

EBIS Microbial Carbon rate and substrate

Ectomycorrhizal Fungi
Glomalin (AM fungi)
Microbial biomass

Margaret Torn
Kathleen Treseder
Jessica Westbrook
Tara Macomber
Julia Gaudinski
Dev Joslin

LBL, U Penn, UCSC, BFR

Ectomycorrhizal fungi

Definition, Source

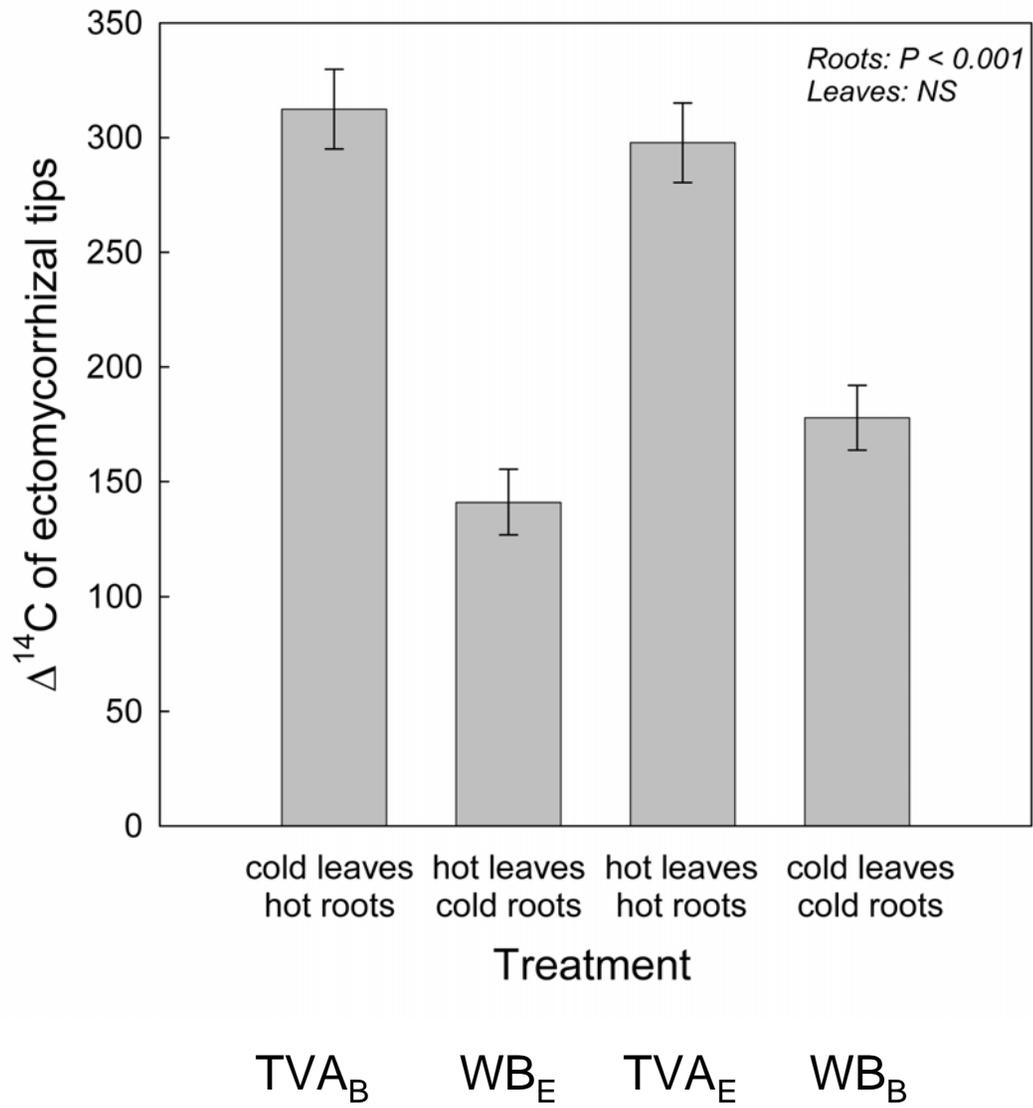
- Culled from root tips.
- At ORR, Ecto's are found on oak trees.

