



Nordregio

NORDREGIO REPORT 2024:9

Towards a grid-based Nordic territorial typology

A new tool for analysis across the urban-rural continuum

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Summary

This report presents the grid-based Nordic urban–rural typology, which was developed as a new analytical tool for studying different types of spatial phenomena across Nordic territories. In this study this meant developing a typology that classifies all Nordic territories into seven different typology classes based on different degrees of urbanity and rurality. A key starting point for this work was the need for a territorial typology that would help enrich and provide new understanding of different types of urban and rural areas across the Nordic countries and shed light on how they are developing.

This report first presents how the typology was created, including the rationale behind the typology, key considerations at different stages of the work, and the main operational steps taken. The main purpose was to create a new territorial typology, to which different types of data could be combined, thus helping to provide a more nuanced and fine-grained understanding of territorial differences across the Nordic countries. Several key principles were specified early in the work. These include that the typology should be created at grid-level (1 x 1 km) as this allows identifying the characteristics of different types of areas at a very detailed territorial level. Another key decision was to create the typology mainly using open-source data and following a replicable method, to make any possible future updates to the typology easier and less costly. For the development of the Nordic typology, the Finnish grid-based urban–rural classification (*Kaupunki-maaseutuluokitus*) was the main source of inspiration.

This Nordic typology and population data at grid level (linked to the typology) is then used as an analytical lens for studying territorial differences, settlement patterns and demographic change dynamics in the five Nordic countries. According to the typology, the Nordic countries are predominantly rural when considering how their land areas are classified. However, an examination of settlement patterns according to the Nordic typology shows that the settlements are rather unevenly distributed in all the Nordic countries, and the majority of the population live relatively concentrated in areas that are classified as urban. In general, the population is largely concentrated in coastal areas and along waterways, where the major urban regions are found, reflecting historical patterns and features of physical geography. The Nordic typology is also used to examine what types of population change dynamics occurred in the Nordic countries during the period 2008–2022. The analysis shows that urbanisation has been a general trend during the past couple of decades, with the largest population growth occurring in the typology classes inner urban and outer urban. A relatively noticeable increase in population is also evident in peri-urban areas, suggesting suburbanisation and that intermediate areas located on the urban fringes have increasingly attracted new residents. In rural areas, the general trend shows that depopulation has occurred in

many rural localities, but different types of rural areas have developed quite differently. Based on the analysis, rural areas that are in the vicinity of cities and towns appear to have become more attractive places for people to settle, while sparsely populated rural areas seem to be less favourably placed and have generally witnessed population decrease.

This report shows how this typology and more fine-grained data can help reveal territorial differences that cannot be observed with more general statistics and data. The grid-based Nordic typology shows that many municipalities are at the same time both urban, intermediate, and rural, and in many cases these different categories seem to be undergoing quite different types of development. While the Nordic urban–rural typology is used in this study to examine settlement patterns and population change dynamics, it should be stressed that the typology is also well-suited to be used in combination with other types of data and as an analytical framework for studying also other types of spatial phenomena across the urban–rural continuum.

Sammanfattning

Denna rapport presenterar den nordiska typologin för stads- och landsbygdsområden som bygger på rutnätsdata och utvecklades som ett nytt analytiskt verktyg för att studera olika typer av rumsliga fenomen över nordiska territorier. Detta innebar att utveckla en typologi som klassificerar alla nordiska territorier i sju olika typologiklasser enligt olika grader av urbanitet och ruralitet. En viktig utgångspunkt för detta arbete var behovet av en territoriell typologi som skulle bidra till att berika och ge ny förståelse för olika typer av stads- och landsbygdsområden i de nordiska länderna och belysa hur de utvecklas.

I studien presenteras först hur typologin skapades, inklusive motiveringen bakom typologin, viktiga överväganden i olika skeden av arbetet och de viktigaste arbetsskeden som tagits. Huvudsyftet var att skapa en ny territoriell typologi, till vilken olika typ av data kan kombineras och därmed ge en mer nyanserad och detaljerad förståelse av territoriella skillnader i de nordiska länderna. Flera viktiga principer fastställdes tidigt i arbetet. En av dessa var att typologin skulle skapas på rutnätetsnivå (1 x 1 km) för att göra det möjligt att identifiera olika typer av områden på en högt detaljerad territoriell nivå. Ett annat viktigt beslut var att skapa typologin huvudsakligen med hjälp av öppna data och en replikerbar metod, för att göra eventuella framtida uppdateringar av typologin enklare och mindre kostsamma. För utvecklingen av den nordiska typologin var den finska rutnätsbaserade klassificeringen av stads- och landsbygdsområden (Kaupunki-maaseutuluokitus) den viktigaste inspirationskällan.

Denna nordiska typologi och befolkningsdata på rutnätetsnivå (kopplad till typologin) används sedan som ett analytiskt ramverk för att studera territoriella skillnader, bosättningsmönster och befolkningsförändringar i de fem nordiska länderna. Enligt typologin är de nordiska länderna till övervägande del landsbygd när man ser till hur deras landområden klassificeras. Analysen av bosättningsmönster enligt den nordiska typologin visar dock att bosättningarna är ganska ojämnt fördelade i alla de nordiska länderna, och majoriteten av befolkningen bor relativt koncentrerat i områden som klassificeras som urbana. I allmänhet är befolkningen till stor del koncentrerad till kustområden och längs vattendrag, där de större stadsregionerna finns, vilket återspeglar historiska mönster samt naturgeografiska faktorer. Den nordiska typologin används också för att undersöka befolkningsförändringar som skett i de nordiska länderna under 2008–2022. Analysen visar att urbanisering har varit en allmän trend under de senaste decennierna, med den största befolkningstillväxten i typologiklasserna inre stadsområden och yttre stadsområden. En relativt tydlig ökning av befolkningen syns också i peri-urbana områden, vilket tyder på suburbanisering och att mellanliggande områden som ligger i utkanten av städerna i allt högre grad har lockat nya invånare. På landsbygden visar den allmänna trenden att avfolkning har skett i många

landsbygdsorter, men olika typer av landsbygdsområden har utvecklats ganska olika. Enligt analysen verkar landsbygdsområden som ligger i närheten av städer ha blivit mer attraktiva platser för människor att bosätta sig på, medan glesbefolkade landsbygdsområden har i allmänhet upplevt en befolkningsminskning.

Denna rapport visar hur denna typologi och mer detaljerade data kan hjälpa att identifiera territoriella skillnader som inte kan observeras med mer allmän statistik och data. Den rutnätsbaserade nordiska typologin visar att många kommuner består av såväl urbana, intermediära som rurala områden, och i många fall verkar dessa olika kategorier ha genomgått väldigt olika typer av utveckling. Den nordiska typologin för stads- och landsbygdsområden används i denna studie för att undersöka bosättningsmönster och befolkningsförändringar, men typologin är också väl lämpad att användas i kombination med andra typer av data och som ett analytiskt ramverk för att studera även andra typer av rumsliga fenomen i olika typer av stads- och landsbygdsområden.

1. Introduction

The Nordic Region is characterised by various demographic trends. A noticeable trend is that all five Nordic countries have seen population growth in recent decades, largely due to immigration. At the same time, demographic development is unbalanced, and different regions, municipalities, and local areas are undergoing noticeably different forms of development. While differences between regions and municipalities have been relatively well studied (see e.g., Grunfelder *et al.* 2020; Norlén *et al.* 2022), there has been comparatively less research on demographic trends occurring more locally within regions and municipalities in the Nordic countries. This is largely due to a lack of easily available, comparable, and harmonized data suitable for such analysis across this region. Against this background, one of the main starting points of this study was to gain a better understanding of these types of changes at more local levels. To achieve this, a new territorial typology for classifying different types of areas suitable for conducting such spatially detailed analysis was developed.

This report and the grid-based [Nordic urban–rural typology](#) presented in this study are outcomes of the project *Remote work: Effects on Nordic people, places and planning 2021–2024*, which is a collaborative project between the three [Nordic Thematic Groups](#) under the [Nordic co-operation Programme for Regional Development and Planning 2021–2024](#). In essence, a territorial typology or classification can be understood as a way of delimiting or classifying different territories according to certain common spatial characteristics and qualities (see e.g., Stjernberg *et al.*, 2023). For this project a typology has been created that classifies different types of territories across the Nordic countries based on different degrees of urbanity and rurality. The Nordic typology was then used as an analytical tool for studying territorial differences, settlement patterns, and population change dynamics across the urban–rural continuum. Here, the terms 'typology' and 'territorial classification' are used interchangeably when referring to the Nordic typology as well as to other typologies or classifications that are addressed in the study.

This project was initiated during the Covid-19 pandemic when remote work became an increasingly common practice for many Nordic workers. One of the hypotheses at the onset of the study was that remote work would have more long-lasting territorial effects, with both workers and employers being keen to maintain at least some flexibility in working conditions, also post-pandemic. Against this background, one of the rationales for developing a new grid-based Nordic territorial typology was to allow for a better understanding of the spatial effects of increased remote work and multi-locality in different types of urban and rural areas. More generally, the main purpose of creating this territorial classification was to generate a new

analytical framework, to which different types of data could be combined, thus helping to provide a more nuanced and fine-grained understanding of territorial differences across the Nordic countries.

The typology was developed through collaboration between Nordregio and Ubigu, where the project team at Nordregio managed and coordinated the work to develop the typology, while Ubigu was tasked with the technical development of the typology. The analysis presented in this report, where the typology is used to study territorial and settlement patterns and development trends, was carried out by Nordregio.

The work has been guided by the following methodological questions:

- How can a grid-based territorial typology that allows for comparative analysis of urban–rural differences across the Nordic countries be developed, mainly using open data, and building on a replicable data process model?
- How can this Nordic typology be used as an analytical framework for studying territorial and settlement patterns and population change dynamics in different types of urban and rural areas?
- How can this Nordic typology be used to complement more general statistics and typologies bound to administrative areas such as municipalities?

The typology is used for examining urban–rural differences across the Nordic countries. The analysis focuses on the following key questions:

- What do territorial and settlement patterns look like in the Nordic countries when examined according to the grid-level Nordic urban–rural typology?
- What types of population change dynamics occurred in the Nordic countries in the period 2008–2022 based on the Nordic urban–rural typology?
- What kind of internal differences in territorial and settlement patterns can be seen within different types of Nordic municipalities?

This report is structured as follows. Section 2 presents the new grid-based Nordic urban–rural typology, focusing on aspects such as the aims and objectives as well as the analytical and operational steps taken in developing the typology. Section 3 shows how the typology can be used as an analytical tool for studying settlement patterns and demographic change dynamics across the urban–rural continuum in the five Nordic countries. Finally, Section 4 presents the main conclusions and final reflections concerning the typology development and a discussion of the main points and observations drawn from the analysis using the Nordic typology.



2. The Nordic urban–rural typology

This section describes the Nordic urban–rural typology and how it was developed. The focus of Section 2.1 concerns the background and aims of the work carried out; also taking account of existing European and Nordic typologies that provided inspiration for the development of the Nordic typology. Section 2.2 describes, more specifically, how the typology was created, including key considerations at different stages of the work, and the main operational steps taken.

2.1 Background and context

Aims and objectives

A key starting point for this study was the need for a territorial typology that would help provide a richer and more nuanced understanding of different types of urban and rural areas in the Nordic countries. Essentially, a territorial typology can be defined as a way of identifying, delimiting, and classifying different places or territories based on certain common spatial characteristics and qualities (Copus *et al.* 2008; van Eupen *et al.* 2012, Eurostat 2019). Most commonly, typologies are used for analytical and research purposes or as tools for supporting policy development and interventions (Stjernberg *et al.* 2023). In this project, the main intention was to develop a typology suitable for analysis. In addition, by providing an analytical tool useful for generating new evidence on territorial development, the typology could also be useful for supporting spatial planning and policy.

While there are many existing typologies widely used for different analytical and policymaking purposes, one of the main shortcomings of most existing typologies is that they are too general and fail to grasp the diversity of Nordic territories observable, for instance, within municipalities. The aim of this study was specifically to acquire a more nuanced understanding of territorial differences, also within regions and municipalities (none of the existing typologies were suitable for such

comparative analysis across the Nordic countries). To achieve this, the objective was to develop a harmonised Nordic typology suitable to be applied as an analytical framework for better understanding the characteristics and differences between different types of urban and rural areas.

The following objectives were specified at the onset of this project:

- Creating a new Nordic urban–rural typology based on harmonised Nordic definitions to help better understand the urban–rural continuum, mainly using open data and building on a replicable data process model.
- Using the typology for carrying out comparative analysis of settlement and mobility patterns and trends.
- Publishing the typology on an interactive digital mapping platform and making the typology layer available for download and further use.

Taking stock of existing typology frameworks

To help determine certain key aspects that should be considered in the development of a Nordic typology, the first step was to consider which potentially relevant territorial typologies currently exist, and what lessons can be drawn from these examples. This section identifies some different relevant typology frameworks and takes stock of these classifications from the perspective of creating a Nordic typology.

Traditionally, most typologies that seek to distinguish urban from rural areas have been based on administrative boundaries. This is the case with most European-wide typologies as well as with territorial classifications that have been created in the different European countries, which in most cases rely on some kind of classification of administrative areas, such as regions, municipalities, or other areal units (Stjernberg *et al.* 2023).

At the European level, the most established and commonly used typology for demarcating urban from rural areas is the [degree of urbanisation](#) (DEGURBA) classification created by Eurostat (2023). This typology categorises [local administrative units](#) (LAUs) into three classes '[cities](#)', '[towns and suburbs](#)', and '[rural areas](#)', or alternatively, using the nomenclature of territorial units for statistics (NUTS) definitions, into 'predominantly rural regions', 'intermediate regions' and 'predominantly urban regions' (see Figure 1) (Eurostat, 2018). The typology is based on a combination of geographical contiguity and [population density](#), measured by minimum population thresholds applied to 1x 1 km [population grid cells](#). In the Nordic countries, this classification means that municipalities are classified as either predominantly urban, intermediate, or predominantly rural (Figure 12). Most previous studies that have examined urban–rural differences across the Nordic countries used this Eurostat classification (e.g., Grunfelder *et al.* 2018, Sánchez

Gassen & Heleniak 2019, Grunfelder *et al.* 2020, Norlén *et al.* 2022). It should, however, be noted that there have been efforts to create a more fine-grained territorial version of the DEGURBA classification. In 2018 DG REGIO published a refined version of this typology at grid level (DEGURBA level 2) consisting of six classes (cities, towns, suburbs, villages, dispersed rural areas, mostly uninhabited areas) (EEA, 2023). Currently, the most established version of DEGURBA classifies municipalities and communes (LAU level) into three categories; most comparable statistical data at the European level are produced at this territorial level.

While the DEGURBA typology can be useful for more general comparisons of different types of regions or municipalities, in the Nordic countries where many municipalities are vast in size and sparse in population (also having great variation in population density patterns) this classification is rather coarse and does not properly reflect territorial differences at a granular level. For example, in northern Sweden, the municipalities of Kiruna and Gällivare are classified as intermediate according to the Eurostat classification while these municipalities largely consist of territories that are either sparsely populated or uninhabited, which can be seen in Figure 1 (below) and in Figure 12 (in Section 2.2).

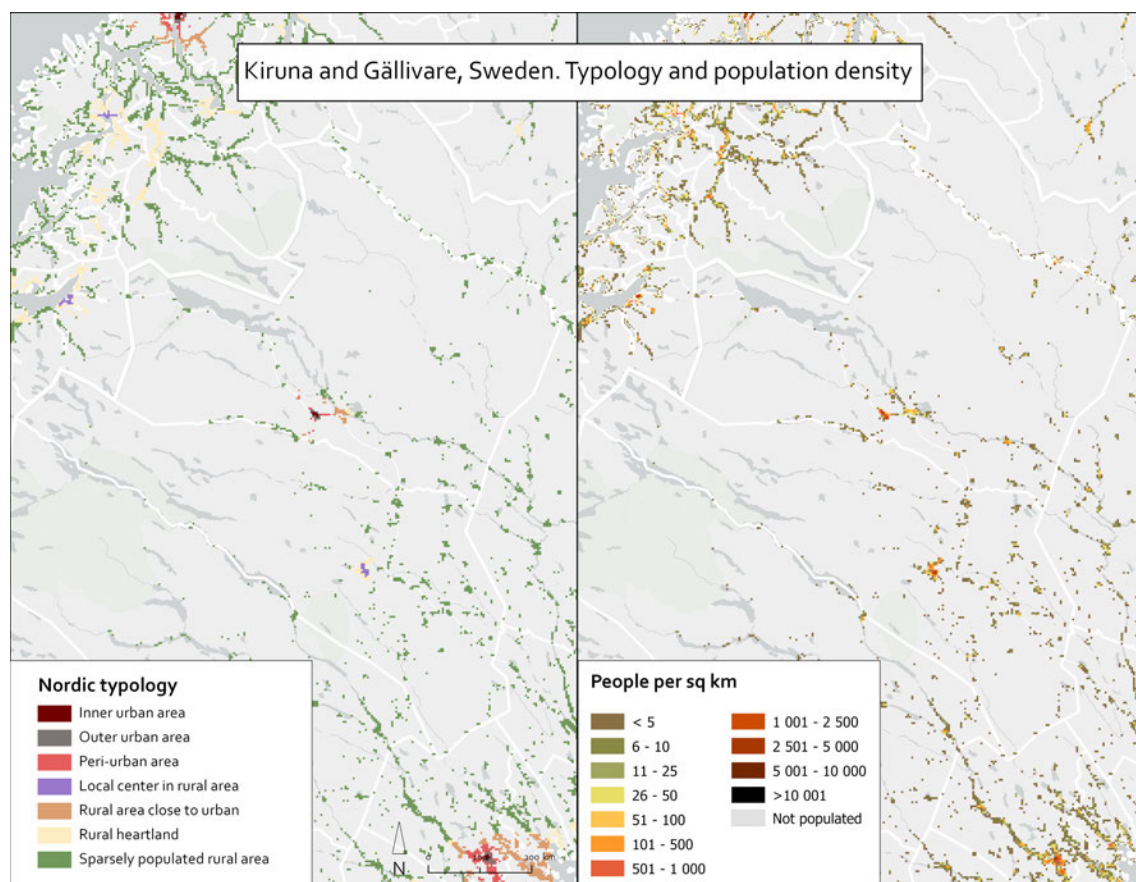
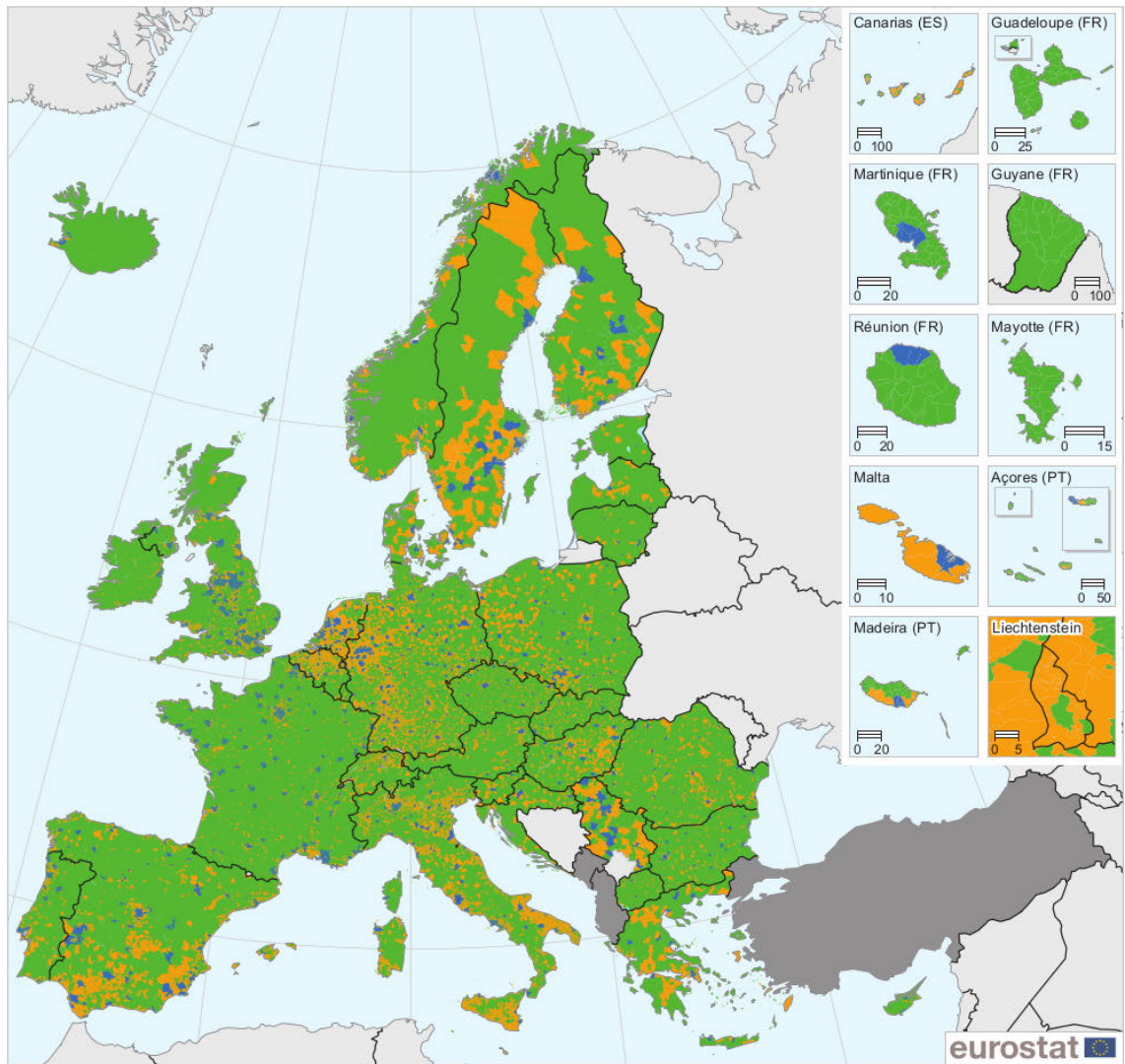


Figure 1. Close-up view of the Swedish municipalities of Kiruna and Gällivare, which are intermediate municipalities according to the DEGURBA classification. The map shows territorial differences based on the Nordic typology and settlement patterns at 1 × 1 km grid level within the municipalities.

Degree of urbanisation for local administrative units (LAU)



Administrative boundaries: © EuroGeographics © UN-FAO © Turkstat
Cartography: Eurostat — GISCO, 05/2018

- Cities**
(Densely populated areas: at least 50 % of the population lives in urban centres)
- Towns and suburbs**
(Intermediate density areas: less than 50 % of the population lives in rural grid cells and less than 50 % of the population lives in urban centres)
- Rural areas**
(Thinly populated areas: more than 50 % of the population lives in rural grid cells)
- Data not available**

0 200 400 600 800 km

Note: based on population grid from 2011 and LAU 2016.

Source: Eurostat, JRC and European Commission Directorate-General for Regional Policy

Figure 2. The degree of urbanisation (DEGURBA) classification of local administrative units (LAUs) in Europe (source: Eurostat).

Across Europe, including the Nordic countries, there are numerous national typologies that have been developed for various policy, analytical, and statistical purposes. These types of typologies often provide a more nuanced outlook on territorial differences within a specific country compared to the more general EU-wide classification, and they are in many cases used as support tools for policymaking or in research in the countries for which they have been developed (Stjernberg *et al.* 2023).

In the Nordic countries, these national classifications are most commonly based on municipalities as the territorial unit. For instance, the Danish Municipality groups (*Kommunegrupper*) typology classifies municipalities into five different classes based on population size in urban settlements and accessibility to jobs (capital municipalities; metropolitan municipalities; provincial municipalities; commuter municipalities; rural municipalities) (Statistics Denmark, 2018). Similarly, the Norwegian Centrality index (*Sentralitetsindeks*) classifies municipalities into six classes (most central municipalities; second most central municipalities; medium central municipalities 1; medium central municipalities 2; second least central municipalities; least central municipalities) based on their centrality, measured through access to jobs and services (Høydahl, 2017). Also, in the Classification of Swedish municipalities (*Kommungruppsindelning*), the typology includes three main groups (large cities and municipalities near large cities; medium-sized towns and municipalities near medium-sized towns; smaller towns/urban areas and rural municipalities) and municipalities are then further divided into a total of nine specific groups based on structural parameters such as population and commuting patterns (SKR, 2023). An overview of these key national typologies from the different Nordic countries is listed below:

Table 1. Key characteristics of select Nordic national typologies.

Country and typology	Background/ purpose	Areas of use	Data used	Number and names of classes
Denmark: municipality groups	The typology was initiated and produced by Statistics Denmark to allow for various analysis from both urban and rural perspective.	The typology is mainly used as a tool for various analyses.	Population by settlement; data of employed (day and night population) at sub-municipal level, road network data with speed limits (to calculate accessibility).	Five classes (capital municipalities, metropolitan municipalities, provincial municipalities, commuter municipalities, rural municipalities).
Finland: urban–rural classification	In the early 2010s, Finnish national authorities saw a need for a classification that better recognized the continuity between urban and rural areas and the characteristics of different areas. Hence, a grid-based classification was developed by the Finnish Environment Institute (SYKE) to replace a former municipality-based classification of urban and rural areas.	Used in various ways to support regional and rural development and policy in Finland. It has been used in several strategies and policy documents at national, regional, and municipal level, and for distributing development funds. Also, widely used as an analytical framework in research.	Various register-based data at grid level (250 x 250 m). Data sources include population, labour force, commuting, buildings, road network data from the Digiroad database and CORINE land-use data.	Seven classes (inner urban areas, outer urban areas, peri-urban areas, local centres in rural areas, rural areas close to urban areas, rural heartland areas, sparsely populated rural areas).

