Habitats: Managing the ecological impacts of noise on wildlife habitats for sustainable development

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ABSTRACT

The objective of the Habitats project is to integrate research in the fields of ecological impacts and of environmental noise, developing management tools and processes to enable sustainable development. Rapid population expansion and economic development against the backdrop of climate and biodiversity crises presents major global challenges. Global society is dependent on ecosystem services, underpinned by biodiversity. In the UK alone, these ecosystem services have been valued by the Office for National Statistics in 2015 at £761 billion and human noise impacts will significantly degrade that value unless managed appropriately. We no longer consider nature to be separate from our economy and society, since it needs to be part of business, cultural and economic decision making. The Habitats project is leading the development of an international industrial and academic network to research and explore new ways and innovative technologies to better measure, understand and model the effects of noise on wildlife habitats. However, current noise pollution legislation is focused on humans; despite policy aspirations, there is no systematic approach to assessing, regulating, or mitigating noise impacts on wildlife. This project will develop the rigorous scientific evidence required for underpinning environmental noise legislation, regulation, and policy development for managing the ecological impacts of noise on wildlife habitats.

1. INTRODUCTION

Rapid population expansion and economic development against the backdrop of climate and biodiversity crises presents major global challenges. Global land area needs to be managed differently, driving changes in ecological soundscapes. Managing natural habitats in the built environment can provide important contributions to tackling the climate and biodiversity crises. Importantly, this can be done in a way that provides economic benefits and sustainable development to the organizations and local communities involved.

Noise environments are changing significantly due to the wide adoption of various technologies, including electric vehicles, drones, and heat pumps. There is a pressing need to develop assessment tools and polices to ensure that the changing noise environment does not significantly impact on biodiversity. Conversely, the introduction of natural sounds such as birdsong or water sounds to the urban environment, even if urban sounds are not completely masked, can improve the urban soundscape quality, therefore improving perceptual reactions. The University of Salford is funding the *Habitats* initiative to address these challenges, commencing with the appointment of a

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postdoctoral research assistant in June 2022. This paper outlines the aims and objectives, methodology, novelty and aspirations for the project.

2. AIM & OBJECTIVES

The overall aim of this work is to cultivate and deliver innovative and interdisciplinary research for managing ecological impacts of noise that will have demonstrable economic and social benefits. The project has two ambitions:

1. To study the impact of the urban soundscape on wildlife.
2. To study the impact of the wildlife soundscape in the urban environment on people.

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3. METHODOLOGY

Working across disciplines is essential to address the complex technical, social, and environmental challenges of managing the ecological impacts of noise on wildlife habitats for sustainable development. Consequently, the initial funding provided by the University of Salford will be used to:

1. Consolidate the interdisciplinary work in ecological impacts of noise performed between the Salford researchers since 2013, re-establishing and consolidating the record of accomplishment
2. Determine the state of the art, define the problem, and propose a programme of research to deliver a solution
3. Host a workshop to increase awareness of this work and to engage partners in the research programme
4. Develop a team of leading UK partners, lead and submit an UKRI (UK Research and Innovation) research proposal
5. Develop a team of leading international partners, lead and submit an EU or similar research proposal

Through this work, the wider consortium will be recognized as a global leader of challenge-led research and solutions-focused enterprise for managing ecological impacts of noise, delivering responsible innovation for economic, environmental, and social impact.

4. RESULTS

The *Habitats* project will develop a creative research & enterprise leader in a unique area of interdisciplinary innovation in managing noise impacts on biodiversity. They will bring together the fundamental principles of environmental acoustics and ecological biodiversity to address some of the emerging challenges related to the impact of noise on both humans and wildlife. This work is particularly important given the government's commitment to halt biodiversity loss, both in the UK and globally, given the vital role of biodiversity in underpinning human health and well-being.

During the period covered by this funding and beyond, the *Habitats* project will:

a) Consolidate and develop an international industrial and academic network
b) Bring to life a step-change in sustainable development methods by nurturing a new generation of PhD researchers that have expertise in both environmental acoustics and ecological biodiversity.
c) Transfer the benefits to policy makers, developers, and the public by transforming sustainable development ethos into practice.

In addition to leading the development of an international industrial and academic network and the subsequent development of major grant applications, the *Habitats* project will consolidate current research on the assessment of noise impacts on biodiversity. This will involve the systematic review of literature and mining of Open Access and in-house datasets to establish the evidence base for the

development of noise impact assessment for wildlife. This work will also inform the development of a conceptual model for noise impact.

