

## Assessment of quiet areas in Europe

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### ABSTRACT

Living in a quiet area provides health benefits such as increased quality of life and well-being. Nearby access to quiet areas can also offer psychological restoration and can help in reducing noise annoyance reactions. Quiet areas are not only beneficial for human health but also help to protect areas of valuable habitat. The Environmental Noise Directive (END) recognises the need to preserve areas of good acoustic quality, referred as “quiet areas”. However, the data reported as part of the END contains little information on how the countries, regions and cities define and protect quiet areas in their territories and whether there has been a significant improvement in designation and protection of these areas over the past years. The aim of this paper is to present an overview of how countries define and protect of quiet areas in Europe. This is achieved using data from case studies comprised of online questionnaires, which were completed by noise representatives of different countries, regions and cities. In addition to the analysis of the questionnaires, a combined spatial assessment of noise exposure, land use and land cover data for areas potentially unaffected by noise pollution in European cities is presented for 2012 and 2017.

Keywords: Noise abatement, Traffic noise, Road traffic noise, Aircraft noise, Railway noise, Quiet areas, Limit values

### 1. INTRODUCTION

Noise pollution is caused by a variety of sources and is widely present not only in the busiest urban environments but also in natural environments [1]. Quiet areas offer lower sound levels from traffic providing restoration from environmental stress and opportunities for rest and relaxation [2]. Apart from the physical and mental health benefits to humans, quiet areas are also important for animals [3].

The Environmental Noise Directive (END) recognises the need of preserving areas of good acoustic environmental quality, referred as “quiet areas”, in order to protect the European soundscape [4]. However, the END does not provide a clear definition of quiet areas, leaving ample discretion for interpretation to the countries [5]. Available guidance suggests that quiet areas are those where noise is absent or at least not dominant [5, 6]. It is also understood that quiet areas generally have further qualities than low noise levels. Even though people seek tranquility, they also want a safe and clean place and a pleasant view, preferably with green or water [6]. Furthermore, quiet areas are also those perceived to have a pleasant soundscape made with natural or man-made sounds [7].

Although the European legislation aims to reduce noise pollution and highlights the need to preserve currently unaffected areas, the designation of quiet areas in Europe is still under development

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and areas identified as quiet are not always protected through action plans [8]. Data reported as part of the END currently contains little information on how the countries, regions and cities define and protect quiet areas in their territories. Likewise, there is no available information on the state of areas potentially unaffected by noise in Europe.

In this paper, an overview of how countries designate and protect quiet areas in Europe is given based on questionnaires and spatial data. This paper aims to provide new information about:

- Characteristics taken into account to designate quiet areas inside agglomerations
- Measures to protect quiet areas currently used by countries/regions/cities
- Increase/decrease in potential quiet areas between 2012 and 2017

## 2. METHODS

### 2.1 Questionnaire

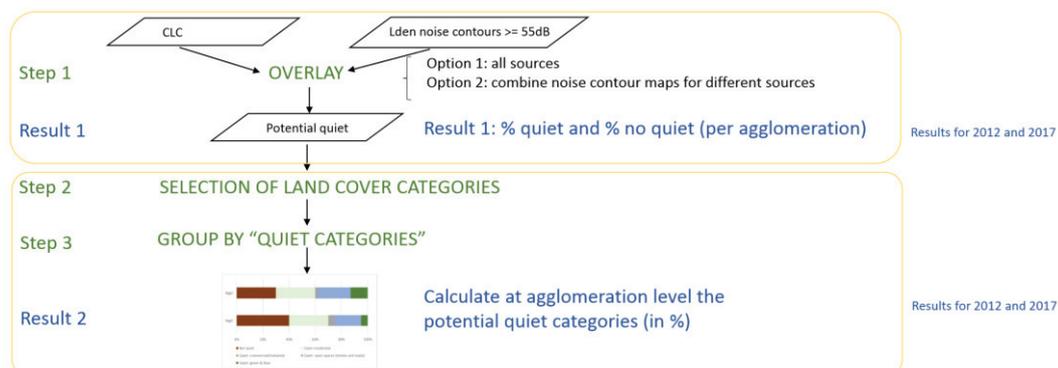
A questionnaire was used to collect information on how countries, regions and cities define, designate and protect quiet areas inside their territories. The questionnaire was prepared with the EU survey platform (<https://ec.europa.eu/eusurvey/>) and was sent to the noise representatives from the countries that are part of the partnership network of the European Environment Agency (EEA). The noise representatives were also asked to distribute the survey to cities and regions in their country. The type of information collected was qualitative. The questionnaire consisted mainly of open-ended questions which aimed at collecting information on the following areas:

