

UQAT



UQÀM

# Rhizosphere Soil Microbiome Response to Clear- and Partial-cut Treatments in Canadian Boreal Forests After 19 Years

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Supervisors

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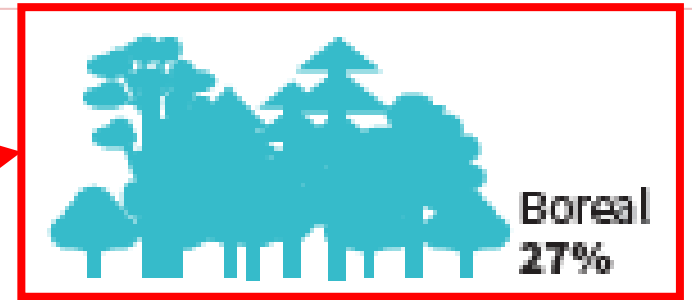
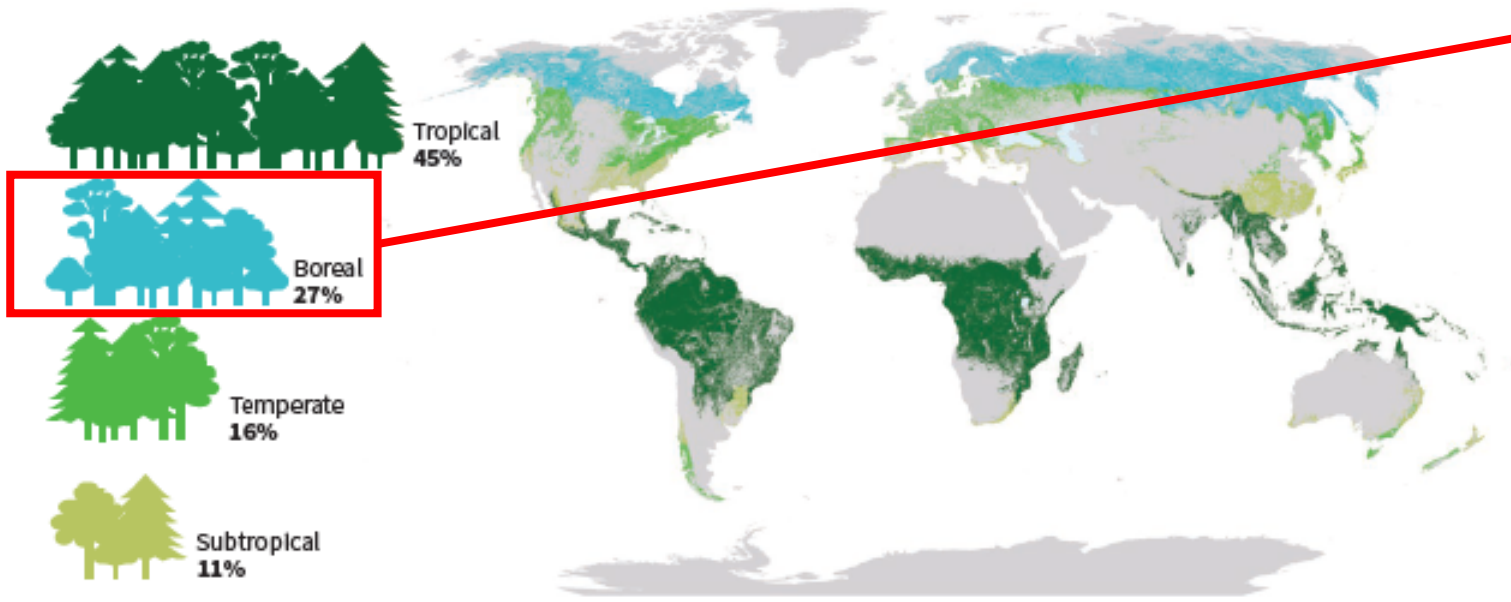




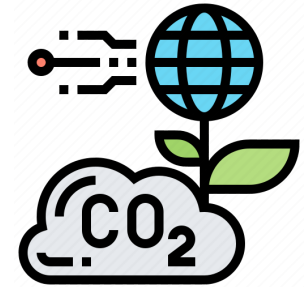


# The Importance of Boreal Forest

Proportion and distribution of global forest area by climatic domain, 2020



11.5% of total land area.



The Largest C stock



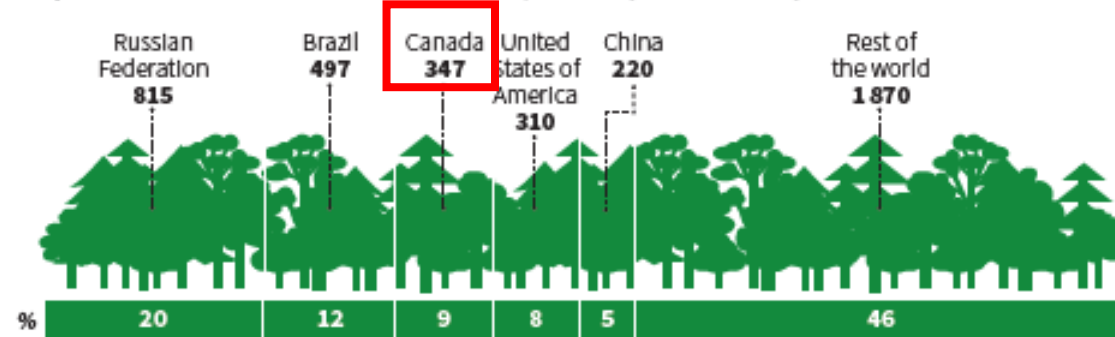
The most freshwater



1/3 forest, timber, 2intact

Source: Adapted from United Nations World map, 2020.

