Forest Research

FR's Core Research Programmes 2021-2026

The Research Agency of the Forestry Commission

Forest Research is the Research Agency of the Forestry Commission and is the leading UK organisation engaged in forestry and tree related research.

The Agency aims to support and enhance forestry and its role in sustainable development by providing innovative, high quality scientific research, technical support and consultancy services.

Introduction

The Science and Innovation Strategy for forestry in Great Britain, published in autumn 2020, provides a clear cross-border statement of research and evidence needed to underpin future sustainable management and expansion of woodlands and forests. Four strategic outcomes are identified and engagement with stakeholders led to the identification of seven key themes with subsidiary areas of research interest for each.

Forest Research was asked to propose a set of new research programmes, building on recent progress, to address these seven new themes. These programmes provide a framework for core research by FR, a springboard for further collaboration and partnership, and a stimulus to enhanced stakeholder engagement and knowledge exchange. Much of the work will draw on skills from across the scientific disciplines present in FR and be interdisciplinary in nature. Progress in several broad themes such as remote sensing, woodland creation, and carbon and other greenhouse gas fluxes, will be the focus of cross-programme working as the breadth of activity cannot be bounded within a single programme.

This document provides a summary of the seven core programmes, their main work areas, and contact points for those wishing to seek further information or explore collaboration. Each programme will be developing knowledge exchange and impact plans under the guidance of our newly appointed research impact coordinator

We look forward to working with stakeholders in each of the countries to develop the programmes of work and engaging with them in ensuring the research and evidence delivers impact.

Prof Chris Quine

Chief Scientist

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Programme 1 - Sustainable Forest Management in the light of environmental change

Summary of Programme

Environmental change describes the far-reaching shifts in the earth's life systems caused by human-induced effects on climate, atmospheric composition and land use. Forests offer opportunities for mitigation of the effects of environmental change (e.g. carbon sequestration, slope stabilisation), and forests can be managed over the long-term to ensure their adaptation to the changes. We term forestry designed to maximise mitigation and adaptation as 'Climate Smart Forestry'.

This research seeks to understand how to deliver Climate Smart Forestry which is consistent with Sustainable Development Goals and principles of sustainable forest management, and can respond to the significant challenges of environmental change and biodiversity loss, whilst supporting the need for green recovery through delivery of a robust and sustainable forest bioeconomy.

The proposed research takes a multi-disciplinary approach and will deliver underpinning scientific knowledge and understanding, as well as practical tools and guidance for forest managers, to make the necessary changes to sustainable forest management in Britain.

Work Areas

WA1: Environmental Change impacts & susceptibility assessments

Bringing together work on forest susceptibility to environmental change impacts, the drivers of responses observed, and risk associated with environmental change and climate extremes.

WA2: Climate Smart Forestry

Generating evidence on Greenhouse Gas balances (GHG), soil carbon function and the environmental change mitigation benefits of different silvicultural systems, forest and peatland management. It will also provide socio-economic evidence supporting the understanding of mitigation/adaptation delivery and barriers to uptake in the forestry sector.

WA3: SFM and building resilience to Environmental Change

Delivering an improved understanding of forest management which accounts for resilience to environmental change and which adheres to sustainable development principles (maintaining production, biodiversity, regenerative capacity, and ability to fulfil ecological, social and economic functions without damage to other ecosystems).

Key Topics

Ecological Site Classification; ForestGales; Climate Smart forestry; Climate projections; Extreme events; Greenhouse Gas balances; Sustainable Forest Management; Long-term experiments; Integrated forest monitoring; Emerging species; Forest vegetation management; Forest soils and peatland management; Soil carbon; Forest hydrology.

Contributing Science Groups

Climate Change Research Group

Physical Environment Research Group

Species, Genes & Habitat Research Group

Land Use and Ecosystem Services

Forest Management Research Group

Social & Economic Research Group

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Programme 2 – Markets for forest products and services

Summary of Programme

The move to a low carbon economy is expected to place an increasing demand on timber and forest products and there is a need to increase our domestic production to support sustainable economic growth in the sector. Increasing demand for sustainable construction and infrastructure materials as well as biomass is expected.

An over-arching objective of the work covered by this programme is to identify and assess current and potential markets for forest products and services and how woods and forests can supply these. The programme involves studying not only wood formation and timber quality of the main species planted in the UK, but also of alternative species that could be considered to increase resilience.

It includes research on timber properties and tree breeding for improvement of timber quality, growth and tolerance to disease and climate change. It also includes work on short rotation forestry for biomass production to reduce the need for imports and to contribute to CO_2 capture, as well as on timber prices. It is expected to extend to ecosystem services more widely through work on development of payments for ecosystem services markets.