- Criteria used to designate quiet areas
- Noise limits used for designating quiet areas
- Differences between quiet areas in agglomerations and in the open country
- Number and size of quiet areas designated
- Characteristics of the quiet areas
- Reasons for not designating or protecting quiet areas
- Legal instruments used to protect quiet areas
- Measures implemented to protect quiet areas

A qualitative analysis was performed on the survey responses given by the noise representatives with the a particular focus on the criteria used to designate quiet areas, noise limits used to designate quiet areas and the measures implemented to protect quiet areas inside agglomerations.

### 2.2 Spatial Data

Noise contour maps of cities submitted under the END for the 2012 and 2017 round of noise mapping were used to determine the changes in areas potentially unaffected by noise. The noise contour maps for all sources of noise (road, rail, air and industry sources) were used. In addition to this, the CORINE Land Cover 2012 and 2018 were used to assess the changes in land cover type (Blanes et al. 2019). The rationale used to conduct the spatial analysis is shown in Figure 1.



**Step 1:** Overlay analysis of noise contour maps with land cover types. The overlay operation combines the attributes of both layers and allowing to identify land cover types in areas affected and unaffected by noise in both 2012 and 2017.  
**Result 1:** Layer of potential quiet and noisy land cover areas inside agglomerations.

**Step 2:** Reclassification of land cover types into four categories (i.e. residential, commercial- recreational, green-blue, other).

**Step 3:** Group by categories.

**Result 2:** Statistical analysis of the potential quiet areas by land cover type inside agglomerations and how those changed between 2012 and 2017.

Figure 1 – Spatial analysis diagram used to assess changes in quiet areas.

The changes in quiet areas using noise contour maps of cities and land cover types were calculated for cities where data was available.

