

TRACC

Transport Accessibility at Regional/Local Scale and Patterns in Europe

Applied Research 2013/1/10

Final Report | Version 30/06/2013

Volume 3

TRACC Regional Case Study Book

Part G

Finland case study

This report presents a more detailed overview of the analytical approach to be applied by the project. This Applied Research Project is conducted within the framework of the ESPON 2013 Programme, partly financed by the European Regional Development Fund.

The partnership behind the ESPON Programme consists of the EU Commission and the Member States of the EU27, plus Iceland, Liechtenstein, Norway and Switzerland. Each partner is represented in the ESPON Monitoring Committee.

This report does not necessarily reflect the opinion of the members of the Monitoring Committee.

Information on the ESPON Programme and projects can be found on www.espon.eu

The web site provides the possibility to download and examine the most recent documents produced by finalised and ongoing ESPON projects.

This basic report exists only in an electronic version.

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Table of contents

	Page
1 Introduction	1
2 The Finland case study region	2
2.1 Spatial structure	4
2.2 Socioeconomic situation	7
2.3 Transport aspects	7
3 Accessibility patterns at regional and local scale	11
3.1 Access to regional centres	11
3.2 Daily accessibility of jobs.....	17
3.3 Regional accessibility potential	23
3.4 Access to health care facilities	31
3.5 Availability of higher secondary schools.....	37
3.6 Accessibility potential to basic health care	43
4 Accessibility situation at different regional subtypes	51
5 Accessibility effects of future TEN-T developments	60
6 Conclusions	68
Annexes	
Annex 1 References	70
Annex 2 Database	71
Annex 3 Accessibility model used.....	72
Annex 4 Acknowledgements.....	74

Figures

- Figure 1 The Finland case study region
- Figure 2 Population distribution
- Figure 3 Job distribution
- Figure 4 Road network
- Figure 5 Public transport network
- Figure 6 Travel time by car to next regional centre
- Figure 7 Travel time by public transport to next regional centre
- Figure 8 Travel time to next regional centre, by urban-rural typology
- Figure 9 Travel time to next regional centre, cumulative distributions
- Figure 10 Jobs accessible by car within 60 minutes
- Figure 11 Jobs accessible by public transport within 60 minutes
- Figure 12 Jobs accessible within 60 minutes, by urban-rural typology
- Figure 13 Jobs accessible within 60 minutes, cumulative distributions
- Figure 14 Potential accessibility to population by car
- Figure 15 Potential accessibility to population by public transport
- Figure 16 Potential accessibility to population, by urban-rural typology
- Figure 17 Potential accessibility to population, cumulative distributions
- Figure 18 Car travel time to next hospital
- Figure 19 Public transport travel time to next hospital
- Figure 20 Travel time to next hospital, by urban-rural typology
- Figure 21 Travel time to next hospital, cumulative distributions
- Figure 22 Higher secondary schools within 30 minutes travel time by car
- Figure 23 Higher secondary schools within 30 minutes travel time by public transport
- Figure 24 Higher secondary schools within 30 minutes travel time, by urban-rural typology
- Figure 25 Higher secondary schools within 30 minutes travel time, cumulative distributions
- Figure 26 Potential accessibility to medical doctors by car
- Figure 27 Potential accessibility to medical doctors by public transport
- Figure 28 Potential accessibility to medical doctors, by urban-rural typology
- Figure 29 Potential accessibility to medical doctors, cumulative distributions
- Figure 30 Zoom-in regions
- Figure 31 Travel time to next regional centre, by zoom-in region
- Figure 32 Travel time to next regional centre, cumulative distributions by zoom-in region
- Figure 33 Jobs accessible within 60 minutes, by zoom-in region
- Figure 34 Jobs accessible within 60 minutes, cumulative distributions by zoom-in region

- Figure 35 Potential accessibility to population, by zoom-in region
- Figure 36 Potential accessibility to population, cumulative distributions by zoom-in region
- Figure 37 Travel time to next hospital, by zoom-in region
- Figure 38 Travel time to next hospital, cumulative distributions by zoom-in region
- Figure 39 Higher secondary schools within 30 minutes travel time, by zoom-in region
- Figure 40 Higher secondary schools within 30 minutes travel time, cumulative distributions by zoom-in region
- Figure 41 Potential accessibility to medical doctors, by zoom-in region
- Figure 42 Potential accessibility to medical doctors, cumulative distributions by zoom-in region
- Figure 43 TEN-T road and rail infrastructure projects
- Figure 44 Potential accessibility to population by car with TEN-T projects
- Figure 45 Potential accessibility to population by public transport with TEN-T projects
- Figure 46 Relative increase of potential accessibility to population by car with TEN-T projects
- Figure 47 Relative increase of potential accessibility to population by public transport with TEN-T projects
- Figure 48 Absolute increase of potential accessibility to population by car with TEN-T projects
- Figure 49 Absolute increase of potential accessibility to population by public transport with TEN-T projects

Tables

- Table 1 Accessibility by car, deviations of zoom-in regions from case study averages
- Table 2 Accessibility by public transport, deviations of zoom-in regions from case study averages

1 Introduction

The ESPON project TRACC (**TR**ansport **ACC**essibility at regional/local scale and patterns in Europe) aimed at taking up and updating the results of previous studies on accessibility at the European scale, to extend the range of accessibility indicators by further indicators responding to new policy questions, to extend the spatial resolution of accessibility indicators and to explore the likely impacts of policies at the European and national scale to improve global, European and regional accessibility in the light of new challenges, such as globalisation, energy scarcity and climate change.

The Transnational Project Group (TPG) for the ESPON project TRACC consisted of the following seven Project Partners:

- Spiekermann & Wegener, Urban and Regional Research (S&W), Dortmund, Germany (Lead Partner)
- Charles University of Prague, Faculty of Science, Department of Social Geography and Regional Development (PrF UK), Prague, Czech Republic
- RRG Spatial Planning and Geoinformation, Oldenburg i.H., Germany
- MCRIT, Barcelona, Spain
- University of Oulu, Department of Geography (FOGIS), Oulu, Finland
- TRT Trasporti e Territorio, Milan, Italy
- S. Leszczycki Institute of Geography and Spatial Organisation, Polish Academy of Sciences (IGSO PAS), Warsaw, Poland

This report is part of the TRACC Final Report. The TRACC Final Report is composed of four volumes.

- Volume 1 contains the Executive Summary and a short version of the Final Report.
- Volume 2 contains the TRACC Scientific Report, i.e. a comprehensive overview on state of the art, methodology and concept, and in particular results on the global, Europe-wide and regional accessibility analyses and subsequent conclusions of the TRACC project.
- Volume 3 contains the TRACC Regional Case Study Book. Here, each of the seven case studies conducted within the project is reported in full length.
- Volume 4 contains the TRACC Accessibility Indicator Factsheets, i.e. detailed descriptions of all accessibility indicators used in the project.

This report on the Finland case study region is one of the major parts of Volume 3 TRACC Regional Case Study Book. The report starts with a short description of the case study region. Then, the results for six different accessibility indicators will be presented and discussed, first for the whole case study region and then in more detail for selected subregions, so called zoom-in regions. This analysis of the current accessibility conditions in the region for car travel as well as for public transport is followed by an analysis of how the planned trans-European transport networks would change the accessibility pattern within the region.

The design of the case study analysis was made in a way that all seven case studies are highly comparable as the definition of the accessibility indicators and its implementation were handled in a rather strict way. Also, the way results are presented in maps, diagrams and more general in the case study reports is highly comparable. A comparable analysis across all case studies is provided in Volume 2, the TRACC Scientific Report. All reports are available at the ESPON website www.espon.eu.

2 The Finland case study region

Finland is the eighth largest country in Europe in terms of area and the most sparsely populated country in the European Union. Thus, the internal distances are long, transport flows are small and congestion problems occur only in the biggest cities. Situated in the Fennoscandian region of northern Europe, Finland is bordered by Sweden, Norway and Russia, while Estonia lies to its south across the Gulf of Finland. Hence, in terms of transport, Finland is situated almost like an island with respect to the rest of the European Union (Figure 1). Seasonal, but particularly winter conditions need to be taken into account in road and maritime and as well as in rail and air transports.

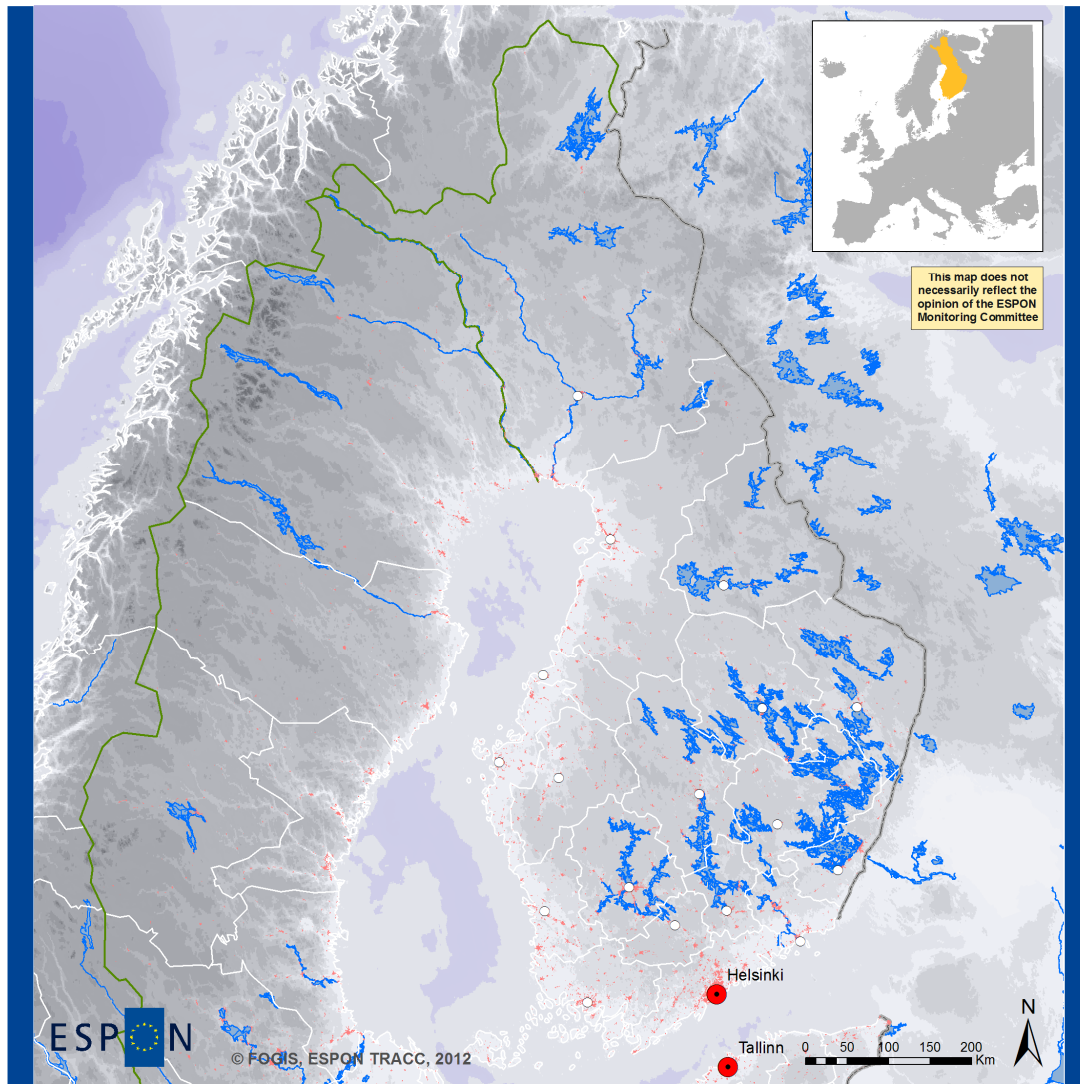
Around 5.4 million people live in Finland, with a majority being concentrated in the southern part of the country. On a north-south axis, the country is about 1,300 km long, and about 500 km wide at the most. Half of the population lives in the 200 km-wide zone along the south coast, and about 80 % of the population occupies an area of just 6,000 km², while the area of the entire country is 338,000 km². The standard of living, education and product per capita are at a high level. Finland has remarkable inland waters which are characterised by their fragmented structure. The Finnish landscape is mostly flat, but hills are characteristic of some regions. Fells are the prevailing landform in the northernmost areas, where the country's highest altitude of 1,324 metres is to be found. The climate is defined as cold and continental without a dry season, but harsh winters may cause temporarily arctic conditions.

In these circumstances, an efficient transport system serving the economy, production, everyday life and tourism, among others, is critical for Finland. The present transport policies strive to guarantee good quality key transport connections. In general, this is seen as essential to the economic development of the regions. In practice, the emphasis is set to ensure the quality of internal connections, most essentially the main domestic routes and the transport systems of the biggest cities.

The Finland case study region constitutes continental Finland only. The region of the Åland Islands is excluded from the case study due to its autonomous status and distinctive conditions of accessibility.

The selected zoom-in areas will provide insight into three unique regional cases in the European context, which are of high importance in the context of Finland.

- The Lapland zoom-in region represents a remote periphery in the European context.
- The Northern Ostrobothnia zoom-in region covers Oulu, one of the northernmost European growth centres, and intermediate periphery.
- The Uusimaa zoom-in region covers the Greater Helsinki region and its surroundings, which form the undeniable metropolis area of Finland, with a population of over one million. Helsinki is the EU's northernmost capital city.




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Finland Case Study Overview map




-  Capital city
-  NUTS-3 capital
-  Settlement area

Figure 1. The Finland case study region.

2.1 Spatial structure

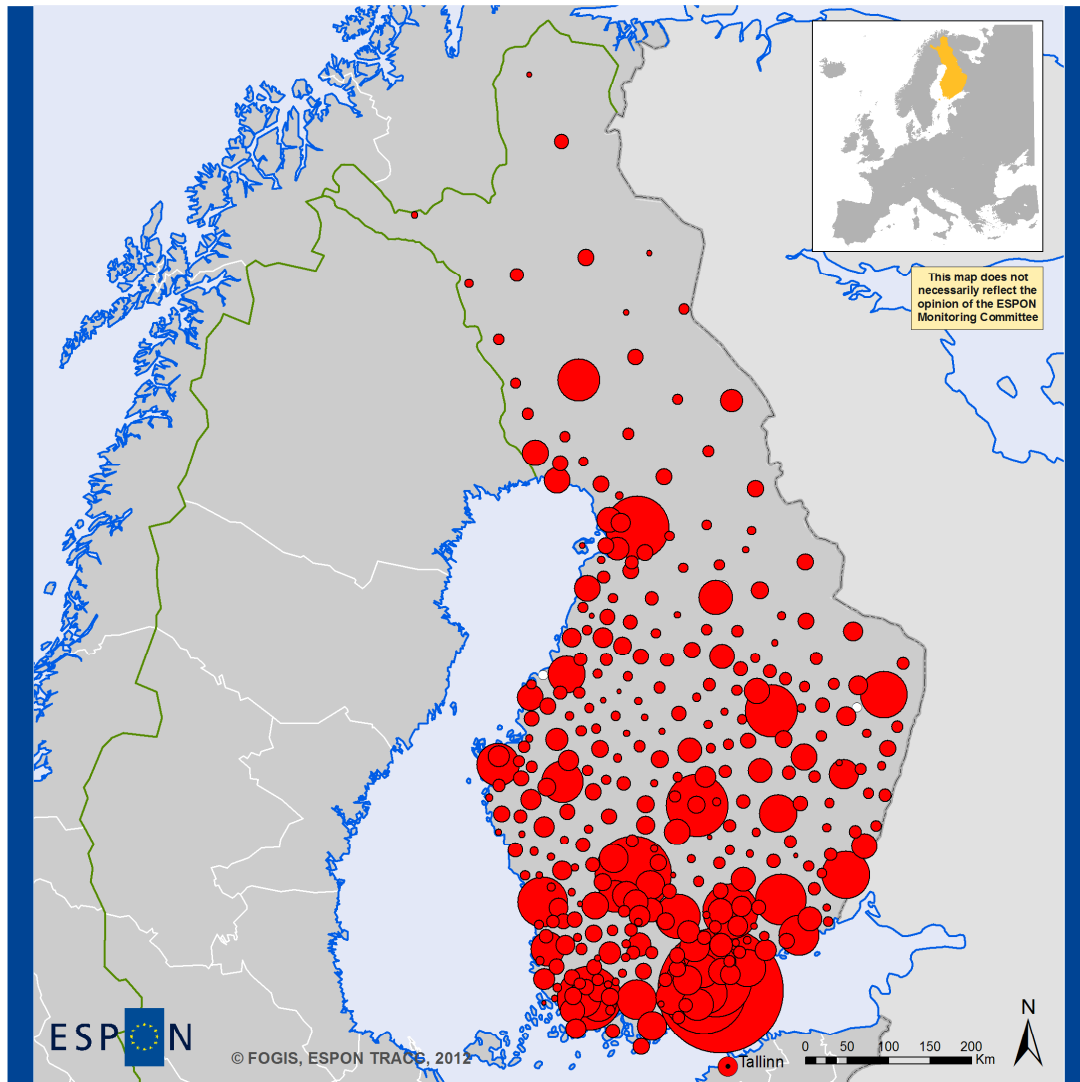
Compared to the general trend in the Western world, Finland experienced relatively late urbanisation, truly beginning in the 1960s in conjunction with increased motorisation and accessibility (Kotavaara et al. 2011a, 2011b). A total of 81.2 % of the population live in urban areas and their immediate surroundings (Statistics Finland 2011). The Greater Helsinki area constitutes 25 % of the country's population, including three cities with more than 200,000 inhabitants (Helsinki, Espoo and Vantaa). Other major cities in the case study region are Tampere (210,000 inhabitants), Turku (175,000 inhabitants), Oulu (140,000 inhabitants), Jyväskylä (130,000 inhabitants) and Lahti (100,000 inhabitants). These are the only cities with more than 100,000 inhabitants. The Finnish population is concentrated in the capital region and in the biggest cities with universities (Figure 2). In 2010, half of the 336 municipalities had fewer than 5,900 inhabitants. Even though the fertility rate is generally higher in rural areas, the death rate is higher than birth rate in 200 municipalities. The density of the municipalities is high in the southern parts of the county, but in sparsely populated eastern and northern Finland, distances between municipal centres may be more than 100 kilometres. Economic activities and employees are even more concentrated in the cities than the population in relative terms (Figure 3). This is related to the fact that in the capital region in particular, there is a great deal of commuting from the suburbs to the city centre. The capital region, other main growth centres and county centres are the true engines of the economy as a whole, whereas some peripheral areas have tourist attractions, industry, mining and primary production, which considerably affect the regional economy.

The zoom-in regions

The NUTS-3 region of Lapland is the northernmost region of Finland, being a vast region constituting almost a third of the entire country but having only 180,000 inhabitants, a half of which are concentrated in the three biggest population centres. This signifies that most of the region is extremely sparsely populated, and indeed large areas of the region are totally unpopulated. The region of Lapland consists of 21 municipalities, which differ significantly both in their area and population. The largest population centres are located in the south-western part of the region, positioned mostly at the mouths of the great rivers running into the Bothnian Bay. The northern parts of the region are extremely sparsely populated with only small local centres.

The Northern Ostrobothnia region consists of 34 municipalities with a population of 390,000 located in the middle of Finland, on the shores of the Bothnian Bay. The city of Oulu, the main centre of the region, has a population of about 140,000 inhabitants, making it the most populous and vibrant city in northern Finland. The Oulu region is characterised by a group of relatively small urban centres surrounded by rural areas. The population density drops rapidly towards peripheries and large areas of the region are unpopulated. Oulu has one of the biggest universities in Finland, offices of several technology companies and also public research institutes. In contrast, the peripheries of the Northern Ostrobothnia region suffer from remarkable net migration loss.

The Uusimaa region consists of 28 municipalities with a total population of around 1.5 million people, making it the most densely populated NUTS-3 region in Finland. Most of the activities are concentrated in the Helsinki metropolitan area, to where a considerable number of commuters travel on a daily basis from the surrounding municipalities by car and public transport. In addition to the universities and public and private research centres, a number of company headquarters contribute to the development of Helsinki. Even though the main transport corridors around Helsinki are densely populated, the population density decreases rapidly outside of the metropolitan area.




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Finland Case Study Population (2010)

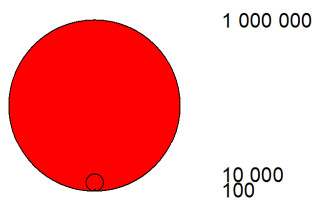
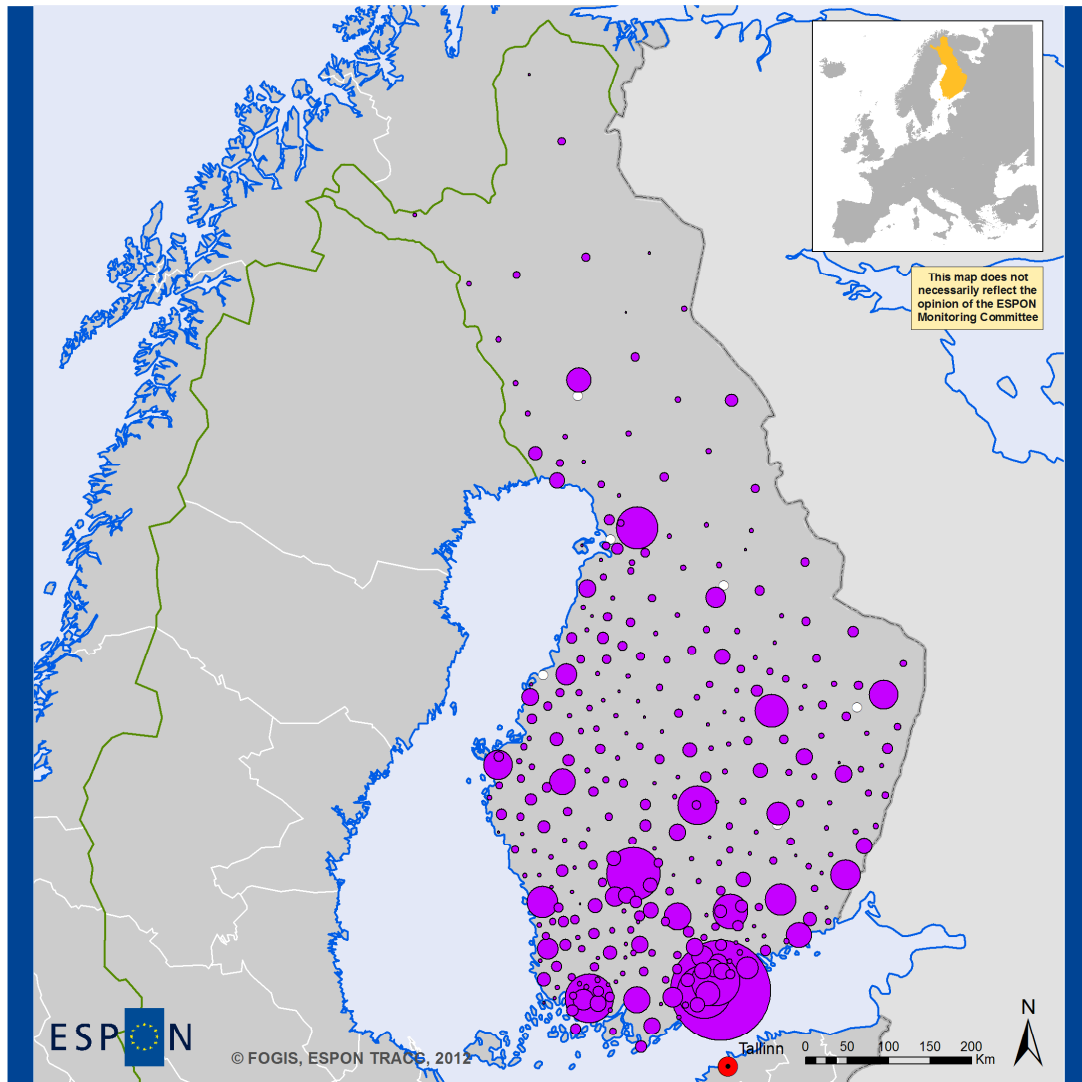


Figure 2. Population distribution




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Finland Case Study
Number of employees (2005)

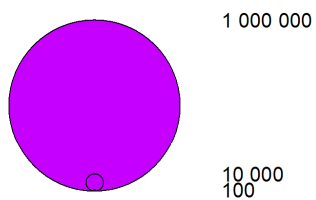


Figure 3. Job distribution

2.2 Socioeconomic situation

Finland has evidently become a post-industrial economy, portrayed by service-emphasised employment (72.9 %). Industry, however, plays an important role (14.7 %) in comparison to construction (6.3 %) and primary production (3.7 %) (Statistics Finland 2012a). In relation to this, the regional structure of Finland has become polarised towards the development of urban cores competing strongly in the market economy and also towards the degeneration of peripheries facing continuous structural changes (Rusanen et al. 2003). Over the past decade, the unemployment rate of Finland has fluctuated at around 8 % and in 2011 it was 7.8 % (Statistics Finland 2012b).

The zoom-in regions

The region of Lapland is generally considered to be one of the least developed and most peripheral parts of Finland, where many socioeconomic problems are apparent. For example, the unemployment rate (14.3 %) in the region is the second highest among the NUTS-3 regions of Finland, clearly above the national average. Generally, the population of the region is in steady decline, and the age structure is becoming increasingly older. The population of the region peaked in 1993, but since then it has decreased by almost 20,000 people. The negative trend has affected the entire region, except for the regional capital and certain population centres benefiting from the expanding tourism industry. While 5.8 % of the population work in the agricultural sector, 21.7 % in industry and construction, services account for the major share (71.0 %) of the sources of livelihood. Tourism in particular has become an important form of economic activity over the past few decades. Although the role of industry has been in slow but steady decline, two paper mills and a large steelworks operate in the south-western part of the region.

Most of the people in the Oulu region work either in the service sector (66.2 %) or the industrial sector (27.0 %), yet the share of primary production (5.7 %) is above average for the country. Traditionally, the economy of the region has relied on the wood processing industry, which has benefited from the location close to rivers. The relative importance of traditional industry has suffered a constant decline, and it has been replaced by high technology industry in particular. However, the industries have suffered from the economic downturns during the past decade, resulting in relatively high unemployment (11.9 %), which is higher than the national average, especially among young people. However, the age structure is tilted towards younger generations, which can be regarded as a potential socioeconomic advantage for the region. The population of the region has seen a constant increase for a long period, due to migration from the peripheral areas of northern Finland, but also as a result of the high birth rate. Specifically, population growth has been strongest in the neighbouring municipalities of Oulu and Oulu itself.

The Uusimaa region, and particularly the Helsinki metropolitan area, form Finland's major political, educational, financial, cultural and research centre. Approximately 70 % of the foreign companies operating in Finland have settled in the Helsinki region. The unemployment rate in the region (7.4 %) is considerably lower than in the rest of the country. Currently less than one per cent of the population work in agriculture. Industry and services account for 18.1 % and 80.4 % of the total employment, respectively. The share of industry has been in constant decline for several decades, which is compensated by the growth in services-related activities. The region accounts for about 38.7 % of the entire GDP of Finland and the GDP per capita (EUR 46,000) is 136 % of the national average (Statistics Finland 2012c).

2.3 Transport aspects

The case study region

The Finnish transport system and transport policies are strongly related to activities of society, industry and business, and again to employment and regional development. The emphasis of the

present policies is on developing emission efficiency and traffic safety, as well as supporting investments. Transport accounts for over 7 % of the GDP. The transport system and its development is funded to the tune of EUR 1.5 billion by the state, while municipalities allocate nearly as much funding. In addition to accessibility effects and direct funding, the construction of transport infrastructure also brings other economic benefits to the regions.

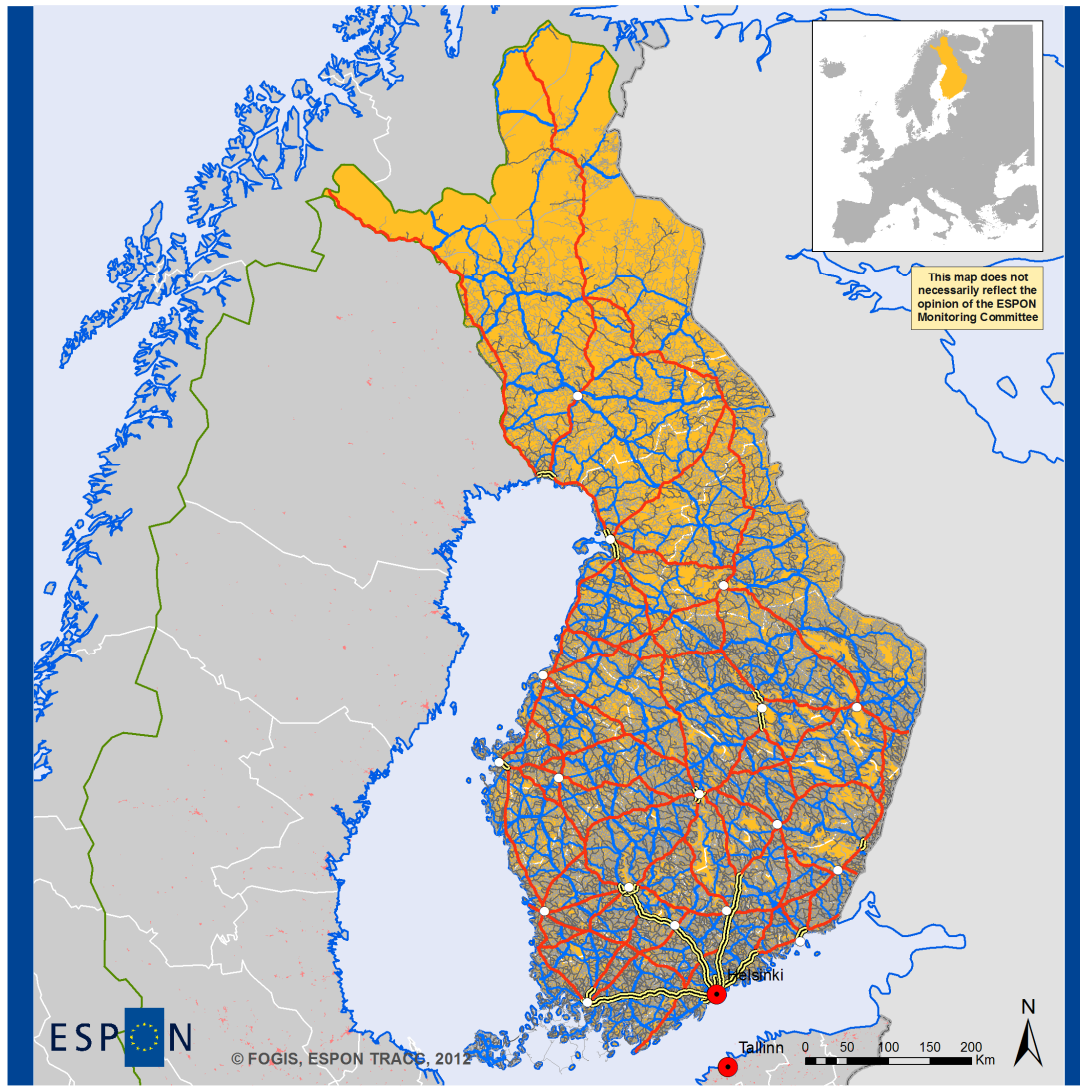
Due to the long transport distances between population centres, private cars dominate the Finnish passenger transport sector. The reasonable bus and coach networks and departure densities are largely restricted to the urban areas, as the demand in the peripheral areas is low. The number of railway stations and the connections provided between them is also quite low, but at least the most prominent urban centres in Finland are served well by fast intercity connections. The extent of the railway network has remained almost unchanged since the early 20th century, the only upgrades involving the construction of shortcut links between some important population centres (the most recent of which being that between Helsinki and Lahti, completed in 2006). The public transit system of Helsinki, involving local train, metro and tram networks, is more extensive than any other city in Finland. Airports cover the country's largest towns quite well and they have an especially important role in the far north. The air transport hub of Finland is Helsinki Airport, comprising 76.6 % of the air transport passengers in 2008. The present transport use of inland waterways is limited to the south-eastern parts of Finland (see e.g. Kotavaara et al. 2012).

The zoom-in regions

Lapland has significantly varying conditions of accessibility and transport in the different parts of the region. The south-western part is well connected to the rest of Finland by road, railway and air connections. The airports in the northern parts of the region improve the domestic and charter-based international tourism accessibility in their surrounding areas. The eastern and western parts of Lapland can also be reached by railway connections. However, long internal distances means that the region is mainly accessible only by road. Two big harbours located in the industrialised south-west part of the region serve the needs of heavy industry. Unlike any other region in Finland, Lapland has trans-border connections to three other countries, but the low population in the northern regions of Sweden, Norway and Russia is a limiting factor to the volume of transports and economic interaction.

The Northern Ostrobothnia region, despite being located far from the main populated centres of Finland, and even further away from Central Europe, can be considered relatively accessible, at least in the national context. Accessibility to the Oulu region is particularly good, not least due to frequently scheduled air connections to the capital city Helsinki, operated by several carriers. In fact, the region has the second biggest airport in Finland by passenger volume. In addition, fast speed trains operate to Oulu, but the current condition of the railway and the congestion of the route reduce their actual benefit. The shortest travel time by train from Oulu to Helsinki is six hours. Railway connections are also provided to many other regional centres, especially in the south, but not as frequently. The Oulu region is also located advantageously with respect to the road network, as the most important highway, extending from Helsinki all the way to the northernmost tip of the country, runs through the Oulu region.

Due to its position as the capital of Finland since the early 19th century, Helsinki and its surrounding region is well connected to the rest of the country by roads, railways and air traffic. The railway network in particular has been designed to connect Helsinki efficiently to the regional centres around the country. The region includes the main international airport of Finland, located remotely from Central Europe, but serving as an important connection hub between Europe and East Asia. The most important port of Finland is also located in the region. In addition to very busy freight traffic, passenger ferries operate mostly to Stockholm in Sweden and Tallinn in Estonia. Domestic passenger traffic by sea is, however, almost non-existent.




