spotlight

highly insulating but expensive windows, optimizing the arrangement of rooftop solar panels or using rooftop vegetation to moderate demand for heating and cooling.

A larger web-based version of the project that does not use the game engine allows users to see the effects of city-wide changes – such as how retrofitting 50% of all buildings in Montreal built before 1950 would affect the city's carbon footprint.

The first real-world outing of the Future City Playgrounds project was Eicker's entry in Montreal's 2021 Reinventing Cities competition, run by C40, the global network of cities dedicated to addressing climate change. The competition brought together teams of architects, developers, academics and planners to design climate-friendly uses for a specific site in their city. Eicker's team used their game engine to create a redevelopment of an old factory building along Montreal's Lachine Canal, incorporating a heat-pump system that used the canal water to supply heat to the building.

They earned second place, so that project will not be built. But Eicker's team repurposed their ideas to retrofit another old factory overlooking the canal. That building was given one of the first zero-carbon certificates in Montreal, but still requires carbon offsets because it uses a gas boiler. The team is working with developers to get its canal-water heat-pump system into the building. "We are basically pursuing the same idea of connecting it to the canal water," she says. "It will be exciting to see that get built in the near future."

The team is working to add measures of liveability into the tool – that is, how things such as parking management, bicycle access and social spaces can make a building or neighbourhood more appealing. "Of course that is much more subjective, and much more difficult to come up with good indicators," says Eicker. But adding those aspects is essential to ensure that the sustainable cities of the future are equitable and comfortable places to live.

Eicker's ultimate goal is to have a tool like Future City Playgrounds available for every development, so people in local planning meetings can get more involved in designing the evolution of their neighbourhoods. "It's more than an academic exercise, and more than a game," she says.

"If you want to transform the city towards the most sustainable future, it's not just about technology," Eicker says. "You need people involved. You need the participation, acceptance and social inclusion of the people living there."

Brian Owens is a freelance writer based in New Brunswick, Canada.

DUNCAN WILSON

A smart monitor in London's Queen Elizabeth Olympic Park records bat activity.

WHAT BATS CAN TEACH US ABOUT URBAN DESIGN

Kate Jones thinks the natural world can inspire a dialogue about cities that are sustainable and healthy for humans and animals.

When I was an undergraduate student at the University of Leeds, UK, I volunteered to help out with a bat-conservation study. Someone put a tiny common pipistrelle (*Pipistrellus pipistrellus*), the country's smallest bat species, in my hand, and it was love at first sight.

I've always been fascinated by nature. Growing up, I fancied myself becoming a cross between David Attenborough and Indiana Jones: Dr Jones, wildlife adventurer! But it was during my university module on bat ecology that I knew I'd found my path.

These days, my research focuses on the interface between ecological and human health, and I use bats as a springboard for investigating some of life's big questions. For example: how can we design cities in a way that's sustainable for both humans and nature?

Bats are amazing. They're also weird – they have a lot of traits that are unusual in mammals. Take their lifespan: there are bats that live for around 40 years, whereas a mouse the same size lives for an average of just 18 months.

The fact that bats break evolutionary rules really helps to illustrate how much we don't know about ecology and the wider world we live in. Studying bats has helped us to understand more about areas including sonar, echolocation, acoustics, biodiversity, infectious diseases, longevity, metabolic stresses,

flight and much more.

As one of the academic leads for the new campus of University College London (UCL) – UCL East, in the city's Queen Elizabeth Olympic Park – I've been helping to design the facilities with ecology in mind. I'm also leading the new People and Nature Lab there, which will focus on these themes and use big data to explore fresh questions: how much nature do we need, for example?

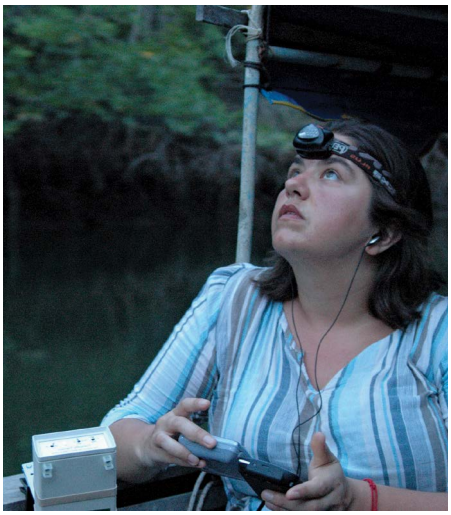
We've set up echo sensors on specially erected bat boxes around the Olympic Park. The idea is that if we can understand the health of bat populations in our cities, then we can understand a lot about the health of the environment more generally – a healthy bat population indicates good biodiversity. We also plan to introduce thousands of sensors over the two new campus buildings at UCL East, to help to determine, in real time, the buildings' impact on the environment and vice versa.

