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SPOTLIGHT

IUFRO Spotlight is an initiative of the International Union of Forest Research Organizations. Its aim is to introduce, in a timely fashion, significant findings in forest research from IUFRO officeholders and member organizations to a worldwide network of decision makers, policy makers and researchers.



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IUFRO Spotlight issues up to September 2019 will primarily focus on the XXV IUFRO World Congress that will take place on 29 September-5 October 2019 in Curitiba, Brazil.

Individual Congress sessions will be highlighted in order to draw attention to the broader Congress themes, the wide variety of topics that will be addressed at the Congress and their importance on a regional and global scale.

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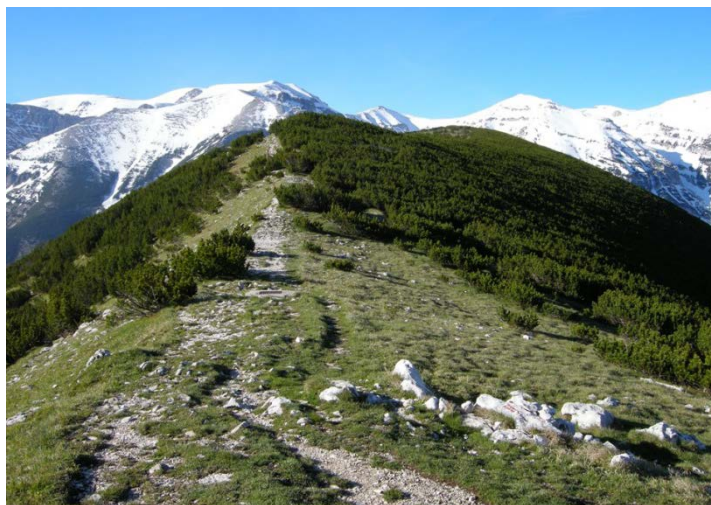
IUFRO Spotlight #68 /July 2019

Forest Trees and the Climate Change Challenge: Survival May Mean Diving into the Gene Pool

Because of climate change, forest tree species have three options. They can adapt, migrate, or extirpate.

“The outcome depends upon the tree species and population, its genetic variation, its reproductive biology and flowering synchronization, its migration potential and whether the environments in the areas it can migrate will be hospitable enough to allow it to survive,” said Dr. Paraskevi Alizoti of the Laboratory of Forest Genetics and Tree Improvement in the School of Forestry and Natural Environment at Aristotle University of Thessaloniki, Greece.

“The adaptation attempt of a population or species to changing climate conditions doesn’t hamper its migration procedures. Both can go on at the same time without one impeding the other, she said. “But the successful outcome of both depends on those other factors I mentioned above.”



*Altitudinally marginal population of Pinus mugo in Italy.
Source: http://map-fgr.entecra.it/?page_id=1377
Photo by Piero Belletti*

Dr. Alizoti, who will present a session at the IUFRO World Congress in Curitiba, Brazil, this fall entitled **Trees on the move: range shifts, potential for genetic adaptation and assisted migration**, said: “Migration – range shifting – is a universal phenomenon for species since climate change has an impact across the globe, though some regions may be more vulnerable, according to Intergovernmental Panel on Climate Change (IPCC) predictions.”

Tree migration has been reported in the forests of the eastern United States where pines are moving north, while oaks and maples are heading west and north; in northeastern Spain, European beech has shifted to higher altitudes; and in the Swedish Scandes, mountain birch, Norway spruce, Scots pine, rowan and willows have advanced to colonize moderate snow-bed communities.

Forest tree species have generally long life spans and grow in niches – locations that fulfill their environmental requirements. And, within each species and population, genetic variation is the cornerstone for its survival in the long term, and also for its potential to adapt to environmental fluctuations or new conditions.

“However”, Dr. Alizoti explained, “climate change causes notable changes in the niches. This imposes severe pressure on the species and populations growing there, challenging their existing genetic variation and even survival – especially in the case of geographically marginal populations, or even environmentally marginal populations growing within the core of a species distribution”.

“Genes that will enable tree species and populations to survive, grow and reproduce under the climate change conditions need to exist in their gene pools, so that those forest trees can potentially adapt to the changes they are experiencing”.

“A population or species with low levels of genetic variation is expected to be less adaptable to new threats due to climate change, resulting in few individuals surviving extreme environmental episodes (i.e. extreme drought, temperature increases),” she said.

“If the number of surviving and reproductively mature trees is below the minimum viable population number, further loss of genetic variation in the next generations will occur. Then, inbreeding build-up and extinction are expected to follow”.

“Marginal/Peripheral populations have been usually neglected, but they may differ genetically and harbour unique genes for specific adaptations,” she added.

At the session she will explore the “progress and promise of forest genetics research for assessing genetic variations in marginal populations, their gene pool changes over time and their extirpation possibility”.

“Assessing these issues will allow us to reach the most suitable decisions for the conservation, use and management of their genetic resources,” she said.

The session aims to raise awareness of the significance of marginal populations and their potential genetic differentiation, as a result of their growth in marginal niches and of their potential isolation from other populations of the same species. The session will examine their unique gene pools, and the risks they face due to climate change. The main goal for their management, she said, is securing their existence and conserving their genetic resources.

“The fast rate of climate change may exceed a species’ ability to adapt to the changing conditions and in some cases even to move, through seed dispersal, to more suitable environments,” Dr. Alizoti added.

With that in mind, she said that assisted migration - deliberately moving trees to more suitable ranges - may play a significant role in the future, especially if the rate of climate change is much faster than that of natural migration of tree species. But before assisted migration starts, the identification of species or populations at risk is necessary, as well as an assessment of the feasibility of such an undertaking, she said.

Using the genetic material of marginal populations as well as trying to enrich the gene pools of other populations with the unique genes for specific adaptations that those marginal populations may harbor, could help in facing climate change impacts. This could be facilitated via ‘assisted gene flow’ and intraspecific hybridization.

“This is a subject that’s of interest to researchers around the globe,” she said, noting that there will also be a subplenary and a technical session on the topic.

Dr. Alizoti is Deputy Coordinator of IUFRO Working Party 2.02.13 – Breeding and genetic resources of Mediterranean conifers: <https://www.iufro.org/science/divisions/division-2/20000/20200/20213/>

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