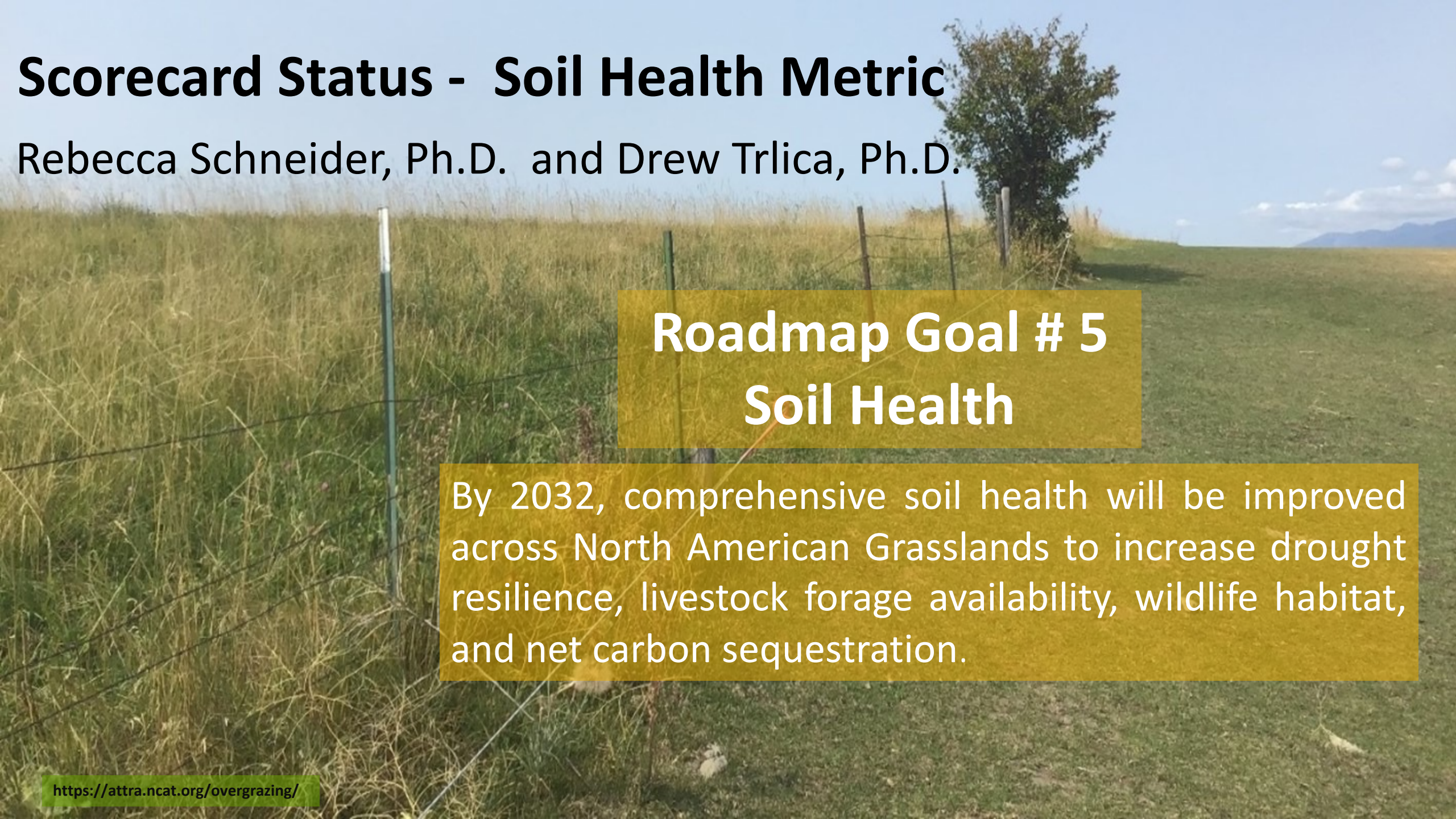
Scorecard Status - Soil Health Metric

Rebecca Schneider, Ph.D. and Drew Trlica, Ph.D.



