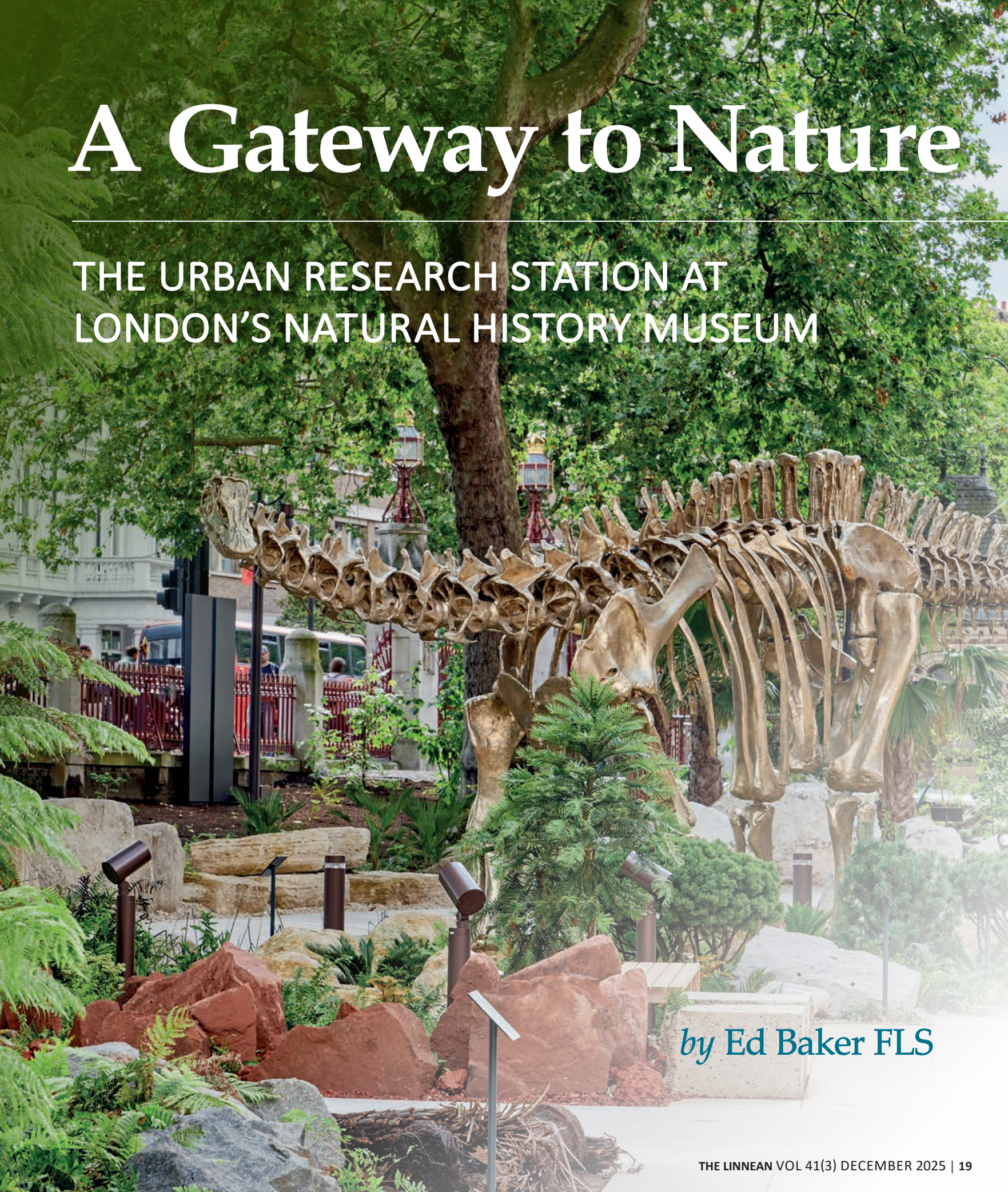
A Gateway to Nature

THE URBAN RESEARCH STATION AT LONDON'S NATURAL HISTORY MUSEUM



by Ed Baker FLS

PREVIOUS PAGE: A bronze replica of 'Fern', a *Diplodocus* skeleton set amongst plants, evocative of a Jurassic fern prairie.

BELOW: The pond was enlarged as part of our effort to create larger areas of better-connected habitats. We have also planted additional areas of scrub, woodland and wildflower grassland across the western gardens. (LEFT: The pond in 2020, RIGHT: In 2024)

It is forecast that 68% of the world's population will live in cities by the year 2050 (United Nations 2018). Natural history museums can play a pivotal role in publicly addressing the interconnected biodiversity and climate crises (Baker *et al.* 2025). Here, Ed Baker FLS looks into how the green public spaces of these institutions can serve not only as places for public education and engagement, but also as vital research centres for understanding biodiversity and ecology in urban environments.

