

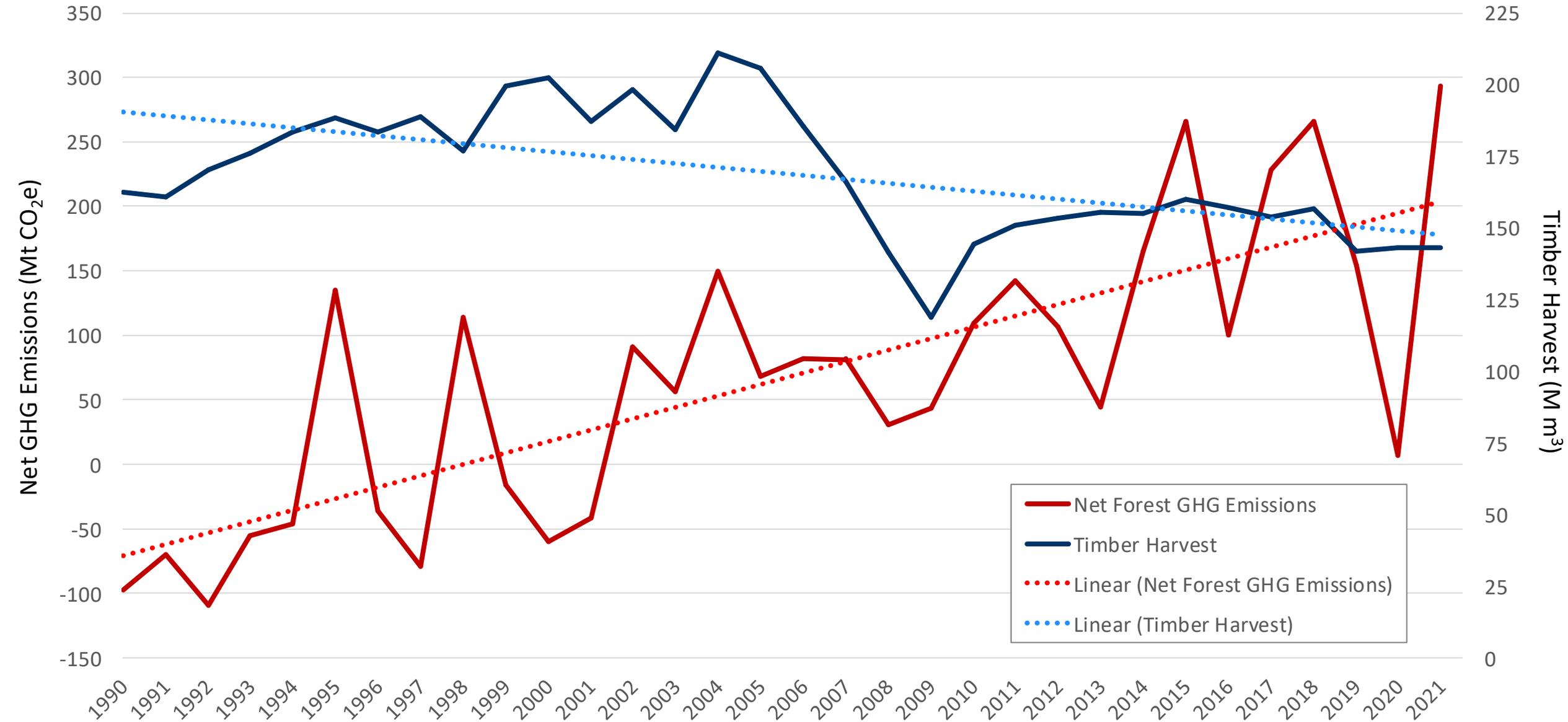
Bioenergy for Forest Management

Putting GHG Reductions in Context

- NWT's anthropogenic GHG emissions: 1.4 Mt CO₂e/y
 - *0.2% of National emissions*
 - *Would rank 37th in Canada's large emitter facility list*
- Territories combined: 2.8 Mt CO₂e/y
 - *0.4% of National emissions*
 - *Would rank 20th in Canada's large emitter facility list*
- The primary drivers for bioenergy in the Arctic must be energy security & affordability
 - *Increasing energy prices to reduce fossil fuel use not acceptable to public*
 - *GHG reductions from avoided fossil fuel use are irrelevant nationally & globally*
- But...bioenergy's role in reducing forest carbon losses is not irrelevant

