

Northern peripheral, sparsely populated regions
in the European Union

Northern Peripheral, Sparsely Populated Regions in the European Union

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Stockholm, Sweden
2005

Contents

Preface

1. Summary	1
2. Introduction	20
2.1. European recognition of the structural weaknesses of sparsely populated areas	20
2.2. Three separate handicaps.....	21
2.3. Theoretical accounts of the main disadvantages associated with Sparsity / Peripherality	23
3. Delimitating sparsely populated areas in the European Union	29
3.1. Delimitation according to NUTS 2 and NUTS 3 average densities	29
3.2. A delimitation approach reflecting the social and economic issues of sparsity.....	34
3.3. Population potentials in Europe	37
3.4. Identification of sparsely populated areas	39
3.5. Delimitatin of the study area	45
4. Demography	
4.1. Settlement patterns in the Nordic peripheries.....	57
4.2. Demographic trends over the last decade	64
4.3. Age structure	72
5. Measuring peripherality and accessibility in the Nordic peripheries	79
5.1. What is accessibility?.....	80
5.2. European accessibility measures	90
5.3. Access to airports	95
5.4. Road maintenance costs	106
5.5. Rail connections in the study area	108
5.6. Seaports and ferry connections.....	110
5.7. Access to universities in the northernmost regions.....	114
6. Socioeconomic characterisation of Sparsely populated areas	121
6.1. Employment.....	121
6.2. Sources of income.....	130
6.3. Educational attainments.....	133
6.4. Wealth production	136

7. Terrain and climate	141
7.1. Climatic conditions in the Nordic peripheries	141
7.2. Assessing the economic effects of extreme climatic conditions.....	143
7.3. Land use.....	147
7.4. Protected areas	151
8. Conclusion: The Northern periphery problem – A Syndrome of Disadvantage	155
References	160

Figures

Chapter 1: Summary

Figure 1.1. Areas with less a population potential of 100,000 persons or less within a radius of 50 km	4
Figure 1.2. Study area delimitation	5
Figure 1.3. Settlement patterns in he Nordic peripheries	7
Figure 1.4. Net migration change and population potential.....	8
Figure 1.5. Population trends from 1993 to 2002.....	9
Figure 1.6. Potential accessibility by road to population in EU 27, Norway and Switzerland.....	11
Figure 1.7. Access to airports, and number of yearly landings	12
Figure 1.8. Unemployment levels by municipality	15
Figure 1.9. Income levels by municipality	16

Chapter 3: Sparsity

Figure 3.1. NUTS 2 average population densities	32
Figure 3.2. NUTS 3 average population densities	33
Figure 3.3. Theoretical model illustrating the effect of centre structures on sparsity	35
Figure 3.4. Population potentials within a 50 km radius in Europe	38
Figure 3.5. Sparsely populated areas in Europe - threshold 50 inh/km ²	42
Figure 3.6. Sparsely populated areas in Europe - threshold 12.5inh/km ²	43
Figure 3.7. Sparsely populated areas in Europe – threshold 8 inh/km ²	44
Figure 3.8. Sparsely populated areas in Europe - threshold 5% of European average	45
Figure 3.9. Sparsely populated areas in Europe – threshold daily services	46
Figure 3.10. Overlay of sparsely populated areas in Europe (threshold 12.5 inh/km ²) with NUTS 2 regions.....	49
Figure 3.11. Overlay of sparsely populated areas in Europe (threshold 12.5 inh/km ²) with NUTS 3 regions.....	50

Figure 3.12	Overlay of sparsely populated areas in Europe (threshold 12.5 inh/km ²) with Objective 1 regions (2000-2006)	51
Figure 3.13	Study area delimitation.....	53
Figure 3.14	Study area delimitation with Objective 1 boundaries (2000-2006)	54

Chapter 4: Demography

Figure 4.1.	Population per 1x1 km grid cell in Sweden and Finland	58
Figure 4.2.	Proportions of grid cells by category, classified according to population numbers.....	59
Figure 4.3.	Three areas with identical area and population, but with distinct settlement patterns	61
Figure 4.4.	Areas with less than 10,000 people within 50 km	62
Figure 4.5.	Percentage change in population due to births and deaths by municipality from 1993 to 2002	66
Figure 4.6.	Percentage change in population due to in- and out-migration by municipality from 1993 to 2002	67
Figure 4.7.	Cross-tabulation of population potential and net migration from 1993 to 2002	68
Figure 4.8.	Total population change by municipality from 1993 to 2002	69
Figure 4.9.	Cross-tabulation of population potential and total population change by municipality from 1993 to 2002	70
Figure 4.10	Population projections from NUTЕК and Statistics Finland for the period 2002-2020	71
Figure 4.11	Old age dependency ratios by municipality (2002).....	73
Figure 4.12	Cross-tabulation of population potentials and the change in old age dependency ratios	74
Figure 4.13	Classification of municipalities according to age structures.....	75
Figure 4.14	Characterisation of the different age structure classes.....	76

Chapter 5: Accessibility

Figure 5.1.	Complexity of accessibility indicators.	82
Figure 5.2.	Transport and regional development.....	83
Figure 5.3.	Transport investments and regional development	85
Figure 5.4:	Multimodal (road + rail) accessibility to GDP at the macroscale	92
Figure 5.5:	Potential accessibility by road to population in EU 27, Norway and Switzerland.....	93
Figure 5.6.	Comparison of air and road accessibilities.....	94
Figure 5.7.	Airports in the northernmost regions	96
Figure 5.8.	Air connections in the northernmost regions	97
Figure 5.9.	60-minute isochrones around airports in the Study area.....	100
Figure 5.10.	Overlay 1x1 grid cell populations and 60-minute isochrones around airports in the Study area	101
Figure 5.11.	Proportion of municipal population living less than one hour (by individual car) from the nearest airport	102
Figure 5.12.	Airport population potential	104

Figure 5.13. Relationship between airport population potential (i.e. total population living within 60 minutes from airport) and airport traffic.....	105
Figure 5.14. Winter maintenance costs per km and per vehicle standardised according to national average values.....	107
Figure 5.15. Winter maintenance costs per km and per vehicle	107
Figure 5.16. Railways and trunk roads in the study area	109
Figure 5.17. Seaports in the Nordic regions: Vessel arrivals and annual cargo handled	111
Figure 5.18. Largest ice cover in the northern parts of the Baltic Sea	113
Figure 5.19. Universities and polytechnics in Europe	116
Figure 5.20. Universities and polytechnics in the northernmost regions	117

Chapter 6: Socio-economic characterisation

Figure 6.1. Municipal unemployment rates standardised according to national average values (1991)	122
Figure 6.2. Municipal unemployment rates standardised according to national average values (1996)	123
Figure 6.3. Municipal unemployment rates standardised according to national average values (2001)	124
Figure 6.4. Cross-tabulation of population potentials and municipal unemployment rates	125
Figure 6.5. Proportion of public sector employment	127
Figure 6.6. Cross-tabulation of population potentials and dependence on public sector employment.....	128
Figure 6.7. Activity rates standardised according to national average values	129
Figure 6.8. Earned income by inhabitant aged 20 to 64	131
Figure 6.9. Proportion of income from transfers	132
Figure 6.10. Cross tabulation of population potentials and the proportion of persons having a secondary degree only	134
Figure 6.11. Cross-tabulation of population potentials and the proportion of persons having a tertiary degree	135
Figure 6.12. GDP levels in PPS at NUTS 3 level (2001).....	137
Figure 6.13. GDP levels in PPS at NUTS 3 level, except Sweden (NUTS 5) and Finland (NUTS 4) (2001)	138

Chapter 7: Terrain and climate

Figure 7.1. Lowest monthly average temperature	142
Figure 7.2. Highest monthly average temperature	142
Figure 7.3. Temperature contrast index	144
Figure 7.4. Mean long-time annual radiation	145
Figure 7.5. Long-time average rainfall across Europe	146
Figure 7.6. Proportion of arable land within municipalities.....	148
Figure 7.7. Proportion of forests in municipalities (source: PELCOM)	149
Figure 7.8. Land uses in the study area (Source: PELCOM)	150
Figure 7.9. Protected areas and national parks in the northernmost areas (UNEP-GRID Arendal, 2005).....	152

Chapter 8: Conclusion

Figure 8.1. The Northern Periphery Syndrome of Disadvantage	156
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Tables

Chapter 3: Sparsity

Table 3.1. Lowest NUTS 2 average population densities in Europe (inh/km ² , 2002)	30
Table 3.2. Lowest NUTS 3 average population densities in Europe (inh/km ² , 2002)	31
Table 3.3. Thresholds and minimum population potential.....	37
Table 3.4. Percentage of sparsely populated area on total area of EU27+2.....	41
Table 3.5. Percentage of sparsely populated areas within each NUTS-2 region	52
Table 3.6. Percentage of sparsely populated areas within each NUTS-3 region	52

Chapter 4: Accessibility

Table 4.1. Proportion of uninhabited 1x1 k m grid cells.....	59
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Chapter 5: Accessibility

Table 5.1. Different parameter dimensions of common accessibility indicators.....	81
Table 5.2. Population at more than 60 minutes from nearest airports per NUTS 3 region.....	99
Table 5.3. Main ports handling at least 80% of the country's total cargo traffic (2001)	110
Table 5.4. List of universities and polytechnics in the northernmost regions of Sweden and Finland and in the capital cities.....	115

Chapter 7: Terrain and climate

Table 7.1. Percentage of protected areas on total NUTS-3 region area	152
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Preface

The present study was commissioned by the North Finnish (Lapland, Northern Ostrobothnia, Central Ostrobothnia and Central Finland), East Finnish (Kainuu, North Karelia, Pohjois-Savo and Etelä-Savo) and North Swedish (Norrbotten, Västerbotten, Jämtland, Västernorrland) regions. Financial support to this study has been channelled to the respective regions by the Swedish Ministry of Industry and the Finnish Ministry of Interior.

The purpose of the study is to make an assessment on the socio-economic impacts of low population density, peripherality and cold climate in the Northern regions of Sweden and in Northern and Eastern regions of Finland.

The study has focused on demographic sparsity as a core element for understanding of the specific needs of these regions. Sparsity has indeed been defined as characterising regions where extremely low population densities and disperse settlement patterns create specific challenges for economic activity and public service provision. A central question is the scale at which one should approach demographic sparsity in order to give the most accurate account of economic challenges connected to low population densities.

A second main characteristic of these regions is peripherality, as reflected by the distance to the main European markets. This induces additional transport costs both for individuals and industries, and makes it difficult to access goods and services produced in European core areas.

Cold climate constitutes an additional challenge for these Northern Nordic regions, which can easily be observed at the scale of individual persons or companies. While it is generally not meaningful to seek to quantify the general macroeconomic impact of this factor, some narrower economic approaches of cold climate have been developed.

Stockholm, November 2005.

1. Summary

Sparsity has been recognised as a major specificity of the Nordic peripheries in the European context, in the accession treaties and Structural Funds regulations up to 2006. These regions have been recognised as belonging to the less prosperous areas of the European Union, habitually suffering from a lack of business and social services and with a poor basic infrastructure endowment.

Sparsity and remoteness are, strictly speaking, distinct concepts – the first relating to the spread or distribution of population within a region, the latter referring to the distance between the region and the main economic centres of Europe. However in the Nordic countries sparsity and peripherality are generally coincident. The degree of remoteness corresponds to the distance to the core areas of Europe, where concentrations of people and companies create the main European markets, and where the most specialised providers of goods and services are to be found.

Even if transport costs in the narrow sense have diminished over the last decade, there is only little hope that this will outweigh the distant geographical location of these areas. Indeed, other types of ‘transaction costs’ are still in favour of agglomerations: costs to compensate for the lack of modern logistics systems, additional costs for the lack of business networks and the lack of innovative milieus, extra costs for diseconomies of scale and for the lack of the critical mass, and extra costs for the lack of specialised business-related service sectors (such as banking, lawyers, tax advisers, translation services). Instead of witnessing the death of space and distance foreseen by some (Harvey, 1989) current trends lead us towards an increasing dominance of agglomerations and central regions.

Sparse and remote Nordic regions also experience harsh climatic conditions. This implies that they are characterised by a short growing season, a soil with a reduced agricultural potential and temperatures considerably below freezing point in the wintertime. In terms of transport, harsh climatic constraints can lead to erratic variations in accessibility during the winter, and to increased costs in respect of keeping the infrastructure free from snow.

Delimitation of sparsely populated areas

Sparsity characterises regions where low population densities and dispersed settlement patterns create specific challenges for economic activity and public service provision. In other words, low regional population densities are not sufficient to characterise a region as “sparse”. Sparsity occurs insofar as the combination of low population densities and dispersed settlement patterns lead to specific challenges for economic activity.

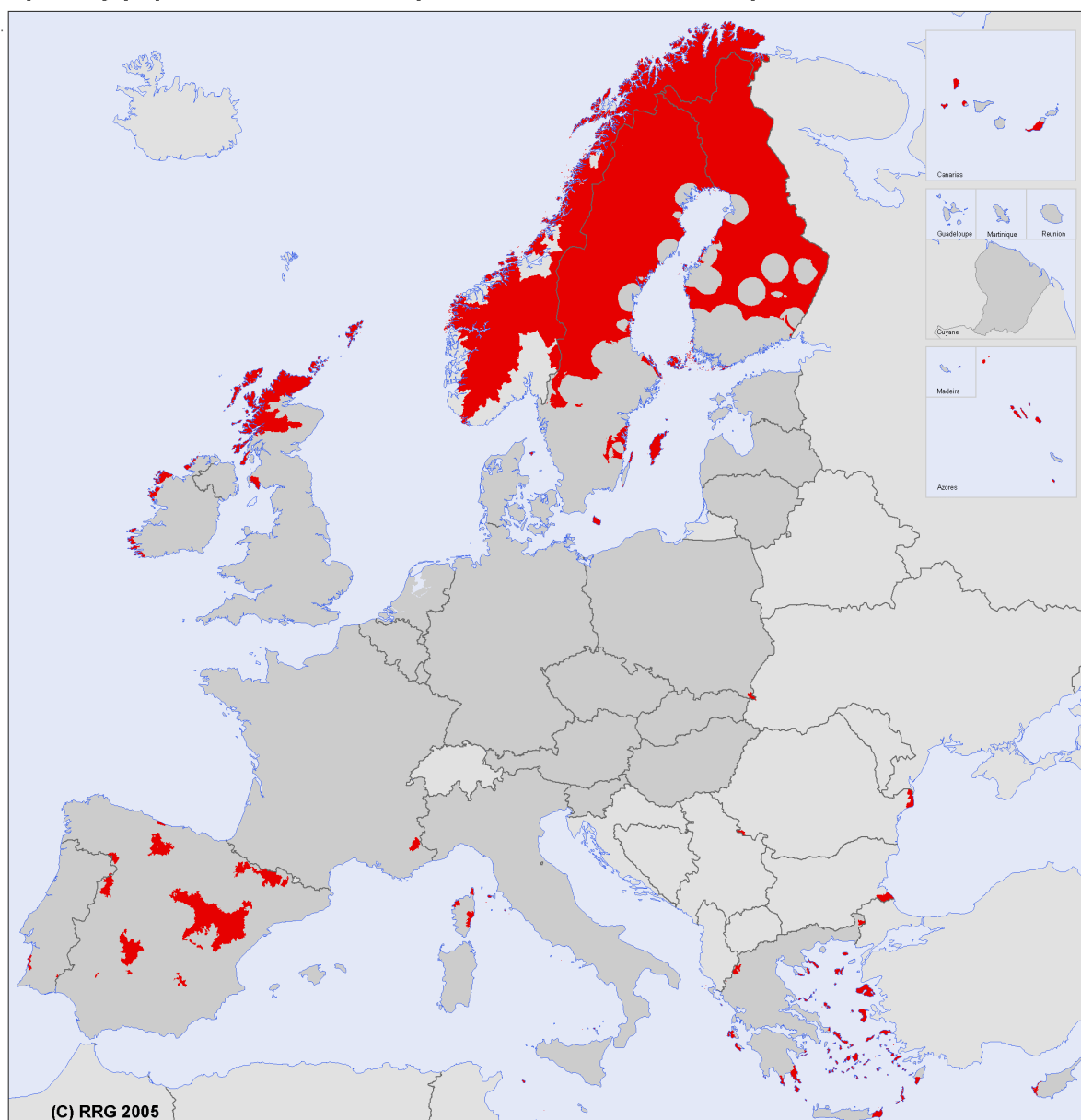
Two ideas are central in this respect: on the one hand, it is not the population of an area as such that is important, but the number of persons that can be reached. For this reason, we have calculated the population within a 50 km radius (i.e. a generally accepted maximum commuting distance) throughout the European territory. This measure corresponds to the “population potential” of each area.

On the other hand, one can hypothesise that there are certain significant population potential thresholds, above which the extent of the challenges related to low population densities and dispersed settlement patterns will increase significantly. These thresholds correspond to the critical population mass for maintaining important service functions, or for preserving a minimal width and variety in the local labour market.

For these two reasons, the appropriate method for delimitating sparsely populated areas is to use the proportion of each region characterised by population potentials below a certain threshold, rather than average population densities. This method indeed reflects the actual challenges of sparsity, is less dependent on regional delimitations and takes into account population concentrations around each region.

We have chosen to use the threshold of 100,000 persons within a radius of 50 km, corresponding to a population density of 12,5 inh/km². For the delimitation of the study area, we have selected NUTS 2 regions with over 75% of their area with population potentials below this threshold. Adjacent NUTS 3 regions have also been included, as a point of comparison.

Sparsely populated areas in Europe: Threshold of 12.5 inh/sqkm



Geographical Base: Eurostat GISCO

Minimum population potential assumed: 100,000

Source: RRG

- Sparsely populated areas
- EU countries: areas not considered as sparsely populated
- Other countries

FI, SE: 1x1 km grid
Rest of EU, CH, NO: NUTS-5

*Figure 1.1. Areas with a population potential of 100,000 persons or less within a radius of 50 km
(corresponding to a population density of 12,5 inh / km²)*

Study area delimitation

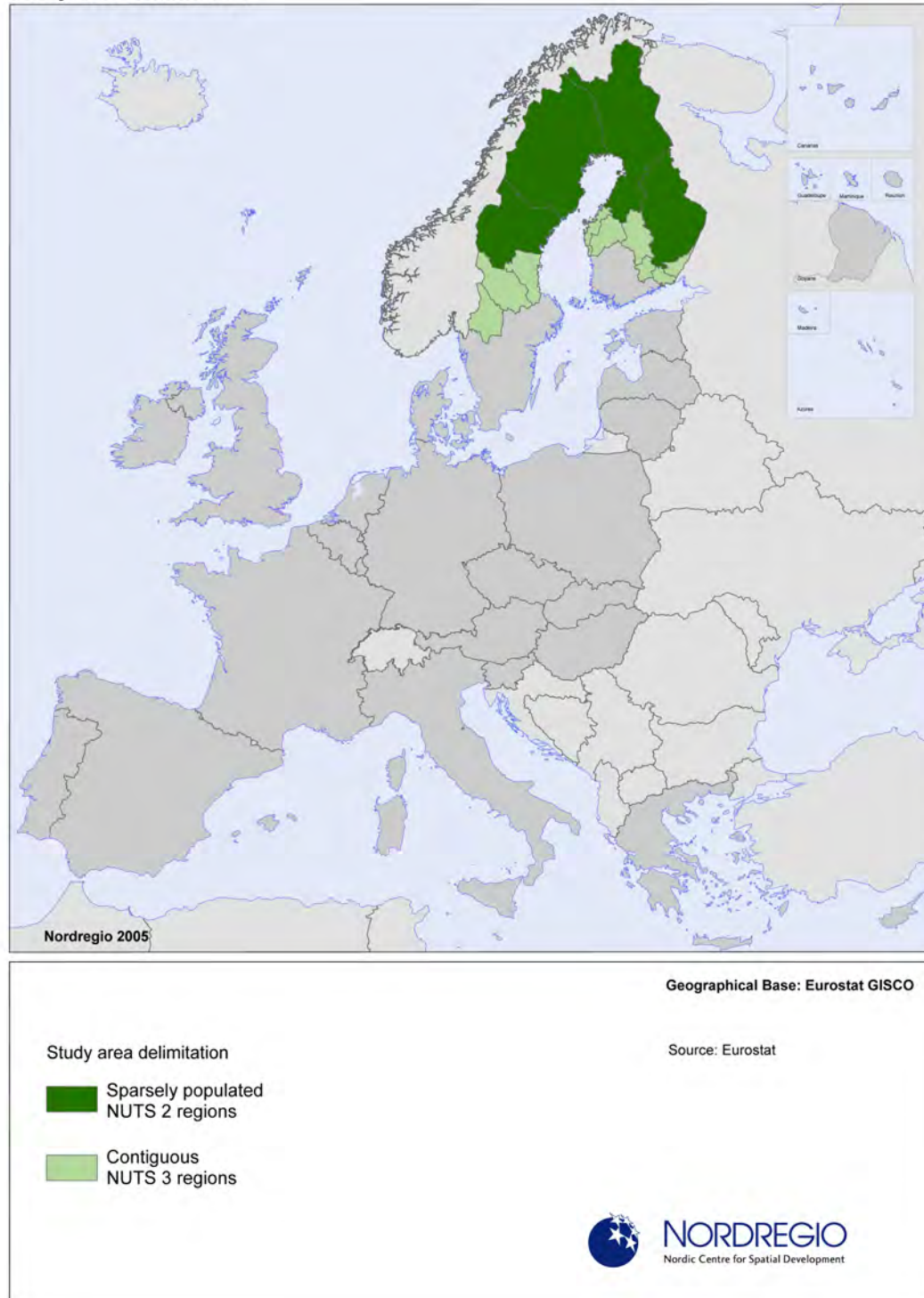


Figure 1.2. Study area delimitation: NUTS 2 regions with at least 75% of their area with a population potential below 100,000 inhabitants, and adjacent NUTS 3 regions.

Demographic characterisation

Contrasted settlement patterns can be observed in the Nordic sparsely populated areas, as illustrated by the significant variations in the number of inhabited grid cells between regions with equivalent population densities. East Finland is in this respect the most extreme case of disperse settlement patterns, while peripheral populations in Sweden and North Finland are mostly concentrated in a few locations. Specific issues and challenges are connected to the concentrated and outspread types of settlement structures in sparsely populated areas. In the case of the more concentrated settlement structure, the few households situated outside of the main nodes and axes are particularly isolated, and social interaction may be difficult to maintain. The outspread nature of the settlement structure is on the other hand a major challenge for the provision of both public services (e.g. community nursing and home help to elderly persons) and transport infrastructure.

Observing figures from 1993 to 2002, one finds that different situations can be observed across the study area in terms of net natural change. While significant sparsely populated parts of North Finland experience natural population growth, such trends occur almost only occur in cities in Sweden and East Finland. Negative net migration, on the other hand occurs throughout the study area, outside of the main cities.

Age structures reveal an ageing trend in the more sparsely populated areas. Because the sparsely populated areas experiencing decline are extensive and continuous, their lack of demographic dynamism can in general not be compensated through extended commuting trips and service provision areas around the nearest city. This makes these Nordic areas specific in comparison with other European areas experiencing population decline.

Population per 1x1 km grid cell in Finland and Sweden

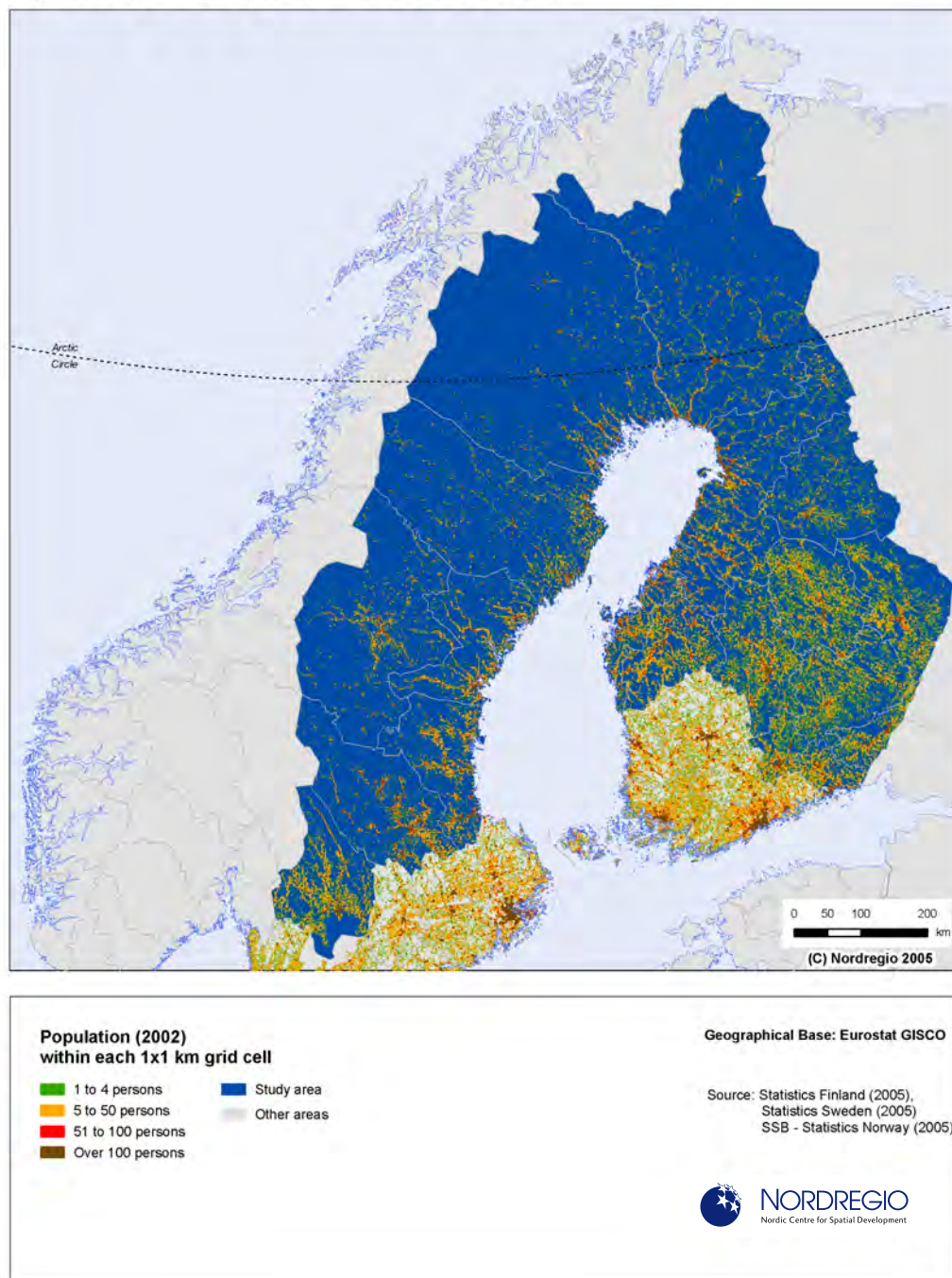


Figure 1.3. Settlement patterns in the Nordic peripheries

Net migration change and population potential

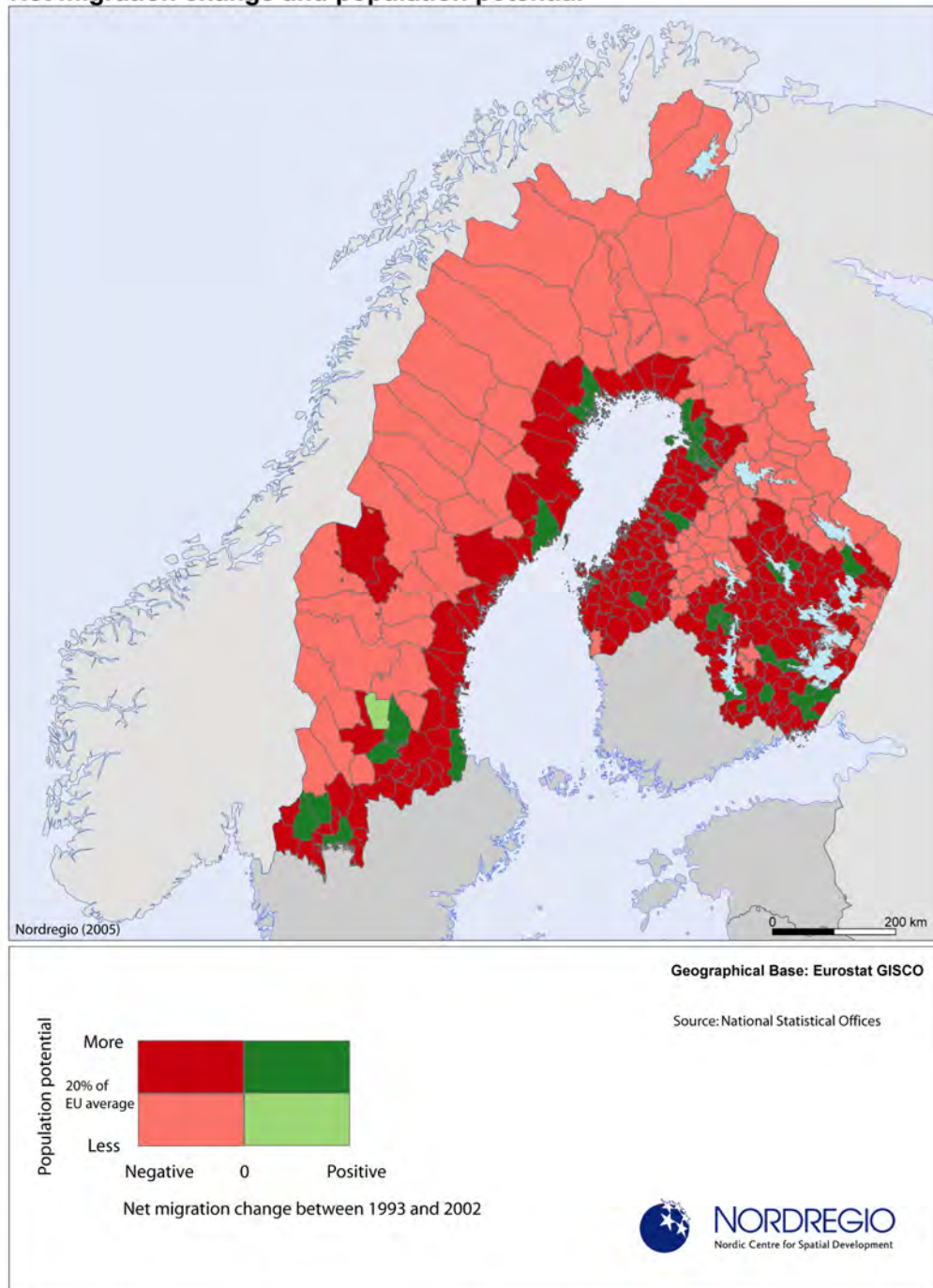


Figure 1.4. Net migration change and population potentials
Negative net migration is highly correlated with low population potentials.

Population change from 1993 to 2002

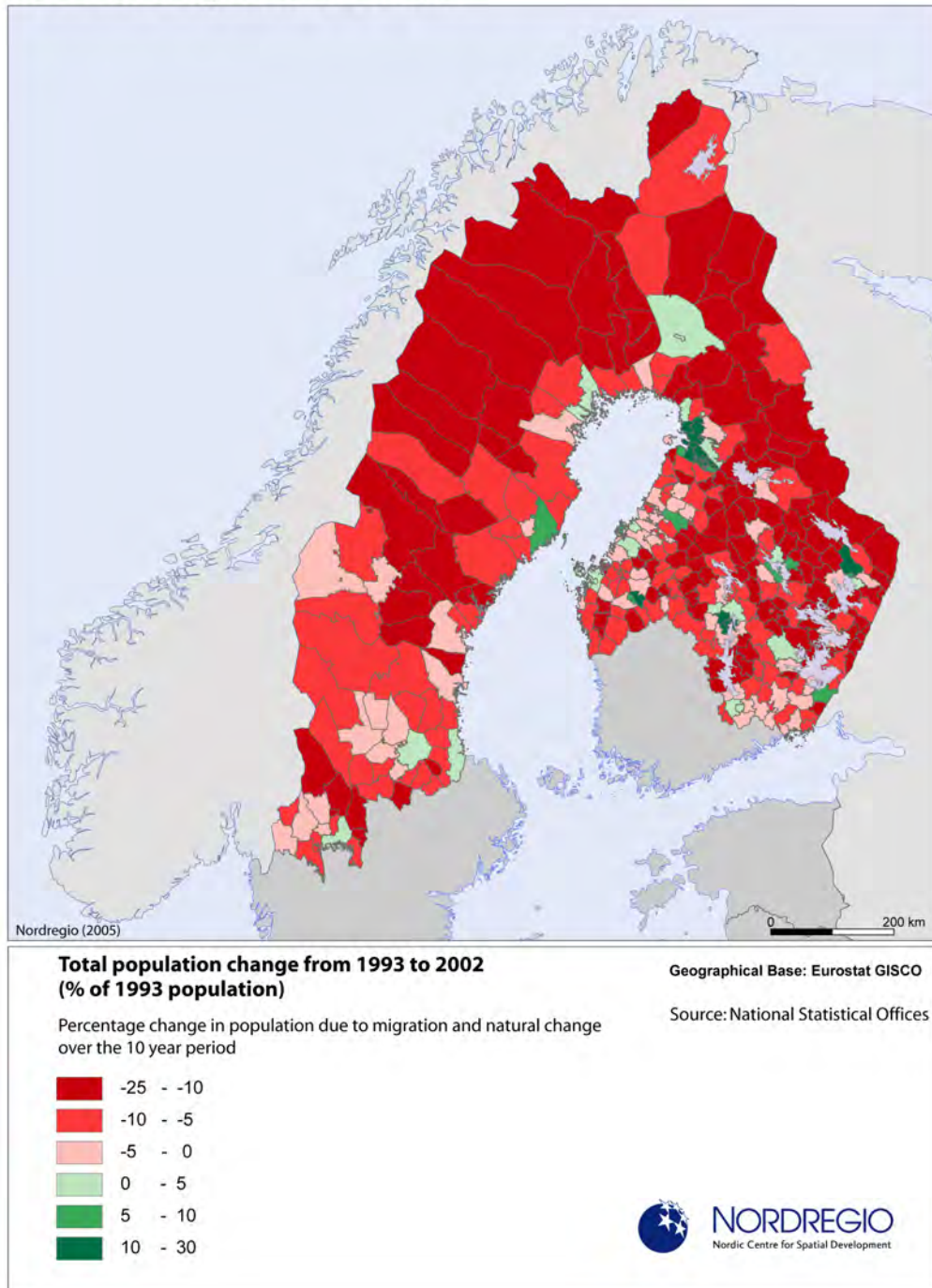


Figure 1.5. Population trends from 1993 to 2002

A large proportion of Northern Sweden and Finland has lost over 10% of their population in this 10-year period.

Peripherality and accessibility

Measures of ground accessibility show that Nordic peripheral regions are among the least accessible in Europe. Some measures of potential accessibility to population show a relatively favourable position for East-Finland, due to the proximity to the 10 million inhabitants of the Saint-Petersburg region (e.g. ESPON Project report 1.2.1 '*Transport trends*'). This however needs to be nuanced as a hypothetical opportunity for the concerned Finnish regions, as the practical, administrative and economic difficulties developing cross-border interaction in these areas are considerable. For this reason, we have developed an alternative calculation taking into account destinations in EU 27, Norway and Switzerland only.

Taking into account air transport very significantly improves the relative accessibility of areas in the immediate vicinity of an airport, but not for the rest of the regions. The current airport network across the Nordic sparsely populated peripheries provides a relatively good access. The main weak point in Sweden and Finland is the lack of transversal relations, which reduces the potential for interaction between peripheral regions and increases the dependence on the capital region. There is also a current risk that deregulation in the air transport sector will lead to a reduction in the number of small regional airports.

Both in terms of roads and seaports, there are significant additional maintenance costs related to the difficult climatic conditions in the Nordic sparsely populated peripheries. The road winter maintenance costs per km driven are multiple times higher in these areas than in the countries as a whole. In the Baltic Sea, icebreakers are necessary to maintain sea traffic from November to April.

The analysis of the University network in the Nordic peripheries reflects the active policies promoting higher education outside of the capital regions, as illustrated by the high proportions of students in a number of labour markets around peripheral cities. It is important to ensure that these facilities are integrated in the local economic environment, and contribute to the development of entrepreneurship and innovation in their area.

An infrastructure strategy for the sparsely populated peripheral regions must be designed to help build and maintain wider regions with complementary functions in the different nodes, with the objective of reinforcing internal regional coherence. Moreover it remains important to continually highlight the fact that a focus on connections to the capital city

will increase the level of dependency on that capital region unless they are accompanied by pro-active policies to preserve strategic sectors in the concerned sparsely populated peripheral regions.

Potential accessibility by road to destinations in EU 27, Norway and Switzerland

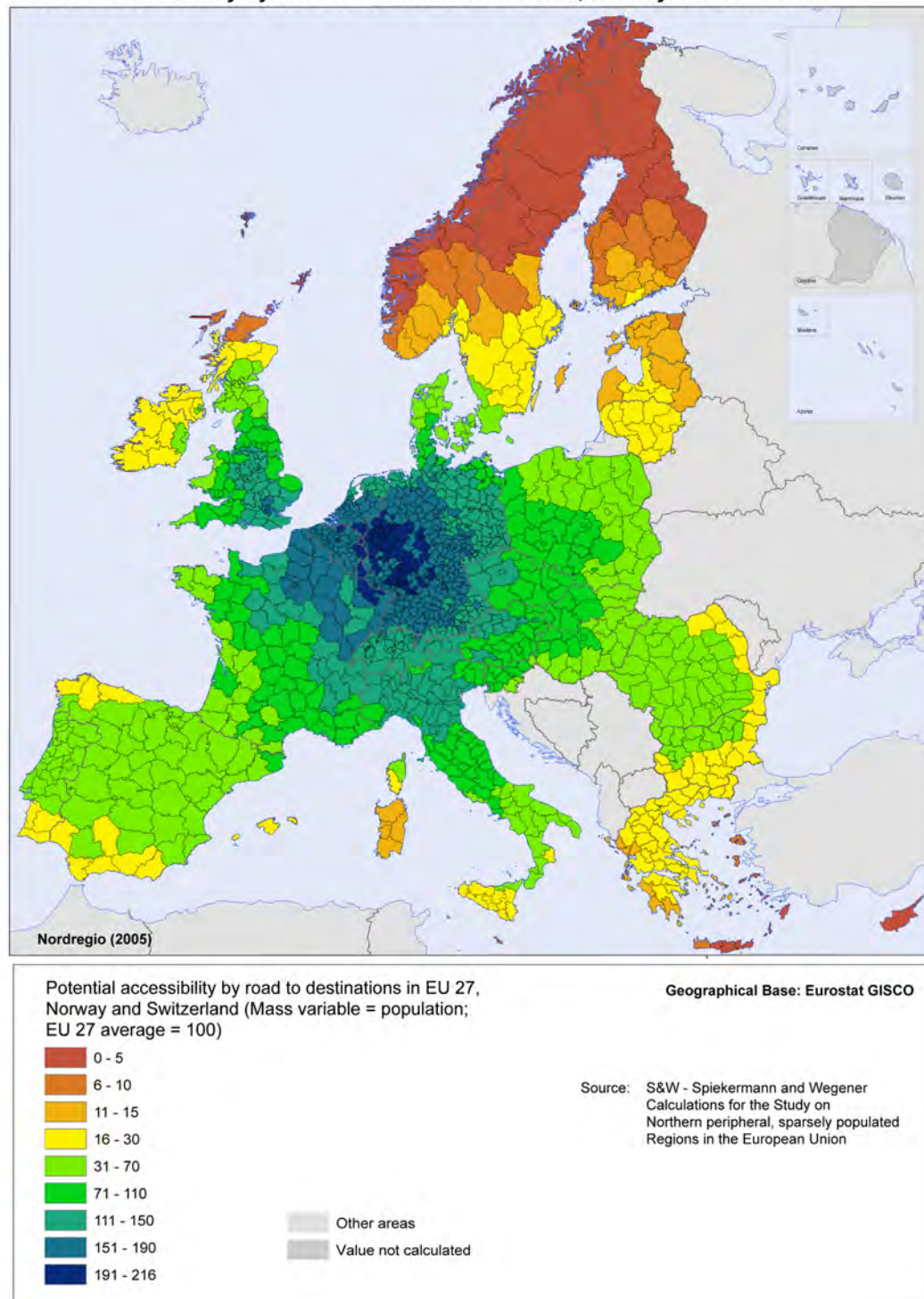


Figure 1.6. Potential accessibility by road to population in EU 27, Norway and Switzerland

Airports in the study area: 60-minutes isochrones

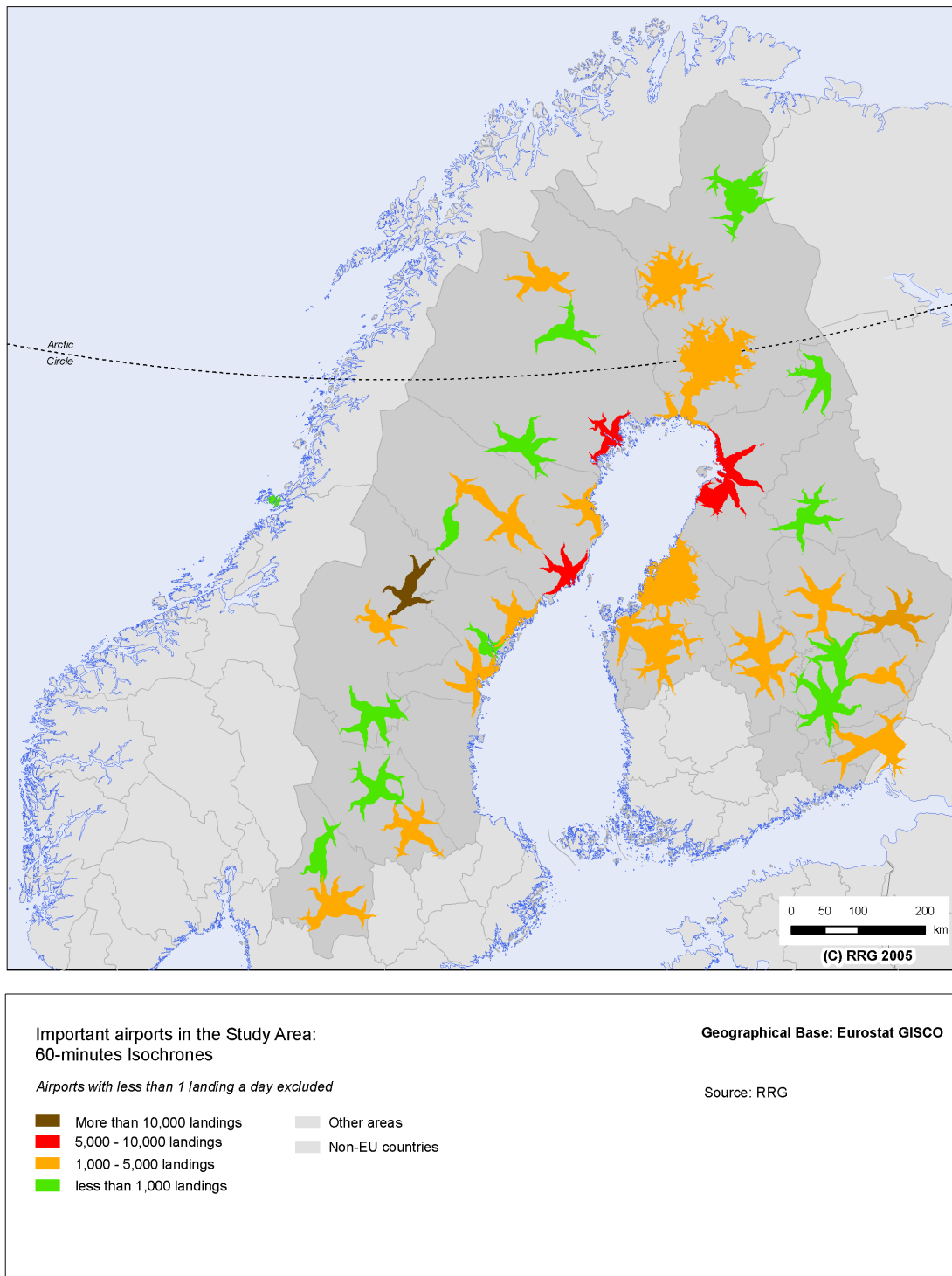


Figure 1.7. Access to airports, and number of yearly landings

Social and economic characterisation

Sparsely populated areas in Sweden and Finland are characterised by higher unemployment rates than the rest of the country. The contrast between sparsest areas and the rest of the national territory has been increasing between 1991 and 2001.

The most sparsely populated areas of Finland and Sweden also have activity rates that are generally below the national average, and a higher degree of dependence on public sector employment.

The analysis of income sources among the inhabitants of each municipality reveals significantly lower income from employment and capital per inhabitant aged 20 to 64 in sparsely populated parts of Finland. These contrasts are less accentuated in Sweden. The proportion of income from transfers (i.e. pensions, unemployment, maternity and sickness benefits) are however generally higher in sparsely populated parts of both countries.

GDP rates per inhabitant in purchase parity standards (PPS) observed in the peripheral Nordic regions are generally close to the EU average. It is however important to note that a the proportion of the GDP based on primary activities such as forestry and hydraulic energy production is up too three times higher in these regions than in Sweden and Finland as a whole. These activities have a small impact on the local economies, as they employ relatively few persons. It should also be note here that East Finland is in a particularly difficult situation within the study area, with GDP values per inhabitant below 80% of the EU average in the NUTS 3 regions of Etelä-Savo and North Karelia.

Comparing values at NUTS 5 and NUTS 4 level for these countries with NUTS 3 values for the rest of Europe reveals strong contrasts between the main cities and the peripheries in the Finnish parts of the Study area. The contrast between the results at NUTS 3 and NUTS 4 level is particularly striking in Northern and Central Finland. In Sweden, a more complex pattern of municipalities with high and low GDP values is revealed. This shows that the production of wealth in peripheral NUTS 3 regions is often concentrated in few locations. The extent of the regions implies that the inhabitants of one part of a NUTS 3 cannot necessarily benefit from wealth production in another part.

Unemployment rates in 2001 and population potential

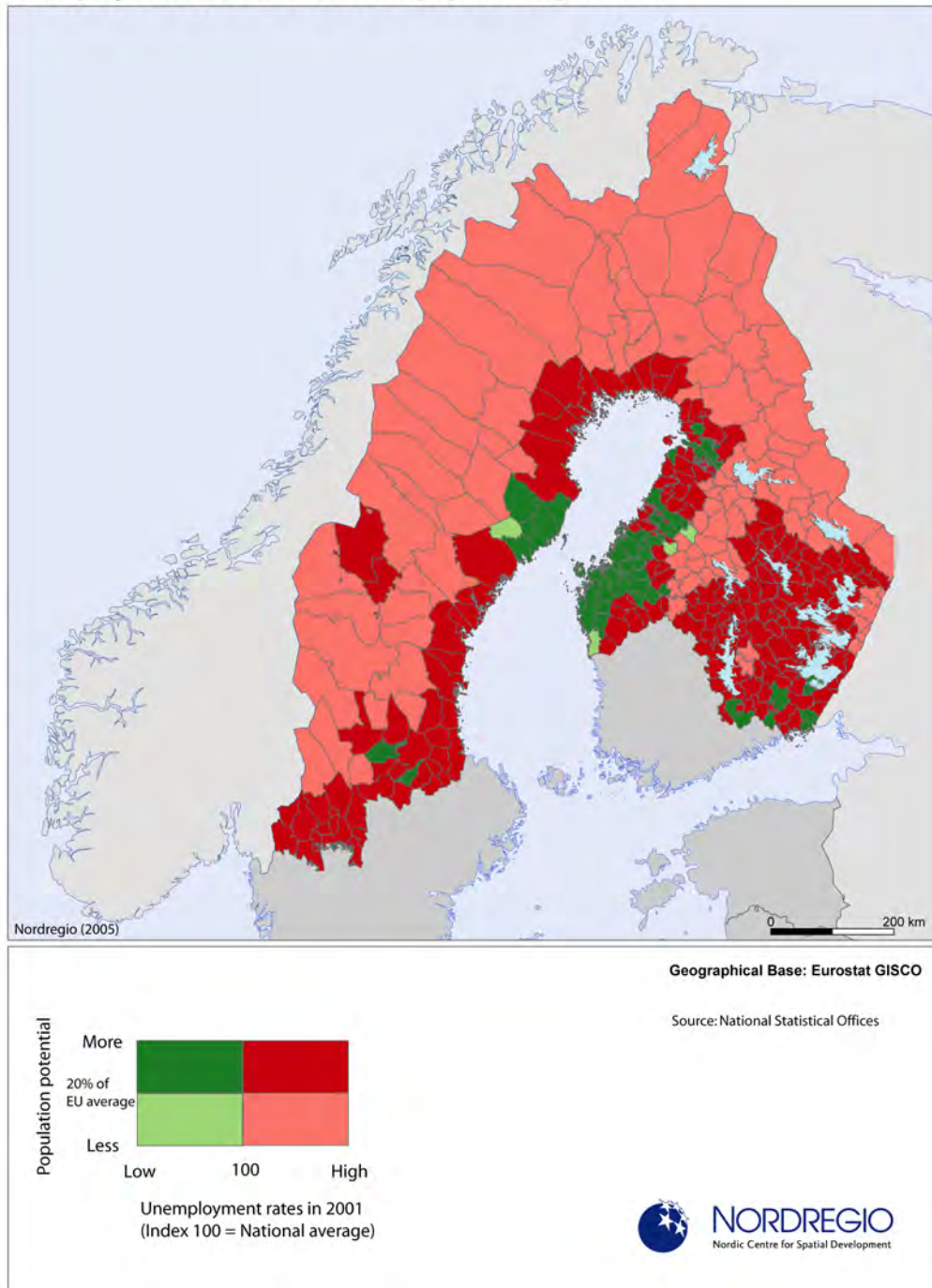


Figure 1.8. Unemployment above national average values are highly correlated with low population potentials.

Standardised income per inhabitant

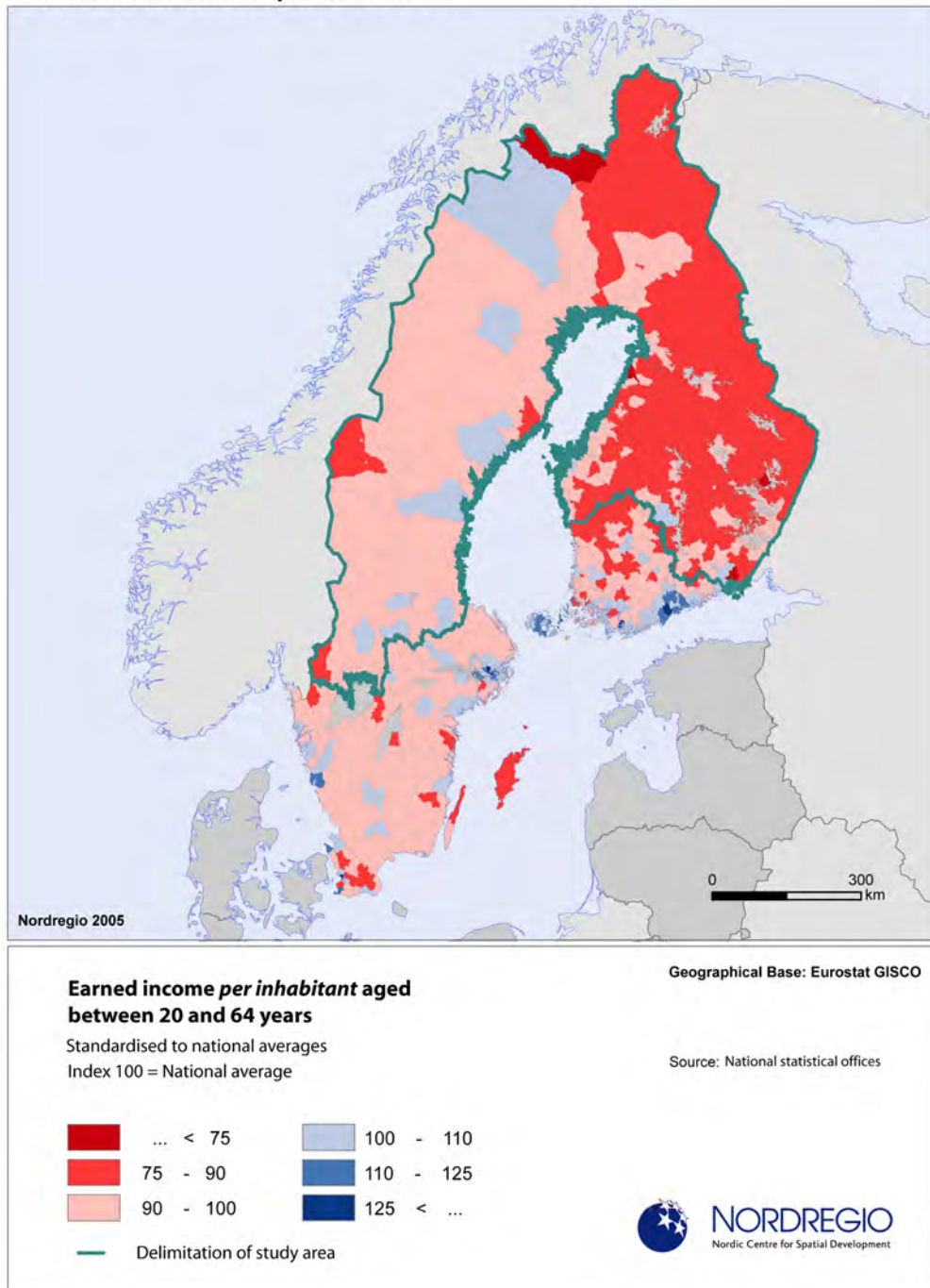


Figure 1.9. Lower income levels are concentrated in Sparsely populated parts of Finland, while the contrasts are much weaker in Sweden.

