***eco2adapt*'s Newsletter**
Volume 1, Series 2
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"*eco2adapt* is a Horizon Europe Research and Innovation action project funded by the European Union and coordinated by INRAE. It began in September 2022 and will run for five years with 31 partners from 11 countries. The project aims to provide solutions to combat the uncertain effects of climate change and promote resilient forest ecosystems for future generations."

eco2adapt: Regulation Mechanisms of Ecosystem Resilience and Adaptive Forest Management (2023-2026).

Prof. Dr. PANG Yong, Chinese Academy of Forestry.

The *eco2adapt* project is funded by the Ministry of Science and Technology of the People´s Republic of China, which brings together 16 Chinese and European expert organizations in the fields of forestry, ecology, and climate change, along with 19 affiliated entities, from 11 countries. This China-EU project carries out cross-regional-multi-scale coupling research on resilience regulation mechanism and adaptive management of forest ecosystem through interdisciplinary research, and strengthens the international community's consensus on forestry coping with climate change. The focused questions are:

Indicators acquisition: Establish a comprehensive assessment system of forest resilience by studying the effects of environment-plant-soil interaction on processes and functions of forest ecosystems.

Resilience evaluation: Obtain multi-scale resilience indicators, and construct resilience assessment models and warning models for typical forest types.

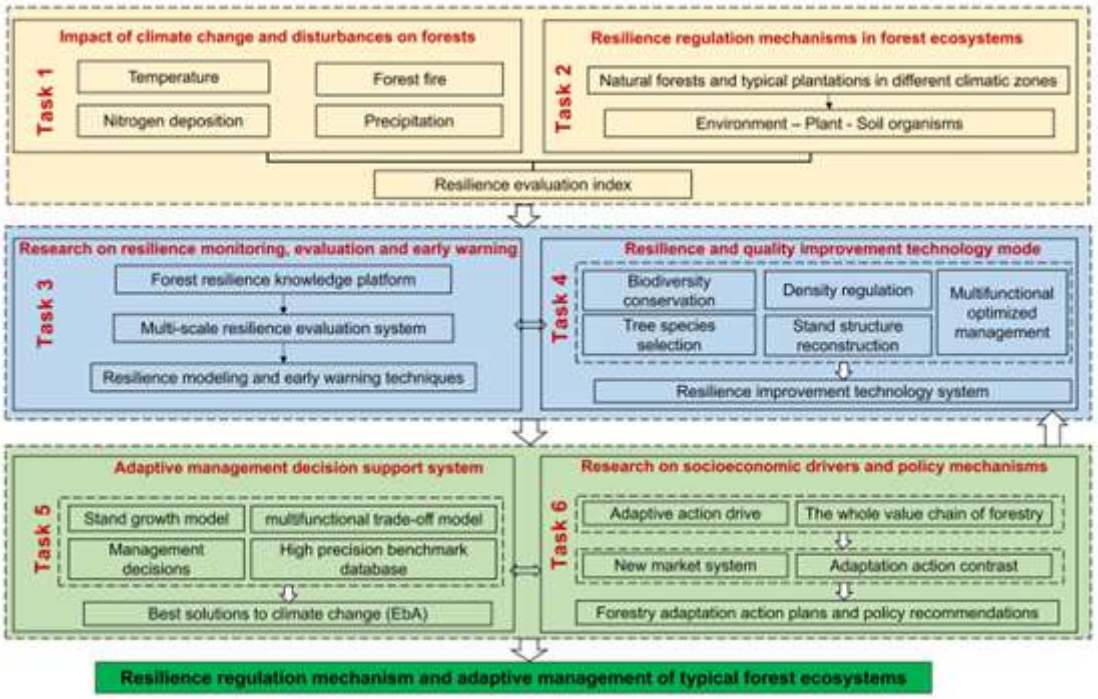


Figure 1. Research contents of six tasks of *eco2adapt*-China.

Quality improvement: Develop key technologies of forest structure optimization, disaster prevention and controlling, multi-functional operation, and construct management expert system for the improvement of resilience and quality of typical forest ecosystems.