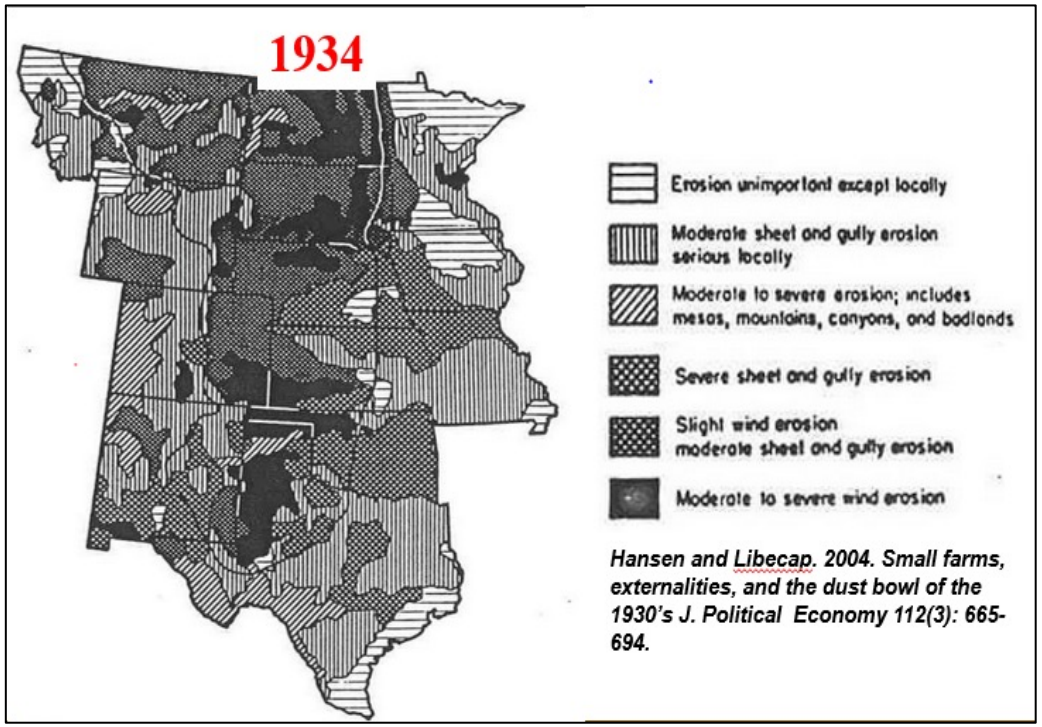
Roadmap Goal # 5
Soil Health

By 2032, comprehensive soil health will be improved across North American Grasslands to increase drought resilience, livestock forage availability, wildlife habitat, and net carbon sequestration.

