Bulk Soil Carbon Pools: Concentrations and Stocks By Site

Chuck Garten and Paul Hanson

EBIS 1-Year Project Meeting

27-28 Jan. 2003

Irvine, CA

ANALYSIS & QUALITY CONTROL

- **Instrument: LECO CN-2000**
- **Every soil sample was analyzed twice**
- **LECO calibration samples are traceable to NIST reference materials**
- **LECO reference soil:**

  3.60 ±0.096% C and 0.290 ±0.022% N

  2.61 ±0.060% C and 0.209 ±0.018% N
- **LECO reference EDTA:**

  40.98 ±0.12% C and 9.56 ±0.03% N
- **Sample to standard ratio was 10:1**
- **Soil standards: for C and N**

  measured/expected = 0.998 (n = 24)

APPROACH

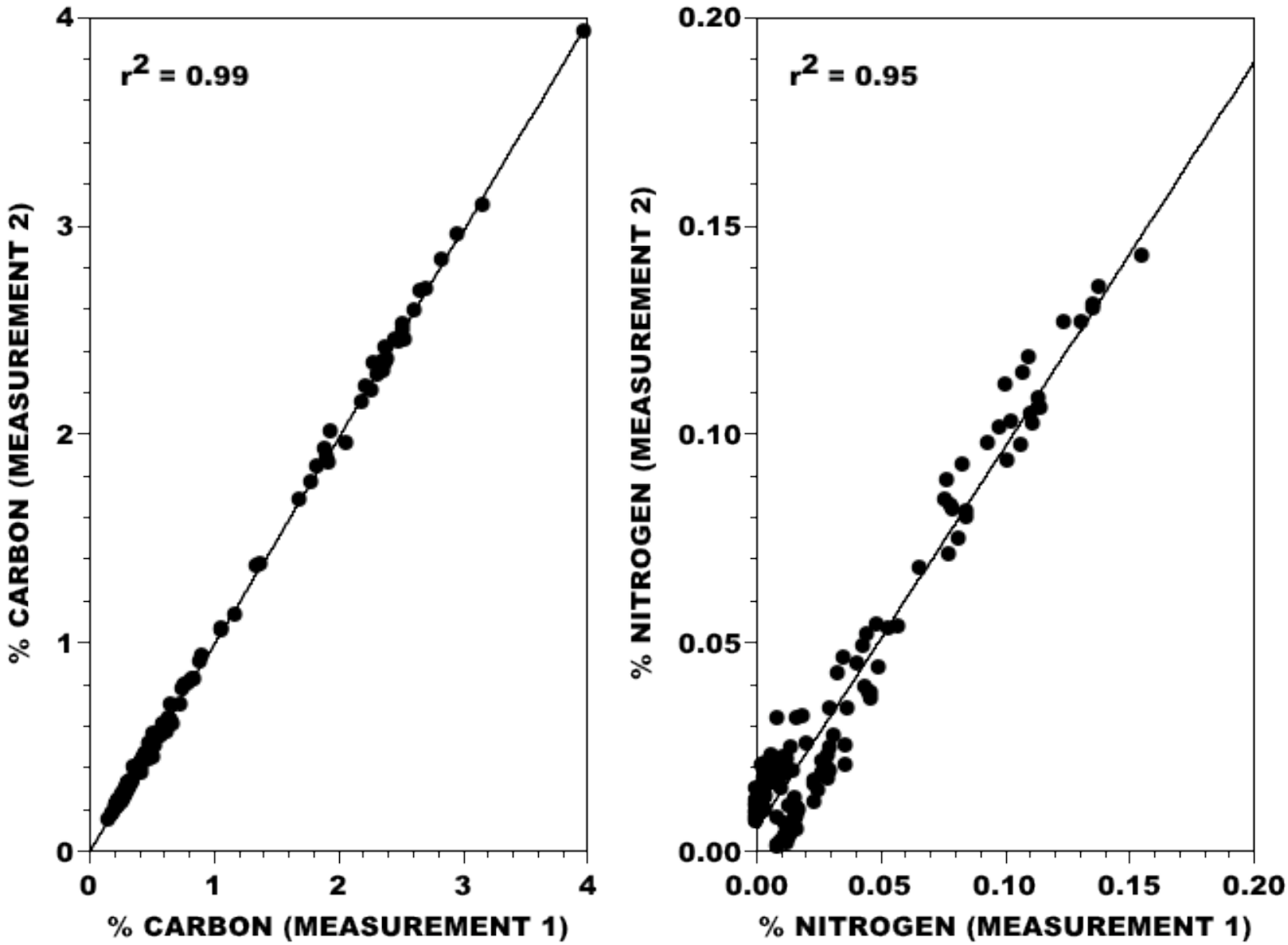
Measurements:

- **Reference density (g soil/cm^3)**
- **Concentration (%/100 = g element/g soil)**