Service application: Identify the socio-economic and ecological driving factors for implementing resilient forest management, and propose precise strategies for climate change adaptation in forest ecosystems.Six research tasks are designed to address the above questions (Figure 1). Task 1 is Impacts of climate change and disturbance on forests, which led by ENCI/CAF. This is a text block. You can use it to add text to your template.

Task 2 is Resilience regulation mechanism of forest ecosystem, which led by ICBR. Task 3 is Study on monitoring, evaluation and early warning of forest ecosystem resilience, which led by ZAFU. Task 4 is Technical model of resilience and quality improvement of forest ecosystem, which led by TFRC/CAF.

Task 5 is Decision support system for adaptive management of forest ecosystem, which led by ENCI/CAF. Task 6 is Study on socio-economic drive and policy mechanism of forestry adaptation action, which led by IFPI/CAF.

All of these six research tasks are linked closely with the seven WPs of the *eco2adapt*-EU (Figure 2). Through collaborations on common interests and activities, the following objectives will be achieved:

- Reveal the regulatory mechanism of forest ecosystem resilience and construct an evaluation indicator system for forest ecosystem resilience (via Task 1 & 2).
- Development the multi-scale monitoring, evaluation, and early warning technologies for forest ecosystem resilience (via Task 3).
- Propose resilience and quality improvement models suitable for typical artificial forests and natural forests in China, and construct a forest ecosystem adaptive management and decision support system (via Task 4 & 5).
- Clarify the socio-economic driving forces and policy mechanisms of forestry adaptive actions (via Task 6).

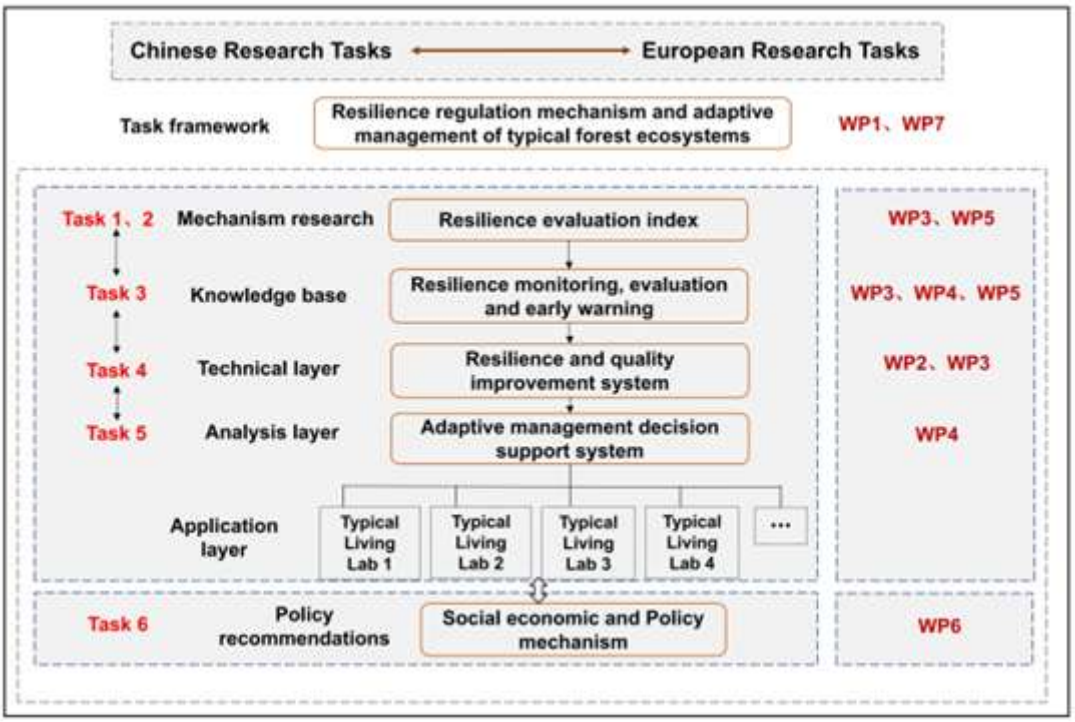


Figure 2. China and Europe cooperation for *eco2adapt*. Based on theoretical foundation, technical methods, system models, and application demonstrations, the six major tasks of the Chinese side correspond to the seven task modules of the European side.