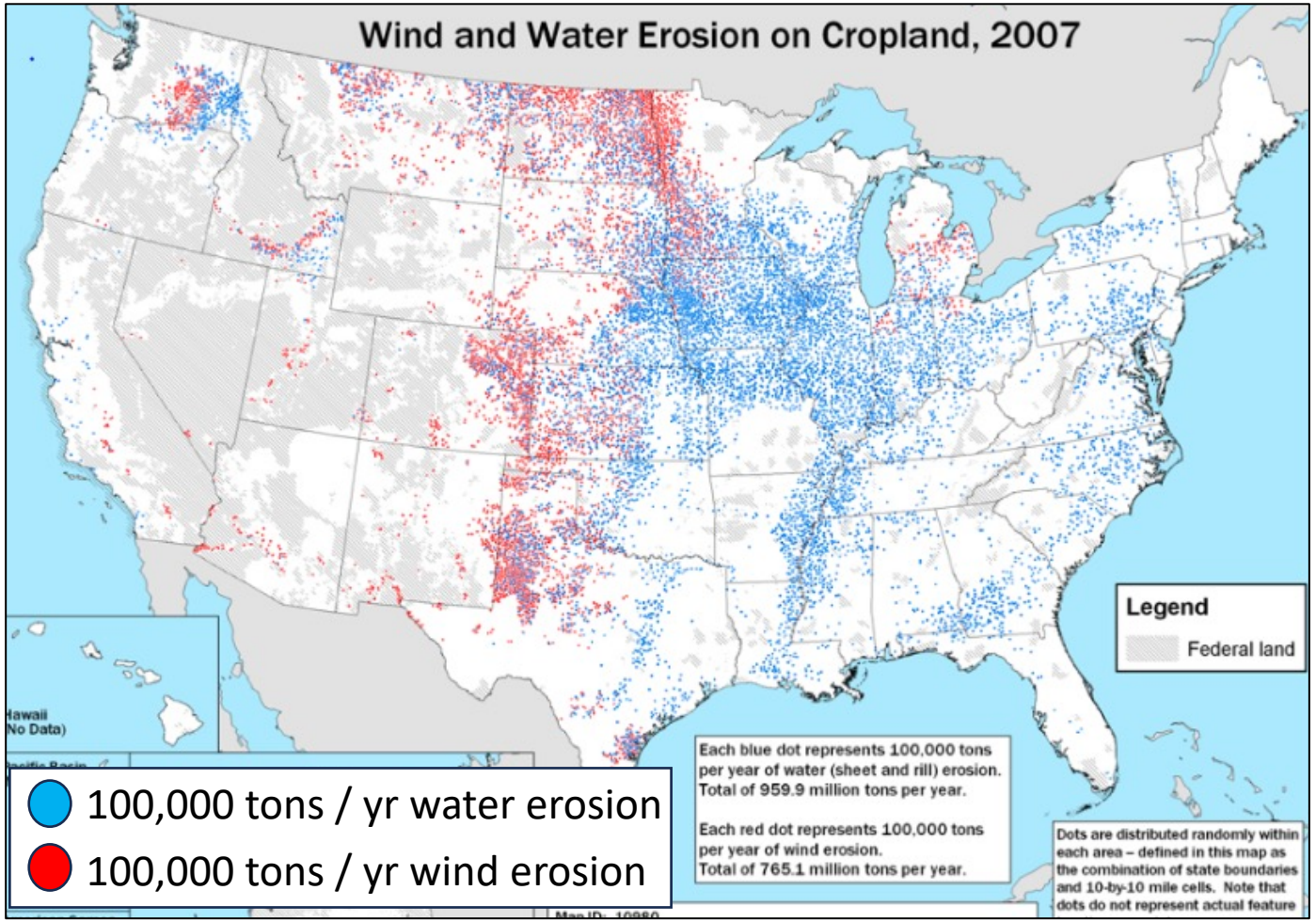
https://attra.ncat.org/overgrazing/

Importance of soil health to grassland habitat

Evidence of historical and ongoing erosion



Hansen and Libecap. 2004. Small farms, externalities, and the dust bowl of the 1930's J. Political Economy 112(3): 665-694.



Metrics of soil health

Chemical

- pH
- Total Carbon
- Total nitrogen
- Phosphorus
- Potassium
- Base cations
- Trace metals

Physical

- Texture
  - % sand
  - % silt
  - % clay
- Aggregate stability

Biological

- Organic matter / carbon
- Microbial respiration rate
- Active carbon
- Soil protein