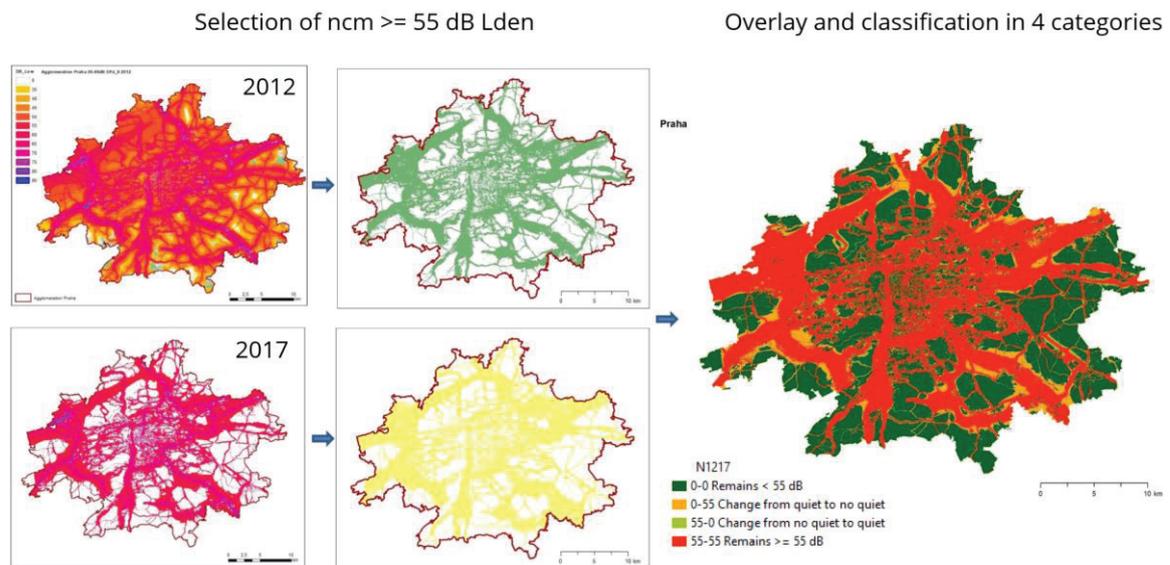


Figure 2 – Analysis of noisy and quiet areas based on noise contour maps from 2012 and 2017

### 3. RESULTS

#### 3.1 Overall questionnaire responses

A total of 21 countries replied the questionnaire (DE, HU, RO, SK, EE, DK, LT, CZ, IE, IT, SI, LU, BG, PT, UK, BE, MK, CH, TR, RS, KV). Information at regional level was collected for DE and IT (3 regions for both) and 1 region reported information for Finland. 45 agglomerations from 9 different countries reported information on quiet areas (AT, BE, BG, DE, FI, IE, IT, PL, PT). See Figure 3.

Out of the countries that responded, 85% indicated that criteria for designating quiet areas in their territories were in place and 60% had designated at least one quiet area. Respondents reported that the criteria used are different between quiet areas in the open country and quiet areas inside agglomerations. To date, most countries focus only on quiet areas inside agglomerations and therefore the following sections report only responses reported by countries and regions regarding the state of quiet areas inside agglomerations as well as the responses received by individual cities.

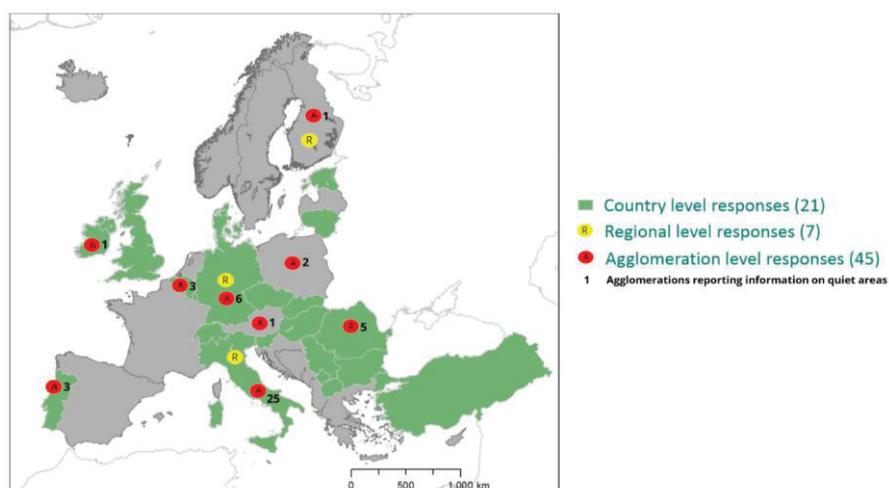


Figure 3 – Distribution of responses

### 3.2 Designation and protection of quiet areas

According to the country questionnaires received, 60% of the countries that responded to the questionnaire reported having some criteria to designate quiet areas inside agglomerations. According to the questionnaires completed by the cities, 30 cities out of 45 reported to have criteria for designating urban quiet areas inside the city. The majority of quiet areas inside agglomerations were designated in the second reporting cycle of the END (2010 – 2014), and most of them were reported through the END directive. The criteria used to designate quiet areas inside urban agglomerations is shown in Table 1.

