

# Territorial typologies manual - cluster types

Statistics Explained

This article forms part of Eurostat's [methodology manual on territorial typologies](#).

Cluster types are groups of 1 km<sup>2</sup> [population grid cells](#) that share similar characteristics, based on a combination of their population density and geographical [contiguity](#).

## Classes for the typology and their conditions

### Details of the typology

The following 3 types of clusters may be identified

- [urban centre \(high-density cluster\)](#) : a cluster of contiguous grid cells of 1 km<sup>2</sup> (excluding diagonals) with a population density of at least 1 500 inhabitants per km<sup>2</sup> and collectively a minimum population of 50 000 inhabitants after gap-filling
- [urban cluster \(moderate-density cluster\)](#) : a cluster of contiguous grid cells of 1 km<sup>2</sup> (including diagonals) with a population density of at least 300 inhabitants per km<sup>2</sup> and a minimum population of 5 000 inhabitants
- [rural grid cells](#) : grid cells that aren't identified as urban centres or as urban clusters.

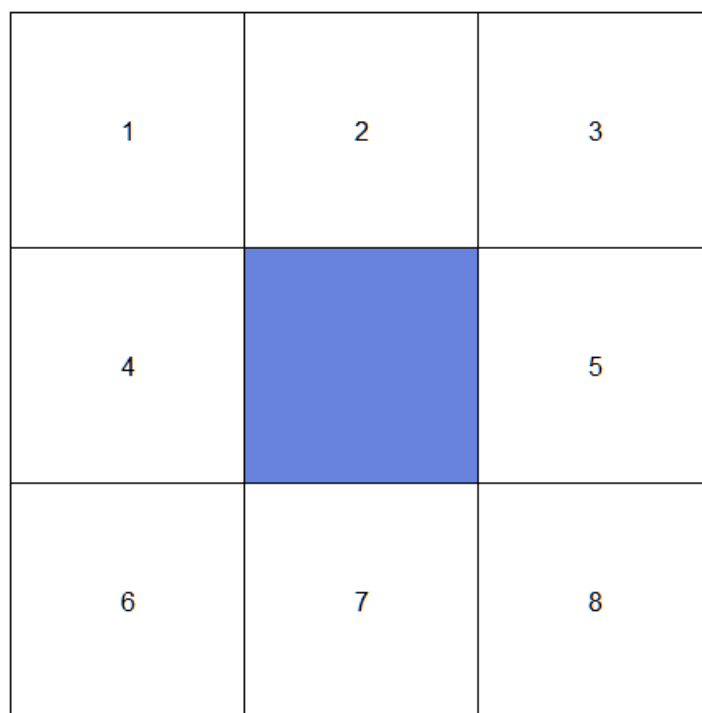
### Methodology for the typology

Cluster types may be identified in relation to the total population living in 1 km<sup>2</sup> grid cells; note, the [introductory chapter](#) provides a more detailed explanation of the population grid. The vast majority of the geographical territory of the [European Union \(EU\)](#) (continental Europe, the Açores, Canarias and Madeira) is covered by the GEOSTAT population grid, while the remaining outermost regions are covered by a [global population grid](#) produced by the [Joint Research Centre \(JRC\)](#) of the [European Commission](#).

Each cluster type is identified by classifying 1 km<sup>2</sup> population grid cells according to characteristics that are based on their total population and population density. Grid cells are classified according to the steps detailed below (note that a cell may belong to an urban centre and an urban cluster as their definitions aren't mutually exclusive).

### Understanding contiguous cells

Before looking at the identification of the 3 cluster types, it is necessary to understand the concept of contiguous cells. Figure 1 shows an array of 9 grid cells, with the focus on the central cell which is surrounded by 8 others, numbered 1 to 8.