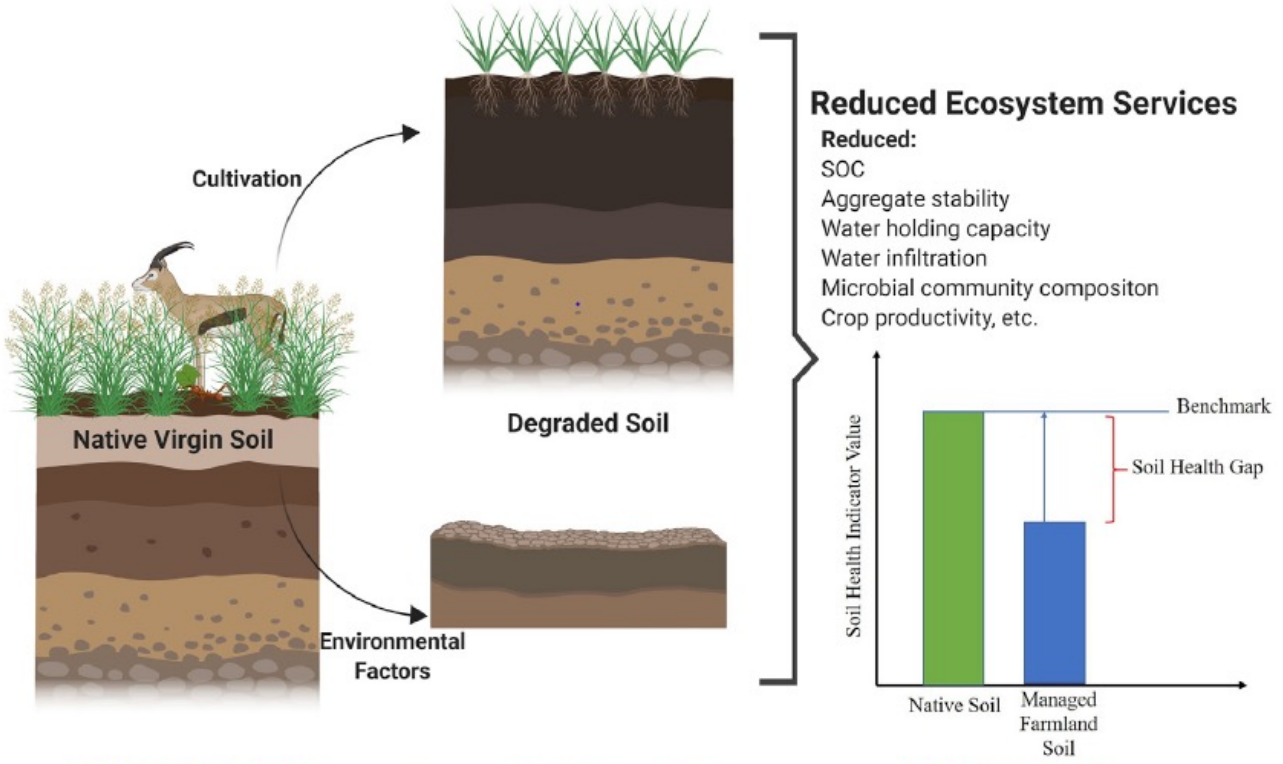
Soil Health Gap Definition

What's the reference?

ROOSEVELT COUNTY, NEW MEXICO

A man holds out his arm to show where the level of the topsoil had been before clean tillage techniques left it vulnerable to the wind. By 1957, when the picture was taken, only this hummock of little bluestem *(Schizachyrium scoparium)*, a native prairie bunch grass, had succeeded in holding the soil in place, the rest blown away.

Soil health gap

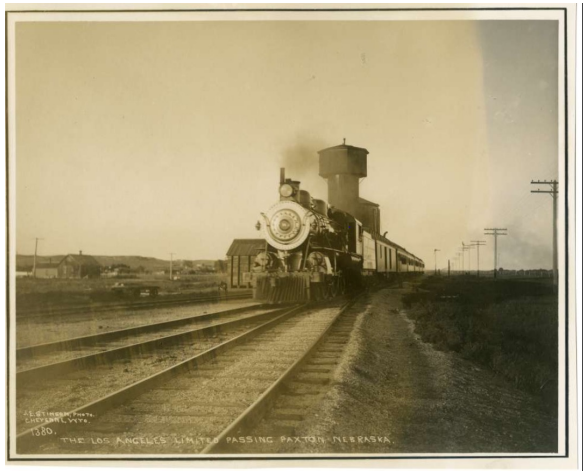


Maharjan et al. 2020

Native grassland remnants as benchmarks

(*ie. never cultivated or overgrazed*)

