RESEARCH AND PRACTICE IN FOREST ECOLOGY

INTERNATIONAL CONFERENCE

International Scientific Conference for Young Scientists
"Research and Practice in Forest Ecology"
Institute of Dendrology, Polish Academy of Sciences
8-12 May 2024, Kórnik, POLAND

The aim of the Conference will be to discuss the results of research in the field of forest ecology, including changes in forest ecosystems in local, regional and global terms, as well as to outline directions and perspectives for new research, including interdisciplinary studies.

We invite presentations dealing with broad aspects of forest ecology, such as:

- biology of trees and associated organisms,
- forest genetics,
- tree breeding, physiology and biotechnology,
- seed biology and technology,
- invasive organisms,
- forest dynamics,
- climate change impacts on forest ecosystems,
- forestry and forest management.

INVITED SPEAKERS

Prof. Paweł Chmielarz
Department of Developmental Biology

Research interests: forest genetic resource conservation, investigating storage complexities in forest tree species, *in vitro* techniques for meristem regeneration, seed desiccation sensitivity studies, micropropagation for genetic preservation

Can we conserve forest genetic resources *ex situ* in Poland for future generations in the face of global climate change?

Ex situ conservation of forest genetic resources is an area of great significance, especially with the unprecedented rate of global climate change. Even in Poland the most important forest tree species produce seeds from different categories, among them seeds very difficult to store in controlled conditions, which belong to the recalcitrant category. To safely store genetic resources, we are focusing on *in vitro* culture, seed desiccation sensitivity, and seed storage behavior (also in liquid nitrogen) both on physiological and molecular levels. *In vitro* techniques are widely used in storage protocols to regenerate isolated meristems after cryopreservation. Attempts at micropropagation of individual trees were recently successfully applied for ca. 800-year-old oaks to store their genetic material (clones) in the field. Results of our research complement knowledge in the area of tree reproduction and are applied in forest practice in the Kostrzyca Forest Gene Bank in Poland.

Prof. Daniel J. Chmura
Department of Genetics and Environmental Interactions

Research interests: quantitative genetics, tree improvement, genetic and physiological determinants of variation in productivity of forest trees, global change and its impacts on forest ecosystems

Contribution of quantitative genetics to adapting forests to climate change

Tree populations will suffer from increasing maladaptation in changing climates projected for the future. Knowledge of within-species variation in traits contributing to adaptation would help to adapt forests to new climates. Information gained from provenance experiments can lead to strategies of assisted migration (assisted gene flow) to maintain forest productivity. Other traits important for adaptation to future climate may also be subjects for selection in breeding populations. The talk will focus on these concepts, illustrated with examples of related research activities.

Prof. Marcin K. Dyderski
Department of Ecology

Research interests: investigating climate change and invasive species, invasive tree species studies, predicting future climatic niches under climate change, investigating the influence of human activities on plant communities

Future of European tree species: how will climate change shape forests?

Climate is a major determinant of species distributions at the coarsest spatial scales. In this talk I will summarize recent studies applying species distribution models to European trees under a wide range of climate change scenarios. Coniferous forest-forming tree species will lose a significant part of their current climatic optimum, and in some parts of Europe will be potentially replaced by broadleaved trees. Among invasive tree species there are similar trends: retreat of conifers and spread of broadleaved species. The discussed shifts will alter functioning of European forests.

Prof. Ewa M. Kalemba
Department of Developmental Biology

Research interests: seed ageing, seed longevity, oxidative stress, redox status, seed germination, seedling establishment

Factors determining seed viability and successful seed germination in a changing world

Transition from a seed to a plant is a critical stage in the plant life cycle, with important implications for ecological success in the environment. To meet targets in biodiversity conservation, genebanking programs and reforestation initiatives, it is necessary to determine all factors shaping the stability of seeds in the soil and their *ex situ* storage. Seed quality declines with age when protective and repair mechanisms become less efficient, and removal of toxic reactive oxygen species becomes less effective. Then, oxidative damage occurs in proteins, organelles (mitochondria) and seed tissues, decreasing seed germinability.

Prof. Grzegorz Iszkuło
Department of Biogeography and Systematics

Research interests: plant ecology, leaf margin analysis, dioecious plants, *Viscum album*

What's the point of toothed leaves?

