessibility level of the CBA in comparison with European countries? What is the general accessibility of the CBA regarding different modes of transport? What is the level of broadband internet access in the Northern Finland – Russia CBA?

[30] ESDP 1999; SURE 2009.
[31] Territorial Agenda 2011.

Data for the accessibility analyses comes from ESPON database. Most of the data for accessibility available at the ESPON database is outdated and available mostly for the 1999 NUTS version. The use of NUTS 1999 delimitations is specially limiting since changes in the coding systems and actual boundaries of the regions have occurred in almost all of the countries in Europe. Nonetheless, the potential accessibility by different modes of transportation has in 2006 been updated and re-calculated for fitting the then ruling NUTS 3 delimitation retroactively for 2001, and it is therefore available for two different comparable years. For us this was particularly useful as this indicator does not limit itself to measuring the transport network, but synthesizes overall accessibility of the regions by relating the travel time (impedance function) with the population that can be reached (activity function).

As for connectivity data, the ESPON database has only very few indicators, which are on NUTS 2 level and only for year 2003. Given the advancements in this area, data from the 5th Cohesion Report and from the European Innovation Scoreboard has been used regarding households' broadband internet access.

Table 27. Parameters studied for the accessibility and connectivity in the Northern Finland – Russia CBA.

Variable name	Geographical scale	Source	Time frame	Observations
Potential accessibility road, rail, air and multimodal indexed to ESPON average	NUTS 3	ESPON DB	2001;2006	
Potential accessibility road, rail, air and multimodal indexed to CBR average	NUTS 3	ESPON DB	2001;2006	
Potential accessibility road, rail, air and multimodal index change 2001-2006	NUTS 3	ESPON DB	2001;2006	
Households with broadband connection, 2009	NUTS 2	European Commission 5th Cohesion Report, Regional Innovation Scoreboard	2009 (2004 NO, PL)	

We have studied the Northern Finland – Russia CBA from the perspective rail, road air and multimodal (synthesizing all the modes of transportation) accessibility. We used an indicator named potential accessibility, which is a similar indicator to demographic potential. This means that it relates activities to be reached with travel time it takes to reach them. Potential accessibility is calculated according to the following formula:

$$A_i = \sum_j W_j \exp(-\beta C_{ij})$$

where A_i is the accessibility of area i, W_j is the activity W to be reached in area j, and C_{ij} is the generalised cost of reaching area j from area i. A_i is the total of the activities reachable at j weighted by the ease of getting from i to j. The interpretation is that the greater the number of attractive destinations in areas j is and the more accessible areas j are from area i, the greater is the accessibility of area i.

The method we applied here originates from ESPON 1.2.1 project. The project stated that the concept of potential accessibility is based on the assumption that the attraction of a destination increases with size,

and declines with distance, travel time or cost. Destination size is usually represented by population or economic indicators such as GDP or income. The potential accessibility model uses centroids of NUTS 3 regions as origins and destinations. The accessibility model calculates minimum travel times between the centroids of the NUTS 3 regions. For each NUTS 3 region the value of the potential accessibility indicator is calculated by summing up the population in all other regions including those outside ESPON space weighted by the travel time to get there. [32]

We have summarized results of the potential accessibility analyses in the following table. It represents how accessible regions of Euregio Karelia are, first, in the context of ESPON countries and, second, in the context of the cross-border region (CBR). Analyses were not performed for the Republic of Karelia due to the lack of data. We will interpret the results separately for each transport mode in the following subchapters.

Table 28. Potential accessibility of the regions of Euregio Karelia in the context of ESPON space and the cross-border region (2006).

NUTS	NUTS ID	Rail ESPON	Road ESPON	Air ESPON	Multimodal ESPON	Rail CBR	Road CBR	Air CBR	Multimodal CBR
North Karelia (Pohjois-Karjala)	FI133	10,3	6,2	55,2	48,2	135,53	142,20	106,65	106,78
Kainuu	FI134	6,3	3,1	50,8	44,2	82,89	71,10	98,15	97,92
Northern Ostrobothnia (Pohjois-Pohjanmaa)	FI1A2	6	3,6	44,8	39,1	78,95	82,57	86,55	86,62
The Republic of Karelia (Respublika Kareliâ)	RU3D	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

As the potential accessibility was in ESPON 1.2.1 project produced for two different years, it was possible for us to study the evolution of infrastructure development between 2001 and 2006. Here, the index change of accessibility was used. For this indicator the accessibility values of 2001 were standardised to the ESPON average of that year and those of 2006 to the average of that year. Each ESPON average was set to 100 and the regional values were transformed accordingly. The maps show the differences in the index values, i.e. the change in position of the regions relative to other regions. Positive values express an improvement in relative locational quality, while negative values express a loss in relative locational quality.[33]

[32] ESPON 1.2.1.
[33] Potential Accessibility Indicators 2007.

Table 29. Standardised potential accessibility of the regions of Euregio Karelia in the context of ESPON countries and the cross-border region (2006).

		Standardised potential accessibility (ESPON = 100)				Standardised potential accessibility (CBR = 100)			
NUTS	NUTS ID	Rail	Road	Air	Multimodal	Rail	Road	Air	Multimodal
North Karelia (Pohjois-Karjala)	FI133	10,3	6,2	55,2	48,2	136,7	144,2	109,8	110,0
Kainuu	FI134	6,3	3,1	50,8	44,2	83,6	72,1	101,1	100,8
Northern Ostrobothnia (Pohjois-Pohjanmaa)	FI1A2	6	3,6	44,8	39,1	79,6	83,7	89,1	89,2
The Republic of Karelia (Respublika Kareliâ)	RU3D	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

5.1. Accessibility by road

In the context of ESPON space potential accessibility of the Finnish regions of Euregio Karelia by road is very low, between 6,2 (North Karelia) and 3,1 (Kainuu). This is understandable considering the remote location of the regions from the main European road infrastructure. In the context of the cross-border region North Karelia has the best accessibility (142,2), while Northern Ostrobothnia and Kainuu value lower in the analysis (82,57 and 71,1). The index change in the accessibility between 2001 and 2006 has been negative in all the regions, varying between -0,3 in North Karelia and -0,1 in Northern Ostrobothnia.

Figure 37. Potential accessibility of the regions of Euregio Karelia by road in the context of ESPON countries (2006).

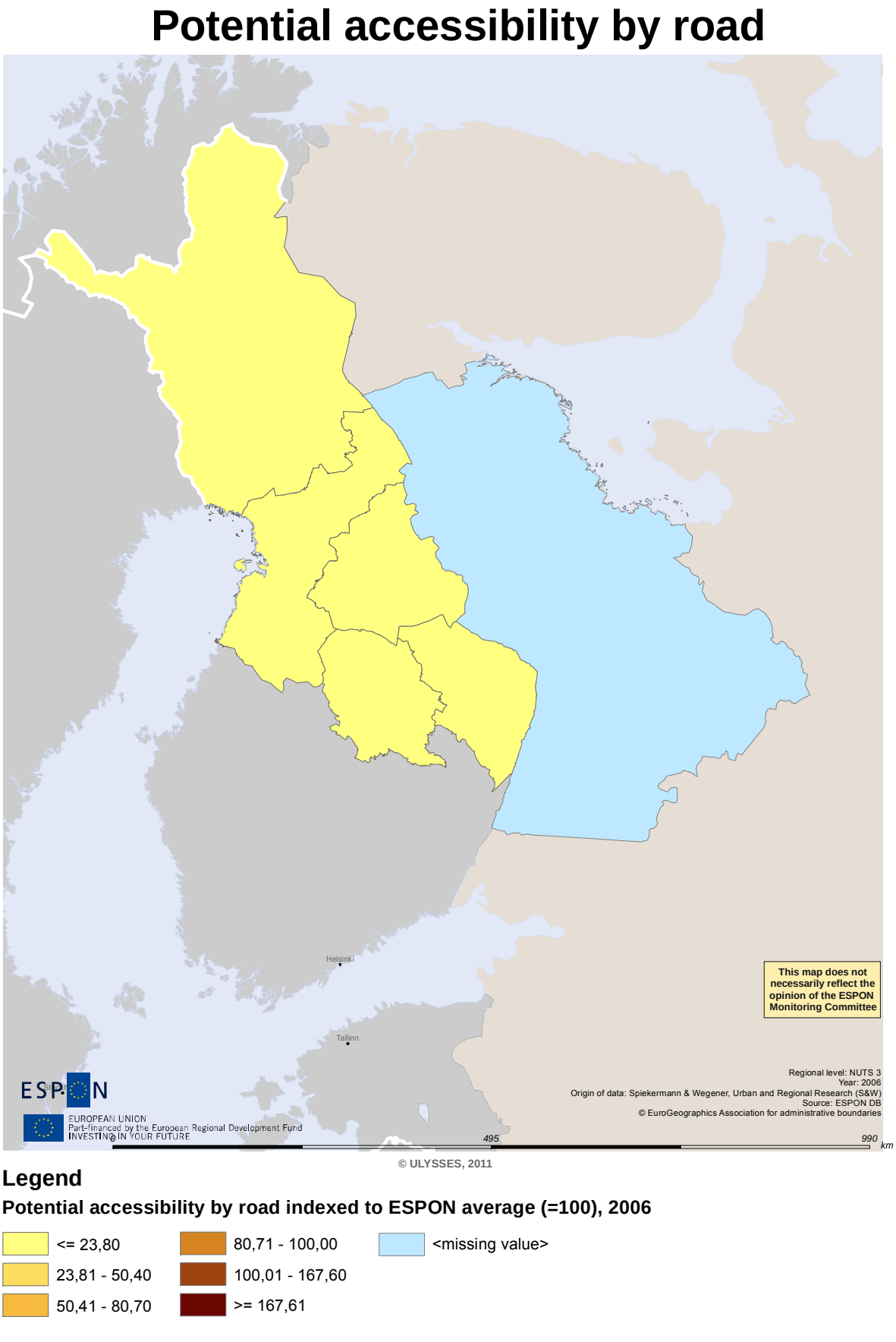


Figure 38. Potential accessibility of the regions of Euregio Karelia by road in the context of the cross-border region (2006).

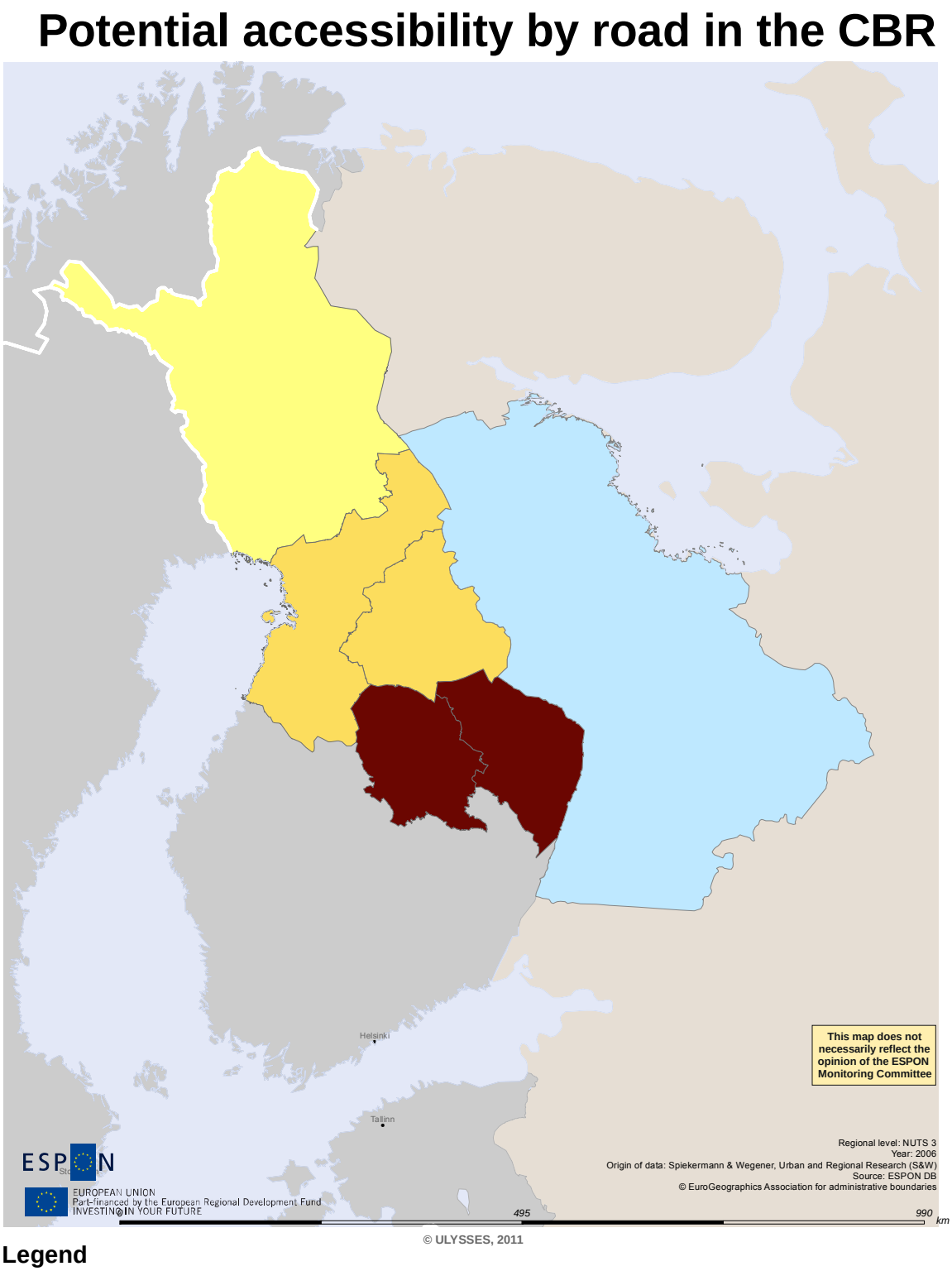
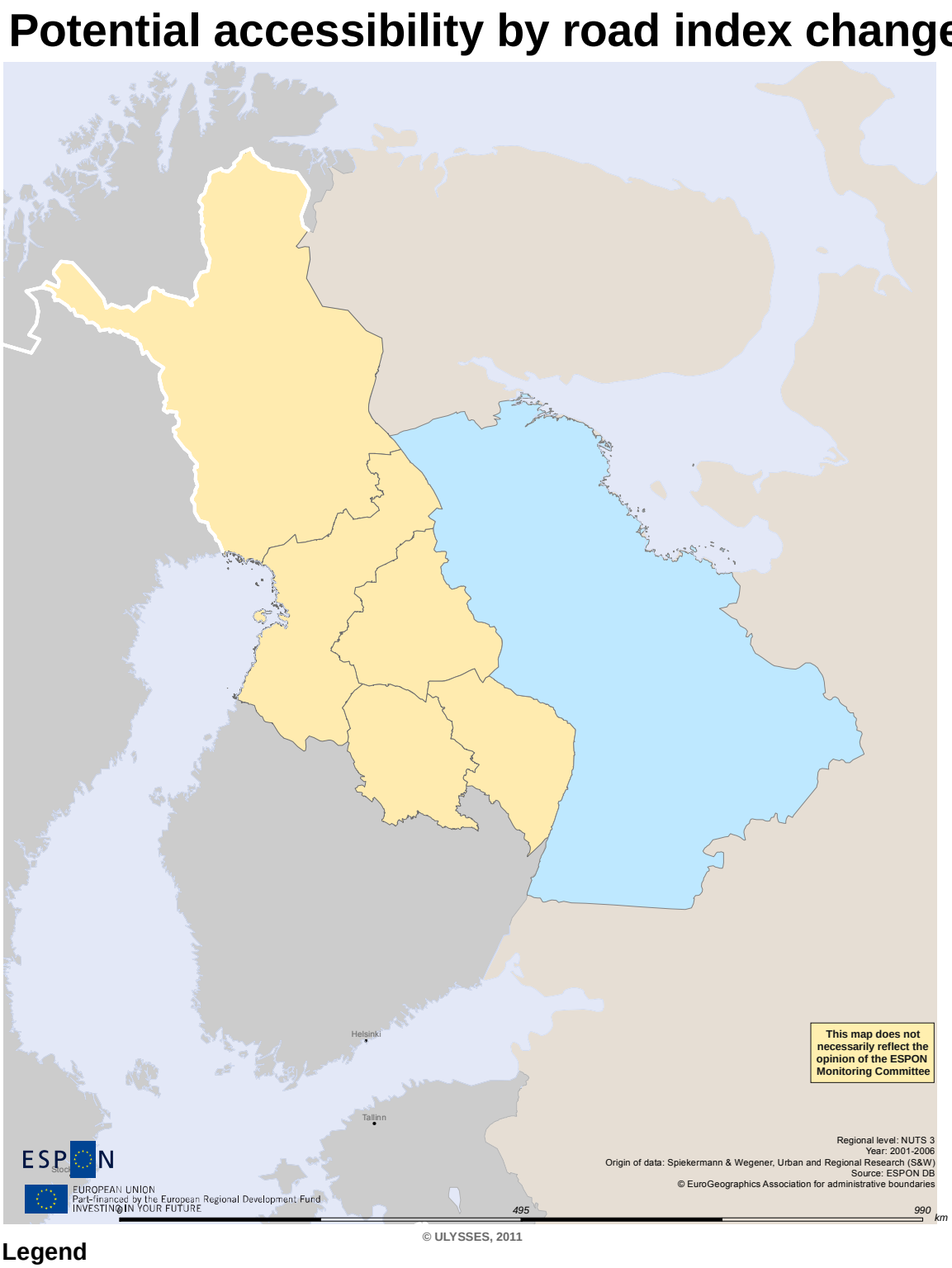


Figure 39. Index change of standardised potential accessibility by road in the regions of Euregio Karelia between 2001 and 2006.



5.2. Accessibility by rail

The regions of Euregio Karelia are not easily accessed by rail in the context of European countries (ESPON space), even if they do value slightly higher in the rail than in the road accessibility; between 10,3 (North Karelia) and 6 (Northern Ostrobothnia). Within the cross-border region North Karelia is the most accessible region by rail (135,53) and Northern Ostrobothnia the least accessible (78,95). Index change in the potential accessibility by rail has been negative in all the regions varying from -0,4 in North Karelia to -0,1 in Kainuu and Northern Ostrobothnia.

Figure 40. Potential accessibility of the regions of Euregio Karelia by rail in the context of ESPON countries (2006).

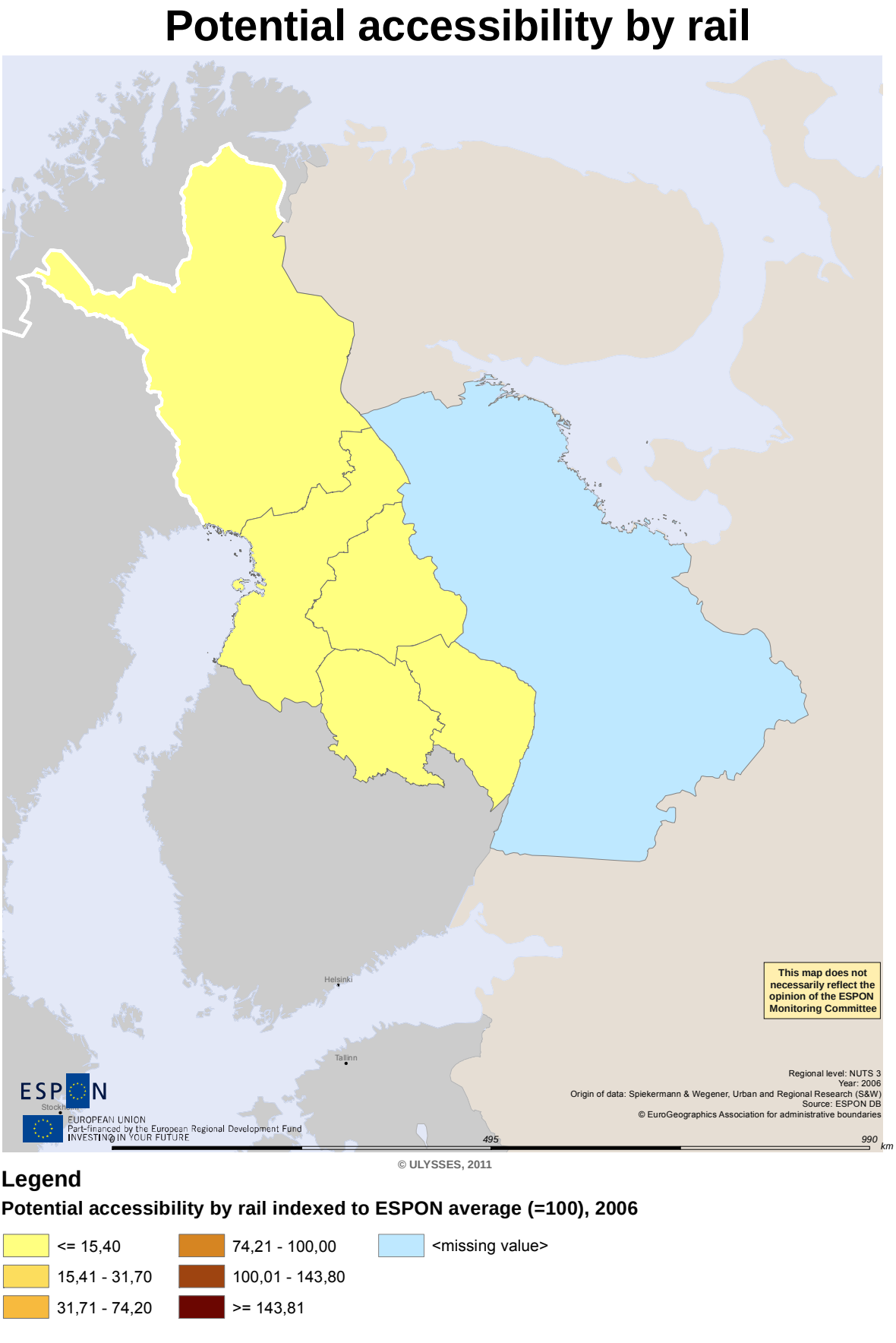


Figure 41. Potential accessibility of the regions of Euregio Karelia by rail in the context of the cross-border region (2006).

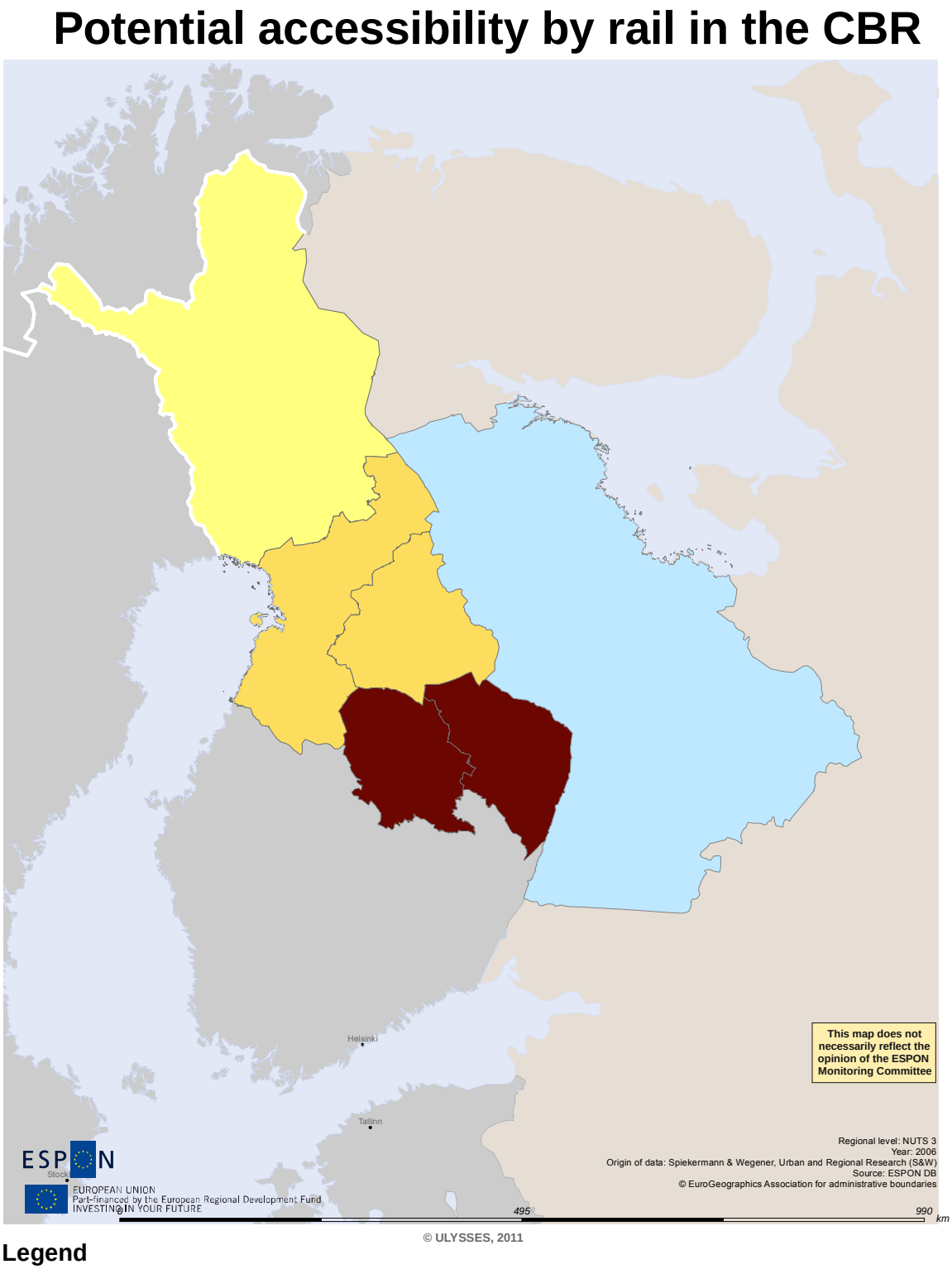
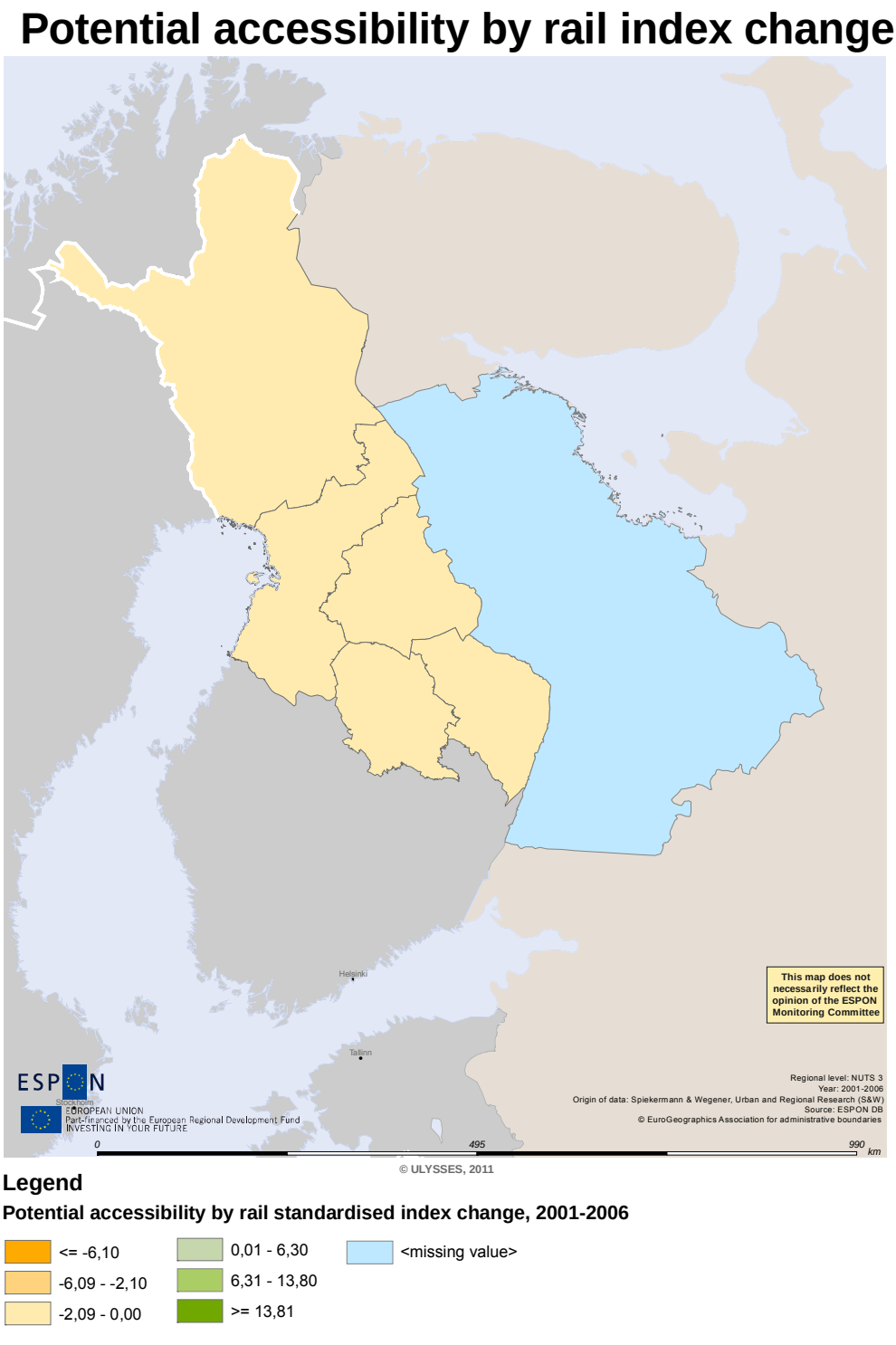


Figure 42. Index change of standardised potential accessibility by rail in the regions of Euregio Karelia between 2001 and 2006.



