# FORESTS BURN, BEETLES FEAST

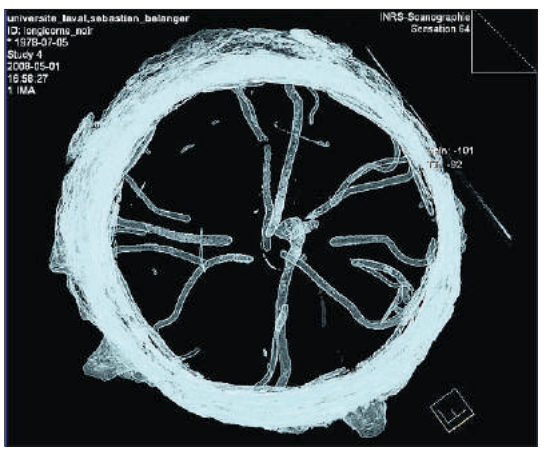
Story by MARK CARDWELL Special to The Gazette

**WALKING IN ANKLE-DEEP ASH THROUGH FORESTS OF CHARRED TREES** that were burned just days earlier is a surreal experience, says Sébastien Bélanger.

DARIO AYALA GAZETTE FILE PHOTO

The aftermath of a fire 100 kilometres north of La Tuque in May 2010: Insects swarm the sites of recent forest fires.

MATHIEU BÉLANGER THE GAZETTE




COURTESY OF SÉBASTIEN BÉLANGER

Above: CT scan of a log infested with white-spotted sawyer beetle larvae.

Left: White-spotted sawyer beetle. The beetles lay eggs under the bark of trees and the larvae are said to make so much noise when chewing through the wood that it sounds like a saw.

"It's like walking on a lunar landscape," said Bélanger, a graduate student and researcher with the department of forest science at Université Laval in Quebec City. "The ground is covered in grey ash, the trees look skeletal and you don't hear birds or any other sounds. It's eerie."

Three summers ago, with the help of the province's forest fire protection agency – SOPFEU – Bélanger led teams of up to a dozen students on several trips to the sites of three freshly extinguished forest fires near Chibougamau, Lac St. Jean and La Tuque.

The visits were part of a project Bélanger was working on to document the arrival of the white-spotted sawyer beetle, a bug that's beneficial to the boreal forest but seen as a destructive pest by Quebec loggers.

The project is one of several under the umbrella of iFor Consortium, a Laval-based team of 13 researchers from eight universities (including McGill and Concordia) and three Canadian Forest Service research centres.

The consortium was created in 2008 and receives funding from the federal and provincial governments as well as multinational paper, tissue and lumber producer Kruger. Its mission is to develop the know-how and tools to help both government and industry better manage forest insect pests and reduce the damage they cause.

**The goal of Bélanger's** project was to develop a model to help predict when and where white-spotted sawyer beetles are likely to cause the most damage to dead and dying trees in fire-ravaged areas.

A member of the family of indigenous North American long-horned beetles, which are named for the long antennae that are twice the length of an adult's inch-long body, the white-spotted or spruce sawyer feeds almost exclusively on conifers like black spruce and jack pine, which are the two most abundant and most commercially valuable species in Quebec's vast boreal forest.

(Though similar in appearance, the white-spotted sawyer is not to be confused with the Asian long-horned beetle that entered North America in wood from China in the 1990s. It attacks healthy hardwoods and can only be controlled by the destruction of infested trees.)

Though adult white-spotted sawyer beetles can cause considerable damage to the foliage and bark of conifer trees, they also play a role in the renewal of the forest, speeding the decomposition of dying trees.

The larvae that hatch from the eggs the beetles lay under the bark of trees are also an important food source for woodpeckers and millions of other birds that nest in the boreal forest.

But they are considered a pest by Quebec's beleaguered forestry industry, which has been hit hard in recent years by the collapse of the pulp and paper industry and a drop in demand for lumber. The larvae, which are white with brownish heads, feed on the ligneous material inside trees, cutting galleries through the interior as they go. Not surprisingly, these U-shaped galleries – which the larvae bore during the two years it takes them to reach adulthood – significantly reduce the commercial value of lumber cut from the infested trees.

The larvae are surprisingly noisy, making "enough noise when chewing their way through wood that it sounds like a distant saw, hence the name," notes a fact sheet on the Royal Alberta Museum website (www.royalalbertamuseum.ca).

White-spotted sawyer beetles are known around Fort McMurray as Tar Sands Beetles because they swarm places where the bitumen that is contained in Canada's oilsands is exposed to the air.

"One theory as to why," the fact sheet reads, "is that the bitumen gives off terpineols, the same substance that recently damaged trees give off, and this is what attracts the beetles."

