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Silenzi In Quota – An Initiative Promoting Soundscape Protection In Mountainous Natural Areas

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ABSTRACT

Silenzi in Quota (SiQ, Silence at High Altitude) is a forward-looking initiative bringing together artists and researchers to explore soundscapes of mountainous natural areas. SiQ is interested in landscapes that people visit to connect with nature and find respite from the urban experience - places where a high-quality soundscape would be expected but the effects of overtourism are often observed. The initiative started in 2021 in Trento (IT), based on expeditions in the Dolomites (IT) and, by 2024, it had expanded to include soundwalks in Italy, Scotland (UK), Finland and Norway. Key outputs of the initiative include: 1) free, public events such as soundwalks and soundscape workshops; 2) documentary footage and social media content; 3) the open-access *Silenzi in Quota* Dataset: Questionnaires with Acoustical and Contextual Information from Soundwalks in Protected Natural Areas; 4) scientific output explaining the effects of environmental sounds on human perception in protected natural areas. Looking ahead, SiQ aims to develop connections between soundscape research focused on human perception and ecoacoustics, highlighting the threats to and potential of sound in nature, and collecting the evidence needed to support management and preservation of these invaluable sensory environments.

Keywords: *soundscape, natural area, overtourism, anthropogenic noise, public engagement.*

1. INTRODUCTION

Protected natural areas are commonly perceived as landscapes of exceptional natural beauty and ecological significance. While visual aesthetics are often emphasized in their promotion, as well as preservation, the acoustic dimension of these environments remains comparatively underexplored. However, soundscapes within natural parks contribute not only to ecological processes but also to human well-being and the quality of recreational and touristic experiences [1–3]. Nonetheless, these soundscapes are increasingly compromised by anthropogenic noise sources, including vehicular and air traffic, often driven by overtourism [4,5]. Assessing individuals' auditory perceptions in such settings is essential for the effective management and preservation of these acoustic environments. Furthermore, fostering public awareness of the importance of natural soundscapes is critical in promoting sustainable tourism behaviours and ensuring long-term environmental protection.

These are the objectives of *Silenzi in Quota* (Silence at High Altitude), a collective founded in Trento (IT) in 2021 that brings together international soundscape researchers, musicians, sound artists, photographers, and filmmakers [6]. From the scientific point of view, this multidisciplinary initiative includes acoustic monitoring and measurements and perceptual assessments to investigate soundscapes in high-altitude protected environments, including the

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Dolomites, the Scottish Highlands, and Nordic regions. These mountain soundscapes are examined and communicated through soundwalks, which serve as both a scientific method—utilizing binaural recordings and participants as perceptual sensors—and a tool for environmental education. By emphasizing the role of sound as an ecological indicator and an element of natural heritage, these soundwalks facilitate a shared listening experience that enhances public understanding of acoustic ecology. By engaging local communities and visitors, the initiative supports informed conservation efforts and contributes to the sustainable management of these vulnerable ecosystems.

This paper brings an overview of the activities delivered by *Silenzi in Quota* since 2021, positioning them as a valuable contribution towards understanding of human auditory perception in natural context together with the related measurable and policy-controllable factors.

2. SOUNDWALKS AND SOUNDSCAPE WORKSHOPS

Expeditions, soundwalks and soundscape workshops are the core activity of *Silenzi in Quota*. In 2021, the initiative started by leading eight soundscape-focused expeditions in the Dolomites. In 2022, their expeditions expanded to start including soundwalks. By 2025, nine soundwalks were completed, engaging 143 participants. Six soundwalks were organised in the Dolomites (IT), one in Scottish Highlands (UK), one in Lapland (FI) and one in Rondane (NO), as shown in **Tab. 1**.

Each soundwalk follows the principles of the ISO/TS 12913-2 [7], featuring 3-8 listening stops, carefully selected to represent a variety of acoustic environments, deliberately seeking contrast and controversial topics that may trigger reflection on environmental justice and climate crisis. Participants are invited to listen in silence and fill out a questionnaire, adapted from the ISO/TS 12913-2 Method A, while researchers collect three to five minutes of calibrated binaural recordings. Where possible, the listening points are documented in three dimensions using a 360 camera and a First Order Ambisonics kit, as per the Recording Stage of the Soundscape Indices Protocol [8].

