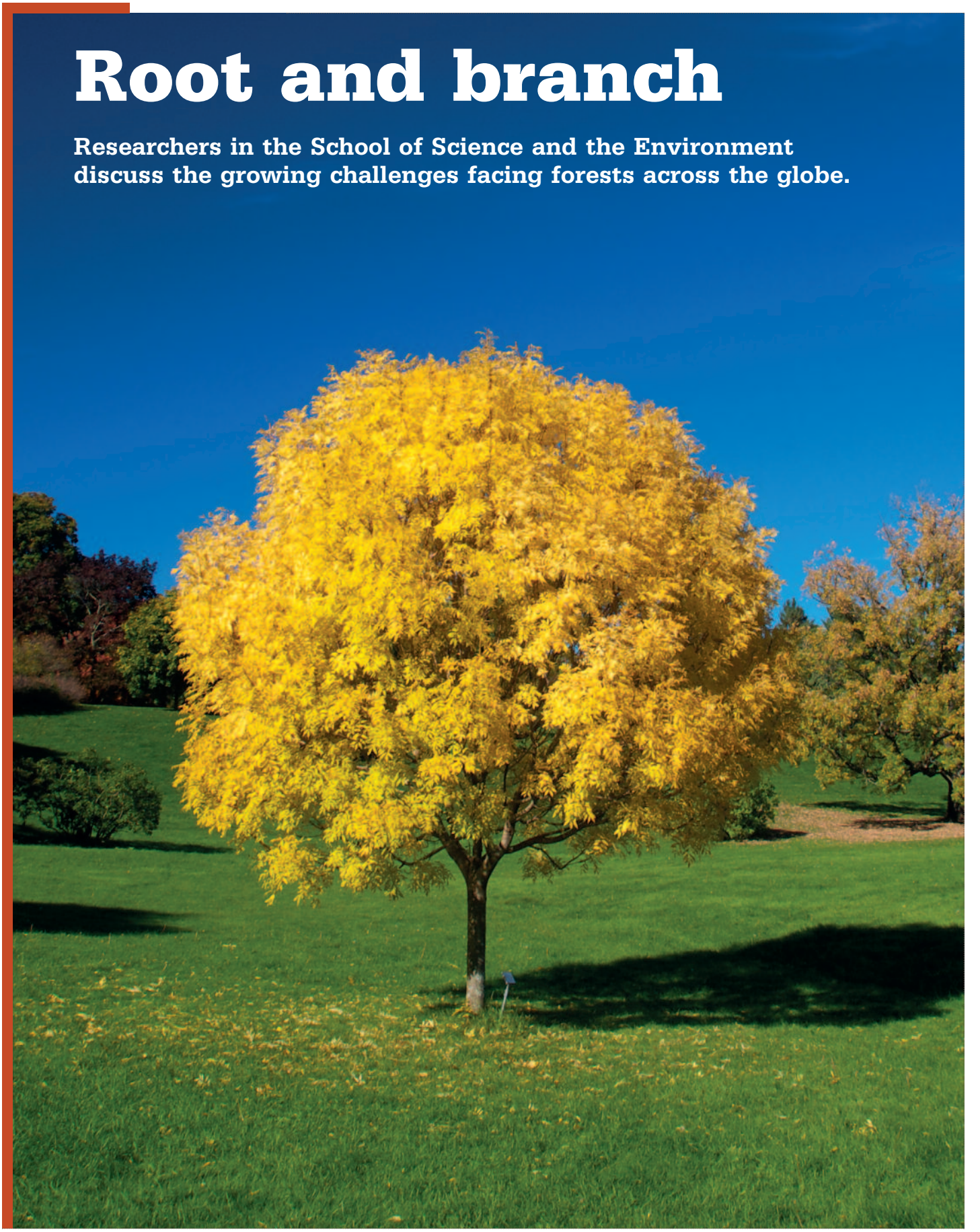
Root and branch

Researchers in the School of Science and the Environment discuss the growing challenges facing forests across the globe.



