



Carbon dioxide respiration from post-harvest slash piles in Howland, Maine

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SURE 2004

CO₂ and Forests

- ambient CO₂ levels are on the rise
- estimates for components of the forest sector carbon budget have an error margin of up to thirty percent (Brown)
- Howland Forest provides an exceptional opportunity to measure and monitor trees, plants, soil, and deadwood
 - forest dominated by hemlock and spruce
 - trees ranging from 45 to 130 years old
 - site covers 7,000 acres of International Paper's 17,000 acre working forest
 - an AmeriFlux site



Slash – a background

- a shelterwood harvest was conducted on the site from November 2001 to February 2002
- to protect the fragile forest soil unwanted branches and small logs - called slash - were piled in the path of the harvester



Harvest and the Carbon Budget



- shelterwood cut encourages growth
 - increase in carbon sequestration



- slash decomposition releases carbon
 - input to the atmosphere
 - decomposition factors



a carbon sink?

a carbon source?



Sample Collection: Organization

- Three slash piles
 - Pile A: flat area of forest floor
 - Pile B: uphill, slightly more drained
 - Pile C: in a hollow, near the base of an incline
- Two size classes
 - Size class II: between 1 cm and 5 cm diameter
 - Size class III: greater than 5 cm diameter
- Two locations
 - On the pile
 - Under the pile
- Seven sampling events
- Four samples per pile at each sampling

Sample Collection: The Tools

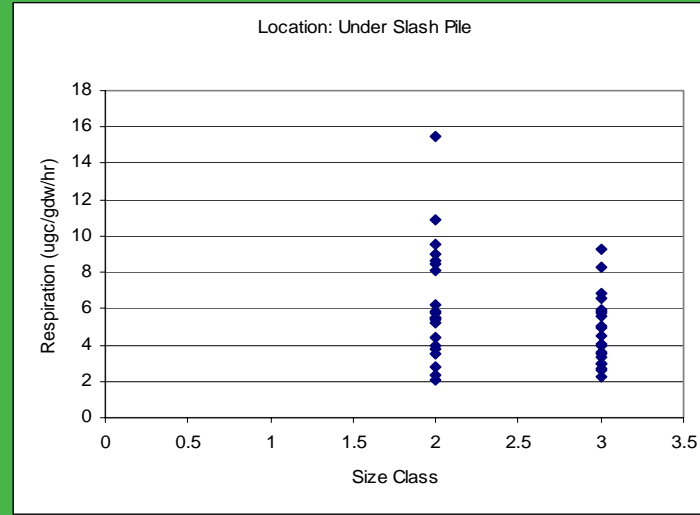




Post-collection Analysis

- Volume determination
- Sample respiration
 - LI-6262 CO₂/H₂O infrared gas analyzer
 - 13 L chamber
- Weight determinations
 - Wet and dry
- Drying process
 - Average of nine days at 60°C
- Water content
 - DC half bridges; gravimetric moisture; Protimeter Mini® moisture meter
- Flux determination

Results: Trends in Respiration

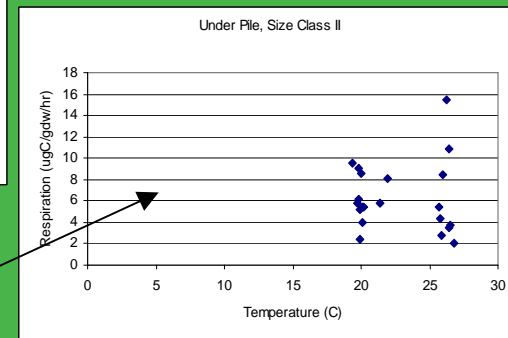
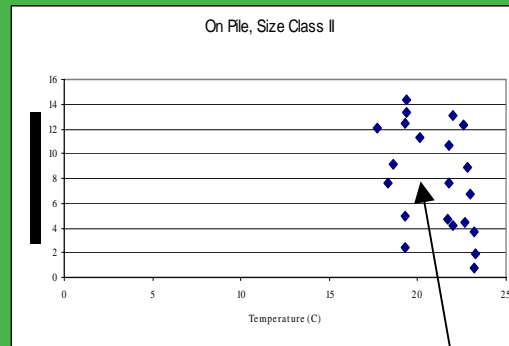
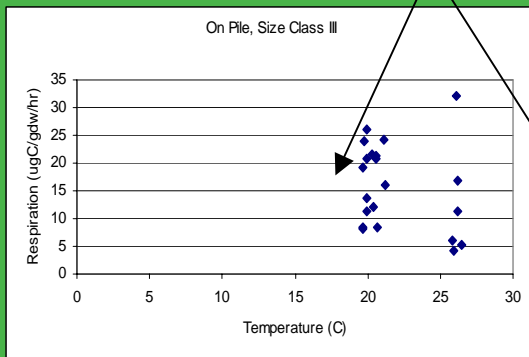