**Figure 1: Contiguous grid cells**

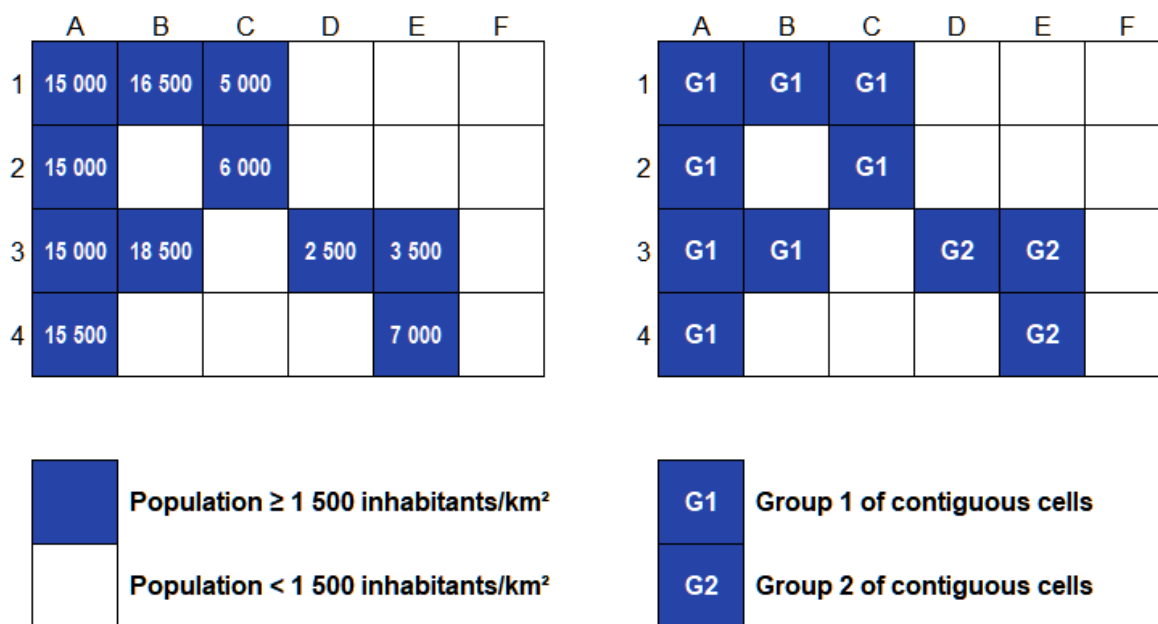
2 types of contiguous grid cells can be identified

- a **narrower definition excluding diagonals** : all cells that touch each other excluding those cells that only touch each other on a diagonal; only cells numbered 2, 4, 5 and 7 are contiguous to the central cell in Figure 1 according to this narrower definition, which is used for identifying urban centres (high-density clusters)
- a **broad definition including diagonals** : all cells that touch each other in any way, including cells that are linked only on a diagonal; all cells numbered 1 to 8 are contiguous to the central cell in Figure 1 according to this broader definition, which is used for identifying urban (moderate-density) clusters.

### 1. Identifying urban centres (high-density clusters)

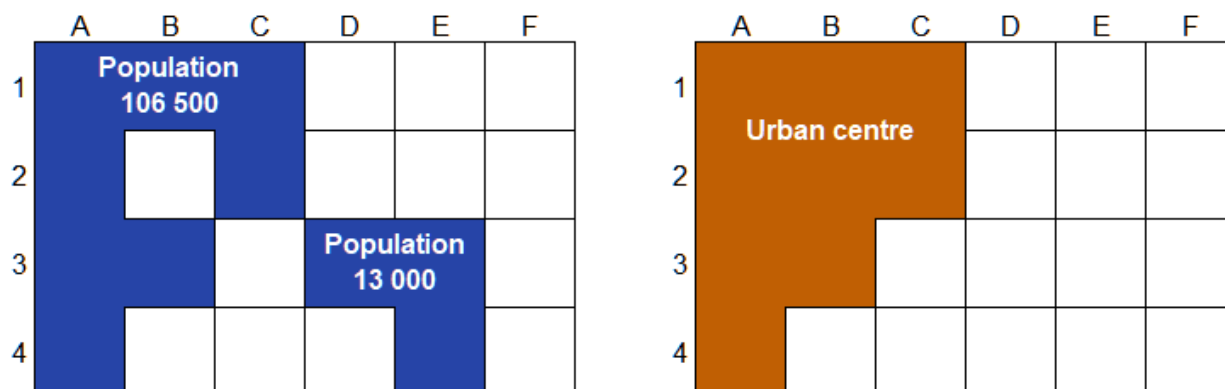
The identification of urban centres (high-density clusters) is done in 2 steps: to begin, all cells with a population density of at least 1 500 inhabitants per km<sup>2</sup> are plotted (dark blue shading in Figure 2); secondly, groups of contiguous grid cells are identified (groups G1 and G2 in Figure 2).