5.3. Accessibility by air

Air connections to Euregio Karelia seem to make the region better accessible to the European countries than road and rail infrastructure. Accessibility by air to North Karelia valued at 55,2, to Kainuu at 50,8 and to Northern Ostrobothnia at 44,8. In the context of the cross-border area the regions valued relatively similarly, North Karelia having the highest (106,65) and Northern Ostrobothnia the lowest (86,55) accessibility. Index change in the standardized potential accessibility was positive in North Karelia and Kainuu (0,3), while Northern Ostrobothnia had performed worse and valued at -2.

It is possible to argue how well these figures correspond to reality. If we look at flight traffic from and to the regions of Euregio Karelia, the busiest airport is located in Oulu, Northern Ostrobothnia. Oulu airport hosted 92 993 passengers on international and 802 791 passengers on domestic flights during year 2008, while the airport of Joensuu in North Karelia hosted only 9 439 passengers on international and 134 274 passengers on domestic flights. Kajaani airport had the least passengers, 3 379 on international and 84 622 on domestic flights.[34] Basing on these figures one would assume that Northern Ostrobothnia would rank as the most accessible region by air in Euregio Karelia.

Considering the figures on accessibility by air in the cross-border region, one should be aware of the fact that there are no direct flights between the regions of Euregio Karelia. In order, for example, to get from Joensuu to Oulu (or Kajaani), one needs to fly to Helsinki and change the flight there. Thus no real flight connections exist between the regions of Euregio Karelia.

[34] Finavia 2008.

Figure 43. Potential accessibility of the regions of Euregio Karelia by air in the context of ESPON countries (2006).

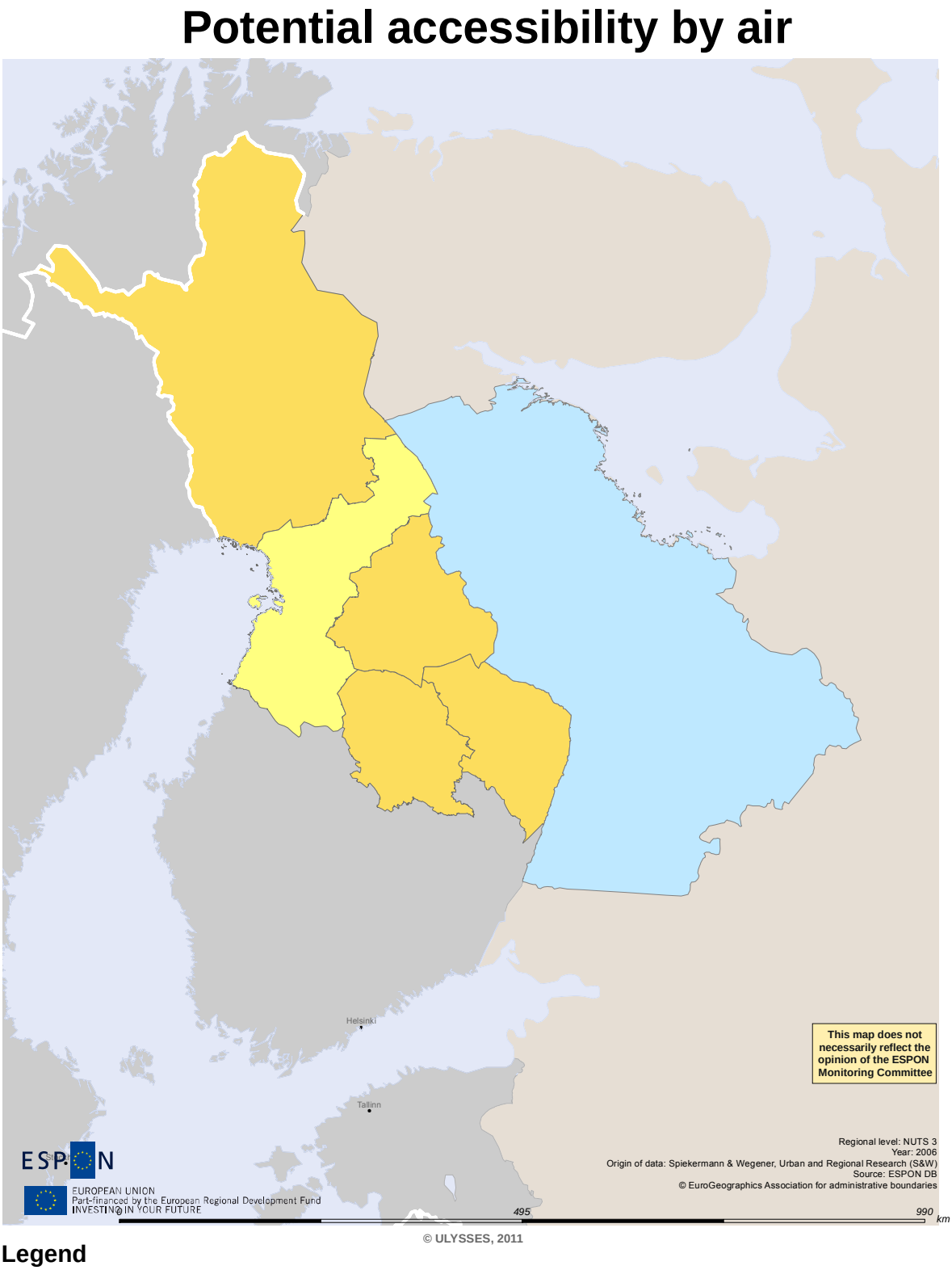


Figure 44. Potential accessibility of the regions of Euregio Karelia by air in the context of the cross-border region (2006).

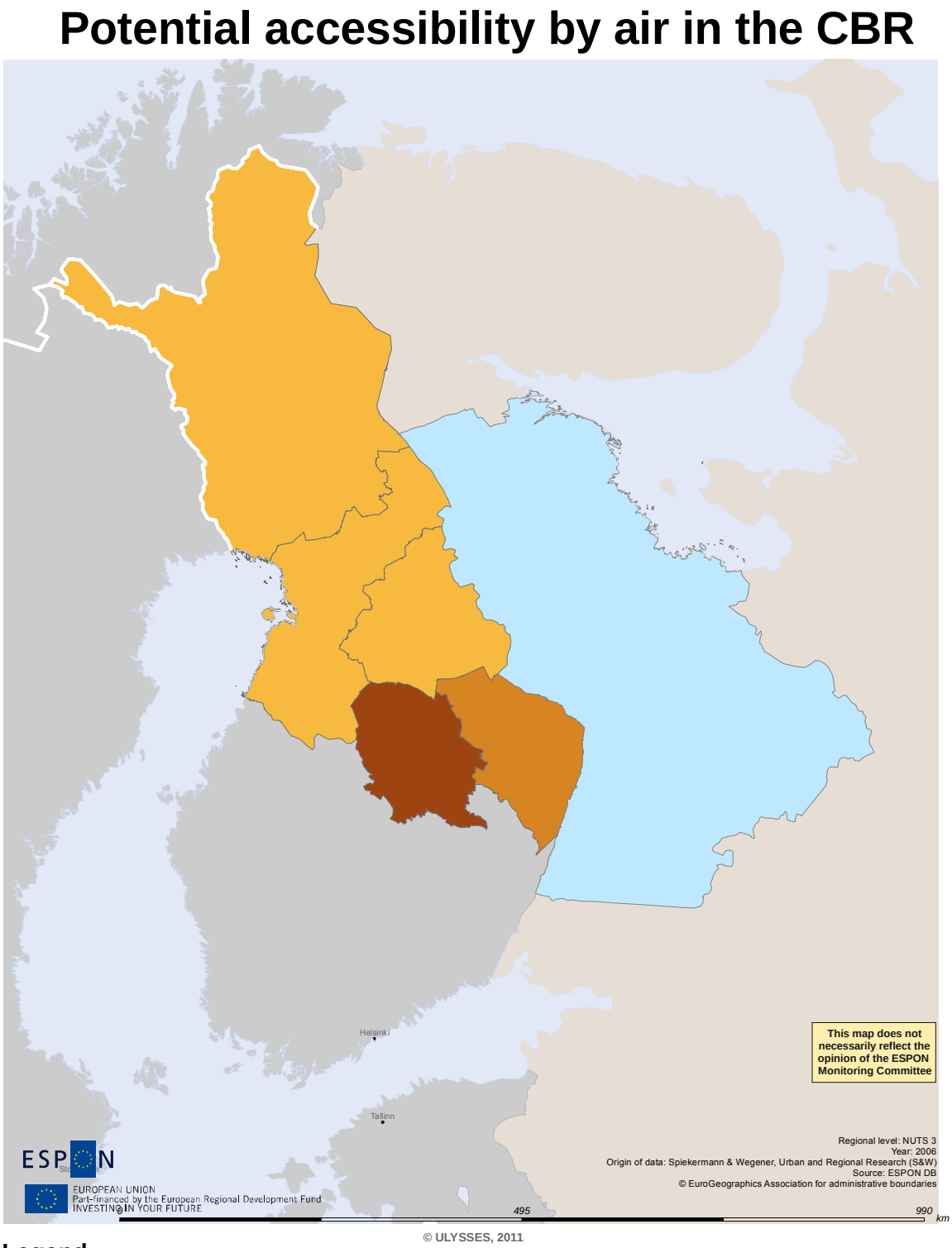
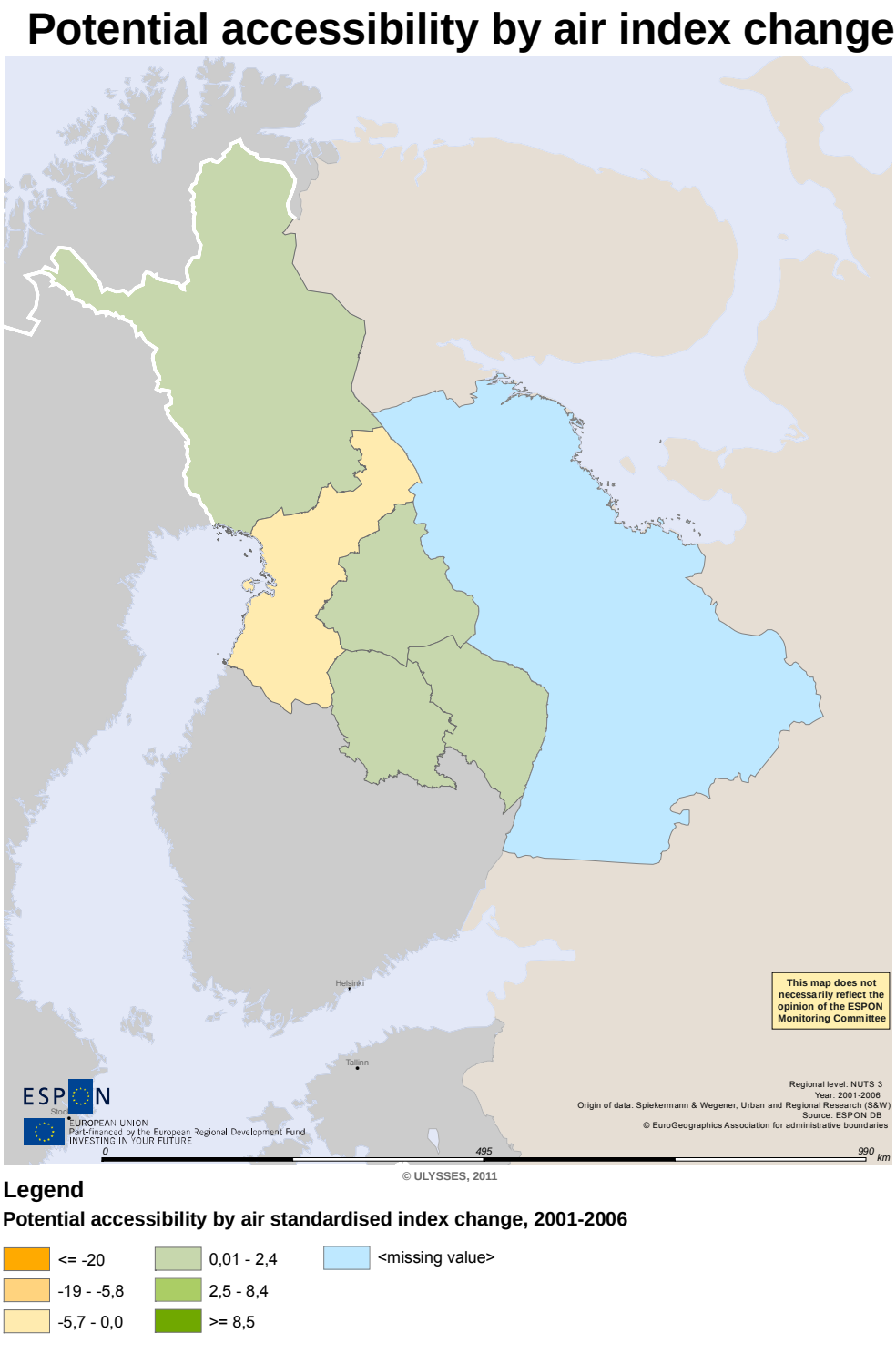


Figure 45. Index change of standardised potential accessibility by air in the regions of Euregio Karelia between 2001 and 2006.



5.4. Multimodal accessibility

Multimodal accessibility combines all the above analysed forms of transport and demonstrates general accessibility levels. Relatively good air accessibility of Euregio Karelia clearly affects the multimodal accessibility levels of the region. In the context of ESPON countries, North Karelia values at 48,2, Kainuu at 44,2 and Northern Ostrobothnia at 39,1. In the context of the cross-border region, North Karelia has the highest (106,78) and Northern Ostrobothnia the lowest (86,62) accessibility. Index change of standardised potential accessibility has in all the regions been negative. According to these analysis, greatest decrease of accessibility has taken place in Northern Ostrobothnia (-2), and the smallest in Kainuu (-2).

Figure 46. Multimodal potential accessibility of the regions of Euregio Karelia in the context of ESPON countries (2006).

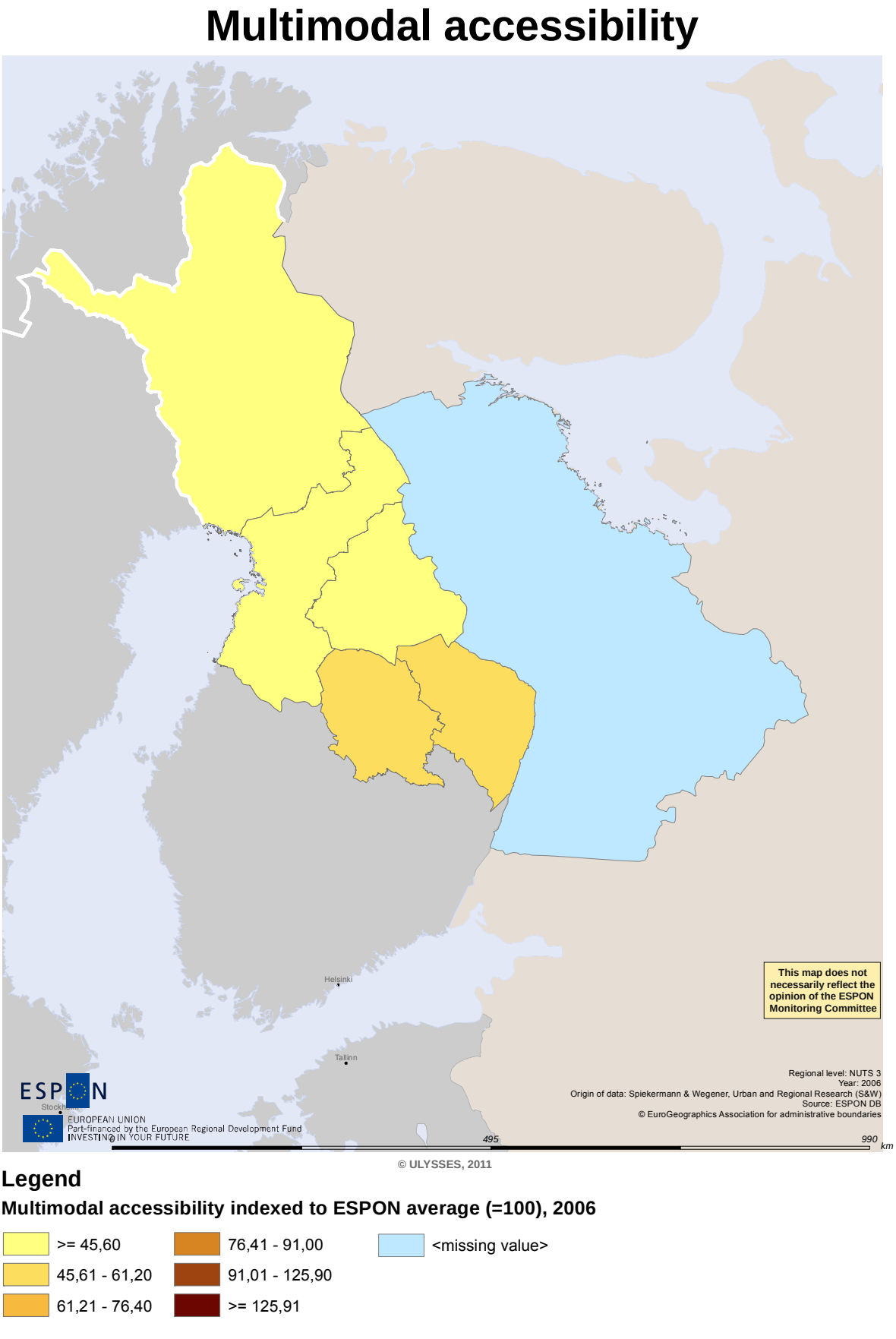


Figure 47. Multimodal potential accessibility of the regions of Euregio Karelia in the context of the cross-border region (2006).

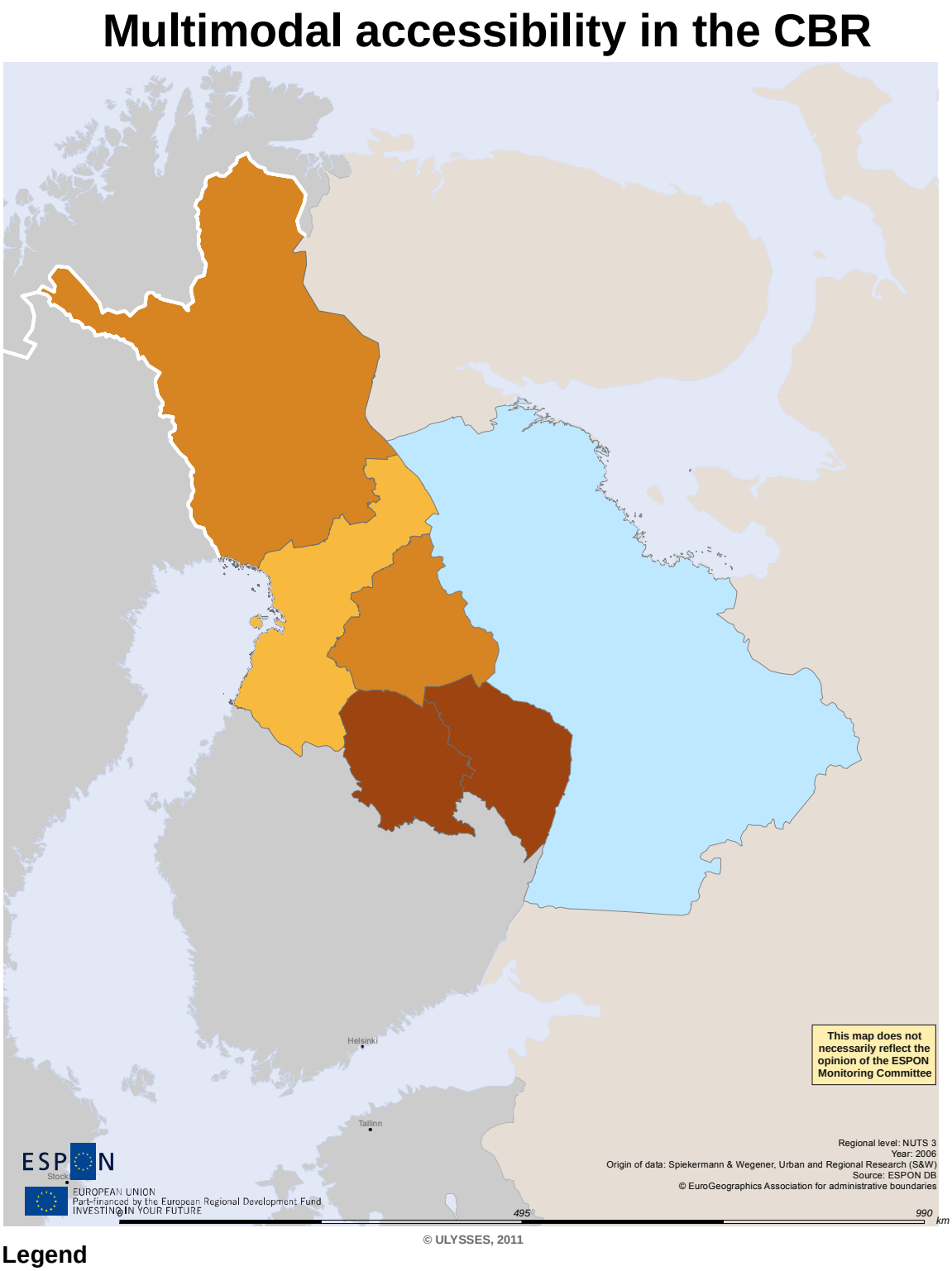
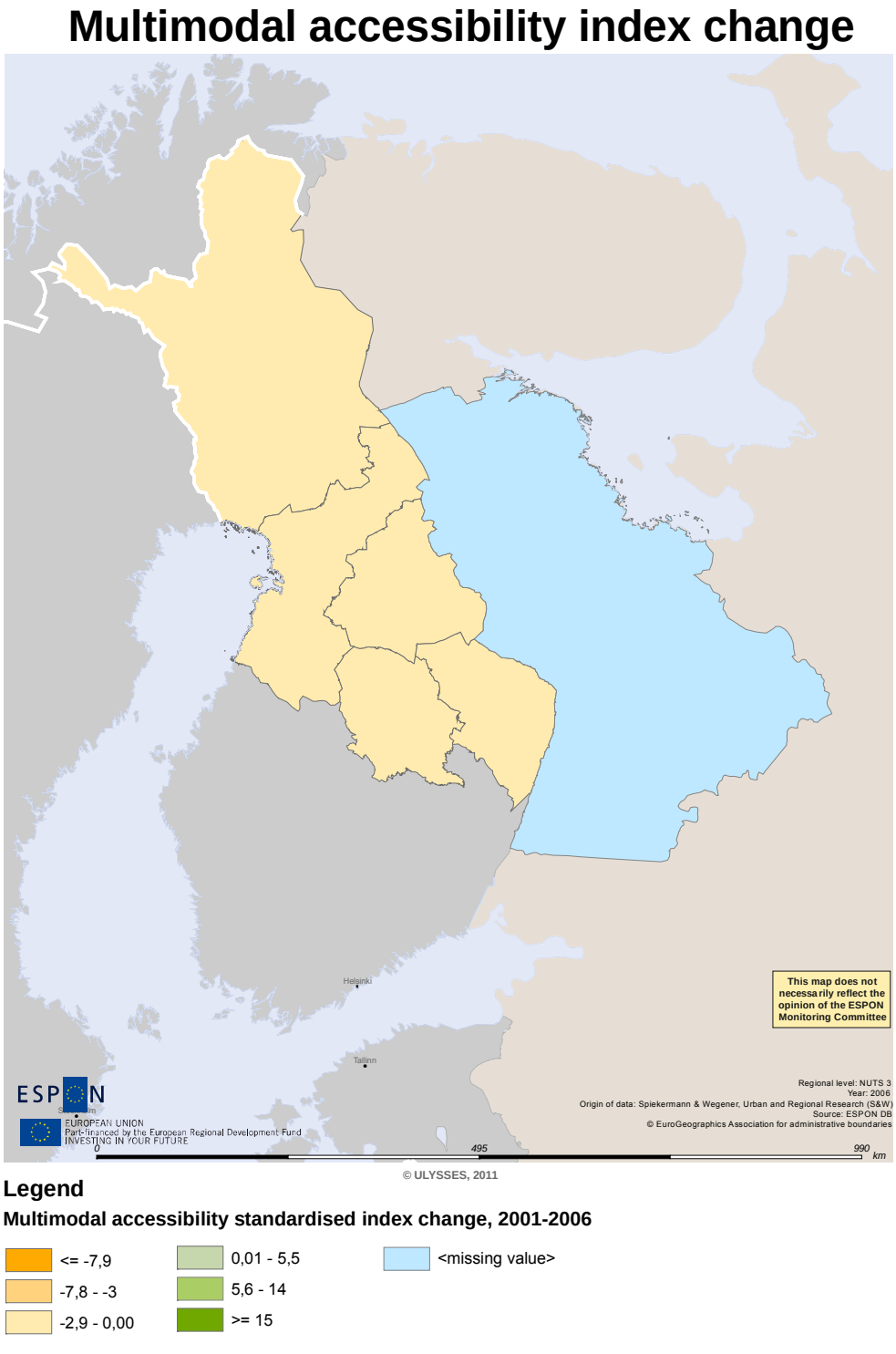


Figure 48. Index change of standardised multimodal potential accessibility in the regions of Euregio Karelia between 2001 and 2006.