A naturally occurring alcohol found in pine trees, terpineol has a sweet lilac-like odour and is widely used as an ingredient in perfume and cosmetics and as a flavour in some food items, notably tea.

According to Bélanger, who studied biology as an undergraduate and has a keen interest in entomology (the study of insects), the release of wind-borne terpineols from burned trees is also believed to be the reason why white-spotted sawyer beetles and many other species of insects swarm the sites of recent forest fires.

"They smell them like we smell steaks on a barbecue," he said. "For them, forest fires are like big outdoor picnics."

**Fires pose a threat** as soon as the snow melts and most forest fires in Quebec occur from April through August; with the majority of those between early May and late June.

Since Quebec forests are so vast – an area the size of Sweden and Norway combined – firefighting efforts are confined to populated and accessible areas south of the 50th parallel, which passes just north of Chibougamau. Forest fires farther north are allowed to burn. (The province is home to two per cent of the world's forests.)

According to SOPFEU, human activity is responsible for most of the roughly 500 forest fires that occur in the province every year.

The harvesting of burned trees, the interiors of which are mostly unscathed thanks to the insulating protection of their bark, has become a major source of lumber for Quebec loggers over the past decade.

Burned trees were the source of 20 per cent of the lumber cut in Quebec in 2005, says a 2011 report by the province's Natural Resources Department that examines the challenges of the conservation-inspired practice, which is aimed at reducing the harvest of green trees.

That percentage soared to 95 in the Saguenay/Lac St. Jean region in 2005 when boreal forest covering almost 3,800 square kilometres – an area nearly three times the size of Montreal Island – burned.

The main challenges facing lumber harvesters are access to burned trees in remote areas and damage caused by insects, in particular the larvae of the white-spotted sawyer beetle.

"Some studies estimate that 30 per cent of lumber cut from burned trees has little value because (it is) riddled with holes," said Bélanger.

Much of that damage, he added, occurs during the same year as the fire, leaving log-harvesting companies little time to plan and build the roads needed to gain access to affected areas.

Bélanger's two-pronged project aims to help the forestry industry deal with that challenge.

**The first objective** – to determine the time of year when the white-spotted sawyers attack burned trees – led him and several students to those three freshly burned sites at the height of the forest fire season in May and June 2009.

At each site, Bélanger and the students wrapped the trunks of 50 burned trees with the waterproof black roofing paper that is used in residential construction.

"We got there fast before the bugs had a chance to arrive," recalled Bélanger. "And when they finally showed up, the paper stopped them from penetrating the trees."

Over the summer, the students returned to the sites on a weekly basis to take the paper off some trees to allow insects access to them.

Exposed trees were cut down the following week and two metre-long sections were cut and transported back to the forestry department at Université Laval.

After removing the bark from their samples, the students counted and examined the white-spotted sawyer beetle larvae to help determine when eggs were laid.

The results showed that the most intensive egg-laying period occurred from mid-June until early July, a three-week window that Bélanger says coincides perfectly with the time when swarms of new long-horned beetles that were larvae emerge from dead trees throughout the boreal forest and take to the skies in search of mates – and dead trees on which to plant eggs.

**The second goal** of Bélanger's project – what he calls "the really cool part" – was to try and determine the level of infestation and the speed with which the larvae dig their galleries.

For that he went to the site of a fire in 2010 and returned with 70 un-infested, metre-long logs cut from 35 black spruce trees and 35 jack pines.

The logs were put in plastic pails with air holes.

Dozens of live specimens of white-spotted sawyer beetles were then brought into the lab, and three males and two females were put in each pail.

"It worked really well," recalled Bélanger. "Females laid lots of eggs under the bark of every log."

Over the next several weeks and months, the logs were subjected to different levels of heat in an effort to determine whether and how temperature affected the development of eggs and larvae.

Bélanger said the results suggest that the speed of development of both increase with a rise in temperature.

The logs also underwent periodic CT scans and those images were converted into three-dimensional pictures using engineering software. "That allows us to see the speed of progression and the dimensions of the galleries," said Bélanger.

He added that further development of his "pretty simplistic" model is needed to make it a reliable management tool for the boreal forest.

"We need to look at and consider a lot more parameters, like geographical factors and weather variables," he said.

"Accurately knowing how far along an infestation is after a fire will help forestry managers decide whether or not a harvesting effort is worthwhile."

MATHIEU BÉLANGER THE GAZETTE

Master's student Sébastien Bélanger at the Laurentian Forestry Centre in Quebec City: "For them (white-spotted sawyer beetles), forest fires are like big outdoor picnics."


COURTESY OF SÉBASTIEN BÉLANGER

In a Chibougamau forest, a student researcher wraps a tree in waterproof roofing paper to protect it from white-spotted sawyer beetles.