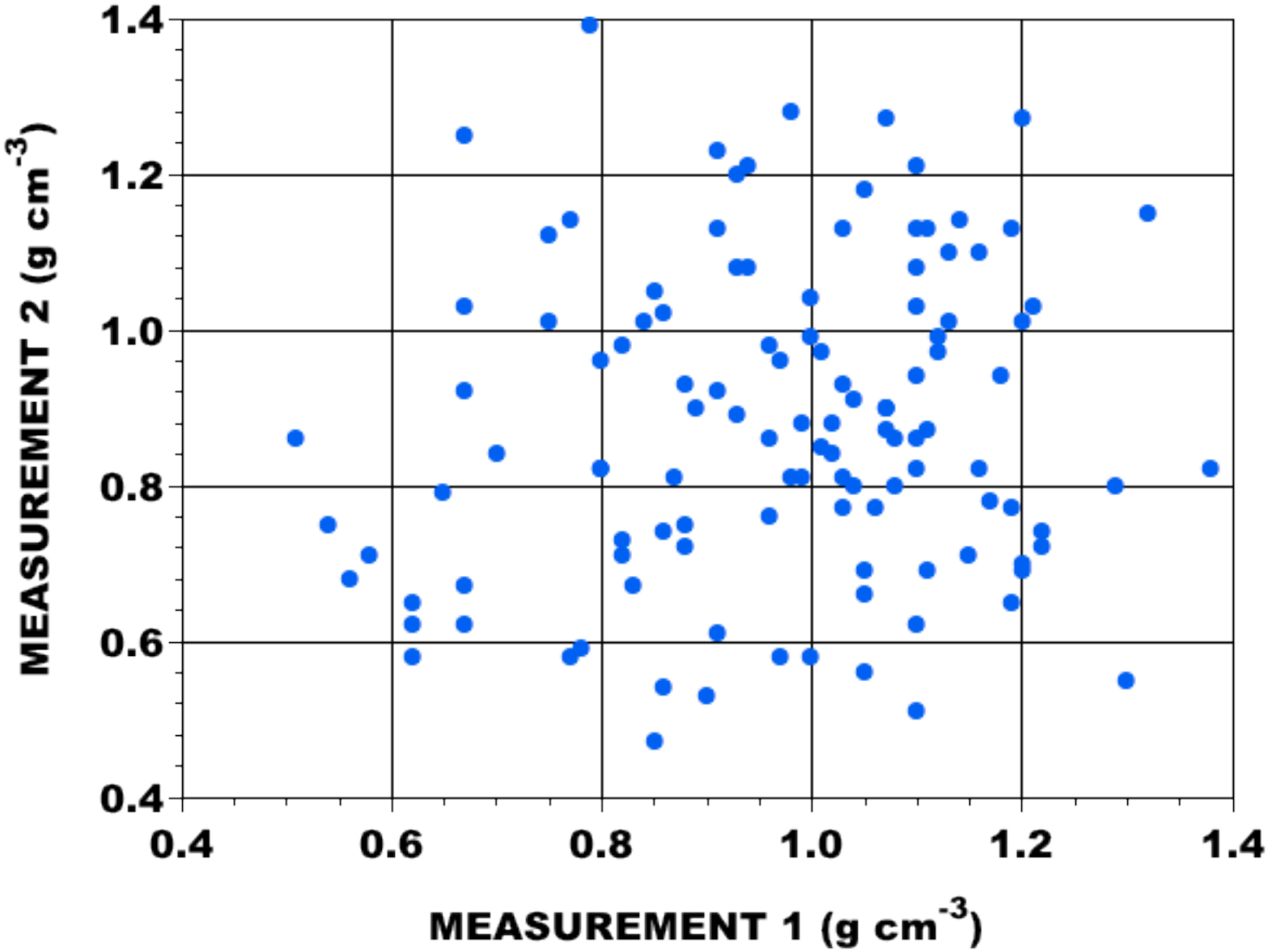
Calculation of soil C or N stock:

- **Reference density (g soil/cm^3) • soil depth (cm) • concentration (g element/g soil) • 10000 (cm^2/m^2) = g element/m^2**
- **Stocks were calculated for every sample**

REPLICATE RUNS FOR C AND N



REPEATABILITY OF REFERENCE DENSITY



WITHIN SITE VARIATION IS FARILY LOW (SMALL C.V.s)

	COEFFICIENT OF VARIATION				
Variable	Depth	PR	HR	TVA	WB
g Soil cm-3	00-15	9.8	10.8	8.2	4.4
	15-30	11.1	7.7	9.0	14.7
	30-60	14.5	9.3	12.2	18.4
	60-90	15.3	12.8	17.3	16.8
[C] %	00-15	21.2	32.8	8.1	25.0
	15-30	29.4	20.1	18.3	24.5
	30-60	32.8	26.6	18.1	25.1
	60-90	32.1	5.9	14.8	17.6
g C m-2	00-15	15.3	23.4	7.4	23.5
	15-30	31.3	16.	22.0	21.0
	30-60	41.8	19.2	23.4	30.5
	60-90	30.4	12.9	15.9	26.0

STATISTICAL ANALYSIS

ANOVA (two-way):

- **Site, litter addition (ambient vs. enriched), and site x litter interaction**
- **Used LSD to compare site means**

Mineral soil and forest floor samples:

- **Reference density (soil increments)**
- **Litter mass for Oi > 1 yr and (Oe/Oa)**
- **Concentrations of C and N**
- **C:N ratio**
- **C and N stocks**

RESULTS

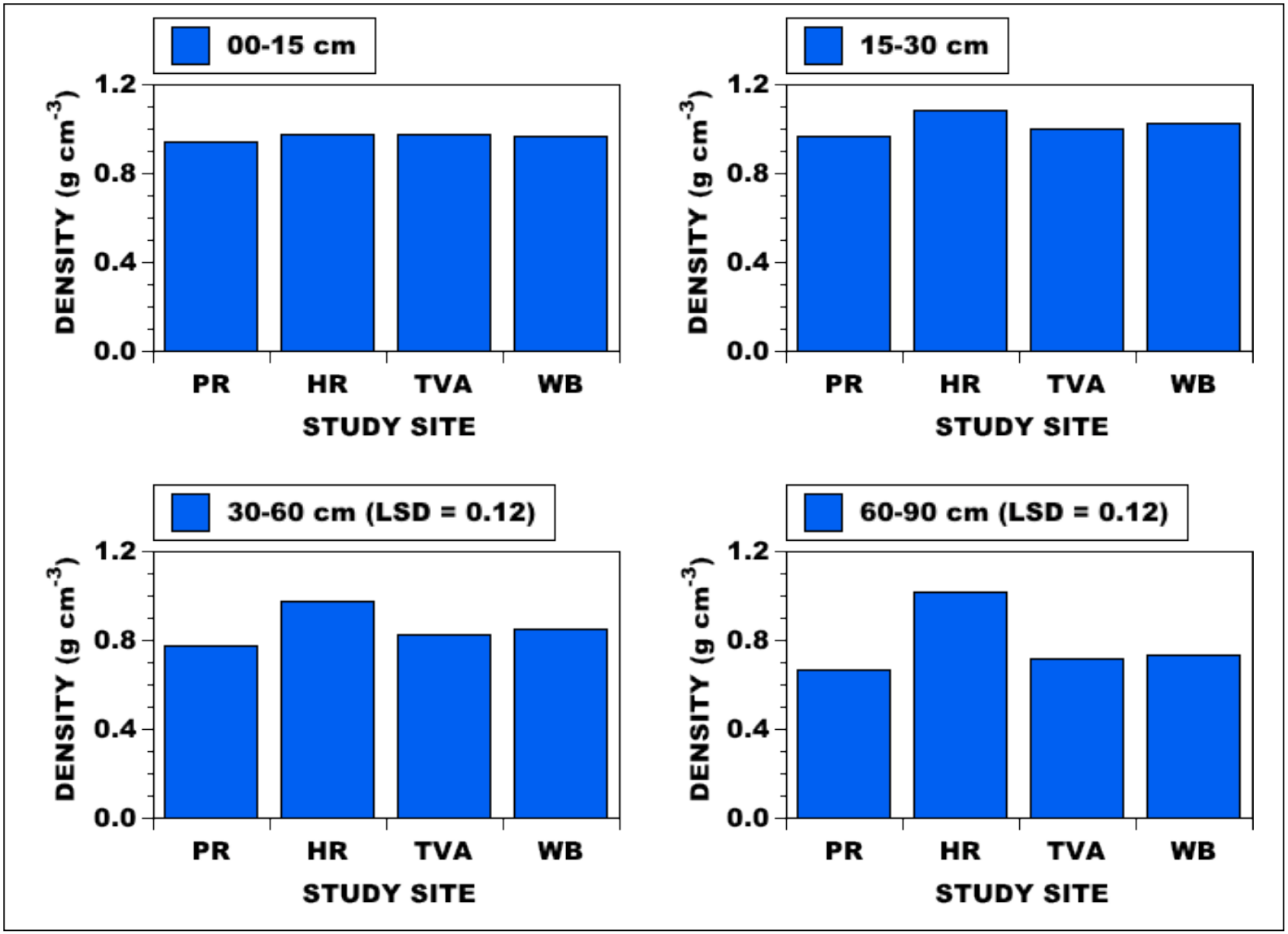
In mineral soil increments:

- **Statistically significant site differences**
- **Effects of litter addition and interaction were not statistically significant**

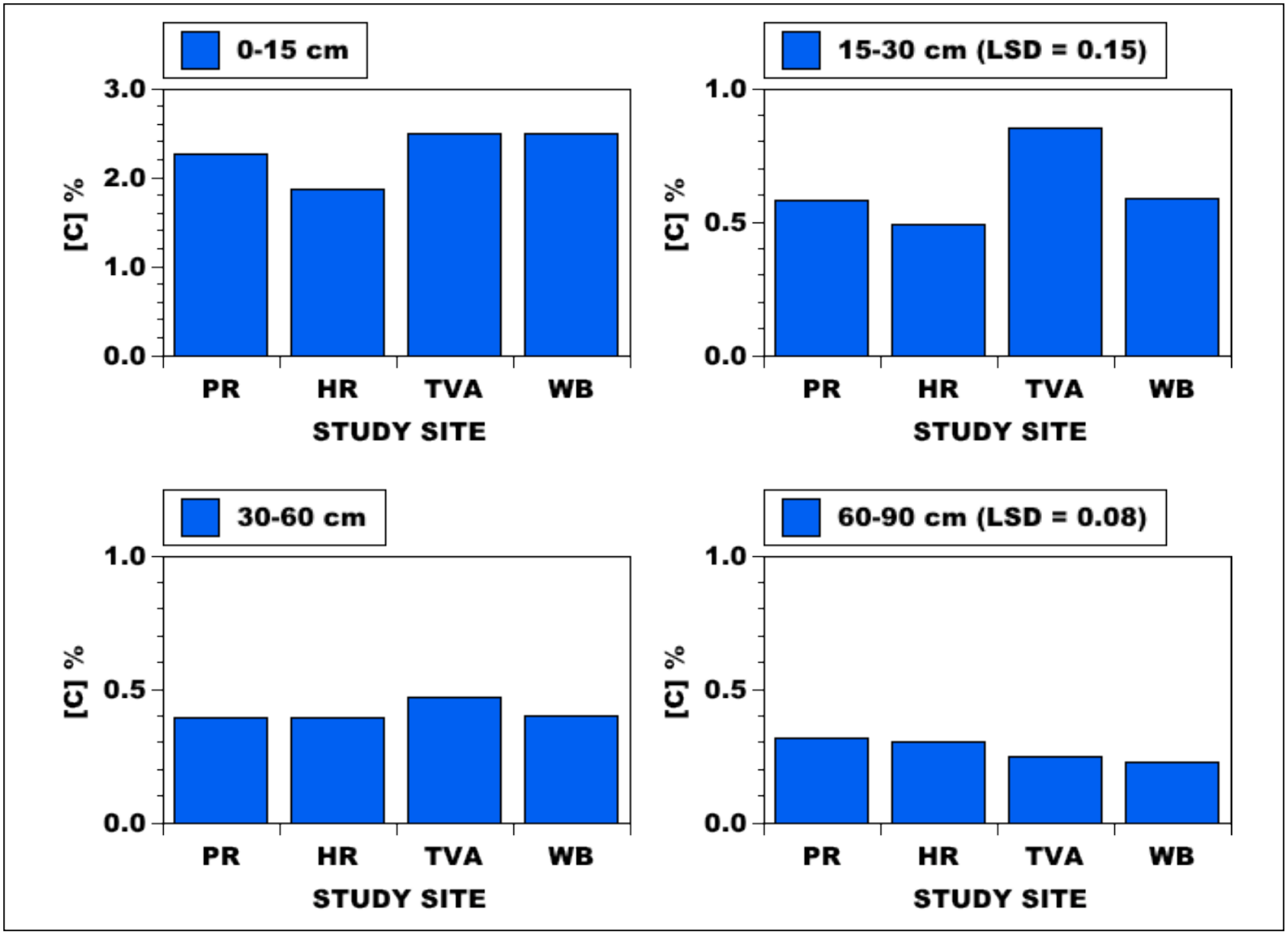
In forest floor horizons:

- **Some site differences**
- **With few exceptions, effects of litter addition and interaction were not statistically significant**
- **With few exceptions, differences between years (2000 vs. 2001) were not significant**

