



# International Innovation

Disseminating science, research and technology



# EuMIXFOR

# Forest future proofing

Europe's single-species forests are highly vulnerable to climate change. **Dr Andrés Bravo-Oviedo** describes the project that is uniting and developing expertise in mixed forest planning and management

## Why is research into the structure, dynamics and functioning of admixtures of tree species of increasing relevance across Europe?

In my opinion there are two main factors. The first is environmental crisis from global change; the second is society's perception of the danger of loss of forest integrity. Wildfires, pest outbreaks and strong windstorm events in Europe are becoming more common. The general perception is that complex forest ecosystems are more resilient and resistant to such events, and this has led to an increasing public interest in what is occurring and the actions the scientific community and policy makers can take. Serious study of the structure, dynamics and functioning of mixed forests should contribute to alleviating concerns about forest integrity, as well as to understanding the response of mixed forest ecosystems to natural or human-induced hazards. This understanding will help us anticipate adverse consequences.

## How are the different features of mixed forests studied?

As in other biology-related sciences, forestry must follow an inductive-deductive research approach where experimental observations and ecological theories are coupled. Forest researchers use experimental designs, analysis and modelling approaches. Some examples of these scientific tools in mixed forests are gradient analyses to study productivity of mixed versus pure stands, experimental designs to test the effect of forest management on biogeochemical cycles, and modelling competition for light in heterogeneous canopies.

## What are the key aims of the EuMIXFOR Action?

The main objective is to create a long-lasting network that can contribute to increased knowledge, sustainable management and



future conservation and improvement of European mixed forests. Actors in the network are both researchers and practitioners. This means that not only



## EUMIXFOR'S MEMBERS

Members are from both research and academic institutions, as well as from Forest Services and Enterprises with interests in the diversification of products and services furnished by mixed forests.

They come from 36 participating COST countries or institutions, including 'near-neighbour countries' such as the Ukraine, Tunisia and Algeria as well as the US, Canada, Costa Rica and Argentina.

EuMIXFOR has also received requests for information from Colombia and Indonesia.

The core group of the Action has sought a balance between countries, gender and early-stage researchers.

### OPEN TO ALL

EuMIXFOR is funded by COST which is supported by the EU RTD Framework Programme. Those institutions and members of the public who are interested in the promotion, conservation and sustainable management of mixed forests are welcome to join.

### UNITED ACTION

In Europe, bioregions are diverse: boreal, Atlantic temperate, continental temperate, Mediterranean, alpine and semi-arid conditions can be found in flat and steep areas where vegetation and species comprising mixtures are quite different in their functional traits, as well as in management practices. This great variability has led to region-focused research and a degree of disconnect between regions, although there are some exceptions, eg. *Pinus sylvestris* research. However, when it comes to mixed forests, these differences are even greater. EuMIXFOR will 'connect' research with the help of our colleagues from outside Europe.

is scientific research discussed, but management and policy too.

### How is it structured?

The Action comprises three working groups, each devoted to a specific target. The first concentrates on forest functioning and dynamics, which means that ecological processes in mixed forests will be described and studied in detail. Some of these processes include biogeochemical cycles and plant interactions.

The second group is about adaptive forest management and silviculture in mixed and pure forest stands. The main task here is to identify current and past management practices and identify or recommend those compatible with the sustainability and integrity of heterogeneous forests.

Finally, the third group is in charge of the economic and social impact of mixed forests. Identification of end users' preferences and economic revenues from mixed forests are within its scope. This structure in working groups is essentially an operating agreement, since the groups must work closely, but not closed off from one another.

# Safeguarding the future

Seeking to establish long-lasting transnational cooperation in forestry research, the EuMIXFOR project is gathering knowledge and best management practice in sustainable forest management of admixtures of tree species

**SUSTAINABLE FOREST MANAGEMENT** is a key concern for the EU; it is a powerful contributor to offsetting the effects of climate change a source of economic viability for the 2.5 million people who work in the forestry sector, and has value for the recreational and aesthetic benefits that forests confer on quality of life. In these terms, Europe's mixed forests are seen by the Commission as a fundamental source of future ecosystem services.