Norway: centrality index	The typology was initiated by the Ministry of Local Government and Regional Development (KDD) to provide a more robust way of categorising municipalities based on centrality, to identify municipalities in need of support and measures.	The typology is used as a part of the KDD district index which is used to identify municipalities in need of measures and support. It is also used for various analyses and research with an urban–rural component.	Population, employment per sector, road network data with speed limits to allow accessibility calculations.	Six classes (most central municipalities; second most central municipalities; medium central municipalities 1; medium central municipalities 2; second least central municipalities; least central municipalities).
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Sweden: municipality grouping	<p>This typology was developed by the Swedish Association of local authorities and Regions (SKR). The first version was produced in 2017 but already since the 1980s SKR have been making municipality groupings. The most recent version is from 2023.</p>	<p>The typology is used for analysis on different aspects of urban and rurality and to be able to compare similar municipalities with each other.</p>	<p>Population, population in built up area, out-commuting as share of night population, out-commuting to city as share of night population, biggest out commuting municipality, in-commuting as share of day population, number of overnight stays, turnover in trade, turnover in hotels, turnover in restaurants.</p>	<p>The typology consists of two levels.</p> <p>First level: three classes: (cities and municipalities close to cities; bigger towns and municipalities close to bigger towns; smaller towns/built-up areas and rural municipalities).</p> <p>Second level: nine classes (cities; commuting municipality close to city; bigger towns; commuting municipality close to bigger towns; low commuting municipality close to bigger towns; smaller towns/built-up-areas; commuting municipality close to smaller towns; rural municipality; rural municipality with tourism).</p>
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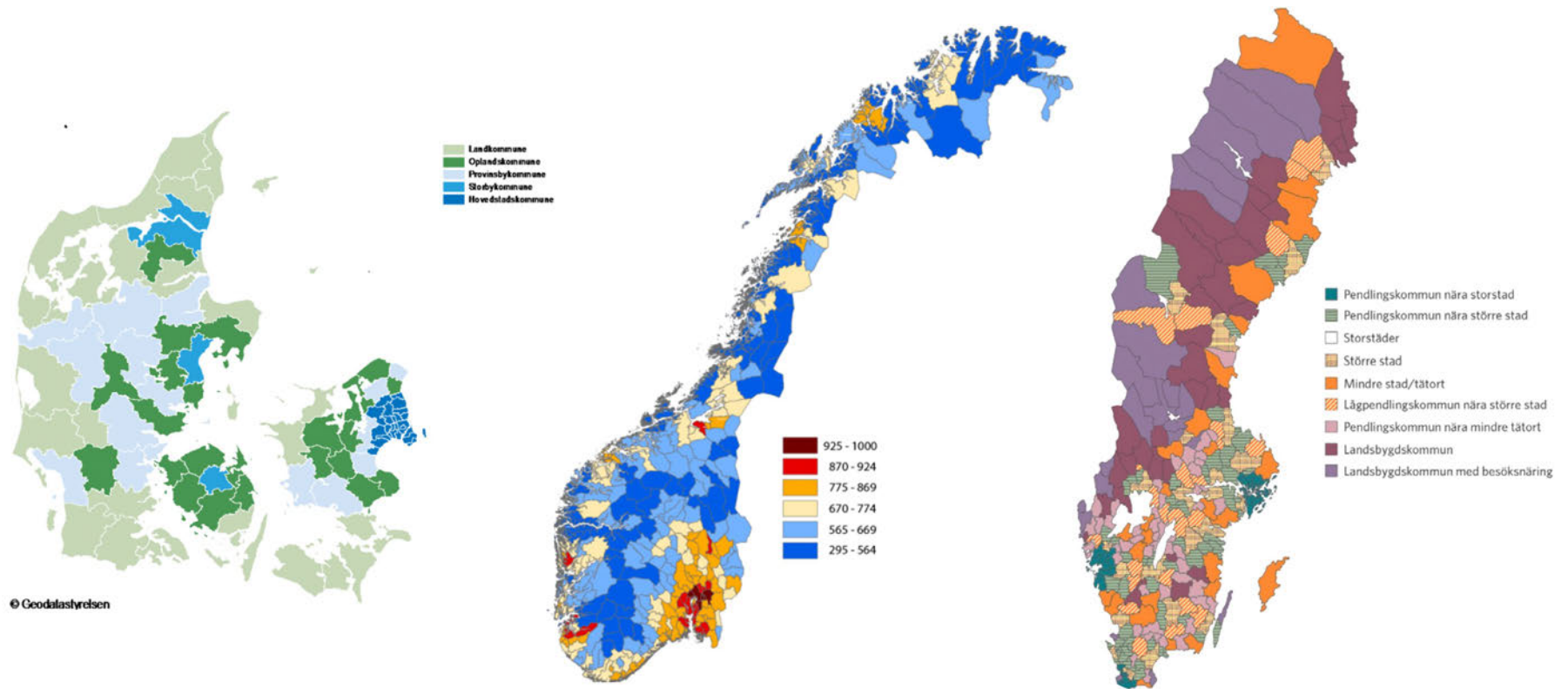


Figure 3. Three different Nordic territorial typologies: the Danish municipality groups (Kommunegrupper), the Norwegian centrality index (Sentralitetsindeks), and the classification of Swedish municipalities (Kommungruppsindelning) (source: Statistics Denmark, 2018a; Høydahl, 2020; SKR, 2023).

One of the advantages of basing typologies on administrative units such as municipalities, as in the previous examples, is that these units are well known and established. This means that it may be easier to communicate the results and relate these to policy purposes. Various statistical data are also produced at the level of municipalities, which means that these data can be easily incorporated and used for analysis based on the territorial classifications. These types of typologies, based on administrative areas, can thus be useful, for example, in statistical monitoring of development trends for supporting policy development. Nevertheless, there are also several limitations with these types of classifications. One of the main shortcomings is that these types of territorial classifications do not take account of markedly different types of areas within a single administrative unit and, for example, most Nordic municipalities are likely to include both urban and rural areas. For instance, according to the DEGURBA classification, the municipality of Uppsala is defined as urban, but it is also the Swedish municipality that has the greatest number of residents living in rural areas (Uppsala, 2023). In typologies where municipalities are classified as either urban or rural, such internal differences within the municipality are thus not reflected. To overcome these limitations and to acquire a more fine-grained and nuanced understanding of territorial differences, within and across administrative borders, the use of more spatially detailed data provides many advantages in more accurately distinguishing urban from rural areas.

Against this background, one of the main starting points for developing a new Nordic urban–rural typology was to use data at grid level. The decision to utilise grid data was also based on the insights gained from an earlier Nordregio study by Stjernberg & Penje (2019), which applied grid data for studying population change dynamics across the Nordic countries and identified that grid-level statistics can reveal trends that are less evident or entirely concealed at more general levels of analysis. An important source of work that guided this work came from the Finnish urban–rural classification (*Kaupunki-maaseutuluokitus*), mainly developed by the Finnish Environment Institute (SYKE), which relies on spatially detailed data to enable a more fine-grained classification of urban and rural areas (SYKE, 2020).

Among the European and Nordic countries, Finland is a rare exception in that the Finnish urban–rural classification, which is the most established and commonly used typology for policy and analytical purposes, is constructed at grid level rather than being based on administrative units. Also, in Finland, information on regional development has traditionally relied on data bound to different administrative units. In the early 2010s national authorities saw a need for a classification that better recognised the continuity between urban and rural areas and the characteristics of different areas. Hence, a new typology for classifying Finnish territories, independent of administrative boundaries, was created to replace a former municipality-based classification of urban and rural areas (see Figure 4). The typology was originally published in 2013 and revised in 2020, and has been widely used to support regional and rural policy in Finland and for different research purposes during the past decade.

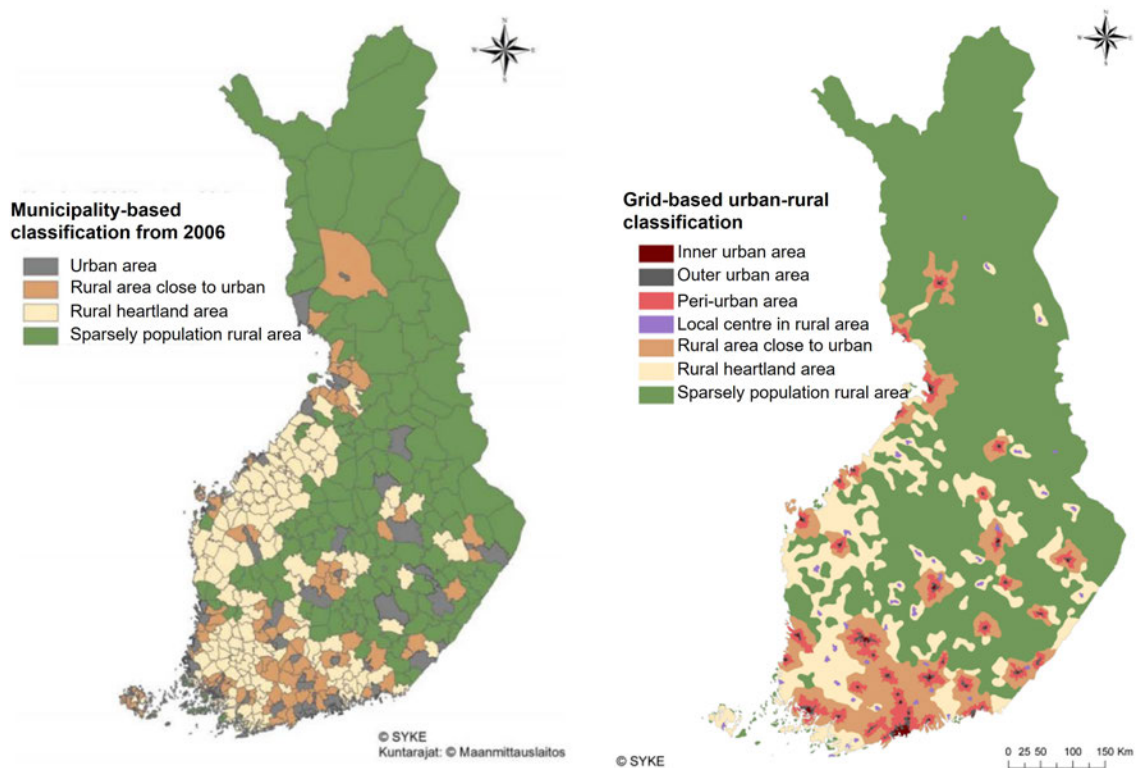


Figure 4. The former Finnish municipality-based classification from 2006 and the newer grid-based urban–rural classification published in 2014 and updated in 2020 (adapted from Helminen et al., 2014).

The Finnish typology uses various register-based data at grid level (250 x 250 m), including data on population, labour force, commuting, buildings, road network, and coordination of information on the environment (CORINE) land-cover data. These data have been used to calculate different measures of quantity, density, accessibility, intensity, and versatility to describe the degree to which different areas are urban and rural (SYKE, 2021). On this basis, all Finnish territories have then been classified into seven different classes: inner urban areas, outer urban areas, peri-urban areas, local centres in rural areas, rural areas close to urban areas, rural heartland areas, and sparsely populated rural areas.

This classification has been used in various ways to support regional development and policy in Finland. For example, it has been used in several strategies and policy documents at national, regional, and municipal level. It has also been utilized for distributing development funds within the framework of LEADER and for distributing public support for businesses in rural settings and for shops in sparsely populated rural areas. Furthermore, the typology has been widely used as an analytical framework in research for analysing different spatial phenomena and for describing differences between different types of urban and rural areas. Because the typology uses fine-grained data and classifies territories at (250 x 250 m) grid level, it provides significantly more spatially detailed analysis than previous administratively based territorial classifications.

Towards a Nordic urban–rural typology

The reason for developing a new Nordic urban–rural typology was to create an analytical tool that would help to better understand settlement patterns and trends as well as other phenomena in different types of areas, ranging from the sparsest rural areas to the densest urban areas. Based on this, the Finnish urban–rural classification was thought to be the most relevant. While it was evident that it would not be possible to directly scale the Finnish typology to the Nordic level, it was possible to incorporate several of its core elements and use the Finnish typology as a stepping stone for developing a Nordic grid-based urban–rural typology based on harmonised Nordic definitions and criteria.

Important key considerations in the early stages of the work were to determine which data sources to use for constructing the typology and what spatial resolution and specific reference grid to use. While the Finnish classification relies on a wide range of different data sources, it was not feasible to apply the same specific data at the Nordic level. This was partly related to the high costs of grid data but also to the fact that most of these datasets were produced nationally, often following different classifications, and hence not harmonized for cross-national comparisons. It was therefore decided to use data that were free-of-charge and openly available, while acknowledging that the availability of free data would differ between the countries. A key advantage of this approach was that future updates or adjustments would be easier to obtain and be more cost effective.

Regarding the spatial resolution of the typology, it was clear early in the process that it would be preferable to use data at 1 x 1 km grid level rather than at 250 x 250 m, as used in the Finnish typology. One of the arguments for this is that most freely available national grid data are primarily at 1 x 1 km grid level. In addition, it was also acknowledged that constructing a Nordic typology would require making some simplifications to the original Finnish model, and that a 250 x 250 m resolution would be too detailed for this purpose.

After choosing the typology on a 1 x 1 km grid size, it was necessary to decide which specific reference grid to use. Here, there were two options. The first would have been to use Eurostat's grid (EPSG:3045) for all countries. An advantage of this option is that all countries are classified according to a uniform grid, and there are no discontinuities at the national borders. The other option was to use national grid available from each country. An advantage of the latter approach was that some of the data were freely available for the national grids. This approach would also be better suited for further use in the different Nordic countries, as grid-level data produced according to the national grid systems could directly be incorporated into the typology for further analysis. Ultimately, all calculations were initially made using the national grids for each country. In the final stages of the work, the calculations from the national grids were then converted into the Eurostat grid.

Based on these considerations, it was decided to develop the Nordic typology based on the Finnish urban–rural classification; however, it was evident that the approach would need to be tailor-made for the purpose. It was also decided to generate the same seven territorial classes as used in the Finnish typology, including maintaining the same class names. Thus, it was decided to develop a Nordic urban–rural typology containing the following seven territorial classes: urban areas, outer urban areas, peri-urban areas, local centres in rural areas, rural areas close to urban areas, rural heartland areas, sparsely populated rural areas.

Based on an assessment of the existing data sources possible for constructing the typology, it was possible to include the five Nordic countries (Denmark, Finland, Iceland, Norway, Sweden) and Åland, whereas it would not be feasible to include Greenland and the Faroe Islands in the typology owing to lack of data.

2.2 Approach for constructing the Nordic typology

Next, the process for generating the Nordic typology and the operational steps taken are described and discussed. Figure 5 illustrates the different phases of work, including the pre-analysis phase as well as the steps for constructing the urban and the rural typology classes. A more detailed discussion of the different work stages and key considerations at each phase are provided in the following.

Pre-analysis

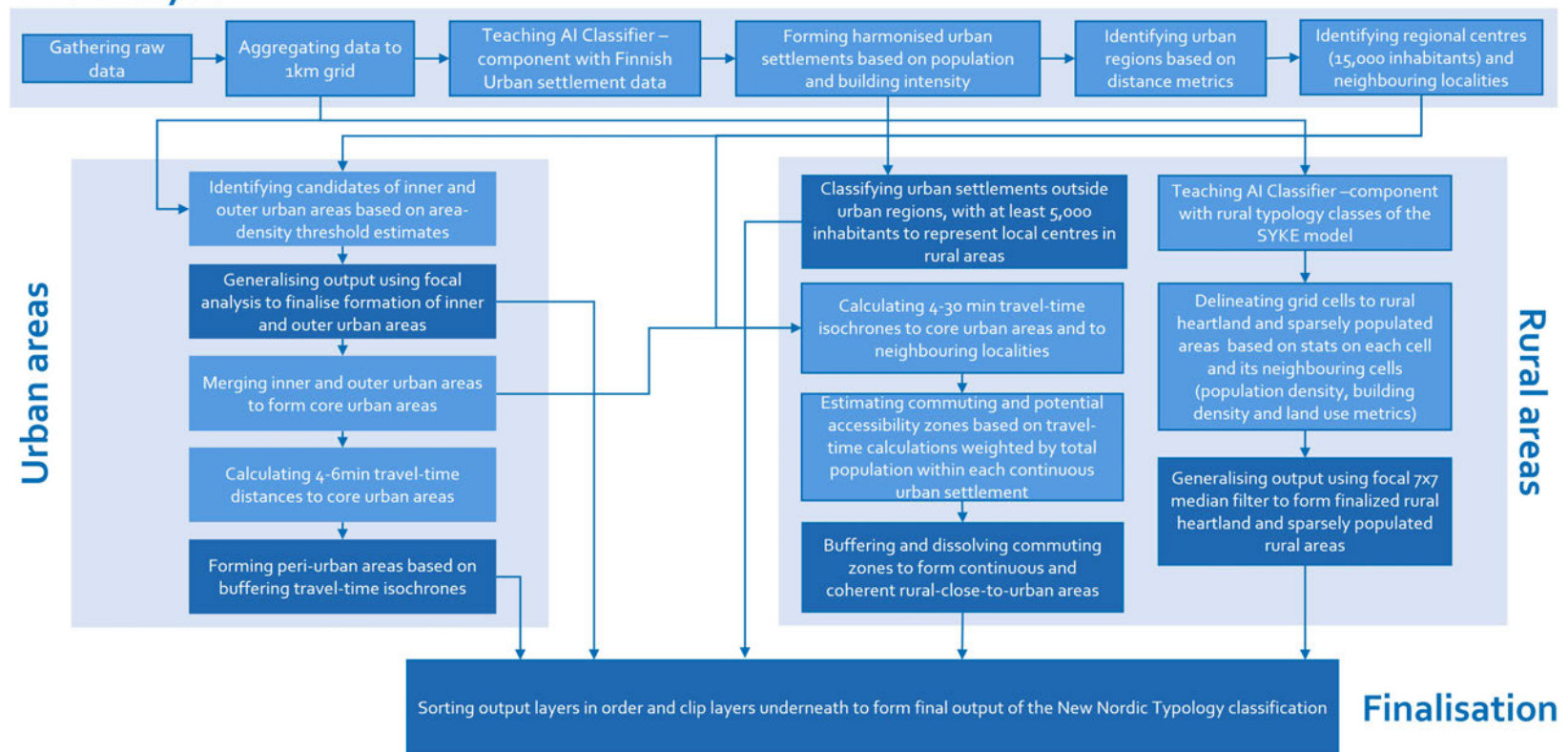


Figure 5. Process of the Nordic urban-rural typology delineation.

Pre-analysis and key considerations

Data and methods

The Nordic typology was constructed using an approach that relies on a combination of both traditional geographic information system (GIS) methods as well as machine learning. The overlap between these two approaches provided the opportunity, upon review of both methods and results, to proceed using a strategy that produced the more accurate results. Thus, it was concluded that traditional GIS methods would provide a firm background with less risk. Machine learning, on the other hand, provides benefits, but with some inherent uncertainty. A combination of both approaches was ultimately adopted for exploring how a Nordic urban–rural typology could be produced using (predominately) openly available data.

The Finnish typology was used as a starting point and as a reference classification for constructing the Nordic typology. An important way of assessing the initial results and to adjust the model was to compare how well the typology classes, generated using the combined GIS and machine learning-based approach (with open data), corresponded to the Finnish urban–rural classification.

Table 2 lists the key data used for generating the Nordic typology. The work was initiated by obtaining national spatial grids (1 x 1 km) including data on population from each of the five Nordic countries, obtained from the National Statistics Institutes of each country. At this stage, experiments to disaggregate population statistics from the municipality level to grid level were also made. While these experiments were not included in the final model, they nevertheless demonstrated the possibility of estimating grid-level population based on annual municipal population statistics, which could possibly be applied in the future.

Data on buildings from the different Nordic countries was regarded as important for generating the typology. Here buildings were classified into three classes based on the number of floors (apartment buildings with 1–2 floors, apartment buildings with 3 or more floors, other buildings). These datasets were not uniform and, for Iceland, the classification of buildings was based on estimates from [OpenStreetMap](#), which resulted in less accuracy. On the other hand, an advantage of using OpenStreetMap data was that it was possible to reproduce building classification for the other countries. Additionally, European CORINE land-cover data were used to generate the typology classes based on which land-use class was most prevalent in each grid (see also the next section).

Table 2. Data used in generating the Nordic Typology.

Country	Population	Buildings	Land use	Routing/Isochrones
Finland	Open data, 1 km grid, Statistics Finland	Open data, General Building Registry data, National Land Survey	CORINE land cover 2018, copernicus.eu	graphhopper.com API
Sweden	Data for authoritative use, 1 km grid, Statistics Sweden	Open data, General Building Registry data, Lantmäteriet	CORINE land cover 2018, copernicus.eu	graphhopper.com API
Norway	Open data, 1 km grid, Statistics Norway	Open data, 1 km grid, Statistics Norway	CORINE land cover 2018, copernicus.eu	graphhopper.com API
Denmark	Data for authoritative use, 1 km grid, Statistics Denmark	Open data, General Building Registry data, Dataforsyningen	CORINE land cover 2018, copernicus.eu	graphhopper.com API
Iceland	Data for authoritative use, 1 km grid, Statistics Iceland	OpenStreetMap (OSM)	CORINE land cover 2018, copernicus.eu	graphhopper.com API

Classification experiments

In the initial stages of work, there was an assumption that it would be easier to predict the urban typology classes from the available data, compared to the rural classes. As the main challenge was expected to be in detecting different types of rural areas, it was decided to follow an experimental approach, using the Random Forest technique. Essentially, Random Forest is a supervised machine-learning classification algorithm that can be used for classification purposes. This approach was tested on one of the rural classes in Finland, namely, rural heartland areas, where this specific class was taught to the classifier, to see how well the areas identified using this technique corresponded to the areas defined as rural heartland in the Finnish typology. The results proved to be so robust that it was decided to broaden the scope of this approach and to attempt to identify all classes using this method.

The outcomes of the Random Forest classification, applied to all classes in Finland, were compared to the original Finnish classification. The overall result was satisfactory and corresponded relatively well to the original classification. While some minor misclassifications and errors were present, it was considered possible to mitigate these errors at later stages of the work.

At this stage, the following data (at 1 x 1 km grid level) were used: total population,

number of 'low' residential buildings with one or two storeys, number of 'high' residential buildings with three or more storeys, and the number of unknown buildings. The aforementioned building data were open-source data from the Topographic Database of the National Land Survey of Finland (NLS, 2023). One observation was that some systematic classification errors had occurred inside larger lakes at this stage, and that these misclassified areas were typically uninhabited and did not contain any buildings. To address this issue, it was evident that there was a requirement to also including a variable for land use, to obtain a more reliable classification. An advantage of the incremental design approach used was that it allowed for experimenting with the model and adapting it easily by further including land-use data as well.

It was also decided to include European CORINE land-cover data, which includes 44 hierarchically structured land-use classes (EEA, 2023a). The most exact land-cover classification was used, and the data were then generalised into a 1 x 1 km grid. As all land-cover classes were not necessarily present in all countries, this required careful handling, and meant that if a certain land-use variable was present in a specific country but not included in the model, the feature was then excluded.

Country-specific considerations

As described, in the early phases, the model was fitted using Finnish data to identify the robustness of the model as well as any needs for improvement. It was, however, still uncertain at this stage how well the model would perform for the other Nordic countries. To assess this, it was necessary to gather source data and compute aggregates for the other countries. In attempting to obtain data from all the Nordic countries, there were several challenges and considerations regarding data that had to be acknowledged and addressed. These included uncertainty about what data were available from the different countries for specific reference years. Another issue was that data classifications may differ between countries, which was the case with the building data, for example. Additionally, the documentation of data is not always available (or up-to-date), adding uncertainty regarding the quality of this input information.

Approaching the final classification

As already outlined, the Random Forest approach was used for classifying all seven typology classes that exist in the Finnish urban–rural classification. While this approach provided satisfactory results, there remained a requirement to have greater control of the final classification, and hence a two-class rural classifier was developed. This meant creating a uniform countrywide canvas for the two classes: rural heartland and sparsely populated rural, for all Nordic countries. Following this is it was necessary to compute all the other classes using traditional GIS methods. Slight adjustments were made to the model's learning material by including urban

areas inside rural areas, to then be able to create a continuous canvas (without gaps) on top of which the actual urban classes could be overlaid.

The identification of urban centres was done using a separate classifier, which was fitted for Finland using the original Finnish urban–rural classification as reference data. This involved aggregating the original urban centre source data to 1 x 1 km grid cells and using the result for fitting the classifier. Here, population and building data aggregated to the grid cells were used in the model as features, and the Random Forest approach was used once again. This resulted in contiguous urban centres with populations of 15,000 inhabitants or more.

In the original Finnish typology, labour mobility is modelled according to the Herfindahl index (see e.g. Eurostat, 2021) and using data on commuting and economic and labour market data structures. However, it was not possible to use a similar approach for the Nordic typology owing to a lack of openly available data from all the Nordic countries. Instead, it was decided to test two alternative approaches, namely, Huff gravity modelling for each centre, along with a fallback approach where travel-time isochrones were computed to show accessibility to urban centres. The Huff model allowed comparison of urban centres and their relative accessibility with other centres. Experiments were carried out for Denmark using this approach. However, as these computations were highly time consuming (and their added value was uncertain) it was instead decided to proxy the missing travel-time data with isochrone computations.

Creating the Nordic typology classes

In the following, a closer look is taken at the operational steps for generating the seven territorial classes of the Nordic urban–rural typology. The focus is first on the main steps for creating the urban typology classes, followed by the rural classes. These steps follow the process presented in Figure 5.

Generating the urban classes

Delineating urban settlements

To generate the urban classes in the typology, a key starting point was to first delineate urban settlement areas in all five Nordic countries. Each Nordic country has its own official definition of urban settlements (tätort (SE), byområde (DK) taajama/tätort (FI), Þéttbýlisstaður (IS), tettsted (NO)) and provide data corresponding to these definitions. The definitions are similar in all the Nordic countries where urban settlements are defined as places where 200 persons live within 200 m (in Norway 50 m) of each other. For the development of the urban classes in the Nordic typology, a first step involved harmonising urban settlements

across all five Nordic countries. This was achieved by estimating and scaling the Finnish urban settlement definition, originally generated using a 250 × 250 m grid, into a 1 × 1 km grid and then adjusting the result based on observations from the other countries (see Figure 6).

More specifically, the results were adjusted according to the following steps. First, based on the population and building densities of a 250 × 250 m grid cell in Finland, the urban classifier was taught to classify these grid cells as either urban or non-urban. This was a necessity since building and population register data were not available for all countries. The 250 m classifier was first validated against the boundaries of the official delimitation of urban settlement areas (taajama/tätort) in Finland. At this stage the classifier estimated, with an accuracy of 250 m, whether grid cells were part of an urban settlement based on the population and number of buildings contained therein. While the 250 × 250 m grid-level urban classifier worked well, for the purpose of the typology, it was necessary to scale it to the 1 × 1 km grid level; this step first involved testing the 1 × 1 km urban classifier in Finland. The final model was not well suited to a direct scale up the population and building densities (250 × 250 m to 1 × 1 km grid level). This was because of the much larger areas covered by the 1 × 1 km grid, which meant that the scaling became too inaccurate because the larger grid size does not sufficiently follow the actual boundaries of built-up areas. The sensitivity of the urban classifier used to form 1 × 1 km grids was therefore adjusted using observations and calculations. The final classifier result was refined using an iterative process using a selection of criteria (i.e., using information based on the total area differences between alternative delineations of urban settlements as compared with the official delineations of the different countries within the group).