Table 1. List of soundwalks and expeditions conducted.

Session / Expedition (E) or Soundwalk (SW)	Protected Natural Area	Date
Becco di Filadonna (E)	N/A (Vigolana Group, IT)	26-27/06/2021
Cima delle Stellune – Paneveggio (E)	Pale di San Martino Natural Park (IT)	2-3/07/2021
Cima d’Asta (E)	N/A (Lagorai Group, IT)	17-18/07/2021
Cima Fradusta (E)	N/A (Lagorai Group, IT)	14 th August, 2021
Cima Sassara (E)	Adamello Brenta Natural Park (IT)	3-4/09/2021
Cima Zoccolo (E)	Stelvio National Park (IT)	11/09/2021
Sass Pordoi (E)	N/A (IT)	9-10/10/2021
Dosso di Costalta (E)	N/A (Lagorai Group, IT)	9/02/2022
Lago di Braies (SW)	Fanes-Sennes Braies Natural Park (IT)	24/04/2022
Val Venegia (SW)	Panaveggio–Pale di San Martino Natural Park	19/06/2022
Passo Rolle (SW)	Panaveggio–Pale di San Martino Natural Park	12/02/2022
Glen Lui (SW)	Cairngorms National Park (UK)	28/05/2023
Tre Cime di Lavaredo (SW)	Tre Cime Natural Park (IT)	25/06/2023
Alpe di Siusi - Seiser Alm (SW)	N/A (IT)	17/12/2023
Mallan Luonnopuisto (SW)	Malla Strict Natural Reserve (FI)	21/02/2024
Bjørnholia – Illmandalen (SW)	Rondane National Park (NO)	24/07/2024
Lago di Carezza (SW)	N/A (IT)	8/12/2024



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After the listening session, a sharing moment is offered, allowing participants to express their thoughts on the acoustic environment and their perceptual responses. Where possible, this is followed by a roundtable, where researchers would present how *Silenzi in Quota*'s soundwalk data can be represented and analysed, what scientific evidence has been gathered so far, and how these findings have been used in artistic works and public engagement initiatives. This activity is a unique feature of *Silenzi in Quota* work, demonstrating how arts and research come together utilizing state-of-the-art analytical tools, aimed at raising awareness and informing planning and management of natural areas.

3. DOCUMENTARY FOOTAGE AND PUBLIC ENGAGEMENT

The expeditions and the soundwalks act also as an arts medium led by a team of sound engineers/artists, photographers and film makers. A documentary movie (**Fig. 1**) was produced, including footage from the eight expeditions in 2021 and the soundwalks 2022-23, which serve as a backdrop to the central thread featuring interviews with individuals about the phenomena surrounding soundscape in mountains. The aim was to highlight the impact of sound in experiencing not only the mountains but also the overall natural environment, which has become increasingly distant for people from urban areas. It also seeks to encourage reflection on the heritage—not just visual but also sonic—that regions such as Trentino, Scotland, and the Arctic Circle struggle to preserve. The documentary was screened at the Trento Film Festival 2025, as part of the “Special screenings_Special events, tributes and restored films, ranging from silent movies to contemporary experimentation”.

As another means of public engagement, video and audio footage from the Nordic soundwalks was featured at an exhibition in the Natural History Museum in Oslo (NHM) and the Climate House [9]. The aim of these exhibits was to lead participants through their expectations of mountain sounds of Norway via a recreated soundwalk of the iconic mountain area of Rondane National Park. People were able to witness how their expectations of natural quiet did not necessarily match the recorded footage of hiking routes in the area. They reflected on the experience as results of the soundwalk conducted in July 2024 were presented in two formal talks connected to the exhibit.

These activities are not only raising awareness of the noise-driven issues in protected areas but also allowing the public to learn about the latest research efforts aimed at managing them, demonstrating the impact of changes individuals can make to improve the natural environments.



Figure 1. Poster for the SiQ documentary.