Top five countries for forest area, 2020 (million ha)





# Concerns About Current Forest Management

## PARTIAL HARVEST

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- Maintained age-structure diversity
- Production of deadwood via windthrow
- Protection of the soil ecosystem
- Preservation of the biodiversity of the original stand

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- Greater risk of windthrow
- Longer forest operations
- More complex artificial regeneration treatments
- Novel approach for the forest industry
- Adaptation required by the forestry sector

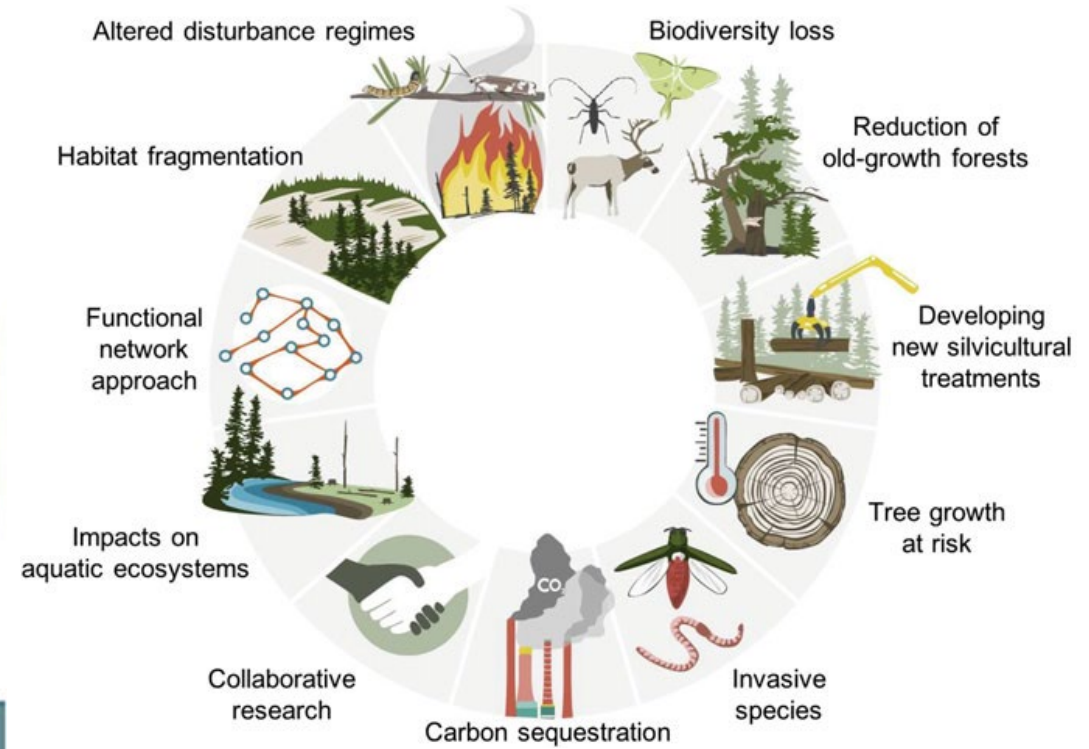
## CLEAR-CUTTING

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- Low cost and easy to implement
- Easier establishment of shade-intolerant tree species
- Adaptable to current equipment and harvest methods
- Optimized artificial regeneration

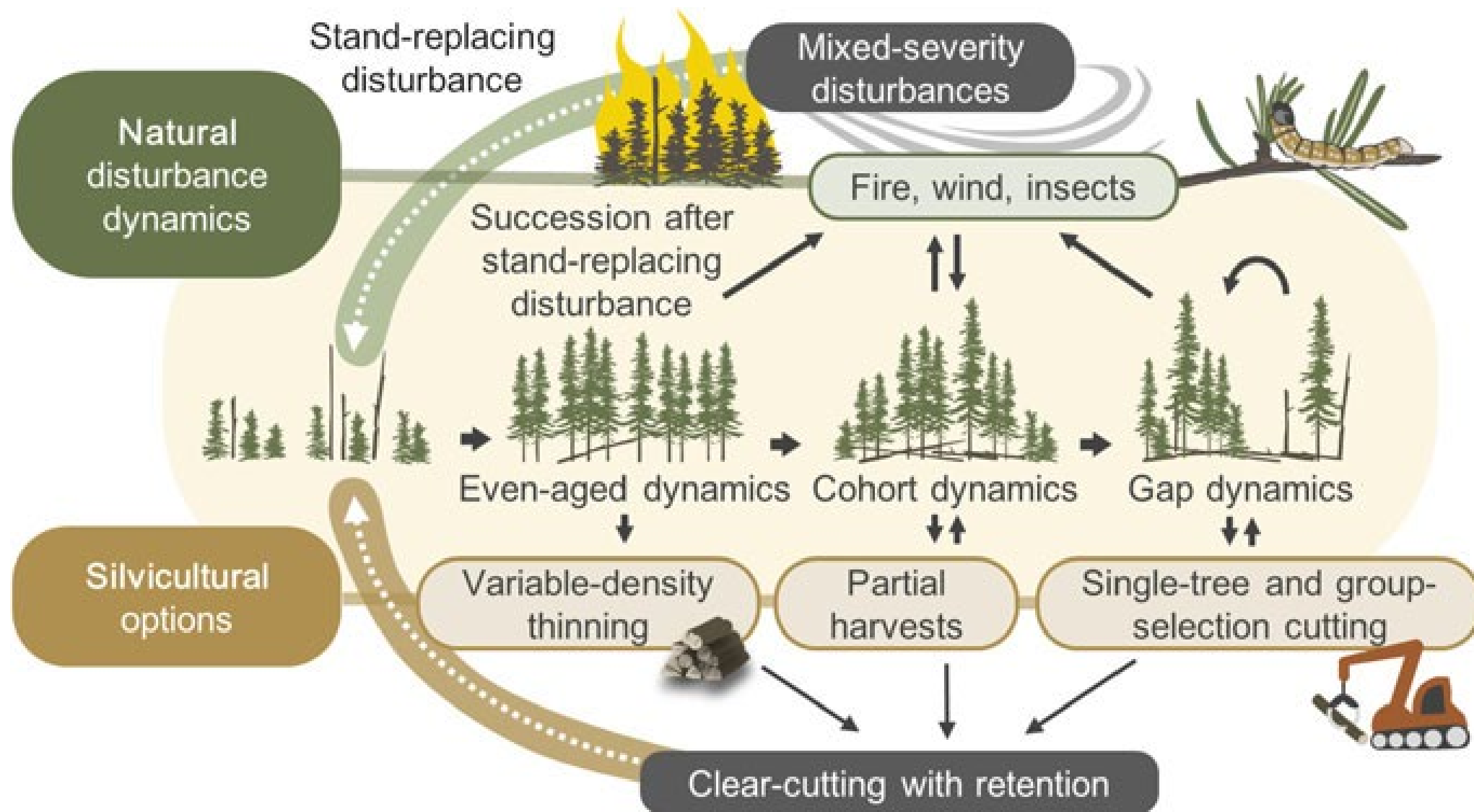
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- Strong visual impact
- Habitat loss, fragmentation, and reduced habitat diversity
- Greater vulnerability to windthrow in retention patches
- Simplified stand structure
- Perturbation of aquatic ecosystems
- Greater evapotranspiration
- Reduced biodiversity