Installing Rhizotrons in Lithuania's Dzukija National Park Living Lab.

Michael Manton, Gediminas Brazaitis. Vytautas Magnus University.

Under the *eco2adapt* project's WP5.2, project partner Vytautas Magnus University (VMU) held a weeklong (June 19-25, 2023) field camp in Dzukija National Park Living Lab (DNPLL). The DNPLL is located in southern Lithuania and known for it large expanse of dry sandy Scots pine forest. In total, the camp involved 18 participants, including VMU staff and students as well as project partners from INRAE and IMSI. The goals of the field camp where to collect and sample forest ground vegetation biomass, mycorrhizal fungi, soil samples and install Rhizotrons. A Rhizotron is a field laboratory constructed underground using windows in order to study the soil and its interactions with plant roots using repeated observations and measurements.

With early morning starts, VDU staff and student were guided by INRAE staff, on how to sample and prepare the biomass, soil and mycorrhizal fungi and install the Rhizotron. Living in an old forest cottage in the forest, our mornings started early and were followed by long hot humid days with an abundance of mosquitoes and small black sand files for company (photo 1). In total we installed twelve Rhizotrons in two different forest habitat types (dry and wet forests) within the DNPLL. The aim of the study is to identify the difference in mycorrhizal fungi and root growth among monospecific Scots pine, Birch stands and its mixture over the next years. Results will also be compared with other *eco2adapt* partners (Photo 2).

Our fun team, the beautiful pine forest and the sandy soil made the work memorable, enjoyable and a highlight of this summer's field work. Finally, each day we would unwind with a traditional food, a sauna, and a swim in the Gruda River. Following the long days work, we processed and prepared the collected biomass, soil and mycorrhizal fungi ready for travel.

Photo 1. Our group was kindly hosted by Dzukija National Park. Director of the park Eimutis Gudelevičius (left) showing the European bison population restoration project for guests from *eco2adapt* project.

Photo 2. Establishment of the rhizotron – how deep it should be?

1st annual meeting of the *eco2adapt* project in Astakos, Aitoloakarnania, 10-13 July 2023.

Anastasia Pantera, Agricultural University of Athens.

The first annual meeting of the research project *eco2adapt* (Ecosystem-based Adaptation and Changemaking to Shape, Protect and Maintain the Resilience of Tomorrow's Forests), funded by the EU HORIZON EUROPE programme, took place in Astakos, Aetoloakarnania.

The meeting was organized by the Department of Forestry and Natural Environment Management of the Agricultural University of Athens in collaboration with the Municipality of Xiromero.

The meeting was hosted in the city hall. The meeting was assisted by the staff of the municipality, whenever it was needed. 60 professors, researchers, and postgraduate students from 23 international universities and research centres participated in the meeting (photo 3).

The meeting was successful, and a lot of important work has been done on the next steps and further development of the project.

Photo 3. Group picture outside the city hall

The attendants had the opportunity to enjoy the natural environment of the region and to visit the

experimental sites of the Department of Forestry and Natural Environment, Agricultural University of Athens, funded by the project. The experimental sites are established in the unique old-growth forest and silvopastoral system of Xeromero (photo 4). The field trip was organized on the 11th of July giving the participants the opportunity to visit several parts of the forest.

Photo 4. The participants had the opportunity to visit the Xeromero old-growth forest and silvopastoral system.

The field visit was organizing on three important aspects: the relation of the natural environment to i. society, ii. Religion and iii. Science. Stakeholder representatives of these aspects were invited and presented their view and opinion on the forest, its management and contribution to the environment and the region in general.

The *eco2adapt* aims to develop a dynamic framework for adapting forest ecosystems to climate change based on their characteristics (EbA), with nature-inspired solutions (Nature-Based Solutions NBS).

Photo 5. The participants had the opportunity to visit the experimental plots and the new rhizotrons established under the project.

