



Collecting and mapping soundscape data across the 15 UK National Parks

Tin Oberman¹
University College London
Central House, WC1H 0NN, London, UK

Francesco Aletta
University College London
Central House, WC1H 0NN, London, UK

Peter Stollery²
University of Aberdeen
MacRobert Building, AB24 5UA, Aberdeen,
UK

Jian Kang
University College London
Central House, WC1H 0NN, London, UK

ABSTRACT

The soundscape approach, as understood by the ISO 12913 series, is most applied in urban settings, aiming beyond noise control in order to holistically employ its quantitative and qualitative facets. On the other side, the current understanding of the soundscape concept in bioacoustics and acoustic ecology is less focused on perception. There is generally a lot of public interest in how to preserve the opportunity for people to experience the “natural quiet” and “the sounds of nature”, and the need to balance that with the protection of the natural areas and national parks from the noise that the visitors themselves generate while on site. However, specific investigations in these environments are scarce in the United Kingdom. Moreover, while there might be acoustic environments and sound sources that people identify with national parks, they are not systematically documented nor implemented in the national parks’ management plans. Therefore, we propose a framework starting with a quasi-crowd-sourced acquisition of soundscape data and mapping those to a freely accessible GIS platform such as Google Earth, leading towards identifying soundscape conservation targets and management tools for the UK national parks, further raising the awareness of the value of sound as a resource.

1. INTRODUCTION

Soundscape is created by all the sounds around us - sounds of plants and animals, non-biological ambient sounds (wind, rain, storms, ice breaking), human sounds (people talking and walking) and mechanical sounds (traffic and construction noises). It is an auditory environment, perceived in context, by people. It changes through time and space, it changes through seasons and it changes over the territory, while those who create it also interact with it.

In National Parks this interaction becomes apparent when we realise how our presence changes the very ambience we came to experience as visitors. National Park Service in the US tries to preserve natural soundscapes that exist in the absence of human sounds and noises, as well as to restore those degraded. *One Square Inch of Silence*, for instance, is advertised as the quietest place in the US, and while it is not by any means large, it is far enough from any roads and flightpaths to be considered

¹ t.oberman@ucl.ac.uk

² p.stollery@abdn.ac.uk

as not affected by human and mechanical sounds. The small size of it is a worrying example of how wide-spread noise pollution is, but it is an effective tool for soundscape management, driving the environmental awareness [1].

Soundscape research has been growing steadily over the past 20 years. While in its current understanding the soundscape approach in Europe is mostly applied in urban settings, concerning the human perception primarily, the concept itself is very well rooted in bioacoustics and acoustic ecology more generally [2]. Indeed, research on soundscape in natural areas and national parks in other countries of the world is quite developed. For instance, in the United States, a lot of research has been carried out about how to manage, preserve or restore natural sound environments in natural parks and protected areas [3,4]. Another example from the US, from Yosemite, reveals a National Park Service Natural Sounds Program featuring a similar focus on the concept of pristine nature and wilderness [5]. This action had impact in terms of changing the flight corridors and a campaign putting up signs asking visitors to be quieter whilst hiking.

There is generally a lot of public interest in how to preserve the opportunity for people to experience the “natural quiet” and the need to balance that with the protection of the abovementioned areas from the noise that the visitors themselves generate while on site [6]. In the United Kingdom, there is research being carried out around the soundscape dimensions of *tranquility*, *quietness* and *wildness* [7,8]. Even though all such dimensions are very relevant for the context of national parks, specific investigations in these environments are scarce in the UK. Hence, the need for explorative research in this direction.

Currently, national parks in the UK operate with the concept of special quality, based on the natural beauty, wildlife and cultural heritage [9]. When thinking about soundscape, this implies the following key requirements related to national parks:

- There is a need to recognise and capture exceptional sounds and acoustic environments.
- There is a need to observe contribution of both natural and cultural heritage on soundscape.
- There is a need to be able to preserve those sounds and acoustic environments in a certain way.

Therefore, the proposed investigation is wrapped around the following key questions:

- How to recognize an acoustic environment emblematic of a national park? Do such acoustic environments exist in the UK national parks?
- Can such an acoustic environment become listed amongst special qualities which are being protected and promoted within a national park’s area?
- How to identify planning and management tools which would be most effective in protecting acoustic environments of national parks in the UK?

