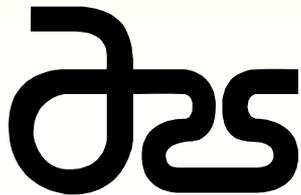


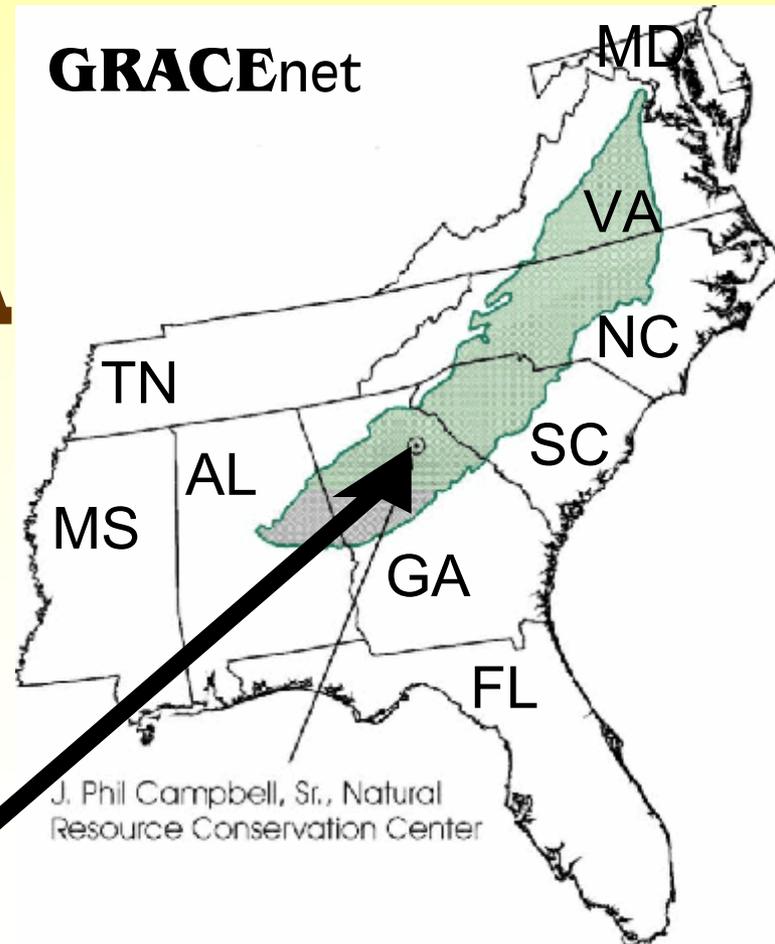
Soil Organic Carbon Sequestration with Conservation Agricultural Systems in the Southeastern USA