# Ecosystem-based Management

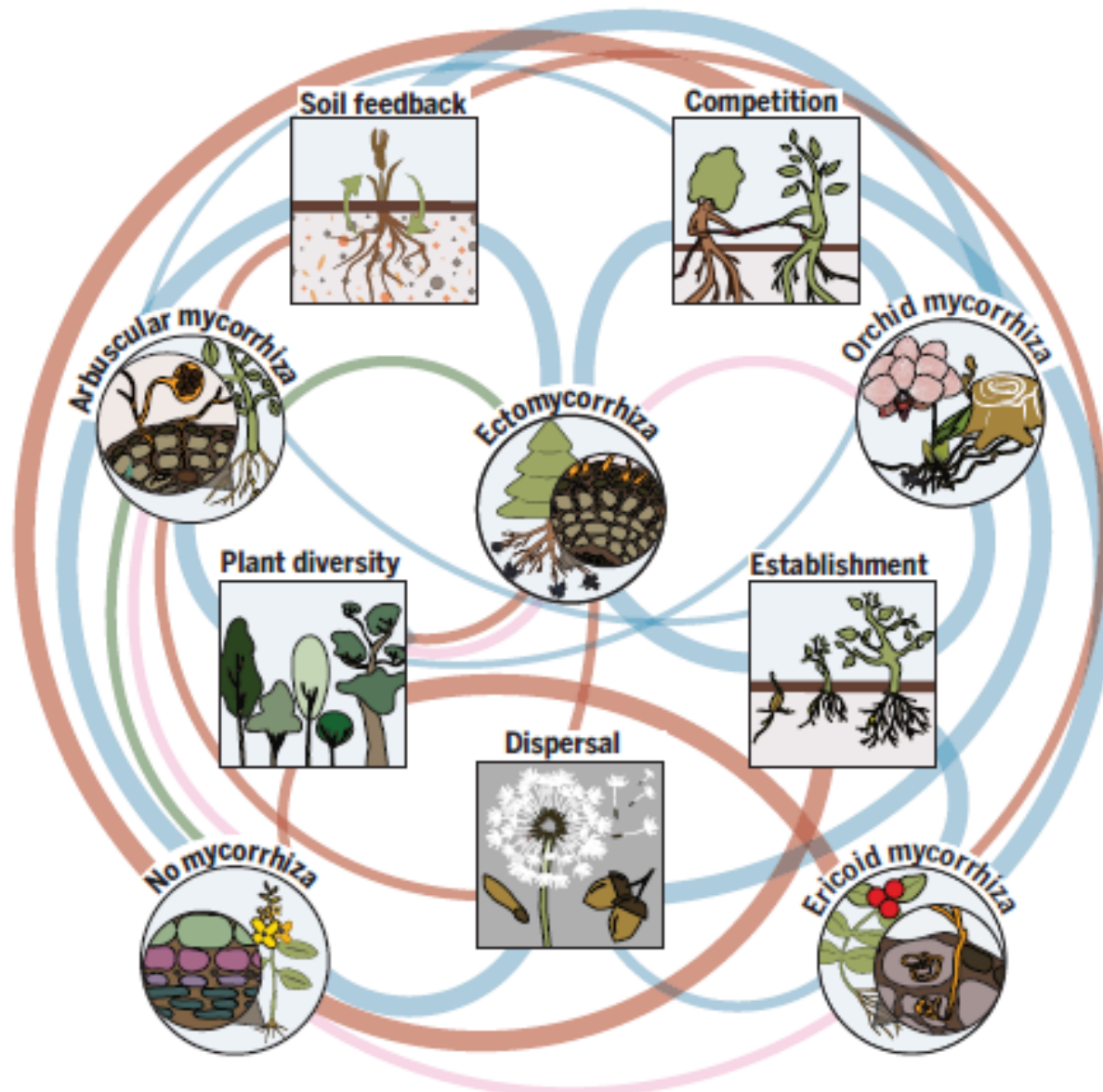


Concept

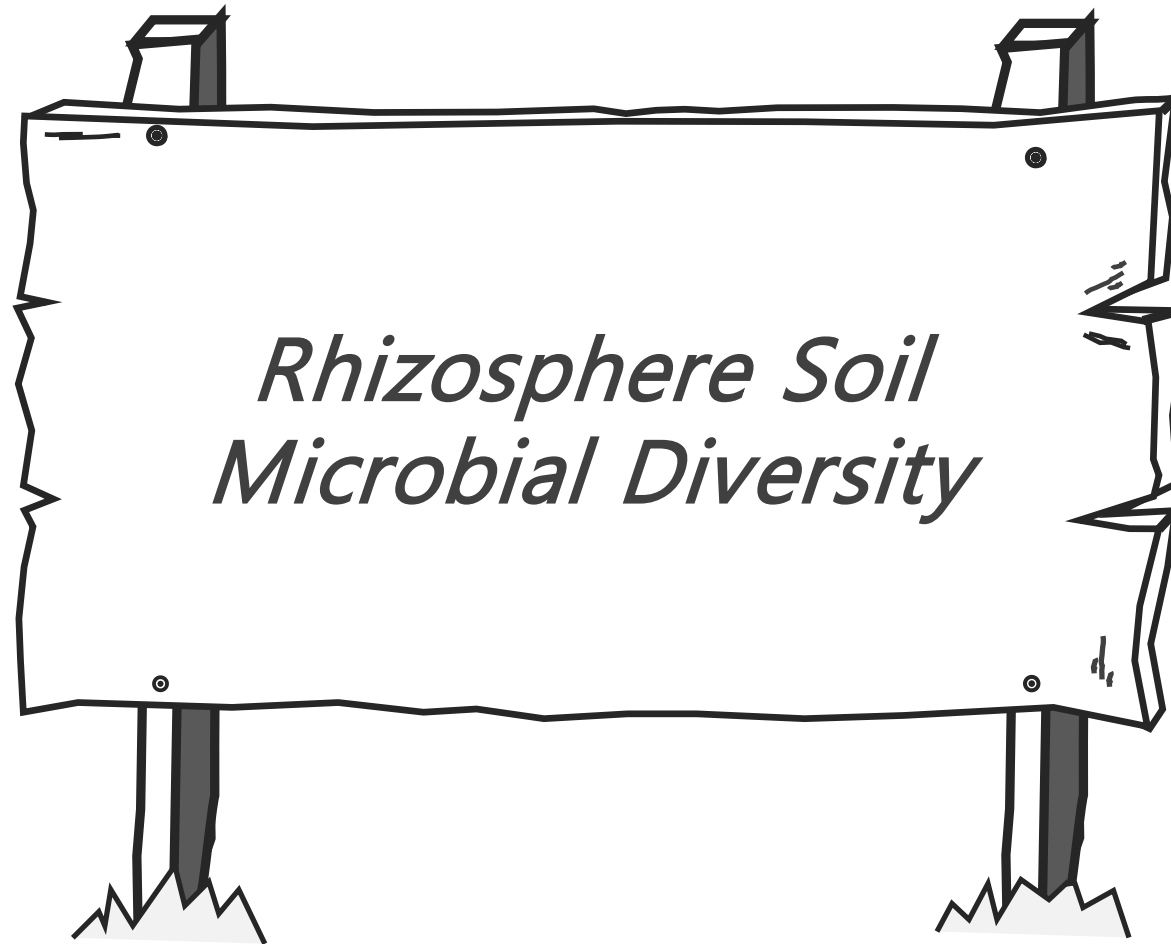




# Plant-Soil Feedback in Boreal Forest Management



- Boreal forest's harsh climate & **nutrient-poor** soil
- Growth **Hormones**, **pathogen** suppression, **stress** tolerance
- In boreal forest, **ectomycorrhizal (ECM) fungi & N-fixing bacteria** facilitate tree establishment
- Remaining trees in **partial harvest** can act as source of **EMF inoculum** for new seedlings