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Finland Case Study Road network








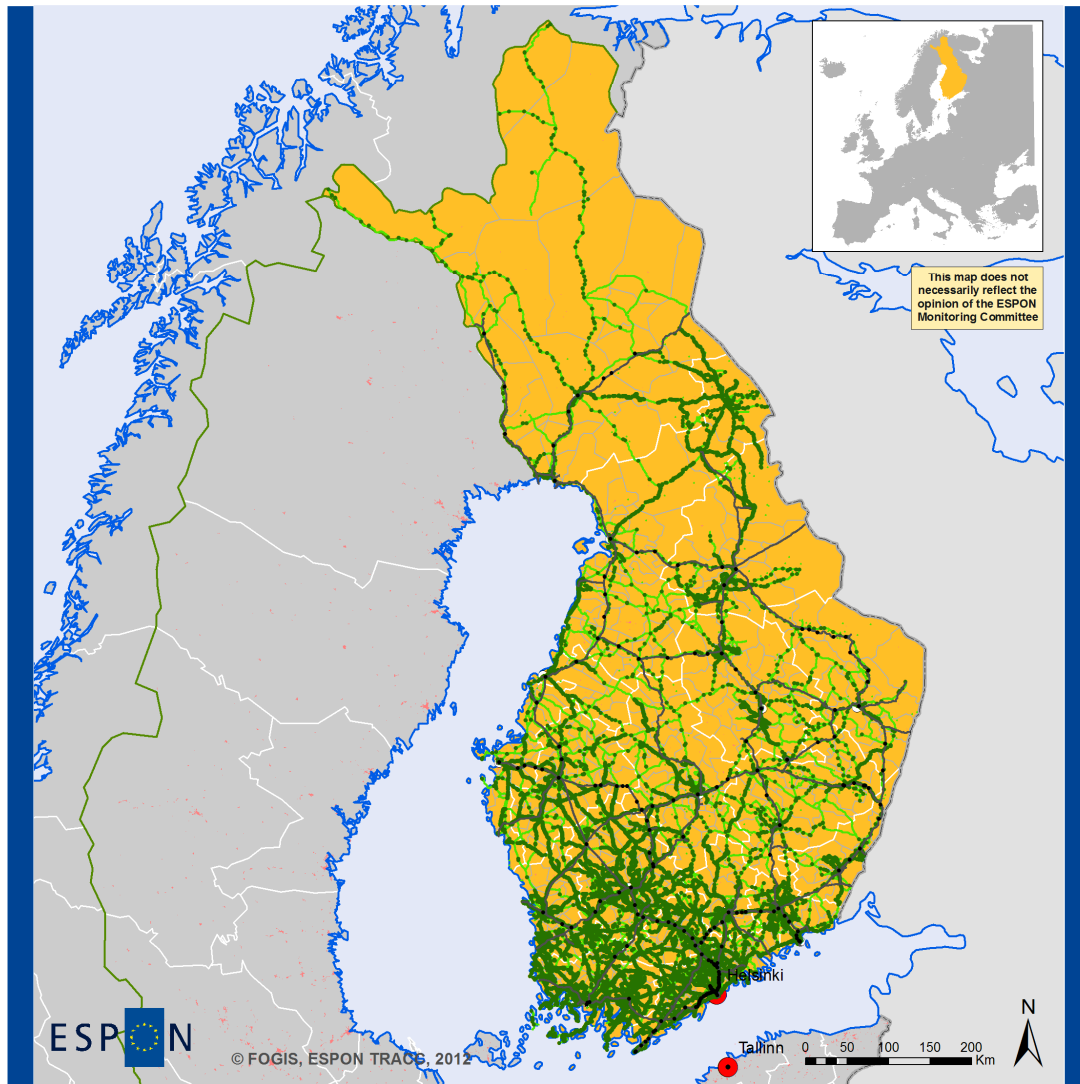
- | | |
|---|--|
|  Motorways |  Settlement area |
|  Primary roads |  Macro region: municipalities |
|  Secondary roads |  Main city |
|  Tertiary roads | |
|  Local roads | |
|  Other roads | |

Figure 4. Road network



Data source: Finnish Transport Agency, 2012, Statistics Finland, 2011, 2010, Oy Matkahuolto Ab, 2012
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Finland Case Study Public transport network

- | | | | | | |
|---|------------|---|------------------|---|------------------------------|
| — | Railways | • | Railway stations | ■ | Settlement area |
| — | Bus routes | • | Bus stops | ■ | Macro region: municipalities |
| | | ○ | Main city | | |

Figure 5. Public transport network

3 Accessibility patterns at regional and local scale

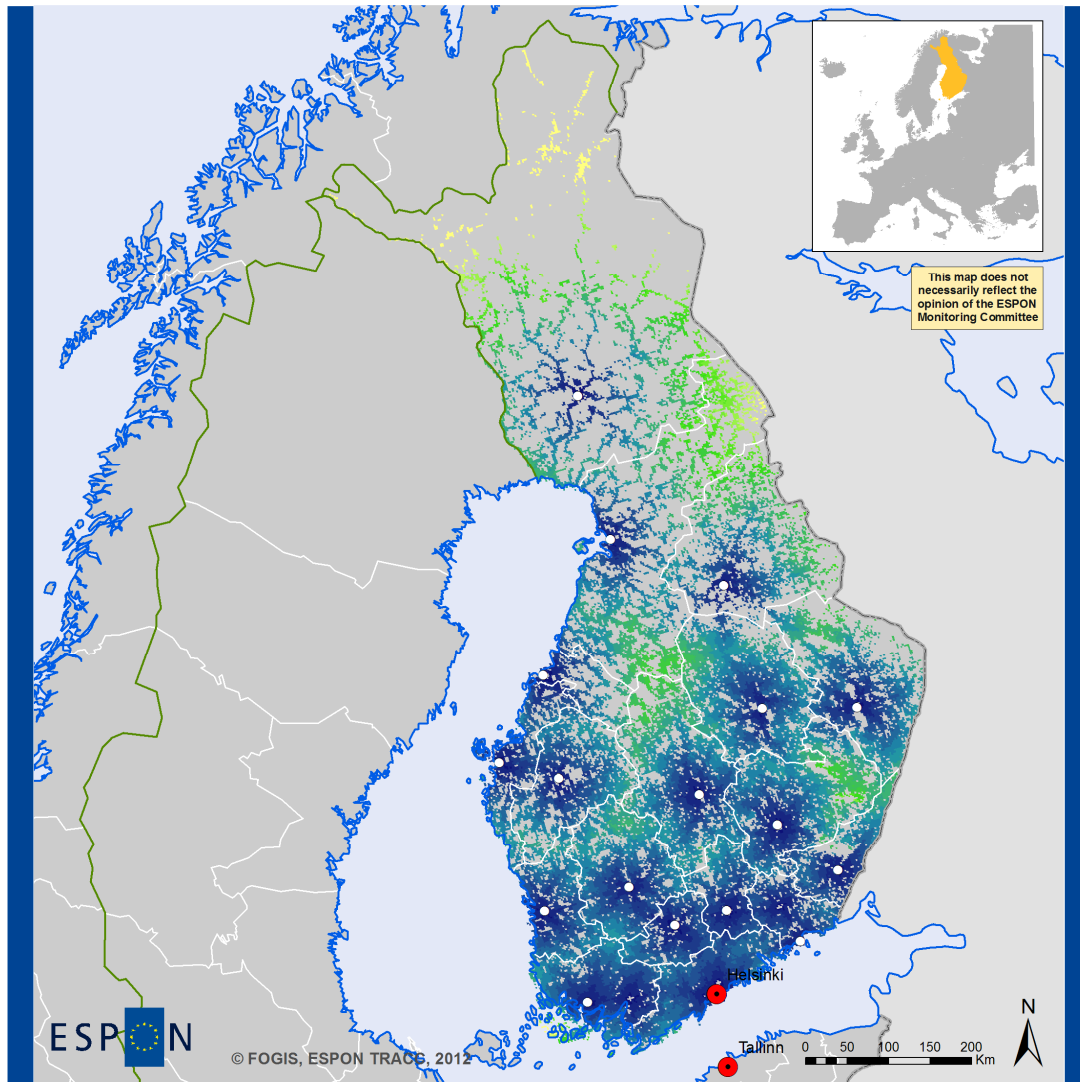
3.1 Access to regional centres

Finland has a wide range of different types of population centres, from a few sprawling cities to numerous small rural villages surrounded by active agricultural areas and intermediate or deep peripheries. Thus, travel times to Finnish regional centres vary remarkably. Most of the population can reach regional centres well, as almost 50 % of the population live in municipalities located within 30 minutes of the next regional centre (Figures 6a and 6b). In contrast, remote peripheries exist in Central and Eastern Finland, where the travel time to the next regional centre is mainly over 60 minutes, and particularly in northern Finland, where the travel time may be over three hours. In southern Finland, accessibility to centres is more consistent with travel times mostly below 60 minutes.

With public transport, travel times to regional centres increase remarkably in comparison to travel by car (Figures 7a and 7b). The public transport system is efficient in and between urban densities and in their immediate surroundings. The regional centres, as well as the cities in southern Finland, have moderate accessibility with a 60-minute travel time, but even in southern Finland there are peripheries between cities in terms of accessibility by public transport. The grid-based assessment in particular shows that travel times of over two hours in central and eastern Finland are common. The regions in northern and north-eastern Finland are particularly distant to regional centres. Therefore, the passenger car is the only reasonable transport mode in these areas, and when public transports are made available, they rely on subsidies and other special arrangements.

The spatial differences in the travel times from municipalities to regional centres are also clearly visible in the box plot diagram, where the accessibility of centres is considered with the NUTS-3 level ESPON typology (Figure 8). The average travel time of total population to centres by car is less than 30 minutes. The majority of the Finnish population is located in centres in areas classified as urban, but there is also a considerable population in rural centres. Thus, the difference between the average accessibility by car in urban (below 20 minutes) and rural (approximately 40 minutes) areas is not high. However, the deviation of accessibility is remarkable as far as the whole country is concerned. In all five classes of typology based on the NUTS-3 regions, accessibility is at a very good level in the proximity of regional centres, but a remarkable increase in the deviation of accessibility can be noted in rural areas. Thus, it is important to differentiate active rural areas and peripheries, even though both may have an emphasis on agriculture and share similarities in the population structure.

In Uusimaa, which is the only urban NUTS-3 region in Finland in terms of the ESPON typology, almost 85 % of the population can reach the regional centre by car in half an hour, while only about half of the population in the rural regions can manage the same (Figure 9). Travel times to the centres by public transport are consistently longer than by car, and travel times by public transport are cumulatively longer when more peripheral areas are in question.



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Finland Case Study Travel time by car to next regional centre (raster level)

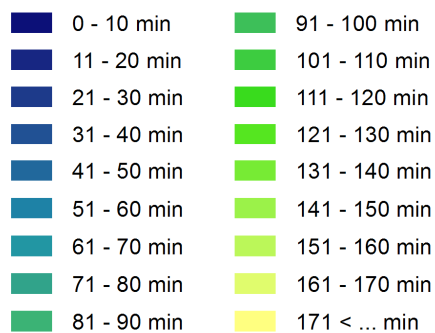
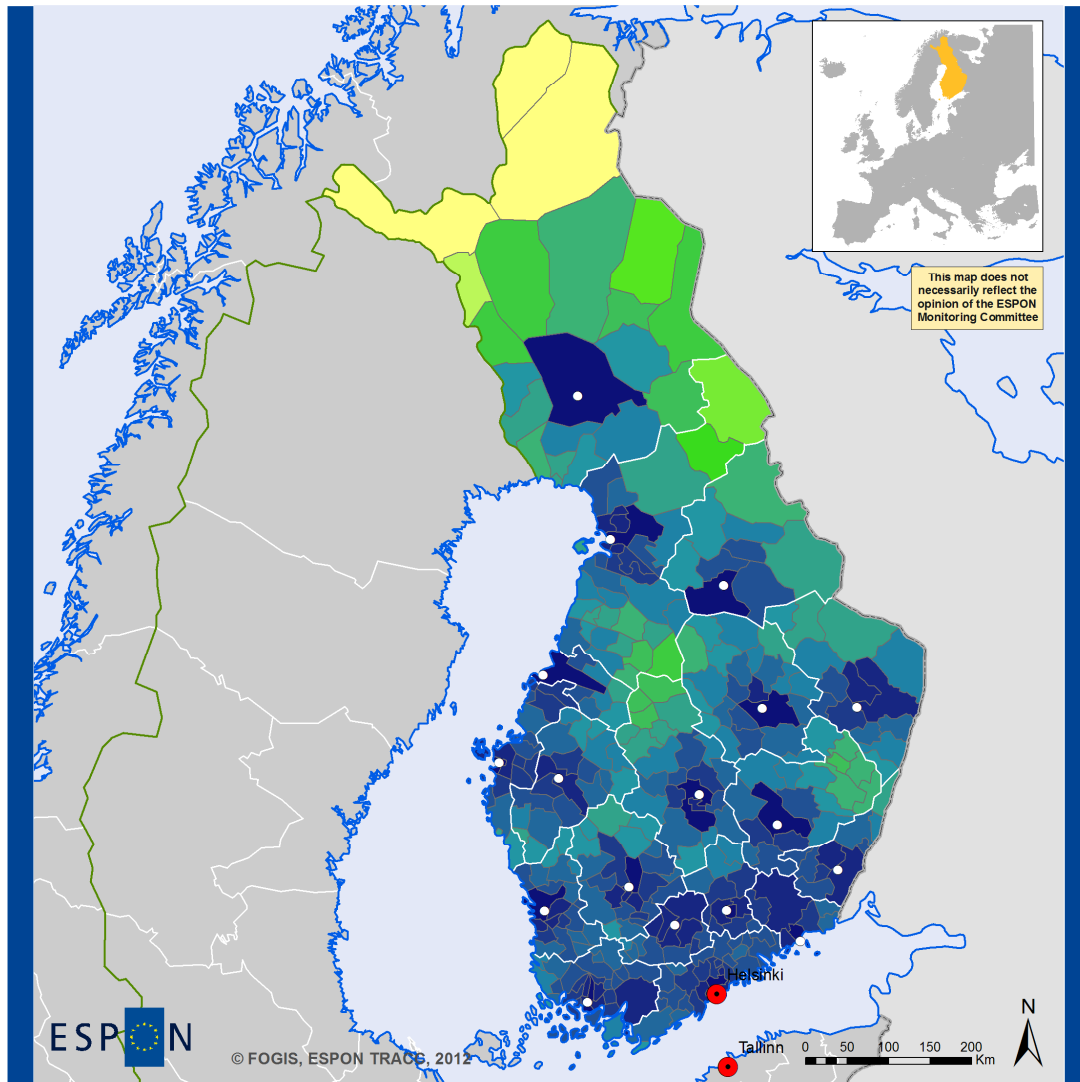


Figure 6a. Travel time by car to next regional centre



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Finland Case Study Travel time by car to next regional centre (municipality averages)

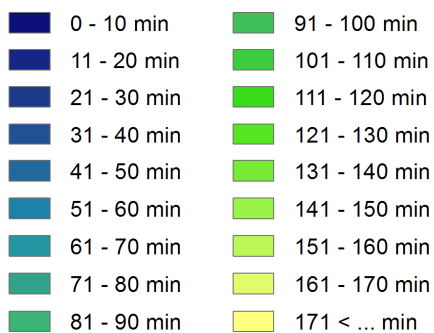
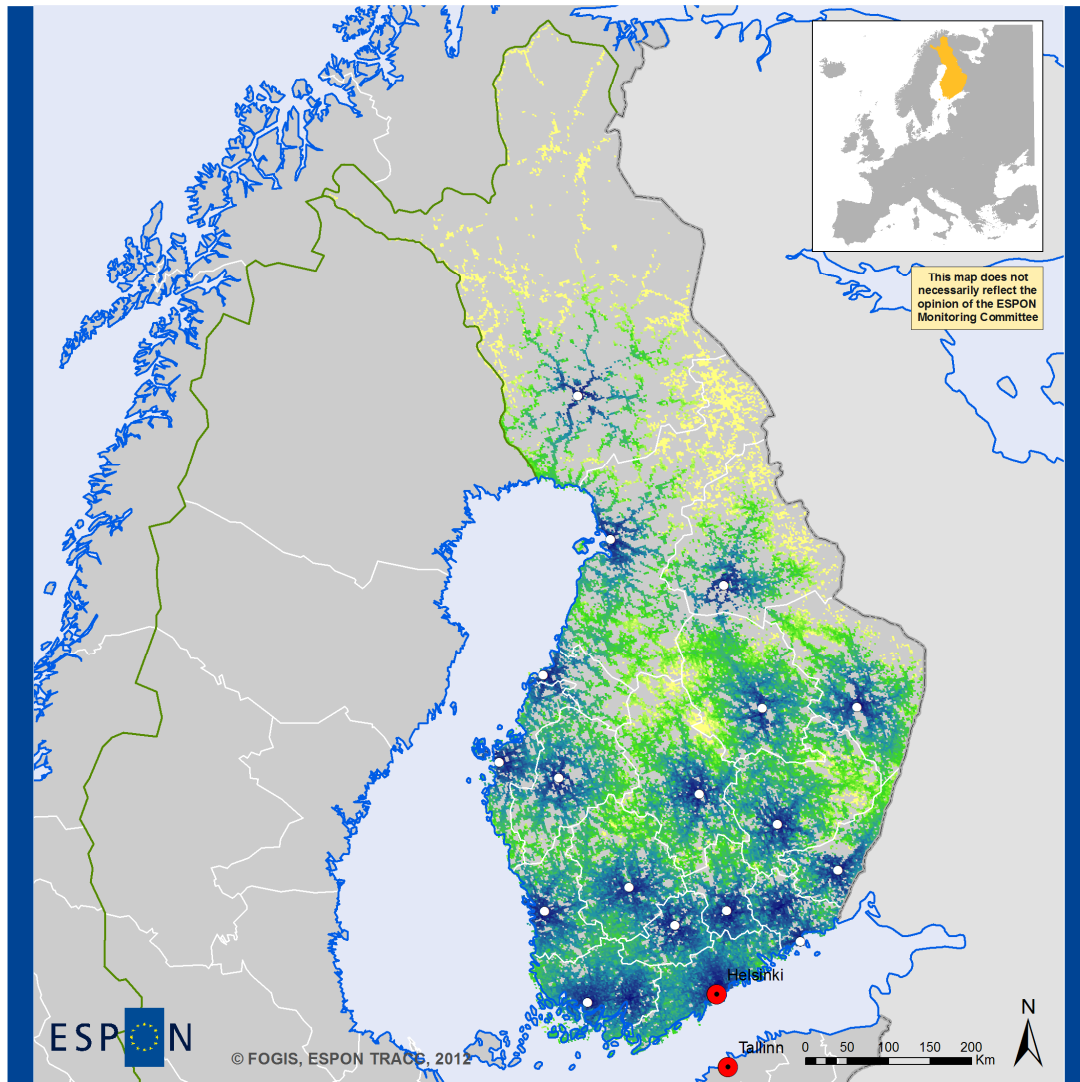


Figure 6b. Travel time by car to next regional centre



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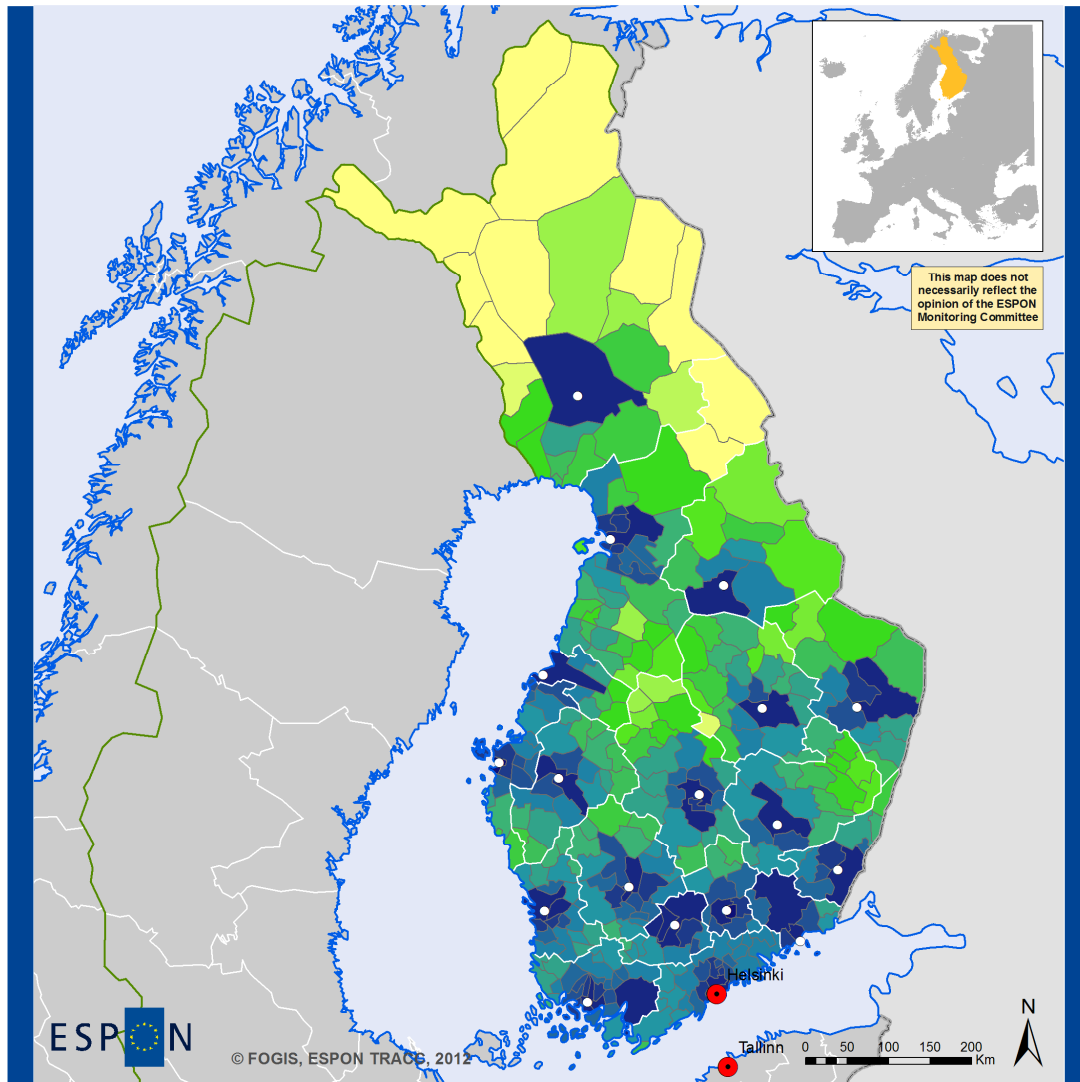
Data source: Finnish Transport Agency, 2012, Statistics Finland, 2011, 2010,
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Finland Case Study

Travel time by public transport to next regional centre (raster level)

0 - 10 min	91 - 100 min
11 - 20 min	101 - 110 min
21 - 30 min	111 - 120 min
31 - 40 min	121 - 130 min
41 - 50 min	131 - 140 min
51 - 60 min	141 - 150 min
61 - 70 min	151 - 160 min
71 - 80 min	161 - 170 min
81 - 90 min	171 < ... min

Figure 7a. Travel time by public transport to next regional centre



Finland Case Study

Travel time by public transport to next regional centre (municipality averages)

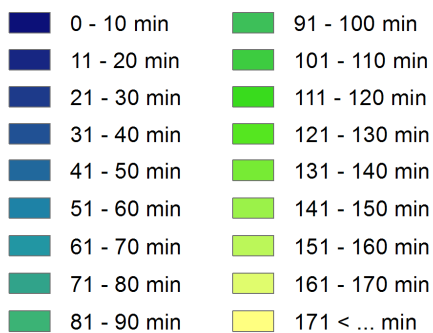


Figure 7b. Travel time by public transport to next regional centre

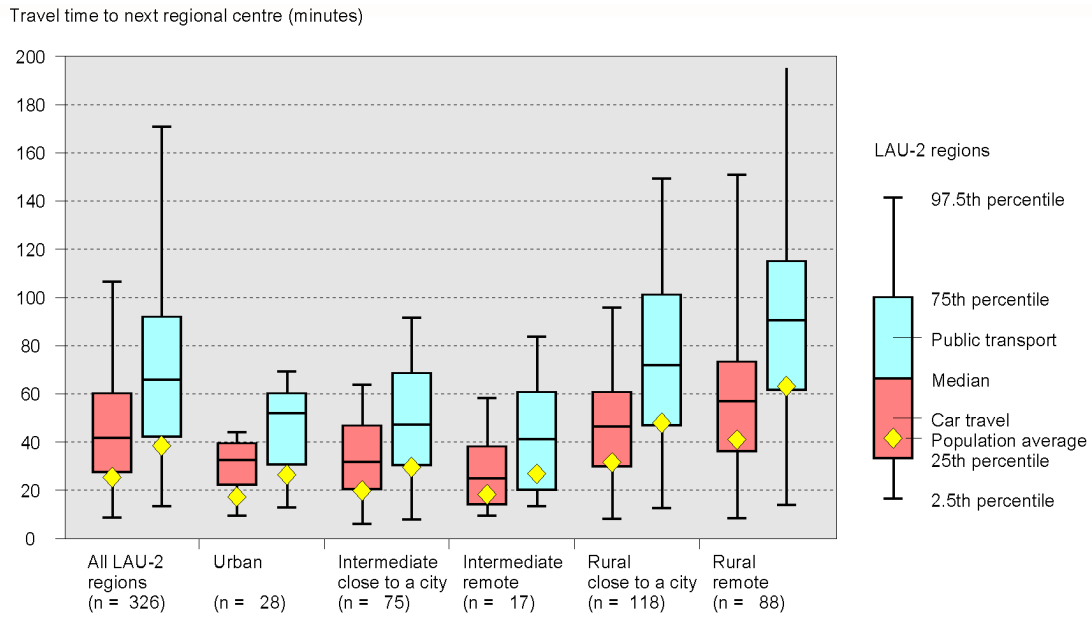


Figure 8. Travel time to next regional centre, by urban-rural typology

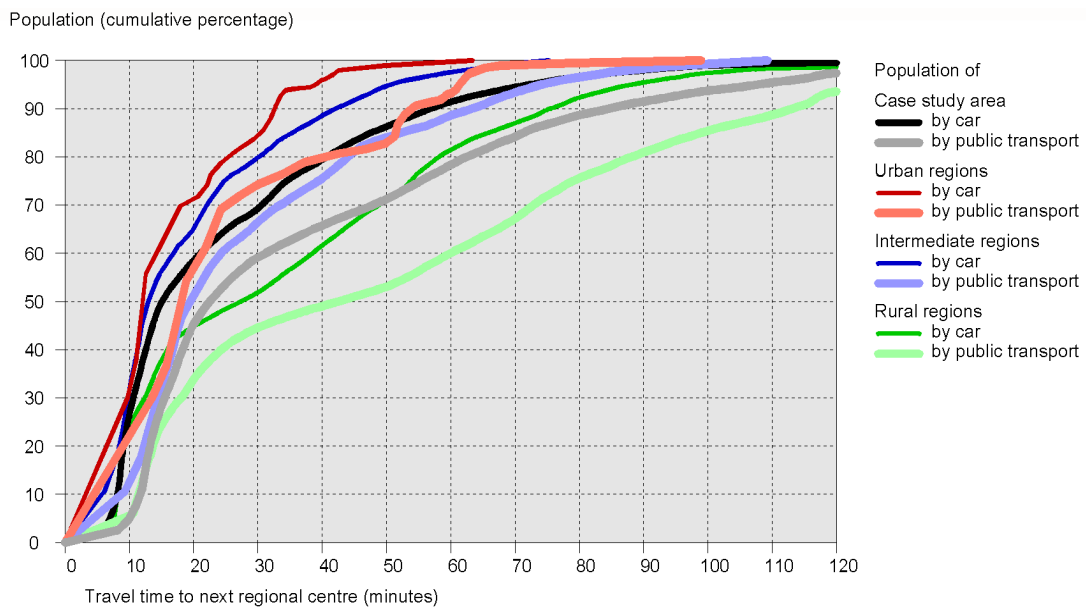


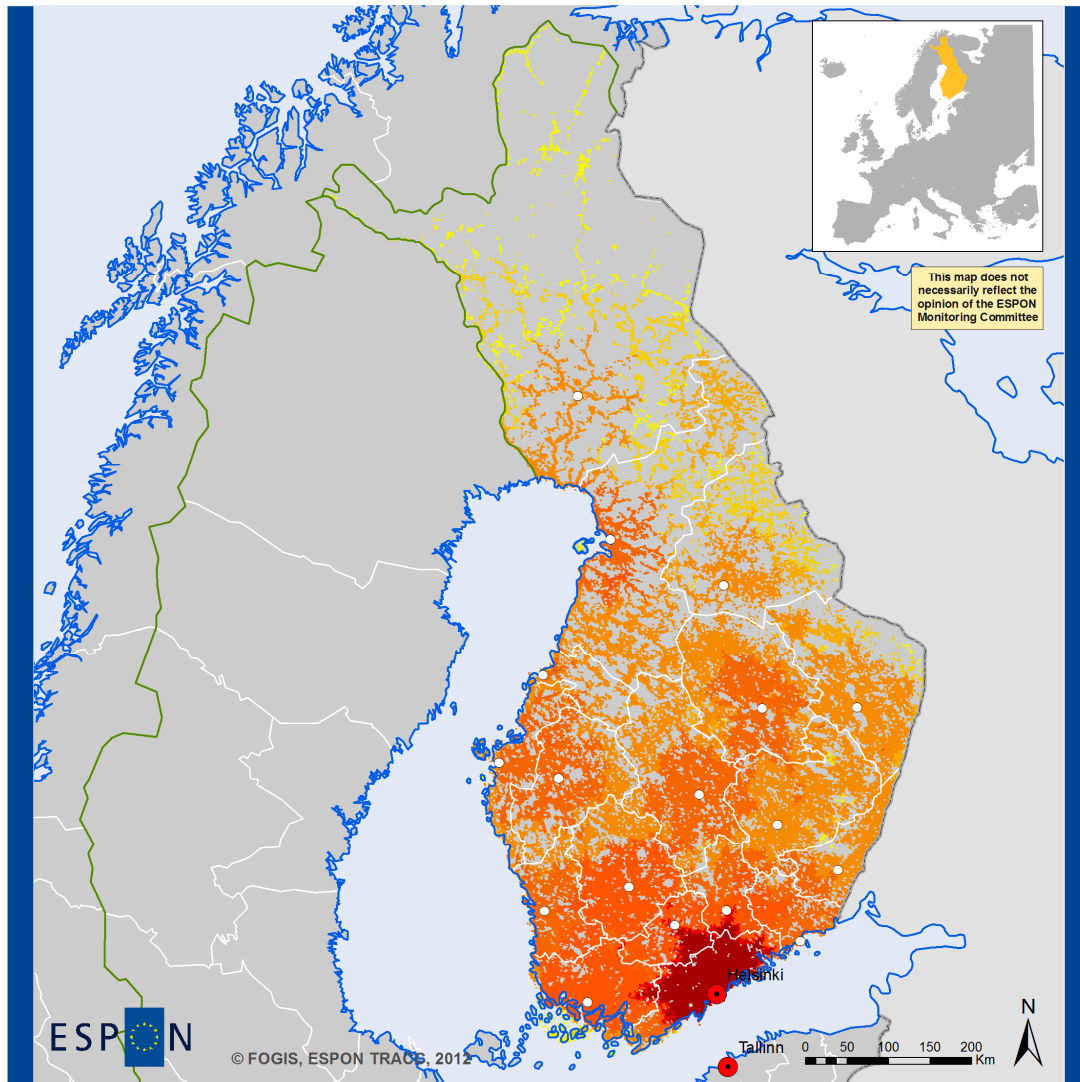
Figure 9. Travel time to next regional centre, cumulative distributions

3.2 Daily accessibility of jobs

The Helsinki metropolitan region has a clear dominance in job accessibility by car (Figures 10a and 10b). This job agglomeration effect reaches far into the surrounding areas via radial motorway connections in all directions. By grid cell analysis it can be visualised that jobs are easily accessible around the regional centres, whereas apparent peripheries exist in central, eastern and particularly in northern areas.

In general, by public transport the accessibility of jobs is considerably lower than that by car. The best accessibility can be found in the capital region (Figures 11a and 11b), but to a more limited extent than by car. The grid cell map shows that public transport-based job accessibility is decent only in the immediate surroundings of the regional centres. In the areas between the cities, accessibility is largely poor. Due to the limited coverage of the bus network, there are large areas with very low accessibility to jobs by public transport, even in the southern part of the country. As the population density outside of centres is low, it is clear that population in these areas may not be served by public transport, due to low demand.

The agglomeration of jobs in the Helsinki region is visible in the urban area class (Figure 12). The average of the region is almost 700,000 accessible jobs, while the values fall below 30,000 at the edge of the region. Intermediate regions close to a city include areas of both good and poor accessibility of jobs, whereas remote and rural areas suffer from poor accessibility to jobs. Hence, it can be concluded that even though the regional centres cover the Finnish population well, there are significant differences in the hierarchy of the centres. The difference between public transport and car accessibility is evident in all types of regions, but in urban and intermediate regions close to a city, areas with good job accessibility by public transport do exist. As for the urban region class, 80 % of the population can reach over 650,000 jobs by car, and over 500,000 by public transport (Figure 13). In the intermediate regions, 100,000 jobs are in the reach of 80 % of population, but in rural areas the corresponding number is only about 5 %.



