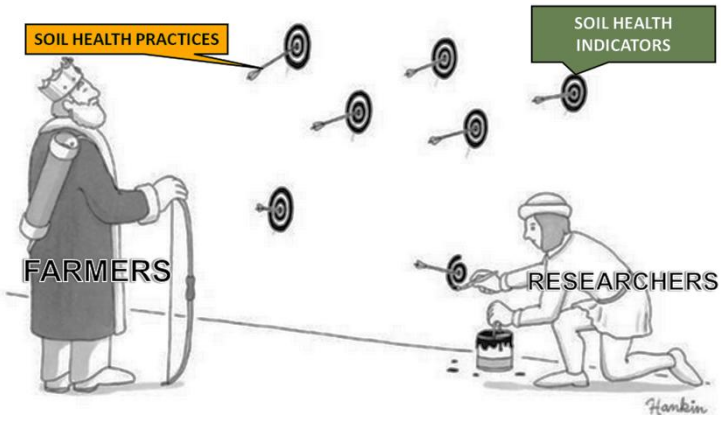
How does soil health change over space and time?

Jed Eberly

MSU Central Ag Research Center

https://agresearch.montana.edu/carc/index.html

Challenges with Measuring Soil Health



"There is a problem with how soil health indicators are being developed. We start with farmers using soil health practices, for instance, no-till, crop rotation, cover crops, and application of manure or compost. Then we look for indicators that are sensitive to the use of these soil health practices. Then we use the most sensitive indicators to measure "the effects" of soil health practices. Do you see the problem?" Credit: Andrew McGuire, WSU (https://csanr.wsu.edu/soil-health-shorts-do-soil-health-indicators-indicate-soil-health/)

Common Soil Health Indicators

Indicator	Category	What it Measures
Cation Exchange Capacity	Chemical	Nutrient holding ability
Base Saturation	Chemical	Nutrient availability
Electrical Conductivity	Chemical	Salt concentration
Phosphorus Availability	Chemical	Plant-available phosphorus
Potassium Availability	Chemical	Plant-available potassium
Penetration Resistance	Physical	Soil hardness/compaction
Porosity	Physical	Pore space percentage
Soil Respiration	Biological	Indicator of microbial activity
Microbial Biomass	Biological	Size of microbial community
Enzyme Activity	Biological	Biochemical processes
Mycorrhizal Colonization	Biological	Fungal symbiosis level

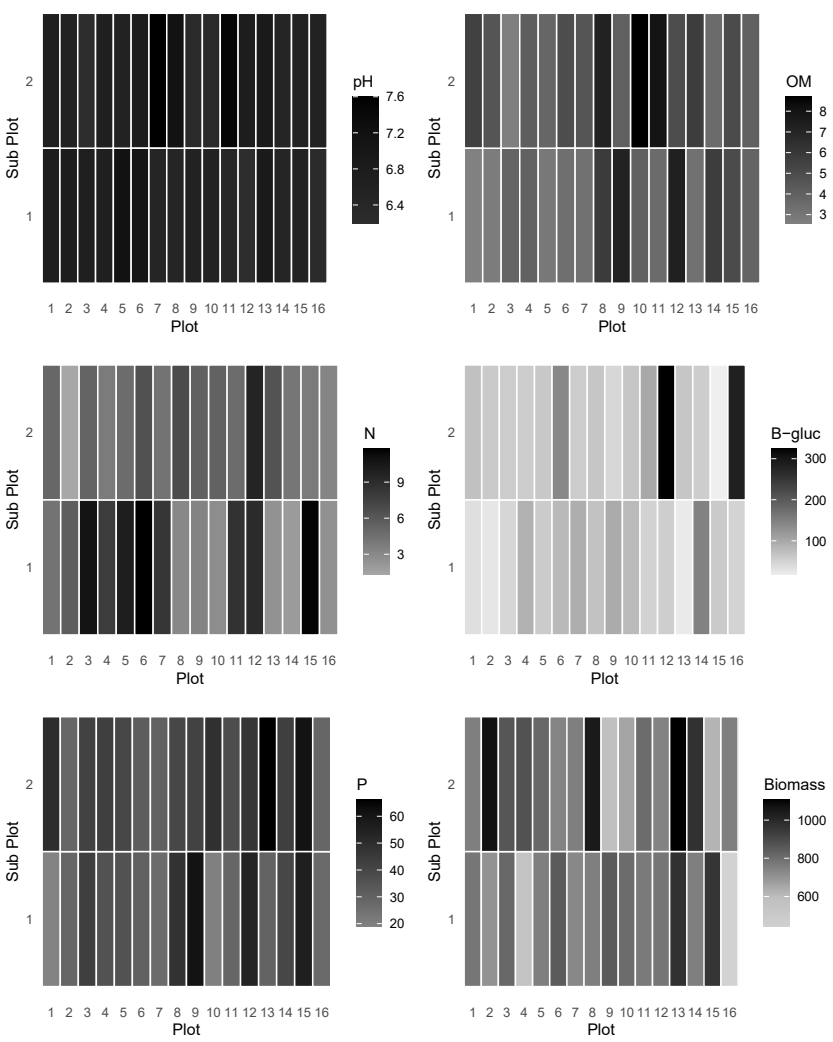


Figure 1: Spatial variation of soil chemistry (left column) and soil health (right column) indicators. N: Nitrate nitrogen (ppm) P: phosphorus (ppm), OM: organic matter (%), B-gluc: Beta glucosidase enzyme activity (mg kg^{-1} soil hr-1), Biomass: Microbial biomass carbon (mg C kg^{-1} soil).

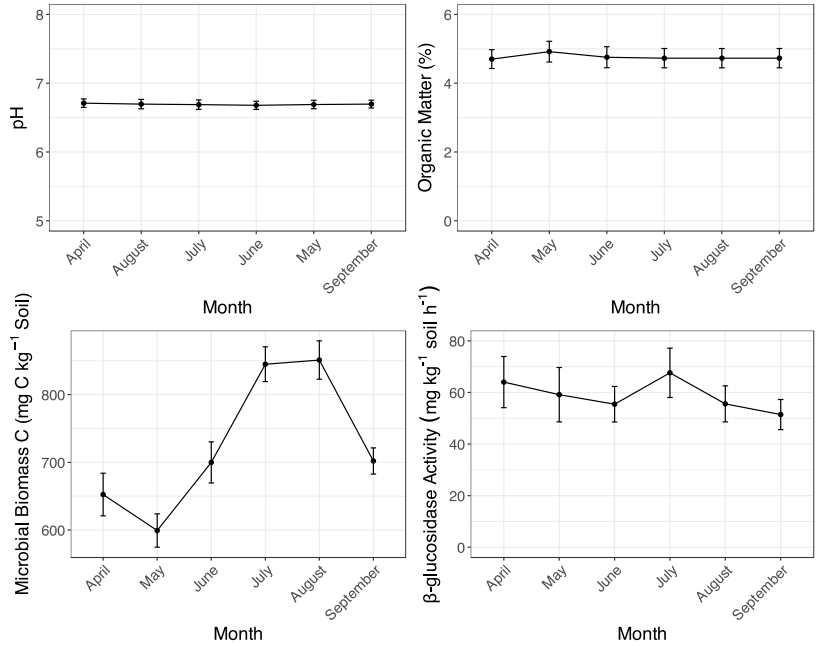


Figure 2: Temporal variability of select soil parameters over time.