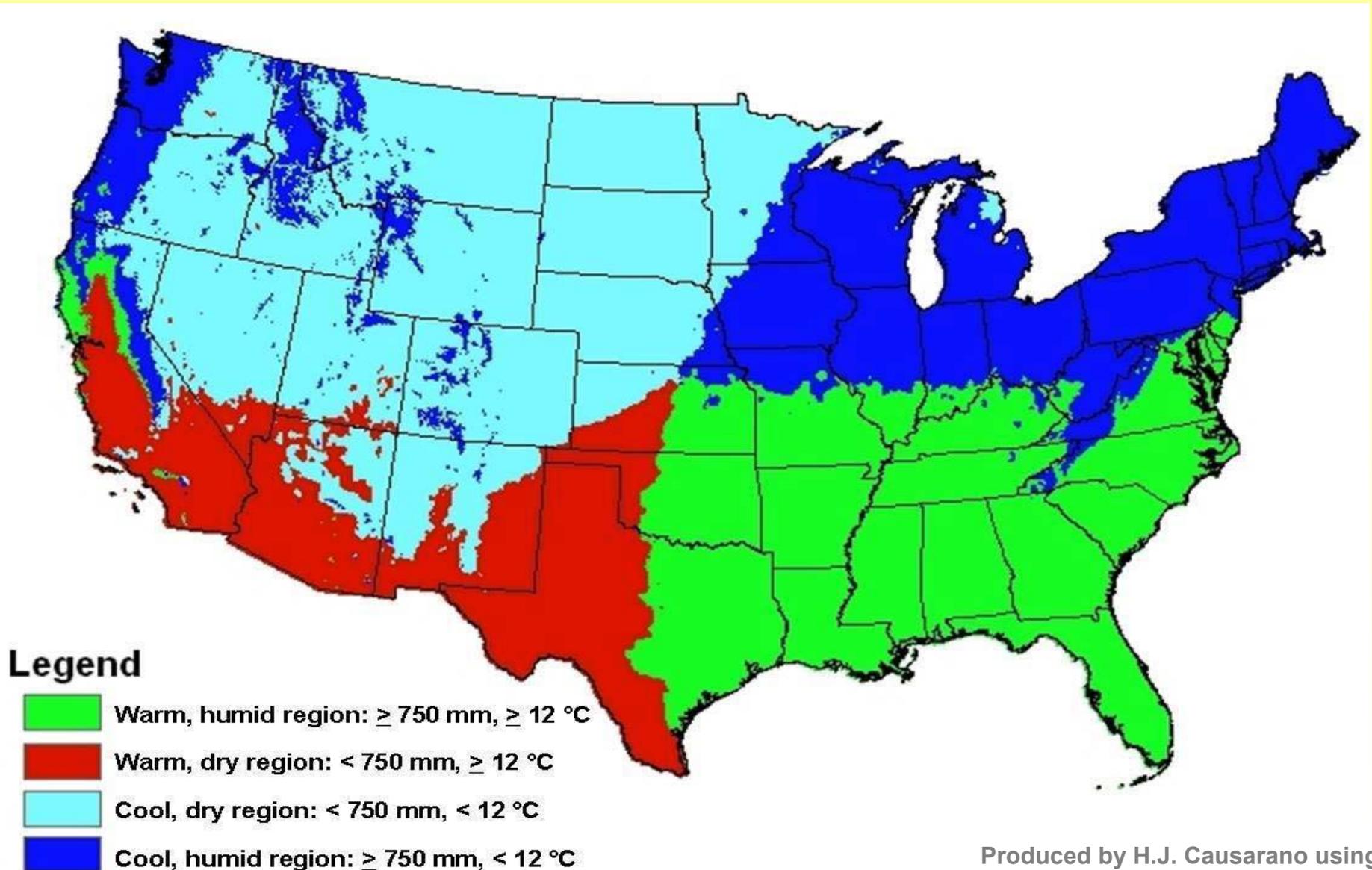
Alan.Franzluebbers@ars.usda.gov



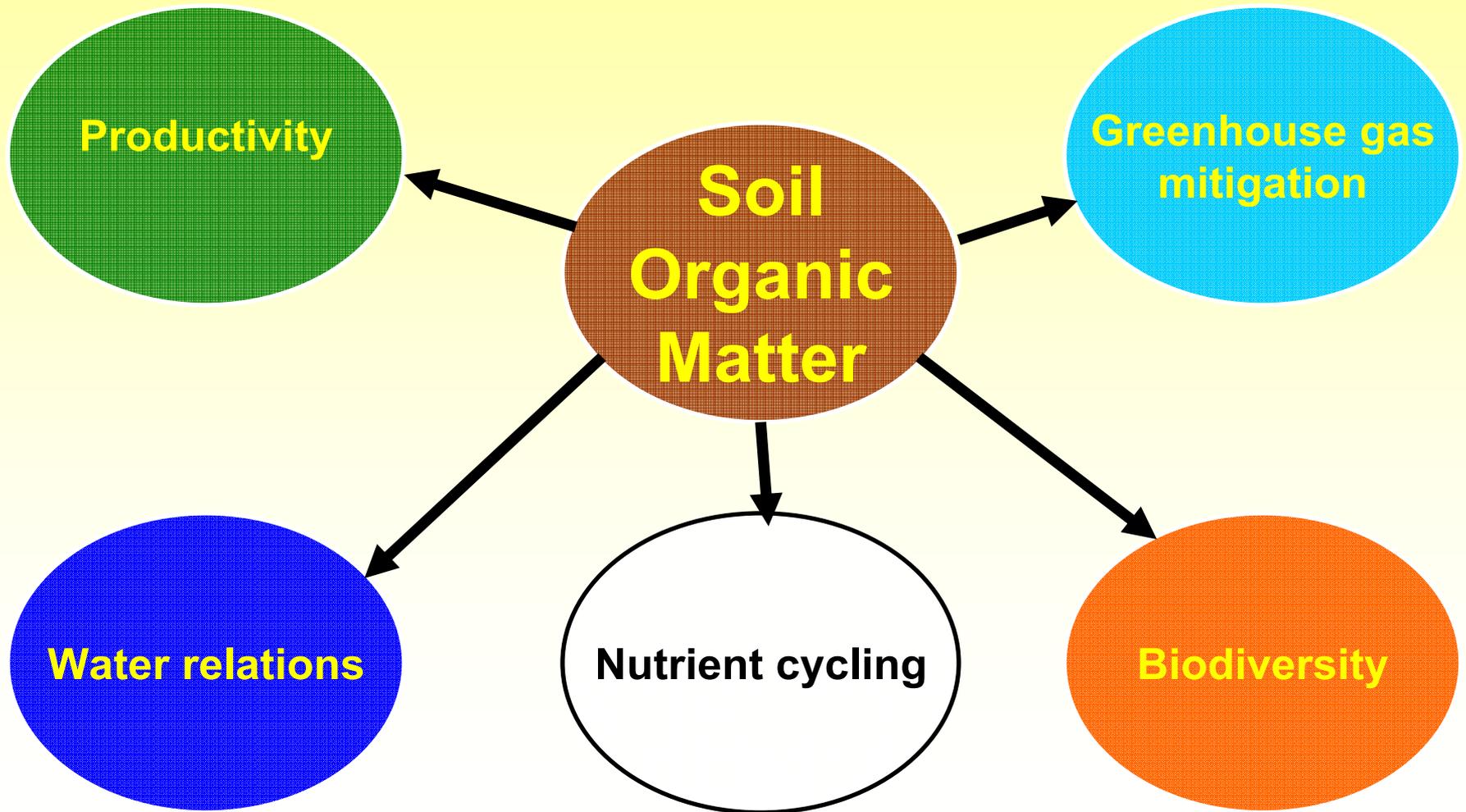
**Watkinsville
Georgia**



Climatic characteristics of region



Soil organic matter (C) important as an indicator of ecosystem services



Conservation agricultural systems

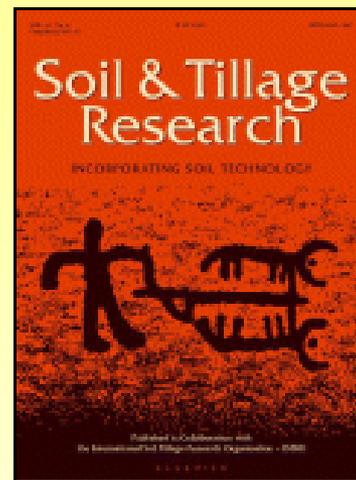
✓ Guiding principles:

- Minimizing soil disturbance, consistent with sustainable production practices
- Maximizing soil surface cover by managing crops, pastures, and crop residues
- Stimulating biological activity through crop rotations, cover crops, and integrated nutrient and pest management



What information is available in the region?