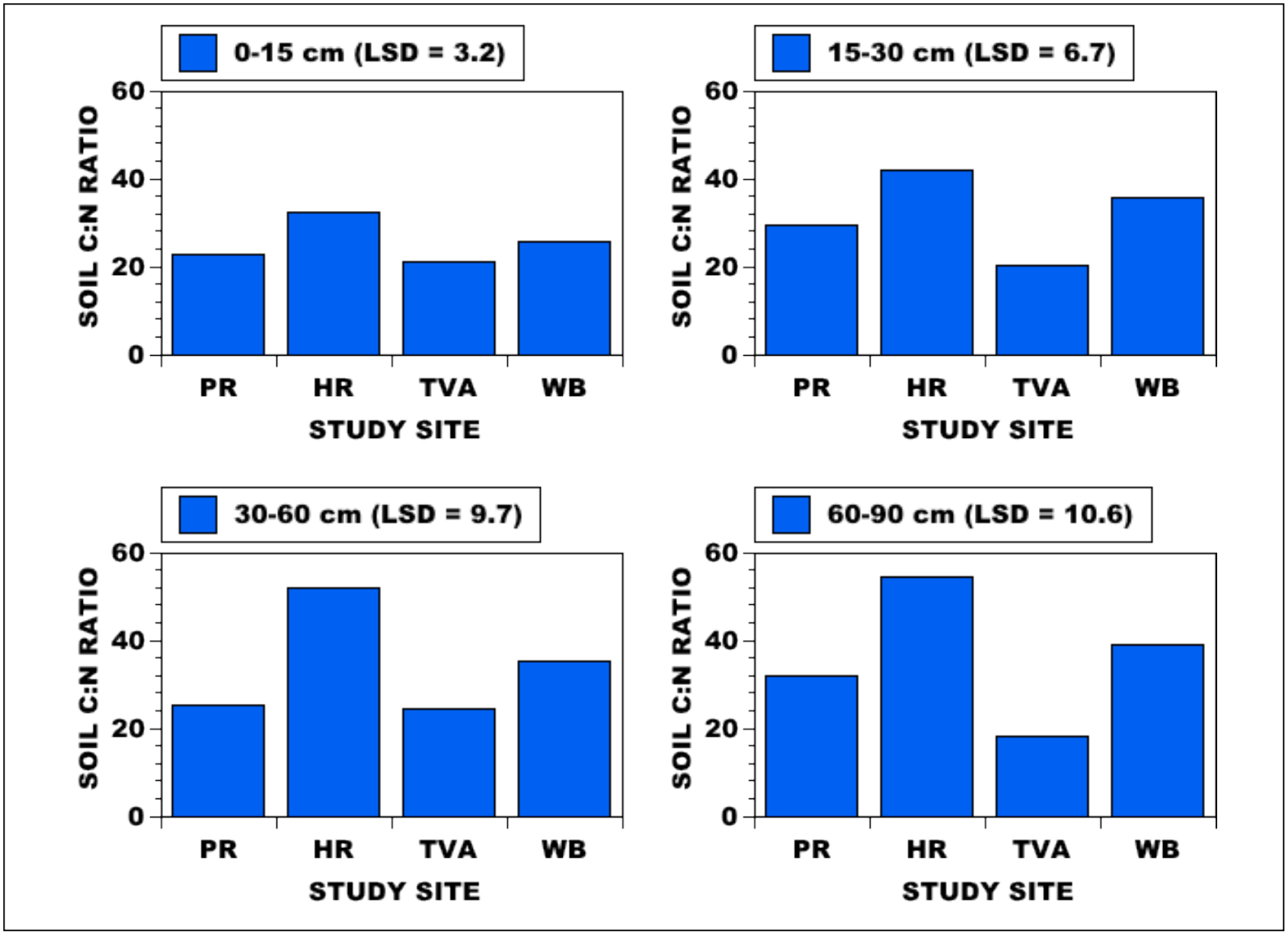
SITE DIFFERENCES (REF. DENSITY)



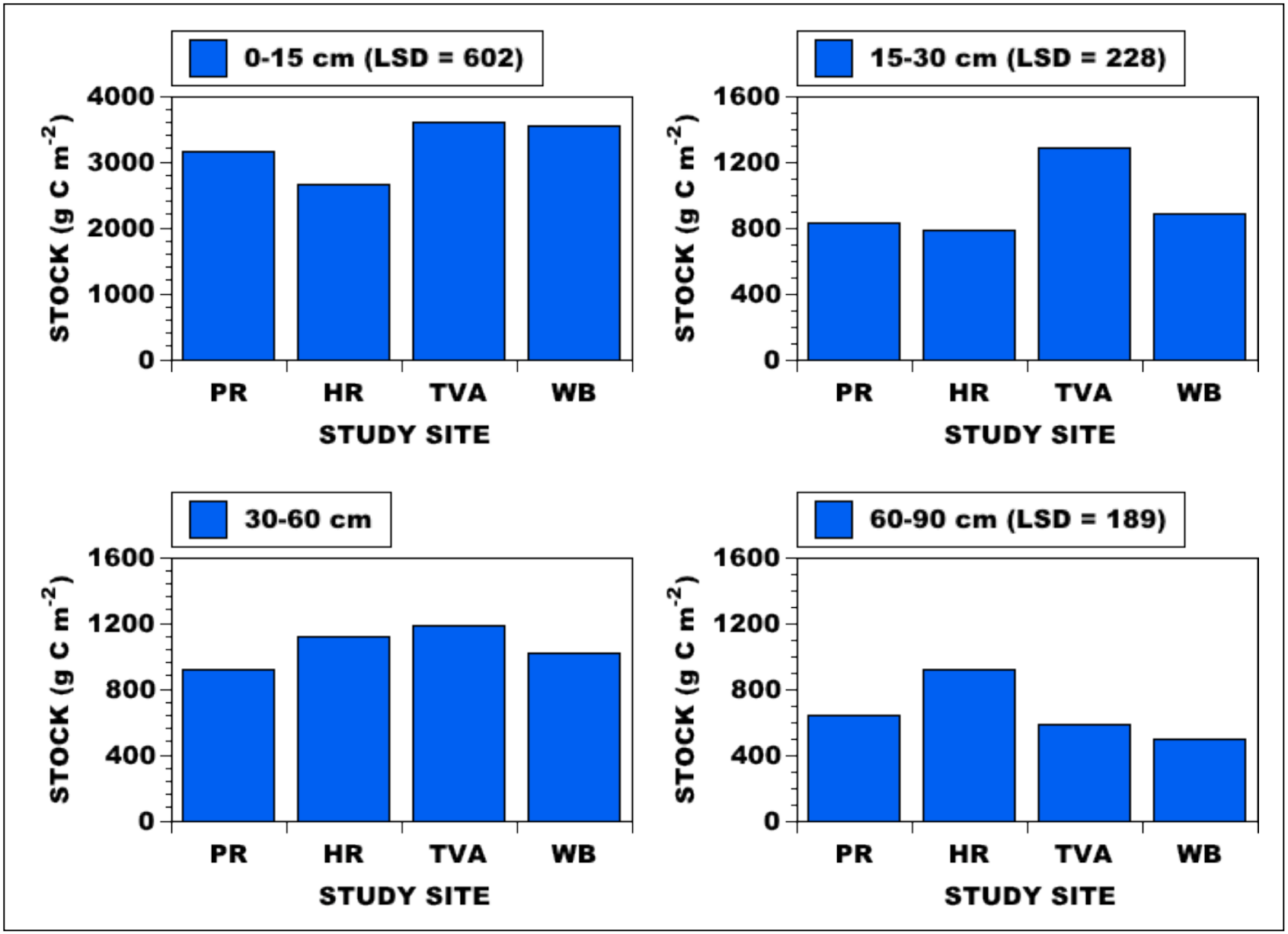
SITE DIFFERENCES (SOIL C CONCN.)



