Research helps forests face the future

Trees are the building blocks of our natural landscapes but forests around the globe are under threat from climate change and disease. Thanks to a transformational £15 million gift, the University is establishing a pioneering institute of forest research to find possible solutions.

A healthy forest is like a healthy economy, it is resilient when it is multi-functional. 'So just like an economy that relies only on banking becomes dysfunctional, a forest where a particular group of trees is destroyed by disease or the effects of climate change is in danger,' says Professor Rob MacKenzie, Director of the Birmingham Institute of Forest Research (BIFoR).

The Institute will conduct research into two fundamental and interrelated challenges to the world's forests: the environmental impacts of climate change and the effects of pests and disease. It will reveal credible solutions to the problems associated with sustaining forests and the vital fibre, food, fuel and environmental cleansing services they provide.

Thanks to an exceptional gift from Professor Jo Bradwell and Dr Barbara Scott combining with University investment, BIFoR will be unique in Europe in size, ambition and scope. As one of only three such research centres in the world, it will firmly establish the UK as a world leader in forestry research.

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BIFoR will provide an opportunity to understand the myriad of individual processes that control how a forest landscape will evolve under the pressures of a changing environment. It will allow researchers to observe, and manipulate where possible, all the individual processes locked together within the ecosystem.

At the centre of the Institute's work will be a mature oak woodland in Staffordshire, which will be transformed with a Free-Air Carbon Enrichment (FACE) system. This will pump controlled levels of additional carbon dioxide into the atmosphere so scientists can monitor its effect on the trees, plants and animals.

The researchers are using the FACE system because they are interested in the whole forest's response to increased carbon dioxide levels, not just the individual plant's. BIFoR's research will be unique because previous experiments have been done in plantation woodland, in very different ecosystems, or on young, growing trees. The timeframe of the project is also unprecedented; Professor MacKenzie and his team will be monitoring the experiment at least every second for at least a decade. Many of us will remember from biology lessons at school that plants photosynthesise. The process of converting carbon dioxide into sugars produces oxygen so surely increased carbon dioxide levels are good for the plant part of the environment?

'We expect we'll see an initially very positive response which will change over time as other aspects of the trees' health are affected,' Professor MacKenzie says. 'For example, some current models suggest that climate change might make the Amazon slightly drier. If that's true, one plausible response of the Amazon rainforest is to dry out and to retreat in its effort to adapt to the conditions.'

BIFoR will work closely with international research centres in the US, Australia and Brazil, and a related area it will investigate is tree disease. If an epidemic such as Ash Die Back kills off a large number of trees in a forest, the amount of carbon dioxide that forest is able to absorb reduces.

'With the global trade in plants, we need a more nimble and agile response when invasive pests and diseases arrive,' Professor MacKenzie says. 'It would be nice to find a magic bullet solution, but we suspect that most of the time we will be thinking about how we can manage our landscape so that when these situations inevitably arise, the result is not catastrophe.'

The FACE experiment will begin in 2016 and beforehand, the scientists will be assessing the forest's health. This will involve departments across the University collaborating to measure the in-flows and out-flows of carbon, nitrogen and phosphorous, the main ingredients that make up living material, through the water, air and soil and, of course, through the plants and animals.

'What we're actually doing is combining expertise that we already have right across the University, from cultural studies, social science and environmental economics all the way through to physics, bioscience and engineering,' Professor MacKenzie says. 'The University has always had a very strong urban identity but, in fact, our research has been relevant to rural landscapes for decades and BIFoR will provide a very visible "home" for that fundamental work.'

An incredible gift

Alumnus Professor Jo Bradwell (MBChB Medicine, 1968; HonDSc, 2011) and his wife Dr Barbara Scott (BSc Biological Sciences, 1977; PhD Medicine, 1981) have enabled the establishment of BIFoR with a £15 million donation, one of the largest ever gifts to a UK university and historically the largest ever gift to Birmingham. The gift was made through the JABBS Foundation.

Jo, who worked as a lecturer in the Department of Medicine and a senior lecturer and professor in the Department of Immunology, founded the Binding Site, a University spin-out company, in 1983. Developing diagnostic products for immune-deficiency and autoimmunity plus a range of important novel cancer tests, the company has continued to expand for 30 years, winning the Queen's Award for Export Achievement twice, and the Queen's Award for Enterprise.

Jo is passionate about the global issue of climate change and how our forests are threatened. He sees woodlands as patients who need diagnosing before the relevant treatment can be decided upon. 'The UK has the lowest woodland cover of any large, European country because of deforestation over the centuries,' he says.

'What little we have remaining is now under serious threat from climate change and imported tree diseases. The new Institute of Forest Research will increase our understanding of these challenges in order to help planners, owners and foresters maintain and improve the health of our woods.'

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