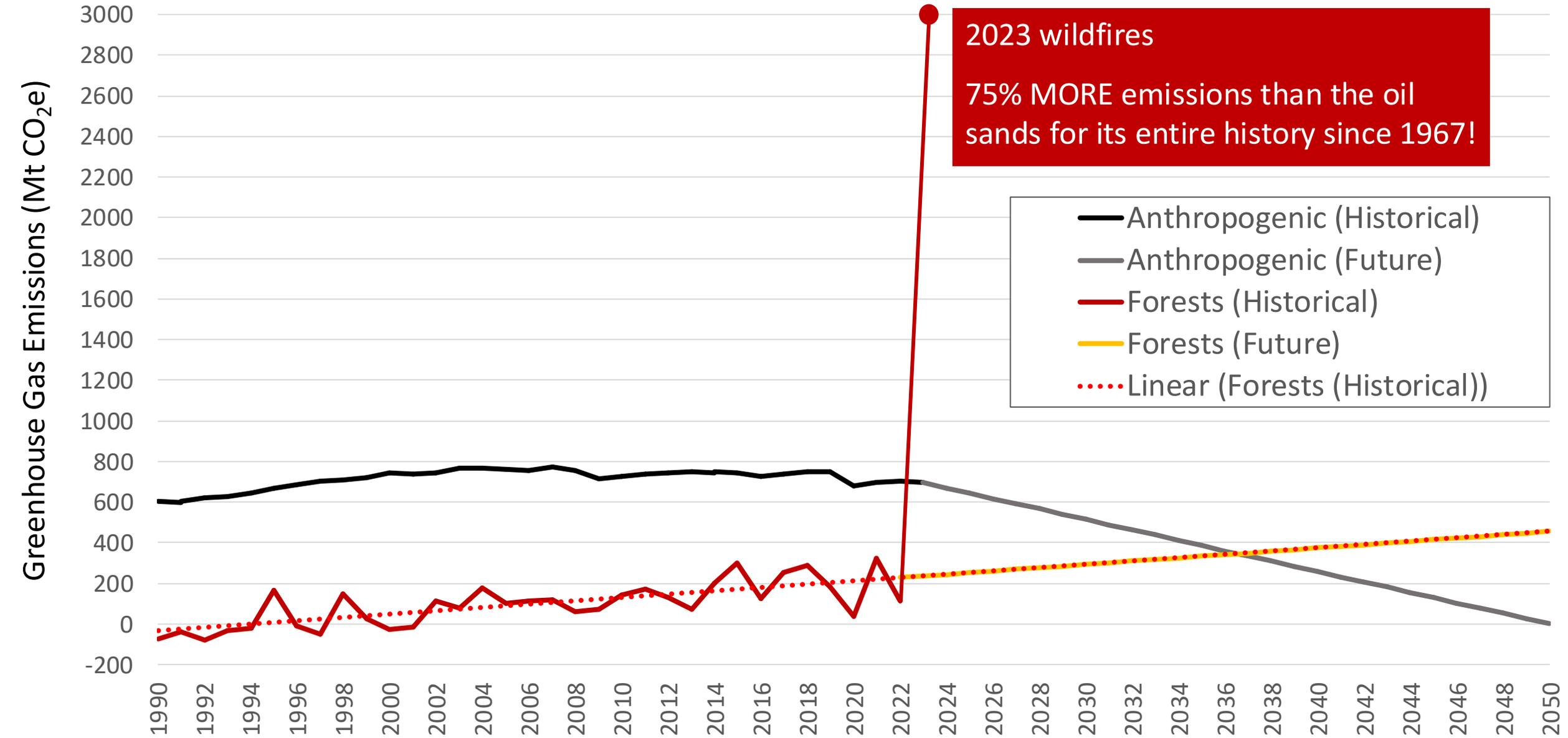
Forest Emissions Nationally

GHGs from Canada's Forests Vs. Timber Harvest





Human Vs. Forest Emissions



Public GHG Emissions

Public Air Pollution

*More emissions than everything else...
combined!*

Wildfires are by far the largest
negative economic impact of
climate change in Canada
\$10-35 B/y

