

Soundscapes of Health Resorts in Poland and their Revitalization

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Abstract

The objective of the studies was to recognise the need for and possibilities of preserving and revitalizing the soundscapes of health resorts in Poland. The research process included an analysis of the legal environment determining the functioning of Polish health resorts. Noise hazards and values of soundscapes were identified and acoustic revitalization measures were proposed for the selected health resorts. A review of scientific literature was performed and health resort surveys and audit reports were conducted. The next stage was focussed on the questionnaire sent out to the local governments of health resort districts and towns in Poland. The discussion referred, inter alia, to the recommendations of the team of experts in the field of changes within the spa treatment system in Poland. The conducted studies demonstrated that most health resorts in Poland have some soundscape values. However, these values may be lost because of the threat of noise from transport and tourism. Health resorts in Poland thus need revitalization measures aimed at achieving a high quality of soundscape.

Keywords: soundscape, noise, health resort, revitalization, Poland

1. Introduction

The quality of the soundscapes in Polish health resorts is rarely a subject of research even though it impacts upon the sense of comfort or discomfort and, consequently, the health of people staying there. The threat of noise pollution in health-resort towns has been discussed by authors such as Kuchcik and Baranowski (2013), and Wójcikowski (2011). The problem was also recognized by the Supreme Audit Office which, in a report published in 2016, highlighted the fact that the permitted noise levels were exceeded in ten out of eleven audited resorts. The noise levels were from 1 to 21 dB higher than the limit during the day and from 0.1 to 14 dB higher at night. Health resort districts were not monitoring the condition of the environment and were not using the essential tool for preventing the violation of the regulations set for health resorts, i.e. they did not adopt resolutions concerning the local spatial development plan, which led to the construction of facilities that posed a threat to the environment. It was stressed that the lack of care about the natural environment could lead to the deterioration of health resort values and could constitute an obstacle to their development. Furthermore, districts that do not meet the requirements set by the law (e.g. by allowing the permitted noise levels to be exceeded) can lose their health resort status. Therefore, it is necessary to take remedial measures that would allow health resorts to maintain their therapeutic function.

This article draws on the approach of acoustic ecology – an interdisciplinary research field analysing the perception and socio-historical aspects of the correlations established by humans with their environment through sounds (Schafer, 1977). Soundscape is a key term used in acoustic ecology. The work of J.D. Porteous and J.F. Mastin (1985) was devoted to soundscape themes as early as the 1980s, although the term soundscape was used by M. Southworth (1969) in the study of urban space in Boston. According to the international standard ISO 12913-1 (2014), it is a perceived physical environment construct and is defined as “the acoustic environment as perceived or experienced and/or understood by a person or people in context”. Therefore, acoustic indicators are not sufficient to describe it as it results from the complex relationships occurring between various sounds and human auditory perception (Jeon and Hong, 2015). Being a multidimensional phenomenon, soundscape cannot be measured and described exclusively with numbers (Kang et al., 2016). Thus, it is important to investigate the subjective evaluation of noise nuisance, which requires learning about people’s sound preferences, and the relationships between certain characteristics of the acoustic environment and the perception of acoustic stimuli (Raimbault and Dubois 2005). However, Pijanowski et al., (2011) note that soundscapes exist objectively as a set of biological, geophysical, and anthropogenic sounds emitted in the landscape, varying in space and time, and reflecting important ecosystem processes and human activities.

The concept of soundscape introduces a different approach to the analysis of the acoustic environment compared to the concept of noise (Brown and Muhar, 2004). Therefore, strategies should not be limited to managing and controlling noise in urban space. Interest in the quality of the soundscape should also increase due to its impact on health, both physical and mental (Meng and Kang, 2016; Preis et al., 2015; Basner et al., 2014; Aletta et al., 2018). The literature review has indicated links between the occurrence of natural sounds and positive health effects (Annerstedt et al., 2013; Alversson et al., 2010; Francis et al., 2017; Marin et al., 2011; Pilcher et al., 2008) and links between the occurrence of noise and negative health effects (Basner et al., 2014; de Paiva Vianna et al., 2015). These include not only tinnitus and hearing damage but also increased risk of ischemic heart disease, sleep disorders, nervous system diseases and cognitive disorders in children (Aletta et al., 2018). Research by Liu and others (2020) has shown that audiovisual comfort is positively correlated with the

percentage of tourists practicing active forms of recreation (running, walking) in mountain areas. Aletta et al., (2018) proved that sound perception can enhance human experience in urban areas from a health perspective.

At present, articles discussing problems related to soundscape studies are published in numerous scholarly journals with a steadily growing intensity. Many articles present case studies, usually concerning specific cities (e.g. Yang and Kang, 2005; Mohammed Rehan, 2016; Hong and Jeon, 2017; Cerwen, 2016; Liu and Kang, 2016). Studies of soundscapes are also conducted in rural and natural areas (e.g. Ren et al., 2018, Votsi et al., 2012; Watts and Pheasant, 2015). The soundscape concept has been drawing increasing attention in the field of landscape planning and design (Fowler, 2013). It was noticed that soundscape perception might be related to the landscape spatial pattern (Liu et al., 2014). Based on sociological methods (semantic differential, sound preference test, mental map, questionnaire, interviews, free descriptions), observations and recordings (soundwalks), and acoustic measurements, soundscape quality assessments are carried out, providing the basis for acoustic design that, according to Schafer (1977), should ensure the creation of a soundscape that is friendly to people. The process of acoustic design should include site identification and the recognition of the context, establishing the acoustic goals, defining “wanted” and “unwanted” sounds, and defining the management and design criteria. The areas of acoustic design should include, inter alia, parks, promenades, squares, areas of natural and cultural value, and walking paths. It is necessary to identify stakeholders and get to know their perceptions at every stage in the process of soundscape planning (Xiao et al., 2018).

