



# ARRANGE

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ADVANCED MULTIFUNCTIONAL  
FOREST MANAGEMENT IN  
EUROPEAN MOUNTAIN RANGES

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# Mountain forest management in a changing world

Cogent natural resource policy is vital for the success of any country. A consortium led by **Dr Manfred Lexer** is re-evaluating the effectiveness of existing forest management regimes in Europe and explains how a current study plans to contribute to future sustainable governance



**Could you begin by outlining the main objectives of the Advanced multifunctional forest management in European mountain ranges (ARANGE) project?**

The overall aim of ARANGE is to investigate the potentials and limitations of current and possible future approaches to mountain forest management. The results will be used for providing portfolios of ecosystem services under current and future climatic and socioeconomic conditions and to identify related risks and uncertainties. We also aim to translate scientific knowledge about the efficient provision of ecosystem services from mountain forests into decision support for policy makers and forest practitioners.

**How does the project define the concept of ecosystem services and why is the sustainable provision of these services crucial in forest management?**

We follow the most recent ecosystem services classification provided by the Millennium Ecosystem Assessment and distinguish provisioning (eg. timber, fuel, water), regulating (eg. climate regulation, avalanche and rockfall prevention) and cultural services (eg. recreation, aesthetic values). To plan, monitor and ultimately justify forest management, the quantification of ecosystem services is a crucial requirement, and making this concept operational is a key challenge of ARANGE.

**Forest management choices have a strong impact on ecosystem services provided by mountain forests. Is there a necessity for new and innovative approaches to mountain forest management?**

The demand for ecosystem services from mountain forests is manifold and essential for many communities. These demands are evolving in a changing society as expressed, *inter alia*, by altering life forms, demographic and social structure, settlement development, energy demands, perception of Nature or recreation patterns. Forest management approaches need to take this into account, besides the long planning horizons and existing risks and uncertainties (eg. disturbances such as storms and insects, socioeconomic and social changes). To ensure decision making is more transparent in such a value-laden multiple actor environment, quantitative information is required about ecosystem service provisioning. As climate change is projected to severely affect mountain regions, sometimes reaching two to three times the average global temperature change, there is a need to adapt forest management to changing conditions and provide relevant actors with tools for proper planning.

**Could you explain how the analysis of current governance systems and EU and national policies has been beneficial to ARANGE?**

Governance systems can be judged from a number of different angles. In ARANGE, we consider it at a macroscale – ie. how different sectoral policies affect forest management – and on a microscale. The latter scope addresses how regional management and marketing patterns for forest products and services are governed. In principle, this analysis of governance systems will support ARANGE in hitting the target, and addressing the right questions with the right portfolio of tools.

**What is the development focus of ARANGE and upon what basis was this chosen?**

The development focus of ARANGE will be on planning and decision support tools and approaches. State-of-the-art models of forest dynamics at stand and landscape scale will be used and further developed. We consider planning methods crucial to the analysis of trade-offs between different ecosystem services and the

identification of management approaches that support in-demand ecosystem service portfolios – such as an online decision support tool box and facilitating interactive, participatory elements of decision making into real-life forest planning.

**The research is being carried out in seven mountain regions across Europe and facilitating stakeholder interactions in these regions is integral to the success of the project. How are you aiming to ensure this and how will your findings be disseminated?**

The set-up of seven case study regions across Europe is instrumental. These areas represent the diversity of socioecological systems in mountain forests and require specific attention. A socioecological systems approach means that we are not only looking at forest ecosystems, but also the societal environment, including forest ownership, management patterns, rural development and people's demands on forests in mountainous areas.

ARANGE emphasises the regional differences in decision support needs as a prerequisite to produce useful knowledge. We harmonise interaction among research groups to avoid stakeholder fatigue, which is a crucial issue in times when stakeholder interaction is becoming increasingly common and a prerequisite for funding.

**Have efforts been made to ensure the project's activities stay relevant to stakeholder requirements throughout the duration of the study?**

Aside from project meetings to harmonise activities, workshops in the case study regions are important and planned accordingly. We expect to hold regular meetings in the regions involving stakeholder panels to negotiate specific issues during the entire lifetime of the project, and introduce ARANGE products into the case studies for final 'real-life' checks during its latter stages.

# The future of forestry

The **ARANGE** project, a Europe-wide collaboration coordinated by the University of Natural Resources and Life Sciences, Vienna is looking to make a lasting, real-world impact on European forest management

**THE VERSATILITY OF** forests is one of their greatest attributes. They are central to timber production, can protect against rockfall and avalanches and are popular locations for leisure activities and tourism. In addition, they perform a number of functions that are central to maintaining human life, such as storing carbon, purifying water and regulating climate. Yet, the demands placed on forests as a result of their multifunctional nature can be contradictory at times, which poses a challenge when managing these ecosystems.

Careful management is therefore necessary to ensure mountain ecosystems continue to fulfil their various roles at the local, landscape and regional scales. This is in line with European efforts towards sustainable forest management, which have been formally implemented by the Ministerial Conference on the Protection of Forests in Europe in the past 20 years. However, this framework needs operational precision and regional implementation concepts such as for mountain forests.

Against this context, the Advanced multifunctional forest management in European mountain ranges (ARANGE) project was established. Professor Dr Manfred J Lexer of the University of Natural Resources and Life Sciences, Vienna (BOKU) leads the project and highlights the importance of addressing forest management: "Designing management concepts that maintain a wealth of ecosystem services, including the maintenance of biodiversity on larger areas outside strict conservation or protection areas, is an urgent issue. This is particularly important in relation to the need to adapt montane forest management to

a changing climate in order to sustain ecosystem service provisioning satisfying both societal needs and natural integrity".