The recent redevelopment of the gardens at the Natural History Museum's site in South Kensington (Baker *et al.* 2025) has enabled the London-based Museum to use new technologies alongside existing techniques to begin collecting datasets that can be used for generating effective urban policy. In short, we aim to address the question 'how can we make urban environments better for people and for nature?'

The gardens and their hidden biodiversity

Since the establishment of the original Wildlife Garden in 1995, more than 3,400 species have been recorded visually, representing approximately 26% of the species documented across Greater London (McCarter *et al.* 2022; NBN Atlas 2025). While clearly skewed by onsite expertise, these figures underscore that even small urban green spaces can harbour significant biological diversity. Despite these remarkable figures, much of the biodiversity on the site remains underexplored scientifically and invisible to the public.

The recently concluded Urban Nature Project has allowed us to re-evaluate the use of our grounds through a large redevelopment, creating three distinct new gardens for education and research.

The **Evolution Garden** brings the educational ethos of the Museum into the gardens, an outdoor gallery where visitors walk through geological time. The planting scheme is evocative of phases throughout the history of the Earth System, and complemented with bronze sculptures, including Fern, a bronze recreation of a *Diplodocus* skeleton.

The **Nature Discovery Garden** expands the previous Wildlife Garden to surround the Western façade of the Waterhouse building with larger areas of better-connected habitat. Two approaches have been taken to highlight the hidden biodiversity to our visitors. An accessible sunken walkway through the

Images: (Previous Page) Trustees of the Natural History Museum, London; (This page) Ed Baker

pond system brings the water surface to eye level, offering unique views into the aquatic environment and facilitating safer pond dipping with school groups. Secondly, sound funnels play recordings of nature from inaccessible environments—soils and the inside of decomposing wood. These sound funnels link to collections within the Museum, which has a collection of recorded wildlife sound (Baker *et al.* 2015) and active research projects in the gardens where we are actively investigating the soundscapes in these understudied areas.

Finally, the **Darwin Centre Courtyard** has been recreated as a climate-change garden, featuring plants that thrive in London's heat island, as well as de-paved areas that are experiments in urban re-colonisation. This environment allows us to study the novel ecosystems of contemporary cities, driven in part by imported plants and warmer microclimates.

The creation of permanent gardens, whether ornamental (Evolution Garden), representative of natural habitats (Nature Discovery Garden), or experimental (Darwin Centre Courtyard), has allowed a step-change in how we are able to monitor their biodiversity.

In addition to standard, manual, survey protocols, we have now included environmental DNA (eDNA) sampling and acoustic monitoring to capture dynamic and often invisible aspects of urban biodiversity. eDNA provides snapshots of species presence in the soils and water, revealing the presence of many microscopic species that would otherwise go unnoticed. Acoustic sensors can deliver real-time data on the activities of insects, birds, and other taxa.

Together, these tools enable continuous biodiversity assessment and facilitate studies on temporal and spatial variability in species activity within a highly urbanised environment. Combining traditional visual observations with eDNA snapshots and acoustics will allow us to assess how these methods can complement each other to holistically monitor biodiversity within cities.

Technology

In addition, the remodelling has allowed for the once-in-a-generation opportunity to install research infrastructure throughout the gardens. While digital methods for studying biodiversity are rapidly advancing (TODO: Refs https://www.sciencedirect.com/science/article/pii/S1877343520300592) they generally hit the same pain points when it comes to permanent installation: power and data. Through an underground network of conduit, we can use power-over-Ethernet to provide continuous power and a Gigabit data connection to almost any point in the gardens without having to lay cables across a path. This is a luxury best appreciated by those who have spent significant periods carrying a rucksack of car batteries and SD cards up mountains in the tropics every few days.

The power and data network has allowed us to install over 25 Raspberry Pi computers and over 50 sensors (so far) to continuously monitor the environmental conditions and biodiversity.

Above: Pomegranates growing in the heat island of the gardeners' compound.