✓ **Conservation tillage compared with conventional tillage cropland**



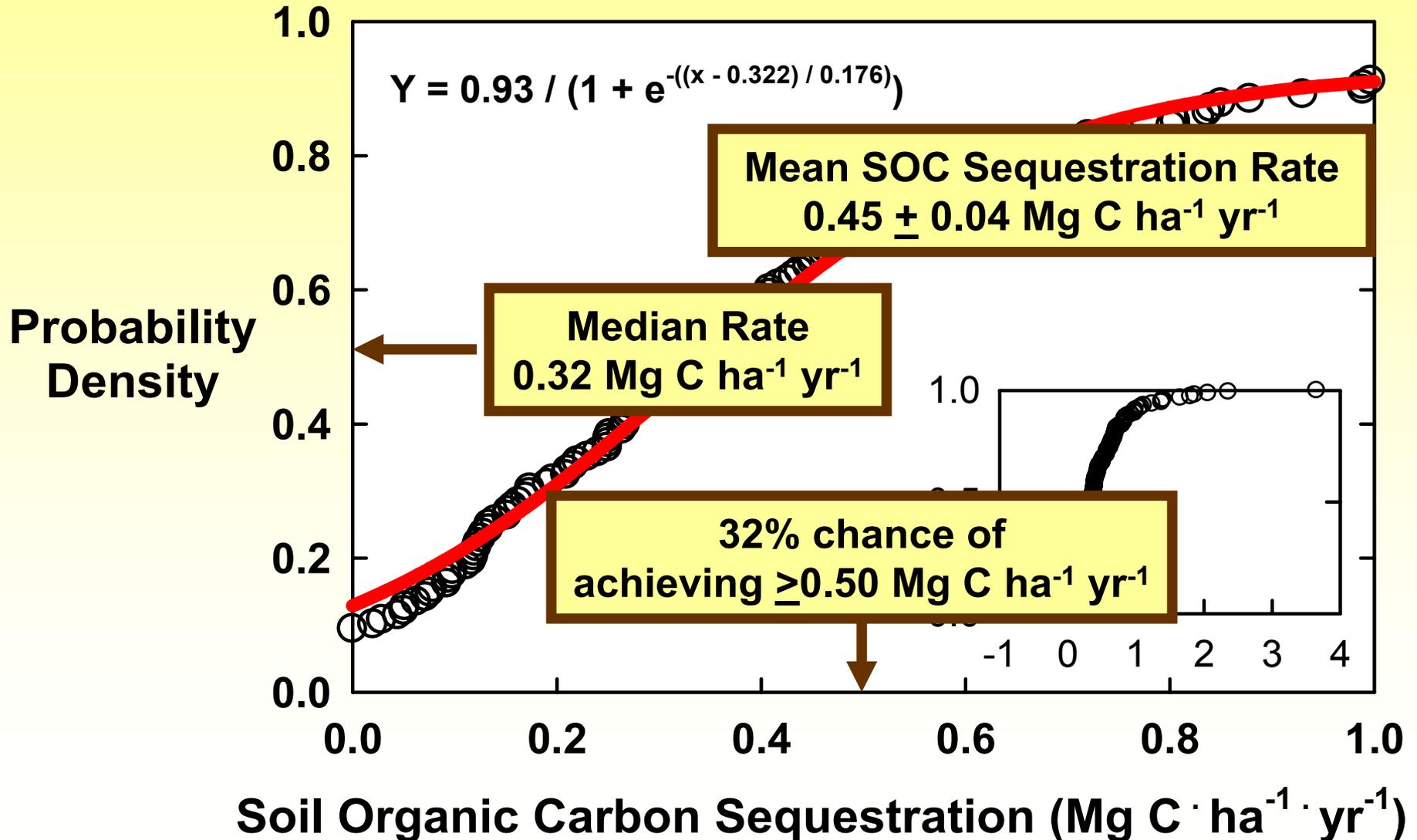
Greenhouse Gas Contributions and Mitigation Potential in Agricultural Regions of North America

Special issue (Vol 83, August 2005)

Property	AL	GA	MD	MS	NC	SC	TX	VA	Mean
Number of comparisons	27	31	13	6	15	9	38	8	147
Duration of comparison (years)	9	8	14	8	7	17	13	10	11
Soil depth (cm)	21	21	23	15	15	15	22	16	20
Soil organic C with conventional tillage (Mg ha ⁻¹)	22.4	25.5	39.2	16.4	21.5	20.7	28.5	19.0	25.5
Soil organic C with no tillage (Mg ha ⁻¹)	26.6	28.8	40.6	19.5	24.5	25.4	33.0	23.5	29.2

