A counterintuitive climate defence: Harvesting forests to combat emissions

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If humans stopped emitting greenhouse gases tomorrow and let nature take its course, it could take a million years for the carbon dioxide in our atmosphere to return to pre-industrial levels. Halting our emissions will be hard, but rapidly bringing CO2 levels back down will be stupendously challenging and costly. Canada's forests could be an opportunity to help meet this global challenge.

We should not overestimate how trees act as natural CO2 absorbers, or "carbon sinks." Young forests are generally stronger C sinks because they contain younger and smaller trees, and have less organic material that's actively decomposing. As trees grow and forest biodiversity increases, the processes of respiration (how organisms obtain energy to grow and reproduce) and decomposition both release progressively more CO2 each year, gradually decreasing the effectiveness of a forest's C sink toward zero. Wildfires accelerate this process.

As Canada's climate warms, our forests and their C-sink capacities will become increasingly threatened. Environmentalists often claim that Canada's remaining old-growth forests must be preserved to mitigate climate change, but for all their natural magnificence, and their value in supporting biodiversity, traditional culture, and recreation, old forests are weak and often vulnerable C sinks. Instead, we should consider harvesting some older forests *before* they are killed by drought, insects or fires.

According to the federal government, between 2011 and 2020, wildfires destroyed more than 26 million hectares of Canada's forests, while insects defoliated or killed about 155 million hectares, releasing approximately 400 megatonnes of carbon into the atmosphere. In the same period, only 7.6 million hectares were logged (four per cent of the area affected by wildfires and insects). When trees are logged and then used to make construction materials, the carbon in their wood remains trapped. Recent studies estimate that about half that carbon will remain in wood-framed buildings for 100 years. This keeps carbon out of the atmosphere for much longer than if the wood was left uncut in forests to die, burn, or rot.

Today's engineered wood products can match steel and concrete in strength, but use only a fraction of the energy to manufacture. With sustainable practices, and by shifting more of our manufacturing practices to the production of "long-lived wood products" (LLWP), logging can help to lock in carbon for decades or even centuries. Using government data, we estimate that the LLWP obtained from logged areas between 2011 and 2020 stopped some 200 megatonnes of carbon from being released into the atmosphere.

B.C.'s coastal forests receive abundant rainfall, which should keep them alive (preserving their carbon) for many decades, even as the climate warms. But not all forests can survive impending climate change. Alberta receives the lowest annual precipitation of all 10 provinces. Higher temperatures will drive more frequent and intense droughts, triggering increasingly severe wildfires. Several recent studies agree that "worst-case" climate scenarios would cause most of Alberta's upland boreal conifer forests to disappear by the year 2100.

An urgent priority is to triage Canada's threatened forests. Field ecologists and ecosystem modellers across the country must collaborate to map our forests into three classes of "climatic injury," and suggest how each category might be managed. Forests in the "protectable" class will survive for the foreseeable future without much human help. We should target these for preservation, with minimal commercial exploitation. Old-growth forests able to live another century or longer will generally retain much of their carbon, even though they are weak C sinks.

"Manageable forests" will suffer damage but can survive with human interventions. These should become our primary sources of LLWP. Some burned areas which fail to regrow naturally could be replanted. Between 2011 and 2020, Canadian forestry companies planted more than 5 billion nursery-grown seedlings on slightly more than half the area they logged, with the remaining area reliant on natural seeding. Burned and harvested areas that are replanted and protected will create younger, stronger C sinks than the older forests they replace.

The third class, "disappearing forests," will likely disintegrate before 2100, due to cumulative climatic stresses. Where they disappear, we should plan other land uses, such as dryland agriculture, renewable energy infrastructure, mining for minerals, and water conservation.

Using our forests to support global CO2-removal efforts will succeed only if we first identify which forests can be saved. Then we must make a multi-century commitment to protect and manage them as the climate (hopefully) stabilizes. Canada's forestry industry can play a critical role in this process by accepting constraints on its activities, while maximizing the manufacturing of LLWP. Regardless, using forests as a C sink will not solve the overarching problem: The world must still transition rapidly from fossil-fuel energy sources.

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