

# AGRICULTURE IN THE BOREAL FOREST

UNDERSTANDING THE IMPACT OF LAND  
USE CHANGE ON SOIL CARBON

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As climate change impacts the northern landscape and expands agricultural opportunities, it is important to consider how land use changes will impact soil carbon and what it will mean for communities in the North.

# NORTHERN AGRICULTURE & SOIL CARBON

Climate change is causing rapid warming across many northern regions and disproportionately affecting ecosystems that northern communities rely upon for traditional food sources. However, climate change is also expanding the range of potentially suitable agricultural land northward, and this is leading to many communities and farmers considering and implementing local food production.

However, **the conversion of boreal forest to agriculture may degrade the carbon rich soils** that characterize the region, resulting in large carbon losses to the atmosphere and negatively and potentially further accelerating the effects of climate change. As a result, it is essential to understand the extent of the environmental impacts of agriculture in northern ecosystems and develop methods and tools to produce sustainable sources of food, while mitigating any trade-offs.

## MEASURING IMPACTS ON SOIL

To understand the impact of northern agriculture on soil carbon and to help northern communities find areas that agriculture would be best suited, David Bysouth, a PhD candidate in the department of Integrative Biology at the University of Guelph, is working on 3 projects:

- Understand the impact northern agriculture has had on soil carbon at a global scale
- Collect and map soil carbon and soil fertility data for the areas between Kakisa and Enterprise
- Collect and compare soil data from active farms, abandoned farms, and undisturbed forest to see the extent of the impact of converting boreal forest to agriculture in the southern Northwest Territories



# RESEARCH FINDINGS

Our research showed that converting boreal forest to agriculture:

- Results in significant soil carbon losses at a global scale in the first 30 years after cultivation;
- Results in soils becoming less acidic and that soil acidity is correlated with soil carbon;
- Creates conditions where soil carbon quantities start to recover long term but don't appear to reach pre-agriculture levels;
- Requires land management practices that help mitigate carbon loss and promote healthy soils and ecosystems.

Our research team also found that the soils in the Kakisa to Enterprise area are:

- Highly variable in terms of their potential fertility for agriculture and the amount of carbon they contain;
- Ideal for agriculture when soil carbon values are lowest, as this generally resulted in soil fertility being greatest;
- Very nutrient depleted and will likely require appropriate management for sustained crop growth.



Soil Cores



Kakisa Greenhouse

# RESEARCH IMPLICATIONS

## What Does This Mean For Communities?

Converting sections of the forest to agriculture will likely result in short term carbon losses to the atmosphere. However, there is the potential to mitigate these losses with the development of agriculture management strategies that promote crop growth but limit soil carbon losses.

Also, agriculture can be conducted in ways that minimizes disturbances to the soil. Using areas that are already cleared of trees, areas that have been abandoned, and areas that have lower initial soil carbon can all be effective ways to minimize soil carbon loss. The use of maps produced from this data can help to identify areas that have the highest potential for agriculture, but the lowest amount of soil carbon to be lost. This will ensure that Kakisa and Enterprise can effectively select areas for agriculture that promote sustainable food production while minimizing environmental impact.



David at the Enterprise Gateway Jamboree, August 2019



Farm near Enterprise

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