CARBON CYCLING IN A MOUNTAIN ASH FOREST: CONTRIBUTION OF BELOW – GROUND RESPIRATION

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INTRODUCTION

Forest soils are responsible for storing up to 75% of forest carbon uptake (Paul *et al.*, 2002) making them extremely large carbon pools. However, soil carbon is eventually released to the atmosphere by below - ground respiration R_{bg} (soil and root respiration), which is limited by environmental variables (soil temperature and moisture), soil characteristics (chemical and physical properties) and stand characteristics (stand age).

SITE DESCRIPTION

The age structure of Mountain Ash forests (*E.regnans)* in the Central Highlands of Victoria may influence how much carbon is returned back to the atmosphere from the soil. Three Mountain Ash sites were selected of different ages, 275 (Site 1), 79 (Site 2) and 22 (Site 3) years old, which were all regrowth from bushfires. The old growth forest soil released a much greater mass of carbon to the atmosphere than the younger soils (figure 1). This was found using chamber-based measurements.

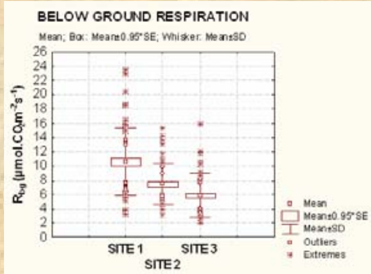


Figure 1 The average R_{bg} rate of 180 (total) measurements from January to May, 2005.

RESULTS

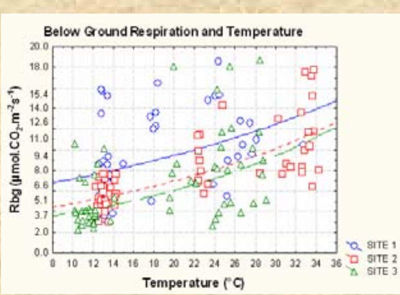


Figure 2 Mean R_{bg} with Air Temperature

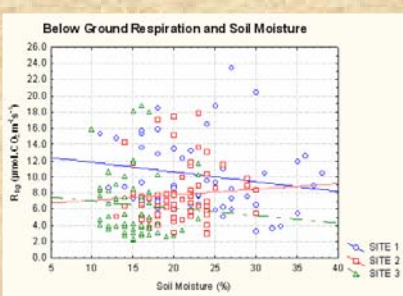


Figure 3 Mean R_{bg} with Soil Moisture

<u>TEMPERATURE</u>: R_{bg} increases exponentially with temperature (figure 2). Its sensitivity (Q_{10}) to temperature decreases with stand – age. Temperature was the main controlling factor within a site, but not necessarily between sites.

<u>MOISTURE</u>: The soils were already moist enough to support optimal rates of R_{bg} over the period of measurement and that the soil was on occasion above field capacity (Figure 3).

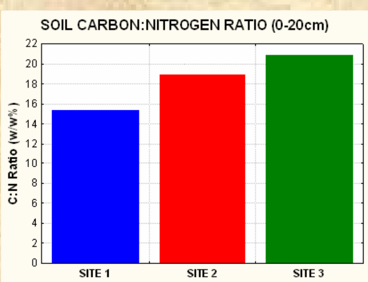


Figure 4 Soil Carbon: Nitrogen Ratio.

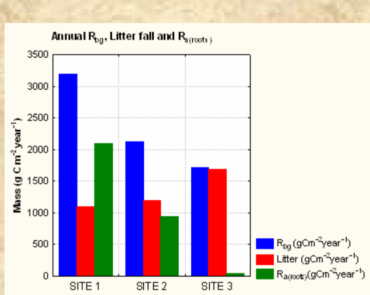
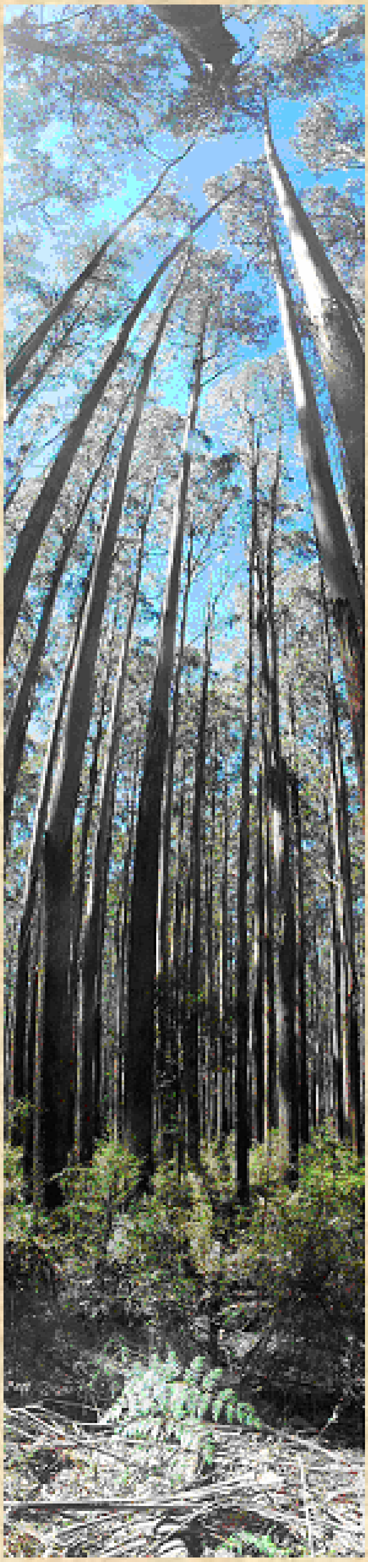


Figure 5 Annual R_{bg}, Litter fall and $R_{a(roots)}$.

<u>SOIL CHEMISTRY</u>: Lower C:N ratios generally correlate with higher rates of root turnover and respiration and faster decomposition of soil organic matter (Pendall *et al*., 2001). The lower C:N ratio in site 1, (figure 4) is likely to result in higher rates of R_{bg}.

<u>SUMMARY</u>: R_{bg} and root respiration ($R_{a(roots)}$) both increase with stand – age, and annual litter fall decreases with stand – age (Figure 5). Root biomass is also highest in site 1, where litter-fall over time is lowest due to a lower LAI.



SITE 2: *E.regnans* in Wallaby Creek.
Source: Jason Beringer, 2005

CONCLUSION

The soils of this cool temperate forest hold a vast amount of carbon, which may be released back to the atmosphere due to disturbance or below – ground respiration. This study gave an insight into the influence that environmental factors and stand age had on R_{bg}. With the old growth forest having the highest rates of R_{bg}, this Mountain Ash soil is releasing the most carbon dioxide to the atmosphere out of the three sites in Wallaby Creek and is higher than many other studied terrestrial ecosystems.

REFERENCES

Paul *et al.*. (2002) Modeling Change in Soil carbon following Afforestation or Reforestation. *AGO no. 29.* ACT 1-3

Pendall *et al*. (2001) Elevated Atmospheric CO2 Effects & Soil Water Feedbacks on Soil Respiration Components in a Colorado grassland. *Glob. Bio*. 1-12.