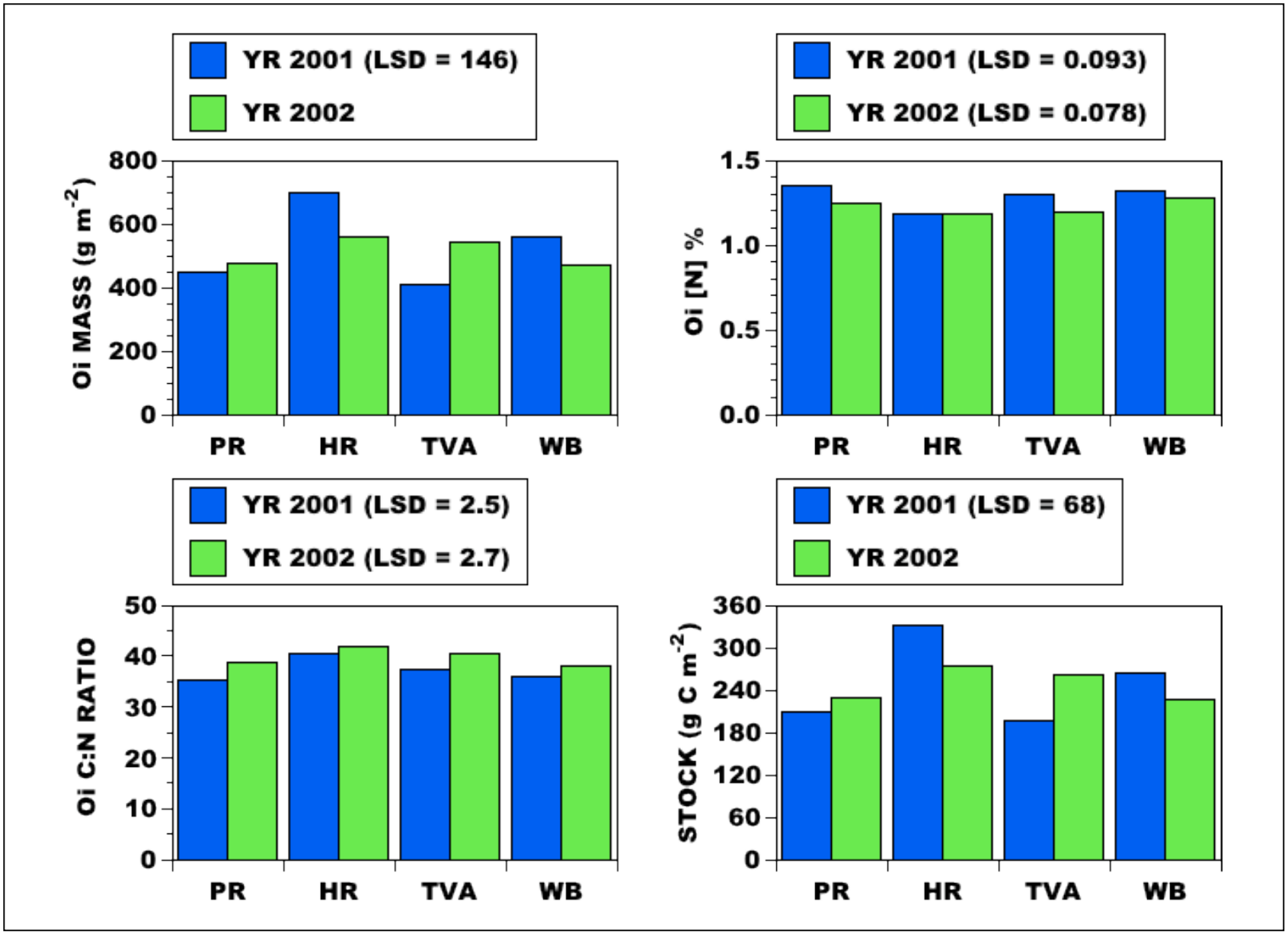
SITE DIFFERENCES (C:N RATIO)



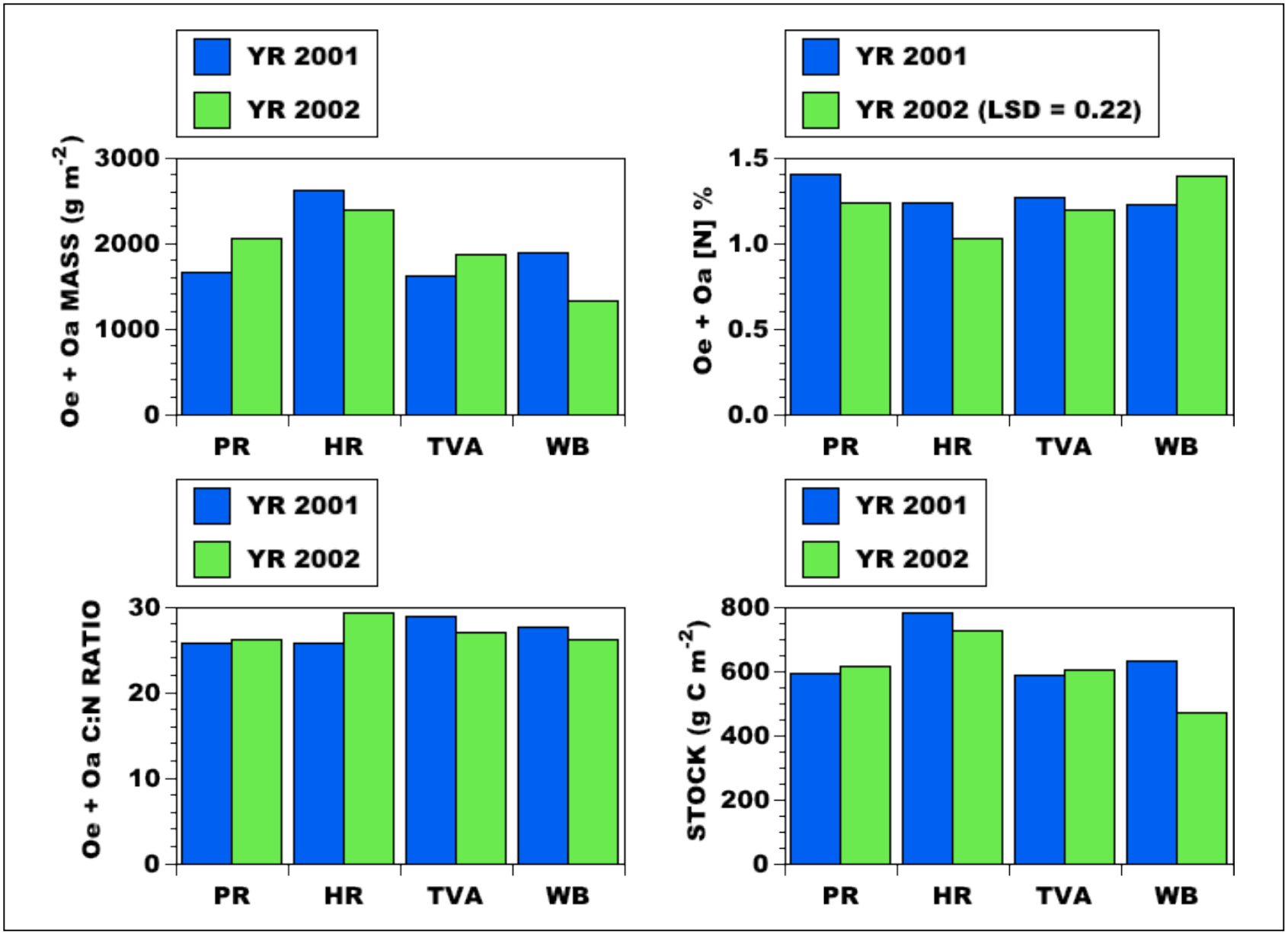
SITE DIFFERENCES (C STOCKS)



