

# The natural variability of paper birch phenotypic, morphological and physiological characteristics

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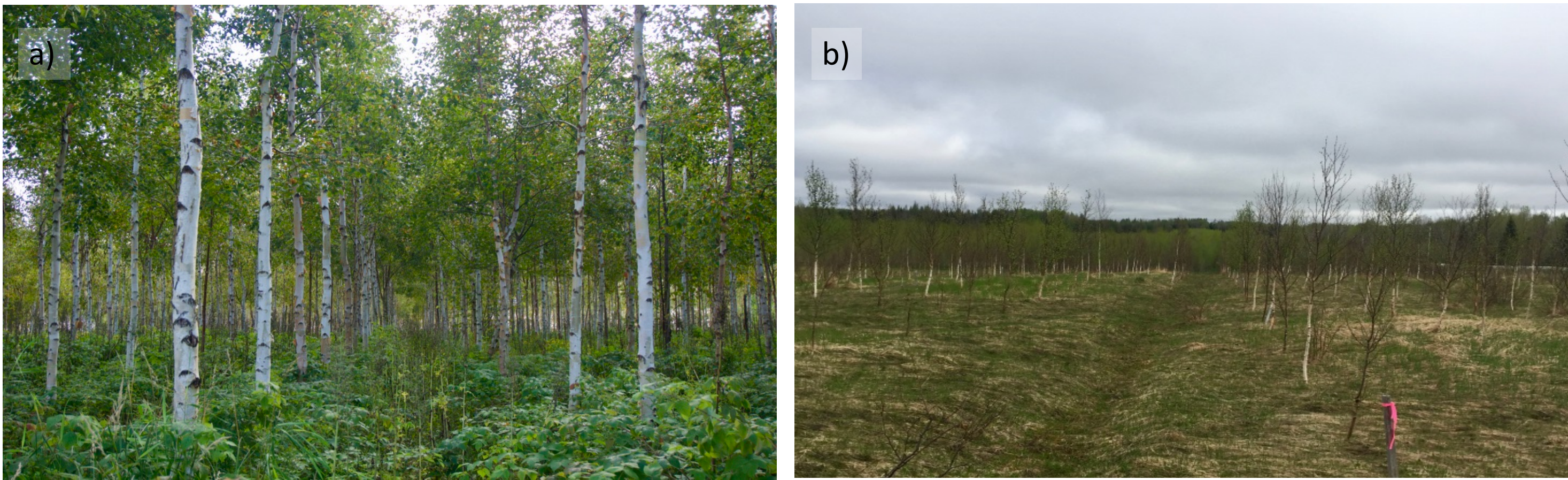


Figure 1: The images above were taken a week apart in June, 2018. The image on the left (a) is at the Senneterre location, whereas the image to the left (b) is of the La Motte site. There is a drastic difference between sites, however, more information is required to determine the driving influence.

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## Introduction

- Forestry is an important component of Quebec’s economy and yet Quebec’s forests are facing multiple sustainability pressures<sup>1</sup>
- A new law aims to increase the economic value of wood by selecting high quality wood species and incorporating silvicultural techniques<sup>1</sup>
- *Betula Papyrifera* (paper birch) is a fast growing, hardwood species with a widespread distribution across North America<sup>2</sup>
- The quality of its fiber has been recognized by the veneer industry and is used for pulp and paper manufacturing, furniture, wooden floors and specialty products<sup>1</sup>
- There is a large degree of physiological and morphological variance between individuals and populations due to its geographic extent<sup>3</sup>
- It is currently unknown to what extent ecophysiological differences have on the productivity of paper birch in intensively managed plantation systems

## Research Questions

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1. Do paper birch provenances, from distinct regions of Quebec, express any phenotypic or physiological difference?
2. How do eco-physiological and environmental drivers affect the growth, productivity and rapid establishment of paper birch provenances in plantations under intensive management?

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## Methodology

- Paper birch seeds were collected from various regions of Quebec and planted in 2008 at four locations in the Abitibi-Témiscamingue region (Figure 2)
- Bud development will be observed at the beginning and end of the growing season to determine the effect of provenance on phenotype/length of growing season and its effect on productivity
- Environmental variables such as temperature, soil texture, pH and nutrient composition (N, P, K and Ca) will be measured to determine whether environmental limitations on tree growth exist (Figure 1)
- Long term water use efficiency will be calculated using  $\delta^{13}C$  analysis
- Gas exchange and stomatal conductance will be measured over the course of the growing season

