



Forest Research

Much more than trees

Foreword

Welcome to Forest Research. We are the research agency of the Forestry Commission, the UK Government department responsible for forestry. However, our research is about much more than trees – it's about adapting to, and mitigating the risks from, climate change and supplying scientific evidence on the human, ecological and economic aspects of sustainable forest management. We also provide data and analysis to underpin a range of policy developments, from environmental justice to renewable energy and land use.

We have teams of experts in the areas of forest sciences and land-use management, whose work focuses on the use of applied science for tree, woodland and forest sustainability. Increasing concerns over climate change and its impacts on the environment make our work more relevant, pressing and important. We are, for example, carrying out important research into protecting trees against an increasing number of pests and diseases, the ecosystem services that forests provide, the protection of biodiversity in forests and the contribution that forests make in sequestering carbon. This brochure shows a small selection of our current work and research areas. If you're interested in working with us or would like to know more about what we do please contact us through www.forestresearch.gov.uk.

Dr James Pendlebury
Chief Executive



Our Vision is to be a robust, market-relevant and flexible research organisation with a reputation for innovative applied science.

Our Aim is to support and enhance the role of trees, woodlands and forests in sustainable development, by providing high-quality research, development and knowledge transfer.

Our Objectives are to:

- inform and support forestry's contribution to the development and delivery of the policies of the UK Government and the devolved administrations;
- provide research, development and monitoring services relevant to UK forestry interests;
- transfer knowledge actively and appropriately.

To best achieve these aims and objectives, Forest Research comprises three interlinking Centres:

- **The Centre for Forestry and Climate Change**
- **The Centre for Forest Resources and Management**
- **The Centre for Human and Ecological Sciences**



Our research

Forest Research provides practical solutions for sustainable forest management through high-quality research and innovation for a broad range of clients. Our scientists provide robust science, evidence, analysis and advice to Government, European and international institutions, and the private sector. We work on a wide variety of issues, UK-wide, including adapting to and mitigating the impacts of climate change, protecting trees from disease, biodiversity and habitat management.

Alongside our traditional research, we continue to innovate, and have moved into new areas such as tourism, recreation, health and well-being, land reclamation, hydrology and renewable energy. We are also developing partnerships and commercial ventures that arise from our research.



Our expertise

Many of our staff are recognised industry and scientific experts in sustainable forest management. Our scientists, mathematical modellers and survey staff work closely together to stay at the forefront of international developments in forestry and tree-related issues and to provide robust, evidence-based research findings and up-to-date advice. Our researchers are supported by a nationwide network of experienced experimental surveying and monitoring staff, which gives us an unrivalled advantage in carrying out research and survey fieldwork across Britain.

Our website offers a practical resource for anyone wishing to learn about our current findings in sustainable forestry: www.forestresearch.gov.uk





Our national and international influence

Forest Research offers a breadth of forestry advice, from site-specific guidance through to undertaking international research with a range of partners from around the world.

Our staff are based at Alice Holt Lodge in Hampshire, the Northern Research Station near Edinburgh, the FC Wales National Office in Aberystwyth and at field stations across England, Scotland and Wales. This network of regional offices and field stations enables us to conduct research across the whole of Britain.

Our Chief Scientist works closely with his counterparts across government to contribute to the development of science policy and strategy across the UK. We also keep a close eye on international developments so that we stay abreast of progress and events further afield and can take effective action – for example, against new pests and diseases. We collaborate with sister institutes across Europe and currently participate in many pan-European and international projects.



The breadth of our work

Our scientists carry out research into many different aspects of forestry and land use. Modern forestry covers a wide range of topics, sometimes in surprising areas, as this sample of our current projects highlights. An inclusive list of our projects is available on our website at www.forestresearch.gov.uk

Responding to a changing climate

Britain's climate is changing faster than at any time since the last global ice age, posing a threat to many of our trees and woodland ecosystems. By improving our understanding of how woodland ecosystems respond to environmental change, we are better able to predict species survival and growth, and can develop practical guidance on how best to adapt to climate changes.

Forest Research's Straits Flux Station, set in a 70-year-old oak woodland in Alice Holt Forest, monitors the exchange of greenhouse gases (such as carbon dioxide, methane and nitrous oxide) and water vapour between the woodland and the atmosphere. Results indicate, for example, that one hectare of woodland absorbs five tonnes of carbon every year. Variation in weather patterns and the corresponding effects on carbon exchange help our researchers quantify the capture and storage of carbon, interpret the likely effects of climate change and develop realistic models of forest growth.

This research, coupled with data from a UK forest carbon inventory that our scientists have developed, is helping quantify the contribution forests make to climate change mitigation through their ability to remove carbon dioxide from the atmosphere.

Generating clean and sustainable energy

Wood and other biomass materials have an important contribution to make towards our energy needs. Generating energy from these sources offers a number of benefits that include reducing fossil fuel usage, mitigating climate change and opening up markets to provide local employment and offer business opportunities for farmers and landowners.

Forest Research created the Biomass Energy Centre (BEC) to actively support the developing bioenergy supply chain across the UK by providing up-to-date and unbiased advice to businesses and individuals planning to produce or use biomass fuel. Since its creation in 2006, the BEC has received many enquiries and much praise from a wide range of organisations and individuals from both public and private sectors. In addition, the team attends events and shows around the UK to promote the responsible use of biomass.



