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Mega genomes of spruce species decoded

Canadian and Swedish scientists today released genome sequences of two of the most economically important forest trees in the world.

Conifers supply raw materials for the Canadian forestry industry, which accounted for \$23.7 billion in Canada's economy in 2011. Gross output of the forest sector in Sweden in 2009 was \$29.7 billion.

At 20-30 billion base-pairs and up to 10 times larger than the human genome, the white spruce genome, published in *Bioinformatics*, and the Norway spruce genome, published in *Nature*, are also the largest genome sequence assemblies to date.

“Attempting the sequencing of such a large genome was an incredibly ambitious task and required the development of novel software and innovative use of DNA sequence technology to piece together short DNA sequences to form this massive genome, much like a large jigsaw puzzle,” says Prof. Steven Jones, senior author of the white spruce genome study.

Jones is Head of Bioinformatics at the BC Cancer Agency Genome Sciences Centre (GSC) and a professor at both the University of British Columbia (UBC) and Simon Fraser University (SFU) in Vancouver.

“Many projects are now attempting to decipher genomes of economically important plants,” says Inanc Birol, lead scientist of the white spruce genome assembly. “We demonstrated a superior and less expensive method to do the job.” Birol is a scientist with BC Cancer Agency's GSC and a professor with both UBC and SFU.

“These genome sequences allow us to develop innovative tools for tree breeding, addressing economically and ecologically important targets such as insect resistance, wood quality, growth rates and adaptation to changing climate” says UBC Prof. Joerg Bohlmann, a co-author of both studies.

“A genome-based marker system could serve to reduce the time of a spruce breeding cycle from currently 25 to as short as five years, and will contribute directly to the competitiveness of the Canadian and Scandinavian forest industry,” says Prof. John MacKay of Université Laval, a co-author of both studies.



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BACKGROUND | Spruce genome decoded

About the studies

The *Bioinformatics* study focusing on the White spruce genome was part of the SMarTForests Project (www.smartforests.ca) and involved researchers from the Genome Sciences Centre at BC Cancer Agency, the University of British Columbia, Simon Fraser University, Université Laval and the British Columbia Ministry of Forests, Lands and Natural Resource Operations. The study was funded by Genome Canada, Genome British Columbia, and Genome Quebec.

The *Nature* study decoding the Norway spruce genome was lead by scientists in Sweden and involved Canadian researchers, including Joerg Bohlmann from UBC's Michael Smith Laboratories and John MacKay from Université Laval. Bohlmann and MacKay are the Project Leaders of the SMarTForests Project, which is developing marker systems for tree breeding. They were funded by Genome Canada, Genome British Columbia, and Genome Quebec.

Partners and funders

Genome British Columbia is a catalyst for the life sciences cluster on Canada's West Coast, and manages a cumulative portfolio of over \$625M in research projects and science and technology platforms. Working with governments, academia and industry across sectors such as forestry, fisheries, agriculture, environment, bioenergy, mining and human health, the goal of the organization is to generate social and economic benefits for British Columbia and Canada. www.genomebc.ca

Since May 2000, **Génome Québec** has been the driving force behind the development of genomics in Québec. By supporting over 70 projects and 800 researchers and managing the operations of the McGill University and Génome Québec Innovation Centre, Génome Québec is helping to accelerate the discovery of new applications for genomics in strategic areas, such as human health, forestry and the environment. The funds invested by Génome Québec are provided by the Ministry of Higher Education, Research, Science and Technology, the Government of Canada, through Genome Canada, and private partners. www.genomequebec.com.

The University of British Columbia is one of North America's largest public research and teaching institutions, and one of only two Canadian institutions consistently ranked among the world's 22 best universities. Surrounded by the beauty of the Canadian West, it is a place that inspires bold, new ways of thinking that have helped make it a national leader in areas as diverse as community service learning, sustainability and research commercialization. UBC offers more than 56,000 students a range of innovative programs and attracts \$550 million per year in research funding



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from government, non-profit organizations and industry through over 8,000 projects and grants.

Simon Fraser University is Canada's top-ranked comprehensive university and one of the top 50 universities in the world under 50 years old. With campuses in Vancouver, Burnaby and Surrey, B.C., SFU engages actively with the community in its research and teaching, delivers almost 150 programs to more than 30,000 students, and has more than 120,000 alumni in 130 countries.

Located in Quebec's historic capital, a World Heritage City, **Université Laval** is the first French-language university in North America. It is one of Canada's leading research universities, ranking 7th among the country's 94 university-level institutions in terms of research funding with \$300 million devoted to research last year. Université Laval's 1,400 professors-researchers share their knowledge with 48,000 students, 10,000 of whom are enrolled in graduate-level programs.