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Finland Case Study Jobs accessible by car within 60 minutes (raster level)

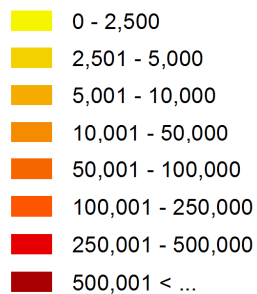
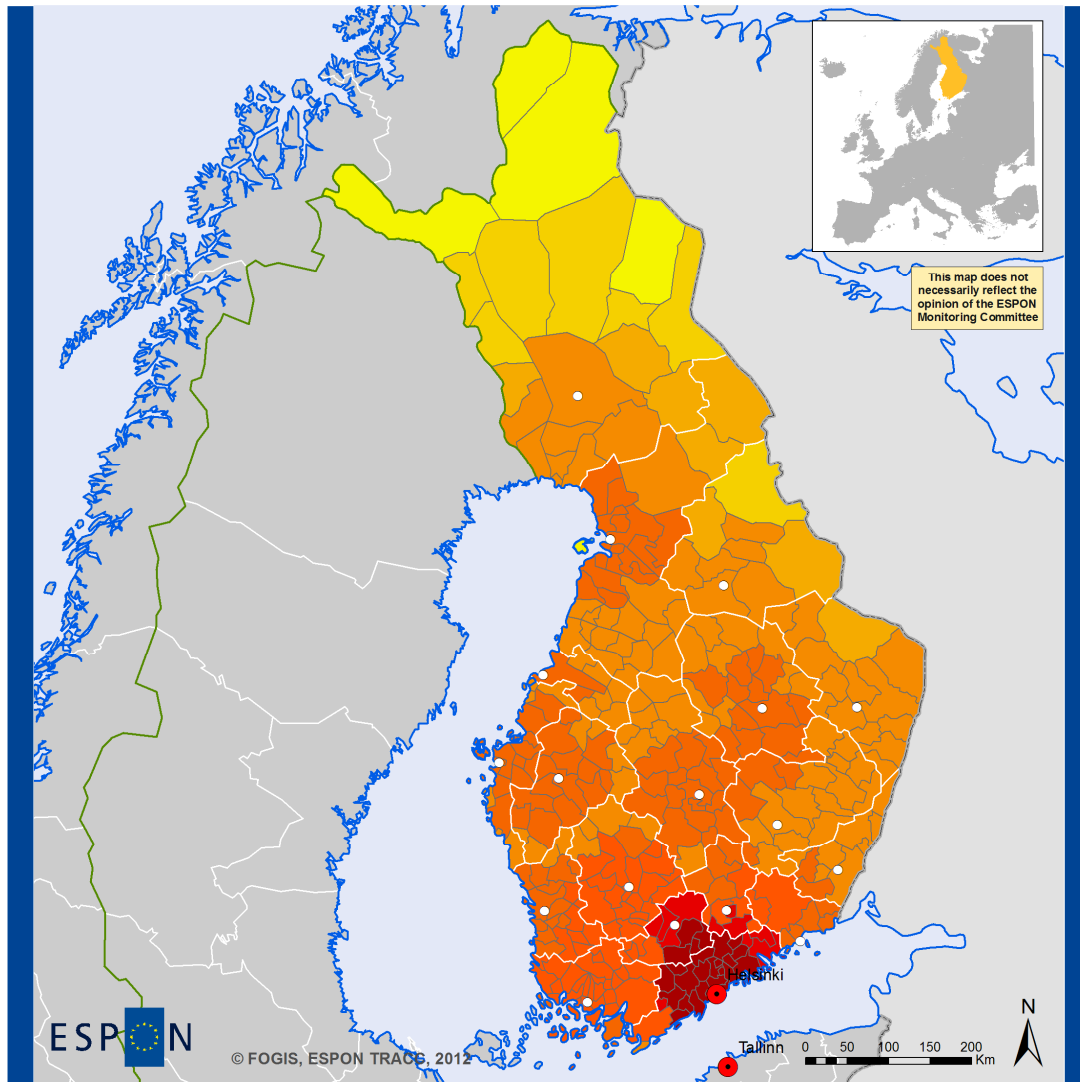


Figure 10a. Jobs accessible by car within 60 minutes



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Finland Case Study Jobs accessible by car within 60 minutes (municipality averages)

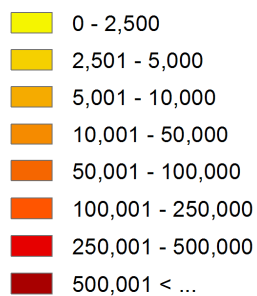
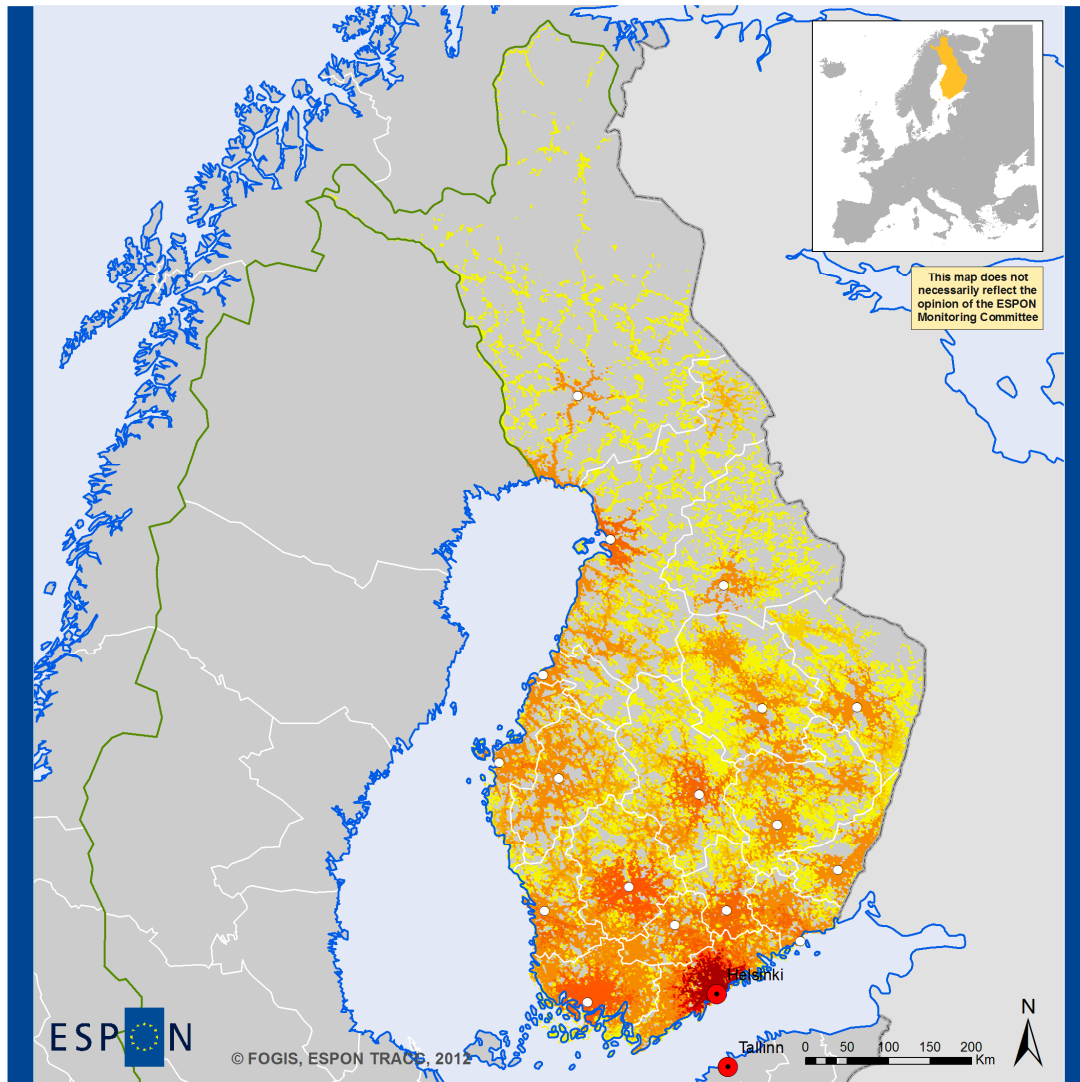


Figure 10b. Jobs accessible by car within 60 minutes



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Jobs accessible by public transport within 60 minutes (raster level)

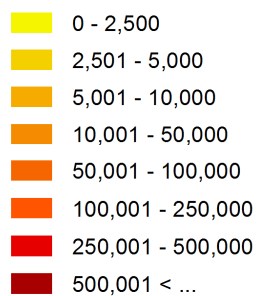
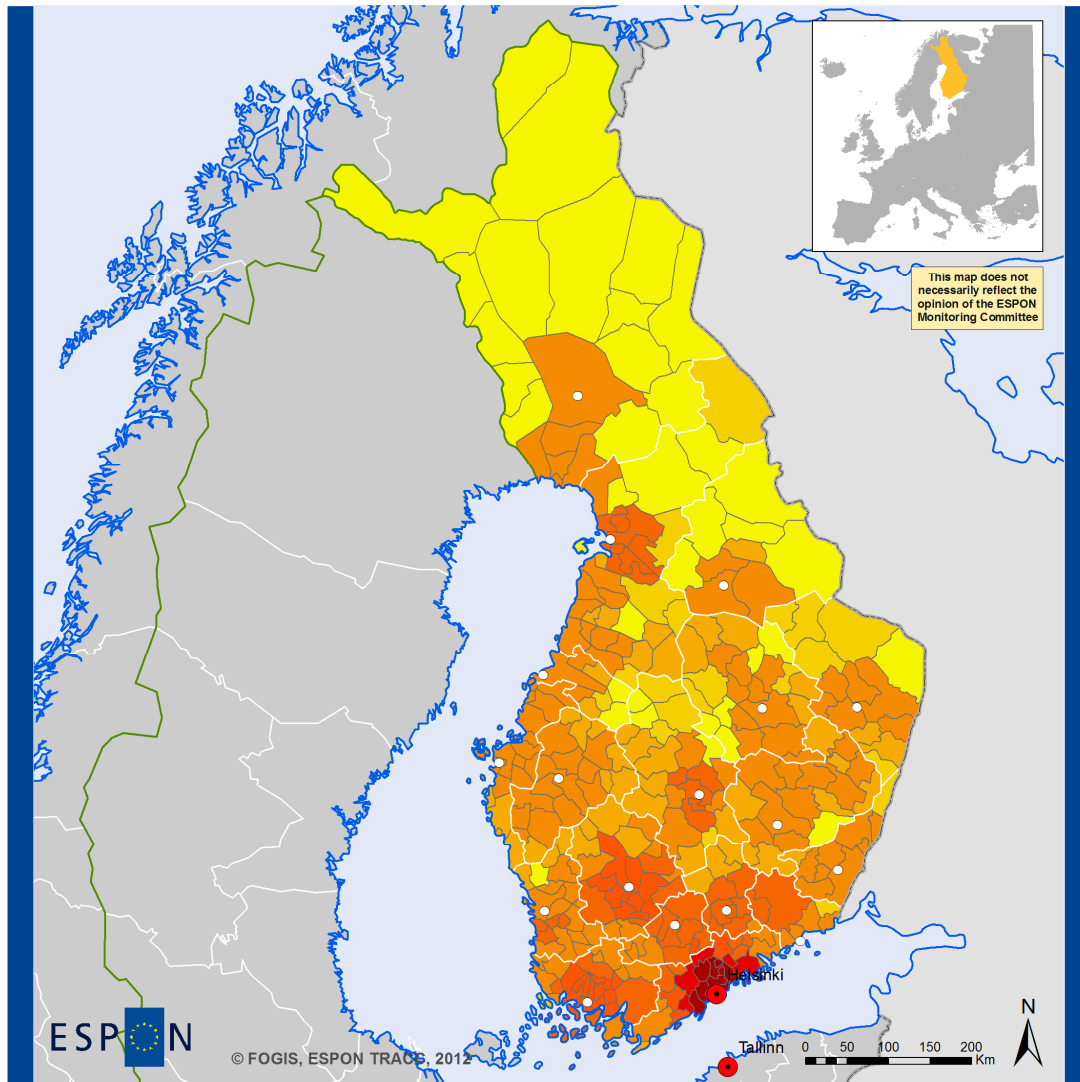


Figure 11a. Jobs accessible by public transport within 60 minutes




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Jobs accessible by public transport within 60 minutes (municipality averages)

- 0 - 2,500
- 2,501 - 5,000
- 5,001 - 10,000
- 10,001 - 50,000
- 50,001 - 100,000
- 100,001 - 250,000
- 250,001 - 500,000
- 500,001 < ...

Figure 11b. Jobs accessible by public transport within 60 minutes

Jobs available within 60 minutes travel time (in 1,000)

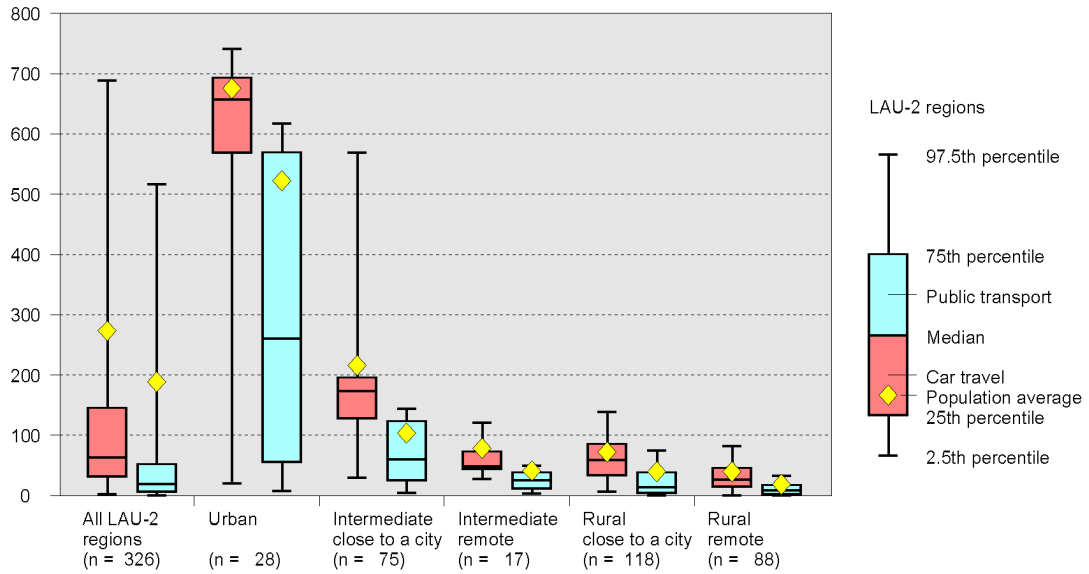


Figure 12. Jobs accessible within 60 minutes, by urban-rural typology

Population (cumulative percentage)

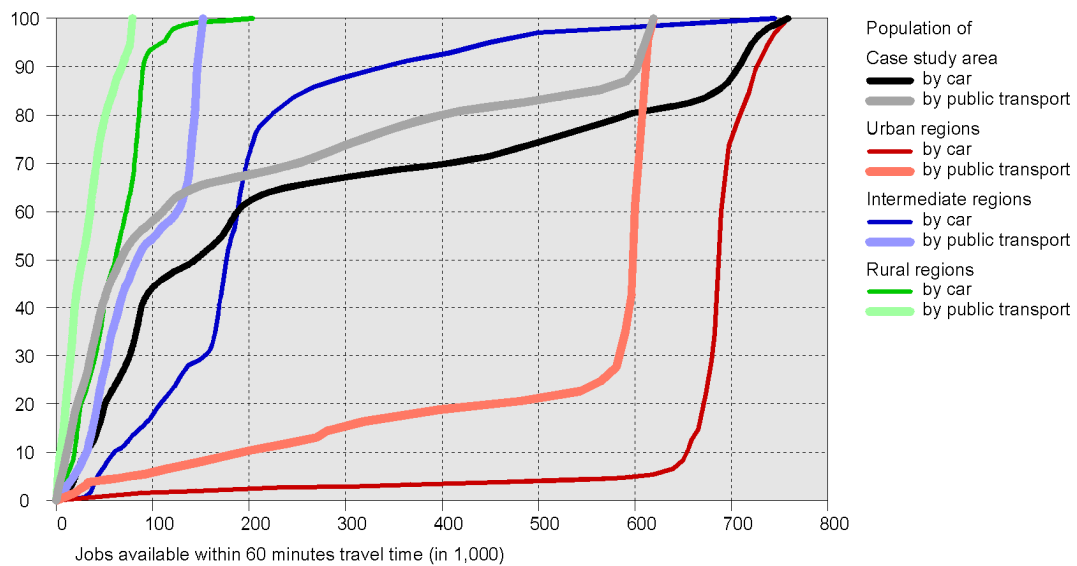


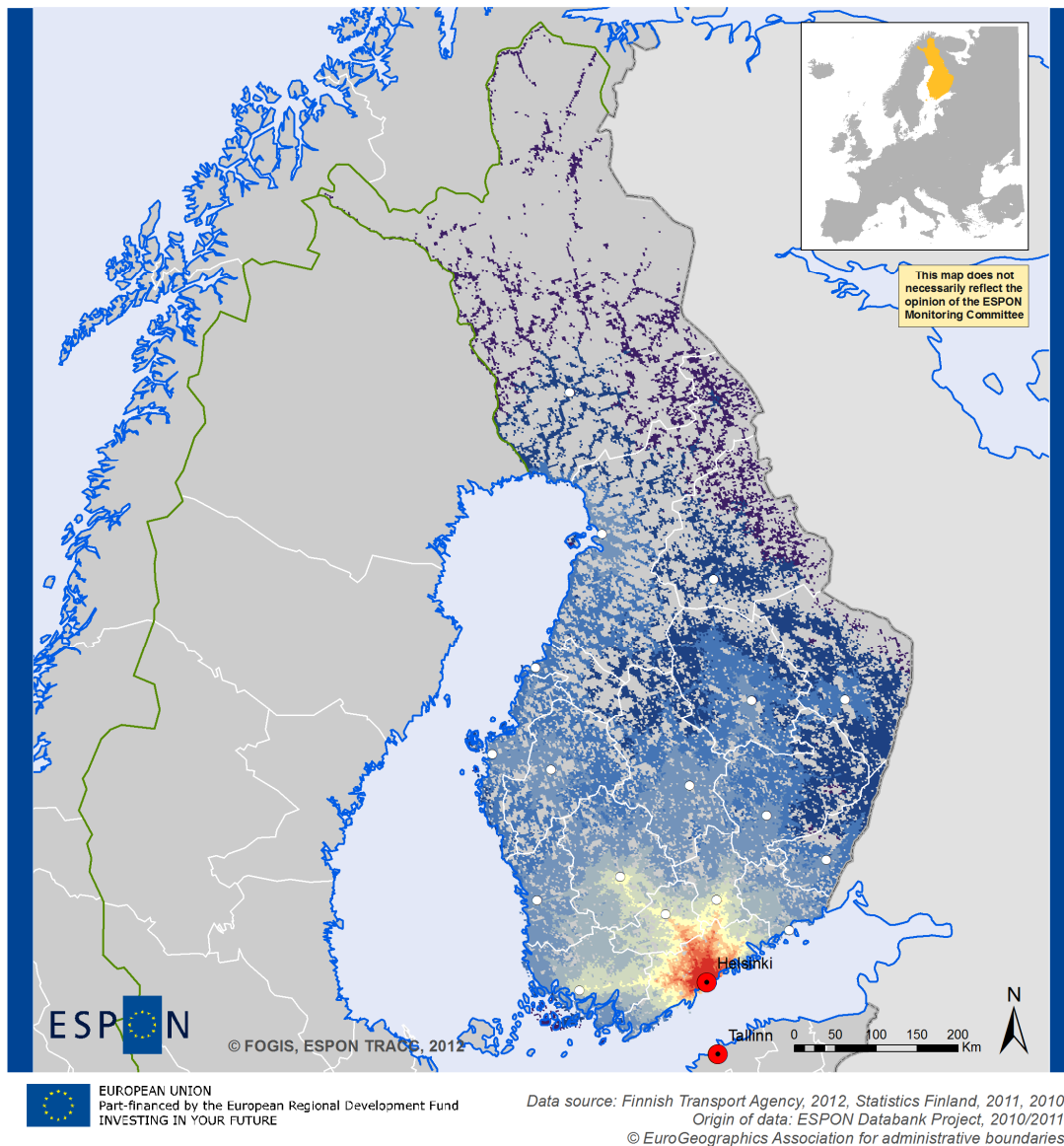
Figure 13. Jobs accessible within 60 minutes, cumulative distributions

3.3 Regional accessibility potential

The dominance of a few cities in the south, particularly the capital region, forms the major pattern in the regional accessibility potentials. The centre-periphery polarisation in Finland is particularly evident (Figures 14a and 14b). Only the accessibility around regional centres is an exception to the pattern in remote peripheries. All municipalities in the Lapland region belong to the most peripheral category. Eastern regions are also characterised by low accessibility. The grid cell analysis also shows the significance of the main roads between the capital and major cities.

Accessibility potentials by public transport are even more polarised than that by car (Figure 15). Absolute values show that car accessibility is generally better, as expected. The Oulu region is in the most accessible class by public transport. By grid cell map it is possible to identify how in terms of land area, most of Finland is poorly accessible by public transport, while the population centres are served pretty well.

The population of urban regions in Finland have an almost 225 % higher average car accessibility potentials than the national average, whereas the rural average potentials are only approximately 20 % of the national average (Figure 16). The box-plots show that the ESPON urban-rural typology works very well in Finland. The average, percentile and median figures of accessibility are in order of magnitude when comparing different urban-rural classes. The trend pertains to both car and public transport accessibility. Again, car travels results in remarkably better accessibilities than travels made by public transport. In the urban areas, over 95 % of the population have higher accessibility than the national car travel average, and almost 80 % of the population may reach the average potential with public transport (Figure 17). In the intermediate regions, over 35 % of the population can reach the car-based average potentials by car, but with public transport the potentials in these areas are below 75 % of the car-based average. In the rural regions the situation is even worse, as the accessibility potential is only about 50 % and 25 % of the car-based average by car and public transport, respectively.



Finland Case Study

Potential accessibility to population by car (raster level)

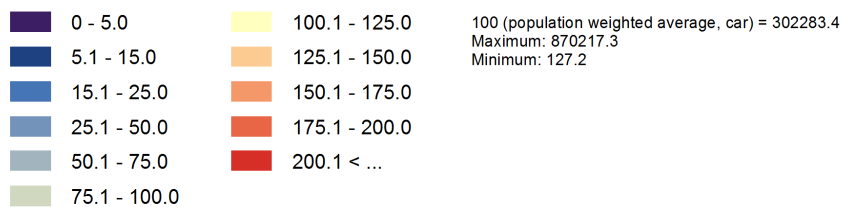
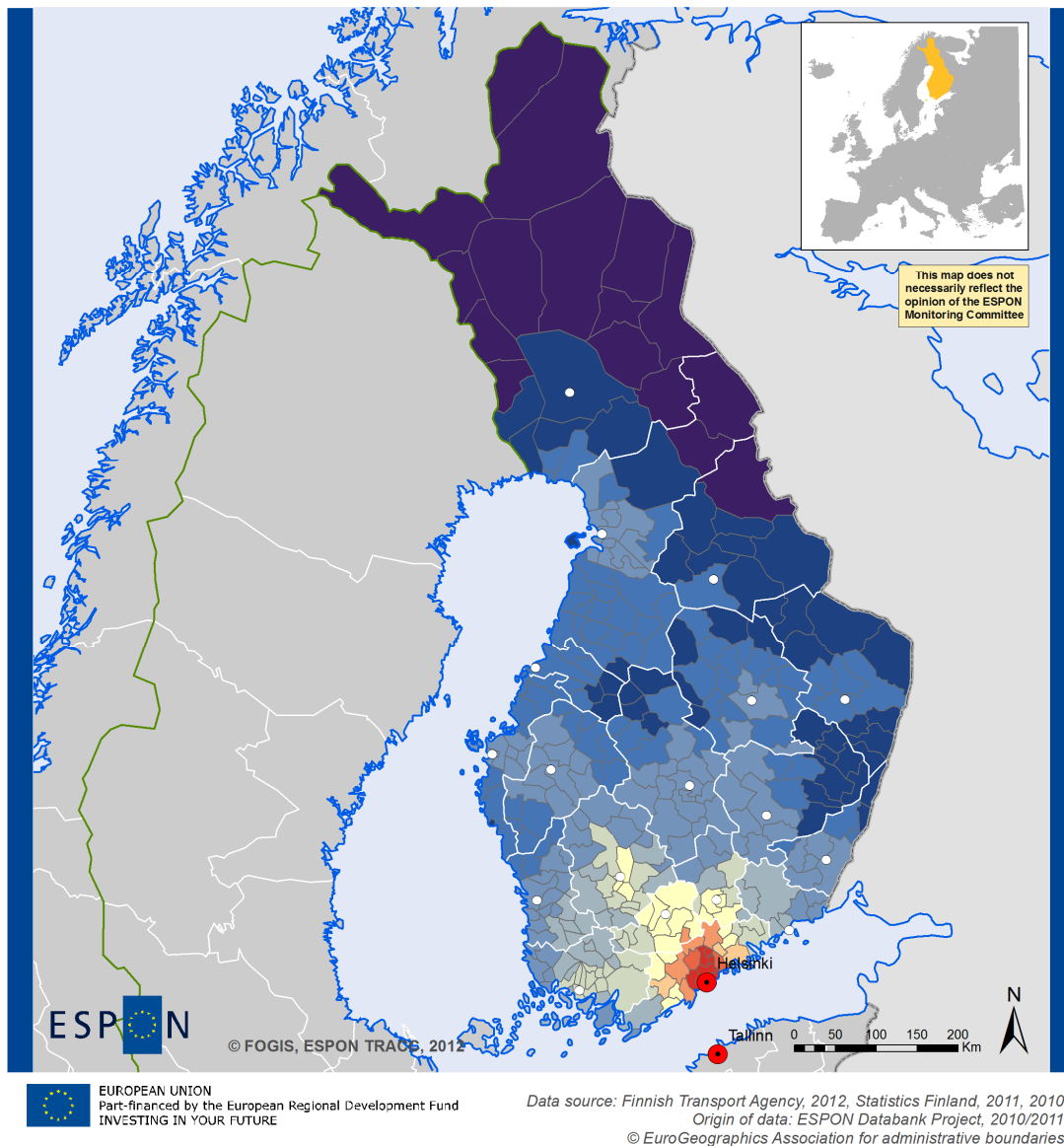


Figure 14a. Potential accessibility to population by car



Finland Case Study Potential accessibility to population by car (municipality averages)

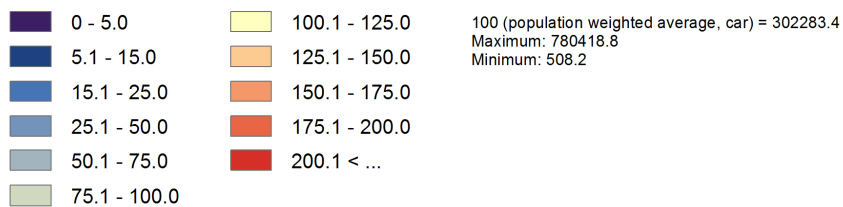
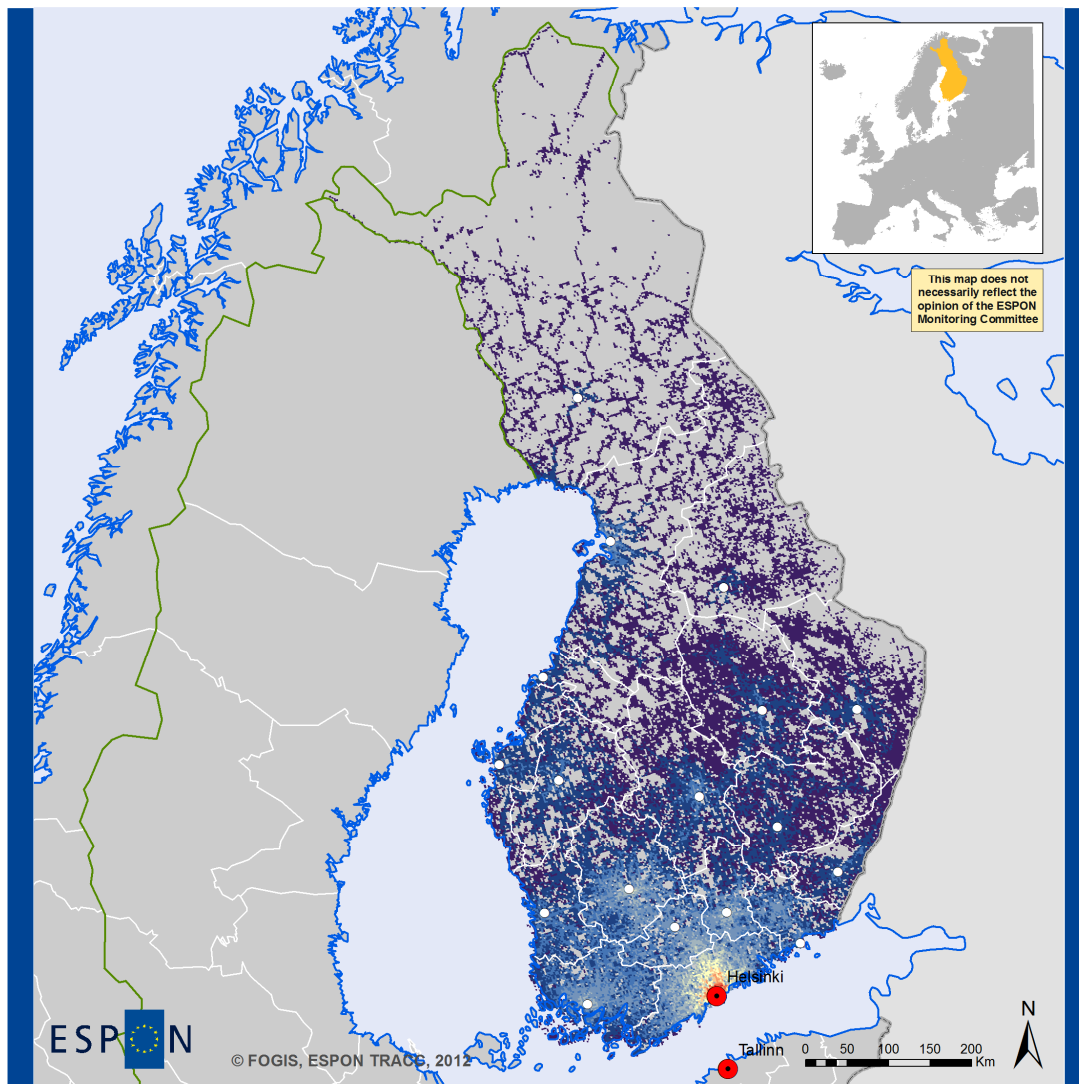


Figure 14b. Potential accessibility to population by car



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Potential accessibility to population by public transport (raster level)

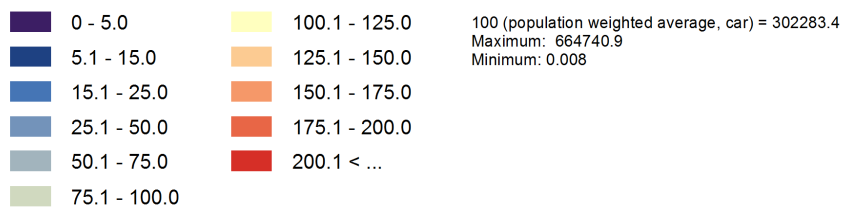
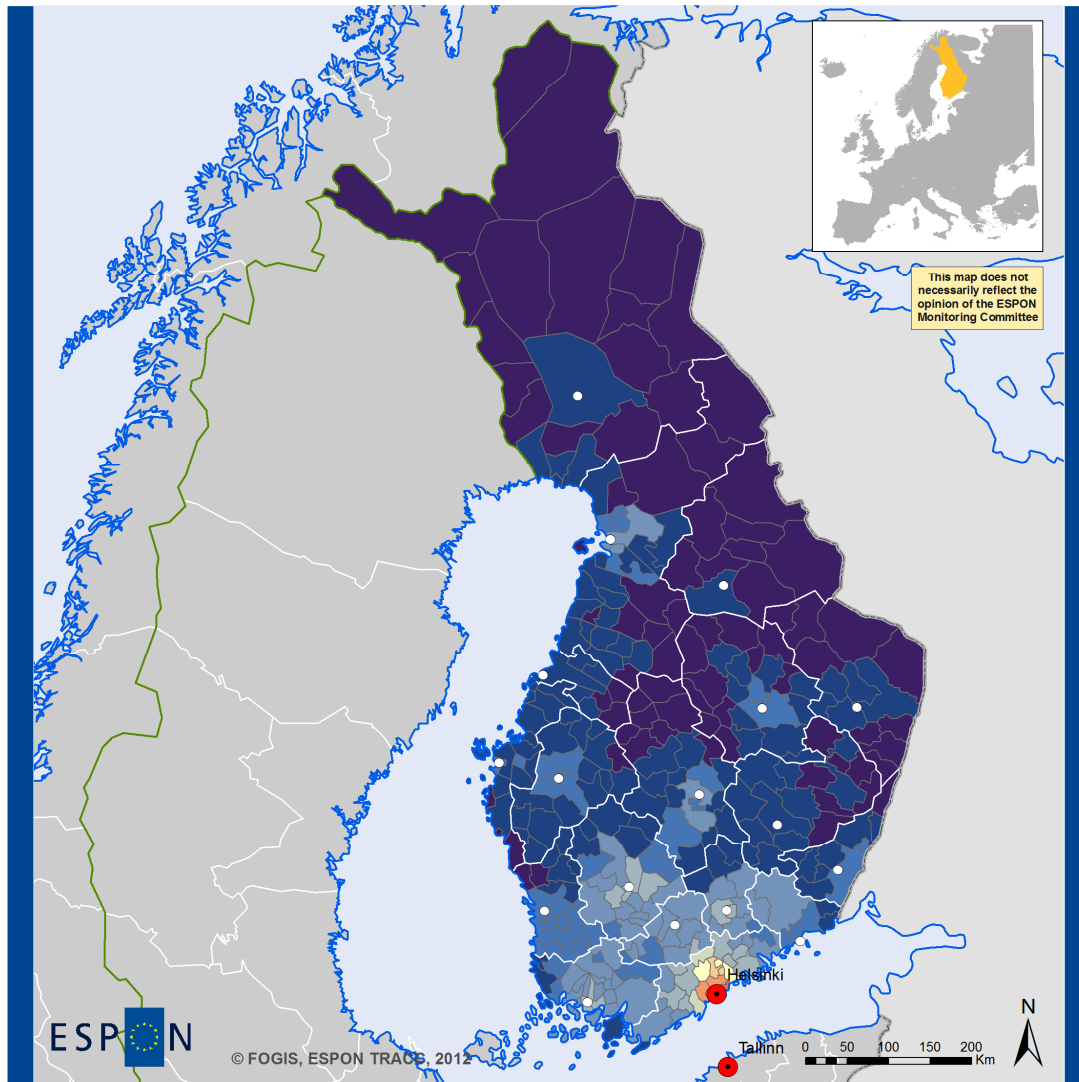