For the final model, the option that generated the smallest difference using the official delimitations of all the countries was selected. The final classifier, therefore, took account of the data for a single 250 × 250 m grid cell and the proportion of the area of the 250 × 250 m grid cells that were classified as urban settlements within the 1 × 1 km grid cells (using a 5 × 5 focal analysis circle). The area of the 250 m grid cells covered at least 50% of the area within the larger grid cells.

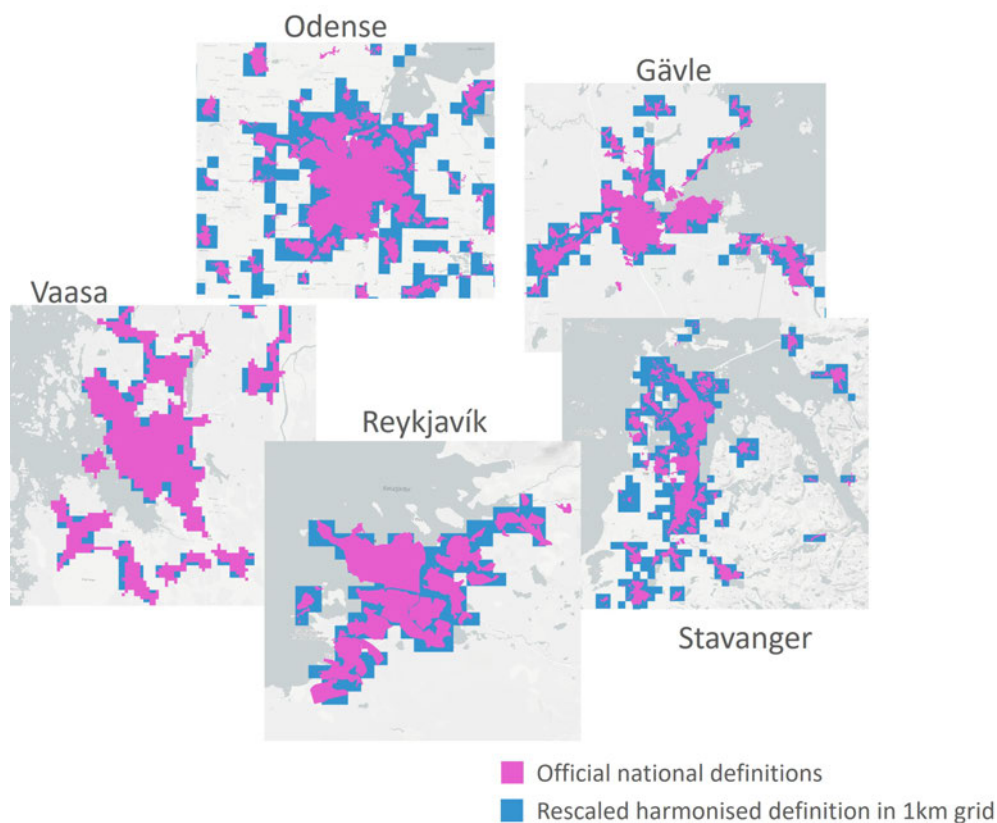


Figure 6. Rescaled harmonized definitions of urban settlements compared with official national definitions.

Identifying urban regions

Following the delineation of urban settlements in all the Nordic countries, the next step involved identifying territories that could be defined as urban regions. Here, urban regions were defined based on those urban settlements having a population of more than 15,000; marked by boundaries showing the extent of these regions (see Figure 7)¹. This meant that the urban regions identified include both the urban settlements as well as their surrounding areas. Smaller settlements with fewer inhabitants, located near the central urban settlement and situated within the previously delimited urban regions, were then defined as neighbouring settlements (provided that the settlement areas touch a 3 km buffer region of those urban settlement areas with over 15,000 inhabitants).

A three-tier classification of urban settlements can be seen in Figure 7. In this map, urban settlements with more than 15,000 inhabitants form the core settlement areas (*keskustaajama/centraltätort*) within urban regions (marked black). Urban settlements with a population in the range 5,000–15,000 (marked red) are considered local centres in rural areas if they are located outside the boundaries of urban regions. Urban settlement areas with fewer inhabitants (marked blue and red) can extend the boundaries of urban regions if these smaller settlements are located sufficiently close to the core settlement areas (within a 3 km radius).

¹ This work was based on the delineation of urban regions in the Finnish Monitoring System of Spatial Structure and Urban Form (YKR). For a more detailed description of the methodology for see SYKE (2023).

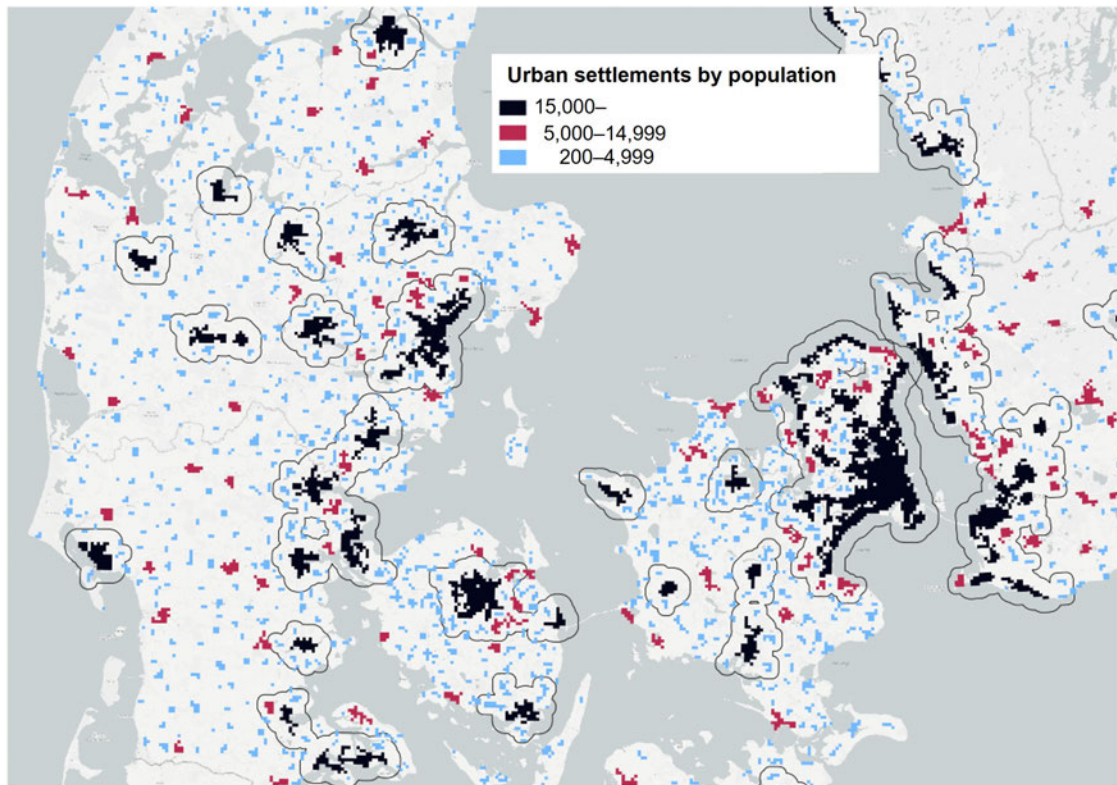


Figure 7. Classifying urban settlements by size and generation of urban regions.

The steps for delineating urban areas and defining the different urban typology classes are illustrated in Figure 8. Having identified central urban settlements and neighbouring settlements within urban regions, the next step involved defining the built environment of these areas according to building density (or floor-area ratio). This was done using proxy-estimates from population and building data. Depending on floor-area ratio (calculated as the floor area of buildings in relation to the size of the urban area), areas were classified as either 'inner urban areas' (with a floor area ratio of 0.1 or greater) or 'outer urban areas' (having a floor area ratio between 0.02 and 0.1). For this step, a circular 3×3 focal analysis was used for generating the final polygons for inner and outer urban areas. This was followed by defining and delineating peri-urban areas that surround the inner and outer urban areas, based on accessibility calculations to the centre of the urban region. Here, generalised 6-minute travel-time zones were calculated around the outer urban areas and 4.5-minute travel-time zones were calculated around smaller urban settlements, resulting in a layer of unified peri-urban areas.

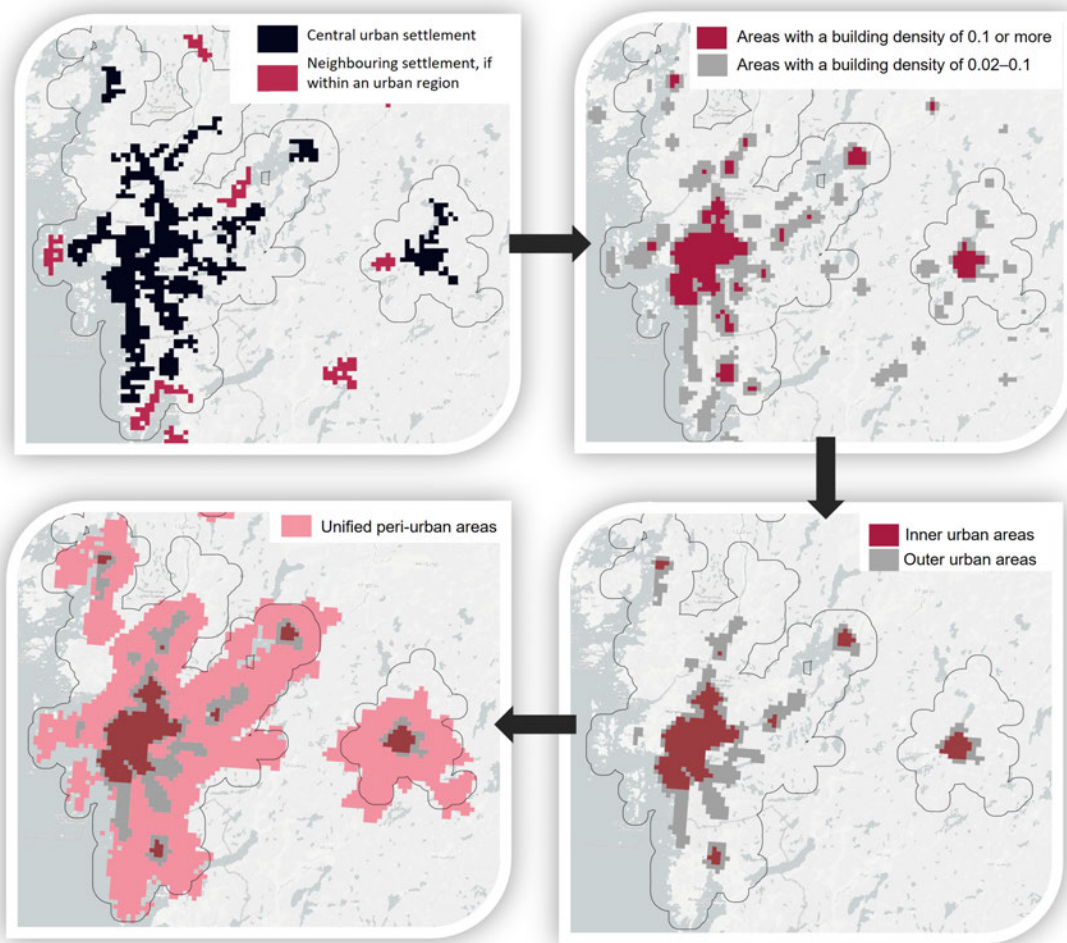


Figure 8. Operational steps for delineating urban areas and defining the urban typology classes.

Generating the rural classes

In generating the rural typology classes, the first step involved identifying areas defined as local centres in rural areas. These areas were identified based on the previously generated urban settlements and by focusing on those settlements that are located outside the previously defined urban regions. Those urban settlements that did not form part of an urban region and had a population between 5,000 and 15,000 were classified as part of this class (red areas in Figure 9).

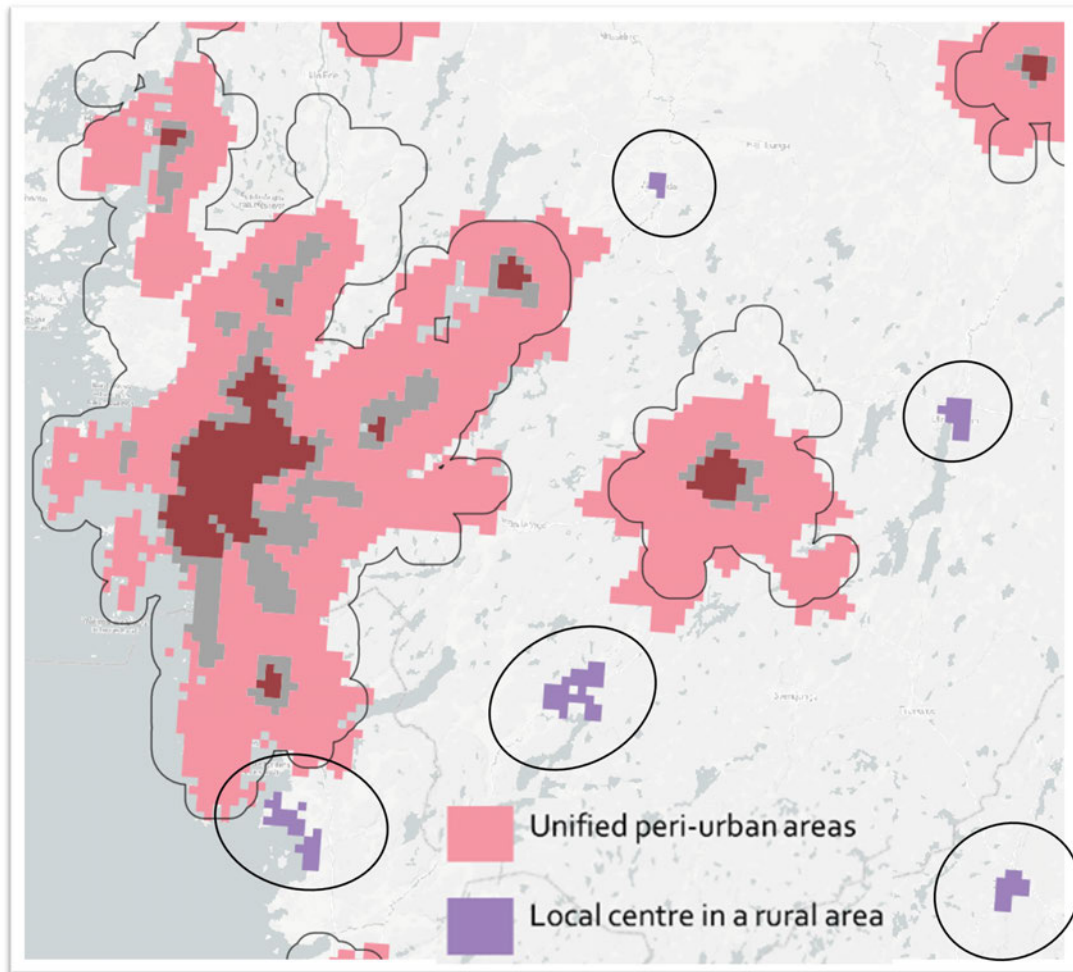


Figure 9. Local centres in rural areas (urban settlements located outside urban regions with a population of 5,000– 15,000).

The remaining rural classes in the typology were created based on population, building density, and land-use intensity estimations derived from CORINE land-cover data. The steps taken are shown in Figure 10 and were achieved by teaching an AI model, based on the Finnish urban–rural classification, to classify rural areas into either rural heartland or sparsely populated rural areas. Areas with a rural character that are functionally connected and close to urban areas were conceptualised as ‘rural close to urban’; estimated based on generalised travel-time and distance estimates from the urban core. The area depends on the size and distribution of the urban area and on the connectiveness between two or more urban areas. The areas that form this typology class are characterised by an average driving time of 20–30 minutes from the edge of outer urban areas.

This stage of the work involved testing, on a step-by-step basis, the most suitable way of using travel-time isochrones calculated from urban settlement areas of different sizes. The result used a multi-step travel-time calculation combined with calculating buffer zones. The final model used travel-time calculations with a 10–24-minute interval. The use of travel-time isochrones was weighted by the population size of the settlement area such that the larger settlement areas had a longer range of influence than smaller settlements.

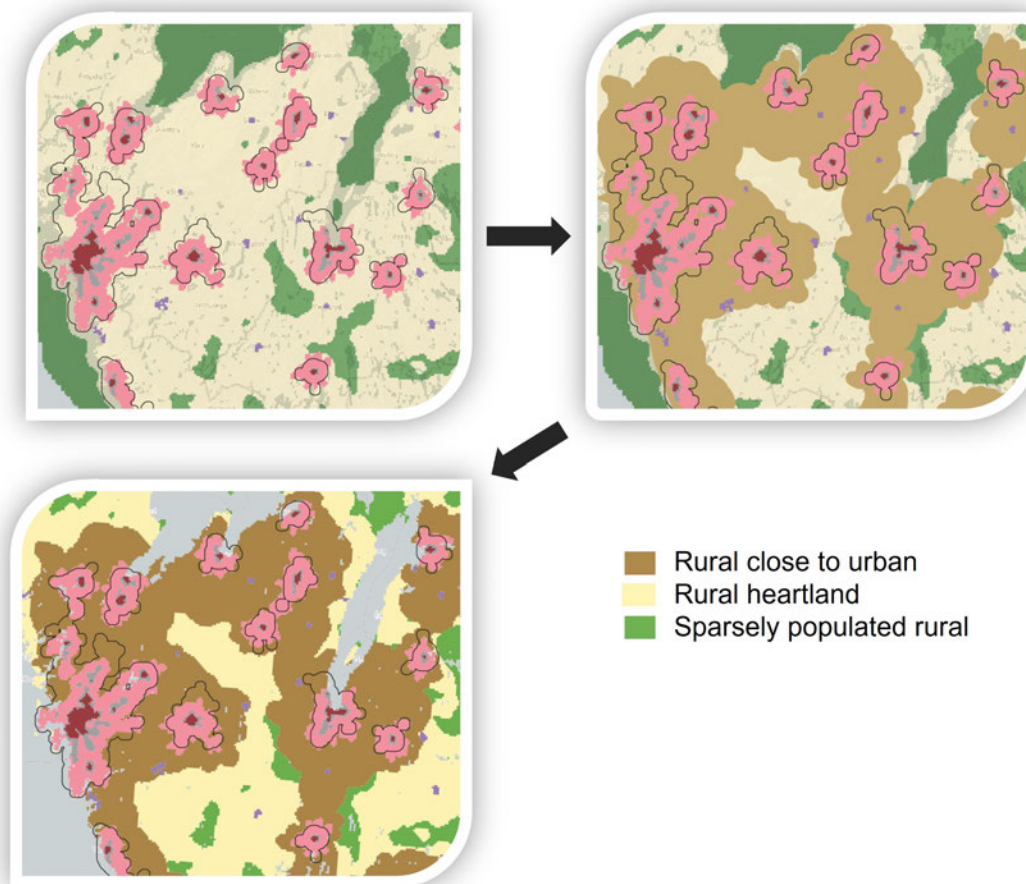


Figure 10. Operational steps for delineating the rural typology classes.

Summary of the main steps for generating the typology classes

The process diagram in Figure 5 shows the steps that were followed to create the Nordic urban–rural typology. The key steps are summarised as follows:

1. Creating urban settlements and identifying those settlements with more than 15,000 inhabitants.
2. Identifying urban regions.
3. Identifying inner urban areas and outer urban areas (core urban areas).
4. Identifying peri-urban areas located on the peripheries of core urban areas.
5. Identifying local centres in rural areas.
6. Identifying rural areas close to urban areas.
7. Identifying rural heartland and sparsely populated rural areas.

The Nordic urban–rural typology

The typology developed through the previously presented steps classifies Nordic territories into seven different classes. Figure 11 shows the framework for how the Nordic urban–rural typology and its different territorial classes can be understood in relation to each other.

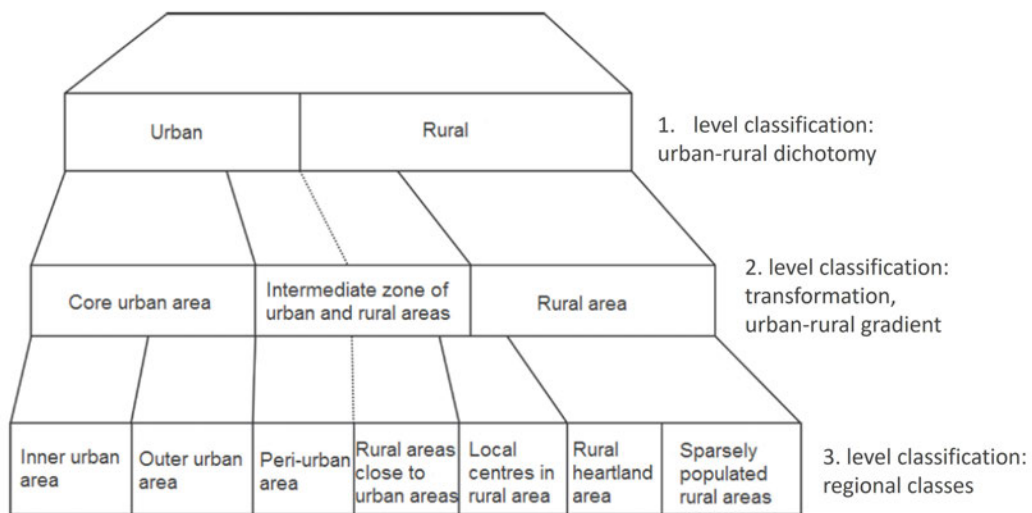


Figure 11. Framework for the Nordic urban–rural typology and its different typology classes, based on the Finnish urban–rural classification (Helminen et al. 2014).

A brief explanation of the key characteristics of the different typology classes is defined below.

- **Inner urban areas:** these are the most densely populated parts of the urban core; urban cores are clustered cells with a total of at least 15,000 inhabitants, which have then been classified as either inner urban areas or outer urban areas, based on density criteria (population density and building floorspace). Inner urban areas have a floor-area ratio (calculated as the floor area of buildings in relation to the size of the area) of 0.1 or more, and outer urban areas have a floor-area ratio of 0.02–0.1.
- **Outer urban areas:** the least densely populated parts of the urban core, identified according to density criteria.
- **Peri-urban areas:** the intermediate zone between urban core and rural areas, identified based on generalized travel-time estimates from the edges of outer urban areas (6-minute travel-time zones) and smaller urban settlements (4–6-minute travel-time zones). The smaller urban settlements (lähitaajama) have a population of 200–14,999 and are located at a maximum distance of 3 km from the core settlements of urban areas.
- **Local centres in rural areas:** population centres located outside urban areas, small towns, and large parish villages, where the population is between 5,000–14,999 inhabitants.
- **Rural areas close to urban areas:** areas with a rural character functionally connected and located close to urban areas. On average, this means a 20–30-minute driving time from the edge of the outer urban areas. This class supersedes the area classes rural heartland and sparsely populated rural areas.
- **Rural heartland:** rural areas with intensive land use, with a relatively dense population, and a diverse economic structure at local level. Most of the agricultural land is in this class.
- **Sparsely populated rural areas:** sparsely populated areas with dispersed small settlements that are located far from each other. Land cover usually consists of forests, mountains, or natural grassland.

Figure 12 shows a comparison of how territories in the five Nordic countries are classified in the new grid-based urban–rural typology compared to the Eurostat DEGURBA typology. The most noticeable differences can be seen in municipalities that are vast in size, for instance in the northern parts of Finland, Norway, and Sweden. While these municipalities and their entire territory are classified as either predominantly rural, intermediate, or urban in the DEGURBA classification, according to the Nordic typology, there are clear territorial differences within these municipalities, which include various areas that belong to several of the different territorial classes of the typology.

The Nordic urban–rural typology has also been published on an interactive digital web-mapping platform where the typology can be better visualized and where it is possible to zoom in on different areas across the Nordic countries (see Figure 12). The interactive version of the typology can be accessed [online](#) from where it can also be downloaded for further use.

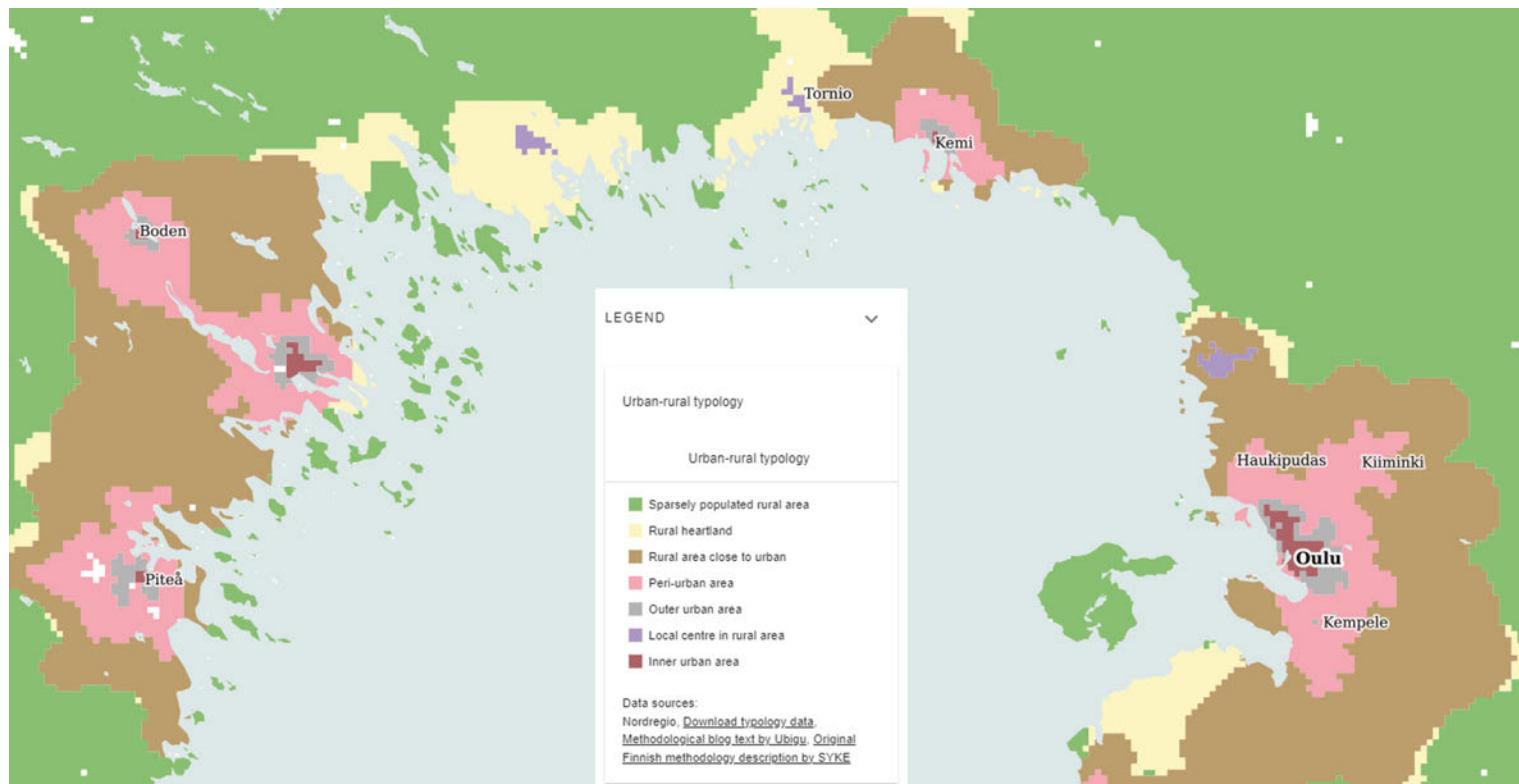


Figure 12. Visualization of the interactive Nordic urban–rural typology web map; showing the cross-border Bothnian arc region in northern Finland and Sweden.