Acoustic design is used, for example, in comprehensive measures related to the alteration of space, and socio-economic and cultural revival, particularly in degraded areas of cities, with a special emphasis on developing a new quality of soundscape. Such measures are aimed at improving the quality of life, restoring spatial order, stimulating economic recovery, and rebuilding social bonds. This process, described as acoustic revitalization, can play an important role in establishing (or re-establishing) order in space (Bernat, 2007). Acoustic revitalization should take into account the fact that the perception of soundscapes occurs in a specific context. Ignoring this fact leads to social conflict (Bernat, 2016a).

Soundscape studies in Poland are conducted by representatives of various fields of expertise and scientific disciplines, particularly acoustics (e.g. Preis et al., 2015; Wiciak et al., 2015), cultural studies (cultural anthropology), musicology (e.g. Losiak and Tańczuk, 2014) and geography (e.g. Bernat, 2015; Romanowska, 2018). However, comprehensive studies of soundscapes in health resorts, including those outside Poland, have not been undertaken so far.

The objective of the studies conducted in the years 2016–2018 was to recognise the need and possibilities of preserving and revitalizing soundscapes in health resorts in Poland. The performed research was aimed at answering the following research questions:

1. What sounds are present in the landscape of health resorts in Poland and what is their value?
2. What is the noise hazard in them and what is the function responsible for it?
3. How can the quality of the soundscape of health resorts be improved in order to strengthen its therapeutic effect?

The research process included an analysis of the legal environment determining the functioning of Polish health resorts. The noise hazards and values of soundscapes were identified and acoustic revitalization measures were proposed for the selected health resorts. The discussion that follows refers to the recommendations from an expert team with regard to changes in the health resort treatment system in Poland. The article presents a mainly qualitative approach.

2. Methods and methodology

Various methods were used for different stages of the research process. In the first stage, a review of scientific literature, health resort surveys and audit reports were conducted. The next stage was focussed on the questionnaire which was sent out to the local governments of all health resort districts and towns in Poland. The questionnaire consisted of fifteen questions concerning noise hazards and the values of soundscapes as well as noise control and soundscape improvement methods. The questions were answered by mayors/ heads of districts or their deputies, district/town secretaries, or specialists responsible for environmental protection, development or promotion. In some cases, it was stressed that the answers were given in consultation with health resort employees. Based on the obtained diagnoses, a project-based method was used for the selected health resorts. The proposals of the respondents and spatial management students from Maria Curie-Skłodowska University in Lublin were used to prepare acoustic revitalization projects for the following twenty-one selected health resorts characterised by the presence of significant noise hazards: Busko-Zdrój, Ciechocinek, Cieplice, Goczałkowice-Zdrój, Inowrocław, Iwonicz-Zdrój, Kamień Pomorski, Kołobrzeg, Konstancin-Jeziorna, Krasnobród, Krynica-Zdrój, Kudowa-Zdrój, Nałęczów, Połczyn-Zdrój, Rabka-Zdrój, Solec-Zdrój, Sopot, Szczawno-Zdrój, Swoszowice, Szczawnica, Świnoujście. For each of the above health resorts, at least one scheme proposal was prepared. A total of thirty-four proposals containing a few similar solutions were prepared.

In view of the objective presented above, the research was mainly of an exploratory and descriptive nature and aimed at recognizing the actual state of the soundscape of health resorts in Poland, for example, in the perception of local authorities and comparing whether the same is true in all health resorts. Moreover, the research was of an explanatory nature, aimed at recognizing the causes and effects of the current state of the soundscape of health resorts. This research introduces proposals for changes in the soundscape of health resorts, both on the part of the surveyed local authorities and students preparing revitalisation projects for specific health resorts, combining scientific and practical approaches that can result in real changes in the spaces of health resorts.

3. Health resort as a special area

According to the Polish Act on Health Resort Treatment (2005), a health resort is an area where health resort treatment is provided that has been separated in order to use and protect natural therapeutic resources located within its borders, and that has been awarded health resort status. A town or village aspiring to receive such status has to meet several requirements. It should have deposits of natural therapeutic resources and a climate with proven therapeutic properties. Within its area, there have to be health resort treatment centres and health resort facilities that are prepared to provide health-resort treatment. Additionally, it should meet the requirements specified in environmental protection law and have the technical infrastructure with respect to water supply and sewage, power supply, public transport and waste management. If the environmental conditions (raw materials, climate) and infrastructure in the field of environmental protection are met but there are no healing plants, the status of the health resort protection area is granted. Both health resorts and health resort protection areas are special areas subject to specific rules of operation (Dryglas and Golba, 2017), defined in a dedicated document – a charter that takes into consideration the requirements set by the law and the provisions of the health resort survey, updated every ten years.