Figure 15a. Potential accessibility to population by public transport (standardised on road average)



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Potential accessibility to population by public transport (municipality averages)

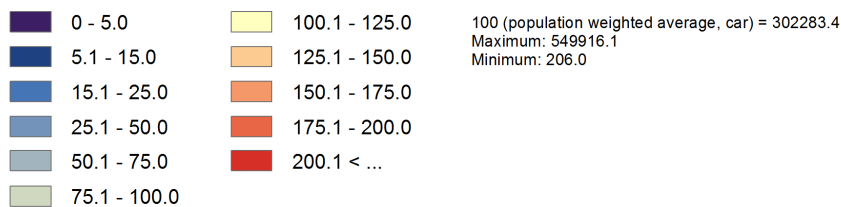
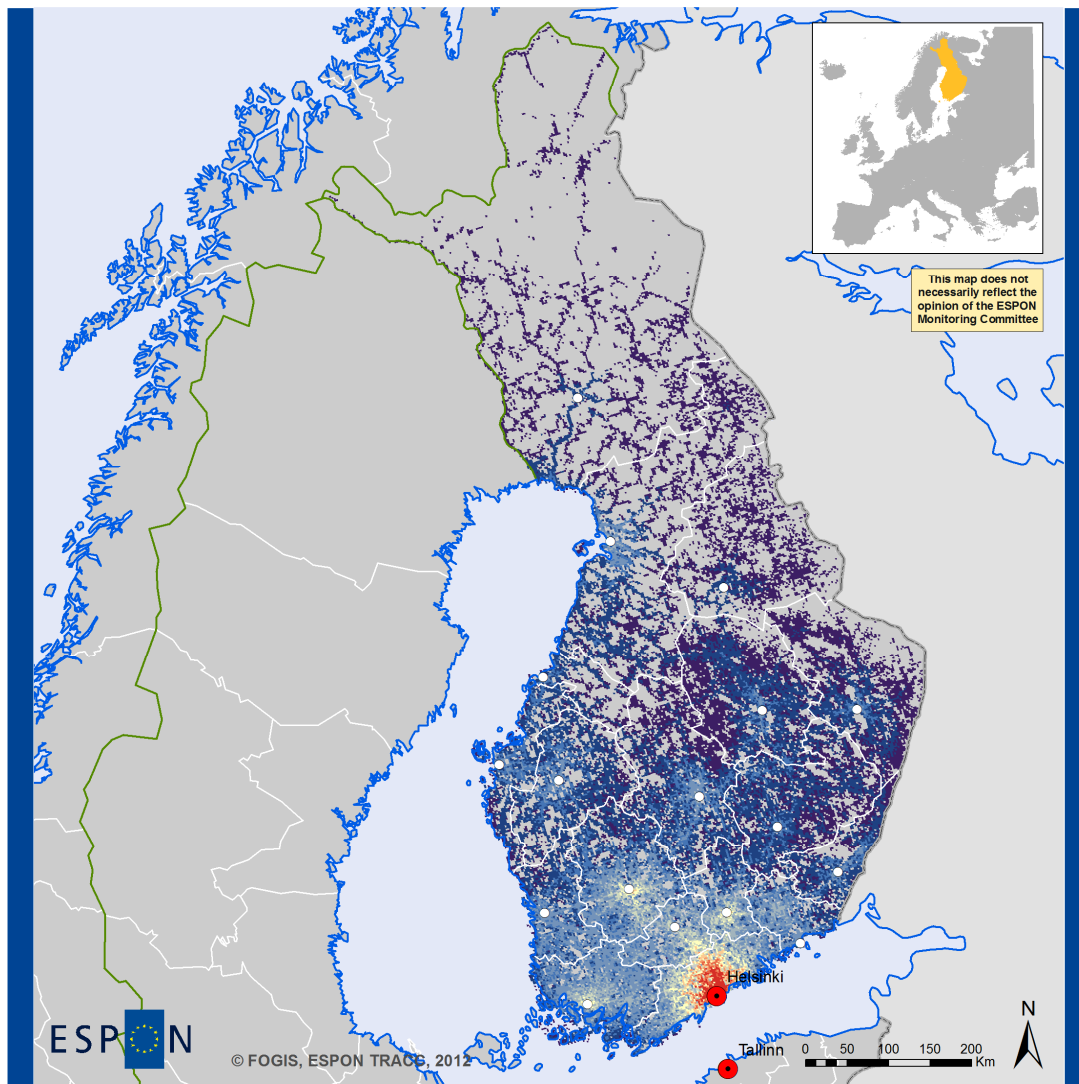


Figure 15b. Potential accessibility to population by public transport (standardised on road average)




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Potential accessibility to population by public transport (raster level)

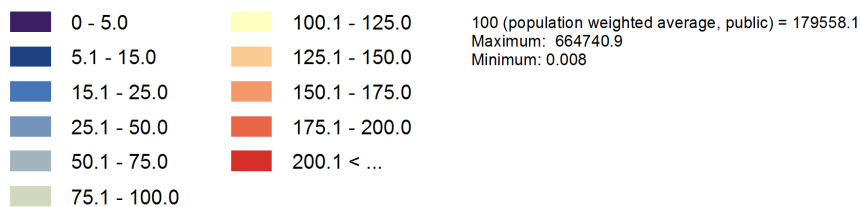
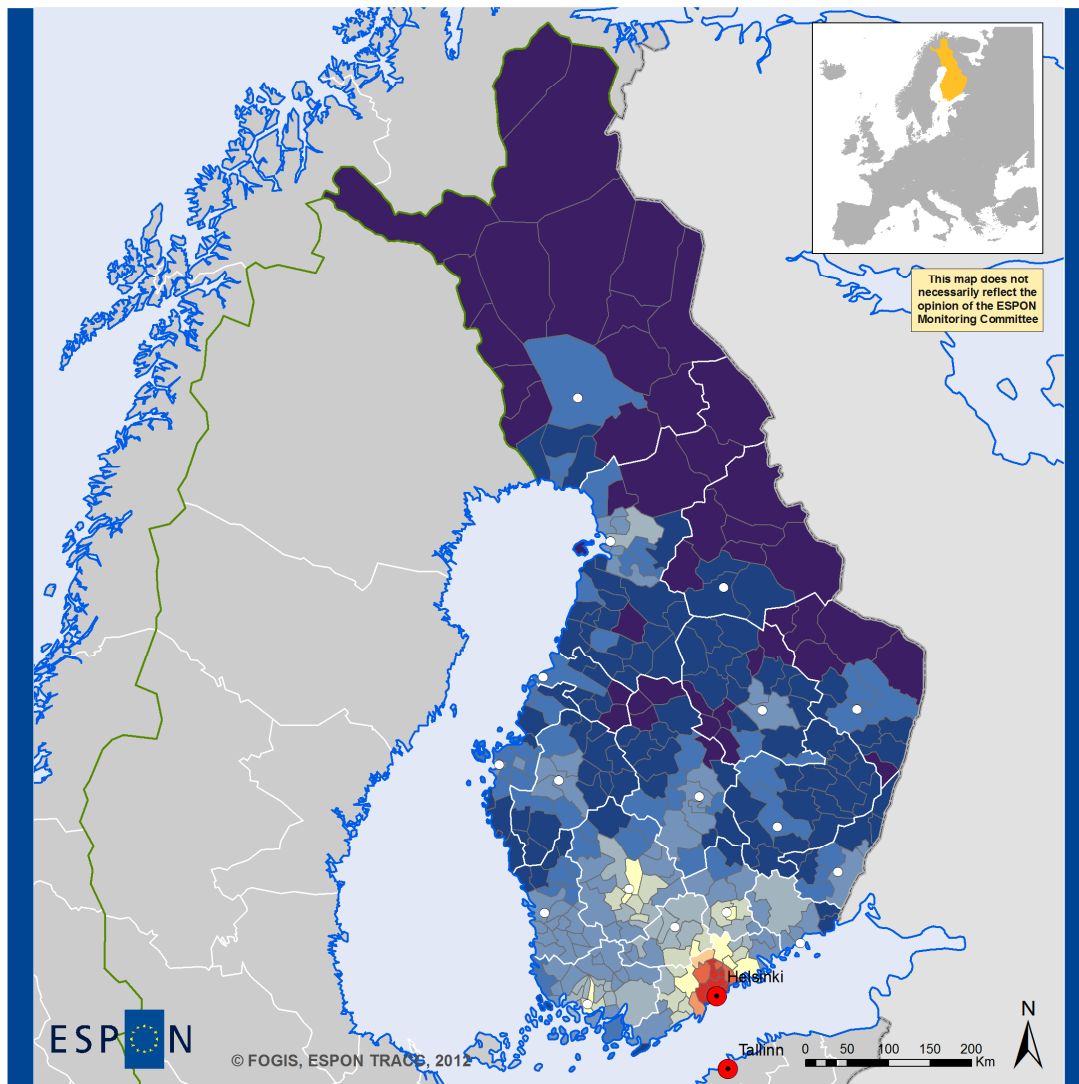


Figure 15c. Potential accessibility to population by public transport (standardised on public transport average)



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Potential accessibility to population by public transport (municipality averages)

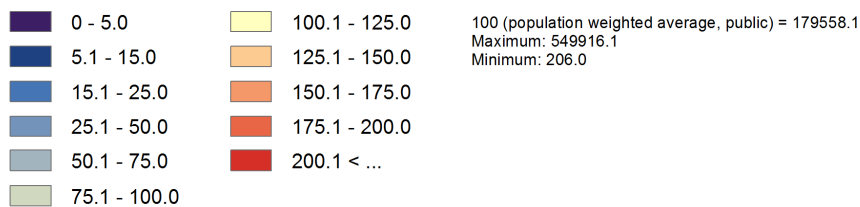


Figure 15d. Potential accessibility to population by public transport (standardised on public transport average)

Potential accessibility to population (car average = 100)

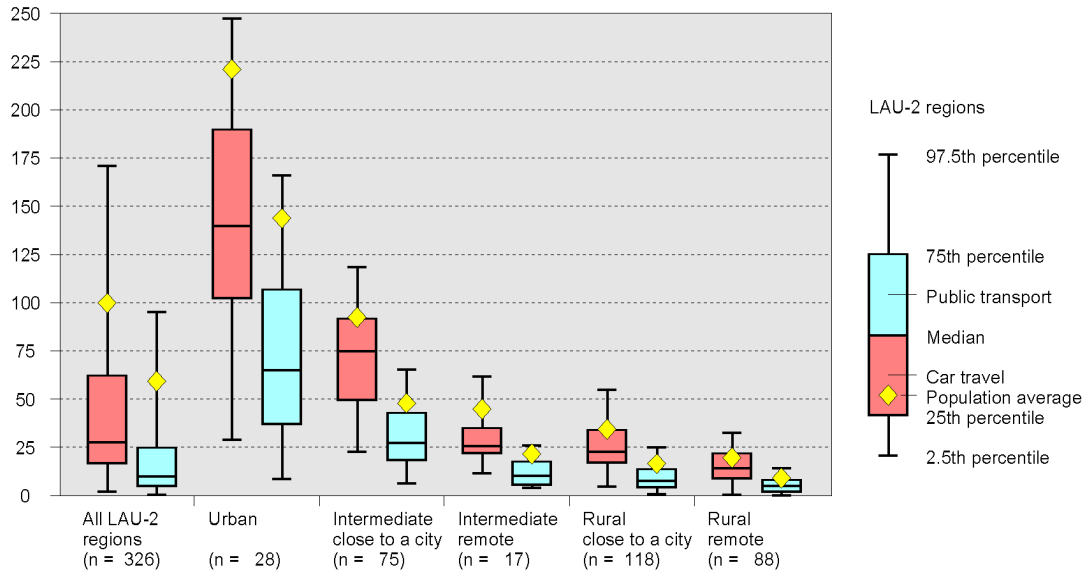


Figure 16. Potential accessibility to population, by urban-rural typology

Population (cumulative percentage)

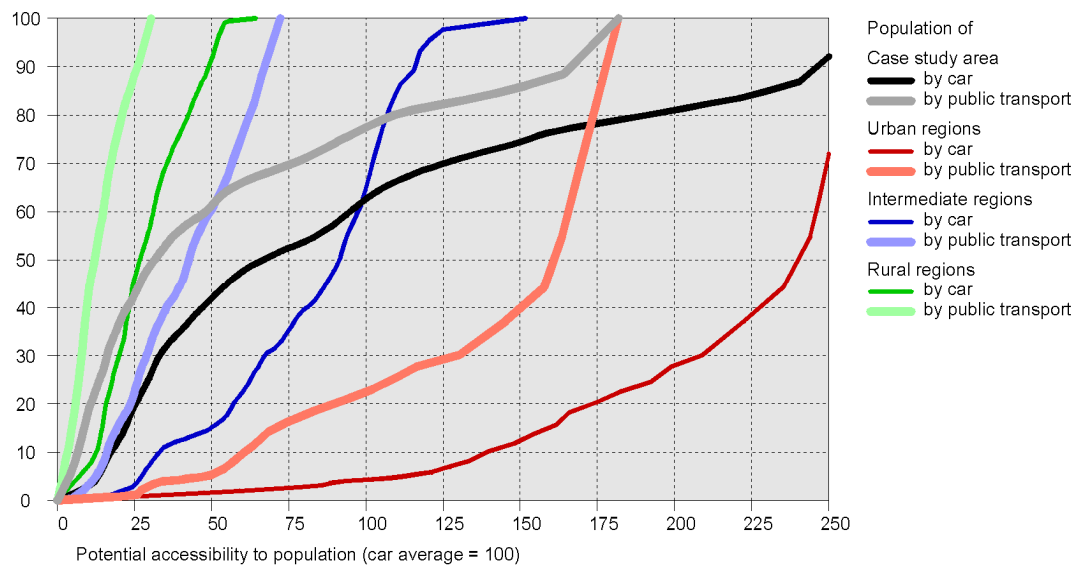


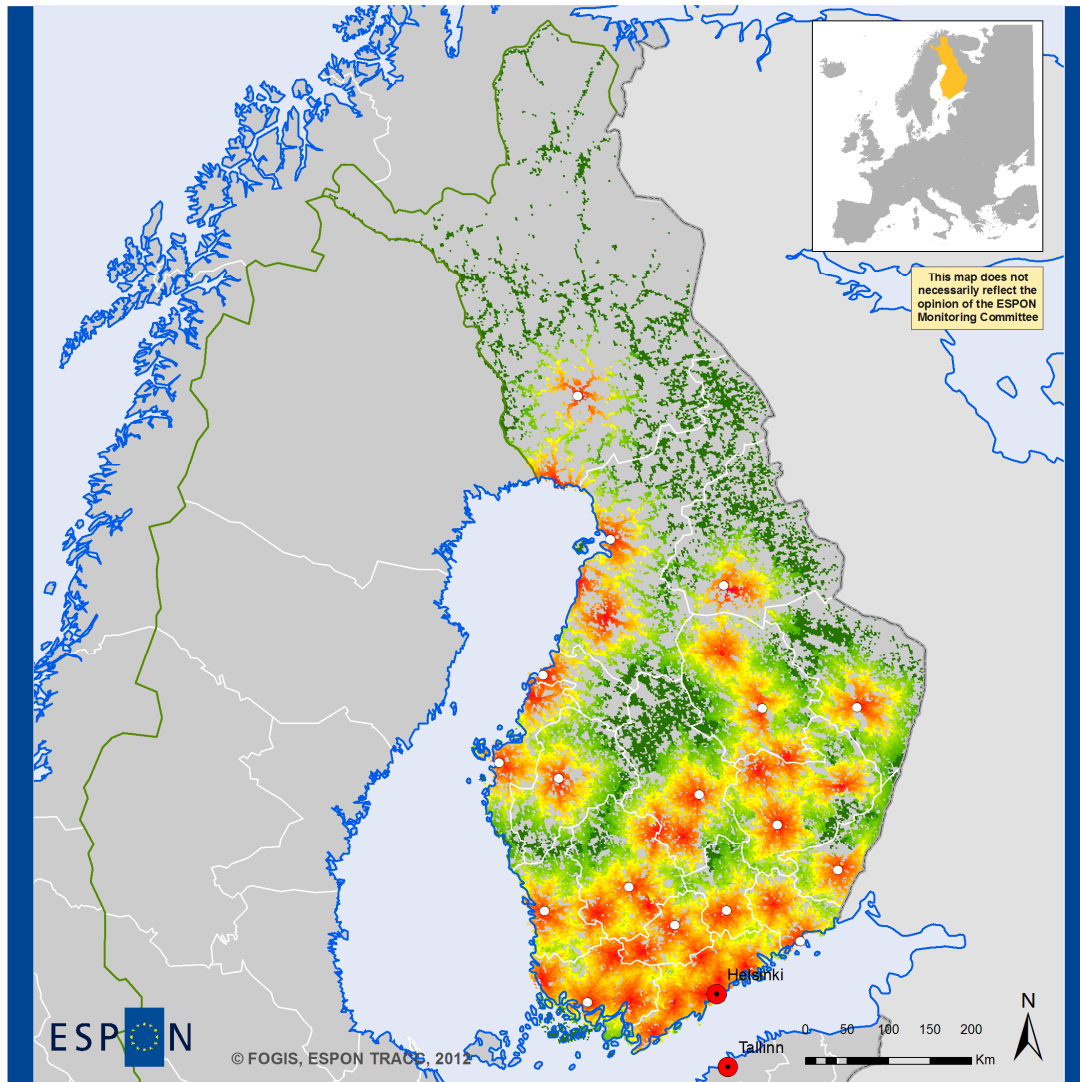
Figure 17. Potential accessibility to population, cumulative distributions

3.4 Access to health care facilities

Health care facilities are accessible within 40 minutes in most parts of Finland (Figure 18a and 18b). Only in the eastern and northern parts of the country can the travel time be close to or longer than 60 minutes. Considering the long distances and sparse population that are typical of Finland, the level of accessibility can be considered relatively good. The grid-based map clearly indicates how access to health care facilities is very good in close proximity to large or medium-sized towns in all parts of Finland. Again, in the northern and eastern parts of the country, as well as in a distinctive area in Central Finland, accessibility remains low.

The results for access to health care facilities by public transport indicate that accessibility can be considered reasonably good only in southern Finland and in the most populated municipalities in the rest of the country (Figures 19a and 19b). Around a half of the populated regions in Finland have a travel time of more than 60 minutes by public transport to the nearest health care facility.

Accessibility of regional centres and particularly accessibility to jobs displayed a major difference between cores and peripheries, but accessibility to hospitals is more equal. The national level average accessibility by car is about 20 minutes and slightly over 30 minutes by public transport (Figure 20). While the average travel time to the next hospital by car is over 10 minutes in urban areas, the approximately 30 minute average travel time in rural areas can be considered decent. Again, the deviation increases in the cases of intermediate and rural areas, exhibiting some extreme values in the sparsely populated peripheries. A relative equality in the accessibility of hospitals is evident, as 50 % of the rural population can reach the nearest hospital in about 15 minutes by car, while the corresponding travel times are a bit over 10 minutes in urban areas and almost 15 minutes in the intermediate areas (Figure 21). However, in the rural areas, travel times by public transport are much longer than by car.



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Finland Case Study Car travel time to next hospital (raster level)

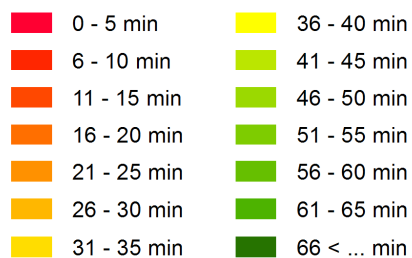
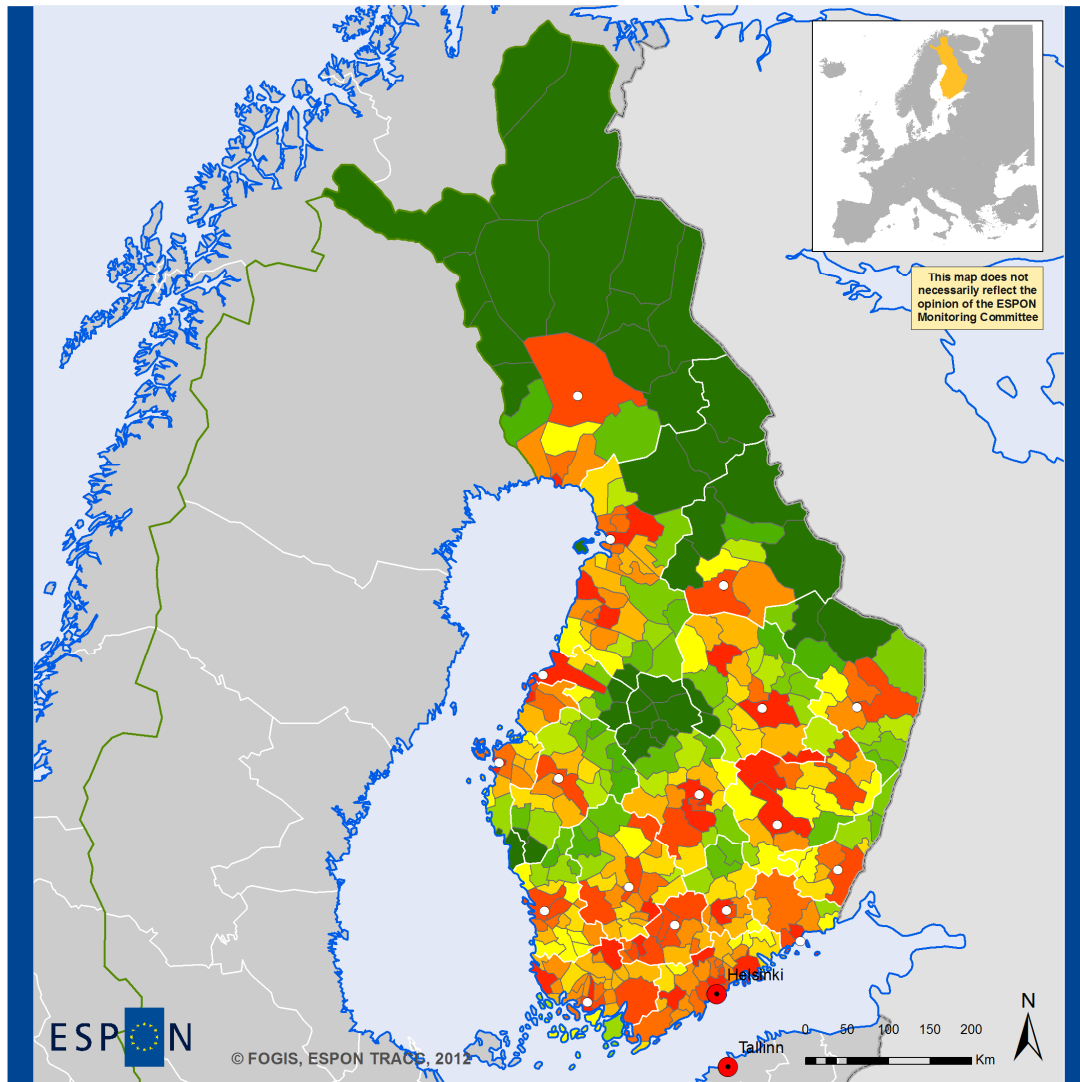


Figure 18a. Car travel time to next hospital



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Origin of data: ESPON Databank Project, 2010/2011
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Finland Case Study Car travel time to next hospital (municipality averages)

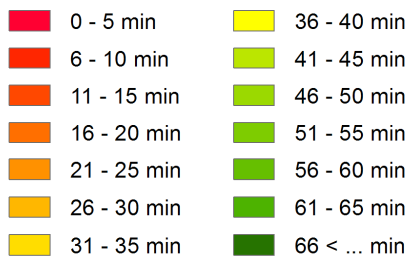
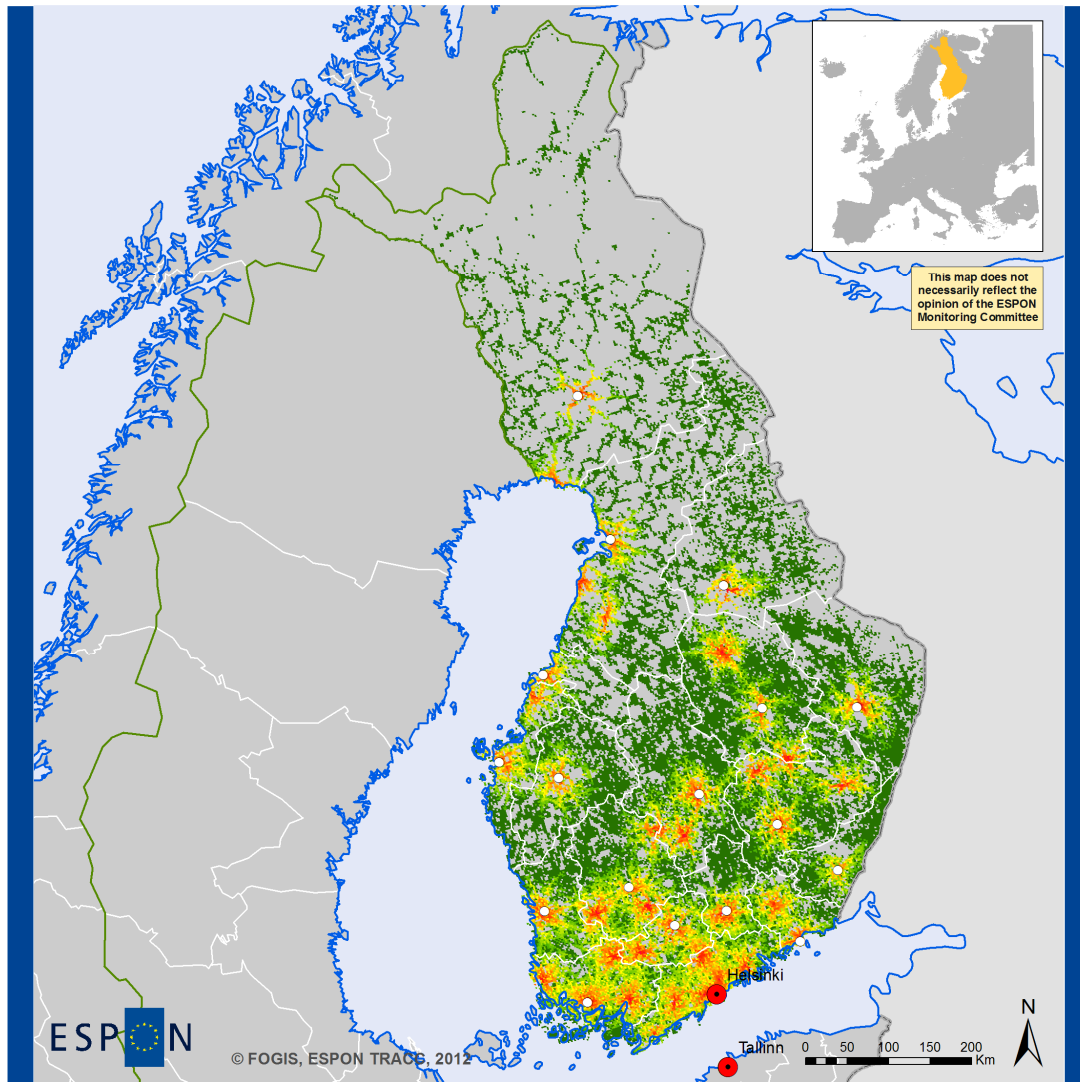


Figure 18b. Car travel time to next hospital



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Public transport travel time to next hospital (raster level)

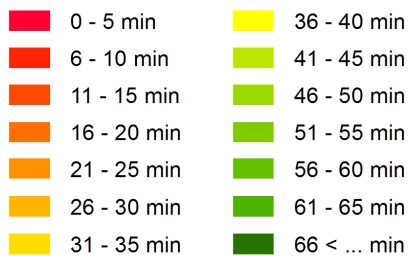
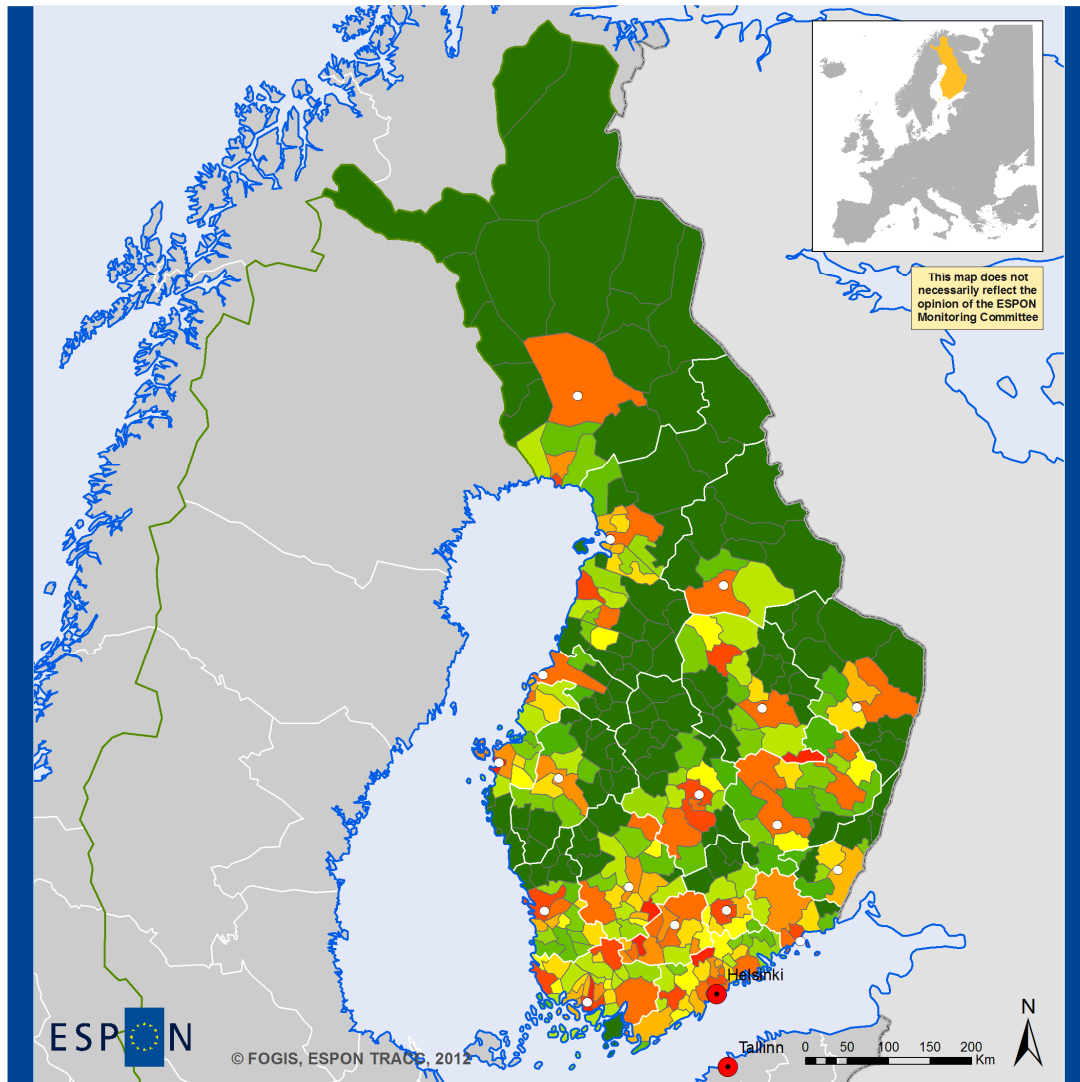


Figure 19a. Public transport travel time to next hospital



Data source: National Institute for Health and Welfare/HILMO, 2011, Finnish Transport Agency, 2012, Statistics Finland, 2011, 2010, Oy Matkahuolto Ab, 2012
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Public transport travel time to next hospital (municipality averages)