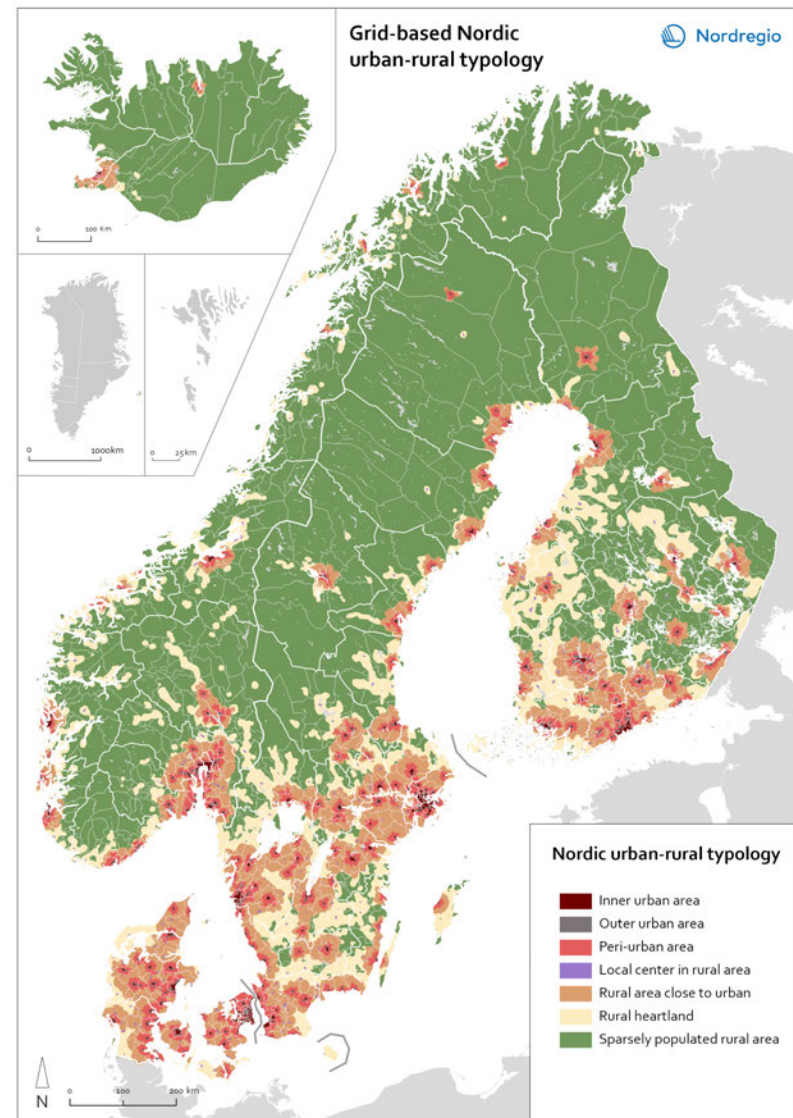
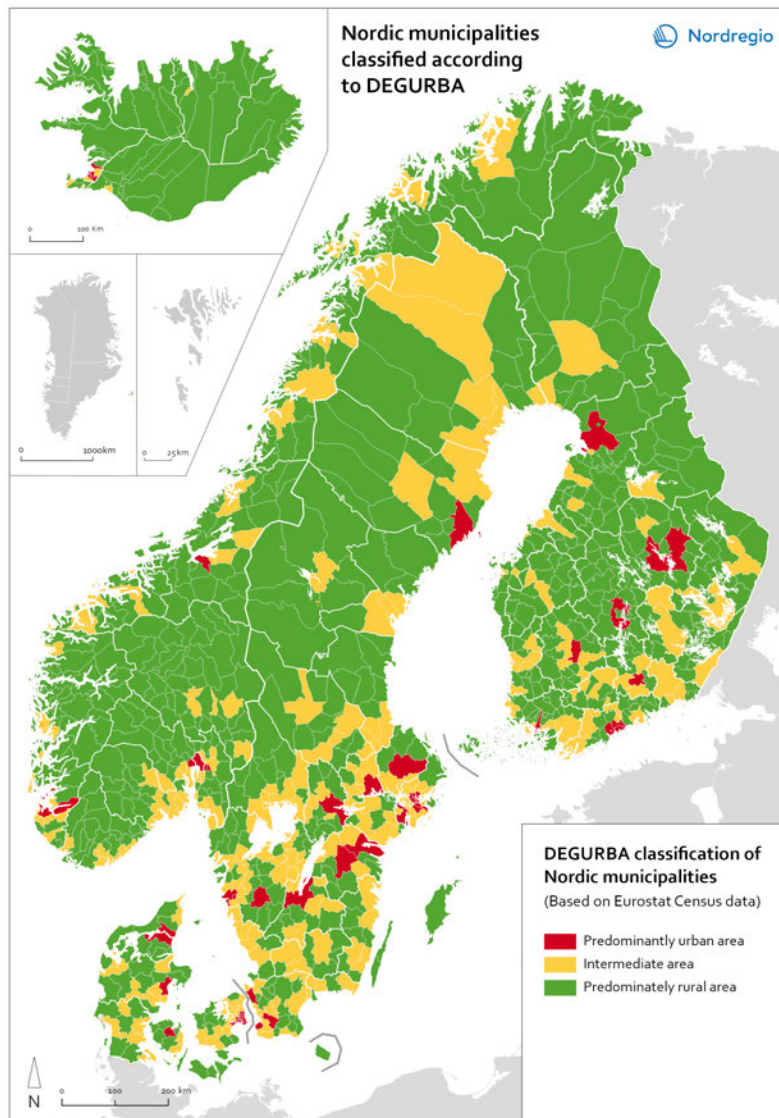


Figure 13. Comparison of how territories are classified in the Nordic urban–rural typology and in the DEGURBA classification.



3. Examining territorial and settlement patterns and population change dynamics across the urban–rural continuum

In this part of the report, the Nordic urban–rural typology is used as an analytical framework for studying territorial and settlement patterns and population change dynamics in the five Nordic countries. As the typology is grid-based and relies on spatially detailed data at the 1 × 1 km grid level, it can be used to analyse territorial differences independently of administrative boundaries. This means that it is possible to uncover more fine-grained differences and nuances within regions and municipalities that cannot be detected at more general levels of analysis.

In Section 3.1, a comparative cross-country examination of different urban and rural territories in the Nordic countries is carried out using the urban–rural typology as an analytical framework. Then, in Section 3.2, the Nordic typology is used in combination with the European-wide DEGURBA for studying territorial and settlement patterns within different types of Nordic municipalities. The following key questions are addressed in this analysis section:

- What do territorial and settlement patterns look like in the Nordic countries when examined according to the grid-level Nordic urban–rural typology?
- What types of population change dynamics occurred in the Nordic countries in the period 2008–2022 based on the Nordic urban–rural typology?
- What kind of internal differences in territorial and settlement patterns can be seen within different types of Nordic municipalities?

3.1 Urban–rural differences according to the Nordic urban–rural typology

The purpose of this section is to provide an outlook on urban–rural differences using the Nordic typology as the basis for analysis. The focus is first, however, on the DEGURBA classification which is used to provide a general picture of what urban–rural differences in the Nordic countries look like according to this Eurostat territorial typology. This is followed by a cross-country analysis of what urban–rural differences look like based on the grid-based Nordic typology in the five Nordic countries and in Åland. The focus is on what kind of key territorial and settlement patterns (as well as population changes) can be observed over time in the different territorial classes. At the end of section 3.1 the grid-based Nordic typology is scaled up to the municipality level to demonstrate how this classification can be aggregated to more general territorial levels and used to complement more general statistics at the municipality level.

DEGURBA classification of Nordic municipalities

The DEGURBA classification is the most established and widely used territorial typology for cross-country comparisons (see also Section 2.1). In addition, most previous studies conducted at Nordregio that have examined urban–rural differences across the Nordic countries have used this Eurostat classification. The most common version of DEGURBA is at municipality level and it classifies municipalities as either urban, intermediate, or rural². Based on this classification, the most common municipality class in all five Nordic countries is rural. This is the case especially in Iceland, Finland and Åland, and Norway where nearly 86%, 80%, and 78% of municipalities, respectively, are categorized as rural according to the DEGURBA classification (Figure 14). This can also be seen in Figure 13, where the map on the left-hand side shows that these three countries along with the northern parts of Sweden stand out as areas that are predominantly characterized by rural municipalities. The intermediate category represents areas that are in between urban and rural areas in terms of population density; it is the most common municipality type in Sweden and Denmark (with approximately 42% and 35% of municipalities, respectively). There are considerably fewer such municipalities in Norway (20%), Finland (17%), and Iceland (10%).

² There have been initiatives to create a more fine-grained territorial typology at a pan-European level and, in 2018, DG REGIO published a refined version of the DEGURBA at grid level (DEGURBA level 2) consisting of six classes. (cities, towns, suburbs, villages, dispersed rural areas, mostly uninhabited areas), to better capture territorial differences (EEA, 2018).

It is noteworthy that municipalities that are defined as urban (according to this Eurostat classification) are rather uncommon in the Nordics, having a significant number of urban municipalities only in Denmark and Sweden (18% and 8% of all municipalities, respectively), while only 4% of municipalities in Iceland, 3% in Finland and Åland, and 2% in Norway belong to this category. Overall, based on the DEGURBA classification, the Nordic countries are largely characterised by rural municipalities, which are often vast in size and cover large parts of the territory (see Figure 13).

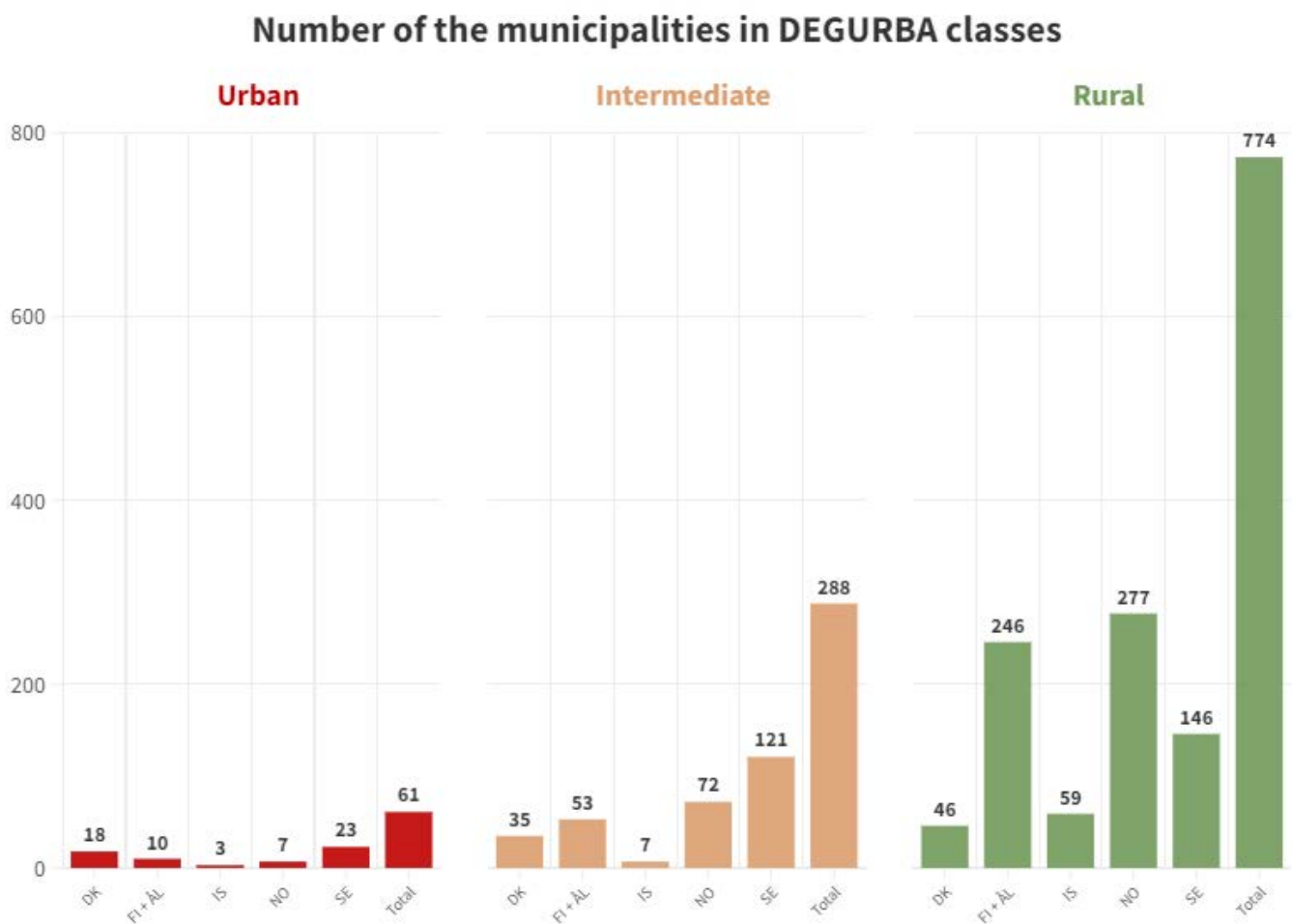


Figure 14. The number of municipalities in the different DEGURBA classes in the Nordic countries. The figure shows the situation in 2020, which is the most recent year for which data connected to the DEGURBA classification were available at the time of writing.

A general outlook on territorial and settlement patterns

A different outlook on urban–rural differences within the Nordic countries can be observed when examined according to the Nordic urban–rural typology. As previously described, this typology has been constructed such that all 1 × 1 km grid cells in each of the five Nordic countries (including Åland) have been classified into one of seven typology classes (inner urban areas, outer urban areas, peri-urban areas, local centres in rural areas, rural areas close to urban areas, rural heartland areas, sparsely populated rural areas) based on the specific characteristics of each grid cell. This means that the Nordic typology is more spatially detailed than the previously discussed Eurostat DEGURBA classification; the latter classifies municipalities, which are noticeably larger spatial units, into one of three categories. The focus in the following is on what territorial and settlement patterns look like in the Nordic countries when using population data at grid level and examined through the lens of the Nordic urban–rural typology.

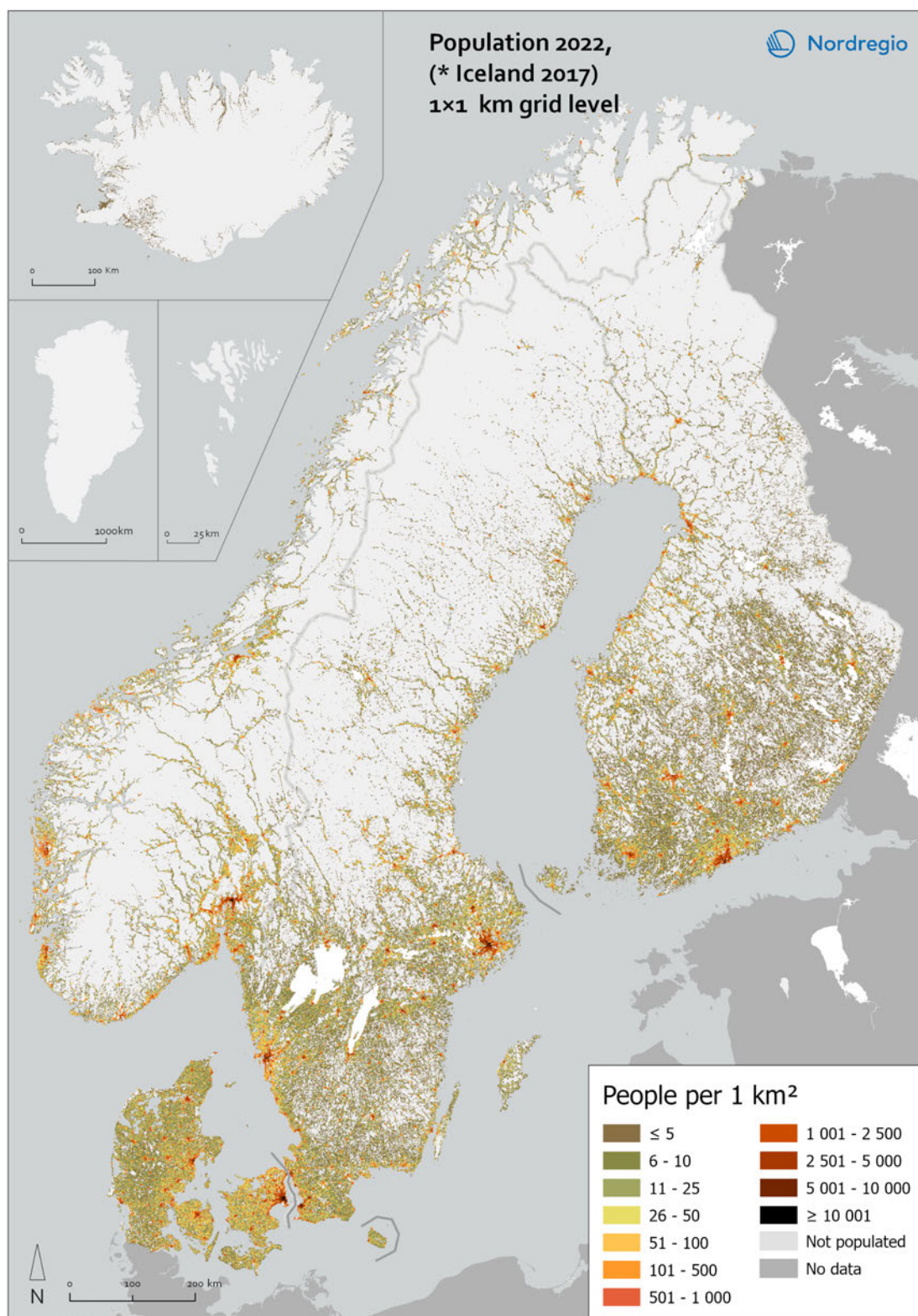


Figure 15. Total population at grid level (1 × 1 km) in the Nordic countries Denmark, Finland and Åland, Iceland (*2017 data), Norway, and Sweden.

The population grid map (Figure 15) shows the population density at 1 × 1 km grid level and illustrates that the settlements of the Nordic countries are rather unevenly distributed. The Nordic population is to a high degree concentrated in coastal areas and along waterways, which contain the major urban regions in all five countries. Current settlement patterns seem to reflect historical patterns that have been determined by the physical geography, including the availability of arable agricultural land and access to waterways (see e.g., Roto, 2012; Smas 2018).

The map shows a highly concentrated settlement, especially in Iceland, where the population live largely in the south-western part of the country around the Reykjavík capital region, while the inner parts of the country are mainly uninhabited. In Norway, the main population concentrations are around the Oslo capital region and along the south-western coast. In Sweden, the population is largely concentrated in the southern parts of the country while the northern parts include many sparsely populated and uninhabited areas. The city regions around Stockholm and Gothenburg are the most densely populated areas in Sweden, and these two regions are connected by a corridor of comparatively high population density. The south-western coast of Sweden, extending from around Oslo to greater Copenhagen, also stands out as a densely populated settlement corridor. The Finnish population is primarily concentrated in the south, mostly in the triangle connecting the urban regions of Helsinki, Tampere, and Turku. The map also shows some clear differences between the Nordic countries. For example, there are comparatively more areas that are entirely uninhabited in Norway and Sweden than in Finland. By contrast, there are noticeably more very sparsely populated areas in Finland than in Norway and Sweden. This observation reflects the physical geography of the countries where many parts of Norway and north-western Sweden have vast mountainous areas that are largely uninhabited. Denmark shows a substantially higher population density than in the other countries; however, in common with the other countries, the population is largely concentrated around the major urban centres, particularly Copenhagen, Aarhus, and Aalborg.

When examining territorial differences based on the proportion of grid cells that belong to the different typology classes in each country, there are certain key differences between the countries that can be seen in Figure 16. First, when considering the different rural typology classes, Iceland stands out as the country where the proportion of sparsely populated rural areas is clearly the highest. The sparsest areas in the Nordic countries belong to this category, which includes small settlements that are located far from each other, and the land cover in this typology class mainly consists of forests, mountains, or natural grasslands. In Iceland, approximately 79% of all grid cells were categorized into this typology class, while Norway and Finland and Åland have comparatively high proportions of sparsely populated rural areas (39% and 37% of all grid cells, respectively). By contrast, the picture is clearly different in Denmark where the sparsely populated

rural areas category is almost non-existent; only 1% of all grid cells belong to this category. Characteristic of both Denmark and Sweden is that most rural areas belong to the class rural area close to urban, which is the most common typology class in both countries. The previously mentioned typology class includes areas that have a rural character but that are functionally connected and located near urban areas, at approximately a 20–30-minute driving distance from the edge of outer urban areas. Also, in Denmark, the class peri-urban area (intermediate areas along the urban fringes between urban and rural areas) is more common than in the other countries. Regarding the urban typology classes, it is noteworthy that inner urban areas account for an approximately similar and low proportion of the land area in all countries. In each of the five countries, only 1–2% of all areas belong to this category. Also, grid cells that are classified as outer urban areas only accounted for approximately 1–4% of the territory in all five countries. In summary, while there are certain key differences between the proportions of the seven different typology classes and several country-specific differences, it is noteworthy that urban areas (inner urban areas and outer urban areas) only constitute a rather small proportion of the land area in all the Nordic countries. This means that the Nordic countries are predominantly rural when considering how their land areas are classified in the Nordic typology. The four rural typology classes constitute the lowest share of the land area in Denmark (67%) and the highest in Iceland (94%).

Territory share, classified according to the Nordic typology (2022, *Iceland 2017)

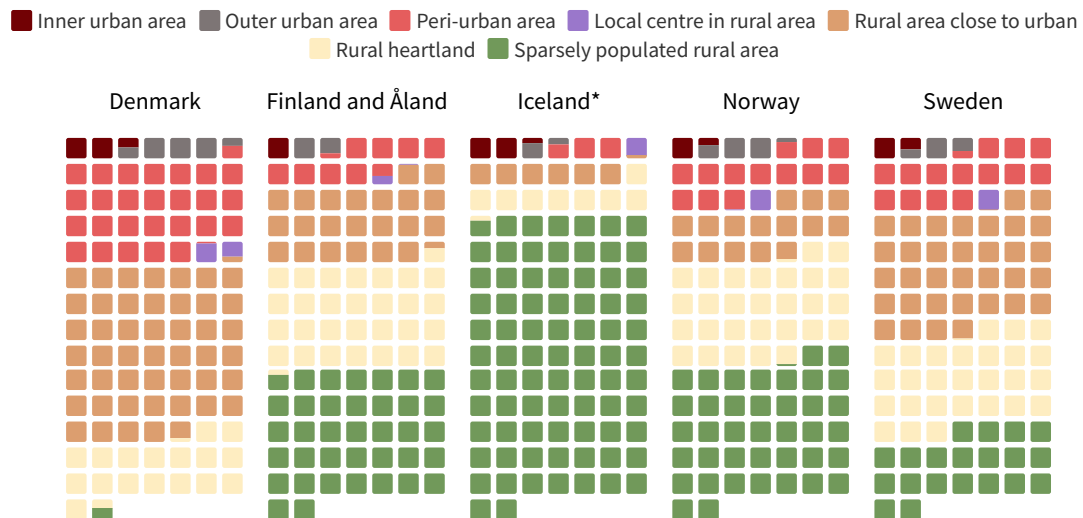


Figure 16. The proportion of the land area in the Nordic countries that belongs to the different Nordic typology classes.

When examining settlement patterns according to the Nordic urban–rural typology, a significantly different picture can be seen (Figure 17) as compared to the previous visualisation. While Figure 16 shows that there are substantial differences between the countries in terms of the proportion of the land area that belongs to the different typology classes, differences between the countries are less noticeable when comparing which typology classes the population in the different countries live.

Figure 17 shows that most of the population in all the Nordic countries live in one of the two urban classes (inner urban or outer urban). Among the Nordic countries, the proportion of the population that live in both urban classes is highest in Iceland (66%) and lowest in Norway (53%). Both typology classes are part of a so-called urban core; generated by clustering grid cells with a population of at least 15,000 (see Section 2.2). Within the urban core, the areas with the highest density (based on population density and building floor space) are classified as part of the inner urban category, while less dense areas are classified as part of the outer urban category. The typology class inner urban areas is the one where most people live in all the countries. In the five Nordic countries and Åland combined, inner urban areas is clearly the most populated class in the Nordic typology, where over 12.2 million (nearly 45%) of the population live. This is followed by outer urban areas and peri-urban areas where almost 15% and 13% of the population live, respectively. Among the Nordic countries, Iceland has the highest concentration of people living in inner urban areas (60%), while this share is the lowest in Norway (34%). Interestingly, Iceland also has the highest proportion of people living in the most sparsely populated rural class (14%), which shows a unique characteristic of Icelandic settlement patterns, where approximately 75% of the population live in either the most urban or the most rural territorial class, while the proportion of the population that live in peri-urban areas is also noticeably lower than in the other countries.

The proportion of the population that live in the rural classes combined is relatively similar in all Nordic countries. However, there are clear country-specific differences between which specific rural class is most populated. For instance, in Denmark, the most populated class is rural close to urban, whereas the class rural heartland areas is the most populated typology in Norway, and the class sparsely populated rural areas is most populated in Iceland.