Work Areas

WA1: Availability of future markets

Improving the productivity and quality of the softwood and hardwood timber resource to widen future markets. Activities will include tree improvement through selection and breeding, together with the development of timber properties models which will be used to assess the quality of future timber supplies and inform management decisions.

WA2: Barriers to use of domestic timber

Overcoming barriers to the use of domestic timber, while improving efficiency in the supply chain and building resilience. Activities will include improved methods for assessing quality, use of remote-sensing, and breeding for resistance to disease.

WA3: Market potential of emerging species

Characterising the properties of timber that will be produced from British forests as managers seek to increase diversity and improve resilience in response to climate change.

WA4: Short Rotation Forestry

Investigating Short Rotation Forestry to improve the productivity of biomass. This activity will reduce the need for imports and contribute to CO_2 capture.

WA5: Payments for ecosystem services

The aim of this WA is to investigate the development of payments for ecosystem service markets.

Key Topics

Timber properties; Tree breeding; Timber quality; Short rotation coppice; payments for ecosystem services.

Contributing Science Groups

Forest Resources and Product Development

Forest Management Research Group

Forest Mensuration, Modelling and Forecasting

Social & Economic Research Group

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Work Area Co-Leads: Elspeth MacDonald, Matt Parratt, Gregory Valatin.

Programme 3- Societal benefits of trees, woods and forests

Summary of Programme

Connecting and engaging diverse people and communities with trees, woods and forests has become increasingly important in recent years due to major societal and environmental issues including concerns about widespread mental health problems, inactive and sedentary populations with obesity and overweight and the Coronavirus pandemic. Increasing tree and woodland cover across the UK will lead to substantial landscape scale change and understanding the different perspectives on this change (both positive and negative) and how society can be engaged with this agenda is critical.

This research programme will focus on the wider societal wellbeing benefits of and relationships with trees and woodlands to explore how these change across the urban-rural continuum, over time, and how to maintain and improve the delivery of these benefits as new treescapes are being created and existing ones expanded. The methodologies and methods used will include data review and synthesis, methodological exploration, innovation and development, and primary data gathering.

Work Areas

WA1: Societal perspectives on and engagement with urban, peri-urban and rural treescapes.

Synthesising and updating existing evidence on how publics engage with trees, woods and forests, and preferences for and understandings of choices made in managing and creating trees and landscapes.

WA2: Methodological development and engagement through new technologies.

Examining the effectiveness and applicability of different digital/novel/media/app/large scale data that can be used to understand who is connecting with and benefiting from trees, woods and forests and how they are doing so.

Key Topics

Public preferences, engagement with nature, perceptions of change,

Cultural ecosystem services, values and benefits; Public preferences; Public perceptions; Engagement with nature children and young people; Engagement with nature during Covid-19; Health and wellbeing; Evaluations.

Contributing Science Groups

Urban Forest Research Group

Land Use and Ecosystem Services

Social & Economic Research Group

Inventory, Forecasting and Operational Support (IFOS)

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Work Area Co-Leads: Clare Hall, Chris Pollard.

Programme 4 – Resource assessment and sector monitoring

Summary of Programme

Sustainable forest management is only possible with the appropriate data and effective models which enable consequences of choices for a range of objectives to be explored and changes monitored. These issues are long standing; relevant evidence is already available from previous forest inventories and published forestry statistics. Models and tools for informing forest resource assessment and management decisions have been available for decades. However, the quality of data and evidence sources require improving, whilst new tools are required, to address the evolving (and generally expanding) expectations of contemporary forestry and wider society, and the growing challenges of climate change, biodiversity loss, the spread of tree pests and diseases, and uncertain economic circumstances. New measurement technologies, inventory techniques and modelling methods need to be developed, integrated, and applied to meet these challenges.

The programme will pursue innovative approaches to forest inventories, data acquisition, high-quality forestry statistics and forest modelling in support of forest policy and practice. New methods will be developed and integrated to inform choices on forest capital.

Work Areas

WA1: Official statistics and international reporting

The collection, analysis and reporting of Official Statistics (including National Statistics) on UK forestry and the provision of UK forestry statistics to international organisations, as well as ensuring the Code of Practice for Statistics is complied with.

WA2: National Forest Inventory programme

The development and delivery of the National Forest Inventory (NFI), to acquire essential data on the spatial distribution and growing stock of woodlands which enable accurate and consistent reporting of the status of woodlands (growing stock, growing stock structure, productive potential, ecological factors) and trends in their development.