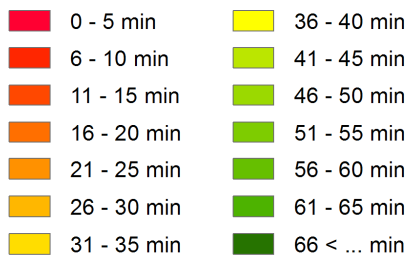


Figure 19b. Public transport travel time to next hospital

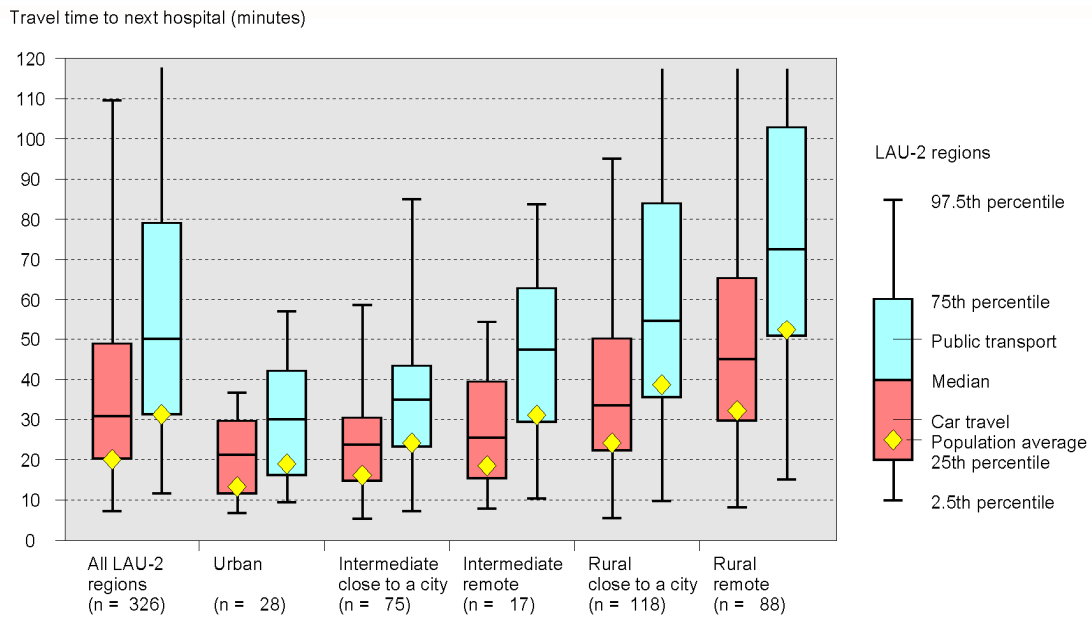


Figure 20. Travel time to next hospital, by urban-rural typology

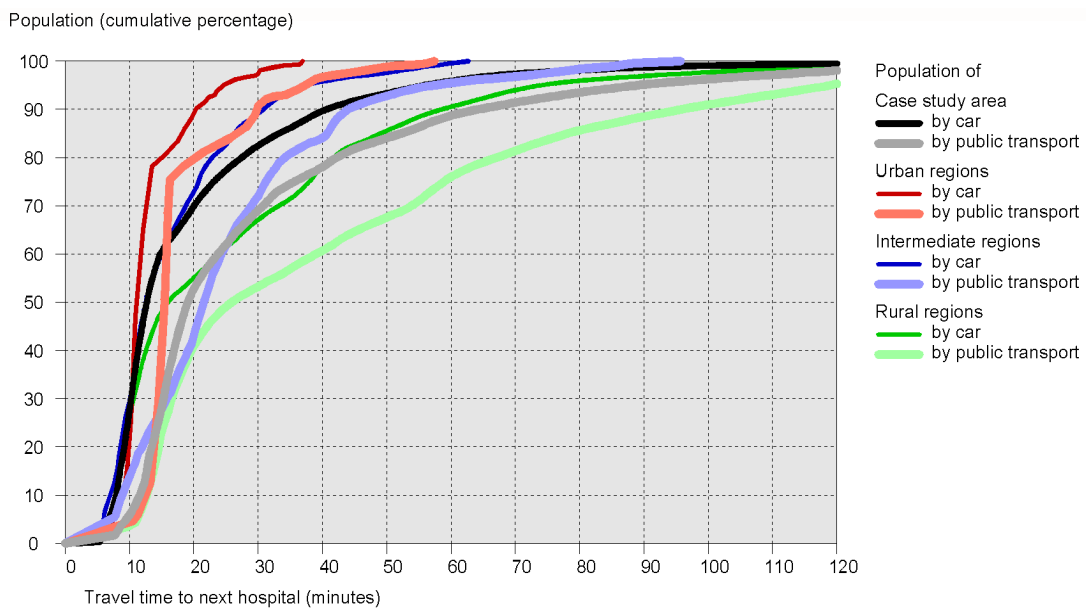


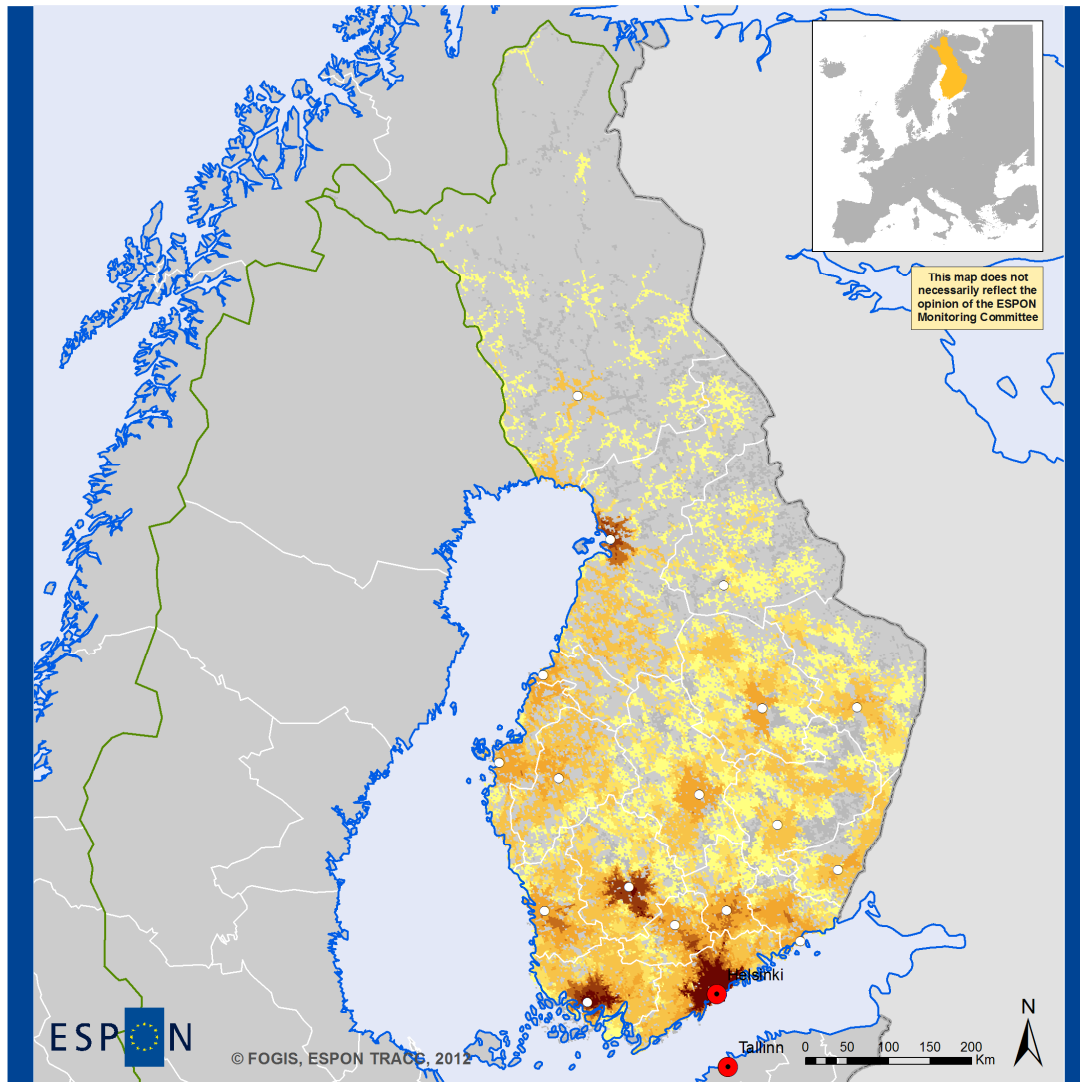
Figure 21. Travel time to next hospital, cumulative distributions

3.5 Availability of higher secondary schools

Only in the major urban areas of Finland does accessibility to higher secondary schools provide a substantial possibility to select between schools (Figure 22a). In most municipalities in Finland, students have no more than two options to choose from when it comes to higher secondary schools (Figure 22b). In the eastern and northern parts of the country, there are areas with no school accessible within 30 minutes by car. The discrepancy between municipalities is therefore very large.

By public transport, accessibility to higher secondary schools is very low (Figures 23a and 23b). There are large areas in Finland where no secondary school is accessible by public transport within 30 minutes (Figure 23a).

The difference between car and public transport accessibility is also evident in Figure 24. As for the NUTS-3 level urban-rural classification, remarkable differences can be observed within and between classes. In the urban class covering the Uusimaa region, the deviation is the most remarkable, particularly by public transport. The presented accessibility numbers are calculated for the total population. In the urban areas, over 90 % of the population can reach more than ten secondary schools in 30 minutes. In the intermediate areas, ten secondary schools are reached by about 50 % of population, and in the rural areas, about 50 % of the population can reach more than five schools. However, the age structure is younger in the central areas than in the peripheries. Therefore, secondary schools are accessed better by young people than the average person.



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Higher secondary schools within 30 minutes travel time by car (raster level)

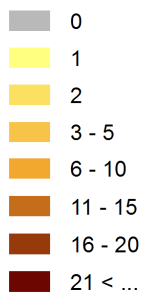
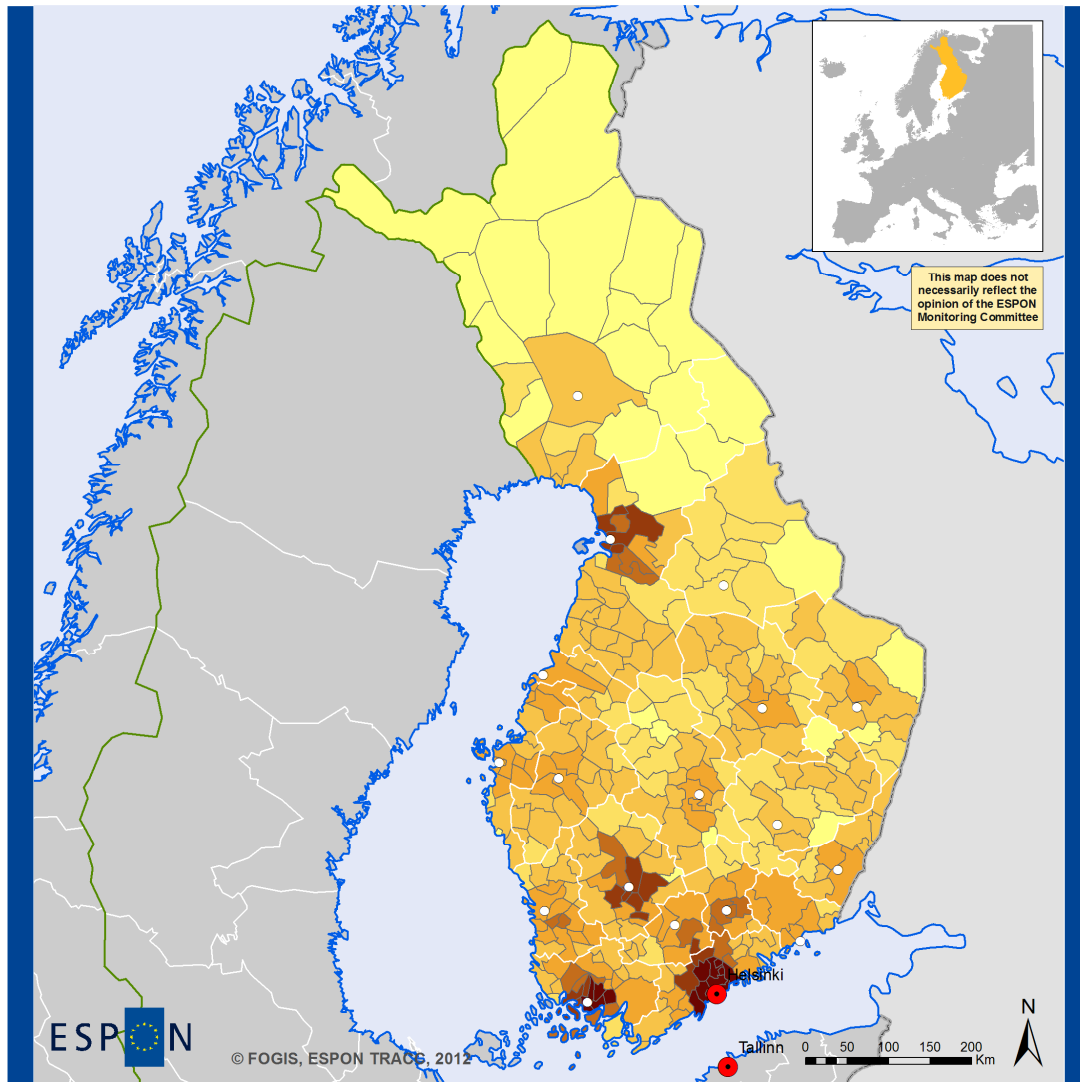


Figure 22a. Higher secondary schools within 30 minutes travel time by car



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Higher secondary schools within 30 minutes travel time by car (municipality averages)

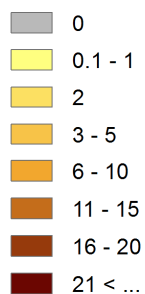
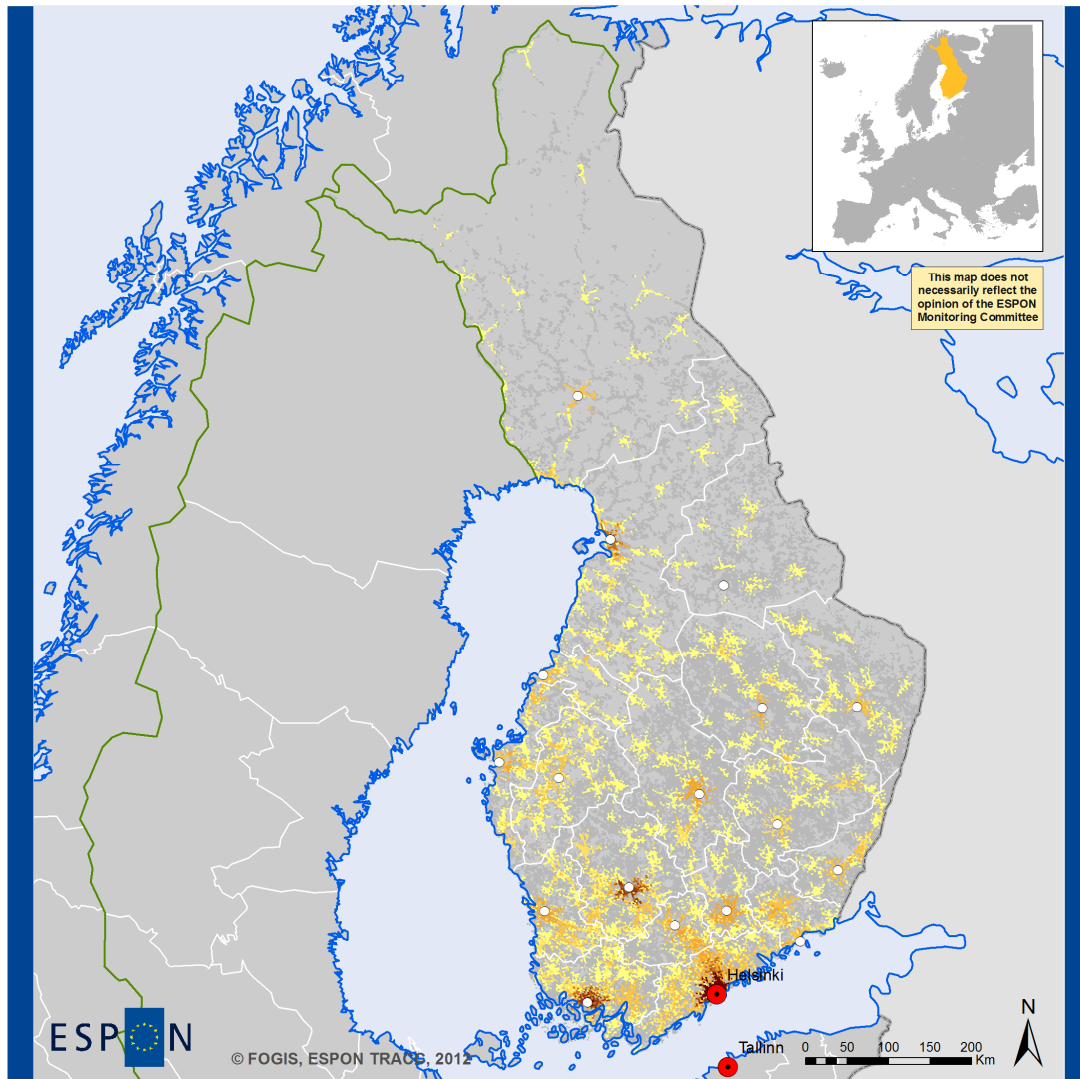


Figure 22b. Higher secondary schools within 30 minutes travel time by car



Finland Case Study
Higher secondary schools within 30 minutes travel time
by public transport (raster level)

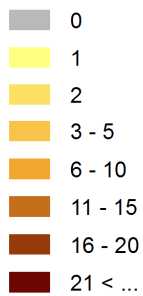
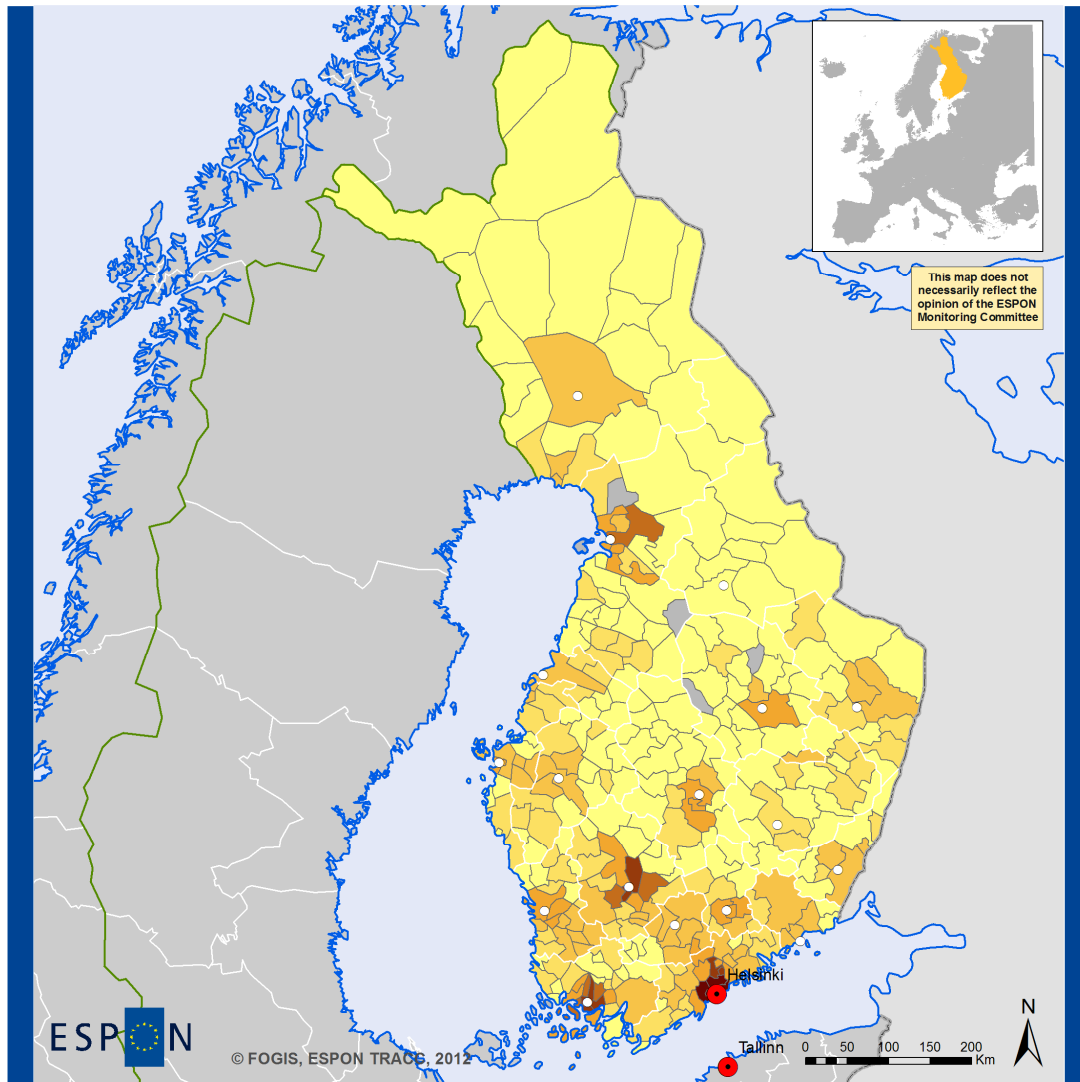


Figure 23a. Higher secondary schools within 30 minutes travel time by public transport



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Finland Case Study

Higher secondary schools within 30 minutes travel time by public transport (municipality averages)

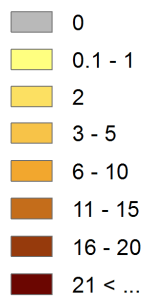


Figure 23b. Higher secondary schools within 30 minutes travel time by public transport

Higher secondary schools available within 30 minutes travel time

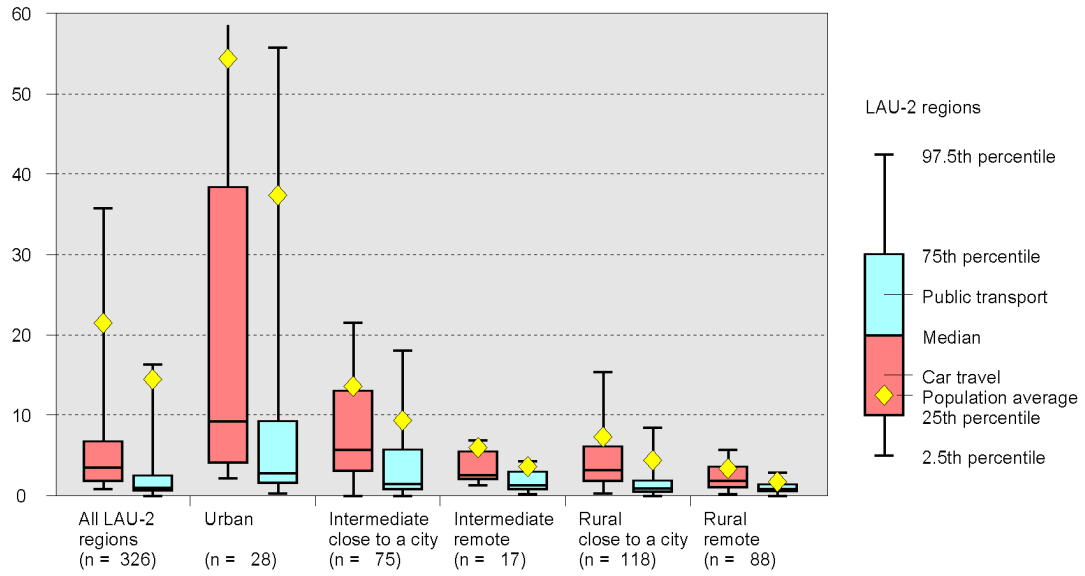


Figure 24. Higher secondary schools within 30 minutes travel time, by urban-rural typology

Population (cumulative percentage)

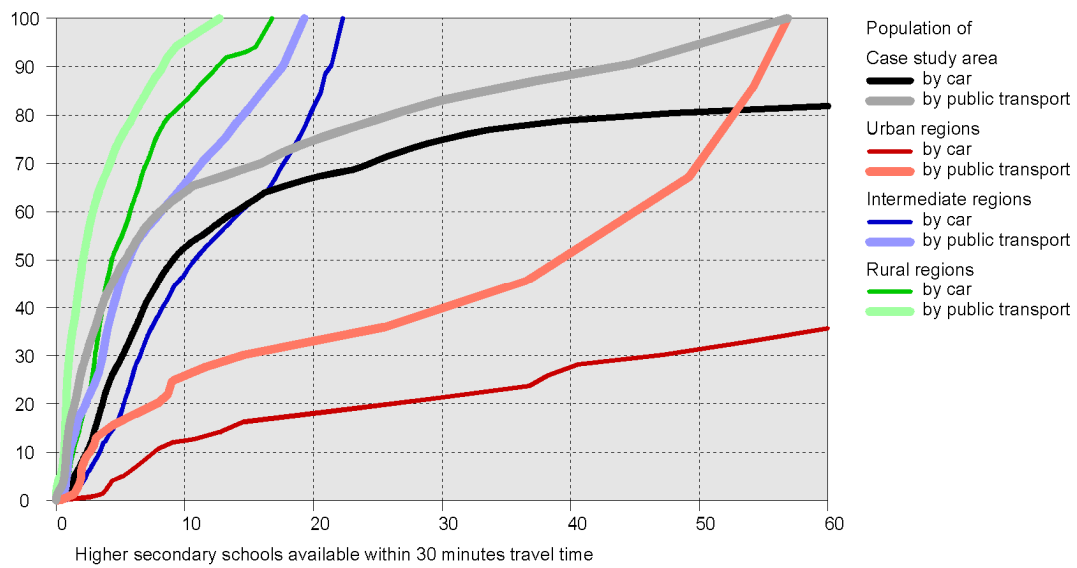


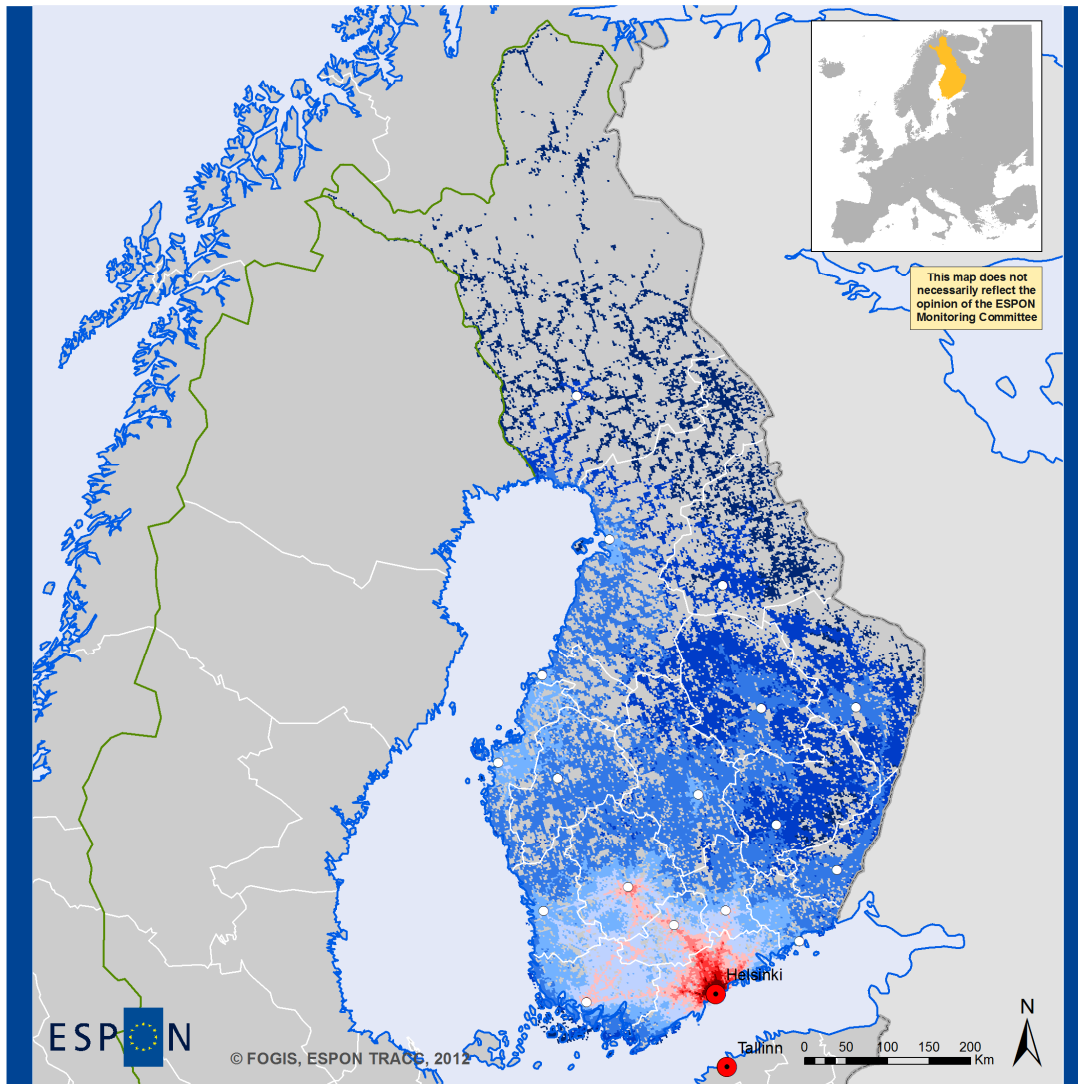
Figure 25. Higher secondary schools within 30 minutes travel time, cumulative distributions

3.6 Accessibility potential to basic health care

There are marked differences in the accessibility potential to basic health care in Finland (Figure 26). It can be noted that accessibility to basic health care is mainly dependent on the service network and accessibility to basic health care mainly follows the regional structure of the population. In the urban areas and within the main transport corridors in south-western Finland, the potential accessibility to medical doctors by car is relatively good. Particularly in the capital region, medical services are very densely available. In addition, regional centres and well-connected adjacent areas have decent basic health care accessibility. The situation is considerably worse in the eastern and northern parts of Finland. This is related to the very long distances and sparse availability of medical services in the peripheral parts of the country.

The analysis of accessibility potential by public transport provides a very similar picture (Figure 27). The accessibility potential is good in the south-western part of Finland and in the biggest municipalities, whereas it is low in those regions poorly served by public transport. Local connectivity to bus transport, however, affects accessibility remarkably.

In the urban-rural axis, a similar centre-periphery pattern is visible, as with the potential accessibility of the population. However, potential accessibility to basic health care facilities is more equally distributed when compared to population potentials, and especially to the accessibility of jobs (Figure 28). Potentials by public transport are much lower, as the three upper quartiles of the population have better accessibility by car in all classes of urban-rural classification than the three lowest quartiles by public transport. By car, the average accessibility is reached by 95 % of the urban population, whereas in the intermediate classes a half of the population reaches the average. In rural areas, 50 % of the population have accessibility potential below 40 % in comparison to the average.