5.5. Broadband internet access

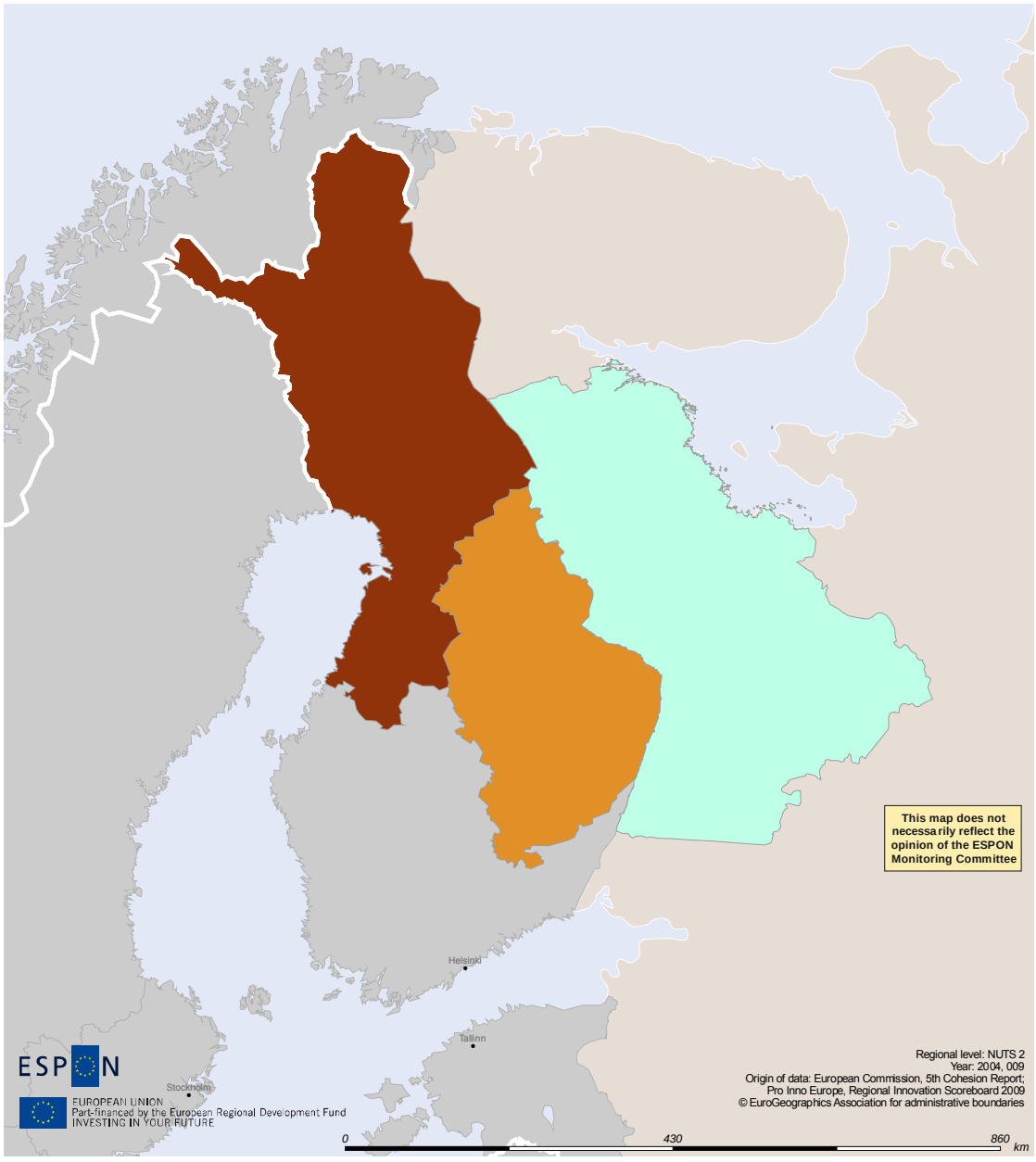
Compared to the physical accessibility, the Northern Finland – Russia CBA ranks considerably higher with its "virtual connectivity". In 2009 75,6 % of households in the NUTS 2 region of Northern Finland had a broadband internet connection and in Eastern Finland the respective figure was 60 %. The European average in 2009 was 56 %.

Broadband access is a political objective in Finland, and in 2008 the Finnish government ratified a project called "Broadband 2015" that aims at providing broadband internet connection to all citizens (99 % citizens should have a maximum two kilometre distance to an optical fibre or cable network, enabling a 100Mbit internet connection).[35] Northern and Eastern Finland are, however, problematic regions when achieving this challenge. These regions are mostly sparsely populated and distances between populated areas are long.

[35] Ficora 2011.

Figure 49. Households with broadband internet connection in the Northern Finland – Russia CBA in 2009.

Households with broadband internet access



Legend

Percent of households with broadband internet access NUTS 2, 2009 (Sweden, Poland 2004)

<= 12,50	50,01 - 62,50	<missing value>
12,51 - 25,00	62,51 - 75,00	
25,01 - 37,50	75,01 - 87,50	
37,51 - 50,00	>= 87,51	

5.6. Chapter conclusions

When analysing accessibility and connectivity of the Northern Finland – Russia CBA geographical facts become evident. The CBA is situated far away from the European core areas and infrastructure.

Potential accessibility of the Finnish regions of Euregio Karelia in the context of ESPON space by road is very low, between 6,2 (North Karelia) and 3,1 (Kainuu). The regions of Euregio Karelia are not easily accessed by rail either, even if they do value slightly higher in the rail than in the road accessibility; between 10,3 (North Karelia) and 6 (Northern Ostrobothnia). Air connections to Euregio Karelia seem to make the region better accessible to the European countries than road and rail infrastructure. Accessibility by air to North Karelia valued at 55,2, to Kainuu at 50,8 and to Northern Ostrobothnia at 44,8. It is possible to argue how well these figures correspond to reality. If we look at flight traffic from and to the regions of Euregio Karelia, the busiest airport is located in Oulu, Northern Ostrobothnia.

Multimodal accessibility combines all the above analysed forms of transport and demonstrates general accessibility levels. Relatively good air accessibility of Euregio Karelia clearly affects the multimodal accessibility levels of the region. In the context of ESPON countries, North Karelia values at 48,2, Kainuu at 44,2 and Northern Ostrobothnia at 39,1. In the context of the cross-border region, North Karelia has the highest (106,78) and Northern Ostrobothnia the lowest (86,62) accessibility. Index change of standardised potential accessibility has in all the regions been negative. According to these analysis, greatest decrease of accessibility has taken place in Northern Ostrobothnia, and the smallest in Kainuu.

Compared to the physical accessibility, the Northern Finland – Russia CBA ranks considerably higher with its "virtual connectivity". In 2009 75,6 % of households in the NUTS 2 region of Northern Finland had a broadband internet connection and in Eastern Finland the respective figure was 60 %. The European average in 2009 was 56 %.

Chapter 6. Performance of Northern Finland – Russia CBA from the perspective of Lisbon / Europe 2020 and Gothenburg objectives

Lisbon Strategy was launched in 2000 by the European Council as a response to the challenges of globalisation and ageing. The core idea of the strategy was for the European Union to become the most dynamic and competitive knowledge-based economy in the world by 2010. The Strategy underlined sustainable economic growth and promoted social cohesion and respect for the environment. Lisbon Strategy was re-launched in 2005 with more focused goals and clearer division of responsibilities between EU and national levels. The new revised Lisbon Strategy concentrated on two particular themes; growth and jobs.[36] European Union member states endorsed the strategy by formulating National Reform Programmes (NRPs). The main focus of the Finnish reform programme 2005-2008 was on securing sound public finances, especially in local government, on fostering and better exploiting the innovation system

[36] Lisbon Strategy evaluation 2010.

and on improving labour market functioning. Between 2008 and 2010 Finland aimed at raising the employment rate and improving the well-being of citizens in a sustainable way.[37]

Objectives of the Lisbon Strategy were achieved only partly in the Member States. Economic crisis was one the biggest obstacles that hindered the realization of National Reform Programmes. In June 2010 European Council adopted a new "Europe 2020 Strategy" that was adjusted to the current economical situation and challenges. The Europe 2020 Strategy identified three key drivers for growth that included smart growth (fostering knowledge, innovation, education and digital society), sustainable growth (making our production more resource efficient while boosting competitiveness of the EU) and inclusive growth (raising participation in the labour market, the acquisition of skills and the fight against poverty).

Europe 2020 Strategy also set five concrete targets to be reached by year 2020. These were following:

- 75 % of the population aged 20-64 should be employed
- 3% of the EU's GDP should be invested in research and development
- the "20/20/20" climate / energy targets should be met
- the share of early school leavers should be under 10 % and at least 40 % of the younger generation should have a tertiary degree or diploma
- 20 million less people should be at risk of poverty

Member States of the European Union prepared national targets for the Europe 2020 Strategy. Finland's target included raising the employment rate to 78 %, maintaining the ratio of R&D funding at a minimum of 4 % of GDP, reaching the climate and energy targets agreed in the EU, raising the proportion of people with tertiary level education to 42 % and keeping the proportion of early school leavers below 8 % and reducing the number of people living at risk of poverty and social exclusion.[38]

Gothenburg Strategy ('A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development') was launched by the European Commission in 2001 to complement the Lisbon Strategy by adding an environmental dimension to the Lisbon process for employment, economic reform and social cohesion. Gothenburg strategy identifies seven long-term objectives to meet unsustainable trends in the EU. These include:

- limiting climate change and its effects by meeting commitments under the Kyoto Protocol and under the framework of the European Strategy on Climate Change
- limiting the adverse effects of transport and reducing regional disparities
- promoting more sustainable modes of production and consumption
- encouraging sustainable management of natural resources
- limiting major threats to public health
- combating social exclusion and poverty and mitigating the effects of an ageing society
- strengthening the fight against global poverty, monitoring global sustainable development and compliance with international commitments[39]

The goal of our study was to measure the performance of the Northern Finland – Russia CBA regarding the socio-economic and environmental goals set up in the Lisbon / Europe 2020 and Gothenburg strategies.

[37] The Finnish National Reform Programme 2005-2008; The Finnish National Reform Programme 2008-2010.
[38] Europe 2020; Finland's National Programme 2020.
[39] Strategy for sustainable development 2009.

Analyses were divided into four subcategories: economy and employment, research and innovation, social cohesion and environment.

Table 30. Indicators applied for the study of Lisbon / Europe 2020 and Gothenburg Strategies.

Variable name	Geographical scale	Source	Time frame	Observations
GDP	NUTS 3	EUROSTAT, Russian Federal State Statistics Service	1997–2009	Regional level missing for CH and RU
Share of Natura 2000 areas	NUTS 3	European Commission's 5th Cohesion Report	2009	
Solar energy resources	NUTS 3		1981–1990	
Wind energy potential	NUTS 3		2000–2005	
Ozone concentration exceedances	NUTS 3		2008	
Urban waste water treatment	NUTS 2		2007	
Soil sealed area	NUTS 3		2006	
Long term unemployment	NUTS 2	Eurostat	2009	
Unemployment rate	NUTS 3		2010	
Youth unemployment rate	NUTS 3		2010	
Population at risk of poverty after social transfers	NUTS 3		2008	
Gross value added by NACE	NUTS 3	Eurostat	1997–2008	
Employment by NACE	NUTS 3	Eurostat & Russian Federal State Statistics Service	2000–2008	
GERD, HERD, BERD	NUTS 2	Eurostat	2007	
Employment in medium and high tech manufacturing	NUTS 2	ESPON DB (Regional Innovation Scoreboard)	2004	
EPO patents by million of inhabitants	NUTS 2	Eurostat	2007	

6.1. Economy and employment

6.1.1. GDP per capita

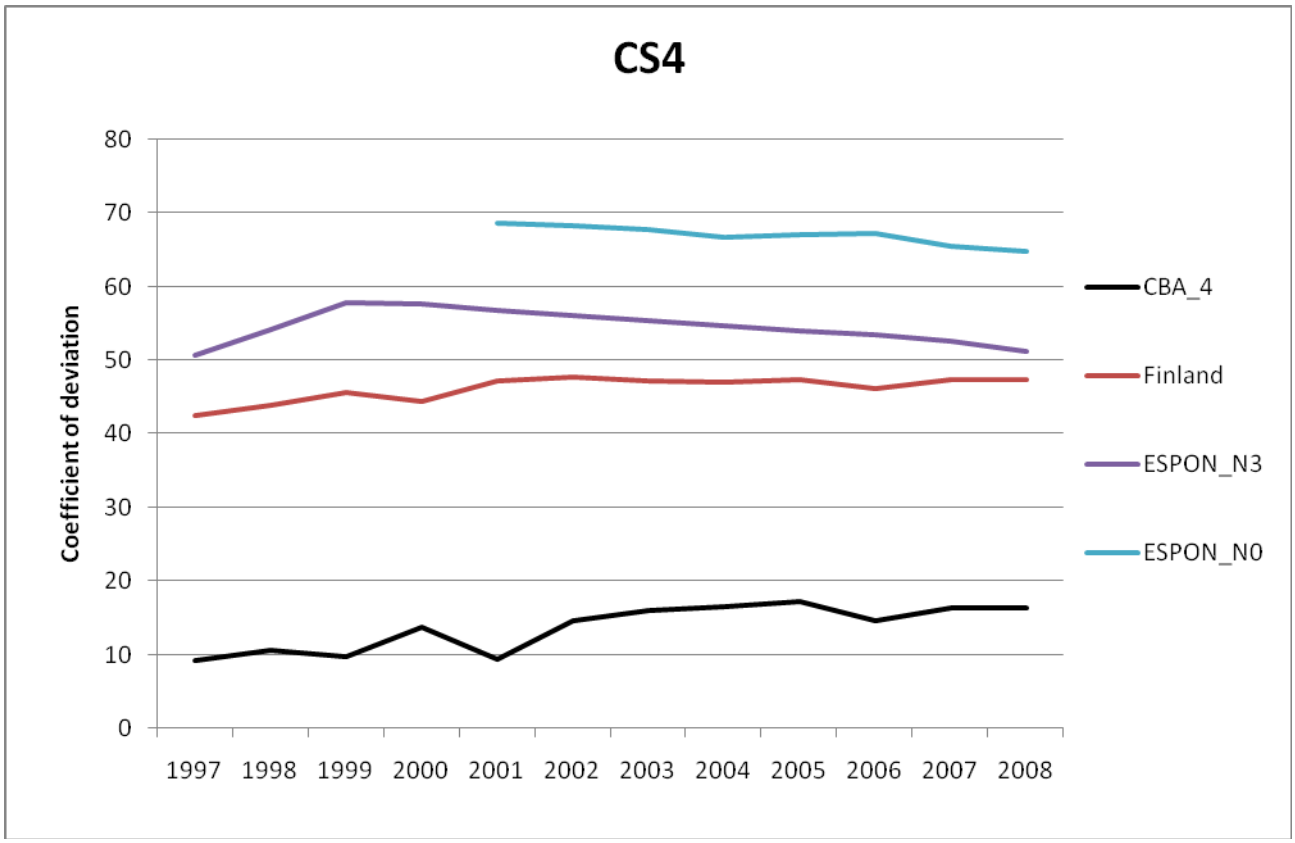
In order to define regional disparities in the GDP per capita we used coefficient of deviation in our analyses. This indicator is obtained by calculating the ratio of the standard deviation to the mean, and it is a good way to compare geographical units which differ greatly in their average values. The coefficient of deviation was calculated, besides the cross-border areas, for the countries of which the CBA is part of as well as for all the NUTS 3 and NUTS 0 level regions and countries of the ESPON space (on NUTS 0 level separately for EU27+CH+NO and EU27). The coefficient was calculated excluding the Swiss and Russian regional data because it was not available. Formula for producing coefficients of deviation is following:

$$Coefficient\ of\ deviation = \frac{Standard\ deviation}{Average}$$

The higher the coefficient of deviation, the higher are the disparities within the analysed geographical unit. The following figure represents coefficient of deviation values regarding GDP in the Northern Finland – Russia CBA (CBA_4 in the figure), Finland and ESPON NUTS 3 and NUTS 0 regions and countries. Even of the coefficient of deviation has been increasing between 1997 and 2008 in the Northern Finland – Russia CBA from 9,2 to 16,4 it shows significantly lower disparity between its regions than Finland in general or ESPON regions and countries.

It is necessary to remind that this analysis included only the Finnish regions of the Northern Finland – Russia CBA. Had the Republic of Karelia been included in the analysis, the results had been quite the opposite. After all, the difference in GDP and GDP per capita between Finland and Russia is far greater than between Finland and other countries of the European Union. To give some idea of the gap between GDP per capita in the regions, we present here figures that we posses. In 2003 the Gross Regional Product per capita in the Republic of Karelia was 67509 roubles, which makes approximately 1985 € (exchange rate of the Bank of Finland for January 1st 2003). In the same year GDP per capita in North Karelia valued at 20200 €, in Kainuu at 19000 € and in Northern Ostrobothnia at 25900 €.

Figure 50. Coefficient of deviation of GDP per capita between 1997 and 2008.



Source: Eurostat

Next, we perform two different analyses on the data on GDP per capita at NUTS 3 level. In the first one we compare each NUTS 3 region with the leading region in terms of GDP per capita (Inner London West region), trough index number analysis. In the second one we apply a logistic function to establish the relative performance of each NUTS 3 to the leading region, exploring the notion of territorial catching-up.

In theory, for both analyses the value of reference for GDP per capita would be the highest value among all NUTS 3, that of the Inner London West region. However, at this territorial level, GDP per capita can be affected by several factors, such as high population fluctuations and significant mismatches between jobs (and wealth production) and the place of residence. In fact, in economically central places (of which London is a good example), there normally is a steady flow of migrant workers, as well as commuters from other NUTS 3 region, and the GDP per capita of the economic centre is seriously overestimated. For that reason, instead of simply considering the GDP per capita of the Inner London West NUTS 3, the whole Greater London NUTS 2 was used as a reference for this analysis.

As to the first analysis, GDP indexed to the leading region, it involves the indexation of GDP per capita in each NUTS 3 region to the value of the leading region in 2008 referred to above. The value of the leading region is by definition 100,0. Following formula is applied in the analysis:

$$Index\ GDP_R = \left(\frac{GDP_R}{GDP_L}\right) \times 100$$

where GDP_R is the GDP per capita of a given NUTS 3 region and GDP_L is the GDP per capita of the NUTS 2 region of London.

Table 31. GDP per capita (euro) in the leading NUTS 2 region (London), in the leading Finnish region (Uusimaa) and the Finnish regions of Euregio Karelia between 1997 and 2008.

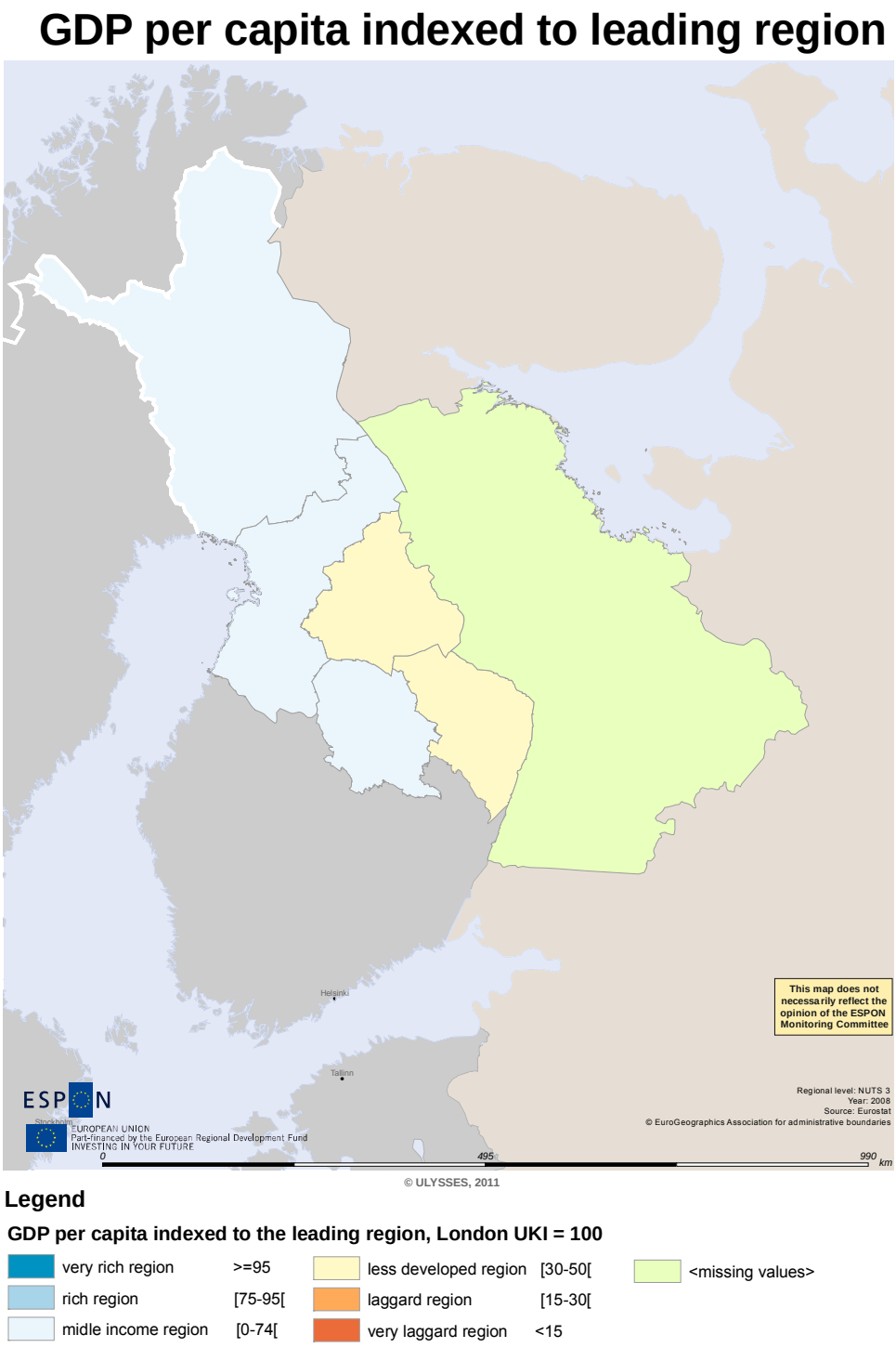
ID		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
UKI	London	32200	35200	38600	43600	44300	46400	44800	48300	50000	53400	56700	50600
FI181	Uusimaa	28000	31000	33100	36000	38000	38300	37800	39400	40600	42800	46200	46900
FI133	North Karelia (Pohjois-Karjala)	15100	15500	16600	18600	19100	19200	20200	21200	22100	23400	24600	25100
FI134	Kainuu	15500	15500	16200	16400	18100	18600	19000	19900	19800	21600	23300	24800
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	19000	19600	20300	22200	21600	24600	25900	27000	27600	27500	30500	31300

The results of the analysis are presented in the following table. The best performing region among the Finnish regions of Euregio Karelia in terms of GDP per capita is Northern Ostrobothnia. Compared to the leading region Northern Ostrobothnia is classified as middle income region, while both North Karelia and Kainuu are indentified as less developed regions. The leading region in Finland, Uusimaa performs relatively well compared to the leading region. It has an index of 92,69 and it is classified as rich region. In the Finnish context this illustrates the accumulation of production and thus welfare in the capital region.

Table 32. GDP per capita of the Finnish regions of Euregio Karelia (and the Finnish region of Uusimaa) indexed to the leading NUTS 2 region of London (2008).

ID		2008	Index number	Class	Code
UKI	London	50600	100	very rich region	1
FI181	Uusimaa	46900	92,69	rich region	2
FI133	North Karelia (Pohjois-Karjala)	25100	49,60	less developed region	4
FI134	Kainuu	24800	49,01	less developed region	4
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	31300	61,86	middle income region	3

Figure 51. GDP per capita of the Finnish regions of Euregio Karelia indexed to the leading NUTS 2 region of London (2008).



The catching up analysis evaluates the speed of catching-up with the leading region, through a standard logistic process. The catching-up process analysis sets the relative position of each NUTS 3 region and its

relative trajectory up to the level of 95% of the GDP of the leading region in 50 years. The difference of performance of each region in comparison to the leading region is measured in years needed to reach the level assumed above. According to these assumptions, the logistic function which describes the problem is represented as follows:

$$X = 0{,}95\,\bar{X} = \frac{\bar{X}}{1 + ke^{-at}} \qquad (1)$$

The data used for the catching up analysis was GDP per capita for the years 1997 and 2008.

All regions with a performance of 95% or higher compared to the leading region were considered leading regions. The analysis distinguishes converging regions from diverging regions, and the different levels of catching-up performance. Leading regions are the ones who already have a GDP close to that of the London NUTS 2. Fast converging regions have a growth rate which allows them to reach the leader in no more than 20 years, steady catching-up regions between 21 to 50 years, slow catching-up regions between 51 to 100 and slow converging regions between 101 to 250 years. Non converging region have great distances in terms of GDP and are growing at a rate equal or slightly superior to the leader and diverging regions are growing less than the leader.

leading region	>=95% (GPD already close to the leader)
fast converging region	[0-20]
steady catching-up region	]20-50]
slow catching-up region	]50-100]
slow converging region	]100-250]
non converging region	>250
diverging region	growth (g) < growth London (g*)

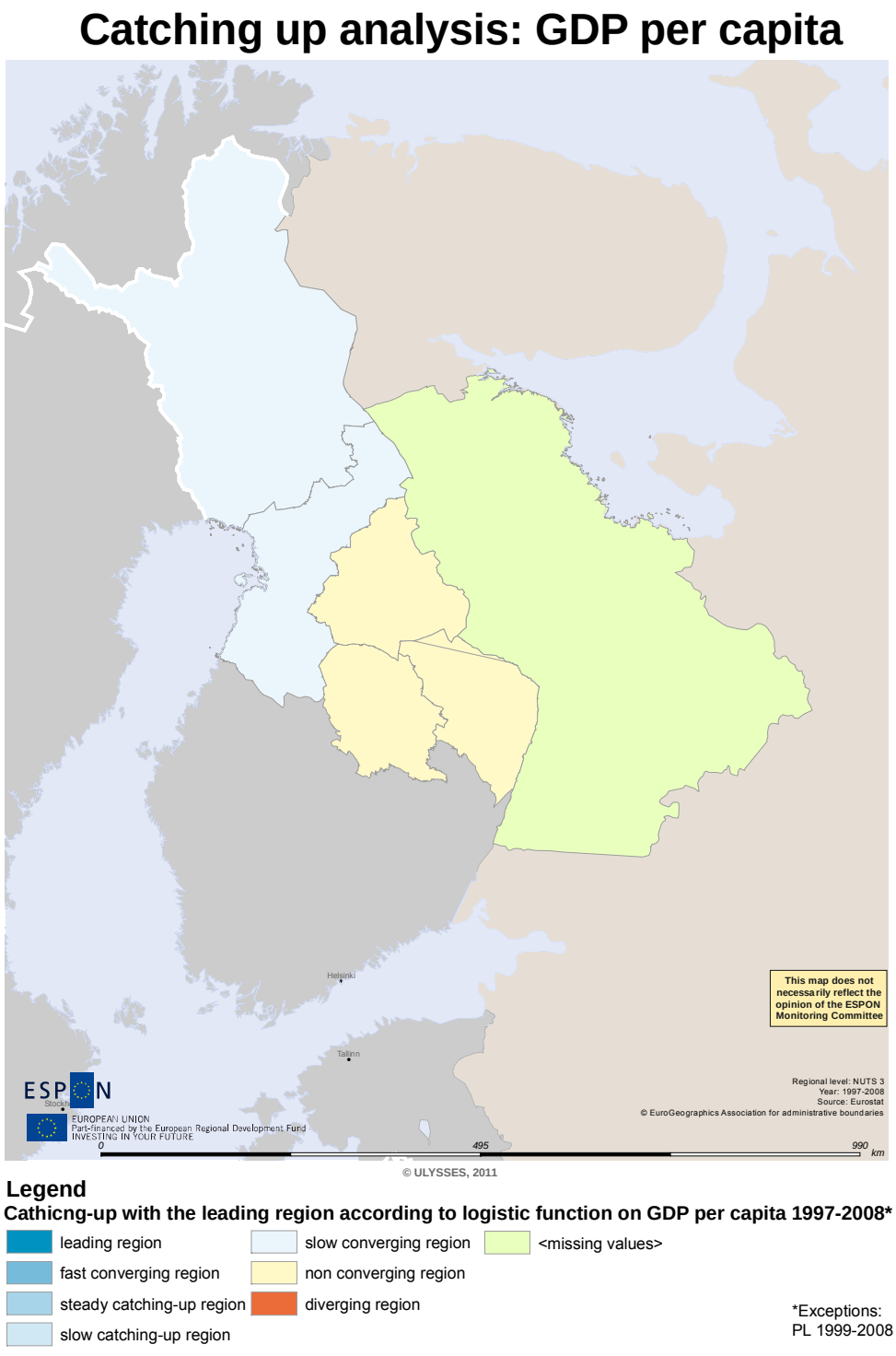
Table 33 and map 52 illustrate the results of the catching-up analysis for the regions of Euregio Karelia. Northern Ostrobothnia is the only region that has been classified as a (slow) converging region, North Karelia and Kainuu have between 1997 and 2008 performed as non converging regions. When compared to the leading Finnish region Uusimaa, which is according to the analysis a fast converging region, it is possible to see the huge internal differences between the growth rates of the Finnish regions. Uusimaa has five years to the leader, while the strongest region of Euregio Karelia, Northern Ostrobothnia, would need 218 years to catch up with the leading region.

Table 33. Catching-up analysis of the Finnish regions of Euregio Karelia (performance in GDP per capita between 1997 and 2008 compared to the leading NUTS 2 region of London).