Ash dieback

When ash dieback hit the headlines, Dr Robin Sen, a reader in soil microbial ecology and biotechnology, was among the first experts to appear on national TV and radio to explain the nature and gravity of the threat.

The disease is caused by a fungus, Chalara fraxinea, which has spread through Europe killing up to 80 per cent of ash trees in the last two decades. There appears to be limited host resistance to this devastating infection.

Dr Sen, who has extensive experience of working in forest microbial ecology and pathology, is greatly concerned by the loss of forestry and, particularly, mycology from British university curricula, which he feels has negatively impacted on research and development in the UK. In *The Times*, he stated that: "Education and research funding in forestry has dwindled so far that the UK now faces a forest ecosystem services crisis at this critical juncture."

He has also said in the BBC interviews that the loss of millions of ash trees would be a massive blow to UK bio-diversity and ecosystem services at a time of increasing pressures linked to climate change.

He is now advising the Government's Parliamentary and Scientific Committee and its President Lord Jenkin on tree disease control and biosecurity risks associated with imports of wood biomass for electricity generation. Information he provided has been used in Parliamentary Questions tabled to the Government.

"It is well established that global agro-forestry trading, lacking strictly enforced bio-security controls, presents ideal conditions for the rapid spread of diseases such as ash dieback," says Dr Sen. "The import of ash seedlings from nurseries in other European countries with high prevalence of the disease should have rung alarm bells long before now."


Dr Robin Sen

Ash was a common sight across the UK and particularly in the Peak District National Park, and its loss is having catastrophic consequences. Dr Sen insists that investment is now essential to recover lost capacity and expertise: "We need to forge closer partnerships with international organisations to develop an early warning system to ensure rapid control and management of emerging diseases."

Among projects, he is also working with the Forestry Commission on developing low-input sustainable production of nursery Scots pine tree seedlings that involves novel application of beneficial root symbiotic mycorrhizal fungi. It is hoped fungal interactions with tree roots could help trigger ash defence responses.