The framework will harness the biodiversity and ecosystem services of forests with the ultimate goal of enhancing the resilience of forest ecosystems as a guarantee for social-ecological sustainability as well. A large part of the project is being implemented in the Xiromeros oak forest. Particularly important is the involvement of stakeholders who can make a positive contribution, from active citizens to policy makers at local, regional and national level (photo 5 & 6).

More information can be found on the website of the programme https://www.eco2adapt.eu/

Photo 6. Social aspect of the field trip: The first stop of the field trip was at the village of Skourtou. Dr. Pantera introduced the social aspects of the forest in collaboration with the community' president Mr. Tzoganis.

A rubric on innovation- Nature-Based Solutions Institute

Cecil Konijnendijk, Nature-Based Solutions Institute

The Nature-Based Solutions Institute, which is based in Malmo, Sweden, is a think tank founded in 2020 that supports the evidence-based greening of cities and the implementation of nature-based solutions. We were initially approached to join *eco2adapt* for our urban forest expertise, connections with partners in China, as well as our work on the policy-science interface. We often work with local authorities, national governments, and international bodies like those of the United Nations in their efforts to develop governance, policies, and planning of urban forests and nature-based solutions. Moreover, we also have considerable experience in forest governance research more widely, another important strength for the *eco2adapt* project. We like to compile and 'translate' research into specific guidance and actions, a role that we will also play within the *eco2adapt* consortium.

A lot of great research on e.g., forest resilience and forest governance exists, but this often does not reach decisionmakers. We hope to help with this in the case of *eco2adapt*.

Our primary task within the project is to lead Task 6.2 on identifying and demonstrating innovative governance and business models for building forest resilience. We will study the Living Labs but also take a wider view of innovation examples. Promising and transferable examples will be compiled and we also hope to 'test' some of these in several of the decision theatres.

Can stakeholders see the benefit of changing local governance and business models? What would be needed to implement new models? We will try to work along an urban to rural gradient in undertaking this work. We will work closely together with other WP6 tasks but also with other policy-related activities in the project. As we also have substantial policy advice and science communication expertise we hope to help strengthen these aspects of *eco2adapt* as well.

Scientific news

Forzieri, G. *et al.* The Database of European Forest Insect and Disease Disturbances: DEFID2. *Global Change Biology* 29, 6040–6065 (2023). https://onlinelibrary.wiley.com/doi/full/10.1111/gcb.16912

Insect and disease outbreaks are biotic disturbances that are intensifying under climate change, jeopardizing the future provision of forest ecosystem services. In this context, recently, has been released the Database of European Forest Insect and Disease Disturbances (DEFID2), containing over 650.000 georeferenced records spanning eight countries and covering incidents from 1963 to 2021. These records were gathered using various methods, including ground surveys and remote sensing techniques, and went through a rigorous data-quality check and harmonization process before popularizing the database.
DEFID2 provides both qualitative attributes (e.g. severity, causal agents, host tree species, etc.) and satellite-based quantitative analysis of affected areas (vegetation index trend, interaction with wildfire and wind). The database is proposed as a valuable resource for large-scale monitoring systems of insect and disease disturbances, assisting in gaining understanding of insect and disease disturbance dynamics, and enhancing representation in land-climate models. The database is freely available, allowing the optimization of the use and reuse of disturbance records collected through a range of methods.