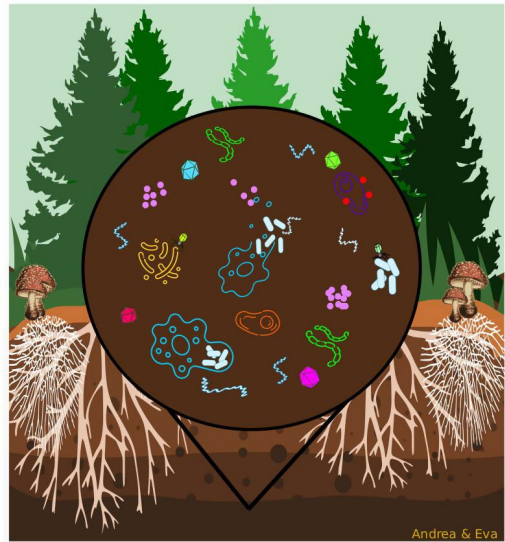




# Chapter 2. Soil Microbial Community Dynamics



## 2. *Rhizo-microbiome*



- **Objectives:**

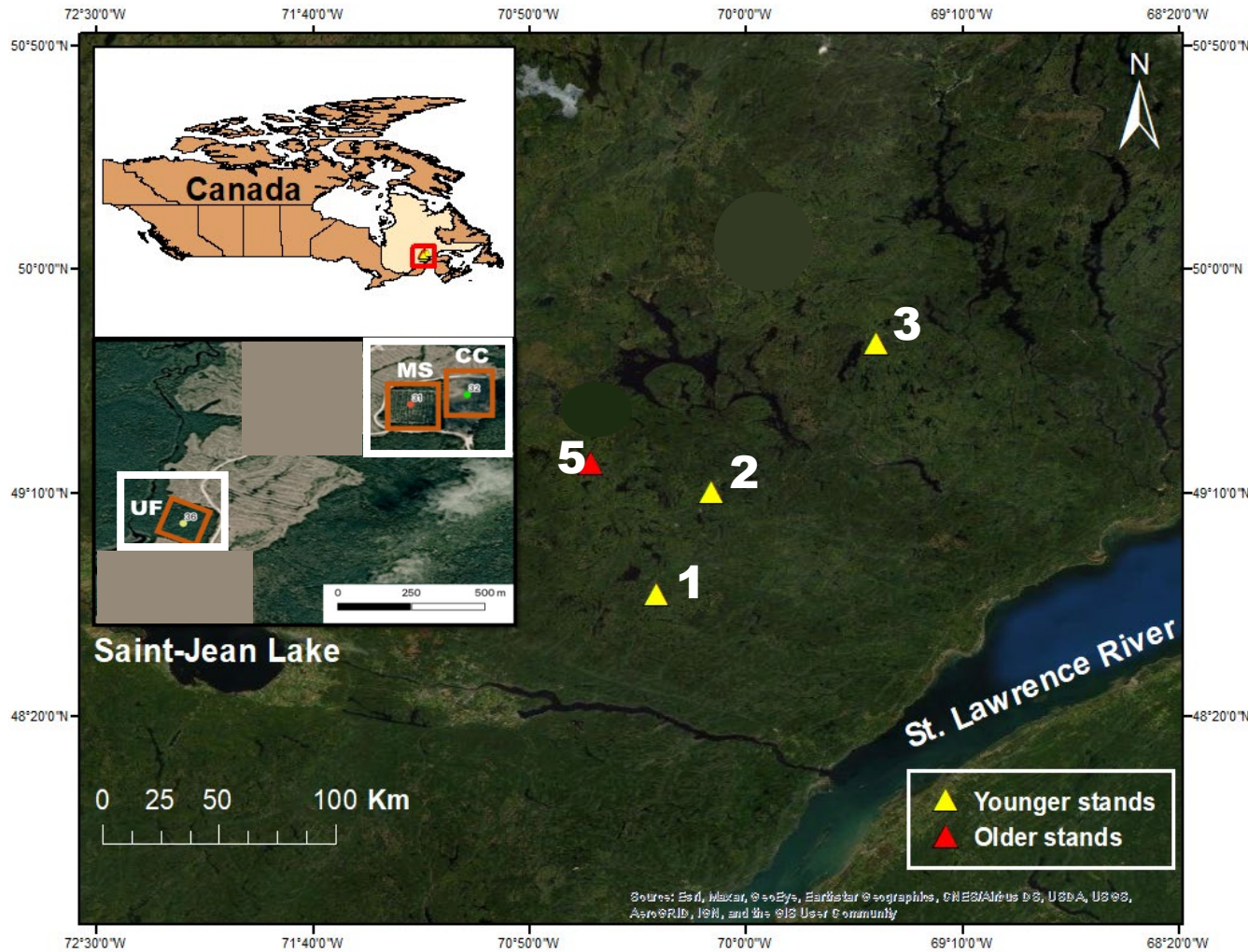
To compare the composition of bacterial and fungal communities in the rhizosphere soil under clearcut and partial cut to identify specific taxa indicative of each silvicultural treatment.

- **Hypothesis:**

- 1) Clearcut will exhibit distinct diversity, showing greater dissimilarity in microbial community composition compared to partial cut & control, due to significant alterations in microhabitats.
- 2) Partial cut will show intermediate diversity, with microbial communities more similar to control than clearcut.



# Study Area



Harvesting (2003)



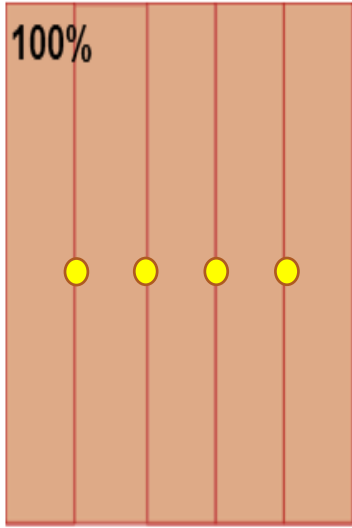
Spot scarification (2004)

- **Natural even-aged** black spruce stands
- Northern Saguenay & North Shore
- **Younger** (2,316 trees/ha, 79yr) & **Older** (1,272 trees/ha, 156 yr) stands from fire history