In 1998, Michel Loreau and Shigeo Yachi applied 'the insurance hypothesis' to biodiversity and ecosystem productivity in a fluctuating environment and proposed that clusters of diverse species, and therefore ecosystems, would respond in a more resilient way to disturbances and recover more quickly, so would be more productive than single-species systems. Extrapolating this proposition to forests in 2009, Jactel's analysis has led to broad recognition that multi-species forests of broad-leaved and coniferous

trees are preferable in terms of risk to single-species forests as they are more resilient to biotic and abiotic stressors and the effects of climate change; have higher carbon storage capacity; offer greater support for ecosystem services; and are ecologically more productive. Because mixed forests contain more diverse species and produce opportunities for more varied ranges of end products, services and silvicultural techniques, they are also seen to offer new employment opportunities in the forest sector.

Currently, mixed stands of broadleaved trees and conifers are estimated variously as accounting for somewhere between 25 and 40 per cent of Europe's forest land, as there is no consistent definition of how a mixed forest is constituted. This has led to uncertainty about how European policy of implementing mixed forests on a greater scale can be achieved. In addition, the majority of the body of existing research into European forest management

and silvicultural techniques focuses on single species or single species stands in specific regions. Silvicultural rules exist almost solely for the most dominant species in Europe's forests. Because of these factors, a four-year programme – 'European Mixed Forests: integrating scientific knowledge in sustainable forest management' – (EuMIXFOR) supported by Cooperation in Science and Technology (COST) has been launched.) "In Europe silviculture has a long tradition of dealing with complex forest ecosystems, but the starting point for EuMIXFOR was that, up until now, silvicultural recommendations and guidelines have been general. Management practices for specific mixtures are lacking or, at best, scattered at national and regional levels," explains Dr Andrés Bravo-Oviedo, who researches silviculture and management of forest systems at the Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria in Madrid, and is the Chair of the EuMIXFOR Management Committee.

## INTELLIGENCE

# EuMIXFOR

### OBJECTIVES

To create a European research network on mixed forests, which can contribute to increased knowledge of adaptive forestry, the sustainability of management, and the conservation and improvement of mixed forests to support rural development.

### KEY COLLABORATORS

**Sustainable Forest Management Research Institute**, University of Valladolid, INIA • **Professor Hans Pretzsch**, Vice Chair, Technische Universität München • **Professor Quentin Ponette**, WG1 leader, Université catholique de Louvain, UCL • **Professor Katarina Strelcova**, WG1 deputy, Technical University in Zvolen • **Professor Piermaria Corona**, WG2 leader, CRA-SEL • **Professor Magnus Löf**, WG2 deputy, SLU • **Professor Jerzy Lesinski**, WG3 leader, University of Agriculture in Krakow • **Professor Lauri Valsta**, WG3 deputy, University of Helsinki • **Dr Susana Barreiro**, STSM manager, Instituto Superior de Agronomia-Universidade de Lisboa

### FUNDING

COST Instrument supported by EU RTD framework through the COST Office, provided by the ESF

### CONTACT

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**DR ANDRÉS BRAVO-OVIEDO** was born in Madrid in 1976. During MSc studies he won an undergraduate fellowship in the Department of Applied Physics I. Having finished his MSc in Forestry at the University of Valladolid he was given a one year grant by INIA to work on applications of National Forest Inventory (NFI) data. Since 2010, he has been teaching MSc courses at the Sustainable Forest Research Institute, University of Valladolid.



## THE IMPORTANCE OF COST

COST is an intergovernmental framework aimed at facilitating the collaboration and networking of scientists and researchers at European level. It was established in 1971 by 19 member countries and currently includes 35 member countries across Europe, and Israel as a cooperating state.