Proportion of transfer-income out of total municipal income

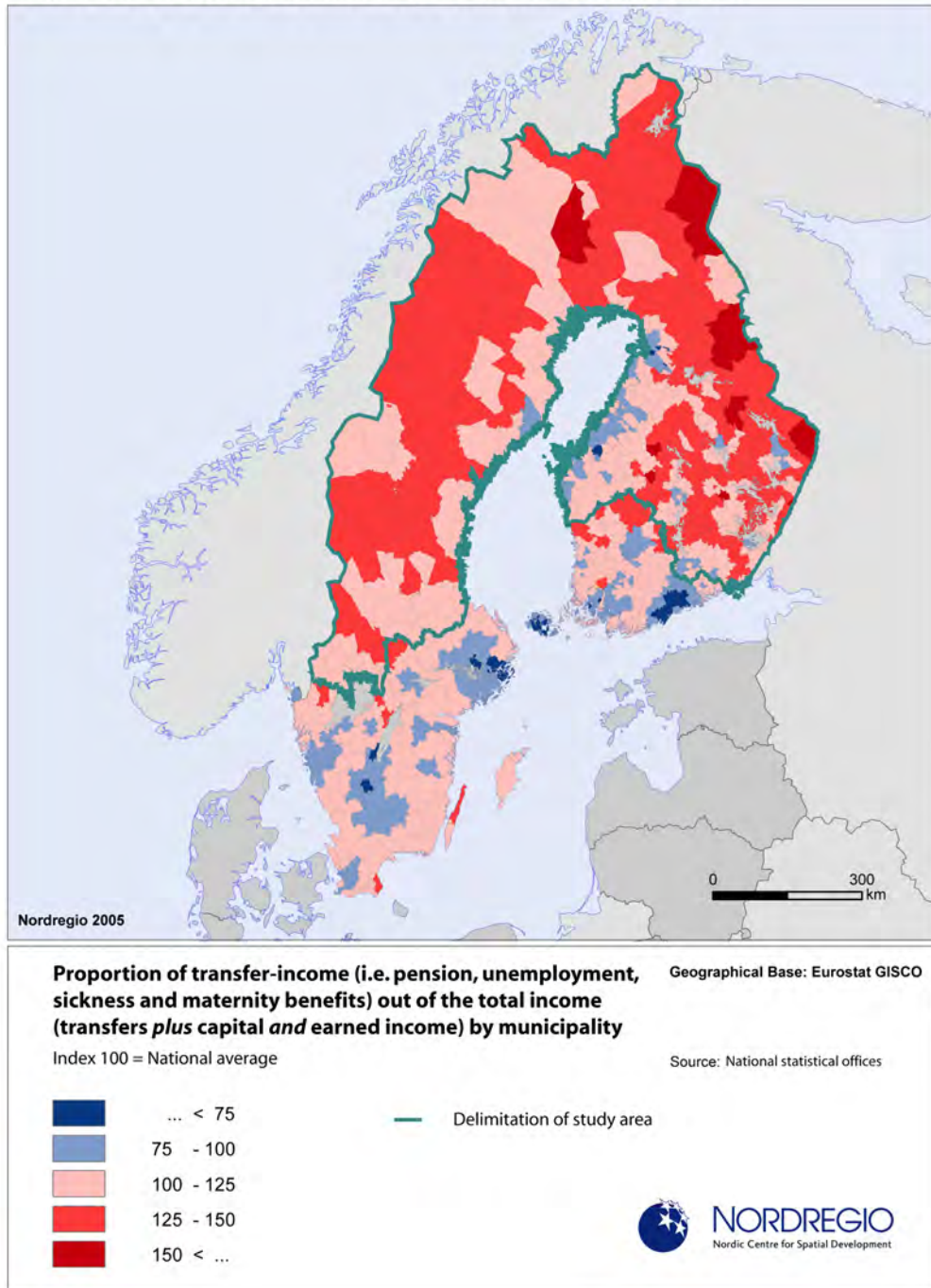


Figure 1.9. Areas with a high proportion of transfer income are concentrated in the sparsely populated parts of the study area.

Conclusion

In reviewing the contents of the above report it is clear that the regions of the Northern Periphery of the Nordic countries experience what may be termed a “syndrome” of disadvantage. The term is appropriate, since as in a medical syndrome, the situation is characterised by a number of associated symptoms of disadvantage, which, although they mutually reinforce the overall disadvantage experienced by these regions, are not necessarily connected in a causal sense. Thus, though sparsity, peripherality and structural weakness (i.e. dependence upon primary industries), are different problems, with distinct causes, they often co-exist, and together contribute to a very substantial cumulative barrier to regional development.

The recognition of the “syndrome” has several potential implications for policy:

- Since the syndrome is made up of several components of disadvantage, which are, to a degree at least, independent in terms of their causes, it follows that no single approach (addressing for example, sparsity, peripherality, migration, or structural issues alone) is likely to be effective.
- Some of the basic handicaps (such as climatic constraints) are clearly not mutable, and in this case it is appropriate to consider measures, directed at “softer” issues, mostly located in the centre of the diagram, (such as improving human and social capital, developing more effective business networks, better governance, and so on), which may compensate or ameliorate.
- Other “basic handicaps” such as peripherality, poor local accessibility, or sparsity exacerbated by migration, although not fixed physical characteristics (in the same way as climate is), are probably almost as difficult to “turn around”, simply because, in a free market economy accessible regions are generally the motors for growth, drawing on resources from the periphery, and therefore always “ahead”. This too leads to the conclusion that development policy for the periphery should focus upon “soft factors” which may better equip the population and businesses to survive within their challenging environment. “Hard” measures such as infrastructure building are nonetheless needed in certain parts, e.g. where transport bottlenecks hampering industrial development have been identified.

Such projects can also act as catalysers of improved regional cooperation and governance.

- In considering policy development for sparsely populated and peripheral regions it is important to recognise and make full use of the particular assets of such regions as locations for “footloose” economic activities. A number of Alpine and peripheral cities have already demonstrated that a favourable environment and quality of life can attract highly qualified personnel, if the appropriate structures are established in terms of public research and higher education.
- In considering policy development for sparsely populated and peripheral regions it is important to recognise and make full use of the particular assets of such regions (as locations for “footloose” economic activities) in terms of environment and quality of life.
- It is worth stressing the fact that although many of the improvements in telecommunications and information technology of recent years have tended to benefit accessible regions more than sparsely populated or remote ones, they do, nevertheless offer new opportunities for the latter. Again, providing that basic cost differentials (due to differences in market size) can be overcome by public support, the key issue is likely to be human capital (i.e., informing local entrepreneurs of the opportunities, and the training of the local workforce).

Although the above points are far from comprehensive, a basic principle is clear: In order to effectively address the effects of the basic handicaps of the Northern Periphery, it will be necessary to focus efforts upon “Intermediate/Contingent” processes, and to develop imaginative “softer” approaches to the “syndrome” of disadvantage.

By combining its strategic role as a centre of expertise for high technology products and services, as a producer of raw material and processing industry products and as a gateway for products from Russia and northern Eurasia, the sparsely populated areas of the Nordic countries hold the key to a strategic role in the European context. It is however important to ensure that these development perspectives are implemented with a focus on the interests of these Nordic peripheral regions. Coordinating regional actors and national stakeholder through appropriate transnational governance structures is therefore of primary importance.

Through the implementation of three above mentioned development strategies, the Nordic sparsely populated areas have the potential to contribute to the achievement of the Lisbon agenda, i.e. making Europe the most competitive economy in the world. Compensating for the higher relative cost of building and operating infrastructure in these areas is in other words likely to be profitable for the European economy as a whole. A European policy compensating for concentrating trends in the economy can ensure that the current and potential human capital, natural resources and strategic transport nodes within the peripheral and sparsely populated regions are made available to the European economy. A European regional policy can in other words constitute an original contribution to the Lisbon agenda, by identifying territories where current market mechanisms fail to take advantage of the existing resources. The Nordic peripheral sparsely populated areas constitute one type of such areas.

2. Introduction

2.1. European recognition of the structural weaknesses of sparsely populated areas

Sparsity has been recognised as a major specificity of the Nordic peripheries in the European context. Protocol no. 6 of the accession treaties of Sweden and Finland led to the implementation of a specific priority objective in areas with low population densities, known as “Objective 6”, until 1999. Between 2000 and 2006 these areas with low population densities have been preserved within the context of the Structural Funds, as extensive parts of North Finland, North Sweden, Mid Sweden and East Finland were defined as “Objective 1” areas. In other words, these regions have been recognised as belonging to the less prosperous areas of the European Union, habitually suffering from a lack of business and social services and with a poor basic infrastructure endowment.

Extracts from Protocol no. 6 of the accession treaties of Sweden and Finland

Article 1

Until 31 December 1999, the Structural Funds, the Financial Instrument for Fisheries Guidance (FIFG) and the European Investment Bank (EIB) shall each contribute in an appropriate fashion to a further priority Objective in addition to the five referred to in Article 1 of Council Regulation (EEC) No 2052/88, as amended by Council Regulation (EEC) No 2081/93, which Objective shall be:

- to promote the development and structural adjustment of regions with an extremely low population density (hereinafter referred to as ‘Objective 6’).

Article 2

Areas covered by Objective 6 shall in principle represent or belong to regions at NUTS level II with a population density of 8 persons per km² or less. In addition, Community assistance may, subject to the requirement of concentration, also extend to adjacent and contiguous smaller areas fulfilling the same population density criterion. Such regions and areas, referred to in this Protocol as ‘regions’ covered by Objective 6, are listed in Annex 1.

[...]

Article 142

1. The Commission shall authorize Norway, Finland and Sweden to grant long-term national aids with a view to ensuring that agricultural activity is maintained in specific regions. These regions should cover the agricultural areas situated to the north of the 62nd Parallel and some adjacent areas south of that parallel affected by comparable climatic conditions rendering agricultural activity particularly difficult.

2. The regions referred to in paragraph 1 shall be determined by the Commission, taking into consideration in particular:

-

the low population density;

-

the portion of agricultural land in the overall surface area;

-

the portion of agricultural land devoted to arable crops intended for human consumption, in the agricultural surface area used.

2.2. Three separate handicaps

The northern and eastern regions of Finland and Sweden are characterised by three main constraints on economic activity, namely remoteness, cold climate and sparse population.

The degree of remoteness corresponds to the distance to the core areas of Europe, where concentrations of people and companies create the main European markets, and where the most specialised providers of goods and services are to be found.

Cold climate can be seen as a general constraint on human settlement, but the most distinct economic impacts concern primary activities such as agriculture and forestry and the transport sector. Areas with a cold climate will generally be characterised by a short growing season, a soil with a reduced agricultural potential and temperatures considerably below freezing point in the wintertime. In terms of transport, harsh climatic constraints can lead to erratic variations in accessibility during winter, and to increased costs in respect of keeping the infrastructure free from snow.

Sparsity characterises regions where low population densities and dispersed settlement patterns create specific challenges for economic activity and public service provision. In other words, low regional population densities are not

sufficient to characterise a region as “sparse”. Sparsity occurs insofar as the combination of low population densities and dispersed settlement patterns lead to specific challenges for economic activity. This point is further elaborated in Chapter 6.

An important point to make is that strictly speaking, sparsity and remoteness are distinct concepts – the first relating to the spread or distribution of population within a region, the latter referring to the distance between the region and the main economic centres of Europe. However in the Nordic countries sparsity and peripherality are generally coincident. It is perhaps worth noting also, that if there is any causal relationship between them it runs from remoteness to sparsity (and not the other way round).

There are however clear similarities in the ways these two dimensions affect economic activity – both result in increased costs and difficulty of doing business (especially for primary and manufacturing sectors), as well as to the increasing cost of, and difficulty in providing public services.

This is quite helpful in fact: There is some literature relating to the handicap of peripherality, and much more to the advantages of agglomeration, but very little on the impacts of sparsity. We can however reasonably assume that these related discussions could tell us a lot about the business environment of sparsely populated areas. To put it another way, it is reasonable to infer that the benefits of agglomeration/central location define what is missing from the economic environment of both sparsely populated and peripheral regions. A brief account of theories around these structural weaknesses will thus be developed below.

2.3. Theoretical accounts of the main disadvantages associated with Sparsity/Peripherality

Increased cost of material inputs, due to higher transport costs

This argument dates back to the earliest writers on the geography of industrial location – perhaps the best known being Weber (1909), with a more recent summary being provided by David M Smith (1971). The basic argument here is that *ceteris paribus*, the optimal location for a manufacturing business that assembles material inputs from various sources will be where the cost of assembling those inputs is minimised. Generally speaking, because many of the required inputs are produced by other firms sparsely populated areas tend to be sub-optimal in this respect. However, it has to be said that the evidence for this is inconclusive: - transport costs are generally a minor element of total production costs these days (Vickermann 1991) and businesses in remoter areas do not seem have a higher transport related costs (PIEDA 1984, 1987, Chisholm 1995). However this may simply reflect a natural selection process favouring businesses that are less sensitive to transport costs in peripheral or sparsely populated areas.

The more optimistic proponents of (transport and communications) infrastructure investment and new technologies (including IT) have gone as far as to argue for the “death of distance” as a constraint to economic activity. However there is plenty of anecdotal evidence to suggest that costs associated with distance from the main hubs of economic activity are still perceived to be a major constraint in the periphery (See, for example Copus 2004 Chapter 6). It is also worth pointing out that infrastructure improvements may have a perverse effect on some service industries in peripheral/sparsely populated regions, as they open them up to competition from other regions (the so called “pump effect”).

Absence of Agglomerative Advantage

The concepts of “agglomerative advantage” and “external economies of scale” also have a long history. Fujita et al (1999) have termed the conventional view of agglomerative advantage “Marshall’s trinity” after Alfred Marshall (1930), who first described them. The three elements are:

- a. Proximity to suppliers of intermediate inputs and purchasers of intermediate outputs
- b. The benefits of “labour pooling” (i.e. sharing a common labour market characterised by development of appropriate skills etc)
- c. Rapid transfer of information between firms.

Agglomerative advantage was a key concept for a group of regional development theorists of the late 1950s, including Myrdal (1957), Hirschmann (1958) and Friedmann (Wight 1983), who argued that regional disparities in economic performance were a natural consequence of processes of “cumulative causation”, which tended to favour densely populated central regions at the expense of sparsely populated peripheral ones.

More recently a group of academics sometimes referred to as the “New Economic Geographers”, the most well known being Paul Krugman have worked extensively on this issue, and have succeeded in providing “buttoned down, mathematically consistent analysis” (Krugman 1994) to show that agglomerative advantage can derive solely from Marshall’s first factor. They have also argued that reduced transport costs and population growth will both (*ceteris paribus*) result in increasing regional differentiation. This is not good news for sparsely populated and peripheral regions.

Exclusion from the benefits of modern logistics systems

In recent years a number of writers have noted that technological changes in transport and communication infrastructures have resulted in a more intense and complex use of logistics. Rapid transport and computerisation of stock

management have allowed the majority of activities to take advantage of just-in-time (JIT) delivery and therefore to reduce stock levels and hence capital requirements and perhaps also waste. (Rietvelt and Vickermann 2004) However scale economies mean that modern logistics systems tend to be best developed in more densely populated, central regions. Sparsely populated and peripheral regions tend to be linked into these systems through attenuated (and slower) links. This constitutes a significant new element of economic disadvantage for such regions.

Attenuated business networks hamper the development of “innovative milieu”

Innovation has long been recognised as a key driver of regional economic growth (Marshall 1930, Schumpeter 1934). The sort of innovation that drives regional development is not necessarily driven by exogenous technological breakthroughs, equally important here are factors such as the incremental and endogenous, “learning by doing”, through which “tacit knowledge” is accumulated within localised networks of firms, institutions and individuals. Thus, for instance, Nijkamp (2003 p402) writes; “local inter-firm networks may be seen as supporting mechanisms for new forms of creative entrepreneurship....”

The assumed connection between well developed and localised networks (bound together by both formal transaction linkages and by informal “non-market” social contacts or familial ties) is the foundation for several strands of research and a very large combined literature, including the Italian “industrial districts” school, “milieu innovateur”, clusters, local/regional innovation systems, and “learning regions”.

Although several writers have argued that effective networking can provide benefits analogous to agglomerative advantage for dispersed firms (Perry 1999 p3, Johansson and Quigley 2004 p165), others (Copus and Skuras 2005) have suggested that firms in remote, sparsely populated regions tend to lack the type of intense, localised network patterns which foster endogenous innovation processes and facilitate regional growth processes.

Lack of Critical Mass and Diseconomies of Scale

Finally, sparsely populated regions suffer from the disadvantage that their population (and therefore the demand for both public and private services) is often too small to allow for economies of scale and cost effective provision. There is generally a maximum range beyond which consumers are either not prepared to travel (due to travel cost) or are unable to travel (perhaps for safety reasons, as in the case of many medical services). In many sparsely populated areas services are (perforce) provided at locations determined by such “range” considerations, but at a very much lower scale than would be optimal, due to the lack of population within range.

Although these basic ideas owe much to Central Place Theory, the recent academic literature is in itself rather sparse. An interesting policy orientated analysis was recently carried out by consultants for Highlands and Islands and Argyll and Bute Councils in Scotland (Paula Gilding Consulting 2004). The analysis compared the cost of providing a range of services (education, cultural, environmental, roads and transport, planning and development and social work) in sparsely populated areas with more densely populated “control” areas. An accounting methodology was developed to enable the additional cost of providing the specified services within the sparsely populated areas (compared with what it would cost if the sparse areas were more densely populated). In the case of Highland Council, for instance the additional cost of providing services in the sparsely populated areas amounted to more than £12m *per annum*. In addition to this it was estimated that because certain services were not offered in the sparsely populated areas to the same standard as elsewhere, a further £0.8m would be required to bring them to the level of the rest of the region.

Additional Infrastructure and Operating Costs

In addition to the diseconomies of scale described above, harsh climatic conditions lead to further additional costs in Nordic sparsely populated regions. These span from operating costs for icebreakers in order to keep the Baltic seaports open in the winter months, to additional domestic and industrial heating expenses and specific technological constraints building and running a water supply system that can resist extreme negative temperatures.

Local government and service providers in sparsely populated areas will also incur additional costs in terms of road maintenance (where this is a regional responsibility), and in terms of the travel/transport element of the cost of operating across the range of services. Where public transport is subsidised, provision will inevitably be more expensive (on a per passenger-mile basis) where traffic volumes are relatively low.

Even if transport costs in the narrow sense have diminished over the last decade, there is little hope that this will outweigh the distant geographical location of these areas. Indeed, other types of ‘transaction costs’ (mentioned above) still favour agglomerations: costs to compensate for the lack of modern logistics systems, additional costs for the lack of business networks and the lack of innovative *miliens*, extra costs for diseconomies of scale and for the lack of critical mass, and extra costs for the lack of specialised business-related service sectors (such as banking, lawyers, tax advisers, translation services). Instead of witnessing the death of space and distance foreseen by some (Harvey, 1989) current trends lead us towards an increasing dominance of agglomerations and central regions.

3. Delimitating sparsely populated areas in the European Union

Delimitating sparsely populated areas is a necessary prerequisite for a policy addressing sparsity, and is commonly done using methodologies based on average population densities. These however do not necessarily reflect the social and economic issues of sparsity, as they do not take into account the settlement structures within each region. For this reason, they are of little help in identifying areas where it is difficult or impossible to establish a level of basic service provision to the population, or where labour markets are too small for companies to find the competences they need. In the present chapter, we will attempt to define a delimitation method that would better reflect the issues of sparsity.

3.1. Delimitation according to NUTS 2 and NUTS 3 average densities

When dealing with sparsity, the accession treaties referred to above as well as other European regulations refer to average population densities at the NUTS 2 or NUTS 3 level¹. Ranking lists resulting from the currently used thresholds (8, 12.5 and, more recently 50 inh/km²) are presented in tables 3.1 and 3.2. Land areas without main lakes have been compiled for Finland and Sweden. These however only change the classification of one region, namely Norra Mellansverige.

Figures 3.1 and 3.2 represent NUTS 2 and NUTS 3 regions with the lowest average population densities. At both scales, Northern and Eastern regions of Sweden and Finland are among the least densely populated areas in the EU. At the NUTS 2 level, Eastern Finland is however a more densely populated area than the Scottish Highlands and Islands (Table 3.1). Zooming in to the NUTS 3 level, one finds that Kainuu is the only region with a population density below 8 inh/km² (Table 3.2). The other three NUTS 3 within the Eastern Finland NUTS 2 have densities varying from 9,75 inh/km² to 11,77 inh/km², which are comparable values to those encountered in the three least densely populated Spanish NUTS 3 regions, namely, Soria, Turel and Cuenca.

¹ NUTS is a French acronym, and stands for Unified Nomenclature of Statistical Territories. The NUTS 3 level corresponds to *län* in Sweden and *maakunta* in Finland, while NUTS 2 areas are groups of NUTS 3 with no specific administrative status in both countries.

More generally, the approach based on average NUTS population densities fails to take into account the geographical structure of the population within these regions. Municipalities with low population densities in the periphery of a region comprising a major city are not taken into account. Even if one can understand the need for a simple approach to define the geographical scope of Structural Funds and for the Regional Aid Guidelines at the European level, alternative approaches need to be developed as a basis for negotiating local adaptations of these rules. These approaches may contribute to justify “swapping” weak areas situated outside officially defined “low population density areas” against stronger areas within them. This may in turn allow for the continued application of the current Objective 1 delimitation in areas where this is considered to be politically desirable.

Table 3.1: Lowest NUTS 2 average population densities in Europe (inh/km², 2002)

Name	Density	Population
Guyane (FR)	2,10	175 400
Övre Norrland (SE)	3,30	509 200
Pohjois-Suomi (FI)	4,70	628 300
Mellersta Norrland (SE)	5,20	373 000
Highlands and Islands (UK)	9,30	368 200
Itä-Suomi (FI)	9,60	674 500
Norra Mellansverige (SE)	12,90	828 100

Source: Eurostat

Table 3.2: Lowest NUTS 3 average population densities in Europe (inh/km², 2002)

Name	Density	Population
Lappi (FI)	2,0	188 500
Guyane (FR)	2,1	175 400
Jämtlands län (SE)	2,6	128 300
Norrbottens län (SE)	2,6	254 200
Kainuu (FI)	4,1	87 900
Västerbottens län (SE)	4,6	255 000
Caithness and Sutherland, Ross and Cromarty (UK)	6,9	88 300
Lochaber, Skye and Lochalsh, Argyll and The Islands (UK)	7,0	100 700
Comhairle Nan Eilan (Western Isles) (UK)	8,4	26 200
Soria (ES)	8,8	90 800
Teruel (ES)	9,2	136 300
Pohjois-Karjala (FI)	9,6	170 300
Dalarnas län (SE)	9,8	276 800
Evrytania (GR)	10,4	19 500
Pohjois-Pohjanmaa (FI)	10,5	369 000
Västernorrlands län (SE)	11,3	244 700
Etelä-Savo (FI)	11,4	163 900
Cuenca (ES)	11,8	200 900
Huesca (ES)	13,2	207 400
Keski-Pohjanmaa (FI)	13,5	70 800
Grevena (GR)	14,2	32 400
Lozère (FR)	14,3	74 100
Etelä-Pohjanmaa (FI)	14,6	194 300
Guadalajara (ES)	13,9	178 800
Lääne-Eesti (EE)	14,9	164 700
Pohjois-Savo (FI)	15,3	252 400
Gävleborgs län (SE)	15,4	277 600
Shetland Islands (UK)	15,4	21 900
Baixo Alentejo (PT)	15,6	131 800
Värmlands län (SE)	15,7	273 700
Kesk-Eesti /EE)	15,9	143 000
Inverness and Nairn, Moray, Badenoch and Strathspey (UK)	15,8	111 900
Keski-Suomi (FI)	15,9	264 900

Source: Eurostat

Average population densities at NUTS 2-level

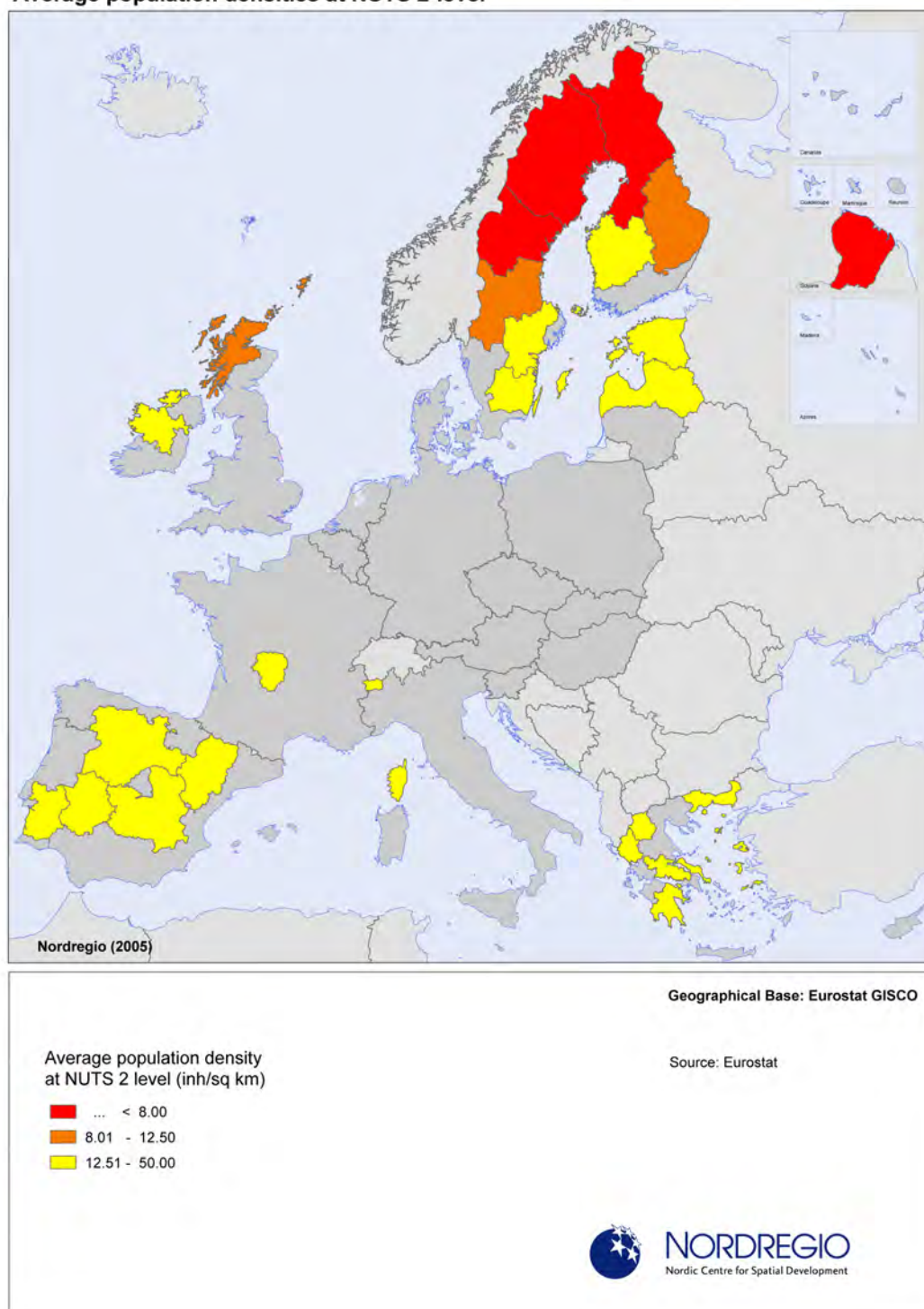


Figure 3.1. North Sweden, North Finland and Mid-Sweden have the lowest average population densities at NUTS 2 level, while East Finland is in the same category as Central Sweden and the Scottish Highlands and Islands.

Average population densities at NUTS 3-level

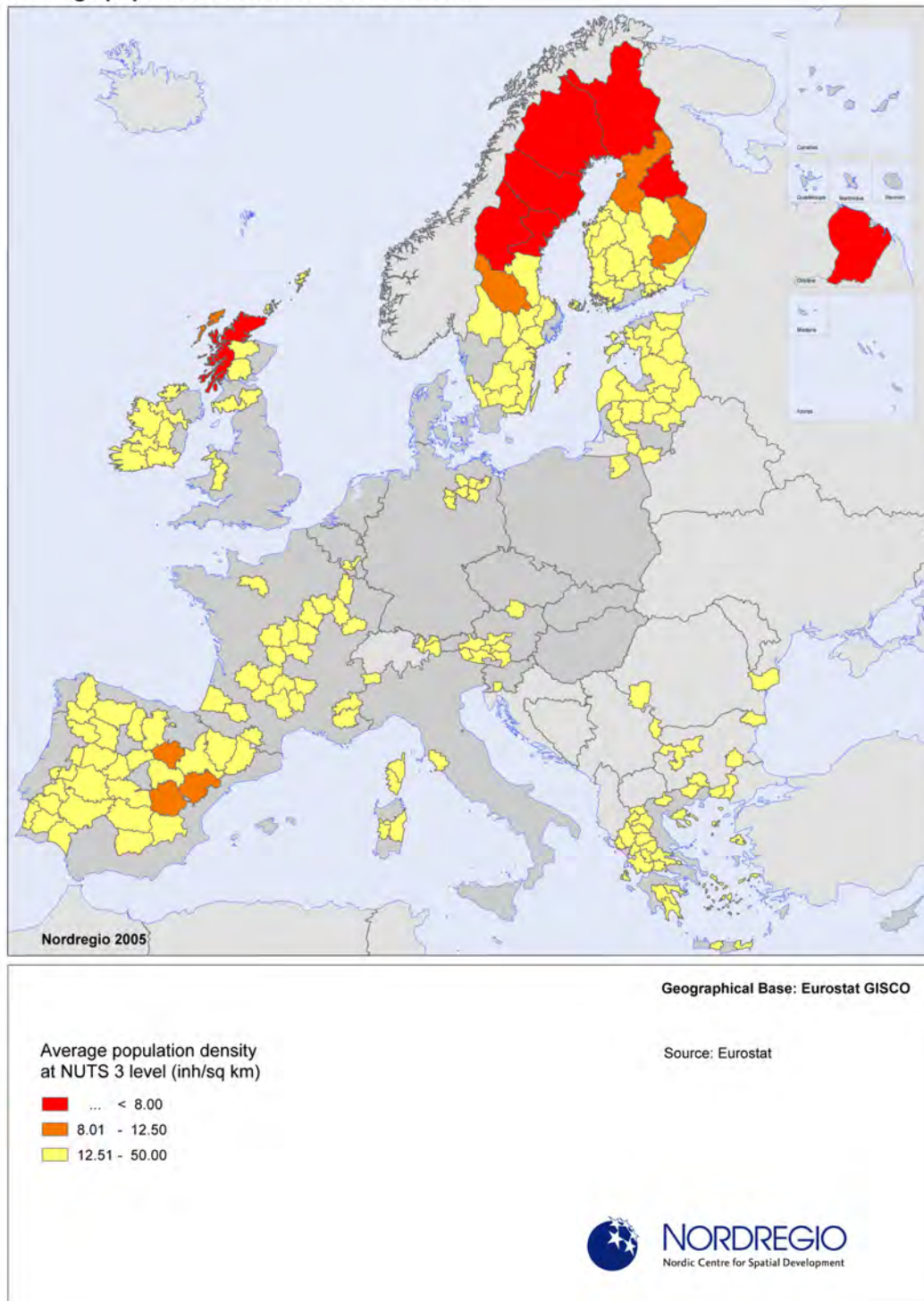


Figure 3.2. Average population densities at NUTS 3-level

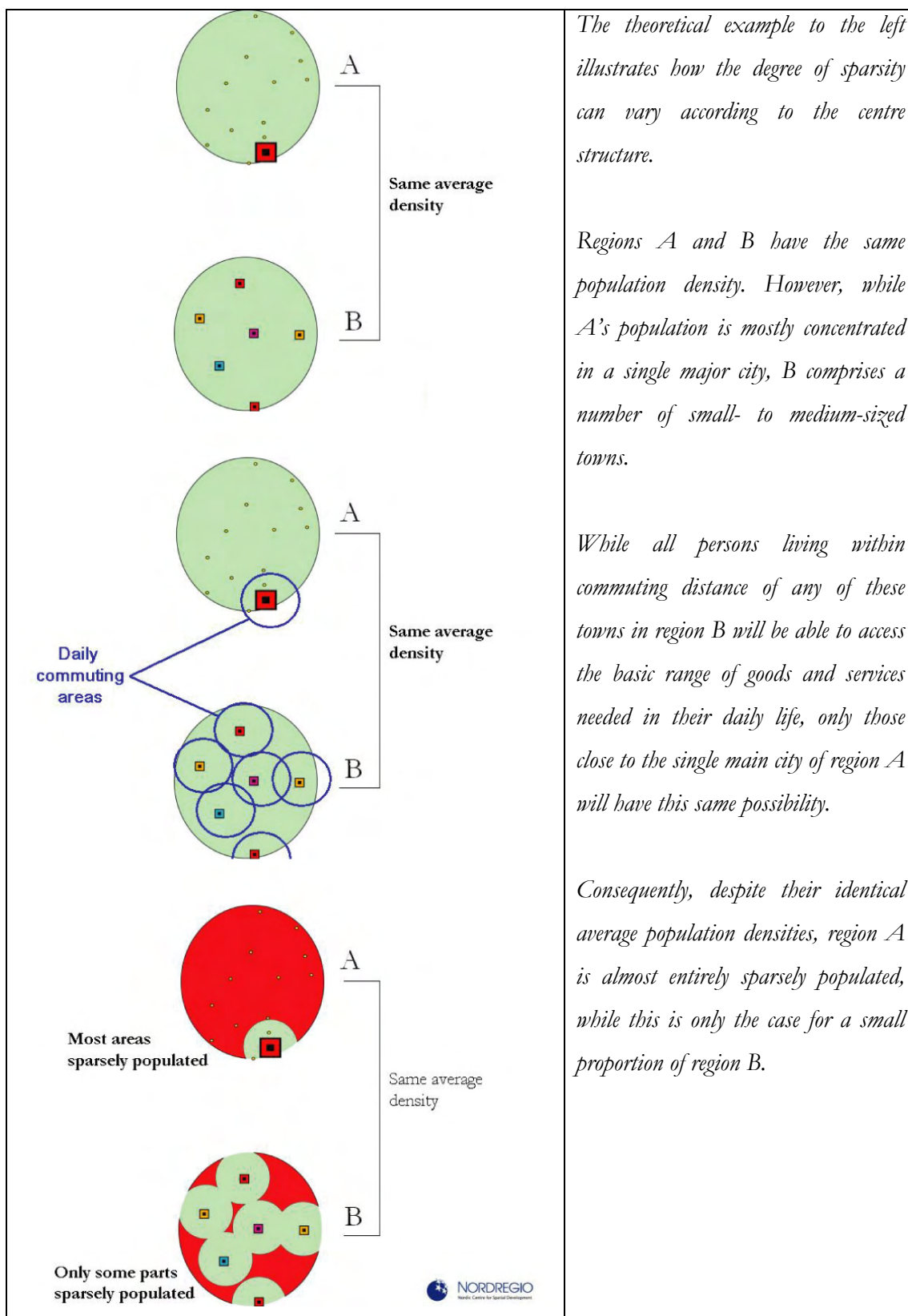
3.2 A delimitation approach reflecting the social and economic issues of sparsity

The use of regional average population densities as a proxy for sparsity is problematic in a number of respects. First, these measures are to a large extent determined by the scale and delimitation of regions. Average population densities are in fact constructed when one draws the limit between two regions.

For this reason, the geographical extent of areas characterised as sparsely populated on the basis of average population densities can vary significantly when administrative boundaries are modified. Results are furthermore not comparable from country to country, depending on the size of NUTS areas and on the way they are constructed: according to some delimitation rationales the rural and urban parts of a region are identified as two separate entities.

But most importantly, average population densities do not reflect the possible problems and challenges linked to sparse population. For the inhabitants of a specific region, the question is whether they can find the services, goods and competencies they need to uphold the living standard they expect. These will generally be present insofar as the demographic potential will be sufficient to make them profitable. Entrepreneurs will want to be able to recruit the personnel they need. They must therefore have access to a sufficiently wide and diverse labour market. The issue is therefore not linked to average regional population density, but to the total number of persons situated within commuting distance of a given point.

Figure 3.3 illustrates the relationship between sparsity and average population densities. This theoretical example is based on two regions, *A* and *B*, which have the same population density. However, while *A*'s population is mostly concentrated in a single major city, *B* comprises a number of small- to medium-sized towns. While all persons living within commuting distance of any of these towns in region *B* will be able to access the basic range of goods and services needed in their daily life, only those close to the single main city of region *A* will have this same possibility. Consequently, despite their identical average population densities, region *A* is almost entirely sparsely populated, while this is only the case for a small proportion of region *B*.



The theoretical example to the left illustrates how the degree of sparsity can vary according to the centre structure.

Regions A and B have the same population density. However, while A's population is mostly concentrated in a single major city, B comprises a number of small- to medium-sized towns.

While all persons living within commuting distance of any of these towns in region B will be able to access the basic range of goods and services needed in their daily life, only those close to the single main city of region A will have this same possibility.

Consequently, despite their identical average population densities, region A is almost entirely sparsely populated, while this is only the case for a small proportion of region B.

Figure 3.3. Theoretical model illustrating the effect of centre structures on sparsity

The most relevant sparsity measure should therefore reflect the number of persons within a reasonable commuting distance. A 50 km distance threshold (measured as the crow flies, i.e. airline distance) has been used for this purpose. This radius translates into an area of about 7,854 km². The total number of persons within this area is referred to as the **population potential** of each point in space. It is calculated using population figures provided for 1x1 km grid cells for Finland, Sweden, and for municipalities in the rest of Europe.

Based on the arguments presented above, one can reasonably assume that the relationship between the population potential and the intensity of constraints linked to sparsity is not a linear one. This relationship is rather determined by a number of thresholds corresponding to the minimum degree of profitability for the provision of each kind of goods and services. These thresholds in other words correspond to the critical population mass for a certain type of activity. The level of constraint will therefore rise steeply at some key levels, e.g. when the population potential is insufficient to establish an economically viable supply of foodstuff.

Within this project, it has not been possible to calculate these thresholds on an empirical basis, as this would require very ample enquiries on profitability threshold levels for the provision of different types of goods and services. Instead, a set of five different population potential thresholds were tested: Three of them correspond to population densities often referred to in the European context: 8 inh/km², 12.5 inh/km² and 50 inh/km². An additional threshold corresponds to 5 % of the European average, while the final one corresponds to a hypothetical minimum population potential to run daily services. Table 3.3. illustrates how these thresholds translate into minimum population potentials within a commuting radius of 50 km. The population potential indicated in Table 3.3. is the maximum value, above which the area is not considered to be sparsely populated.

Table 3.3. Thresholds and minimum population potential

Threshold	Minimum population potential (i.e. threshold x 7,854 km ²)	Rounded minimum population potential
8 inh/km ²	62 832	65 000
12.5 inh/km ²	98 175	100 000
50 inh/km ²	392 700	395 000
5 % of European average	14 370	15 000
Daily services	10 000	10 000

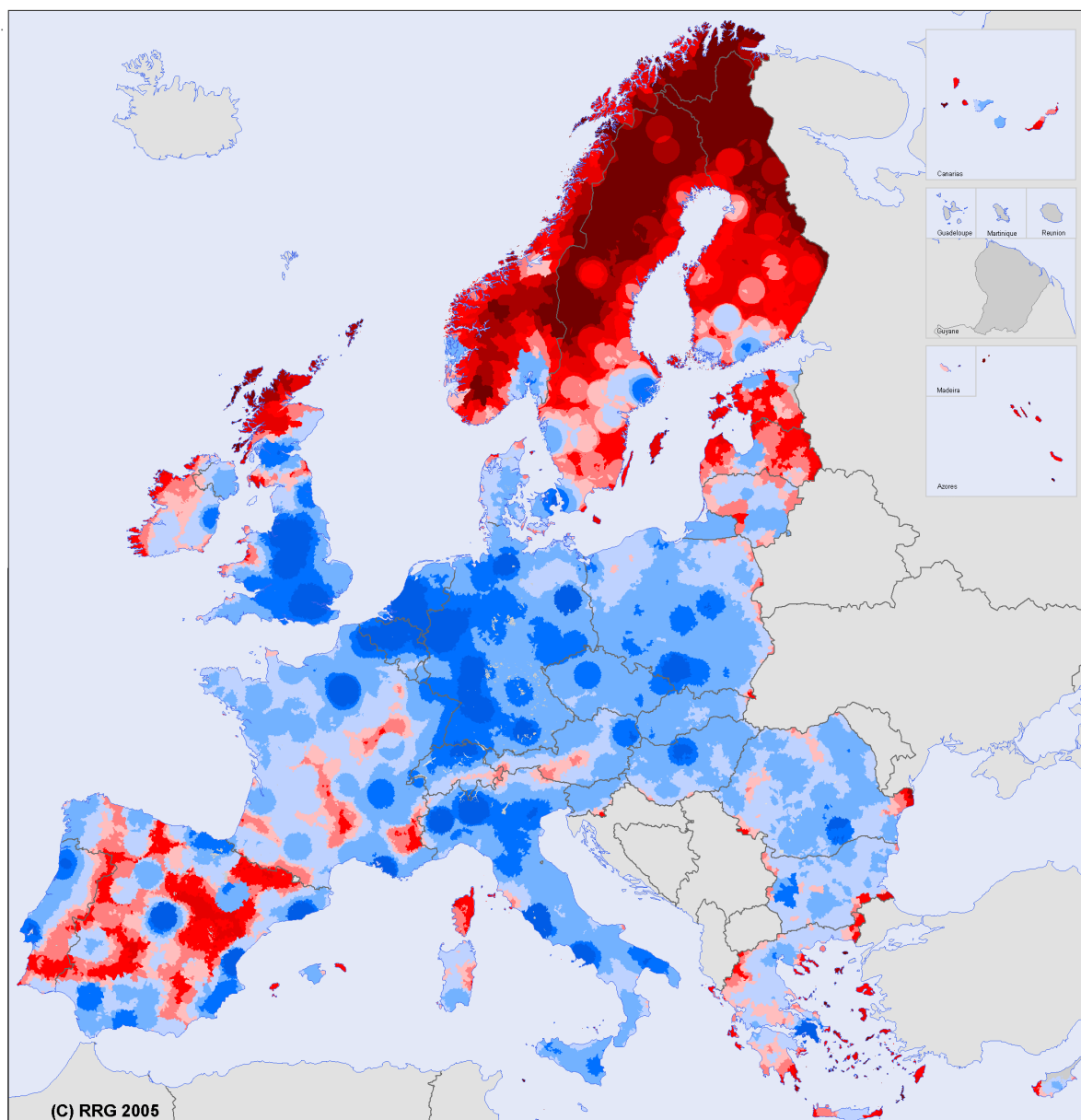
3.3. Population potentials in Europe

Figure 3.4. shows population potential within a 50 km radius standardised at the European average. The potential is defined as the sum of all people living within a 50 km radius from the origin location, measured as the crow flies.

The potentials are presented in a standardised form as percentages on the respective European average, 100 corresponding to the European average value. Areas with population potentials below 5% of the European average can only be found in Northern Scandinavia (Figure 3.4.). These areas can be found in the inner parts Sweden north of Dalarna, and in the interior of Finland north of Kainuu. In the case of Eastern Finland, no areas with population potentials below 5 % of the European average can be found.

Eastern Finland is indeed mostly composed of areas with a population potential corresponding to 25 to 50 % of the European average. Comparable values can be found in the Scottish Highland and Islands, in Eastern Ireland, in central Spain, in the Baltic countries and in most of the Greek islands.

Population potential in Europe



Geographical Base: Eurostat GISCO

Standardised population potential:
Europe (EU27+NO+CH)=100=287,407

Source: RRG

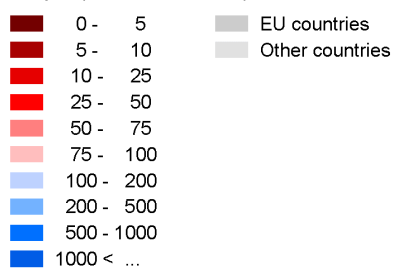


Figure 3.4. Population potentials within a 50 km radius in Europe

3.4. Identification of sparsely populated areas

Based on the arguments presented above, we consider that the most valid measure of regional sparsity is the proportion of the area characterised by low population potentials. Defining which population potentials are to be considered as low depends upon which types of economic activities or public services are taken into account, as the demographic critical mass can vary according to the sector, the organisational framework or to the institutional context. Given this complexity, the choice of a threshold value can only to a limited extent be informed by empirical and scientific evidence: it thus remains a fundamentally political choice.

Population potentials corresponding to a density below 50 inh/km²

As could be expected, the least restrictive threshold of 50 inh/km² (Figure 3.5.), or 395,000 people within a 50 km radius, considered significant parts of Europe as sparsely populated. The inclusion of a large part of France, stretching from most of the South-Western regions to the Ardennes in the North-East, implies that the perspective on sparsity is rather remote from that generally envisaged in the European context. The two Nordic countries Finland and Sweden are almost entirely considered sparsely populated, except for the capital city areas and the areas around Turku, Malmö and Gothenburg. In addition, major parts of Scotland, Wales and Ireland, as with major parts of Greece (and all Greek islands except for the close area around Heraklion), Spain, and Eastern Portugal are considered sparsely populated. Another arc also emerges here crossing the inner Alps with even the rural areas in Mecklenburg-Vorpommern and Brandenburg in Germany being considered sparsely populated according to this threshold, as are the outermost islands of Spain and Portugal with the exception of Gran Canaria and Teneriffa. Altogether, almost half of the EU27+2 area (43 %) is considered as being sparsely populated (Table 3.4.) according to this scenario.

One can note that a relatively high proportion of areas situated along the terrestrial outer borders of the study area (EU 27 + Norway and Switzerland) also appear as being sparsely populated in this map. These results may be due to a statistical effect. Indeed, as we did not have access to municipal population figures outside of the study area, the

population potential figures for areas situated at less than 50km from an outer terrestrial border are artificially reduced (e.g. along the Eastern border of Poland)

Population potentials corresponding to a density below 12,5 and 8 inh/km²

Applying the threshold of 12.5 inh/km² (Figure 3.6), or a number of 100,000 people within a 50 km radius, significantly reduces the extent of sparsely populated areas in Europe. Clearly, most parts of Finland, Sweden and also Norway remain sparsely populated, however, the southern parts of all three countries are excluded, as well as some coastal areas. Otherwise, most parts of Scotland, all of the Greek islands (with the exception of Crete) and significant regions in Spain are still considered as being sparsely populated. Interestingly however Madeira and Lanzarote are now no longer considered as being sparsely populated. Altogether, the overall proportion of sparsely populated areas on the EU27+2 area is reduced to 18.7 percent (Table 3.4) under this scenario.

The difference between the threshold of 12.5 inh/km² (Figure 3.6) and that of 8 inh/km² as shown in Figure 3.7 is only marginal. Basically, the same European regions are considered sparsely populated, except that the spatial extent of all of them is reduced compared to the previous threshold. Consequently, the proportion of these areas from the total EU27+2 area is reduced to 15.2 percent (Table 3.4) in this scenario.

In both these maps, a number of island regions have population potentials below the envisaged thresholds. This is the case for most Greek islands, as well as for the Danish island of Bornholm and the Finnish archipelago of Åland. There is a parallel between insularity and sparsity in terms of population potential: in both cases, the population can experience the same types of problems accessing the goods and services they need in their daily life (except in cases where the island's population density is very high, as for example on Gran Canaria and Tenerife). However, as insularity is a specific type of permanent handicap in European policies, these island regions have been disregarded in respect of the succeeding analyses.

Population potentials below 5% of the European average

In contrast, the threshold of 5 % of the European average (or in other words, 15,000 people within the 50 km radius) results in a major fall in the number and extent of sparsely populated areas in Europe. With the exception of insular areas, the areas considered as sparsely populated are now limited to Finland and Sweden (Figure 3.8). In contrast to the previous picture, the extent of these areas in the three countries is again reduced, particularly on the Norwegian side. All coastal areas in Finland and Sweden along the Baltic Sea are now no longer considered as sparsely populated. As to be expected, the overall proportion of the sparsely populated areas in the total EU27+2 area is reduced to a mere 7 percent (Table 3.4) under this scenario.

The final threshold, based on an arbitrary level below which access to daily services would be jeopardized, of 10,000 inhabitants within the 50 km radius reveals no greater differences to the previous one, (Figures 3.9).

Table 3.4 Percentage of sparsely populated area on total area of EU27+2.

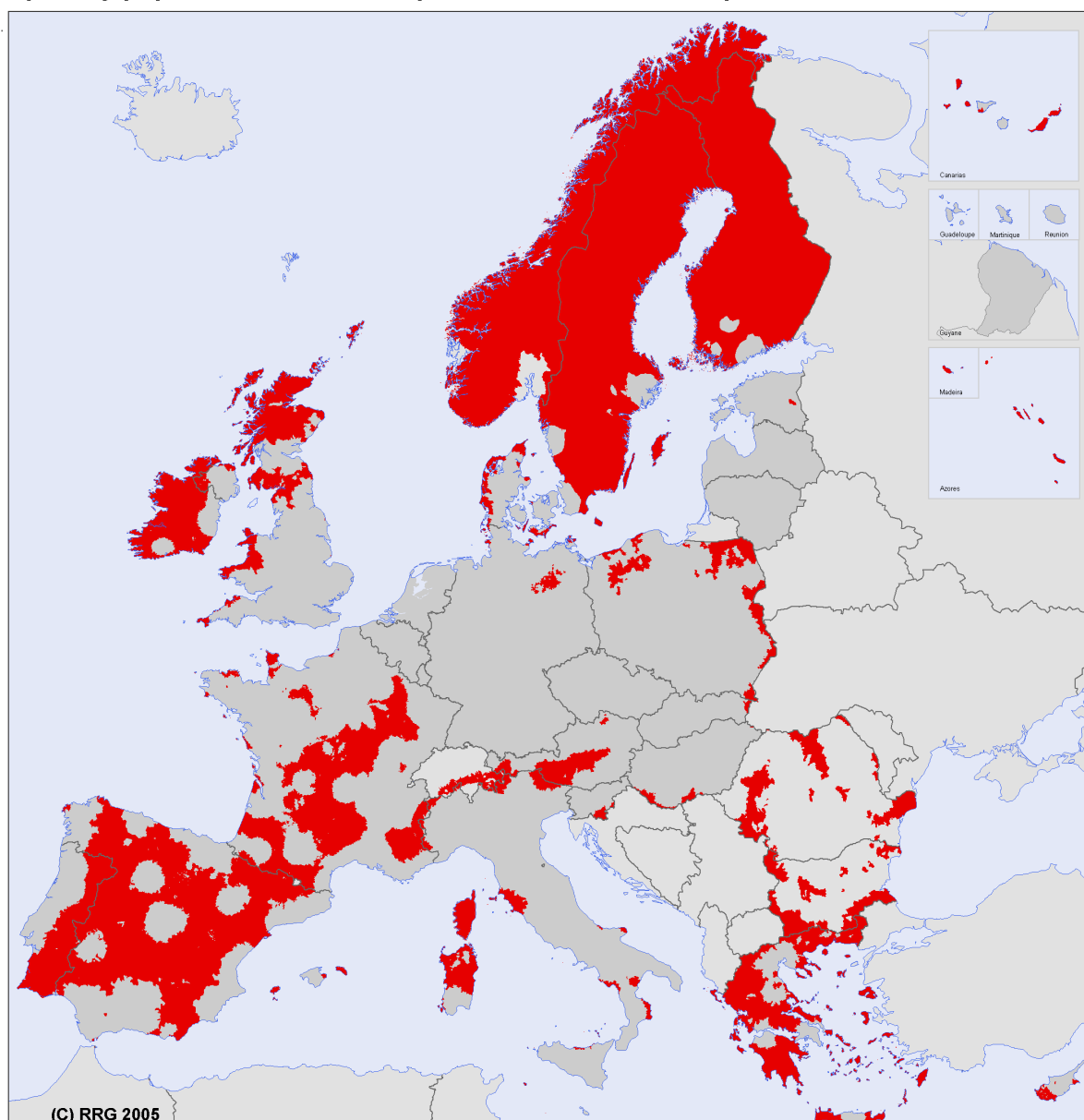
Threshold	Sparsely populated areas	
	in km2	% on EU27+2
50 inh/km2	2,011,264	43.0
12.5 inh/km2	876,494	18.7
8 inh/km2	709,529	15.2
5% European average	340,967	7.3
Daily services	251,969	5.4

EU27+2 = European Union, plus Bulgaria, Romania, Norway, and Switzerland.

Conclusion

The threshold of 12,5 inh/km² appears most adapted to the geographical focus of the present study. It furthermore corresponds to a threshold that is already embedded in European policies, as it is applied in European State aid regulations. We have consequently chosen to use this threshold in the following analyses.