When identifying urban centres diagonal contiguity is excluded. As such, in the example of Figure 2, cells C2 and D3 aren't considered as contiguous; rather, they are each part of different groups (G1 and G2).



**Figure 2: Contiguous groups for urban centres**

In a second step, each group of contiguous grid cells is analysed in relation to its total number of inhabitants and only those groups of contiguous cells with 50 000 inhabitants or more are selected (see Figure 3).

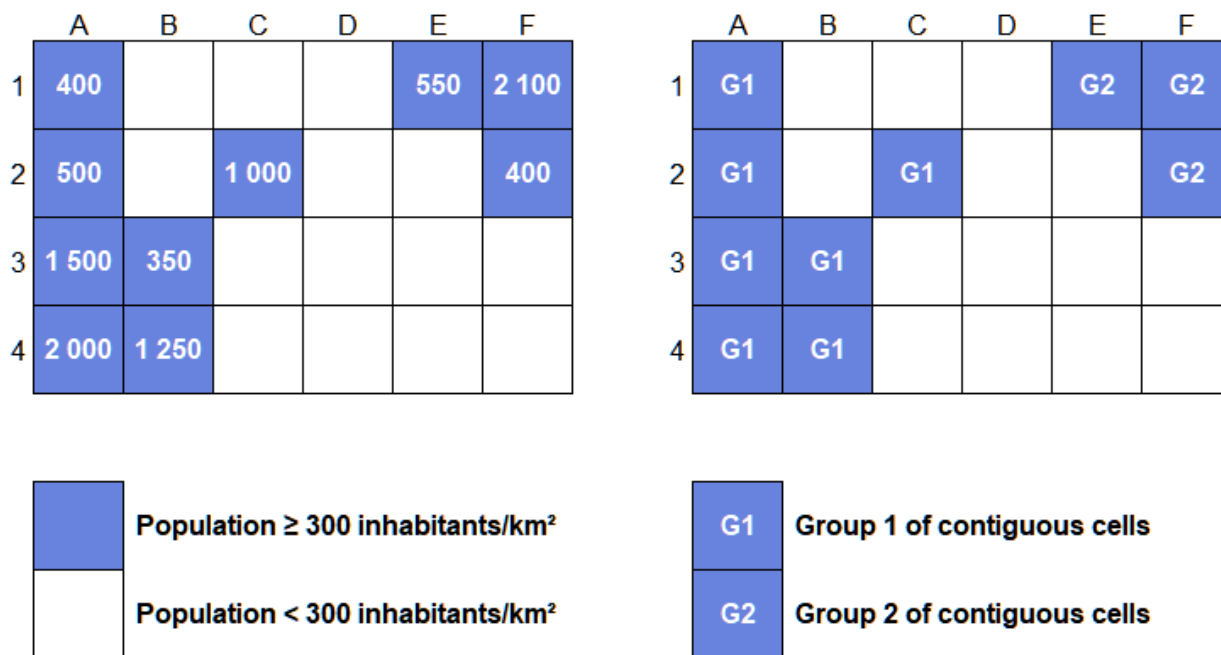


**Figure 3: Identifying urban centres**

The identification of urban centres involves a third step, which is taken to fill gaps and smooth borders. This is done by applying an iterative majority rule: if 5 or more of the (8) cells surrounding a particular cell belong to the same unique urban centre, then that cell is also considered to belong to the same urban centre; this process is repeated (iteratively) until no more cells are added. Note that the criterion for gap-filling includes cells that are linked only on a diagonal. For example, cell B2 on the left-hand side of Figure 3 has 7 of its 8 surrounding cells that belong to the same urban centre. This cell should therefore subsequently be added to the urban centre to smooth borders (as shown on the right-hand side of Figure 3).