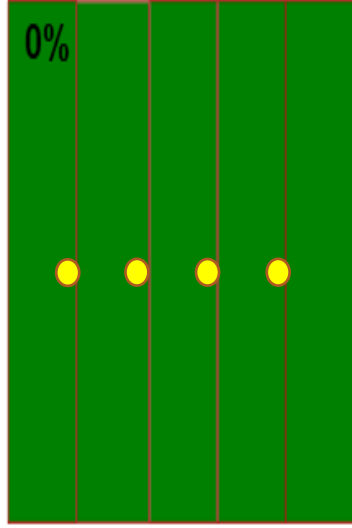


# Experimental Design – Rhizosphere

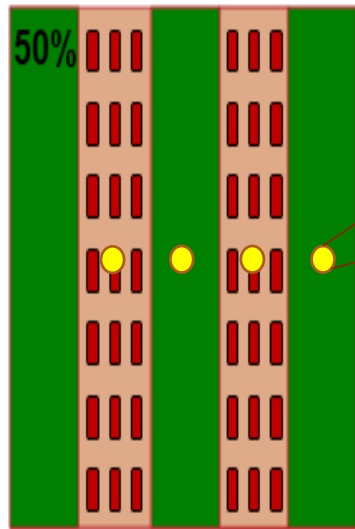
Methods



Clearcut



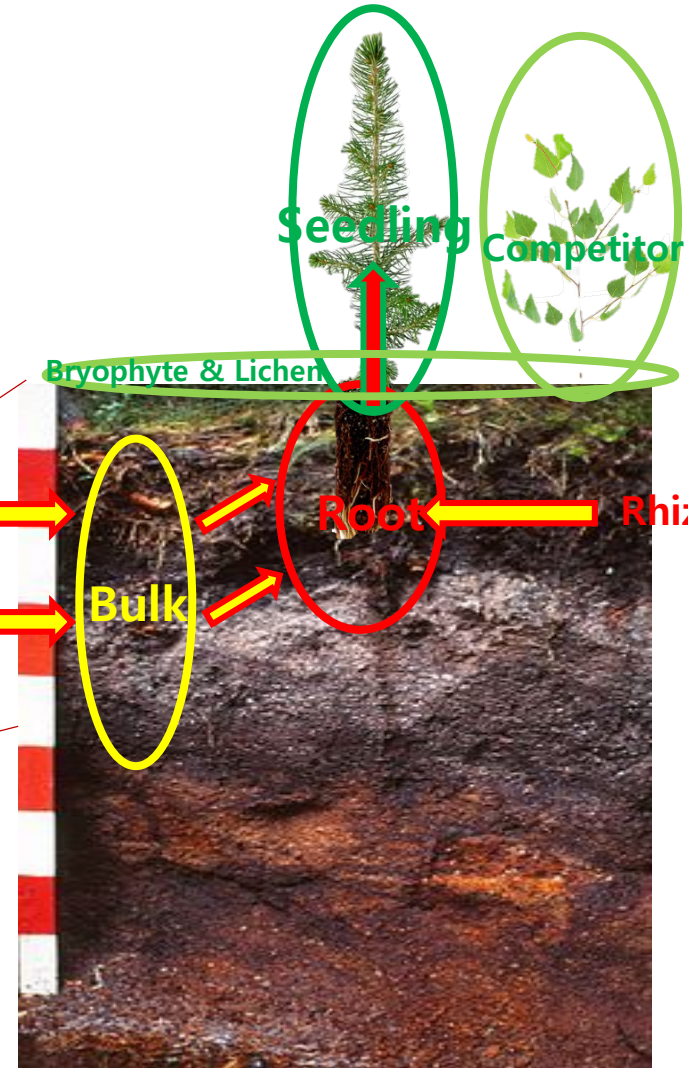
Unmanaged



Partial cut

- Scarification plot
- Total harvested
- Partial harvested
- Intact residual strip
- \* Shelterwood
- Composite**

X 4 sites  
 X 3 treatments  
 X 4 replicates  
**= 48 rhizosphere soil samples**  
 X 2 kingdoms  
**= 96 sequence outputs**