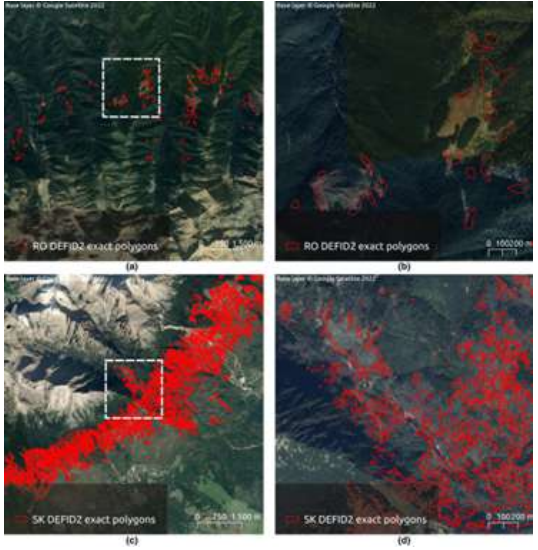
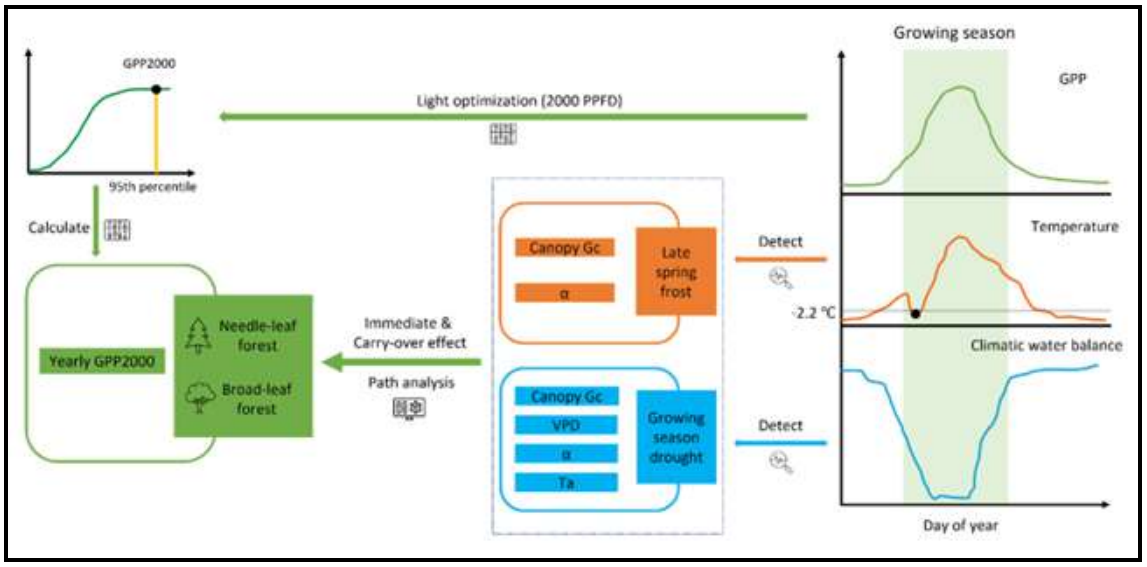


Figure 3 (Left). Examples of insect disturbances recorded in the DEFID2 database. (a, b) Forest area in the Făgăraș Mountains, Southern Carpathians, Brașov and Sibiu districts, Romania (RO), affected by insect outbreaks surveyed over the period 2014–2017. (c, d) Tatra Mountains in Poprad district, Slovakia (SK), affected by insect outbreaks surveyed over the period 2005–2009. Zoomed-in plots in (b, d) depict the area in the white boxes in (a, c).

Chen, L. *et al.* Immediate and carry-over effects of late-spring frost and growing season drought on forest gross primary productivity capacity in the Northern Hemisphere. *Global Change Biology* 29 (14), 3924-3940 **(2023).** https://doi.org/10.1111/gcb.16751

Forests are increasingly exposed to extreme global warming-induced climatic events. However, the immediate and carry-over effects of extreme events on forests are still poorly understood. We analyzed the immediate and carry-over effects of late-spring frost (LSF) and growing season drought on needle-leaf and broadleaf forests in the Northern Hemisphere using eddy covariance data from 34 forest sites. The results show that LSF had clear immediate effects on the GPP capacity of both needle-leaf and broadleaf forests. However, GPP capacity in needle-leaf forests was more sensitive to drought than in broadleaf forests. There was no interaction between LSF and drought in either needle-leaf or broadleaf forests. Drought effects were still visible when LSF and drought coexisted in needle-leaf forests. Path analysis further showed that the response of GPP capacity to drought differed between needle-leaf and broadleaf forests, mainly due to the difference in the sensitivity of canopy conductance. Moreover, LSF had a more severe and long- lasting carry-over effect on forests than drought. These results enrich our understanding of the mechanisms of forest response to extreme events across forest types (Figure 4- below).