Sampling

- Sites Walker Branch and TVA
- Depths O horizon and 0-5 cm of A horizon
- Date Sept 10, 2001.
- Composites 3 sub samples per plot were composited

Lab Analysis

- Hand picked from root tips by Kathleen



Glomalin

Definition, Source

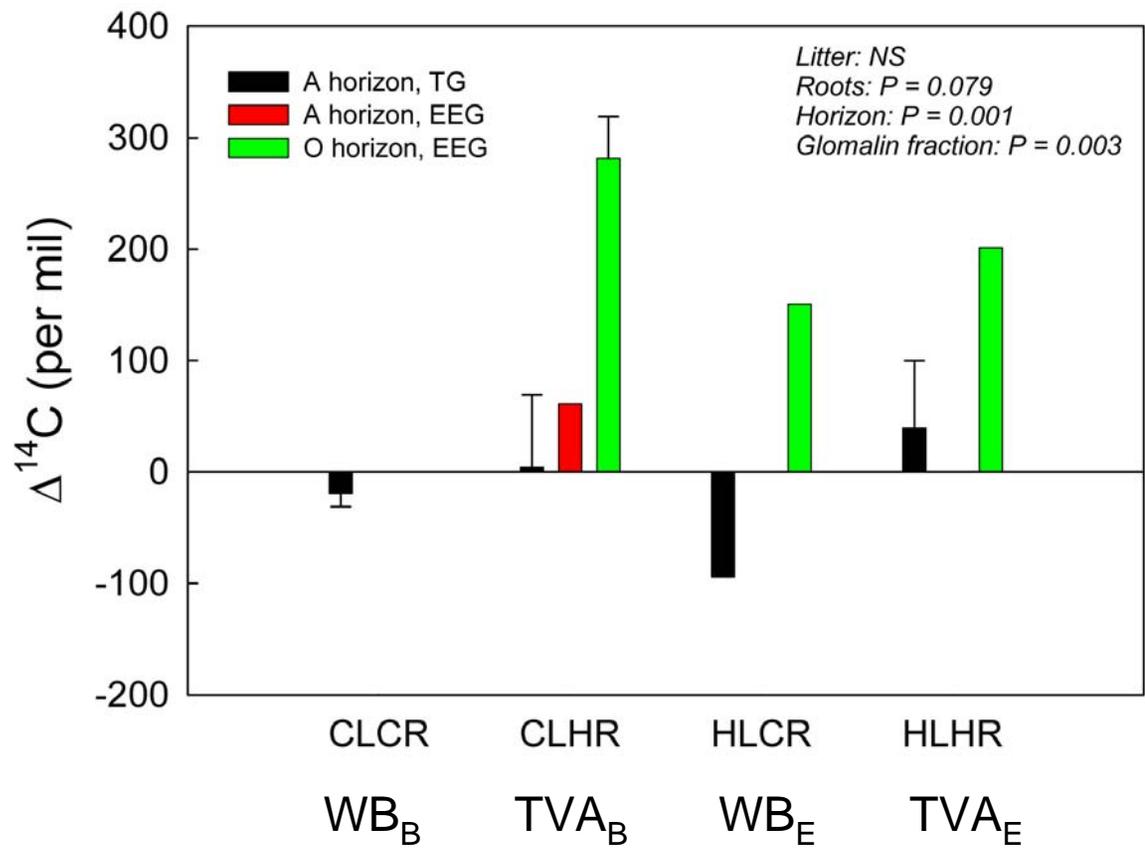
- Glomalin is a protein made by Arbuscular Mycorrhizal fungi. Endomycorrhizal.
- At ORR, AM fungi colonize grasses and herbaceous understory.

Sampling (same as ecto's)

- Sites Walker Branch and TVA
- Depths O horizon and 0-5 cm of A horizon
- Date Sept 10, 2001.
- Composites 3 sub samples per plot were composited

Lab Analysis

- Extracted with sodium citrate (Wright and Updayaya 1998).
 - EEG = Easily Extractable Glomalin. Most recently deposited. First round of extraction.
 - TG = Total Extractable Glomalin. Sum of all subsequent extractions.
- Residual carbon in reagents is removed by osmosis.
Test: In soils from Chile, the ^{13}C of SOM and glomalin were in same range (-24.3– -28.9‰) whereas reagent ^{13}C was -17‰.



