The Influence of Inherent Soil Properties and Management on Soil Health Indicators of Wisconsin Pastures

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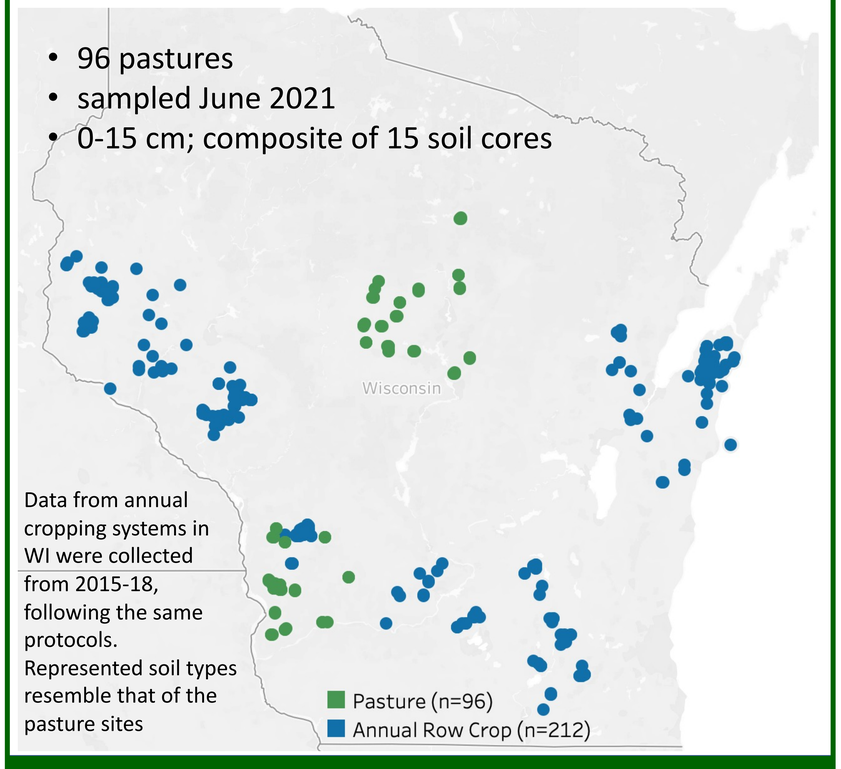
- Soil health measurements need to be benchmarked based on cropping system
- Pasture typically has greater soil health values than annual crops, but little is known about variation
- Measurements of labile carbon and nitrogen are valuable soil health metrics that are cost-effective and responsive to management

Objectives:

1. Compare soil health indicators for conventional, annual cropping systems and pasture
2. Evaluate how inherent soil properties influence soil health indicators of pastures
3. Assess if pasture management can improve soil health values and what management practices are most beneficial to adopt

- 96 pastures
- sampled June 2021
- 0-15 cm; composite of 15 soil cores



Data from annual cropping systems in WI were collected from 2015-18, following the same protocols. Represented soil types resemble that of the pasture sites

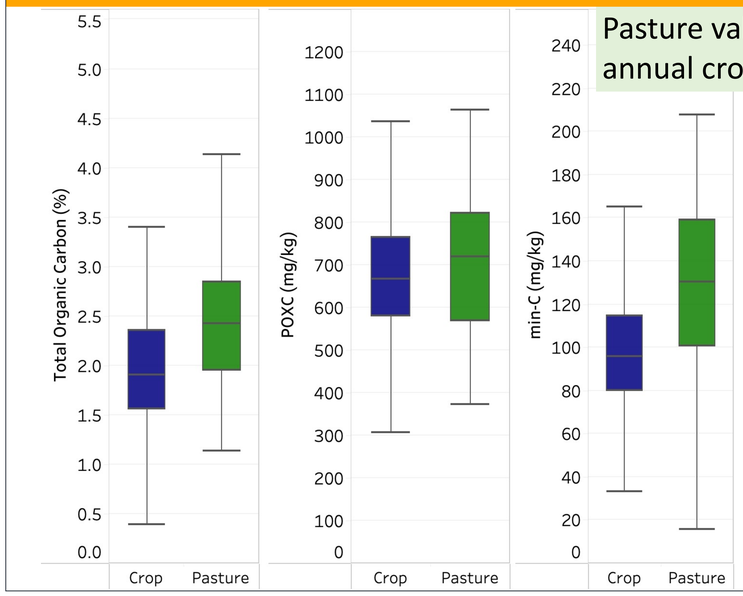
Key measurements:

Chemical Extractions: Permanganate oxidizable carbon (**POXC**), Autoclaved-citrate extractable protein (**ACE**)
Incubations: Potentially mineralizable carbon (**min-C**), Potentially mineralizable nitrogen, 7-d anaerobic (**PMN**)

Pastures have greater labile carbon and nitrogen pools than annual cropping systems. But among pastures, the variability in soil health indicators suggest that there is still capacity to improve.