Population share, classified according to the Nordic typology (2022, *Iceland 2017)

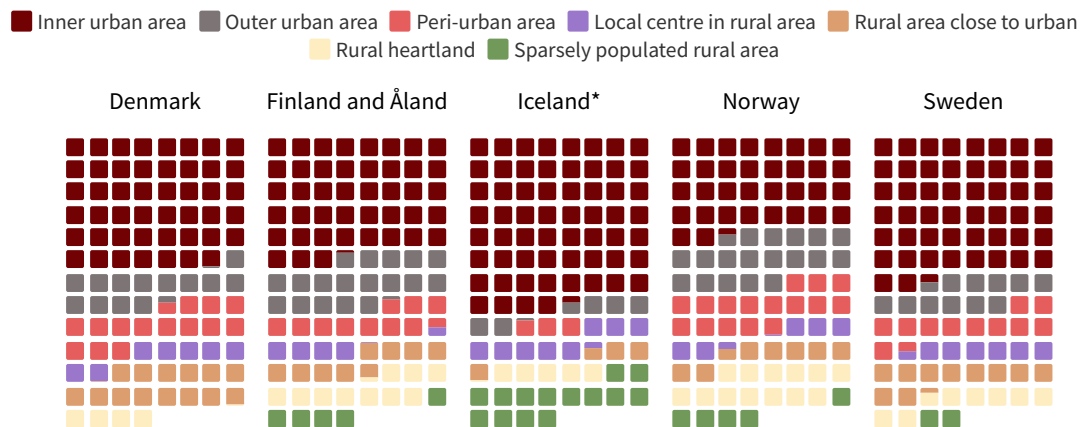


Figure 17. The proportions of the population in the Nordic countries that live in the different Nordic typology classes.

Comparison of Figures 16 and 17, shows that even though the urban classes in the Nordic typology only constitute a low proportion of the territory in all countries, most of the population live in relatively concentrated areas categorised as urban. Conversely, in terms of territorial coverage, all Nordic countries are, to a high degree, rural when considering the proportion of the land area that is categorized into one of the rural typology classes (where only a relatively small proportion of the population live). This can also be seen at the Nordic level in Figure 18 and table 3 which show the proportions and total numbers of the population that live in each typology class, and how much of the land area is categorized as part of the different typology classes in the Nordic countries combined. For example, the classes rural heartland and sparsely populated rural areas, which include less than 12% of the total population, constitute over half (53.7%) of the territory in the Nordic countries. This characteristic feature, where the land area is overwhelmingly rural but the population predominantly urban, is related to the fact that the urban typology classes have a significantly higher population density than the rural classes. This can be seen in Figure 19 which shows how many people, on average, live in a 1 × 1 km grid cell that belongs to each of the seven typology classes.

Population and territory share in Nordics, classified according to the Nordic typology (2022, *Iceland 2017)

■ Inner urban area
 ■ Outer urban area
 ■ Peri-urban area
 ■ Local centre in rural area
■ Rural area close to urban
 ■ Rural heartland
 ■ Sparsely populated rural area

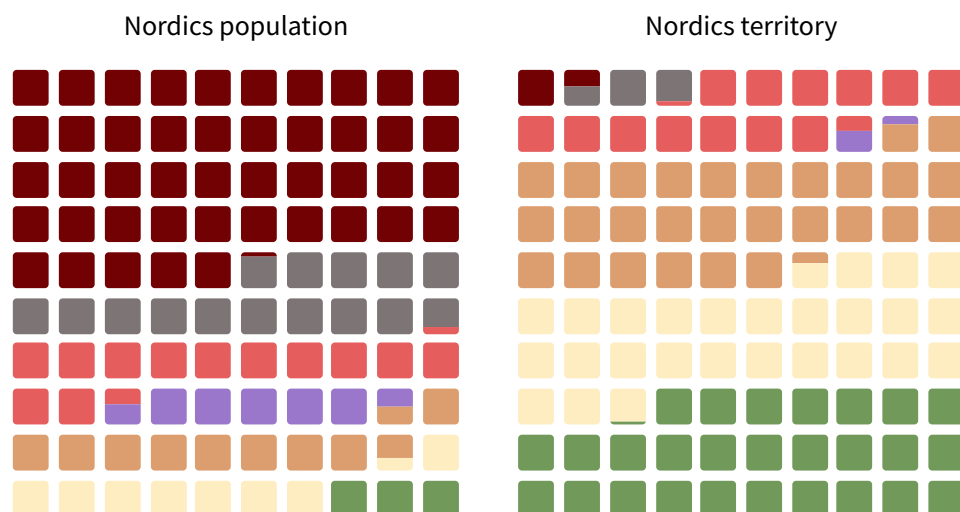


Figure 18. The proportions of the land area and of the population in the different Nordic typology classes in the Nordic countries combined.

Table 3. The proportions, total number of grid cells, and populations in the different Nordic typology classes for the Nordic countries combined (figures for Iceland are from 2017, while statistics for the other countries are from 2022).

Typology class name	Total number of grid cells in different typology classes (n)	Proportion of territory (grid cells in a certain typology class) (%)	Population in different typology classes (n)	Proportion of population in different typology classes (%)
Inner urban area	4,874	1.46	12,236,091	44.82
Outer urban area	7,734	2.32	3,993,355	14.63
Peri-urban area	4,5427	13.65	3,487,337	12.77
Local centre in rural area	2,849	0.86	1,667,161	6.11
Rural area close to urban	9,3339	28.05	2,781,806	10.19
Rural heartland	8,8120	26.48	2,332,817	8.55
Sparsely populated rural area	9,0440	27.18	801,088	2.93
Total	47,1896	100	27,299,655	100

As shown in Figure 19, in terms of population density, inner urban areas are the most densely populated among the typology classes, which is expected as this territorial class was created based on population and building density. In the five Nordic countries, an average inner urban grid cell has a population ranging from

between 2,266 in Norway to 2,711 in both Denmark and Sweden. The second most densely populated typology class is either outer urban area or local centre in rural areas, with some variation between countries. The class peri-urban areas, which is essentially an intermediate category between the urban and rural classes, has a clear lower population density than the urban classes, while at the same time being much more densely populated than the rural classes. In addition, the class local centres in rural areas, which is a category for the most densely populated settlements in rural areas, can at the same time also be regarded as an intermediate category of sorts (see Figure 11). The higher population density in these areas compared to the other rural classes corresponds to the notion that these areas are, by definition, the main population centres located outside urban areas and small towns, where the population is within the range 5,000–14,999 (see Section 2.3). The categories rural close to urban and rural heartland are, on average, rather similar in terms of population density, while sharing a less dense population than the urban and peri-urban classes. The category sparsely populated rural areas has by far the lowest population density among all classes, with an average ranging from seven people per 1 × 1 km grid cell in Finland to 16 people in Iceland. The substantially higher population density in the urban typology classes highlights that while the Nordic countries predominantly consist of territories that can be described as rural, the population live largely in the more densely populated urban areas.

Population density 2022 *(Iceland 2017)

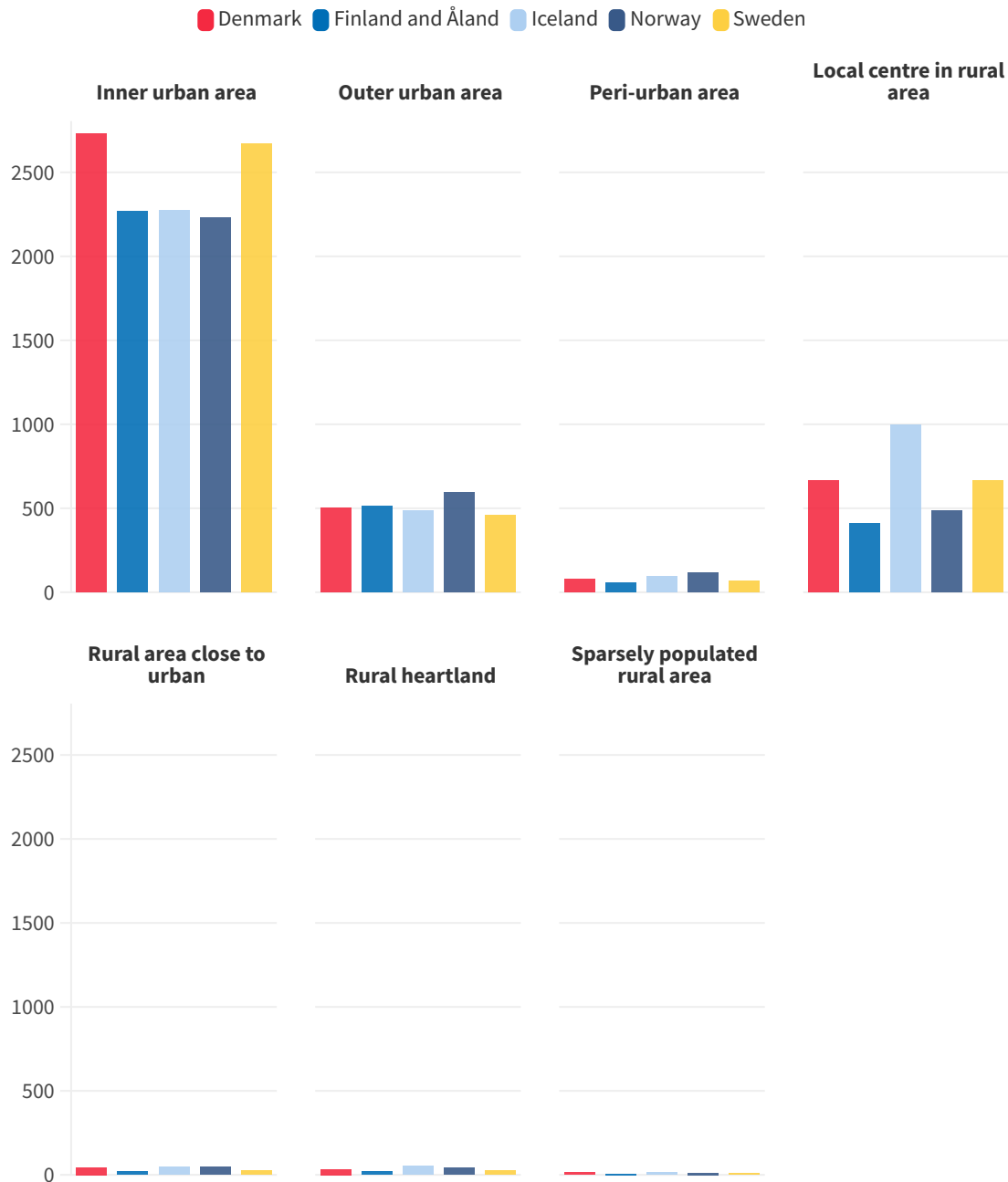


Figure 19. Average population density in a 1 × 1 km grid cell that belongs to each of the seven Nordic typology classes.

Population-change dynamics in different types of urban and rural areas

In the following, the focus is on what types of recent population change dynamics can be observed in the Nordic countries in the different typology classes between 2008 and 2022. Population changes are examined in Denmark, Finland and Åland, Norway, and Sweden; because of a lack of data Iceland is not included in the analyses of this section.

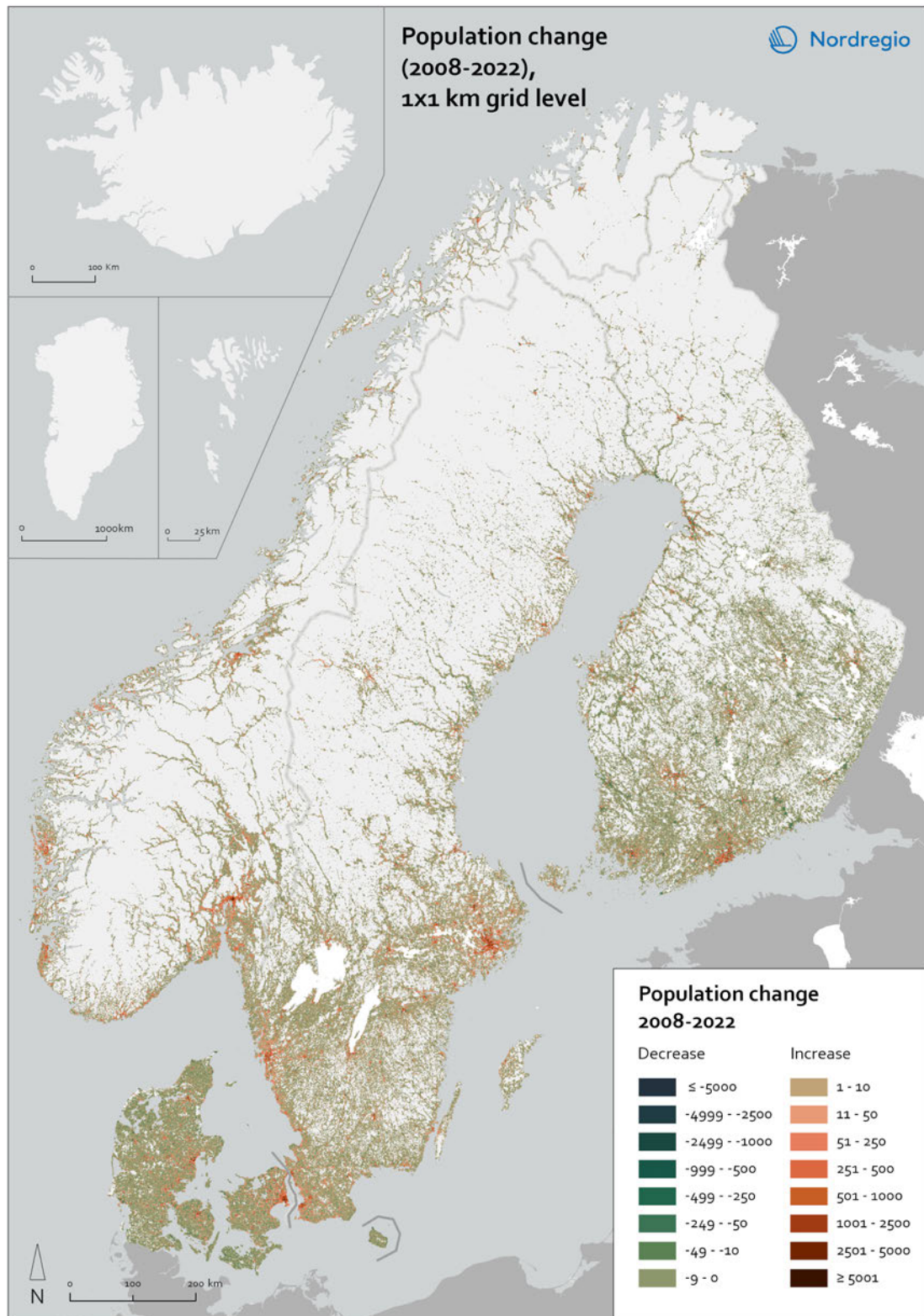


Figure 20. Absolute population change at grid level (1 × 1 km) in Denmark, Finland and Åland, Norway, and Sweden between 2008 and 2022.

Figure 20 shows population change at the 1 x 1 km grid level in Denmark, Finland and Åland, Norway, and Sweden between 2008 and 2022. A common characteristic in these countries is that the major urban regions stand out as the most noticeable areas of population increase during this time. An increase in population is most evident in the capital city regions of each country, but also in other major and medium-sized urban regions. In Denmark, the capital region surrounding Copenhagen has the largest concentration of population increase, but also Aarhus, and to a lesser extent Odense and Aalborg are urban regions where the population has grown. In Finland, the Helsinki region has undergone the most noticeable growth; Tampere, Oulu, Turku, and Jyväskylä are examples of other urban regions where noticeable population increase has occurred. In Norway, the most noticeable concentration of population increase is around Oslo, while other recognizable growth regions are along the coast around Bergen, Stavanger, and Trondheim. In Sweden, the most visible concentration of population growth can be observed in the Stockholm region, followed by the Gothenburg region, on the country's western coast. Other clear concentrations of population growth in Sweden are in the southern region of Skåne and especially around the city of Malmö.

While population growth is concentrated around certain large and medium-sized cities and their surrounding regions, by contrast, population decrease, is clearly more dispersed over larger areas. This general pattern can be seen in all four countries in Figure 20. In Denmark, areas of declining population are found especially in the northern and southern parts of Jutland, in Lolland, and in Bornholm. Also, several growing urban regions, such as Odense, Aarhus, and Aalborg, are largely surrounded by areas of population decline. Similarly, in Finland, the main growth in urban regions is surrounded by grid cells where the population is shrinking. Even though population decline is evident throughout the country, certain regions, such as Kymenlaakso in south-eastern Finland and Kainuu in the north-east, are predominantly shrinking. The areas of population decline in Denmark are more visible than in Finland (Figure 20) owing to a considerably higher overall population density, while population shrinkage in Finland is dispersed over larger and more sparsely populated areas. In Norway, there are comparatively few shrinking areas visible; those that exist are relatively scattered around the country. Unlike Denmark and Finland, where there are vast and continuous areas of significant population shrinkage, the scattered shrinking areas in Norway mainly show a moderate population decrease. In Sweden, there are noticeably more areas of population decrease in the central and northern areas than in the south, but overall shrinkage is clearly less evident than in Denmark or Finland. A difference that can be seen when comparing the northern parts of Finland, Norway, and Sweden is that there are more noticeable concentrations of population increase in northern Norway, including the medium-sized cities of Bodø and Tromsø and their surroundings. In northern Finland, population shrinkage is clearly more common than population growth.

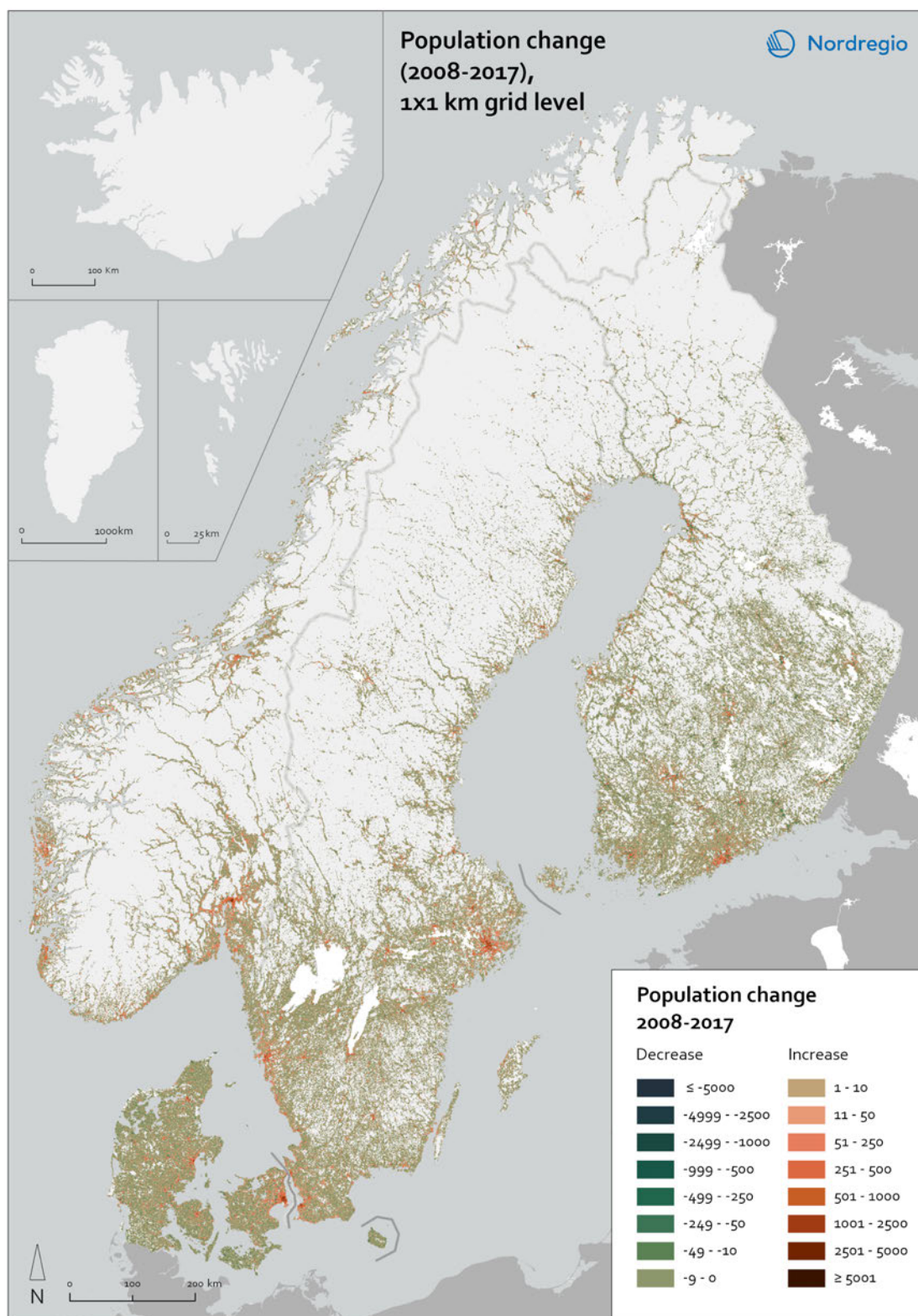


Figure 21. Absolute population change at grid level (1 × 1 km) in Denmark, Finland and Åland, Norway, and Sweden between 2008 and 2017.

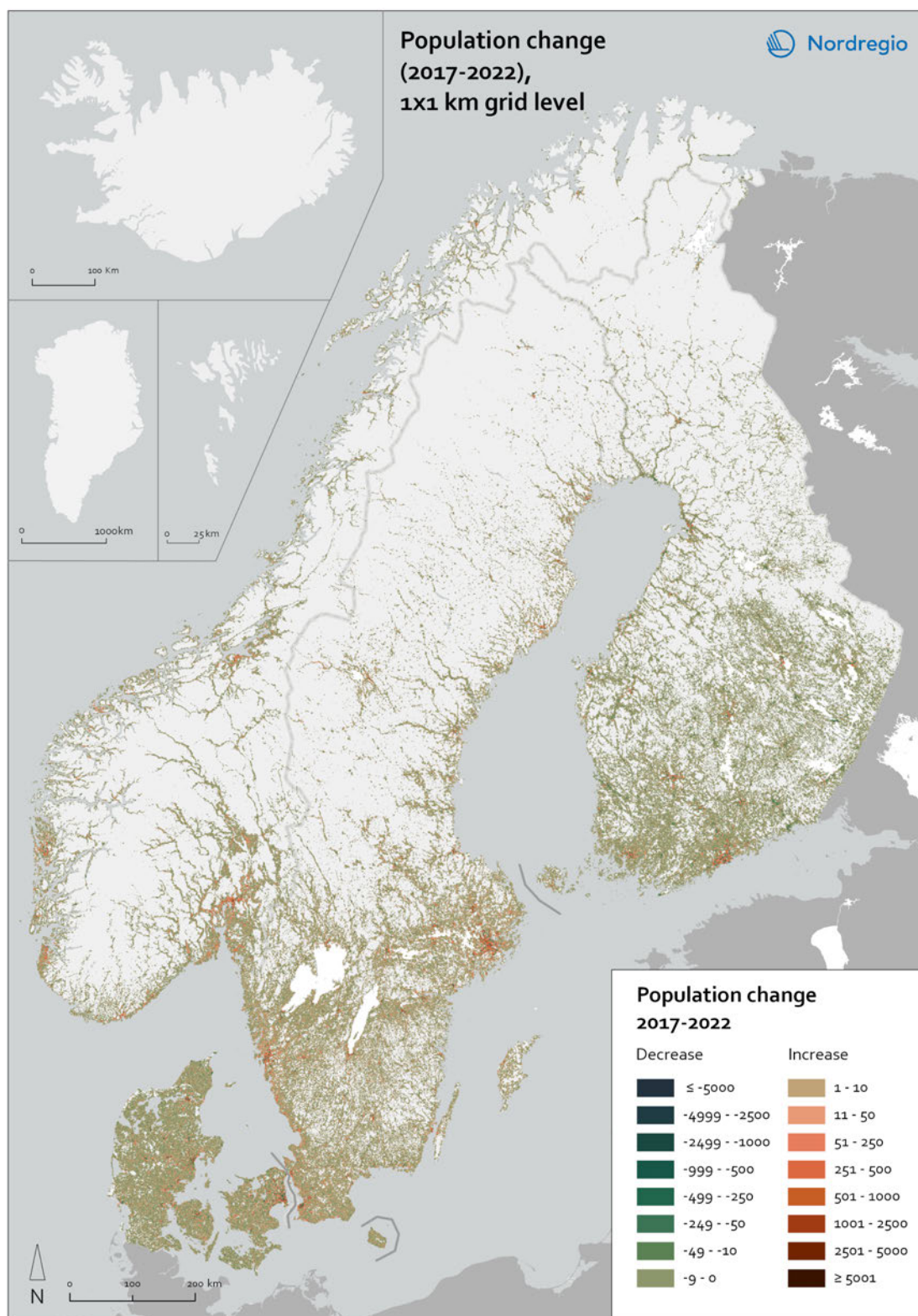


Figure 22. Absolute population change at grid level (1 × 1 km) in Denmark, Finland and Åland, Norway, and Sweden between 2017 and 2022.

Figures 21 and 22 show a slightly more detailed picture of the population development trends seen during approximately the past decade and a half. Figure 21 shows the population development during the period 2008–2017, while Figure 22 shows the development during the period 2017–2022. It should be acknowledged that these two time periods and the two maps are not entirely comparable; Figure 21 shows changes during a ten-year period, whereas Figure 22 shows changes during a ten-year period. Nevertheless, by comparing these two time periods, it is possible, in a broad sense, to identify whether the general development that occurred during the period 2008–2017 also continued during 2018–2022, or whether some differences can be observed. This is of interest from the point of view of the possible territorial implications that come with increased remote working. This was a topic that was widely discussed during the Covid-19 pandemic (when this project was initiated) and there were debates about whether changed remote-working practices could potentially lead to a shift in the way that different types of urban and rural areas develop (see also Randall *et al.* 2022).

When comparing the two previous maps (Figures 21 and 22), the general picture is similar, with the areas of population increase and decrease being in largely the same places. This suggests that the general patterns of population change in Nordic territories have not radically shifted in the periods 2008–2017 and 2018–2022. Nevertheless, more noticeable differences can be observed when examining certain specific regions and municipalities at a more detailed level. Figures 23 and 24 provide a more nuanced outlook on the cross-border Øresund Region and the Stockholm Region, showing territorial differences within the regions based on the Nordic urban–rural typology and what the population development looked like in the years 2008–2017 and 2018–2022. While these are the two largest urbanised regions in the Nordic countries, the figures show that they both include a variety of different types of areas. What is noticeable in both these regions is that a shift in the patterns of population change can be seen between the two periods in time. While the years 2008–2017 were characterised by noticeable population increase in the inner and outer urban areas of these regions, in 2018–2022, many of the same areas that had previously grown saw a decrease in population. This is a common trend that can be observed both in the Stockholm region (Figure 24) and around Copenhagen, Malmö, and Helsingborg-Helsingør (Figure 23).