ID		Annual	G = relative	K = relative	A =	years to the	class	code

		growth rate	growth	position (GDP)	constante for G e K	leader		
UKI	London	0,0419						
FI181	Uusimaa	0,0480	0,0058	0,08	0,080	5,085844042	fast converging region	2
FI133	North Karelia (Pohjois-Karjala)	0,0473	0,0051	1,02	0,010	291,3114868	non converging region	6
FI134	Kainuu	0,0437	0,0016	1,04	0,003	928,0722515	non converging region	6
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	0,0464	0,0043	0,62	0,011	218,3128582	slow converging region	5

Figure 52. Performance of the regions of Euregio Karelia in GDP per capita between 1997 and 2008 compared to the leading NUTS 2 region of London.



6.1.2. Economic sectors

Following tables differentiate the economic structure and evolution between 1997-2008 in the regions of Euregio Karelia, and enables comparing the economical and employment structure of the region to the EU27 and the national averages. The economic performance of the regions is expressed in Gross Value Added, which presents the overall contribution of different economic sectors to the total output of the region. The employment by sectors, on the other hand, illustrates the importance of different economic sectors in the composition of the regions' workforce.

The leading sector in the North Karelia and Kainuu in 2008 was public administration and community services, which produced 26,54 % of the total GVA in North Karelia and 28,61 % in Kainuu. Compared to the EU27 and Finnish average, the share is relevantly large. In Northern Ostrobothnia the leading economic field was industry (32,38 % of total GVA).

Table 34. Share of GVA by NACE (Rev. 1.1) in the regions of Euregio Karelia in 2008.

		Share of GVA by NACE (Rev. 1.1) 2008 (%)					
NUTS ID	NUTS	Agriculture; fishing (A-B)	Industry (except construction) (C-E)	Construction (F)	Wholesale and retail trade; hotels and restaurants; transport (G-I)	Financial intermediation; real estate (J-K)	Public administration and community services; activities of households (L-P)
EU27	EU27	1,75	19,61	6,48	21,08	28,27	22,80
FI	Finland	2,87	25,00	7,25	19,70	23,09	22,09
RU	Russia	N/A	N/A	N/A	N/A	N/A	N/A
FI133	North Karelia (Pohjois-Karjala)	7,64	21,85	9,09	16,16	18,72	26,54
FI134	Kainuu	9,57	18,35	9,38	15,05	19,05	28,61
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	3,38	32,38	8,59	14,03	19,45	22,16
RUD3	The Republic of Karelia	N/A	N/A	N/A	N/A	N/A	N/A

Construction (F) has been the field of economic activity that has shown greatest growth in all the regions of Euregio Karelia between 1997 and 2008. Annual growth rate of the share of construction in total GVA was highest in Kainuu, where it valued at 12,13 %. Also in North Karelia and Northern Ostrobothnia construction had increased its share in total GVA more than any other economic sector (annual rate was 11,45 % in North Karelia and 9,61 % in Northern Ostrobothnia). In Finland the share of construction had also increased during the given period, while in the European Union the share had decreased by an annual rate of -4,33 %. The second greatest positive annual growth rate was recorded in all the regions of Euregio Karelia by financial intermediation and real estate (J-K).

Table 35. Annual growth rate of GVA by NACE in Euregio Karelia between 1997 and 2008 (% share of total GVA).

		Annual growth rate of GVA by NACE 1997-2008 (%)						
NUTS ID	NUTS	All NACE	Agriculture; fishing (A-B)	Industry (except construction) (C-E)	Construction (F)	Wholesale and retail; hotels & restaurants; transport (G-I)	Financial intermediation; real estate (J-K)	Public administration and community services; activities of households (L-P)
EU27	EU27	3,12	1,26	-1,48	-4,33	-2,96	4,36	3,37
FI	Finland	5,08	1,70	4,17	7,86	4,58	6,66	4,85
RU	Russia	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FI133	North Karelia (Pohjois-Karjala)	4,33	2,38	3,03	11,45	4,09	5,61	3,77
FI134	Kainuu	3,35	2,86	-0,13	12,13	3,24	5,52	3,24
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	5,42	1,11	5,33	9,61	3,57	7,46	4,84
RUD3	The Republic of Karelia	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Highest share of employment in all the Finnish regions of Euregio Karelia was in 2008 recorded in public administration and community services (L-P). This was also the sector with highest share of employment in Finland and EU27 countries. In Kainuu the share was exceptionally high, as 43,30 % of total employment was recorded in this sector. In the Republic of Karelia wholesale and retail trade (G-I) had the same share of employment (28,95 %) as public administration and community services (L-P) (28,84 %). Even if construction (F) generated a large share of the GVA in the regions, the share of employment in that sector was relatively low in 2008. The importance of forestry sector on economy in Kainuu and North Karelia is reflected in the share of employment in sector A-B (agriculture, hunting, forestry and fishing). While the European average share in that field was 5,67 % and the Finnish average 4,83 %, the share of employment in sectors A-B was 10,34 % in Kainuu and 12,81 % in the Republic of Karelia in 2008.

Table 36. Share of employment in total employment by NACE sectors (Rev. 1.1) in Euregio Karelia (2008).

		Share of employment by NACE 2008 (%)					
NUTS ID	NUTS	Agriculture; fishing (A-B)	Industry (except construction) (C-E)	Construction (F)	Wholesale and retail trade; hotels and restaurants; transport (G-I)	Wholesale and retail; hotels & restaurants; transport (G-I)	Public administration and community services; activities of households (L-P)
EU27	EU27*	5,67	18,08	7,72	25,10	14,31	29,13

FI	Finland	4,83	18,14	7,58	23,32	13,63	32,50
RU	Russia	11,48	20,62	8,00	27,38	9,17	24,89
FI133	North Karelia (Pohjois-Karjala)	9,72	18,39	8,22	17,94	7,77	37,97
FI134	Kainuu	10,34	13,41	6,98	17,32	8,94	43,30
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	7,12	19,60	8,52	19,11	12,11	33,60
RUD3	The Republic of Karelia	12,81	19,66	6,82	28,95	5,78	28,84

Annual growth in employment between 2000 and 2008 has been strongest in construction (F) in all the regions of Euregio Karelia. Only in Northern Ostrobothnia the growth has been stronger in the sector of financial intermediation and real estate (J-K), that has been growing at an annual rate of 6,20 % of total employment. The share of employment in agriculture and fishing (A-B) and industry (C-E) has decreased in all the regions of Euregio Karelia, Finland, Russia and European Union.

Table 37. Annual growth rate of the share of employment by NACE sectors in total employment in Euregio Karelia between 2000 and 2008.

		Annual growth rate of employment by NACE 2000-2008 (%)						
NUTS ID	Nuts name	All NACE	Agriculture; fishing (A-B)	Industry (except construction) (C-E)	Construction (F)	Wholesale and retail; hotels & restaurants; transport (G-I)	Financial intermediation; real estate (J-K)	Public administration and community services; activities of households (L-P)
EU27	EU27*	0,82	-4,05	-0,48	2,00	1,18	2,59	1,47
FI	Finland	1,21	-1,44	-0,66	2,59	1,22	3,88	1,50
RU	Russia	0,75	-3,26	-0,99	2,99	2,99	2,51	0,94
FI133	North Karelia (Pohjois-Karjala)	0,63	-1,27	-0,40	3,74	0,10	3,02	0,92
FI134	Kainuu	0,57	-1,27	-1,46	3,49	0,20	5,41	0,75
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	1,32	-2,04	-1,07	3,06	1,53	6,20	1,76
RUD3	The Republic of Karelia	0,26	-2,91	-0,20	4,68	1,55	-0,98	0,30

*EU27 data for 2000 includes data for 2001 for NL and 2002 for UK. EU27 data for 2008 includes data for 2007 for IT.
Source: Eurostat and Russian Federal State Statistics Service

6.2. Research and innovation

Tree types of indicators can be distinguished for studying research and innovation of regions. These include enablers, firm activities and outputs. Since a wide-ranging analysis on all of these topics could not have been possible in the context of this project and due to the lack of data (NUTS 2 coverage is very poor for most of the indicators) we have selected in our analysis a few indicators from all the above mentioned groups. These are:

- Total intramural R&D expenditures (R&D expenditures in the government sector (GOVERD) and the higher education sector (HERD), Business R&D expenditures (BERD) and as a percentage of GDP)
- EPO patents
- Employed persons in high and medium tech manufacturing activities

Total intramural R&D expenditure in 2007 was higher in Finland than in EU countries in average (3,47 in Finland and 2,01 in EU27). Expenditure was even higher than the Finnish average in Northern Finland (5,38) while in Eastern Finland R&D expenditure was below Finnish and EU average (1,61). When looking at the sectoral R&D expenditure it is obvious that expenditure in Northern Finland and Finland in general has been greatest in the business sector. Expenditure on high education was slightly above Finnish and EU average in both Eastern and Northern Finland (0,74 in Eastern and 0,77 in Northern Finland).

Northern Finland shows stronger performance than Eastern Finland both in the amount of EPO (European Patent Office) patent applications and the amount of persons employed in high and medium tech manufacturing activities. If there were 97,13 EPO patent applications per million inhabitants from Northern Ostrobothnia in 2007, there were only 30,49 patent applications from Eastern Finland. The share of employed persons was indexed here to the share of employed persons in EU25 countries that was valued as 100. The share of employed persons in high and medium tech manufacturing activities was slightly below the European average (98,94 %) in Northern Finland, while in Eastern Finland the share was only 61,63 %. The amount of EPO patent applications from Russia was two per million inhabitants in 2007. This value, however, does not reflect the performance of the country in the field of innovation, since Russia has its own patent system and legislation.[40]

Table 38. Indicators for research and innovation in the Northern Finland- Russia CBA

NUTS ID	NUTS	Total intramural R&D expenditure 2007				EPO patents per million of inhabitants 2007	Employed persons in high and medium tech manufacturing activities (% of total workforce EU25 = 100) 2004*
		Total	Business enterprise sector	Government sector	Higher education		
EU27	EU27	2,01	1,18	0,24	0,42	N/A	N/A

[40] There have been attempts to harmonize the Russian patent system with the European one under a EU-funded project. http://www.epo.org/news-issues/news/2009/20091105.html

RU	Russia	1,12	0,72	0,32	0,07	2	N/A
FI	Finland	3,47	2,51	0,29	0,65	111,37	103,47
FI13	Eastern Finland (Itä-Suomi)	1,61	0,65	0,21	0,74	30,49	61,63
FI1A	Northern Finland (Pohjois-Suomi)	5,38	4,33	0,29	0,77	97,13	98,94
RU3D	The Republic of Karelia (Respublika Kareliâ)	N/A	N/A	N/A	N/A	N/A	N/A

Source: Eurostat
*Source: ESPON DB (Regional Innovation Scoreboard)

6.3. Social cohesion

We have studied social cohesion of the Northern Finland – Russia CBA by analysing following indicators: youth unemployment rate, long term unemployment rate, infant mortality rate, and population at risk of poverty after social transfers. While all the other indicators are standard demographic variables, population at risk of poverty is defined as "persons having equalised disposable income (i.e. adjusted for household size and composition) of less than 60% of national median" (European Commission's 5th Cohesion Report database).

Unemployment in Eastern and Northern Finland were slightly above the Finnish and European average in 2010. While unemployment rate in Eastern and Northern Finland was 10,1 %, it was 8,4 % in Finland and 9,6 % in the European Union (EU27). Concerning the other social cohesion indicators, Eastern Finland performed slightly weaker than Northern Finland. Long term unemployment rate in the region was 2,0 % in 2009 (1,3 % in Northern Ostrobothnia) and youth unemployment rate 25,1 % in 2010 (22,9 % in Northern Ostorbothnia). The share of population at risk of poverty after social transfers rated at 17, 8 % for Eastern Finland, while the share in Northern Ostrobothnia was 15,6 %. There was also a smaller share of population aged 25 to 64 with tertiary education in Eastern Finland (31,9 %) than in Northern Finland (34,7 %). Both regions performed in this respect below Finnish average (38,1 %) but well above the European average (25,9 %).

Table 39. Social cohesion indicators for the Northern Finland – Russia CBA.

NUTS ID	NUTS	Unemployment rate, 2010	Long-term unemployment rate, 2009 (>=12 months)	Youth unemployment rate, 2010 (% of labour force aged 15-24)	Population at risk of poverty after social transfers, 2008 (% of total population)	Infant mortality rate 2008	Population aged 25-64 with tertiary education, 2010
EU27	EU27	9,6	3,0	20,9	17,0	4,3	25,9
RU	Russia	N/A	N/A	N/A	13,4*	N/A	N/A
FI	Finland	8,4	1,4	21,4	13,6	2,6	38,1
FI13	Eastern Finland (Itä-Suomi)	10,1	2,0	25,1	17,8	2,3	31,9
FI1A	Northern Finland (Pohjois-Suomi)	10,1	1,3	22,9	15,6	2,6	34,7
RU3D	The Republic of Karelia (Respublika Kareliâ)	N/A	N/A	N/A	16,7*	N/A	N/A

*Amount of population with income below poverty level

6.4. Environmental analysis

We have applied two sets of indicators for environmental analysis of the Northern Finland – Russia CBA; indicators from the European Commission's 5th Cohesion Report[41] and indicators from the ESPON Climate Project regarding the region's sensitivity for climate change. From the European Commission's 5th Cohesion Report we selected six indicators, namely, soil sealed area, ozone exceedance, waste water treatment, Natura 2000 areas, solar energy, wind potential. While the first four indicators show concrete environmental performance of the region, the last two indicate what could be the region's capacity in exploiting alternative energy sources in an energy source transition scenario.

6.4.1. Environmental performance

The first indicator of environmental performance that we have studied is soil sealing. Soil sealing means covering of soil for housing, roads or other land developments. When land is sealed, the area for soil to carry out its natural functions including the absorption of rainwater for infiltration and filtering is reduced. Sealed areas may have a great impact on surrounding soils by changing water flow patterns and by increasing the fragmentation of biodiversity.

According to the 5th Cohesion Report Soil sealing is particularly high in highly urbanised areas such as parts of the Netherlands, North Belgium, West and South Germany and central and southeastern parts of the UK.

[41] Fifth Report on Economic, Social and Territorial Cohesion 2010.

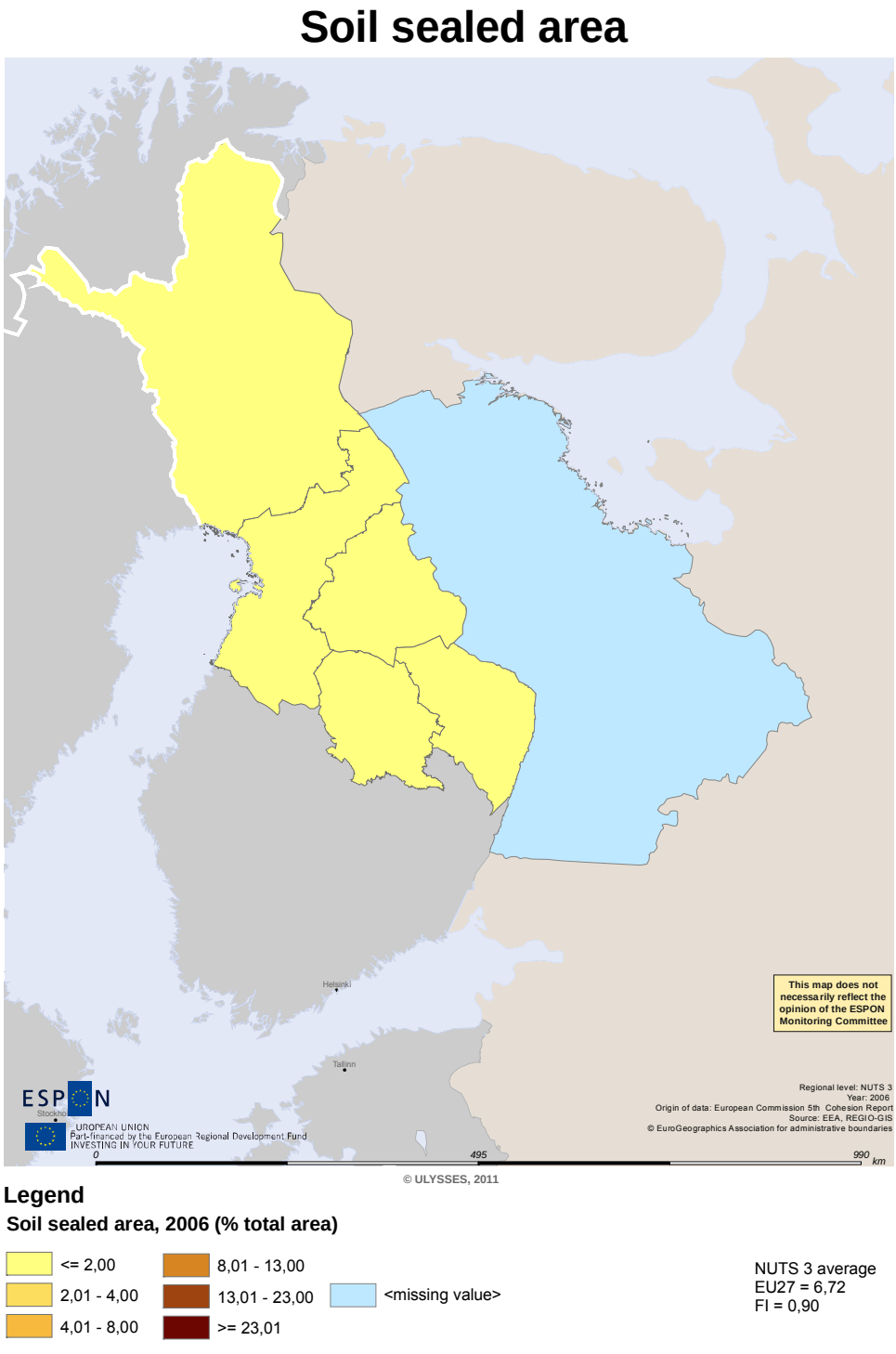
In Mediterranean regions, soil sealing is relatively high along the coasts where rapid urbanisation is associated with the expansion of tourism.

If we have a look at total values for soil sealed areas in the regions of Euregio Karelia, it occurs as if there has been no soil sealing. However, the indicator for soil sealing per inhabitant reveals that in North Karelia 97 km², in Kainuu 100 km² and in Northern Ostrobothnia 415 km² of soil per inhabitant was sealed in 2006. The value for Northern Ostrobothnia is well above the Finnish (217,75 km²) and European averages (214 km²).

Table 40. Soil sealing in the regions of Euregio Karelia in 2006.

NUTS CODE	NUTS NAME	Soil sealed area, 2006 (% total area)	Soil sealing per inhabitant (m² per inhabitant), 2006
EU27	(NUTS 2 average)	6,72	214
FI	Finland	0,90	217,75
RU	Russia	N/A	N/A
FI133	North Karelia (Pohjois-Karjala)	0	97
FI134	Kainuu	0	100
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	0	415
RUD3	The Republic of Karelia (Respublika Kareliâ)	N/A	N/A

Figure 53. Soil sealed area in Euregio Karelia in 2006.



The European Union aims at reducing ozone levels and particulate matter in the air. After all, good air quality helps to prevent respiratory diseases and premature death. The 5th Cohesion Report states that there is much evidence on high ground-level ozone concentrations harming lungs and irritating the respiratory system. Ozone concentrations often exceed EU thresholds in cities, especially in southern Europe.[42]

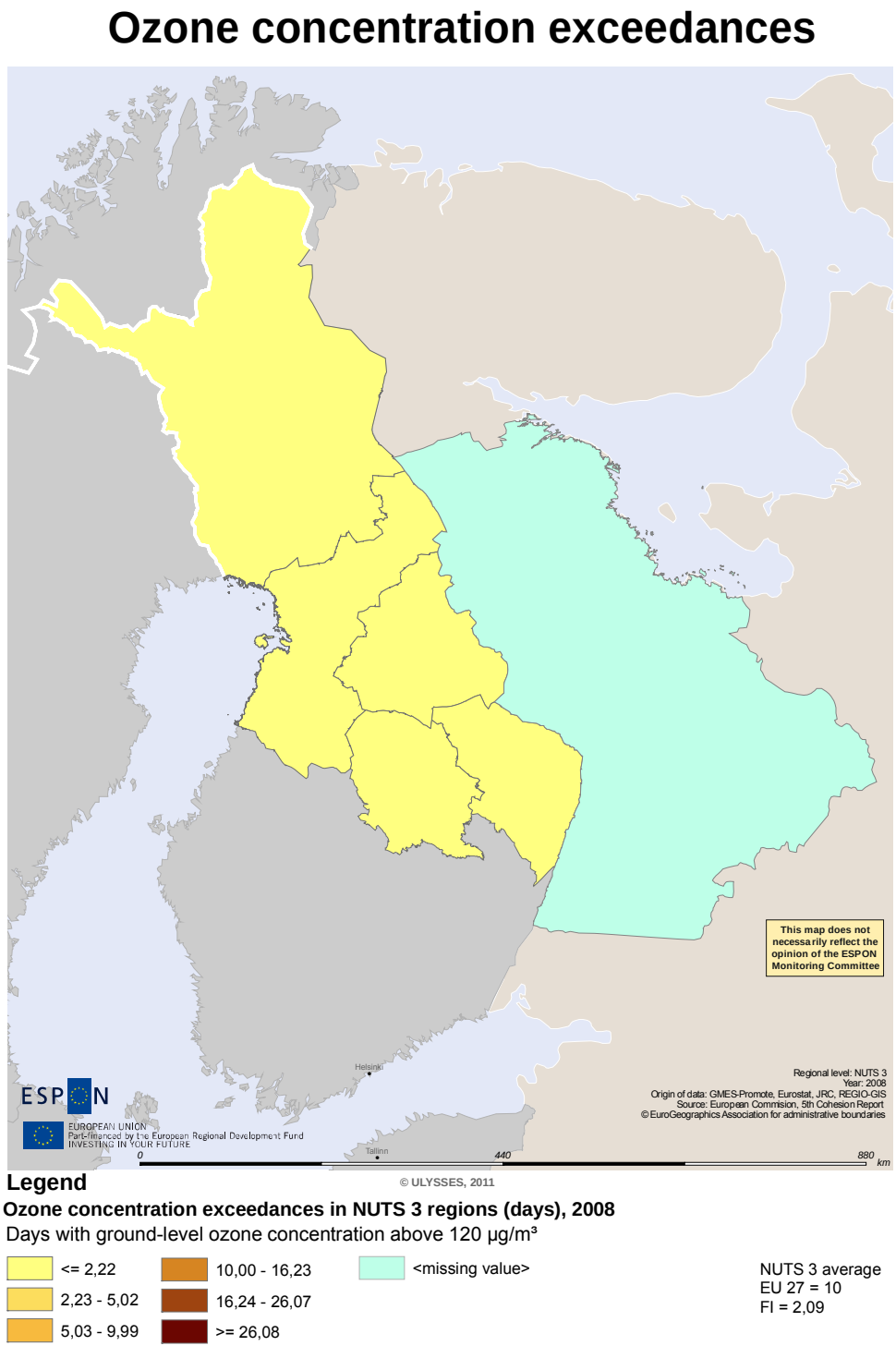
Ozone concentration exceedances were low or non-existence in Euregio Karelia. North Karelia and Kainuu had no days with exceedances in 2008 and Northern Ostorbothnia only one. Finnish average for the given year was 2,09 and European (EU27) average 9,99.

Table 41. Ozone concentration exceedances in the regions of Euregio Karelia in 2008.

NUTS ID	NUTS	Ozone concentration exceedances in NUTS 3 regions (days), 2008
EU27	(NUTS 2 average)	9,99
FI	Finland	2,09
RU	Russia	N/A
FI133	North Karelia (Pohjois-Karjala)	0
FI134	Kainuu	0
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	1
RUD3	The Republic of Karelia (Respublika Kareliâ)	N/A

[42] Fifth Report on Economic, Social and Territorial Cohesion 2010.

Figure 54. Ozone concentration exceedances (days) in Euregio Karelia in 2008.



According to the 5th Cohesion Report, urban waste water is not yet treated adequately in all the Member State, especially in regions of EU-12 countries, but also several of the EU-15 countries. Treatment of waste water is, however, necessary to preserve the quality of water reserves, for drinking, use by industry, tourism and agriculture and for environmental reasons generally. For urban areas, treatment which removes most contaminants from sewage is mandatory.[43]

Urban waste water treatment capacity in the Northern Finland – Russia CBA is slightly above the Finnish and EU averages. In 2007 urban waste water treatment capacity in both Eastern and Northern Finland was 99 %, while in Finland the capacity was 98,98 % and in the European Union (EU27) it was 92,53 %.

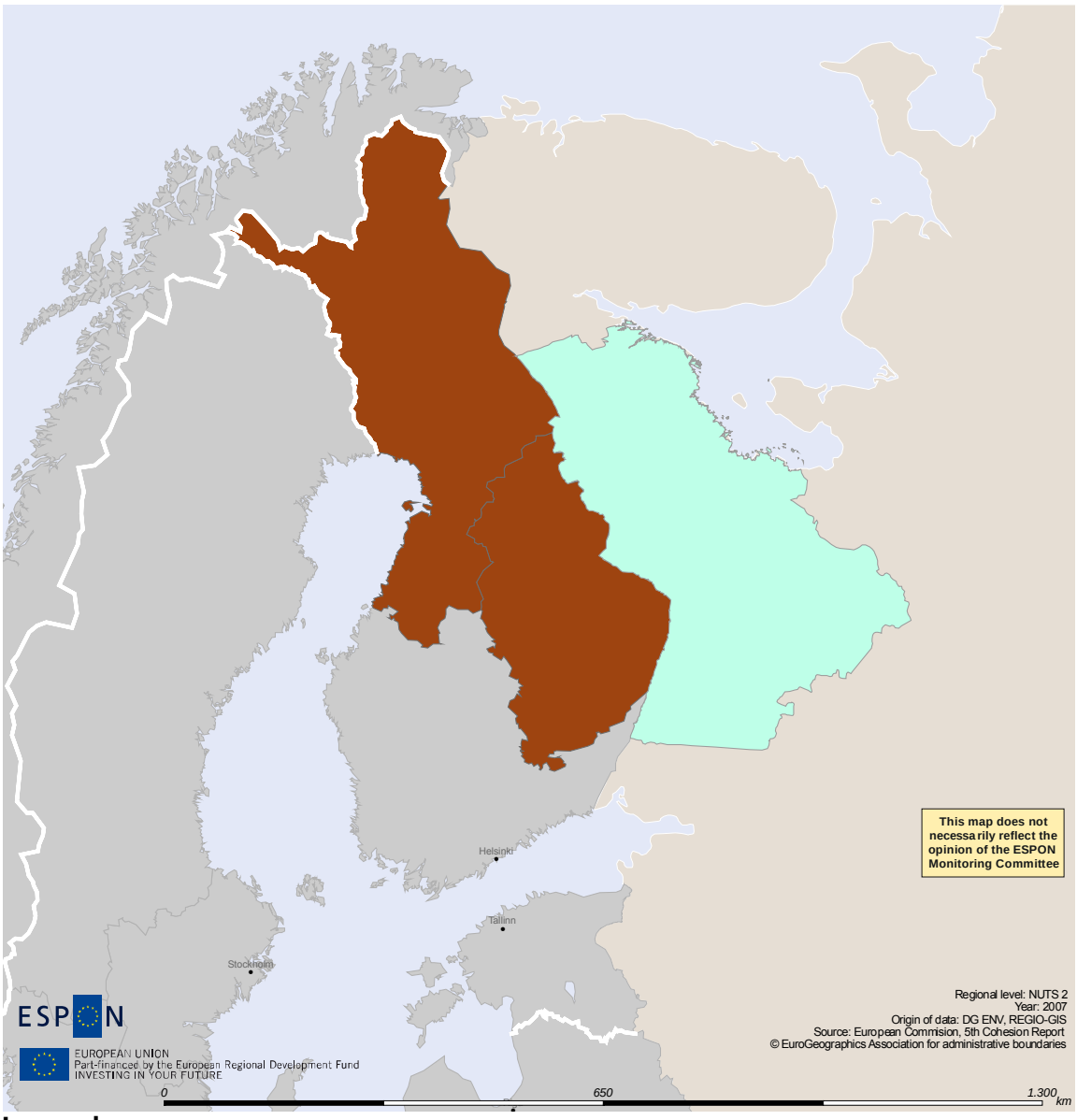
Table 42. Urban waste water treatment capacity in the Northern Finland – Russia CBA (2007).

NUTS ID	NUTS	Urban waste water treatment capacity, 2007
EU27	(NUTS 2 average)	92,53
FI	Finland	98,98
RU	Russia	N/A
FI13	Eastern Finland (Itä-Suomi)	99
FI1A	Northern Finland (Pohjois-Suomi)	99
RUD3	The Republic of Karelia (Respublika Kareliâ)	N/A

[43] Fifth Report on Economic, Social and Territorial Cohesion 2010.