Courtesy Michael Heffernan

Forest Research operates the BEC on behalf of the Department for Environment, Food and Rural Affairs (Defra), the Department for Energy and Climate Change (DECC) and Forestry Commission England, and is supported by the Scottish Government. To find out more visit www.biomassenergycentre.org.uk.

Using genetics to guide forest practice and conservation

Technical advances in genetics are enabling researchers to gain a clearer understanding of the genetic diversity of major tree species grown in Britain. The mighty English oak, for example, actually originated in Spain, colonising the UK in the post glacial period some 7000 years ago. On a smaller scale, studies on cherry trees have shown that many of the trees within a single wood are likely to be clones, but there will be considerable pollen flow into the wood from other places, thereby maintaining the genetic diversity of new seedlings. Understanding genetic diversity and gene flow on different scales is important for guiding our selection of planting stock for the future, especially in a changing climate.

Our research is also helping conservationists develop strategies to conserve the genetic diversity of rare trees, such as the threatened native black poplar, and woodland dwelling flora and fauna.





Dealing with new pests and pathogens

Increasing global trade brings more opportunities for pests and pathogens to spread geographically and invasive, damaging organisms are now regularly detected in the UK. Our tree health experts actively monitor Britain's forests to detect new threats. For each pest or pathogen found, they research its biology, distribution, genetic origin and impact on woodlands so that containment and management procedures can be developed.



Our teams participate in international collaboration and knowledge gathering to identify potential new threats and assess the likelihood that they will arrive in the UK. Climate change will affect the geographic dispersal and severity of pests and pathogens, and our researchers are analysing climatic information, biology and epidemiology to determine the potential impact. For example, warmer winters may enable some pests to thrive and more easily attack susceptible, weather-stressed trees. Since 2000, our scientists have been monitoring and analysing *Phytophthora ramorum*, known as sudden oak death – a disease that has killed many oaks in California and which has now been found on both rhododendrons and trees in the UK.



Forestry—wood chain and timber quality

Significant changes are taking place in timber production and forestry practices. Tree growth rates and the quality of wood produced are affected by both forest management techniques and environmental conditions. Our researchers are analysing both of these elements to find ways to increase the sustainability and productivity of forests and woodlands. They have developed the first GIS-based model that predicts the probability of storm damage in forests based on soil type, topography, management methods and tree species.

Other decision support tools are being developed to help managers make the best choices for growing trees in a changing climate. For example, software models show the effects of different management options on the quantity and quality of carbon stored or wood produced and give timber processors a better idea of the likely volumes of timber available. The aim is to provide a suite of harvesting and management techniques that are both financially viable and in harmony with the other uses and environmental requirements of our forests.

Forest Research also works with the timber industry to increase understanding of the properties of timber amongst end-users and so increase the use of sustainable British timber for purposes such as construction and cladding. This information also guides tree improvement programmes that aim to improve timber quality over time.

Promoting healthy living through woodlands

Forest Research's studies into people and woodlands have found that contact with nature, including forests and green spaces, can benefit our physical, mental and social well-being. Our UK woodland resources offer huge opportunities for improving the lives of people of all ages and abilities. Forest Research's scientists are investigating the interactions between people, trees and woods, and evaluating the ways that people use woodland – such as for active exercise or more gentle leisure activities. The team is also analysing what factors influence particular social groups in their relationships with local woods; these findings are being used to develop national policy and practice.



Creating green spaces in urban settings

Forest Research has developed new techniques for integrated remediation and greening that cut the costs of restoring derelict and contaminated land. For example, we are testing the use of trees as biological indicators to evaluate the effects of contaminants on greenspace vegetation. This could help developers select the best tree species for different sites and make planting schemes more sustainable.

Research shows that having green spaces in urban areas brings about a wide range of benefits for communities – as well as health and social improvements, they also bring economic and environmental benefits. Establishing urban green spaces therefore requires a truly multidisciplinary research approach that considers all of these aspects. Our teams work closely with others to provide the best practice guidance and support needed to develop truly sustainable land management practices.



Managing forest habitats for priority and protected species

Dormice and nightjars, juniper and twinflowers are just some of the UK's protected species associated with woodlands. Forest Research supports the government's action plans for priority species and habitats, and is researching how best to protect and expand 'at risk' groups.

With the help of our experts, forest managers are injecting new life into forests by encouraging deadwood habitats. Almost a fifth of woodland plants and animals are dependant on dead and dying wood in some way – for example, bats use holes in upright trees for roost sites and a huge range of beetles and other invertebrates live in rotting tree trunks or branches.

Our research has shown that the survival of mobile species, such as the capercaillie and the red squirrel, is much improved by having large networks of woodland with numerous interconnections between sites. As a result, Forest Research is providing computer and web-based tools to help policy-makers and land managers to make the right decisions to safeguard the future of some of our most vulnerable species and precious landscapes.

Discovering floodplain forestry

Floodplain woodlands are unique ecosystems that are rich in biodiversity, offering valuable habitats while simultaneously helping to protect people's homes and livelihoods. Unfortunately, fewer floodplain habitats exist in Britain today. Increasing interest in restoring these precious habitats has benefited from our researchers' analysis of the wide range of environmental benefits that these habitats offer, particularly their ability to slow the passage of flood water. This effect, caused by the presence of trees and woodlands, provides a method of protecting land and property. The restoration of floodplain woodlands, with their flood-control benefits, can help tackle the increasing risk of floods.



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