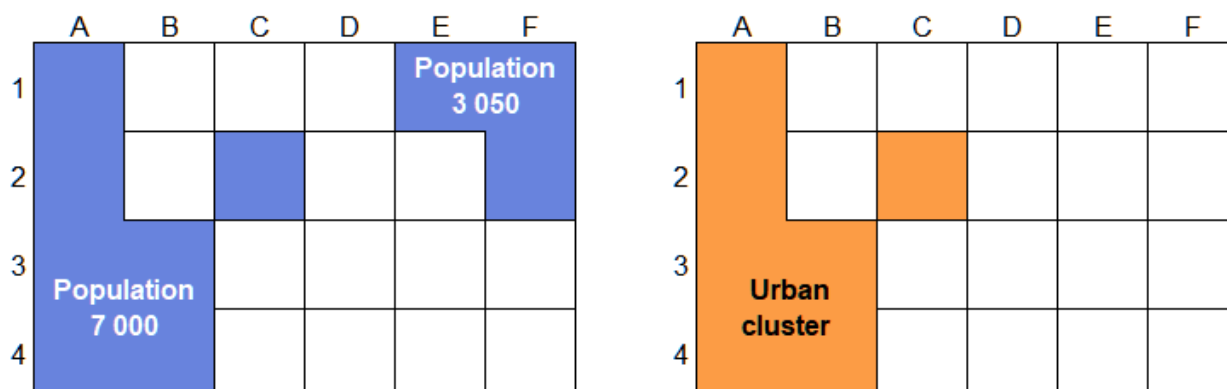
## 2. Identifying urban clusters (moderate-density clusters)

The method used to identify urban clusters (moderate-density clusters) is similar to that used for urban centres (high-density clusters). Rather than using a threshold of at least 1 500 inhabitants per km<sup>2</sup>, the identification of urban clusters is based on grid cells with a population density of at least 300 inhabitants per km<sup>2</sup> (see Figure 4).



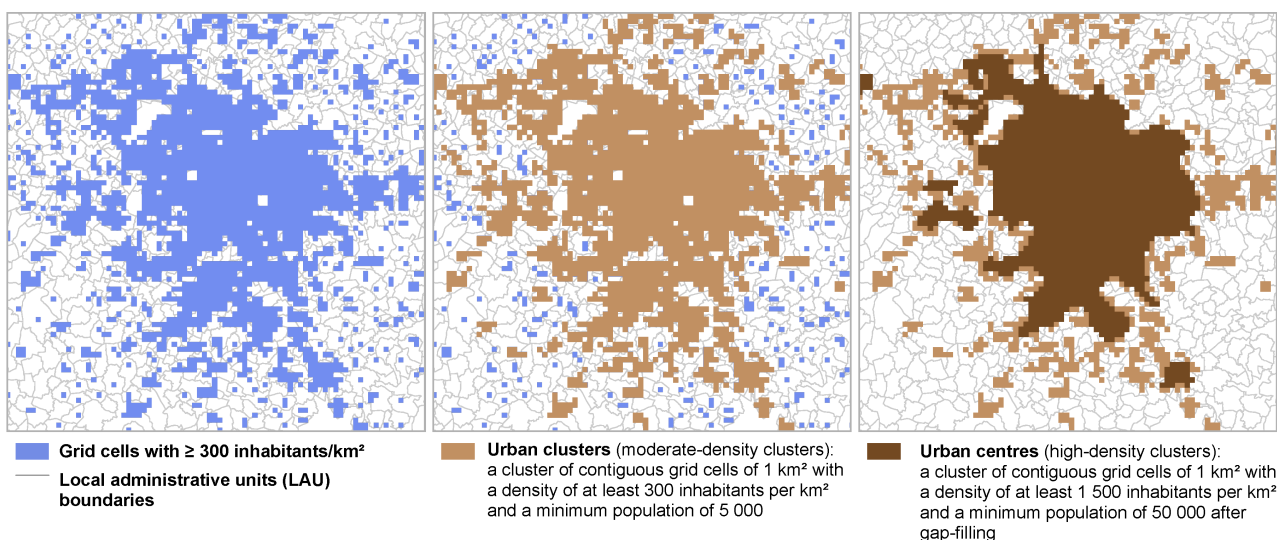
**Figure 4: Contiguous groups for urban clusters**

The identification of urban clusters is done in 2 steps: to begin, all cells with a population density of at least 300 inhabitants per km<sup>2</sup> are plotted (light blue shading in Figure 4); secondly, groups of contiguous grid cells are identified (groups G1 and G2 in Figure 4); note that contiguous grid cells may include cells that are linked only on a diagonal – as shown, for example, by cell C2.