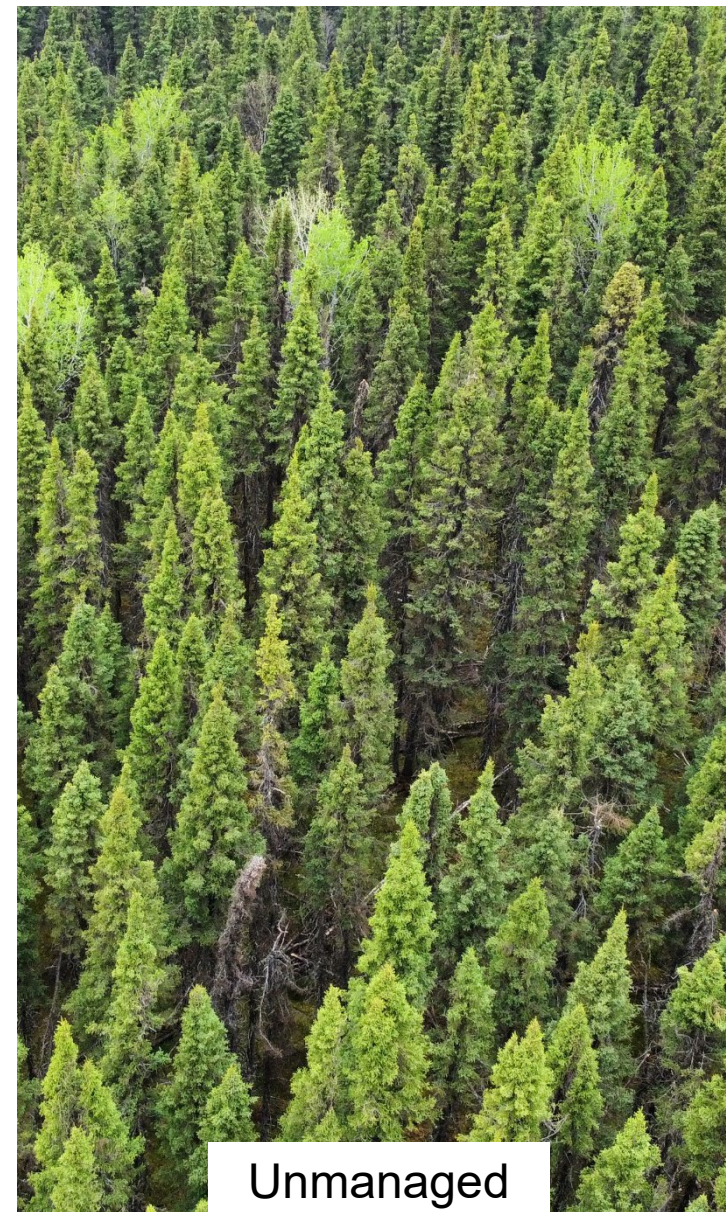






# From Above: 19 Years After Silvicultural Treatments

Methods