Sparsely populated areas in Europe: Threshold of 50inh/sqkm



Geographical Base: Eurostat GISCO

Minimum population potential assumed: 395,000

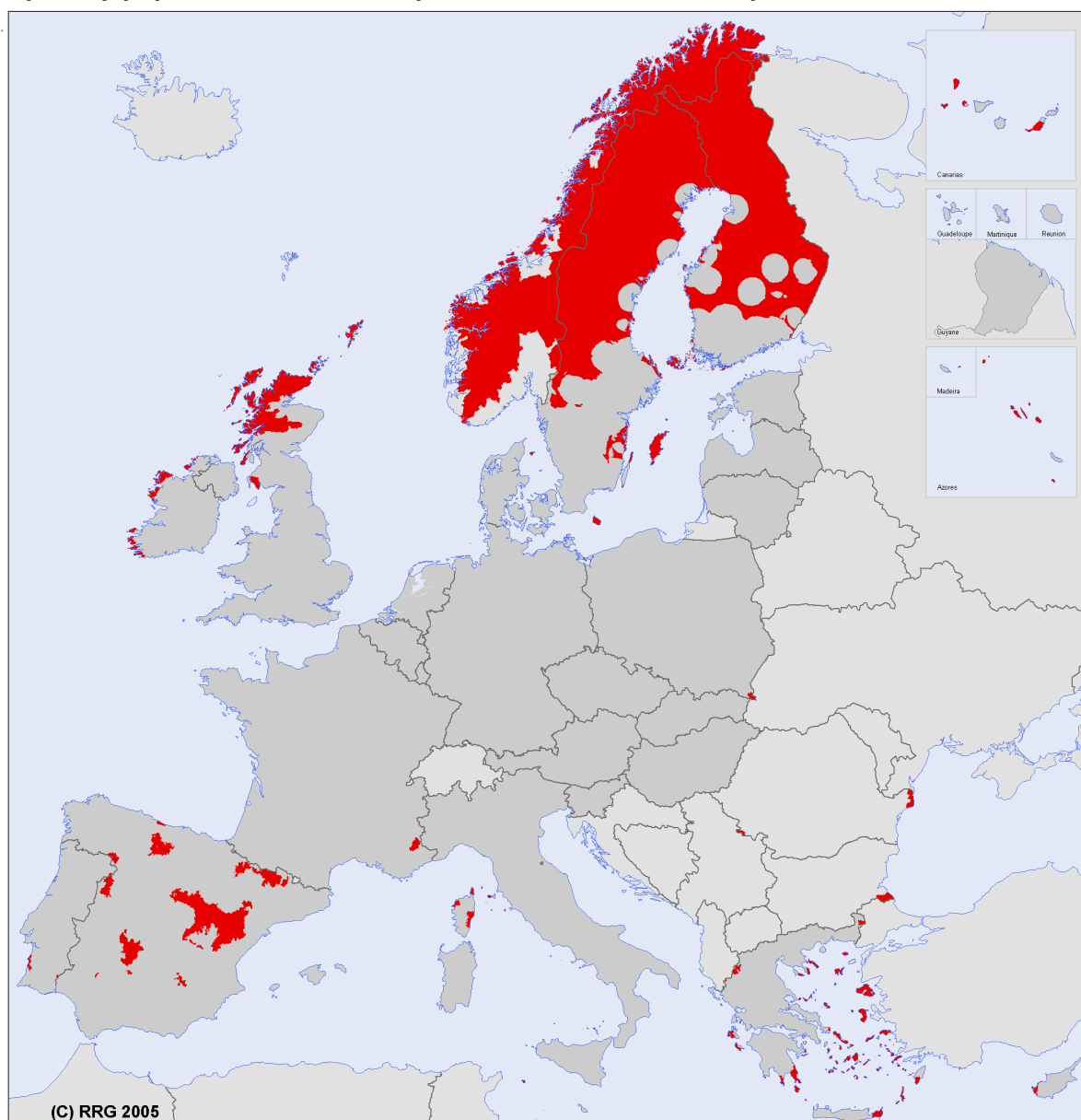
- Sparsely populated areas
- EU countries: areas not considered as sparsely populated
- Other countries

Source: RRG

FI, SE: 1x1 km grid
Rest of EU, CH, NO: NUTS-5

*Figure 3.5. Sparsely populated areas in Europe - threshold 50 inh/km²:
in all red areas, the number of people living within a 50 km radius is lower than 395 000.*

Sparsely populated areas in Europe: Threshold of 12.5 inh/sqkm



Geographical Base: Eurostat GISCO

Minimum population potential assumed: 100,000

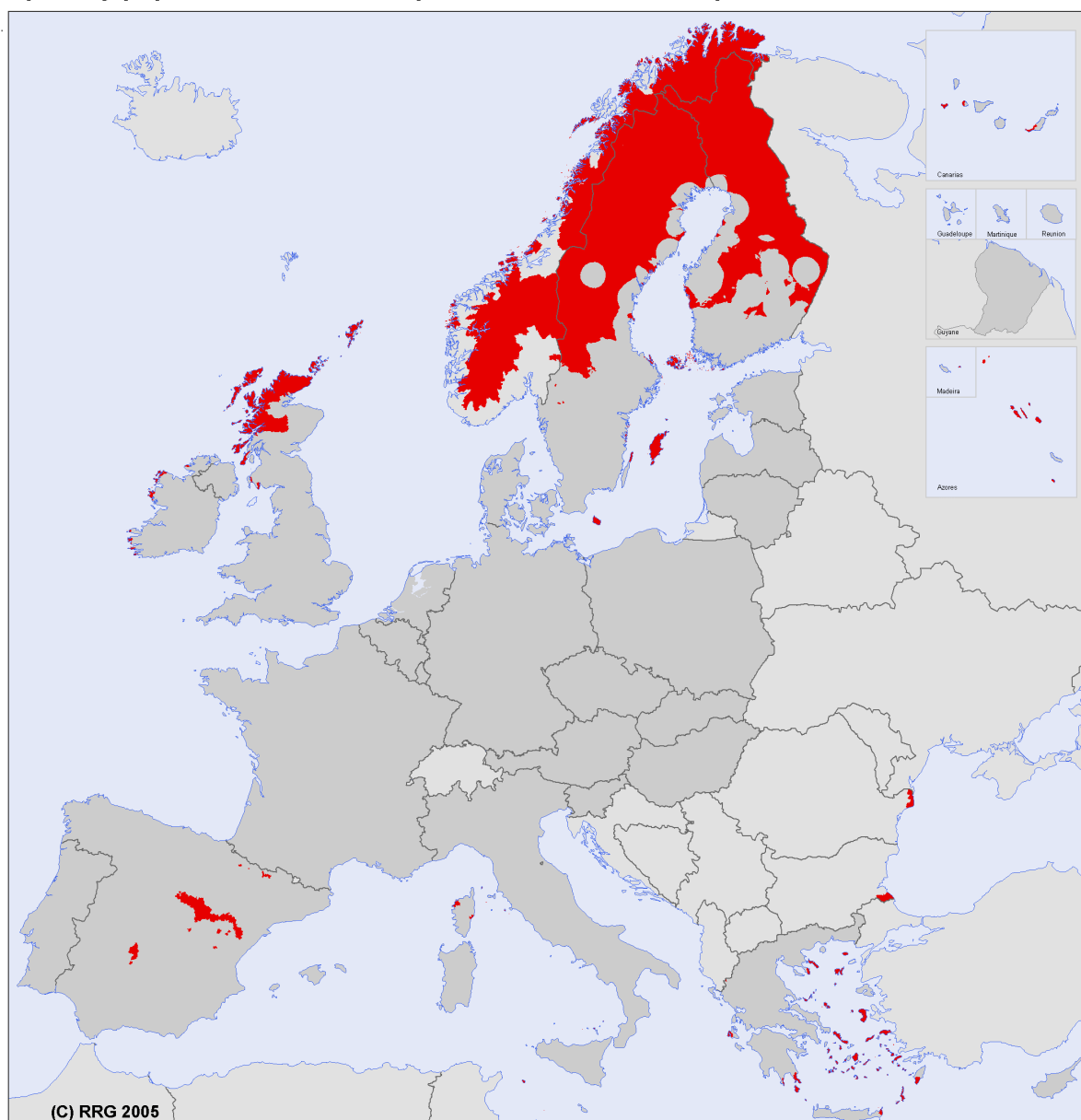
Source: RRG

- Sparsely populated areas
- EU countries: areas not considered as sparsely populated
- Other countries

FI, SE: 1x1 km grid
Rest of EU, CH, NO: NUTS-5

*Figure 3.6 Sparsely populated areas in Europe - threshold 12.5 inh/km²:
in all red areas, the number of people living within a 50 km radius is lower than 100 000.*

Sparsely populated areas in Europe: Threshold of 8 inh/sqkm



Geographical Base: Eurostat GISCO

Minimum population potential assumed: 65,000

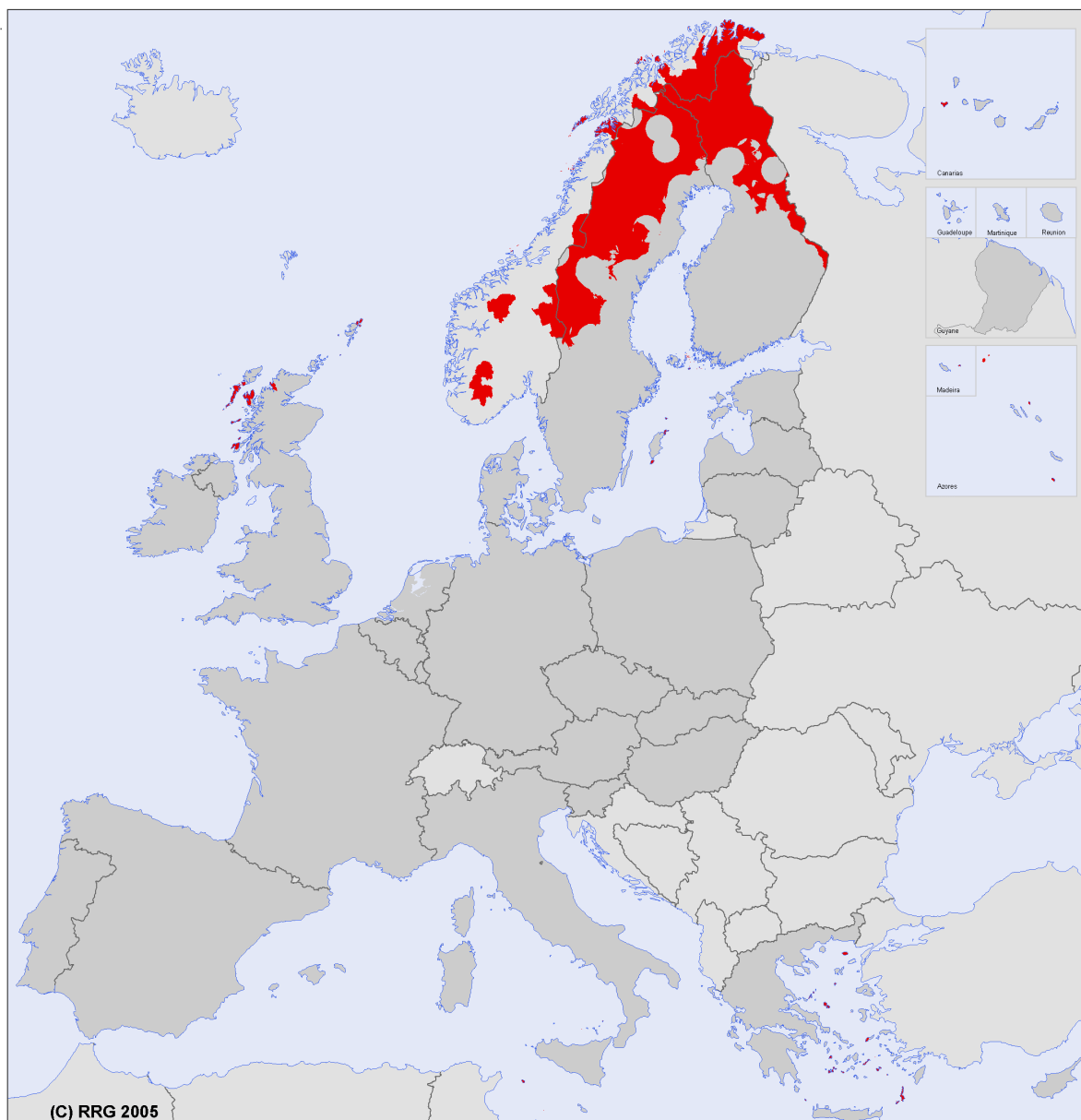
- Sparsely populated areas
- EU countries: areas not considered as sparsely populated
- Other countries

Source: RRG

FI, SE: 1x1 km grid
Rest of EU, CH, NO: NUTS-5

*Figure 3.7 Sparsely populated areas in Europe – threshold 8 inh/km²:
in all red areas, the number of people living within a 50 km radius is lower than 65 000.*

Sparsely populated areas in Europe: Threshold 5 % of European average



Geographical Base: Eurostat GISCO

Minimum population potential assumed: 15,000

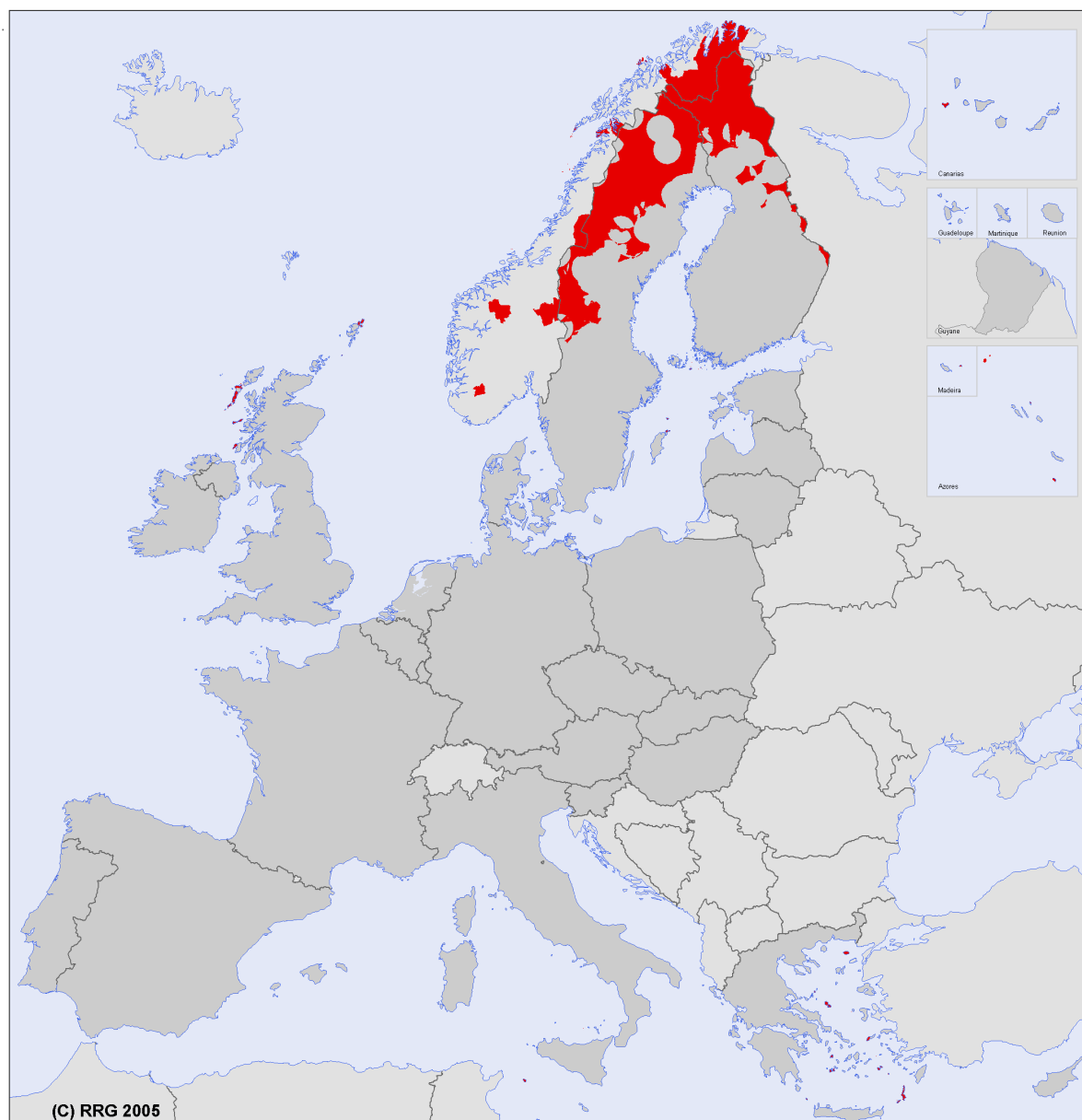
Source: RRG

- Sparsely populated areas
- EU countries: areas not considered as sparsely populated
- Other countries

FI, SE: 1x1 km grid
Rest of EU, CH, NO: NUTS-5

*Figure 3.8 Sparsely populated areas in Europe - threshold 5% of European average:
in all red areas, the number of people living within a 50 km radius is lower than 15 000*

Sparsely populated areas in Europe: Threshold 'daily services'



Geographical Base: Eurostat GISCO

Minimum population potential assumed: 10,000

- Sparsely populated areas
- EU countries: areas not considered as sparsely populated
- Other countries

Source: RRG

FI, SE: 1x1 km grid
Rest of EU, CH, NO: NUTS-5

*Figure 3.9 Sparsely populated areas in Europe – threshold daily services:
in all red areas, the number of people living within a 50 km radius is lower than 10 000*

3.5. Delimitation of the study area

The previously identified sparsely populated areas need to be approximated to regional entities in order to gain political relevance. We have therefore overlaid them with NUTS 2 and NUTS 3 regions (Figures 3.10 and 3.11).

Tables 3.5 and 3.6 provide a ranking of NUTS 2 and NUTS 3 regions according to the proportion of the each region defined as sparsely populated according to these criteria. This ranking includes a number of island regions (Åland, Voreio Aigaio and Azores), as the calculation of population potential does not distinguish between land and sea areas. As previously noted, these island regions can however be disregarded in this context, insofar as insularity is considered as a physical handicap in its own right.

The alternative ranking is otherwise similar to that produced according to regional average values (Tables 3.1 and 3.2) concerning the most sparsely populated regions, insofar as these are Pohjois Suomi, Övre Norrland and Mellersta Norrland in both cases. However, the proportion of sparsely populated areas is significantly higher in Eastern Finland than in the Highlands and Islands (79% and 70%, respectively) even if the average population density is slightly higher in the Finnish region (9,82 inh/km², against 9,31). There is consequently some coherence to considering the NUTS 2 regions of Pohjois Suomi, Itä Suomi, Övre Norrland and Mellersta Norrland as the most sparsely populated regions in the European Union (including Bulgaria and Romania).

Suggested study area delimitation

Sparse population densities are a challenge not only to the directly concerned areas, but also to neighbouring regions. These regions are indeed placed in a situation of peripherality as at least one border is facing a predominantly uninhabited land area. It therefore seems natural to include in the study area not only the previously mentioned NUTS 2 regions, but also contiguous NUTS 3 regions. The justification is to consider how these areas are dealing with their specific geographic situation, and to what extent they may be similar or unlike the sparsely populated regions *per se*.

Figure 3.13 illustrates the resulting study area delimitation. The Swedish region of Värmland is included as it is contiguous to the Norwegian sparsely populated region of

Hedmark and Oppland. As shown by Figure 3.14, this study area comprises all of the Nordic Objective 1 areas.

The study area delimitation is not to be considered as a “sparsely populated area” as such, but as a territory delimited for the analysis of population sparsity. It should not therefore be seen as a proposed intervention area. It is merely to be considered as an empirically grounded spatial context for further enquiries on the social and economic impact of sparse population, peripherality and harsh climatic conditions. Within this spatial context, further statistical analyses are developed in the following sections of this report.

Sparsely populated areas in Europe: Threshold of 12.5 inh/sqkm

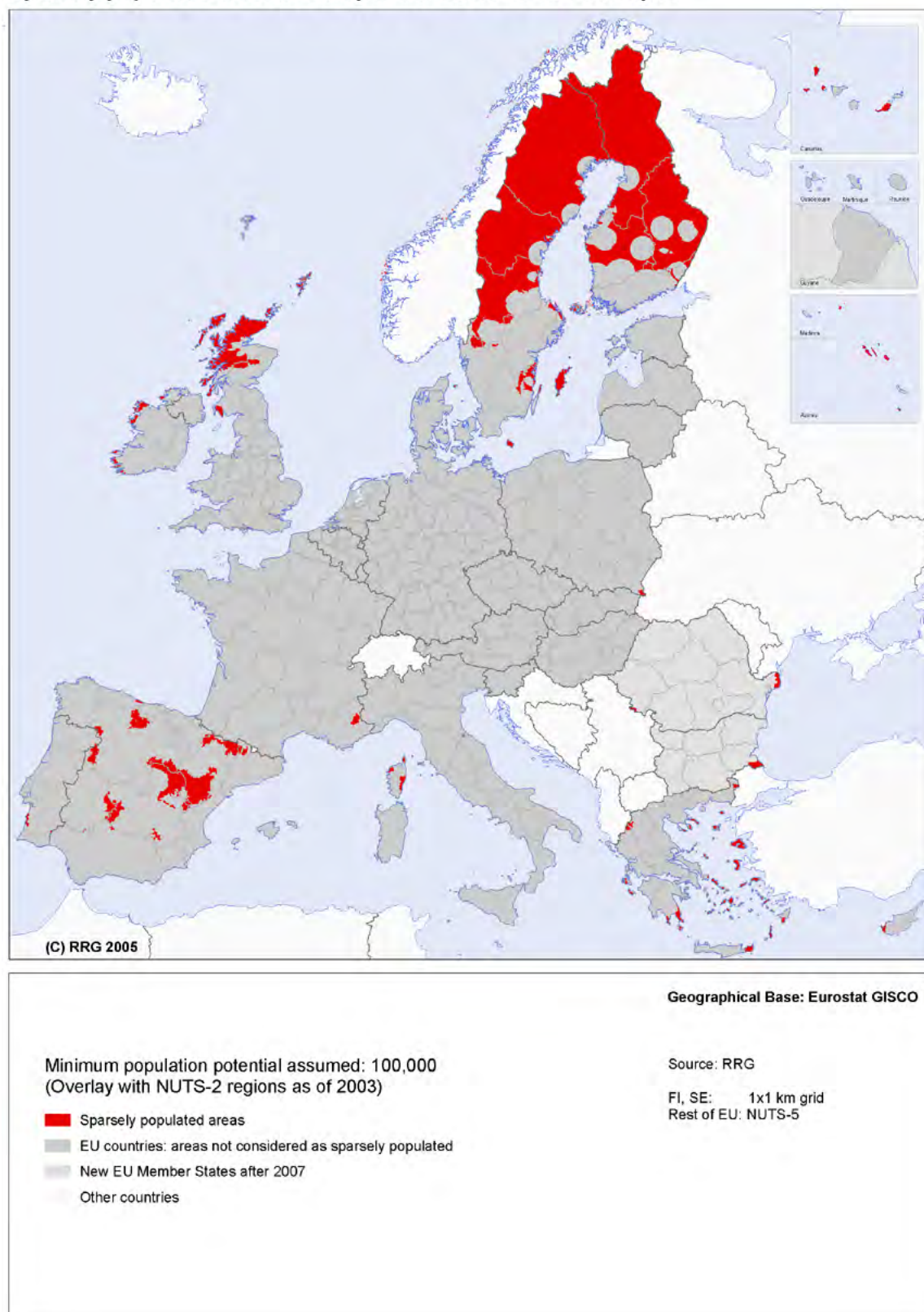


Figure 3.10 Overlay of sparsely populated areas in Europe (threshold 12.5 inh/km²) with NUTS 2 regions

Sparsely populated areas in Europe: Threshold of 12.5 inh/sqkm

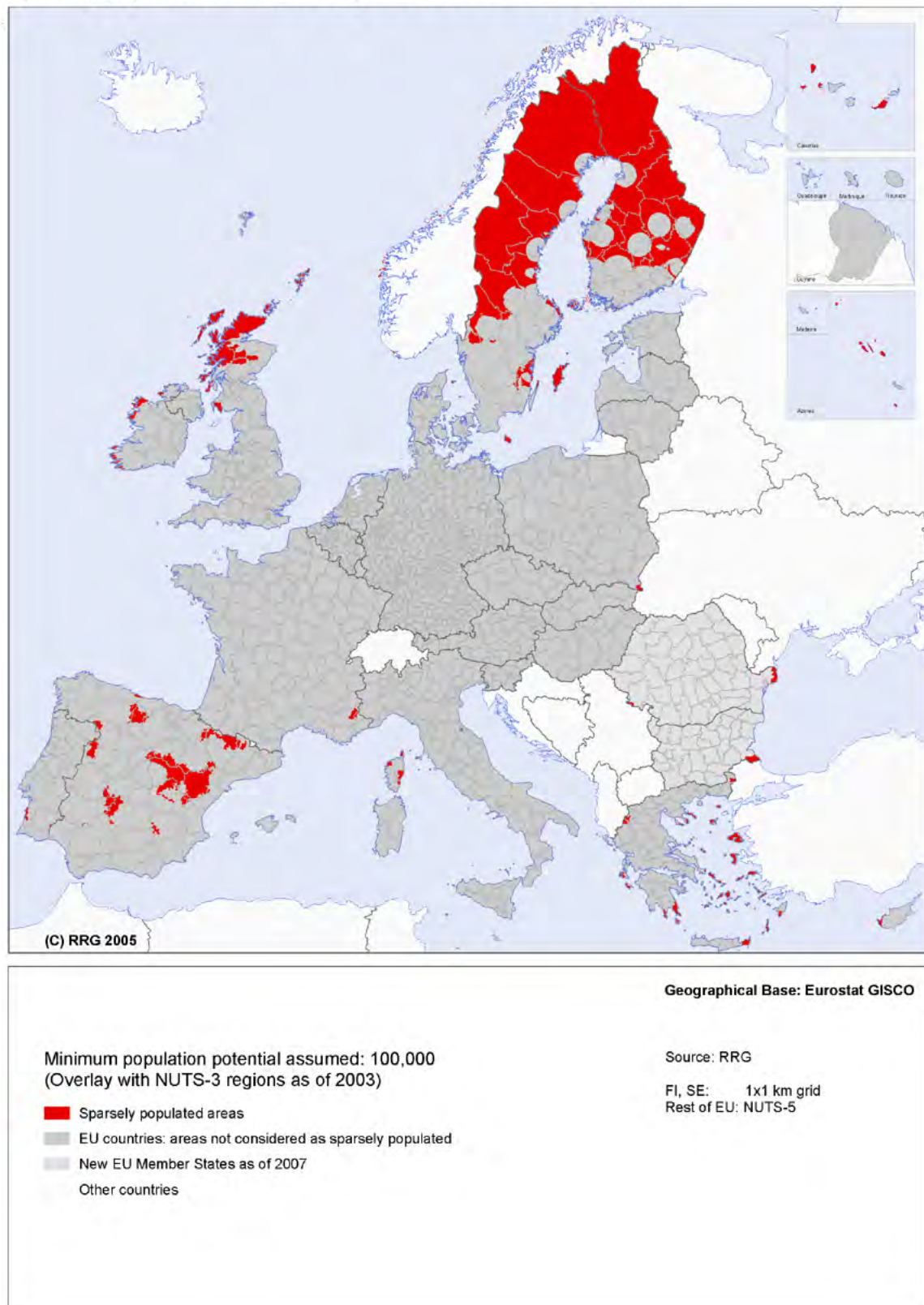


Figure 3.11 Overlay of sparsely populated areas in Europe (threshold 12.5 inh/km²) with NUTS 3 regions

Sparsely populated areas in Europe: Threshold of 12.5 inh/sqkm

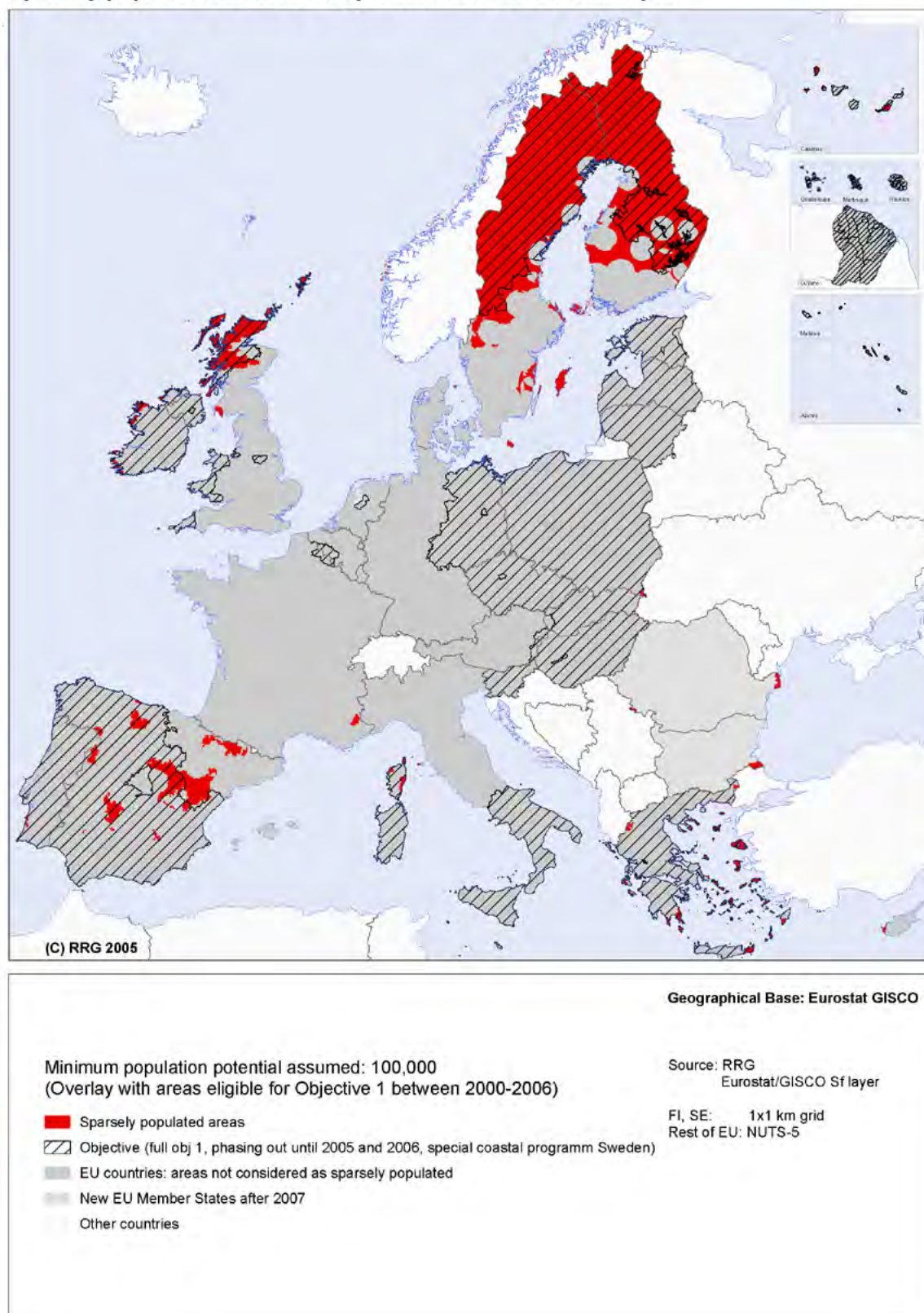


Figure 3.12 Overlay of sparsely populated areas in Europe (threshold 12.5 inh/km²) with Objective 1 regions (2000-2006)

The major part of Nordic sparsely populated areas are covered by Objective 1 regions for the period 2000-2006

Table 3.5 Percentage of sparsely populated areas within each NUTS-2 region, using a threshold value 12,5 inh/km2 and a 50 km radius

Code	Name	Percentage
FI1A	Pohjois-Suomi	94
SE08	Oevre Norrland	94
SE07	Mellersta Norrland	93
FI20	Aaland	86
GR41	Voreio Aigaio	86
FI13	Itae-Suomi	79
UKM4	Highlands and Islands	70
PT20	Regio Autonoma dos Acores	65
SE06	Norra Mellansverige	62
GR42	Notio Aigaio	58

Table 3.6 Percentage of sparsely populated areas within each NUTS-3 region, using a threshold value 12,5 inh/km2 and a 50 km radius.

Code	Name	Percentage
SE072	Jämtlands län	100.00
FI1A3	Lappi	99.90
DK007	Bornholms amt	99.00
FI134	Kainuu	98.90
SE082	Norrbottens län	96.20
SE094	Gotlands län	94.45
SE081	Västerbottens län	91.20
UKM44	Eilean Siar (Western Isles)	88.70
FI200	Aaland	87.30
GR413	Chios	87.30
UKK30	Cornwall and Isles of Scilly	86.70
GR411	Lesvos	86.50
UKM41	Caithness and Sutherland and Ross and Cromarty	85.30
FI1A2	Pohjois-Pohjanmaa	83.20
GR412	Samos	81.90
FI131	Etelä-Savo	81.60
UKM46	Shetland Islands	79.80
UKM45	Orkney Islands	79.60
SE071	Västernorrlands län	77.90
FI1A1	Keski-Pohjanmaa	76.10
FI133	Pohjois-Karjala	73.60
GR422	Kyklades	72.50
ES242	Teruel	71.40
UKM43	Lochaber, Skye and Lochalsh and Argyll and the Islands	71.00
SE062	Dalarnas län	69.40
GR221	Zakynthos	65.00
PT200	Regio Autonoma dos Acores	64.50
SE063	Gävleborgs län	62.90

Study area delimitation

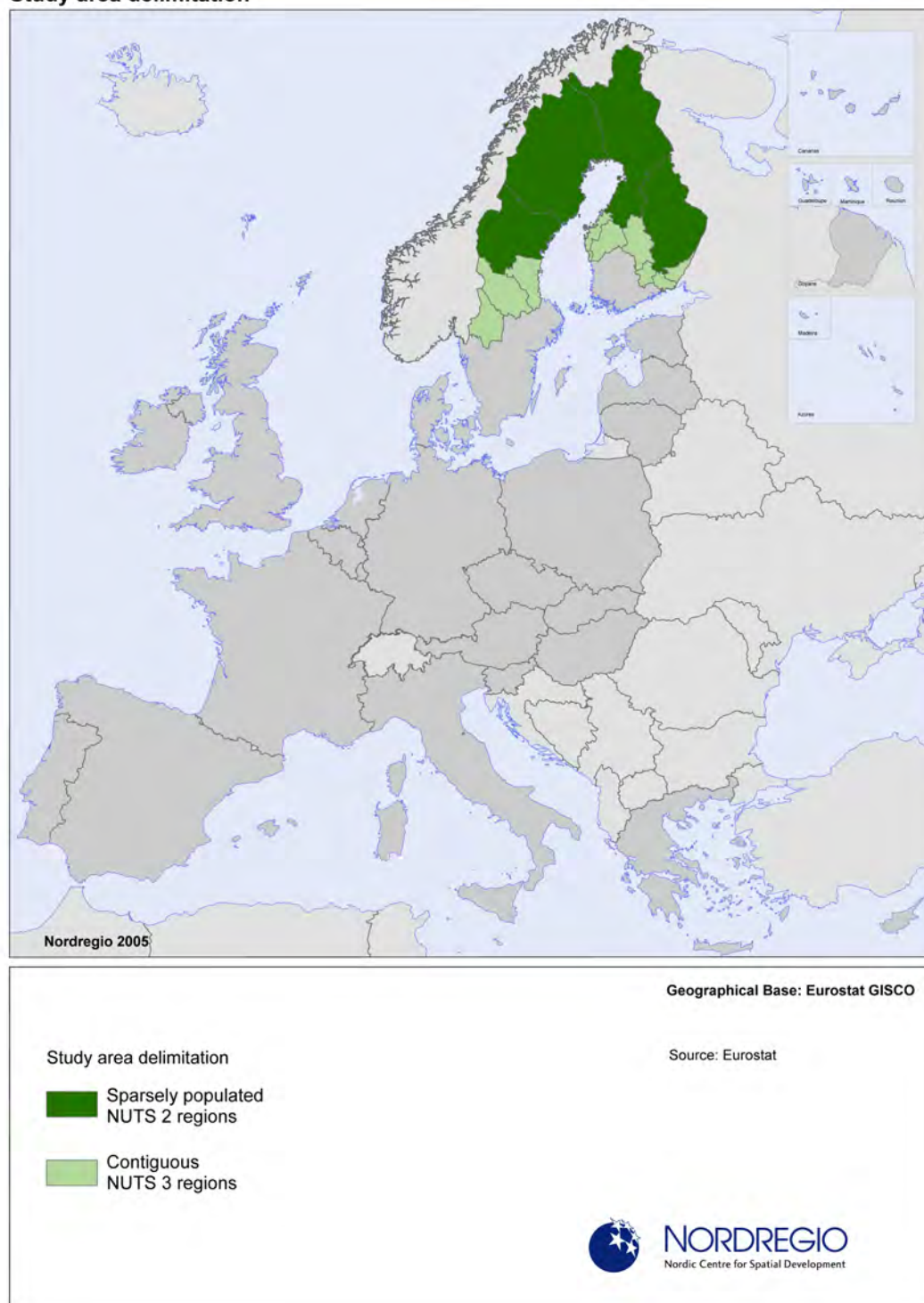


Figure 3.13 Study area delimitation

The Study area comprises NUTS 2 areas with over 75% sparsely populated areas, as well as adjacent NUTS 3 areas.

Study area delimitation with Objective 1 areas

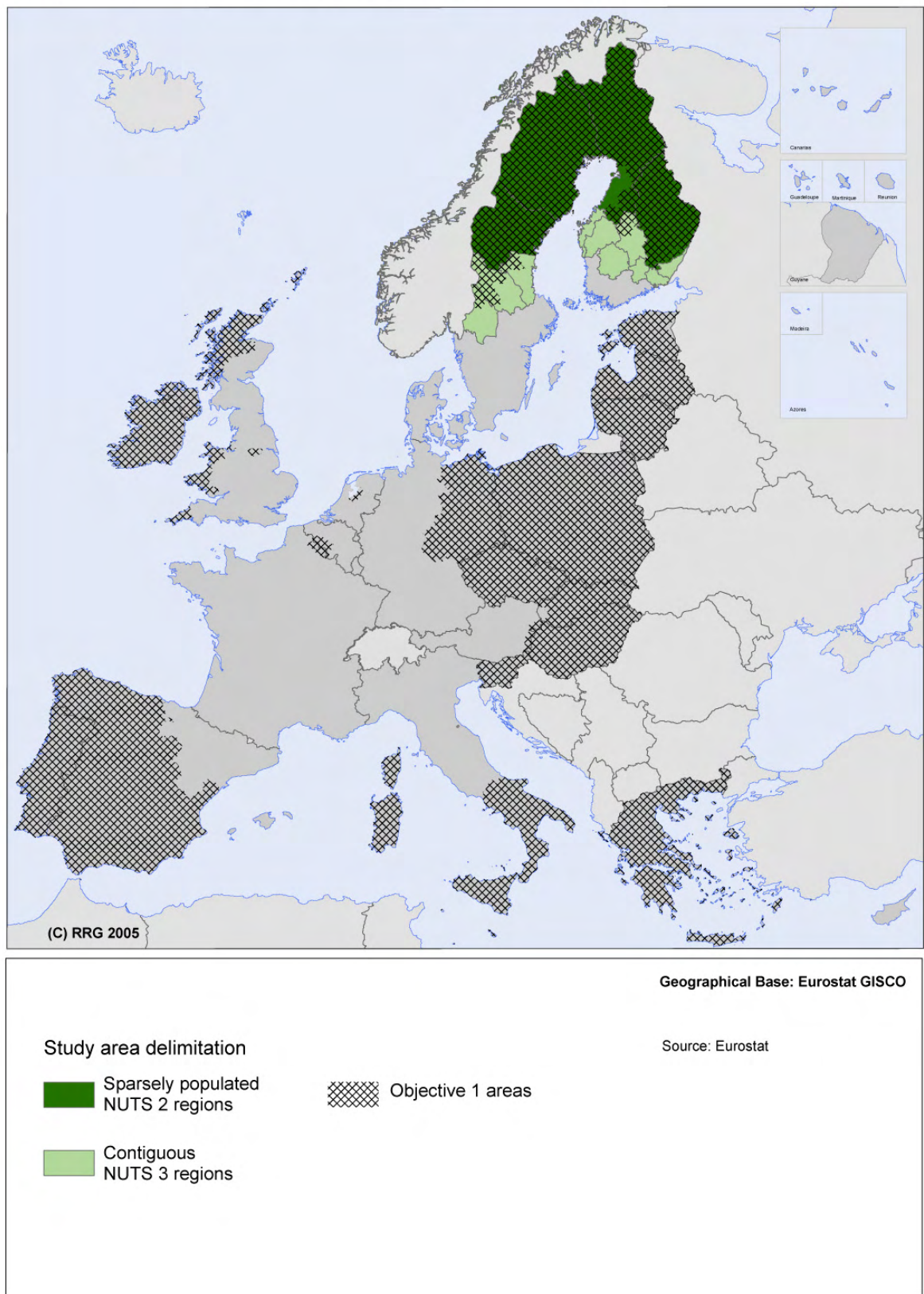


Figure 3.14 Study area delimitation with Objective 1 boundaries (2000-2006)

The entire Swedish and Finnish Objective 1 area for the period 2000-2006 is within the Study area.

Conclusion

The basis for the delimitation of the study area for this study is demographic sparsity. Sparsity is traditionally approached through average population densities within regions, but this measure does not reflect the social and economic issues raised. Instead, the proportion of areas where less than 100,000 persons can be found within a maximum commuting distance of 50 km has been used. This measure better reflects the central challenge of sparsity, i.e. that services and economic activities are not established either because the market potential is below the critical population threshold, or because the potential labour market is too small. This measure can also be mapped independently of NUTS regions. This means that the effects of changes in regional boundaries will have smaller effects on the delimitation of policy intervention areas. It also implies that sparse areas within NUTS regions with major population concentrations can be identified and taken into account, even if the regional average population density gives no indication of sparsity. Finally, this measure takes into account the context of each region, as areas within 50 km from its borders are taken into account in the calculations.

The study area is composed of European Union (at 27) NUTS 2 regions with the highest proportions of areas where less than 100,000 persons can be found within a maximum commuting distance of 50 km. These regions are all situated in Sweden and Finland. In addition, NUTS 3 regions that are contiguous to these NUTS 2 regions have been taken into account: this buffer area will help us to look at spatial gradients from the less to the more sparse areas, in order to identify the possible social and economic effects of sparsity. In other words, the study area is not as such a sparsely populated area, but an area that is conducive to an analysis of the social and economic effects of sparsity.

The overlay with Objective 1 areas in Sweden and Finland in the period 2000-2006 shows that they are entirely included in the study area.

4. Demography

Nordic peripheral communities have been described as “thinning out societies” (Aasbrenn, 1989). According to this perspective, it is not so much the challenge of depopulation as the continued reduction in population figures that needs to be managed, for example in terms of public service provision. In the present chapter, we seek to explore the amplitude, spatial extent and driving forces of this “thinning out” process.

4.1. Settlement patterns in the Northern peripheries

Nordic sparsely populated regions are characterised by contrasting settlement patterns. Figure 4.1. represents the number of inhabitants by 1x1 km grid cell in Finland and Sweden. While Swedish settlements are concentrated along valleys and rivers and in a small number of towns and cities, on the Finnish side of the border the population of the area is considerably more thinly spread. The contrast is apparent in the northernmost parts: While scattered isolated settlements can also be found in Sweden (e.g. in Västerbotten), there is a continuum of such settlements along major roads in Finland stretching north of the Polar Circle in Lapland. However, extremely spread out population patterns distinguish East Finland, where the inhabited cells end to outweigh the uninhabited ones in spite of very low population densities (see Figures 4.1 and 4.2). This settlement pattern, where grid cells with only 1 to 4 inhabitants cover around 20% of the territory, has eloquently been designated as the “shotgun model”. This East-Finnish specificity is linked to a number of factors: The absence of relief and the presence of numerous lakes has historically facilitated access in these remote rural areas. In addition, urbanisation through rural out-migration is a more recent phenomenon in Finland than in most other European countries. Such a spread of population leads to obvious additional challenges for public service provision.

Figure 4.2 synthesises these differences between regions, by showing the proportion of each region covered by grid cells classified according to their total population. Significantly, 50% of the grid cells of the East Finnish region of Etelä-Savo are inhabited (lakes excluded), in spite of a population density of only 8 inh/km². By way of comparison, the Swedish region of Dalarna has a population density of 9,1 inh/km², but less than 20% of its grid cells are inhabited.

Population per 1x1 km grid cell in Finland and Sweden

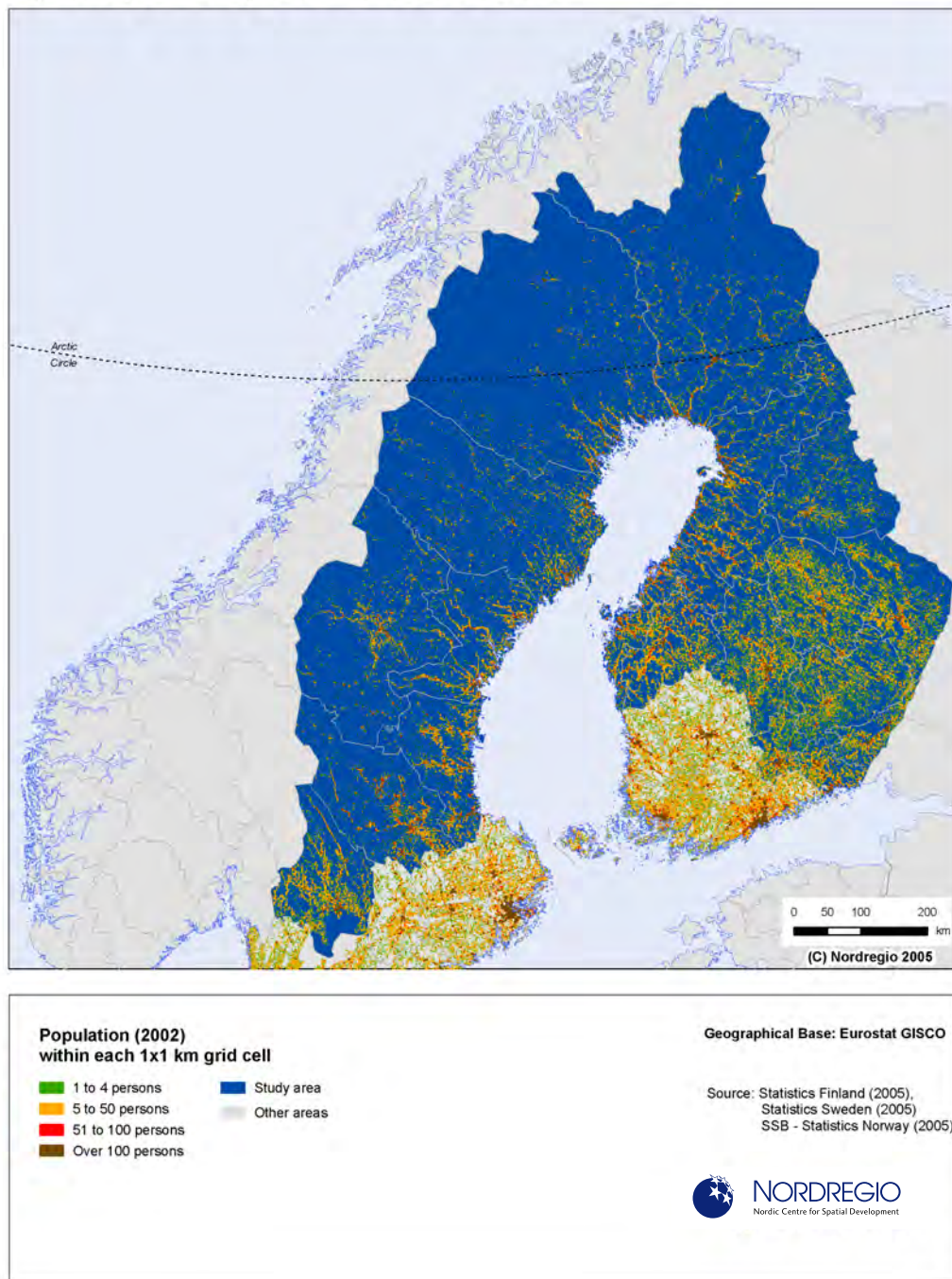


Figure 4.1. Population per 1x1 km grid cell in Sweden and Finland

The vast majority of 1x1 km grid cells in the study area are uninhabited

Repartition of the population, as a percentage of the total area, per NUTS 3 region

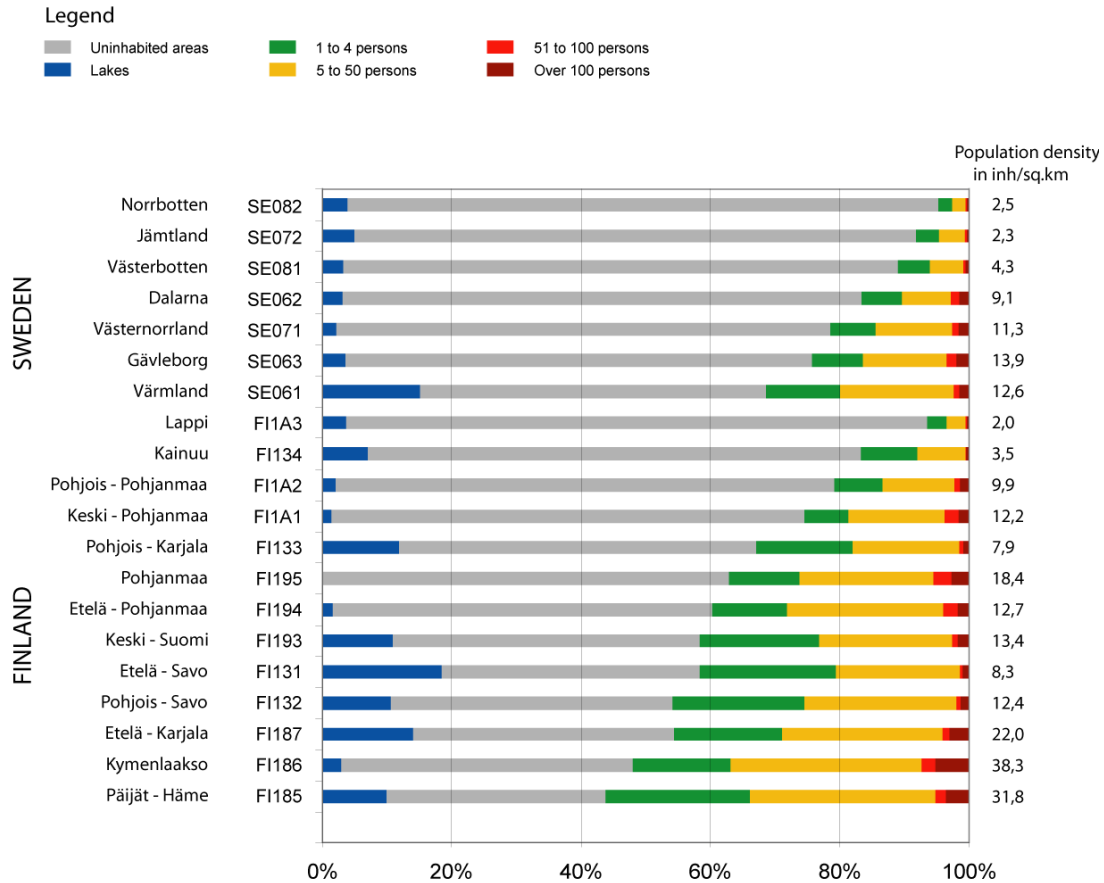


Figure 4.2 Proportions of grid cells by category, classified according to population numbers

A significantly higher proportion of grid cells are inhabited in Finnish study area regions, as compared to Swedish ones with equivalent population densities.

Moreover, the overall proportion of uninhabited areas within the Nordic countries and within the study area is significant. Table 4.1 is providing these numbers for Finland and Sweden.

Table 4.1. Proportion of uninhabited 1x1 km grid cells.

	Country	Study area
Finland	30 %	76 %
Sweden	25 %	88 %

In total, uninhabited areas account for some 30 % on the overall territory of Finland (Table 4.1) and for some 25 % on the overall Swedish country area. However, when accounting for the study area, these proportions rise to some 76 % for the Finnish part and some 88 % for the Swedish part.

Figure 4.3 illustrates these differences in settlement patterns in the study area, by taking three cities in the Nordic peripheries as examples. Within a 50 km radius around Östersund in Sweden and Mikkeli and Lapinlahti in Finland, one finds an equivalent number of persons. However, as illustrated by the figure, the proportion of inhabited cells varies considerably, as they cover most of the area in the two Finnish cases, but are considerably less numerous in the Swedish one. What mainly differentiates the two types of situations is the extent of areas with only 1 to 4 inhabitants per cell, which is likely to correspond to a distance between individual houses of about 800-1000 meters. In the case of Mikkeli, a large proportion of the inhabited cells furthermore correspond to lakes.

These examples can be compared to the theoretical example presented in Figure 3.3 (p. 33). It is important to note that there is a difference in scale between the two approaches: While figure 3.3 reflected centre structures, and considered the spatial spread of commuting areas, the present examples deal with settlement structures around single urban commuting areas (i.e. within the blue commuting area circles of Figure 3.3). In Figure 3.3, the spread of urban centres was said to contribute to a reduced degree of economic and social sparsity. This dynamic cannot however be transposed at the scale of settlements within a single commuting area. The spread out settlement structure will indeed hardly contribute to an improved access to services, insofar as the population figures outside of the core areas are so small (1 to 4 inhabitant per 1x1 km grid cell in most cases).

Specific issues and challenges are connected to the concentrated and spread out types of settlement structures in sparsely populated areas. In the case of the more concentrated settlement structure, the few households situated outside of the main nodes and axes are particularly isolated, and social interaction may be difficult to maintain. The spread out nature of the settlement structure is on the other hand a major challenge for the provision of both public services (e.g. community nursing and home help to elderly persons) and transport infrastructure.

