Warrior trees: Distinct DNA of 'survivor' pines may hold the key to mountain pine beetle resiliency

Mapping genetic differences of survivor trees could help reforestation efforts

Wallis Snowdon · CBC News · Posted: Aug 27, 2021 7:00 AM MT

A mountain pine beetle infestation proves fatal for most lodgepole pines; the few that survive share distinct DNA markers. In this photo, a beetle crawls out of a ponderosa pine in Colorado. (Hunter McRae/The Gazette/The Associated Press)

Alberta researchers unlocking the genetic secrets of lodgepole pines that can survive attacks by mountain pine beetles hope the trees can help a new generation of hardier forests take root.

When the destructive pine beetle devours a forest — leaving swaths of canopy red and tinder-dry — only a small number of lodgepole pines will survive. The survivors on the forest floor share DNA that is distinct from that of the dead. DNA screening shows the beetle-resistant trees all share a similar genetic "fingerprint," said Janice Cooke, a University of Alberta biological sciences professor leading a genomics research project. "They're not just lucky," Cooke said. "There's something about them that enables them to escape that attack, to become survivors."

'Truly warriors'

Cooke and her team made the discovery by analyzing pine cone seedlings grown from seeds gathered from infected stands in central British Columbia.

"The trees that we're working with are part of a special collection that was made in the centre of B.C. during the height of the [pine-beetle] epidemic," Cooke said.

"So these survivors are truly warriors."

A dead pine beetle is shown on the inside of a piece of bark peeled from a beetle-killed tree. Infestations have made vast tracts of once valuable forest into barren stands of dead trees. (Dan Elliott/The Associated Press) The project, awarded $6.4 million in federal support in July, is being conducted in partnership with Genome Alberta and Ontario Genomics. It involves scientists, engineers, social scientists, economists and mathematicians from across the country.

Cooke is leading the research alongside Catherine Cullingham, an assistant professor of biochemistry and physiology at Carleton University.

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Cooke and her team hope their work can help conservationists select only the most beetle-resistant pines. Seedlings could be planted in forests wiped out by the beetle.

The strongest seedlings

Through modelling, they will also attempt to chart the potential impact of planting beetle-resilient lodgepole pines within active outbreak zones.

They have already planted some beetle-resistant plots in B.C. in an effort to develop a reforestation strategy informed by their findings.

There are many aspects of a tree that can make the chocolate cake or make it brussels sprouts.-*Janice Cooke, researcher*

Cooke and her team are now working to analyze samples from outbreaks zones in Alberta and B.C.— where 20 million hectares of forest have been already destroyed — to see if the same genetic fingerprint can be found. "If it can, then we have a pretty powerful tool that we can use in tree selection for the seedlings that get planted out after a mountain pine beetle outbreak," Cooke said.

Her team hopes that mapping the genetic markers will provide some answers on what makes some lodgepole pines less appetizing to beetles. Some trees may have strong defences, or may evade detection entirely, Cooke said. "There are many aspects of a tree that can make the chocolate cake or make it brussels sprouts," she said. "That's the million-dollar question."

A new host, a new threat

Cooke's work is part of a sweeping study examining the potential impact of the beetle's continued march eastward and its recent infestation of a new host, the jack pine. Mountain pine beetles typically target lodgepole pines, but outbreaks have been recently identified in jack pines. Alberta is considered a gateway for invasion. The trees extend from the Prairies into the Maritimes, giving the pests a clear path across Canada. The research project will examine whether jack pine forests east of Alberta are likely to be infested, and determine how winter temperatures and tree characteristics may impact future outbreaks.

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While no distinct genetic marker for survival has been detected in jack pine trees, there is some suggestion that they will be hostile hosts, Cooke said.

"There are other qualities about jack pine that seem to make it less yummy to mountain pine beetles," Cooke said.

"Trying to figure out why has been a long journey. We're part of the way there."

The green forests in and around Jasper National Park are increasingly marred by rusty-coloured trees, a sign that the mountain pine beetle has devastated the areas. Conservationists hope 'survivor' trees could see a stronger forest take root. (Alex Zabjek/CBC)

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