WA3: Improved forest models, resource assessment methods and supporting data

Methodological development to deliver updated yield models, progress new 'elemental models' representing aspects of tree growth, development of next-generation growth and yield models to address mixed species forests and enhance carbon/GHG balance models. Data acquisition on fundamental tree characteristics and long-term growth to underpin model development.

WA4: Trees outside of woodland and urban and peri-urban forest monitoring.

Further development of urban and rural Trees Outside of Woodland monitoring of extent and composition, and continuation of the Urban Canopy Cover web map citizen science project at electoral ward level for the UK.

Key Topics

National Forest Inventory (NFI); sample plot network; growth and yield models; earth observation data.

Contributing Science Groups

Land Use and Ecosystem Services

Forest Mensuration, Modelling and Forecasting

Inventory, Forecasting and Operational Support (IFOS)

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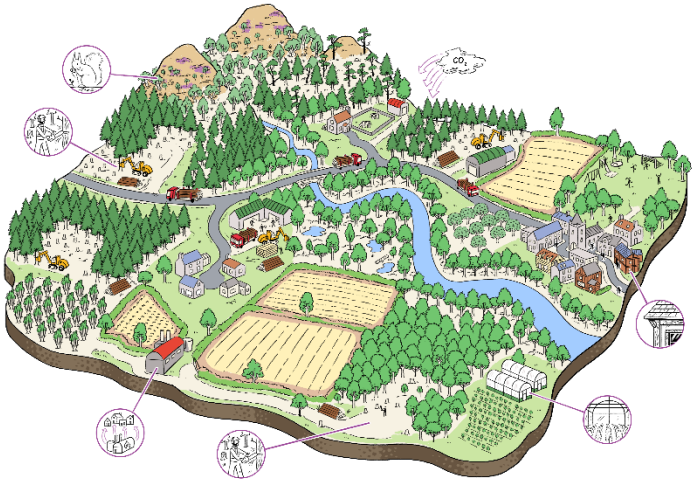
Programme 5 – Achieving multiple ecosystem benefits

Summary of Programme



Trees, woods and forests provide multiple benefits to society and many of these are recognised in the forestry and woodland strategies spanning the next 25-50 years. In particular, there are benefits to the environment through climate change mitigation and adaptation, air quality improvement, protecting water quality and soil health, flood mitigation and addressing the biodiversity crisis. Whilst there is much research to examine goods and benefits associated with single ecosystem services, challenges remain for assessing multiple benefits at the level of detail (including temporal and spatial scales) to enable informed decision-making.

The aim of this programme is to increase understanding of the multiple ecosystem service benefits that different types of trees, woods and forests can provide and how choices influence synergies and trade-offs at a range of spatial scales. The programme will be delivered through the generation of new data and evidence through social and physical sciences, molecular analyses and the development of methods, models and tools to express how choices, interactions and trade-offs affect the benefits from trees, woods and forests spatially and over time.

Work Areas

WA1: Valuing and promoting the benefits from trees, woods and forests

Generating knowledge, data and analysis to evidence, understand and value the ecosystem services from trees, woods and forests. The work will provide an assessment of benefits and how these can be expressed and promoted to achieve multiple benefits.

WA2: Methods and tools to assess multiple benefits and trade-offs from trees, woods and forests.

Developing methods and tools to assess multiple ecosystem service benefits from trees, woods and forests, and their synergies and trade-offs. This on-going research will support the Woodland Creation and Expansion programme's work on identifying optimal areas for woodland creation and Societal benefits programme on valuing Tree/forest-based solutions for improved health and well-being.

WA3: Management choices to achieve multiple benefits from trees, woods and forests over time and space

Developing and utilising methods and tools to demonstrate and promote how management choices affect the delivery of multiple benefits from trees, woods and forests over time and space.

Key Topics

Ecosystem services; Spatial analysis; Indicators; Scenarios

Contributing Science Groups

Physical Environment Research Group

Species, Genes & Habitat Research Group

Land Use and Ecosystem Services

Social & Economic Research Group

Urban Forest Research Group

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Programme 6 – Woodland creation and expansion

Summary of Programme

Increasing woodland cover is a priority for all three nations and there are now ambitious targets for woodland creation across Britain. This provides opportunities to restore degraded landscapes as well as a means of tackling the climate and biodiversity crises. However, there is a need for research to understand more about the best possible location for new woodland integrated with other land uses; the character and development of new woodlands and the range of benefits and services they provide over time, and the means by which land managers and others may achieve increased woodland cover that provides these expected benefits.