Mauri, A. *et al.* Assisted tree migration can reduce but not avert the decline of forest ecosystem services in Europe. *Global Environmental Change* 80, 102676 (2023). https://www.sciencedirect.com/science/article/abs/pii/S0959378023000420

European forests are under increasing pressure from both natural and human-induced factors, with a projected decline in tree diversity across the continent. The study addresses the challenge of incorporating assisted migration into climate adaptation strategies, aiming to identify tree communities that balance resilience to climate change and delivery of ecosystem services.

By utilizing a comprehensive dataset of tree species occurrences, future climate projections, tree functional traits and ecosystem services provision, a novel modeling framework based on three species replacement strategies was developed and assessed.

The replacement strategies went from a) random replacement from a pool of suitable species, b) chose species to maximize a given ecosystem service, and c) chose species aimed to the best overall optimization of all services. Incorporating the assisted species migration strategies into the modeling framework could potentially reduce ecosystem service losses from 15% to 10% on average in Europe, from 52% to 33% in the Mediterranean region, and even increase service availability in certain regions. The study provides a formal analytical framework to inform the design of forest tree species communities capable to withstand future climate while ensuring a high provision of ecosystem services, supporting both decision and policy makers.

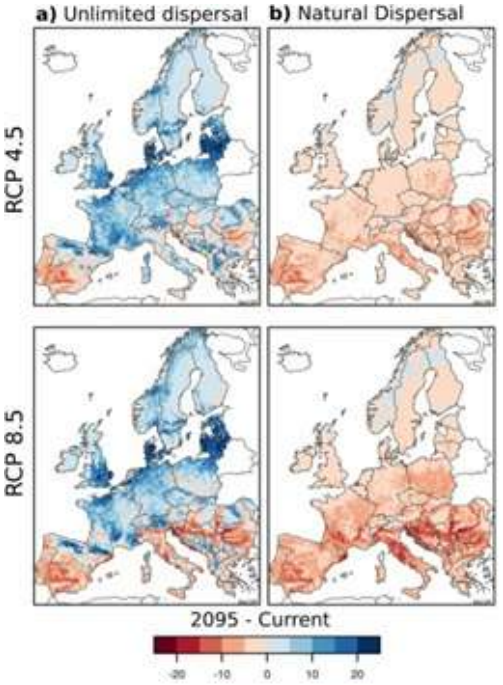


Figure 5 (Right). Changes in tree species richness by the end of the 21st century relative to the current period. Results are presented for two climate trajectories (RCP 4.5 and RCP 8.5) and two dispersal scenarios: a) an unlimited dispersal scenario, which assumes that all suitable areas can be successfully colonized by the European tree species under consideration; this represents the potential pool of species (blue areas) that can be sourced as replacement tree species in the forest management strategies; b) a natural dispersal scenario, where most tree species, due to limited dispersal abilities, will lose substantial portions of their range (red areas) and will not colonize enough new areas to compensate for the losses. Tree species richness was calculated as the number of tree species present in a given grid cell. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Past events

eco2adapt attended Silva Forest Exhibition on 8-9 September 2023 in Joensuu.

Minna Luoto, Finnish Forest Centre.

Silva Forest Exhibition brings forestry professionals, forestry students and all forest minded people together. Silva is a warm and welcoming event for a whole family where you meet forestry operators, forest scientists, and get to know about natural forest products and lumberjack tradition.

eco2adapt attended Silva Forest Exhibition on a stand called Climate and Forest. The stand presented how forests can adapt to climate change and how climate change affects to forests. One of the presented means was ecosystem-based adaptation, such as mixed forests, to protect the resilience of tomorrow's forests. In addition, the stand presented how to detect bark beetle damages with satellite images (photo 7).

Photo 7. Metsäkeskus stand (Right)

Photo 8. UEF stand area

The stand also attracted children and youth because it was involved in a Seppo-game that was played

throughout the event. The game was based on a mobile phone application where a player needs to navigate through tasks that a player sees on the map in the mobile phone. In the Climate and Forest stand the task was to recognize tree seedlings.There were multiple tasks in the exhibition area. The stand was bustling throughout the exhibition, and according to estimates, more than 1,000 people visited the stand. Besides, UEF also had a stand where students and young researchers visited. Leaflets and newsletters from *eco2adapt* were displayed on the table at the stand (photo 8).