Figure 4.4 highlights those areas with least population potentials in Finland and Sweden, i.e. areas with a potential of less than 10,000 people within a 50 km radius. These areas cover a large proportion of the study area in Sweden, while in Lapland a majority of such areas have a population potential below even the 5,000 people level. These areas account for some 22 % of the whole of Finland and some 28 % of Sweden, while 45,000 people

live on the Finnish side and some 60,000 on the Swedish side (which amounts to less than 1 % of the total population for both Finland and Sweden).

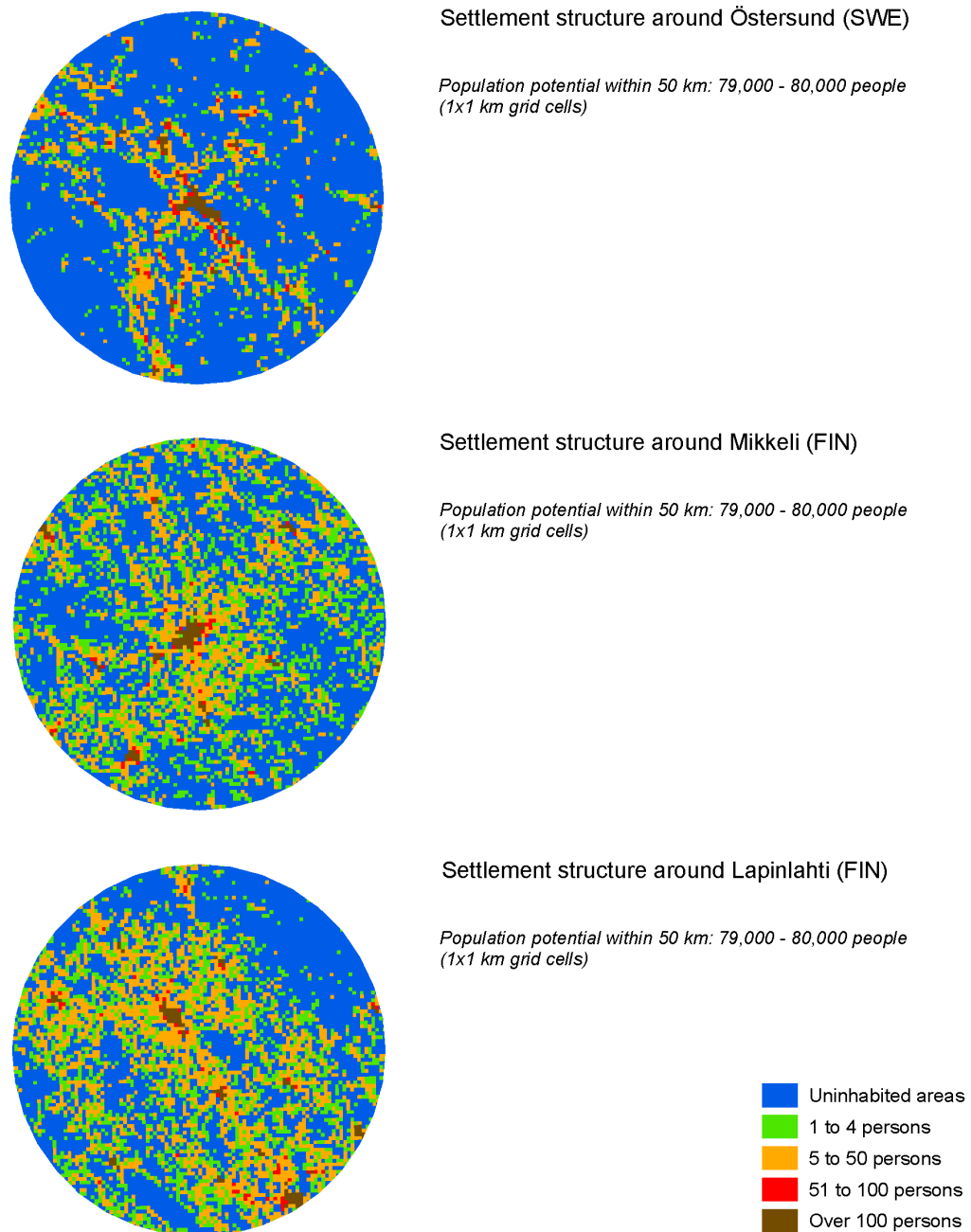


Figure 4.3 Three areas with identical area and population, but with distinct settlement patterns

Areas with less than 10,000 people within 50 km distance

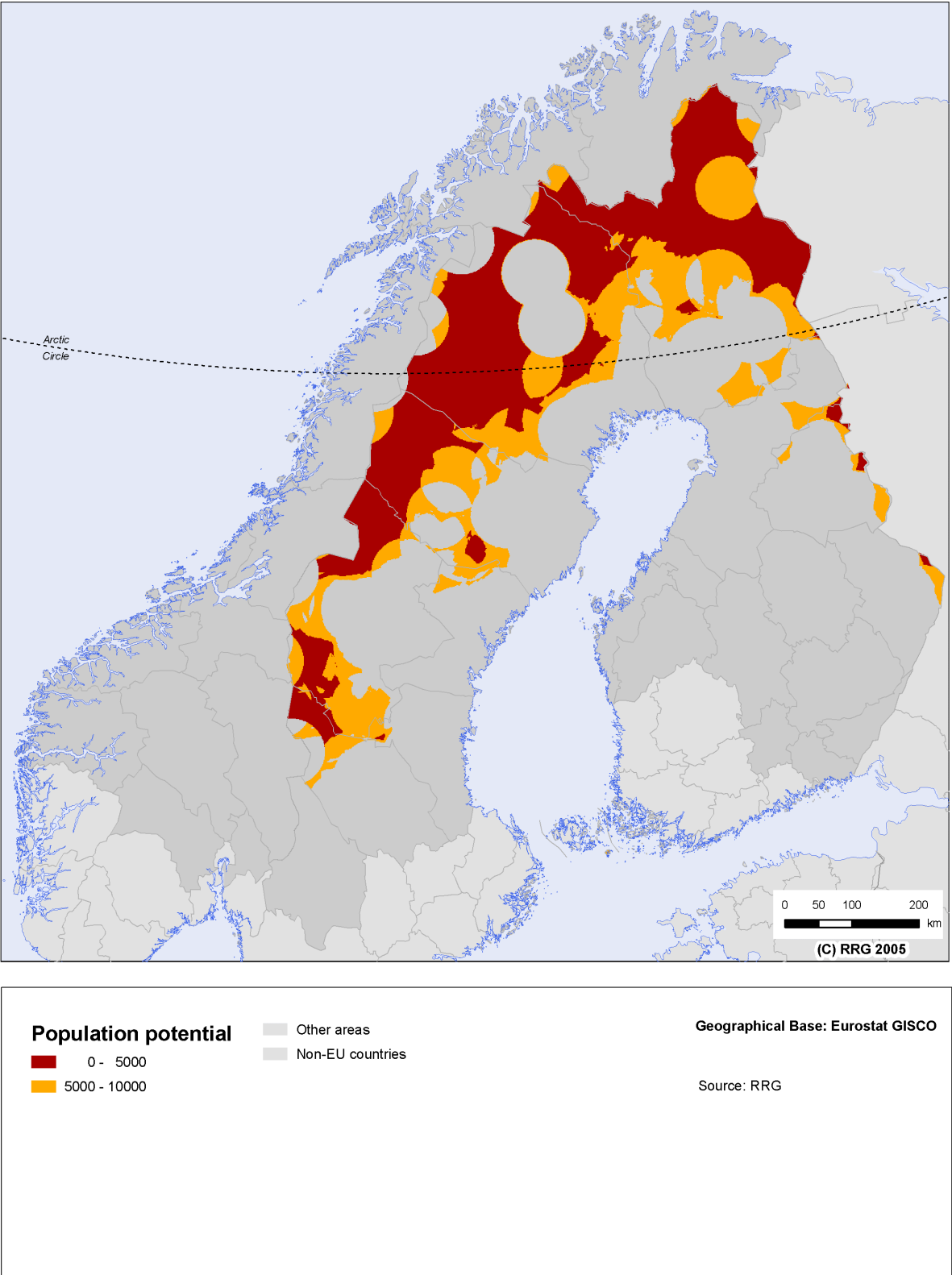


Figure 4.4 Areas with less than 10,000 people within 50 km cover a significant part of the study area, but have a total population of 105 000 inhabitants only.

The Samis



The area where traditional Sami living and herding areas can be found is here seen from the North Pole.

Image source: www.samer.se - Pär-Joel Utsi, NOAA®, © ESA/Eurimage 1993. © Metria 2001.

The sparsely populated areas of Norden are also the traditional living areas of the Samis, one of the indigenous peoples of Europe. The Sami population is spread out over a large territory, from the central part of Sweden and Norway to the northern parts of Finland and the Kola Peninsula in Russia. There are approximately 75 000 Samis in the four countries cited above: More than 40 000 in Norway, Between 15 000 and 25 000 in Sweden, between 6 000 and 7 000 in Finland and approximately 2 000 in Russia.

The Samis have their own language, which is composed of several distinct dialects, and culture. Reindeer herding is a traditional economic activity for the Samis and occupies a central place in their culture, even if only 10% of the Swedish Samis are still active in reindeer herding nowadays. While Samis in Sweden and Norway have the exclusive privilege of reindeer herding, this is no longer the case in Finland. Other traditional economic activities include fishing, hunting and handicraft production. Tourism has also become a significant source of income for the Sami people. The Samis are involved in different types of transnational co-operation. The main cooperative body for the Samis of Finland, Norway, Sweden and Russia is the Sami Council. Since the accession of Sweden and Finland to the European Union, different programmes such as the Objective 1 Sápmi North and South in Sweden, and Interreg IIIA sub-programmes have been designed specifically for issues related to the Sami population.

In Sweden, Norway and Finland, the Samis have the ability to elect a parliament, which has advisory status in respect of the national authorities. In Finland, the purpose is mainly to attend to the rights and interests of the Samis in the national context. In Sweden, the purpose of the parliament is to work towards a self-sustained Sami community in co-operation with Sami and non-Sami organisations. (North Calotte, Kolarctic and Sápmi).

Sources:
www.sametinget.se
www.samer.se
virtual.finland.fi

4.2. Demographic trends over the last decade

Sparsely populated areas are sensitive to demographic trends, as even a modest decline can bring them under the previously described demographic threshold levels under which economic activity and service provision is longer economically viable (i.e. the “critical mass”). Due to these mechanisms, a self-reinforcing negative trend of demographic decline remains a potential threat for these regions.

Demographic trends are moreover the most comprehensive synthetic indicator of economic and social dynamism. The observation of evolutions in total population and in age structures gives a good indication of the relative performance of different sparsely populated areas.

In the context of this project we have looked at the main demographic trends between 1993 and 2002. Demographic trends are however the sum of two main components: net natural population change (differences between number of births and deaths) and net migration change (differences between the in-migrants and the out-migrants). It is therefore important first to consider these parameters separately.

In terms of net natural change between 1993 and 2002, the situation is rather different across the study area (Figure 4.4). While a negative trend can be observed in all municipalities outside of the main cities in Sweden (i.e. outside cities such as Uleå, Luleå, Östersund and Kiruna), significant parts of the Finnish study area experienced natural population growth. This is to a large extent due to local cultural and religious factors, especially along the north-eastern coast of the Gulf of Bothnia and in Lappland. Finnish municipalities along the Russian border and in the South-eastern parts of the study area however face negative net natural change, with the exception of some cities such as Kuopio, Joensuu or Jyväskylä.

The situation in terms of net migration trends is more uniform, as negative trends can be observed across the entire study area, with only few exceptions (Figure 4.5). As illustrated in Figure 4.6, these exceptions all concern municipalities with relatively higher population potentials, apart from a single Swedish municipality (Orsa). One can therefore conclude that there is a strong correlation between out-migration and low population potential. It has furthermore been shown (Hanell et al, 2002) that

these net-migration trends are negatively correlated with national growth figures. In other words, when growth increases, peripheral municipalities tend to lose population through migration. This is not primarily linked to unemployed persons moving to find a job, which is a relatively marginal phenomenon (Hanell et al, 2002). Instead, high growth leads to decreasing in-migration to the periphery, especially among students from peripheral areas who tend not to return to their birthplace if they can find a job in the area where they are studying. Growth policies that are not accompanied by measures in favour of sparse areas will therefore lead to increased depopulation.

The total demographic trend over this 10-year period shows a relatively complex pattern in which both distance to the nearest city and to the major national population concentrations play a role (Figure 4.8). Municipalities in immediate danger of depopulation, having lost over 10% of their population within a decade, are in an unfavourable position in both these respects. The concentration of these municipalities in Northern Sweden, as opposed to their spread across the Finnish study area, is however mainly due to the smaller size of Finnish municipalities: The same figures could probably have been observed in Sweden, if data at a more detailed geographical scale had been available.

Population projections for the period 2002-2020, envisaged by Statistics Finland and NUTEK point to the continuation of these depopulating trends outside of the main cities (Figure 4.10). In Sweden, the main gainers are the coastal municipalities of Umeå and Luleå. More moderate increases are however also foreseen around Östersund, Gävle and Karlstad. The only peripheral rural areas expected to gain population are those that have managed to position themselves within a specific industrial activity, such as for example the car testing centres in Arjeplog.

In Finland, the clear winners are the areas polarized around the largest urban areas: Oulu, Vaasa, Jyväskylä, Kuopio and Joensuu. The other areas, especially in the northern and central parts of Finland, as well as along the Russian border, are forecast to lose population, most by a rate of at least 15%. Complementarily to the maps displayed previously, this means that in the time period of 30 years (roughly from the 1990s to 2020), a major part of the Finnish sparsely populated areas will lose around 40% of its population.

Net natural change from 1993 to 2002

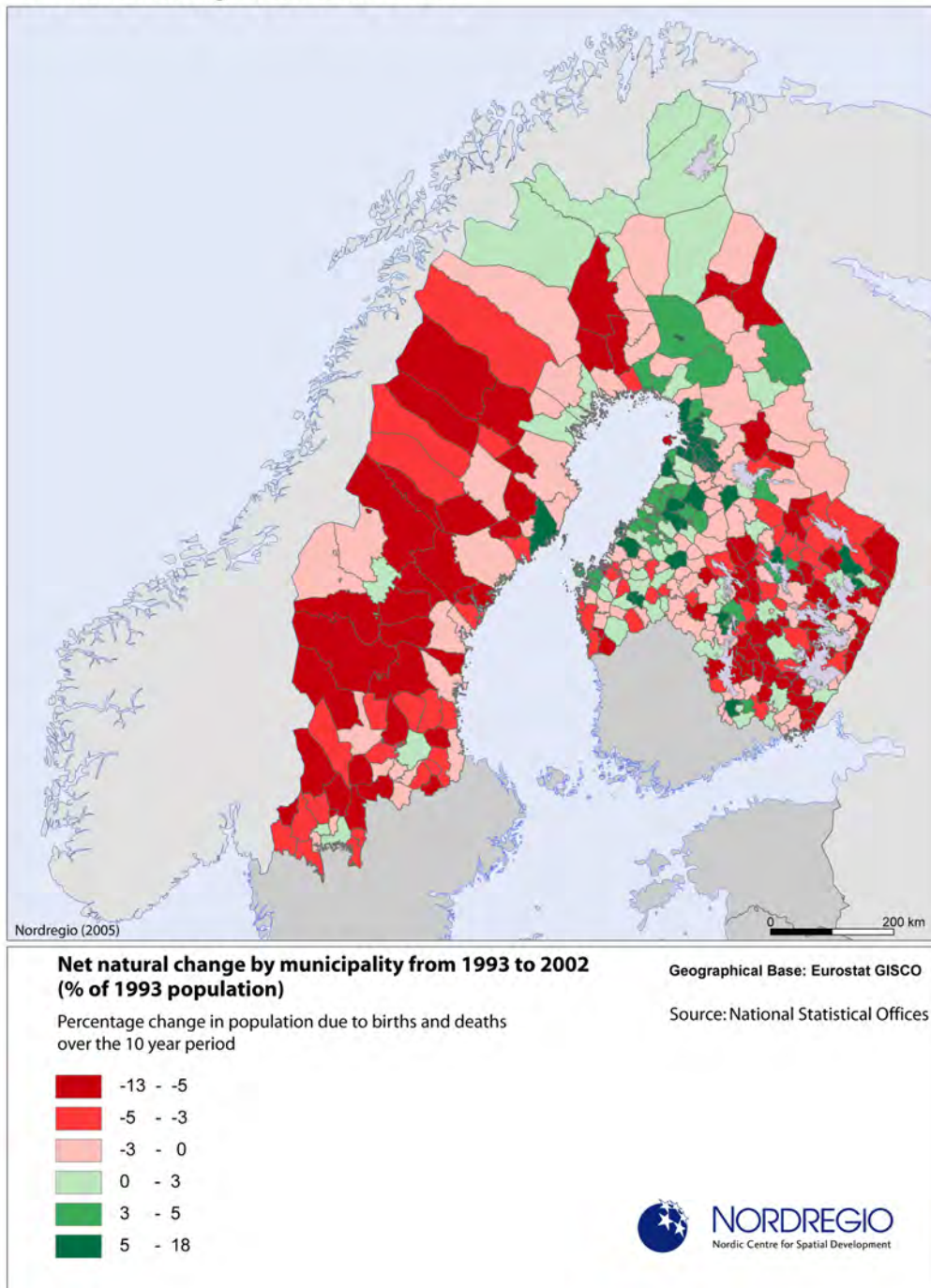


Figure 4.5 The percentage change in population due to births and deaths by municipality from 1993 to 2002 reveals relatively contrasted situations across the study area.

Net migration from 1993 to 2002

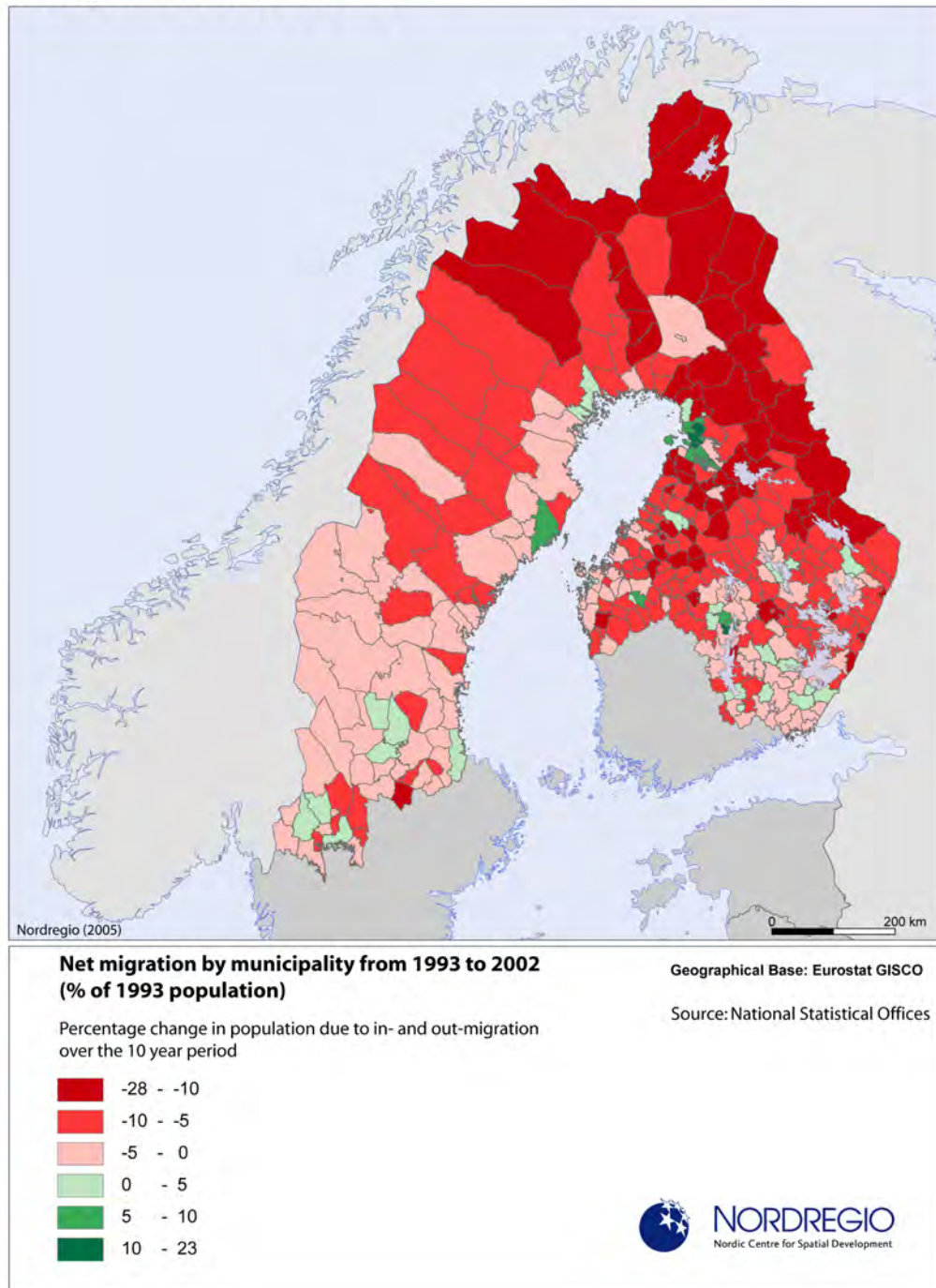


Figure 4.6 Percentage change in population due to in- and out-migration by municipality from 1993 to 2002: only municipalities close to a city experienced positive net migration.

Net migration change and population potential

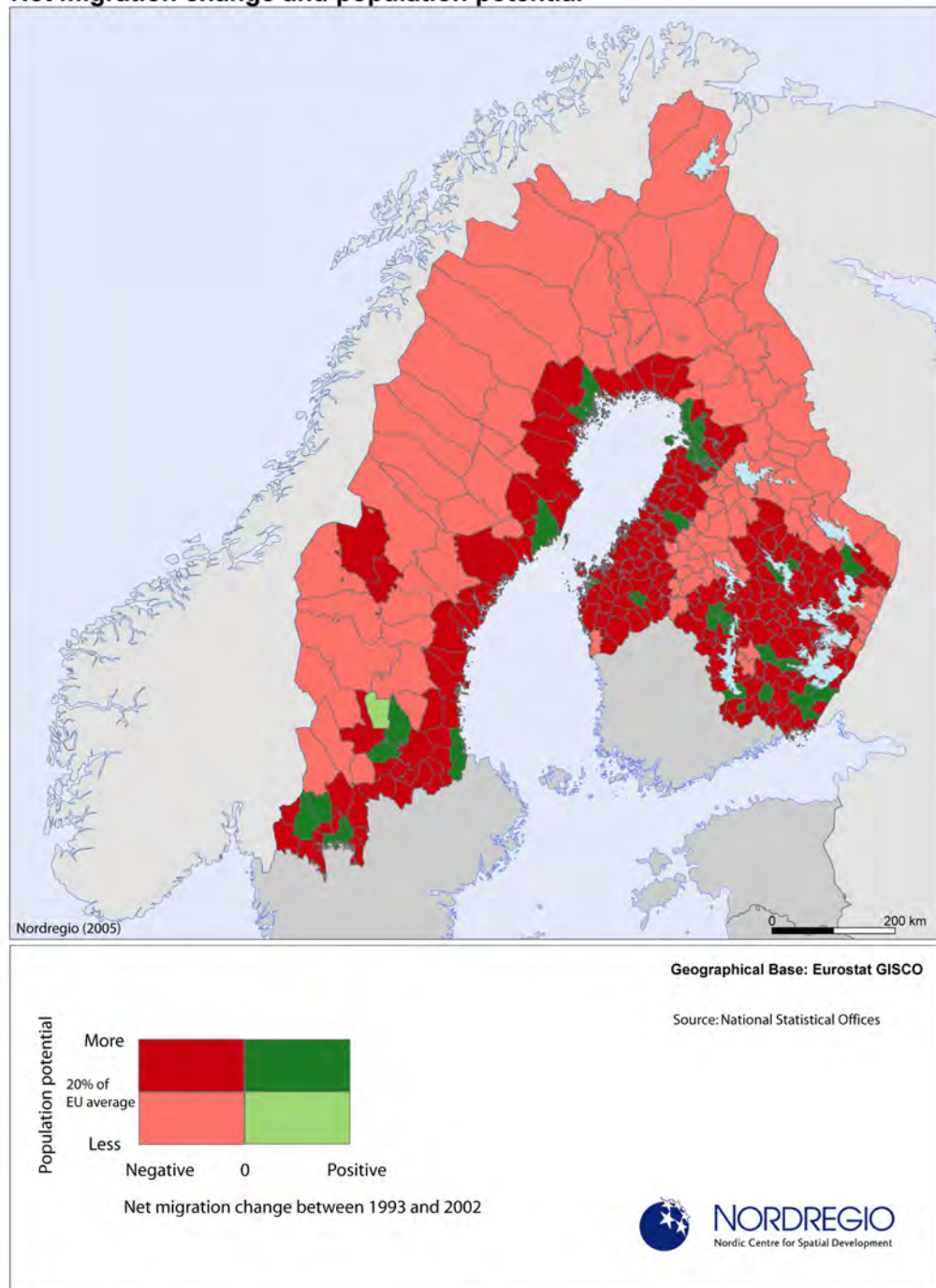
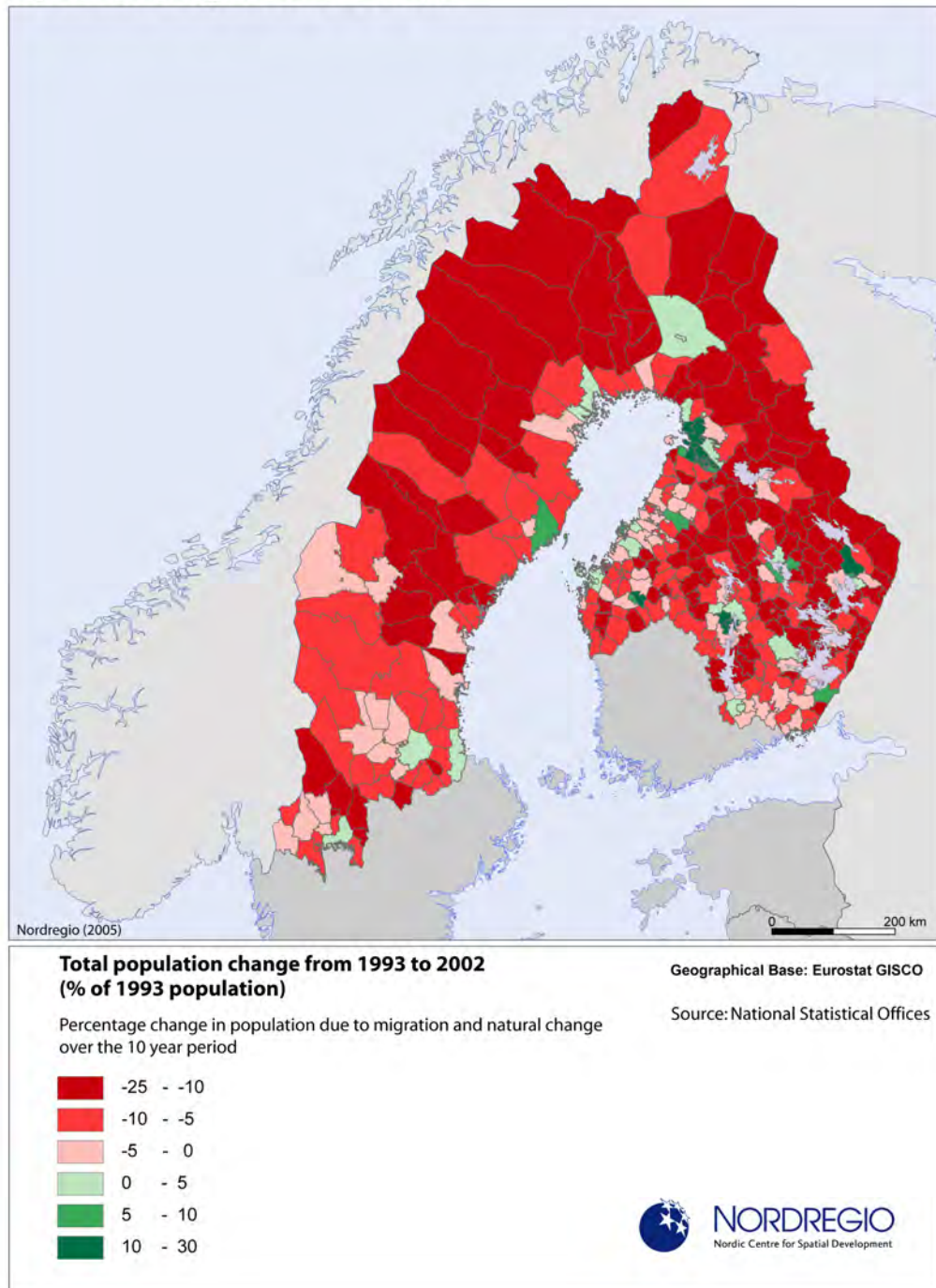


Figure 4.7 Cross-tabulation of population potential and net migration from 1993 to 2002

Net migration figures by municipality from 1993 to 2002 are highly correlated with population potentials.

Population change from 1993 to 2002



*Figure 4.8 Total population change by municipality from 1993 to 2002:
Growth is concentrated in and around main cities.*

Total population change and population potential

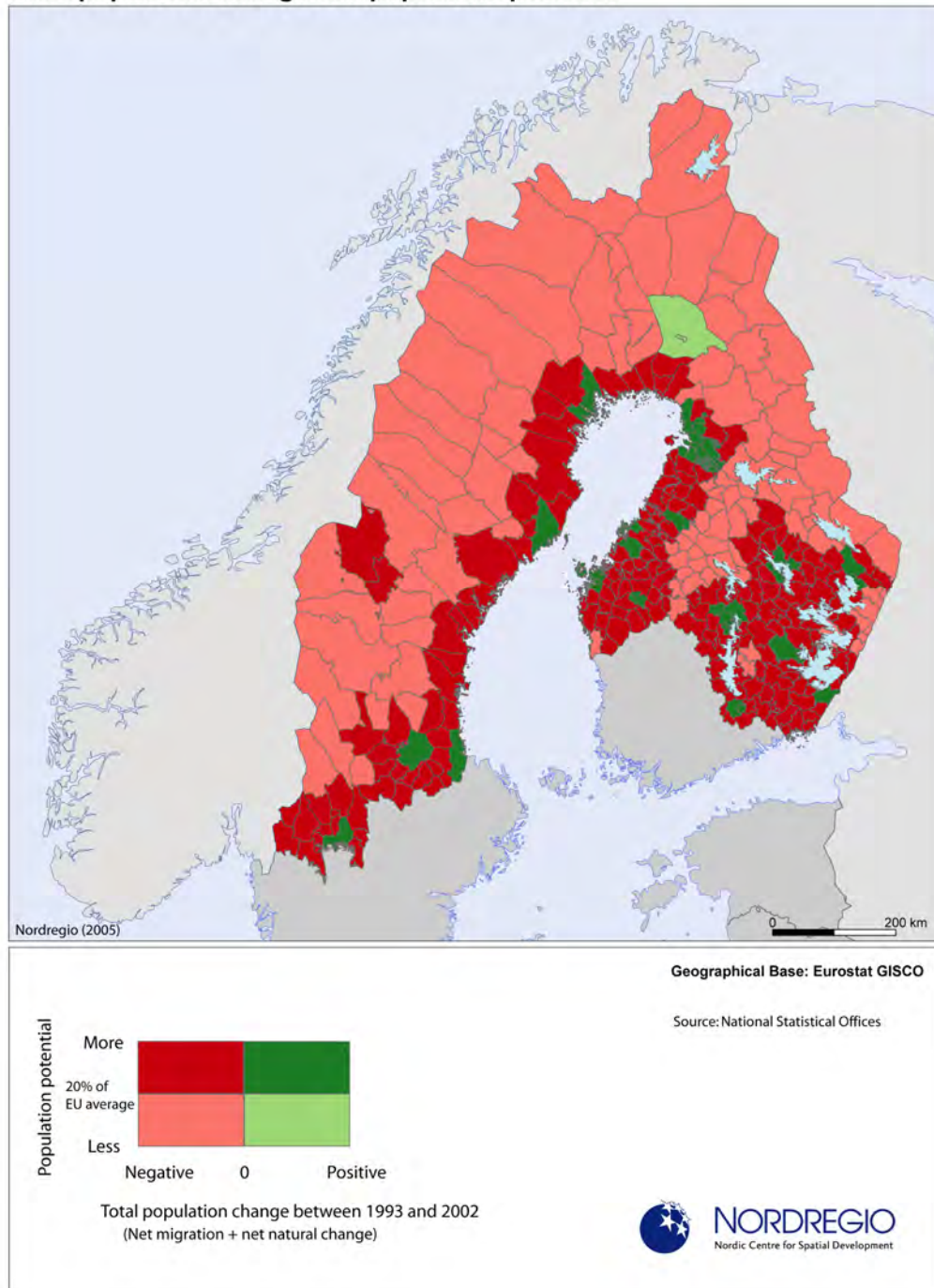


Figure 4.9 Cross-tabulation of population potential and total population change by municipality from 1993 to 2002

The total population change is highly correlated with population potentials.

Population change projections

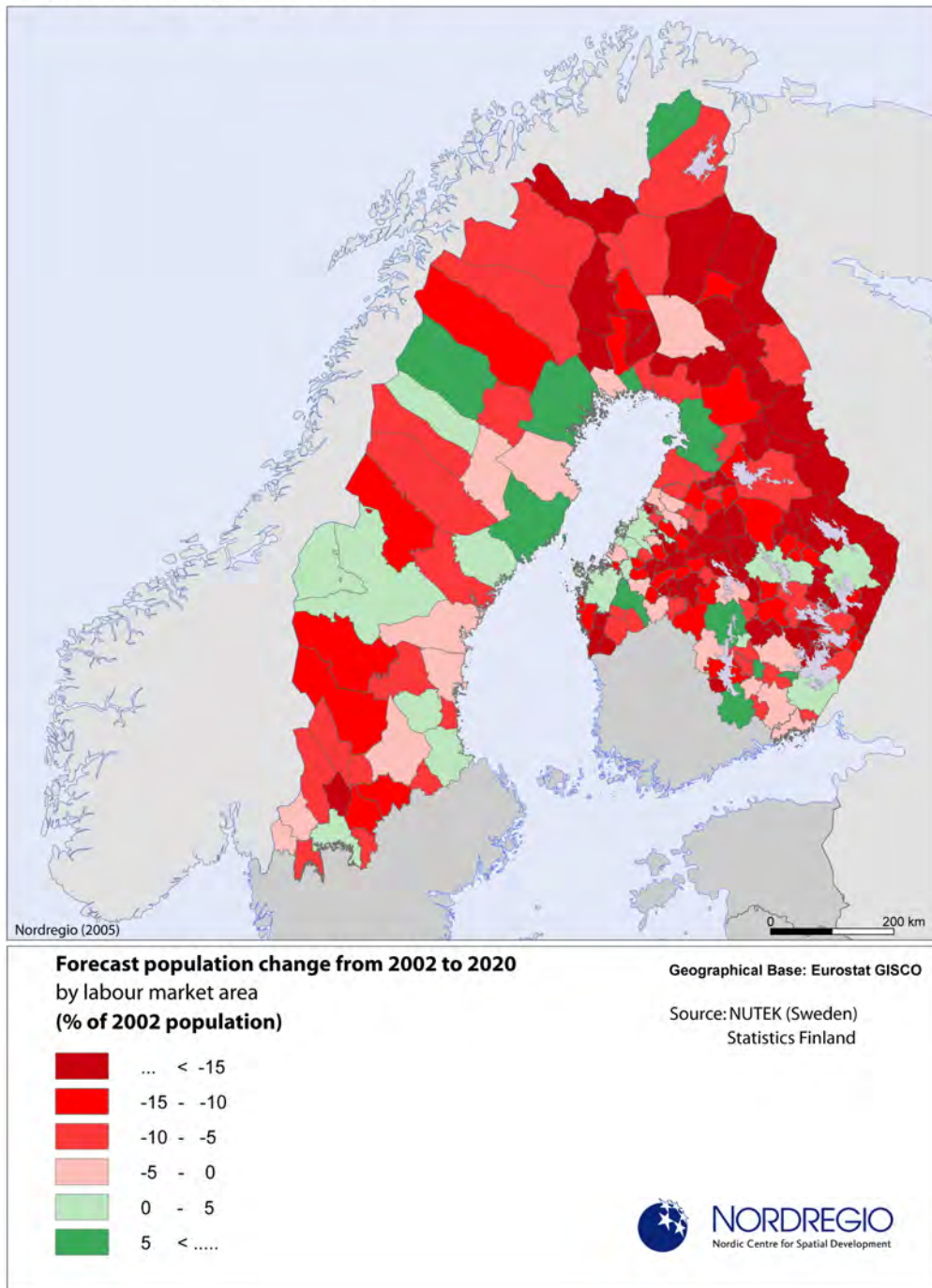


Figure 4.10 Population projections from NUTEK and Statistics Finland for the period 2002-2020 show continued population decline in major parts of the study area

4.3. Age structures

Age structures can complement the previously described projections, as depopulation will tend to increase in the context of an ageing population. Their analysis is also important from a public service provision perspective, as an ageing population significantly increases the needs in this respect.

Old age dependency ratios

The old age dependency ratio corresponds to the ratio between the number of elderly people (over than 65) and the total working-age population. The observation of these ratios shows distinct contrasts between areas around the main urban centres and other areas in Finland, and generally higher and more homogenous values in Sweden (Figure 4.11). It is interesting to note that the dependency ratios are low in the northernmost parts of Finland, which may be a combined effect of forced out-migration during the Second World War, after which a number of young persons did not return, and the demographic behaviour of the Sámi population. The relatively higher dependency ratios observed in Eastern Finland, as compared to the rest of the country, can be due to a higher outmigration of students and young professionals and a higher proclivity for return migration in direction of these regions at the age of retirement.

Figure 4.12 represents the change in old age dependency ratios between 1993 and 2002. Ageing populations can be found throughout the Finnish study area, but only in sparsely populated areas situated north of Östersund and Sundsvall on the Swedish side. This may reflect a greater propensity to move out when reaching the age of retirement in these southern parts. These trend figures are however extremely difficult of interpret, as they are highly dependent on the cyclical differences in the size of cohorts. The specific figures for Southern Sweden may therefore be due to a difference in the structure of these cycles.

Irrespective of these trends, available statistics show a high concentration of the aged population in the sparsely populated areas. While the European average (UK excluded¹) is less than one aged person for every 4 persons aged 15 to 64, ratios of

¹ Eurostat does not provide UK population figures per age group for the year 2002.

over one to three are commonly encountered in the Study area. This implies that the provision of public services for this population will be higher in these regions. In both Finland and Sweden, each municipality supports these costs, which implies that national transfer policies need to take into account variations in the age structure.

Old age dependency ratio in 2002

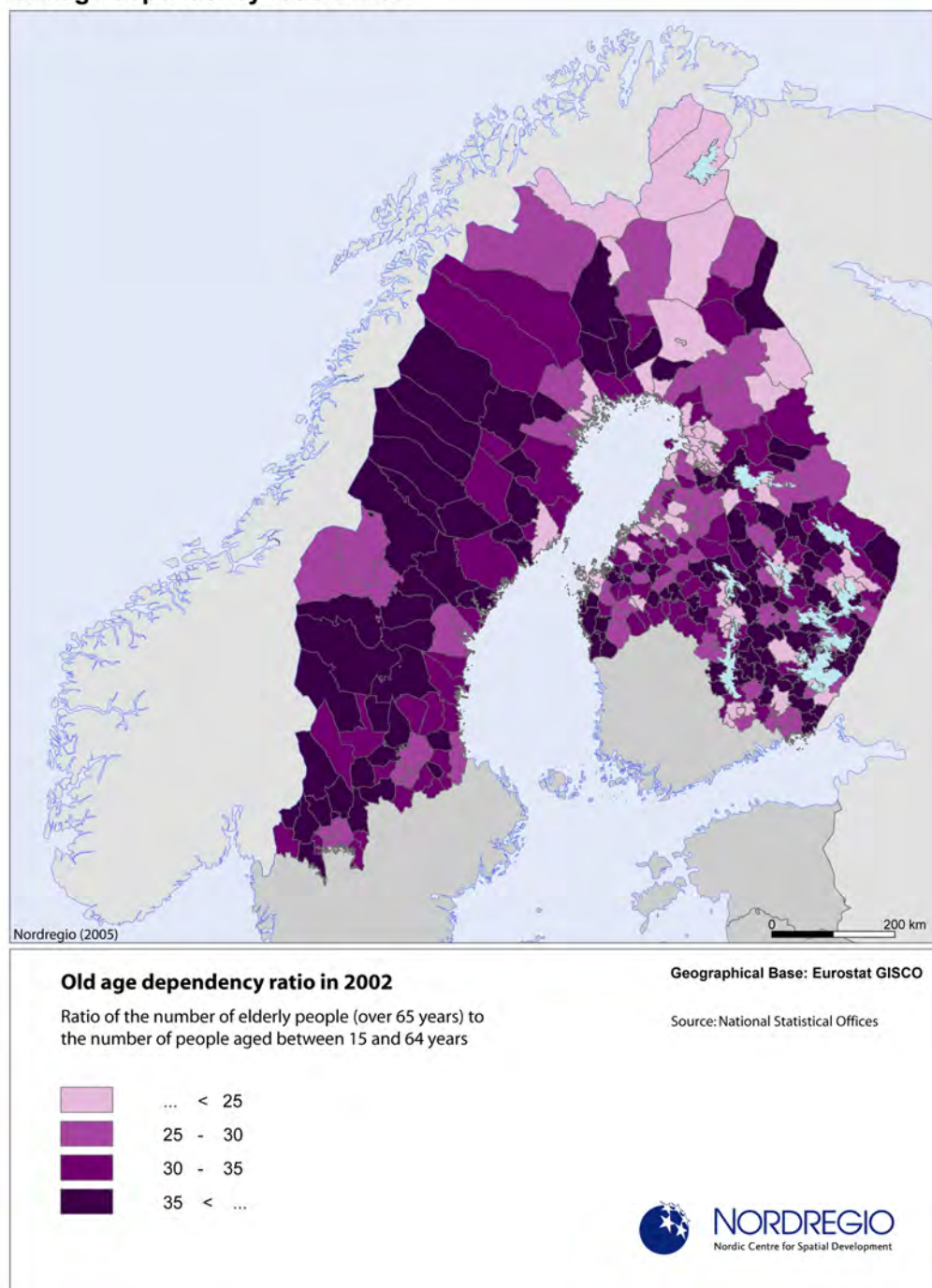


Figure 4.11 Old age dependency ratio by municipality (2002)

Large parts of the Study area have more than one elderly person for every 3 persons aged 15 to 64, while the European average value (UK excluded) is less than one elderly person for every 4 persons aged 15 to 64.

Change in the old age dependency ratio and population potential

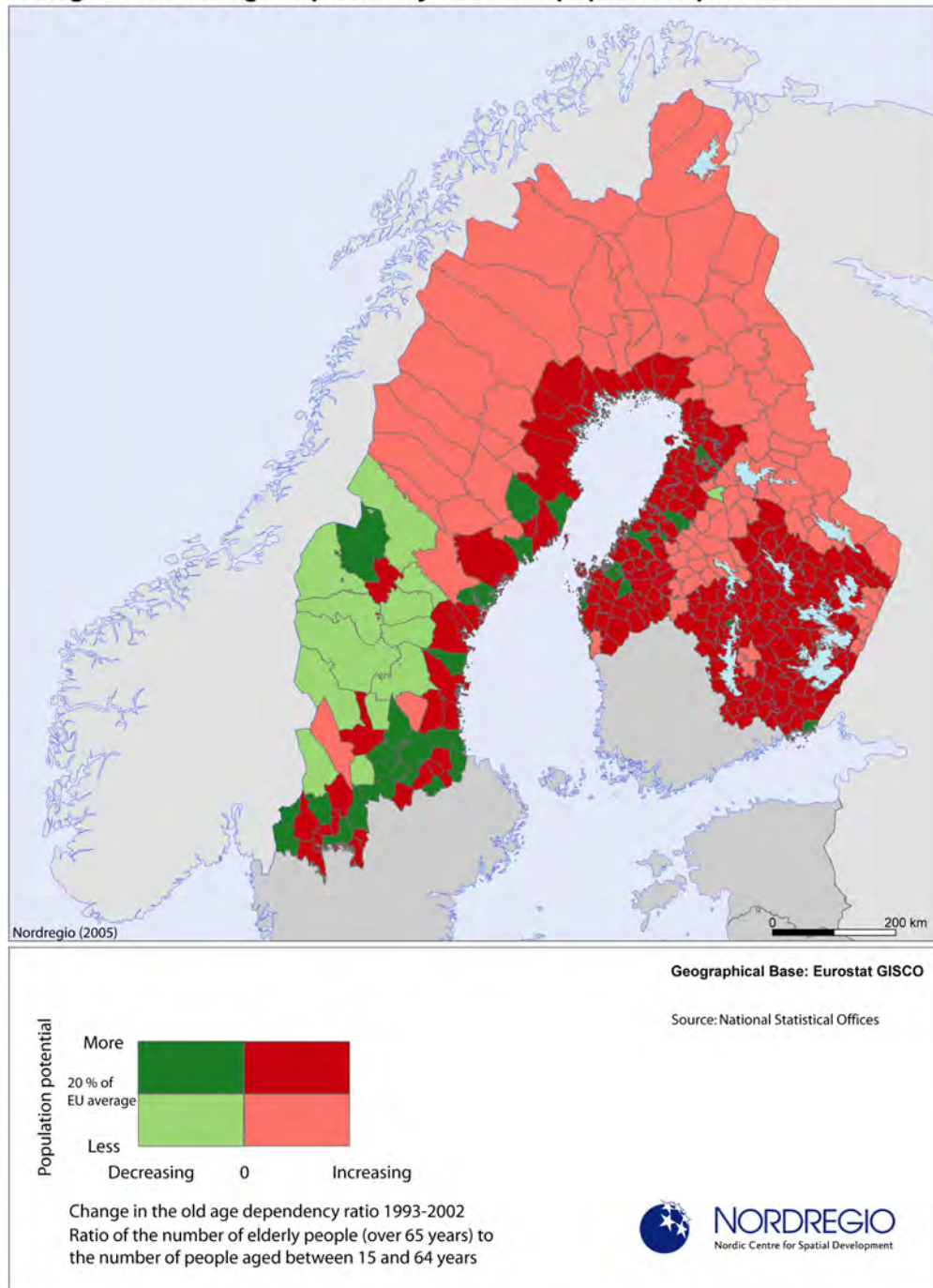


Figure 4.12 Cross-tabulation of population potentials and the change in old age dependency ratios

The ratio of the number of elderly people to the number of persons aged between 15 and 64 years tends to increase in most parts of the study area, except in Central Sweden. Because of cyclical variations in cohorts sizes, these results are however highly dependent on the choice of start and end dates.

Classification of municipalities according to the age structure

Analysing the age structure of an area gives a good perspective on the challenges faced by this area. In the following map, we have produced a classification of the municipalities of our study based on their age structure. The population was divided into 16 age categories, the first one consisting of children aged between 0 and 4 years, and the last one focussing on elderly people aged over 75 years.

Based on this analysis, a classification of municipalities into 4 different classes was produced (Figure 4.13). This classification is based on a mathematical model designed so as to construct classes that are as homogenous as possible (internally) and as different as possible (when comparing any two classes). The reference for this classification is the overall age structure in Norway, Finland and Sweden. A Nordic reference was preferred to a European one, as this allows us to observe the internal differentiation of the study area. The results can be analysed on different territorial scales. Class 1 is characterized by an over-representation of elderly people compared to the average for Finland, Norway and Sweden. Class 2 displays an over-representation of families with young children. Class 3 can be characterized by an over-representation of young active persons, whereas class 4 is in line with national averages. The exact profile of these classes is presented in Figure 4.14, both in absolute and relative terms.

Most municipalities in the Study area belong to the first category, that is to say that their population exhibits a higher share of elderly people than the Nordic average. However, the other 3 classes are also represented. A number of municipalities with a greater proportion of families with children (class 2) can be found in the coastal areas of Finland, especially around Oulu, and also around some important Finnish cities in the study area, such as Kuopio or Joensuu. Municipalities belonging to the third category, with an over-representation of young active persons are few and are situated in the city centres of Oulu and Jyväskylä. The fourth category, in line with average age structure for Norway, Finland and Sweden, is constitutive of the rest of the main urban areas in the study area.

Similar patterns can be found in Sweden, but with fewer local differentiations. This could be due to the larger size of the municipalities, which has a tendency to smooth out the territorial disparities, for instance between urban and rural areas.

The over-representation of elderly people leads to higher demands in terms of public service provision, which implies higher costs for the concerned municipalities. In

some cases, recruiting qualified personnel can also be a problem. As part of its population projections, the Swedish national public agency for economic policy issues (NUTEK) therefore includes the evolution of the ratio of people with medical and healthcare qualifications to the number of elderly persons.

Classification of municipalities by age structure

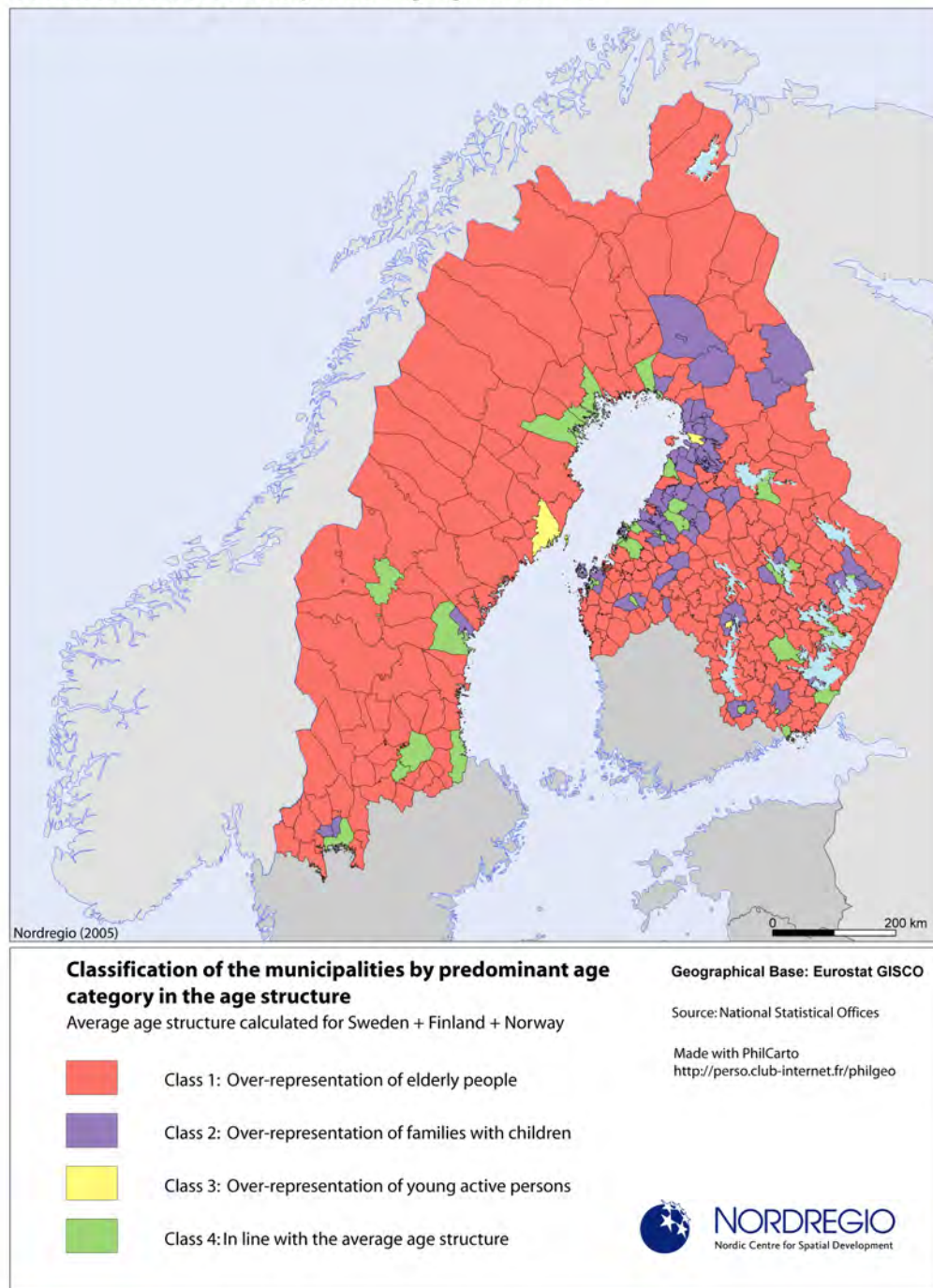
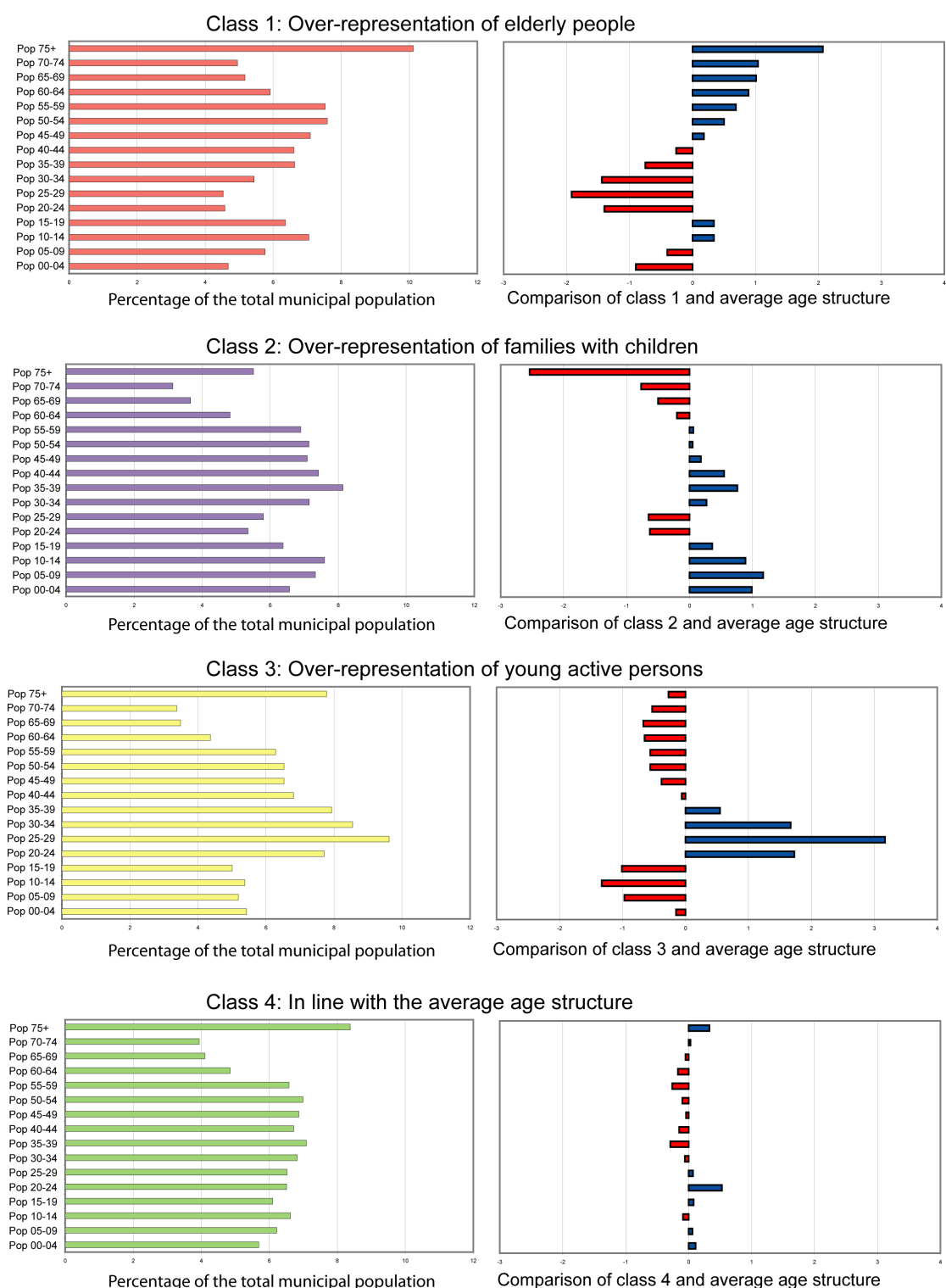


Figure 4.13 Classification of municipalities according to age structures



Classification of the municipalities by predominant age category in the age structure

Detailed age structure by class

Average age structure calculated for Sweden + Finland + Norway

Figure 4.14 Characterisation of the different age structure classes
Each class is characterised by the proportion of population in each age category, and by the deviations to the overall proportions in the three Nordic countries.