Figure 55. Urban waste water treatment capacity in the Northern Finland – Russia CBA (2007).

Urban waste water treatment capacity



Legend

Urban waste water treatment capacity NUTS 2, 2007

- <= 23,65
- 23,66 - 69,21
- 69,22 - 79,65
- 79,66 - 92,53
- 92,54 - 99,00
- >= 99,01
- <missing value>

NUTS 2 average
EU 27 = 92,53
FI = 98,98

Natura 2000 is an EU wide network of nature preservation areas. The aim of NATURA is to ensure the long-term survival of threatened species and habitats. According to the EU Nature Directives, conservation should be achieved while taking account of economic, social, cultural, regional and recreational needs. Regions should consider the sites as important assets in development strategies: NATURA 2000 areas could be used to attract more visitors and to develop economic activities related to ecotourism, as well as enhancing the quality of life of the people living in the nearby regions.[44]

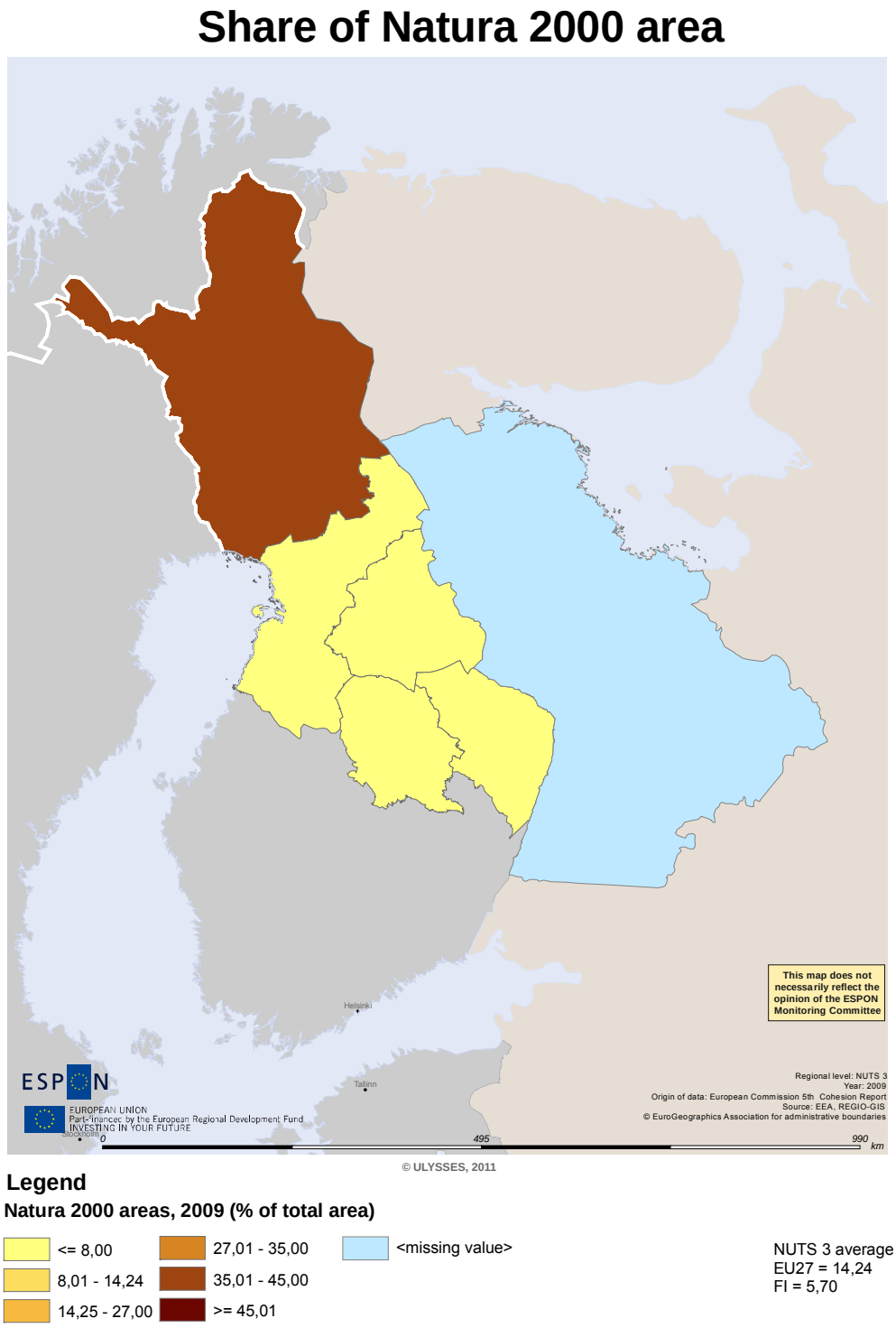
The share of NATURA 2000 areas in the Finnish regions of Euregio Karelia corresponds with the average Finnish share of NATURA areas. It, however values significantly lower than the average European (EU27) share of NATURA 2000 areas. While 4% of the total area of North Karelia and 7 % of the total area of Kainuu and Northern Ostrobothnia are NATURA areas, in the European countries (EU27) the average share is 14,24 %.

Table 43. Share of Natura 2000 areas of total area (%) in the regions of Euregio Karelia in 2009.

NUTS ID	NUTS	NATURA 2000 areas, 2009 (% of total)
EU27	(NUTS 2 average)	14,24
FI	Finland	5,70
RU	Russia	N/A
FI133	North Karelia (Pohjois-Karjala)	4
FI134	Kainuu	7
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	7
RU3D	The Republic of Karelia (Respublika Kareliâ)	N/A

[44] Fifth Report on Economic, Social and Territorial Cohesion 2010.

Figure 56. Share of Natura 2000 areas of total area (%) in Euregio Karelia in 2009.



6.4.2. Environmental capacity

The 5th Cohesion report points out that production of renewable energy has a strong geographical dimension. Solar energy potential is far greater in the southern regions, while the potential of wind power is greatest in areas along the Atlantic and North Sea coasts. The report reminds that regions can play an important role in facilitating and encouraging renewable energy production.

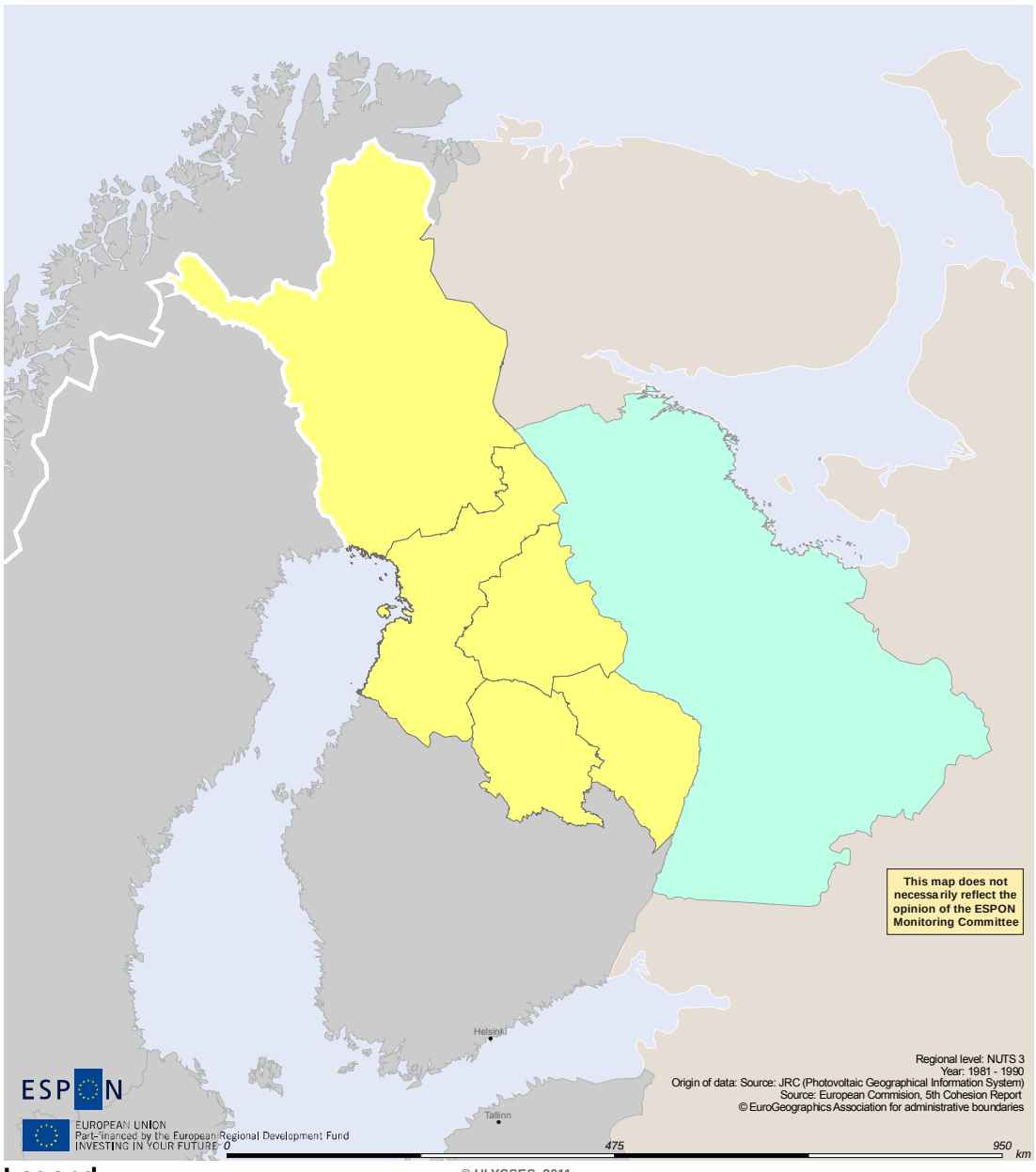
Solar energy resources are in all the regions of Euregio Karelia below national and EU27 average. The potential is approximately 1050 KWh per year, which is well below the leading European regions (Ragusa in Italy with 2027 kWh per year), but also well above European regions with the least solar potential (UK Shetland islands with 922 kWh per year).

Table 44. Solar energy resources in the regions of Euregio Karelia between 1981 and 1990.

NUTS ID	NUTS	Solar energy resources per NUTS 3 regions (kWh per year, 1981-1990)
EU27	(NUTS 2 average)	1304,46
FI	Finland	1094,42
RU	Russia	N/A
FI133	North Karelia (Pohjois-Karjala)	1 046
FI134	Kainuu	1 042
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	1 057
RUD3	The Republic of Karelia (Respublika Kareliâ)	N/A

Figure 57. Solar energy resources (kWh per year) in Euregio Karelia between 1981 and 1990.

Solar energy resources



Legend

Solar energy resources per NUTS 3 regions (kWh per year, 1981-1990)

Average is calculated on the yearly sum of global irradiation on optimally-inclined surface (kWh/m2)

- <= 1100,53
- 1100,54 - 1182,65
- 1182,66 - 1303,99
- 1304,00 - 1595,14
- 1595,15 - 1777,86
- >= 1777,87
- <missing value>

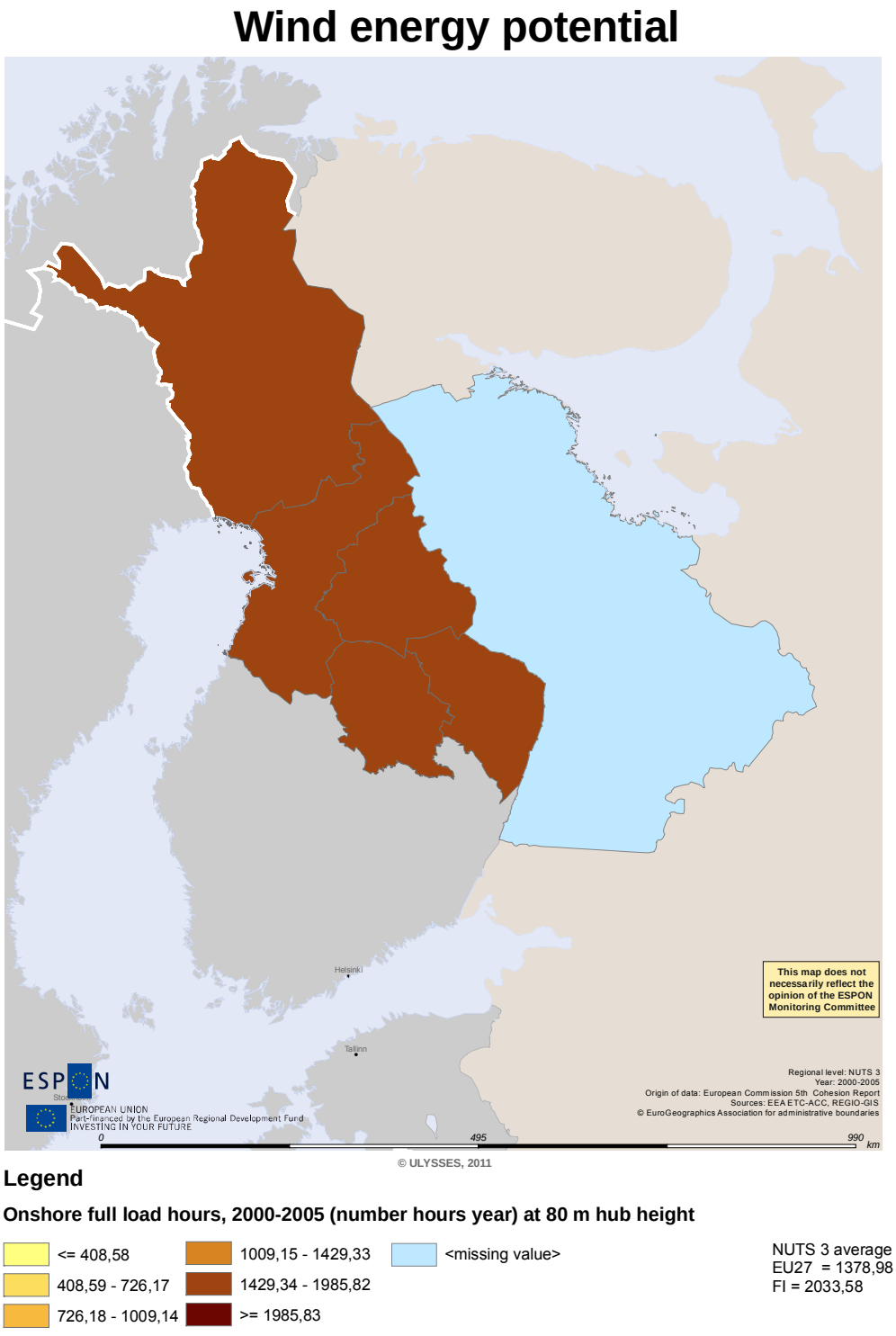
NUTS 3 average
EU 27 = 1.304
FI = 1094,42

Wind energy potential, on the other hand, is above the European average in all the regions of Euregio Karelia. Northern Ostrobothnia with sea shore has the biggest wind energy potential of 1715 onshore full load hours per year.

Table 45. Wind energy potential (onshore full load hours) in Euregio Karelia between 2000 and 2005.

NUTS ID	NUTS	Wind energy potential: onshore full load hours, 2000-2005 (number of hours year) At 80 m hub height.
EU27	(NUTS 2 average)	1378,98
FI	Finland	2033,58
RU	Russia	N/A
FI133	North Karelia (Pohjois-Karjala)	1 532
FI134	Kainuu	1 540
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	1 715
RUD3	The Republic of Karelia (Respublika Kareliâ)	N/A

Figure 58. Wind energy potential (onshore full load hours) in Euregio Karelia between 2000 and 2005.



6.4.3. Climate change

We have studied the sensitivity of the Northern Finland – Russia CBA to climate change based on methods applied in ESPON Climate project (Climate Change and Territorial Effects on Regions and Local Economies in Europe) [45]. The methodology consisted of the main components: "The exposure analysis focused on the climatic changes as such. It made use of existing projections on climate change and climate variability from the CCLM climate model, whose results have been used, among others, by the 4th IPCC assessment report on climate change. Using the IPCC climate scenario A1B (Nakicenovic et al. 2000) the ESPON Climate project aggregated data for two time periods (1961-1990 and 2071-2100) for eight climate stimuli. River flooding and sea level rise were added as two immediate 'triggered effects' of these climate stimuli. Each region was then assessed in regard to its climate change sensitivity. For each sensitivity dimension (physical, environmental, social, economic and cultural) several sensitivity indicators were developed. Each indicator was calculated in absolute and relative terms and then combined." We have selected three following themes for analysis:

- Combined physical sensitivity, which relates to all human artefacts that are important for territorial development and potentially affected by climate change. This includes settlements, roads, railways, airports and harbours. These physical assets of a region are typically adapted to normal regional weather conditions and can withstand smaller climatic changes. However, buildings and infrastructure are sensitive to extreme weather events like flash floods, large scale river floods and coastal storm surges which's frequency and magnitude may change due to climate change.
- Combined social sensitivity, which relates to human populations that may be adversely or positively affected by climate change. In particular, this encompasses climate-related sensitivities in regard to public health and personal mobility. In particular this dimension includes populations sensitive to river flooding, coastal flooding, flash floods and heat (i.e. senior citizen in urban heat islands). These populations are mainly concentrated in Southern European agglomerations and along the coastline, and the most sensitive regions are coastal agglomerations in the Mediterranean.
- Combined economic sensitivity, which relates to economic activities or sectors that are especially sensitive to climatic changes. This includes agriculture and forestry whose economic goods are highly dependent on suitable climate. Tourism, both summer and winter tourism, capitalises on specific climatic conditions. The energy sector is also very sensitive: Power plants need water for cooling and are sensitive to flooding. Private households and the service sector require heating and/or cooling and thus demand more or less energy.

Sensitivities to climate change were generally low in all the regions of Euregio Karelia. Physical sensitivity was slightly higher in Northern Ostrobothnia (0,21) than in North Karelia (0,13) and Kainuu (0,10).

Table 46. Climate sensitivity values for the Finnish regions of Euregio Karelia.

NUTS ID	NUTS	sens_phys	sens_soc	sens_env	sens_cult	sens_econ
FI133	North Karelia (Pohjois-Karjala)	0,13075	0,121373	0,528294	0,132645	0,482306
FI134	Kainuu	0,103853	0,093605	0,564205	0,135309	0,497818
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	0,207093	0,157675	0,597053	0,089436	0,766142

[45] ESPON Climate 2011.

Figure 59. Physical sensitivity to climate change of the regions of Euregio Karelia.

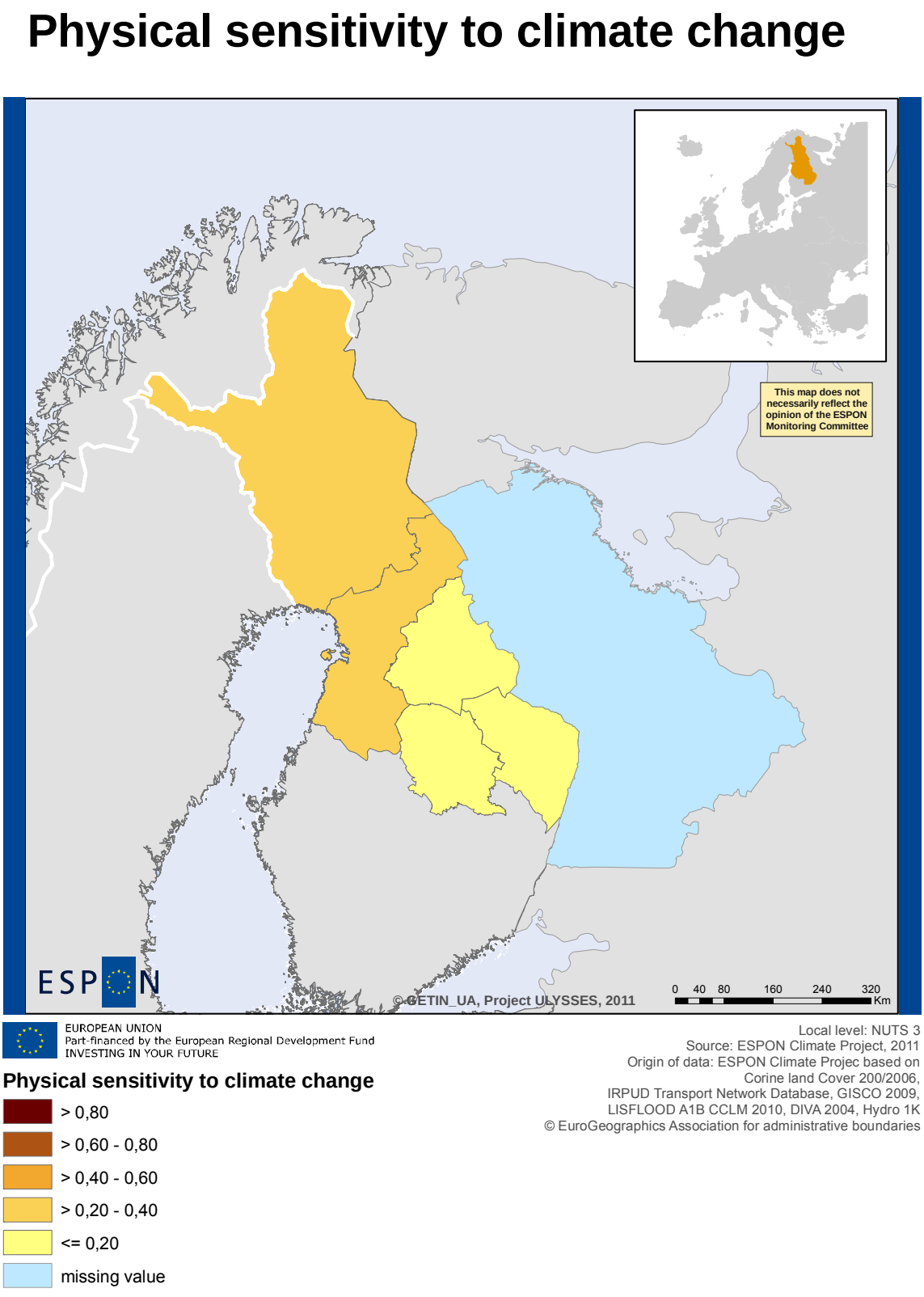


Figure 60. Social sensitivity to climate change in the regions of Euregio Karelia.

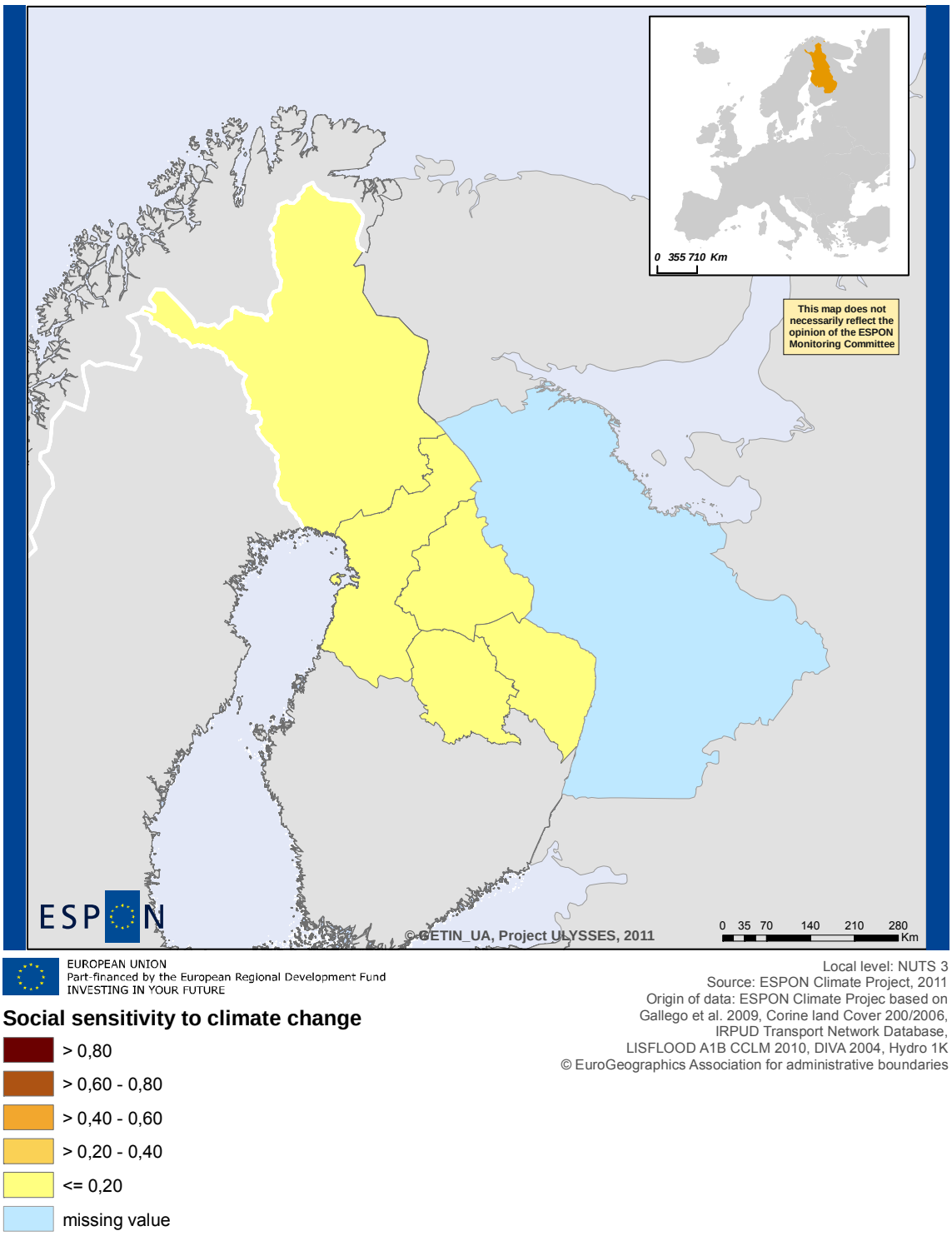
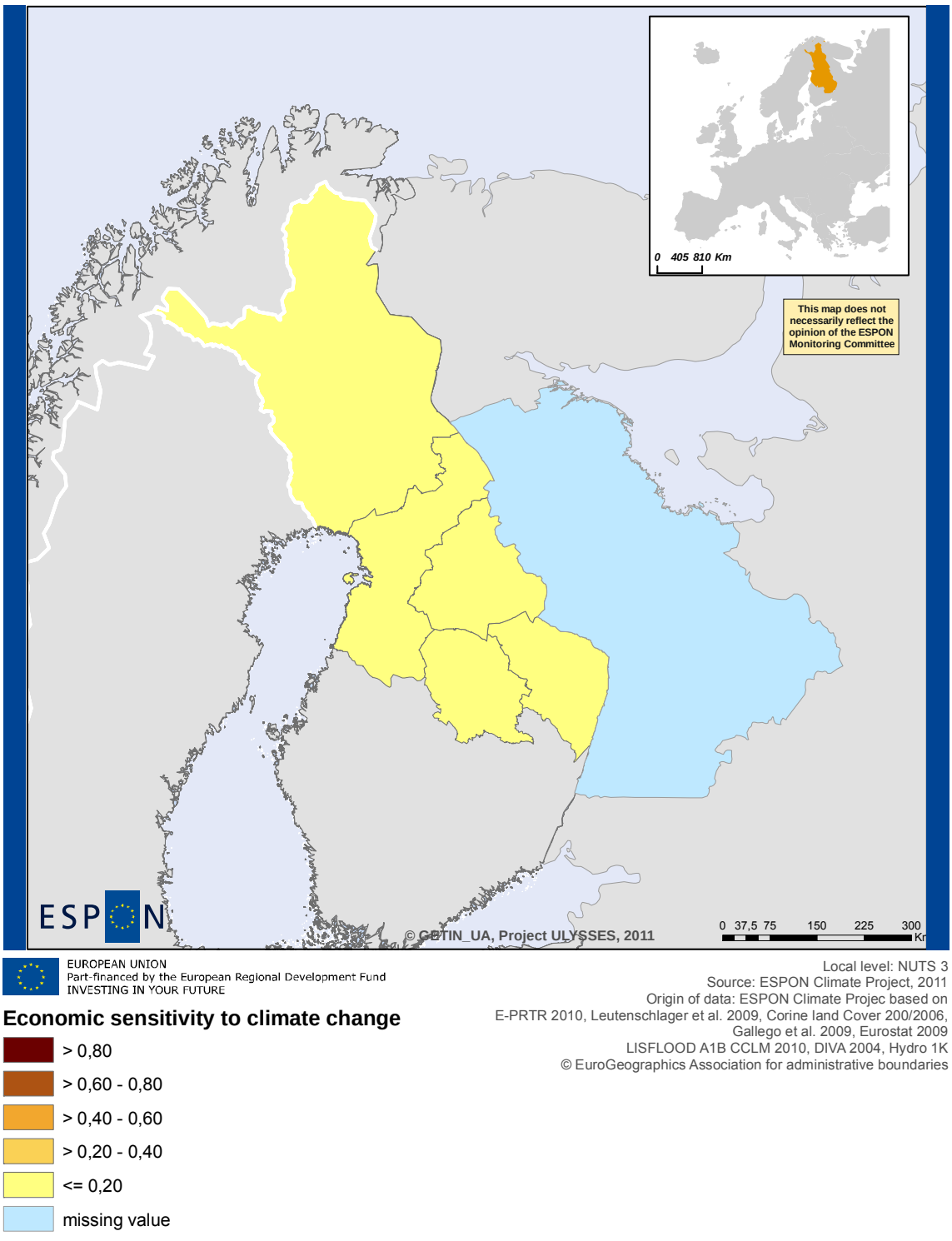


Figure 61. Economic sensitivity to climate change in the regions of Euregio Karelia.