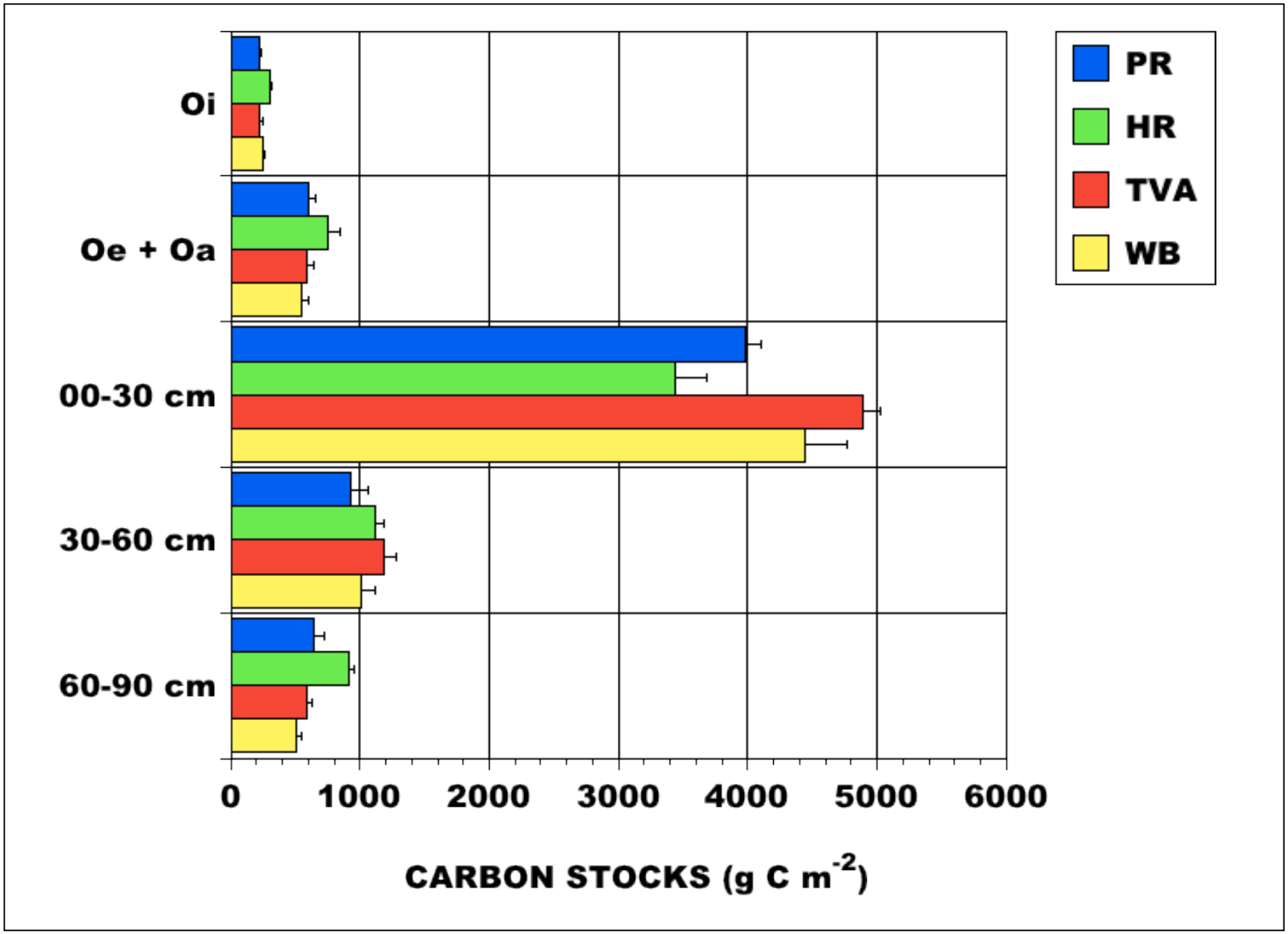
SITE DIFFERENCES (Oi>1 yr)



