FORESTS OF THE FUTURE:
Considering Stakeholder Views for Climate-Adaptive Reforestation

What is Assisted Migration?

Traditionally, in British Columbia, we have collected seeds from local tree populations to re-grow forests. Going forward, however, this procedure is not anticipated to work well in a changing climate as these trees will be poorly adapted to warmer temperatures, diseases, and pests. And climate change isn't just bad for trees, it's also bad for the economic and environmental benefits they provide to Canada, including upstream and downstream benefits such as jobs, habitat protection and carbon sequestration.

This is where assisted migration comes in. In the context of reforestation, assisted migration refers to planting seeds genetically adapted to future climatic conditions (e.g. planting warmer-climate adapted seeds further north or higher in elevation).

Genomics in Action

Dr. Sally Aitken of the University of British Columbia (UBC), Dr. Samuel Yeaman of the University of Calgary, and Dr. Richard Hamelin of UBC and Université Laval, are leading a team using genomics to develop tools for implementing assisted migration by testing the ability of trees from different populations to adapt to and/or resist heat, cold, drought and disease. The goal of the project, called CoAdapTree, is to develop better reforestation options for high-value tree species such as Douglas-fir, lodgepole pine, western larch and jack pine. The team's work will provide policy and reforestation recommendations to support tree breeders and foresters in selecting and planting trees that will be healthy and productive in new climates in western Canada. It is expected that this effort could result in increased timber yields, with a proportional impact on the economy and employment, as well as possible ecological and environmental benefits.

Social Science and Humanities

A key aspect of genomics research is the social science research component, known as GE³LS (Genomics, Ethical, Environmental, Economic, Legal and Societal). Many funders, including Genome BC and Genome Canada require that genomics research programs include a robust component of social research to ensure that societal perceptions, concerns, and questions are considered and addressed. These insights help scientists, companies, government regulators, policy makers, and the public better understand how new genomic technology will impact society.

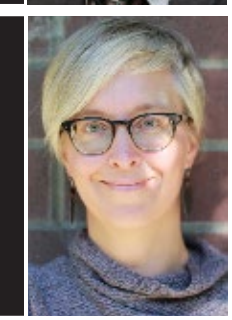
The GE³LS portion of the CoAdapTree project is led by Dr. Shannon Hagerman and Dr. Robert Kozak. The team is examining how the public and stakeholders think about the risks, benefits and overall acceptance of genomics-informed assisted migration and other management alternatives for reforestation in BC. Understanding public views about genomics-based forest management strategies arising from CoAdapTree could play a major role in the extent to which they can be successfully implemented in BC.

In order to obtain a complete understanding of the risks, benefits and levels of support for assisted migration, the GE³LS team carried out four phased studies:

1. A web-based public survey was conducted to assess perceptions of risk and levels of support across six different reforestation strategies. The six strategies include two conventionally used strategies, two strategies that are used elsewhere, but not considered for BC and two genomics-informed strategies that are under specific consideration for BC (Figure 1).
2. The results of the survey suggested issues to explore in depth through a series of focus groups that were conducted in forest-dependent communities across BC.
3. Cost benefit analyses were then conducted for these communities to determine the socio-economic outcomes of various reforestation strategies including assisted migration under different climatic scenarios.
4. Interviews were conducted with specialists from government and industry who are involved in assisted migration policy.

Lisey Mascarenhas, MBA, PhD, leads Genome BC's Agrifood and Natural Resources sector team, developing the strategy and vision, and overseeing the project portfolio, stakeholder engagement, partnerships, and proposal development within the agrifood, fisheries and aquaculture, forestry, energy, mining, and environment sectors. Lisey has more than 25 years in the life sciences community in Canada, developing business opportunities and managing large life sciences research programs and projects across multiple sectors.

Robert Kozak, PhD, is a professor and associate dean, academic at the UBC Faculty of Forestry. His current research and teaching interests include sustainable business management practices and issues with a focus on complex problems related to sustainable development, forestry, wood products, and the emerging conservation economy. He was awarded the International Union of Forest Research Organization's Scientific Achievement Award in 2014 and is a proud recipient of the Killam Teaching Prize in 2001 and 2014.