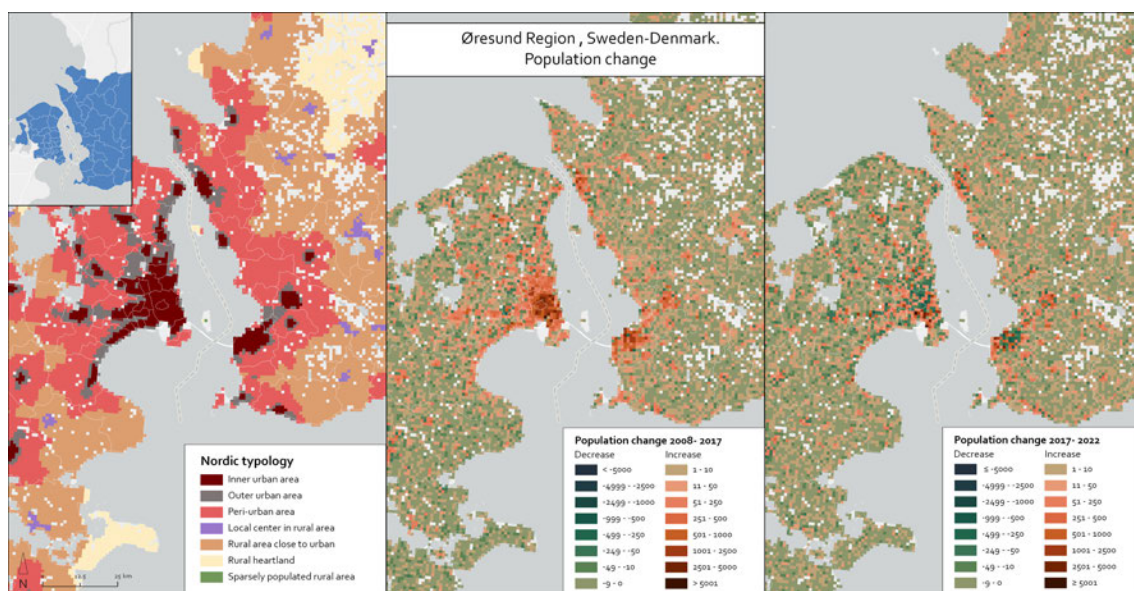


Figure 23. Close-up view of the Øresund Region encompassing the Capital Region of Denmark and Zealand, in eastern Denmark, and Skåne, in southern Sweden. The map shows territorial differences based on the Nordic typology and the population development in the years 2008–2017 and 2018–2022 at 1 × 1 km grid level.

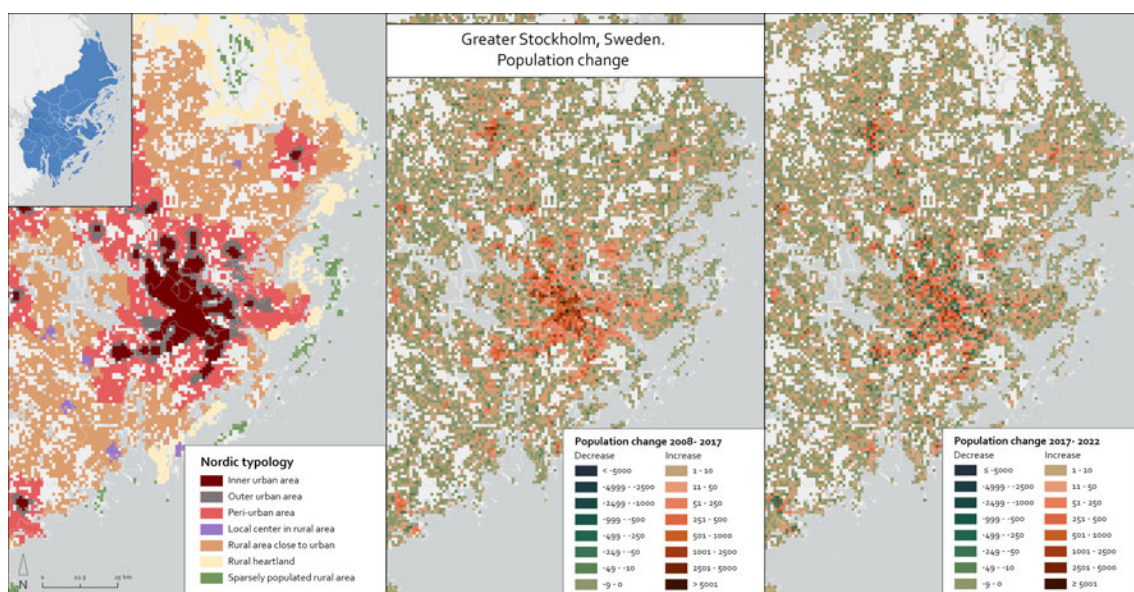


Figure 24. Close-up view of the Stockholm Region in Sweden. The map shows territorial differences based on the Nordic typology and the population development in the years 2008–2017 and 2018–2022 at 1 × 1 km grid level.

Figure 25 provides a similar, detailed outlook on population change dynamics within the Norwegian municipality of Ullensaker, located in Akershus county, north-east of Oslo. Ullensaker is categorised as an intermediate municipality according to DEGURBA. Based on the Nordic typology, the most densely populated settlements in the municipality, mainly including Jessheim, are classified as inner urban and outer urban while approximately three-quarters (75.5%) of the populated area within the municipality belongs to the peri-urban class. Ullensaker is one of the fastest-growing municipalities in the Nordic counties, and its population has nearly doubled over the past two decades, from approximately 22,000 to 42,000 between 2002 and 2022. An interesting characteristic that can be observed is that while most of the population in the municipality lives in peri-urban areas, this typology class has seen a decrease in population from 2008 to 2022. At the same time, the population of both inner urban and outer urban areas has increased, and sometime between 2017 and 2022, the number of people living in inner urban areas exceeded that of outer urban areas (see Figure 26). This trend of population growth in the most urbanised areas together with the significant absolute population growth in the municipality mean that Ullensaker is one of the most rapidly urbanising Nordic municipalities.

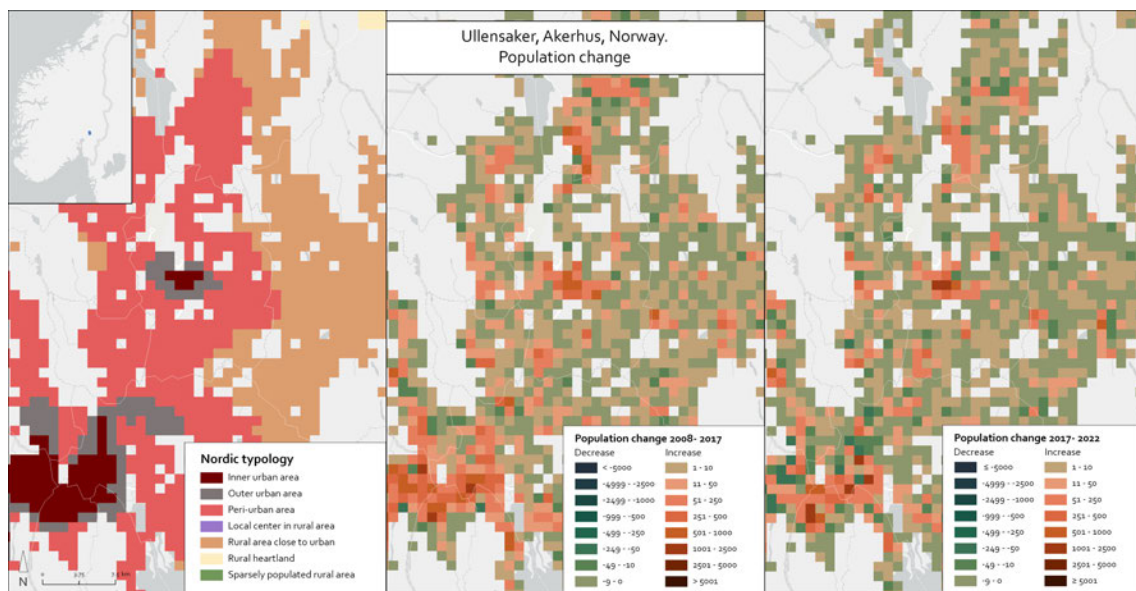


Figure 25. Close-up view of the municipality of Ullensaker, Norway. The map shows territorial differences based on the Nordic typology and the population development in the years 2008–2017 and 2018–2022 at 1 × 1 km grid level.

Ullensaker , territory and population by Nordic urban-rural typology classes

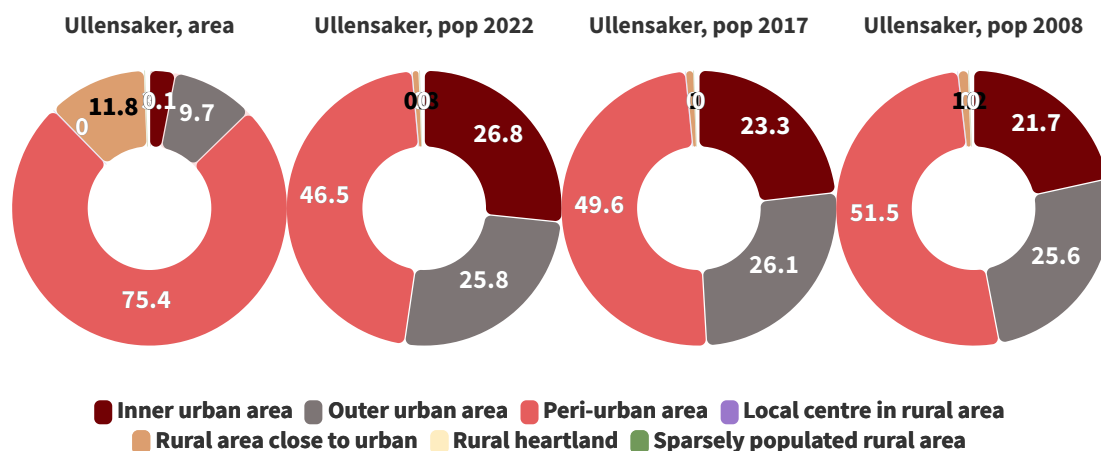
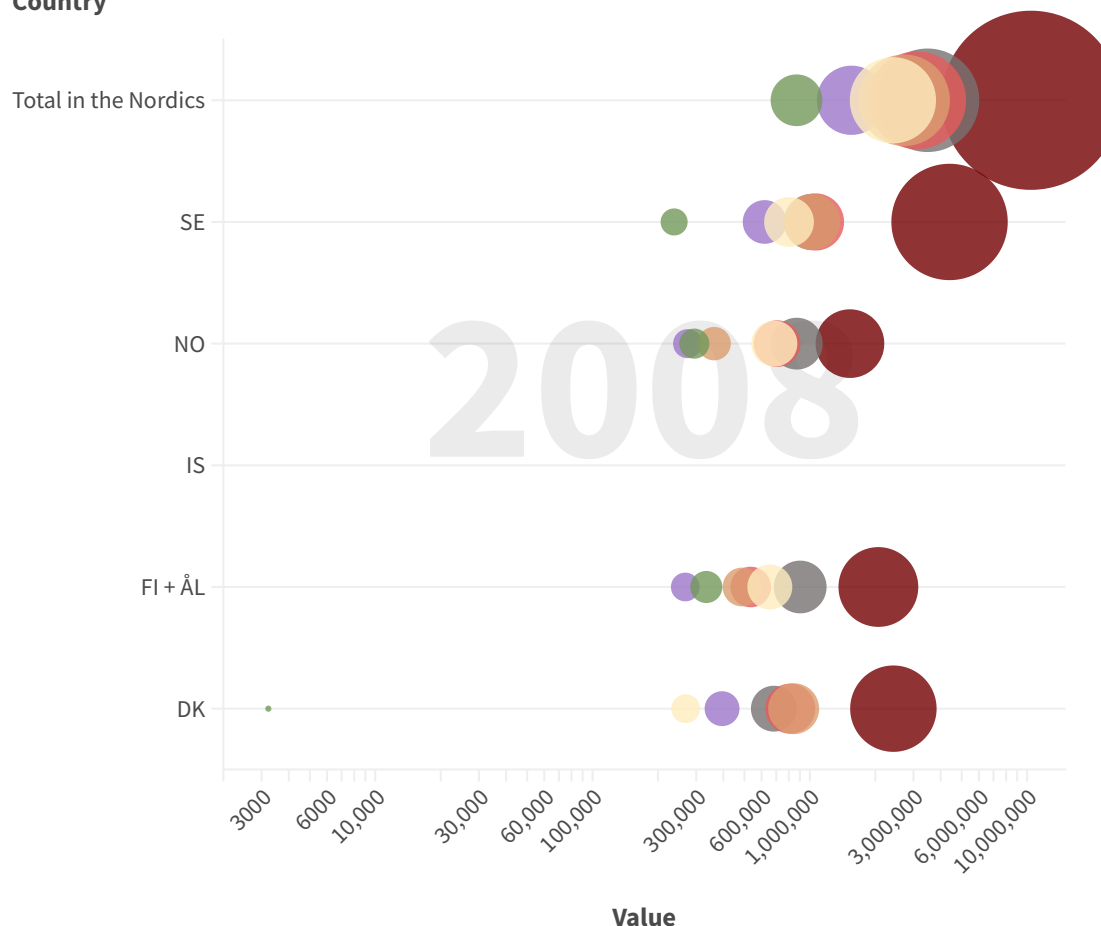


Figure 26. Ullensaker, Norway. Population and populated area by Nordic rural-urban typology.

Next, we consider what kind of population development trends can be seen over time in the different territorial classes of the Nordic urban–rural typology. Figure 27 shows how the total population has changed over time in the Nordic countries in the different typology classes. A bubble chart is used to highlight the different reference years (2008, 2017, 2022) and to aid examination of the population change in the different countries, both separately and combined. While it was possible to examine population changes for the period 2008–2022 in each of these typology classes for Denmark, Finland and Åland, Norway, and Sweden, data for Iceland was only available for 2017.

Country



Typology ● Inner urban area ● Local centre in rural area ● Outer urban area ● Peri-urban area
 ● Rural area close to urban ● Rural heartland ● Sparsely populated rural area

Figure 27. Population changes in the different Nordic typology classes for the years 2008, 2017, and 2022.

The Nordic countries have undergone a noticeable population increase in recent decades. For the five Nordic countries combined, the population grew from 25 million in 2008 to 27.7 million in 2022; this trend was evident for all countries (Nordic statistics, 2024). However, Figure 27 reveals a rather unbalanced development with different types of areas developing quite differently; certain territorial classes in the Nordic typology have undergone greater population growth than others, while some typology classes have seen a decrease in population.

The most significant population increase occurred in inner urban areas. This line of development can be observed in Sweden, Finland and Åland, Norway, and Denmark, where the combined population grew from 10.3 million to 12.0 million in the period 2008–2022. However, in the case of Denmark, it is noteworthy that the population in inner urban areas increased between 2008 and 2017 (from 2.42

million to 2.67 million), while there was a slight population decrease in this typology class between 2017 and 2022 (from 2.67 million to 2.53 million). In addition, in outer urban areas there was an increase in population in all four Nordic countries, from 3.48 million to 3.97 million between 2008 and 2022. Similarly, the intermediate typology class of peri-urban areas saw an increase in population in all four countries (from 3.11 million to 3.48 million between 2008 and 2022).

The rural typology classes have undergone a more differentiated development. For instance, there was an increase in population in the typology class rural close to urban in Norway and Sweden during the period 2008–2022, while the population decreased in these types of areas in Denmark and Finland and Åland. Also, in local centres in rural areas, the population increased in Denmark, Norway, and Sweden, while there was only a slight population decrease in this typology class in Finland. In areas that are classified as rural heartland, Norway is the only country where population increased, while these types of areas decreased in population in all other countries. The final typology class, sparsely populated rural areas, has the lowest total population among all the territorial classes, and these types of areas are also those where population shrinkage has been the most pronounced in all the countries (from 868,000 to 753,000 in the Nordic countries combined).

We have illustrated that urbanisation is a clear trend that can be seen in the Nordic countries during the past couple of decades. The main urban regions have seen the most noticeable increases in population. The analysis of population change in the different typology classes, with the largest population growth occurring in inner urban and outer urban areas, also underlines this development. It can also be concluded that peri-urban areas have undergone a noticeable increase in population, which indicates growth on the fringes of urban regions, suggesting suburbanisation. The general trend seen in rural areas points towards depopulation, but the changes that can be observed in the different typology classes suggests a more differentiated development, where different types of rural areas have developed differently. This is highlighted by the fact that rural areas close to urban areas have generally seen an increase in population, in a manner similar to that of local centres in rural areas, which suggests that some of the rural areas that are located in the vicinity of cities and towns may have become more attractive places for people to settle (see also Randall *et al.* 2022). In addition, sparsely populated rural areas appear to be in a more disadvantaged position and the general trend in these areas is that their population has decreased noticeably.

It should be noted that, in addition to the previously described general trends in the Nordic countries, the more specific population changes that can be observed in different regions and municipalities also differ from one another. To better understand these context-specific differences would require closer examination of the more local and regional conditions that are driving the different developments seen.

Scaling up the Nordic typology from grid level to municipality level

While the Nordic urban–rural typology is grid-based (constructed on a 1 × 1km grid) it is also possible to aggregate or scale up this classification to more general territorial levels, such as to the municipality level. This flexibility of the typology can be regarded as an advantage. For instance, from a policymaking and planning point of view, municipalities in the Nordic countries are self-governing authorities, and by scaling up the typology from grid level to municipality level, the typology can help provide new perspectives on territorial differences to support local-governance and planning. Also, from a statistical point of view, most data are produced at the level of administrative area, and the typology and grid data linked to this classification can be used to complement the more general spatial data. The Nordic typology has been constructed such that all 1 × 1 km grid cells in each of the five countries have been classified into one of the seven typology classes based on the specific characteristics of each grid cell. In Figure 28, the typology has been aggregated to the municipality level in two different ways: 1. based on the typology class that is most common in each municipality, when considering how much of the land area belongs to the different typology classes and, 2. based on the typology class where most people live in a specific municipality. This means that the figure shows the number of municipalities in each Nordic country, and in all countries combined, where a certain typology class is most common in terms of territorial coverage, and where most people live in that municipality.

Number of municipalities in the Nordic countries based on most common Nordic typology class

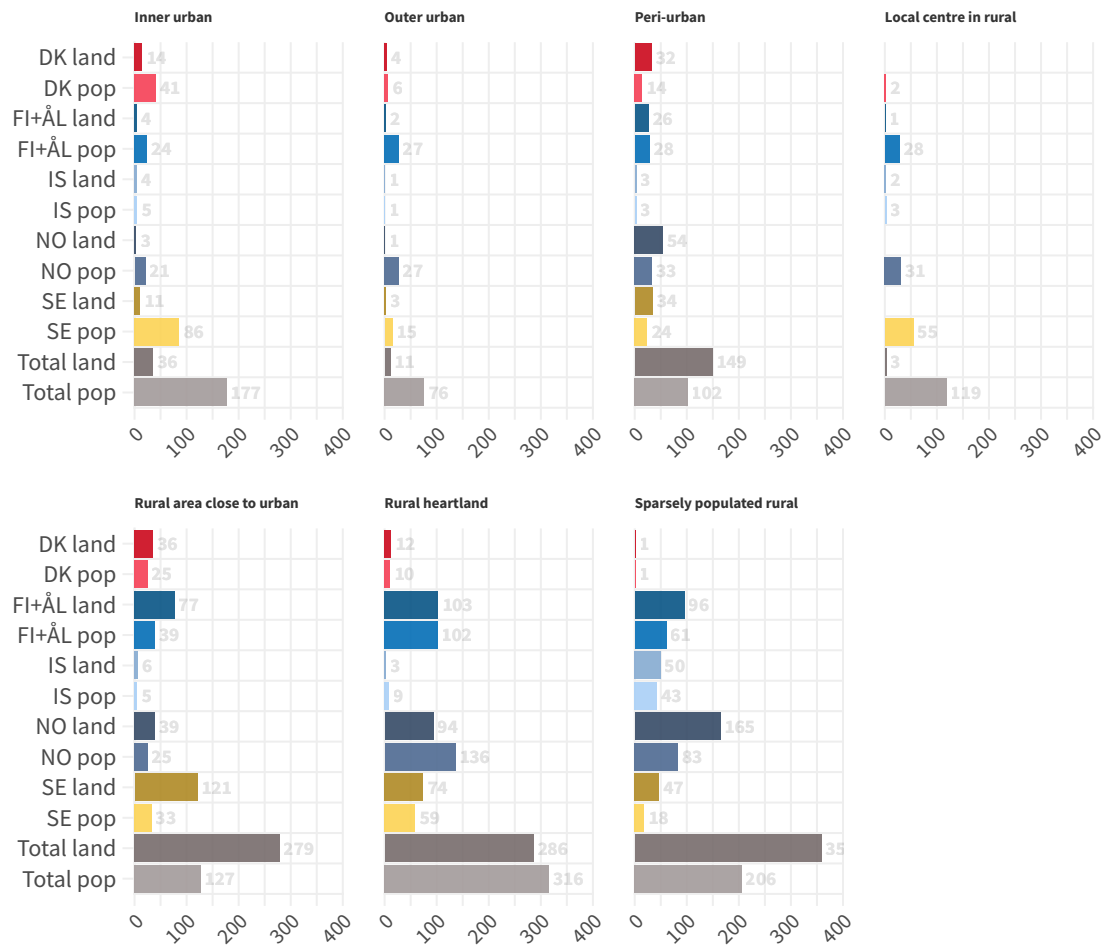


Figure 28. The number of municipalities in the Nordic countries based on the Nordic typology class which is most common in each municipality, in terms of territorial coverage and where most people live in that municipality.

When examining how common the different typology classes are in the Nordic countries, Figure 28 aids in showing that there is a total of 177 municipalities in the Nordic countries combined, where inner urban areas is the typology class where the largest number of people live. Many of these municipalities are found in either Sweden (86 municipalities) or Denmark (41 municipalities). In addition, there are only 36 municipalities in the Nordic countries combined, where inner urban areas is the most common typology class when calculated as a proportion of all grid cells in that municipality. It is also noteworthy that even though a relatively low proportion of the population in the Nordic countries live in the rural typology classes (see Figure 18 and Table 3), there remain many municipalities where the population predominantly live in one of the rural classes. For example, there are 316 Nordic municipalities where rural heartland is the most populated typology class, and many of these municipalities are found particularly in Norway (136 municipalities) and Finland and Åland (102 municipalities). There are also 206 Nordic municipalities

where most of the population live in sparsely populated rural areas, which are located mainly in Norway, Finland, and Iceland. In Denmark, there is a single municipality, Christiansø, where sparsely populated rural is the most common typology based on where the population live and proportion of the land area⁴.

It is an interesting point that in over half of all Nordic municipalities the most common typology class is either rural heartland or sparsely populated rural. This can be seen clearly in the map presenting the Nordic urban–rural typology (Figure 13), where both categories, and especially sparsely populated rural areas, cover a significant proportion of the Nordic territory. Regarding the rural typology classes, it is also noteworthy that there are 119 Nordic municipalities where local centres in rural areas is the most populated typology class, but only three municipalities where this typology class is the predominant one in terms of territorial coverage. This is something that can be related to the notion that while local centres in rural areas have a high population density (see Figure 19), they are generally small in terms of geographic size.

⁴ Christiansø is a small Danish island municipality with a total area of 39 hectares and a population of 93 (in 2023), which is entirely classified as sparsely populated rural in the Nordic urban–rural typology.

3.2 Comparing the Nordic typology with the DEGURBA classification

Following the previous sections where urban–rural differences were briefly examined according to the Eurostat DEGURBA classification and then according to the Nordic urban–rural typology (Section 3.1), this section draws on both these territorial classifications and examines how well the two classifications match each other. The key question addressed in this section is what kind of differences in territorial and settlement patterns can be seen within urban, intermediate, and rural municipalities? The answer sheds light on how heterogeneous the Nordic municipalities are. Throughout the analysis the purpose was to show how the grid-based Nordic typology can be used to complement the municipality-level DEGURBA classification and further nuance the picture of territorial differences across the Nordic countries.

The diversity of Nordic urban, intermediate, and rural municipalities

For the analysis in this section, the seven different typology classes of the Nordic urban–rural typology have been grouped into three further general combined Nordic typology classes (see Table 4) as follows:

- Inner urban areas and outer urban areas are examined together as urban areas.
- Peri-urban areas and rural areas close to urban areas are combined into a category of intermediate areas.
- Local centres in rural areas, rural heartland areas, and sparsely populated rural areas are examined as a combined class of rural areas.

The new groups better correspond to the three-class DEGURBA classification.

Figure 29 shows to what degree the Nordic urban–rural typology and the DEGURBA classification correspond to each other when classifying Nordic municipalities based on the Nordic typology class; this being most common in each municipality, when considering how much of the land area belongs to the different typology classes.

Table 4. The seven detailed territorial classes and combined general territorial classes in the Nordic urban–rural typology.

