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Matters to consider: Planting trees to tackle climate change?

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During the last federal election several campaigns mentioned planting thousands of trees as a response to climate change. A number professionals, educated and trained in professional forestry, landscape architecture, planning and engineering, found those statements curious and gathered to discuss the opportunities and constraints of such action, and actions like tree planting. Each of us address climate change in our day to day work and are constantly exploring ways to, through a climate change lens and singular or interdisciplinary action, protect human and ecological communities while also enabling and supporting financially, culturally and ecologically sustainable environments. This includes reducing carbon emissions, seemingly the focus of the tree planting advocated in the political campaigns and other popular media.

While we all recognize that we all have a role to play in the collective effort to adapt to the changing climate, tree planting being one such measure, there is a worry that Canadians are too quick to support, often times without question, an asserted 'solution' without taking a bit of time to ask questions regarding the viability of each 'solution' presented. The disproportionate linking of one solution as THE SOLUTION eludes the fact that it will be many solutions for mitigation and adaptation, relying upon many factors within each locale.

To be clear, trees garner a huge amount of respect from us and we recognize they have a significant role in mitigating the anticipated effects of climate change: they provide beauty, shade, cooling and wind shelter for human and animal well being; they create opportunities for understory and groundcover growth, i.e. the vegetative layers needed to complete an ecosystem and provide habitat and food for birds, wildlife, beneficial insects etc.; their roots mitigate soil erosion, de-compact soil to improve water infiltration and support new vegetative growth; and they sequester carbon. Unfortunately, planting a tree to achieve long-term climate change benefits, especially carbon sequestration, may not be as straightforward as it sounds.

As a trees grows it absorbs carbon from the atmosphere; it sequesters (collects and separates) some of the carbon in its leaves and wood (trunk and branches) and sends a considerable amount underground to support its roots and associated microorganisms. Some studies indicate that young trees growing in open and sunny deforested areas may sequester carbon more quickly than older trees competing with neighbours for space and sunlight,[i] and other studies suggest that tree carbon accumulation increases with tree age and size.[ii] Regardless, when a tree is cut down or dies, carbon intake stops.

Land use changes that disturb that soil and/or burning or rotting of dead trees is what releases the sequestered carbon back to the atmosphere. So, trees that are used for lumber have long term sequestration value, but trees that are used for firewood, compost or otherwise burned have no sequestration value. This is particularly relevant when considering urban trees. A 2019 study suggests that given the high carbon costs associated with urban trees - nursery production, transportation, planting, irrigation, pruning, removal, and disposal- urban trees must survive for several decades (26–33 years) to attain carbon neutrality[iii]. While trees in private urban gardens and parks may survive past 30, the typical urban street tree would not, generally, live that long. And since urban street trees are unlikely candidates for lumber, their value for long term sequestration is questionable unless we alter

our current practices to include converting the aged-out tree to biomass thereby maintaining the carbon storage value.

According to NRCan[1], Canada has 347 million hectares (ha) of forest, in mostly remote and sparsely populated areas that are not under pressure for development or agriculture; 62 million ha. of Canada's forest land is in BC. And while BC's forests appear currently stable, NRCan notes they will be impacted by climate change: coastal forests will likely see an increase in the number and intensity of storms, thereby increasing susceptibility to fire, disease and windthrow damage, and drier areas of the southern interior may experience regeneration problems due to an increase in summer droughts. Forest tree growth rates will be impacted with increased competition from new species more suited to the changed climate, and the potential ranges of species will move (species migration). [iv]

Given both current stability and increased future vulnerability, the idea of confidently introducing thousands of new trees to the sustainably managed forest land base at this time seems like a questionable action. How would they fit? What species would be best? What risk would they pose to current tree stocks intended for harvest in the coming years? Where will we secure the significant increase in tree seedling stock (seedlings that can take up to 3 years in a nursery prior to planting) that is appropriate for the various biogeoclimatic zones. Is there sufficient knowledge and expertise in place to manage the new forest? What are the potential social and economic outcomes of such forest change? How will the effort be managed and paid for?

These questions resonate for us and are among the many questions currently being researched by forest resource scientists. We posit that forest restructure, such as introducing thousands of trees over the next few years, requires a science-based approach including a long-term management plan and adaptive monitoring. Forest landowners, including our governments, must be held responsible and accountable to all Canadians and the world at large given Canada's involvement in the United Nations program known as REDD$^+$ (Reducing Emissions from Deforestation and Degradation) and supporting sustainable forest management.

Canadian resource scientists and allied professionals are working intensely to develop climate adaptation strategies, including those that encompass our forests. There is an interest in furthering this research in light of the focus of the national government on qualifying and valuating resource-focused mitigation measures including commitments in the Pan-Canadian Framework on Clean Growth and Climate Change[2] which is focused upon encouraging and enabling emissions reductions and clean growth by increasing the amount of carbon that is stored in our forests, wetlands, and soils.

> "Canada is home to 9% of the world's forests. These forests can help absorb carbon emissions."[3]

Tree planting could be a useful tool in the toolbox that recognizes the role of forests in combating climate change, with support from current research and practitioner knowledge and experience to guide the effort.

Some approaches to using forests productively include:

- wildfire management,

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[1] https://www.nrcan.gc.ca/our-natural-resources/forests-forestry/state-canadas-forests-report/how-much-forest-does-canada-have/17601

[2] https://www.canada.ca/en/services/environment/weather/climatechange/pan-canadian-framework.html

[3] https://www.canada.ca/en/services/environment/weather/climatechange/climate-action/forestry-agriculture-waste.html

- considering traditional cultural practices,
- supporting assisted migration,
- applying eco-system-based approaches to enhancing community resilience,
- having an urban forestry strategy to buffer stormwater and reduce heat island affects,
- developing bio-energy and low-carbon fuel solutions, and
- mainstreaming encapsulated mass timber and pre-fabricated wood buildings.

Part of the efforts for adaption is the requirement for conversations regarding the desire to adapt and the need to be prudent and thoughtful in how we proceed in doing so, thereby minimizing the potential for maladaptation. Initiatives that enable and support politicians in participating in collaborative dialogue with multi sectors that focus upon innovative and unique solutions is one such way for informed conversations to occur.

Actions taken today to create well managed and highly productive working forests are the best option for the mitigation of the negative effects of a changing climate. They also provide a side-benefit of stimulating the local economy through the prudent use of our natural resources.

Forestry and silviculture practices offer some of the most promising, timely and affordable solutions available when it comes to climate change, but there is potential for oversimplifying solutions and double-counting benefits (with offsets in particular). It is prudent to understand the overarching governmental and sectoral strategies and to work with experts in order to ensure that the proposed projects and initiatives are economically beneficial and fit within an overarching environmental management strategy. Building resilience requires all of us to be prudent and thoughtful in how we proceed in doing so.

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[i] https://psmag.com/environment/young-trees-suck-up-more-carbon-than-old-ones
[ii] https://foresteurope.org/importance-big-old-trees-carbon-sequestration-recognized-new-study/
[iii] https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0215846
[iv] www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2008/10277