This programme will draw on past studies, complementary research in the other six programmes and in ongoing collaborative work, to untangle the complex interactions implicit in choices over location, extent and species and which lead to reliable options for multiple benefits, including carbon capture and improved biodiversity. The work will co-design or co-produce knowledge products and tools which support land managers, sector stakeholders and policy makers to increase engagement with woodland creation and expansion activities.

Work Areas

WA1: Land manager engagement for woodland creation

Examining who creates new woodlands, who might create new woodlands and what are the reasons for doing so? This will include investigating the decision-making context for land managers, including the perceived benefits and disbenefits of woodland creation and expansion and factors influencing their assessment of trade-offs in the provision of public goods.

WA2: Mapping of new woodland resources

Characterising where and how have new woodlands been created? This will include developing and testing methods for identifying the locations of existing Trees Outside Woodlands in rural and urban settings from remote sensing data to inform assessments of woodland creation.

WA3: Evidence of woodland creation benefits

Considering what benefits are new woodlands providing and when do you receive them? This will involve understanding the benefits of woodland creation on biodiversity and selected ecosystem services, including the success and development of woodlands created through 'natural colonisation' and 'planting'.

WA4: Scenarios of future woodland creation

Exploring where and how should new woodlands be created to maximise benefits? This will define a typology of land managers to be incorporated into the agent-based model and determine appropriate woodland creation and expansion scenarios.

Key Topics

Woodland creation, natural colonisation, land manager decision-making, monitoring

Contributing Science Groups

Land Use and Ecosystem Services

Social & Economic Research Group

Urban Forest Research Group

In addition, to progress Woodland Creation and Expansion as a theme, rather than these 4 work areas, there will be collaboration with all science groups.

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Programme 7 – Tree health and biosecurity

Summary of Programme

The importance of pests and diseases associated with forest and woodlands in the UK has never been greater, with highly damaging outbreaks, evidence of greater spread and impact, new organisms being introduced through trade pathways, and established pest threats exacerbated by changes in climate and host availability.

This programme responds to these challenges, builds on recent progress in understanding and seeks to support sector preparedness for an enhanced response, to increase the range of techniques available to manage problems and guide environmental resilience from the local to national level. Cross-cutting research with partners and collaborators will support the expansion of resilient treescapes and provide the evidence base for enhancing resilience to biotic challenges.

Work Group Areas

WA1: Diagnostic, advisory and phytosanitary provision

Operating and evolving FR's Tree Health Diagnostic and Advisory Service (THDAS), providing an early warning system, detecting new biotic threats and prompting reactive research. Reporting will be promoted via the web-based tool TreeAlert, and citizen science surveillance through Observatree. It integrates with phytosanitary work to evaluate risks from new and existing regulated pests and pathogens through horizon scanning and surveillance, thereby informing the responses of Plant Health teams, policymakers and practitioners.

WA2: Understanding pest and pathogen threats

Focussing on understanding new and changing pest and pathogen threats including invasive beetles (such as of Ips typographus) and pathogens with changing profiles or altered behaviour (including Dothistroma and Phytophthora) to determine the vulnerability of UK forest types to their establishment and to identify proactive management actions. There will also be a focus on host species, as part of an integrated approach to understand the susceptibility of new and emerging tree species to pests and diseases.

WA3: Improved detection, monitoring and surveillance

Develop existing and new methods for monitoring and surveillance of key pests and pathogens, based on a greater understanding of their ecology, dispersal capability, host preferences, epidemiology and genetics. Approaches include use of improved trapping methodologies, development of DNA based diagnostic tools and metabarcoding, and exploration of the use of remote sensing.

WA4: Pest and disease management for resilient treescapes

Informing forest management to increase resilience to pests and diseases. Work includes refining established management methods such as spatial modelling, chemical treatments and non-chemical or bio-control treatments. Novel methods will also be developed for control, improved prediction of pest spread, and use of viruses to control fungal pathogens. The WP also includes ongoing support and advice for control of mammal pests, particularly grey squirrels.

WA5: Interdisciplinary approaches to enhance biosecurity

Adopting an interdisciplinary approach on topics relevant to woodland expansion. It will harness natural resistance in tree populations, particularly oak, larch and juniper and explore the social dimensions of tree health including evaluation of biosecurity messaging on public behaviours and improving our understanding of the biosecurity practices of hard-to-reach stakeholder along plant pathways.

Key Topics

Tree Health Diagnostic and Advisory Service; pests; diseases; horizon scanning

Contributing Science Groups

Land Use and Ecosystem Services

Social & Economic Research Group

Urban Forest Research Group

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