6.5. Chapter conclusions

In this chapter we analysed the behaviour of Northern Finland – Russia CBA from the perspective of Lisbon/Europe 2020 and Gothenburg strategies. Analyses included four subcategories: economy and employment, research and innovation, social cohesion and environment.

The coefficient of deviation, which measures regional disparities in the GDP per capita has been increasing between 1997 and 2008 in the Northern Finland – Russia CBA from 9,2 to 16,4. The coefficient shows significantly lower disparity between the regions of the CBA than between Finnish or ESPON regions in average. It is necessary to remind that this analysis included only the Finnish regions of the Northern Finland – Russia CBA. Had the Republic of Karelia been included in the analysis, the results had been quite the opposite.

We compared NUTS 3 regions of the CBA with the leading region (Inner London West region) in terms of GDP per capita, trough index number analysis. Northern Ostrobothnia was classified as middle income region, while both North Karelia and Kainuu were identified as less developed regions. In the catching up analysis we evaluated the speed of catching-up with the leading region (Inner London West region). Northern Ostrobothnia is the only region that has been classified as a (slow) converging region, while North Karelia and Kainuu had performed as non converging regions. The strongest region of Euregio Karelia, Northern Ostrobothnia, would need 218 years to catch up with the leading region.

The leading economic sector in the North Karelia and Kainuu in 2008 was public administration and community services. Highest share of employment in all the Finnish regions of Euregio Karelia was in 2008 recorded in public administration and community services (L-P).

Total intramural R&D expenditure in Northern Finland (5,38) was higher than the Finnish average, while in Eastern Finland R&D expenditure was below the Finnish and EU average (1,61). Unemployment in Eastern and Northern Finland was slightly above the Finnish and European average in 2010. Concerning other social cohesion indicators, Eastern Finland performed generally weaker than Northern Finland.

We studied environmental performance of the Northern Finland – Russia CBA based on indicators from the European Commission's 5th Cohesion Report and ESPON Climate Project. From the 5th Cohesion Report we selected six indicators; soil sealed area, ozone exceedance, waste water treatment, Natura 2000 areas, solar energy and wind power potential.

In North Karelia 97 km², in Kainuu 100 km² and in Northern Ostrobothnia 415 km² of soil per inhabitant was sealed in 2006. Ozone concentration exceedances were low or non-existence in Euregio Karelia. Urban waste water treatment capacity in the Northern Finland – Russia CBA is slightly above the Finnish and EU averages. The share of NATURA 2000 areas values significantly lower than the average European (EU27). Solar energy potential in the CBA is well below the leading European regions, but also well above European regions with the least solar potential. Wind energy potential, on the other hand, is above the European average in all the regions of Euregio Karelia. Sensitivities to climate change were generally low in all the regions of Euregio Karelia.

Chapter 7. Factor analyses

The aim of the factor analyses was to compare the CBA's territorial profile to the performance of the CBA from the perspective of Lisbon/Europe 2020 Strategy and Gothenburg objectives. Two sets of indicators were established for the analyses: one for territorial profile variables and one for performance variables.

The first set considered variables linked to overall characteristics of the different regions on the themes that where considered in previous chapters (accessibility, rural-urban relationship and demography). Polycentricity was excluded at this point, because instead of using NUTS 3 level as a unit of analysis, it is based on the definition of FUAs and thus is not comparable. On the other hand, indicators that are normally associated with the Lisbon/Europe 2020 and Gothenburg objectives at the input level (such as R&D investment, active population with tertiary education and so forth) have also been included, since the differentiation was made between dependent and independent variables and not merely based on thematic categories. Unlike most studies on innovation, the EPO patent applications have also been included at this level. This is because, although they can be understood as an output of innovation, innovation in itself is an input of economic performance.

Table 47. Indicators for the study of territorial profile of the Northern Finland – Russia CBA.

Indicator	UNITS	Year	Geographical unit
Population density	inhabitant/km2	2009	NUTS 3
Crude rate of pop increase	per 1000	2008	NUTS 3
Crude rate net migration	per 1000	2008	NUTS 3
Crude rate of natural increase	per 1000	2008	NUTS 3
Young age dependency	%	2008	NUTS 3
Old age dependency	%	2008	NUTS 3
Total fertility rate		2008	NUTS 2
Commuters to other region	per 1000	2009	NUTS 2
Rural typology	nominal	2008	NUTS 3
Percent_agric_area	%	2006	NUTS 3
Annual growth rate 90-06 agricultural areas	per 10000	1900-2006	NUTS 3
Net formation of urban fabric by total area 00-06	per 10000	1900-2006	NUTS 3
Potential accessibility by air index	%	2006	NUTS 3
Potential accessibility by rail index	%	2006	NUTS 3
Potential accessibility by road index	%	2006	NUTS 3
Change of the standardized rail index	%	2001-2006	NUTS 3
Change of the standardized road index	%	2001-2006	NUTS 3
Change of the standardized air index	%	2001-2006	NUTS 3
Share of employment in agriculture and fishing (A_B)	%	2008	NUTS 3
Share of employment in industry (except construction) (C-E)	%	2008	NUTS 3
% employment in construction (F)	%	2008	NUTS 3
% employment in wholesale and retail trade; hotels and restaurants; transport (G-I)	%	2008	NUTS 3

% employment financial intermediation; real estate (J_K)	%	2008	NUTS 3
% employment in public administration and community services; activities of households (L-P)	%	2008	NUTS 3
Agriculture; fishing (A_B)	%	2008	NUTS 3
Industry (except construction) (C-E)	%	2008	NUTS 3
Construction (F)	%	2008	NUTS 3
Wholesale and retail trade; hotels and restaurants; transport (G-I)	%	2008	NUTS 3
Financial intermediation; real estate (J_K)	%	2008	NUTS 3
Public administration and community services; activities of households (L-P)	%	2008	NUTS 2
Total intramural R&D expenditure by GDP	%	2007	NUTS 2
Intramural R&D expenditure of business enterprise sector by GDP	%	2007	NUTS 2
intramural R&D expenditure government sector by GDP	%	2007	NUTS 2
intramural R&D expenditure higher education sector by GDP	%	2007	NUTS 2
EPO patents per million of inhabitants by GDP	%	2007	NUTS 2
Employed persons in high and medium tech manufacturing activities by total workforce (EU 25 = 100)	%	2004	NUTS 2
Population aged 25-64 with tertiary education	%	2010	NUTS 2
Physical sensitivity to climate change	rate	n/a	NUTS 3
Social sensitivity to climate change	rate	n/a	NUTS 3
Environmental sensitivity to climate change	rate	n/a	NUTS 3
Cultural sensitivity to climate change	rate	n/a	NUTS 3
Economic sensitivity to climate change	rate	n/a	NUTS 3

The second set considered variables linked to the performance of the regions concerning indicators related to the Lisbon/Europe 2020 and Gothenburg indicators at the output level.

Table 48. Indicators for the study of territorial performance of the Northern Finland – Russia CBA.

Indicator	UNITS	Year	Geographical unit
Unemployment rate	%	2008	NUTS 3
Long-term unemployment rate (>=12 months)	%	2009	NUTS 2
Youth unemployment rate, per labor force aged 15-24	%	2008	NUTS 3
Infant mortality rate	%	2008	NUTS 2
GDP per capita indexed EU average	%	2008	NUTS 3
Catching-up	nominal	1997-2008	NUTS 3
Natura 2000 area	%	2006	NUTS 3
Ozone concentration exceedance, per year	%	2008	NUTS 3
Waste water treatment capacity	%	2007	NUTS 2
Soil sealed area	%	2006	NUTS 3

In order to analyse the relations between the territorial profile and the regions performance, two different analysis where performed. First, a factor analysis for each set of indicators. Second, several multiple linear regressions having as independent variables each factor of the performance indicators and as dependent variables all the factors of the territorial profile.

7.1. Centrality (FAC1_1)

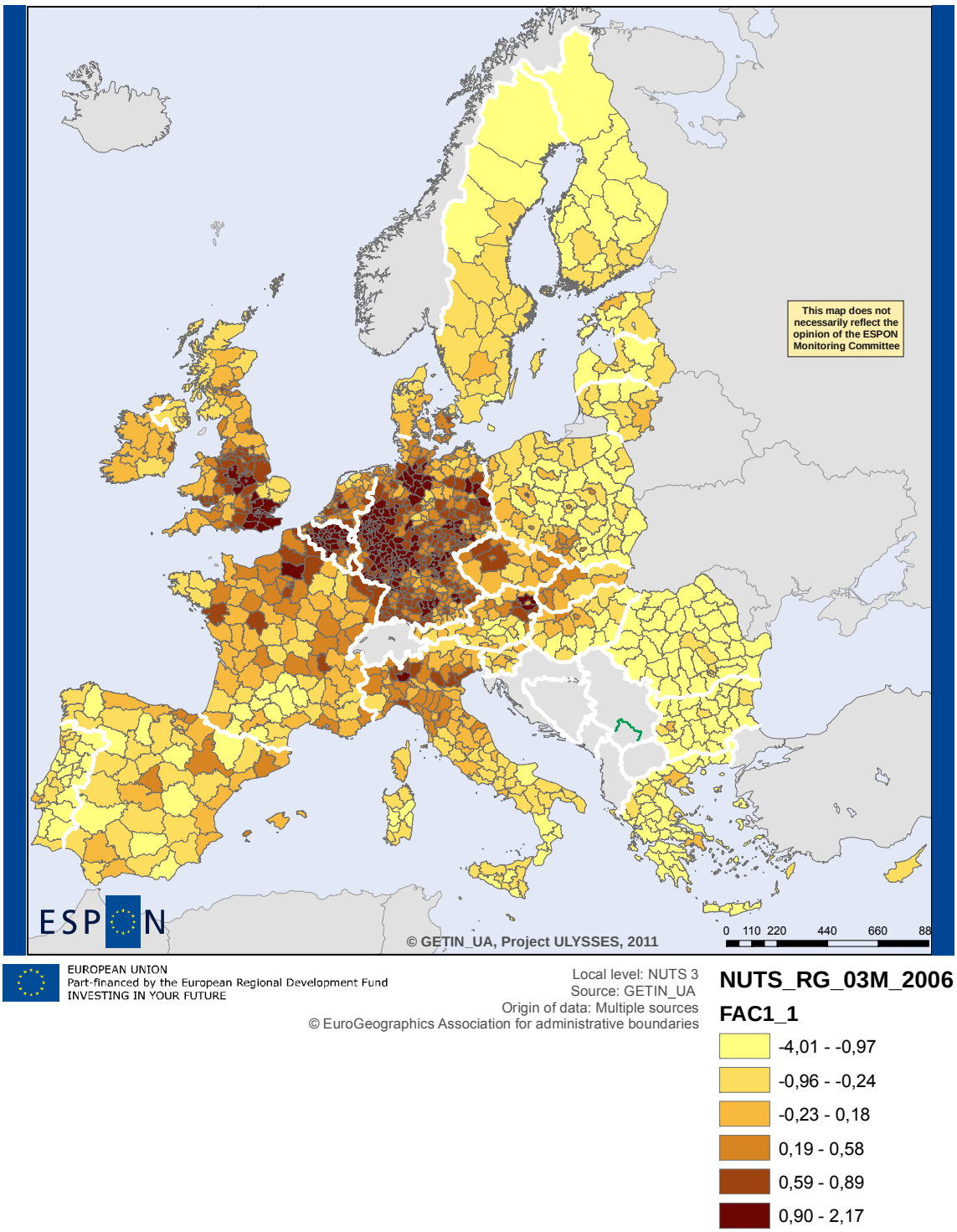
The first factor essentially expresses central location and has an explained variance of %14,83. It has high positive correlations with all the indicators regarding potential accessibility and, to a lesser extent, with the share of employment in financial intermediation and real estate, employment in high and medium tech manufacturing activities and with commuting to other regions. It also has a strong negative correlation with the share of employment and GVA in agriculture and fishing.

This factor has its highest values in central European countries, especially in the Ruhr, Belgium and Southern England, in a pattern that clearly lines out the blue banana. In the less central region, the higher values tend to be concentrated around capitals and other major urban agglomerations. This is valid also Euregio Karelia, where all the regions are below country average and the average of all the studied countries.

Table 49. Results of analysis on Centrality FAC1_1 in Euregio Karelia.

NUTS ID	NUTS	FAC1					
		Scores	Country comparison (weighted NUTS 3 average)			Country /CBA country level (+ -)	Percentile all NUTS 3
CS4			RU	FI	All CBA countries		
All	All Countries	-0,96					20
RU	Russia						
FI	Finland	-0,96		0,00	0,00		20
FI133	North Karelia (Pohjois-Karjala)	-1,43		-0,47	-0,47	- -	20
FI134	Kainuu	-1,66		-0,70	-0,70	- -	20
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	-1,59		-0,63	-0,63	- -	20
RU3D	The Republic of Karelia (Respublika Kareliâ)						

Figure 62. Results of analysis on Centrality FAC1_1 in Euregio Karelia.



7.2. Research and development (FAC2_1)

The explained variance of the research and development factor is % 8,04 and it mainly relates variables that are linked to innovation and scientific development such as R&D investment of different sectors and, to a lesser extent, EPO patent applications and tertiary educated active population. As said in the introduction, the indicators in this factor are mostly available on a NUTS 2 level, meaning that a very high score in a specific NUTS 3 can lead to a whole cluster with high values.

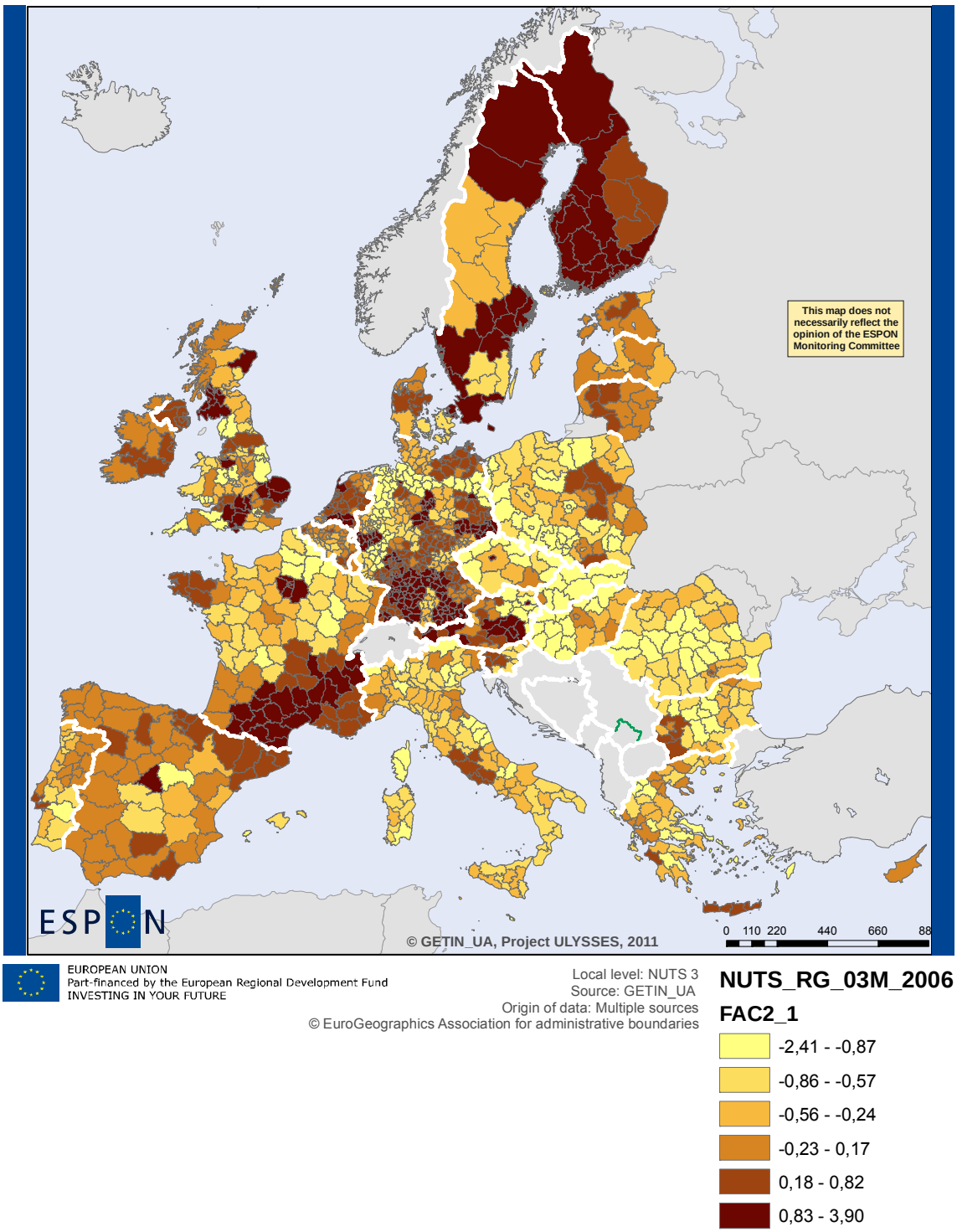
It is interesting to note that, besides the capital cities, it is possible to identify specific innovation strongholds such as important university towns or high tech industries (Airbus in the Toulouse area, Volkswagen around Wolfsburg, Cambridge or the Silicon Glen). The Scandinavian countries also have a very favourable position in this factor.

In Euregio Karelia Northern Ostrobothnia is the only region performing better in research and development analysis that basically confirms the previous analyses conducted in this study on this topic.

Table 50. Results of analysis on Research and development (FAC2_1)in Euregio Karelia.

NUTS ID	NUTS	FAC2					
		Scores	Country comparison (weighted NUTS 3 average)			Country /CBA country level	Percentile all NUTS 3
CS4			RU	FI	All CBA countries		
All	All Countries	1,85					95
RU	Russia						
FI	Finland	1,85		0,00	0,00		95
FI133	North Karelia (Pohjois-Karjala)	0,69		-1,15	-1,15	- -	95
FI134	Kainuu	0,79		-1,05	-1,05	- -	95
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	2,99		1,14	1,14	+ +	> 95
RU3D	The Republic of Karelia (Respublika Kareliâ)						

Figure 63. Results of analysis on Research and development (FAC2_1) in Euregio Karelia.



7.3. Administrative centres (FAC3_1)

The indicators with the highest coefficients of correlation of this factor are the share employment and GVA in public administration, community services and activities of household and the share of employment and GVA in industry. Its explained variance is % 8,36.

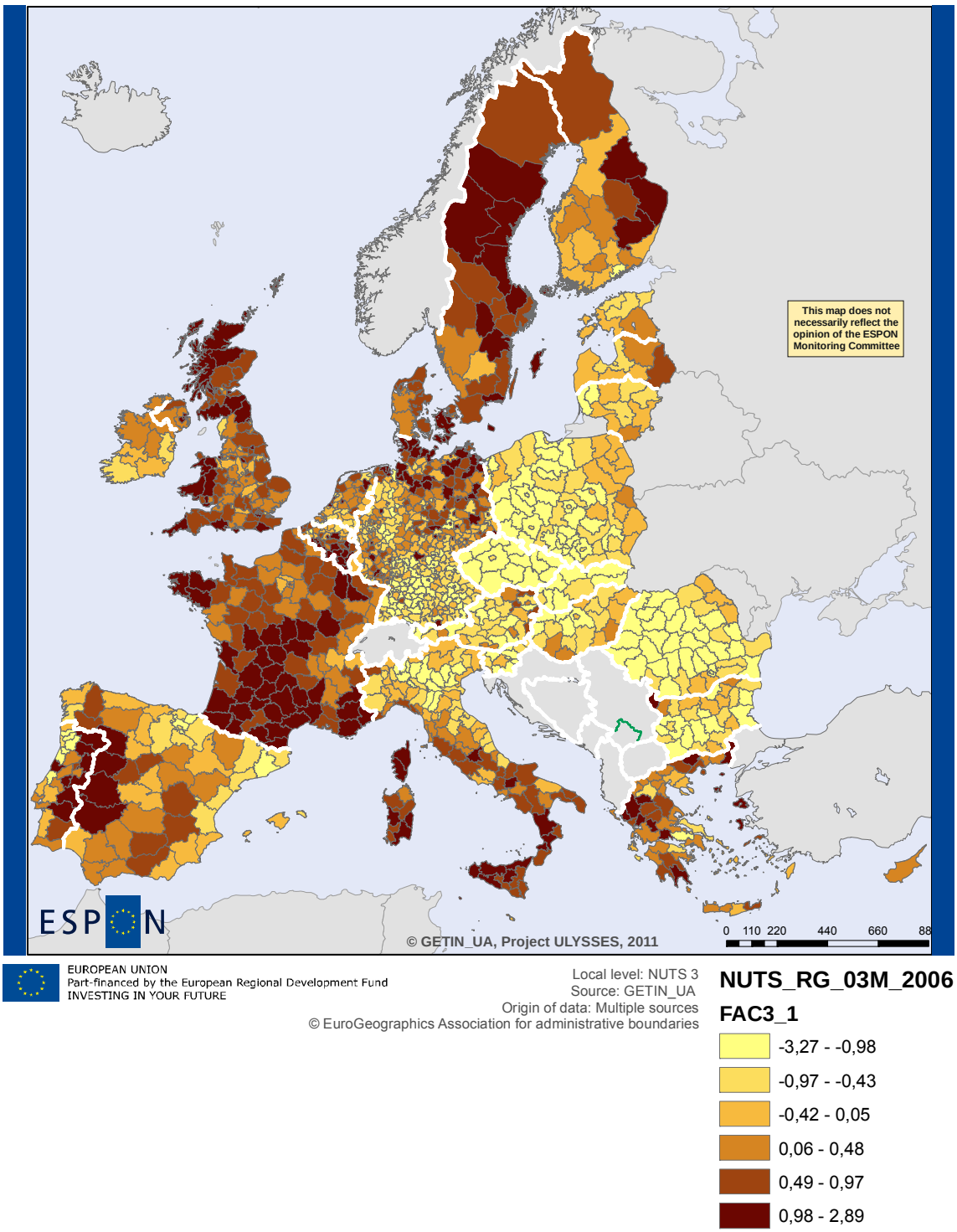
The regions with the highest scores of this factor are highly depressed regions in which, because of their poor economic performance, the public sector assumes an important position. It is interesting to see that most of the border NUTS 3 in Spain and Portugal have very high scores in this factor, as well as Karelia. The other cross-border regions seem to be closer to the national patterns.

On a different note, this indicator also relates to the different levels of state interventionism, with the Scandinavian countries and France revealing overall high scores. In Euregio Karelia Northern Ostrobothnia scored the weakest results and Kainuu the highest. This again reflects the earlier presented GVA and employment statistics for these regions.

Table 51. Results of analysis on Administrative centres (FAC3_1) in Euregio Karelia.

NUTS ID	NUTS	FAC3					
		Scores	Country comparison (weighted NUTS 3 average)			Country /CBA country level	Percentile all NUTS 3
CS4			RU	FI	All CBA countries		
All	All Countries	0,09					80
RU	Russia						
FI	Finland	0,09		0,00	0,00		80
FI133	North Karelia (Pohjois-Karjala)	1,04		0,95	0,95	+ +	95
FI134	Kainuu	1,60		1,50	1,50	+ +	> 95
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	-0,04		-0,14	-0,14	- -	50
RU3D	The Republic of Karelia (Respublika Kareliâ)						

Figure 64. Results of analysis on Administrative centres (FAC3_1) in Euregio Karelia.



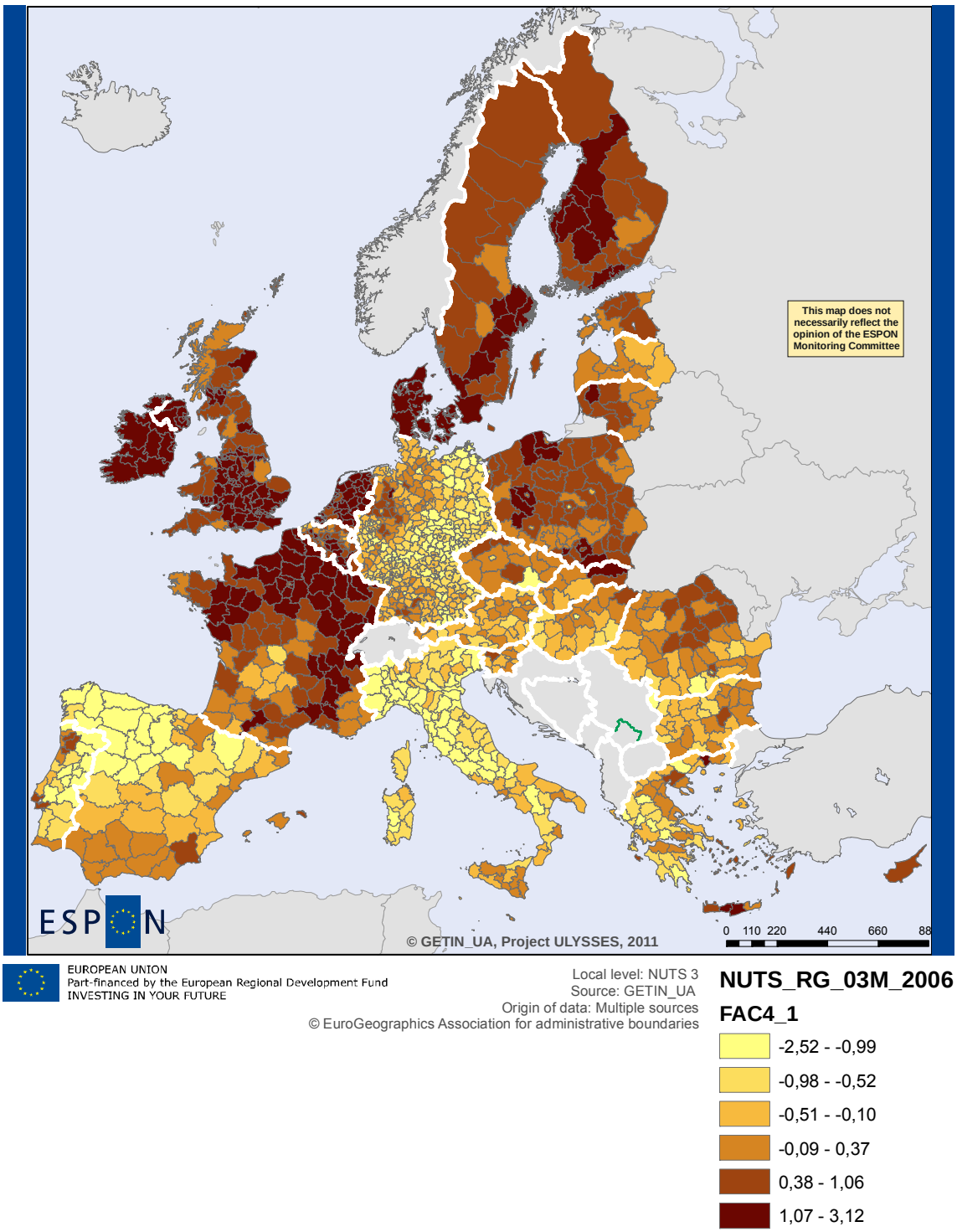
7.4. Demographic dynamism (FAC4_1)

This factor has an explained variance of % 7,22. The variables with the highest coefficient of correlation are young age dependency rate, the crude rate of natural population increase, the total fertility rate and the old age dependency rate (this last one has a negative correlation). The region with the lowest scores of this factor are in the Mediterranean countries, such as Portugal, Spain and Greece as well as Germany. In Euregio Karelia the best performance in demographic dynamism has Northern Ostrobothnia, while the Kainuu has the lowest dynamism.