Distribution of observations

Conservation tillage

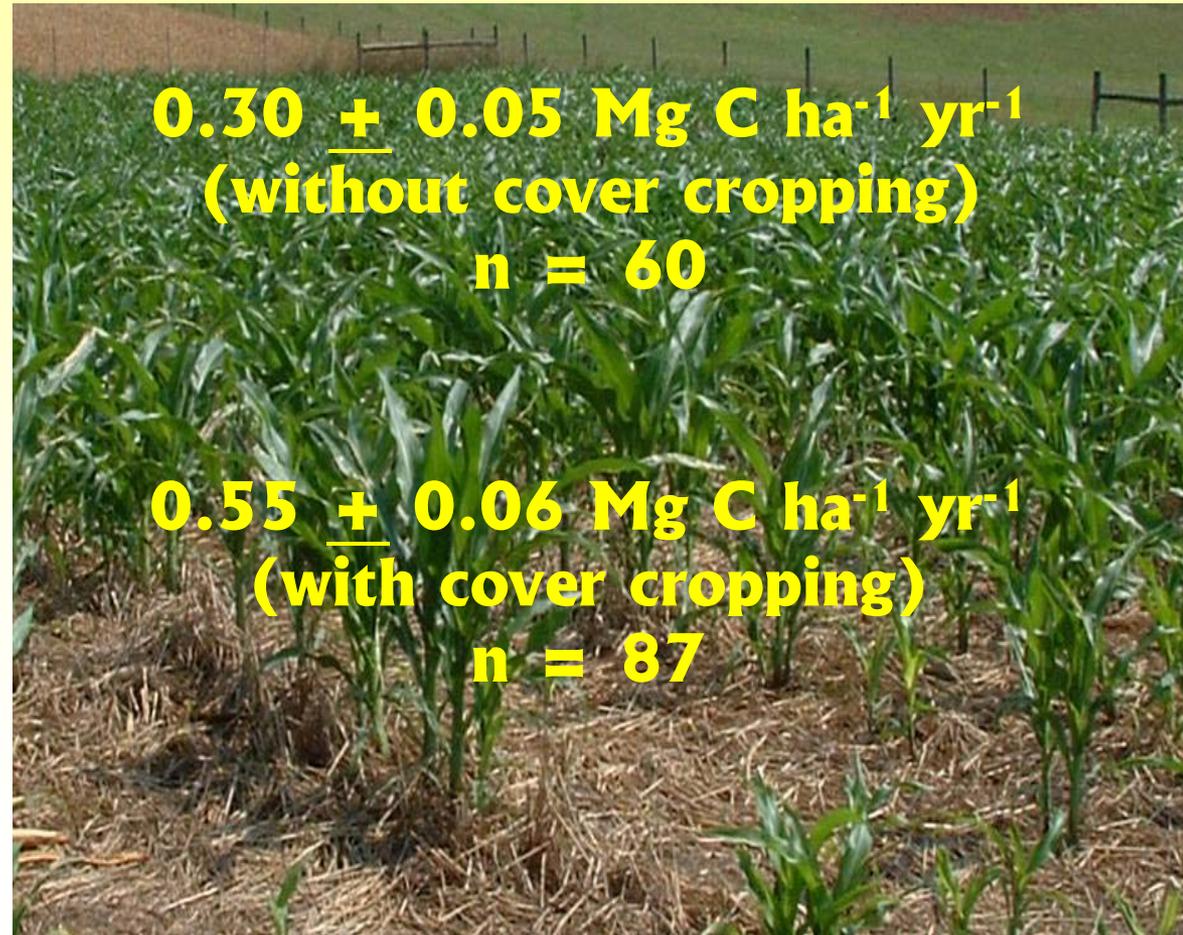


Looking deeper into the data

Soil Organic Carbon Sequestration in the Southeastern USA



Photos of 2 no-tillage
systems in Virginia USA

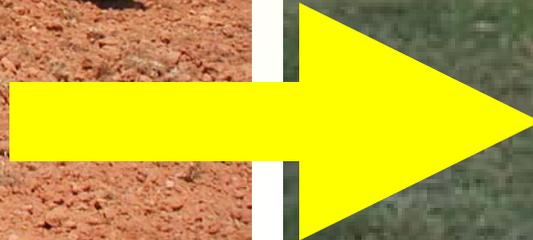


0.30 + 0.05 Mg C ha⁻¹ yr⁻¹
(without cover cropping)
n = 60

0.55 + 0.06 Mg C ha⁻¹ yr⁻¹
(with cover cropping)
n = 87

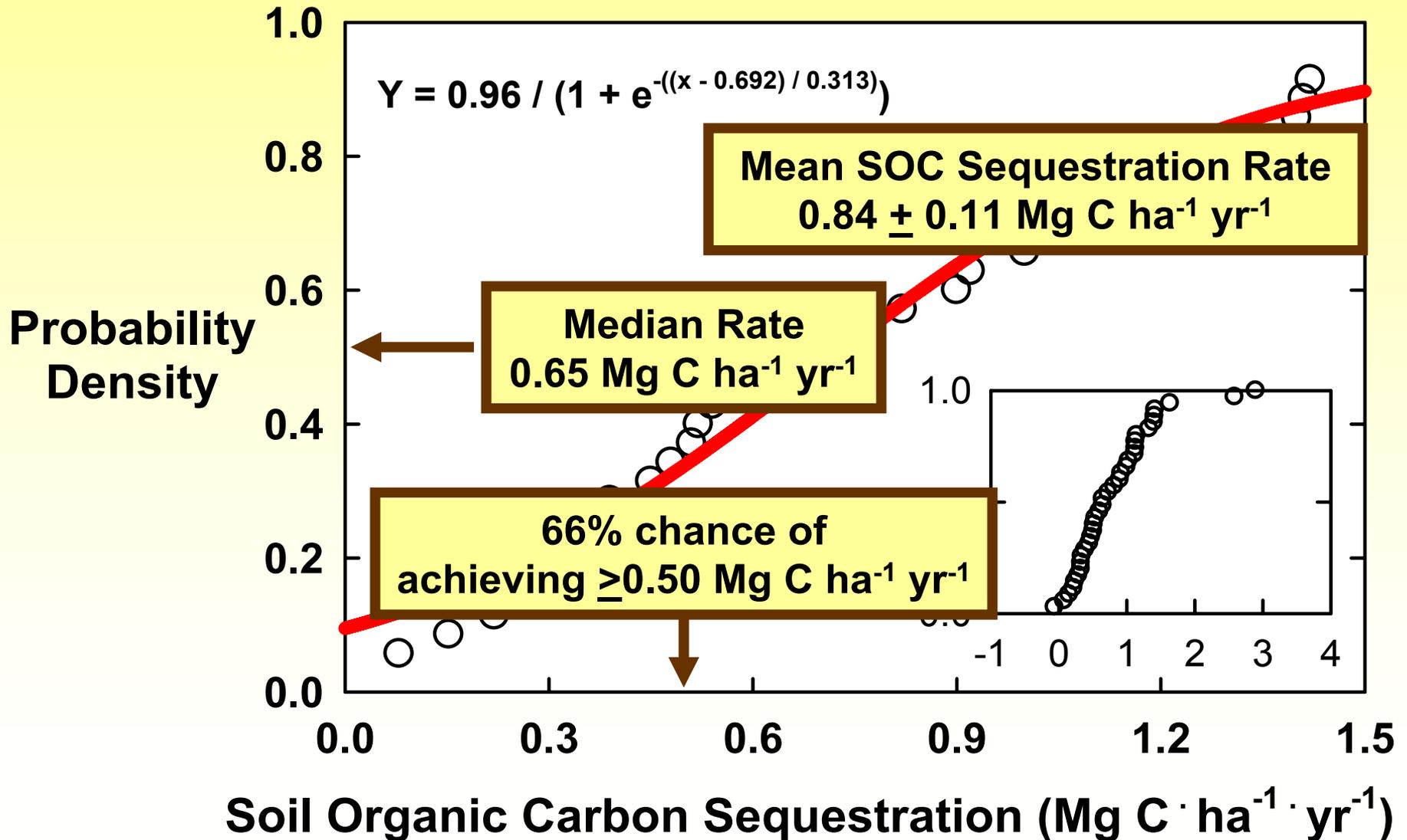
What information is available in the region?

