DEVELOPMENT OF FORESTRY AT BANGOR UNIVERSITY: AN INTERNATIONAL DIMENSION

Forestry studies at Bangor University began before the introduction of the 1919 Forestry Act. John Healey MICFor, Professor of Forest Sciences, and Dr James Walmsey, Senior Lecturer in Forestry, put the history into perspective.

t was the first university to offer a degree in forestry in the UK with the subject dating back 115 years. Now Bangor University is a world-leading institution which has achieved a huge impact on the profession of forestry and the sustainable management of forests globally.

One of the outstanding aspects is the role of international students throughout the history of forestry at Bangor, with students from more than 100 countries graduating over the last 40 years.

Forestry education at Bangor first took on a strongly international dimension after the appointment of Eric Mobbs CBE as Professor of Forestry in 1947, following his 20 years of senior experience in the Indian Forest Service. It expanded rapidly as the Forestry Commission's afforestation programme grew and the role of forestry in international development became increasingly recognised.



Study tour to James Jones and Sons, Lockerbie, Scotland, February 2019

Forestry education

In today's undergraduate programmes, the BSc Forestry degree remains the core of the subject at Bangor. The BSc Conservation with Forestry degree is buoyant, linking two of the university's highest profile subjects, and the new degree in Geography with Environmental Forestry launched in 2017 is growing well. The names and degree results of 1,700 forestry graduates since 1922 are listed in an historic register.

At the postgraduate level, the university's full-time MSc in Environmental Forestry started in 1978 and continues strongly, followed by an MSc in Agroforestry. A major boost has been the recent renewal of European funding for the Erasmus Mundus masters' degrees in Sustainable Tropical Forestry (SUTROFOR) and Sustainable Forest and Nature Management (SUFONAMA), through which outstanding international students spend one year of their joint degree at Bangor. Over the 41 years of these full-time MSc courses, Bangor has educated 835 students in forestry, 327 from the UK and 508 from 88 other countries.

Over the past decade, the really notable growth in forestry student numbers has been in part-time distance-learning Masters programmes, with the successful

Rich History of Research

Research at Bangor University has a rich history and a truly international outlook with projects currently planned or under way on every forested continent worldwide. Here are some highlights:

In **forest management and silviculture** research includes methods for predicting Sitka spruce natural regeneration (in collaboration with Forest Research), reduced impact logging and silvicultural interventions in Ghana (co-authored by Bangor MSc study tour students), logging effects on intact forest landscapes of the Congo Basin, modelling sustainable harvesting from miombo woodland in Malawi, selecting native tree species for reforestation in Lebanon, and ecosystem function of understorey vegetation in Indonesian oil palm plantations.

Research into improved methods for forest inventory and structural assessment, based on airborne laser scanning, has produced papers on its use for monitoring forest restoration, and its combination with citizen science observations of forest bird habitats. Improved forest practice is informed by models to better value growing stock using GIS and stem quality data, with a bucking simulator.

Research on **tree disease** includes two joint projects with Forest Research, one funded by Woodland Heritage. Resulting papers report advances in understanding the microbiology of acute oak decline, including the amazing discovery that it is caused by a consortium of separate bacterial species. Linking to forest management and policy, bio-economic modelling has shown how tree species diversity influences economic costs of pests and diseases and what factors influence UK public willingness to pay for disease control.

Research into **forest ecology and soils** has resulted in high-profile papers on regulation of soil carbon stocks by tree roots, and how soil microbes respond to monoculture versus mixed-species afforestation, based on the BangorDIVERSE experimental site, part of the global Tree Diversity Network. In Welsh woodlands, grazing causes a notable shift in sapling tolerance of shade, drought and waterlogging.



Trip to four-year-old Cedrela odorata plantation, Ghana, July 2017

MSc in Forestry now joined by an MSc in Tropical Forestry, which has attracted generous support from the Commonwealth Scholarship Commission (CSC) since 2011. To date, 107 scholars, comprising staff from research and training institutes, government and private forest management bodies and environmental NGOs, from 17 countries have registered for this degree. Of these, 58 have now graduated and 10 new CSC scholars start in September 2019.