- Total organic carbon (TOC) is more related to chemical extractions (POXC, ACE) and soil texture is more related to incubations (min-C, PMN)
- Time under pasture associated with greater soil health values, but more related to TOC than POXC or min-C

Soil Health Measurements



Pasture values greater than annual crops, but range of values suggests potential to improve soil health.

Variability among pastures may be attributed to soil properties or management

Soil Texture of Pastures

	R^2	
	% Sand	% Clay
POXC	0.06	0.01*
ACE	0.01*	0.03*
min-C	0.35	0.19
PMN	0.30	0.12

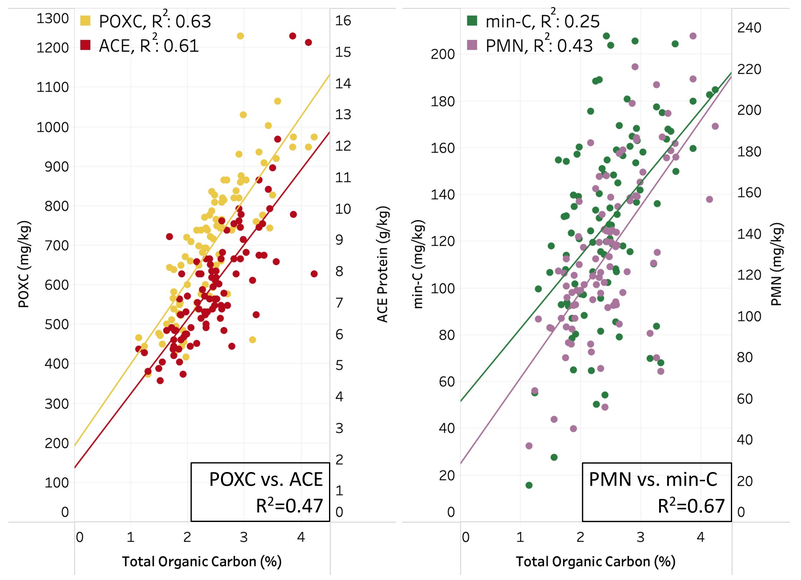
Extractions not related to soil texture; Incubations somewhat related

*not significant at $p < 0.05$

Total Organic Carbon of Pastures

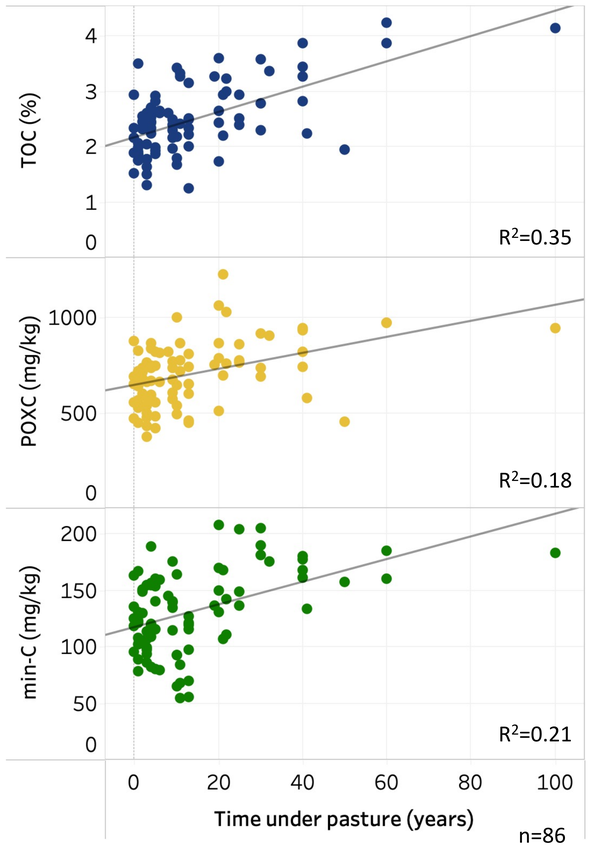
Extractions more related to TOC than each other.

Incubations more related to each other than TOC.



Time under Pasture

Indicators increase with time under pasture. More related to TOC than POXC or min-C



Future Analysis

- Regression tree analysis and multivariate analysis
- Explore relationships between management, soil health indicators and ecosystem services: productivity, greenhouse gas emissions, and carbon sequestration

Other Management Factors to Consider

- Pasture composition:
  - Percent legumes had no effect on indicators
- Intensity of grazing
- Grazing management
- Days since grazing at time of sampling

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