Table 1 – Criteria for designating quiet areas inside agglomerations

Type	Responses
Acoustic criteria	<ul style="list-style-type: none"> <li>• Areas undisturbed by noise. Countries and cities designate areas as quiet areas if noise levels in a substantial percentage or surface of the “quiet area” are below a certain noise threshold. The noise limit values used to designate quiet areas are reported in Figure 4.</li> <li>• Difference in noise levels between the “quiet area” and surrounding areas is established in some countries/cities. Differences reported are between 6 dB(A) to 15 dB(A).</li> </ul>
Urban functionality	<ul style="list-style-type: none"> <li>• Quiet areas inside agglomerations are generally attributed to areas with a certain type of functionality. A diverse range of functionalities were reported such as health sensitive sites (i.e. hospitals, schools), recreational sites (i.e. play-grounds, sporting facilities, outdoor theatres), parks, cultural heritage sites (i.e. castles, churches, archeologic sites) and public areas (i.e. urban squares, cemeteries).</li> </ul>
Land cover type	<ul style="list-style-type: none"> <li>• Green/blue landcovers (i.e. high degree of vegetation, city parks, gardens, green urban areas)</li> </ul>
Location of the area	<ul style="list-style-type: none"> <li>• A minimum distance from noisy activities from industry and major roads needs to be met.</li> <li>• Areas within or adjacent to densely populated settlement area or near residential areas.</li> </ul>
Accessibility to the area	<ul style="list-style-type: none"> <li>• To be publicly accessible. One city has designated quiet areas as those where at least 10.000 inhabitants have access to the relatively quiet area within a walking distance (1 km).</li> <li>• Interconnected natural spaces connecting with inter-urban links to</li> </ul>

	adjacent landscape areas through forests, green spaces, parks, fields and meadows.
	<ul style="list-style-type: none"> <li>• Quiet axes with networking function: connecting routes away from the main traffic routes in attractive inner-city open spaces.</li> </ul>
Size of the area	<ul style="list-style-type: none"> <li>• Minimum size needed. Different sizes have been reported from 0.3 ha to 5 ha.</li> </ul>
Visual qualities	<ul style="list-style-type: none"> <li>• Areas with established scenic importance.</li> </ul>
Subjective judgement	<ul style="list-style-type: none"> <li>• A quiet area needs to be perceived to have a pleasant soundscape.</li> </ul>

The majority of countries also provided information on the specific noise limits that are applied to designate quiet areas inside agglomerations. The noise limits reported can be seen in Figure 4. It should also be highlighted that we found that more emphasis was given to the difference in noise level between the core part of the quiet area and the surrounding areas.

Noise indicator	≤ 30 dB(A)	≤ 35 dB(A)	≤ 37 dB(A)	≤ 40 dB(A)	≤ 45 dB(A)	≤ 47 dB(A)	≤ 50 dB(A)	≤ 55 dB(A)	≤ 60 dB(A)	≤ 65 dB(A)	40-45 dB(A)	40-55 dB(A)	50-55 dB(A)
L <sub>den</sub>				■			■	■				■	■
L <sub>day</sub>				■	■			■	■	■			■
L <sub>night</sub>	■	■		■	■		■				■		
L <sub>evening</sub>		■		■			■	■					
L <sub>Aeq,day</sub>						■	■						
L <sub>Aeq,night</sub>			■	■									

Figure 4 – Noise indicators and limit values considered to designate quiet areas in urban areas.

32 cities provided information on the type of measures that were conducted to protect quiet areas, including preserving the areas and preventing any deterioration of existing quietness. A summary of the different measures applied by cities is shown in Table 2. Nevertheless, the main reasons highlighted by cities where no action plan has been conducted to protect quiet areas are that there is no definition in place for quiet areas, there is a lack of protection tools, as well as a lack of interest from the population concerning quiet areas.