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Potential accessibility to medical doctors by car (raster level)

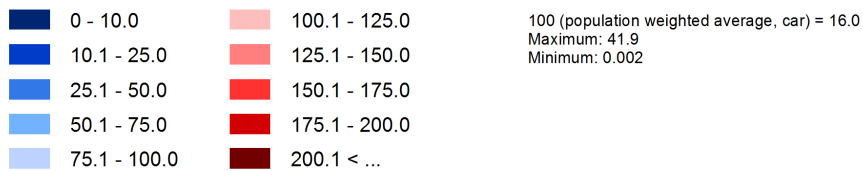
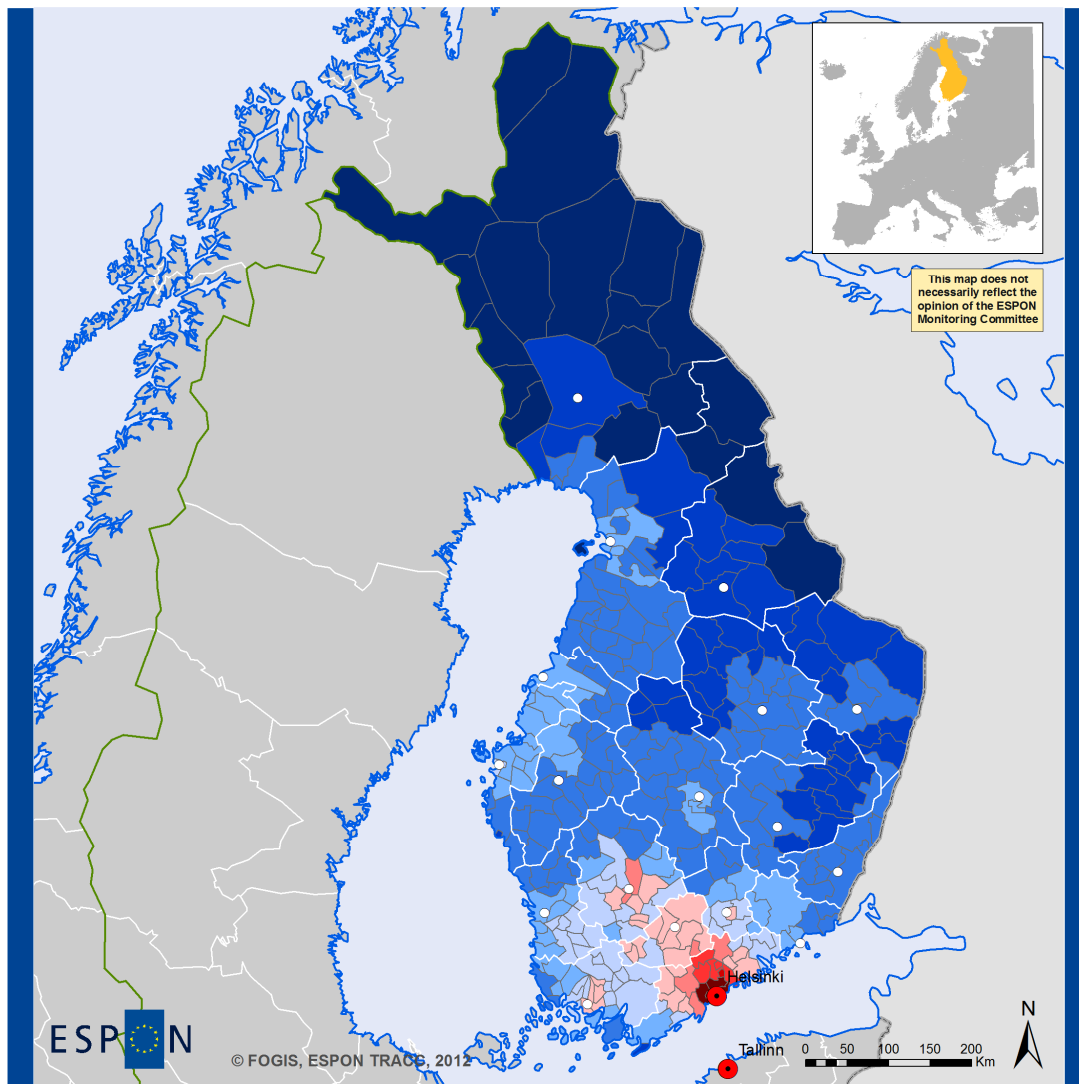


Figure 26a. Potential accessibility to medical doctors by car



Data source: National Institute for Health and Welfare/HILMO, 2011, Finnish Transport Agency, 2012, Statistics Finland, 2011, 2010
Origin of data: ESPON Databank Project, 2010/2011
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Potential accessibility to medical doctors by car (municipality averages)

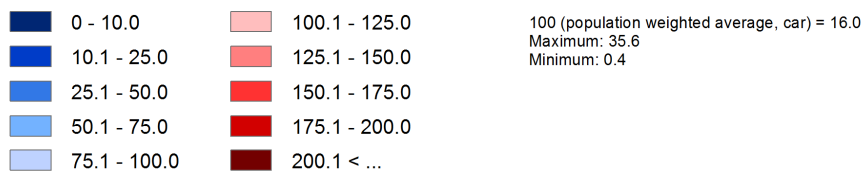
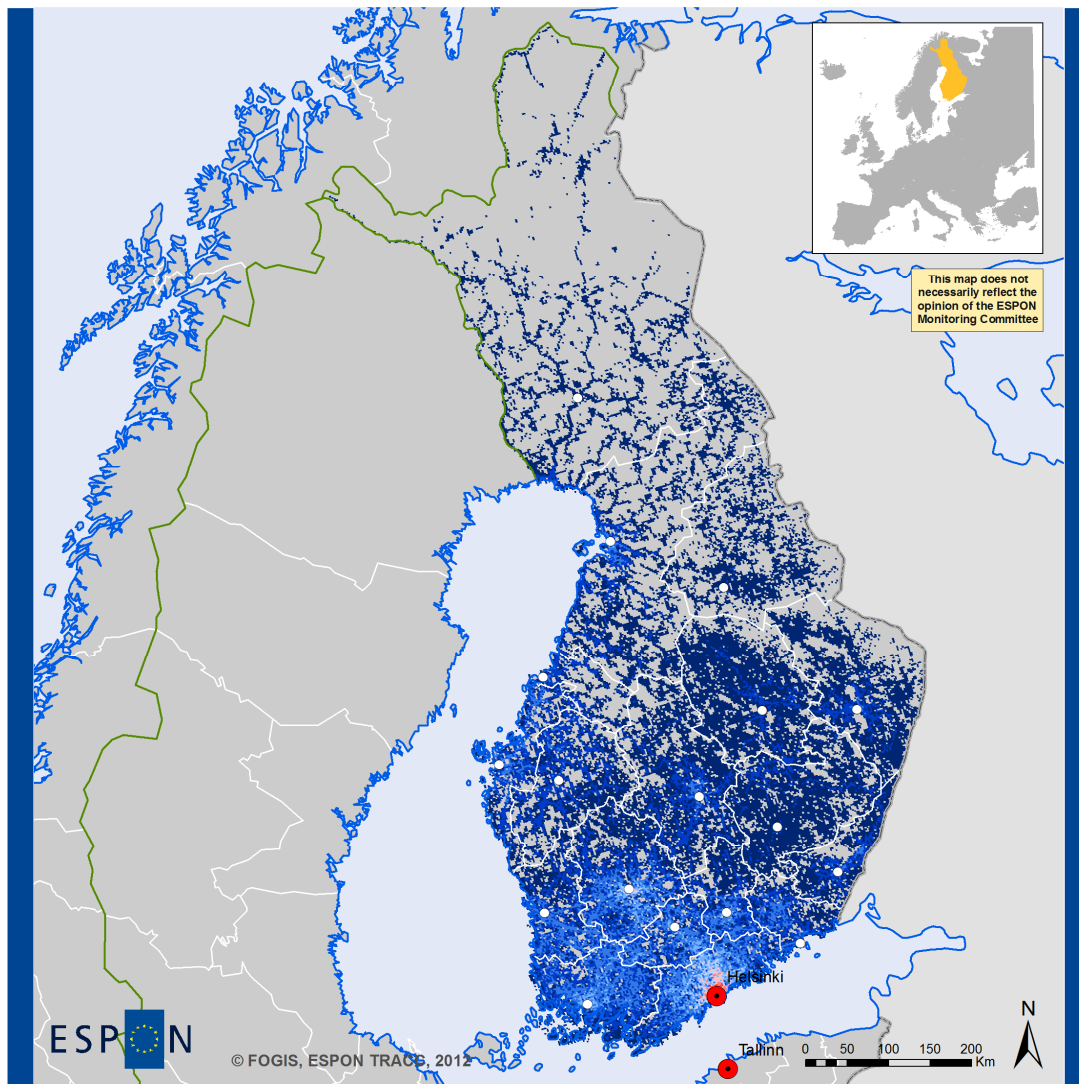


Figure 26b. Potential accessibility to medical doctors by car



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Potential accessibility to medical doctors by public transport (raster level)

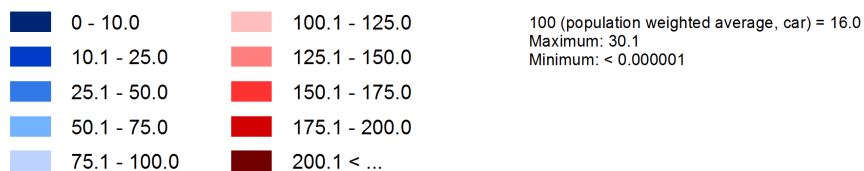
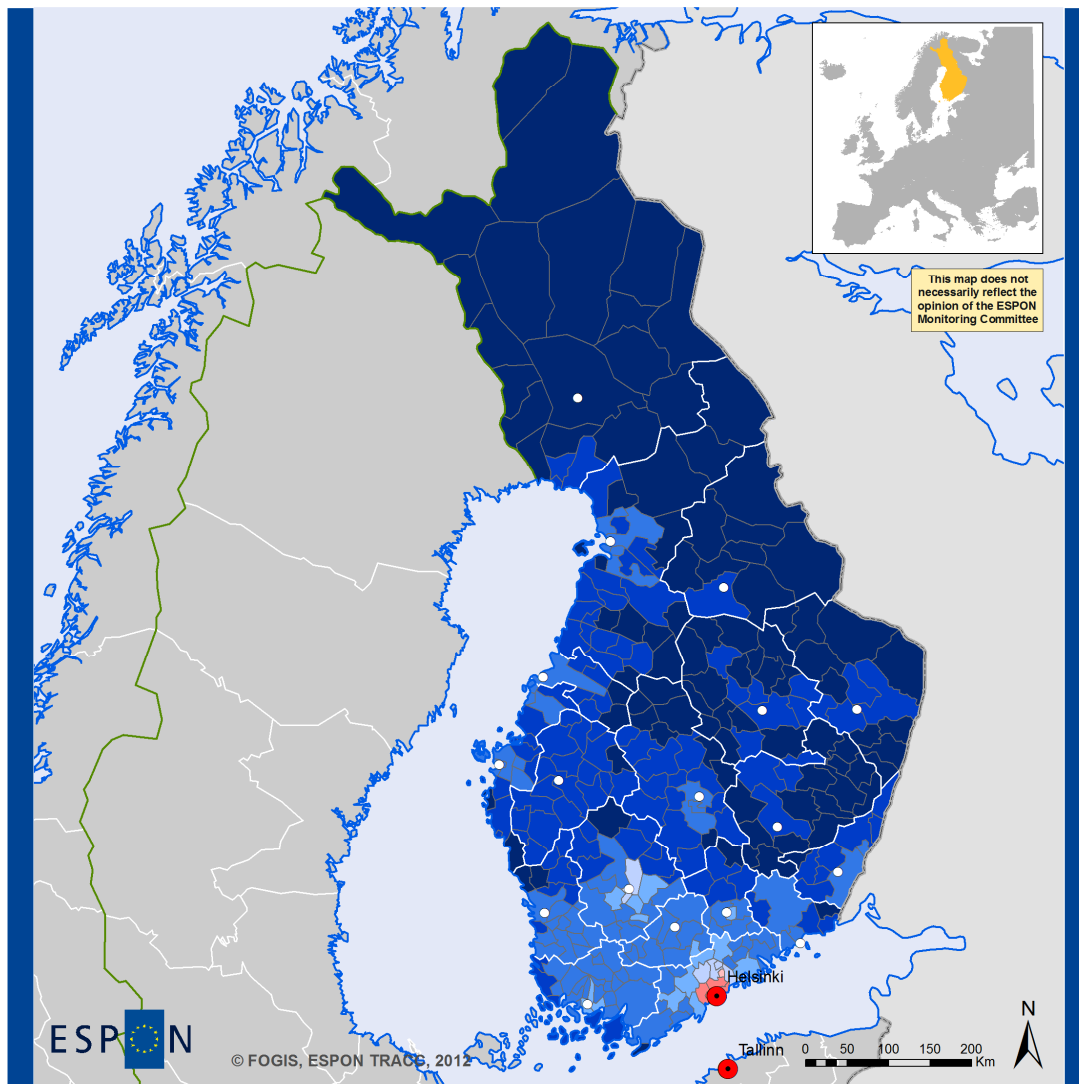


Figure 27c. Potential accessibility to medical doctors by public transport (standardised on road average)



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Data source: National Institute for Health and Welfare/HILMO, 2011,
Finnish Transport Agency, 2012, Statistics Finland, 2011, 2010
Oy Matkahuolto Ab, 2012
Origin of data: ESPON Databank Project, 2010/2011
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Potential accessibility to medical doctors by public transport (municipality averages)

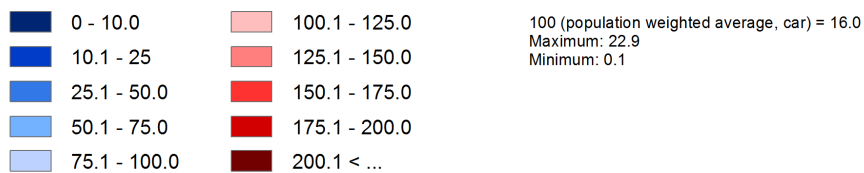
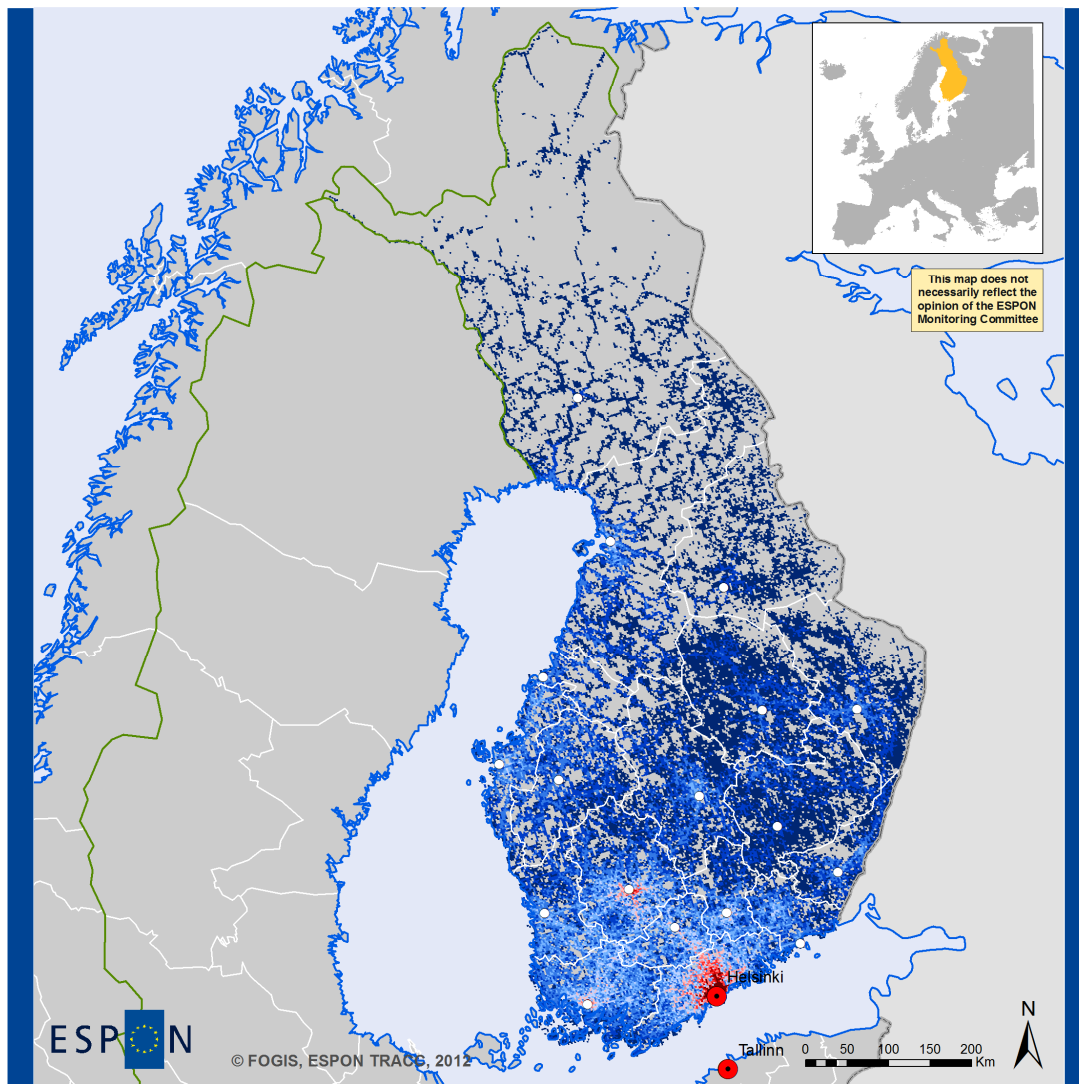


Figure 27d. Potential accessibility to medical doctors by public transport (standardised on road average)




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 Finnish Transport Agency, 2012, Statistics Finland, 2011, 2010
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 Origin of data: ESPON Databank Project, 2010/2011
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Finland Case Study

Potential accessibility to medical doctors by public transport (raster level)

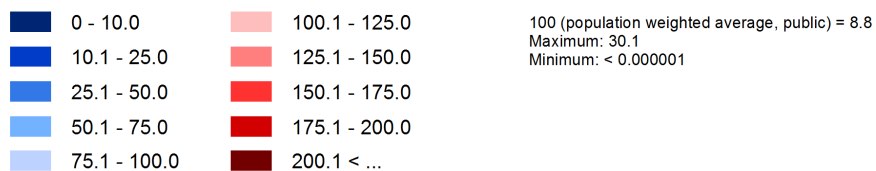
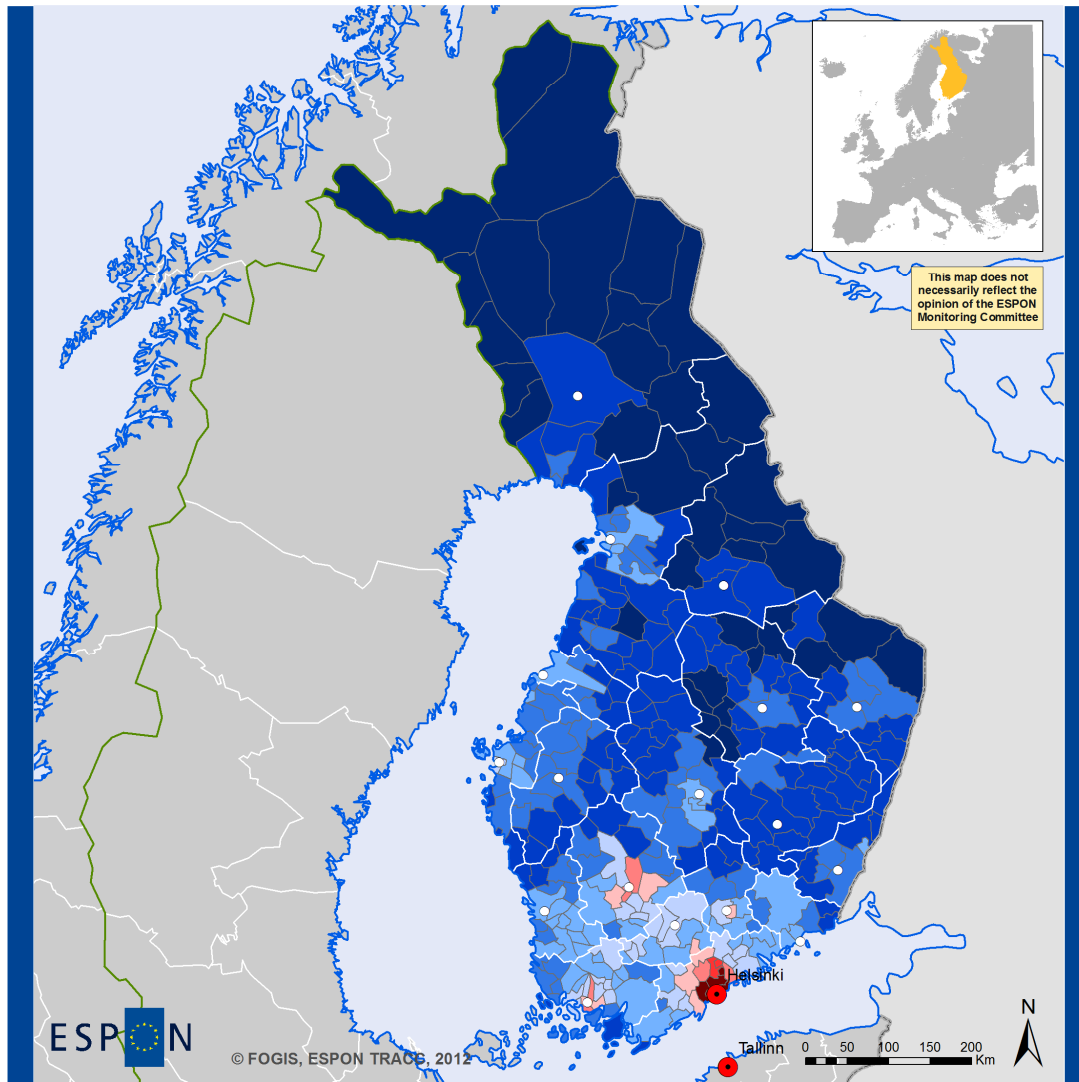


Figure 27e. Potential accessibility to medical doctors by public transport (standardised on public transport average)



Data source: National Institute for Health and Welfare/HILMO, 2011,
Finnish Transport Agency, 2012, Statistics Finland, 2011, 2010
Oy Matkahuolto Ab, 2012
Origin of data: ESPON Databank Project, 2010/2011
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Finland Case Study

Potential accessibility to medical doctors by public transport (municipality averages)

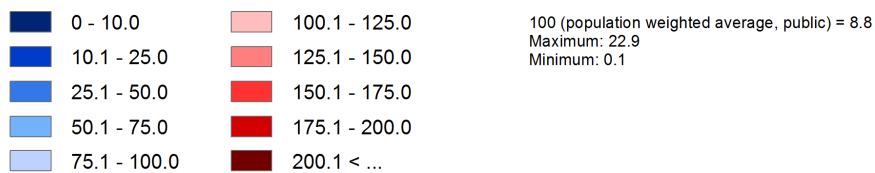


Figure 27f. Potential accessibility to medical doctors by public transport (standardised on public transport average)

Potential accessibility to medical doctors (car average = 100)

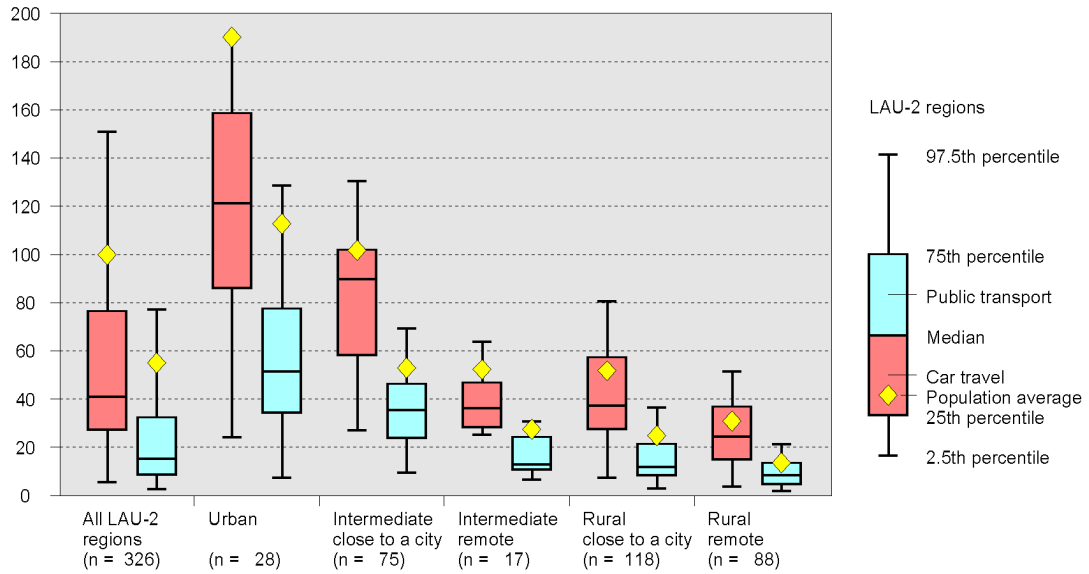


Figure 28. Potential accessibility to medical doctors, by urban-rural typology

Population (cumulative percentage)

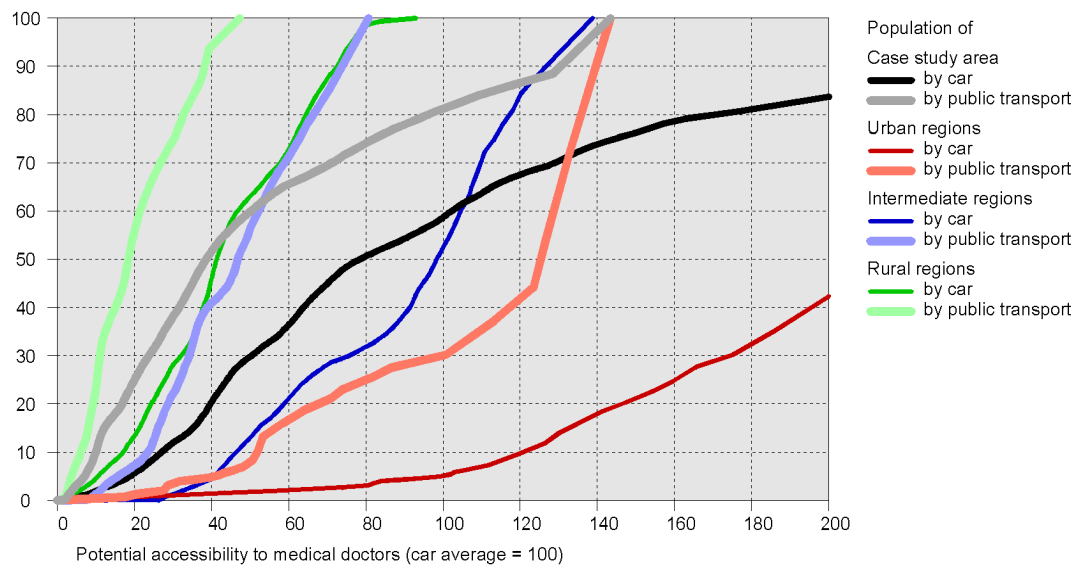


Figure 29. Potential accessibility to medical doctors, cumulative distributions

4 Accessibility situation at different regional subtypes

The regions selected for this study to represent particular regional subtypes were Lapland, Northern Ostrobothnia and Uusimaa NUTS-3 regions. Lapland is an example of northern periphery, Northern Ostrobothnia includes the northernmost Finnish growth centre, Oulu, and Uusimaa includes the capital of Finland and its surroundings. The regional differences in accessing the main cities of the region are evident (Figure 31). The average accessibility in the Uusimaa region is below 20 minutes, whereas in Northern Ostrobothnia travel times are almost 40 minutes on average, and in Lapland the average is over 60 minutes. By public transport, accessibility is comparable to some extent to car accessibility to nearby centres, but travel times are remarkably longer in the peripheries (Figure 32).

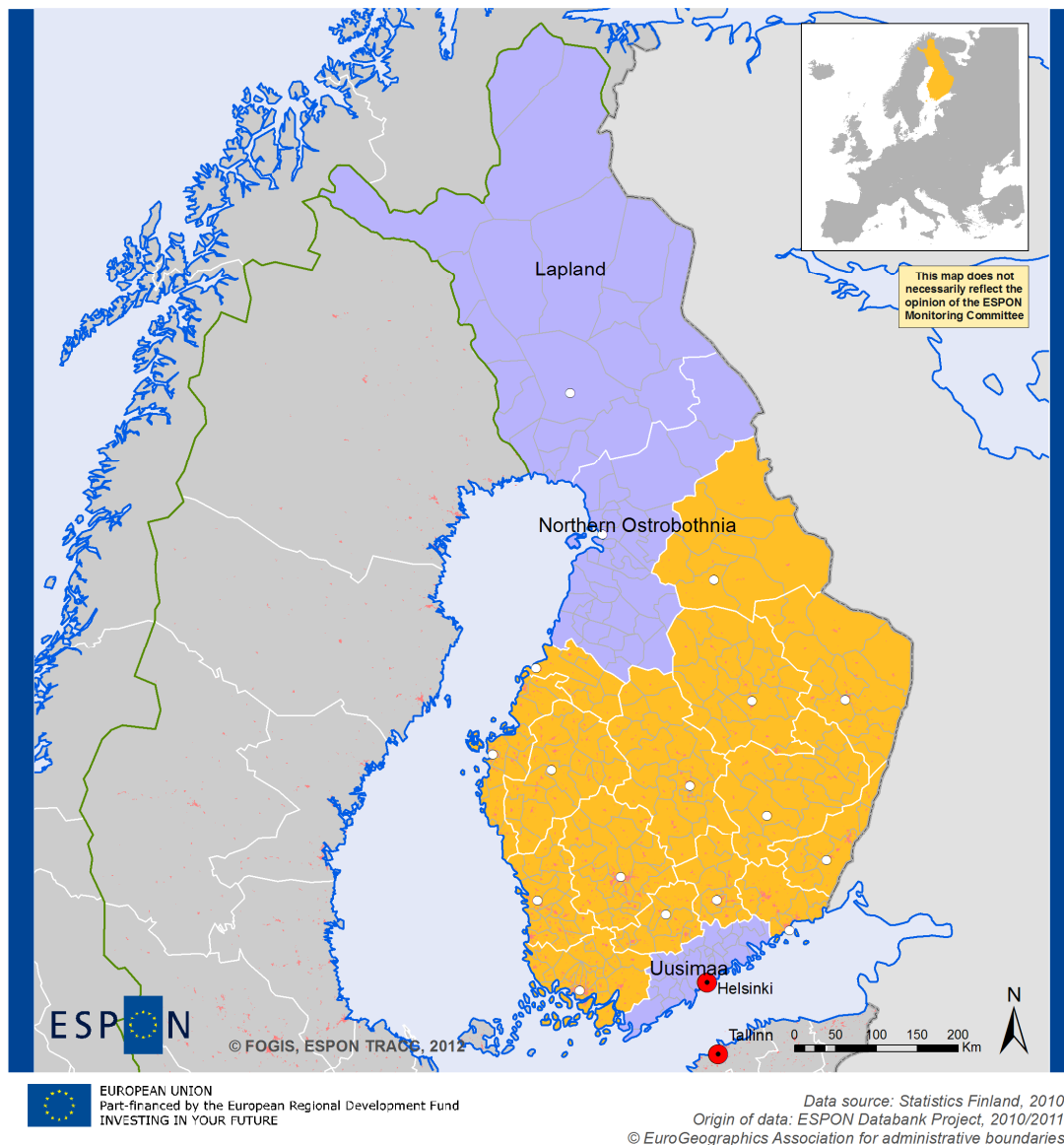
The domination of the Uusimaa region in terms of job accessibility is clear, with the population in the area having over 700,000 jobs within their reach, but there is a remarkable difference between car and public transport accessibility at the edge of the region (Figure 33). In the core of Northern Ostrobothnia, almost 100,000 jobs are within reach, whereas accessibility to jobs in Lapland is low due to the sparse regional structure and the low number of jobs. The agglomeration of jobs in the capital region is evident in Figure 34, as when the edge of the area reaching 600,000 jobs is reached, the amount of jobs decreases quickly. In contrast, in Lapland job accessibility is rather equal, with a relatively long 60-minute travel time. Accessibility potential in Uusimaa is clearly above the national average and again, clearly below the average in Northern Ostrobothnia and Lapland. The distribution of population accessibility potentials represent a similar pattern to job accessibility (Figure 35), but due to living preferences, sprawl and late urbanisation, the population distribution is more spread out. Accessibility potentials based on public transports have a similar deviation to the car-based potentials, but have consistently lower values (Figure 36).

The good coverage of Finnish hospitals is visible in Figure 37. The median area in Uusimaa has corresponding accessibility with the 25th percentile in Northern Ostrobothnia, and the 25th percentile in Lapland is not far from this. However, the average travel time is over 45 minutes in Lapland, whereas it is below 15 minutes in Uusimaa. About 90 % of population in Uusimaa can reach the nearest hospital in 20 minutes, while the corresponding percentage is 60 in Northern Ostrobothnia and Lapland (Figure 38). Again, the most extreme, sparsely populated peripheries are a long way from the nearest hospital.

The huge difference in the availability of secondary schools between centres and peripheries can be seen in Figure 40. In the core areas of Uusimaa and in Northern Ostrobothnia, there is a good availability of secondary schools. In Lapland, schools are located in the largest population centres, and the possibility to select schools is very limited or virtually non-existent.

When comparing the potential accessibility to basic health care, it can be seen that the distribution is more equal than in the case of population potentials (Figure 41). Again, the three upper quartiles of the population have better accessibility by car in all areas, in comparison to the three lowest quartiles by public transport. The areal differences are, however, remarkable as 95 % of the population in Uusimaa have better accessibility than the national average, and in Lapland the maximum accessibility is below 40 % of the national average (Figure 42).

When considering the accessibility of these regions as a whole, the patterns are very similar for both car and public transport, except that public transport involves lower accessibility values in general (Tables 1 and 2). These three very different regions are most equal in terms of the accessibility to centres and travel time to hospitals. The biggest differences can be found in the accessibility of jobs. In potential accessibility of population and the availability of secondary schools, there are also remarkable differences, and the differences in the potential accessibility of basic health care are almost as high.



