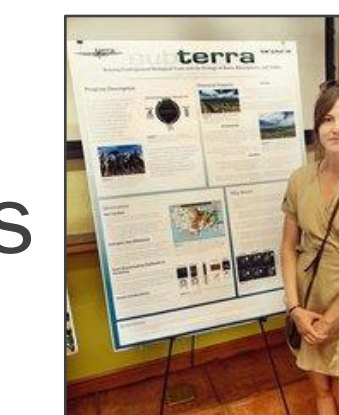


CLOSING THE SOIL HEALTH GAP

QUANTIFYING "SOIL HEALTH" IN HIGH PLAINS AGROECOSYSTEMS

Alyssa Hanofee
Soil and Crop Sciences
College of Agriculture



Mentor: Dr. Jim Ippolito,
Soil and Crop Sciences
College of Agriculture



PROJECT DESCRIPTION

- Identify benchmark sites in the Nunn soil series in (un)disturbed high plains soils in conjunction with geographically similar sites implementing unique agroecological management practices set within the same Nunn soil series for quantifiable comparison.
- Work closely with several soil health and agronomic experts in the region to quantify "soil health gap" differences between cropping systems and "benchmark" or "target" soils from relatively undisturbed ecosystems.
- Quantify and link baseline soil health metrics from undisturbed, local/regional ecosystems and the dominant agroecosystem practices in the High Plains region.

HYPOTHESIS

- Undisturbed ecosystems (e.g., short- or mixed-grass prairies) have soil physical, chemical, and biological attributes that are different from managed agroecosystems, and represent the potential soil health gap.