Co-design and living labs emphasized at the AgriResearch conference.

Jaana Kaipainen, Finnish Forest Centre.

The AgriResearch conference held in Brussels from May 31 to June 1, 2023, highlighted the importance of co-creation and co-design in research projects. The concept of living labs was discussed as a way to enhance the involvement of multiple stakeholders and promote project ownership among landowners and other actors. By utilizing living labs, the relevance of research can be increased, leading to changes in the actions of farmers and forest owners. In the breakout session concerning the management for multifunctional forests Mr Michael Wolf from the DGAgri presented good examples of forest related research under Horizon, the *eco2adapt* -project being mentioned as one of these.

One of the key topics of discussion was the integration of social sciences and humanities into agriculture and forestry research, policy development, and governance. It was recognized that these disciplines play a crucial role in translating knowledge, new methods, and innovations into practical applications that can bring about actual changes in the management of natural resources. Including social sciences and humanities is essential to achieving the objectives set for the sustainable use of resources. Forests face various challenges and objectives, necessitating the generation of new knowledge and the re-evaluation of resilience, economic models, and governance approaches.

Transitioning towards sustainable forestry systems and rural communities requires local solutions that take into account the specific drivers and strategies of each region. Research and innovation are vital for developing, scaling up, and sharing knowledge, skills, technological advancements, social innovations, policies, and governance models.

During the conference, emphasis was also placed on non-wood products and services and the need to understand the supply, marketing, and value chains associated with them. Exploring the potential of non-wood products can create new employment opportunities in rural areas, enhance their attractiveness, and strengthen social resilience. Recognizing and respecting the diversity of forest management practices, local conditions, objectives, the structure of forest ownership, and the natural environment were highlighted as important considerations in forest-related research as well as forest management.
The focus of the AgriResearch conference was to identify research and innovation priorities for the future EU agricultural research and innovation agenda. By bringing together scientists, farmers, rural communities, industry representatives, advisors, policymakers, citizens, and NGO representatives, the conference aimed to foster critical thinking on how research and innovation can address the challenges faced by agriculture, forestry, and rural areas. The conference sought to build upon existing activities and achievements while exploring new opportunities for advancement.

Next coming events

The 2024 General Assembly Meeting in Brasov.

Victor Dan Pacurar, Universitatea Transilvania Din Brasov.

The 2024 General Assembly Meeting will be organized at Brasov, a city in the central part of Romania, south-eastern Transylvania, where **Transilvania University of Brasov** is located.

Brasov City and its surrounding region are one of the most important tourist attractions in Romania. There are many reasons for this, but probably the most significant are the beautiful natural scenery, with mountain hillslopes covered by magnificent forests, coming close to the centre and the historical and cultural heritage of this old Saxon town (Kronstadt, in German) settled on an important trade route, that was connecting Europe with the Orient in the Middle Ages. This appealing blending of the two above mentioned factors could be also observed in the photograph below (Photo 9), showing the central square of Brasov, with the forested hillslope of the Tampa Mountain (with the large white letters -BRASOV- in a Hollywood style, on the top) and the old City Hall. It is also noteworthy that somewhere, below the clouds in the image, is located the best ski resort in Romania (Poiana Brasov).

Photo 9. Brasov City Historical Central Square

Transilvania University (UNITBV) is a comprehensive university, presently the largest academic hub in the centre of Romania (Photo 10a), with 18 faculties (43 study domains), the oldest among these, being the initial core, is the Faculty of Silviculture and Forest Engineering (the unique faculty in the country, in this domain, before 1989; Photo 10b).

Photo 10a & 10b. **Transilvania University** Rectorate Building (left) and the Faculty of Silviculture and Forest Engineering main building (right).

