Project Proposal Form – 2022 entry

Project Title	**OU12 - Building quieter greener cities with trees**
University (where student will register)	The Open University
Which institution will the student be based at?	As above
If other	
Theme (Max. 2 selections)	Climate & Environmental Sustainability ☒ Organisms & Ecosystems ☐ Dynamic Earth ☐
Key words	
Supervisory team (including institution & email address	**PI: Phil Wheeler, OU Philip.Wheeler@open.ac.uk** **Co-I: Keith Attenborough, OU keith.attenborough@open.ac.uk, Shahram Taherzadeh shahram.taherzadeh@open.ac.uk** **Kieron Doick, Forest Research. (External)**
Is the project co-designed by a student?	Yes ☐ No ☒
Is the PhD suitable for part time study?	Yes ☒ This is a requirement of NERC

Project Highlights:

- Understand how trees can help reduce urban noise pollution.
- Work with leading researchers on noise mitigation and urban trees.
- Develop skills in environmental monitoring and computer modelling of urban noise pollution.

Overview:

Noise pollution is a significant, but poorly appreciated, cause of illness in urban environments (Basner et al. 2014). It also has impacts on urban biodiversity (Francis et al. 2009). Trees have the potential to reduce noise pollution and provide many more benefits, but how they can be best used to do this is not well understood (Attenborough & Taherzadeh, 2016). The characteristics of different tree species, such as bark structure, trunk height, diameter, canopy structure and foliage density affect sound differently. In addition, trees planted as individuals along streets will have different effects on sound to those planted in groups in urban woodlands or forests. The influence of trees on the soils in which they are planted, and the litter and humus layers that develop under them, can contribute additional sound-modifying effects. Understanding the different effects of these variables will allow us to model the interactions between trees and noise in urban environments. This will allow us to better assess noise mitigation as an ecosystem service that trees provide, and account for it in the way that urban trees are managed. Using expertise at the OU in tree mapping with field surveys and acoustic monitoring, the models developed can be used to predict noise mitigation by urban treescapes. The latter stages of the PhD project will include simulating future treescapes as a tool for stakeholders to

better understand optimal placement, species composition and size of tree stands in an urban noise mitigation context.

This project will be based in Milton Keynes, one of the UK's greenest cities. It will take advantage of the city's extensive urban treescape, and work collaboratively with Forest Research's Urban Forest Research Group, Milton Keynes Council and The Parks Trust (the charity that manages much of MK's urban greenspace). This is a highly interdisciplinary, applied project. The successful PhD candidate will work across environmental science and engineering and with stakeholder organisations to generate results with real-world significance.

Methodology:

This project will use a combination of field surveys and acoustic modelling to understand the effects of trees of different species, sizes, ages and planting schemes (e.g. individual trees vs urban woodland) on urban noise reduction.

Specific activities will include:

- measurements of acoustic scattering by individual trees in order to understand how sound reverberation patterns differ between streets with differing tree configurations.
- measurements of sound attenuation through existing urban woodland against which to develop and validate models for such transmission
- exploring the relationship between foliage characteristics and the parameters that enable prediction of sound attenuation through foliage
- investigating the relationship between tree age, size and sound attenuation in order to forecast future noise mitigation as urban treescapes develop.
- Reconstructing 3D cityscapes from high resolution aerial imagery to model noise mitigation by trees a city scales.

Training and skills:

Students will be awarded CENTA2 Training Credits (CTCs) for participation in CENTA2-provided and 'free choice' external training. One CTC equates to 1⁄2 day session and students must accrue 100 CTCs across the three years of their PhD.

Students will receive training in field methods for acoustic sampling and urban tree surveys. Enthusiasm for, and an ability to carry out, fieldwork to a high standard is essential. There will be additional training in acoustic modelling using state of the art software tools and advanced statistical analysis. Since a significant portion of the project will involve computer modelling, experience of some computer programming (in e.g. R, Python, Matlab) would be valuable.

Partners and collaboration:

The project will be delivered in partnership with Forest Research, the UK's leading forestry research organisation, Milton Keynes Council and The Parks Trust. This will give the PhD candidate an excellent insight into the practical applications of their research and provide them with links to professional networks that will benefit their future career prospects.

COVID-19 Resilience of the Project:

The fieldwork to be carried out can be done in a socially distanced way. Since it is outdoors and does not require large groups of people it should be resilient to any future changes in the rules on group gatherings. A significant part of the project involves computer modelling of sound and its interaction with trees. This desk-based work will be able to continue in the event of fieldwork being disrupted by future COVID-19 lockdowns and this could be developed into the core of the project if making ground measurements became impossible.

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Possible timeline:

Year 1: Literature review; Site selection; Methods development; Initial field Surveys – characterising species-specific effects.

Year 2: Building species-specific models; Field surveys expand species-specific effects; Field surveys on tree planting arrangement, size and age.

Year 3: Synthesising field and model results to develop predictive models of noise mitigation in future treescapes; Writing up.

Further reading:

Attenborough, K. and Taherzadeh, S., 2016. Sound propagation through forests and tree belts. Proceedings of the Institute of Acoustics, 38(1), pp.114-125.

Basner, M., Babisch, W., Davis, A., Brink, M., Clark, C., Janssen, S. and Stansfeld, S., 2014. Auditory and non-auditory effects of noise on health. The lancet, 383(9925), pp.1325-1332.

Francis, C.D., Ortega, C.P. and Cruz, A., 2009. Noise pollution changes avian communities and species interactions. Current biology, 19(16), pp.1415-1419.

Further details:

Please contact **Dr Phil Wheeler,** Philip.wheeler@open.ac.uk for further information.

Applications should include:

- an academic CV containing contact details of three academic references
- a CENTA application form, downloadable from: CENTA application
- and an Open University application form, downloadable from: Home OU application form (if you are resident in the UK) or an Overseas OU application form (if you are an international applicant).

Applications must be sent to **STEM-EEES-PHD@open.ac.uk** **by Friday 7th January 2022 (12 pm, noon)**