The determinants of health resort treatment are similar across Europe. They differ only with regard to the details of the forms of protection, the strictness of the public law regime within the protected area and, in some cases, stricter

technical standards concerning air quality and noise levels (Dryglas and Golba, 2017). In the area of health resort and a health resort protection area in Poland, there are three types of zones marked with the letters “A”, “B” and “C”, differing in the percentage share of green areas (not less than 65%, 50% and 45%, respectively). In the “A” zone, there are very stringent standards regarding permissible short-term noise levels, resulting from the specificity of the area and the need to ensure acoustic comfort: 50/45 dB in the day, 45/40 dB at night (Regulation of the Minister of the Environment 2012). Additionally, for the “A” zone, within two years of obtaining the status, the spa commune has the obligation to draw up and adopt a local spatial development plan. Zones should be determined at the stage of creating a spa frame and then finally defined and described in the health resort and a health resort protection area statute.

At present, there are approximately 1500 various health resorts in Europe, most of them being located in Germany (350), Italy (300), Spain (128) and France (107). Forty-five charter health resorts currently exist in Poland (Fig. 1). Additionally, Wieliczka was awarded the status of an underground health resort. Most of the health resorts are located in the southern part of Poland that is more “privileged” thanks to the peculiar geological conditions and the occurrence of mineral waters, peloids and therapeutic gases. Most health resorts are located within the administrative boundaries of towns and cities, which are usually not very big and for which health resort activities become the catalyst of development (Cieślak 2014). Only three health resorts, namely Konstancin-Jeziorna, Sopot and Swoszowice, are located within the metropolitan area (Warsaw, Tri-City and Kraków, respectively). Eleven health resorts are located in rural areas, which are influenced, among other factors, by the presence of an open, high-quality natural landscape (including the acoustic dimension, i.e. so-called acoustic comfort). In terms of the number of treatment centres, the biggest health resorts are located in Ciechocinek and Kołobrzeg, while the smallest are in Augustów, Krasnobród, Supraśl, Piwniczna-Zdrój, and Wapienne.

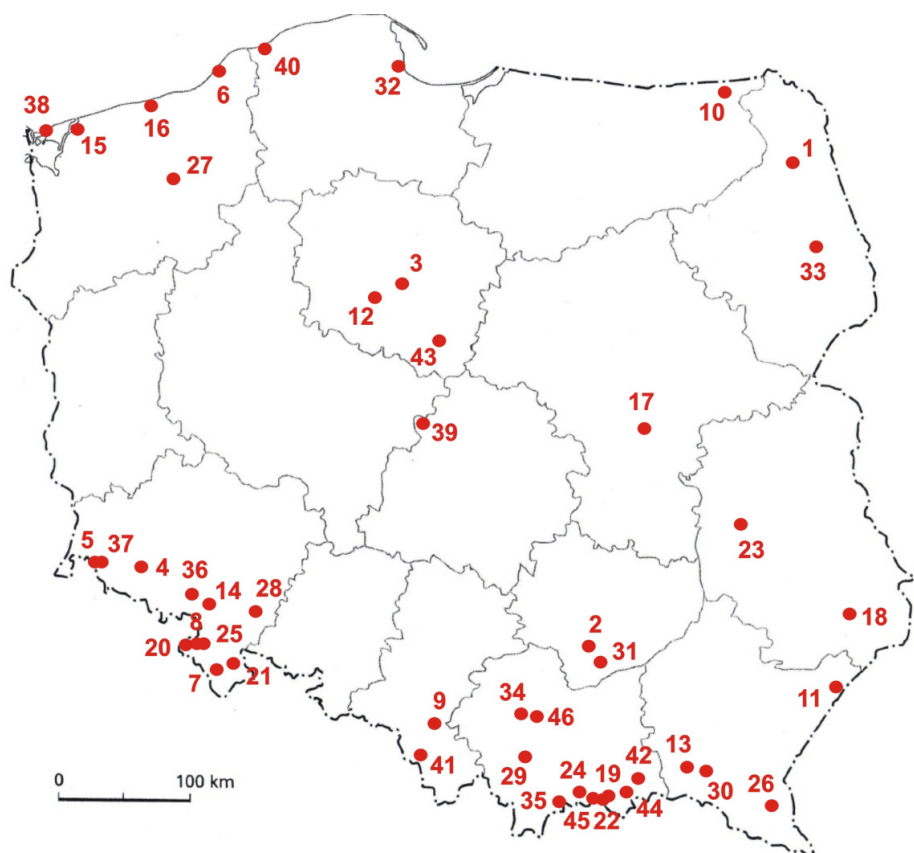


Fig. 1. Location of the places with the status of health resort in Poland:

1. Augustów, 2. Busko-Zdrój, 3. Ciechocinek,
 4. Cieplice, 5. Czerniawa-Zdrój, 6. Dąbki,
 7. Długopole-Zdrój, 8. Duszniki-Zdrój,
 9. Goczałkowice-Zdrój, 10. Gołdap,
 11. Horyniec-Zdrój, 12. Inowrocław,
 13. Iwonicz-Zdrój, 14. Jedlina-Zdrój,
 15. Kamień Pomorski, 16. Kołobrzeg,
 17. Konstancin-Jeziorna, 18. Krasnobród,
 19. Krynica-Zdrój, 20. Kudowa-Zdrój,
 21. Łądek-Zdrój, 22. Muszyna-Złockie,
 23. Nałęczów, 24. Piwniczna-Zdrój,
 25. Polanica-Zdrój, 26. Polańczyk,
 27. Połczyn-Zdrój, 28. Przerzeczyn-Zdrój,
 29. Rabka-Zdrój, 30. Rymanów-Zdrój,
 31. Solec-Zdrój, 32. Sopot, 33. Supraśl,
 34. Swoszowice (Kraków), 35. Szczawnica,
 36. Szczawno-Zdrój, 37. Świeradów-Zdrój,
 38. Świnoujście, 39. Uniejów, 40. Ustka,
 41. Ustroń, 42. Wapienne, 43. Wieniec-Zdrój,
 44. Wysowa, 45. Żegiestów-Zdrój, 46. Wieliczka
- (Source: own elaboration)

Health resorts also constitute urban development whose spatial layout stems from their functions and is the result of a several-century-long tradition of creating such layouts in order to satisfy various needs related to human health (Węclawowicz-Bilska, 2008). A spa park, often having a network of avenues, promenades, and squares, is an important feature of a health resort. Polish health resorts are not spatially autonomous systems; they are linked with permanent settlement units of varying size. Węclawowicz-Bilska (2008) distinguishes six kinds of spatial layouts: isolated, conjugated (dominance of a health resort or town), parallel conjugated, integrated, absorbed, and mixed. The mixed model is inconvenient to health resort users who have to move across areas with an urban function. The absorbed model is equally inconvenient, particularly when a health resort is small and there are no cultivated green areas of sufficient size in its close proximity. In such cases, the threat of noise pollution and air pollution is considerable.

4. Research review

The problem of noise pollution in health resorts was recognised nearly twenty years ago when it was observed that the noise levels in the spa park in Swoszowice considerably exceed the limits set for the buffer zone (zone A), and lead to its ecological degradation (Bielak 2000). According to the current health resort survey (2018), the permitted noise levels were only slightly exceeded at two measurement sites in zone A of the health resort as a result of the proximity of roads with a high intensity of traffic.

The noise hazards occurring in Nałęczów, Szczawno-Zdrój, Muszyna, Piwniczna-Zdrój, Żegiestów-Zdrój, and Sopot were pointed out by Wójcikowski (2011). He observed that ensuring appropriate acoustic conditions in health resorts necessitates the obligatory preparation of acoustic maps and the introduction of a remedial programme, which often requires arrangements at a level higher than that provided at the district level and the requirement for national government assistance to a greater extent than was previously the case.

According to a survey of the acoustic climate in four health resorts that are particularly exposed to noise (Goczałkowice-Zdrój, Swoszowice, Iwonicz-Zdrój, Kudowa-Zdrój), the equivalent sound levels were usually within the 50–60 dB range, although the highest levels exceeded 80–90 dB (Kuchcik and Baranowski 2013). This results from the location of these health resorts close to major traffic routes (Goczałkowice-Zdrój, Swoszowice) and from the accompanying function of a popular tourist resort (Krynica-Zdrój) where additional sounds are generated by the accommodation infrastructure and food establishments. According to Kuchcik and Baranowski (2013), the maximum noise levels permitted in zone A of the health resort are likely to be exceeded even if car traffic in the health resorts is drastically restricted because the background sound levels (i.e. the sounds of nature, health resort clients talking, and the sounds of essential business activity) already exceed these limits. On the other hand, the authorised administration agencies do not show enough initiative in reducing transport noise pollution, e.g. by building noise barriers, restricting traffic in the centre of health resorts, or prohibiting vehicles that generate the worst noise nuisance (lorries, motorcycles).

The report entitled “Identification of selected environmental threats to health resorts in Podkarpackie Province” showed that Horyniec-Zdrój was the only health resort where noise level standards were not violated (Lipińska, 2014). In other health resorts in the province, the noise levels permitted for zone A were exceeded by at least 10 dB (Iwonicz-Zdrój), and even by as much as 18 dB (Rymanów-Zdrój).

In several health resorts, noise has been identified as a source of a few social conflicts (Bernat, 2016a). In Nałęczów, heavy goods vehicle traffic going through its centre due to the lack of a ring road leads to the violation of the permitted

noise levels. Consequently, in 2008, Nałęczów faced the threat of losing its health resort status. The town's authorities made a pledge to launch a remedial plan under which transit traffic would be diverted from the town centre, thanks to which, the health resort status has been conditionally extended to the year 2019. Similar problems have also been reported in Kamień Pomorski, Szczawno-Zdrój, Goczałkowice-Zdrój, Połczyn-Zdrój and Cieplice. According to the current health resort survey for Cieplice, the acoustic conditions are not favourable, and they show great spatial variation. This is related to the very high intensity of traffic in the street crossing the centre of zone A (mean daytime value: 62.9 dB, mean night-time value: 53.6 dB). By contrast, in the remaining area of zone A, the permitted noise levels were exceeded by only a small margin. Therefore, one of the proposals was to restrict motor vehicle traffic on the noisy road and plant strips of dense trees and shrubs in the neighbouring parks.