NUNN SERIES BENCHMARK SITES

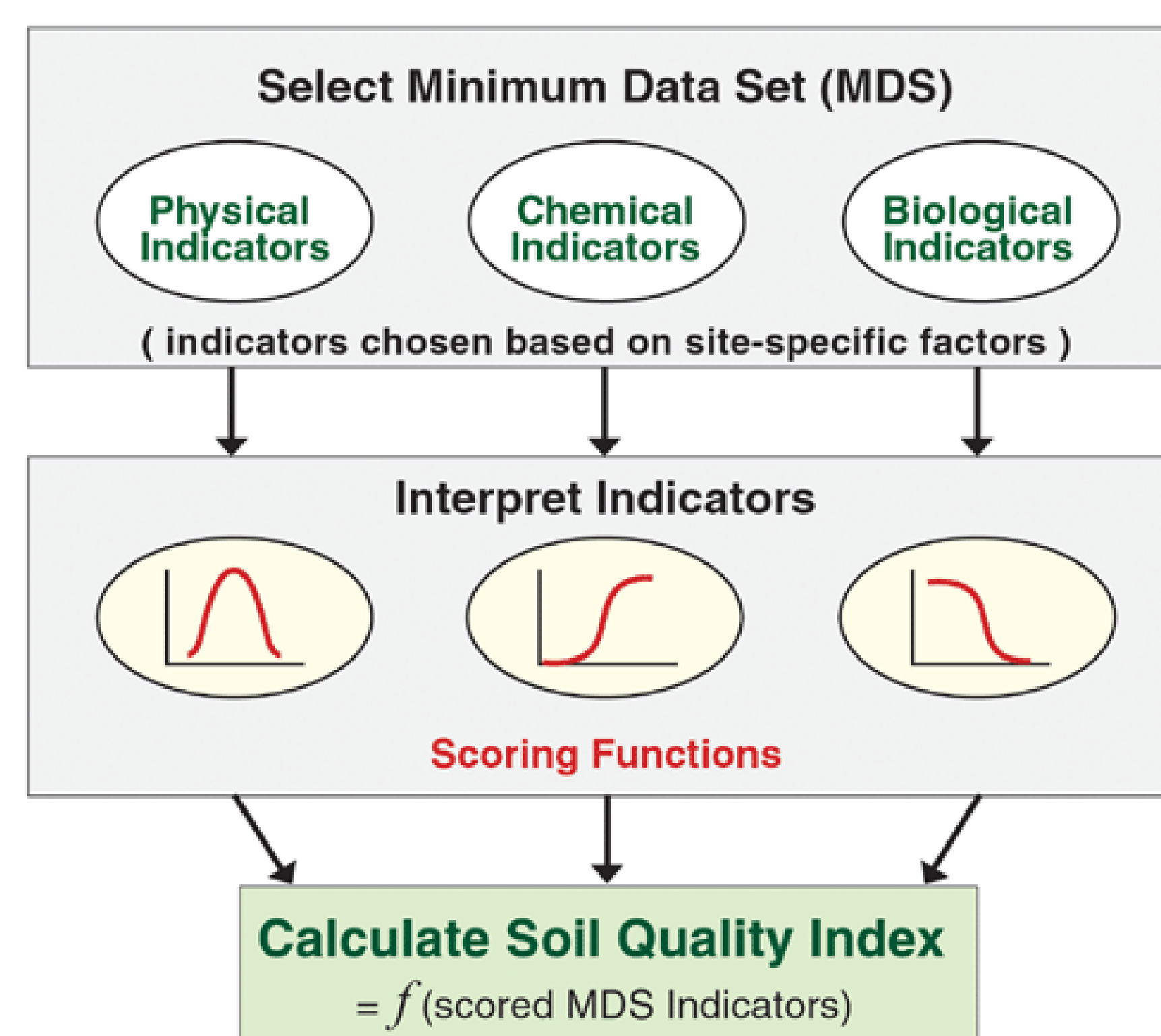


Sampling at CSU's Agricultural Research, Development and Education Center (ARDEC) meant to mimic management integrating side of ruminants and its effect on soil quality.

- Golden Prairie Farm – Nunn, CO** (Organic Ag, Wheat/Millet/Rye, Land in Conservation Reserve (CRP))
- Hellbaum Farm – Chugwater, WY** (Grain/Oilseed/Fallow, Organic to Conventional Ag, Land in CRP (30 years))
- ARDEC Rotational Grazing Pivot – Fort Collins, CO** (Est. 2016, Irrigated, Managed Research Site)
- Pawnee National Grasslands – New Raymer, CO** (Relatively Undisturbed ~60 years)

METHODS

- Sites were sampled in linear transects (North, Middle, South) at two depths (0-15 cm & 15-30 cm) using Soil Probe of 3.2 cm to provide a reasonable field estimate of bulk density
- Multiple samples (>30) were collected and pooled from each depth to ensure heterogeneity of replicate cores
- A sub-sample was pulled, air-dried and sieved for lab analysis
- 11 soil indicators were tested and entered into the Soil Management Assessment Framework (SMAF) to calculate a Soil Quality Index (SQI)
- The measured indicator values will be transformed with non-linear scoring curves
- This process will provide a unitless score ranging between 0 and 1 reflecting performance of each indicator with regard to critical soil functions
- Indicators can be viewed individually or aggregated into an overall SQI for the specific conservation practice and soil map unit that it represents.



SOIL QUALITY INDICATORS

- Microbial Biomass Carbon (MBC)
- Water-Stable Aggregates (WSA)
- Potential Mineralizable Nitrogen (PMN)
 - pH & Electrical Conductivity
 - Soil-Test Potassium and Phosphorus
- Total Carbon, Inorganic Carbon, Organic Carbon
 - Soil Texture
- Beta-Glucosidase Enzyme Activity (BG)
- Water Content and Percent Moisture

CONVERTED AG LAND TO CRP vs. ORGANIC FARMING PRACTICES



IMPACT

- Data can be used as reference to suggest potential best management alterations to help producers create a more resilient, sustainable, and productive agroecosystem
- Utilize soil health metrics to agroecosystem productivity based not only on conservation practice but linked by soil series classification
- Compile a database reference for quantifying and comparing soil health across agroecosystems based on soil indicators for Colorado-specific soils

EXAMPLE SOIL MANAGEMENT ASSESSMENT FRAMEWORK DATA

Soil Health Indicators		Soil Quality Index (SQI)		Soil Health Indicators		Soil Quality Index (SQI)	
Indicator	Score	Indicator	Score	Indicator	Score	Indicator	Score
Soil Organic Carbon	0.85	Soil Water Content	0.92	Soil Bulk Density	0.78	Soil pH	0.88
Microbial Biomass Carbon	0.75	Water Stable Aggregates	0.88	Soil Nitrogen	0.82	Soil Phosphorus	0.85
Potential Mineralizable Nitrogen	0.80	Soil Texture	0.85	Soil Electrical Conductivity	0.80	Soil Beta-Glucosidase	0.78
Soil-Test Potassium	0.82	Soil Inorganic Carbon	0.80	Soil Percent Moisture	0.85	Soil Water Content	0.92
Soil-Test Phosphorus	0.85	Soil Organic Carbon	0.85	Soil Bulk Density	0.78	Soil pH	0.88
Soil Water Content	0.92	Water Stable Aggregates	0.88	Soil Nitrogen	0.82	Soil Phosphorus	0.85
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