Four very distinct types of situations are identified.

Conclusion

Sparsely populated areas face the double challenge of progressive population ‘thinning’ and of ageing. An increasingly fragile demographic structure is therefore emerging beyond the main cities, which implies major challenges ahead for public service provision both in terms of costs and labour availability.

Major cities along the coast and in southeastern parts of the Finnish study area are preserved from demographic decline, as recipients of out-migration from their respective hinterlands. The sparsely populated areas experiencing decline are however extensive and continuous. Their lack of demographic dynamism can in general not be compensated through extended commuting trips and service provision areas around the nearest city. This makes these Nordic areas specific in comparison with other European areas experiencing population decline.

We have in addition seen that population decreases are strongest in areas which already have the weakest population potential. Even if these cases only experience a progressive demographic “thinning out”-process, they risk falling under the critical mass threshold for basic service provision. The over-representation of elderly people furthermore leads to higher demands in terms of public service provision, which implies higher costs for the concerned municipalities. In some cases, recruiting qualified personnel can also be a problem. There is therefore a constant need to look for innovative solutions that allow for such areas’ continued access to the most important public and private services.

Finally, one can see that depopulation trends accelerate in periods of high growth, especially as a result of reduced return migration among young people having moved in order to obtain a higher education degree. One can conclude from this that growth policies that are not accompanied by measures in favour of sparse areas will lead to increased depopulation.

5. Measuring peripherality and accessibility in the Nordic peripheries

“Remote regions” may appear to be a relatively intuitive, easy to grasp concept. Moreover as we have already noted, they are connected to the notion of the “distance to the core areas of Europe”. But because remote regions are often also characterised by less favourable living conditions, less highly developed infrastructures and reduced population densities, “remoteness” is often also used as a generic term encompassing a wide range of handicaps which may often not be causally linked to the “distance to the core areas of Europe”. A scientific approach of “remoteness” and “peripherality” must therefore first isolate the notion of “distance to the core areas of Europe” from these other dimensions.

The notion of “remoteness” moreover implies that the core areas of Europe possess some valuable assets, to which it may be a problem to be separated from geographically. This entails a twofold challenge when trying to quantify remoteness: First, what types of “core area specific assets” should one take into account? Should one take into account population mass, the intensity of industrial activity or specialised services? Second, how does distance make it more difficult to make use of these assets? Is distance a problem at 20, 50 or 500 km? How much greater is the constraint of distance at 300 km, as compared to 150 km?

These difficulties make it close to impossible to assess the economic effects of remoteness. The issue is further complicated by the fact that industries established in peripheral regions will naturally be less sensitive to distance to markets, or be place-bound through the presence of a natural resource. Empirical evidence furthermore shows that there is no deterministic causal link between peripherality and reduced growth: the high growth levels achieved in e.g. southern Ireland and the Oulu region in northern Finland have shown that the constraints of peripherality can be overcome.

5.1. What is accessibility?

Measuring accessibility

Accessibility is the main 'product' of a transport system. It determines the locational advantage of a region relative to all regions. Indicators of accessibility measure the benefits households and firms in a region enjoy from the existence and use of the transport infrastructure relevant for their region. In general terms, accessibility then is a construct of two functions, one representing the activities or opportunities to be reached and one representing the effort, time, distance or cost needed to reach them.

The result can be compared to Newton's law of gravitation (see Stewart, 1947). According to the law of gravitation the attraction of a distant body is equal to its mass weighted by a decreasing function of its distance. Instead of mass, the attractors here are the activities or opportunities in all destination regions. The measure of distance can take many forms, e.g. airline distance, distance along the road or rail network, travel-time, transport cost. One can also consider that crossing a boundary or changing from one mode of transport to another increases the distance: different taxation systems, different legislations or simply different languages can be taken into account as additional 'transaction costs'. In social and economic terms, the notion of distance is therefore complex.

Finally, in terms of the quantification of accessibility, three approaches are possible:

- . The first option is to sum up the number of opportunities within a given travel time. This would typically correspond to a *daily accessibility rate*, where the aim is to identify resources available within commuting distance.
- . The second option is to calculate the distance one has to cover to reach a certain type of activity. For example, when seeking to optimise an economic activity's location, one would look at the *travel cost* to and from other locations where inputs to this activity are produced.
- . The third and more complex solution considers that the shorter the distance to a given type of opportunity is, the more relevant it is. This measure, which is generally used when characterising the general regional accessibility, is called *potential accessibility*. Its calculation presupposes a hypothesis on how the relevance of opportunities decreases with distance, e.g. in a linear or exponential way. This is referred to as the "impedance function" of distance.

Table 5.1 provides a further account of important concepts as regards the measurement of accessibility.

Table 5.1 Different parameter dimensions of common accessibility indicators (Wegener et al., 2001, 9).

Dimension	Comments
Origins	Accessibility indicators may be calculated from the point of view of different population groups such as social or age groups, different occupations such as business travellers or tourists or different economic actors such as industries or firms.
Destinations	Accessibility indicators may measure the location of an area with respect to opportunities, activities and assets such as population, economic activities, universities or tourist attractions. The activity function may be rectangular (all activities beyond a certain size), linear (of size) or non-linear (to express agglomeration effects).
Impedance	The spatial impedance term may be a function of one or more attributes of the links between areas such as distance (Euclidean or network distance), travel time, travel cost, convenience, reliability or safety. The impedance function applied may be linear (mean impedance), rectangular (all destinations within a given impedance) or non-linear (e.g. negative exponential).
Constraints	The use of the links between areas may be constrained by regulations (speed limits, road gradients, maximum driving hours) or by capacity constraints (vehicle size, congestion). In addition to spatial impedance, non-spatial barriers (e.g. political, economic, legal, cultural or linguistic ones) may be considered. In addition, non-spatial linkages between areas such as complementary industrial composition may be considered.
Types of transport	One may consider only personal travel or only goods transport, or both.
Modes	Accessibility indicators may be calculated for road, rail, inland waterways or air. Multimodal accessibility indicators combine several modal accessibility indicators. Intermodal accessibility indicators include trips by more than one mode.
Spatial scale	Accessibility indicators at the continental, transnational or regional scale may require data of different spatial resolution both with respect to area size and network representation, intra-area access and intra-node terminal and transfer time.
Equity	Accessibility indicators may be calculated for specific groups of areas in order to identify inequalities in accessibility between rich and poor, central and peripheral, urban and rural, nodal and interstitial areas.
Dynamics	Accessibility indicators may be calculated for different points in time in order to show changes in accessibility induced by TEN projects or other transport policies, including their impacts on convergence or divergence in accessibility between areas.

Figure 5.1 is an attempt to summarise the complexity of the different accessibility indicators that are widely used in the literature. Simple endowment indicators (infrastructure measures, e.g. length of motorways in each region) can be best applied at higher NUTS levels (NUTS-0 to NUTS-3), and show the least complexity (provided that the respective data is available). Travel time or travel cost indicators such as the travel time to the nearest airport, university or agglomeration, or the accumulated travel costs to a set of certain activities are more complex in terms of data requirements and the way

they are calculated, however, they are still relatively easy to communicate. They can best be applied at NUTS levels 2 to 5; applications at NUTS-0 or NUTS-1 level is of course possible from a technical point of view, however, the explanatory power is then very limited.

Daily accessibility and potential accessibility indicators are the most complex ones, both in terms of data needs and calculation requirements, but they are also those indicators with the greatest explanatory power, as they really take into account a full set of origin-destination-pairs, and consider both the activities at any destination and the impedances to reaching them.

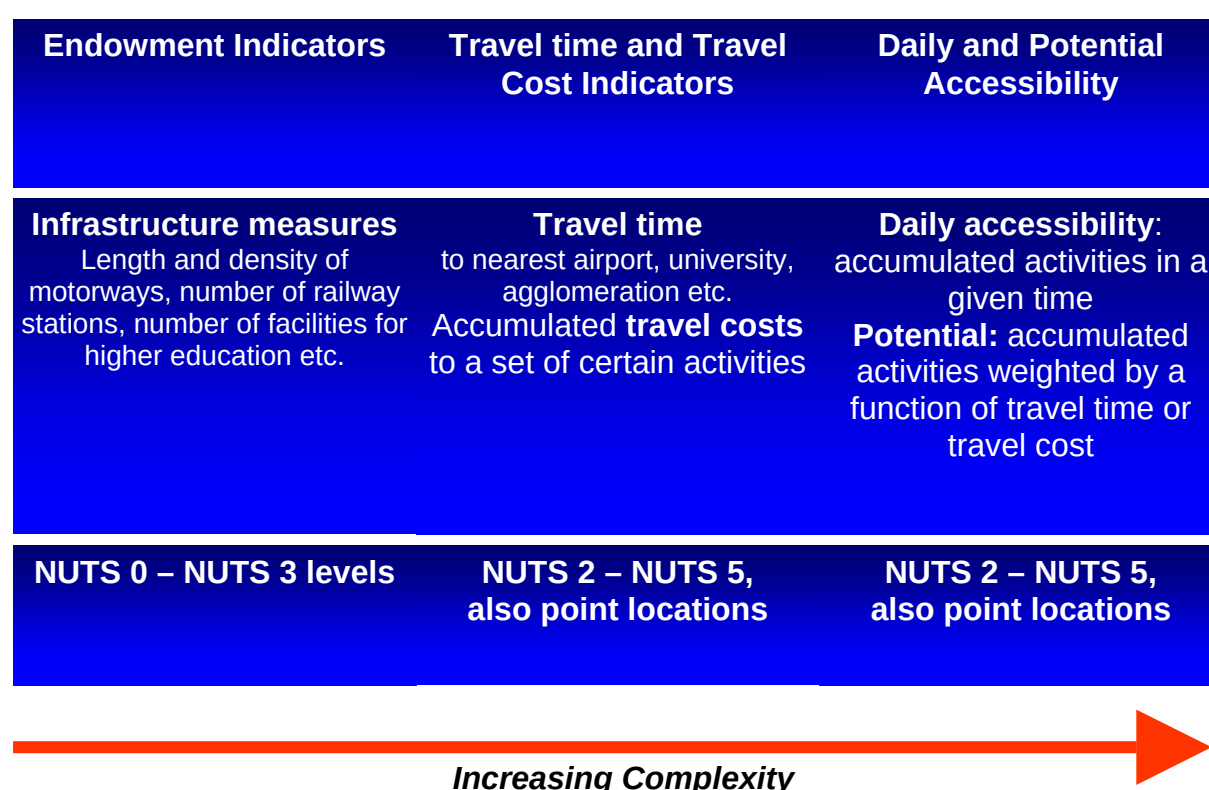


Figure 5.1. Complexity of accessibility indicators.

Accessibility, Regional Development and Cohesion

The important role played by the transport infrastructure in regional development is one of the fundamental principles of regional economics. In its most simplified form it implies that regions with better access to the locations of input materials and markets will, *ceteris paribus*,

be more productive, more competitive and hence more successful than more remote and isolated regions (see Linneker, 1997).

The two-way interaction between regional economic development and interregional transport is illustrated in Figure 5.2. The relationship between regional development and transport can be seen as a self-reinforcing positive feedback loop in which regional economic growth creates more traffic and, vice versa, transport opportunities generate regional economic growth, with congestion and factor prices acting as equilibrating negative feedbacks:

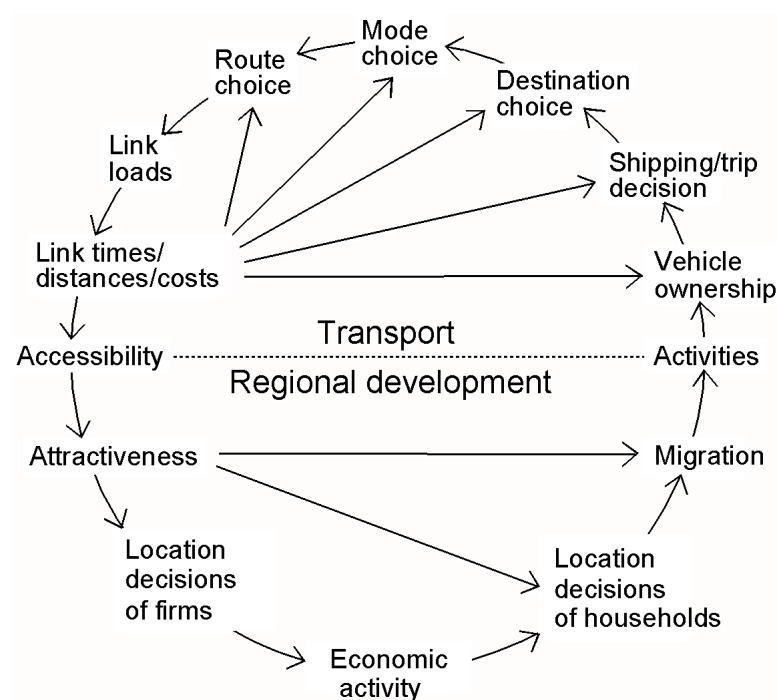


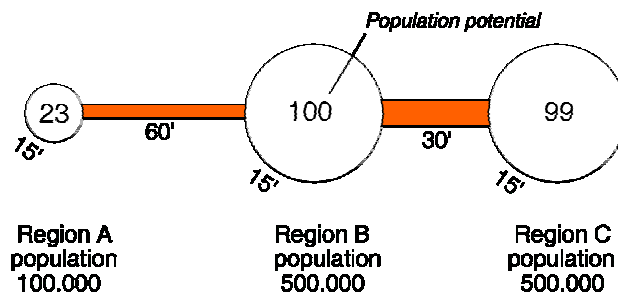
Figure 5.2. Transport and regional development (Wegener et al., 2000).

- (1) The spatial distribution of economic activity and population gives rise to shipments of goods and movements of travellers between the regions.
- (2) Shippers and traveller make use of the existing transport infrastructure by a sequence of decisions about vehicle ownership, trips to make (or not to make), choice of destination, choice of mode(s) and choice of route(s).
- (3) These decisions lead to congestion in parts of the networks, which result in increases in transport and travel costs and times, which in turn affect the transport decisions of shippers and travellers.
- (4) Transport and travel costs in the (congested) networks are location factors co-determining the attractiveness of regions for investors and households.

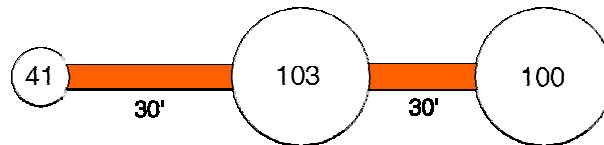
- (5) Investors decide on the location or relocation of capital and firm locations, this leads to changes in employment opportunities in the regions.
- (6) Households make migration decisions as a function of employment opportunities, this leads to changes in regional population which then will lead to changes in the spatial configuration of the activities.

According to SACTRA (1998) a list of the important regional effects of the effects of transport investment must include the following aspects: Transport investment may broaden the access of employers to qualified labour, expand market areas, attract inward investment, improve the image of a region, unlock suitable development sites and induce further economic activity and further employment. However, there may be also negative impacts: The net effect on employment and regional activities depends on the balance between export promotion and import substitution for local production. Transport improvement may have displacement effects in other regions or within the region itself (firms move from their previous remote location to locations in the neighbourhood of higher-level transport infrastructures). Marginal changes in the quality of an already good infrastructure system are less likely to have significant effects. Transport investments may reduce the demand for transport resources (e.g. drivers and vehicles) by improving the productivity of the transport sector. And finally, labour market characteristics have to be considered.

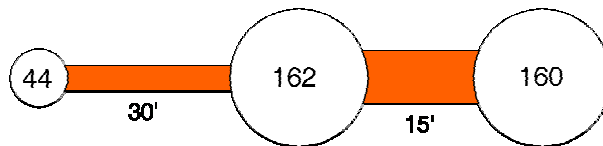
Whether the positive effects of transport investments outweigh the negative effects, cannot be judged theoretically but instead depends on the type of investments and type of transport infrastructure project in question, and of course also depends upon the existing transport network within a region. From the point of view of regional development policies, Figure 5.3 illustrates the dilemma between the positive effects and the counteracting negative effects of transport investments:



Peripheral region A is disadvantaged by its peripheral location and by its poor transport connections to the central regions B and C.



An improvement of the transport link between A and B enables Region A to market its products in B and C, but also opens it up to the products of B and C.



In the real world, however, primarily the transport connections between the central regions are improved.

Figure 5.3. Transport investments and regional development.

This theoretical example supposes that a peripheral region *A* is disadvantaged by its peripheral location, its poor transport connections to the central regions *B* and *C* and by its low population mass (i.e. small internal markets). An improvement of the transport link between that peripheral region *A* and the central region *B* enables region *A* to market its products in *B* and *C* more easily and efficiently (and so expands its potential markets), but it also opens it up to the products of *B* and *C*. Very often, producers in *B* and *C* are more productive compared to those in region *A*, as they have higher skilled labour forces available, lower *per-capita* costs, economies of scale, and more advanced technologies at hand, and so there is severe danger that the formerly closed monopolist local markets in region *A* will be destroyed by the new competitors of central regions *B* and *C*. Of course, in monopolist closed markets consumers usually have to pay higher prices for goods, however, in this case the destruction of the formerly closed markets may end up in the closure of the small scale local companies and firms, and so may

increase unemployment rates. In the real world, moreover, not only the transport link between peripheral region *A* and central region *B* will be improved, but primarily the transport connections between the central regions *B* and *C* will be improved, because of the high traffic demands there, so the central regions will benefit proportionally more. At the end there are improvements in accessibility for all regions, however, the gap between the central regions and the peripheral ones will be widened. While the transport investments has positive effects in macro-economic terms, but the outcomes described above are not satisfying from a cohesion perspective. Eventually, the positive macro-economic effects in the short run may under certain circumstances be cancelled out by higher costs for unemployment in the medium or long run.

This of course is only one possible scenario of the spatial impacts of transport investments among others. However, similar processes could be observed in the real-world in a number of regions where the general economic growth triggered by transport investments was at the expense of losing jobs and raising local or regional unemployment.

The impact of transport infrastructure on regional development has been difficult to verify empirically. According to several empirical studies, there seems however to be a clear positive correlation between both the transport infrastructure endowment and the location in interregional networks, and the *level* of economic indicators such as GDP *per capita* (e.g. Biehl, 1986; 1991; Keeble et al., 1982, 1988). However, this correlation may merely reflect historical agglomeration processes rather than causal relationships effective today (cf. Bröcker and Peschel, 1988). Attempts to explain *changes* in economic indicators, i.e. economic growth and decline, by transport investment have been much less successful. The reason for this failure may be that in countries with an already highly developed transport infrastructure further transport network improvements bring only marginal benefits. The conclusion is that transport improvements have strong impacts on regional development only where they result in removing a *bottleneck* (Blum, 1982; Biehl, 1986; 1991; Fürst et al., 2000a, 2000b).

While there is uncertainty about the magnitude of the impact of transport infrastructure on regional development, there is even less agreement on its direction. It is hotly debated whether the transport infrastructure contributes to regional polarisation or decentralisation.

Some analysts argue that regional development policies based on the creation of infrastructure in lagging regions have not succeeded in reducing regional disparities in Europe (Vickerman, 1991a), whereas others point out that it has yet to be ascertained whether the reduction of barriers between regions has disadvantaged peripheral regions (Bröcker and Peschel, 1988). From a theoretical point of view, both effects can occur. A new motorway or high-speed rail connection between a peripheral and a central region, for instance, makes it easier for producers in the peripheral region to market their products in the large cities, however, it may also expose the region to the competition of more advanced products from the centre and so endanger formerly secure regional monopolies (see Figure 2) (Vickerman, 1991b; Bundesminister für Verkehr, 1996).

While these two effects may partly cancel each other out, one factor unambiguously increases existing differences in transport infrastructure. New transport infrastructure tends to be built not between core and periphery but within and between core regions, because this is where transport demand is highest (Vickerman, 1991a). It can therefore be assumed that the trans-European networks will largely benefit the core regions of Europe.

As shown in many studies, accessibility indicators can be used to analyse and quantify the impacts of transport investments on regional development (Schürmann et al., 1997; Fürst et al., 2000a; Geurs and van Eck, 2001; Bröcker et al., 2004). However, apart from calculating the accessibility indicators this implies the application of a more general model of regional economic development.

If the negative effects outweigh the positive effects in the long run, as discussed above, this would likely shed a negative light on the fulfilment of major policy goals of the European Union:

Article 2 of the Maastricht Treaty states as the goals of the European Union the promotion of harmonious and balanced economic development, stable, non-inflationary and sustainable growth, convergence of economic performance, high levels of employment and social security, improvement of the quality of life and economic and social coherence and solidarity between the member states.

The trans-European networks in the fields of transport, communications and energy (TEN) play a prominent role in the achievement of these goals. Indeed, Article 129b of the Maastricht Treaty linked the TEN to the objectives of Article 7a (free traffic of goods, persons, services and capital) and Article 130a (promotion of economic and social cohesion). In particular the trans-European transport networks were to link landlocked and peripheral areas with the central areas of the Union. These objectives were confirmed in the European Spatial Development Perspective (ESDP 1999, 14).

In the ESDP document, improvements in accessibility are given a high priority as a policy target: *"Good accessibility of European regions improves not only their competitive position but also the competitiveness of Europe as a whole."* (ESDP 1999, 69). *"The creation of several dynamic zones of global economic integration, well distributed throughout the EU territory and comprising a network of internationally accessible metropolitan regions and their linked hinterland (towns, cities and rural areas of varying sizes), will play a key role in improving spatial balance in Europe"* (ESDP, 1999, 20). However, it is admitted that, "it is not possible to achieve the same degree of accessibility between all regions of the EU" (ESDP, 1999, 36).

This goal-setting reflects the assertion that improvements in accessibility have positive implications for regional (economic) development. Unfortunately, as the above discussions have shown, there is no uni-causal or straightforward link between these two phenomena, and thus the question remains *a priori* open: upgrading a region's accessibility provides actors in that particular region with improved possibilities to reach destinations outside, but at the same time, they meet increasing competition from outside. The net effect on regional development remains an empirical issue.

Accessibility indicators can be used to analyse peripherality in several ways: regions can be classified into central and peripheral regions, impacts of different policy measures such as transport investments can be evaluated, or impacts of accessibility on regional development can be analysed.

Large-scale accessibility measures and small-scale accessibility measures

From the perspective of regional development, and thus also from the perspective of the Nordic sparsely populated areas, it is important to analyse the degree of peripherality (as being the negative notion of accessibility) at different spatial levels.

First, large-scale European-wide accessibility measures are positioning the regions relative to all other regions in the European Union, revealing differences in accessibility and in the development of accessibilities over time. These types of indicators mainly represent business activities and the transportation of goods; for business trips and also for the movements of goods it is important to know how quickly any destination is reachable, and of course at what cost. The daily accessibility and also the potential accessibility indicator can, moreover, also be interpreted as the market potential that any origin may offer to businesses (how many people can be reached in a reasonable time?) and to producers (how many customers are living in close proximity?). However, private trips are not so well covered by these kinds of measures as long-distance international travel is not the main concern of daily life, contributing very little to the quality of life in the regions (apart from some holiday travel).

Second, small scale accessibility measures are more concerned with intra-national or intra-regional types of accessibilities, and so try to contribute to measuring the quality of life and infrastructure provision in a region in a broad sense. Here, the focus lies on the endowment and travel time indicators: How long does it take to go to the nearest hospital, or university, or to the nearest airport? What is the travel time to the three nearest large cities? As these activities are more concerned with daily life, these types of indicators can be considered as more individual-driven rather than economically driven. The very practical implication of these measures is, for instance, that if a region is performing badly in terms of the above-mentioned indicators, people may be forced to leave because the region is lacking in basic infrastructure (for example, hospitals); or in other words: if a region is performing above-average (for example, as regards facilities for higher education), the region may attract people from outside the region, and so may generate additional income and additional economic activities.

It is therefore important to analyse both large-scale European-wide accessibility indicators, as well as small-scale accessibility indicators to obtain a full picture of a region's external and internal accessibility.

Accessibility indicators in the SPA study

In this study on the Nordic sparsely populated peripheral areas, accessibility indicators play a crucial role at several stages:

First of all, a derivate of the accessibility potential measure has been used to delimitate the sparsely populated areas (how many people can be reached within 50 km), and so to delimitate the study area (see Chapter 3).

Second, travel time indicators have been used to analyse the infrastructure provision and infrastructure supply in the regions with respect to airports, hospitals and universities and functional urban areas. These indicators represent the small-scale accessibility measures.

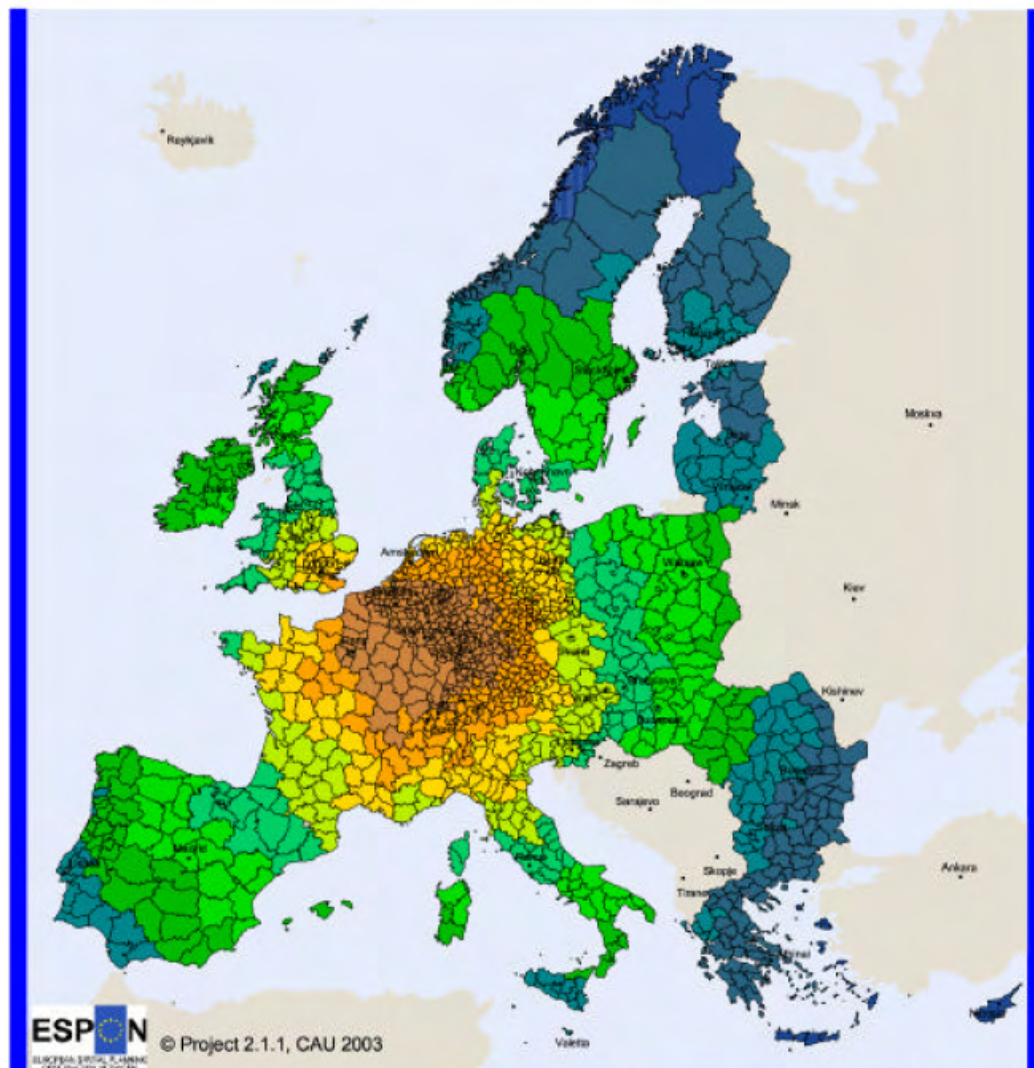
5.2. European accessibility measures

A possible measure of accessibility introduced by the ESPON 2.1.1 project uses GDP as an indicator of economic activity in destination regions, and considers that its relevance for the origin region decreases by 50% for every 1000 minutes (16,6 hours) of travel time (Figure 5.4). Based on these hypotheses, the northernmost Finnish region of Lappi appears to be among the most remote areas in Europe, while most other regions of the study area appear in the same group as the Eastern parts of Romania, Bulgaria and Greece. Generally, as for all accessibility maps based on ground transport, the dominant feature is the centre-periphery patterns from a European core area stretching from the Benelux countries to Paris and Frankfurt to the outer parts of Europe. This illustrates the monocentric structure of Europe, organised around only one major core area.

This pattern can indeed also be observed in Figure 5.5, which corresponds to the potential accessibility to population in EU 27 (including Romania and Bulgaria), Norway and Switzerland, by road. In this calculation, the exceptionally low accessibility levels in the Study area appear, compared to the rest of Europe, even more clearly, as only Cyprus and some Greek islands have equivalent values. Some measures of potential accessibility to population show a relatively favourable position for East-Finland, due to

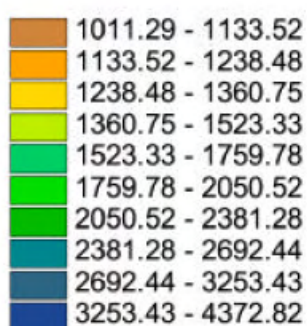
the proximity to the 10 million inhabitants of the Saint-Petersburg region (e.g. ESPON Project report 1.2.1 "Transport trends"). This however needs to be nuanced as a hypothetical opportunity for the concerned Finnish regions, as the practical, administrative and economic difficulties developing cross-border interaction in these areas are considerable. For this reason, we have developed an alternative calculation taking into account destinations in EU 27, Norway and Switzerland only. From the Finnish perspective, the border with Russia is perceived as an important barrier, not only for historical reasons but also because of the contrasts in terms of revenue and welfare. Furthermore, the political and administrative situation creates a certain degree of unpredictability in terms procedures, tariffs and general trade conditions. For these reasons, it is from some perspectives reasonable to assume that the population situated beyond the Eastern border of the EU should not be taken into in the accessibility calculations.

If air transport is introduced, more complex spatial patterns appear, as accessibility to airports can often be better in remote regions than in centrally located rural regions. Figure 5.5, based on data provided by Spiekermann and Wegener, illustrates these differential effects of air transport on the relative levels of accessibility in regions across Europe. Most centrally located regions (pink regions in Figure 5.5) have a lower relative level of accessibility when air transport is introduced, because their *gain* in terms of accessibility from air transport is much weaker than in other parts of Europe. At the other end of the scale, the remote regions of the Nordic periphery are those who gain most from the introduction of air transport. Most regions of the study area have relative accessibility levels that are more than 500% higher with air transport than without. These increases however only concern the areas around the main regional airport. In all other parts of the regions, accessibility remains low even when taking into account air transport (see subchapter 5.3)



© EuroGeographics for the administrative boundaries

Time to market in minutes



Origin of data: own calculations

This map does not
necessarily reflect the
opinion of the ESPON
Monitoring Committee

Figure 5.4: Multimodal (road + rail) accessibility to GDP at the macro scale

Potential accessibility by road to destinations in EU 27, Norway and Switzerland

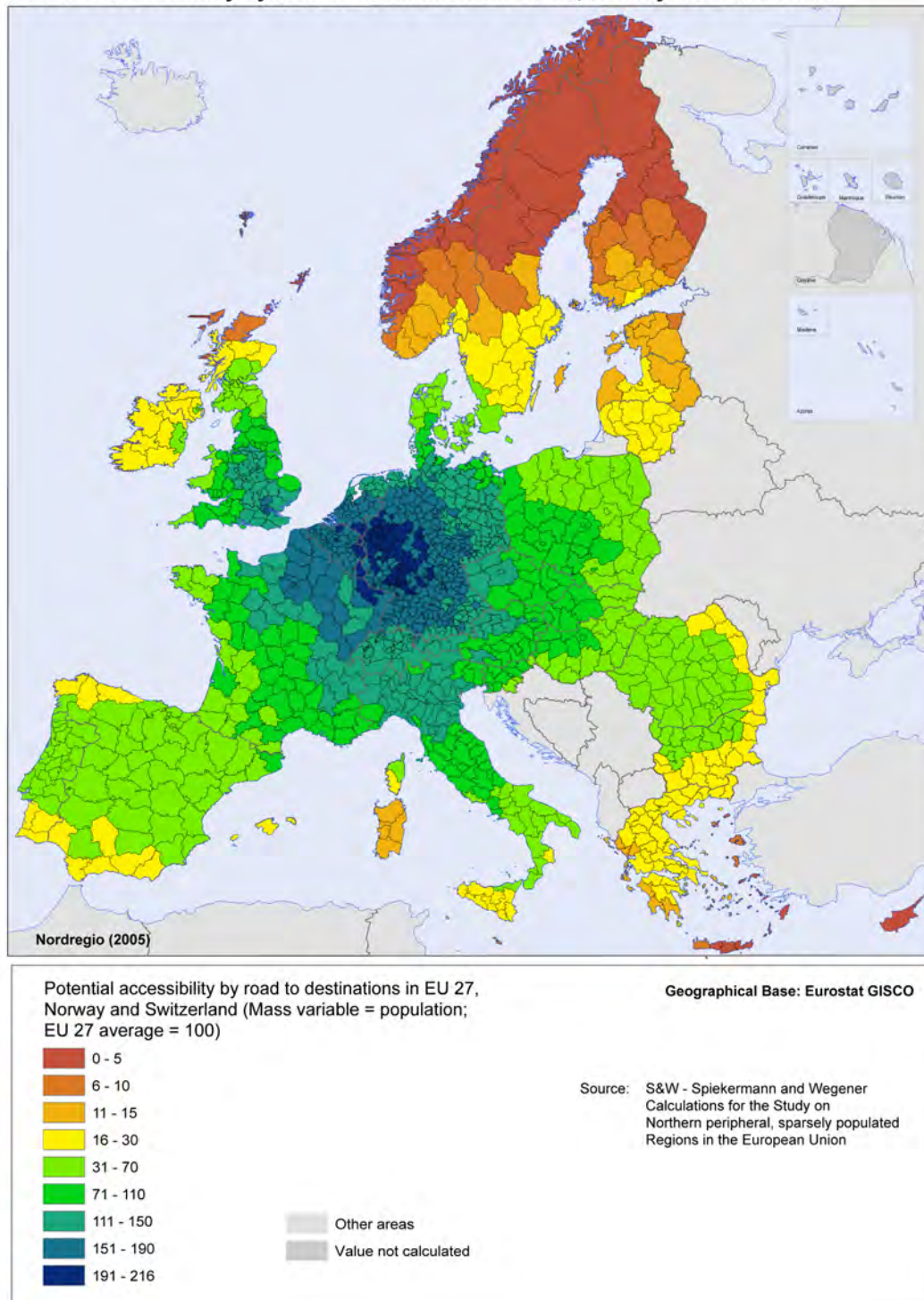


Figure 5.5: Potential accessibility by road to population in EU 27, Norway and Switzerland

According to this calculation, most of the study area regions have the lowest potential accessibility to population in EU 27, Norway and Switzerland.

By not taking into account destinations in other countries, such as Russia, Belarus, Ukraine and Moldova, this map reflects the difficulties crossing the border to these countries and the contrasts in terms of economic, administrative and social systems that significantly reduce trade possibilities.

Comparison of multimodal and road accessibilities

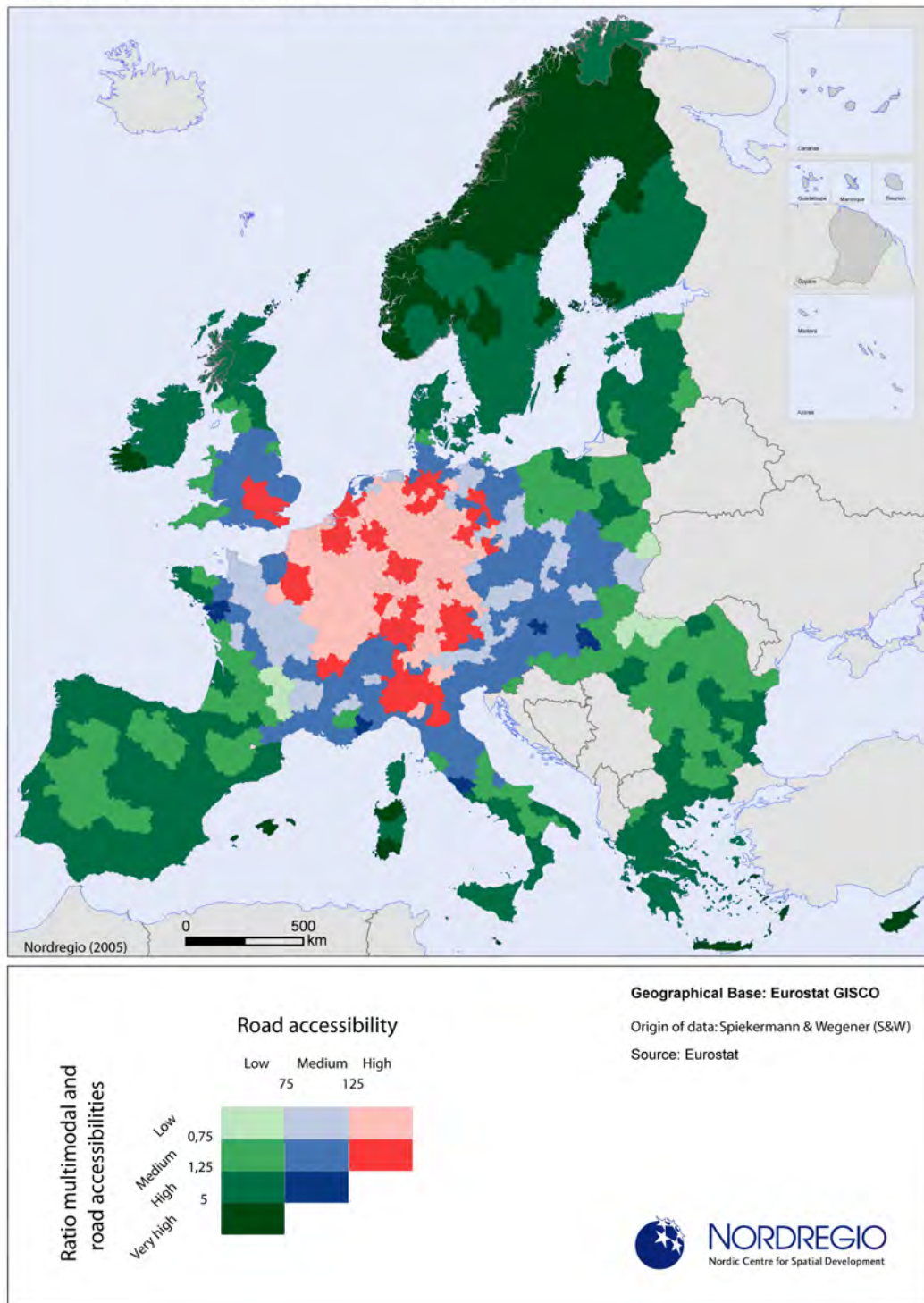


Figure 5.6. Comparison of air and road accessibilities

There is strong improvement of relative accessibility levels in Nordic peripheries through air transport. relative accessibility levels generally increase by over 500%. This illustrates the high dependency on air transport in these regions. It should however be noted that the increase only concerns the areas around the airports of each of these regions.

5.3. Access to airports

As shown in the previous section, air traffic increases the accessibility of Northern Peripheries up to a level that may, in some respects, be equivalent to that of the rural regions of continental Europe. The intra-regional contrast between areas which can access an airport with regular traffic, and those that cannot, is however all the greater.

This section introduces some quantitative analyses on the access to airports in the Nordic peripheral regions. These are based on the present situation, or on the latest available data. One should however bear in mind that, based on the current deregulation of air traffic, trends in passenger numbers, and increased demands in terms of profitability, national airport authorities in both countries expect a number of smaller airports to be closed in the years to come.

As shown by Figure 5.9, a rather balanced distribution of airports exists in the Study area. There are 29 airports in the Finnish part of the study area and 38 in the Swedish part. However, many of them are of very local importance, as they are not IATA members. There are almost no international routes from any of the airports in the study area.

The dominant destinations served from airports in the remote regions of Sweden and Finland are the capital cities, i.e. Stockholm and Helsinki (Figure 5.10). There are very few routes interconnecting airports within the northernmost regions with each other in these countries. The only exceptions are the Luleå-Kiruna and Vilhelmina-Storuman connections in Sweden.

Air transport connections that are exclusively oriented towards the national capital region create a monocentric type of relations, which may increase the dependency of remote regions. Indeed, rather than developing certain common specialised services for a group of interconnected peripheral regions, they will tend to refer to existing facilities in the capital region. Transversal links between peripheries are therefore of fundamental importance for the constitution of viable autonomous economic development nodes outside of the capital regions.

Airports in the northernmost regions

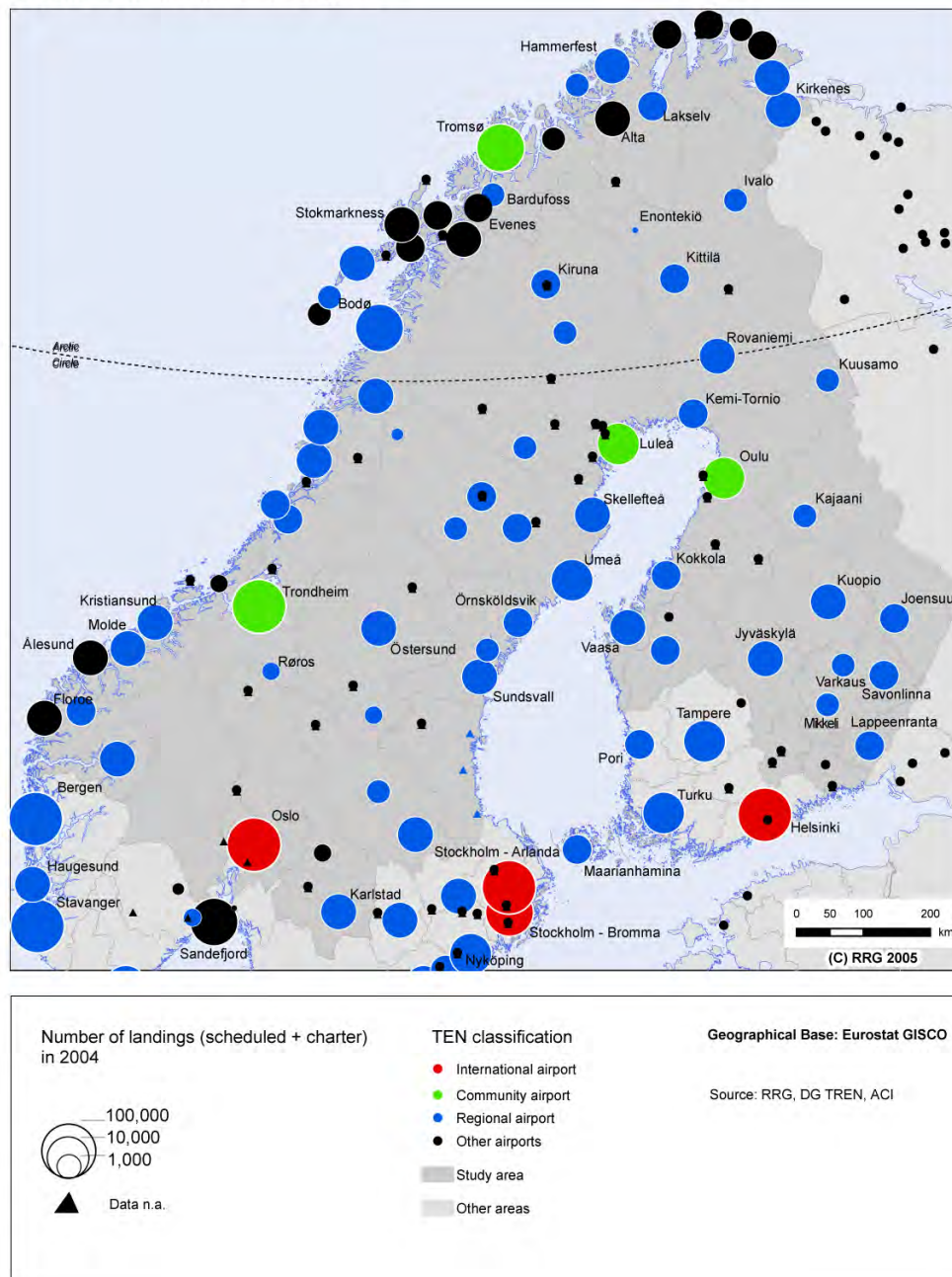
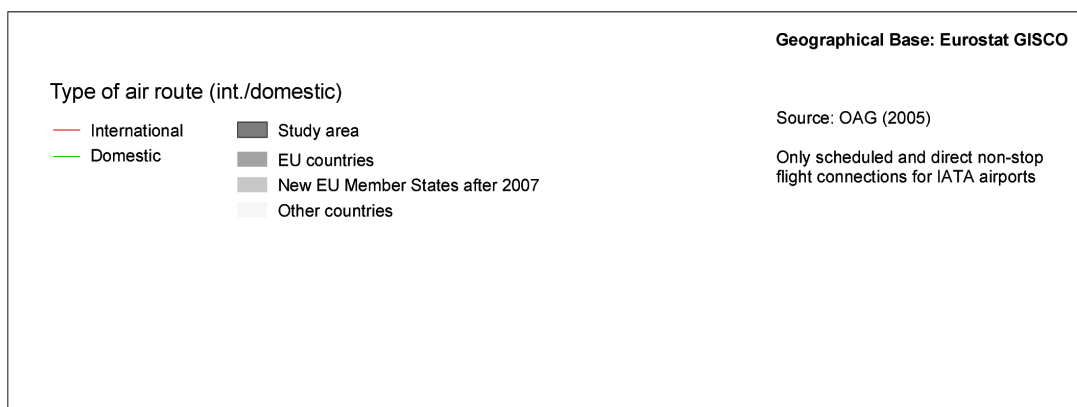
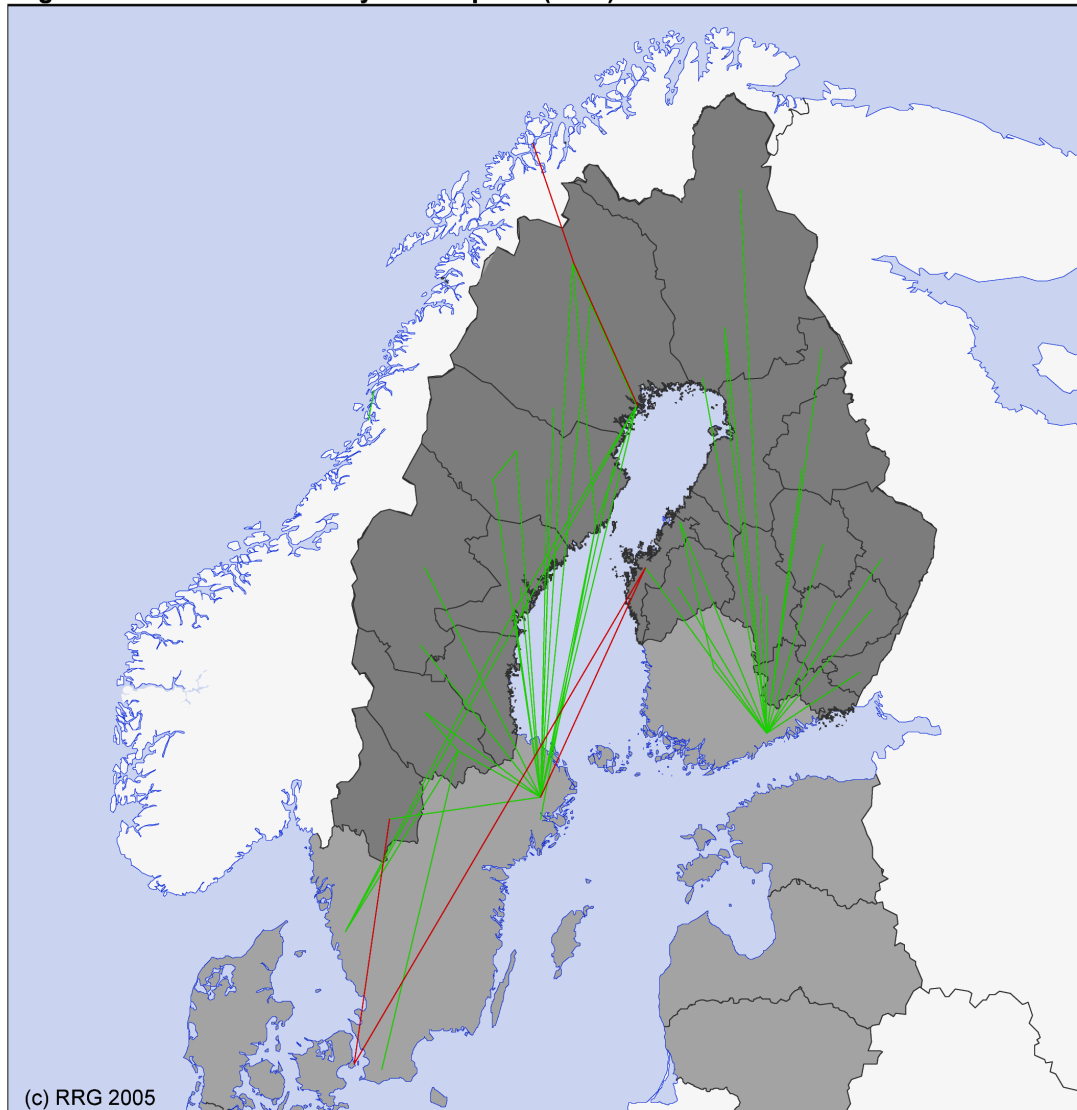


Figure 5.7 Airports in the northernmost regions
(RRG, 2005, European Commission, 2005, ACI, 2003).

Flight connections from study area airports (2005)



*Figure 5.8 Air connections in the northernmost regions
(RRG, 2005, European Commission, 2005, ACI, 2003).*

There are very few transversal connections in the peripheries of Finland and Sweden, which greatly reduces the potential for interaction between peripheral regions.

Air connections in peripheral parts Finland and Sweden cannot, in other words, be expected to contribute to the notion of functional regional enlargement (“*regionförstoring*”), often evoked in national policies as a way of compensating for the lack of critical mass in these areas.