- Zhang et al., 2025, Nature:

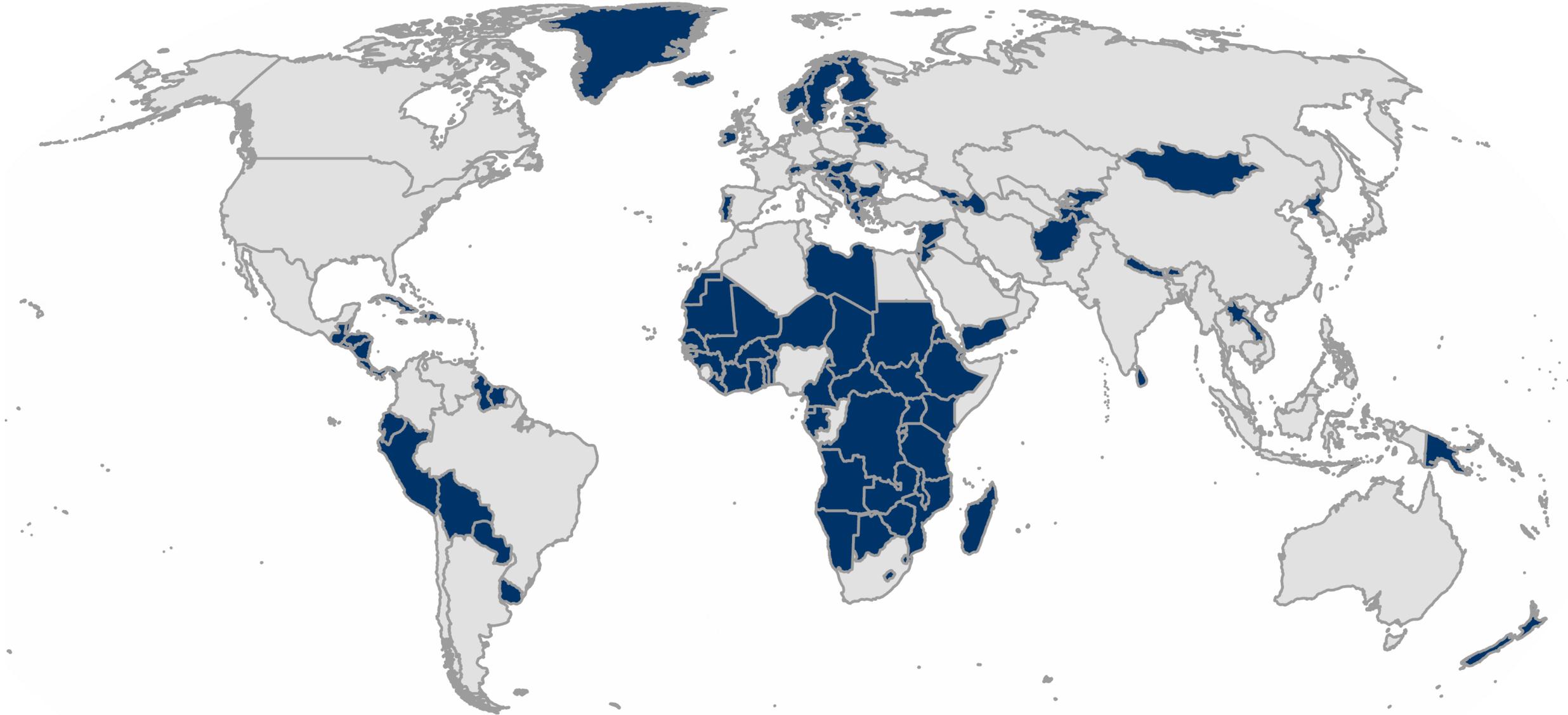
“Worldwide, we estimate that 82,100 people died prematurely attributable to chronic smoke exposure from the 2023 Canadian wildfires...Of these deaths, 41,900 occurred in North America, including 33,000 in the USA and **8,300 in Canada**...In Europe, we estimate 22,400 attributable chronic deaths in Europe related to the intercontinental transport of smoke from the Canadian fires.”