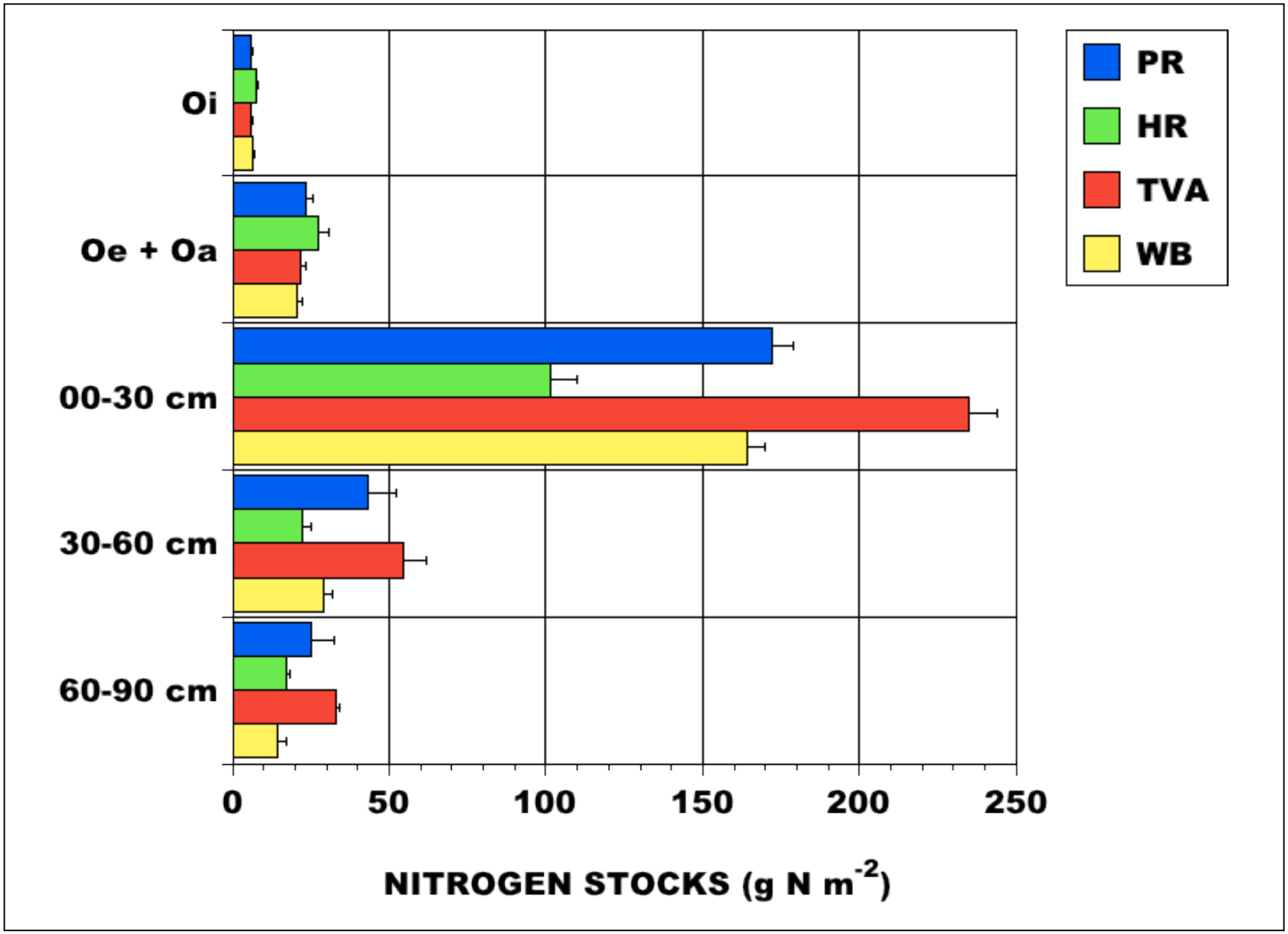
SITE DIFFERENCES (Oe/Oa Horizon)



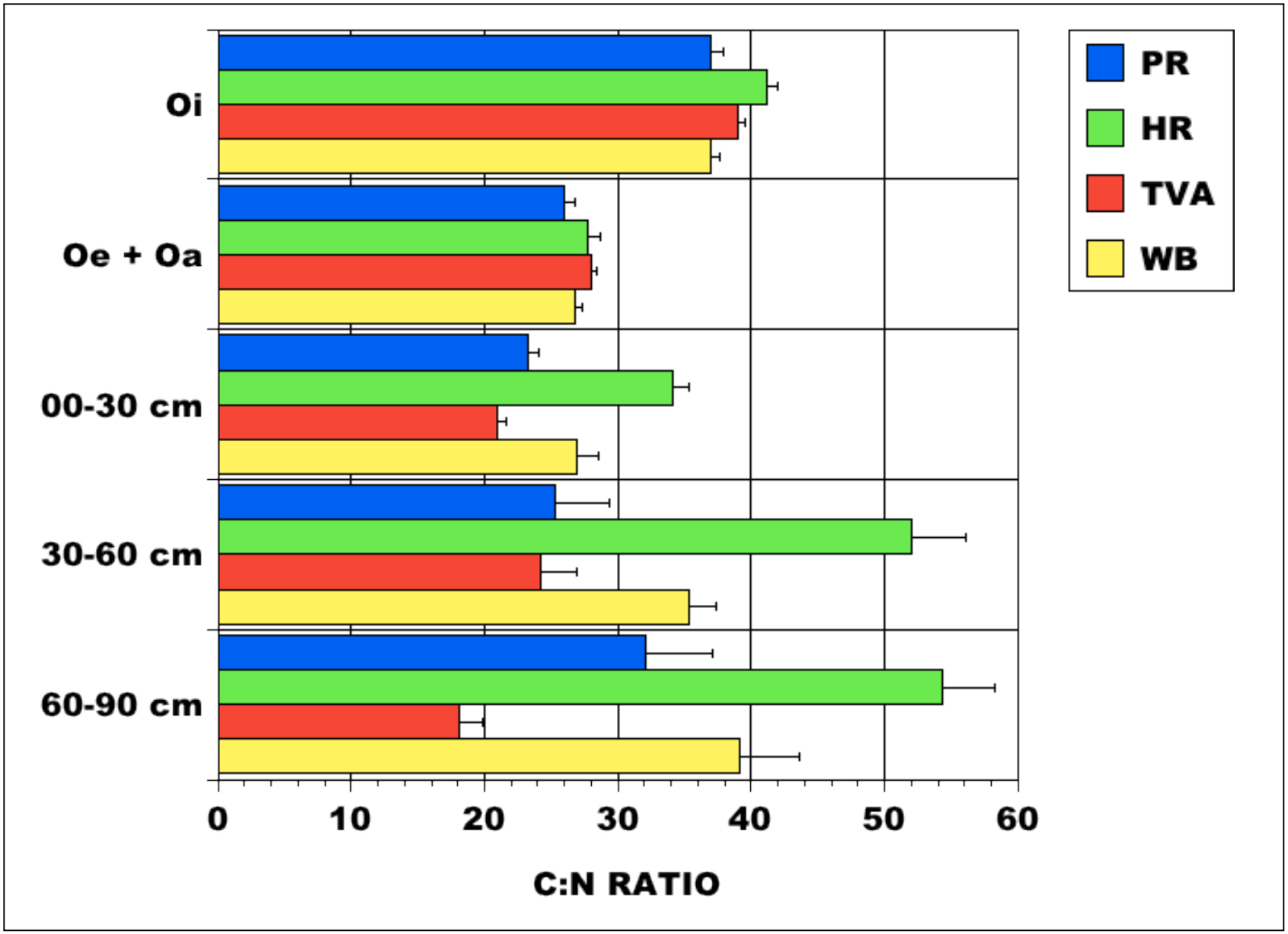
SITE DIFFERENCES (C STOCKS)