Table 52. Results of analysis on Demographic dynamism (FAC4_1) in Euregio Karelia.

NUTS ID	NUTS	FAC4					
		Scores	Country comparison (weighted NUTS 3 average)			Country /CBR country level	Percentile all NUTS 3
CS4			RU	FI	All CBR countries		
All	All Countries	1,11					5
RU	Russia						
FI	Finland	1,11		0,00	0,00		5
FI133	North Karelia (Pohjois-Karjala)	0,52		-0,60	-0,60	- -	5
FI134	Kainuu	0,40		-0,71	-0,71	- -	5
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	2,40		1,29	1,29	+ +	5
RU3D	The Republic of Karelia (Respublika Kareliâ)						

Figure 65. Results of analysis on Demographic dynamism (FAC4_1) in Euregio Karelia.



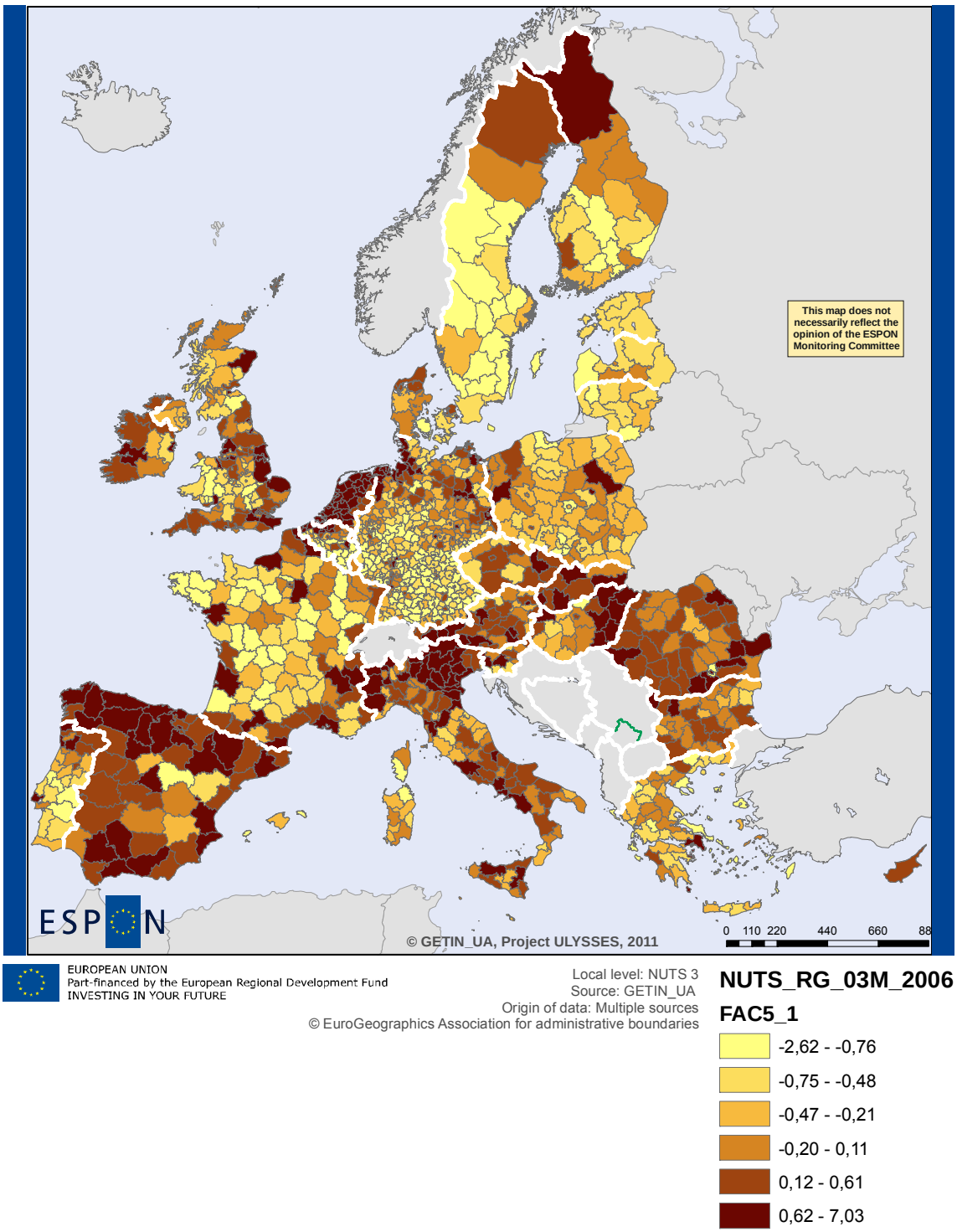
7.5. Environmental risks (FAC5_1)

This factor relates mainly to variables linked to the regions' sensitivity to climate change. As can be seen in the map, these regions are essentially located in coastal areas and other flood prone areas, such as areas close to the Danube or the Po. The regions of Euregio Karelia have a lower sensibility to climate change that Finnish or European regions in general.

Table 53. Results of analysis on Environmental risks (FAC5_1) in Euregio Karelia.

NUTS ID	NUTS	FAC5					
		Scores	Country comparison (weighted NUTS 3 average)			Country /CBR country level	Percentile all NUTS 3
CS4			RU	FI	All CBR countries		
All	All Countries	-0,42					50
RU	Russia						
FI	Finland	-0,42		0,00	0,00		50
FI133	North Karelia (Pohjois-Karjala)	-0,13		0,29	0,29	+ +	80
FI134	Kainuu	-0,18		0,24	0,24	+ +	80
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	-0,11		0,30	0,30	+ +	80
RU3D	The Republic of Karelia (Respublika Kareliâ)						

Figure 66. Results of analysis on Environmental risks (FAC5_1) in Euregio Karelia.



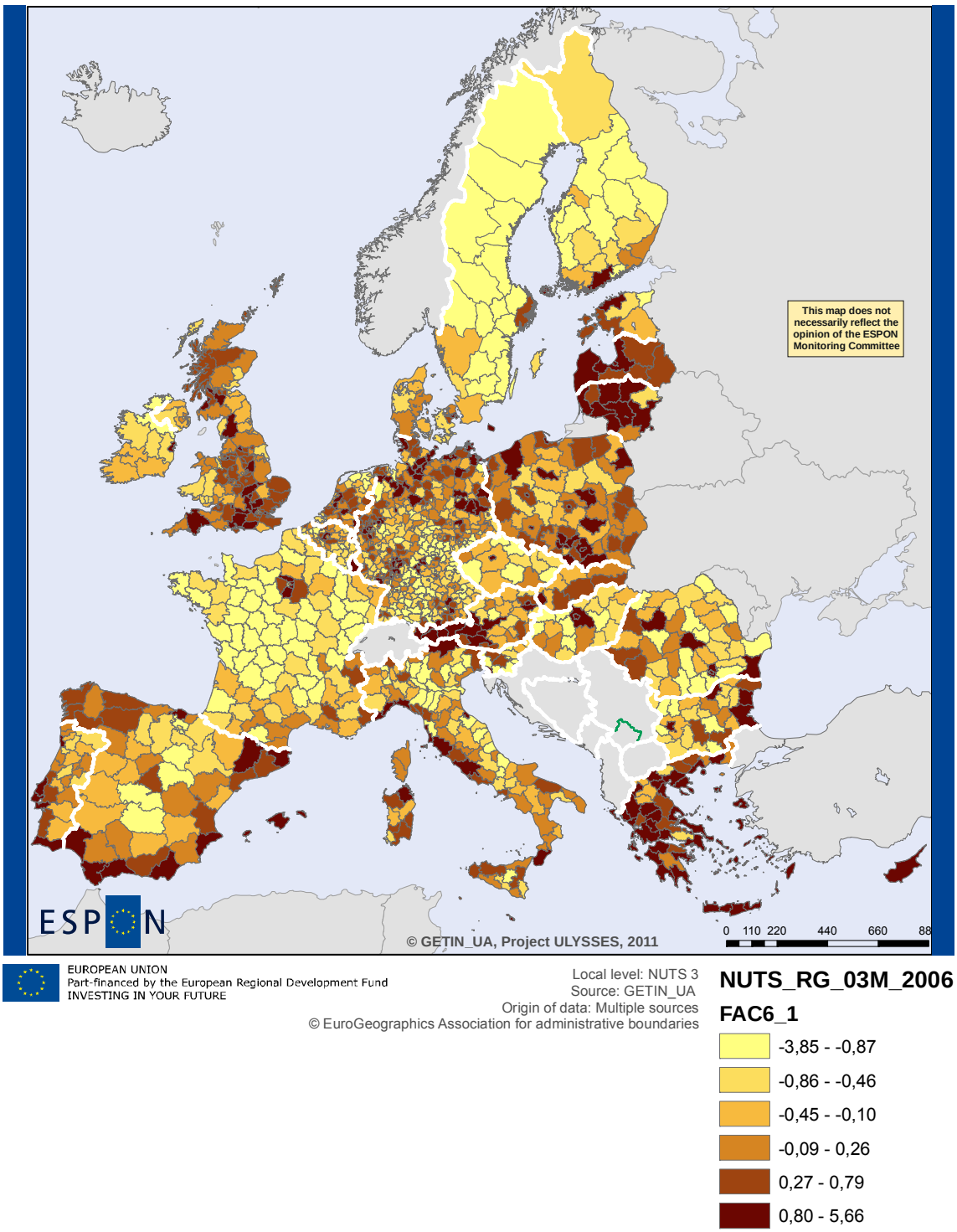
7.6. Services and transport (FAC6_1)

The significant indicators of this factor are the share of GVA and employment in wholesale and retail trade, hotels and restaurants and transport (NACE G-I). Many of the regions with the high scores in this factor seem to be linked to tourism (Southern Spain and Portugal, the alpine regions, Paris, Greece, Rome, etc.). The significance of services and transport in Euregio Karelia seems low according to these analysis, since all its regions score significantly lower than the Finnish or European average,

Table 54. Results of analysis on Services and transport (FAC6_1) in Euregio Karelia.

NUTS ID	NUTS	FAC6					
		Scores	Country comparison (weighted NUTS 3 average)			Country /CBR country level	Percentile all NUTS 3
CS4			RU	FI	All CBR countries		
All	All Countries	-0,22					50
RU	Russia						
FI	Finland	-0,22		0,00	0,00		50
FI133	North Karelia (Pohjois-Karjala)	-1,19		-0,97	-0,97	- -	20
FI134	Kainuu	-1,20		-0,98	-0,98	- -	20
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	-1,19		-0,97	-0,97	- -	20
RU3D	The Republic of Karelia (Respublika Kareliâ)						

Figure 67. Results of analysis on Services and transport (FAC6_1) in Euregio Karelia.



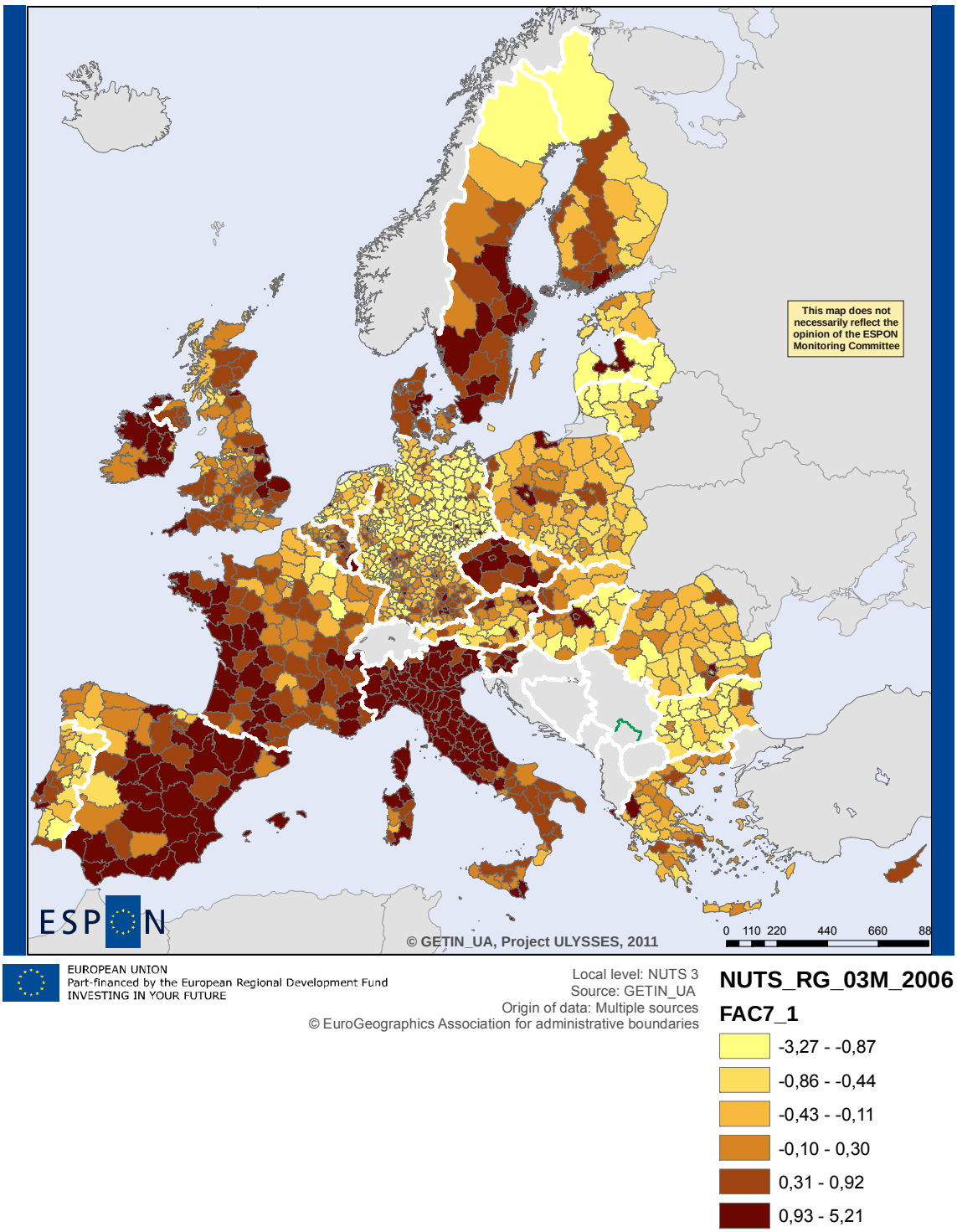
7.7. Immigration (FAC7_1)

The highly correlated variables of the factor 7 are population growth and net migration rate. While many regions in Central and Western Europe show high scores in this factor, in the eastern countries the high scores are generally restricted to the capital cities. In Portugal border regions in general (and Alentejo in particular) have much lower values than the coastal regions, suggesting an internal migrations process towards the coast. In Finland an extra analysis of migration flows should be added to the study, so that differences in migration patterns between the regions of Euregio Karelia could be revealed.

Table 55. Results of analysis on Immigration (FAC7_1) in Euregio Karelia.

NUTS ID	NUTS	FAC7					
		Scores	Country comparison (weighted NUTS 3 average)			Country /CBR country level	Percentile all NUTS 3
CS4			RU	FI	All CBR countries		
All	All Countries	0,45					80
RU	Russia						
FI	Finland	0,45		0,00	0,00		80
FI133	North Karelia (Pohjois-Karjala)	-0,50		-0,95	-0,95	- -	50
FI134	Kainuu	-0,86		-1,31	-1,31	- -	20
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	0,59		0,14	0,14	+ +	80
RU3D	The Republic of Karelia (Respublika Kareliâ)						

Figure 68. Results of analysis on Immigration (FAC7_1) in Euregio Karelia.



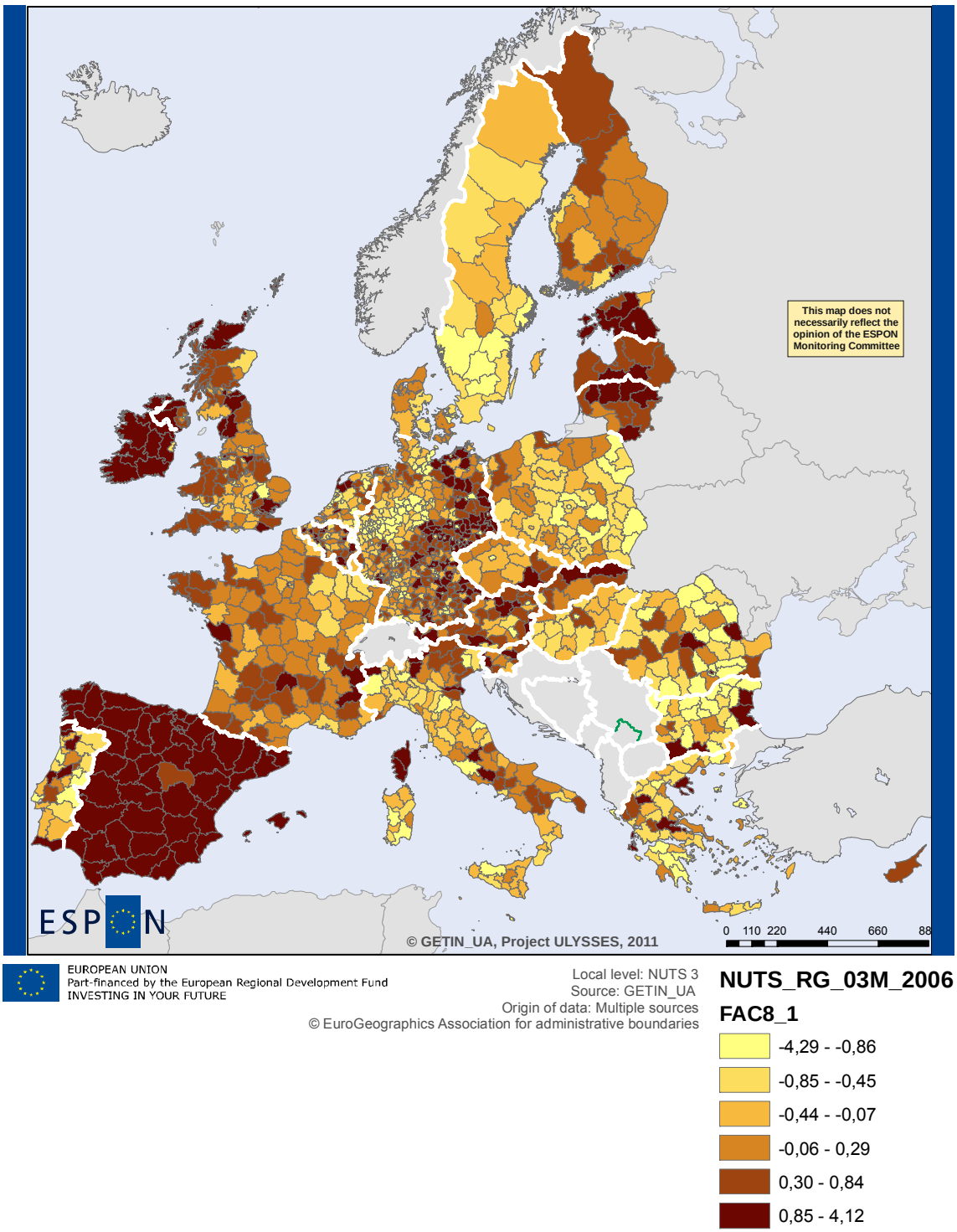
7.8. Construction (FAC8_1)

The highly correlated variables of this factor are GVA and employment in construction. The regions with the highest score in this factor belong to Ireland, Spain, the Baltic States and Eastern Germany. In Euregio Karelia the highest score is received by Northern Ostrobothnia and the lowest by Kainuu.

Table 56. Results of analysis on Construction (FAC8_1) in Euregio Karelia.

NUTS ID	NUTS	FAC8					
		Scores	Country comparison (weighted NUTS 3 average)			Country /CBR country level	Percentile all NUTS 3
CS4			RU	FI	All CBR countries		
All	All Countries	-0,06					80
RU	Russia						
FI	Finland	-0,06		0,00	0,00		80
FI133	North Karelia (Pohjois-Karjala)	0,25		0,31	0,31	+ +	80
FI134	Kainuu	0,02		0,09	0,09	+ +	80
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	0,33		0,39	0,39	+ +	80
RU3D	The Republic of Karelia (Respublika Kareliâ)						

Figure 69. Results of analysis on Construction (FAC8_1) in Euregio Karelia.



7.9. Unemployment (FAC1_2)

The first component explains % 24,19 of the variance and its highly correlated variables are unemployment, long-term unemployment and youth unemployment. The geographical distribution of this factor's scores show a concentration of the highest values in the more depressed areas of Europe and countries with a structurally high unemployment such as (e.g. Southern Italy and Spain, Eastern Germany, Slovakia and Greece). Regions which used to have a strong industrial base also evidence relatively high scores in this factor, namely some regions in northern France and Portugal, Wallonia, the Setúbal Peninsula, Liverpool and Manchester.

In some border-areas, the regions seem to have higher scores in this indicator than the more centrally located regions. This is the case in Portugal, on the northern border of France and Bulgaria, Finnish Karelia or the Czech Republic where it borders eastern Germany. The previously presented unemployment statistics in the regions of Euregio Karelia support the results of this analysis.

Table 57. Results of analysis on Unemployment (FAC1_2) in Euregio Karelia.

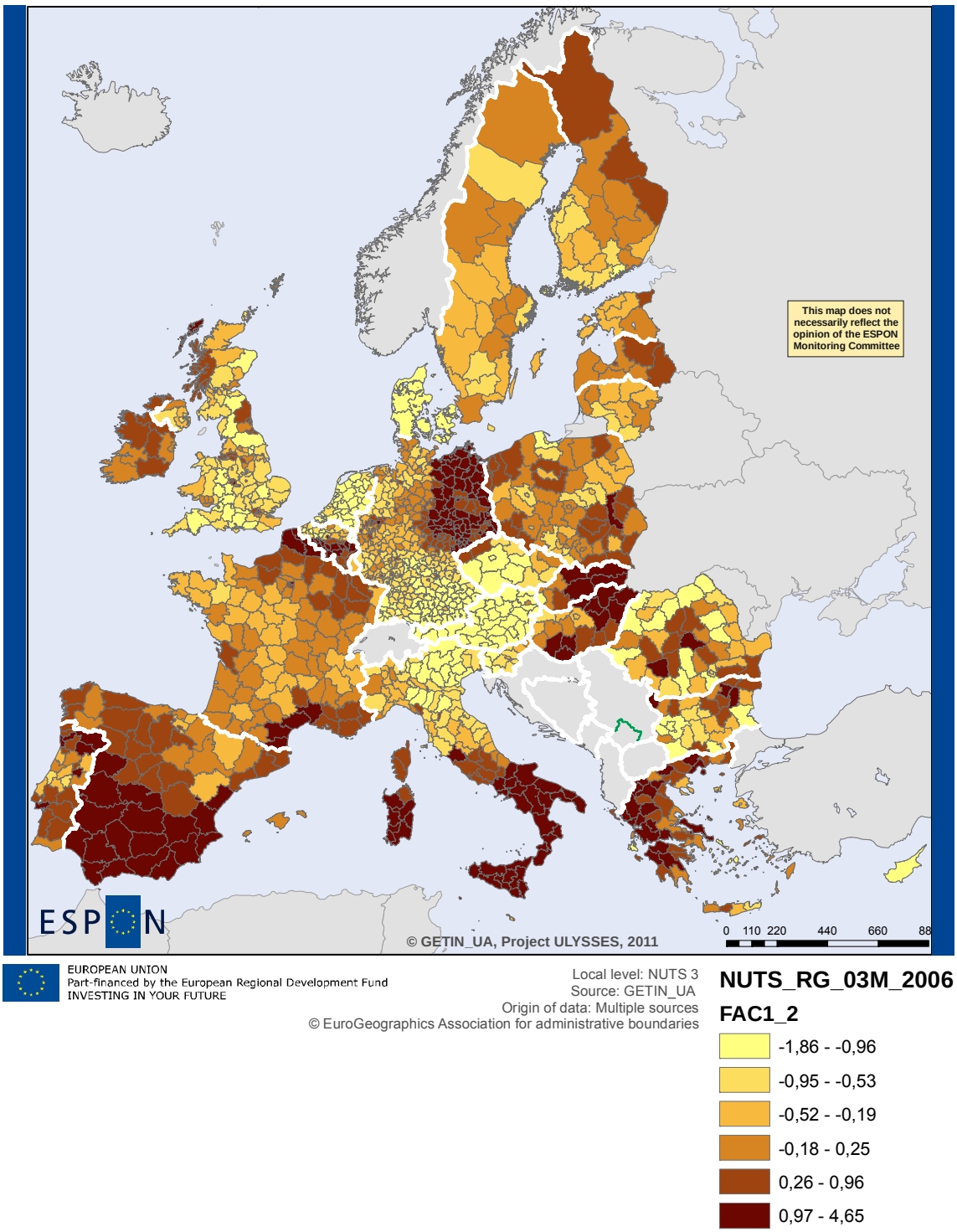
NUTS ID	NUTS		FAC1_2					
		Percentile all NUTS 3	Scores	Country comparison (weighted NUTS 3 average)			Country /CBR country level	Percentile all NUTS 3
CS4				RU	FI	All CBR countries		
All	All Countries	20	-0,38					50
RU	Russia							
FI	Finland	20	-0,38		0,00	0,00		50
FI133	North Karelia (Pohjois-Karjala)	5	0,59		0,97	0,97	+ +	80
FI134	Kainuu	5	0,56		0,94	0,94	+ +	80
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	5	-0,11		0,26	0,26	+ +	80
RU3D	The Republic of Karelia (Respublika Kareliâ)							

From the regression it is possible to see that, although the overall variation of the factor that is explained by the context factors is small its relation to most of them is statistically significant. The coefficients indicate that high levels of unemployment have a strong negative relation to a high investment in R&D, demographic dynamism, central locations and high levels of immigration. As expected, the factor referring to administrative centres has a significant and positive impact and unemployment.

Regression Statistics	
Multiple R	0,59374
R Square	0,35252
Adjusted R Square	0,34699
Standard Error	0,80809
Observations	1298

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	-3,4E-09	0,022430	-1,5E-07	1	-0,0440	0,0440	-0,0440	0,0440
FAC1_1	-0,13913	0,022438	-6,20045	7,57172E-10	-0,1831	-0,0951	-0,1831	-0,0951
FAC2_1	-0,17056	0,022438	-7,60142	5,62205E-14	-0,2146	-0,1265	-0,2146	-0,1265
FAC3_1	0,35445	0,022438	15,79682	1,64522E-51	0,3104	0,3985	0,3104	0,3985
FAC4_1	-0,17954	0,022438	-8,00162	2,72054E-15	-0,2236	-0,1355	-0,2236	-0,1355
FAC5_1	-0,01938	0,022438	-0,86369	0,387920516	-0,0634	0,0246	-0,0634	0,0246
FAC6_1	0,04804	0,022438	2,140949	0,032465709	0,0040	0,0921	0,0040	0,0921
FAC7_1	-0,12934	0,022438	-5,76408	1,02676E-08	-0,1734	-0,0853	-0,1734	-0,0853
FAC8_1	0,07384	0,022438	3,29098	0,001025468	0,0298	0,1179	0,0298	0,1179
FAC9_1	-0,16827	0,022438	-7,49914	1,19255E-13	-0,2123	-0,1242	-0,2123	-0,1242
FAC10_1	-0,29276	0,022438	-13,0475	1,24326E-36	-0,3368	-0,2487	-0,3368	-0,2487
FAC11_1	-0,08551	0,022438	-3,81081	0,000145058	-0,1295	-0,0415	-0,1295	-0,0415

Figure 70. Results of analysis on Unemployment (FAC1_2) in Euregio Karelia.