Transylvania, the name of the region and of the university, is associated by many foreign people with Dracula legend but the most significant linkage should be the one with forests, as the name itself indicates (Transylvania, coming from Latin, meaning the country over the forests). There are here gorgeous forests, even some pristine natural ecosystems. In Brasov Mountains there are several forest types: the dominant beech-fir-spruce mixtures, replaced by pure spruce stands at higher elevations (but also, in some areas, at the contact with the depression -in frost prone zones, due to temperature inversions), pure beech forests below, oak mixtures in lower areas and some others. Apart of observing the magnificent forests surrounding Brasov, there will be also a visit south of the Carpathians, in the Iedera Living Lab, comprising broadleaved forests, with the main species: beech (42 %), lime (20%), sessile oak (14 %) and hornbeam (10%).

Our Researchers at IUFRO 2024!

In 2024, a select group of our dedicated researchers will actively participate in the prestigious International Union of Forest Research Organizations (IUFRO) World Congress. The IUFRO World Congress, a once-in-five-years event, serves as a global platform for collaboration and knowledge exchange in the field of forest research. This significant event brings together experts from around the world to explore the latest developments in forest research. Our researchers will contribute to various sub-plenary and technical theme sessions at this esteemed gathering, sharing their expertise and contributing to the global discourse on forest research.

The Sub-plenary Sessions will address topics like forest adaptation strategies, socio-ecological conflicts in forest management, and forest water management, among others. Our researchers will also partake in various technical theme sessions at IUFRO 2024, encompassing a wide range of forest research topics, including forest management, forest resilience, forest sustainability, and forest monitoring, among others (Table 1).

Stay connected with us as we continue our journey toward making a positive impact on the world of forest research. We will be sharing updates and insights from our researchers' participation at IUFRO 2024 in our future newsletters.

Table 1. Our researchers at IUFRO 2024

Theme	Researcher	Organisation	Title
S1.4	Henrik Hartmann *(Coordinator, Monitoring of Global Tree Mortality Patterns and Trends)*	MPI for Biogeochemistry, Germany	Global water provision: Understanding the forests oil-water nexus under forest management, climate change and increasing disturbances.
S4.1	Alexia Stokes	INRAE, France	Building international initiatives to strengthen forest adaptation strategies in a changing climate.
S4.4	Rasoul Yousefpour *(Coordinator, Risk Analysis)* Marielle Brunette *(Deputy Coordinator, Risk Analysis)*	University of Freiburg, Germany and University of Toronto, Canada INRAE, France	Socio-ecological conflicts in forest management: Risks of (not) adapting?
S5.6	Palle Madsen	InNovaSilva ApS, Vejle	Transforming and restoring forests for more resilient landscapes and societies – towards the IUFRO Stockholm declaration.
T1.13	Frank Berninger	University of Eastern Finland	Forest management for climate change mitigation.
T1.16	Rasoul Yousefpour	University of Freiburg, Germany and University of Toronto, Canada	Implementing fire-resilient landscapes (IUFRO Unit 4.04.07 "Risk Analysis")
T3.11	Frank Berninger Alexia Stokes	University of Eastern Finland INRAE, France	Forest resilience: the vision from belowground.
T3.12	Palle Madsen	InNovaSilva ApS, Vejle	Forest Restoration Success and How to Achieve it.
T3.27	Palle Madsen	InNovaSilva ApS, Vejle	New forests with greater resilience: the importance of forest genetic resources in forest landscape restoration.
T5.15	Henrik Hartmann *(Coordinator, Monitoring of global tree mortality patterns and trends)*	Max Planck Institute for Biogeochemistry	Global forests in a hotter and drier world: Assessing Forest damage and tree mortality from climate change accelerated insect outbreaks and infectious diseases.
T5.3	Rasoul Yousefpour	University of Freiburg, Germany and University of Toronto, Canada	Assessing forest sustainability through operations research (IUFRO Unit 4.04.07 "Risk Analysis").
T5.34	Alexia Stokes Hans Verkerk	INRAE, France EFI, Finland	The new age of forest monitoring: A common European forest monitoring system in a global perspective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CHINESE ACADEMY OF FORESTRY

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BAMBOO AND RATTAN

1958

1929

South China Botanical Garden
Chinese Academy of Sciences

PEKING UNIVERSITY
1898


ForestRe
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