FireSmart™ Fuel Management – Bioenergy Nexus in Remote and Indigenous Communities

[1]*FireSmart, Intelli-feu and other associated Marks are trademarks of Canadian Interagency Forest Fire Centre Inc. https://firesmartcanada.ca/*

Nicolas Mansuy, Jennifer Buss, Kelvin Hirsch
Canadian Forest Service, Northern Forestry Centre, Edmonton, Alberta

Workshop: Wildfire Resilience and Biomass Supply
Workshop organized by IEA Bioenergy Task 43 and Université Laval, Thursday, October 5, 2023.

Context

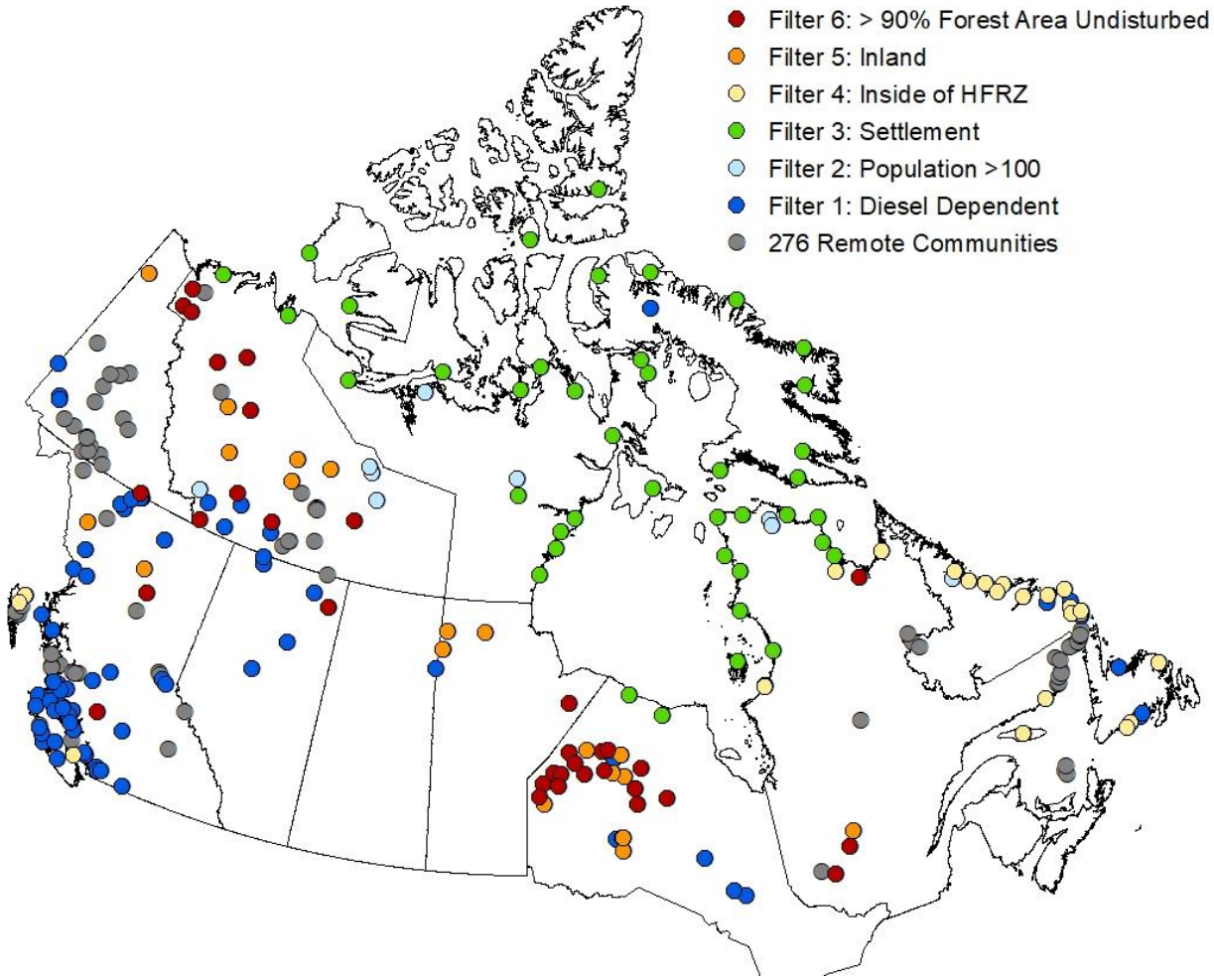
- Approximately 200 (73%) of northern and remote communities in Canada are off-grid and dependent on local diesel-powered generators as their main source of electricity and heat
- Diesel-dependent communities are mostly Indigenous and face many social-economic challenges to access clean and affordable energy.
- Energy costs are 2 to 6 times higher than those of the average Canadian
- Approximately 80% of Indigenous communities in Canada are located in fire prone forested areas
- Indigenous people only make up 5 % of the population in Canada but 42% of wildfire evacuation events occur in their communities