Preserves

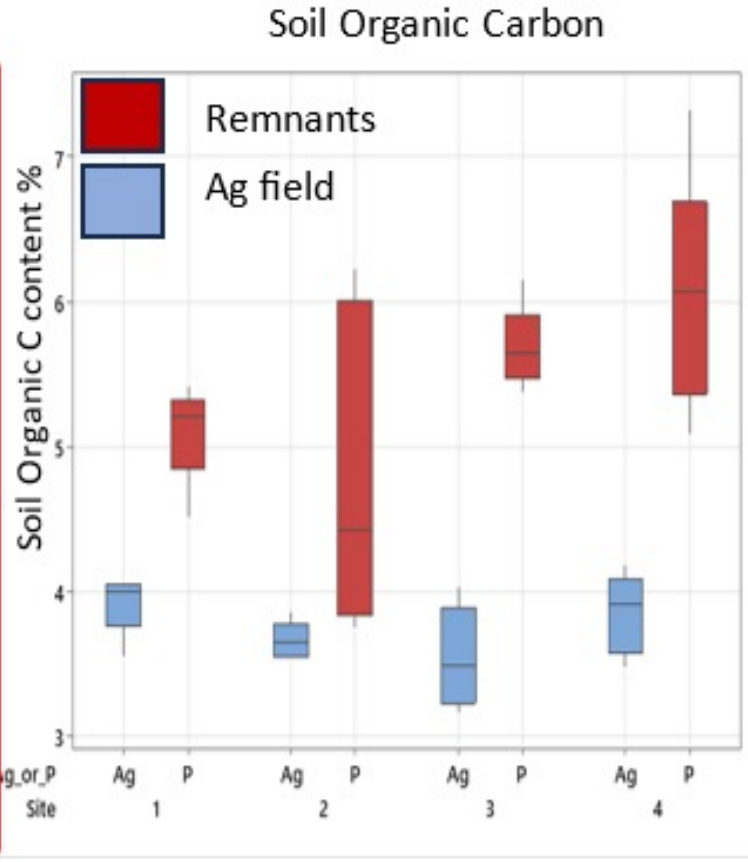


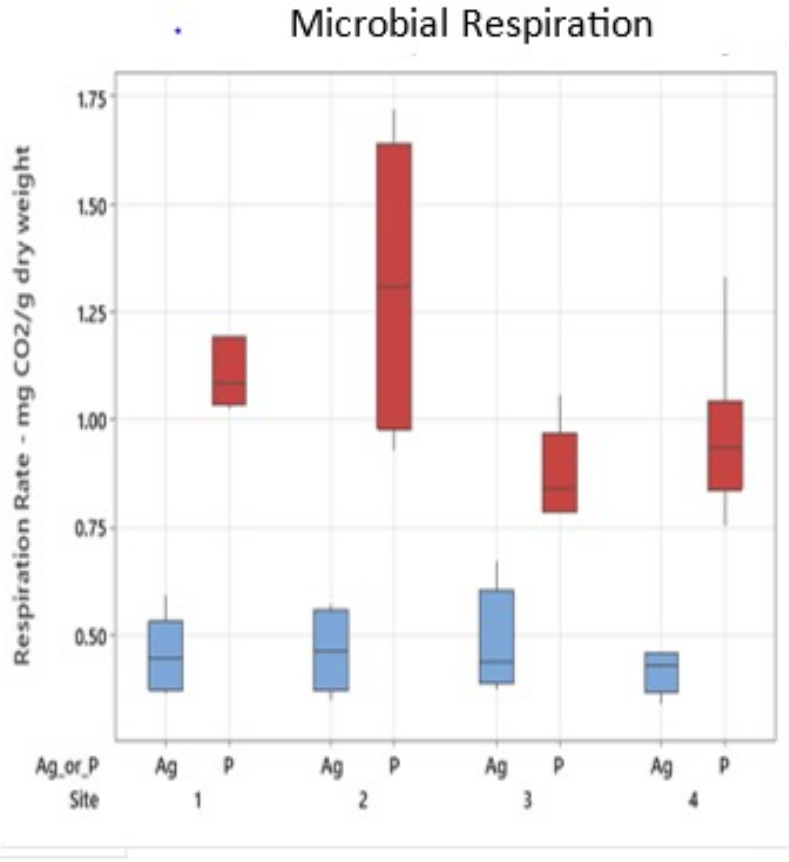
Railway lines

Cemeteries

Old fence lines

Soil Health Gap - Example





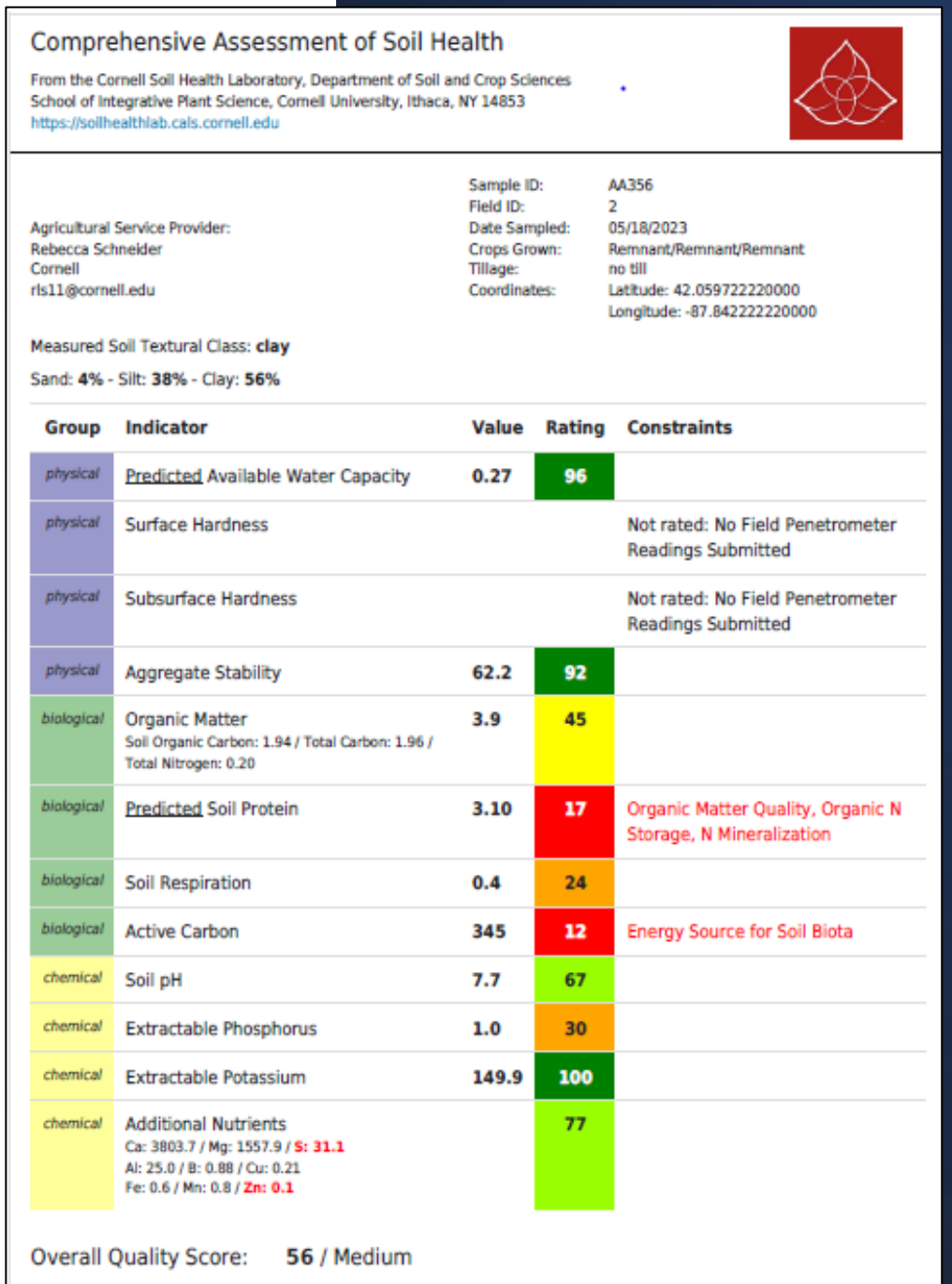
E. Nebraska tallgrass prairies

Soil Health Scorecard

- Low organic matter
- Poor microbiological health

Recommendations

- Reduce tillage
- Organic matter amendments
- Liming



Comprehensive Assessment of Soil Health

From the Cornell Soil Health Laboratory, Department of Soil and Crop Sciences
School of Integrative Plant Science, Cornell University, Ithaca, NY 14853