In addition, as noted previously, even if air transport makes some towns and cities relatively easily accessible, albeit at the cost of a transit through the main national airport, this only reinforces the relative isolation of areas that are further away from the nearest airport. It is therefore interesting to assess the relative extent and demographic weight of areas in the study area from which one cannot access any airport in less than 60 minutes. As illustrated by figures 5.11 and 5.12 this concerns only marginal inhabited parts, except possibly in Eastern Finland. This is expressed more explicitly by calculating the proportion of municipality population living within the 60 minutes isochrones as a percentage of the total municipality population (Figure 5.13).

According to the airport locations, in municipalities located on the Baltic Sea more than 80 %, often even more than 90 % of the population lives within one-hours driving time. This holds true for both Finland and Sweden, with only few exceptions. However, on moving further away from the coastlines the situation in Finland and Sweden differ to some extent: As the percentages in Sweden remain rather high often at more than 50 % even in remoter hinterland municipalities, in the Finnish hinterland municipalities these percentages often do not exceed the 50 % limit. This finding of course not only reflects the airport’s location, but is also illustrative of the different population patterns in both countries (see Chapter 4). Table 5.2 sums up these results at NUTS-3 level.

Table 5.2. Population at more than 60 minutes from nearest airports per NUTS 3 region

NUTS 3 region	Total population	Proportion at more than 60 minutes from nearest airport (%)
Etelä-Savo	162,635	24.99
Pohjois-Savo	246,584	32.78
Pohjois-Karjala	166,249	45.26
Kainuu	87,276	43.43
Päijät-Häme	182,528	3.48
Kymenlaakso	200,075	5.21
Etelä-Karjala	132,038	12.78
Keski-Suomi	262,069	25.40
Etelä-Pohjanmaa	192	26.91
Pohjanmaa	145,371	23.72
Keski- Pohjanmaa	69,008	10.04
Pohjois- Pohjanmaa	377,397	37.33
Lappi	196,158	25.08
FINLAND	5,241,946	17.74
Värmlands Län	274,919	19.18
Dalarnas Län	276,217	24.54
Gävleborgs Län	276,154	9.29
Västernorrlands Län	245,829	16.53
Jämtlands Län	125,908	36.14
Västerbottens Län	250,87	23.97
Norrbottnens Län	215,064	18.09
SWEDEN	8,557,947	17.63

Airports in the study area: 60-minutes isochrones

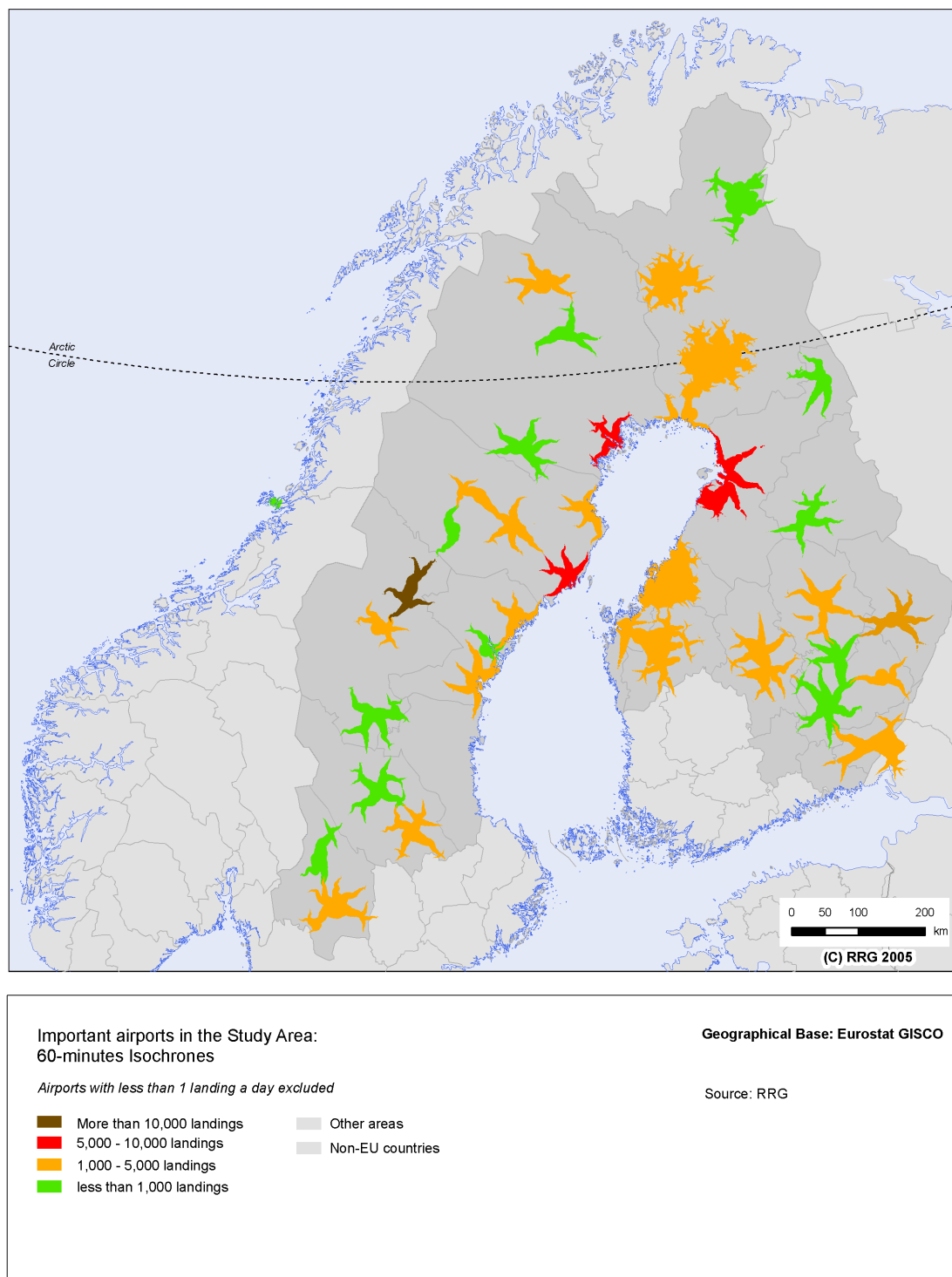


Figure 5.9 60-minute isochrones around airports in the Study area.

Population and airport isochrones

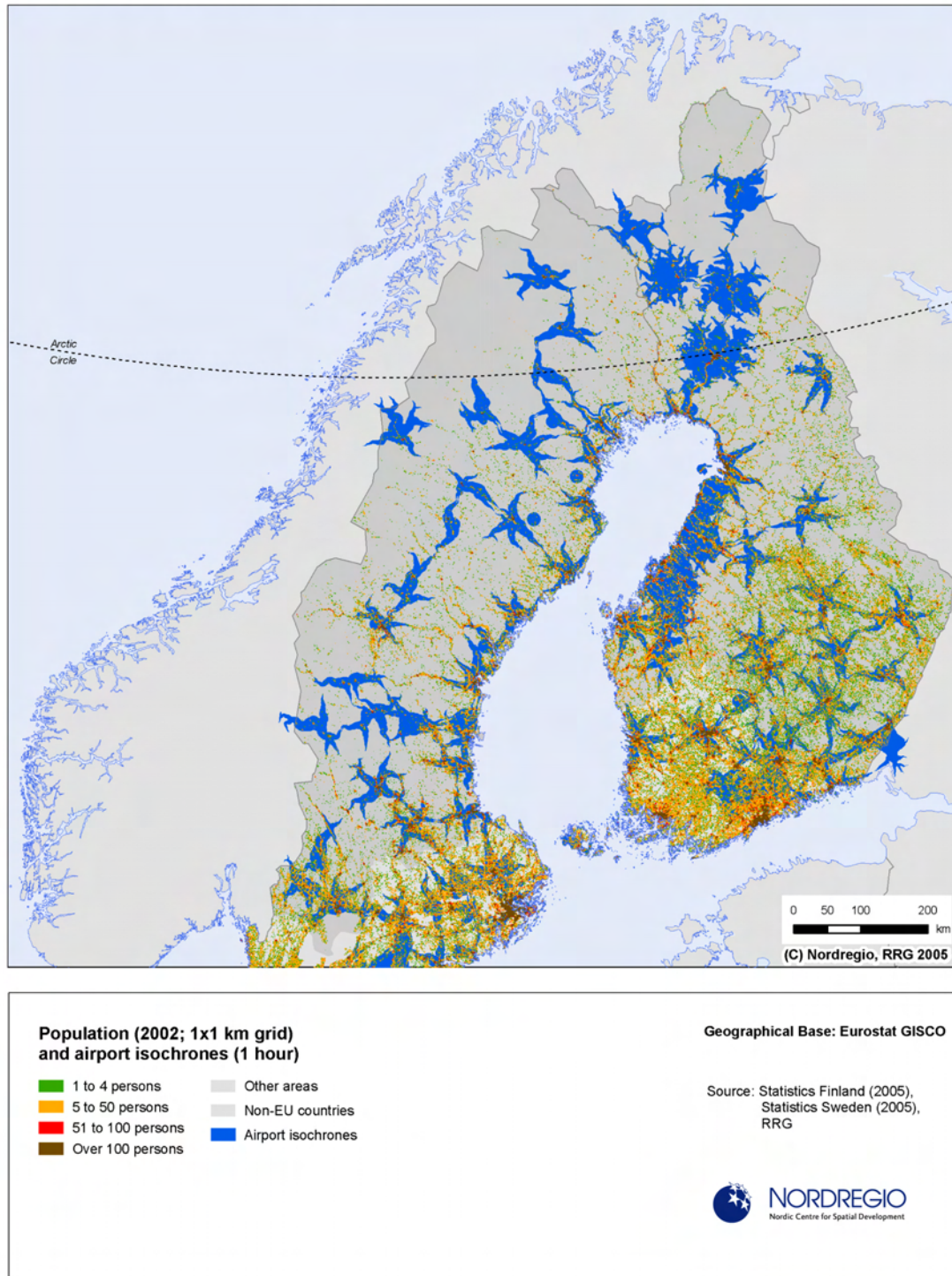


Figure 5.10. Overlay 1x1 grid cell populations and 60-minute isochrones around airports in the Study area.

Municipality population within 1 hour airport isochrones

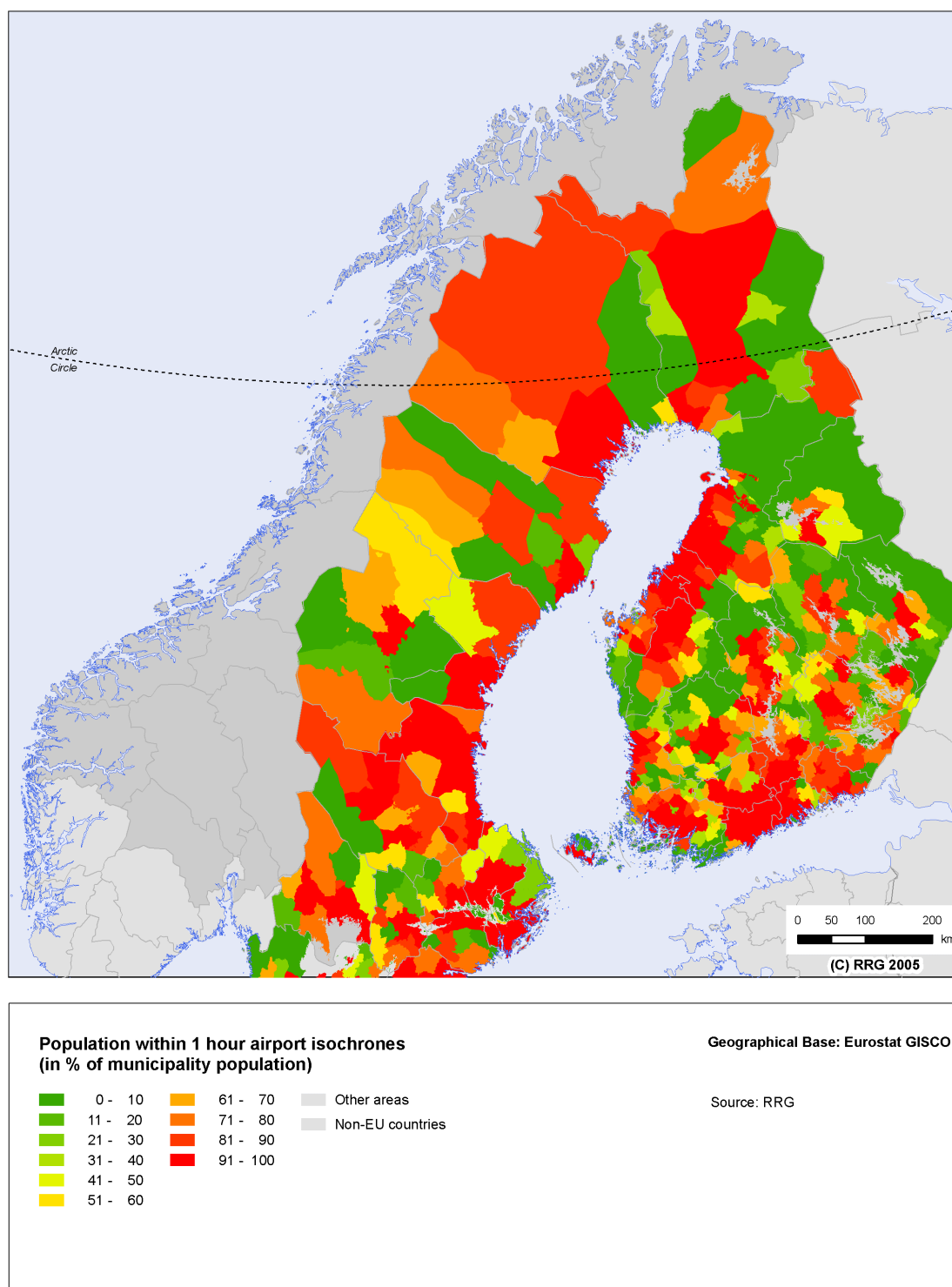
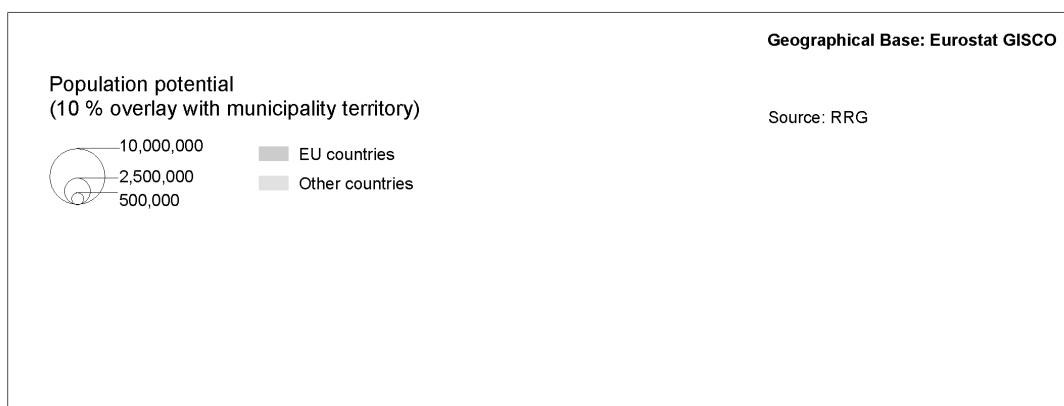
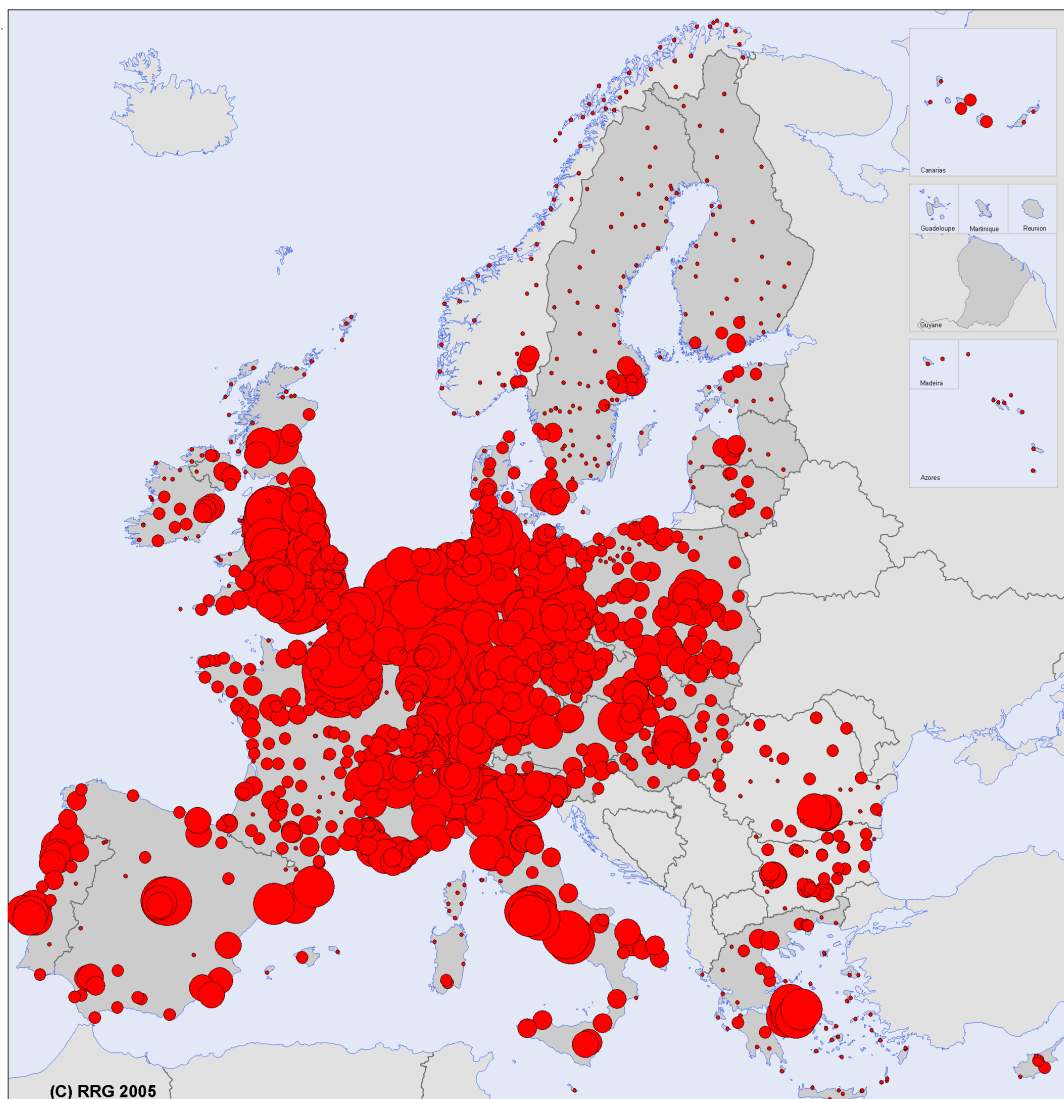


Figure 5.11 Proportion of municipal population living less than one hour (by individual car) from the nearest airport (in %)

Using this same methodology, one can thus also assess the population potential of each airport, i.e. the local population that, having a travel time of less than 60 minutes, is potentially likely to using it. This population potential is presented in Figure 5.14. It shows the exceptional character of Nordic peripheral regions in the European context: no other part of the continent has such low values over such a wide territory. As these areas cannot generally rely upon mass-tourism to improve the profitability of the airport infrastructure, in the same way as for example a number of Mediterranean islands, a proactive public policy in their favour is necessary.

If one looks at the relationship between the number of passengers and the local population potential (Figure 5.15), it is interesting to note that the ratio is similar for some very peripheral Nordic airports, and in major tourism destinations such as Majorca and the Greek islands, or European air traffic hubs such as London and Paris. This shows the intense use that is made of the airport infrastructure by the local population, and suggests that the closure of the smaller peripheral airports could have dramatic consequences for the concerned local communities.

Airports in Europe: Population potential (10 % overlay)



*Figure 5.12 Airport population potential
(i.e. total population living within 60 minutes from airport)*

Airports in Europe: Passenger surplus compared to population potential (10 % overlay)

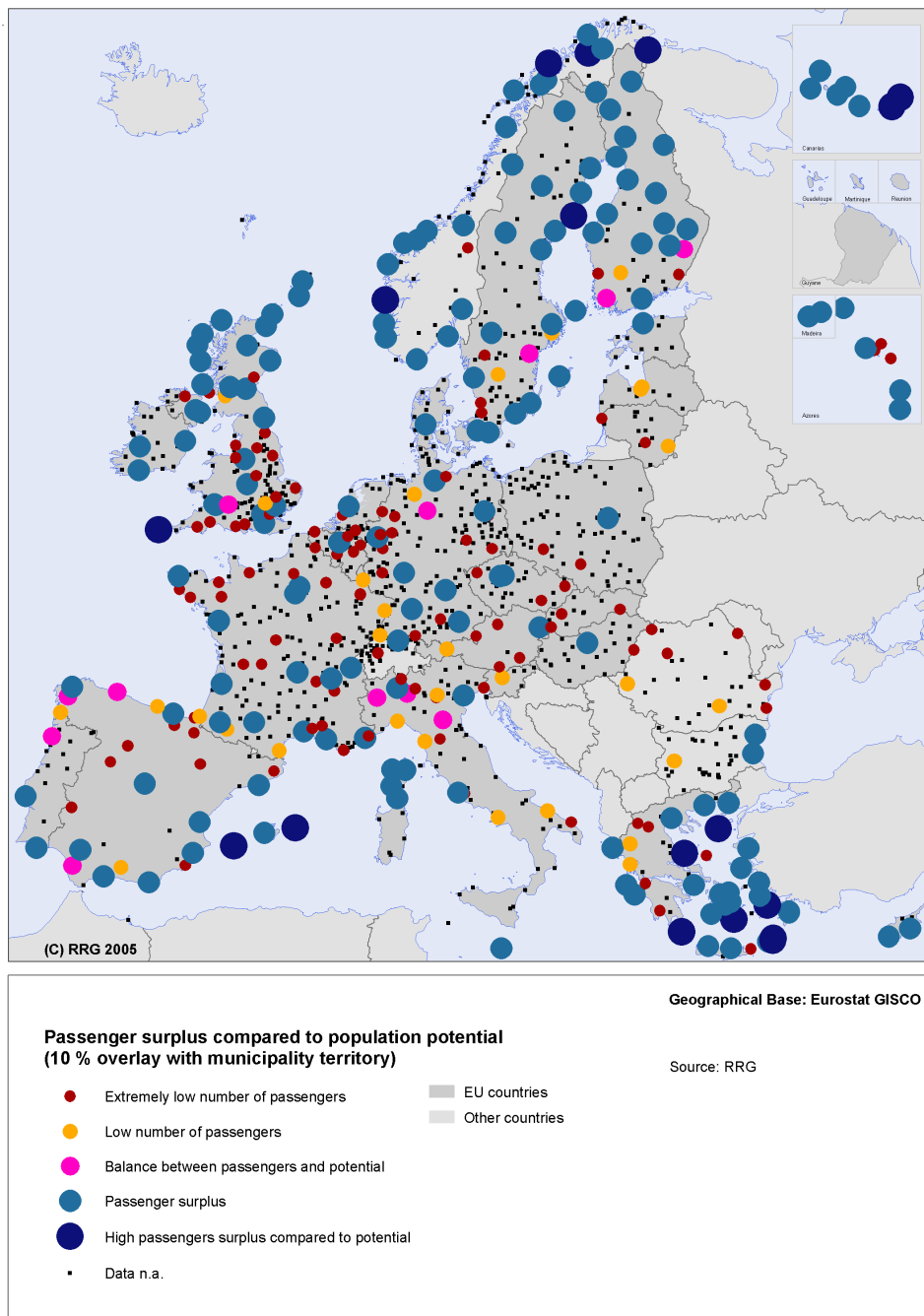


Figure 5.13 Relationship between airport population potential (i.e. total population living within 60 minutes from airport) and airport traffic

5.4. Road maintenance costs

Cold climates imply a number of specific challenges for the building, maintenance and operation of a road network. For safety reasons, the use of specific winter tyres is compulsory throughout the study area. These winter tyres tend to be studded, particularly in more sparsely populated areas. This leads to a significantly higher degree of erosion of the road surface. In terms of road building, road surfaces in the Nordic peripheries are therefore designed to resist a much higher degree of erosion than in other parts. Roads built in areas of cold climate moreover need to be built in order to resist both the weathering effects of freeze-thaw and of gullies created by melting snow in the spring season.

In terms of road maintenance, keeping the road open for circulation during the winter months has major cost implications. The actual expense depends not only on the number of days with snowfall, but also on wind intensities. In exposed mountainous or coastal areas, most snow clearing operations will be carried out because of snow blown back onto the road surface, and not following a snowfall. The frequency of road clearing operations also depends on the intensity of traffic on each portion of the road network. Nonetheless, the cost per travelled kilometre is considerably higher in the most sparsely populated areas, compared to the national capital regions (Figures 5.14 and 5.15).

The low density of trunk roads (as shown by Figure 5.16) can also be an obstacle to mobility. There will not in many cases be any alternative itinerary if one road is closed for climatic reasons.

Winter road maintenance costs

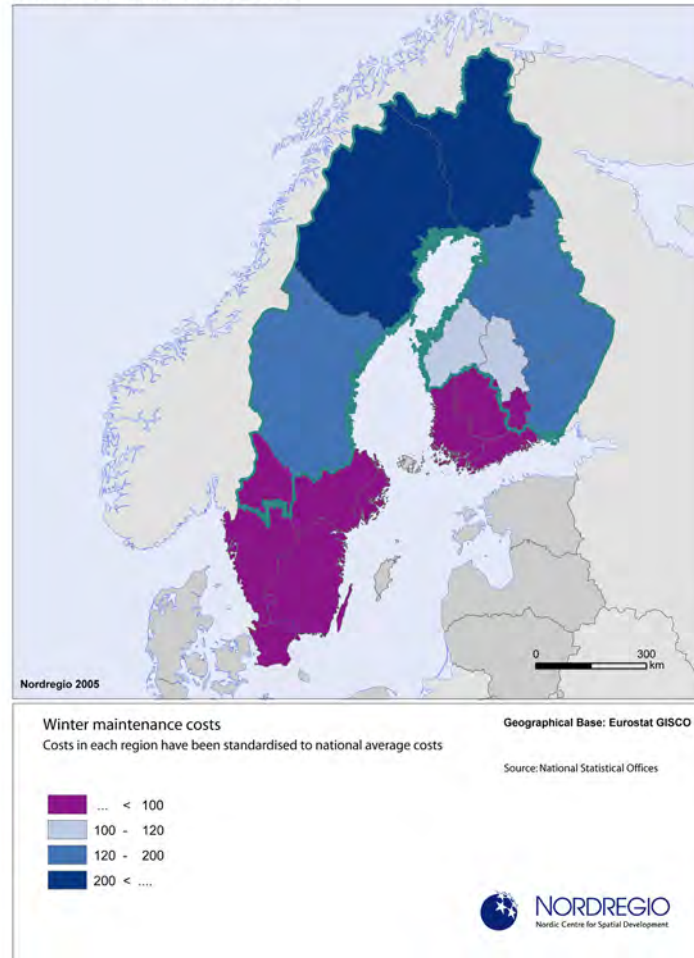


Figure 5.14 Winter maintenance costs per km and per vehicle standardised according to national average values

Comparative road maintenance costs in Sweden and Finland

Costs in each region have been standardised to national average costs

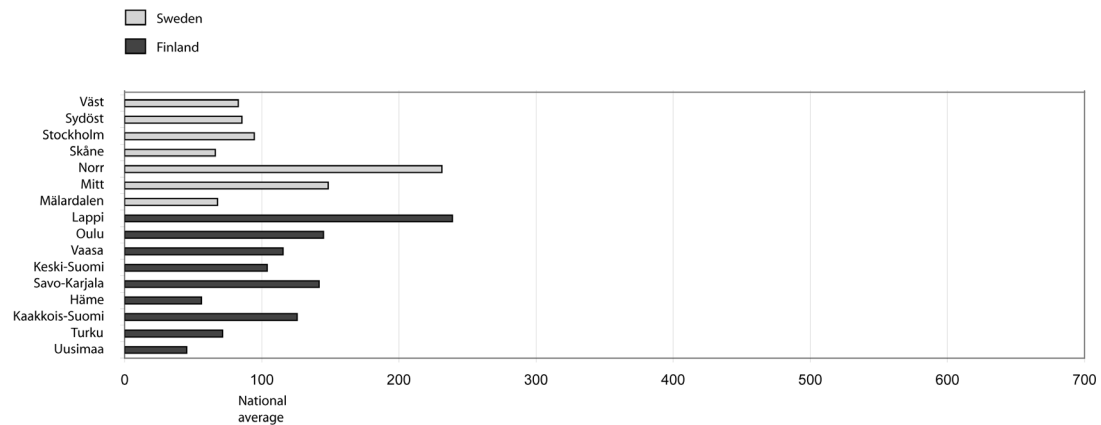


Figure 5.15 Winter maintenance costs per km and per vehicle standardised according to national average values

5.5. Rail connections in the Study area

Rail links in the study area are of essential importance for the major steel industry plants and paper mills, and continuous improvements are being made. The Iron Ore Line running from Boden in Sweden in direction of the Narvik harbour facilities in Norway for example handles 90% of the Swedish iron ore company LKAB's annual production of 22 million tons. (Johnsson, 2004).

On the other hand, data from the Swedish railway authorities indicate that the main North-South railway connection between cities of Northern Sweden does not offer a sufficient capacity and can therefore be a bottleneck for industrial development in the sparsely populated regions of the North. The cost of transporting goods per weight and distance unit on this part of the Swedish rail network is furthermore significantly higher than in the rest of the country. The fact that the coastal cities of the North are connected by a railway that is situated about 50 km from the shoreline further complicates their interconnection. This for example makes it impossible to operate passenger traffic to and from cities such as Skellefteå and Piteå (Swedish rail authority, 2003)

A number of railways in Northern and Eastern Finland are in such a condition that commercial traffic may have to cease. This is for example the case of the Salla railway in Eastern Lapland, which is currently only used to transport timber. Such a closure would imply increases transport costs for the forestry industry, and a reduction of the value of standing timber. In East Finland, the future of the Savonlinna-Huutokoski railway is also uncertain, despite its importance for the development of flows between Central Finland and Russia via Karelia, using the border crossing point of Parikkala. More generally, the Northern and Eastern sparsely populated regions could benefit from an upgrading of the railway network in north-western Russia.

The development of railways in the study area should also be envisaged at the wider scales of the Bothnian and Barents Corridors, as well as the Transcontinental Northern East-West Freight Corridor from Eastern Asia to Northern America (International Union of Railways, 2004). These programs can potentially generate a substantial added value for the area, but presuppose that all regional and national actors

contribute to this long-term development perspective. The closure of railway sections due to insufficient traffic and the incapacity to finance improvements on sections that are currently functioning at maximum capacity could jeopardize these transnational programs and limit the industrial development of the regions.

Road and railway networks in the Nordic regions



Figure 5.16 Railways and trunk roads in the study area

5.6. Seaports and ferry connections

Seaports play an important role in the economy of the northernmost regions. Due to the low densities of other high-level infrastructures such as motorways or railways, most of the freight either exported from, or imported to these regions is transported through seaports. On the other hand, due to the harsh climatic conditions, ice can reduce the free movement of cargo vessels in the Baltic Sea over the winter period. This, of course, also has consequences for regular ferry services operating between the Finnish and Swedish regions.

Out of the eleven main Finnish seaports, three are located in the northernmost regions (Raahe, Kokkola, Kemi), while only 2 out of the 14 main Swedish ports are located in the study area (these being Luleå and Gävle). Although the number of vessels approaching them is lower compared to seaports in other parts of the two countries, they account for a significant proportion of cargo transhipped (see Table 5.3), as most of them are concerned with the transshipment of natural resources such as ore, wood, etc. One can also note that the port of Oulu has been developing over the past years, and ranges at the same level as the port of Kemi in 2005 (<http://www.finnports.com/>).

Table 5.3 Main ports¹ handling at least 80% of the country's total cargo traffic (2001) (European Communities, 2003; Eurostat, 2005a; 2005b).

Finland (11 main ports out of 21)				Sweden (14 main ports out of 27)			
Name	Study area	Arrival of vessels ²	Seaborne goods transport (1,000 t) ³	Name	Study area	Arrival of vessels ²	Seaborne goods transport (1,000 t) ³
Sköldvik		344	17,453	Gothenburg	no	1,668	32,356
Helsinki	no	3,269	11,688	Brofjorden		25	19,440
Kotka	no	549	8,384	Trelleborg	no	1,537	10,655
Naantali	no	495	7,159	Helsingborg	no	11,308	6,913
Raahe	yes	188	5,943	Luleå	yes	49	7,605
Rauma	no	322	5,934	Malmö	no	378	7,215
Pori	no	235	6,087	Stockholm	no	1,220	5,025
Hamina	no	370	5,940	Oxelösund	no	98	5,126
Turku	no	814	3,688	Karlshamn	no	219	4,596
Kokkola	yes	150	3,020	Norrköping	no	223	4,113
Kemi	yes	176	2,833	Gävle	yes	191	3,442
				Stenungsund	no	88	3,273
				Slite/Industrihamn	no	38	2,380
				Storugns		n.a.	2,409
Sum		6,912	72,195			17,042	114,548

Notes: ¹ Main ports are ports that handle a cargo volume of at least 1 million tonnes.

² Arrival of vessels represents the quarterly number of vessels arriving in a seaport in the 4th quarter of 2003.

³ Total annual seaborne transport by ports in 1,000 tonnes in 2003

Figure 5.19 shows over a quarterly period the number of vessel arrivals and the annual seaborne cargo tonnage handled in each port. In terms of the number of vessels approaching the seaports, those located further south clearly dominate (e.g. Helsinki, Turku and Mariehamn in Finland, and Stockholm in Sweden), each with more than 750 vessel arrivals within each quarter. However, in terms of the cargo handled the picture is more complex (Figure 5.17, right). Of course, seaports such as Helsinki, Stockholm or Turku still play a dominant role, but now other seaports located in the Gulf of Bothnia claim significant shares: the ports of Luleå and Husum (Sweden) and Tornio, Kemi, Oulu, Raahе, and Kokkola (Finland) all handled more than 2 million tonnes of cargo in 2003, demonstrating their important role as gateways for goods transported from/to the Nordic regions.

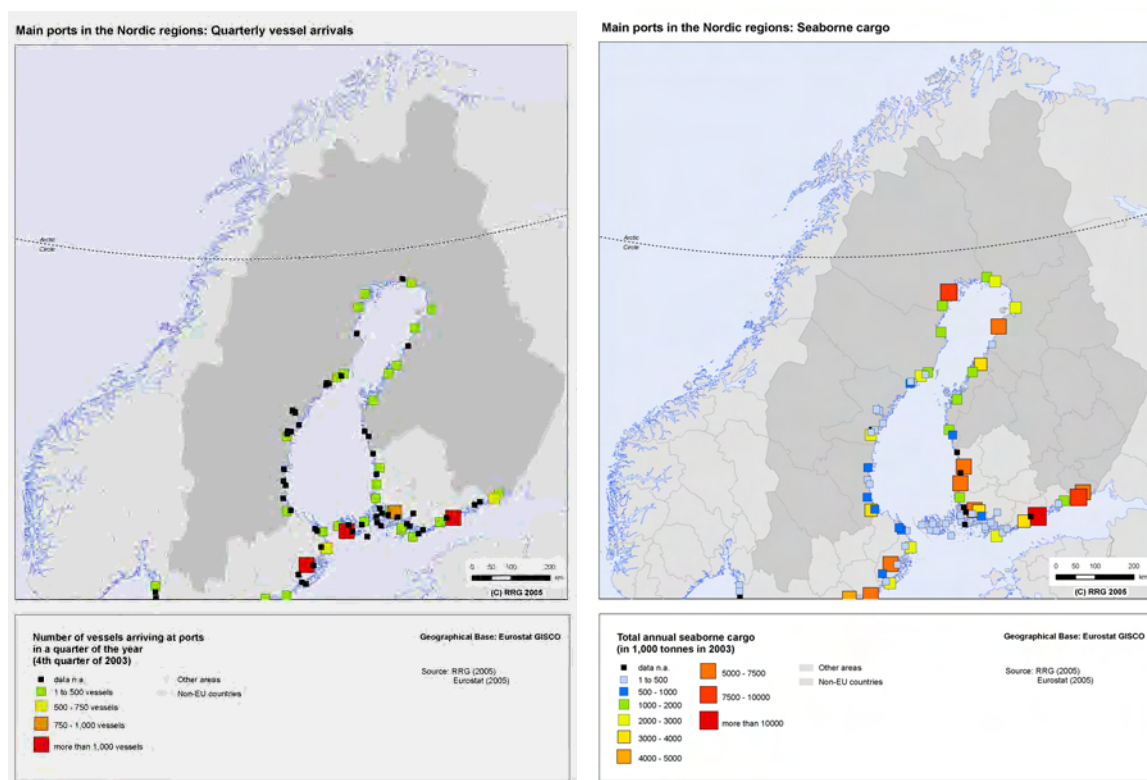


Figure 5.17. Seaports in the Nordic regions: Vessel arrivals (left), annual cargo handled (right)

In the case of Eastern Finland, freight volumes on inland waterways on the Lake Saimaa are in many cases comparable to those of main seaports. These massive freight flows are mainly generated by forestry related industries. In 2004, 3,55 million tons were transported on Lake Saimaa by boat, while timber floating reached 1,2 million cubic metres. The Saimaa Channel is in use 9-10 months of the year, depending on the ice conditions. The possible growth in the use of wood as a source of energy could significantly increase transport volumes on the Lake Saimaa in the coming years.

Ice coverage

Given its specific geographical position, some 80-90 % of Finnish exports and imports are carried via merchant vessels. The ice season in the most northern part of the Baltic Sea lasts for six months and in the central parts 2-3 weeks, thus making all Finnish harbours, as well as many Swedish ones ice bound during normal winters. Finland is, consequently, the only country in the world in which all ports are ice bound during winter. Figure 5.18 illustrates this by showing the ice coverage in the Northern parts of the Baltic Sea, the Gulf of Bothnia and the Gulf of Finland for the last three years 2003-2005. Although the maximum extent of the ice coverage varies significantly over the three years, it can be seen that throughout the years in question all Finnish ports, all ports in northern Sweden, as well as all seaports in Estonia and along the Russian coast were frozen.

On average the Baltic Sea starts to freeze in October / beginning of November each year, while the ice remains until April or even May (depending on the actual climatic conditions and on the lat./long. position). During this period any shipping service can only be maintained through the use of icebreakers, which keep certain channels to dedicated ports open. However, although icebreakers are widely used, the free movement of cargo vessels is nonetheless limited during winter.

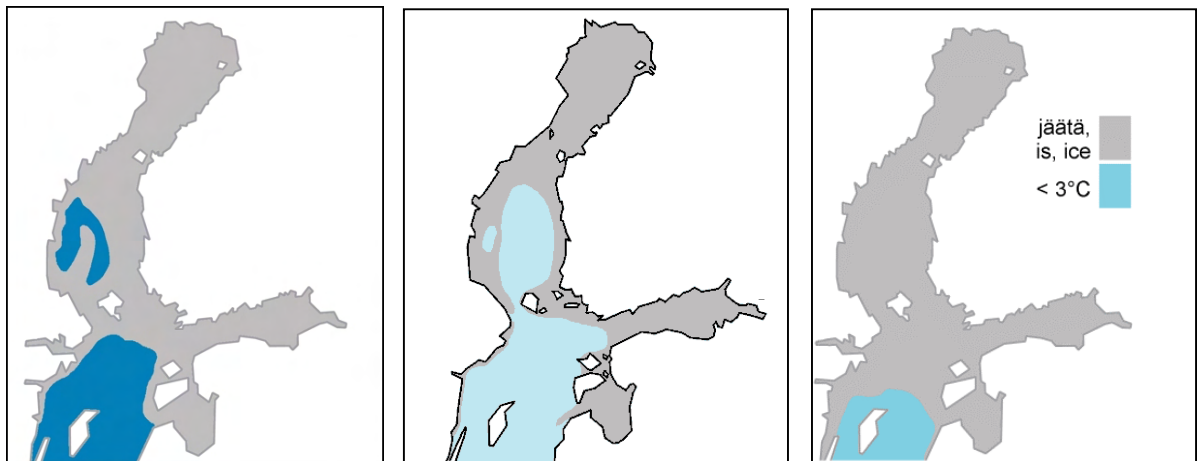


Figure 5.18 Largest ice cover in the northern parts of the Baltic Sea: (left) in 2005 at 16 March with 177,000 km²; (middle) in 2004 at 11 March with 152,000 km²; (right) in 2003 at 5 March with 232,000 km² (Finnish Institute of Marine Research, 2005).

5.6. Access to universities in the northernmost regions

Education and educational attainment is one of the policy fields that have gained increasing recognition in recent years (see, for instance the OECD PISA study – *Programme for International Student Assessment, OECD 2005*). In the context of the transition of the economy towards a service-oriented society, education, knowledge, and research and development are widely expected to become the key locational factors for successful regions. Thus, regions with higher proportions of a skilled labour force are assumed to be more competitive and hence more successful than regions with lower numbers of skilled labour force members. It is undisputed that universities and polytechnics play a crucial role in this process. Moreover, the presence of higher-education facilities also helps (rural) regions not only to keep young people, but also to potentially enable them to attract young people from other parts of the country (or even from the rest of the world) and so eventually helping them to avoid ‘brain drain’ and to maintain a balanced age structure across the society. Thus, the lack of access to higher education has long been identified as a critical constraint on the development of rural and peripheral areas. In the past, in many rural areas the brightest young people nearly always had to leave their home regions in order to gain the university-level education that enabled them to qualify for higher-income jobs in the technology or service sectors. Moreover, after their education, many of these people did not return, as equivalent jobs in the rural peripheral areas were not available.

Despite the low population numbers, a number of higher education facilities are located in the northernmost regions of Finland, Sweden and Norway (Figures 5.19 and 5.20). In the Finnish part of the study area there are 14 facilities (i.e. universities and universities of applied sciences) located in ten cities, in the Swedish part, six facilities can be located in six different cities. Most of these facilities are universities of applied science (polytechnics), and only in eight cities can universities also be found, of which four are located in Finland (Oulu, Kuopio, Joensuu, Rovaniemi) and two in Sweden (Umeå and Luleå).

Most of these facilities are rather small, compared to similar functional facilities in other parts of Europe and also compared to other universities in the respective countries themselves. Only four of them have around 10,000 students or more. These are Oulu, Kuopio and Joensuu in Finland, and Umeå in Sweden (Table 5.4). Nevertheless, in terms

of the number of students *per inhabitant*, even the smaller ones account for a high ratio, sometimes accounting for even higher ratios than in the respective capital cities. Helsinki and Stockholm yield ranges between 3.4% and 5.2% of students within the labour market area. These ratios are easily reached and often excelled by many of the smaller university towns, such as Oulu (9,4%), Joensuu (8,5%), or Rovaniemi (11,1%) in Finland, and Umeå (15%) in Sweden. As such then, these ratios give an indication of the importance of these facilities in demographic terms (attracting younger people) but also in economic terms. In Finland, almost 25 % of all students are studying in the northernmost regions, as compared to only 11 % of students in Sweden.

The figures consequently reflect the active policies promoting higher education outside of the capital regions, as illustrated by the high proportions of students in a number of labour markets around peripheral cities. It is important to ensure that these facilities are integrated in the local economic environment, and contribute to the development of entrepreneurship and innovation in their area.

Table 5.4 List of universities and polytechnics in the northernmost regions of Sweden and Finland and in the capital cities.

Country	City	Fac.	Number of students			Inhabitants in labour market area - 2001	Students / inhabitant*
			Polytech.	University	Total		
Finland	<i>Helsinki</i>	UP	25 273	44 863	70 136	1 355 008	5,2%
	Oulu	UP	5 905	13 380	19 285	204 971	9,4%
	Kuopio	UP	5 711	4 651	10 362	121 662	8,5%
	Joensuu	UP	3 540	6 251	9 791	97 575	10,0%
	Rovaniemi	UP	2 944	3 382	6 326	56 991	11,1%
	Mikkeli	P	4 200	0	4 200	54 407	7,7%
	Tornio	P	2 616	0	2 616	22 456	11,6%
	Iisalmi	P	1 983	0	1 983	40 111	4,9%
	Varkaus	P	1 983	0	1 983	41 626	4,8%
	Kajaani	P	1 699	0	1 699	55 729	3,0%
Sweden	<i>Stockholm</i>	UP	17 314	56 666	73 980	2 190 164	3,4%
	Umeå	U	0	20 495	20 495	137 067	15,0%
	Luleå / Boden	P	0	9 097	9 097	140 783	6,5%
	Östersund ¹	P	4 655	0	4 655	94 009	5,0%
	Sundsvall	P	4 073	0	4 073	110 915	3,7%

Facilities: UP University and polytechnic available in town

U University available in town

P Polytechnic available in town

* Labour market area population

¹ Östersund has obtained the status of University after these data were compiled

Universities and selected polytechnics in Europe

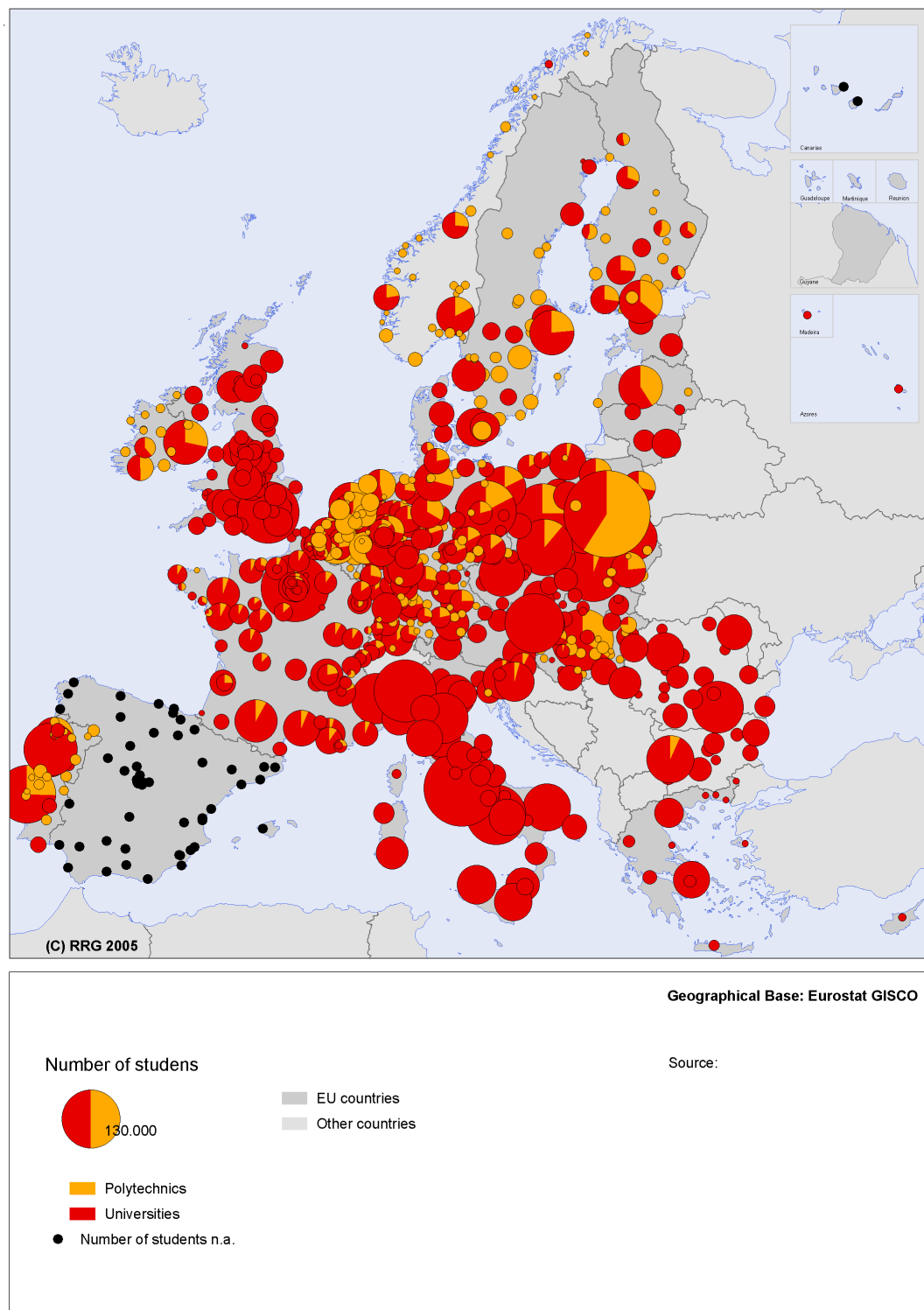


Figure 5.19. Universities and polytechnics in Europe.

Universities and selected polytechnics in the Nordic regions

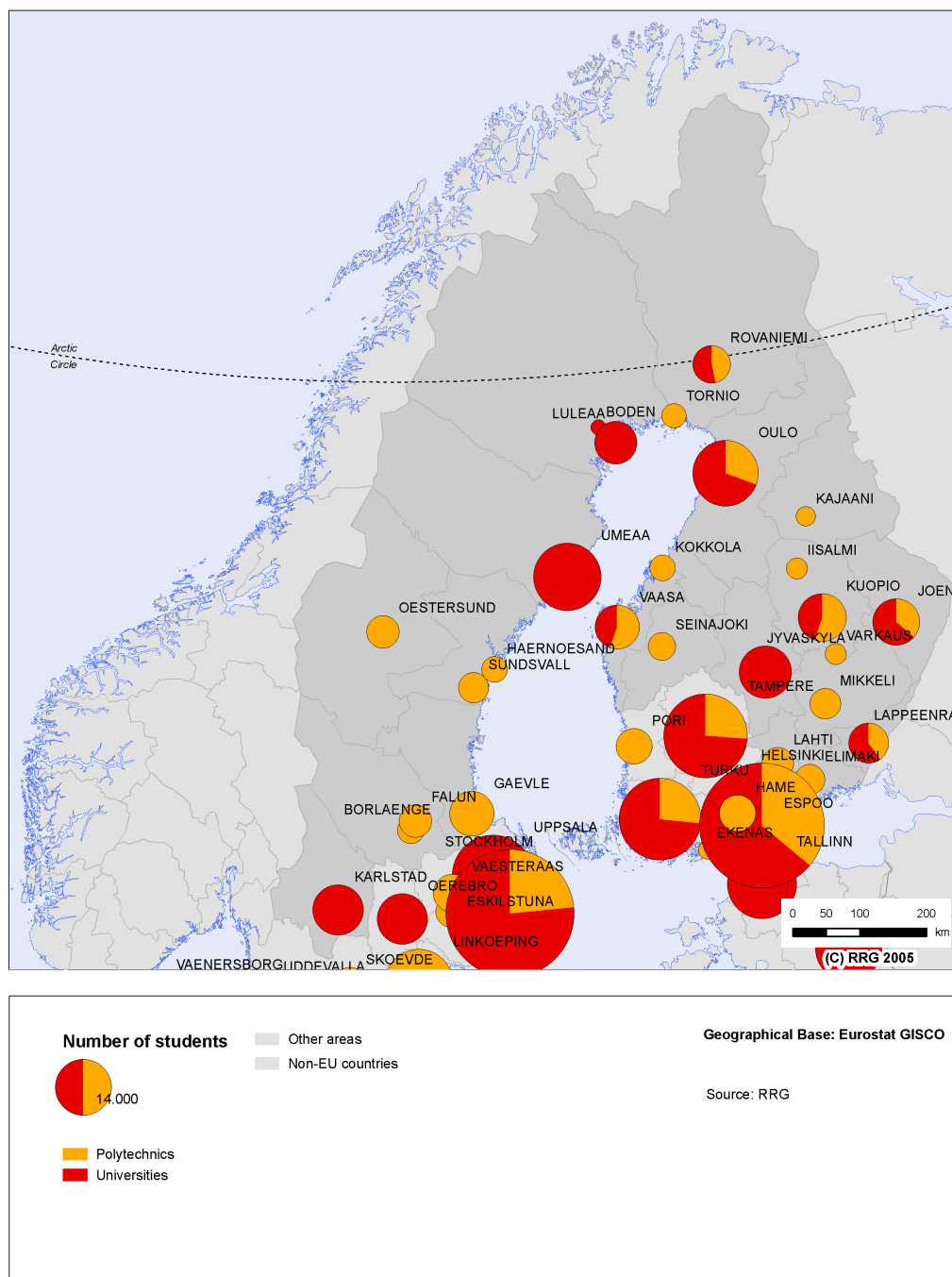


Figure 5.20 Universities and polytechnics in the northernmost regions

Access to hospitals

Hospitals are an important and indeed integral part of the public infrastructure. Therefore, the availability of hospitals and the question of access to hospitals should be analysed as being crucial for public health care. Given the decentralisation trends in public health care services in the Nordic countries, and the complexity of hospital typologies, it has unfortunately not been possible to gather complete data for the study area within the scope of this project.

Two main general aspects should however be highlighted. The first is access to emergency medical treatment. In this respect, hospital location is only one parameter, as one also needs to be able to alert the hospital in case of emergency, and to be transported to the hospital within a sufficiently short period of time. The ongoing development of a new type of mobile telephony network, specifically adapted to sparsely populated areas (i.e. combining long range and low capacity, by using a lower frequency than for traditional mobile telephony systems) is therefore important from a public health perspective. Likewise, the continued availability of an operational hospital helicopter service is essential. Both these elements however entail costs for the community. These three dimensions would have to be combined in order to assess the quality of the offer in terms of medical emergency treatment, which proved to be beyond the scope of the present study.

The second aspect is access to specialised health care. The population mass required to develop such services with a good cost ratio is generally very high. However, it can be perceived as a major social handicap to require transport to another part of the country for medical services, where social and family networks are not available.