Shannon Hagerman, PhD, is an associate professor in the Department of Forest Resources Management and principal investigator of the Social-Ecological Systems Research Group at UBC. Her research examines the science-policy-management interface in the context of adapting conservation and resource management to climate and other drivers of change. Shannon teaches human dimensions of conservation, and qualitative methods and is a proud recipient of the Killam Teaching Prize in 2018.

Phases one and two are now complete. Phases three and four are near completion and will soon be published as stand-alone scientific articles.

Insights for Forest Management

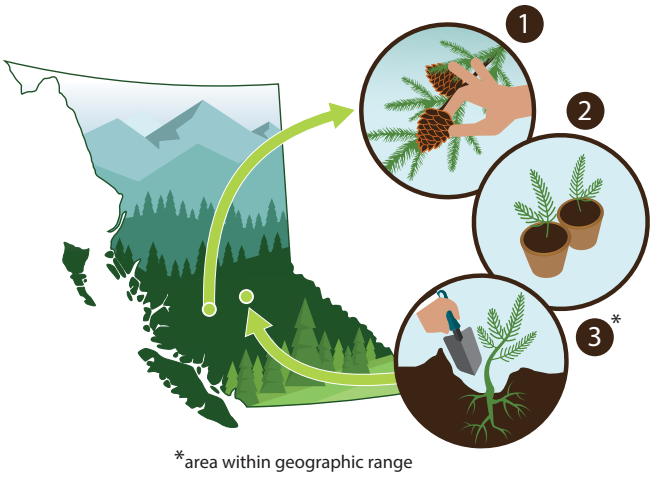
These studies have led to a substantial amount of often lacking social science data that is essential to inform the implementation of assisted migration in BC's forests and to ensure that public views are heard. Two significant publications have come out of the GE³LS research to date[1]. This work provides new empirical information about current levels of public support for and ethical views of different options for reforestation, including assisted migration (Figure 2). A key finding shows that levels of support decrease with increasing human intervention, with reforestation by assisted migration beyond native range, non-native species, or genetically modified organisms receiving significantly lower levels of support. This, in combination with results from phase two (focus groups), suggests that the risks that matter to diverse publics and stakeholders are not necessarily associated with genomics technologies as much as with how these technologies will be implemented and by whom. Our results also show that foresters are uniquely positioned to play a key role in navigating this complex socio-ecological landscape given that levels of public trust in government and industry are often low and professional expertise is essential.

This combination of social science and genomics research will help ensure that new technologies for future forests, including those that are genomics-based, are informed both by ecological realities and social values and needs.

REFERENCE

1. Peterson St-Laurent, G., Hagerman, S. & Kozak, R. Climatic Change (2018) 151: 573. https://doi.org/10.1007/s10584-018-2310-3; and Peterson St-Laurent, G., Hagerman, S., Findlater, K. & Kozak, R. Journal of Environmental Management (2019) 242: 474. https://doi.org/10.1016/j.jenvman.2019.04.065

Figure 1: Reforestation informed by Assisted Migration (within range)



Reforestation informed by Assisted Migration (outside of range)

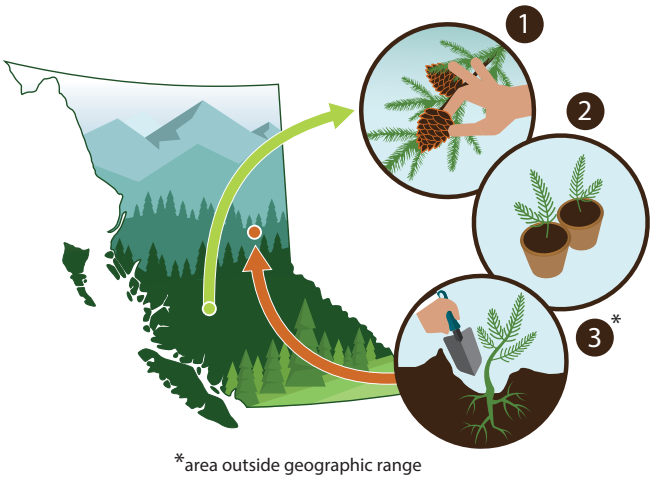


Figure 2