Extractable and Microbial Carbon

Definition, Principal of measurement

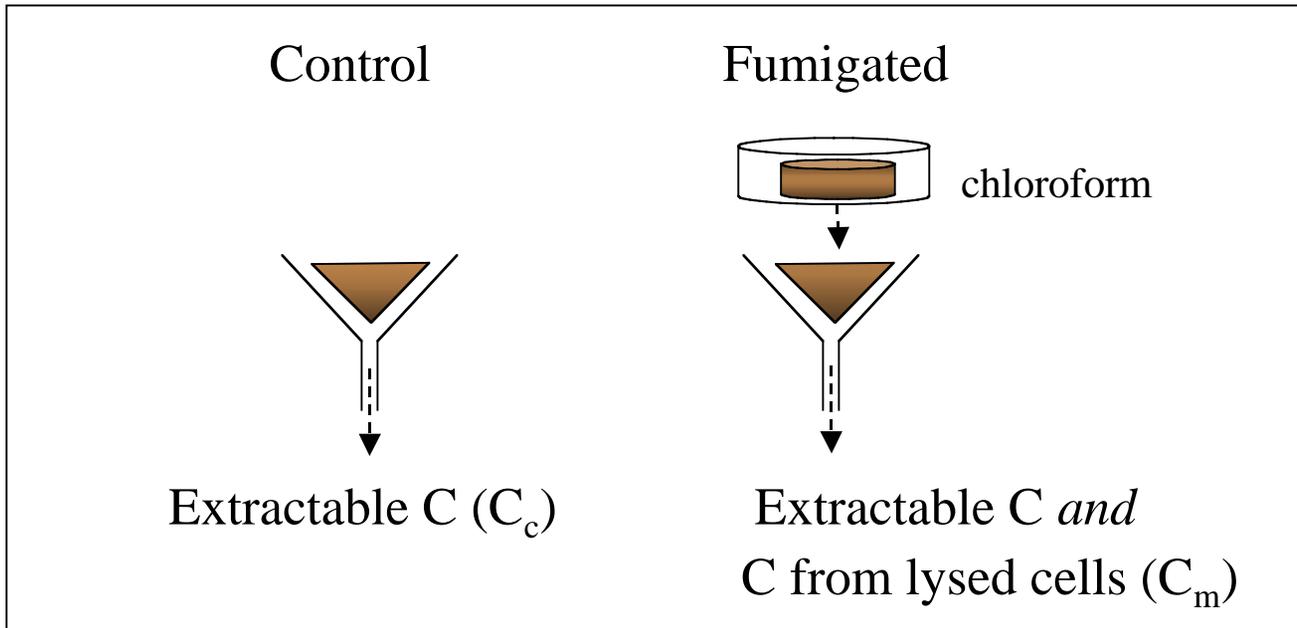
- Bulk microbial biomass, bacteria and fungi. Active and dormant.
- Assumes chloroform makes microbial C soluble without affecting solubility of other C.

Sampling

- Sites Walker Branch and TVA
- Depths 0-5 cm, 5-15 cm
- Date July 2002
- Composites 3 sub samples per plot

Lab Analysis

- Control Extracted with 0.5 M K_2SO_4
Salt extractable carbon
- Fumigated Fumigated in chloroform and extracted with 0.5 M K_2SO_4
Cells lysed by chloroform and salt-extractable carbon.
- Total carbon total organic carbon analyzer
- Isotopes freeze-dried, combustion double-tubed with extra copper and silver



$$\text{Microbial C} = C_F - C_c$$

$$C_F \Delta_F = C_m \Delta_m + C_c \Delta_c$$

$$\Delta_F = m \Delta_m + (1 - m) \Delta_c$$

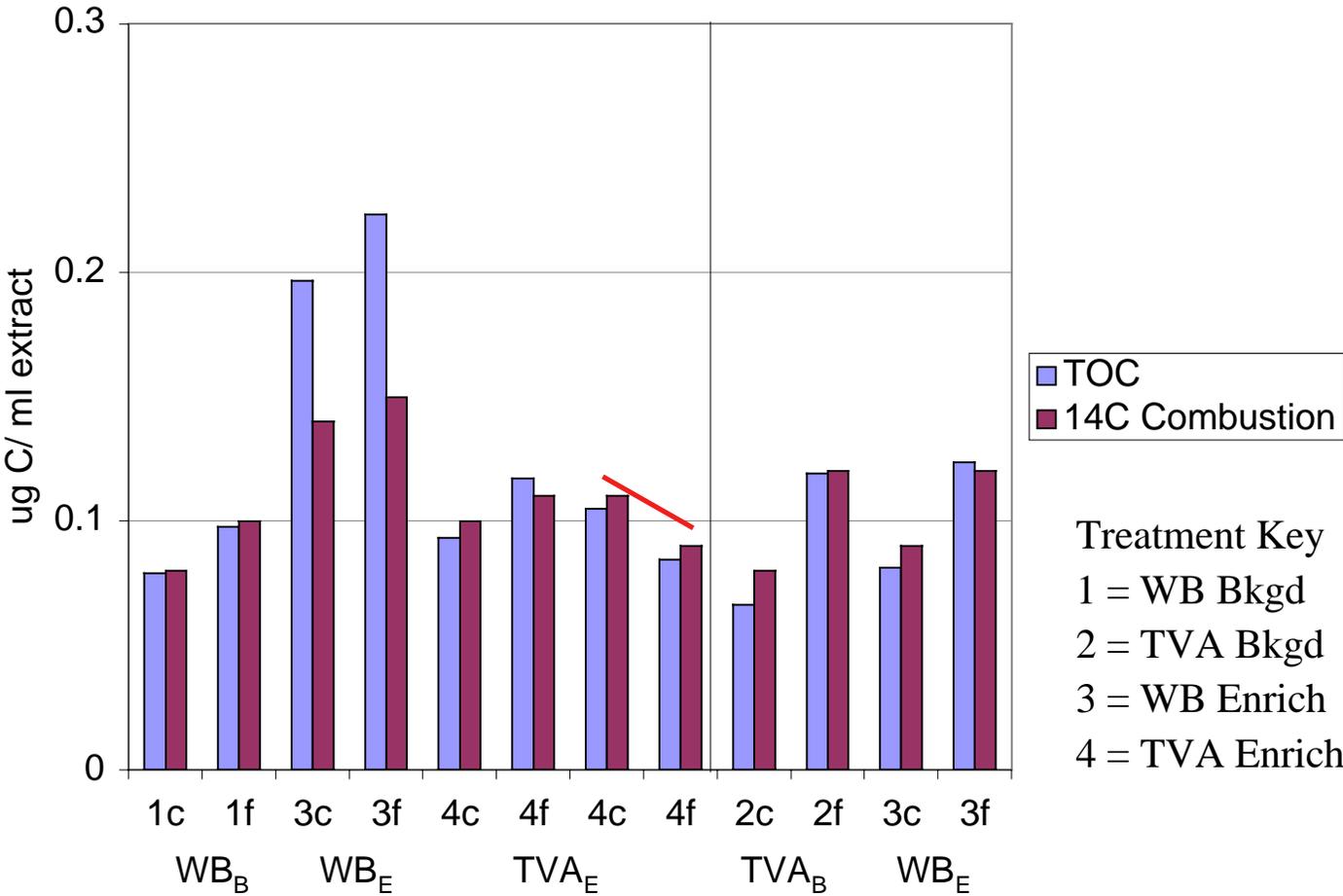
$$\Delta_m = \frac{C_F \Delta_F - C_c \Delta_c}{C_F - C_c}$$