2. METHODOLOGICAL FRAMEWORK

Given that the Methods A and B of the ISO 12913 series on soundscape [10–12] feature questionnaire tools developed on case studies of urban acoustic environments, they are not likely to provide information on soundscape and sound source characterisation that would necessarily capture all the specifics needed for a hypothetical soundscape management plan of an area such as a national park. Therefore, a specific framework for capturing and characterising national park soundscapes is needed. Indeed, the Method C of the ISO/TS 12913-2 is based on interviews, which isn’t practical to employ for monitoring perceptual outcomes of large areas over an extended period of time, but it could rather be used to develop a dedicated questionnaire tool. Moreover, the examples from the United States imply an orientation towards visitors’ experience of untouched wilderness, and national parks in the UK cover a vast area consisting of natural, cultural, rural and urban landscapes, so a more inclusive and sustainable approach is sought. This paper elaborates on the *Collecting and mapping soundscape data across the 15 UK National Parks* project, aiming to build such a framework, starting with focus groups and quasi-crowd sourced data collection.

2.1. Focus Groups

Focus groups are planned to be held online and transcribed for further analysis, to be used for building a tool for soundscape characterisation.

Several groups of stakeholders were considered for the first stage of the project: residents, local artists, local businesses, scientists engaged around the sites of interest, and visitors. National Park staff has been selected as group to be invited first to take part in the project because they were considered most likely to overlap with the above-mentioned groups and to cover the following: hands on experience with large areas of the park, managerial perspective, and residents' perspective. These were prioritised given the aim to go beyond the visitors' perspective. Staff backgrounds cover a range from members of communication teams to rangers and age groups above 18 years with no upper limit. The questions and talking points for the focus groups are shown in Table 1. The questions were conceived to get participants thinking about soundscape in a personal and engaging way and to elicit as wide of a spread of ideas as possible. Stories about single sound sources are expected to be picked up equally valuable as thoughts on the complete acoustic environments and ambiances. It is expected that the discussion will reveal potential associations between the emblematic sound/environment and perceptual dimensions characteristic for the ISO 12913 series and the before mentioned explorations of the constructs such as tranquillity and wildness. Further, it is expected this will reveal the level of connection between an emblematic sound and the special quality of a park.

Table 1: Questions and talking points for the focus groups.

Theme	Focus group question	Subquestions – talking points
Q1 - Ice breaker question	What sounds do you particularly like / hate (choose)?	This could be anything - a part of a song you love, a sound of your kettle in your kitchen, a sound you remember from your childhood, a sound your neighbour annoys you with...
Q2 – Sound source characterisation	Can you recall specific sounds from your park?	Could you describe them as natural sounds or human sounds? would you call them positive or negative? Would those be single sounds or unique complex environments? Would you call them emblematic?
Q3 - Seasonality	At what times of day / year can you experience that sound?	Would you say it can be considered an everyday sound in your park or you need to be lucky to experience it?
Q4 - Exit question	How would you go about the emblematic sound if you were to protect it?	
Q5 - Exit question	What the park you work in is about - in one sentence?	

2.2. Field Recordings

Quasi-crowd sourcing process of field recording is relying on the same population of participants as the focus groups. Given the range of experience the volunteers have in audio recording, as well as the limitations of the available equipment, use of mobile handheld devices is encouraged. The selection and the number of audio recordings to be submitted to the project team is steered by the focus group discussion but otherwise left entirely on to the volunteers.

Following the recommendations outlined in the ISO/TS 12913-2, the minimum equipment needed for the data collection needs to consist of: 1) sound level meter (and an acoustic analyzer), 2) stereo recorder. It is important to capture both aspects of the audio to acquire 1) objective indication about sound levels, frequency composition and time structure of an environment considered to be emblematic; 2) representative, good-quality audio recording so it can be listened to, analyzed for sound source composition, and be used for outreach purposes, i.e. published on Google Earth. Hence, the need to have two devices which would ideally be used in parallel or subsequently one after another within the same session. It is presumed that calibrated hand-held devices would provide sufficient precision and reliability for the purpose [13,14].

2.3. Sound Map

An open access, GIS-based sound map was conceived as one of the project's key deliverables, as well as a means of further engaging the Parks and the public. Areas of the 15 parks are outlined on the map, and by clicking on each of them an audio recording is played, followed by a brief textual description. Each Park is expected to accommodate for various 'emblematic audio recordings', geo located on the map.



Figure 1: The screenshot of the mock-up of what the map in Google Earth might look like.

