

# Effects of Forestry Operations on Soil Respiration in Intensively Managed Boreal Jack Pine Plantations

Phillip E. Reynolds\*, Gordon Brand, Natural Resources Canada, Canadian Forest Service, 1219 Queen Street East, Sault Ste Marie, Ontario P6A 2E5

## Ontario Long-Term Soil Productivity (LTSP) Study

- The Ontario LTSP Study was established in 1993 to examine the effects of harvesting and other site preparation techniques, including vegetation management, on long-term productivity (i.e., yield, biomass, Carbon sequestration) of either jack pine or black spruce plantations
- A component of the larger North American LTSP study being directed by the US Forest Service
- The overall hypothesis of the LTSP study is that soil compaction or nutrient removals seriously impact future stand productivity and presumably Carbon assimilation & sequestration
- This study reports on the Wells township jack pine plantation site located near Thessalon, ONT within north-central Ontario

## Wells Treatments were:

- Tree Length (TL) harvest with disc-trenching (DT)
- Full-tree (FT) harvest with DT
- FT harvest with blading (B)
- FT harvest with B and soil compaction (C)
- Herbicide (H) & non-herbicide (NH) sub-plots
- Unharvested forest control

## Objectives of this study were:

- To quantify jack pine soil respiration differences among treatments at the Wells plantation site
- To compare soil respiration differences for plantation treatments with unharvested forest
- To ascertain how these treatment differences compare with Carbon assimilation treatment differences at the same site

## Methods



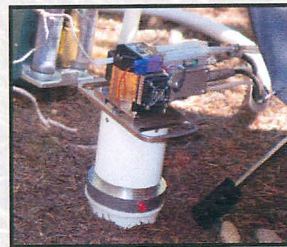
Installing Collar



Installed Collar



Li6400 Measuring Soil Flux



Soil Chamber on Collar



Li6400 with Soil Temperature Probe



Measuring Soil Moisture with Hydrusense TDR

## Results & Conclusions

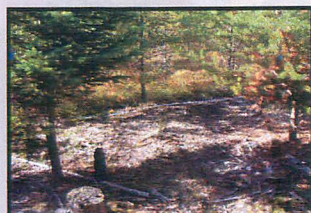
- Soil respiration peaked in July/August declining thereafter (Figure 1, 2)
- No treatment differences between any of the 4 plantation treatments at any measurement time (Figure 1, 2)
- Nominally speaking, TL, DT, H subplots showed highest respiration rates of the 4 plantation treatments (Figure 1)
- Large differences between rates for plantation treatments versus rates for adjoining unharvested forest (Figure 1, 2)
- Biggest differences in soil respiration rates are due to harvesting and not site preparation techniques
- Soil respiration appears to be primarily affected by harvesting alone
- This finding is opposite measured Carbon assimilation rates where site preparation (B & C) has adversely impacted assimilation rates, and where avoidance of B & C is recommended
- Carbon assimilation is more sensitive to site preparation (B & C) than soil respiration



Wells Jack Pine Plantation



Ground Vegetation



Herbicided Area



Unharvested Stand

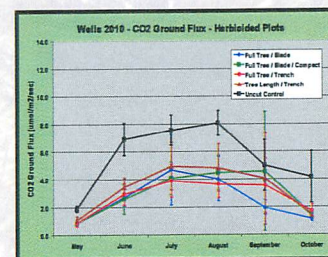


Figure 1

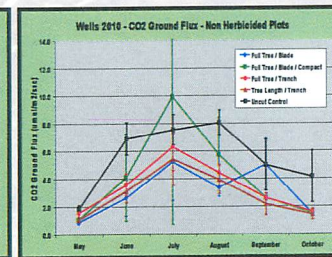


Figure 2

## Further Work

- Data will be combined with daily diurnal meteorological data in order to estimate soil respiration on a per hectare basis for varying silvicultural treatments

\*Corresponding Author preynold@nrncan.gc.ca