- ✓ Pasture establishment

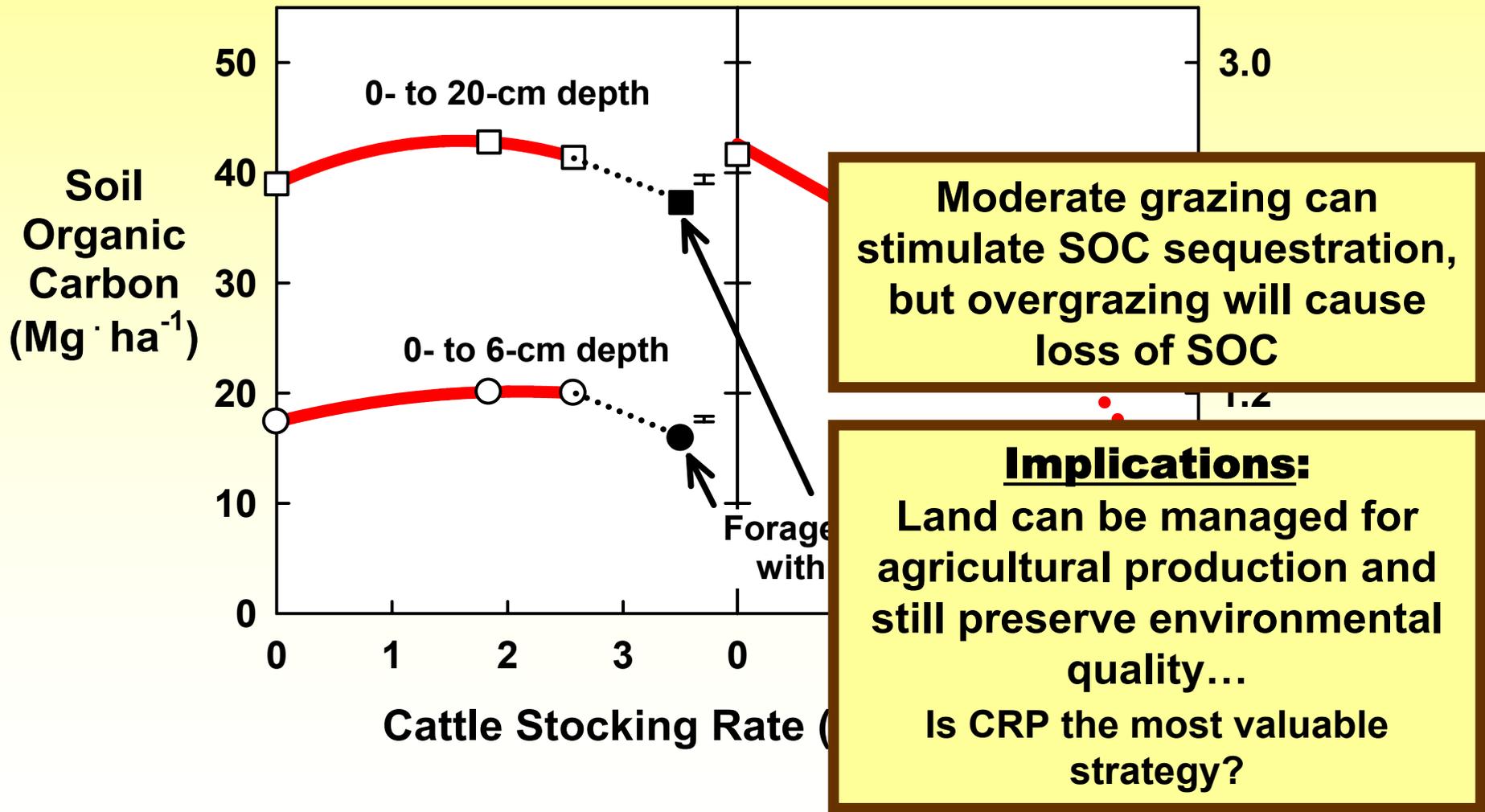


Distribution of observations

Pasture establishment

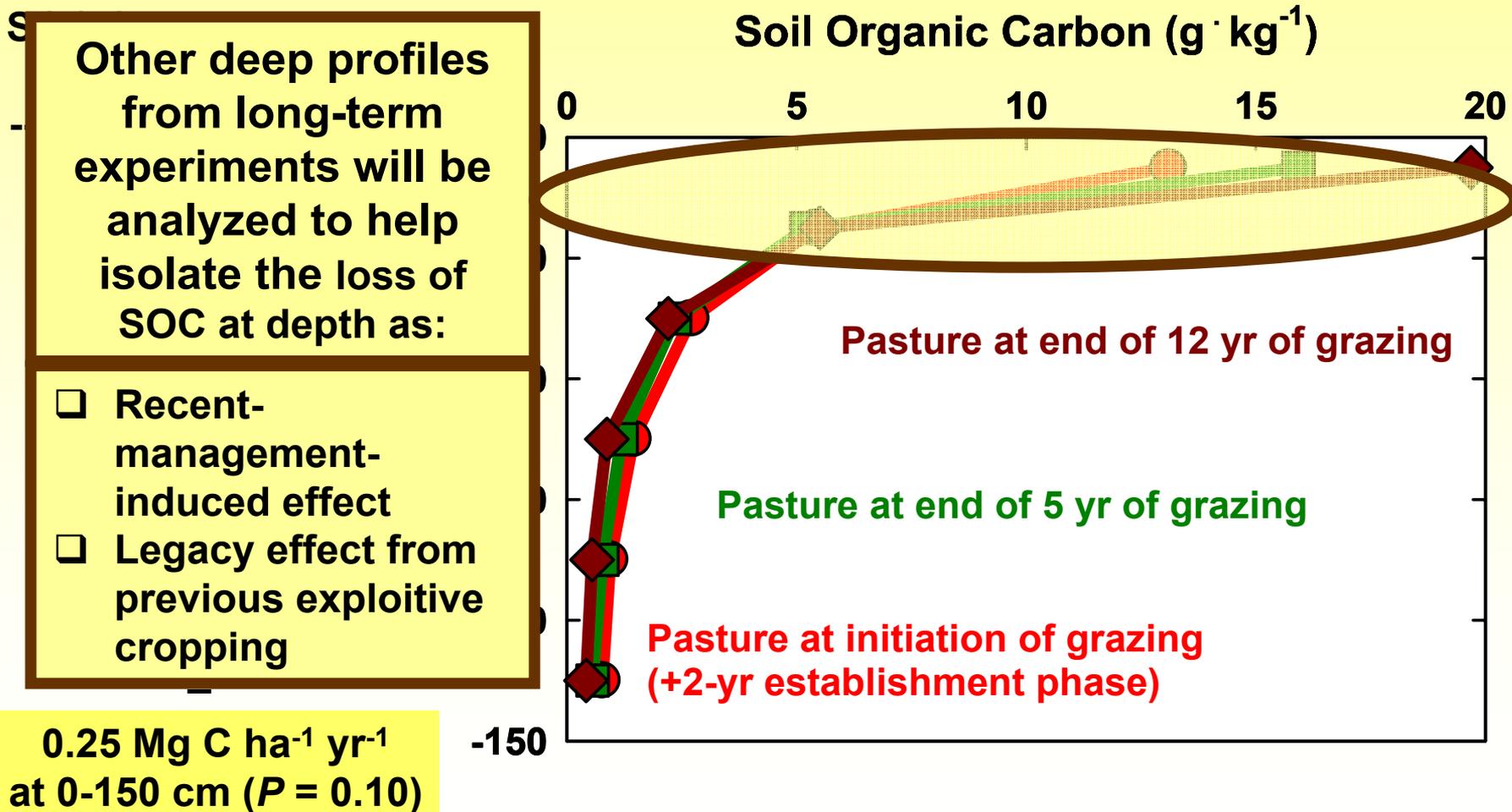


How does cattle grazing affect SOC sequestration?