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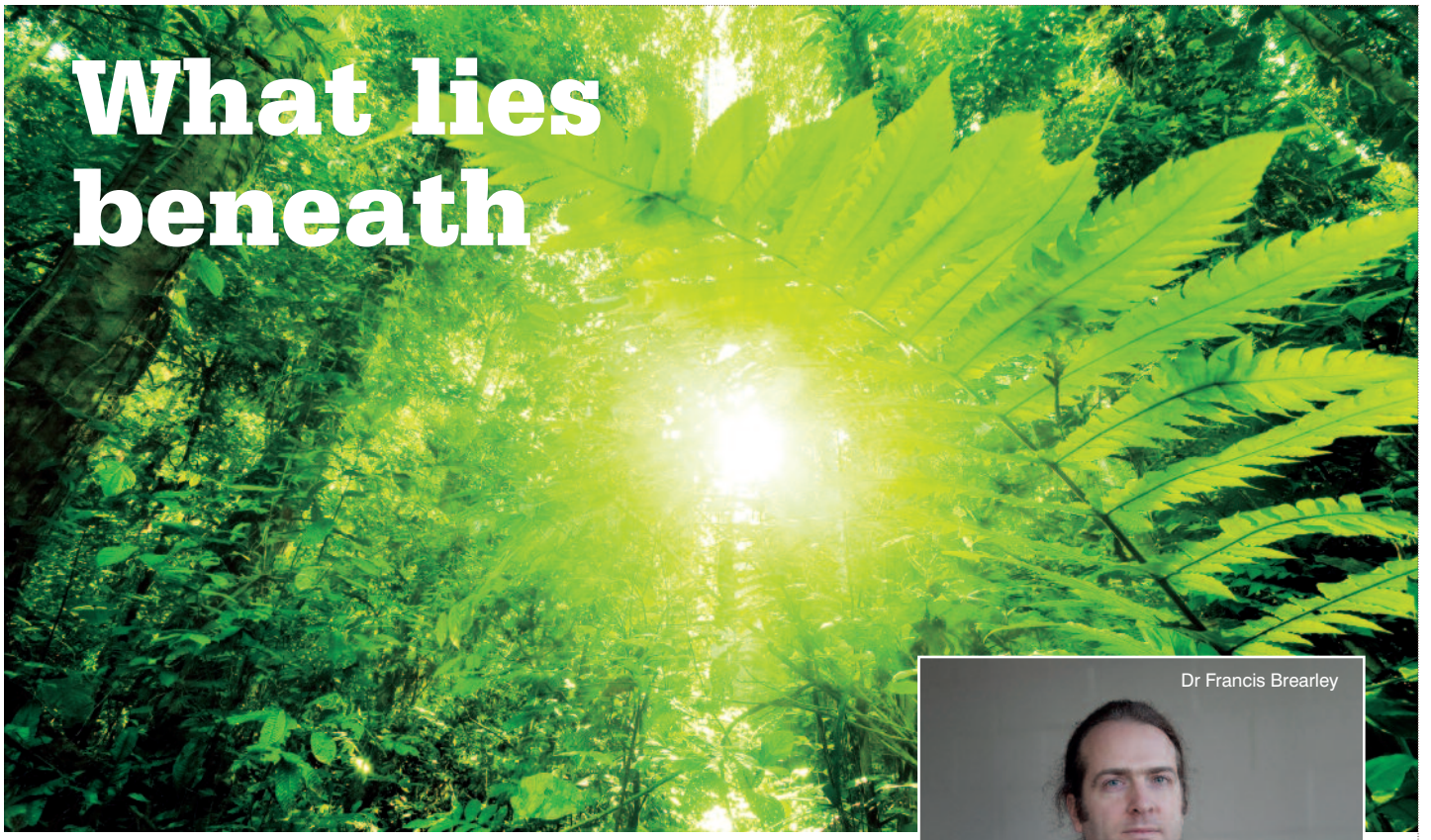
What lies beneath




Dr Francis Brearley

Climatic and human impacts are creating a combined threat to much of the tropical rainforest, with implications for ecosystems and animal life, according to Dr Francis Brearley, Senior Lecturer in Ecology.

And with the increased disturbance and destruction of primary forests, understanding the dynamics and recovery of emerging secondary forests is of increasing importance.

Dr Brearley specialises in diversity in tropical forests, analysing the linkages between diversity below and above the ground to analyse how human disturbances and interactions affect tropical biodiversity.

Since 1998 he has been conducting ongoing research in Borneo, where there is a large demand for land and timber, looking specifically at re-growth of forests following disturbance.

He explains: "We have a series of trees marked out in permanent quadrats of 50 metres square. We know when the forest was cut down and the age of the secondary forest so we can look at the changes in species composition over time. The younger forests are dominated by a few species, maybe 10 or 15. The community becomes more even and more diverse over time.

"Ultimately we'd expect some sort of convergence with the undisturbed forest but that would certainly be over 100 years. So we need to establish the attributes of these secondary ecosystems. In the tropics, now, we have a mosaic of systems, some undisturbed, some highly disturbed, some recovering and some converted to agriculture."

In French Guiana deforestation levels are low, where, as part of the EU, there is less pressure and demand for land.

Dr Brearley's objective is to determine the species diversity beneath the land surface: "We know that tropical forests are some of the most diverse ecosystems above ground but are they equally diverse below ground? Looking at one type of fungi, we initially found that the diversity below ground was fairly similar to temperate ecosystems. Now we want to discover if below ground is somehow different by extending that to other groups of organisms.

"Clearly micro-organisms are important; some improve plant nutrient uptake and many break down organic matter and make it available to plants. They are influential in affecting a whole range of greenhouse and other gases. Micro-organisms functioning below ground are vital. We're walking on them every day but we don't give them sufficient thought."

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