Nearly 200,000 Canadians have been placed under an evacuation order this season 2023.

Scope and Objectives

- The integration of fuel management and biomass removal for bioenergy can represent a win-win solution for communities that are particularly vulnerable to fire risk and face energy insecurity.
- The aim of this study is multiple:
  - ✓1) Identify diesel-dependent communities that are at risk from wildfire in Canada;
  - ✓2) Estimate the amount of biomass available from fuel treatments (BAFT) and fuel treatment areas (FTA) at the community level that could be used to meet their annual energy demand (AED) ;
  - ✓3) Perform a ranking of community suitability for fuel treatments using a hierarchical clustering analysis based on the current and future fire risk

Method

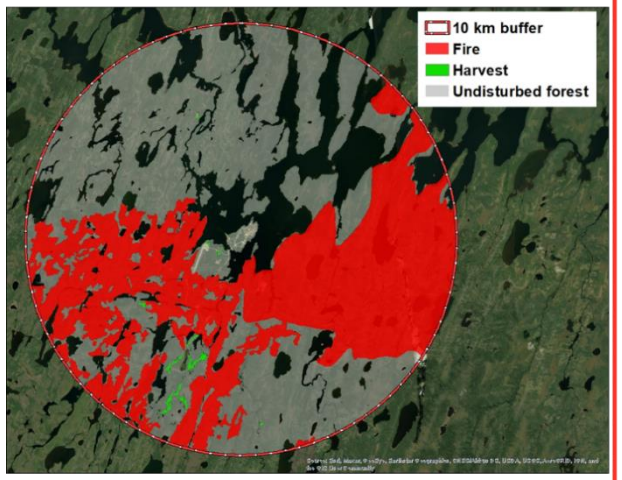


<u>Community selection</u>

- As of 2022 the Remote Communities Energy Database (RCED) classifies 276 communities as being remote
- After 5 selection steps, we identified 53 communities eligible for further analyses
- Communities outside of the boundaries of the homogeneous fire regime zones (HFRZ; filter 4) or not inland (filter 5) were excluded