$$\Delta_F = \frac{C_m \Delta_m + C_c \Delta_c}{C_m + C_c}$$

C density estimated by TOC and 14C combustion

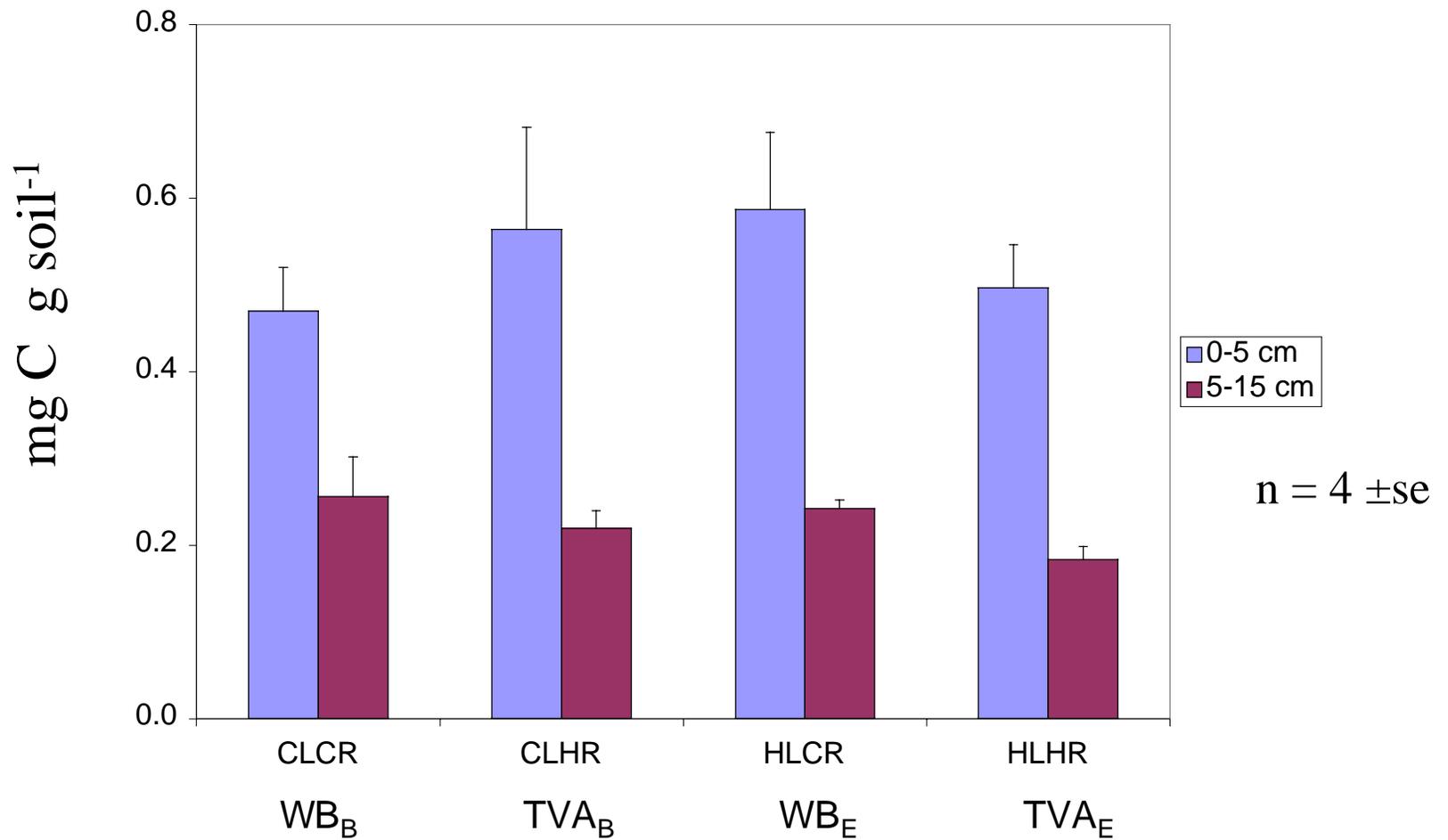
- Complete combustion
- Fumigated > Control in most cases

