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# HARNESSING FUNCTIONAL GENOMICS TO BENEFIT FORESTS

**Until now, most research in tree genetic engineering has focussed on transferring genes from one organism to another to obtain a new silvicultural characteristic. The resulting transgenic plants have considerable economic potential, but their very existence raises questions and concerns about possible environmental impacts.**

At the Laurentian Forestry Centre of the Canadian Forest Service, functional genomics plays a central role in biotechnology research. Functional genomic methods involve identifying the location and the mode of operation and control of tree genes. As with traditional tree breeding, the goal is to delineate and exploit the genetic diversity that is present in commercial species. The difference, however, is that functional genomic techniques can do so more rapidly and more precisely.

*Poplar has approximately 40,000 genes. Spruce probably has more, with possibly over 100,000 genes.*
Photo: G. Sirois
Photo: A. Séguin

The work that is getting under way is aimed at gaining insight into the physiology, productivity and adaptive capacities of forest trees in their environment at the molecular level. Research is focussed on two species: poplar, which serves as a model in genomics, and white spruce, which has considerable economic potential. The focus is on traits such as insect or disease resistance and wood quality.

Efforts must thus be devoted to identifying, with large-scale analysis methods such as DNA chips, the candidate genes involved in the natural variation of these characteristics. The potential for application ranges from the development of molecular methods for genetic improvement (see box) to the assessment of tree health and yield.

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# HARNESSING FUNCTIONAL GENOMICS TO BENEFIT FORESTS

Functional genomics represents a powerful tool for furthering the goals of tree genetic improvement programs. Well-designed plantations of improved trees could make it possible to optimize yields and enhance the quality of the wood that is harvested, thereby helping to increase the competitiveness of the Canadian forest sector.

## USEFUL LINKS

**Genome Canada**
www.genomecanada.ca

**Biotechnology at the Canadian Forest Service**
www.nrcan-rncan.gc.ca/cfs-scf/science/biotechnology/index_e.html

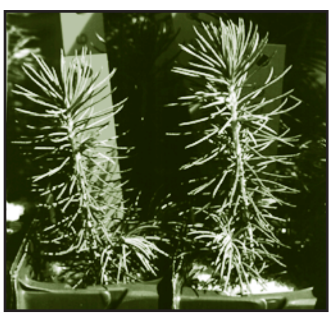
**Université Laval: Arborea**
www.arborea.ca

**FAO: Biotechnology in the forest sector**
www.fao.org/biotech/sector5.asp

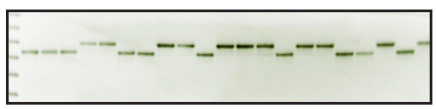
## MARKER-ASSISTED SELECTION

The evaluation of certain characteristics of interest for forestry requires a lot of time because it can only be carried out on trees aged 15-20 years. Thanks to the knowledge gathered on a species' genome, this problem can be solved by searching for genetic markers closely linked to the candidate genes expressing these characteristics.

The detection of such markers makes it possible to select trees that carry the gene of interest when they are still very young (seedlings). By only crossing such trees, it is possible to create a new line that has every chance of reproducing the desired characteristic.



*White spruce seedlings*
Photo: N. Isabel



*Marker linked to a gene of interest*
Photo: N. Isabel

*Selection of trees bearing the desired trait*
Photo: J. Beaulieu

## FOR FURTHER INFORMATION, PLEASE CONTACT:

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