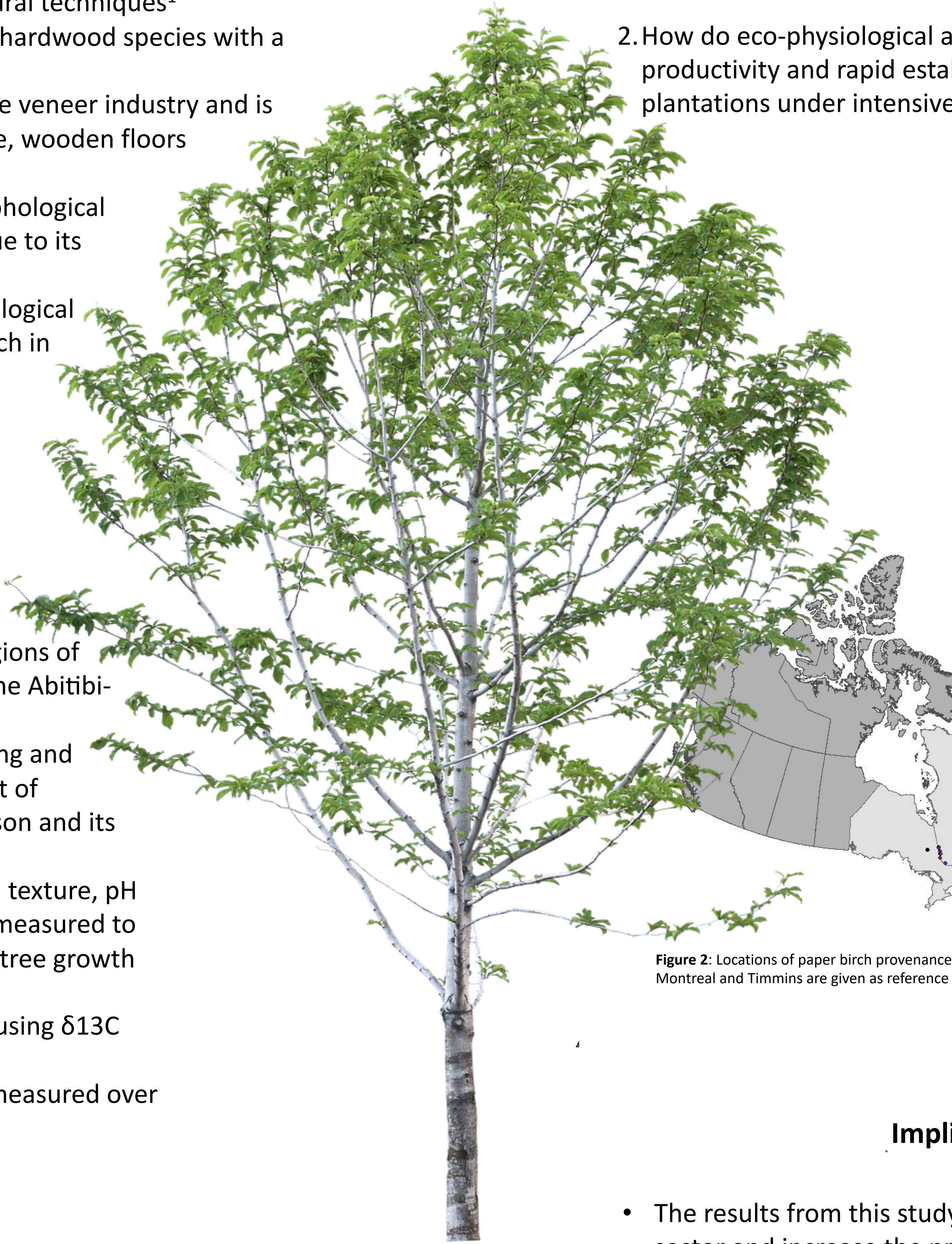


Figure 3: *Betula Papyrifera* (paper birch)<sup>6</sup>

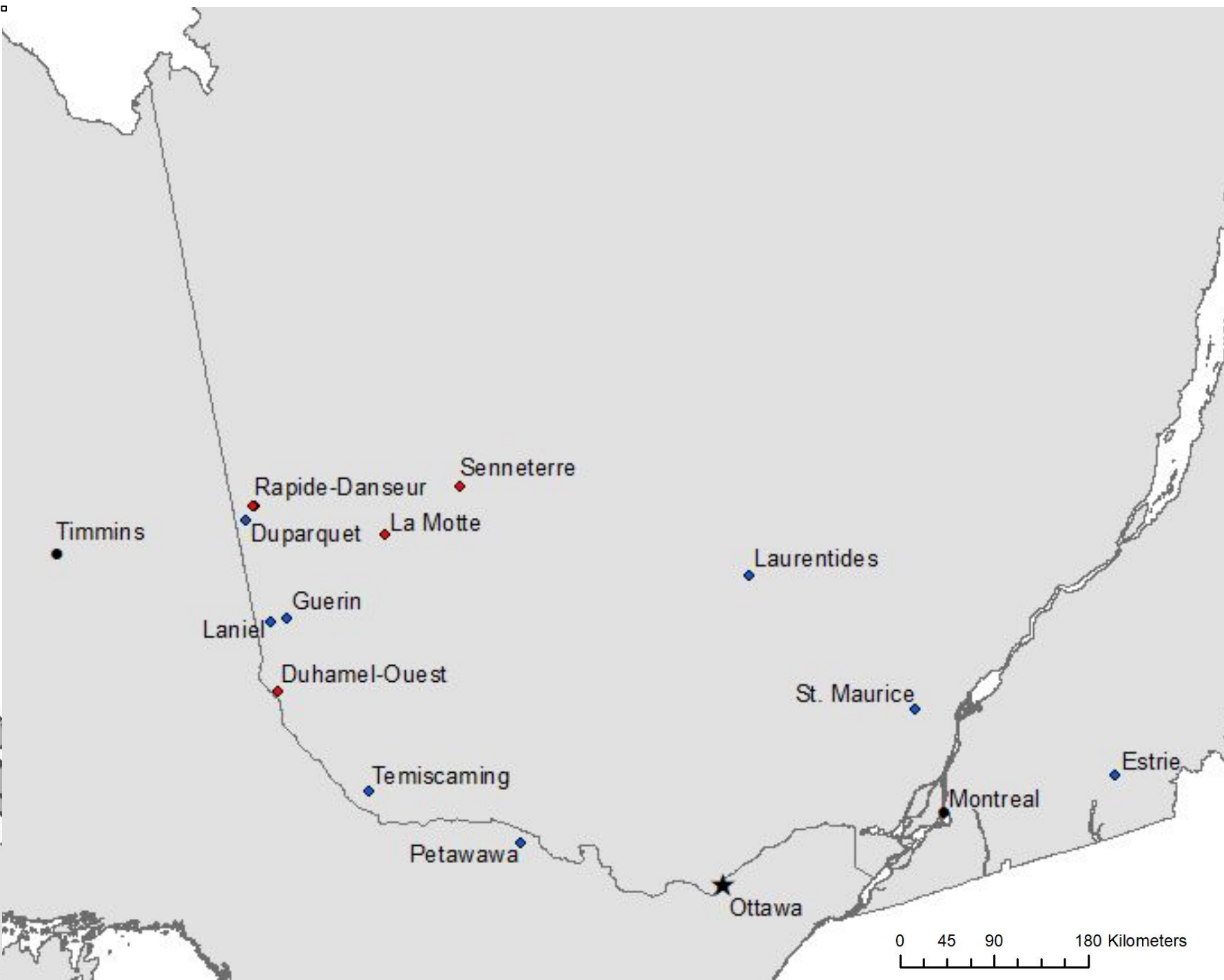


Figure 2: Locations of paper birch provenance source (blue) and plantation sites (red). Ottawa, Montreal and Timmins are given as reference locations.

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## Implications of Study

- The results from this study could benefit the Canadian forestry sector and increase the profit margins of private woodlot owners who have been targeted for the establishment of fast-growing, high quality wood plantations in Quebec<sup>1</sup>
- High phenotypic variance amongst paper birch populations is preferable when selecting advantageous traits for hybridization<sup>4</sup>
- The hybridization of paper birch could potentially create a complex that is more efficient in terms of growth and quality, which aligns with ecological and economic sustainability practices<sup>5</sup>