Resort towns also face a growing problem of noise related to the functioning of local restaurants, clubs, discos, etc. These problems were reported in Świnoujście, Sopot, Kołobrzeg, and Ciechocinek, among other localities. In 2007, the city council in Świnoujście passed a resolution restricting the use of amplification equipment in restaurant gardens between 10 pm and 10 am in the summer season (June–September). The resolution was a response to complaints made by health resort clients about loud music and to acoustic measurements indicating that the permitted noise levels were being exceeded, which could have resulted in the city losing its health resort status. The results of the noise intensity measurements performed in Świnoujście in 2008 showed a serious threat of noise pollution in the sanatorium and recreation section of the resort, especially in the high season (Błażejczyk, et al., 2008). The recorded levels constituted a medium or high level of nuisance (pursuant to the transport noise pollution scale developed by the National Institute of Hygiene). The main threat to acoustic comfort comes from intensive vehicle traffic on the streets within zone A or in its vicinity, and commercial noise generated by cafés, beer gardens, street food outlets, etc. This is why it was stressed that restoring the acoustic climate to a level below the maximum permitted noise levels should be a priority for the local government. It is particularly important to introduce restrictions on entertainment activity, especially in the vicinity of sanatoriums. Ultimately, this kind of service should be kept out of zone A.

In Inowrocław, noise levels of 53.8–57.3 dB were recorded in the central part of the spa park in the summer season, which resulted from the concentration of entertainment facilities, among other reasons (Sztubecka and Skiba, 2016). Noise-free and walking zones are located on the edge of the spa park. This is why it is necessary to separate tranquil zones from noisy zones with neutral zones. Since artificial acoustic fencing was not recommended, it was noted that the noise levels along the paths and streets in the park need to be reduced. Furthermore, it was stressed that the direction of the health resort district development should be clearly stated in the town planning documents, along with the recommended building and paving materials due to them influencing the acoustic climate of the health resort. Such a solution would help prevent unfavourable changes in spatial development and the acoustic climate (Sztubecka et al., 2016).

5. Survey results

In the years 2016–2017, studies were conducted in order to examine the noise threats and soundscape values as well as the need for the acoustic revitalization of Polish health resorts (Bernat, 2016b). It was demonstrated that most health resorts in Poland have considerable acoustic values. There are mainly the sounds of nature (the singing of birds, the sounds of animals, the sound of the surf, the murmur and splashing of water in rivers, the rumble of waterfalls, the rustling of trees) but also music from cafés or vendors' stalls, ultrasounds, health resort clients talking during their walks, the sounds

of a graduation tower in operation and the sounds of a harbour, areas of former shipyards, and a military training ground. However, these values may be lost mainly because of the threat of noise from transport and tourism (including entertainment) (Fig. 2). When asked about places with exceptionally pleasant soundscapes, the respondents most frequently indicated spa parks pedestrian routes (pedestrian zones), a nearby forest, the shore of a lake or pond, the proximity of a waterfall, scenic open spaces (meadows, forest clearings), the coastal belt, ecological land, environmental and landscape complexes, Natura 2000 areas, river valleys, tourist trails, and a nearby church. By contrast, places generating noise nuisance include primarily traffic routes, town/city centres, the vicinity of a restaurant, areas close to recreational lakes, construction sites or railway tracks, and areas of former shipyards. It was observed that health resorts in Poland needed regeneration measures aimed at achieving a high quality of soundscape. Noise was monitored in only eleven health resorts. Noise measurements were performed only occasionally (usually at the stage of applying for health resort status); systematic measurements as part of environmental monitoring were conducted in fewer cases. The subjective noise hazard was most often rated as low (in nineteen health resorts) or medium (in twelve resorts) (Fig. 3). However, in the case of four health resorts, it was rated as high or even very high (Iwonicz-Zdrój, Kudowa-Zdrój, Swoszowice, Kamień Pomorski).

According to the officials of most health resort districts and towns, the high quality of the soundscape and public space in health resorts should be one of the goals of revitalization. However, feasible measures for reducing noise and protecting tranquillity and soundscapes were proposed for less than half of the health resorts. The measures that have been proposed most often included restricting (permanently or temporarily) motor traffic (especially vehicles causing the greatest noise nuisance), diverting motor traffic (particularly lorries of over five tonnes) beyond highly urbanised areas (a ring road), prohibiting transit of goods, changes in the traffic scheme, excluding motor traffic from certain stretches of streets, maintaining existing and creating new traffic calming zones, especially in zone A (vehicle speed limited to 30–40 km/h). The following measures have also been proposed:

- ▶ the systematic modernisation of alternative means of public transport and the introduction of transport based on electric vehicles or horse-drawn carriages;
- ▶ developing local commercial centres to reduce traffic within towns;
- ▶ modernising and maintaining high-quality paving of roads (even asphalt surfaces, without ruts and holes, storm drain covers fitted with vibration isolation gaskets);

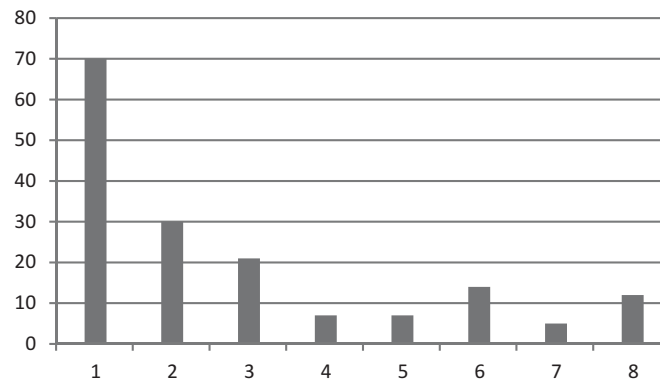


Fig. 2. Sources of noise nuisance in health resorts (in per cent) (1) motor traffic, (2) loud music, (3) loud behaviour of restaurant/club clients, (4) recreation, (5) flying aeroplanes and helicopters, (6) construction, (7) other, (8) none (Source: own research)