Table 2 – Measures carried out to protect quiet areas inside agglomerations

Type	Responses
Monitoring	<ul style="list-style-type: none"> <li>• Monitoring noise levels in quiet areas and urbanised areas</li> </ul>
Limitation of noise	<ul style="list-style-type: none"> <li>• Restriction of certain noise-making activities</li> <li>• Determine the appropriate noise limit values and include them in the ecological and environmental impact assessment analysis (quiet areas in open country)</li> <li>• Further limitations (linked to their use) in those areas (e.g. large concerts)</li> </ul>
Traffic mitigation and management measures	<ul style="list-style-type: none"> <li>• Speed control, traffic patterns, traffic management</li> <li>• Increase and prioritize the use of public transport</li> </ul>

	<ul style="list-style-type: none"> <li>• Promotion of cycle mobility</li> <li>• Creation of a cycle track/path/infrastructure</li> <li>• Installation of electronic speed detection system</li> <li>• Sustainable development of the urban transport system</li> <li>• Traffic bans / restricting car access to the central parts of the city</li> <li>• Replacement of intersections with roundabouts</li> <li>• Green wave light / optimization of traffic lights</li> <li>• Sound-absorbing asphalt / improving road surfaces</li> <li>• Creation of 30 km/h zones</li> <li>• Road movement reorganization in some areas / reorganization of spaces</li> <li>• Interventions for a more fluid traffic flow / traffic calming</li> </ul>
Urban planning	<ul style="list-style-type: none"> <li>• Increase and widen pedestrian areas</li> <li>• Organizing car parks near the start and end stops of public transport</li> <li>• Designing sites for public use, reforestation of free areas and construction of landscaping zones and parks</li> <li>• Limiting the creation and development of ground infrastructures (roads, rail, recreation)</li> <li>• Avoidance of construction in quiet areas</li> <li>• Creation of buffer zones within quiet areas</li> <li>• Determine the impacts concerning traffic planning</li> <li>• Consideration of quiet areas within (environmental) planning / development decisions</li> <li>• Consideration of environmental noise in new plans</li> </ul>
Noise barriers	<ul style="list-style-type: none"> <li>• Installing sound barriers, green barriers and protection screens</li> </ul>
Promotion and awareness	<ul style="list-style-type: none"> <li>• Appropriate signage</li> </ul>

### 3.3 Changes in urban quiet areas between 2012 and 2017

There is variability between cities in terms of gain/loss of potential quiet areas. Figure 5 shows the percentage change of potential quiet areas between 2012 and 2017 for two different types of land use, green/blue areas and residential areas. As it can be seen, cities such as Bern, Zürich, Cork, Hamburg, Lausanne, Munich, Aalborg and Aarhus experienced a net gain in land that is green/blue and potentially quiet (shown with a light green percentage denoting the “no quiet-quiet option” of the legend). On the other hand, cities such as Vilnius, Praha, Dusseldorf, Cologne, Dublin, Copenhagen and Valleta have experienced a decrease in potential quiet areas that are green/blue. Looking at the gain of residential quiet areas, it can be seen that Aarhus, Aalborg, Munich, Dublin, Hamburg, Cork, Zürich and Lausanne have experienced a net gain in potential quiet areas that are residential. Although the reason for these changes is unknown, local noise action plans, nature conservation plans as well as measures related to urban planning can have an effect on the gain or loss of quiet areas in urban settings. On the other hand, a change in the modelling methodologies used for traffic could also lead to changes that are not strictly related to a real increase/decrease of noise.