Finally, access to maternity hospitals remains a major issue of debate in all Nordic peripheral regions.

While it is obvious that operating specialised hospital services with a low demographic basis entails additional costs, these costs cannot be quantified in a European comparative perspective. The additional expenses depend upon on the general level of public healthcare in each country, and on the politically defined level of “universal health service” which should be made available to all inhabitants, irrespective of their place of abode. Any quantification of additional expenses is therefore only valid within the country where it is carried out.

Conclusions

Northern peripheral regions face major challenges in terms of accessibility, both at the continental scale (distance to European markets) and at the regional scale (lack of critical population mass). In order to compensate for these handicaps, major efforts have been made, for example in developing dynamic higher education facilities, and maintaining a relatively dense network of airports. Sustaining these efforts in the years to come is of critical importance for such sparsely populated regions, but may be difficult in a context of public service rationalisation and deregulation.

An infrastructure strategy for the sparsely populated peripheral region must therefore be designed to help build and maintain wider regions with complementary functions in the different nodes, with the objective of reinforcing internal regional coherence. One objective of such regional infrastructure policies is to facilitate the establishment of higher value-added processing industries, capable of drawing benefits from primary resources in the northern peripheries.

Maintained efforts to ensure high quality external freight connections are equally essential, so as to ensure that industrial outputs can be exported efficiently to major European and global markets. Over the last decades, multiple projects have highlighted the potential for a further development of East-West connections, from Russia to the North Sea, or even at the scale of the Eurasian continent (International Union of Railways, 2004). All project capable of asserting crossroads of major freight corridors in northern and central Sweden and Finland are of essential importance, as they can compensate for current centralising trends.

6. Socioeconomic characterisation of Sparsely Populated Areas

The possible causal relationships between population sparsity, peripherality and cold climate on the one hand, and social and economic characteristics on the other lie beyond the scope of the present study. What we do seek to identify are the correlations between certain types of social and economic characteristics, and population sparsity. The observation of such correlations is sufficient to consider whether sparsity is an appropriate criterion to delimit regional policy intervention areas. However, the formulation of strategies to solve identified problems would require an analysis of the processes at stake.

6.1. Employment

Unemployment

Figures 6.1, 6.2 and 6.3 present municipal unemployment rates in 1991, 1996 and 2001, respectively. The values are standardised according to national average values, as the objective of the present study is to compare the effects of sparse population and peripheral location across the study area, rather than national employment structure structures. The maps give an indication of how well each municipality is performing in terms of employment, as compared to the rest of the country. For 2001, the national unemployment rates considered are 10.2% in Finland and 4.9% in Sweden.

In Sweden, most municipalities in the study area have unemployment rates above the national average. The few exceptions are mainly situated around the city of Umeå. Unemployment levels twice as high as the national average can be encountered in the northernmost municipalities along the border to Finland, and in some inner parts. In Finland, there is a clear divide between the coastal areas, most of which have an unemployment rate below the national average, and the internal parts of the country. Indeed, the entire Lappi region and most of the Russian border areas are well above the Finnish national average when it comes to unemployment rates. Some municipalities in the southern part of Finland have an unemployment rate below the national average.

Between 1991 and 2001, there seems to have been an increase in polarisation, as relative unemployment levels rose in areas where they were already high. As shown by Figure 6.4, almost all municipalities with a low population potential also have unemployment rates above the national average. The few exceptions here are all contiguous to a municipality with a higher population potential.

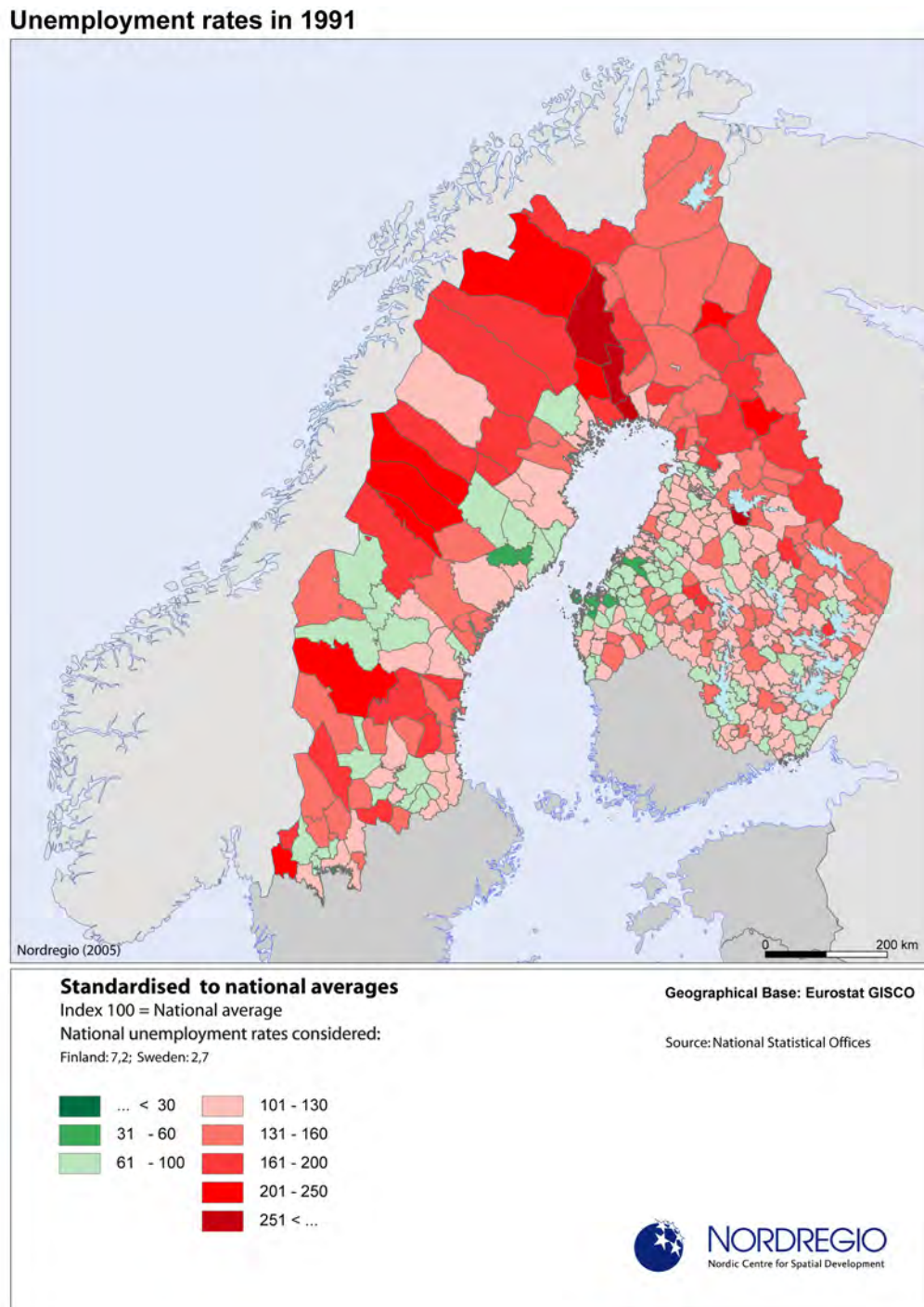


Figure 6.1 Municipal unemployment rates standardised according to national average values (1991)

Unemployment rates in 1996

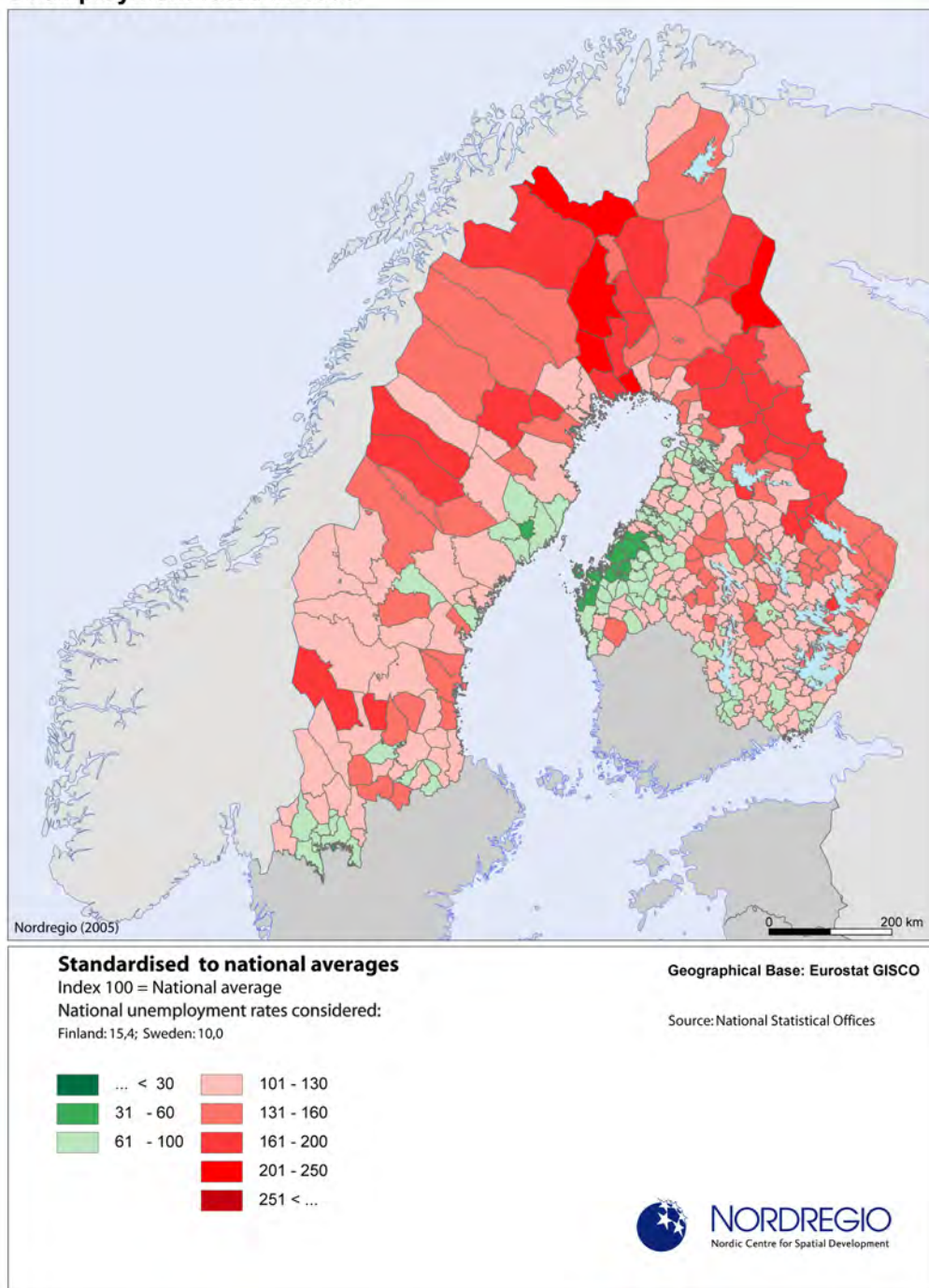


Figure 6.2 Municipal unemployment rates standardised according to national average values (1996)

Unemployment rates in 2001

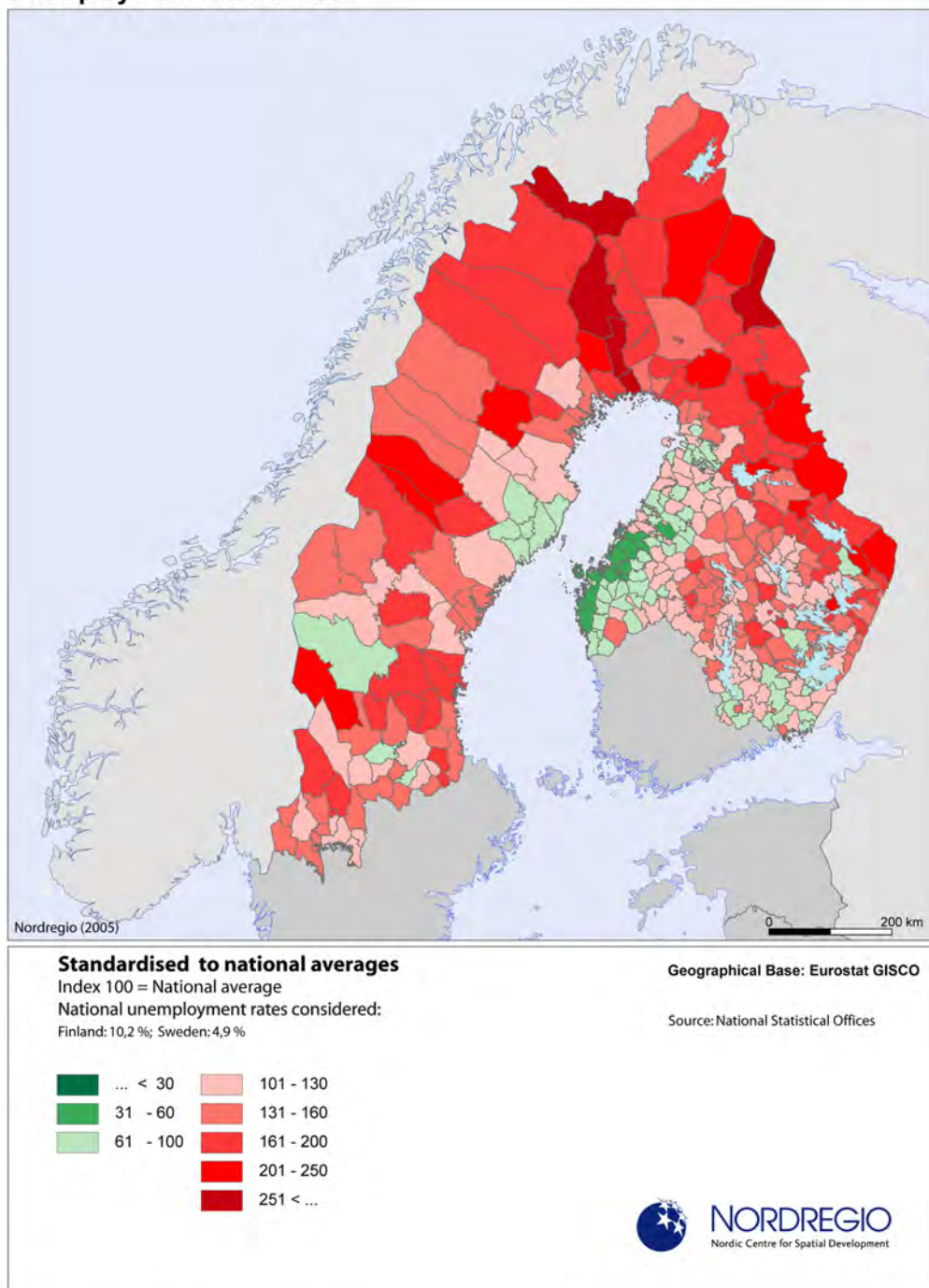


Figure 6.3 Municipal unemployment rates standardised according to national average values (2001)

Unemployment rates in 2001 and population potential

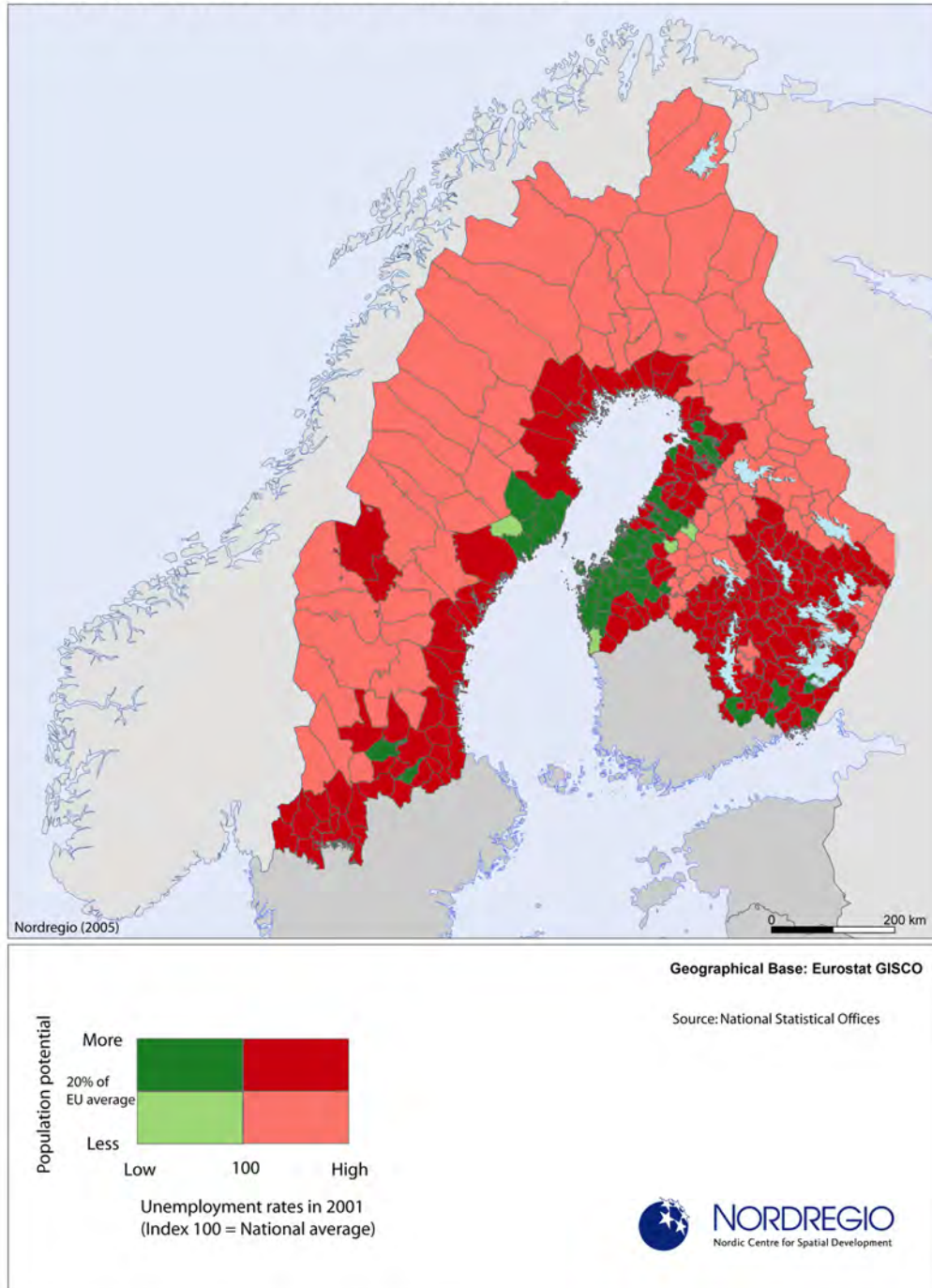


Figure 6.4 Cross-tabulation of population potentials and municipal unemployment rates standardised according to national average values (2001)

Unemployment rates below national average are systematically found either within areas of higher population potential or in their immediate vicinity.

Activity rates

As shown by figure 6.5, the northern and inner parts of Finland and Sweden have considerably higher proportions of public employment. In order to make the comparison between the three countries relevant, the public sector dependency indicator has been standardized to the calculated national averages: 28.1% for Finland and 36.7% in Sweden.

These areas with a relatively high level of employment in the public sector activity are, in general, also those that also have a low population potential (Figure 6.6). Transfer policies compensating for differences in taxation incomes between municipalities allow for these increased proportions of public employment. Interestingly, however, even the largest cities of our study regions have a public sector dependency ratio that is above the national average for that country. This underlines the active role played by national and local public authorities in maintaining a sufficient level of public services and job opportunities in these areas.

Nonetheless, almost the entire study area has an activity rate below the respective national averages. The municipalities that are above this mark are the ones hosting a city of regional interest such as Oulu and Vaasa in Finland, and Umeå, Östersund and Gävle in Sweden (Figure 6.7).

Proportion of public sector employment

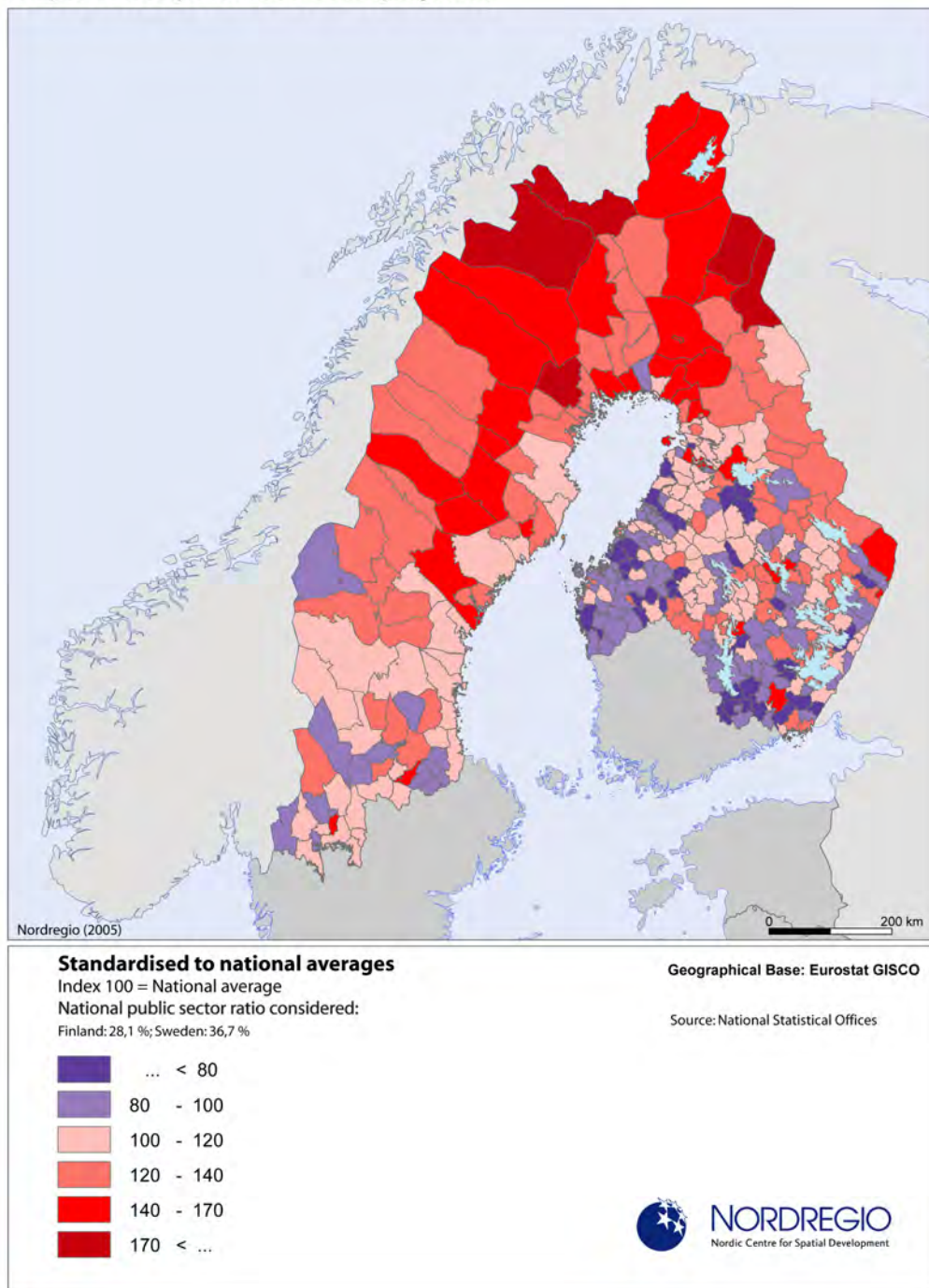


Figure 6.5 Proportion of public sector employment, standardised according to national average values

Dependence on public sector and population potential

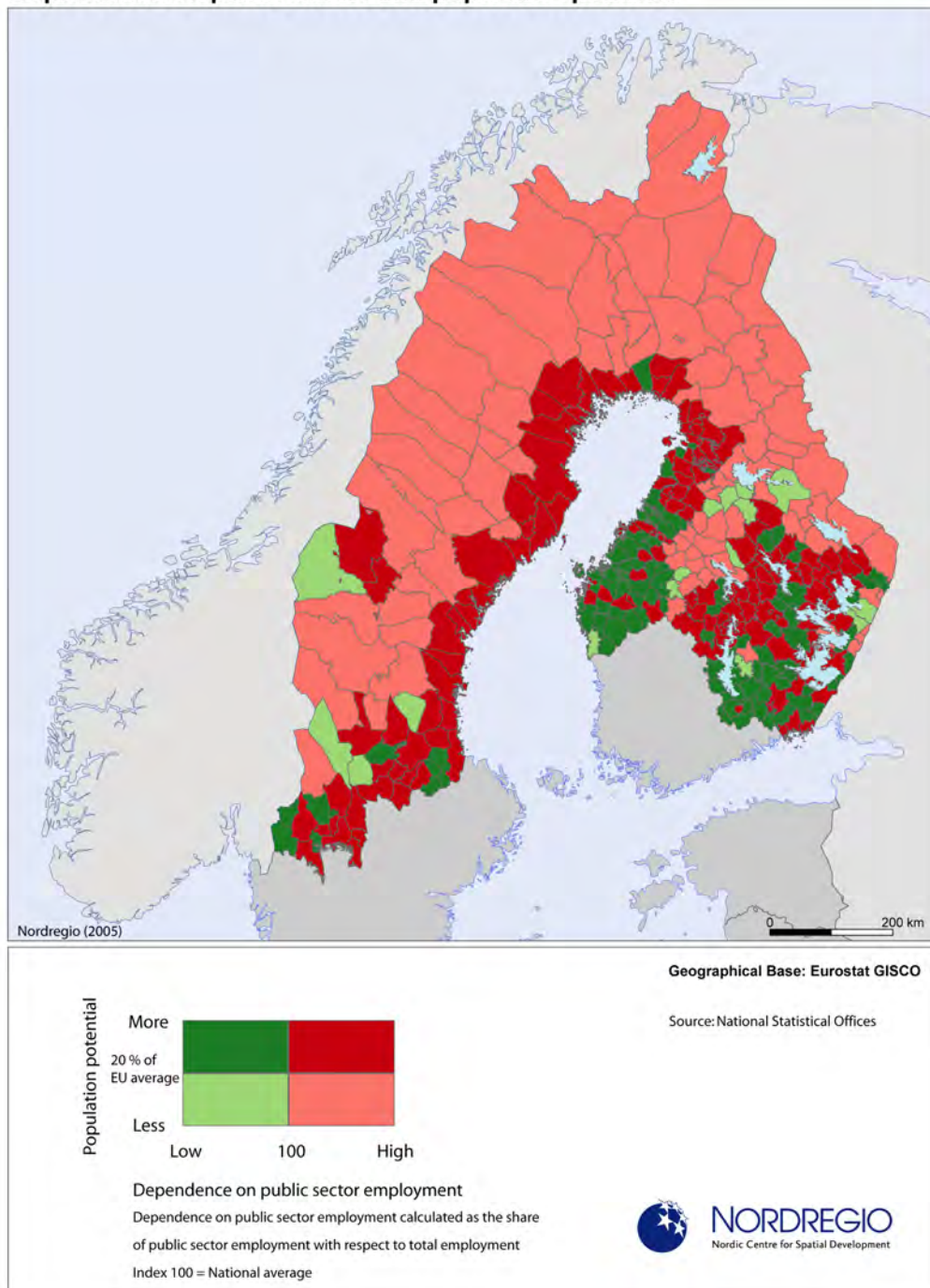


Figure 6.6 Cross-tabulation of population potentials and dependence on public sector employment (2001)

Activity rates in 2002

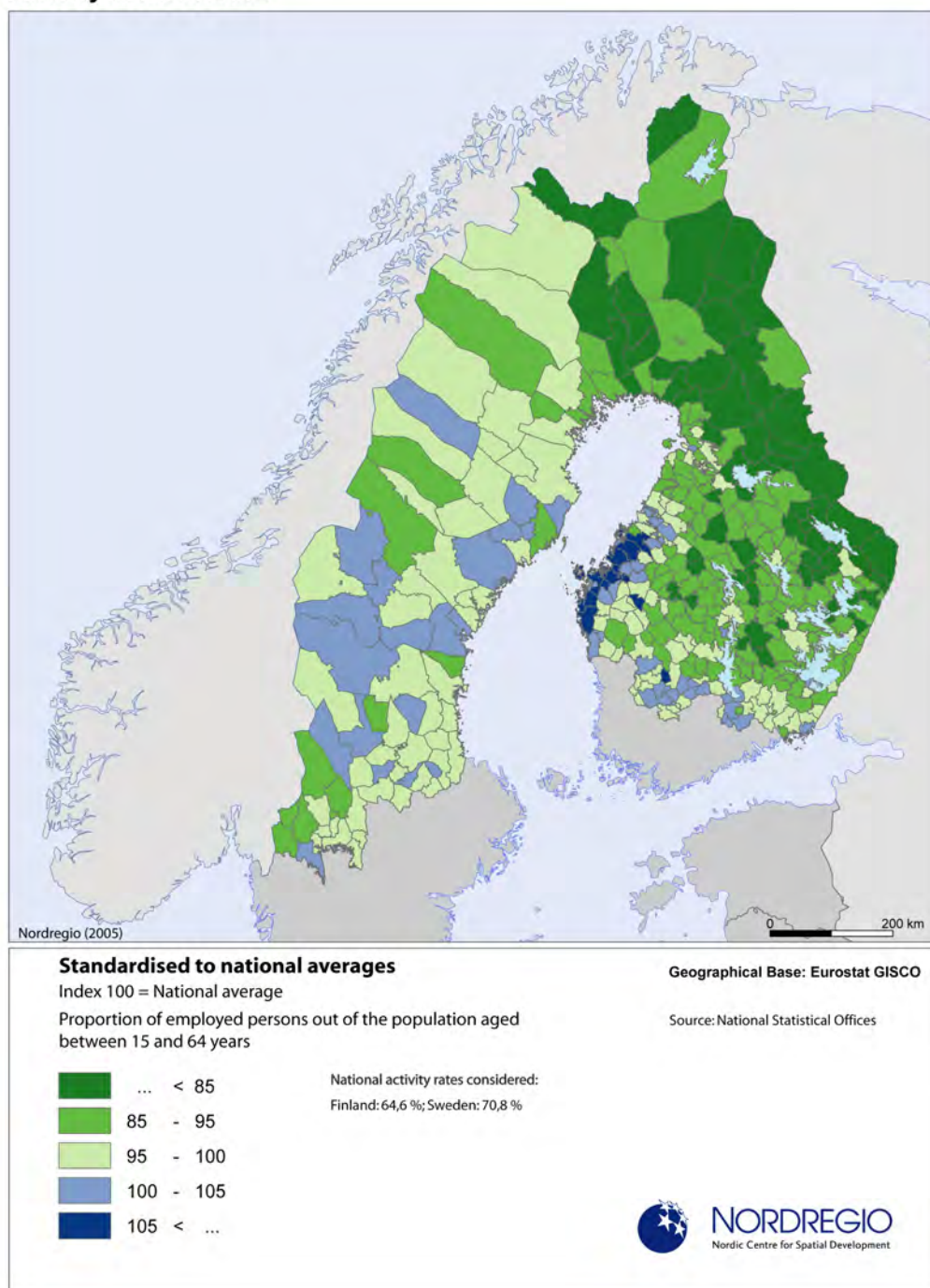


Figure 6.7 Activity rates standardised according to national average values (2001)

6.2. Sources of income

A significant proportion of the economies of these sparsely populated Nordic areas are based on income from transfers. Two main dimensions should be taken into account in this respect: On the one hand, transfers between municipalities and the location of state-owned public bodies *de facto* imply a transfer of tax resources within each country. On the other hand, the inhabitants of each municipality benefit from transfers of income to different extents, depending on the age structure, the number of unemployed persons, etc. We have here chosen to focus on the latter aspect, identifying whether the inhabitants of sparsely populated areas have higher or lower average income from activity, and whether transfers constitute a higher or lower proportion of their total income.

Figure 6.8 shows the ratio of earned income to the population aged 20 to 64, i.e. the population in working age. Two distinct pictures appear in Sweden and Finland: In Sweden, the contrasts are relatively weak. Cities are characterised by higher income ratios than other areas, but also sparsely populated municipalities such as Jokkmokk and Kiruna. In Finland, stronger contrasts can be observed, and the lowest values can be found practically throughout the study area. This reflects the traditionally stronger welfare contrasts in Finland.

In Figure 6.9, we look at the proportion of transfer income in each municipality (considering pensions, unemployment and sickness benefits only). In this respect, the two countries are more similar, as most study area municipalities devoid of major urban centres have proportions of transfer income that are more than 25% higher than the national average. The combination of an ageing population and high unemployment rates is the key parameter here.

Standardised income *per inhabitant*

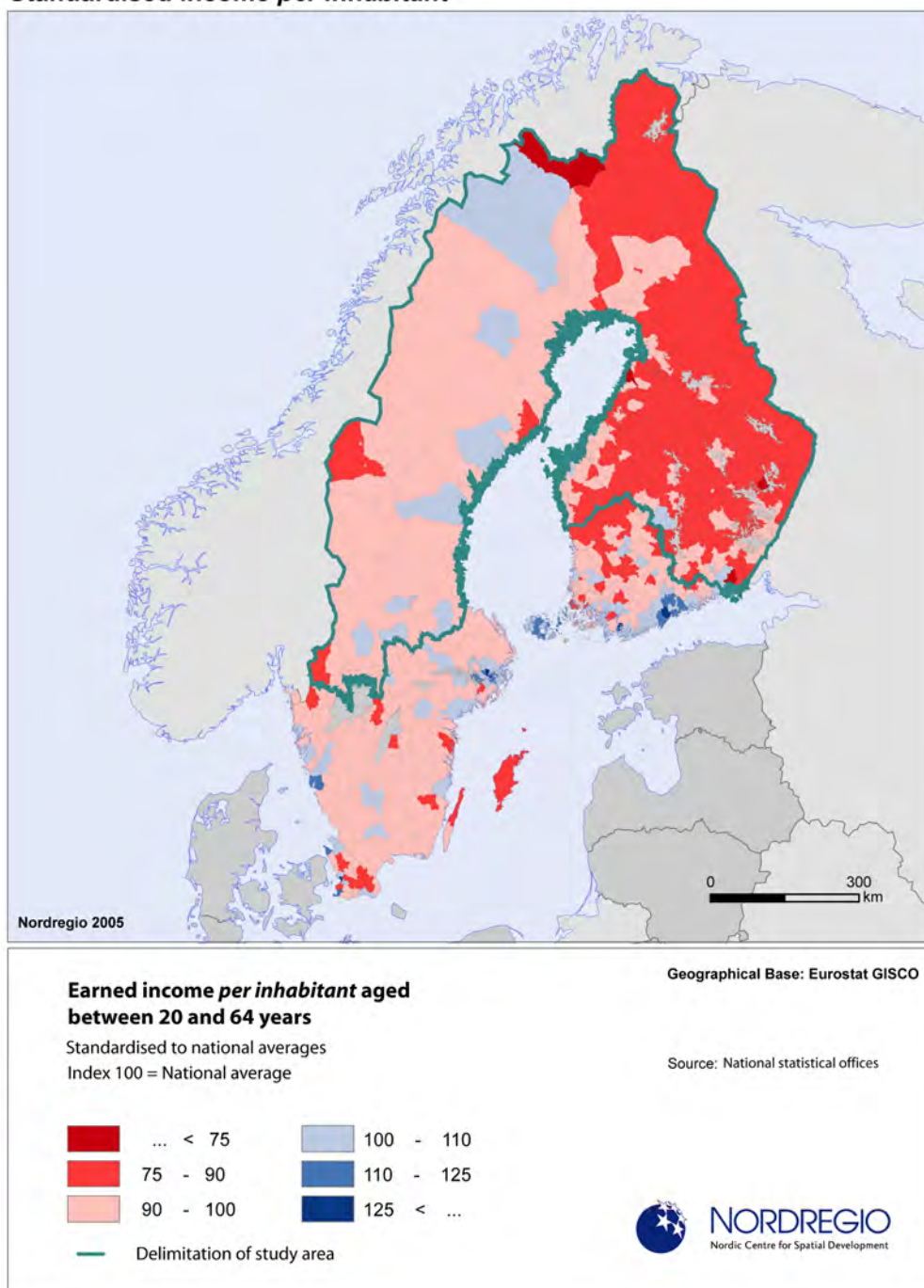


Figure 6.8 Earned income by inhabitant aged 20 to 64

Contrasts are considerably larger in Finland than in Sweden.

Proportion of transfer-income out of total municipal income

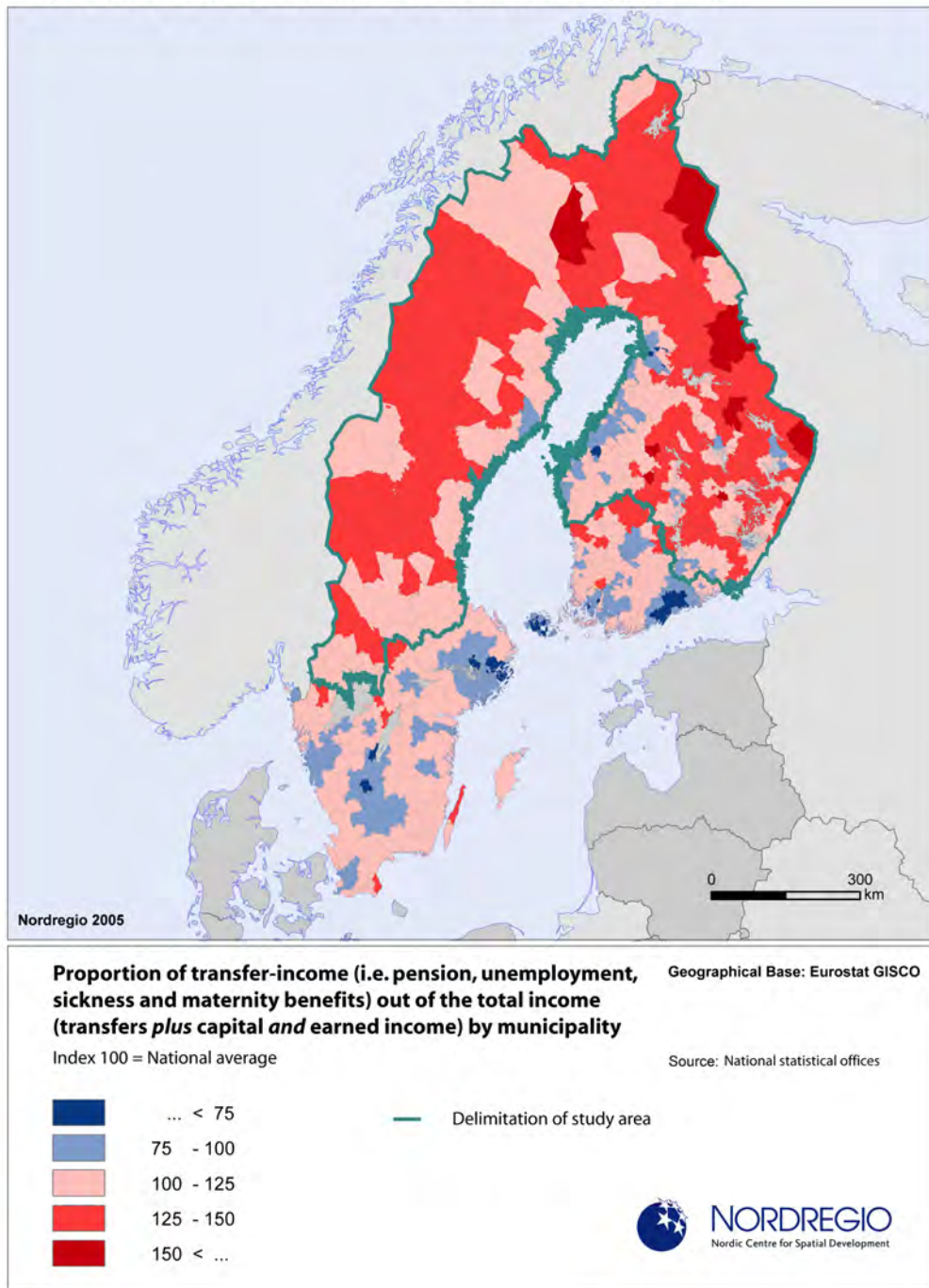


Figure 6.9 Proportion of income from transfers (i.e. pension, unemployment, sickness and maternity benefits) out of total income by municipality

Study area municipalities are characterised by considerably larger proportions of income from transfers, both in Finland and in Sweden. The main urban areas are however not concerned.

6.3. Educational attainments

The assessment of the situation as regards the educational attainment of the population gives valuable input to the design of development strategies for these areas. The educational attainment indicator relates to the highest degree obtained by a person. For instance, an individual who has achieved a tertiary degree will be counted in the tertiary educational attainment indicator and not the secondary one. Due to differences in statistics between the three countries considered, the educational attainment indicator is based on information on the following basic population: people aged between 16 and 64 in Sweden and people over 15 years of age in Finland.

Figures 6.10 and 6.11 present the secondary and tertiary educational attainment, crossed with the population potential indicator, in order to underline the perspective of the sparsely populated areas. The two maps provide complementary sets of information and therefore need to be analysed together.

Most of the municipalities of the study area have a proportion of persons that have completed upper secondary education that is higher than the national average, but then they have not pursued their studies any further. This is especially true for Sweden. In Finland, the situation is more nuanced, as significant parts of the study area have municipalities where this category is under-represented.

Geographical patterns are much more homogenous across the study area when it comes to the proportion of persons having completed tertiary education. Not surprisingly, the municipalities that have a proportion superior to their respective national average are the ones surrounding the most important cities of that area, e.g. Umeå, Luleå and Karlstad in Sweden; and Rovaniemi, Oulu and Vaasa in Finland. Persons with a tertiary educational degree are concentrated in and around the regional capitals.

Secondary educational attainment and population potential

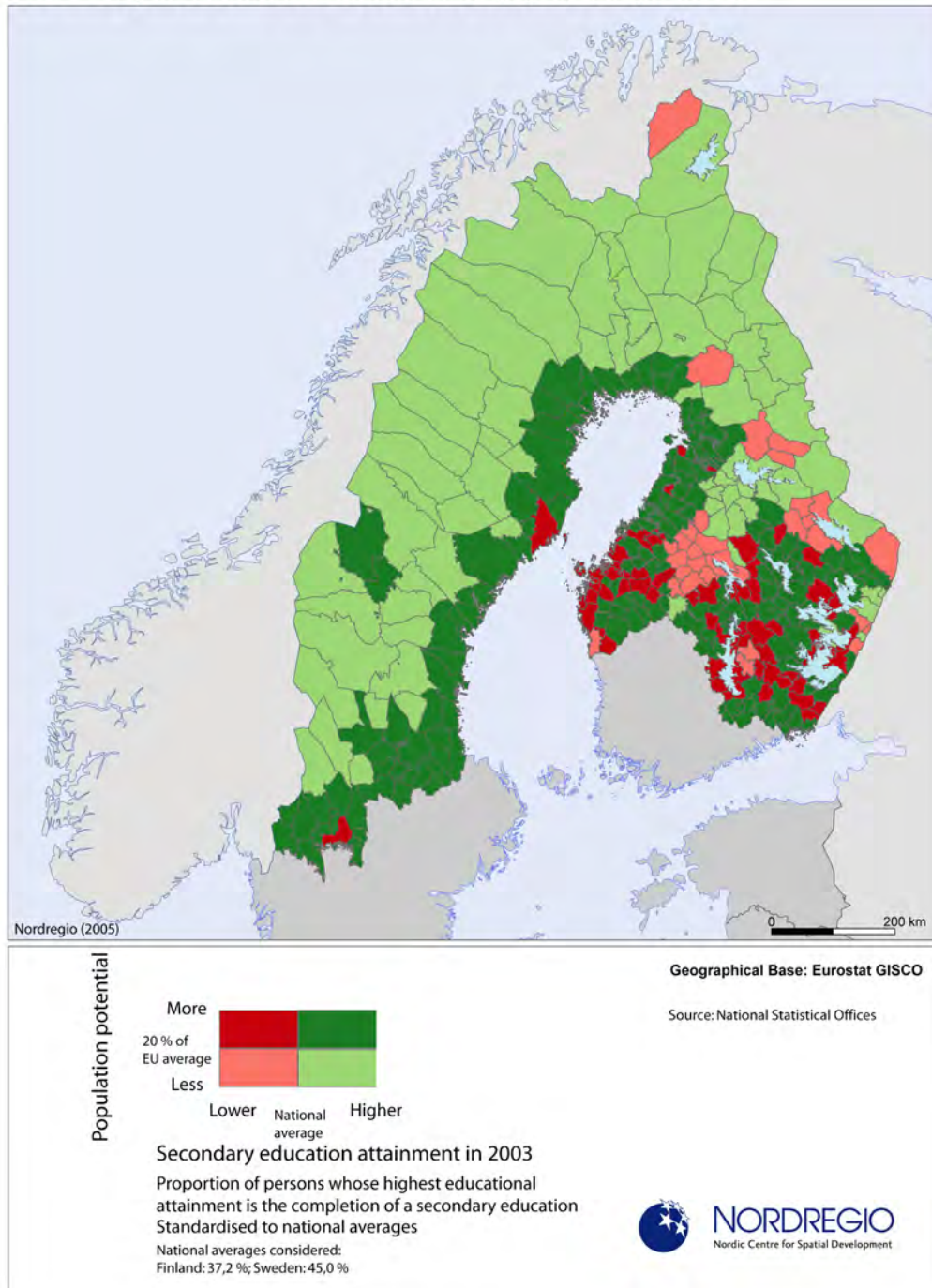


Figure 6.10 Cross tabulation of population potentials and the proportion of persons having a secondary degree only (standardised according to national average values)

Tertiary educational attainment and population potential

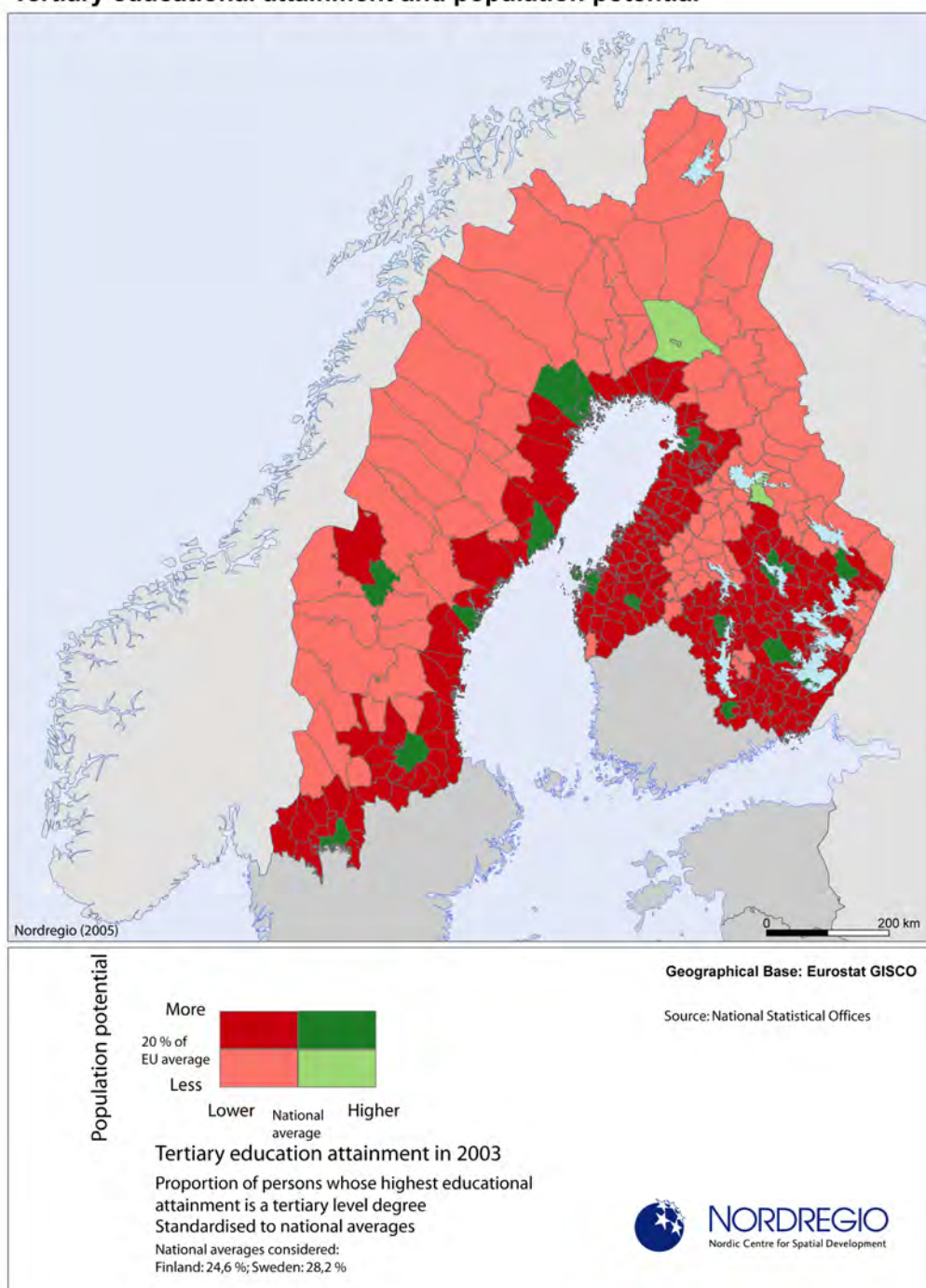


Figure 6.11 Cross-tabulation of population potentials and the proportion of persons having a tertiary (university or equivalent) degree (standardised according to national average values)

6.3. Wealth production

As illustrated by Figure 6.12, the GDP rates *per inhabitant* in purchase parity standards (PPS) observed in the peripheral Nordic regions are generally close to the EU average. It is however important to note that the proportion of the GDP based on primary activities such as forestry and hydraulic energy production is up to three times higher in these regions than in Sweden and Finland as a whole. These activities have a small impact on the local economies, as they employ relatively few persons.

It should also be noted here that East Finland is in a particularly difficult situation within the study area, with GDP values *per inhabitant* below 80% of the EU average in the NUTS 3 regions of Etelä-Savo and North Karelia.

Northern Swedish and Finnish NUTS 3 areas are considerably larger than in other parts of Europe (Figure 6.13). It is therefore appropriate to compare values at NUTS 5 and NUTS 4 level for these countries, with NUTS 3 values for the rest of Europe. This reveals strong contrasts between the main cities and the peripheries in the Finnish parts of the Study area. The contrast between the results at NUTS 3 and NUTS 4 level is particularly striking in Northern and Central Finland. In Sweden, a more complex pattern of municipalities with high and low GDP values is revealed. High values for example appear in some peripheral municipalities with a very sparse population, but major natural resources such as hydraulic energy or mines. These high values do not necessarily reflect a dynamic economy, as the income from these activities only to a small degree benefits local communities.