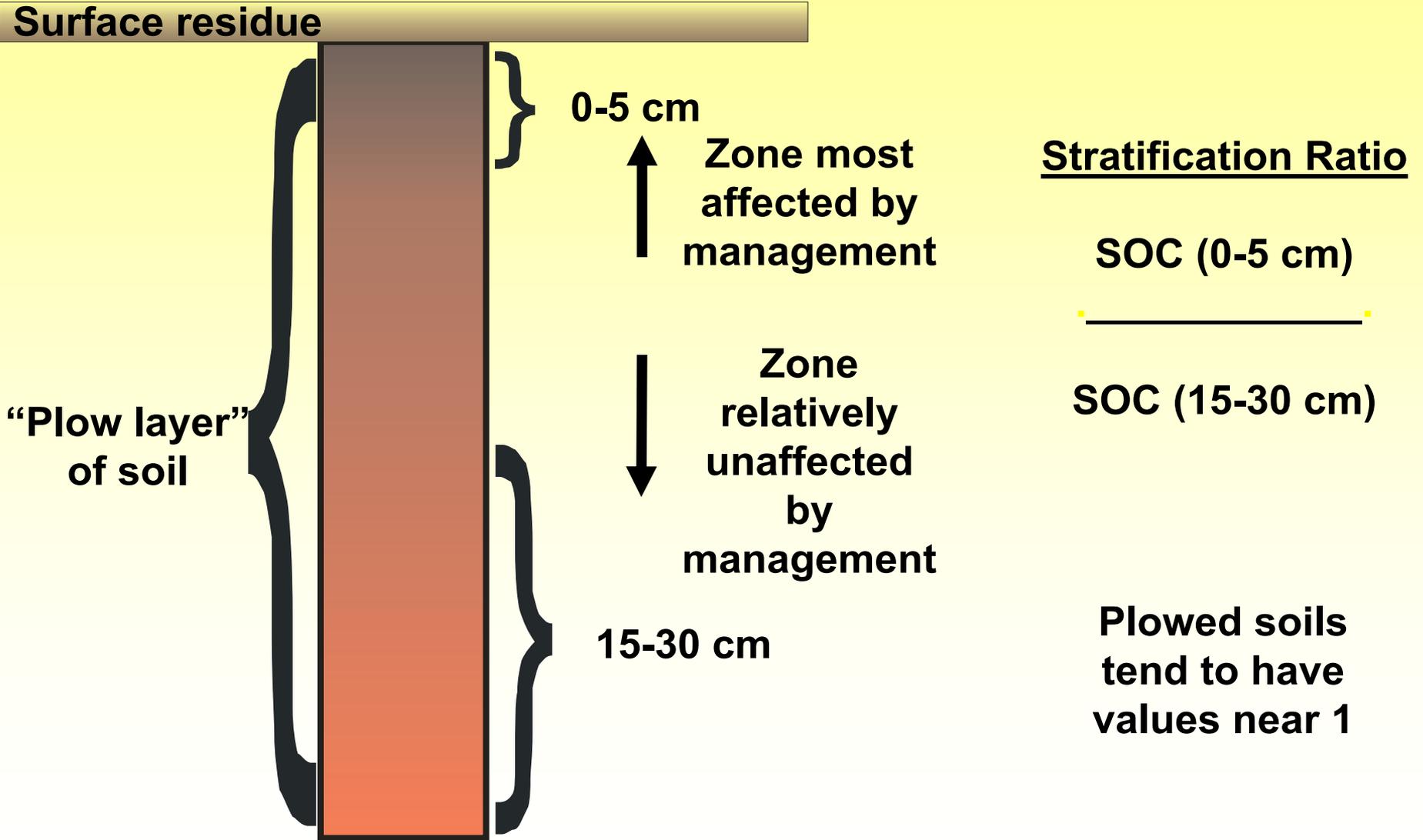


Depth distribution of SOC

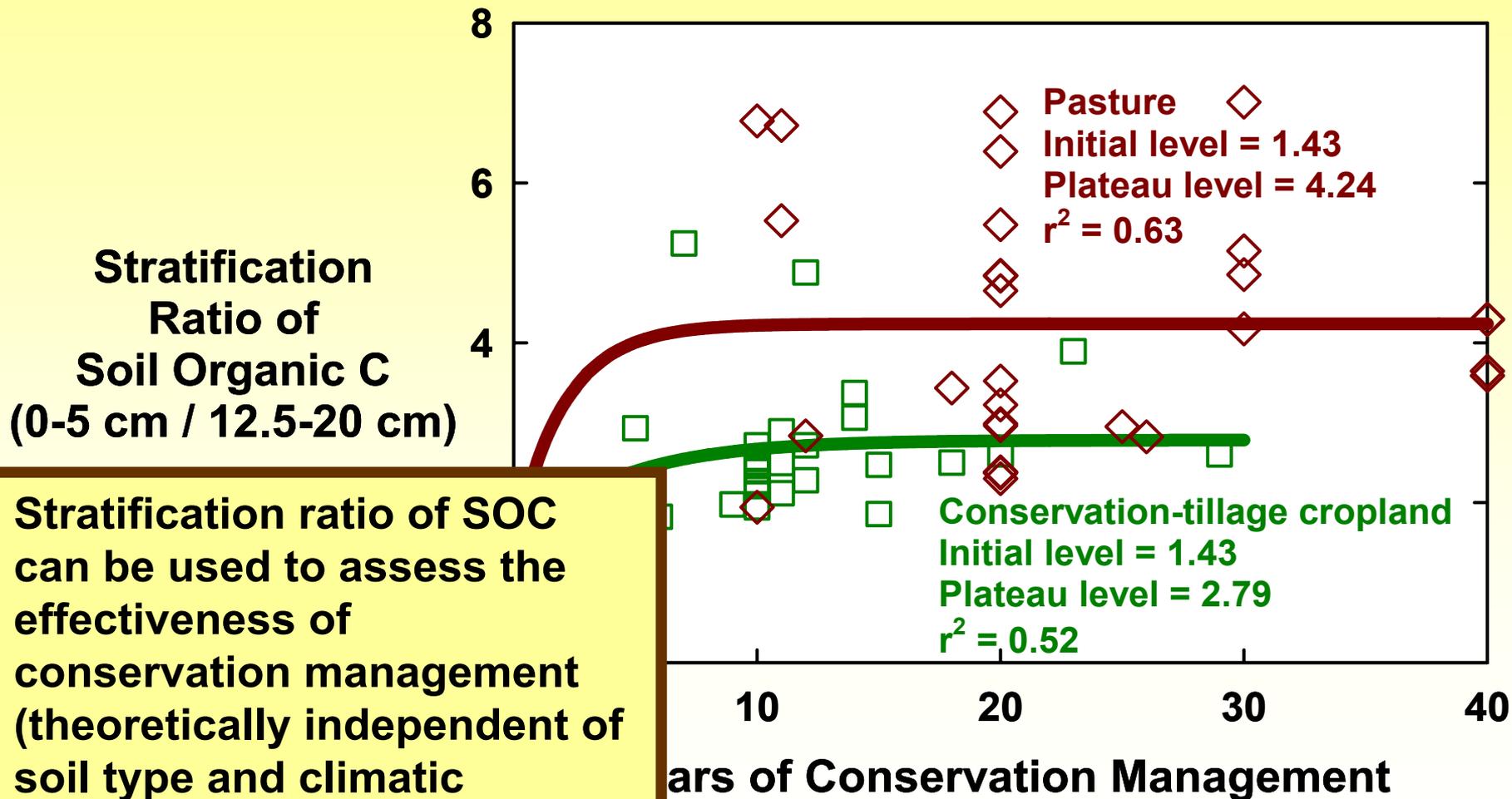
Cecil sandy loam – Typic Kanhapludult in Georgia