**Figure 5: Identifying urban clusters**

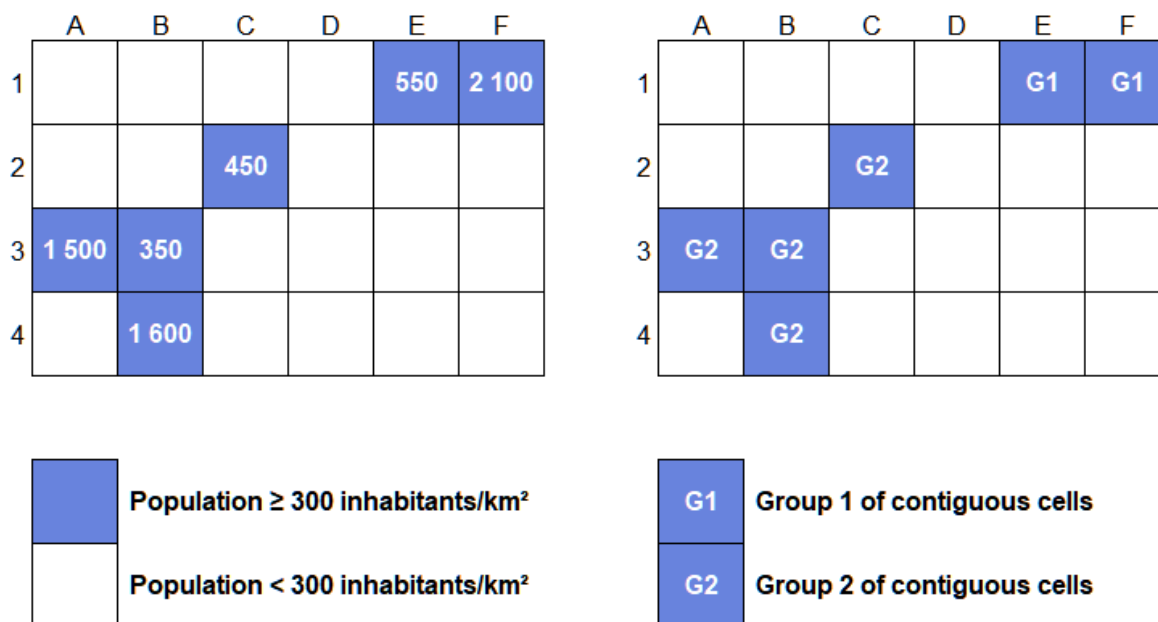
Thereafter, each group of contiguous grid cells is analysed in relation to its number of inhabitants and those groups of contiguous cells with 5 000 inhabitants or more are selected; these are urban clusters. Continuing with the same example, Group G1 is considered an urban cluster as it has a population of 7 000 inhabitants, as shown on the right-hand side of Figure 5, while G2 isn't an urban cluster as its population is only 3 050 inhabitants.



**Figure 6: Schematic overview identifying urban centres and urban clusters** Source: Eurostat, JRC and European Commission, Directorate-General Regional and Urban Policy and Directorate-General Agriculture and Regional Development