Each bat monitor captures the soundscape around it – that is, the collective sound that an environment makes, including human noises, birds and insects – through an ultrasonic microphone. The data are processed and turned into a spectrogram, a visual representation of the frequencies of the various audio signals. With help from artificial-intelligence specialists, we can pick up individual species' sounds and interpret them, looking at changes over time and even mapping out population trends.

Bats were the starting point for my research into infectious diseases. Part of the reason why they can live for such a long time is because they've evolved effective mechanisms for DNA repair; they're also good at fighting off viruses because their immune systems are always on. This means the viruses that are in bats are adapted to their super immune systems – and when those viruses transfer into other animals or humans, we're in big trouble.

My work aims to understand what promotes the transfer of pathogens from animals to human populations using big models that look at socio-economic drivers, climate change and biodiversity. In 2008, I published a paper with Peter Daszak, a zoologist at the EcoHealth Alliance, a non-profit organization in New York City, on using spatial modelling to determine urban hotspots of infectious disease, and how they relate to the natural environment[1].

That research laid the groundwork for more-detailed studies mapping urban biodiversity and predicting where disease outbreaks might happen. One study I worked on in 2020 highlighted the impact of human development and diminishing biodiversity on such outbreaks[2]. We analysed 3.2 million records from ecological sites across six continents and found that, as the landscape changed from natural to urban, populations of bats and other mammals known to host pathogens transmissible that are to humans increased.



ALANNA COLLEN

Kate Jones listens for bat calls.

Take Lassa fever, which is spread by rats. We've found that their habitat has been altered by human changes in land use and climate change[3]. That creates areas where people and rats come into contact more often – the rats' urine and faeces get into crops, for example, and cause outbreaks. I'm now working with much more sophisticated models and thinking about how to forecast spikes in Lassa fever.

"The fact that bats break evolutionary rules really helps to illustrate how much we don't know."

Protecting the natural environment while incorporating it into urban spaces is crucial to maintaining human and planetary health. Our work on UCL East builds on the 'one Earth, one health' principle: human health, sustainable development, climate change and biodiversity are interdependent. It means we need to take a much more holistic approach to managing ecological systems. At its heart is an attempt to consider what future universities should look like; if we are to address some of the biggest societal challenges, we need cross-disciplinary research and creative thinking.

Ecologists and architects need to talk to each other about the design of our cities – having primarily concrete spaces with separate green parks and conservation areas is not the way forwards if we want to reduce the urban heat-island effect and flood risk. We need to think about sustainable drainage solutions – building resilience into the system with designated flooding areas, and designing urban areas to include more trees and vegetation. This can also provide natural shade to help to cool buildings as we face higher temperatures.

We still have a lot to learn about the role of trees in lowering air pollution, too: historically, we've never designed cities with that in mind. Another big part of the People and Nature Lab is linking ecology to urban areas: not preaching from an ecological pulpit, but working with architects to effectively put ecology at the heart of urban regeneration.

For these same reasons, we wanted to build interdisciplinarity into UCL East – physically incorporating it into the buildings by having open, flowing spaces that can be used by the local community for events and socializing. This builds on the sustainability legacy of the park, which was built for the London 2012 Olympics.

The ground floor of One Pool Street, our campus building that is due to open in late September, is purposefully open-plan, removing the standard departmental silos. In the People and Nature Lab, we have a rooftop field that will be open to everyone to enjoy. I published a paper last year looking at the positive effect of woodland on adolescents[4], but the link between community mental health and nature is just beginning to be explored. The United Kingdom is currently passing legislation on biodiversity targets for businesses and urban spaces, but we won't know whether we've met those targets if we don't monitor them. Better engagement of citizens in understanding how to monitor the environment will be crucial.

East London is a very special place. It's hugely diverse, with people from all socio-economic backgrounds, and that's something to be treasured. I want people who are maybe not from an academic background to be able to walk into UCL East, see what's going on and feel included. I'm proud to work at a place that thinks about those things.

Through cross-disciplinary projects, we are actively nurturing a new generation of urban ecologists as well as architects and city planners, who can come together to solve the biggest biodiversity challenges.

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Interview by Rachael Pells.

This interview has been edited for length and clarity.