https://soilhealthlab.cals.cornell.edu

Agricultural Service Provider:
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Sample ID: AA356
Field ID: 2
Date Sampled: 05/18/2023
Crops Grown: Remnant/Remnant/Remnant
Tillage: no till
Coordinates: Latitude: 42.059722220000 Longitude: -87.842222220000

Measured Soil Textural Class: **clay**

Sand: **4%** - Silt: **38%** - Clay: **56%**

Group	Indicator	Value	Rating	Constraints
physical	Predicted Available Water Capacity	0.27	96	
physical	Surface Hardness			Not rated: No Field Penetrometer Readings Submitted
physical	Subsurface Hardness			Not rated: No Field Penetrometer Readings Submitted
physical	Aggregate Stability	62.2	92	
biological	Organic Matter Soil Organic Carbon: 1.94 / Total Carbon: 1.96 / Total Nitrogen: 0.20	3.9	45	
biological	Predicted Soil Protein	3.10	17	Organic Matter Quality, Organic N Storage, N Mineralization
biological	Soil Respiration	0.4	24	
biological	Active Carbon	345	12	Energy Source for Soil Biota
chemical	Soil pH	7.7	67	
chemical	Extractable Phosphorus	1.0	30	
chemical	Extractable Potassium	149.9	100	
chemical	Additional Nutrients Ca: 3803.7 / Mg: 1557.9 / S: 31.1 Al: 25.0 / B: 0.88 / Cu: 0.21 Fe: 0.6 / Mn: 0.8 / Zn: 0.1		77	