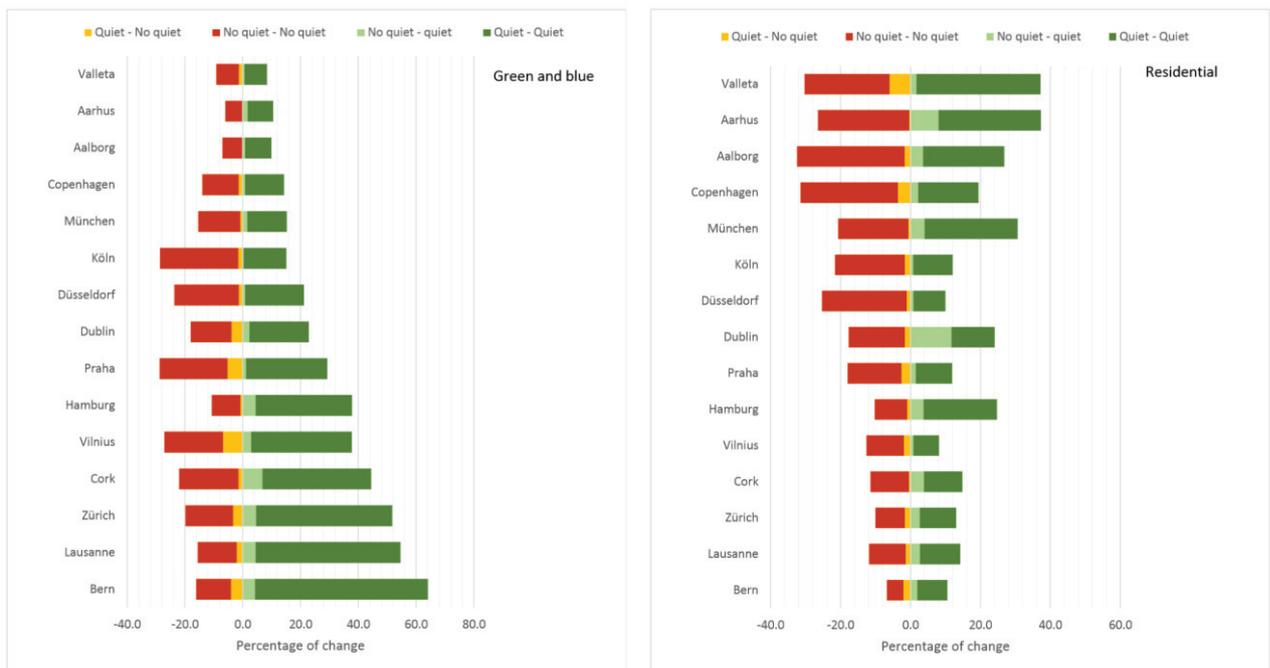


Figure 5 – Gain and loss of green/blue and residential quiet areas between 2012 and 2017 in selected cities.

#### 4. DISCUSSION AND CONCLUSIONS

The designation and protection of quiet areas in agglomerations was investigated through the analysis of a questionnaire completed by noise representatives of 21 countries, 7 regions and 45 cities. The results show that the majority of respondents indicated to have definitions of quiet areas in place as well as selection criteria to designate them. The responses indicate that the selecting criteria used for the designation of quiet areas vary widely. Sound-pressure levels seem to play an important role in the selection criteria for designating quiet areas. However, sound levels are not the only important factor for designating these areas. Other factors taken into account to designate quiet areas are those related to visual qualities of the area, distance from the noise sources, subjective perception of the area, accessibility to the area, size of the area as well as land use type and functionality of the area. These results support the previous calls for new kinds of indicators as well as new methods for identification or measurement of perceived acoustic quality/appreciation of quiet areas as current measurement methods cannot discriminate pleasant natural sounds such as birds, water or wind from unwanted sound from transportation, industry or recreational sources [5].

A significant number of competent authorities have made an effort to protect quiet areas. About 60% of the cities that completed the questionnaire indicated that they are applying some mitigation or management measures to protect quiet areas inside their urban areas. Most of the measures applied are very similar to those used for management and mitigation of transportation noise. Urban planning measures that are being used to protect quiet areas include pedestrianisation, and the evaluation of noise effects during the planning process of new infrastructure projects. Public engagement and awareness don't seem to be widely used measures for protecting quiet areas. A higher promotion and awareness of quiet areas could be beneficial since cities have reported that one of the stoppers for protecting quiet areas is that there is a lack of interest from the population concerning quiet areas.

A variability between cities in terms of gain/loss of potential quiet areas was found. However, further investigations are needed to determine whether these results are due to other factors such as the use of different traffic noise modeling methodologies between 2012 and 2017, or a lack of common assessment methods between cities.

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