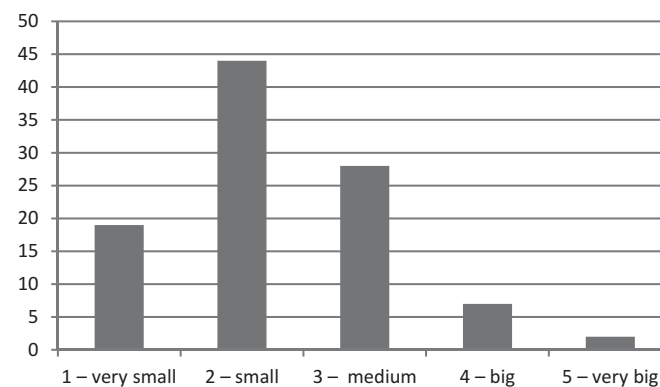


Fig. 3. Subjective assessment of noise nuisance in health resorts (in per cent) (Source: own research)

- ▶ planting of trees and shrubs, particularly green belts separating public space from vehicle traffic routes;
- ▶ moving mass events out of zone A and prohibiting outdoor events at night;
- ▶ restrictions on the provision of services generating noise from 10 pm to 6 am and prohibiting entertainment establishments in zone A included in spatial development plans;
- ▶ permanent cooperation with the police with regard to observing the night-time quiet regulations;
- ▶ designating noise-free zones;
- ▶ building noise barriers/acoustic fencing (after analysing their impact on the landscape) and earth embankments (with trees and shrubs planted on them) along railway tracks and roads;
- ▶ replacement of window and door joinery and thermomodernisation;
- ▶ limiting tourism and giving priority to health resort treatments, channelling tourist traffic, limiting the number of tourists and constantly monitoring tourist trails;
- ▶ prohibiting quad bikes, off-road motorcycles and ultralight trike access.

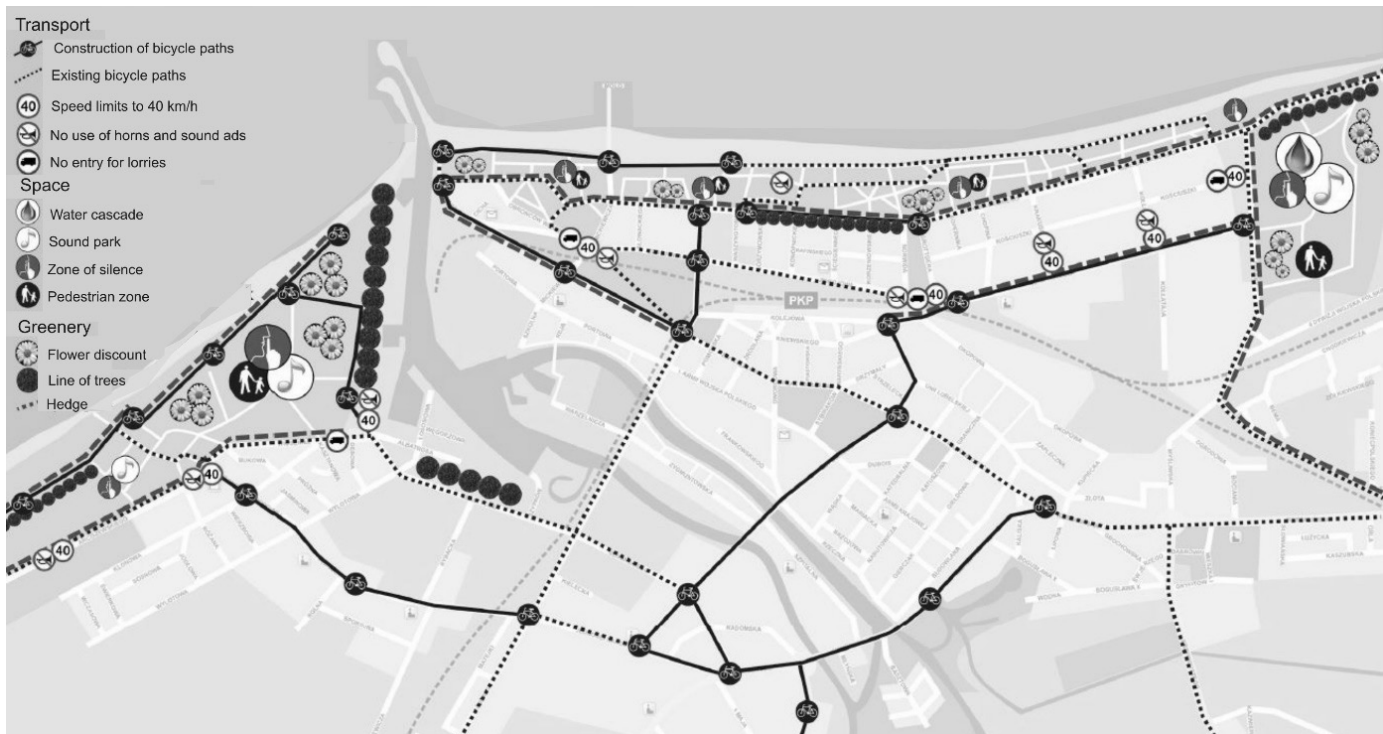
6. Acoustic revitalization projects

In the acoustic revitalization projects prepared by students for the selected health resorts, the following solutions were proposed (order according to the number of projects):