For over 100 years, it has been known that with an increase in annual temperature, there is a corresponding increase in the proportion of species with entire leaf margins in the world's flora. Several hypotheses have been proposed to explain the function of irregular leaf margins. The most convincing suggests that irregular margins enhance the edge effect. Consequently, at the beginning of the growing season, both transpiration and photosynthate production are increased, maximizing carbon gain when temperature is cold but moisture and nutrients are readily available. The correlation between the proportion of species with entire leaf margins and those with toothed margins, in relation to the average annual temperature, is currently used to infer the climate of past floras from fossil records. However, such analyses often show anomalies in cold climates. This has led to the hypothesis that the discrepancies are due to a high percentage of evergreen species with entire leaves that winter under snow. The floristic composition of 10×10 km squares in 20 km wide transects running through Finland, Poland, and Germany was analyzed. A negative correlation was observed between the percentage of deciduous species and the average annual temperature, contradicting the typical positive relationship. This pattern was only noted at higher latitudes, where average annual temperatures range from about -2.5°C to +2-4°C. The hypothesis that this phenomenon is caused by a high proportion of evergreen full-leaf species wintering under the snow cover has been dismissed. These findings somewhat challenge the validity of using leaf margin analysis as a method for estimating past temperatures.

Prof. Andrzej M. Jagodziński
Department of Ecology

Research interests: forest ecology, biodiversity patterns, biomass production, carbon storage estimation, nature conservation, functional ecology

Carbon storage estimation in forest ecosystems – research and practice

Sustainable and multifunctional forest management may play a key role in mitigation of negative effects of increasing carbon dioxide concentration in the atmosphere and thus global warming. Forest ecosystems are a very important carbon reservoir, and organic carbon may be stored both in living and dead biomass, as well as in soils. However, it is highly important to increase the accuracy of carbon estimations in forest ecosystems both at local, as well regional and global scales. In the lecture I will focus on carbon storage estimation of the main European tree species stands and forest management activities that may increase carbon storage in forest ecosystems.

Prof. Tomasz A. Pawłowski
Department of Genetics and Environmental Interactions

Research interests: seed dormancy and germination, seed ecology, plant hormones, proteomics and gene expression regulation, climate change and the early stages of the life cycle

Climate legacy in seed and seedling traits of European beech populations

Trees ability to persist within their current distribution ranges is determined by seed germination and seedling growth. Exploring variation in these traits helps to predict tree population dynamics under future climates. Beech populations were analyzed to test whether adaptation to climatic conditions is reflected in seed germination and seedling traits. The climatic conditions at the origin shape the intraspecific variation of seed germination and seedling traits, and may limit regeneration and affect adaptation potential of beech to increasing temperatures and decreasing precipitation**.**

Prof. Marcin Pietras
Department of Biogeography and Systematics

Research interests: invasive fungi, plant-fungus interactions, mycorrhizal symbiosis, cointroduction of plants and fungi, biogeography of fungi, fungal ecology

Biogeography of potentially invasive non-pathogenic fungi in Europe

The occurrence of alien and invasive organisms is one of the main problems in nature conservation. In this context, little is known about the spread of potentially invasive macrofungi. Various methodological approaches, from the classical taxonomy of fungi, and molecular biology methods, to ecological modeling tools, can be used in biogeographical studies of non-pathogenic fungi. Here we present comprehensive information about the distribution and spread of alien taxa in Europe, specifically ectomycorrhizal *Aureobolerus projectellus*, *Suillus lakei* and *S. placidus*, as well as the saprotrophic taxa *Stropharia rugosoannulata* and *Clathus archeri*.

Prof. Maria Rudawska
Department of Symbiotic Associations

Research interests: forest ecosystems, fungal communities, ectomycorrhizas, sporocarps, diversity and conservation

Ectomycorrhizal communities in forest ecosystems: state of the art and questions for future research

Ectomycorrhizal (ECM) symbiosis is a significant component of forest ecosystems. Key ecosystem functions of ECM symbiosis such as carbon cycling, nutrient mobilization, and supporting the health and growth of forest trees will be presented. The most important methods applied in the studies of ECM communities will be demonstrated. The species richness and functional diversity of ECM fungi will be shown, based on our research from, e.g., forest nurseries, peat bogs, and managed forest vs forest reserves. Finally, the recent challenges in ECM research in forest ecosystems will be presented.

Prof. Witold Wachowiak
Department of Genetics and Environmental Interactions

Research interests: population structure, local adaptation, natural selection, nucleotide polymorphisms, genetic markers, DNA genotyping

Genomics of population history and adaptive variation in forest trees

Many forest tree species show high differentiation of quantitative traits between populations exposed to different environmental gradients related to photoperiod, temperature, or water availability. This variation results from natural selection due to local adaptation of populations and is maintained under a migration-selection equilibrium. Genetic bases of variations in adaptive traits are mostly unknown. However, recent developments in DNA sequencing and genotyping methods provide new opportunities to search for genes and genomic regions under selection. During the talk I will highlight recent developments in forest tree genomics, focusing on pine.

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