SITE DIFFERENCES (N STOCKS)



SITE DIFFERENCES (C:N RATIO)



MULTIPLE REGRESSION

VARIABLE	COEFFICIENT
(Y) Soil C stock (g m^{-2})	
(a) Intercept	-75.45
(X1) Soil [C] %	1244.1***
(X2) Density (g cm^{-3})	480.7***

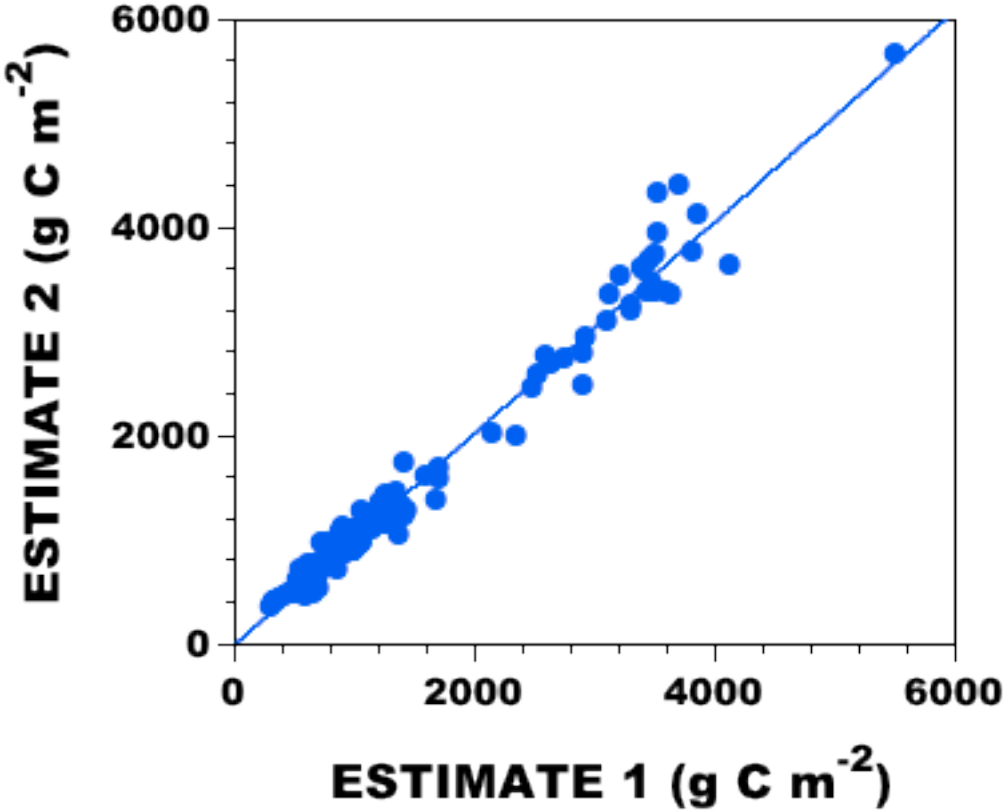
$Y = -75.45 + 1244\ (X1) + 481\ (X2)$

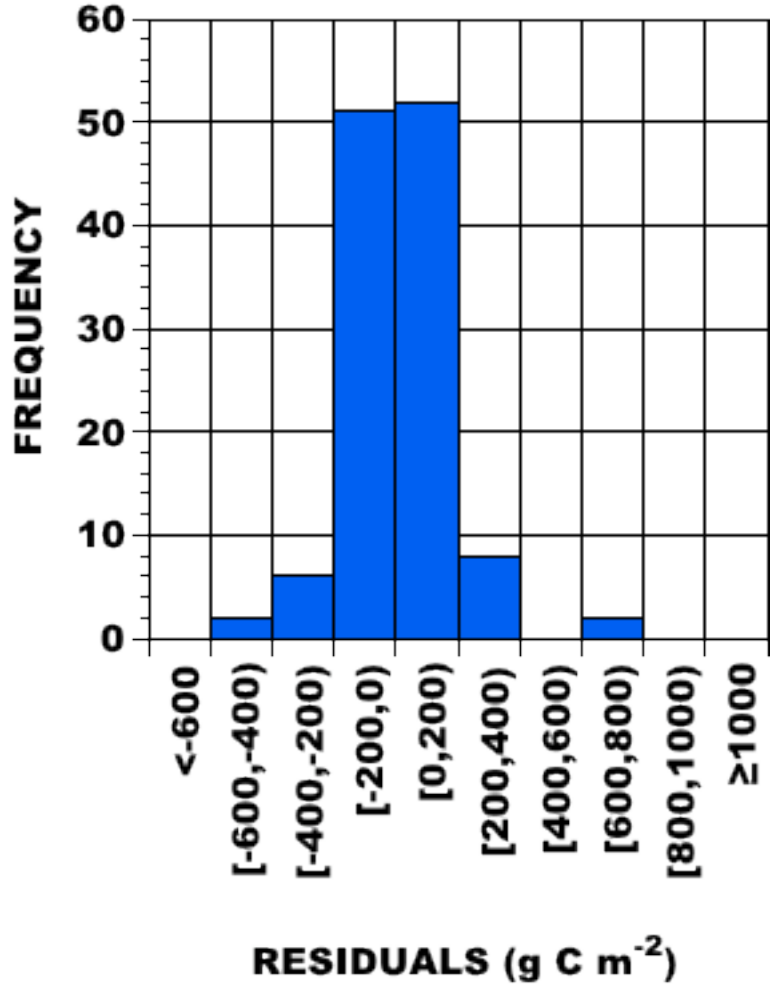
$F = 1448$***

$r^2 = 0.96$

Variation in soil C concentrations account for most of the variation in soil C stocks

COMPARISON OF ESTIMATED STOCKS





Estimate 1: uses reference density data for each soil core
Estimate 2: uses mean density (site x soil increment)

Difference between estimates is usually less than ± 200 g C m^{-2}