- ▶ designating tranquil areas/noise-free zones (21 projects);
- ▶ introducing green belts (planting trees, afforestation) along roads (21 projects);
- ▶ establishing sound parks/gardens and other parks (15 projects);
- ▶ introducing speed limits, building speed bumps, separation of zones of calmed traffic (14 projects);
- ▶ prohibiting traffic, especially transit of goods, at 10 pm–6 am (13 projects);
- ▶ building acoustic screens, long roads and also at industrial facilities and restaurant gardens (7 projects);
- ▶ prohibiting mass events after a specific hour, restrictions on the location of such events (5 projects);
- ▶ changes in the traffic scheme (5 projects);
- ▶ introducing sound installations/sculptures into public space (3 projects);
- ▶ prohibiting sound signals, sound advertisements, and the use of sound amplification in zone A (3 projects);
- ▶ building bicycle paths (3 projects);
- ▶ introducing quiet pavement systems (2 projects);
- ▶ noise monitoring (2 projects);
- ▶ organising soundwalks and other educational activities (2 projects);
- ▶ increase in the number of car parks outside zone A, construction of underground car parks (2 projects).

Other proposals included: designating traffic calming zones; introducing paid parking zones; prohibition of entertainment facilities in zone A; building a ring road; planning local commercial centres; replacement of window frames in buildings; construction of a concert shell, trees conservation; use of ivy climbers on buildings; marking out walking paths; lighting and retrofitting of the spa park; limiting the placement of billboards and posters in public space; creating a transitional zone of “spa recreation”; detailed provisions regarding acoustic standards in local spatial development plans; social participation (single projects).

The projects for the specific health resorts vary in terms of the number of solutions proposed. Proposals for Kołobrzeg are the most interesting and the most numerous (Fig. 4).



7. Discussion

Health resorts are often regarded as oases of tranquillity, and this is why the issue of noise nuisance is not addressed there. However, as Sztubecka and Skiba (2016) observe, such a view is not justified even with regard to health resort parks because they are a place of both recreation and social gatherings. The playing of music outside various establishments reduces the comfort of people spending time in their vicinity. Besides, some parks are adjoined by busy roads, i.e. line sources of noise. Therefore, an assessment of the acoustic comfort of a park should take into consideration factors such as distance from main roads, the size and shape of the land and the landforms. Noise-free zones can be located on the edges of parks, far from the main sources of noise.

Kujawski et al., (2008) rightly observed that an objective assessment of noise in health resorts is extremely difficult and requires correlating the physical measurements of noise with surveys of its perception by people. Therefore, as Sztubecka and Sztubecki (2015) aptly remarked, an appropriate assessment of the acoustic climate in a health resort park should be performed on the basis of simultaneous sound measurements and questionnaire surveys. An observation about noise nuisance occurring in a given park does not necessarily correspond with the distribution of transport noise determined on the basis of measurements (Sztubecka et al., 2016) because individuals spending time in the park can pay attention to noise that is not encompassed by standards. A complete assessment can be obtained through questionnaire surveys that provide the basis for determining the subjective perception of noise nuisance. Another important aspect are the provisions in planning documents that allow specific ways of developing and using the space of health resort parks as they influence the acoustic quality of these parks.

According to Czarnecki (2017), the use of quiet pavement does not contribute to solving the problem of excessive noise in health resorts because this kind of pavement fulfils its function on roads with a speed limit of above 50 km/h. Restricting heavy vehicle traffic is a more promising option. Based on studies conducted for a stretch of provincial road no. 824 in Puławy, it can be concluded that introducing a traffic calming zone in health resorts can also have a beneficial

Fig. 4. Acoustic revitalization scheme for the Kołobrzeg health resort (Source: student's elaboration, modified)

influence on noise emission to the environment. In the case of that road, noise levels were reduced by more than 7dB in some road sections (Bohatkiewicz et al., 2014). Traffic calming is thus recommended for the reduction of noise in town/city centres, i.e. areas where the implementation of other measures (e.g. noise barriers or quiet pavements) can be very difficult or simply impossible.