for all size classes, 'on' samples had higher fluxes than 'under' samples

size class III

average respiration for 'on': 15.84 $\mu\text{gC/gdw/hr}$

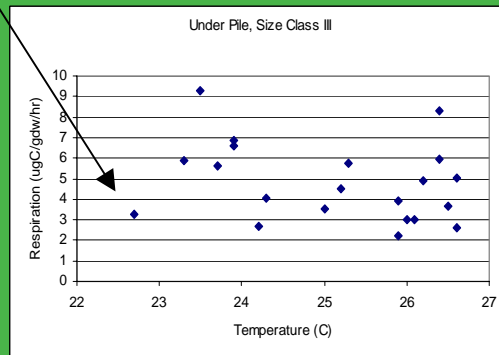
average respiration for 'under': 4.79 $\mu\text{gC/gdw/hr}$



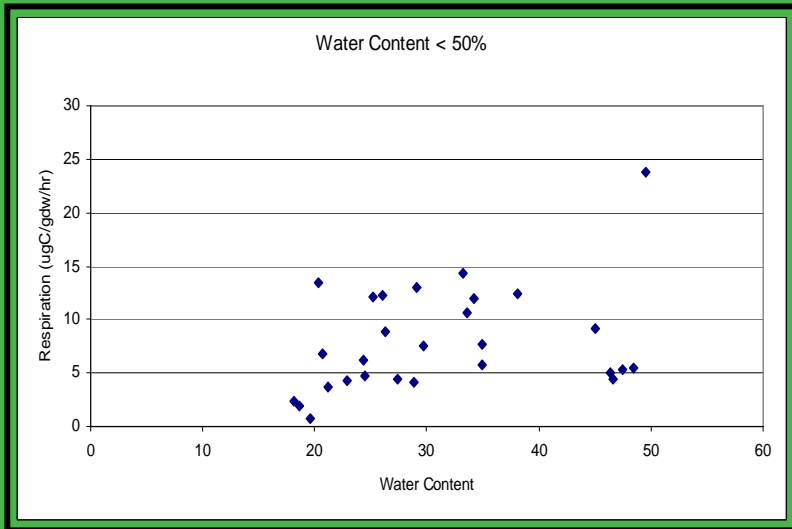
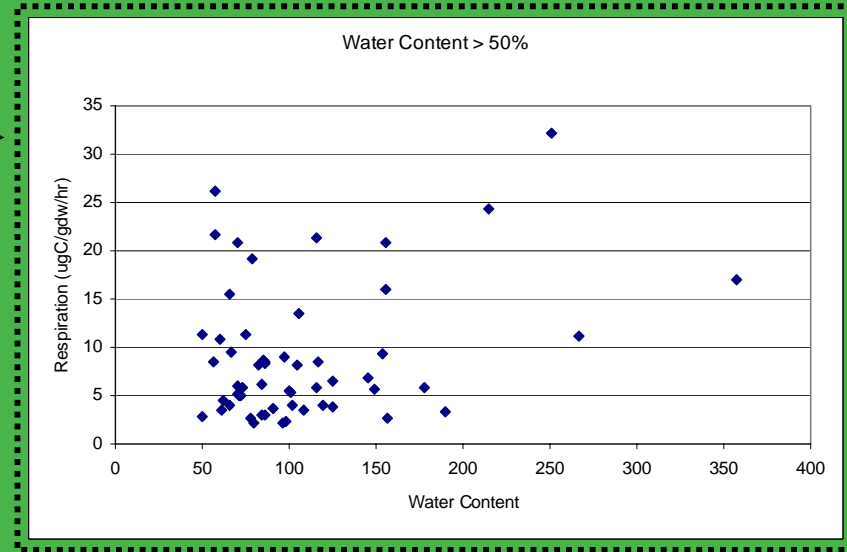
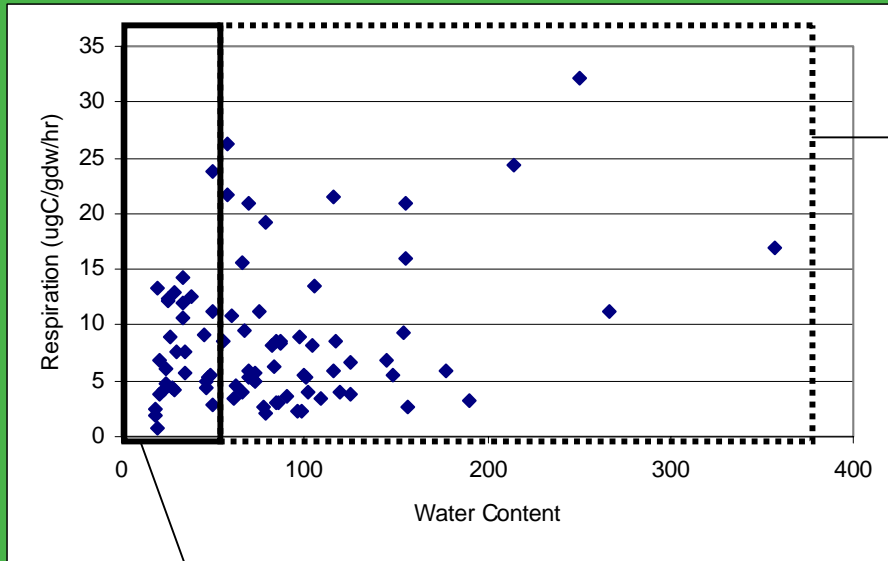
size class II