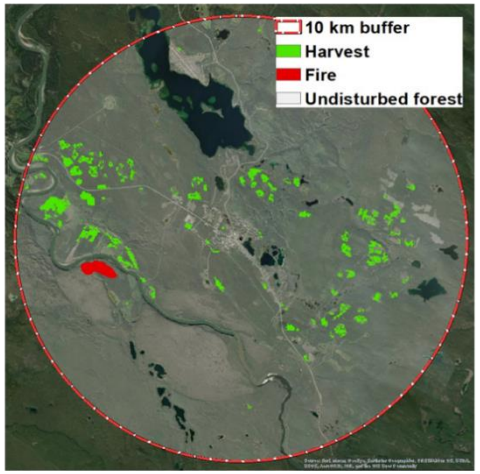
Method

Not at Risk from Wildfire



Kasabonika, ON: 55% forest is undisturbed

At Risk from Wildfire



Watson Lake, YT: 98% forest is undisturbed

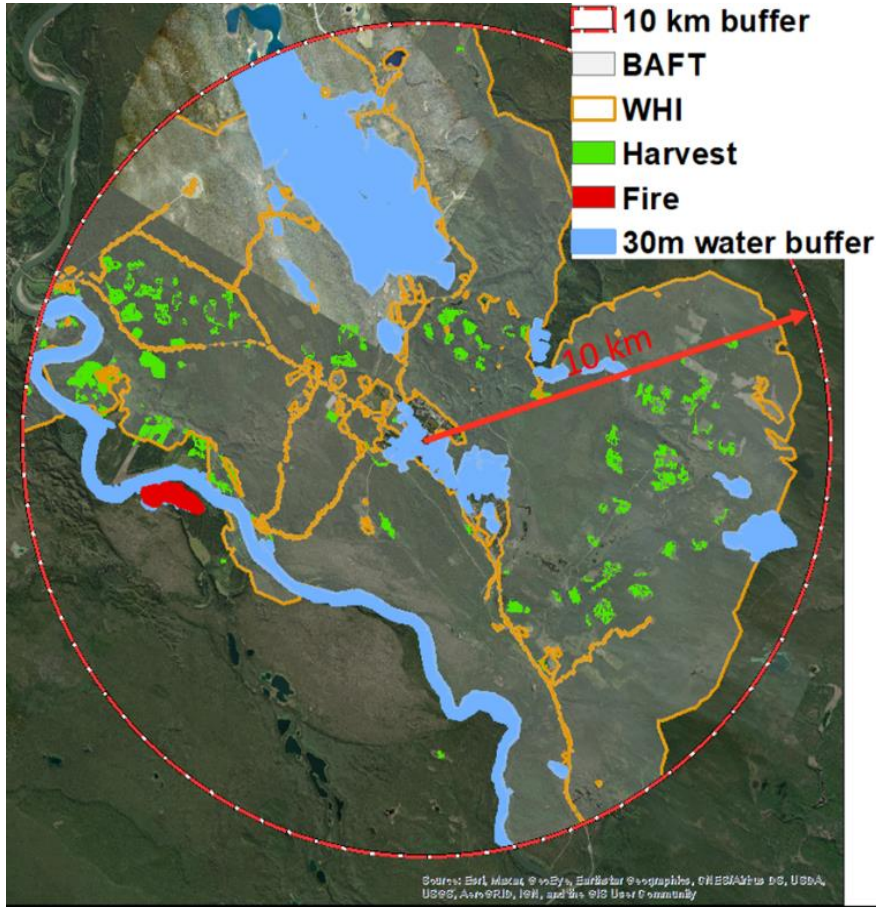
Fire risk at the community level

- Vulnerability to fire risk at the community level was determined by having at least 90% of undisturbed forest area (i.e., forest > 30 years old) of the total forested area within a 10km buffer around the community.
- Based on these criteria, 33 communities were identified as being particularly vulnerable to forest fires.

Method

<u>Biomass available from fuel treatments (BAFT)</u>

- BAFT was calculated using a national aboveground biomass dataset in (odt/ha) including branches, foliage, bark, and stemwood from trees in forest stands from 2020 at 30 m resolution
- In addition to the 10km buffer, we considered the Wildland Human Interface (WHI) at the community level. The WHI layer is an aggregation of 3 types of anthropogenic interfaces:
  - ✓ wildland–urban interface
  - ✓ wildland–infrastructure interface
  - ✓ wildland–industrial interface
- Each interface is defined by the intersection of human built structures and wildland fuels with a variable-width buffer surrounding human-built structures up to a maximum distance of 2.4 km determined by the burning potential of the fuel type
- We excluded biomass within 30 m of water bodies