It has been indicated recently that noise level standards for zone A in health resorts are difficult to comply with (e.g. Kuchcik and Baranowski, 2013; Dryglas and Golba, 2017), which results from the presence of various sources of noise, often over a vast area (from 70 to 350 ha), for example, in the vicinity of public roads with a high intensity of traffic. The total elimination of all sources of noise pollution and complying with the noise level standards for zone A would either be too costly or would require excessive interference with the environment (Dryglas and Golba, 2017). Noise in health resorts is generated by various sources in areas owned by many separate entities that are independent from one another. Furthermore, the permitted noise limits can also be exceeded owing to natural phenomena (e.g. the sound of the surf/the sea). Similar conclusions can be found in the final report of the team tasked with developing the concept of changes in the health resort treatment system (2017). In the report, attention is drawn to the fact that the standards existing so far have not distinguished sources of noise such as the rustling of leaves in the trees, birds singing, or the sound of the sea, and they treated these sources of noise in the same way as roadway noise. The team mentioned above recommends conducting at least two series of noise intensity measurements at various locations in a given health resort during the year preceding the issuing of the certificate confirming the therapeutic properties of the resort's climate. Measurements should be conducted in typical situations in a functioning health resort, taking into account traffic intensity (on workdays and holidays) and the time of day (daytime, night-time). The assessment of the acoustic climate should also include information about the sources of noise (natural, anthropogenic), the duration of the violations of noise level standards, and the acoustic background level. The solutions proposed are very important because health resort districts are not legally bound to conduct environmental noise intensity measurements. So far, district governments have been able to obtain this information from the national environment monitoring system and acoustic maps; however, these do not fully reflect the current state of the acoustic climate in health resorts. Furthermore, an amendment is proposed to the ordinance concerning the permitted environmental noise levels in order to restrict the most stringent standard to areas of health resort treatment centres, similar to the standards applied to areas of hospitals outside of cities. The remaining area of zone A would be subject to the next less stringent standard, appropriate for areas with single-family housing, areas with buildings related to permanent or temporary stays of children and youth, areas of care homes, and areas of hospitals in cities (61 dB during the day, 56 dB at night). Additionally, it is recommended that health resorts are granted the right to introduce, by way of a resolution of the district council, restrictions on the traffic of certain categories of motor vehicles along public roads in these districts. The proposed solutions have the potential to prove effective in the face of the risk of losing health resort status. However, constant attention should be paid to the quality of the soundscape in health resorts, especially considering the therapeutic role of soundscape.

8. Conclusions

The conducted studies have demonstrated that most health resorts in Poland have some soundscape values. However, these values may be lost because of the threat of noise from transport and tourism (including entertainment). The standards applicable in zone A of health resorts are frequently violated, which can lead to the deterioration of therapeutic values and the loss of health resort status. Health resorts in Poland thus need revitalization measures aimed at achieving a high

quality of soundscape. Acoustic revitalization, including acoustic design in the regeneration of degraded areas, is essential in modern times characterised by the prevalence of noise. Acoustic revitalization by exposing characteristic and valuable sounds contributes to the recognisability of places, strengthens their geographical and cultural identity, and their unique character, while the soundscape acquires a new quality. In the light of the conducted research, it is necessary to first of all limit the traffic of cars, to designate noise-free zones and tranquil areas and to expand green areas. The following measures related to urban transport and traffic management are also important: designating traffic calming zones, keeping heavy vehicle traffic out of zone A, supporting pedestrian and bicycle traffic. It is also necessary to include noise reduction provisions in local spatial development plans, apply appropriate standards to specific areas, choose suitable locations for new facilities, observe the law of zoning, and reduce nuisance caused by entertainment facilities (particularly at night). The achievement of the expected outcomes of revitalization schemes will only be possible if the schemes address the reasons of degradation. It is important to use a variety of solutions adapted to the specificity of the given location. At the same time, it is necessary to cooperate with specialists representing various scientific disciplines and with the owners (managers), local governments and users of health resorts.

It is important to implement remedial measures and maintain the image of health resorts as tranquil places with unique soundscapes. The acoustic revitalization of landscapes is thus a long-term goal in the development of Polish health resorts, especially in view of their therapeutic function and, consequently, the necessity of preserving high-quality soundscapes. These measures must be based on scientific research. As part of further research, the following in-depth fieldwork is planned: noise measurement, observation, soundwalks, soundscape evaluation, and questionnaire surveying of the expectations of health resort clients with regard to soundscape quality in health resorts. This research should have an interdisciplinary character, in accordance with the principles of acoustic ecology.

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Krajobrazy dźwiękowe uzdrowisk w Polsce i ich rewitalizacja

Streszczenie

Celem badań było rozpoznanie potrzeby oraz możliwości ochrony i rewitalizacji krajobrazów dźwiękowych uzdrowisk w Polsce. W postępowaniu badawczym przeprowadzono analizę uwarunkowań prawnych funkcjonowania uzdrowisk w Polsce. Następnie rozpoznano zagrożenia hałasem i wartości krajobrazów dźwiękowych oraz zaproponowano działania w zakresie rewitalizacji akustycznej w wybranych uzdrowiskach. Przeprowadzono kwerendę literatury naukowej oraz operatów uzdrowiskowych i raportów kontrolnych. Następnym etapem był sondaż diagnostyczny z wykorzystaniem ankiety adresowanej do samorządów gmin i miejscowości uzdrowiskowych w Polsce. W dyskusji odwołano się m.in. do rekomendacji zespołu ekspertów w zakresie zmian w systemie lecznictwa uzdrowiskowego w Polsce. Badania wykazały, że większość uzdrowisk w Polsce posiada pewne walory dźwiękowe krajobrazu. Jednak pod wpływem presji komunikacyjnej i turystycznej odpowiedzialnej za zagrożenie hałasem mogą one zostać utracone. Miejscowości uzdrowiskowe w Polsce wymagają zatem podjęcia działań rewitalizacyjnych ukierunkowanych na kształtowanie wysokiej jakości dźwiękowej krajobrazu.

Słowa kluczowe: krajobraz dźwiękowy, hałas, uzdrowisko, rewitalizacja, Polska