7.10. Catching-up regions (FAC2_2)

The total explained variance of this factor is %18,71 and its most significant variable is catching-up. This indicator relates the GDP level and growth between 1997 and 2008 of a given region to the pattern evidenced by the leading region. Its correlated variables also include urban waste water treatment capacity and infant mortality.

As can be seen on the map that the correlation between high GDP growth and poor social conditions is essentially a consequence of a very high growth rate witnessed by the eastern European countries throughout the late 1990 and early 2000 (some countries even had occasional double digit growth rates), while the central European countries, although starting from a high initial position, witnessed relatively small growth rates. The overall pattern of the border regions seem to essentially follow the national tendency.

Table 58. Results of analysis on Catching-up regions (FAC2_2) in Euregio Karelia.

NUTS ID	NUTS	FAC2_2					
		Scores	Country comparison (weighted NUTS 3 average)			Country /CBR country level	Percentile all NUTS 3
CS4			RU	FI	All CBR countries		
All	All Countries	-0,09					80
RU	Russia						
FI	Finland	-0,09		0,00	0,00		80
FI133	North Karelia (Pohjois-Karjala)	-0,48		-0,39	-0,39	- -	50
FI134	Kainuu	-0,51		-0,42	-0,42	- -	50
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	-0,18		-0,09	-0,09	- -	80
RU3D	The Republic of Karelia (Respublika Kareliâ)						

As said above, the negative correlation of the catching-up indicator with other performance indicators in this factor is essentially linked to the high growth rates of the eastern countries in the initial decades of their transition to a market economy. As this is an historic contingency and does not follow a deeper causal nexus, the regression analysis was made only for the catching-up indicators.

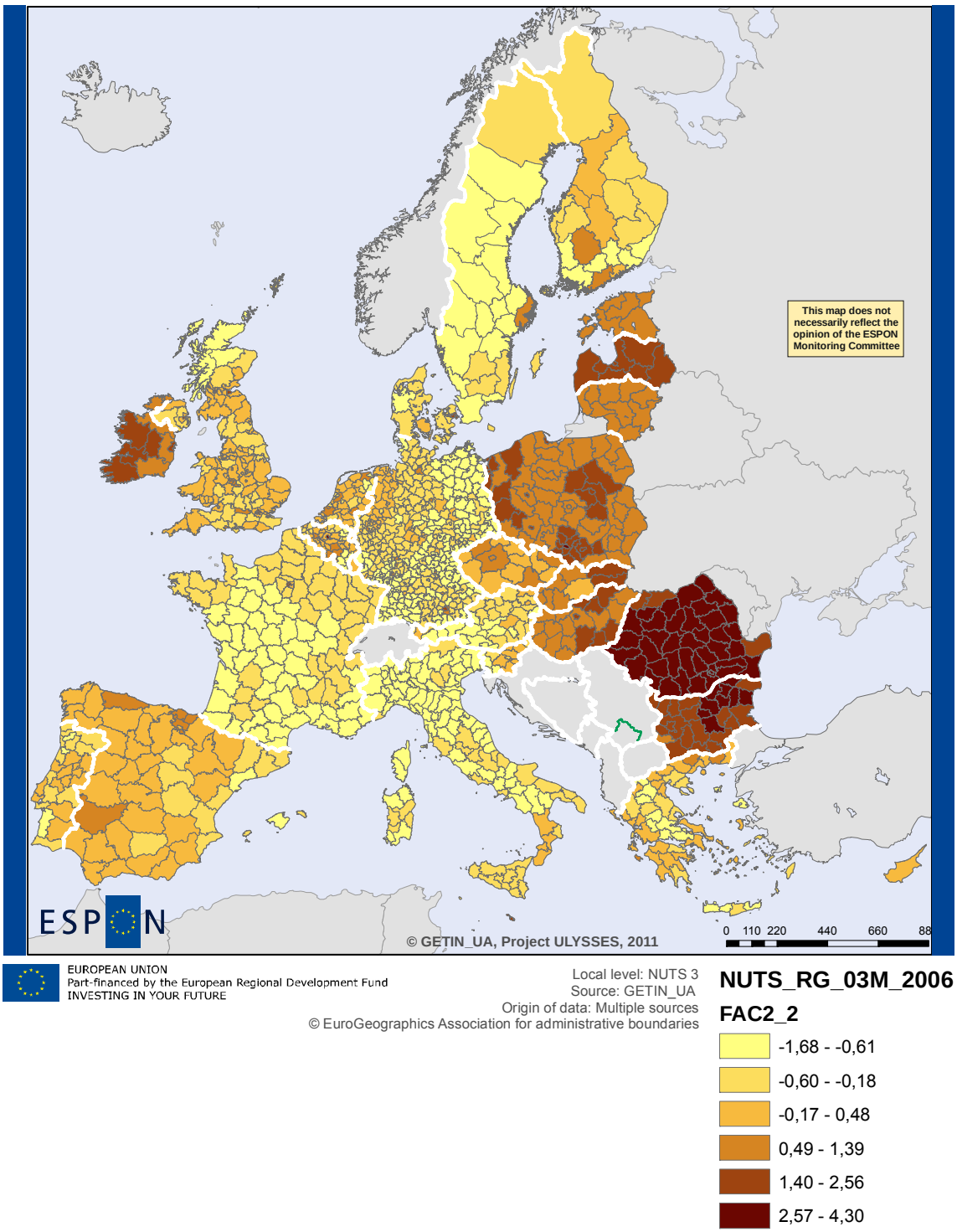
The regression of this indictor, which has a slightly higher R square then the previous one, shows that it is statistically related to many components of the territorial profile. Confirming what has previously been said about this indicator, the catching up process is especially strong in eastern countries and therefore the highest negative coefficients occur in factor 1 (central location) and factor 3 (administrative centres). On the other hand, in central Europe the regions which perform best in this indicator are the ones located in the blue banana and, even in Eastern Europe, the top performing regions tend to be the more central ones.

This might explain why the catching-up process is also negatively related to rurality (factor 9 - low density and growth of agricultural areas).

Regression Statistics	
Multiple R	0,6261119
R Square	0,3920161
Adjusted R Square	0,3868156
Standard Error	0,7830609
Observations	1298

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	-6,26829E-08	0,0217	-2,884E-06	0,9999977	-0,043	0,043	-0,043	0,043
FAC1_1	-0,352	0,0217	-16,197241	7,7102E-54	-0,395	-0,310	-0,395	-0,310
FAC2_1	-0,102	0,0217	-4,7047433	2,8164E-06	-0,145	-0,060	-0,145	-0,060
FAC3_1	-0,326	0,0217	-14,995851	5,713E-47	-0,369	-0,283	-0,369	-0,283
FAC4_1	0,053	0,0217	2,4167366	0,01579882	0,010	0,095	0,010	0,095
FAC5_1	0,140	0,0217	6,44670648	1,6131E-10	0,098	0,183	0,098	0,183
FAC6_1	0,091	0,0217	4,18168723	3,0895E-05	0,048	0,134	0,048	0,134
FAC7_1	0,042	0,0217	1,9210766	0,05494291	-0,001	0,084	-0,001	0,084
FAC8_1	-0,049	0,0217	-2,2370838	0,02545166	-0,091	-0,006	-0,091	-0,006
FAC9_1	-0,297	0,0217	-13,645679	1,0773E-39	-0,339	-0,254	-0,339	-0,254
FAC10_1	-0,168	0,0217	-7,7085769	2,5325E-14	-0,210	-0,125	-0,210	-0,125
FAC11_1	0,017	0,0217	0,78598351	0,43202194	-0,026	0,060	-0,026	0,060

Figure 71. Results of analysis on Catching-up regions (FAC2_2) in Euregio Karelia.



7.11. Economic development (FAC3_2)

The variables with the highest coefficient of correlation in this factor are GDP per capita, % of Natura 2000 and soil sealed area and its explained variance is % 17,57. It can therefore be understood as a factor which expresses high degrees of development and urbanization. As expected, the regions with the highest scores for this factor are concentrated in central Europe and Scandinavia and also include the capital cities of more marginal countries. In Euregio Karelia Northern Ostrobothnia was (as in the previous analyses) the region with the strongest economic performance. North Karelia and Kainuu scored significantly lower than Northern Ostrobothnia and the Finnish and European average.

Table 59 Results of analysis on Economic development (FAC3_2) in Euregio Karelia.

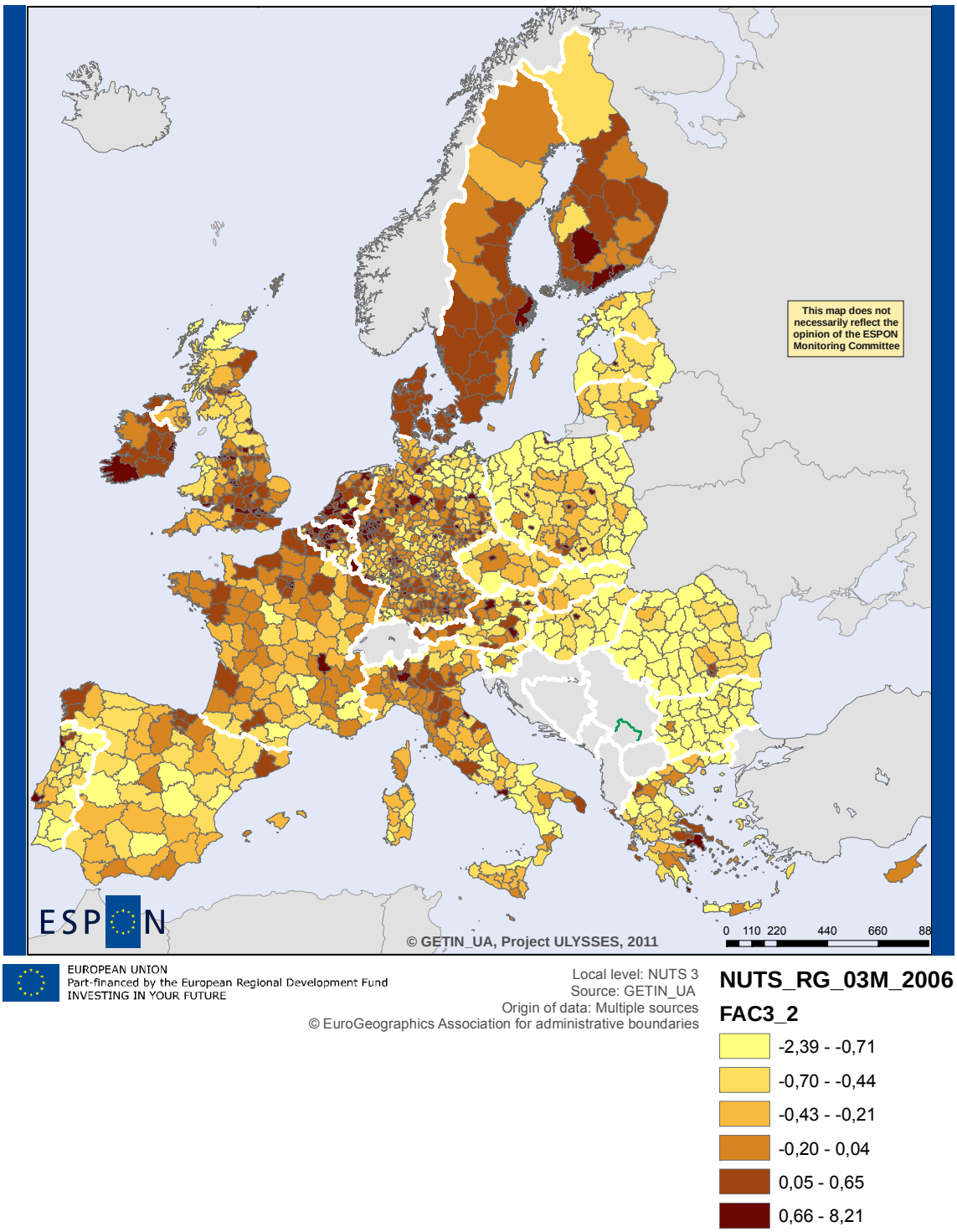
NUTS ID	NUTS	FAC3_2					
		Scores	Country comparison (weighted NUTS 3 average)			Country /CBR country level	Percentile all NUTS 3
CS4			RU	FI	All CBR countries		
All	All Countries	0,66					95
RU	Russia						
FI	Finland	0,66		0,00	0,00		95
FI133	North Karelia (Pohjois-Karjala)	0,05		-0,61	-0,61	- -	80
FI134	Kainuu	-0,03		-0,69	-0,69	- -	80
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	0,22		-0,44	-0,44	- -	80
RU3D	The Republic of Karelia (Respublika Kareliâ)						

The explanatory capacity of this regression is significantly higher than that of the previous factors. The coefficients, once again, show a significant relation with most of the factors of the territorial profile. The overall picture from the coefficients is a positive effect from factors related to location and R&D (factor 1 and 2). It is also interesting to see that the central location explains much more of different economic development levels than the investment in R&D. Similar conclusions can be drawn from the highly negative coefficient of the indicator related to rurality (factor 9) meaning that, on themselves, density and central location seem to be more important than research and innovation. The weight of the construction sector is also considerably negative, probably meaning that, at a certain stage, high economic development is more linked to a strong service sector than infrastructural development.

Regression Statistics	
Multiple R	0,824258
R Square	0,679401
Adjusted R Square	0,676659
Standard Error	0,568631
Observations	1298

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	-1E-07	0,01578	-7,1E-06	0,999994301	-0,0310	0,0310	-0,0310	0,0310
FAC1_1	0,4545	0,01579	28,78786	4,4844E-141	0,4236	0,4855	0,4236	0,4855
FAC2_1	0,1623	0,01579	10,27749	7,24251E-24	0,1313	0,1932	0,1313	0,1932
FAC3_1	0,0837	0,01579	5,303401	1,33687E-07	0,0528	0,1147	0,0528	0,1147
FAC4_1	0,0844	0,01579	5,348225	1,05025E-07	0,0535	0,1154	0,0535	0,1154
FAC5_1	0,1545	0,01579	9,785094	7,39012E-22	0,1235	0,1855	0,1235	0,1855
FAC6_1	0,0372	0,01579	2,356502	0,018597296	0,0062	0,0682	0,0062	0,0682
FAC7_1	0,1029	0,01579	6,518061	1,02027E-10	0,0719	0,1339	0,0719	0,1339
FAC8_1	-0,3541	0,01579	-22,4252	2,83549E-94	-0,3851	-0,3231	-0,3851	-0,3231
FAC9_1	-0,5195	0,01579	-32,9051	8,784E-173	-0,5505	-0,4886	-0,5505	-0,4886
FAC10_1	-0,0122	0,01579	-0,7752	0,438363708	-0,0432	0,0187	-0,0432	0,0187
FAC11_1	-0,0321	0,01579	-2,03075	0,042485717	-0,0630	-0,0011	-0,0630	-0,0011

Figure 72. Results of analysis on Economic development (FAC3_2) in Euregio Karelia.



7.12. Pollution (FAC4_2)

The significant variable of this factor is ozone concentration exceedance. The ozone concentration is related to a photo chemical reaction of pollutants and depends on the presence/absence of heavy industries, traffic levels, sun exposure but also on wind conditions. This means that emissions in one place can affect neighbouring regions, that high emission in southern countries will lead to higher ozone levels than in northern countries and that favourable wind conditions can lead to low levels in regions with high emissions and vice-versa. Therefore, a regression analysis of this indicator with the context factors has necessarily a very limited explanatory capacity and can lead to relations that lack any evident logic if the atmospheric conditions are not taken into account. Although the map shows as some overall tendencies, the regression analysis shouldn't be taken into account.

There also seem to be some discrepancies on the way it is measured in different countries, as it is not plausible that there are so clear cuts on some borders, such as can be seen in Ireland.

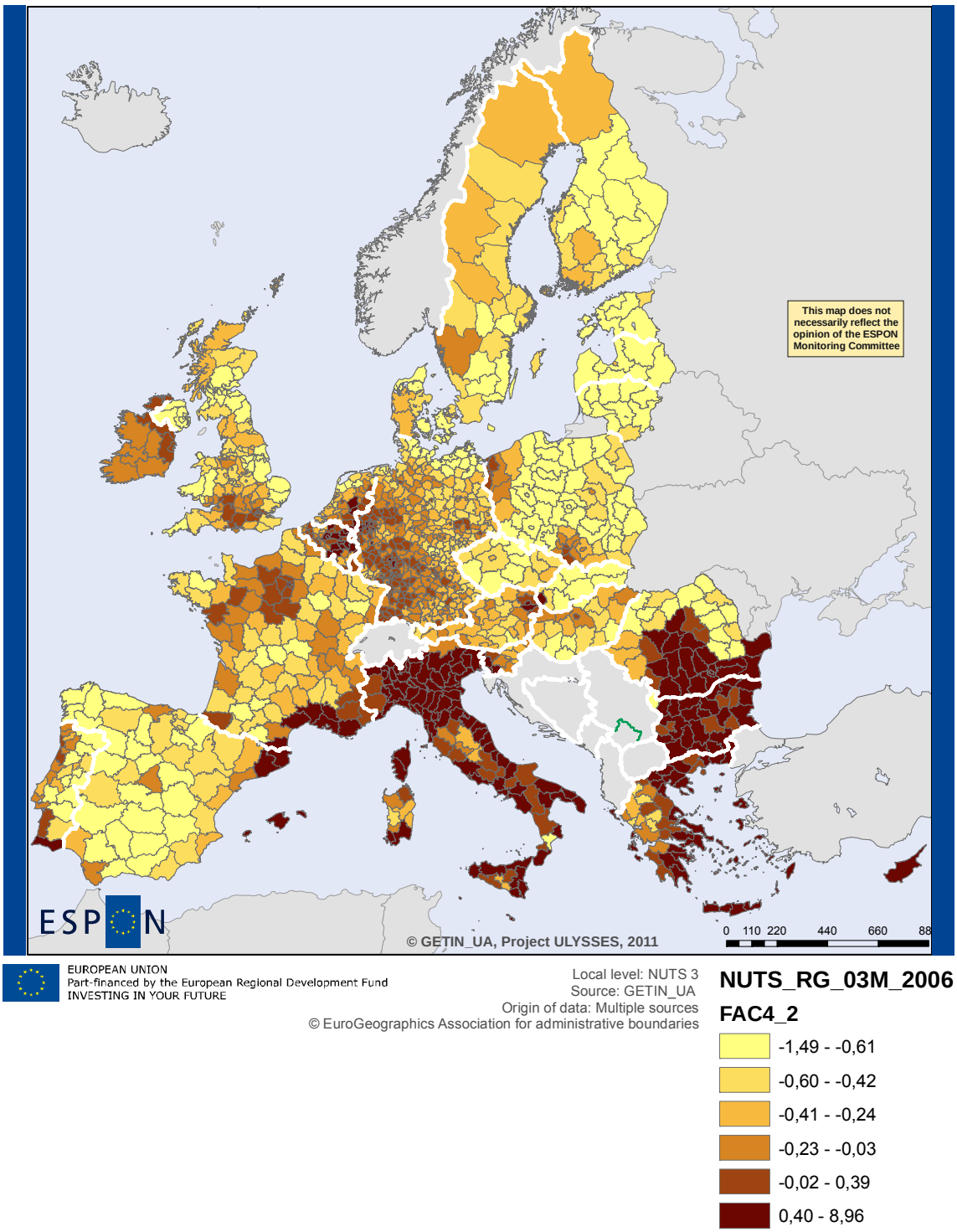
Table 60. Results of analysis on Pollution (FAC4_2) in Euregio Karelia.

NUTS ID	NUTS	FAC4_2					
		Scores	Country comparison (weighted NUTS 3 average)			Country /CBR country level	Percentile all NUTS 3
CS4			RU	FI	All CBR countries		
All	All Countries	-0,58					20
RU	Russia						
FI	Finland	-0,58		0,00	0,00		20
FI133	North Karelia (Pohjois-Karjala)	-0,87		-0,28	-0,28	- -	20
FI134	Kainuu	-0,86		-0,28	-0,28	- -	20
FI1A2	Northern Ostrobothnia (Pohjois-Pohjanmaa)	-0,78		-0,19	-0,19	- -	20
RU3D	The Republic of Karelia (Respublika Kareliâ)						

Regression Statistics	
Multiple R	0,453723
R Square	0,205864
Adjusted R Square	0,199071
Standard Error	0,894946
Observations	1298

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	1,07E-07	0,0248	4,3E-06	0,999996569	-0,04873	0,04873	-0,04873	0,04873
FAC1_1	-0,0666	0,0249	-2,67974	0,007461916	-0,11534	-0,01784	-0,11534	-0,01784
FAC2_1	-0,1221	0,0249	-4,91213	1,01672E-06	-0,17082	-0,07332	-0,17082	-0,07332
FAC3_1	-0,0901	0,0249	-3,62692	0,000298046	-0,13888	-0,04138	-0,13888	-0,04138
FAC4_1	-0,1422	0,0249	-5,72284	1,30207E-08	-0,19096	-0,09346	-0,19096	-0,09346
FAC5_1	0,0631	0,0249	2,537822	0,011271718	0,01431	0,11182	0,01431	0,11182
FAC6_1	0,2723	0,0249	10,95641	9,05477E-27	0,22352	0,32102	0,22352	0,32102
FAC7_1	0,2268	0,0249	9,12637	2,66302E-19	0,17804	0,27554	0,17804	0,27554
FAC8_1	-0,1153	0,0249	-4,63984	3,8429E-06	-0,16405	-0,06655	-0,16405	-0,06655
FAC9_1	-0,0461	0,0249	-1,85425	0,06393185	-0,09483	0,00267	-0,09483	0,00267
FAC10_1	0,1137	0,0249	4,573888	5,24943E-06	0,06491	0,16241	0,06491	0,16241
FAC11_1	-0,0175	0,0249	-0,70285	0,482273479	-0,06622	0,03129	-0,06622	0,03129

Figure 73. Results of analysis on Pollution (FAC4_2) in Euregio Karelia (tendencies).



Chapter 8. Conclusions

To be completed later.

For future development of the study it would be necessary to include more Russian data into the analyses. This applies both to data on the Republic of Karelia and Russia in general, as it would make it more accurate to examine and to view the Northern Finland – Russia CBA in the European and Russian contexts than relying almost solely on Finnish data.

What also needs to be studied in the future is how the connections in the CBA actually work. What is the role of the border in connecting / disconnecting the regions from each other? Since data is available on border traffic, we will make at least qualitative analysis on the development of the traffic across the Finnish-Russian border in Euregio Karelia.

References

Antikainen, Janne. The concept of Functional Urban Area. Findings of the ESPON 1.1.1 project. In Metropolregionen 7/2005. http://www.bbsr.bund.de/cln_032/nn_340582/BBSR/DE/Veroeffentlichungen/IzR/2005/Heft07Metropolregionen.html?__nnn=true

ESDP. European Spatial Development Perspective. Towards Balanced and Sustainable Development of the Territory of the European Union. European Commission 1999. http://ec.europa.eu/regional_policy/sources/docoffic/official/reports/pdf/sum_en.pdf

ESPON Climate. Climate Change and Territorial Effects on Regions and Local Economies. Draft Final Report 2011. http://www.espon.eu/export/sites/default/Documents/Projects/AppliedResearch/CLIMATE/ESPON_Climate_SummaryReport_final.pdf

ESPON 1.1.1. Potentials for Polycentric Development in Europe. Project report. Nordregio 2005. http://www.espon.eu/export/sites/default/Documents/Projects/ESPON2006Projects/ThematicProjects/Polycentricity/fr-1.1.1_revised-full.pdf

ESPON 1.1.2. Urban-rural relations in Europe. 2005. http://www.espon.eu/export/sites/default/Documents/Projects/ESPON2006Projects/ThematicProjects/UrbanRural/fr-1.1.2_revised-full_31-03-05.pdf

ESPON 1.2.1. Transport services and networks: territorial trends and basic supply of infrastructure for territorial cohesion. Project report 2004. http://www.espon.eu/export/sites/default/Documents/Projects/ESPON2006Projects/ThematicProjects/TransportTrends/fr-1.2.1-full.pdf

ESPON 1.4.3. Study on Urban Functions. Project report. 2007. http://www.espon.eu/export/sites/default/Documents/Projects/ESPON2006Projects/StudiesScientificSupportProjects/UrbanFunctions/fr-1.4.3_April2007-final.pdf

Europe 2020. A strategy for smart, sustainable and inclusive growth. European Commission 2010. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:EN:PDF

Fertility statistics - Statistics Explained (2011/10/4), Eurostat. http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Fertility_statistics

Ficora: Laajakaista 2015 - Haja-asutusalueiden 100 megan laajakaistahanke. 2011. http://www.ficora.fi/index/saadokset/ohjeet/laajakaista2015.html

Fifth Report on Economic, Social and Territorial Cohesion. Investing in Europe's future. European Commission 2010. http://ec.europa.eu/regional_policy/sources/docoffic/official/reports/cohesion5/index_en.cfm

Finavia: Suomen lentoliikennetilasto 2008. http://www.finavia.fi/files/finavia2/liikennetilastot_pdf/40021_Finavia_tilasto_LR.pdf

Finland's National Programme. Europe 2020 Strategy. Ministry of Finance 2011. http://www.vm.fi/vm/en/04_publications_and_documents/01_publications/02_economic_surveys/20110406Europe/Eurooppa_2020_enkku_taitto._liitteet.ndd.pdf

The Finnish National Reform Programme 2005-2008, Annual Progress Report. The Lisbon Strategy for Growth and Jobs. 2006. http://www.vm.fi/vm/en/04_publications_and_documents/01_publications/02_economic_surveys/20061012Lisbon/name.jsp

The Finnish National Reform Programme 2008-2010. The Lisbon Strategy for Growth and Jobs. 2008. http://www.vm.fi/vm/en/04_publications_and_documents/01_publications/02_economic_surveys/20081009TheLis/englanti_lissabon_netti.pdf

Koncepciâ soveršenstvovaniâ regional´noj politiki v Rossijskoj Federacii. Ministerstvo regional'nogo razvitiâ Rossijskoj Federacii. www.minregion.ru/OpenFile.ashx/koncept.doc?AttachID=1677
Kūle, Laila. Urban-Rural Partnership in Latvian Regional Policy and Practice Context. Regional Studies Association Annual International Conference 2010. http://regional-studies-assoc.ac.uk/events/2010/may-pecs/papers/Kule.pdf
Lisbon Strategy evaluation document. European Commission 2010. http://ec.europa.eu/archives/growthandjobs_2009/pdf/lisbon_strategy_evaluation_en.pdf
Peterburgu nužno policentričeskoe razvitie. Pro Estate Events 9.9.2011. http://www.proestate.ru/index-1900.html

Population and population change statistics - Statistics Explained (2011/10/4), Eurostat. http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Population_and_population_change_statistics
Proekt "Moskoviâ". Zavtra 3.8.2011. http://www.zavtra.ru/cgi/veil/data/zavtra/11/924/print81.html
A revised urban-rural typology. Eurostat regional yearbook 2010. http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-HA-10-001-15/EN/KS-HA-10-001-15-EN.PDF
Statistics Finland. Suomen maapinta-alasta 4,4 prosenttia rakennettua maata. Tiedote 5.7.2011. http://stat.fi/ajk/tiedotteet/2011/tiedote_007_2011-07-05.html
Strategičeskoe planirovanie v regionah i gorodah Rossii. 2010. http://www.minregion.ru/press_office/terms/836.html
Strategy for sustainable development 2009. http://europa.eu/legislation_summaries/environment/sustainable_development/l28117_en.htm
SUccess for convergence Regions' Economies (SURE). Structured empirical analysis for convergence regions: identifying success factors for consolidated growth / SEARCH. Interim report 2009. http://www.espon.eu/export/sites/default/Documents/Projects/TargetedAnalyses/SURE/SURE_Interim_Report.pdf
Suomen aluekehittämisstrategia 2013. Aluekehittämisstrategiatyöryhmän mietintö. Sisäasiainministeriön julkaisu 10 / 2003. http://www.intermin.fi/intermin/biblio.nsf/C35EF1AFD77776E8C2256CE100228AEE/$file/aluekehittamisstrategia_2013.pdf
Territorial Agenda of the European Union 2020. Towards an Inclusive, Smart and Sustainable Europe of Diverse Regions. 2011. http://www.eu2011.hu/files/bveu/documents/TA2020.pdf
Update of Selected Potential Accessibility Indicators. Final Report 2007. http://www.mdrl.ro/espon_cd2/Project_Reports/Scientific_briefing_and_networking/MapUpdate_final_report.pdf

www.espon.eu

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