Finland Case Study Overview map and zoom-in regions

- Capital city
- NUTS-3 capital
- Zoom-in regions
- Settlement area
- Macro region: municipalities

Figure 30. Zoom-in regions

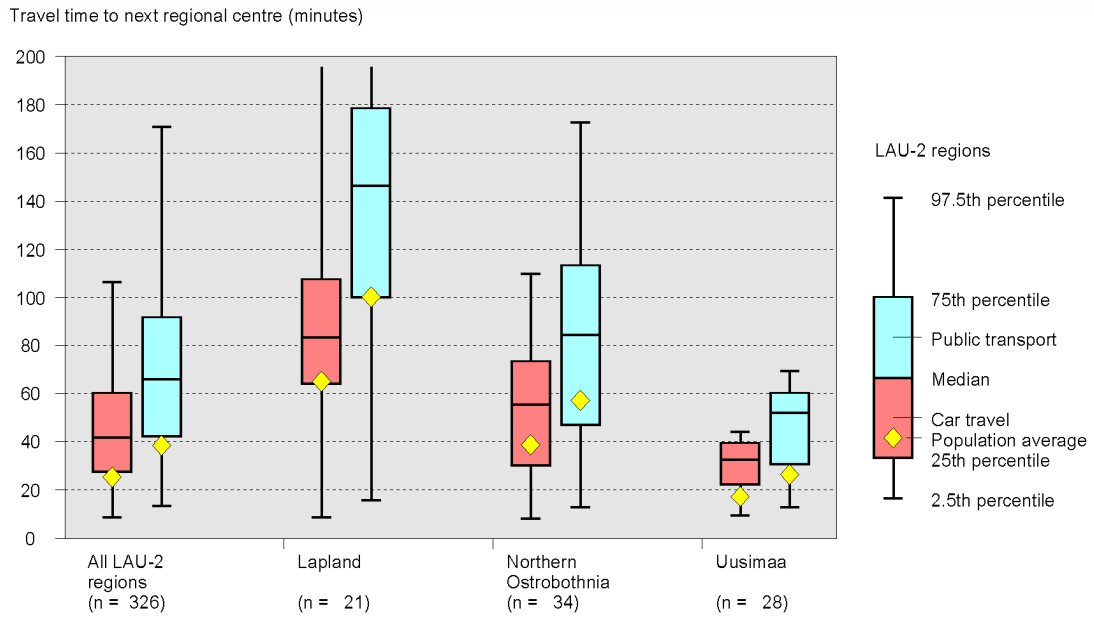


Figure 31. Travel time to next regional centre, by zoom-in region

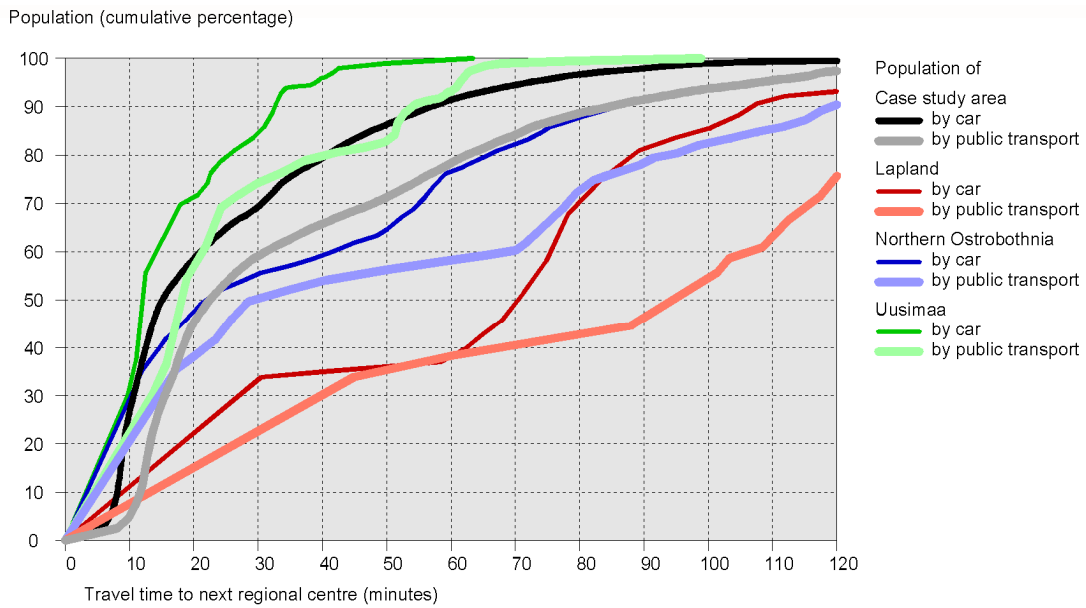


Figure 32. Travel time to next regional centre, cumulative distributions by zoom-in region

Jobs available within 60 minutes travel time (in 1,000)

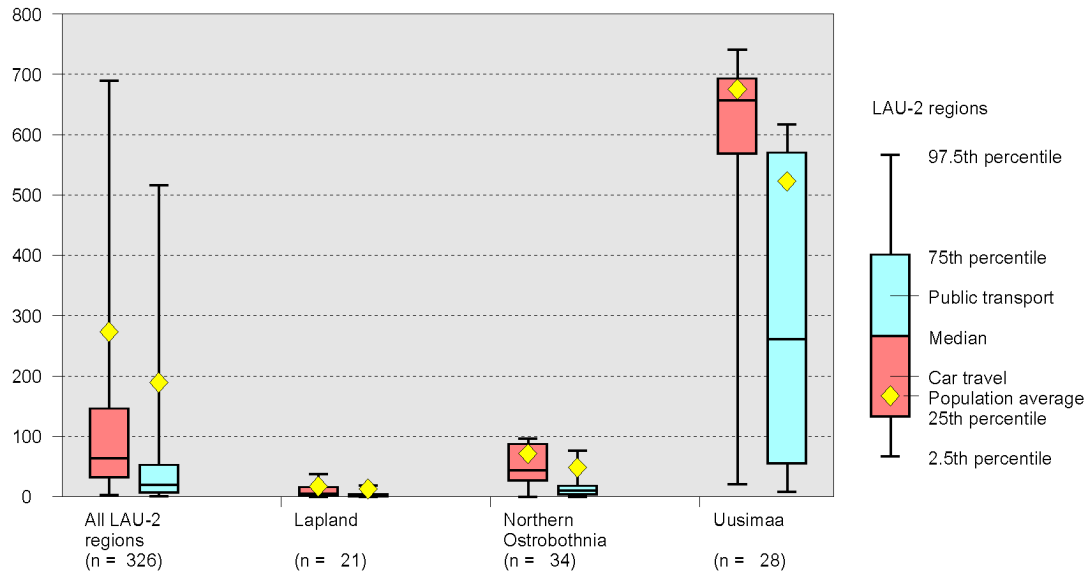


Figure 33. Jobs accessible within 60 minutes, by zoom-in region

Population (cumulative percentage)

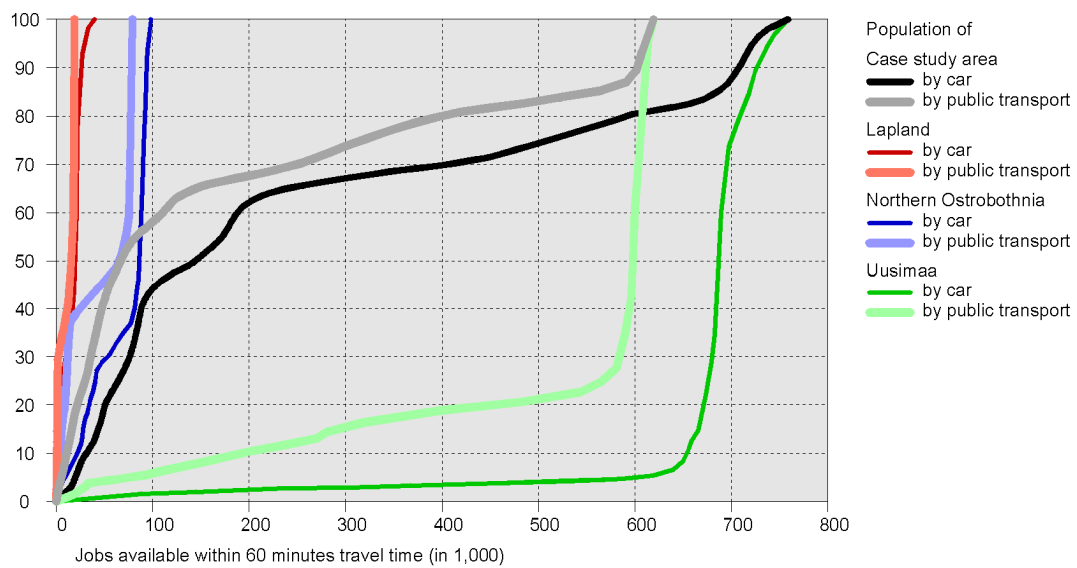


Figure 34. Jobs accessible within 60 minutes, cumulative distributions by zoom-in region

Potential accessibility to population (car average = 100)

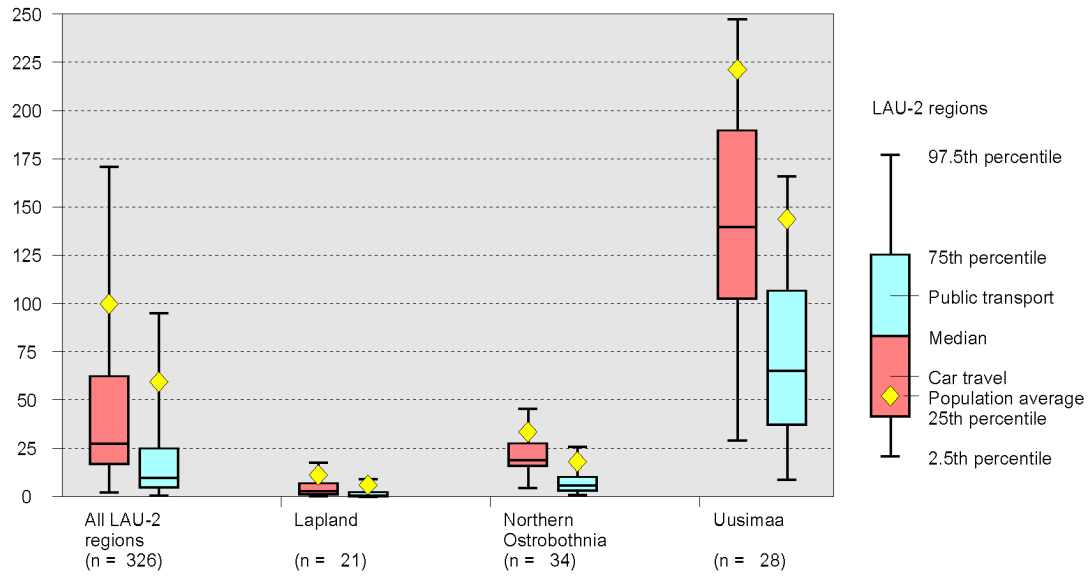


Figure 35. Potential accessibility to population, by zoom-in region

Population (cumulative percentage)

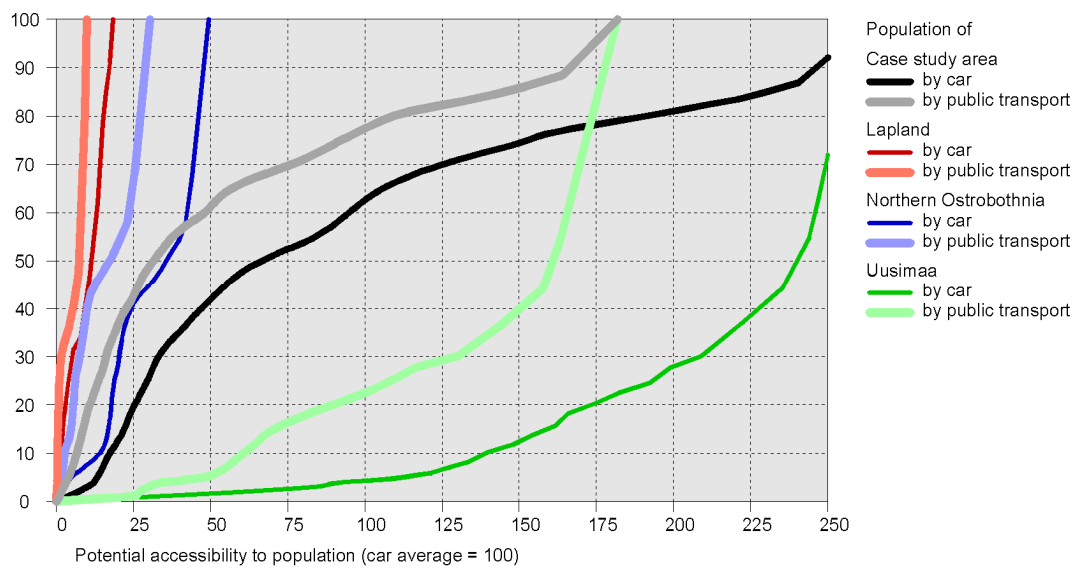


Figure 36. Potential accessibility to population, cumulative distributions by zoom-in region

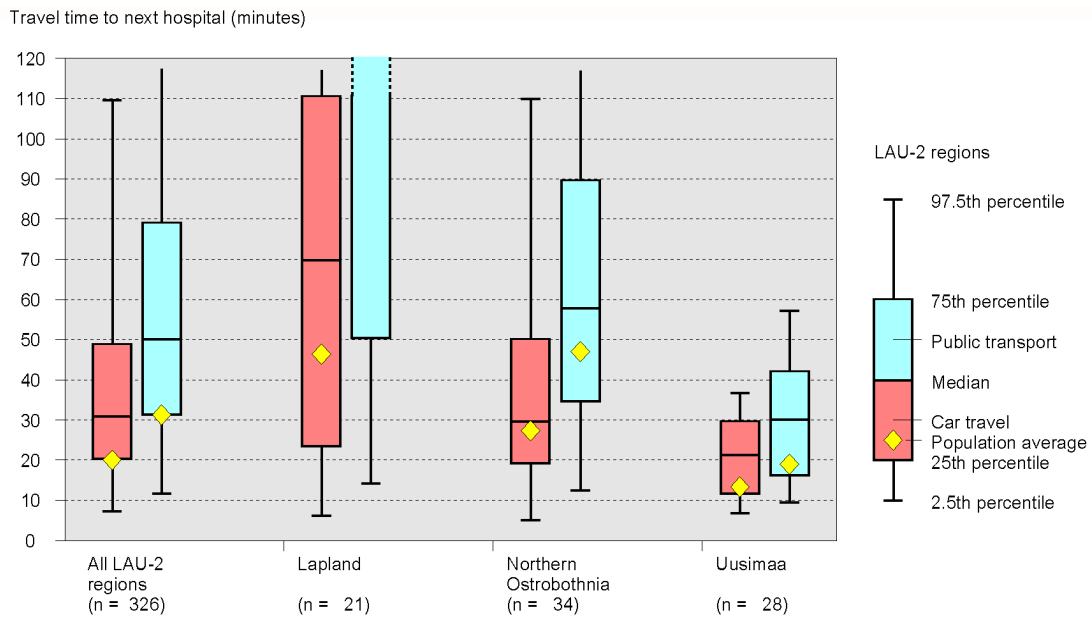


Figure 37. Travel time to next hospital, by zoom-in region

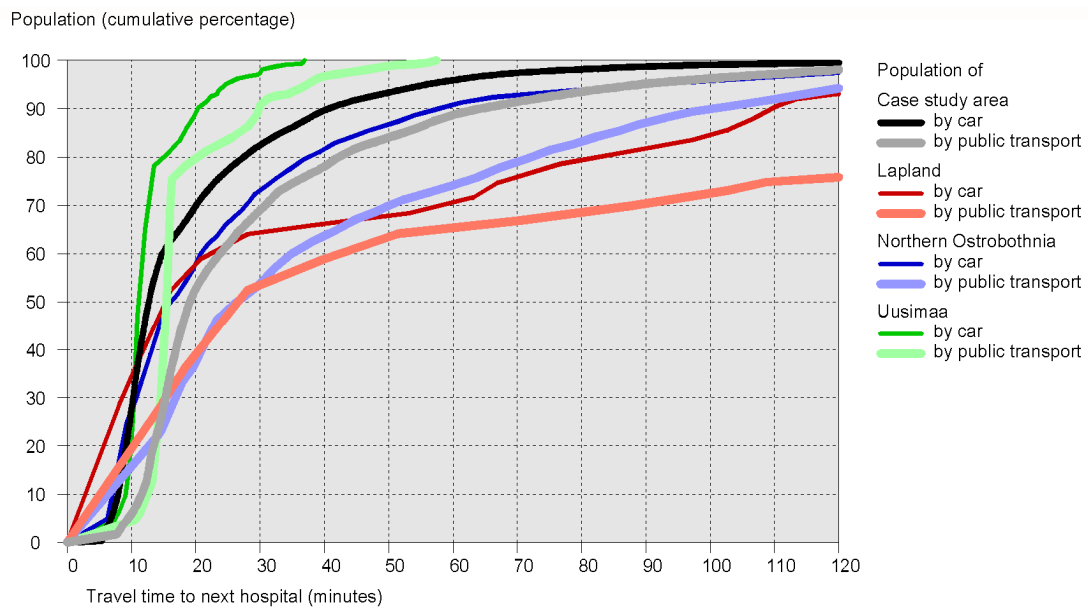


Figure 38. Travel time to next hospital, cumulative distributions by zoom-in region

Higher secondary schools available within 30 minutes travel time

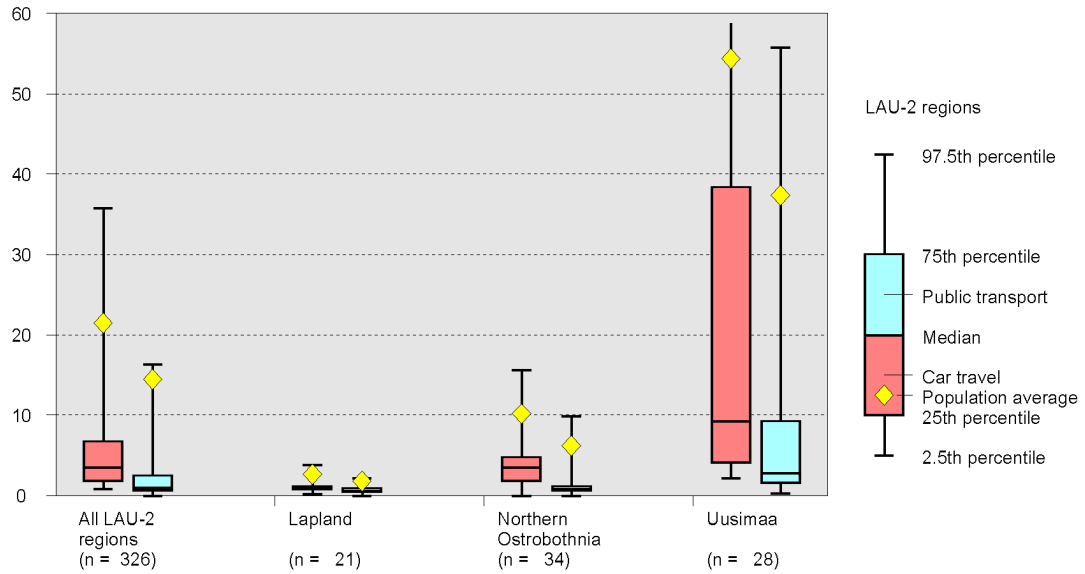


Figure 39. Higher secondary schools within 30 minutes travel time, by zoom-in region

Population (cumulative percentage)

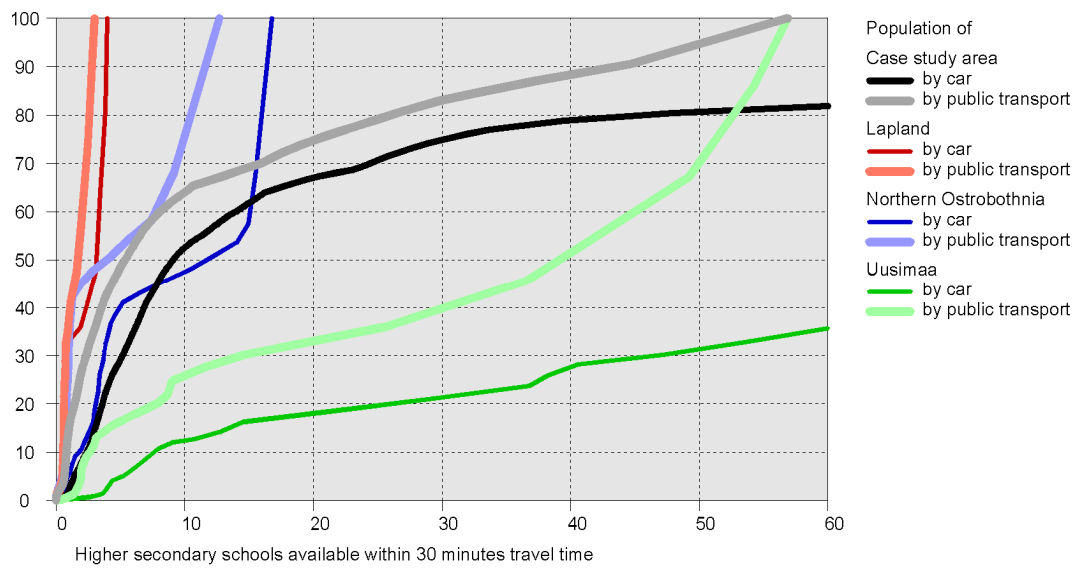


Figure 40. Higher secondary schools within 30 minutes travel time, cumulative distributions by zoom-in region

Potential accessibility to medical doctors (car average = 100)

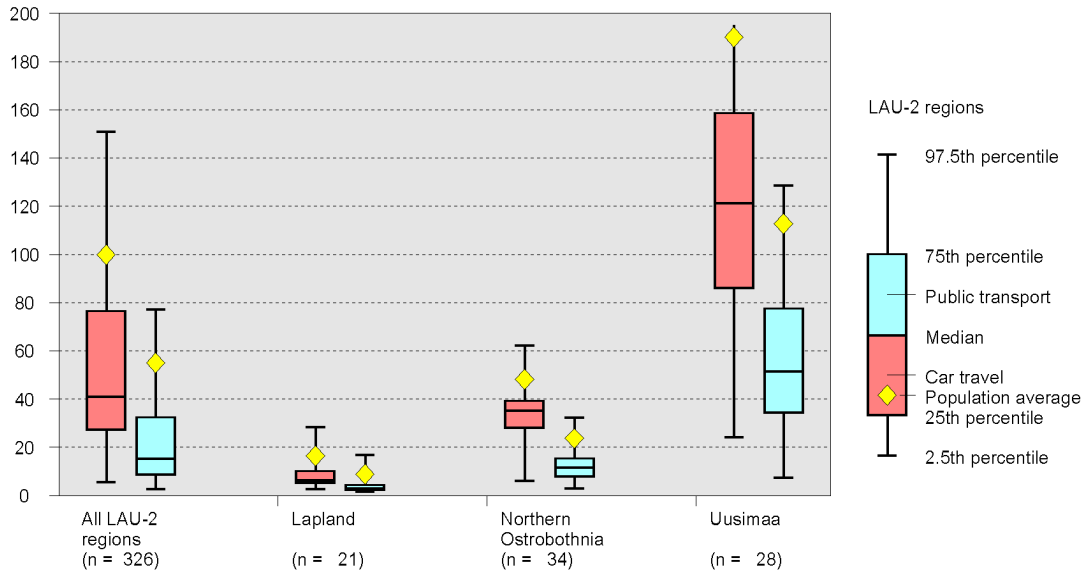


Figure 41. Potential accessibility to medical doctors, by zoom-in region

Population (cumulative percentage)

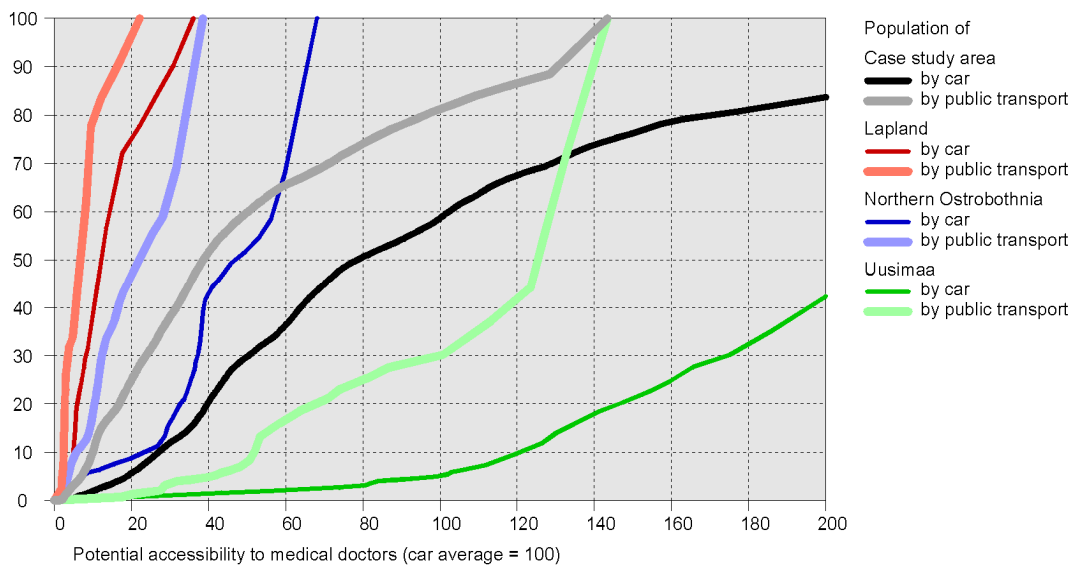


Figure 42. Potential accessibility to medical doctors, cumulative distributions by zoom-in region

Table 1. Accessibility by car, deviations of zoom-in regions from case study averages

Area	Travel time to next regional centre		Jobs accessible within 60 minutes		Potential accessibility to population	Travel time to next hospital		Higher secondary schools within 30 minutes		Potential accessibility to medical doctors
	Minutes	Index	In 1,000	Index	Index	Minutes	Index	Number	Index	Index
Lapland	65.0	256	16.9	6	11	46.3	231	2.6	12	17
Northern Ostrobothnia	38.7	153	71.0	26	34	27.3	136	10.2	47	48
Uusimaa	17.3	68	675.1	247	221	13.3	66	54.4	253	190
Case study region	25.3	100	273.1	100	100	20.0	100	21.4	100	100

Table 2. Accessibility by public transport, deviations of zoom-in regions from case study averages

Area	Travel time to next regional centre		Jobs accessible within 60 minutes		Potential accessibility to population	Travel time to next hospital		Higher secondary schools within 30 minutes		Potential accessibility to medical doctors
	Minutes	Index	In 1,000	Index	Index	Minutes	Index	Number	Index	Index
Lapland	100.3	261	12.5	7	6	76.9	246	1.8	12	9
Northern Ostrobothnia	57.1	149	47.8	25	18	47.1	151	6.2	43	24
Uusimaa	26.3	68	522.5	277	144	19.0	60.7	37.4	258	113
Case study region	38.4	100	188.6	100	100	31.2	100	14.4	100	100

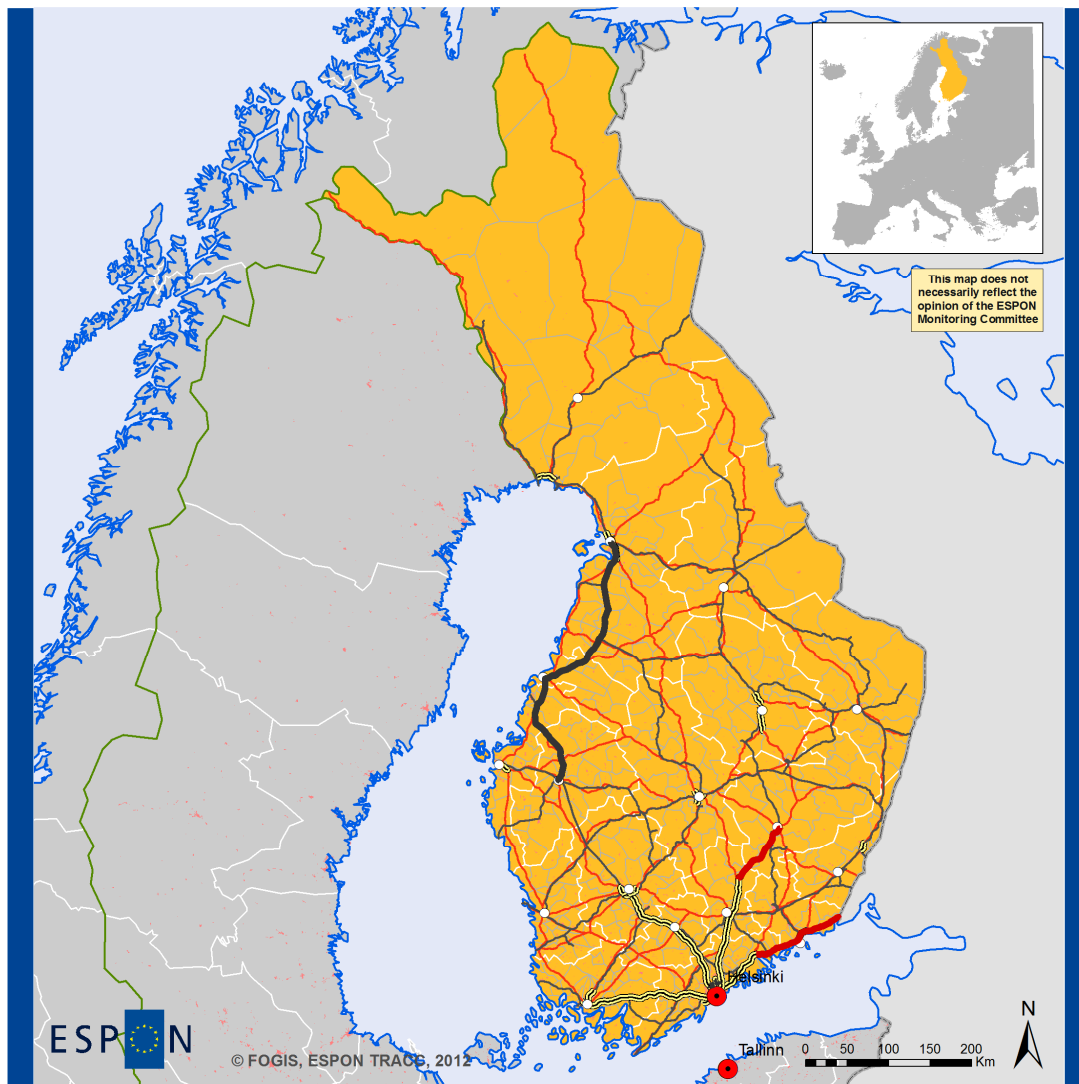
5 Accessibility effects of future TEN-T developments

The TEN-T projects in Finland include investments in roads, railways, harbours and traffic management. For this study, all Finnish TEN-T-funded projects under construction or in the planning phase were scrutinised. TEN-T policies are actively applied in Finland, but the majority of projects focused on how to improve transport facilities and consequently did not directly improve traffic speeds in road or rail networks. In addition, several TEN-T projects were completed before the study and many transport investments are made nationally. The datasets of the study represent the situation in 2012. Thus, only actual future investments were considered. The TEN-T projects included in the study are the rail upgrading between central and northern Finland, a local railway connection to Helsinki airport, and road upgrades for extending the southern motorway network towards the eastern border and to the north-east (Figure 43) (European Commission 2011, Finnish Transport Agency 2012, TEN-T Executive Agency 2012).

The key finding is that only very limited local effects were found, even though the population potential accessibility by car and by public transport were calculated using a relatively gradual distance decay ($\beta=0.034657$). The accessibility pattern of Finland is essentially the same after TEN-T investments by car (Figures 44) and by public transport (Figure 45).

A noticeable relative increase in accessibility by car is achieved with the motorway upgrade when measured by potentials (Figures 46). This effect is, however, very local. The effect of the northern rail improvement is evident in municipalities close to the railway, and remarkable improvements in accessibility may be found in municipalities with stations (Figure 47).

The reach and quality of the transport networks in Finland are at a relatively good level, especially when compared to demand. The network investments may be considered to develop infrastructure rather than establish it, therefore absolute improvements yielded by the investments may be very efficient in terms of transport volumes, but relatively low when measured in travel times. (Figures 48 and 49).