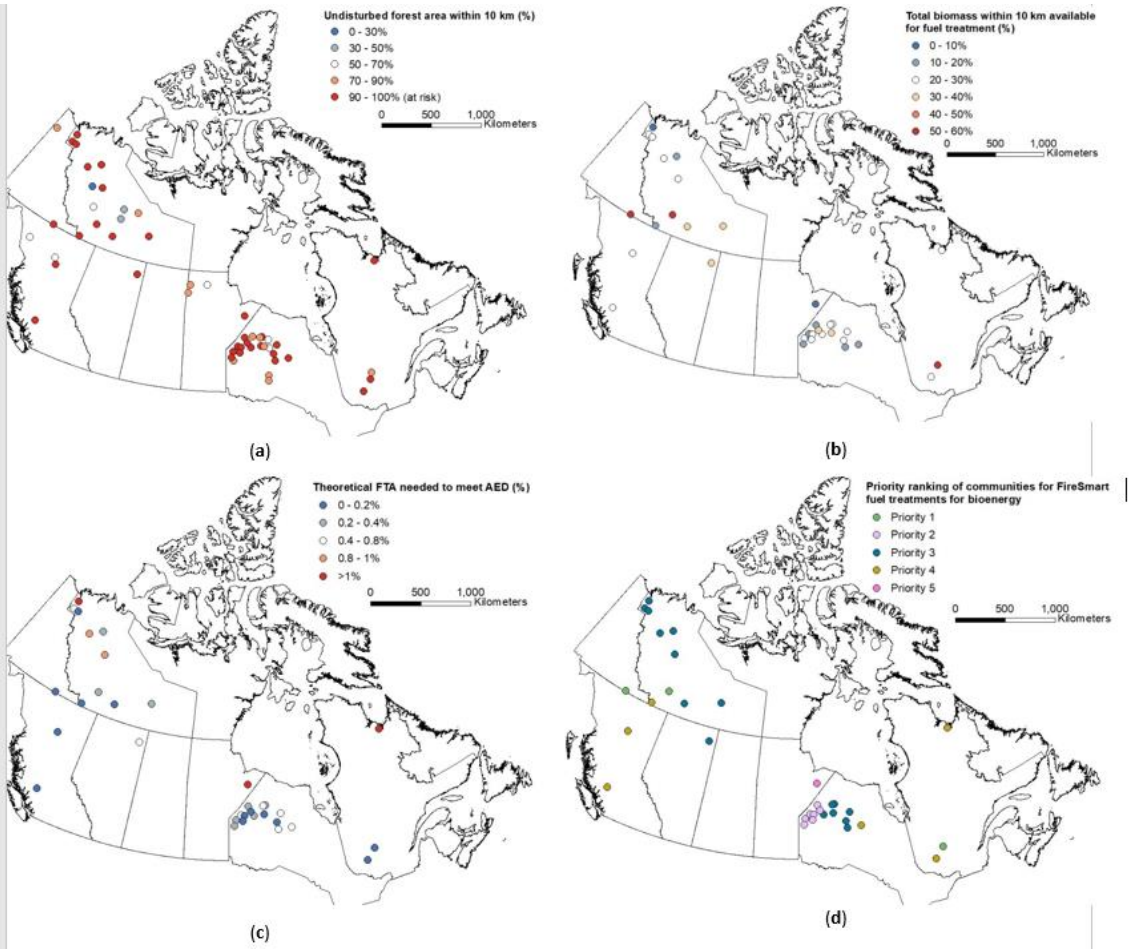


Method

Biomass meeting community energy needs

- The annual energy demand (AED) for the 33 at risk communities ranged from 600 to 20,000 MWh /year with an average of 5,000 MWh /year and was based on the annual fossil fuel consumption available in the RCED.
- The theoretical biomass needed (odt/yr) to meet the AED of each community was calculated using an energy conversion factor of 5,3 MWh per metric tonne of dry woody biomass (at 0% moisture content).
- Different boiler energy efficiencies and fuel treatments options have been taken into account in more operational scenarios (sensitivity analysis).

Results



Identifying priority communities

- Regardless of their energy needs, all 33 communities can theoretically meet their AED by harvesting less than 1% of their BAFT per year
- Or can theoretically meet their AED by harvesting an average of 0.62% (up to 7% of the FTA per year).
- While FTA range from 900 to 17,000 ha, with an average of 6000 ha for the 33 selected communities, the areas to be treated each year at the community level remain relatively small, ranging from 2 ha to 137 ha for an average of 26 ha, and are well below the areas currently reported in the literature

Keys Messages

- Diesel-dependent communities are particularly exposed to wildfire risk based on biomass at risk and AAB (current and future)
- The surrounding biomass is important and accumulating (even in the arctic)
- Many remote communities are suitable for proactive fuel treatments directed towards the bioenergy sector
- The efficiency of biomass removal (fuel treatments) for reducing fire risk at the community are still uncertain and require further analysis
- Biomass removal operations for bioenergy can benefit from existing fuel treatment standards developed by FireSmart Canada
- Synergies, collaborations (between local government and fire agencies) and education are needed
- Evaluate cost-sharing opportunities between the bioenergy sector and fuel management, and increase benefits at the community level (jobs and revenues) and community leadership

Questions