GDP in EU 25 in 2002

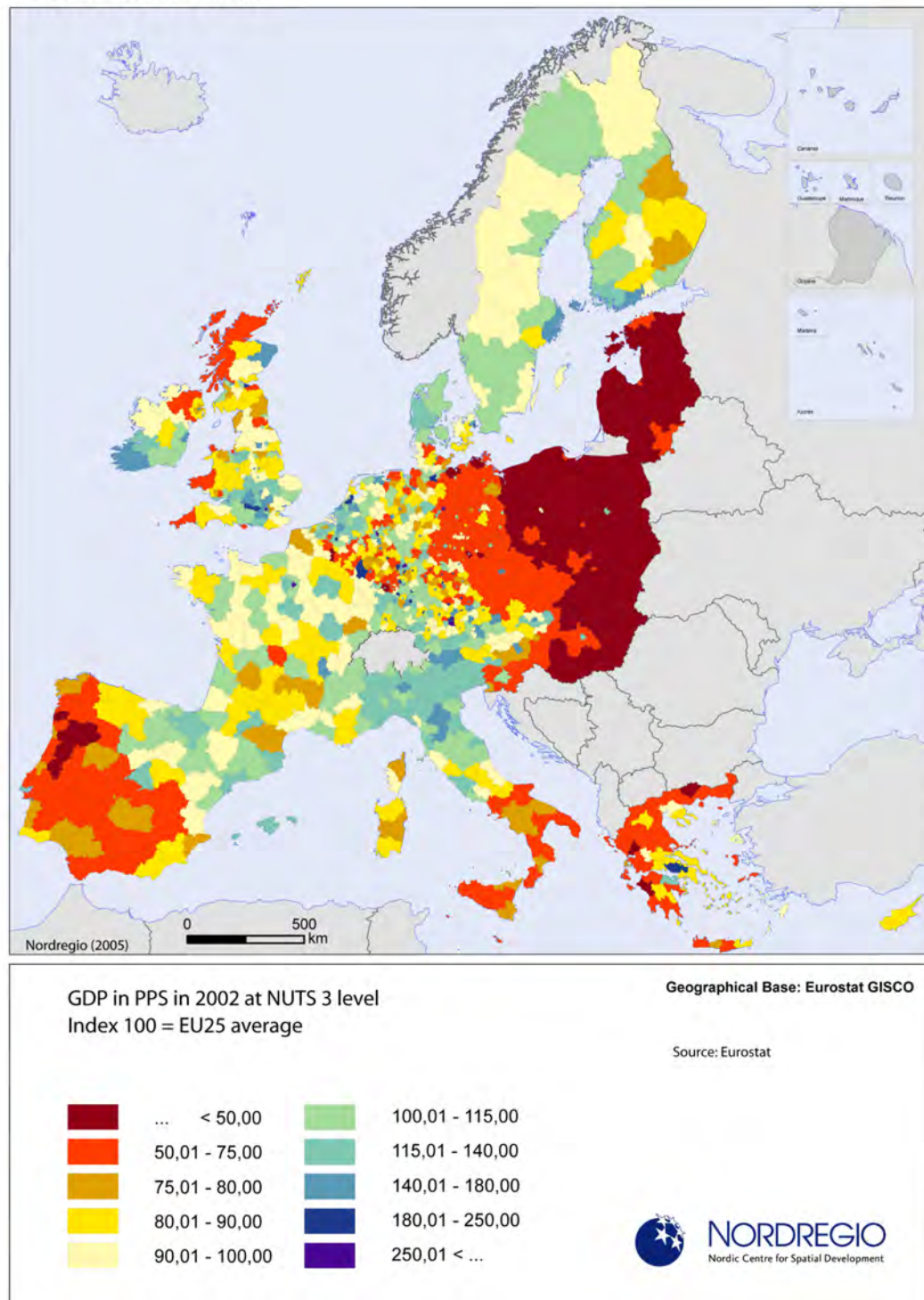


Figure 6.12 GDP levels in PPS at NUTS 3 level (2001)

GDP in EU 25 in 2002

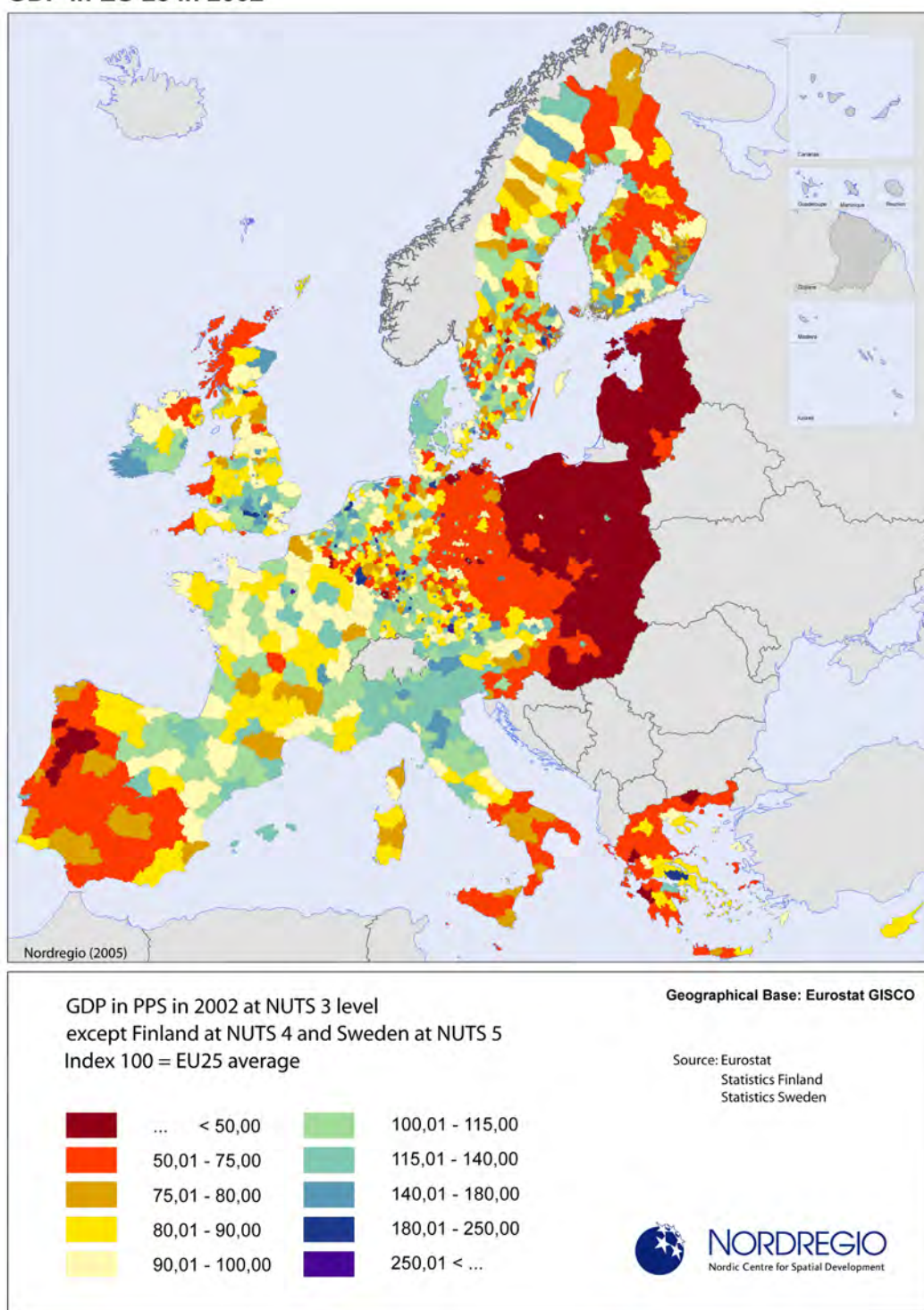


Figure 6.13 GDP levels in PPS at NUTS 3 level, except Sweden (NUTS 5) and Finland (NUTS 4) (2001)

Conclusion

All of the socio-economic parameters envisaged here have shown that the sparsely populated areas are generally in an unfavourable position, even in terms of GDP where the regional average values fail to render the strong local contrasts. There is, in addition, a high level of dependency on public employment, and a higher proportion of transfers in the total income of the inhabitants. In addition, we have observed polarising trends in terms of unemployment between 1991 and 2001, as unemployed persons are increasingly over-represented in sparse and peripheral municipalities.

The main challenge in the years to come then is to design a growth policy that fully uses the potentials of the main cities of the study areas, without also concentrating the regional population to these main nodes. It is therefore necessary to look at the economic role that secondary nodes can play, so that they can actively contribute to maintaining a territorial balance in respect of population structures. Creating institutional and financial structures facilitating the elaboration and implementation of individualised strategic development plans by local actors in these secondary cities should therefore be a priority.

The further development of knowledge centres, research institutes and industries, for example around existing primary activities in the Northern peripheries, is a second main priority. One objective of this policy is to compensate for the continued decline of employment opportunities in these branches through continual innovation, by building on sectors within which there is an established local expertise. In this respect, the low level of educational attainment in the Nordic peripheries poses a significant challenge yet to be overcome.

7. Terrain and climate

We have already touched upon the climatic aspects of the Nordic sparsely populated areas, with regard to road maintenance and maritime accessibility. The present chapter gives a more complete description of the climate encountered in these areas, in a comparative European perspective. The final sub-chapter then deals with the extent and position of protected areas within the study area.

7.1. Climatic conditions in the Nordic peripheries

Climatic conditions provide both opportunities and constraints for economic activities in regions. The main driving forces are temperatures, rainfall, and sunshine duration, which affects the vegetation periods and so the natural land coverage of regions. These conditions of course do also affect human activities in one way or the other. Just to mention a few such impacts, the energy consumption for heating systems or air conditioning is directly related to the prevailing temperature; the vegetation period also has an influence on the possibilities for agriculture, farming and forestry in a region. We shall look at three aspects of climate in this section, namely: temperature, the amount of sunshine and rainfall.

Figures 7.1 and 7.2 show the lowest monthly average temperatures and the highest monthly average temperatures, respectively, measured as long-time averages. These maps illustrate the interaction between various factors: on the one hand temperatures decrease in areas of high altitude or latitude; on the other, oceanic influences reduce the range of temperatures observed throughout the year, especially in the Western parts of the continent.

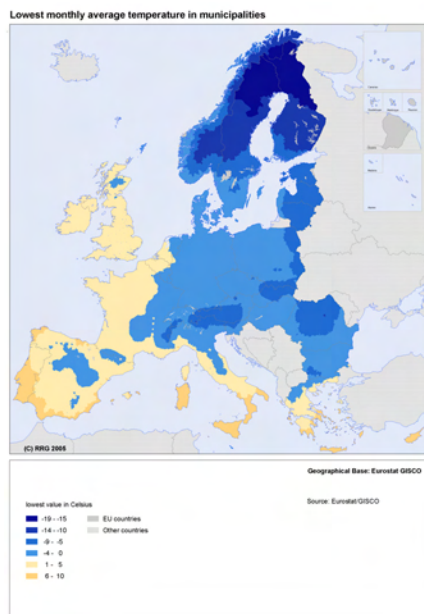


Figure 7.1 Lowest monthly average temperature

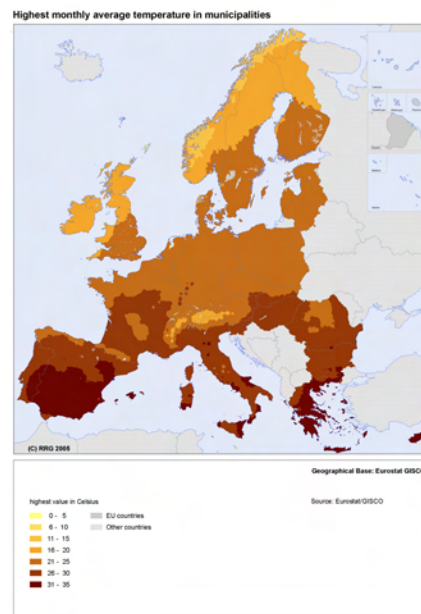


Figure 7.2 Highest monthly average temperature

The temperature contrast index which was developed for the DG *Regio* “Mountain Study” (Nordregio, 2004, 23) (Figure 7.3) summarises the effects of both the highest and lowest average temperatures into one value: Although there are many parts of Europe that experience low long-time average monthly temperatures (see by Figure 7.1), and although there are also other areas in Europe yielding relatively moderate to low highest monthly average temperatures (e.g. Scotland and Ireland) (see Figure 7.2), the northernmost parts of Finland, Sweden and also Norway stand out as unique with respect to the overall temperature contrast index. Only some small ‘cold spots’ in the Alps display temperature contrasts that are as extreme as those encountered in the study area.

Another important climatic factor here is the amount of sunshine. This amount is quantified by the long-time mean annual radiation measured in kWh/m² (see Palz and Greif, 1995) (Figure 7.4). A radiation of less or equal to 2,20 kWh/m² can only be found in Iceland and the northernmost regions of Finland, Sweden and Norway. Similar extreme values of less or equal to 2,60 kWh/m² can then only be found in a strip stretching from Northern Scotland to the area of Liverpool/Manchester/Birmingham. Here, the polar night with long periods of darkness shows its consequences.

A third important climatic condition (apart from temperature and radiation) is the amount of rainfall, i.e. the average yearly amount of rain per square metre (Figure 7.5). Here again the oceanic-continental gradient with predominant west wind areas can be observed: Many windward areas in Europe experience significantly higher average yearly amounts of rain than the leeward sides of the massif ranges. These effects can clearly be seen in Norway, western parts of Scotland, Wales and Ireland, but also further away from the Atlantic Ocean, e.g. in respect of the Adriatic coast of Croatia and Bosnia-Herzegovina. The inner parts of the Alps and of the Pyrenees also experience extreme rainfall conditions with more than 3,000 ml/m² on average *per annum*. In contrast, many leeside areas showing low amounts of rain can be identified. For example, the driest area in continental Europe is the Central plateau of the Iberian peninsula with less than 200 ml/m² on average *per annum*. In contrast to the rain-fed coastal western coast of Norway, the northernmost parts of Finland and Sweden are among the driest in Europe, together with the leeward areas of Spain, Romania and central Poland, all of which have an average rainfall ranging between 250 and 500 ml/m².

7.2. Assessing the economic effects of extreme climatic conditions

Extreme climatic conditions lead to a range of additional costs for individuals, economic actors and public authorities. These span from operating costs for icebreakers in order to keep the Baltic seaports open in the winter months (see Figure 5.18), to additional domestic and industrial heating expenses and specific technological constraints building and running a water supply system that can resist extreme negative temperatures. As described under point 5.6, climatic constraints also induce higher road construction and winter maintenance costs: In 2001/2002, these road maintenance costs alone amounted to about 0,15% of the GDP in the Finnish region of Lappi, and about 0,12% of the GDP in the Swedish regions of Norrbotten and Västerbotten. These costs in other words represent a significant additional financial burden for the concerned public authorities.

The general additional economic cost of these climatic constraints can however not be quantified, as they are incorporated in expenses which depend on a number of other factors.

Temperature Contrast Index in Europe, Isolines

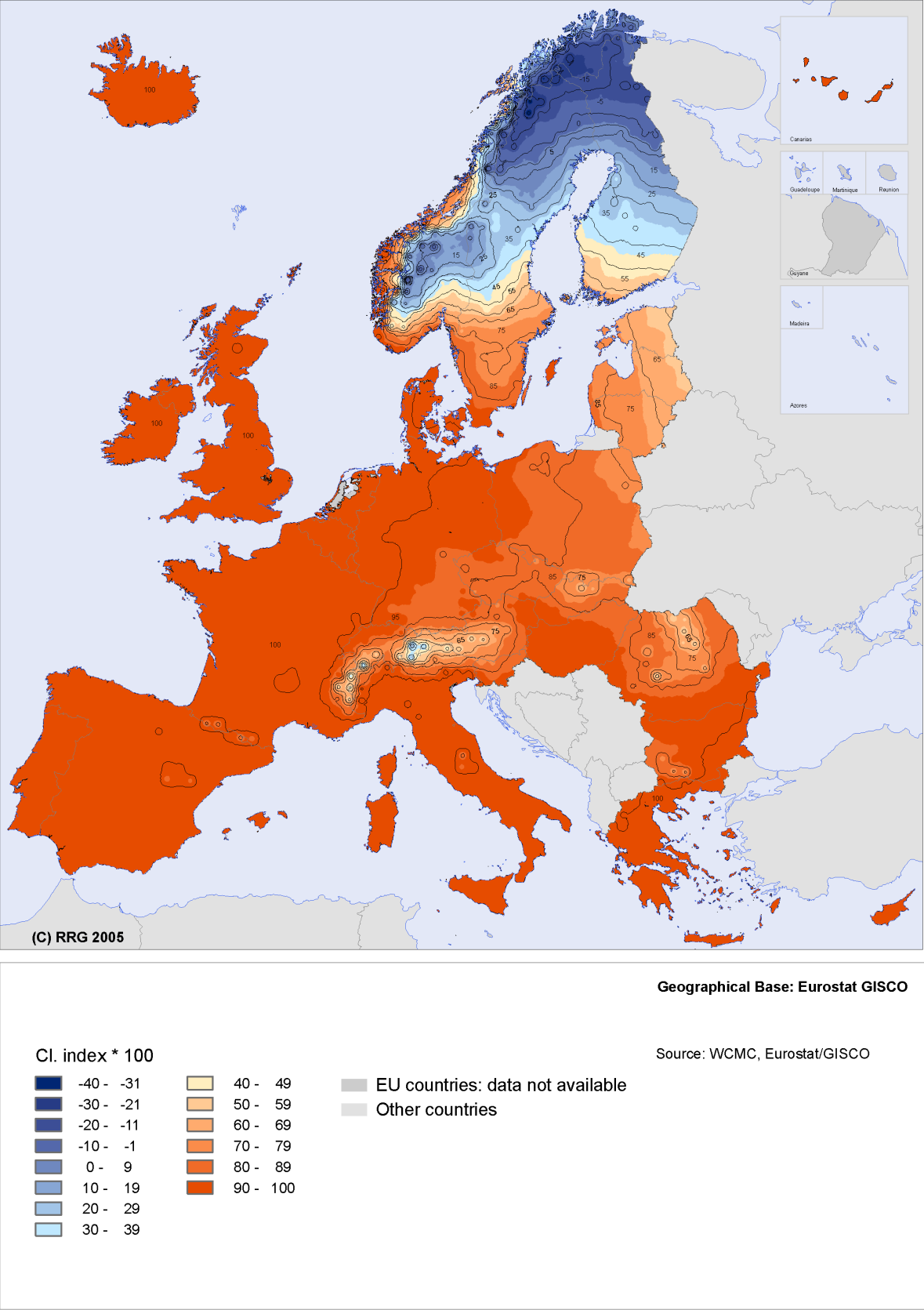


Figure 7.3 Temperature contrast index.

Mean annual radiation across Europe

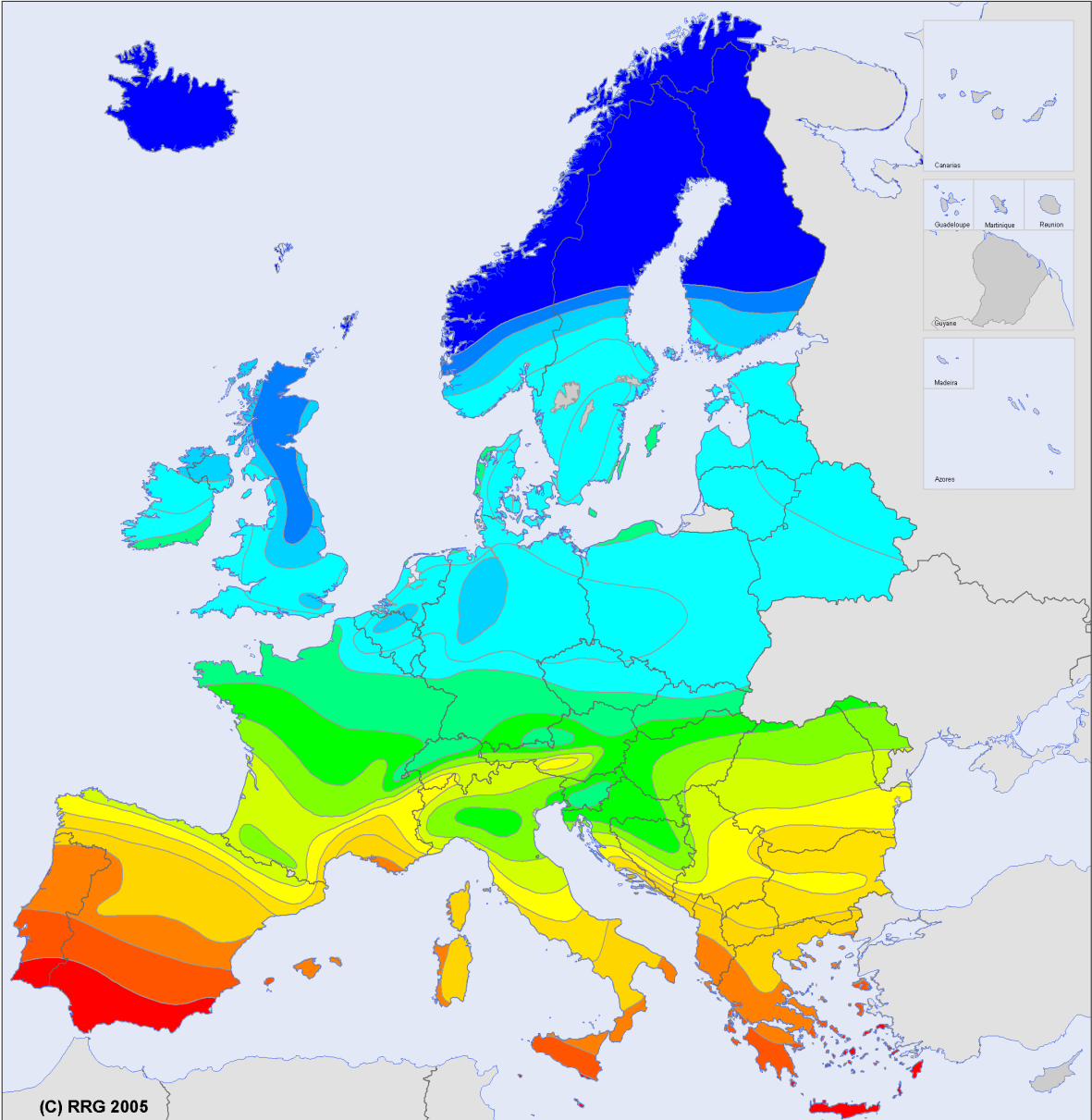
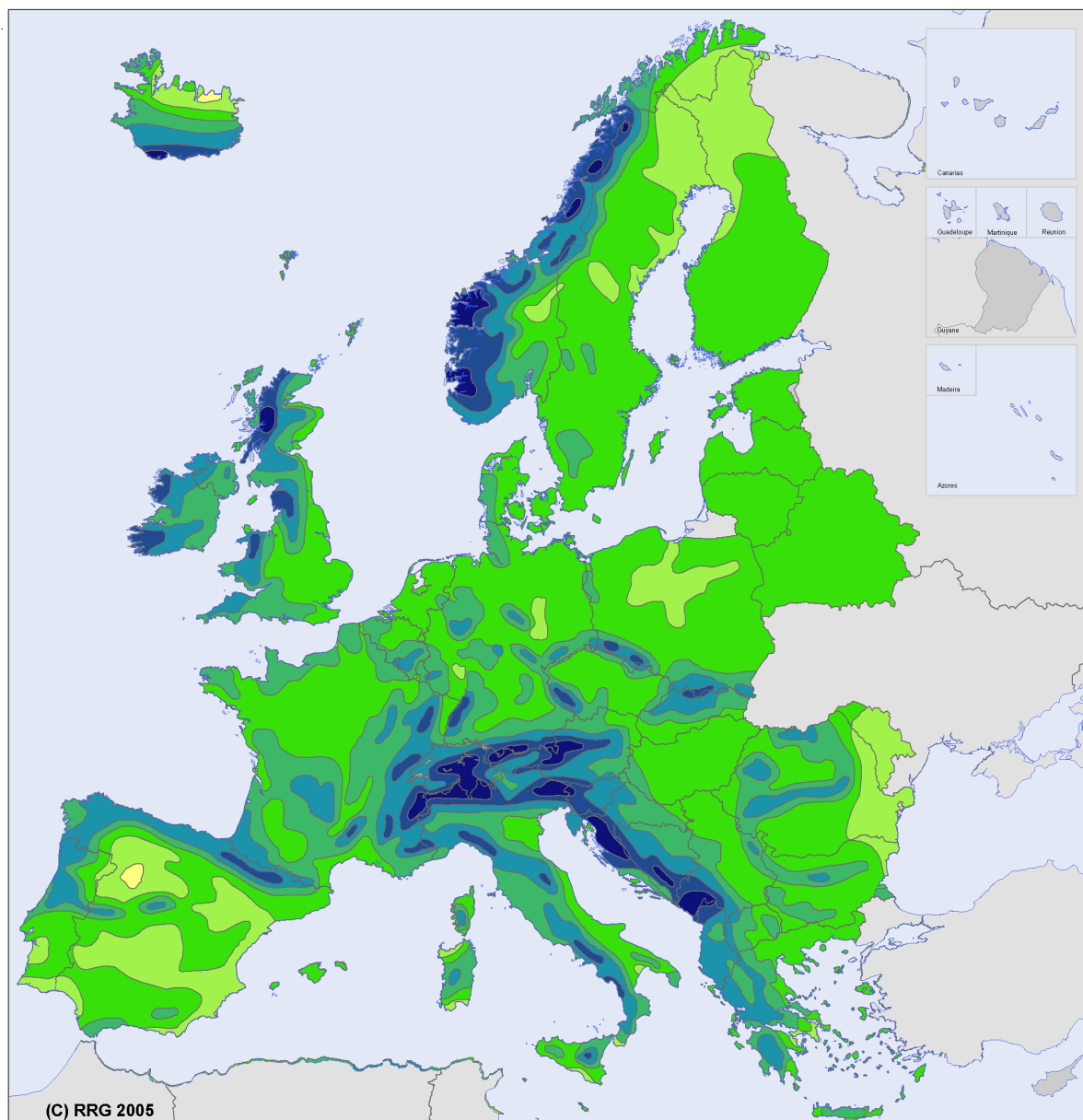


Figure 7.4 Mean long-time annual radiation (Palz and Greif, 1995).

Average yearly amount of rain



Geographical Base: Eurostat GISCO

Source: Westermann, 1997

in ml/sqm

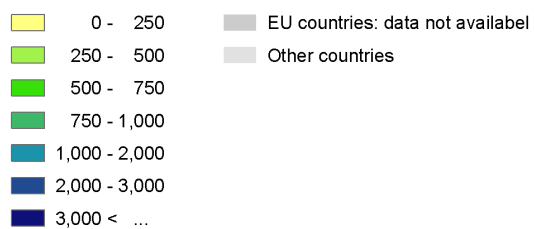


Figure 7.5 Long-time average rainfall across Europe (Westermann, 1997).

The northernmost sparsely populated areas of Finland and Sweden do have specific handicaps with regard to the climatic conditions. The combination of exceptionally cold winters, cool summers and a low yearly amount of sunshine create difficult conditions. Altogether, these climatic conditions significantly affect the natural land coverage and limit the possibilities for agriculture, farming and forestry in these areas.

7.3. Land use

Due to the extreme climatic conditions, as outlined in the previous sections, and the short vegetation period in the northernmost regions, there are in consequence few opportunities for agriculture in the northernmost regions:

The northernmost regions of Finland, Sweden and Norway are characterised by a very reduced proportion of arable land (Figure 7.6), as hardly any municipalities display a proportion of arable land exceeding 10%. Moreover, in both Sweden and Finland, the major part of the land area is occupied by coniferous forests (Figures 7.7 and 7.8). In this respect, the northernmost regions are to some extent similar to many mountain areas in Europe (e.g. the Alps, Massif Central in France, the Pyrenees, and the Highlands in Scotland). However, while these mountain areas often combine agricultural land in the valleys with forested areas on the hillsides, the northernmost regions of Sweden and Finland rely almost exclusively on forestry. Forestry-related industries therefore play a greater role, and the reduced need for manpower due to mechanisation has in some parts had a more direct demographic impact.

Generally, while most parts of Europe display a patchwork of different land covers (Figure 7.8), a high degree of homogeneity prevails in Finland and Sweden: there are large continuous areas of coniferous forests, with interstitial areas of grassland (e.g. along the lakes in Finland).

Proportion of arable land within municipalities

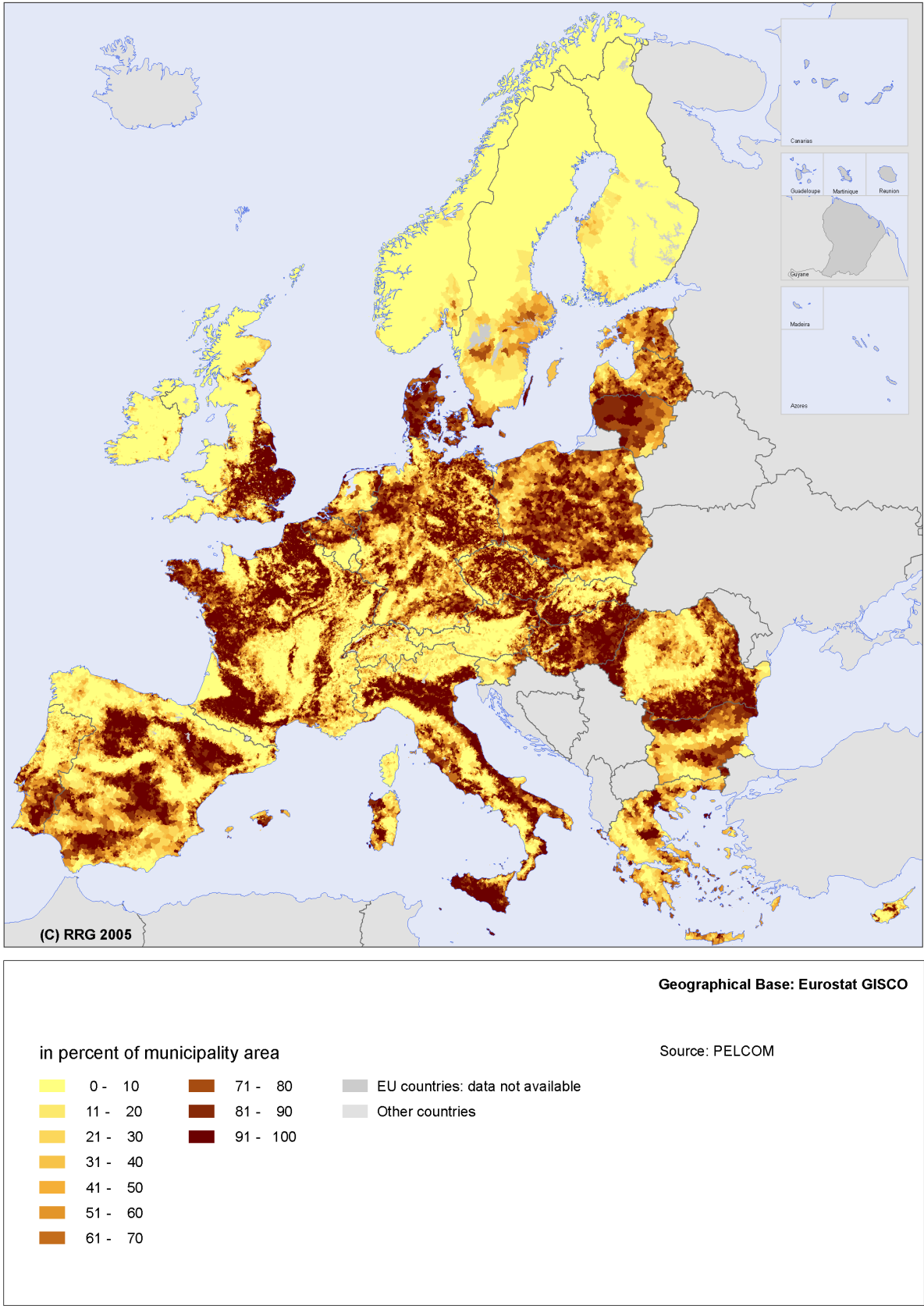
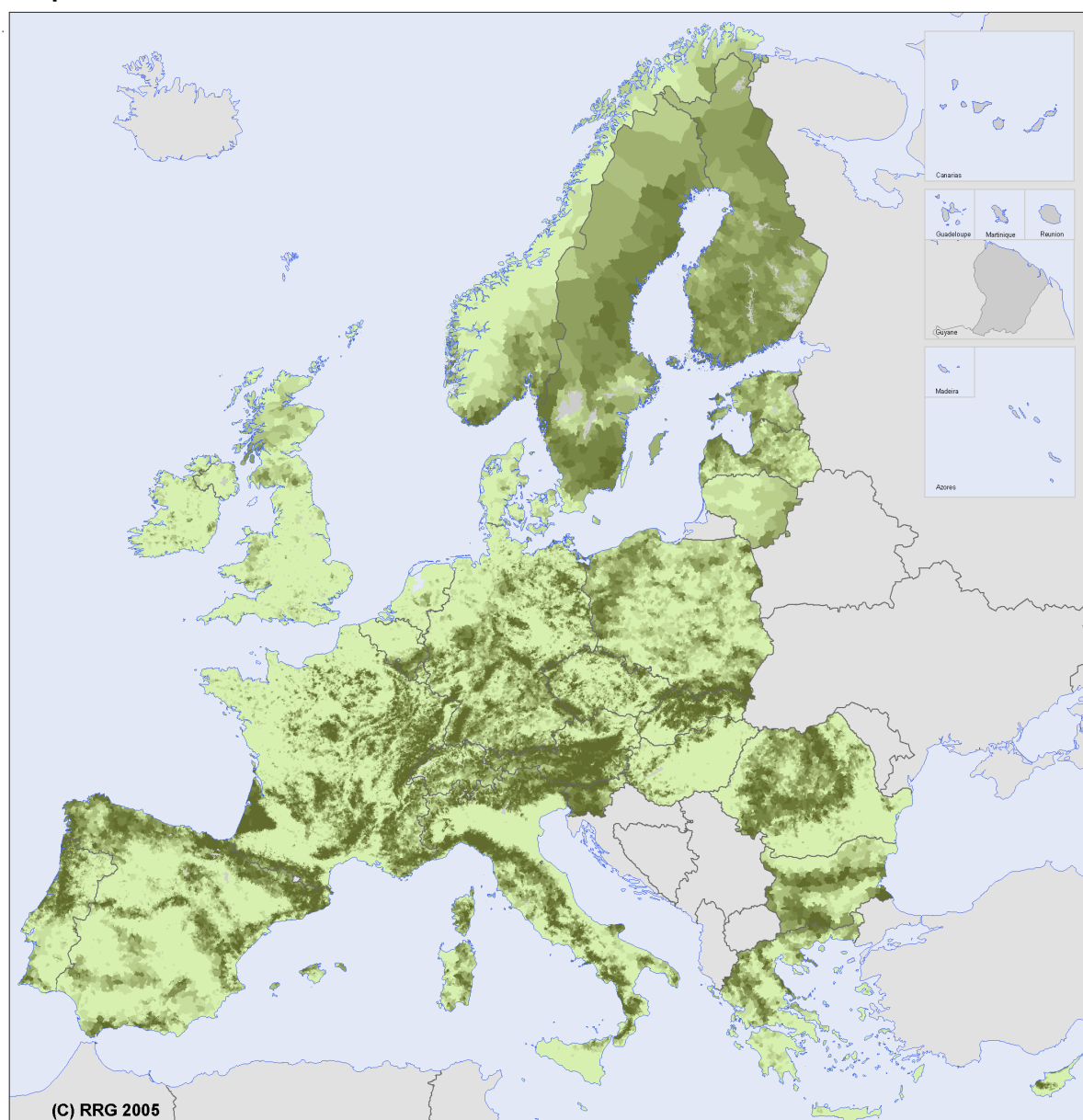


Figure 7.6 Proportion of arable land within municipalities

Proportion of forests



Geographical Base: Eurostat GISCO

Source: PELCOM

in percent of municipality area

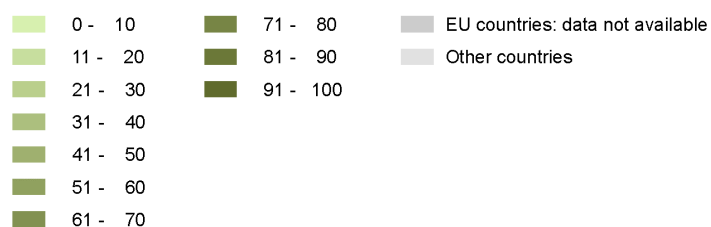


Figure 7.7 Proportion of forests in municipalities (source: PELCOM).

Land cover and land use in the northernmost regions

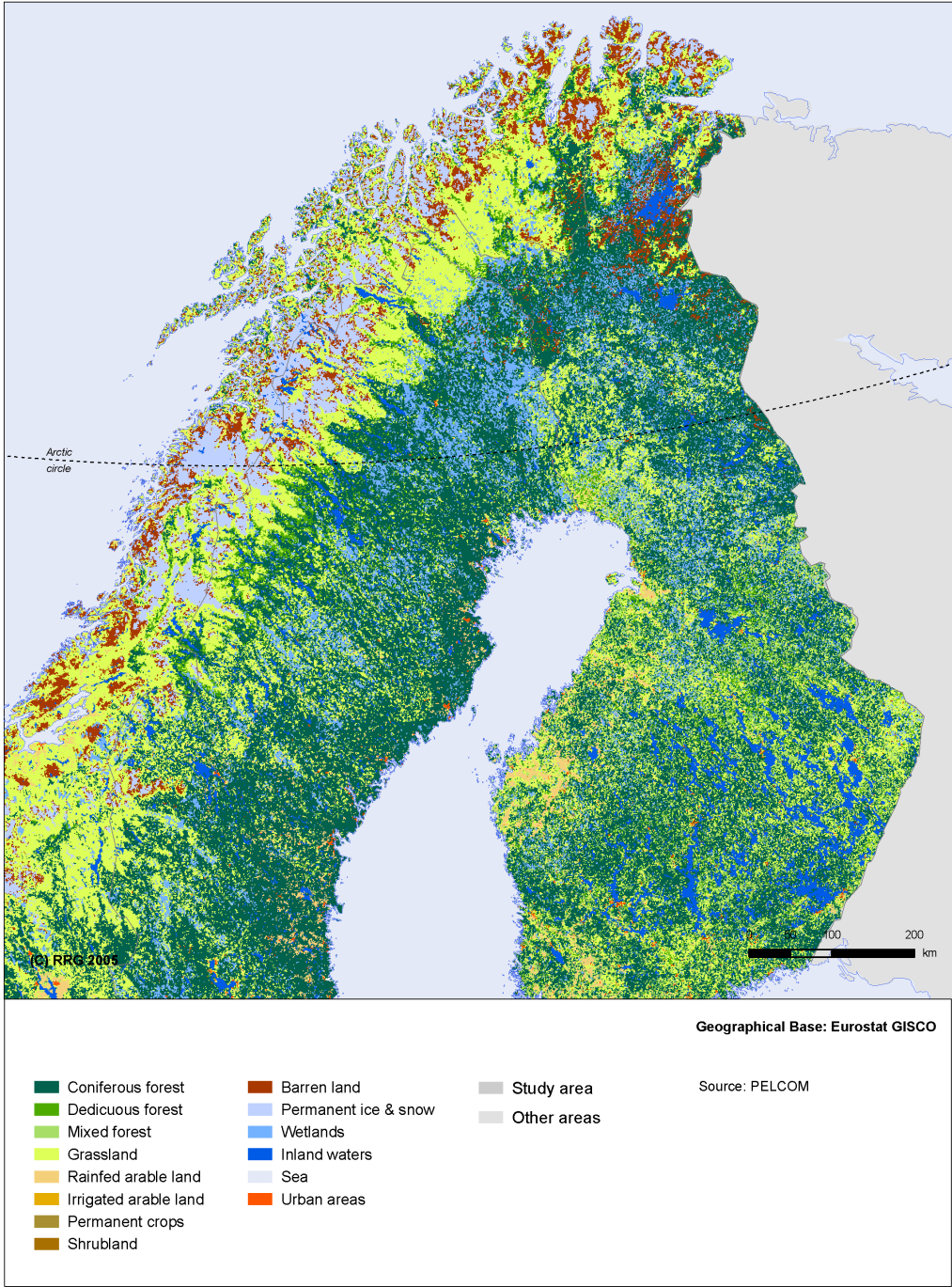


Figure 7.8. Land uses in the study area (Source: PELCOM)

7.4. Protected areas

Major protected areas are to be found in the inland areas, especially along the national borders, mostly in areas previously identified as uninhabited. Conflicts in terms of land use and land ownership however arise, especially in relation to the rights of the Sami population and particularly in respect of reindeer grazing.

There is unfortunately no available data for protected areas in Finnish regions other than Lapland.

Altogether, the national parks, reservations and other protected areas cover an area of 5,255,717 *ha* in the northernmost regions, which accounts for about 11 % of the total study area (excl. the other Finnish NUTS-3 regions, as no data on protected areas for these regions were available). Table 7.1 differentiates the NUTS-3 regions in the study area according to the percentages of protected areas.

Table 7.1 Percentage of protected areas on total NUTS-3 region area.

NUTS-3 code	Name	Total area (km ²)	Protected area (km ²)	%
FI131	Etelä-Savo	14,435.8	2,266.9	15.7
FI132	Pohjois-Savo	16,509.6	477.8	2.9
FI133	Pohjois-Karjala	17,782.1	1,205.1	6.8
FI134	Kainuu	21,566.9	1,729.2	8.0
FI185	Päijäti-Häme	5,132.8	211.0	4.1
FI186	Kymenlaakso	5,106.4	144.9	2.8
FI187	Etelä-Karjala	5,673.7	192.2	3.4
FI193	Keski-Suomi	16,582.2	827.3	5.0
FI194	Etelä-Pohjanmaa	13,457.4	405.8	3.0
FI195	Pohjanmaa	7,675.0	344.0	4.5
FI1A1	Keski- Pohjanmaa	5,285.6	432.2	8.2
FI1A2	Pohjois-Pohjanmaa	35,291.3	3,804.5	10.8
FI1A3	Lappi	93,002.8	35,972.4	38.7
SE071	Vaesternorrlands Laen	21,678.2	1.9	0.0
SE072	Jaemtlands Laen	49,443.4	4,236.1	8.6
SE081	Vasesterbottens Laen	55,401.2	7,406.8	13.4
SE082	Norrbottens Laen	98,910.7	12,667.7	12.8

Sources: own calculations, based on: UNEP-GRID Arendal (2005), Circumpolar Protected Areas Network (CPAN), Conservation of Arctic Fauna and Flora (CAFF), Finnish Environment Institute (2005). Protected areas on sea excluded from summary statistics.

Protected areas in the northernmost regions

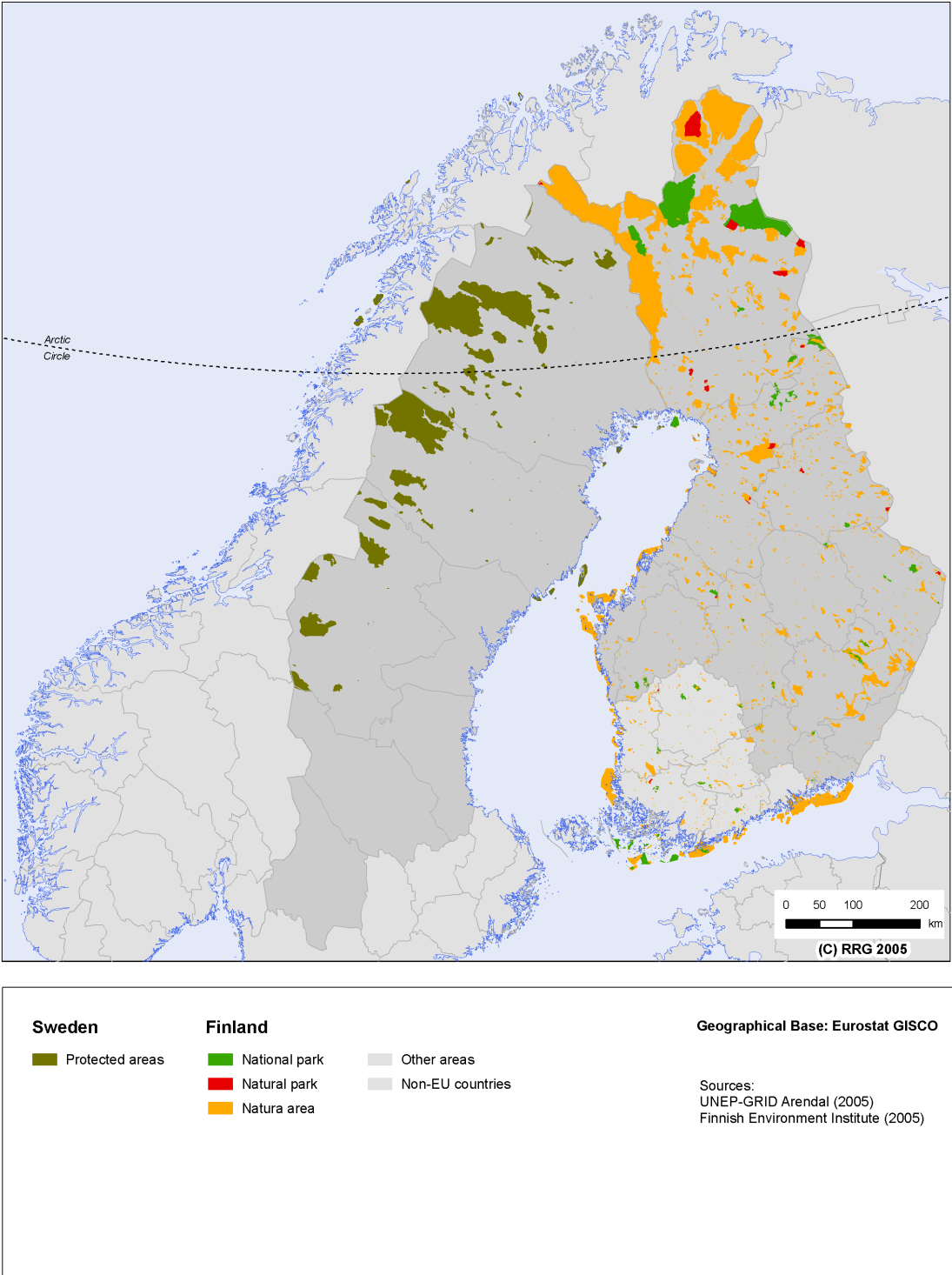


Figure 7.9 Protected areas and national parks in the northernmost areas (UNEP-GRID Arendal, 2005).

Conclusion

This overview of climatic and land use aspects confirms the relatively unique profile of the Nordic sparsely populated areas from a European perspective, especially with regard to temperature and radiation levels. The quantification of the economic effects of these constraints is however close to impossible, as there is no valid point of comparison available. It is nonetheless obvious that the extreme climatic conditions induce additional costs in the Nordic sparsely populated areas, with regards to the construction and operation of transport infrastructure as well as energy and water supply, and also as far as expenses for heating and lighting are concerned.

In a general context of progressively declining access to fossil energy, a strategic policy to meet the specific energy needs of the Nordic sparsely populated areas needs to be developed. Wide areas of woodland could be further exploited in order to meet some of these local energy needs. Incentives should be developed in this regard, in order to prepare the Sparsely populated regions for an upcoming shift in the energy supply situation.

8. Conclusions: The Northern Periphery Problem - A Syndrome of Disadvantage

In reviewing the contents of the above report it is clear that the regions of the Northern Periphery of the Nordic countries experience what may be termed a “syndrome” of disadvantage. The term is appropriate, since as in a medical syndrome, the situation is characterised by a number of associated symptoms of disadvantage, which, although they mutually reinforce the overall disadvantage experienced by these regions, are not necessarily connected in a causal sense. Thus, as we noted in the introduction, though sparsity, peripherality and structural weakness (i.e. dependence upon primary industries), are different problems, with distinct causes, they often co-exist, and together contribute to a very substantial cumulative barrier to regional development. This situation is illustrated in Figure 8.1 below.

Figure 8.1 has a two-dimensional layout, so that both horizontal and vertical position is important. The top section of the diagram relates to the physical geography and location of the regions, whilst below we find the economic/business and demographic/social aspects.

On the left of the diagram are located a number of basic handicaps (top heading) and historic legacies (lower heading). These are in a sense, fixed preconditions, and include climate, peripherality, sparsity, and the legacies of long-term demographic trends.

In the central section of the diagram we find various processes and characteristics, which derive from the basic handicaps, often exacerbating the wider regional problem. For instance climatic constraints result in limited agricultural opportunities, travel and transport disruption, the increased cost of infrastructure provision, and so on. Local accessibility problems, peripherality, and the historic dependence upon the primary sector interact in various ways to impose structural constraints on economic growth, as well as high costs for materials and distribution, inadequate access to modern logistics systems, a lack of agglomerative advantage and “attenuated” business networks.

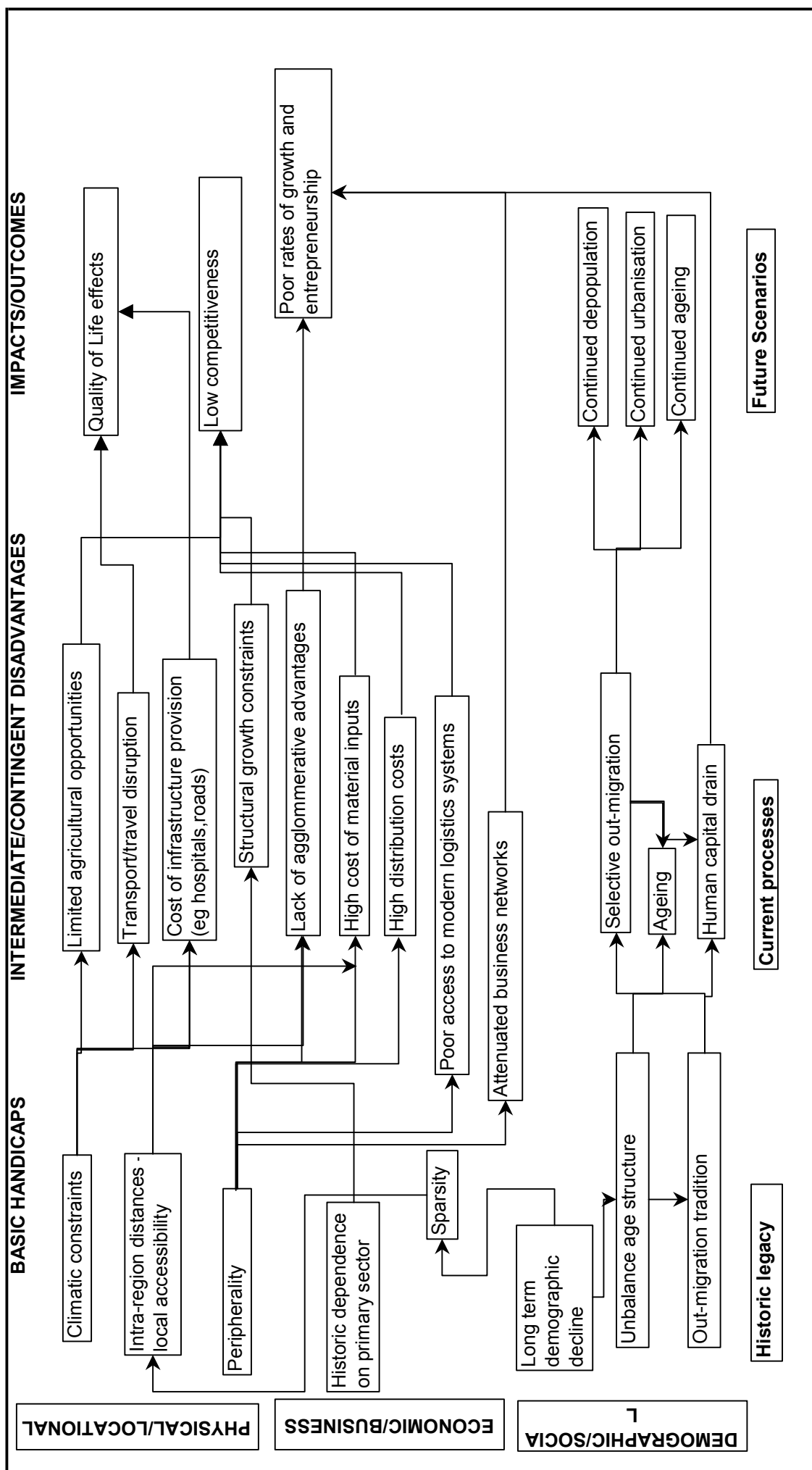


Figure 8.1: The Northern Periphery Syndrome of Disadvantage

The historic legacy of demographic trends (driven by selective out-migration) is self-perpetuating, driven by an ageing of the population and the drain of human capital out of the periphery and towards the south.

The last column, on the right, shows the final impacts of these processes, (and the likely outlook for the future, in the absence of effective intervention), such as low competitiveness, poor rates of entrepreneurship and innovation, and a continued “downward spiral” in terms of demographic development.

Possible Policy Implications

The recognition of the “syndrome” has several potential implications for policy:

- Since the syndrome is made up of several components of disadvantage, which are, to a degree at least, independent in terms of their causes, it follows that no single approach (addressing for example, sparsity, peripherality, migration, or structural issues alone) is likely to be effective.
- Some of the basic handicaps (such as climatic constraints) are clearly not mutable, and in this case it is appropriate to consider measures, directed at “softer” issues, mostly located in the centre of the diagram, (such as improving human and social capital, developing more effective business networks, better governance, and so on), which may compensate or ameliorate.
- Other “basic handicaps” such as peripherality, poor local accessibility, or sparsity exacerbated by migration, although not fixed physical characteristics (in the same way as climate is), are probably almost as difficult to “turn around”, simply because, in a free market economy accessible regions are generally the motors for growth, drawing on resources from the periphery, and therefore always “ahead”. This too leads to the conclusion that development policy for the periphery should focus upon “soft factors” which may better equip the population and businesses to survive within their challenging environment. “Hard” measures such as infrastructure building are nonetheless needed in certain parts, e.g. where transport bottlenecks hampering industrial development have been identified. Such projects can also act as catalysers of improved regional cooperation and governance.”

- In considering policy development for sparsely populated and peripheral regions it is important to recognise and make full use of the particular assets of such regions as locations for “footloose” economic activities. A number of Alpine and peripheral cities have already demonstrated that a favourable environment and quality of life can attract highly qualified personnel, if the appropriate structures are established in terms of public research and higher education.
- It is worth stressing the fact that although many of the improvements in telecommunications and information technology in recent years have tended to benefit accessible regions more than sparsely populated or remote ones, they do, nevertheless offer new opportunities for the latter. Again, providing that basic cost differentials (due to differences in market size) can be overcome by public support, the key issue is likely to be human capital (i.e. informing local entrepreneurs of the opportunities, and the training of the local workforce).

Although the above points are far from comprehensive, a basic principle is clear: In order to effectively address the effects of the basic handicaps of the Northern Periphery, it will be necessary to focus efforts upon “Intermediate/Contingent” processes, and to develop imaginative “softer” approaches to the “syndrome” of disadvantage.

By combining its strategic role as a centre of expertise for high technology products and services, as a producer of raw material and processing industry products and as a gateway for products from Russia and northern Eurasia, the sparsely populated areas of the Nordic countries hold the key to a strategic role in the European context. It is however important to ensure that these development perspectives are implemented with a focus on the interests of these Nordic peripheral regions. Coordinating regional actors and national stakeholder through appropriate transnational governance structures is therefore of primary importance.

Through the implementation of three above mentioned development strategies, the Nordic sparsely populated areas have the potential to contribute to the achievement of the Lisbon agenda, i.e. making Europe the most competitive economy in the world.

Compensating for the higher relative cost of building and operating infrastructure in these areas is in other words likely to be profitable for the European economy as a whole. A European policy compensating for concentrating trends in the economy can ensure that the current and potential human capital, natural resources and strategic transport nodes within the peripheral and sparsely populated regions are made available to the European economy. A European regional policy can in other words constitute an original contribution to the Lisbon agenda, by identifying territories where current market mechanisms fail to take advantage of the existing resources. The Nordic peripheral sparsely populated areas constitute one type of such areas.

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