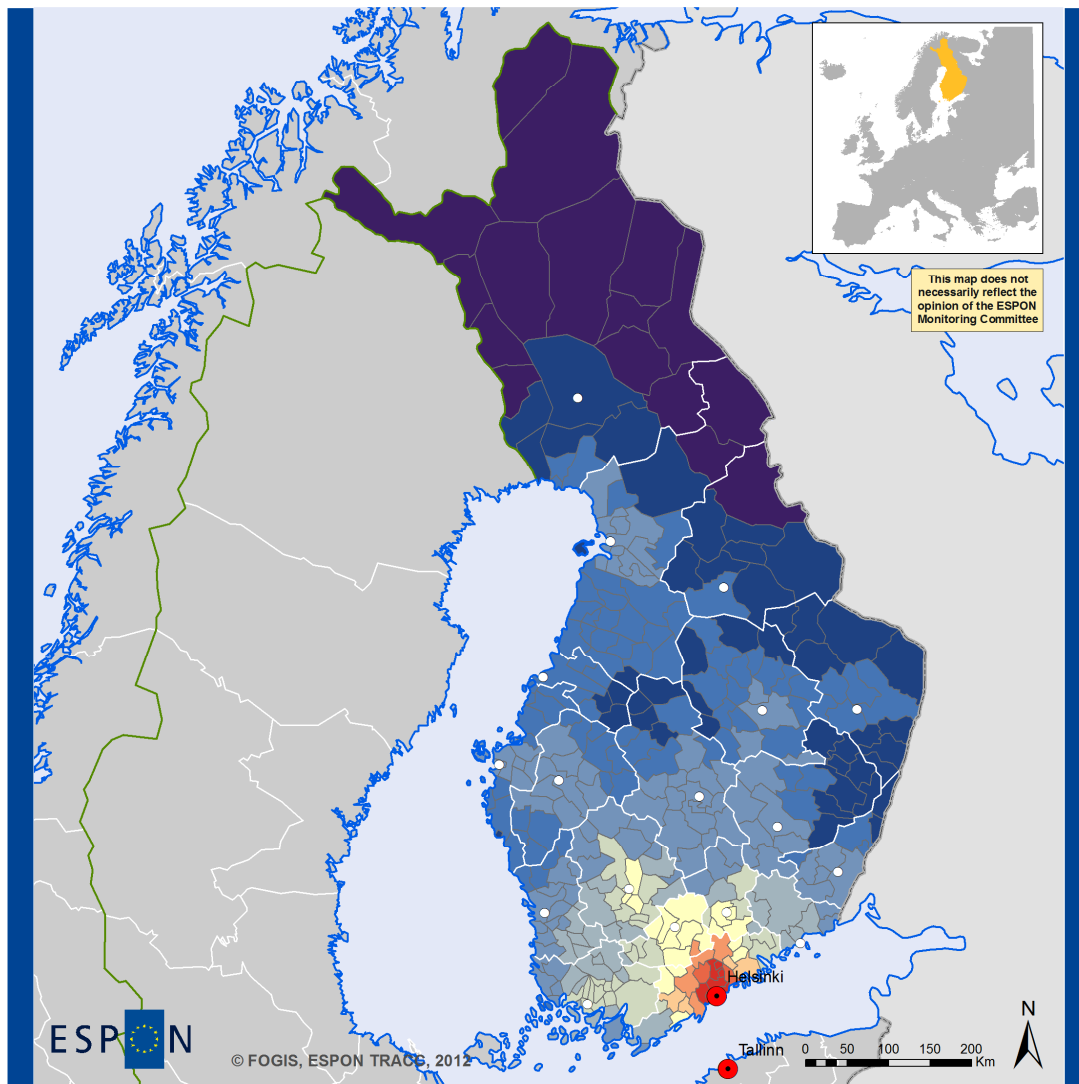


Data source: Finnish Transport Agency, 2012, Statistics Finland, 2010
European Commission, 2011
Origin of data: ESPON Databank Project, 2010/2011
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Finland Case Study TEN-T road and rail infrastructure projects

- | | | |
|---------------------|---------------|------------------------------|
| TEN-T road projects | Motorways | Main city |
| TEN-T rail projects | Primary roads | Settlement area |
| | Railways | Macro region: municipalities |

Figure 43. TEN-T road and rail infrastructure projects



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Finland Case Study Potential accessibility to population by car with TEN-T projects (municipality averages)

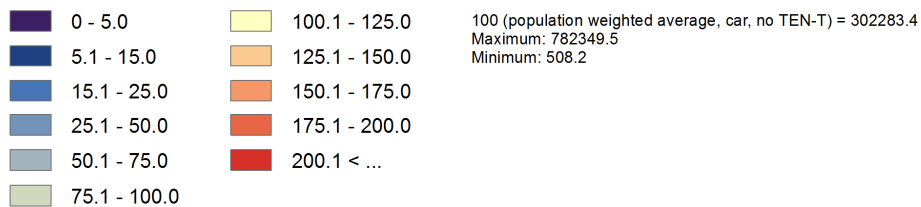
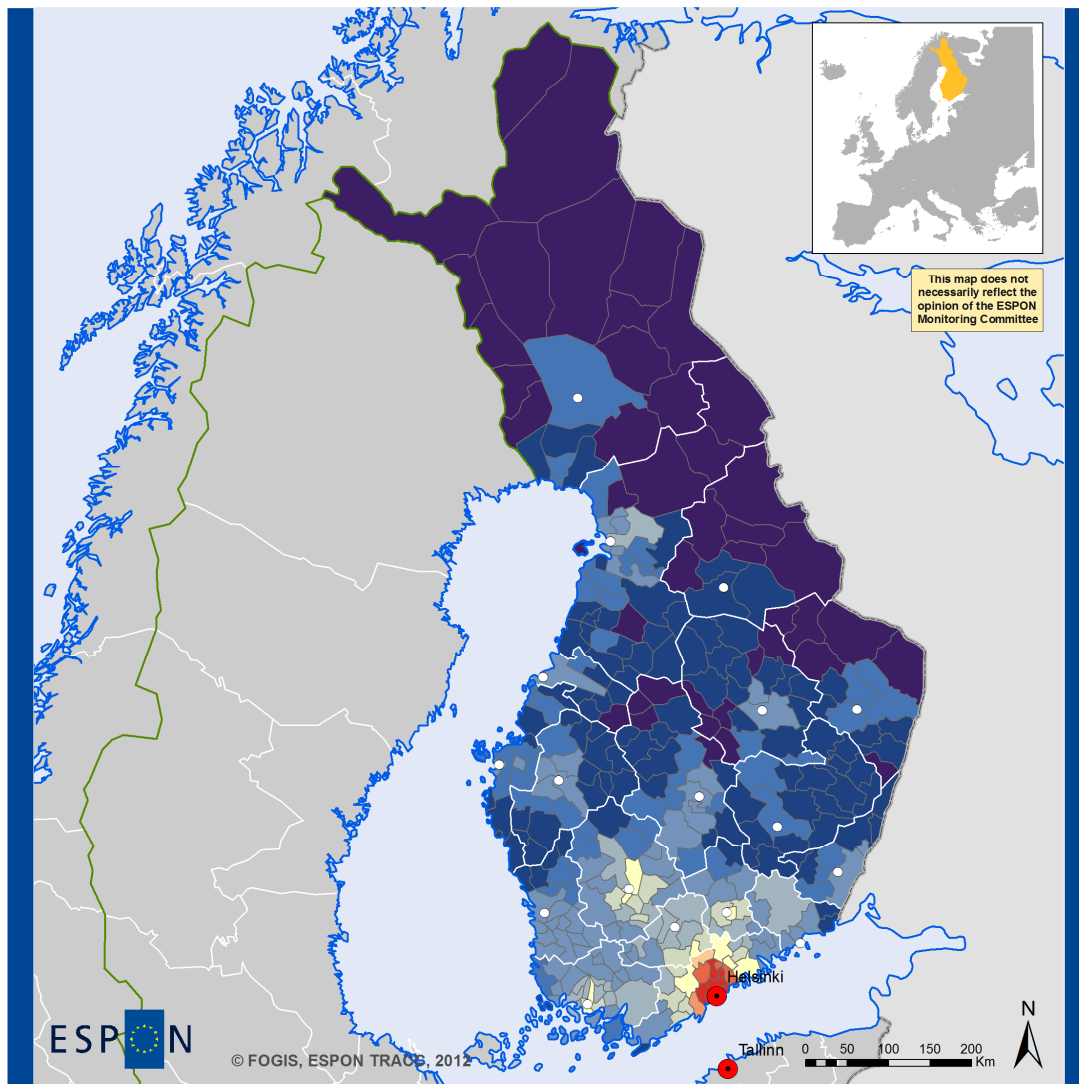


Figure 44. Potential accessibility to population by car with TEN-T projects



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Finland Case Study

Potential accessibility to population by public transport with TEN-T projects (municipality averages)

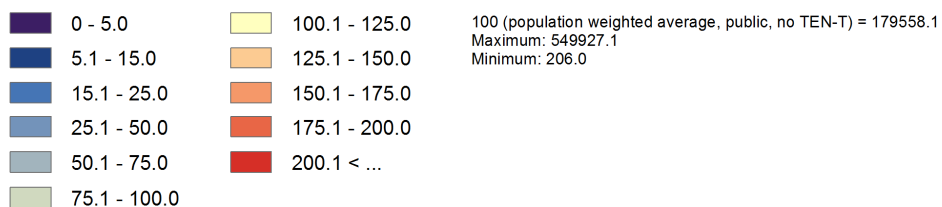
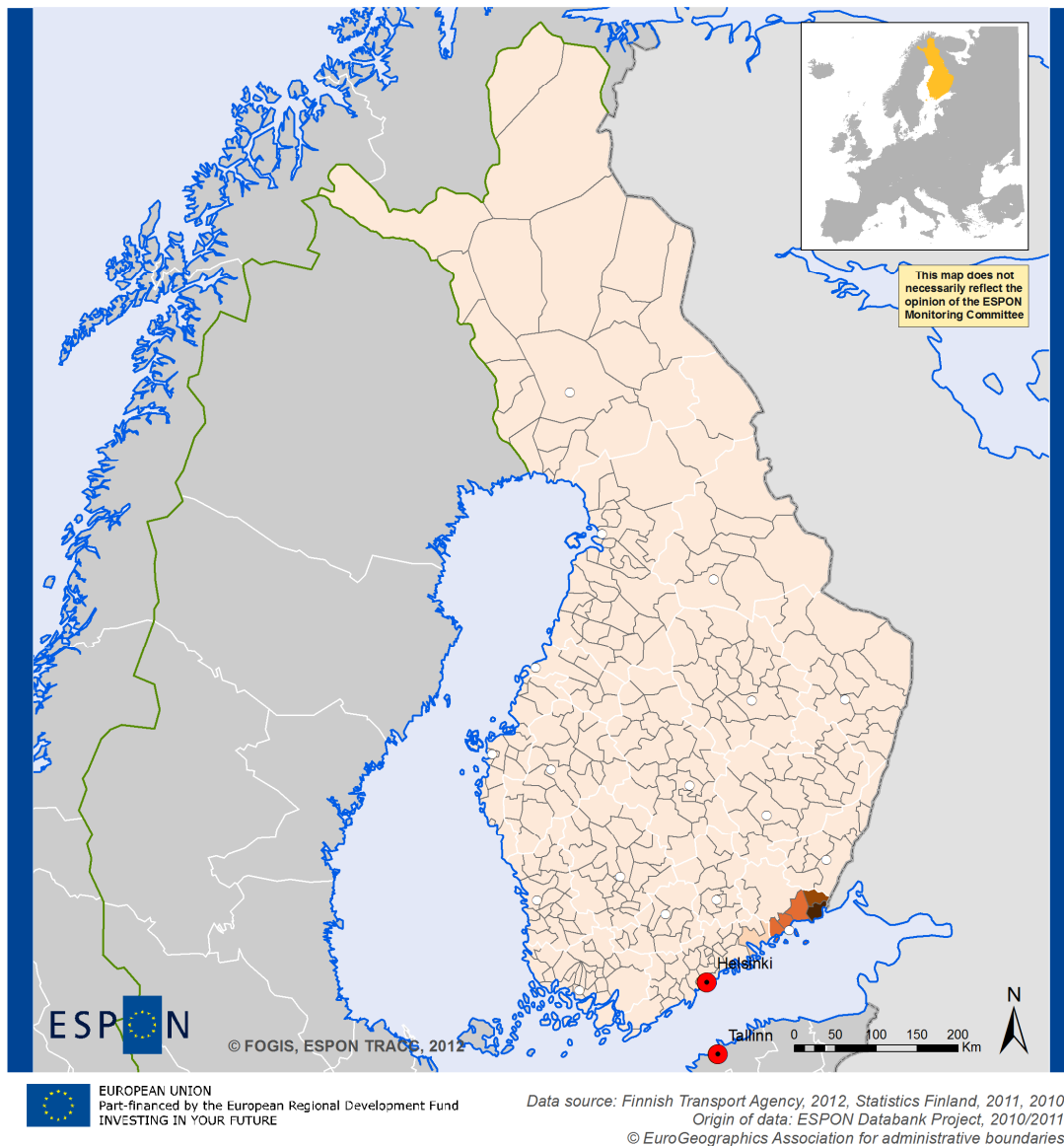


Figure 45. Potential accessibility to population by public transport with TEN-T projects



Finland Case Study
Relative increase of potential accessibility to population by car
with TEN-T projects (municipality averages)

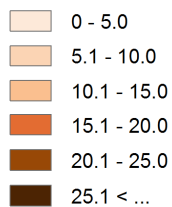
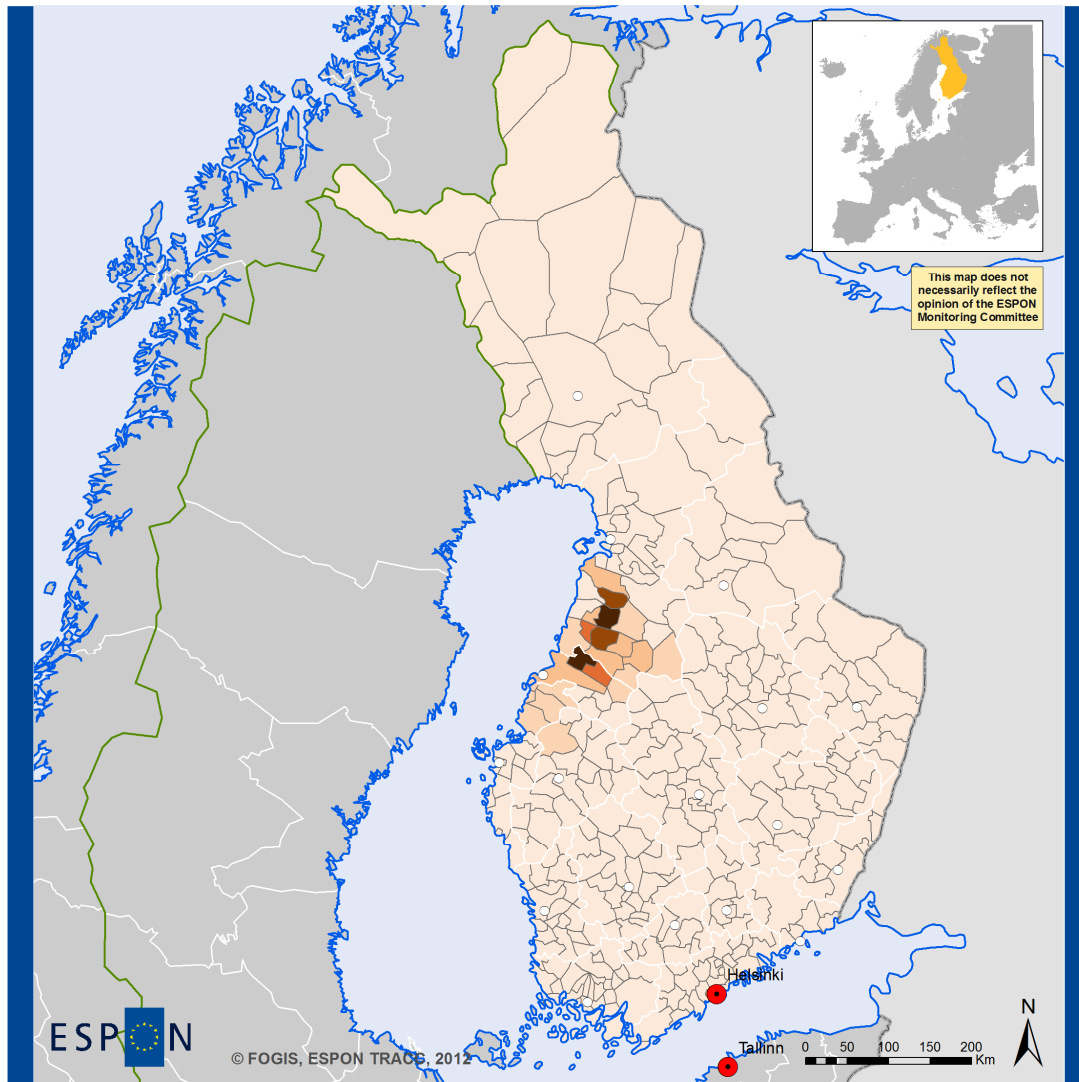


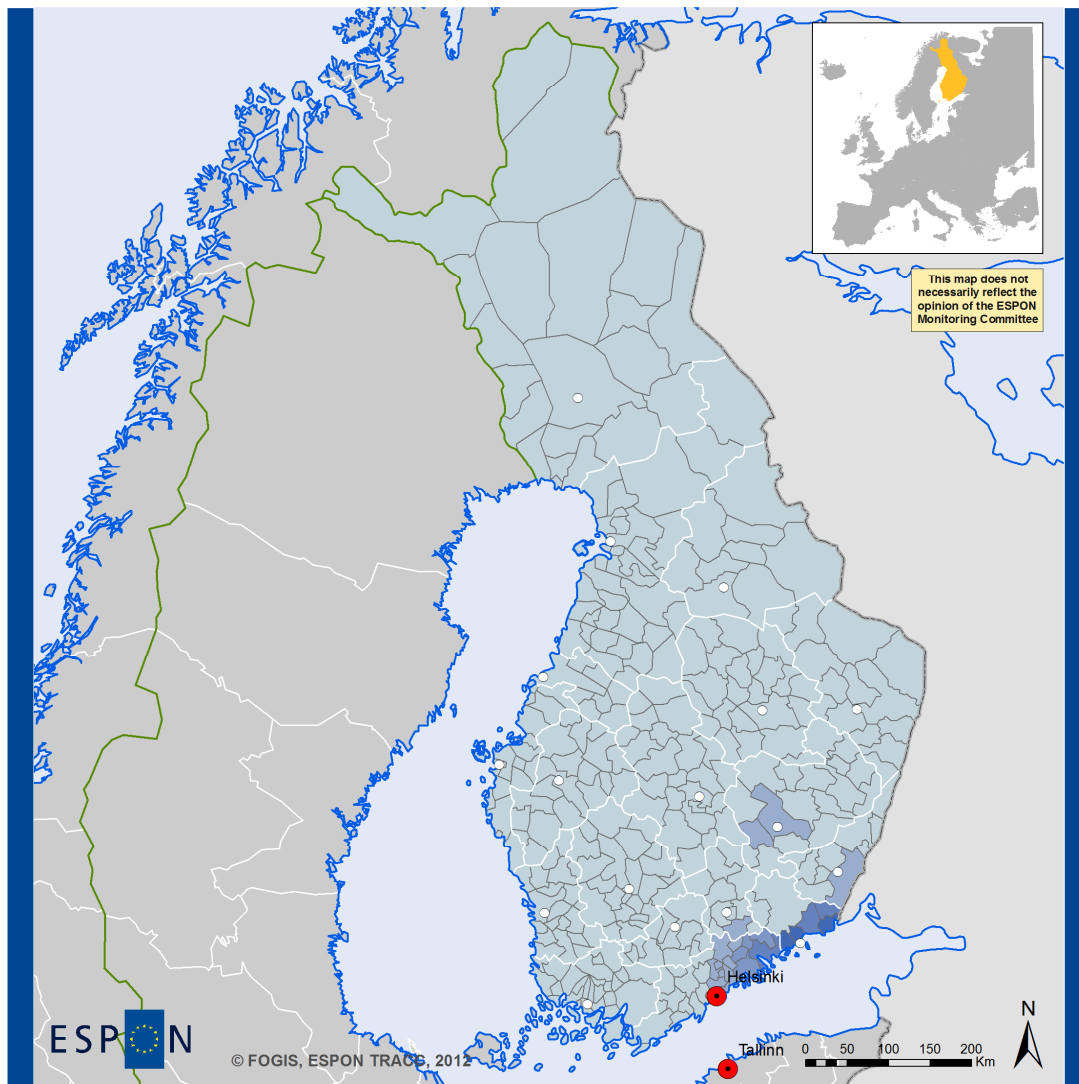
Figure 46. Relative increase of potential accessibility to population by car with TEN-T projects



Finland Case Study
Relative increase of potential accessibility to population by public transport with TEN-T projects (municipality averages)

- 0 - 5.0
- 5.1 - 10.0
- 10.1 - 15.0
- 15.1 - 20.0
- 20.1 - 25.0
- 25.1 < ...

Figure 47. Relative increase of potential accessibility to population by public transport with TEN-T projects



Finland Case Study
Absolute increase of potential accessibility to population by car with TEN-T projects (municipality averages)

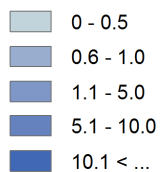
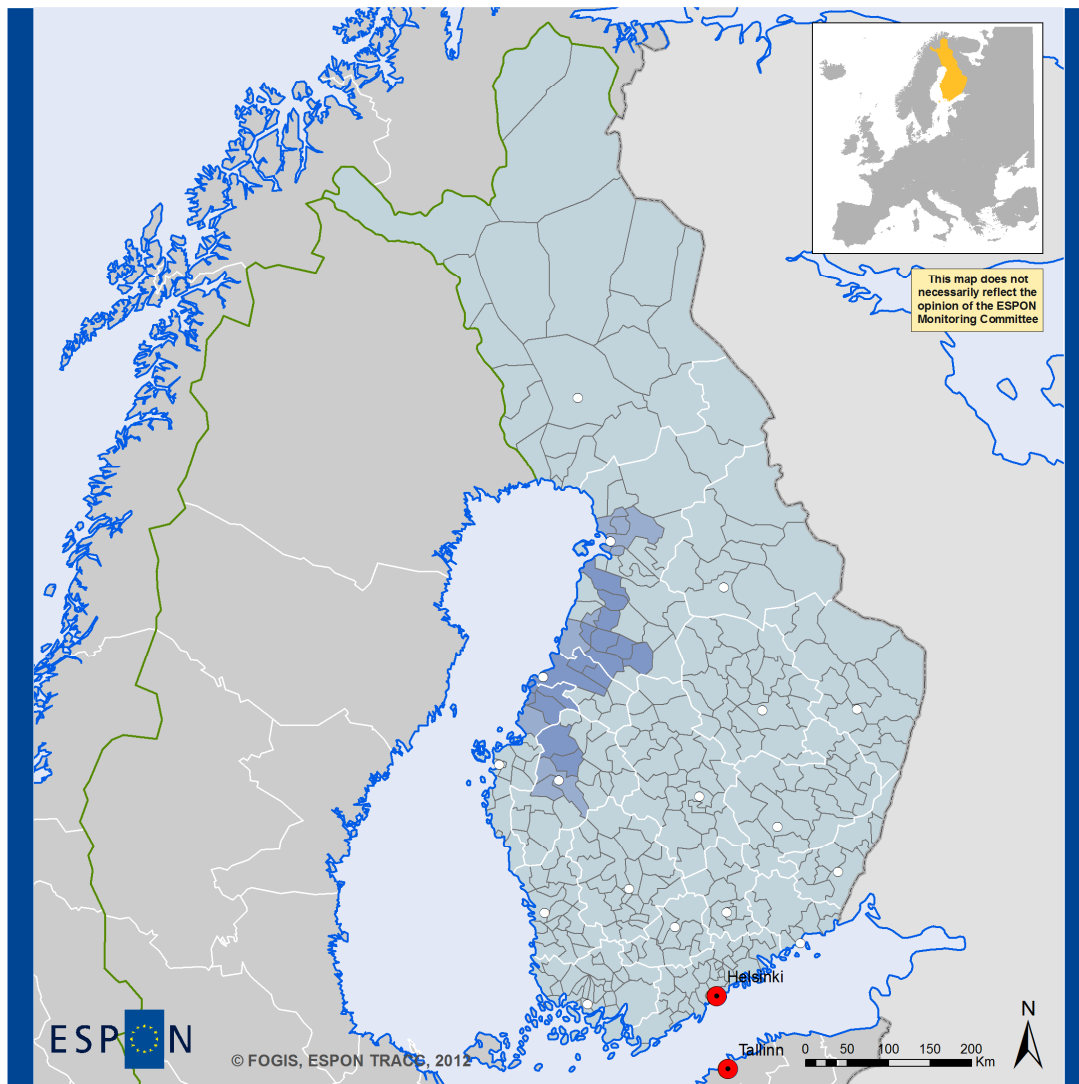


Figure 48. Absolute increase of potential accessibility to population by car with TEN-T projects



Finland Case Study
Absolute increase of potential accessibility to population by public transport with TEN-T projects (municipality averages)

- 0 - 0.5
- 0.6 - 1.0
- 1.1 < ...

Figure 49. Absolute increase of potential accessibility to population by public transport with TEN-T projects

6 Conclusions

Finland, as a whole, is one of the most sparsely populated countries in Europe. In the spatial divisions of the population and jobs, the presence of both urban densities and extremely sparsely populated areas that have long distances to major population centres is evident in the analyses of accessibility. Polarisation is intense in the centre-periphery axis when compared to European standards, and the division is deepening due to the location choices of companies and the overall urbanisation process.

The availability of services is relatively good, even in peripheral areas, but naturally the number of choices decreases along with decreased demand. This is evident in the case of health care accessibility. There are hospitals in every major city and town, and accessibility to basic health care corresponds to population distribution. Most municipalities in Finland have at least one higher secondary school, but in many parts of the country, students have no real choice concerning their school, and travel times are long. Only in the sparsely populated peripheries, accessibility to services can be considered poor.

The car is clearly the dominant travel mode in Finland. The regional structure favours travelling by car in areas outside urban densities, and in the peripheral areas public transport is weak. For all indicators of accessibility, it appears that dependency on public transport significantly reduces accessibility in all parts of the country, with the exception of the capital city and its surrounding areas, and the core areas of other major cities. Outside the immediate surroundings of centres, accessibility by public transport decreases rapidly and in the deepest peripheries connections are totally missing. Because of the geography of Finland, distances are generally long, transport flows are thin, and there is not sufficient population in many areas to ensure adequate demand for public transport.

The capital region and its surroundings, constituting the Uusimaa zoom-in area, clearly stand out as areas of good accessibility compared to any other parts of the country. However, congestion problems are common and often the accessibility of the area is much lower than the optimal situation implies. The other major population centres, especially regional capitals, constitute the second best category of accessibility, while large peripheral regions are generally characterised by low accessibility. However, rural areas exhibit different levels of accessibility in different parts of the country. In the eastern and northern regions in particular, the accessibility of services is extremely poor for the rural population, while in some predominantly rural regions, the presence of strong regional centres may be associated with improved indicators of accessibility. In the Finnish case study, the Lapland zoom-in area is representative of a remote periphery with accessibility limited by long distances and sparse service network. The Northern Ostrobothnia zoom-in area represents a combination of remote periphery and a major regional centre having positive implications on accessibility for the adjacent areas.

Transport corridors and networking between urban regions and centres within their zones of influence have been a key element of Finnish transport policy (Ministry of the Environment, 2006). In order to secure the needs of foreign trade, functional transport connections must exist to all parts of the world. Indeed, in economic terms, the most important elements of the Finnish transport system are connections to foreign countries (harbours and aviation in particular), the capacity and the level of service of the trunk roads and railways, the internal transit system of Helsinki, and the connections between the most important regional centres. A fundamental requirement of a functioning logistics chain is that the services of the road and railway infrastructure, as well as harbours, are available. In the case of Finland, it has to be noted that the availability of services is also critical in winter. This is something that cannot be taken for granted, especially in the more northern latitudes. With regard to this, a special need of the Finnish transportation system, also

affecting international accessibility, is the use of ice-strengthened ships and icebreakers in maritime transport during the winter season.

In early 2012, the Finnish government published an extensive report on national transportation policy (Liikenne- ja viestintäministeriö, 2012). The Finnish transport policy and the transport system are tightly connected to the other functions of society, including the requirements of industry, economy and employment, as well as regional development, since good accessibility is a key factor in the economic development and prosperity of regions. In contrast, improving the accessibility of remote rural areas will not be the focus of Finnish transport policy. This effectively signifies that these areas will remain in a disadvantaged position in terms of accessibility in the future, as the development measures will be mostly directed at those regions which have the most favourable conditions with regard to economic activity and population.

The majority of the findings of this study are based on grid cell maps, free of administrative divisions. Several particular areas and spatial patterns can be seen only on the grid cell basis. The LAU2 division, i.e. the municipal structure of Finland, is sparse in some areas and municipal consolidations have been common. There are significant political efforts being made to reduce the number of municipalities even further. Therefore, it is important to acknowledge that the spatial analysis based on the municipal classification suffers from a loss of accuracy, and comparability between different years is poor. This underpins the argument that the LAU-2 classifications need supplemental regional classification systems, which could be based on grid cells. In Finland, this type of regional typology is in a pilot stage (Finnish Environment Institute 2012).

The components of accessibility are the accessed place or object and travel for reaching it in general. Population distribution changes slowly and transport networks maybe even more slowly, particularly in Finland, whilst the coverage of the road and rail networks has reached a sort of maturity. Thus, the service supply, location choices of companies and population change will evidently have a greater impact on accessibility development in Finland than any foreseen transport investment.

Annexes

Annex 1 References

- European Commission (2011): *Proposal for a Regulation of the European Parliament and of the Council on Union Guidelines for the Development of the Trans-European Transport Network*. COM(2011) 650/2. [http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52011PC0650R\(01\):EN:NOT](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52011PC0650R(01):EN:NOT).
- Finnish Environment Institute (2012): *Aluetypologia - kaupungin ja maaseudun paikkatietoperusteinen aluerajaus, alueluokituksen kommentointi*. [in Finnish]
- Finnish Transport Agency (2012) *Hankeet*. <http://portal.liikennevirasto.fi/sivu/www/f/hankeet>. [in Finnish]
- Kotavaara, O., Antikainen, H., Rusanen, J. (2011a): Population change and accessibility by road and rail networks: GIS and statistical approach to Finland 1970–2007. *Journal of Transport Geography* 19, 926–935.
- Kotavaara, O., Antikainen, H., Rusanen, J. (2011b): Urbanization and transportation in Finland, 1880–1970: A GIS analysis. *Journal of Interdisciplinary History* 42, 89–109.
- Kotavaara, O., Antikainen, H., Marmion, M., Rusanen, J. (2012): Scale in the effect of accessibility on population change: GIS and a statistical approach to road, air and rail accessibility in Finland, 1990–2008. *The Geographical Journal* doi: 10.1111/j.1475-4959.2012.00460.x.
- Liikenne- ja viestintäministeriö (2012): *Kilpailukykyä ja hyvinvointia vastuullisella liikenteellä. Valtioneuvoston liikennepoliittinen selonteko eduskunnalle 2012*. <http://www.hare.vn.fi/upload/Julkaisut/17748/670671812912207.PDF>. [in Finnish]
- Ministry of the environment (2006): Competitiveness, welfare and eco-efficiency. Perspectives for spatial structure and land use in Finland. *The Finnish Environment* 31en|2006.
- Määttä-Juntunen, H., Antikainen, H., Kotavaara, O., Rusanen, J. (2011): Using GIS tools to estimate CO₂ emissions related to the accessibility of large retail stores in the Oulu region, Finland. *Journal of Transport Geography* 19, 346–354.
- Rusanen, J., Muilu, T., Colpaert, A., Naukkarinen, A. (2003): Georeferenced data as a tool for monitoring the concentration of population in Finland in 1970–1980. *Fennia* 181, 129–144.
- Statistics Finland (2011): *Grid Database*. http://www.stat.fi/tup/ruututietokanta/index_en.html.
- Statistics Finland (2012a): *Työssäkäynti*. http://pxweb2.stat.fi/database/StatFin/vrm/tyokay/tyokay_fi.asp. [in Finnish]
- Statistics Finland (2012b): *Labour Market, Population by activity, Unemployment*. http://www.stat.fi/tup/suoluk/suoluk_tyolama_en.html.
- Statistics Finland (2012c): *Maakuntien pinta-ala, väestö ja bruttokansantuote*. (NUTS 3) http://www.stat.fi/tup/suoluk/suoluk_vaesto.html. [in Finnish]
- TEN-T Executive Agency (2012): *TEN-T Projects by Country, Finland*. http://tentea.ec.europa.eu/en/ten-t_projects/ten-t_projects_by_country/finland.htm.

Annex 2 Database

Network data (input)

- node-link data of road and ferry network in 2012
- node-link data of bus network and bus stops in 2012
- node-link data of railway network and railway stations in 2012

The links of the network data sources include an estimate of the travel time between both ends of each link.

The bus network data has been built upon the road data by determining the sections of the network that include bus stops. Therefore, the bus network data is based on the same node-link structure as the road network data.

Together, the bus and railway network datasets constitute a public transport network dataset, in which the railway stations serve as points of transfer between the two.

Manually edited versions of the network datasets, involving the changes associated with the TEN-T projects, have also been produced.

Statistical data (input)

- regional population in 2010
- regional employment in 2005
- university hospitals, central hospitals and regional hospitals in 2011
- health care centres in 2011
- secondary schools in 2011

The population and employment data are recorded in 1×1 km grid cells, as defined by Statistics Finland.

The data for hospitals, health care centres and secondary schools were originally obtained in the form of street addresses. The addresses have been transformed into coordinate locations by means of geocoding, using the ArcGIS Online geocoding service.

Accessibility indicators (result)

- travel time to next regional centre, by car and public transport
- jobs accessible within 60 minutes of travel, by car and public transport
- potential accessibility to population, by car and public transport
- travel time to next hospitals, by car and public transport
- higher secondary schools within 30 minutes of travel, by car and public transport
- potential accessibility to medical doctors, by car and public transport

The indicators (result data) have been calculated in LAU-2 level regional units (municipalities) and 2×2 km grid cells. For both of these regional units, the population and employment figures have been calculated by aggregating the corresponding data fields in the original 1×1 km grid cell data. The indicators are produced separately for the original network datasets and datasets involving the TEN-T projects.

Annex 3 Accessibility model used

Accessibility by car

The accessibility model calculates spatial accessibility indicators as a function of travel time, measured in minutes. For travel by car, the travel time has been estimated according to the speed limits effective in the unfrozen season, as expressed in the road network database. In case there was no speed limit information available for a road segment, the default speed of 30 km/h was used for roads located in urban areas and 50 km/h for roads outside urban areas. In order to take account of the effect of turns on travel times, a time penalty of 12 and 24 seconds was assigned to right and left turns, respectively (Määttä-Juntunen et al., 2011). The travel speed of regular ferry links was estimated to be 20 km/h, while for cable ferries, the corresponding speed was 10 km/h. For all ferry links, an additional time penalty of 15 minutes was included for car travels to represent the time spent waiting.

The locations of population were represented by the centroid points of 2×2 km grid cells. The distance of each point to the transport network, whether an origin or destination, was measured as a straight-line distance, and the speed of 30 km/h was used to determine travel time estimates from each location to the closest position along the transport network.

Grid cells located on islands connected to the mainland by ferry, but having no actual road infrastructure, were excluded from the model. In addition, grid cells having their centroid more than 5 km away from the closest point along the road network were omitted.

Accessibility by public transport

As for railway transport, the travel speed and the halting times at the stations were estimated according to current timetable information. The access to the railway network as well as the exit from it was assigned a 5-minute time penalty.

The coverage of bus transport was estimated on the basis of the presence of bus stops along the roads. Using this information as a guideline, the bus network was constructed from the relevant road segments representing the four highest functional classes of the road network (local main streets and roads or higher). For long-distance coach transport, the speed was estimated to be 30 km/h in urban areas and 60 km/h in other areas. For local bus traffic, the corresponding figures were 20 km/h and 30 km/h.

The bus stops and railway stations serve as access points to the public transport network, and the speed of reaching the network was assumed to be 6 km/h, representing typical walking velocity. This speed was associated with the lowest functional classes of the road network (feeder and collector streets), which, in other words, are assumed to be used to reach the access points of public transport.

Accessibility calculations

The model calculates the fastest route between any two locations through a given network using the classic Dijkstra's algorithm. The route information is used to calculate the indicators of cumulated opportunities and potential accessibility. Cumulated opportunities, expressing the number of opportunities (jobs, schools, medical care) reached within a prescribed time threshold, is calculated by

$$A(O) = \sum_{j=1}^n B_{ij} O_j$$

where O_j is the number of opportunities in location j , and B_{ij} is a binary value (B is 1 if the travel time between locations i and j is smaller than the given threshold, and 0 if the time exceeds the threshold).

To calculate potential accessibility, the population of a location is used as the weight factor (P). Potential accessibility A is calculated according to the formula

$$A(P) = \sum_{j=1}^n \frac{P_j}{e^{-\beta d}}$$

where the parameter β determines the slope of the distance decay effect. In this model, the value 0.034657 was used for potential accessibility to population and the value 0.046210 for potential accessibility to medical doctors in the calculation of the final maps, albeit any other value can be used for β in the model. No self-potential has been used in the calculations of potential accessibility, as the calculations have been made at the 2×2 km grid cell level. The potential accessibility scores calculated for the raster cells have then been transferred to the regional level by means of population-weighted averaging.

TEN-T projects

The effect of TEN-T projects on the travel speeds throughout the railway network were taken into account by multiplying the current speeds by a factor of 0.77, expressing the estimated degree of improvement.

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