2.4. The Seasonality and Climate Change

Having in mind the expected seasonality of the acoustic environments in question, the initial data collection should be a longitudinal process. This is due to the inherent seasonality of the phenomena observed as certain sound sources are not equally present throughout the seasons, or years. It is crucial to establish the longitudinal approach to this, with monitoring, so data would not be lost due to the increased fluctuations in weather conditions due to the ongoing climate change. Within this stage, this would remain on parks' management and staff being trained and motivated to continuously take this issue into account and log their observations when they find it appropriate.

3. CONCLUDING REMARKS

Given the wide-spread interpretation of a national park as a place of preserved natural beauty intended for consumption by tourists/visitors, the idea that a preserved natural environment in question needs to sound like one, provides an opportunity to spark the conversation about an often-neglected factor such as soundscape. The aim of this project is however, to go beyond this prejudice and help developing an inclusive and sustainable framework for national park authorities to be able to manage the parks soundscape for all the stakeholders equally.

This paper has set a methodological framework of the *Collecting and mapping soundscape data across the 15 UK National Parks* project. The project is aimed at starting a conversation about soundscape between the National Parks and empowering them with a tool to start managing acoustic environments across their respective territories.

The initial activities are the focus group discussions and field recording exercises, where an online sound map is introduced to facilitate the later and increase the visibility of the results, as well as the potential outreach of the project. This activity is hoped to build towards a large-scale soundscape crowd-sourcing campaign in the future.

Further analyses of the data collected via the focus groups, triangulated with basic environmental acoustic indicators extracted from the field recordings are expected to facilitate building a tool for soundscape assessment in the UK national parks, likely expanding on the principles of the Methods A and B of the ISO 12913 series.

It is hoped that developing a soundscape approach for parks, and adding the human perception of parks' acoustic environments on top of the knowledge gathered from the existing bioacoustics monitoring research, will further and more directly raise the awareness of the impact human activities have on the environment, in the face of a global crisis such as climate change.

4. ACKNOWLEDGEMENTS

The authors gratefully acknowledge support of the UKAN+ and the forthcoming staff of the national parks. The UCL authors are also supported by the European Research Council (ERC) Advanced Grant (no. 740696) on "Soundscape Indices" (SSID).

5. REFERENCES

1. Hempton G, Grossmann J. One square inch of silence: one man's search for natural silence in a noisy world. 1st Free Press hardcover ed. New York: Free Press; 2009.
2. Truax B. Handbook for Acoustic Ecology [Internet]. Cambridge, MA: Cambridge Street Publishing; 1999. Available from: <https://www.sfu.ca/sonic-studio-webdav/handbook/index.html>
3. Krause B, Gage SH, Joo W. Measuring and interpreting the temporal variability in the soundscape at four places in Sequoia National Park. *Landscape Ecol.*,**26(9)**,1247–56 (2011).
4. Miller NP. US National Parks and management of park soundscapes: A review. *Applied Acoustics.* **69(2)**,77–92 (2008).
5. Newman P, Fristrup K, Trevino K, Lawson S, Taff D, Weinzimmer D, et al. Protecting soundscapes in U.S. National Parks: lessons learned and tools developed. *The Journal of the Acoustical Society of America.* **131(4)**,3381–3381 (2012).
6. Lynch E, Joyce D, Fristrup K. An assessment of noise audibility and sound levels in U.S. National Parks. *Landscape Ecol.* **26(9)**,1297–309 (2011).
7. Pheasant RJ, Watts GR. Towards predicting wildness in the United Kingdom. *Landscape and Urban Planning.* **133**,87–97 (2015).

8. Watts GR, Pheasant RJ, Horoshenkov KV. Predicting perceived tranquillity in urban parks and open spaces. *Environ Plann B*. **38(4)**,585–94 (2011).
9. National Parks UK [Internet]. National Parks UK; [cited 2021 Dec 8]. Available from: <https://www.nationalparks.uk>
10. International Organisation for Standardization. ISO 12913-1:2014 Acoustics — Soundscape — Part 1: Definition and conceptual framework. 2014.
11. International Organisation for Standardization. ISO/TS 12913-2:2018 Acoustics — Soundscape — Part 2: Data collection and reporting requirements. 2018.
12. International Organisation for Standardization. ISO/TS 12913-3:2019 Acoustics — Soundscape — Part 3: Data analysis. 2019.
13. Celestina M, Hrovat J, Kardous CA. Smartphone-based sound level measurement apps: Evaluation of compliance with international sound level meter standards. *Applied Acoustics*. **139**,119–28 (2018).
14. Kardous CA, Shaw PB. Evaluation of smartphone sound measurement applications (*apps*) using external microphones—A follow-up study. *The Journal of the Acoustical Society of America*.**140(4)**,EL327–33 (2016).