Combined Nordic typology classes	Detailed Nordic typology classes
Urban areas	<ul style="list-style-type: none"> • Inner urban areas • Outer urban areas
Intermediate areas	<ul style="list-style-type: none"> • Peri-urban areas • Rural areas close to urban areas
Rural areas	<ul style="list-style-type: none"> • Local centres in rural areas • Rural heartland areas • Sparsely populated rural areas

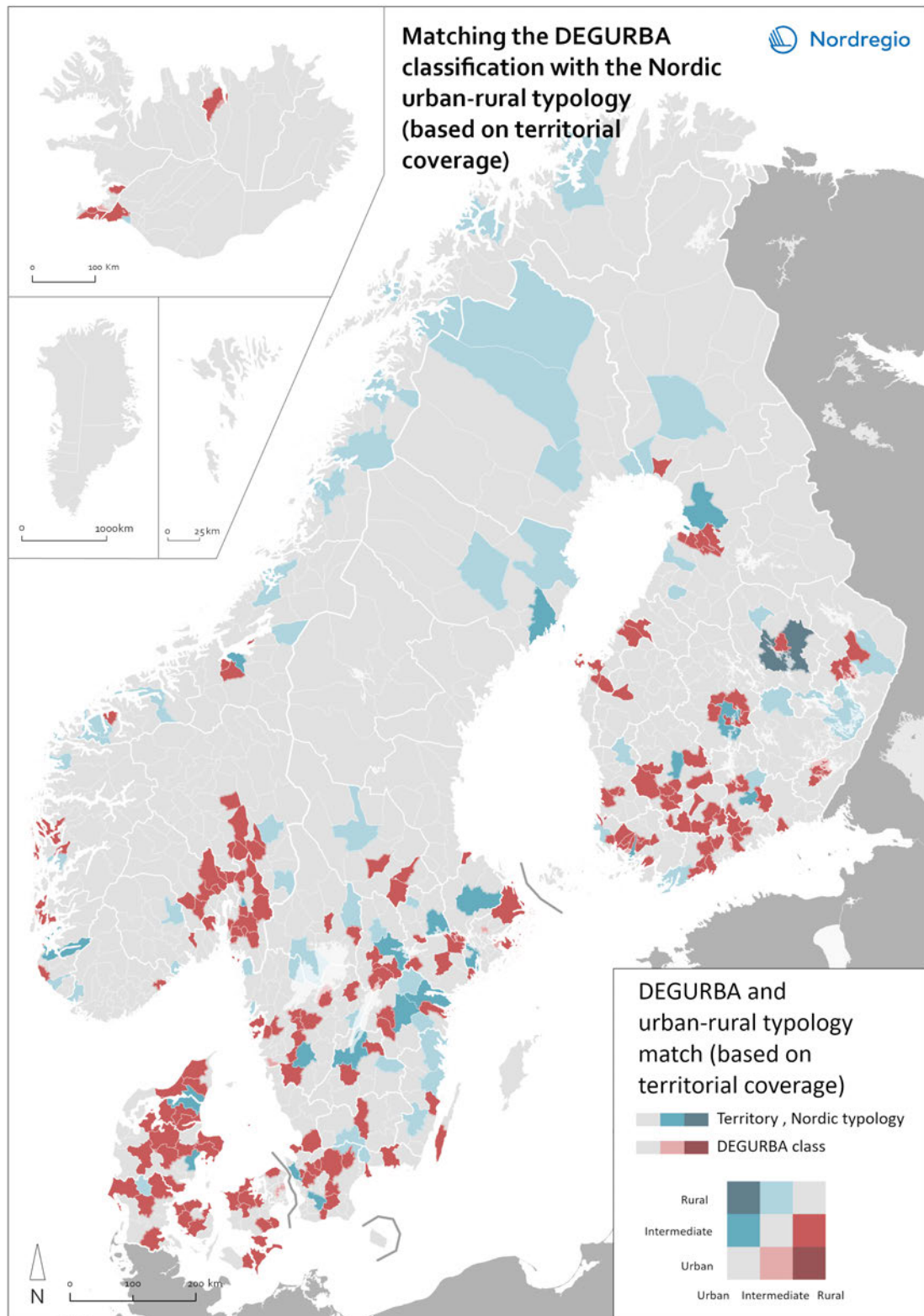


Figure 29. Comparison of how well the Nordic urban-rural typology and DEGURBA classification correspond when classifying Nordic municipalities based on the Nordic typology class which is most common in terms of territorial coverage.

In Figure 29 most municipalities are coloured grey. This colour represents municipalities where the Nordic typology and the DEGURBA classification correspond well to each other; the map shows that most Nordic municipalities fall into this category. This means that, for instance, in a municipality that is classified as rural in DEGURBA, then the most common territorial class in the Nordic typology is one of the rural typology classes. However, there are also some municipalities that are coloured either red or blue. These represent municipalities where there is a more noticeable difference between the two territorial classifications.

For example, the City of Kuopio, located in Eastern Finland (shown in dark blue in the map in Figure 29) is classified as an urban municipality according to DEGURBA, while the land area is predominantly rural in the Nordic typology. According to the Nordic typology, in Kuopio, approximately 76% of the land area is classified as rural, 21% as intermediate, and only 3% as urban (see Figure 31). Figure 30 shows a magnified image of Kuopio, indicating clear internal territorial differences and rather unevenly distributed settlement patterns within the municipality. The inner urban areas and, to a lesser extent, the outer urban areas have a significantly higher population density and contain most of the population in the municipality; rural heartland areas and especially sparsely populated rural areas, on the other hand, have a rather low and dispersed population.

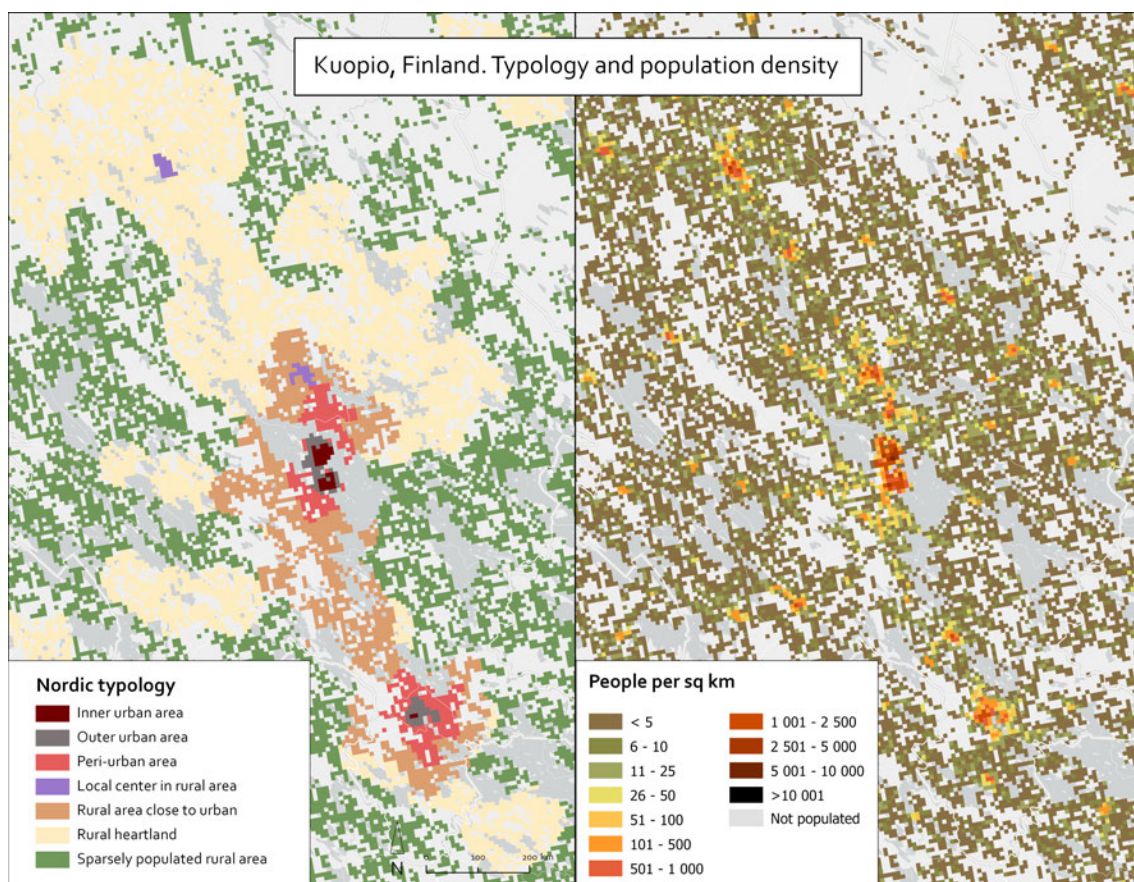


Figure 30. Close-up view of the Finnish municipality of Kuopio, which is an urban municipality according to the DEGURBA classification. The map shows territorial differences based on the Nordic typology and settlement patterns at 1 × 1 km grid level within the municipality.

Figure 31 shows (along with Kuopio) a selection of municipalities that are classified as urban according to DEGRUBA, but where the land area is largely composed of intermediate or rural areas according to the Nordic typology (mainly peri-urban areas). The figure shows, for the municipalities of Norrköping in Sweden, Sandnes in Norway, and Aalborg in Denmark, how much of the land area in these municipalities belongs to the different territorial classes of the Nordic typology, and the proportion of the population that live in the different typology classes.

Common to all these municipalities is that they are relatively large or medium-sized towns; vast in size but have a population that live in a concentrated area in the main urban settlements. As DEGURBA classifies municipalities based on a combination of geographical contiguity and population density, the high concentration of population in the main urban settlements means that they are classified as urban. Using the Nordic typology to classify the same territories results in a largely intermediate or rural classification; there are numerous such municipalities in the Nordic countries (shown red on the map in Figure 29) including Gribskov in Denmark, Svalbarðsstrandarhreppur in Iceland, Sipoo in Finland, Løten in Norway, and Bjuv in Sweden. All are rural according to DEGURBA, while the land areas are predominantly intermediate (peri-urban) according to the Nordic

typology. It is also noteworthy that while there are numerous municipalities classified as urban according to DEGURBA but are largely rural according to the Nordic typology, there are no municipalities classified rural according to DEGURBA whilst at the same time predominantly urban according to Nordic typology.

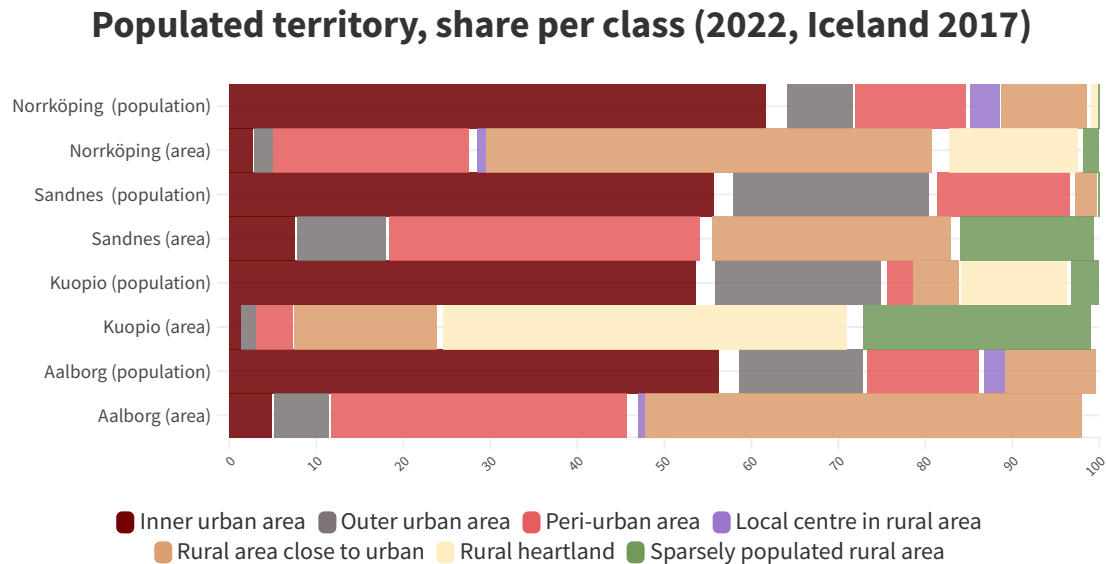


Figure 31. The proportion of land area and population in the different Nordic typology classes in selected Nordic municipalities that are urban according to the DEGURBA classification.

Another way of indicating how well the Nordic urban–rural typology and the DEGURBA classification match is shown on the map in Figure 32. The map shows how well these two classifications correspond to each other when classifying municipalities based on the territorial class in the Nordic typology where most people in the municipality live. Areas shaded grey indicate a good classification match in most Nordic municipalities. For example, most municipalities classified as urban according to DEGURBA (either inner urban areas or outer urban areas) correspond to Nordic typology classes with the most inhabitants. Also, in most municipalities that are classified as rural according to DEGURBA, the population primarily live in one of the rural classes of the Nordic typology.

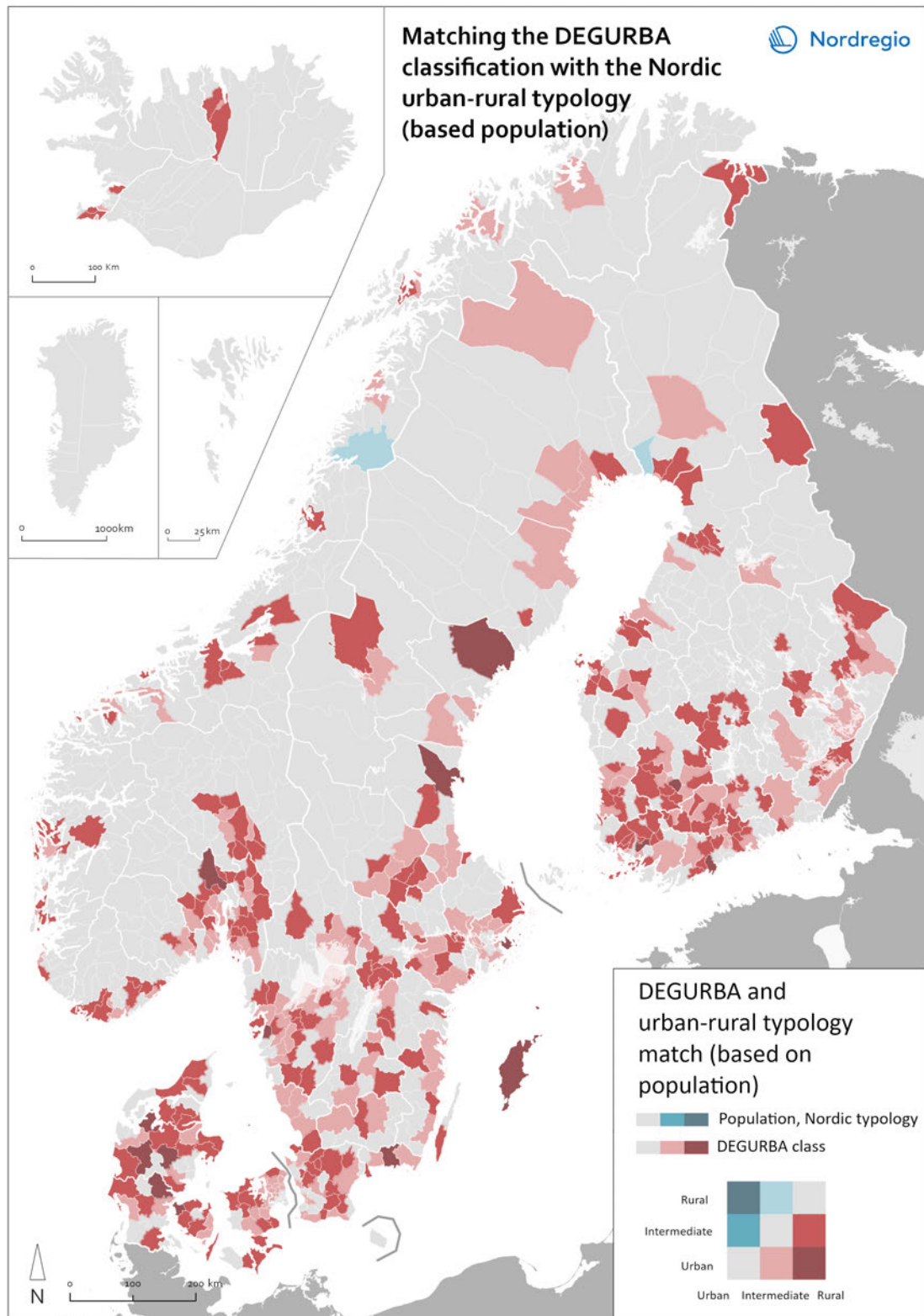


Figure 32. Comparing how well the Nordic urban–rural typology and DEGURBA classification correspond when classifying Nordic municipalities based on the Nordic typology class where most people live.

However, there are some municipalities where there is a more noticeable difference between the two different territorial typologies. Shown in blue in Figure 32, both Rana in Norway (situated on the Norwegian–Swedish border), and Tornio (on the Finnish–Swedish border) are intermediate municipalities according to DEGURBA, but where the entire population live in the rural classes of the Nordic typology⁵.

Furthermore, the municipalities shown with the darkest shade of red (Figure 32) are categorised as rural according to the DEGURBA (but where the clear majority of the population live in areas that are classified as either urban or intermediate in the Nordic typology). For instance, the Danish municipality of Vejle is rural according to DEGURBA but approximately only 15% of the population live in rural areas according to the Nordic typology. Examples of similar types of municipalities in the other countries are Ringerike in Norway, Lempäälä in Finland, Hveragerðisbær in Iceland, and Stenungsund in Sweden, which are all rural according to DEGURBA, but where the vast majority or nearly entire population live in either urban or intermediate areas (see Figure 33).

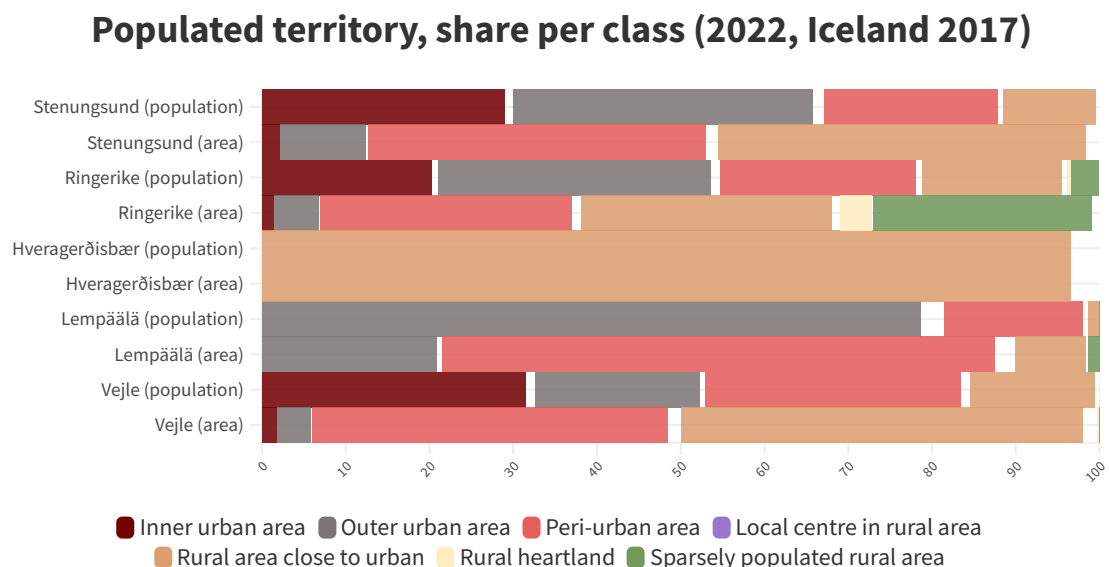


Figure 33. The proportion of land area and population in the different Nordic typology classes in selected Nordic municipalities that are rural according to the DEGURBA classification.

A more detailed outlook on what kind of internal territorial differences can be seen within Nordic municipalities can be seen in Annex 1 and Annex 2. Annex 1 includes a dynamic graph that shows the proportion of population that lives in the different Nordic typology classes in all Nordic municipalities, while Annex 2 shows the proportion of the land area in the different Nordic typology classes in a similar way.

⁵ In the case of Tornio and Haparanda (both Finnish–Swedish cross-border towns) it should be acknowledged that the classification calculations in the current version of the Nordic typology were made based on the national grid of each country. Nevertheless, it is possible that carrying out these calculations in a common Nordic grid would generate a better representation of reality in these certain cross-border areas.

Territorial differences within urban municipalities

Next, a closer look is taken at territorial differences among Nordic municipalities that are categorized as part of the same territorial class in the DEGURBA classification.

We now focus on the 61 municipalities in the Nordic countries that are defined as urban according to the Eurostat typology (Figure 34). The different municipalities are shown based on the proportion of the population that live in areas that are classified as urban (inner urban areas or outer urban areas) according to the Nordic typology (y-axis), and the proportion of the territory that is classified as urban (inner urban areas or outer urban areas) (x-axis). The graph is interactive, and it is possible to examine the different municipalities more closely by hovering over them in the bubble chart; it is also possible to filter municipalities according to country by clicking on the selection feature in the top left-hand corner of the graph.

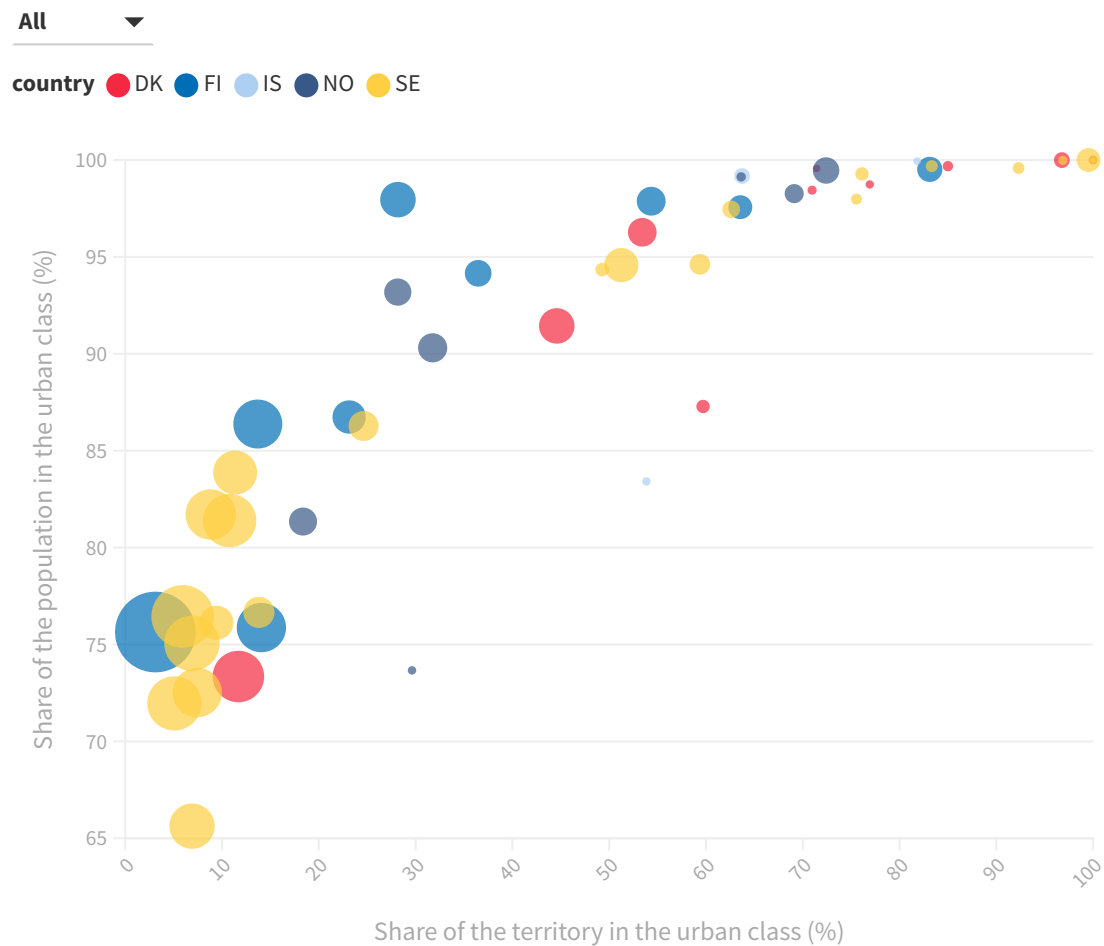


Figure 34. Nordic municipalities classified as urban in the DEGURBA classification based on the proportion of the population that live in and the land area that belongs to the urban classes (inner urban areas and outer urban areas) of the Nordic typology.

Municipalities where almost the entire population live in one of the urban classes of the Nordic typology, and where also almost the entire land area of the municipality is classified as part of one of the urban classes, are shown in the upper right-hand corner of the graph in Figure 34. Specifically, these include densely populated municipalities that are part of the major Nordic urban regions, such as Copenhagen and Glasaxe in the Copenhagen capital region, Stockholm and Danderyd in the Stockholm region, and Kauniainen in the Helsinki capital region, where over 98% of all grid cells are classified as urban and where a similar proportion of the population live in these urban grid cells. The graph also shows other types of municipalities, such as those where the population largely reside in urban areas, but where the territory of the municipality is predominantly non-urban (bottom left-hand corner of the graph). For example, in Tampere and Stavanger where approximately 98% and 93%, respectively, of the population live in urban grid cells, urban areas only constitute approximately 28% of the land area of these municipalities. An even more striking example is Kuopio in Finland (discussed in the previous section) where approximately 76% of the population live in areas that are classified as urban, while the proportion of urban grid cells only constitute approximately 3% of the territory in the municipality. In the case of Kuopio, this can be related to the vast size of the municipality, which is a result of several municipal mergers during the past few of decades. The result of these mergers is that several predominantly rural municipalities which were large, but with sparse populations and few residents, were combined with Kuopio such that it became one of the largest Finnish municipalities by area (Kuopio, 2024). From this perspective, the grid-based Nordic typology helps provide a more nuanced picture of urban–rural differences within the municipality which would otherwise remain concealed if the whole municipality is classified as part of a specific territorial class.

Territorial differences within rural municipalities

Figure 35 shows the diversity of the 774 Nordic municipalities that are defined as rural according to the DEGURBA classification. Municipalities are shown (top right-hand corner of the figure) where the population predominantly live in areas that are classified as part of one of the rural classes in the Nordic urban–rural typology (y-axis) and where also the land area is primarily classified as rural (x-axis). For example, Læsø in Denmark, Ähtäri in Finland, Flóahreppur in Iceland, Balsfjord in Norway, and Pajala in Sweden are all municipalities that are rural according to the Eurostat typology, but where nearly the entire population and the land area are rural according to the Nordic typology. By contrast, in the bottom left-hand corner of the graph are municipalities that are categorised as rural according to DEGURBA, but where the land area and the population is predominantly intermediate according to the Nordic typology. These include the municipalities of Nurmijärvi in Finland, Strängnäs in Sweden, and Viborg in Denmark. A common characteristic of several of these municipalities is that they are often small or

medium-sized towns, which in some cases are located relatively close to or on the outskirts of large urban regions. For instance, Nurmijärvi is located on the outskirts of the Helsinki metropolitan region. Overall, the municipalities are quite scattered (in the figure), which illustrates that those municipalities that are classified as rural in the DEGURBA classification are far from a homogenous category.