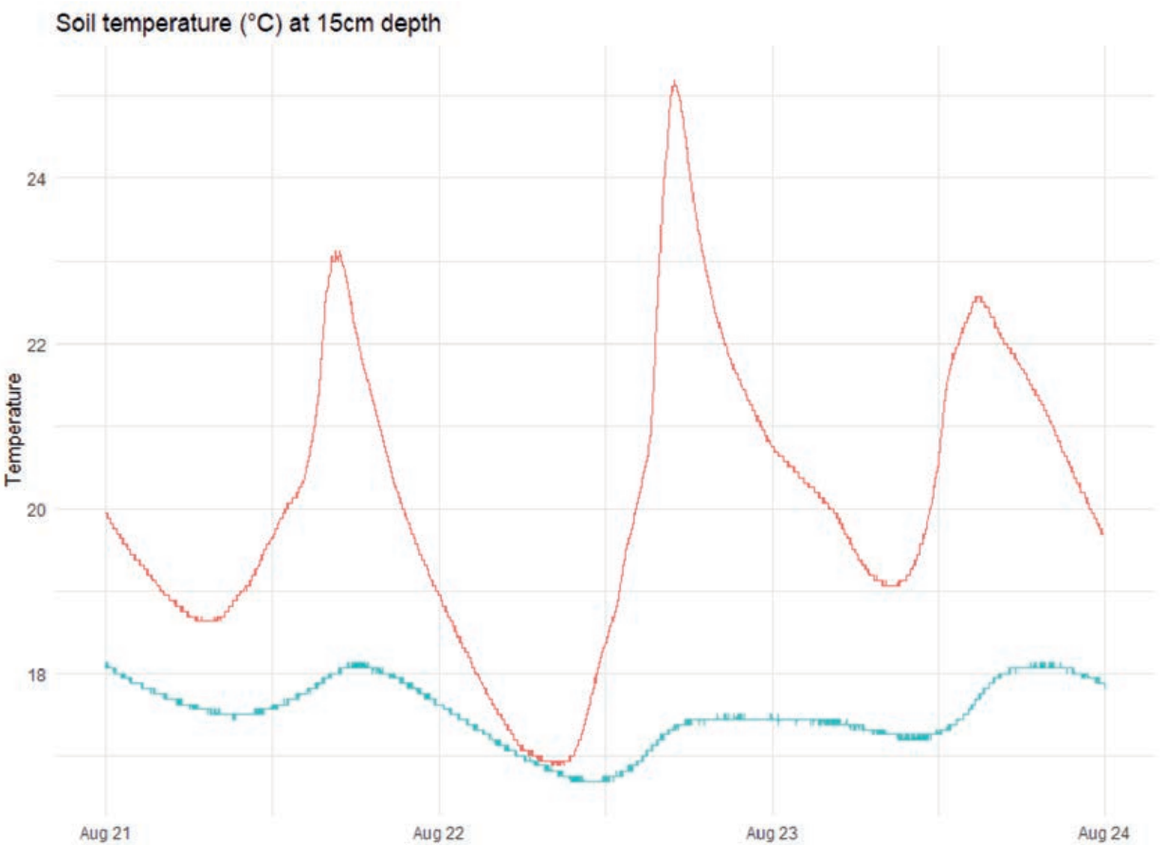
Image: Ed Baker

Below:
Soil temperature varies across the site, with the sunny courtyard (Top, red) showing higher temperatures and greater variability then the shaded woodland (Bottom, blue).

This research infrastructure is available to Museum staff and external collaborators, so that we can collectively address the challenges facing nature and humanity within our urban environments. Our first in-depth study using the sensor network is aiming to understand the challenges of urban heat at a microhabitat scale.

Heat Islands

Densely populated urban areas, such as central London, experience pronounced urban heat island effects that influence both human comfort and ecological processes (Venter *et al.* 2023). The Museum's gardens provide an opportunity to study these effects, and possible mitigations, using a distributed network of environmental sensors that monitor temperature at micro-habitat scales. As an estimated 59% of species live in soil (including 30% of arthropods; Anthony *et al.* 2023), understanding the thermal complexity of urban environments is crucial to developing a comprehensive understanding of urban ecosystems.



Integration

The Urban Research Station concept represents the synthesis of multiple scientific, educational, and community engagement initiatives within the Museum gardens. Integrating data from visual observations, eDNA, acoustic monitoring, and environmental sensors allows researchers to study biodiversity, abiotic conditions, and ecological processes across temporal and spatial scales.

The resulting datasets feed into the NHM's Data Ecosystem, a digital platform designed to facilitate storage and analysis of these diverse data types. By linking data across disciplines, this system supports not only Museum researchers but also external collaborators who wish to use the gardens as a model urban study site.

Image: Supplied by Ed Baker

An engaging urban centre

The integration of research, education, and technology transforms the NHM gardens into an exemplar of how cultural institutions can contribute to urban biodiversity and environmental research. We are working towards making the methods and technologies more widely available through the Data Ecosystem, initially through work with existing collaborators and those with a closely aligned mission to our own.

The goal of the Museum is to create empowered advocates for the planet, and to do so we need to engage the public with our research. The Urban Research Station concept allows us to conduct science in full view of the public, and to understand how people and nature can interact positively in an urban centre.

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