- Qiu et al., 2025, Nature:

“...increase in annual excess deaths due to climate-driven wildfire smoke would result in annual damages of \$608 billion in 2050 (2019 dollars)...our estimates suggest that damages from climate-induced smoke-related mortality could substantially exceed damages from all other estimated causes by mid-century in the US combined.”

- Consistent with Health Canada’s cost findings (pre-2020, up to \$20 B/y)

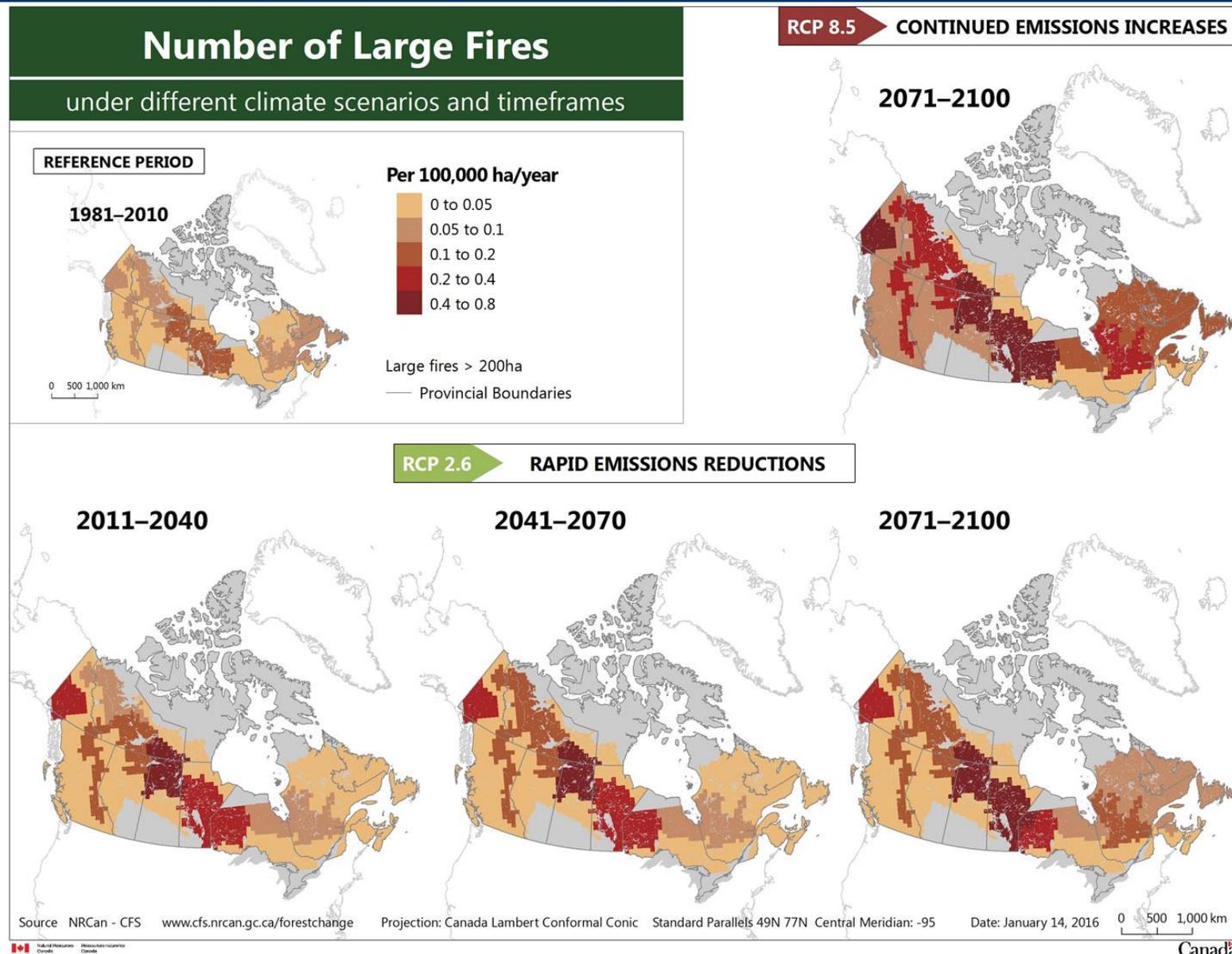
More than 138 Countries



100% of EU Emissions

50% of US Emission

Trends Say More Emissions



Canada vs Sweden

50x

2023: 500x

Canada = 75

Sweden = 0.7

Wildfire Rate (per Ha)