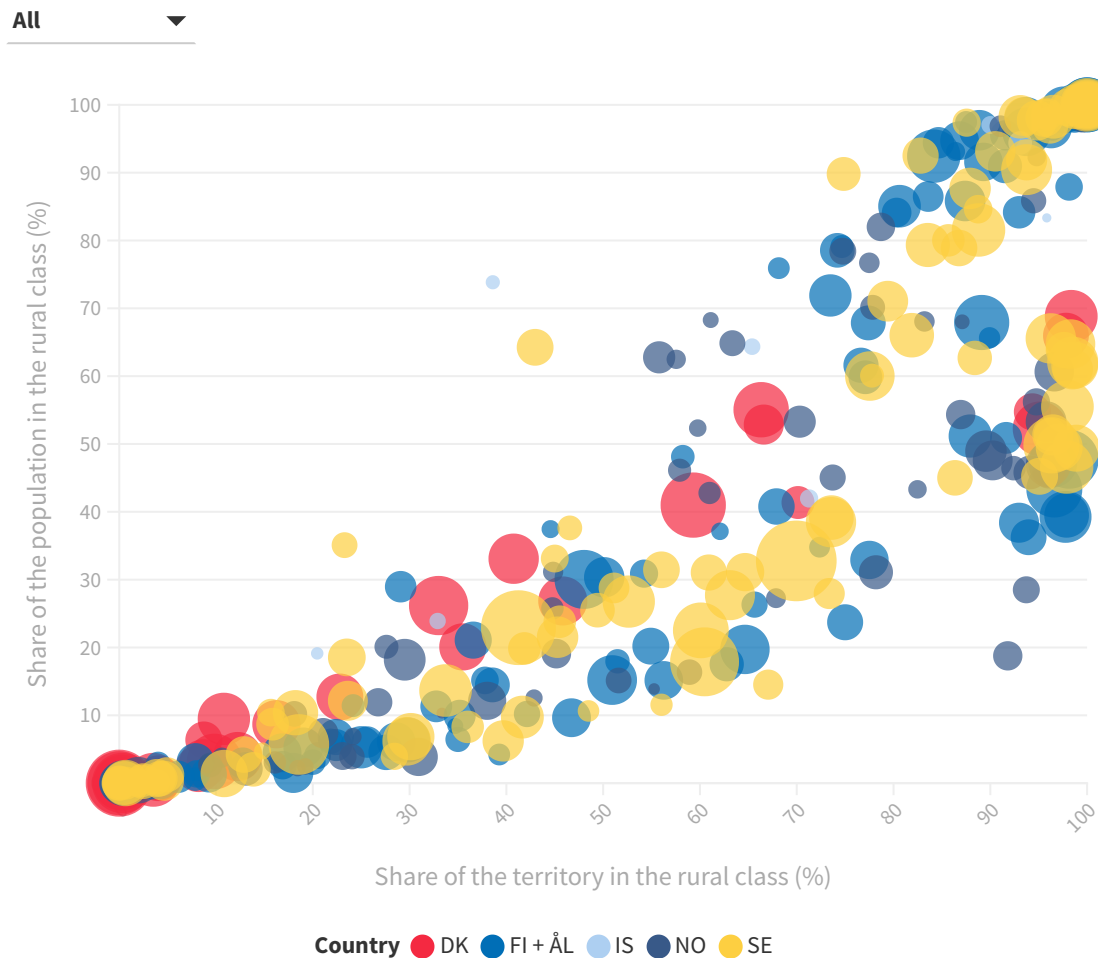


Figure 35. Nordic municipalities that are classified as rural in the DEGURBA classification based on the proportion of the population that live in and the land area that belongs to the rural classes (local centres in rural areas, rural heartland areas, and sparsely populated rural areas) of the Nordic typology.

Territorial differences within intermediate municipalities

Figure 36 shows the 288 Nordic municipalities that are classified as intermediate according to the DEGURBA classification. These municipalities are highly dispersed (in the figure), meaning that there is great variation among these municipalities in terms of how urban and rural they are according to the Nordic urban–rural typology. In the top right-hand corner of the chart are municipalities where the DEGURBA classification and the Nordic typology correspond closely to each other. Municipalities categorized as intermediate according to Eurostat typology are similarly categorized according to Nordic typology. Larvik in Norway, Paimio in Finland, and Knivsta in Sweden are examples of municipalities of this type.

The bottom right-hand corner of the graph shows intermediate municipalities where the land area is largely intermediate (or peri-urban) according to the Nordic typology, but where the population primarily live in one of the urban classes of the Nordic typology. There are several municipalities of this type in Sweden, such as Eskilstuna and Vänersborg, where over three-quarters of the population live in urban areas while over 90% of the territory is classified as intermediate according to the Nordic typology. The upper left-hand part of the graph shows intermediate municipalities, where a clear majority of the population live in the intermediate classes of the Nordic typology, while the land area is mainly classified into one of the rural categories, such as in Pieksämäki in Finland and Gällivare in Sweden. Finally, the bottom left-hand corner of the graph shows where neither the population nor the land area of the municipality is intermediate according to the Nordic typology. These include Järvenpää in Finland and Ballerup in Denmark, located in major urban regions, and where both the land area and the population belongs almost entirely to one of the urban classes. Among these municipalities is also the previously highlighted example of Rana in Norway, which according to DEGURBA is an intermediate municipality, while the Nordic typology classifies both the population and the land area as entirely rural.

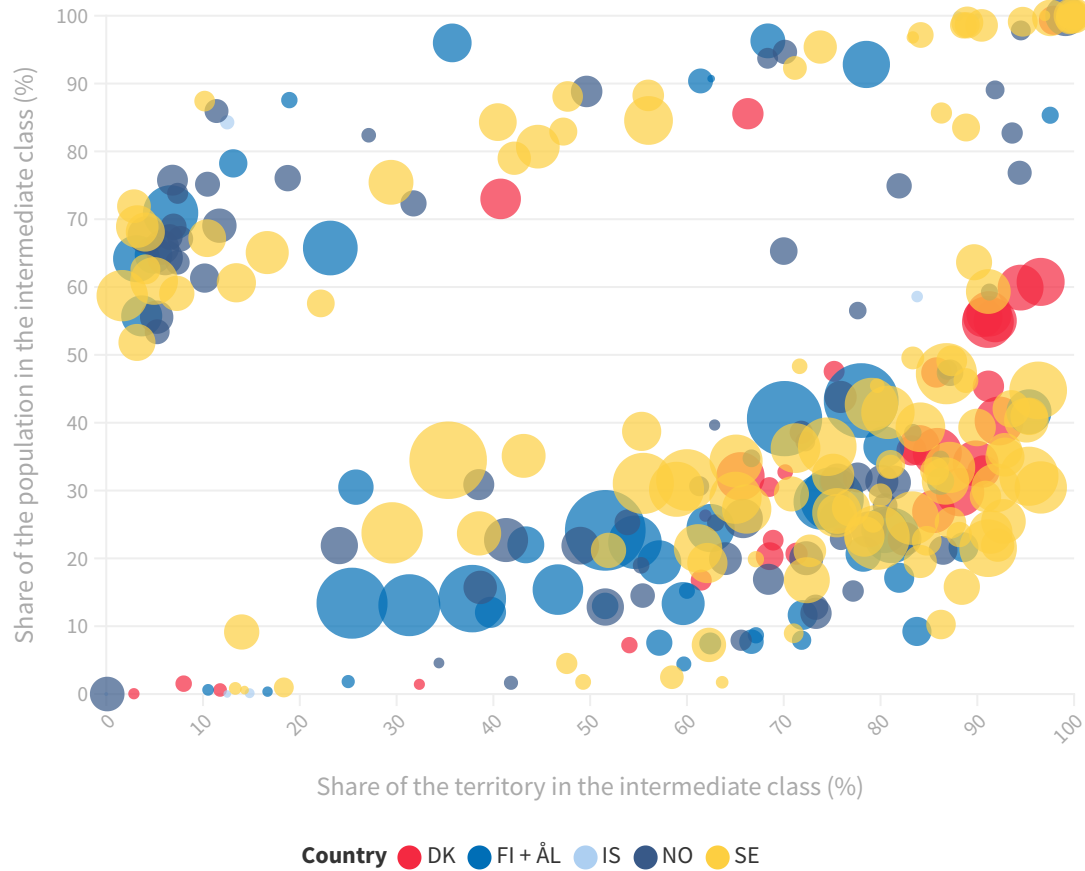


Figure 36. Nordic municipalities that are classified as intermediate in the DEGURBA classification based on the proportion of the population that live in and the land area that belongs to the intermediate classes (peri-urban areas and rural areas close to urban areas) of the Nordic typology.



4. Concluding discussion

This work presented herein describes the grid-based Nordic urban–rural typology, which was developed as a new analytical tool for studying different types of spatial phenomena across Nordic territories. The report is in two main parts, first, Section 2 describes how the typology was created, including the rationale behind the typology, key considerations at different stages of the work, and the main operational steps taken in developing the typology. Second, Section 3 describes the use of the typology as an analytical lens for studying territorial and settlement patterns and demographic change dynamics across the urban–rural continuum in the five Nordic countries. Finally, a concluding discussion and final reflections concerning the typology development are presented, followed by a discussion of the main conclusions and observations that can be drawn from the analysis using the Nordic urban–rural typology.

A concluding outlook on the Nordic urban–rural typology

As described in Section 2, a key starting point for this study was the requirement for a territorial typology that would help enrich and further understanding of different types of urban and rural areas across the Nordic countries and shed light on how they are developing. While there are many European and national typologies that are useful for both research and policymaking purposes in the contexts for which they have been developed, none of these existing typologies is well suited for cross-Nordic comparisons at more detailed territorial levels. For instance, the widely used DEGURBA typology which is suitable for more general comparisons of different types of regions or municipalities does not reveal territorial differences at a more detailed level, such as within municipalities. A shortcoming of the more general territorial classifications is that they do not consider that there can be very different types of areas within a single administrative unit; an issue especially prevalent in the Nordic countries, where many municipalities are vast in size and most Nordic municipalities tend to include both urban and rural areas. Thus, the objective was to develop a harmonised Nordic

territorial typology that would allow capture of these internal differences and to which different types of data could be combined and then used for further analysing these areas.

Several key principles were specified early in the work. One of these was that the typology should be created at grid-level as this allows identification and capture of the characteristics of different types of areas at a very local and detailed territorial level. From a Nordic perspective, it is a clear advantage that all Nordic countries annually produce statistics at grid level, and that these datasets can easily be combined with a grid-based territorial classification to then identify patterns and trends that are less evident or entirely concealed at more general levels of analysis. Another data-related advantage of the Nordic typology is that while administrative units are bound to change over time, grids are uniform, uni-size, and constant, which is useful from the perspective of carrying out temporal analysis. Another advantage is that high-resolution grid data can be scaled up to a more general level of aggregation, while more general spatial data cannot (in the same) way be scaled down and made more detailed with the same accuracy. Based on an assessment of the existing data sources available for constructing the typology, it also became evident that it would be possible to include the five Nordic countries (Denmark, Finland, Iceland, Norway, Sweden) and Åland, whereas it would not be feasible to include Greenland and the Faroe Islands in the typology at this stage owing to a lack of data from these two autonomous territories.

For the development of the Nordic typology, the Finnish grid-based urban–rural classification (*Kaupunki-maaseutuluokitus*) was the main source of inspiration. While it was obvious that it would not be possible to directly scale up the Finnish typology to the Nordic level, it was possible to incorporate several of its core elements and use the Finnish classification as a stepping stone for the Nordic typology. Another key decision was that the typology should be developed using (mainly) open-source data and following a replicable data process model. As data can in some cases be quite expensive, a key advantage of this approach is that any possible future updates or adjustments to the typology will be easier and less costly. While the Finnish typology is constructed at 250 x 250 m grid level, it became evident early in the process that it would be preferable to develop the Nordic typology at 1 x 1 km grid level; most freely available national grid data are at 1 x 1 km grid level. It was also acknowledged that constructing a Nordic typology would require making some simplifications (as compared to the original Finnish model), which meant that a 250 x 250 m resolution would be too detailed at Nordic level. Nevertheless, the Finnish typology provided important inspiration and it was decided to develop a Nordic urban–rural typology consisting of the same territorial classes and named similarly as in the Finnish classification. The Finnish typology was also used as a reference classification for constructing the Nordic typology, and the initial results of the Nordic classification were assessed by comparing how well the Nordic territorial classes corresponded to the classes of the Finnish urban–rural typology.

A concluding outlook on the analysis of urban–rural differences

In the analysis in Section 3, the Nordic urban–rural typology and population data at grid level (linked to the typology) were used to examine what territorial and settlement patterns look like in the Nordic countries. This Nordic typology was used in parallel to the European-wide municipality-based DEGURBA classification, which is the most established and widely used territorial typology for cross-country comparisons. The purpose was to shed new light on urban–rural differences across the Nordic countries by using grid-based Nordic typology to examine what types of differences might be observed more locally within municipalities (that cannot be observed with more general data at the municipal level). According to the DEGURBA classification, most Nordic municipalities are rural. This is the case especially in Iceland, Finland and Åland, and Norway where almost 86%, 80%, and 78%, respectively, of municipalities are categorized as rural according to the Eurostat classification, while in Sweden and Denmark, the corresponding proportions are 50% and 46%, respectively. It is characteristic of many of the Nordic rural municipalities that they are often vast in size and cover large parts of the territory in their respective countries. This is where the Nordic typology can be useful as it can help reveal territorial differences particularly within those municipalities which are vast in size and contain different types of areas.

In addition, according to the grid-based Nordic urban rural typology, the Nordic countries are predominantly rural when considering how their land areas are classified in the Nordic typology. However, based on the Nordic typology, there are noticeable differences between the countries in terms of which types of rural areas are most common. For example, in Iceland almost 80% of the land is classified as sparsely populated rural, while Norway and Finland and Åland have relatively high proportions of sparse rural areas (almost 40% of the land area). By contrast, in Denmark, these types of highly sparse areas are almost non-existent, and what is characteristic for both Denmark and Sweden is that most rural areas belong to the class rural area close to urban. It is also noteworthy that the urban typology classes, namely, inner urban areas and outer urban areas, only account for a low proportion of the land area in all Nordic countries. This share was the highest in Denmark where these two urban classes constitute less than 7% of the territory.

An examination of settlement patterns according to the Nordic typology and population density at 1 × 1 km grid level shows that the settlements are highly unevenly distributed in all the Nordic countries. The population is to a high degree concentrated in coastal areas and along waterways, where the major urban regions are found, reflecting historical patterns and features of physical geography. The majority of the population live relatively concentrated in areas that are classified as urban, and the combined proportion of people living in inner and outer urban areas ranged from approximately 53% in Norway to approximately 66% in Iceland. The

substantially higher population density in the urban typology classes explains that while the Nordic countries consist predominantly of territories that can be described as rural, the population live largely in the more densely populated urban areas.

The second part of the analysis involved use of the Nordic typology and grid-level data to examine what types of population change dynamics occurred in the Nordic countries during the period 2008–2022. The analysis shows that urbanisation has been a general trend in the Nordic countries during the past couple of decades. This means that urban regions have seen the most noticeable increase in population, with the largest population growth occurring in the typology classes inner urban and outer urban. A relatively noticeable increase in population is also evident in peri-urban areas, suggesting that intermediate areas located on the urban fringes have increasingly attracted new residents. In rural areas, the general trend shows that depopulation has occurred in many rural localities, but the analysis shows that different types of rural areas have developed quite differently. For instance, contrary to the general trend seen especially in sparse rural areas, rural areas close to urban areas have generally seen an increase in population, in a similar manner to local centres in rural areas. Based on this, some of these rural areas that are in the vicinity of cities and towns appear to have become more attractive places for people to settle. In addition, sparsely populated rural areas seem to be less favourably placed and the general trend in these areas points to noticeable population decrease.

The final part of the analysis was to examine the types of internal differences in territorial and settlement patterns that can be observed within Nordic municipalities. This was carried out by using the Nordic grid-based typology to further examine the characteristics of those municipalities that are defined as urban, intermediate, and rural according to the DEGURBA classification. This was also a way to assess how well the Nordic typology classes correspond to the territorial classes of DEGURBA.

A comparison of these two territorial classifications shows that in most cases these territorial classifications correspond relatively well to each other. This means that, for instance, in most Nordic municipalities that are categorised as urban according to the DEGURBA classification, the urban territorial classes of the Nordic typology are where most people live. Also, in most municipalities that are classified as rural according to DEGURBA, the population primarily live in one of the rural classes of the Nordic typology, which also constitute most of the land area. Nevertheless, there are also many cases where the Nordic and the DEGURBA classifications differ more clearly from each other and where the Nordic typology reveals more considerable territorial differences within the municipality.

There are 61 Nordic municipalities that are defined as urban according to the Eurostat typology, and these municipalities are rather diverse. They include urban municipalities where almost the entire population live in one of the urban classes of

the Nordic typology, and where almost the entire land area of the municipality is classified as part of one of the urban classes. The most densely populated municipalities that are part of the major Nordic urban regions fall into this category. On the other hand, the analysis also shows that there are urban municipalities where the population largely resides in the urban classes of the Nordic typology, but where the territory of the municipality is predominantly either intermediate or rural. These urban municipalities are typically vast in size and have a population which is concentrated in and around the main urban centres.

Noticeable differences are also manifest among the 774 Nordic municipalities that are defined as rural according to the DEGURBA classification. One distinct type is municipalities that are rural according to the Eurostat typology and where nearly the entire population and the land area are rural according to the Nordic typology. Other types of municipalities are those that are classified as rural according to DEGURBA but where the land area and the population is predominantly intermediate according to the Nordic typology. Among this type are those municipalities that are in the vicinity of large and medium-sized urban regions.

However, the greatest internal differences can be seen among those 288 Nordic municipalities that are classified as intermediate according to the DEGURBA classification. At one end of the spectrum are those municipalities that have a rather urban character and where both the land area and the population almost entirely belong to one of the urban classes of the Nordic classification. At the other extreme are those intermediate municipalities with a clearly more rural character and where either the population or the land area is predominantly rural according to the Nordic typology. In between these two distinct categories are those municipalities classified as intermediate according to DEGURBA, which also have an intermediate or peri-urban character based on the Nordic typology.

Overall, the main guiding purpose for creating the Nordic urban–rural typology presented in this report was to provide a new analytical framework for analysing territorial differences in the Nordic countries at a detailed spatial resolution. We have illustrated how this typology can help reveal territorial differences that cannot be observed with more general statistics and data, and shown how it can be used to complement more general statistics and typologies bound to administrative areas such as municipalities. The analysis shows that more fine-grained data can help reveal patterns and developments that are less evident or entirely concealed at more general levels. More specifically, grid-based Nordic typology shows that many municipalities are at the same time both urban, intermediate, and rural, and in many cases these different categories seem to be undergoing quite different types of development. While this study used the Nordic urban–rural typology to examine settlement patterns and population change dynamics, it should be stressed that the typology could also be used in combination with other types of data and be used as an analytical framework for studying other types of spatial phenomena across the urban–rural continuum.

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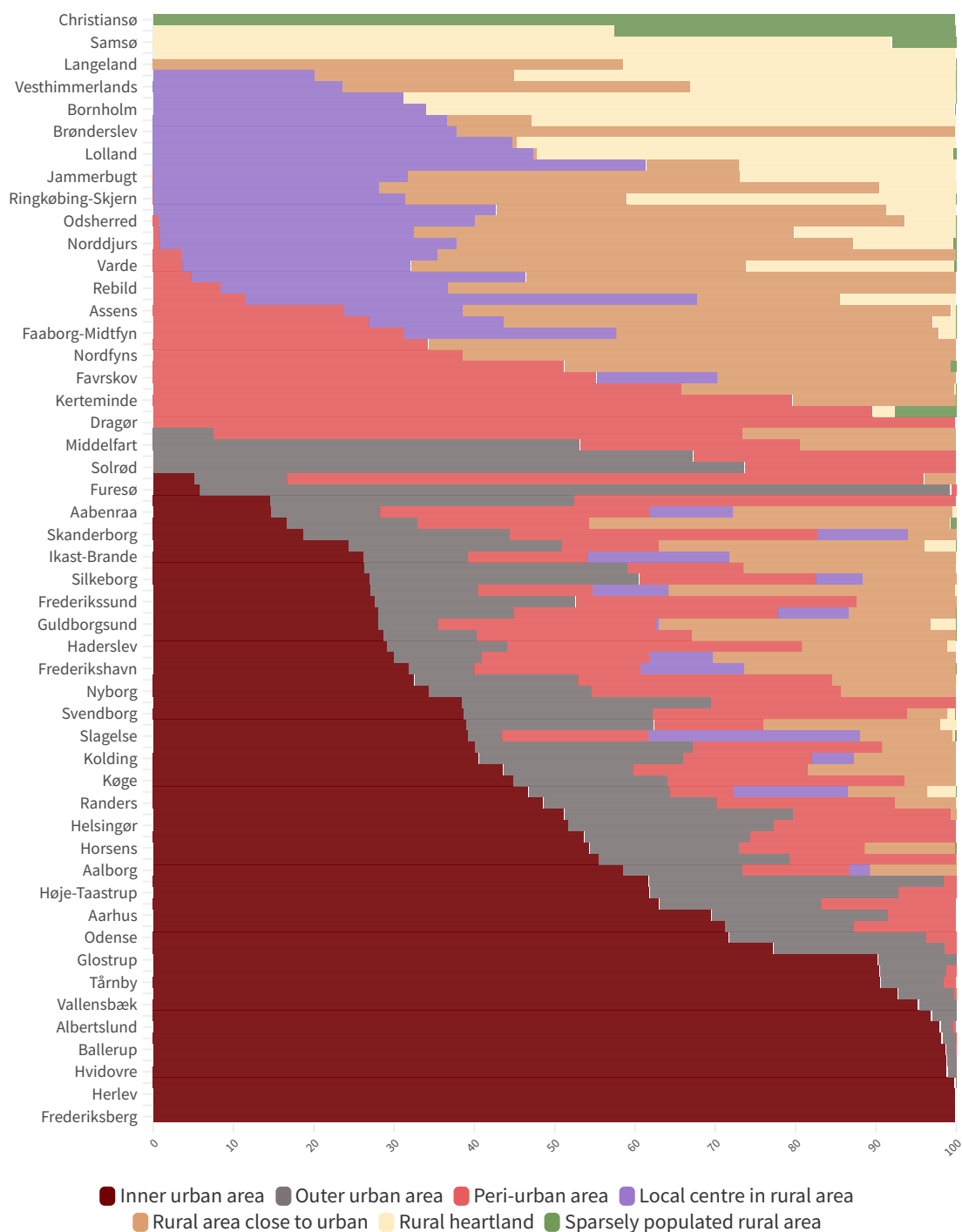
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Annex 1

Proportion of population in the different Nordic typology classes in all Nordic municipalities. References

Population, share per class (2022, Iceland 2017)

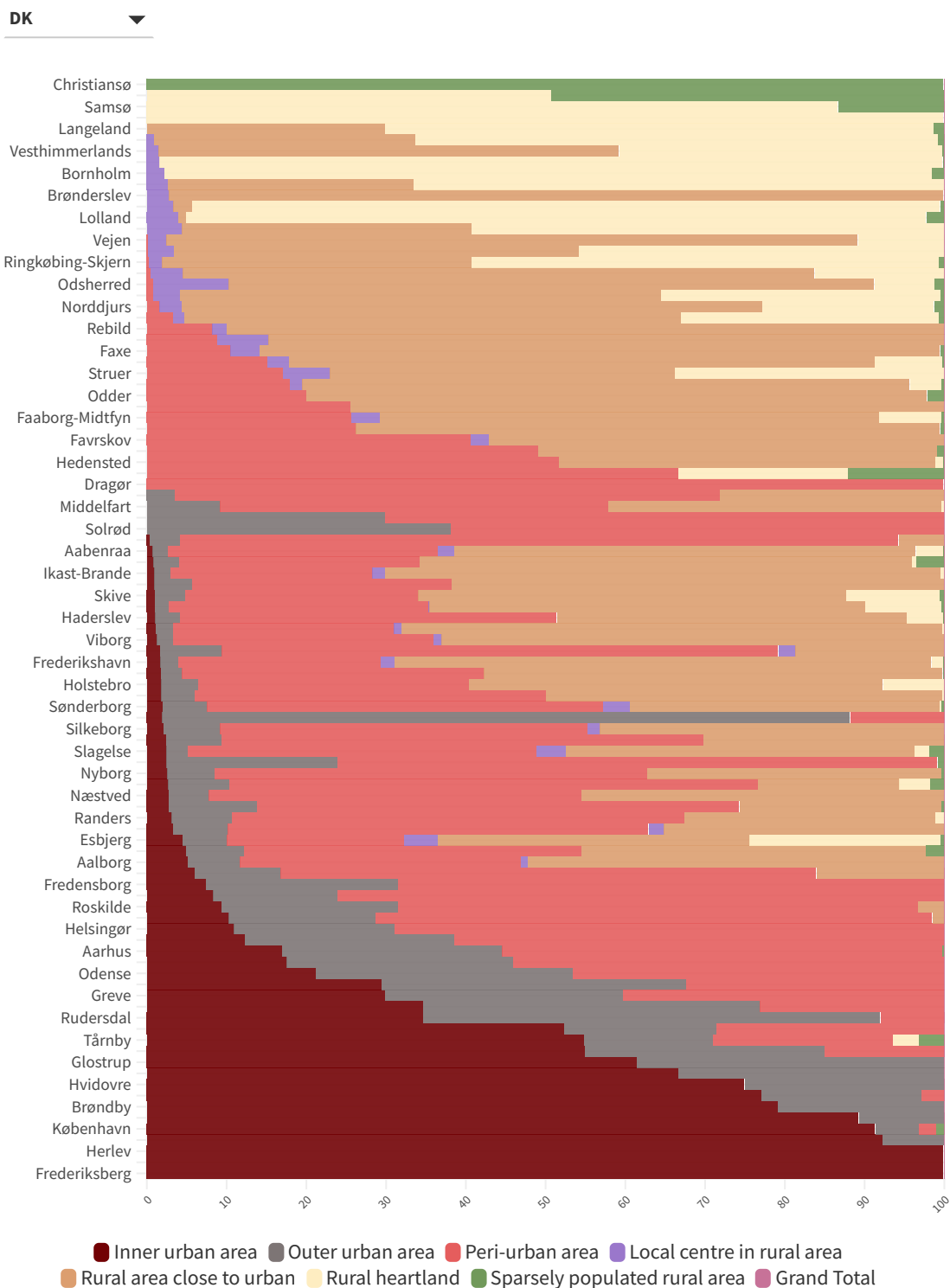
Denmark



Annex 2

Proportion of land area in the different Nordic typology classes in all Nordic municipalities. References

Populated territory, share per class (2022, Iceland 2017)



About this publication

Towards a grid-based Nordic territorial typology – a new tool for analysis across the urban-rural continuum

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This report and the grid-based Nordic urban–rural typology presented in this study are outcomes of the project Remote work: Effects on Nordic people, places and planning 2021–2024, which is a collaborative project between the three Nordic Thematic Groups under the Nordic co-operation Programme for Regional Development and Planning 2021–2024. The Nordic Thematic Groups have been formed by the Nordic Committee of Senior Officials for Regional Policy (EK-R), under the Nordic Council of Ministers for Sustainable Growth. Members consist of representatives from relevant ministries, national, regional and local authorities as well as cross-border cooperation committees.

Nordregio report 2024:9

ISBN: 978-91-8001-096-2

ISSN: 1403-2503

<http://doi.org/10.6027/R2024:91403-2503>

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Layout: Louise Ögland

Cover Photo: Unsplash

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