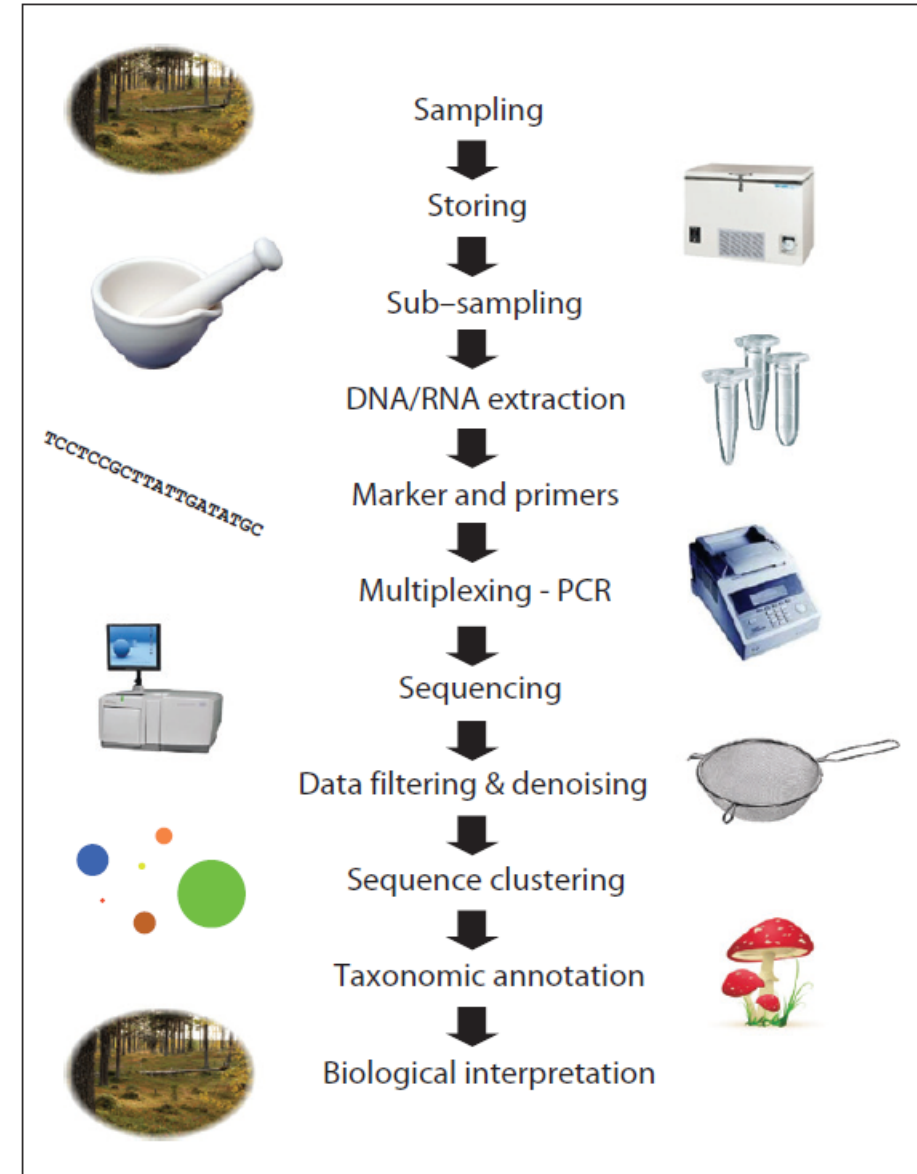
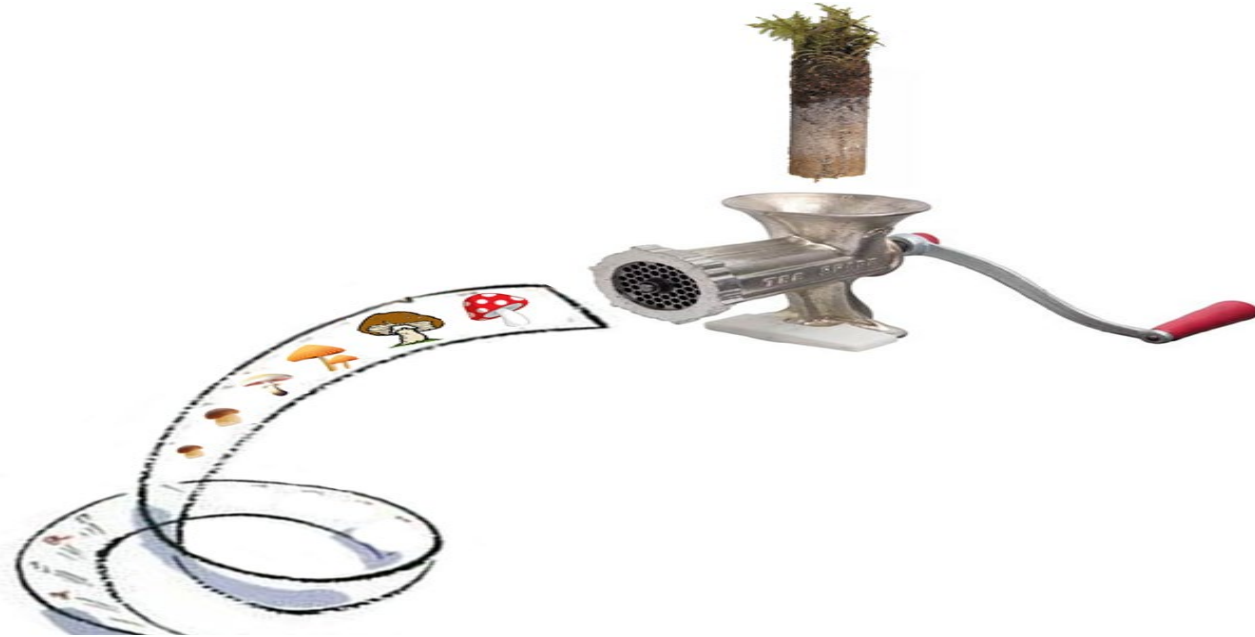