average respiration for 'on': 7.94 $\mu\text{gC/gdw/hr}$

average respiration for 'under': 6.31 $\mu\text{gC/gdw/hr}$



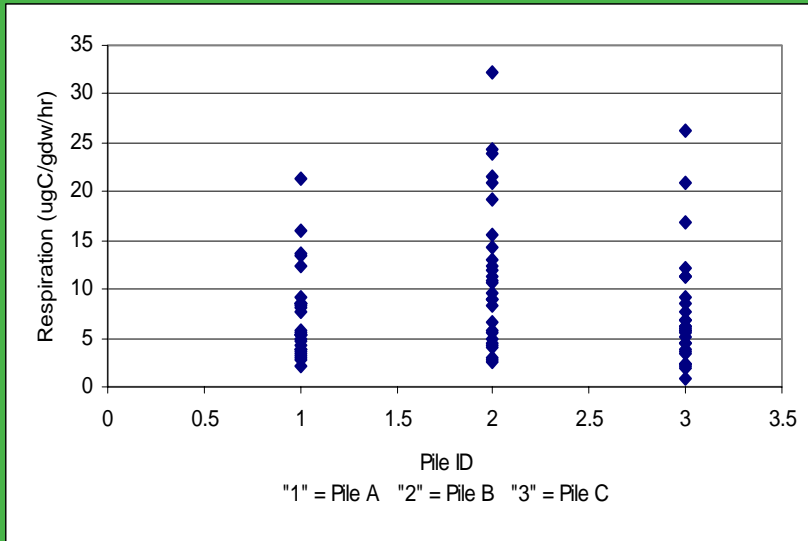
Results: Water Content and Respiration



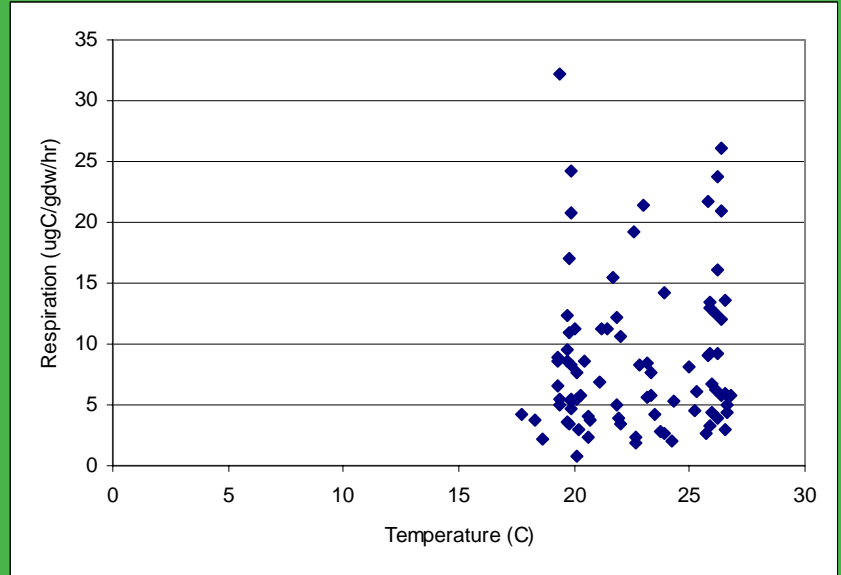
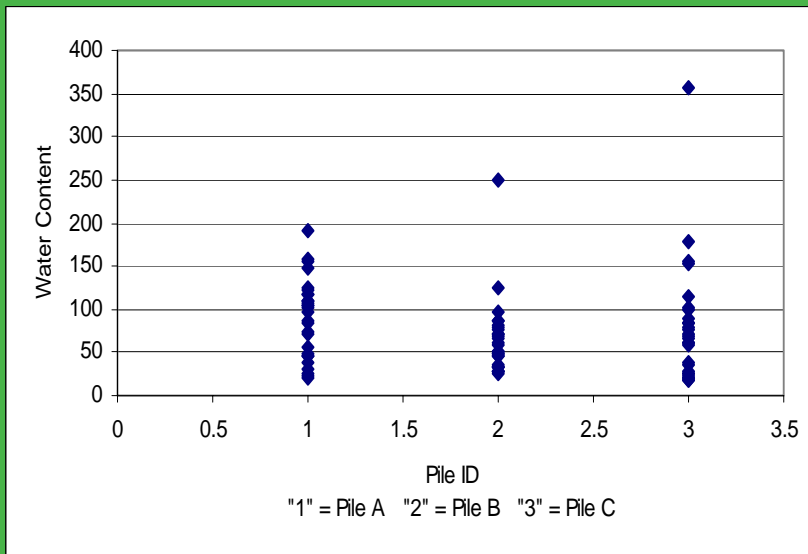
average respiration <50% water content: 7.95 $\mu\text{gC/gdw/hr}$

average respiration >50% water content: 9.1 $\mu\text{gC/gdw/hr}$

Unexpected Results



pile B has the highest respiration rate, yet...
it averages the lowest water content of the
three slash piles



respiration rates did not show as close a
correlation with temperature as hypothesized



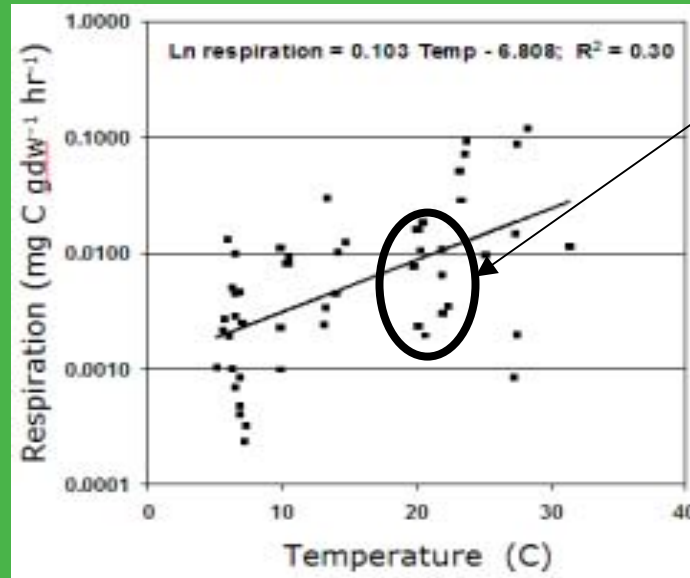
Discussion

- respiration rates and location
 - residual heat effects
- respiration rates and size class
 - sample size and water content
 - sample size and temperature

Relationship Between Deadwood Respiration and Temperature

graph courtesy of Woods Hole Research Center

http://www.whrc.org/new_england/Howland_Forest/deadwood_respiration.htm



the temperature range of sampling events



Discussion: Future Direction

- increase variation of weather conditions for collection periods
- expand the temperature range of collection periods
- seek additional relationships of Summer 2004 sample collection to previous and forthcoming sample sets
- determine a biotic component of decomposition
 - temperature/moisture/ CO_2 thresholds in wood species



References

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