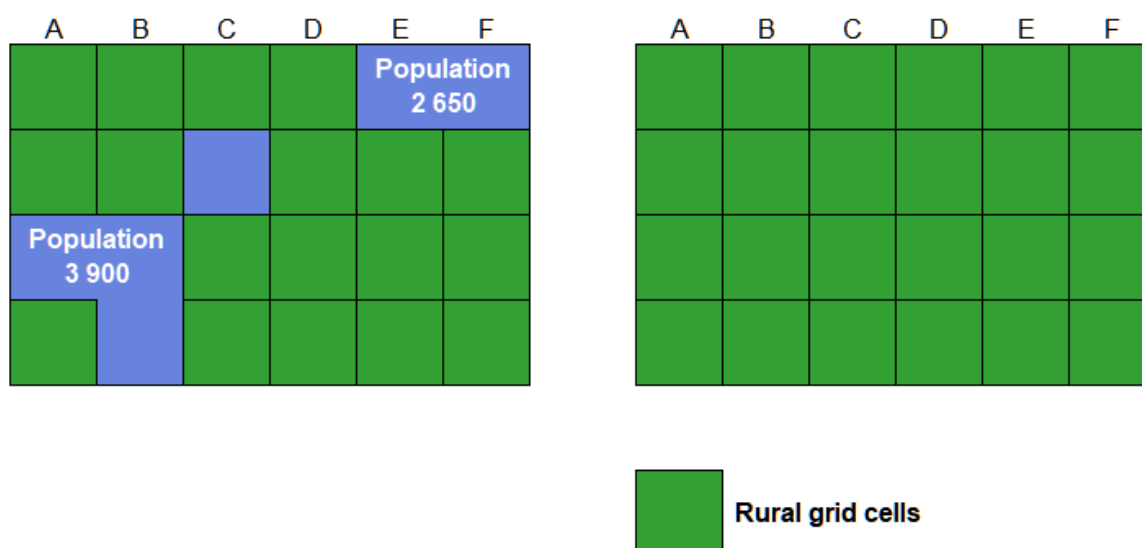
### 3. Identifying rural grid cells

Rural grid cells are those cells that aren't identified as urban centres or as urban clusters. The majority of rural grid cells have a population density that is less than 300 inhabitants per km<sup>2</sup>, although this isn't necessarily the case. Some rural grid cells may have a higher number of inhabitants if they don't form part of a cluster that meets the criteria for an urban centre or an urban cluster.



**Figure 7: Identifying rural grid cells**

In Figure 7, cells A3, B4 and F1 each meet the population criterion for an urban centre (at least 1 500 inhabitants per km<sup>2</sup>), while cells B3, C2 and E1 each meet the population criterion for an urban cluster (at least 300 inhabitants per km<sup>2</sup>). Each group of contiguous grid cells (groups G1 and G2 in the right-hand side of Figure 7) may be analysed in relation to their total number of inhabitants and those groups of contiguous cells with 5 000 inhabitants or more are selected.



**Figure 8: Identifying rural grid cells**

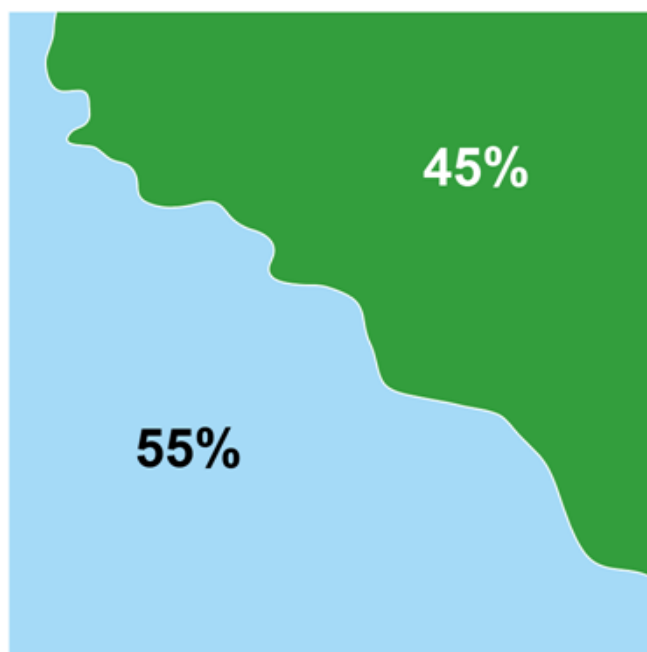
In Figure 8, neither group G1 with a total population of 3 900 inhabitants, nor group G2 with a total population of 2 650 inhabitants reaches the population threshold for an urban cluster. As such, each cell in these 2 groups is classified as a rural grid cell, as shown on the right-hand side of Figure 8, despite some cells having populations that are higher than the thresholds for urban centres and/or urban clusters.

Note also, as mentioned above, that it is possible for grid cells with a population density of less than 300 inhabitants per km<sup>2</sup> to be classified as part of an urban centre, due to gap-filling.