(7 rejects out of 32 pairs)



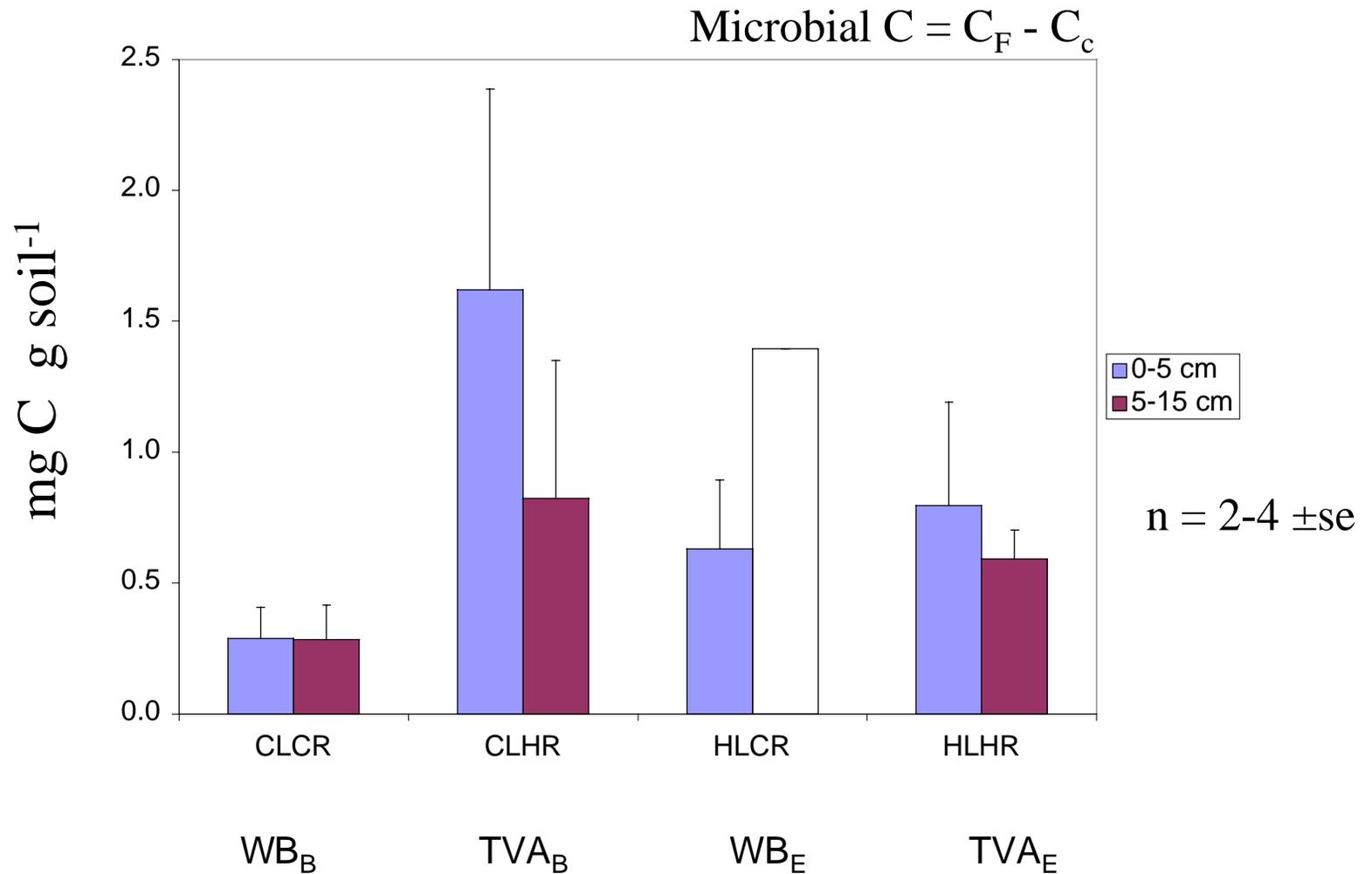
Extractable C

no site differences
surface > 5-15 cm



Microbial C

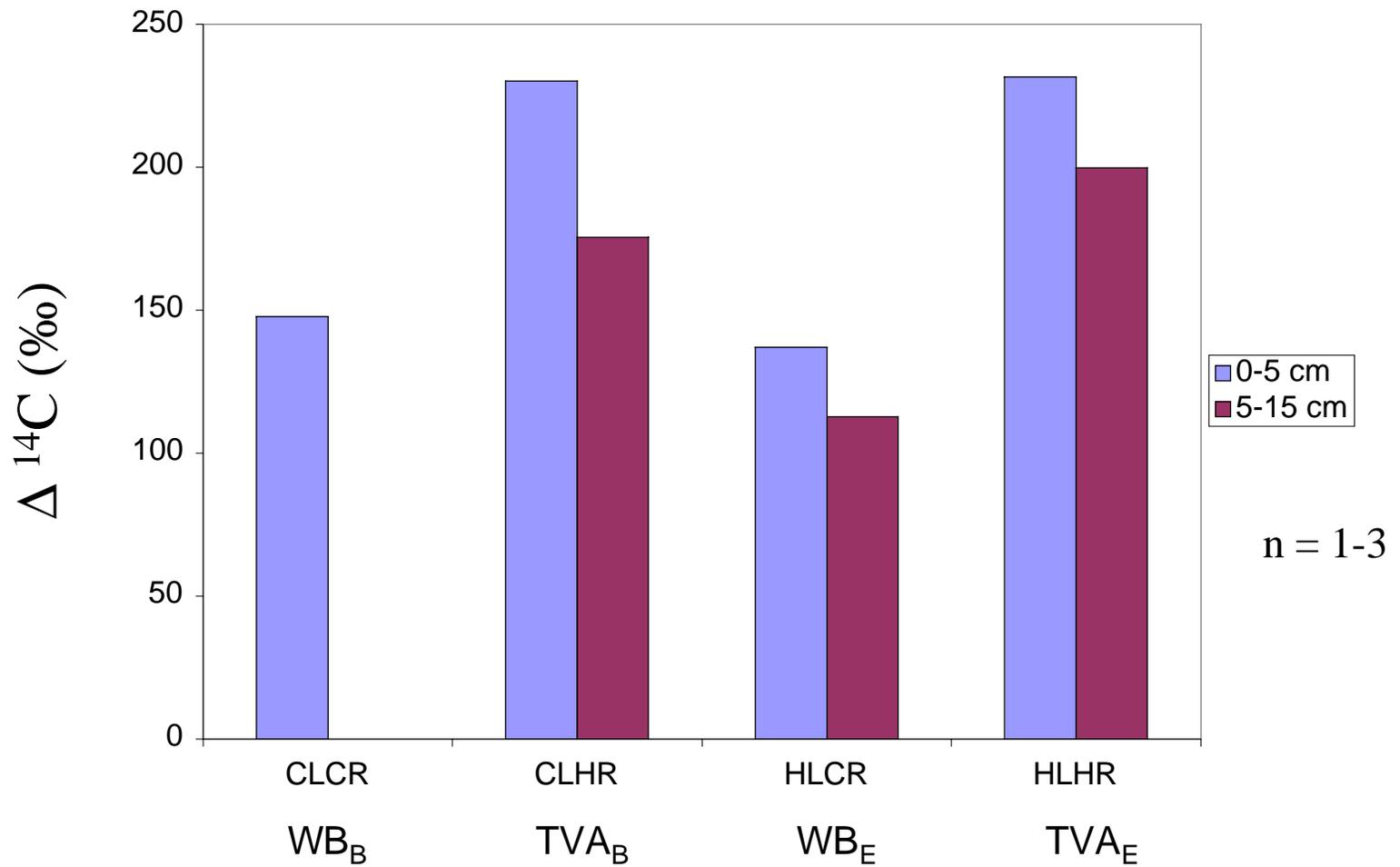
TVA > WB but variability high



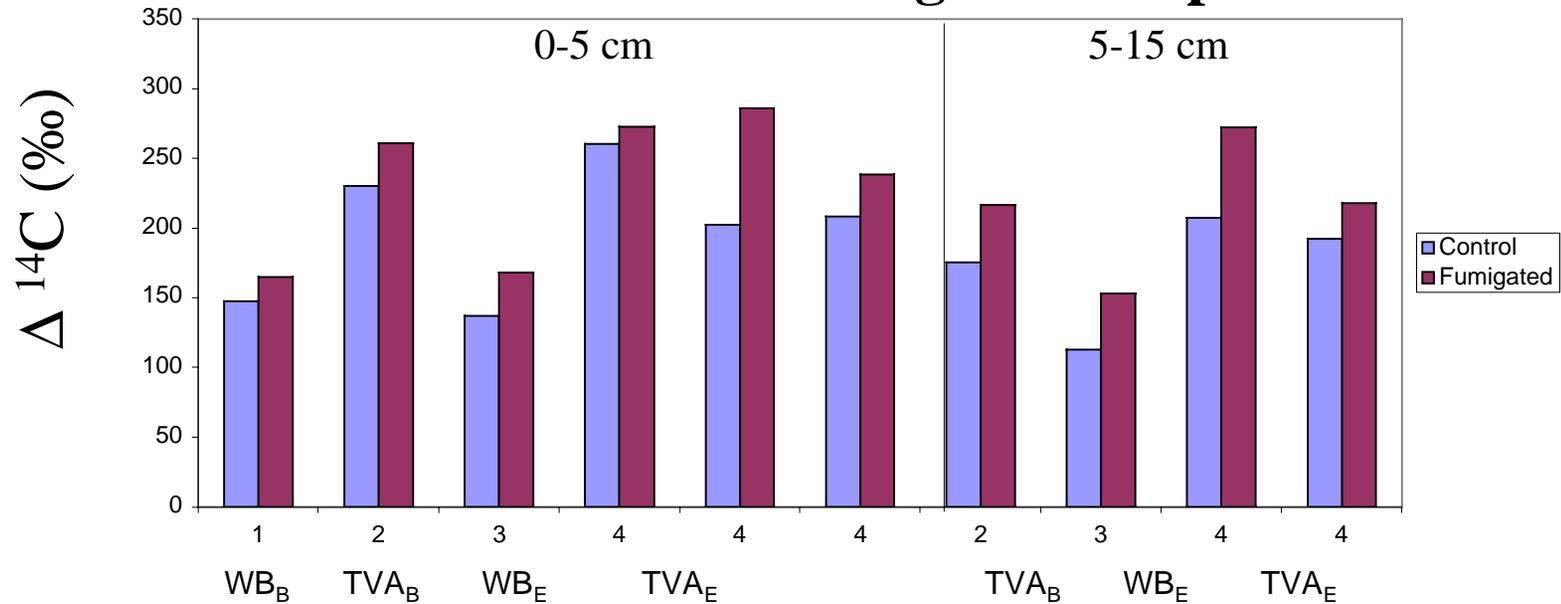