Canada vs Sweden

50x

2023: 500x

Harvest Rate

Sweden/Canada = 7

CA: Harvest <3.9% of growth

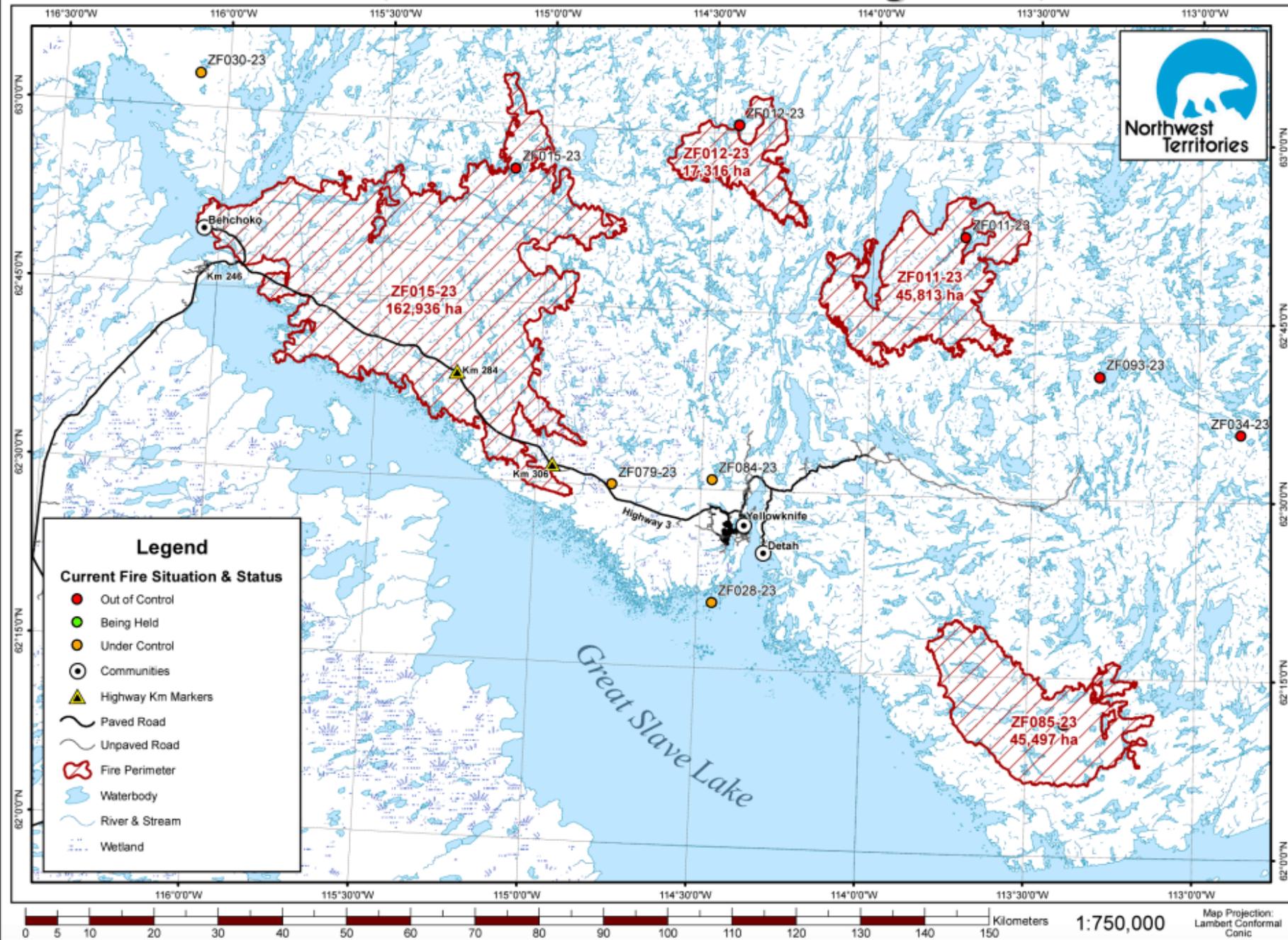
SE: Harvest <28% of growth

But Sweden is increasing forest carbon while
Canada is losing it rapidly

NWT



Yellowknife, NT - Fire Situation - August 15, 2023



NWT Forest Carbon

- World Resources Institute estimate: 110 Mt CO₂/y lost from NWT forests
 - *2001-2024 average, net basis*
 - *~80x anthropogenic GHG emissions*
- EU CAMS 2023 forest carbon loss estimate: 400 Mt CO₂/y
 - *Equal to 285 years of NWT anthropogenic GHG emissions at current rate*
- NWT's forests are subject to 100% of global GHG emissions
 - *Reducing anthropogenic GHG emissions in NWT will not help*
- Eliminating all wildfires in NWT will not happen...
 - *...but Bioenergy can be used to reduce risk and limit scale of megafires*
 - *Essential market for low-grade wood*
- Forest growth rates in NWT very slow, so operations must be thoughtful
 - Purpose is wildfire risk mitigation, NOT energy supply

We've Forgotten Something



Black Carbon

- Black carbon is a component of fine particulate matter (PM_{2.5}) -> “Soot”
- Black carbon is a climate forcing molecule. Reduces albedo (sunlight reflection). Absorbs sunlight.
- Impact varies dramatically by geography
 - Closer to the Arctic, greater the impact
 - Global warming potential (GWP) 460-1,500x CO₂
