INTRODUCTION

An estimated 70-80% of carbon residing in temperate forested ecosystems may exist in the soil, termed soil organic carbon (SOC)1,2. Our understanding of SOC dynamics in these systems originates from studies conducted in well drained, and to a lesser degree poorly and very poorly drained organic substrates, environments. Few studies have focused on understanding SOC dynamics in imperfectly drained systems. Imperfectly drained soils may provide linkages between terrestrial and aquatic systems, or occur in extensive isolated areas in the landscape as in the glaciated northeastern United States. Our primary research questions were:

- Do differences exist in SOC dynamics among distinct soil drainage classes?
  - Moderately well drained (MWD)
  - Somewhat poorly drained (SWPD)
  - Poorly drained (PD)

- Do differences exist in SOC dynamics between different dominant forest types?
  - Coniferous (CF)
  - Broad-leaved deciduous (BLD)

METHODS

- Experimental design: 6 compartments (3 soil classes * 2 forest types) * 3 plots = 18
- 18 quantitative pedons were excavated in 2010 for C and chemical analysis3,4
- Total C determined on LECO® CN-2000 Analyzer
- Sequential C extraction conducted on air dry samples using hot water (HWEC) and 6 M HCl (AHCl)5,6
- Monthly soil respiration (Rsoil) measurements conducted with LI-COR® 6400
- Samples collected for seasonal measurements in conjunction with Rsoil for gravimetric soil moisture (gsoil) and HWEC extraction on the O horizon and upper 5 cm of the mineral soil

RESULTS & DISCUSSION

- MWD mineral soil (Fig. 3) and CF whole pedon (Fig. 4) had the highest soil C content.
- Differences in fine soil mass and potentially fine root biomass may explain higher C content in MWD and CF systems.

SELECTED SOIL CHEMICAL PROPERTIES

- Soil chemical properties that display significant differences (p<0.05) among soil drainage classes include LOI, C:N and pH, especially descending the profile. Differences between forest types were confined to the O and upper B horizon.

CONCLUSIONS

Results from this study indicate SOC differs among drainage classes, and to a lesser degree forest types. It was initially hypothesized that a conventional sequence would exist of high to low SOC from PD to MWD, and from conifer to broad-leaved deciduous, due to reduced decomposition and increased accumulation. Yet evidence suggests the contrary for this drainage sequence, and only occasional differences were noted in forest types. One key contributing factor to these results could be the role of root biomass as a SOC source. A slightly different pattern emerged for Rsoil during the 2010 growing season, a year with soil moisture deficits greater than normal. The Rsoil results suggest that SWPD, and to a lesser extent PD soils are more resilient to moisture stress. This can be an important consideration in evaluating ecosystem resilience to intensified weather regimes associated with a changing climate. The results of this research indicate that understanding spatial patterns of soil drainage on the landscape is essential to defining ecosystem processes and SOC dynamics.