An indication of the combined success of all these degrees is, firstly, the South Scotland field course in February this year, which hosted 70 forestry students from BSc year two, full-time MSc and part-time MSc cohorts, and secondly the biannual Tropical Forestry study tour in Ghana, run in collaboration with the Forestry Institute of Ghana and Makerere University, Uganda, attended by 30 students from 20 countries.

Forestry PhDs

PhD students are another important component of the university's forestry programme. They dominate membership of the 20-strong fortnightly *Forestry and Woodlands Discussion Group*, a crucial component of our research culture. Over 40 years, more than 230 students from at least 50 countries have completed PhDs in forestry, wood science and agroforestry at Bangor, providing important high-level expertise to the sector in the UK and worldwide.

Funding sources for PhDs have shifted over the years. While Commonwealth Scholarships remain important for international students, for UK students a major development has been the prestigious *Envision* Doctoral Training Partnership jointly between Lancaster, Bangor and Nottingham universities, which was competitively awarded another five years of funding from 2019 by the Natural Environment Research Council. Envision supports Bangor PhD research on the role of symbiotic mycorrhizal fungi in tree establishment, developing environmentally sustainable forestry value chains, quantifying effects of deer on woodland structure, ecological impacts of tree pathogens in Panama, and conservation of red colobus in Zanzibar. Discussions are under way to establish a joint Forest College to deliver specialist training in forest research skills with the University of Birmingham-led CENTA Doctoral Training Partnership, linked to the Birmingham Institute of Forest Research.

New staff appointments

To further support all this successful development, in the past year Bangor University has made four new academic appointments in the forestry area, providing an enhanced international dimension to the curriculum and strengthening key aspects of new technology and of social sciences crucial to forestry today. Lecturer in Forest Sciences, Rubén Valbuena, is an expert in the application of remote sensing to forest inventory and resource assessment, with research across Europe, Asia, Africa and South America. His Forestry PhD is from the Technological University of Madrid, he has a Doctor of Science from the University of Eastern Finland, Joensuu, and he has held research posts at the European Forest Institute, Joensuu, Forest Research and the University of Cambridge.

Isabel Rosa, Lecturer in Environmental Data and Analysis, has Forestry BSc and MSc degrees from the Technical University of Lisbon, a PhD from Imperial College London, and subsequent research posts at Imperial College and the German Centre for Integrative Biodiversity Research, Leipzig. Isabel uses spatial modelling to research deforestation, forest protection

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The abundance of lianas (woody climbers) has increased in many tropical rain forests and we showed how lianas are able to conduct water so efficiently that they can outcompete trees under drier conditions occurring with climate change. Climate variation is important in the geographical distribution of seasonally dry tropical forests of Caribbean islands.

Forest conservation is a major research strength at Bangor spanning science and social sciences. Recent important papers show the effectiveness of strict forest protection in national parks, yet in Madagascar some of the world's poorest people are bearing a high cost for forest conservation policies. Tropical forest tree species diversity is only weakly linked to carbon storage, so policies to protect carbon stocks may miss many forests important for biodiversity conservation.

Research in Africa and South America reports implications of **human migration** to the forest frontier, how land change modelling can inform forest policy, and complex effects of a Payment for Environmental Services programme on deforestation.

Agroforestry also remains a research strength. The main focus is engagement with African farmers to determine what influences willingness to adopt agroforestry practices in response to climate change. Linked research reports on collections of wild urban plants for food and medicine. In Wales, modelling has shown how tree shelter belts reduce wind speed providing thermal benefits to sheep. To increase the impact of research on policy and practice efficient communication with decisionmakers is key. A recent example is the policy brief *Impacts of Trees on Farm Ecosystem Services*.

The Biocomposites Centre's research on **forest products** maintains Bangor's long standing strengths in wood chemistry and materials science. While work continues into how to protect wood from decay, innovative new research has tested the use of wood-decay fungi to pre-treat forestry biomass to improve efficiency of bio-refining industrially valuable chemicals.