- Global climate forcing impact of carbon black may be second to only CO₂ (but ahead of methane)
- Canada publishes black carbon inventory of anthropogenic emissions
 - Diesel is largest source (41%)
 - Residential wood combustion is second largest source (20%)
- Canada’s Black Carbon Inventory EXCLUDES actual largest sources
 - Wildfires
 - Slash pile burning
- High efficiency biomass CHP plants can reduce black carbon emissions by 99.99%

Black Carbon

- Emission rate calculations:
 - Open Burn: >20 g $\text{PM}_{2.5}$ /kg dry wood
 - ECCC Residential Ratio: black carbon/ $\text{PM}_{2.5}$: 9.6%
 - NWT Black Carbon GWP Assumption: 1,500
- NWT: 100 Mt CO_2 /y from wildfire emissions = 55 M bdt/y
- 1,100,000 t $\text{PM}_{2.5}$ /y = 105,000 t Black Carbon/y
 - ECCC Black Carbon Inventory (erroneously) states Canada's total BC emissions = 23,000 t/y
- With a 1,500 GWP, avg annual NWT wildfire emissions have BC climate impact of 160 Mt CO_2 /y
 - Valuation @\$170/t CO_2e = \$27 B/y
- 2023 NWT wildfires: CO_2 + BC climate impact of 630 Mt CO_2e
 - Roughly equal to all of Canada's reported anthropogenic GHG emissions

Conclusions

- Use the lever!
- Even a small % reduction in fire emissions will be larger than reducing fossil emissions
 - Use bioenergy values to pay for fire treatments
- Climate policy in Canada must be about forests to be effective

Bioenergy for Forest Management

Putting GHG Reductions in Context