Extractable ^{14}C

TVA > WB

Surface > 5 - 15 cm



^{14}C of control and fumigated soil pairs

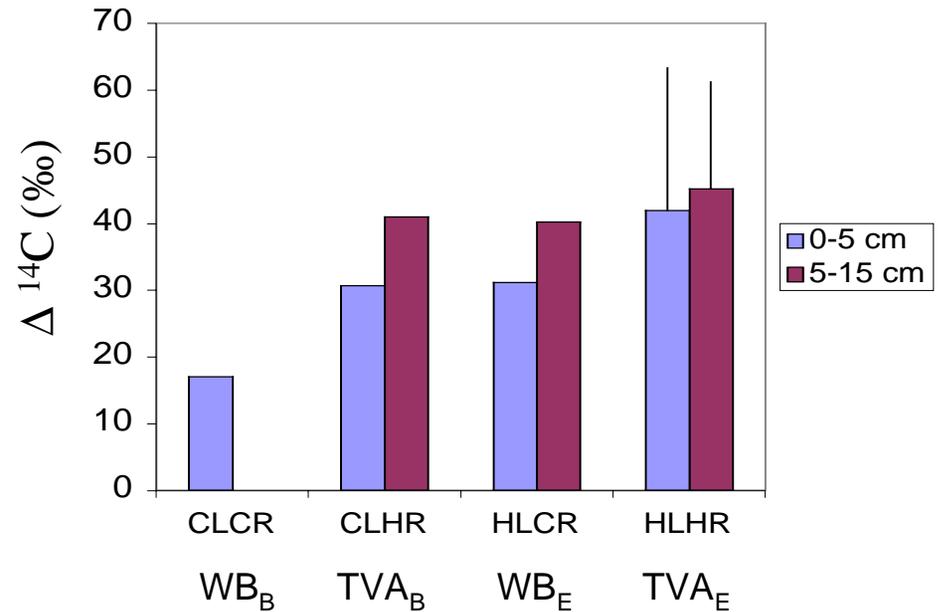


^{14}C Higher in Fumigated

^{14}C Higher at TVA

^{14}C Difference ~ 12 to 40 ‰

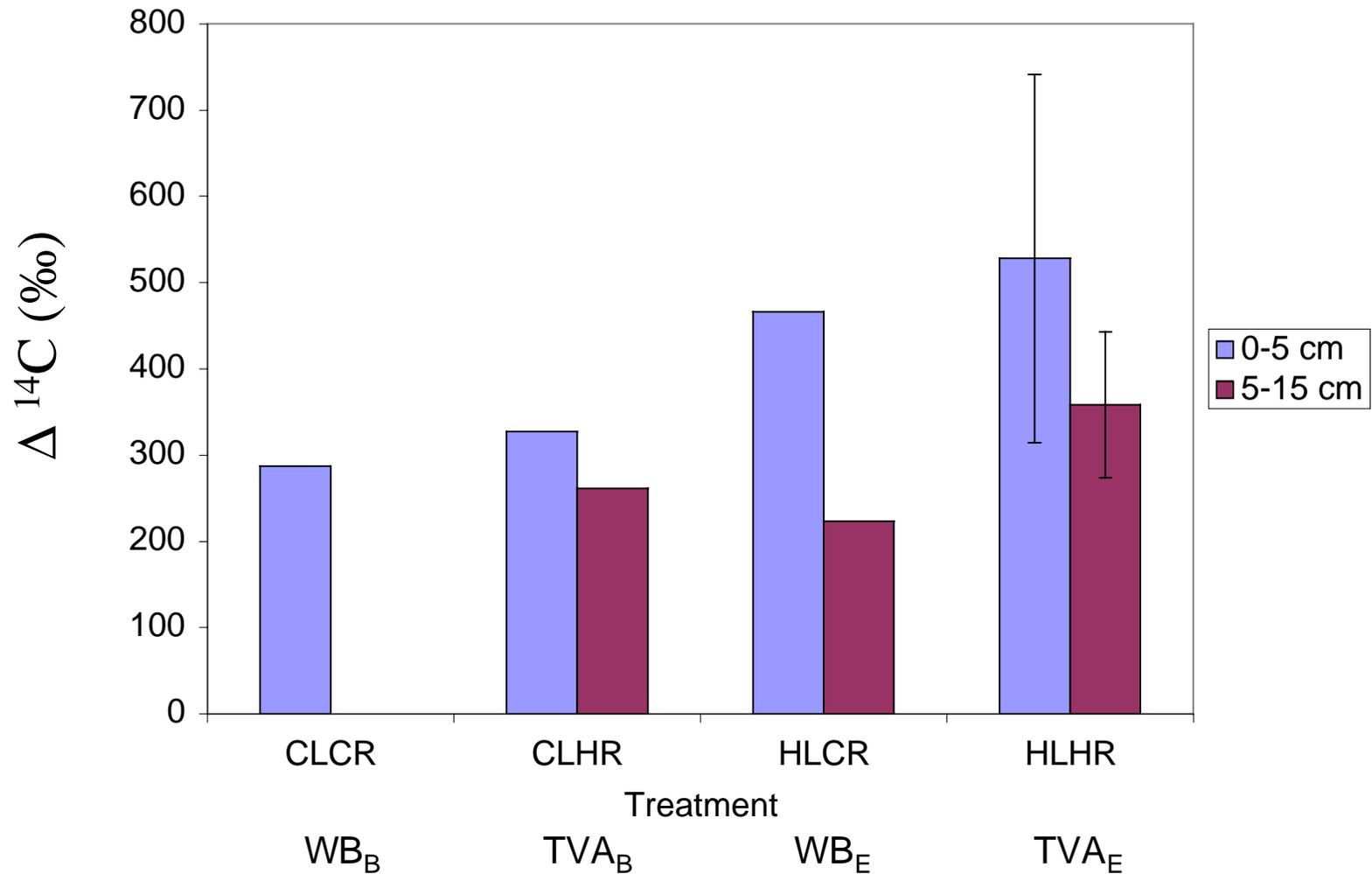
Difference higher 5-15 cm



Microbial Biomass ^{14}C

- Surface is more enriched
- Litter substrate more impt

$$\Delta_m = \frac{C_F \Delta_F - C_c \Delta_c}{C_F - C_c}$$



Conclusions

- Ectomycorrhizal fungi contain mainly root carbon (not SOM or litter)
- Glomalin is mainly derived from root inputs. More ^{14}C enrichment in O horizon.
- Microbial biomass ^{14}C
 - method works ‘ok’ (problems with variability and negative differences)
 - Enriched by litter but not roots
 - Enriched 0-5 cm but not 5-15 cm.