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Commentary

Climate Change and Genetic Resources of Forest

Stuart Battermanc *

Department of Environmental Health Sciences, University of Michigan, Michigan, USA

DESCRIPTION

Forest genetics is the study of genes in forest tree species and the processes that regulate them. The NCROC's forest genetics research focuses on increasing forest production and genetic conservation by understanding and utilizing a species genetic variety. Historically, forest genetics research and tree breeding have been exclusively conducted by government organizations or multiparty cooperatives. With global pressures to cut taxes, governments have tended to disengage from such initiatives. Biotechnology's advancement, particularly in relation to DNA, has inspired considerably more exclusive attitudes about intellectual property. This, together with numerous recent changes in forest ownership, is putting pressure on tree-breeding cooperatives. All of these reasons are putting a strain on long-term strategy planning. Appropriate risk-spreading technology portfolios are also hampered by proprietary views regarding particular technologies, which discourage collaboration.

Exotic forest genetic resources have frequently been transported by humans throughout origins because they were a potential food source (e.g., Pinus pinea, Olea europaea), had landscape or religious value (Cupressus sempervirens), and may stop degradation processes and yield more wood than the local resource (e.g., Pinus nigra subsp. nigra and Cedrus atlantica in France during the nineteenth century). With the advent of tree breeding, certain types have been planted extensively in recent years. The introduction of new taxa has resulted in the formation of entirely new ecosystems, enhancing local biodiversity. However, even though these artificial woods frequently lack a comprehensive biologically viable structure, phytosanitary concerns are severe. When the exotic resource is genetically close to the local resource (e.g., subspecies of Pinus nigra), the risk of hybridization is significant, with apparent fitness loss for the local resource. The Department's main research activities are in the fields of genetic improvement and genetic diversity evaluation using conventional and DNA analysis, reproductive biology, DNA fingerprinting, and gene flow. Some of our important activities include:

Forest genetics research tree improvement

Tree enhancement is a branch of forest genetics that generates reforestation seedlings with improved growth rates, disease resistance, and wood quality while maintaining their adaption to local growing conditions. They manage the Minnesota Tree Improvement Cooperative's (MTIC) breeding and seed orchard management research on jack pine, red pine, white pine, black spruce, white spruce, and tamarack—plus hybrid aspen—along with researchers at the Cloquet Forestry Center.

Epigenetic response to climate change

According to recent data, temperature during seed development may impact bud break phenology in trees. The capability and extent to which forest tree species can adapt to rising temperatures by modifying their phenology is being investigated at this location.

Breeding for white pine blister rust resistance

The non-native disease white pine blister rust, which affects five-needled pines, was imported to Minnesota in the 1920s and 1930s. White pine is still being wiped off by the disease, especially along rivers, lakes, and streams. Long-term field trials and short-term greenhouse investigations were used in this study to identify specific trees with higher-than-average rust resistance.

To select, breed, and develop forest trees and tree populations that are vital to our state, nation, and globe, our forest genetics programs employ a variety of methods from genetics, statistics, molecular biology, biotechnology, and chemistry.

- Increase the productivity and economic value of landowners.
- improve the forest products industry's value of forest trees harvested from plantations.
- Forest ecosystems should be improved and restored.
- At the molecular, organ, tree, and population levels, we understand the genetic control of crucial features.
- Using genetics and genomics, develop forest trees' resilience to pests and illnesses.
- Increase the effectiveness of forest trees to adapt to climate change through breeding.
- Important commercial and native tree species' genetic diversity should be preserved.

Correspondence to: Stuart Battermanc, Department of Environmental Health Sciences, University of Michigan, Michigan, USA, E-mail: stuartb48@umich.edu

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