5. POLICY RELEVANCE

5.1. International policy

As the most overarching international policy context, the UN's 2030 Agenda for Sustainable Development[1] is devoted to protecting, among other things, natural resources and biodiversity, on land and below water. Sustainable Development Goal (SDG) 14 sets out the aim to *"Conserve and sustainably use the oceans, seas and marine resources for sustainable development"*. SDG 15 asserts the intention to *"protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss"*. Going beyond the scope of SDGs 14 and 15, biodiversity and functional ecosystems provide the essential resources and ecosystem services that directly support a range of societal sectors and economic activities. Biodiversity is thus immediately relevant to the achievement of SDG 1 on ending poverty, SDG 3 on health, and SDG 8 on decent work and economic growth, and will have significant implications for achieving zero hunger (SDG 2) and the tackling of inequalities (SDG 10).

The Global Environment Outlook (GEO-6) Assessment[2] puts specific focus on the better protection of the public against health emergencies and the facilitation of healthy lives and well-being through, amongst others, health-promoting local environments. This work considers, for example, the health relevance of natural environments and ecosystem services as well as the One Health approach, ensuring that environmental risks affecting both humans and animals are tackled in an intersectoral manner.

5.2. European policy

The EU's Biodiversity Strategy for 2030[3] is a comprehensive, long-term plan to protect nature and reverse the degradation of ecosystems. The strategy aims to put Europe's biodiversity on a path to recovery by 2030 and contains specific actions and commitments. It is the proposal for the EU's contribution to the international negotiations on the global post-2020 biodiversity framework. A core part of the European Green Deal[4], it will also support a green recovery[5] following the Covid-19 pandemic.

5.3. UK national policy

The UK Government's 25 Year Environment Plan[6] sets out goals for improving the environment, *"within a generation, leaving it in a better state than we found it"*. It details how the UK government will work with communities and businesses to do this. The long-term environmental plan requires consideration of the often-hidden additional benefits of every aspect of the environment for national wellbeing, health and economic prosperity, including for decision making. The concept of Environmental Net Gain (ENG), an established principle in biodiversity features, although the National Planning Policy Framework[7] (NPPF) also requires that planning policies and decisions should encourage multiple benefits from land, including taking opportunities to achieve ENG.

6. IMPLEMENTATION STRATEGY

6.1. National implementation

In the UK, Defra are responsible for improving and protecting the environment. They aim to grow a green economy, and support the food, farming and fishing industries. Defra's primary source on the effects of noise and biodiversity[8] is implemented by the (English) Environment Agency, Scottish Environment Protection Agency (SEPA), Natural Resources Wales and Northern Ireland Environment Agency. These agencies have a duty to regulate noise from certain industrial processes to protect and improve the environment, public health and wellbeing.

6.1. Environmental Permitting and Guidance

These agencies issue environmental permits that have conditions requiring operators to control pollution, including noise and vibration, and have produced guidance[9] to help holders and potential holders of permits apply for, vary, and comply with their permits. This guidance covers how the

environment agencies will assess noise from certain industrial processes; what the law says must be done to manage noise and vibration; and advice on how to manage noise. The guidance details how to carry out a noise impact assessment and what operators should include in a noise management plan. This includes consideration of noise impacts on other species and habitats, for example when the site is next to a Site of Special Scientific Interest (SSSI) or nature reserve.

6.1. Operator Responsibilities

The UK environment agencies require operators to identify any potentially noise sensitive wildlife areas and consider both the threshold of hearing of the key sensitive species, and the characteristic of the sound source. Regarding potential impacts, the guidance notes that disturbances such as noise, light and proximity of humans can have an impact on wildlife, and that this could cause changes in behavior such as foraging; the pitch of bird song; reproduction rates; and population density.

6.1. Limitations of Technical Guidance

The UK environment agencies technical guidance recognizes that it is not appropriate to use the BS4142 methodology because that standard is based on human hearing and sensitivity to sound. The frequency of human hearing ranges from 20 to 20kHz, which is quite different to other species. For example, many species of birds have relatively insensitive hearing above 10kHz but are more sensitive at lower frequencies. Sounds that might trouble humans may not be detectable by other species, and vice versa. The guidance acknowledges that the impact of noise on non-human species is a growing area of research and must be considered on a species-by-species basis.

6. CONCLUSIONS

Working across disciplines is essential to address the complex technical, social, and environmental challenges of managing the ecological impacts of noise on wildlife habitats. This means that the *Habitats* project will need to develop and integrate the current state of the art in both acoustics and ecology in the impacts on wildlife habitats for sustainable development. This will require building effective strategic partnerships with leading industry and government partners to deliver interdisciplinary innovation.

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