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New Genomic Tools Hold Promise for Economic Boon in Forest Industry

Just over half the trees in Canada’s 348 million hectares of forest are spruce, offering the spruce budworm immense opportunity to turn lush green conifer stands from coast to coast into scorched-looking landscapes. Among the many reasons to stop the defoliating larvae: the white spruce harvest annually injects billions of dollars into the country’s economy. The announcement in 2013 that Canadian scientists had sequenced the entire genome of the white spruce, accelerating future applications for the discovery of a gene with natural resistance to the spruce budworm was, therefore, welcome news. Given that the white spruce genome is six times larger than a human’s, the Genome Canada-funded research, co-led by Drs. John MacKay of Université Laval and Jörg Bohlmann of the University of British Columbia, faced formidable challenges.

“It wasn’t cost effective until recently,” says Dr. MacKay. As soon as it was, the team built on a decade’s work in spruce genomics to produce the sequence in just a year and a half. “We’re now improving that draft,” he says, “extracting all the information.” They have found, for instance, that the budworm-resistant gene is active in the foliage where and when the larvae feeds, but activity levels vary considerably in the same gene from tree to tree. Ongoing studies will determine how efficiently scientists can select the highly active genes. The researchers are also investigating genes affecting yield and quality in the white spruce. Wood stiffness and durability, for example, are important traits in building construction.

The genomic tools that result from their research will allow breeders to evaluate spruce trees after a couple of years, rather than waiting 15 years for the trees to mature in a demonstration plot. “The impacts could be rapid,” says Dr. MacKay. If 50 percent of saw-logs came from trees selected for traits related to wood stiffness, for example, the average grade of lumber for the typical Canadian sawmill would improve by 15 percent, adding \$1.5 million a year to its product value. Across Canada, that’s an increase of \$300 million.

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