Another new research area is the improvement of indoor **air quality** resulting from use of wood-composite panels. Innovation in construction has been explored by assessing what can be learned from plant cell walls for the design of building envelopes.

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policy and impacts on biodiversity and greenhouse gas emissions, focused on the Amazon, with other pantropical, African and European projects.

Eefke Mollee, Lecturer in Agroforestry/ International Development, has a joint PhD from the University of Copenhagen and Bangor University on the use of urban plant resources for health and food security in Kampala, Uganda. Her Bangor post continues our close collaboration with World Agroforestry Centre (ICRAF), maintained for more than 30 years. As well as leading Agroforestry teaching, Eefke is developing a new module in Urban Forestry, an important strategic development in the university's forestry education.

Norman Dandy, an environmental social scientist previously at Forest Research, is Director of the university's new Sir William Roberts Centre for Sustainable Land Use. Norman's expertise covers forest governance, social aspects of forest health policy, behavioural economics, forest recreation and deer management.

These four new colleagues take the total complement of academic staff in Bangor University's forestry group to 15, and a further 12 staff in the university's new School of Natural Sciences contribute to forestry research and teaching. While Bangor no longer teaches wood science as a degree, the Biocomposites Centre's research strength is 16 PhD-qualified staff.

Within UK, uniquely in Bangor, more than half the forestry teaching staff are 'research active', carrying out and publishing research of international importance. Given the rapid changes in context, we predict that forestry professionals will see huge shifts in policy and practice during their careers, which makes it so important that their education gives them a strong capacity to adapt and to innovate, based on a robust understanding of the underlying science and the process of research through which it is generated. This is why Bangor is strongly committed to making its forestry teaching research-led, as well as informed by forest policy and practice, and embedded in a strongly international perspective. More than 40 research papers have been published in international journals on forest topics by Bangor staff during the past two years.

Student experience

At the core of the university's mission is how the international research of its staff enriches the education and experience of its students, leading to continued growth in recruitment to Bangor's undergraduate and postgraduate forestry degrees.

This will be of huge importance to meet the increasing demand for expertise to meet both the challenges of reducing rates of deforestation and forest degradation, and expanding forest cover to meet demands for forest products, carbon sequestration



Tropical Forest Study Tour, Taungya Restoration site, Ghana



BSc forestry final year management planners, 2019

and the delivery of other ecosystem services.

A high proportion of Bangor's British forestry students have a strong interest in international forestry and the university provides many opportunities for this to develop. Across the university, Bangor is now promoting the benefit of students gaining international experience during their degree, and forestry has been in the vanguard with a long record of students spending a year studying at partners such as the University of British Columbia or the University of Eastern Finland, or spending a sandwich year gaining forestry work experience overseas.

A major development at the BSc level has been the opening of Bangor College China, a partnership with the Central South University of Forestry and Technology in Changsha, Hunan Province. The BSc in Forestry and Environmental Science was a founding degree, with Bangor employing international forestry teaching staff in Changsha. Five of the first cohort of Chinese students transferred to Bangor for the second and third years of their degree. They have thrived and greatly enriched the experience of the whole forestry cohort in Bangor. All our MSc classes include many overseas students from around the world.

Bangor's forestry students themselves take the initiative in developing international links. The Bangor Forestry Student Association (BFSA) is very active in organising an excellent programme of weekend work experience, for instance tree planting or woodland management in North Wales, and evening visiting speakers, including joint events with the Royal Forestry Society and Woodland Heritage.

BFSA also plays an increasingly prominent role in the International Forestry Students' Association, sending delegates to meetings, such as the annual International Students' Symposium and the Global Landscapes Forum, and hosting the 2019 Northern Europe Regional Meeting, with 30 students visiting forest sites across North Wales. The Association has strongly supported its member, Jemima Letts, in implementing the pilot phase of her Tree Sparks social media initiative, which she presented at the Institute's National Conference.

With this level of commitment by both its staff and students to develop an ever-greater international dimension to the forestry programme at Bangor University, its future prospects look set to grow from strength to strength.

Photos by James Walmsley

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