Block 1			Block 3			1 = Duparquet 2 = Guérin 3 = Laniel 4 = Temiscaming 5 = Petawawa 6 = St. Maurice 7 = Laurentides 8 = Estrie 9 = Gaspésie
3	7	6	8	9	3	
2	5	4	4	1	7	
8	9	1	2	5	6	
Block 2			Block 4			1 = Duparquet 2 = Guérin 3 = Laniel 4 = Temiscaming 5 = Petawawa 6 = St. Maurice 7 = Laurentides 8 = Estrie 9 = Gaspésie
1	7	2	6	5	4	
6	4	5	8	3	1	
9	3	8	9	2	2	

Table 1: A conceptual design of each experimental plantation with four repetitive blocks at each site. The numbers identify provenance source as shown beside the table. Gaspésie will not be included in this experiment as it is believed to belong to a separate species of birch.

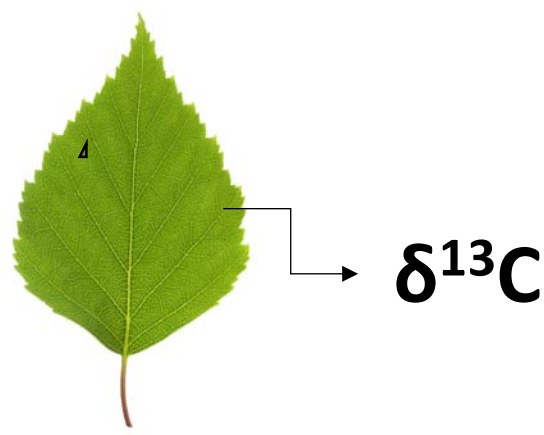


Figure 4: Leaves will be collected to determine how efficient water strategies are and if there differences between provenances.

## Acknowledgements:



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