### Special grid cells

The identification of different cluster types is generally a relatively simple operation for those cases where grid cells cover the land. However, the population count for a 1 km<sup>2</sup> cell is more complex if it covers both land and sea (or ocean). In such a case, it is necessary to first identify the proportion of the grid cell that covers land. This can be calculated using the CORINE land cover raster dataset. For example, if a grid cell has a population count of 100, and 50% of that cell covers the sea, then the calculation would be  $100/0.5$ , resulting in a population density of 200 inhabitants per km<sup>2</sup>. In the case that the whole of a cell covers the sea, it isn't possible to divide by zero and therefore the population density is set to the population count of the cell. These kinds of 'cell modifications' are particularly important when the population density of an individual cell can impact the identification of contiguous grid cells. As discussed earlier, if a cell can potentially form part of a group of contiguous grid cells that constitute a high-density cluster, then it has to have a population density of at least 1 500 inhabitants per km<sup>2</sup> and the group of contiguous cells has to have a total population of at least 50 000 inhabitants.

Figure 9 provides an example for a grid cell where 45% of its area covers land and 55% covers the sea. Let's assume the total number of inhabitants of the cell is 1 200. Generally, this would mean the population density is 1 200 inhabitants per km<sup>2</sup>. However, assuming that all of the inhabitants live on land, then the actual population density can be computed as  $1\,200/0.45 = 2\,667$  inhabitants per km<sup>2</sup>. As a result, the grid cell in this example could potentially form part of a group of contiguous grid cells in a high-density cluster (urban centre), as the modification taking into consideration the land and sea areas results in the population density rising above the 1 500 inhabitants per km<sup>2</sup> threshold.



**Example:**

- total number of inhabitants in the grid cell = 1 200
- assume all of the inhabitants live on land
- the population density is computed as  $1\,200 / 0.45 = 2\,667$  inhabitants/km<sup>2</sup>

**Figure 9: Calculation of the population density for a 1 km<sup>2</sup> grid cell that covers land and sea**

## Links to other spatial concepts/typologies

Cluster types are used as a basis for the following local territorial typologies

- the [degree of urbanisation](#) (see [Chapter 2](#) for more information), to identify cities, towns and suburbs, and rural areas.

Commuting flows may then be used to identify

- the commuting zones of cities and hence their [functional urban areas](#) (see [Chapter 3](#) for more information).

Cluster types are used as a basis for the following regional territorial typologies

- the [urban-rural typology](#) (see [Chapter 5](#)), to identify predominantly urban regions, intermediate regions and predominantly rural regions.

Functional urban areas may then be used as a basis for the following regional territorial typology

- the [metropolitan typology](#) (see [Chapter 6](#)), to identify metropolitan and non-metropolitan regions.