Stratification ratio of SOC

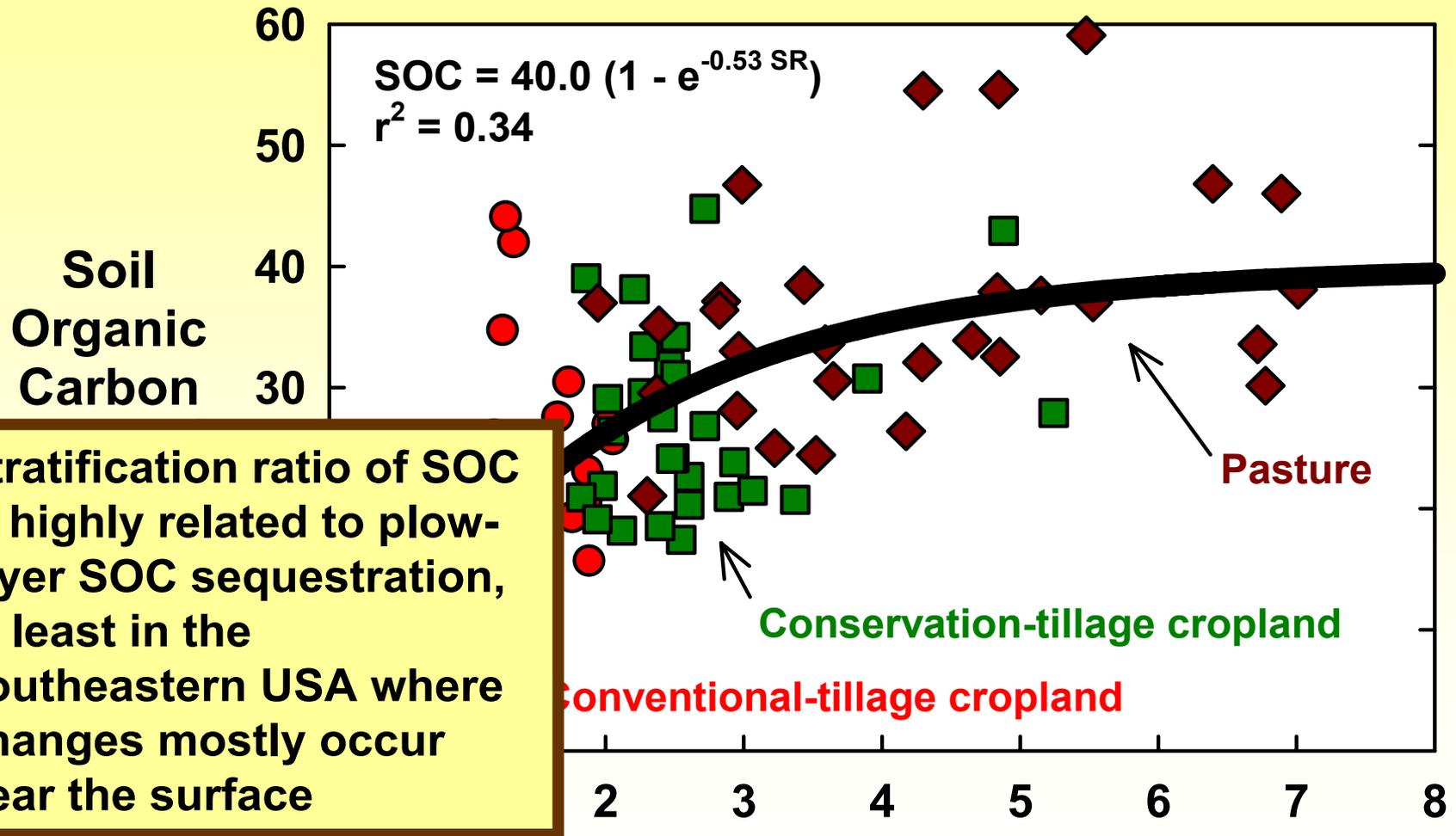


Rate of change in surface SOC



Stratification ratio of SOC can be used to assess the effectiveness of conservation management (theoretically independent of soil type and climatic conditions)

How relevant are these surface changes in SOC?



Stratification ratio of SOC is highly related to plow-layer SOC sequestration, at least in the southeastern USA where changes mostly occur near the surface

Data from Causarano et al. (2008) Soil Sci. Soc. Am. J. 72:221-230

Stratification Ratio of Soil Organic C (0-5 cm / 12.5-20 cm)

Summary

- ✓ **Preponderance of evidence suggests that conservation agricultural systems will sequester a significant amount of soil organic C:**
 - **Mean of 0.45 ± 0.04 Mg C ha⁻¹ yr⁻¹ (n = 147, depth = 20 ± 1 cm, time = 11 ± 1 yr) with no tillage**
 - **Mean of 0.84 ± 0.11 Mg C ha⁻¹ yr⁻¹ (n = 35, depth = 25 ± 2 cm, time = 17 ± 2 yr) with pasture establishment**

- ✓ **Further work is needed to...**
 - **Determine significance and potential for change (+ and -) in soil organic C deep in profile**
 - **Obtain soil organic C sequestration estimates for the many management systems not yet investigated throughout this region (e.g., irrigation response, peanut rotations, management-intensive grazing, mixed forages, etc.)**