4. OPEN ACCESS DATASET

The *Silenzi in Quota* Dataset [10] was conceived as an evolving, publicly available online repository containing the results of the expanding number of soundscape assessments completed in various protected natural areas across the world. The data, collected onsite, in line with the ISO/TS 12913-2: 2018 Method A [7], features questionnaire responses and acoustic analyses' output.

While all the data available at the time of writing this report, has been collected by the *Silenzi in Quota*, the authors would welcome contributions from other teams across the world, which followed the same data collection protocol.



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5. SCIENTIFIC OUTPUT

The scientific output by SiQ contributes to the body of research that is building evidence on both the positive effect of natural acoustic environments on human health and well-being, and the adverse effects of anthropogenic noise in natural areas on humans and the whole habitats. While the ISO 12913 methods are being extensively utilized for research in urban areas in the recent years, the application of mixed methods approaches and statistical predictive modelling by the SiQ researchers in mountainous natural areas provides new insights into the environmental acoustics and soundscape.

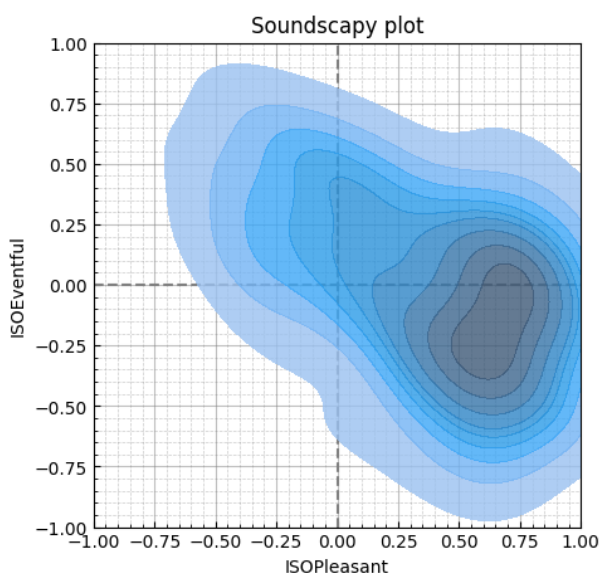


Figure 2. A density plot showing the range of subjective soundscape outcomes from the *Silenzi in Quota* soundwalks, in the two-dimensional perceptual space defined by ISOEventful and ISOPleasant, as recommended in [13].

Indeed, the SiQ researchers have confirmed that soundscape in natural areas varies from very calm perception to chaotic, as shown in **Fig. 2**. While previous studies have confirmed that experience of human sounds in natural areas can lead to negative perceptual outcomes [4], the decibel-only monitoring doesn't capture this perceptual quality of an acoustic environment. The initial SiQ findings, based on 443 questionnaires gathered across 28 evaluation points, together with the corresponding binaural measurements, revealed a strong association between the

dominance of human sound sources, increase in (psychoacoustic) tonality and the perception of chaotic soundscapes – unlike in urban context [11,12]. This implies that monitoring an index such as tonality, instead of level-only indices, could allow for more sustainable management of visitors in natural areas.

It is hoped that this work is paving the way for future standardisation of soundscape investigations in PNAs and sustainable approach to visitors' numbers and behaviour.

6. CONCLUDING REMARKS

Silenzi in Quota initiative demonstrates an effective way to combine artistic and research activities aimed to inform policy, planning and management of protected natural areas across the world. The various collected material is valuable for research, particularly for understanding visitors' auditory perception and the related measurable and policy-controllable factors, such as the evidence that soundscape in natural areas isn't always what people would expect it to be, and that a large portion of its quality is in the visitors' own hands. These also serve as raw material for artistic derivations to shape and make tangible the delicate balance between the soundscape in protected natural areas, its inhabitants, and overtourism. Examples include a documentary screened at the Trento Film Festival and a sound installation featured at the *Signal To Noise 4.0* music festival (installation by Enrico Dorigatti). The initiative was awarded the *Highly Commended John Connell Soundscape Award 2023*.

Looking ahead, SiQ aims to develop connections between soundscape research focused on human perception and ecoacoustics, highlighting the threats to and potential of sound in nature, and collecting the evidence needed to support management and preservation of these invaluable sensory environments.

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