The overall aims of the project are threefold. The benefits and limitations of approaches to mountain forest management will be investigated; risks and uncertainties will be identified; and ultimately the findings will be applied to support policymaking in 'real-world' scenarios. Project members will work towards these key objectives by conducting seven regional case studies, utilising state-of-the-art models, involving stakeholders and creating novel planning and decision support tools.

## A COLLABORATIVE EFFORT

ARANGE began in 2012 and, with nearly €4 million in funding from the EU's Seventh Framework Programme (FP7) under the Knowledge Based Bio-Economy (KBBE) programme, the project will run for three years. Collaboration is central to the project and this is evident through the geographical diversity of the project members, which include 16 partner institutions from 11 countries. The European Forest Institute (EFI) also contributes to ARANGE by acting as an international partner and the Institute of Silviculture at BOKU serves as the coordinating institution.

The expertise within the group is similarly diverse. The consortium benefits from backgrounds in social, natural and applied sciences, competence in biodiversity and nature conservation, as well as modelling experience: "Furthermore, there are strong research groups in natural resource economics specialised in operations research and the integration of risk and uncertainty in decision making. We are also comprised of partners that contributed to most recent projects within FP6 and FP7 dealing with forest management and climate change," Lexer reveals.

## STRUCTURED RESEARCH

Bringing together the different disciplines represented in ARANGE is vital since a number of ecosystem services must be considered

## INTELLIGENCE

# ARANGE

## ADVANCED MULTIFUNCTIONAL FOREST MANAGEMENT IN EUROPEAN MOUNTAIN RANGES

### OBJECTIVES

To evaluate the capacity of current forest management regimes and possible alternative future management to provide portfolios of ecosystem services from mountain forests.

### PARTNERS

Universitaet für Bodenkultur Wien, Austria • Swiss Federal Institute of Technology, Zürich, Switzerland • Institut National de Recherche en Sciences et Technologies pour l'Environnement et l'Agriculture (IRSTEA), France • Technische Universität München, Germany • Sveriges lantbruksuniversitet (Swedish University of Agricultural Sciences – SLU) • University of Ljubljana, Biotechnical Faculty, Slovenia • Národné lesnícke centrum (National Forest Centre), Slovakia • Forest Research Institute, Bulgaria • National Institute for Agricultural and Food Research and Technology (INIA), Spain • European Forest Institute (EFI), Finland • Universitaet Graz, Wegener Zentrum für Klima und Globalen Wandel (UNIGRAZ), Austria • The Institute of Forest Ecosystem Research (IFER), Czech Republic • Geoexpert Research and Planning GmbH (GEO), Austria • Stichting BirdLife Europe (BLE), Belgium • Aranzada Gestión Forestal, S L P (AGF), Spain • Dr Stephen Matthew Webb, RTD Services (RTDS), Austria

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DR MANFRED J LEXER is Associate Professor for Silviculture and Vegetation Modeling. His main research interests include multi-purpose forest resource planning and decision making, multi-criteria decision support systems and ecosystem modelling. He has been actively involved in several European-scale research projects and initiatives in the past 15 years.

when addressing the sustainability of forests. This imposes technical and conceptual challenges. Lexer elaborates on the benefits of the ARANGE project structure: "The work packages facilitate building a bridge between natural and social sciences, including a range of ecosystem modelling, policy analysis and stakeholder involvement". In particular, the study addresses four main ecosystem services that have been identified as important to mountain forests. These include timber production, protection against gravitational natural hazards, climate change mitigation and conservation of Nature and biodiversity.

### CASE STUDIES

The research comprising the first five WPs involves case studies in seven mountain regions across Europe: the Iberian Mountains, Western Alps, Eastern Alps, Dinaric Mountains, Scandinavian Mountains, Western Carpathians, and Western Rhodopes. Each was chosen in order to generate a fair representation of the most important types of mountain forest around Europe and to include the distinct biophysical and governance settings around the continent.

A number of tools and methods will be employed to investigate current status and assess space- and time-dependent interrelationships among ecosystem services provided by mountain forests. The researchers will gather information from literature reviews, surveys and interviews with experts and state-of-the-art forest models. The models will help with projections of future forest development in the case study regions as well as providing indicators of ecosystem services. "Advanced planning and decision-making approaches including optimisation and multicriteria analysis will be used across all case study regions to design useful and efficient solutions for improved forest management," Lexer adds.

Based on these methods, several common themes will be addressed during the project, such as better understanding of the relationships between the main ecosystem services. Current policy and governance framework will be analysed and further developed, and the most economically efficient management strategies for ecosystem services will be determined, based on the needs of both

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landowners and the public. Importantly, the research for each case study region will take into account climate change when analysing and devising management concepts.

### AN EYE TOWARDS THE FUTURE

ARANGE not only seeks to understand the current state and challenges for forest management, but also to apply knowledge to real-life situations. With this in mind, the research conducted within each case study will be analysed alongside regional stakeholder panels consisting of forest owners and managers, decision makers and SMEs. "This will help to provide a sound basis to identify and address decision-making problems and issues, and contribute to improved knowledge transfer," Lexer explains. Five SME partners are also included in research and development activities and additional SMEs in each case study regions will be involved in outreach activities. Moreover, to ensure ARANGE's work continues to impact on forest management beyond the project's culmination in 2015, a web-based decision support tool box is being developed for stakeholders to use.

ARANGE recently celebrated its first annual meeting, which gathered more than 40 members representing every partner institution to discuss the progress made to date. A vast amount of data has been collected so far, and the next step for project members will be to combine the data and models and begin to analyse the information. Although there is still much work to be done before the project finishes, the efforts made by the ARANGE team will serve to maintain and enhance multifunctionality of mountain forest ecosystems for many years to come.