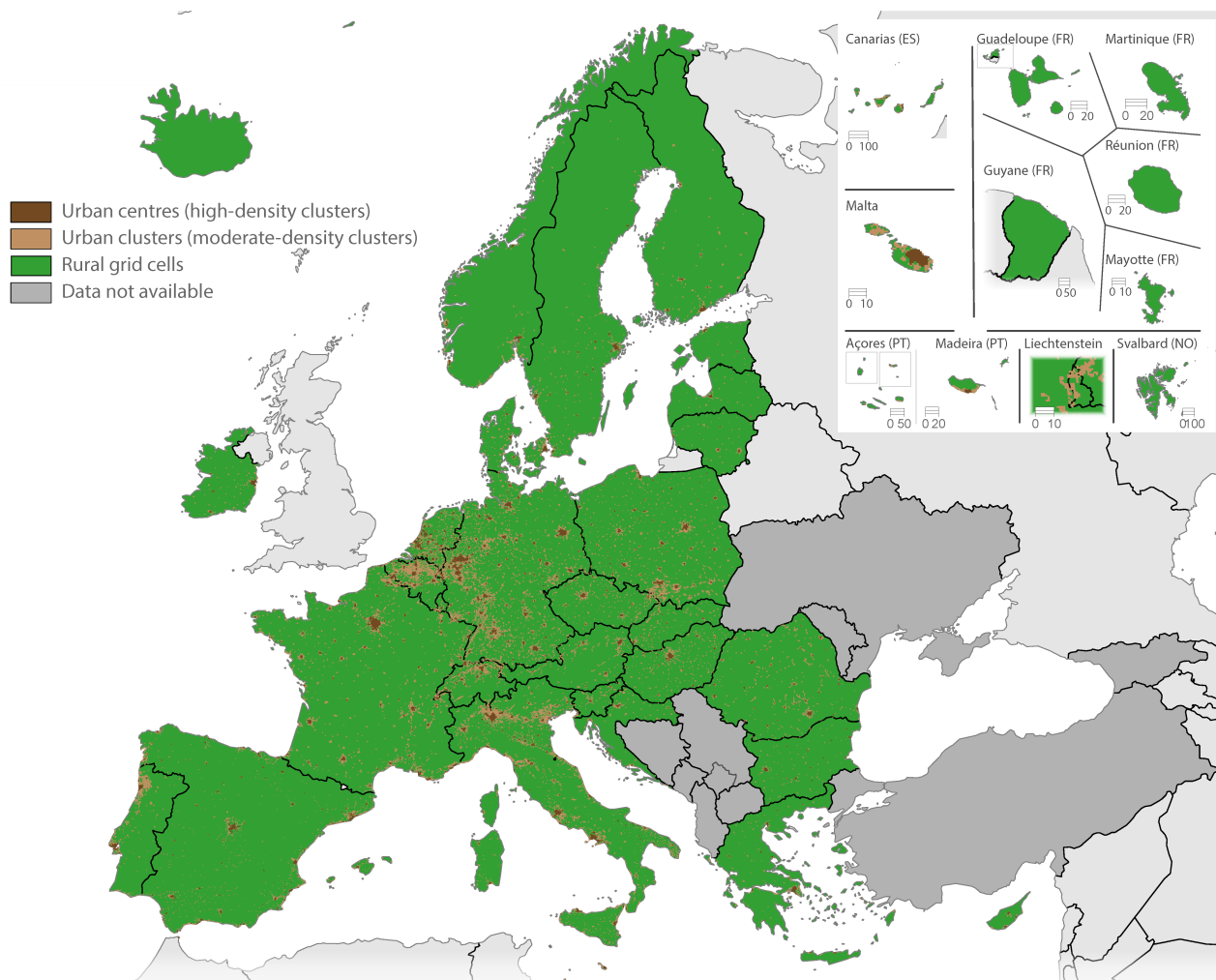
## An example

Map 1 provides an overview of the final classification of cluster types for a 1 km<sup>2</sup> population grid (as established in 2021). It shows that some of the largest concentrations of urban centres are located in western Germany and the Benelux countries.

The information presented in Map 1 may be compared with Map 11 (in the [introductory chapter](#)) which shows the population density of individual 1 km<sup>2</sup> grid cells. While aggregating information for cluster types (as done for Map 1)

allows some of the noise to be removed from the map, thereby highlighting more clearly the main urban centres in the EU, it is also apparent that a considerable amount of information may be lost when aggregating individual grid cells to larger clusters.

## Cluster types based on 1 km<sup>2</sup> grid cells



eurostat

Source: Eurostat (GISCO) based on census population grid 2021

Administrative boundaries: © EuroGeographics © OpenStreetMap contributors © Turkstat

Cartography: Eurostat — GISCO, 12/2024

\*This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

**Map 1: Cluster types based on 1 km<sup>2</sup> grid cells** Source: Eurostat (GISCO) based on census population grid 2021

## Further information

### Glossary entries

[Urban centre \(high-density cluster\)](#)

[Urban cluster \(moderate-density cluster\)](#)



Rural grid cell

## Explore further

### Thematic section

- [GISCO: geographical information and maps](#)
- [GISCO: geographical information and maps – clusters](#)
- [GISCO: geographical information and maps – GEOSTAT](#)

### External links

- [Global population grid](#) – produced by the Joint Research Centre (JRC) of the European Commission.
- [Joint Research Centre \(JRC\)](#) of the European Commission

### Visualisation

- [Regions and cities illustrated](#)
- [Statistical atlas](#)