# DNA Metabarcoding (16S/ITS amplicon sequencing)

Illustrated by Björn Lindahl

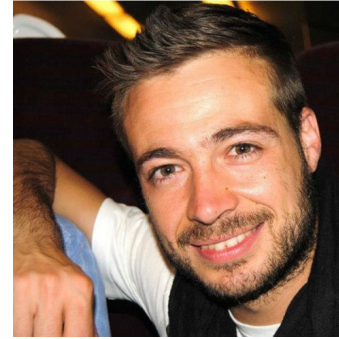




# Acknowledgement

## Supervisors

- Miguel Montoro Girona (UQAT-SLU)
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- Patricia Raymond (MFFP)

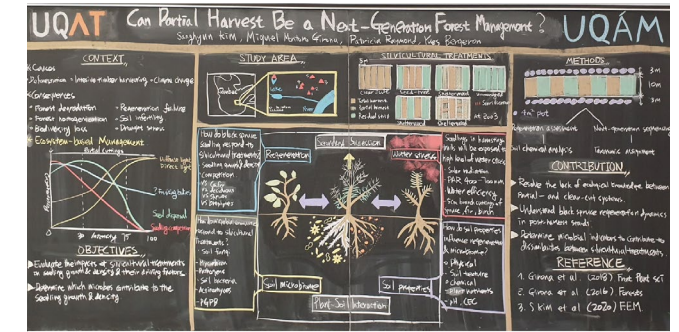


## Collaborators

- Christine Martineau (NRC)
- Greg Thorn (UWO)
- Vera Tai (UWO)

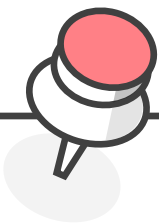
## Merci beaucoup

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- Victor Beaudet
- Hugo Morin Brassard



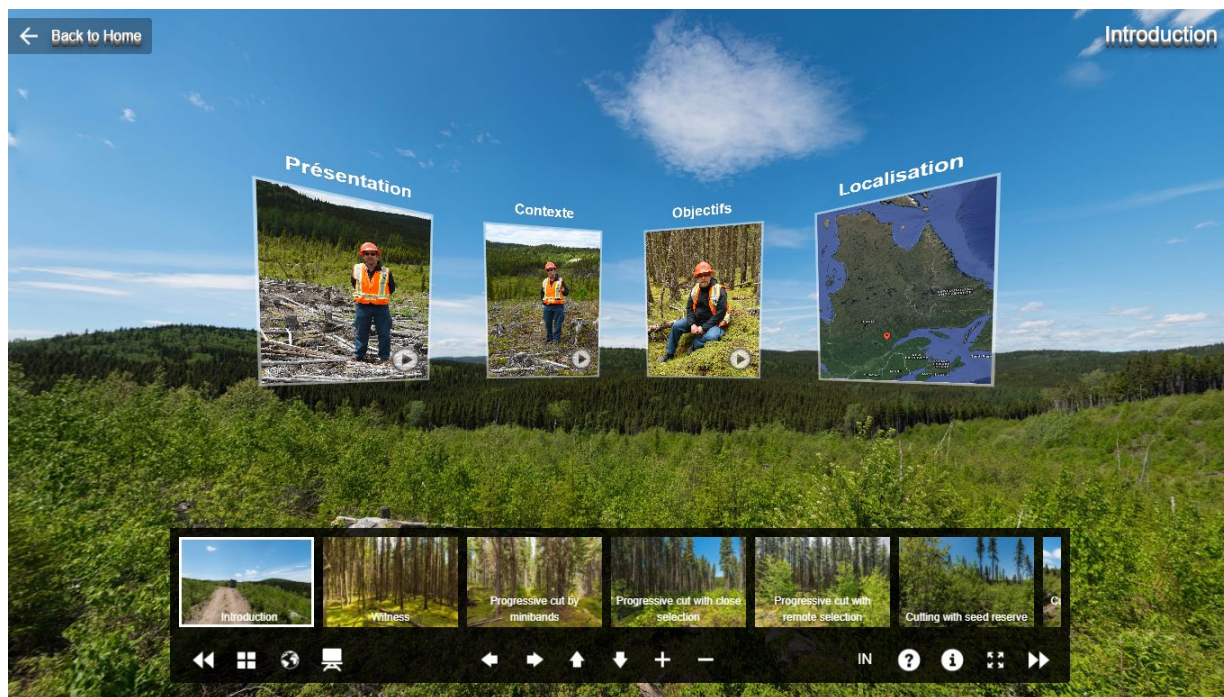
1st Prize for Best Poster in CEF 2021 (500\$)





# For More Information – MISA Virtual Visit

## MISA Virtual Visit



Website: <https://visitesvirtuelles.partenariat.qc.ca/monts-valin/fr/>

## Partial harvest (Mini-strip)