COST funds pan-European, bottom-up networks of scientists and researchers across all science and technology fields. These networks, called 'COST Actions', promote international coordination of nationally-funded research.

Through its inclusiveness, COST supports the integration of research communities, leverages national research investments and addresses issues of global relevance. Every year thousands of European scientists benefit from being involved in COST Actions.

### THE AIMS OF EUMIXFOR

EuMIXFOR stakeholders comprise policy makers, local and regional authorities, landowners, scientists, the forestry sector, end users of products and services, and the general public. The expectation is that the project will ultimately provide definitive guidance on the constitution of mixed forests in terms of species proportions, planting and management techniques and structural features such as canopy characteristics.

EuMIXFOR primarily seeks to globally integrate researchers and past and present work in the forestry arena to achieve synergies that deliver added value and foster long-term transnational collaboration. In support of this, EuMIXFOR will provide a sound overview of the potential roles of mixed forests in providing environmental services in Europe's boreal, Atlantic temperate, continental temperate, mountainous and Mediterranean European bioregions. This will ideally include comparisons against equivalent regions worldwide; analysis of barriers to, and opportunities for, adaptive changes to cope with threats and opportunities presented by environmental challenges to the needs of rural and urban populations; identification of objective-orientated silvicultural practices and decision support tools for the creation and sustainable management of heterogeneous forests; and the establishment of standard protocols, common methodological approaches and experimental designs to facilitate the sharing of experience and the dissemination of results for all stakeholders. Support for networking, information and tool sharing, along with dissemination of results, is therefore being provided using a range of approaches over the Internet.

The project is building upon a number of separate European projects concerning mixed forest silviculture and biodiversity. A key difference is that EuMIXFOR explicitly aims to establish a network of researchers that will share findings with all stakeholders at an early stage to inform research and practitioners in real time. It is also intended to complement ongoing research programmes in Europe dealing with tree species, biodiversity and ecosystem functioning, such as TreeDivNet and, especially, FunDivEurope. The research also connects with past EU Seventh Framework projects (eg. BACCARA), which are examining risk of loss of forest biodiversity and productivity under climate change and adaptive measures for coping with land use and climate change respectively.

### NETWORKING KNOWLEDGE

In EuMIXFOR, a number of strategies have been devised to encourage and consolidate networking. Past and recent research on mixed forests in the different bioregions is being gathered into a central repository, and experts are being invited to contribute knowledge and information from their experiences; any gaps in knowledge will then be addressed. EuMIXFOR will assemble existing best practice in the form of an IT platform holding mixed forest management models and tools: "Research gaps and social demands will guide the development of new models and supporting decision tools," explains Bravo-Oviedo.

Local and regional authorities, landowners, SMEs, researchers and other stakeholders are being asked to discuss topics such as how mixed forests might address environmental and social challenges from events like climate change and pest outbreaks, end users' perspectives on the economic and ecological role of mixed forests, the willingness of forest owners to change management practices, and the economic and institutional changes that can affect the provision of goods and services from the sector.

Forest managers in particular are being requested to explore and determine specific management practices for mixed forests, taking into account technical feasibility, attitudes of landowners and managers and the social acceptability of the consequences of integration of functions. This networking activity will address such questions as how to establish mixed stands or to diversify single-species stands sustainably, which mixtures should be used for which objectives, whether new models are necessary for multifunctional sustainable management of mixed forests and how mixed forest establishment and management might contribute to rural development.

Lastly, policy makers and forest managers are being invited to participate in harmonisation of research and analysis protocols for studies in areas such as tree diversity and monitoring ecosystem services and silviculture effects.

The project will use social networking websites for dissemination of information, and will take steps to ensure the perpetuation of cooperation between European research institutions in the form of a common research network on mixed forests after completion. EuMIXFOR will also identify and communicate new job opportunities arising from the expansion of scope of forest management to multiple strands of products and services.