Overall Quality Score: **56** / Medium

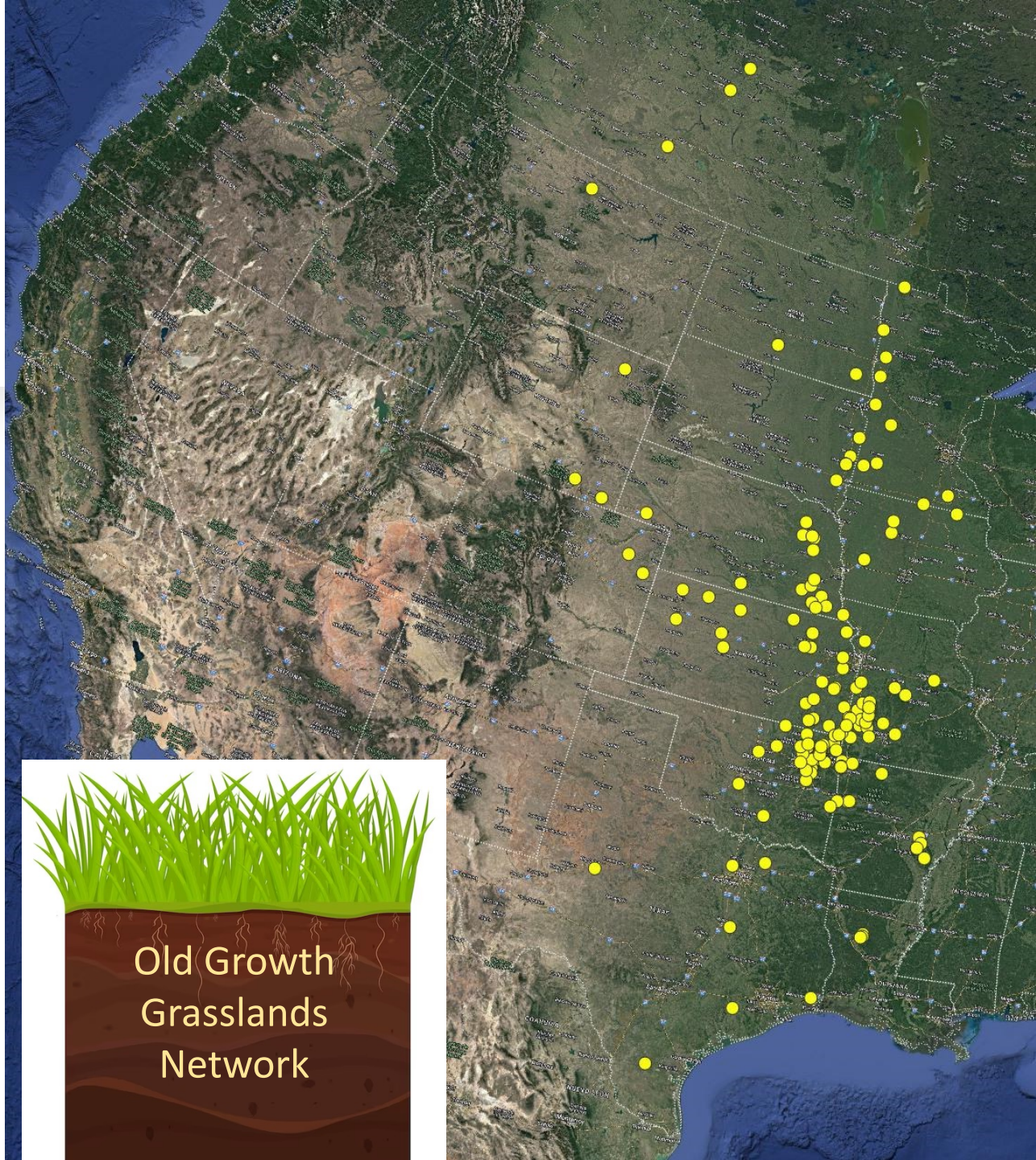
Roadmap Goal # 5
Soil Health

By 2032, comprehensive soil health will be improved across North American Grasslands to increase drought resilience, availability of livestock forage, wildlife habitat, and net carbon sequestration.

Metrics: by 2025

- Soil health data on Old-Growth Grassland Remnants collected throughout the CPG will be integrated into a newly-created, web-based, and publicly available data repository.

>> **300 literature values**
>> **website under development early spring launch of OGGN**



By 2025:

- OGG Remnants will be identified and sampled within each sub-region of the Great Plains to serve as soil health reference sites. (along with nearby agland soil)

>> 4 sites identified

>> more needed

Cornell Atkinson Center for Sustainability Seed Grant Funding:

Cornell Atkinson Center for Sustainability

Soil Health Working Group Initiated

- Team will identify several direct metrics that are easily sampled, visually-based, and inexpensive, to be conducted by landowners and rangeland managers. Possible metrics include: % bare ground, % noninvasive plant cover, soil compaction, infiltration rate, ActiveC-POXC

  >> Input from ranch managers and farmers needed

Soil Health Working Group

By 2025:

- A collaborative program of soil health outreach will be expanded throughout the Central Plains Grasslands.

- Workshops planned for Outreach Hubs
  - >> **Northern Hub in Mandan, ND @ USDA Northern Great Plains Long-term Agro-ecosystem Research Laboratory**
  - >> **Master Naturalists, Johnson Co., KS**
  - >> **Other regions needed**

- **Identify collaborating partners for USDA Soil Health Proposal September 2024**

By 2025:

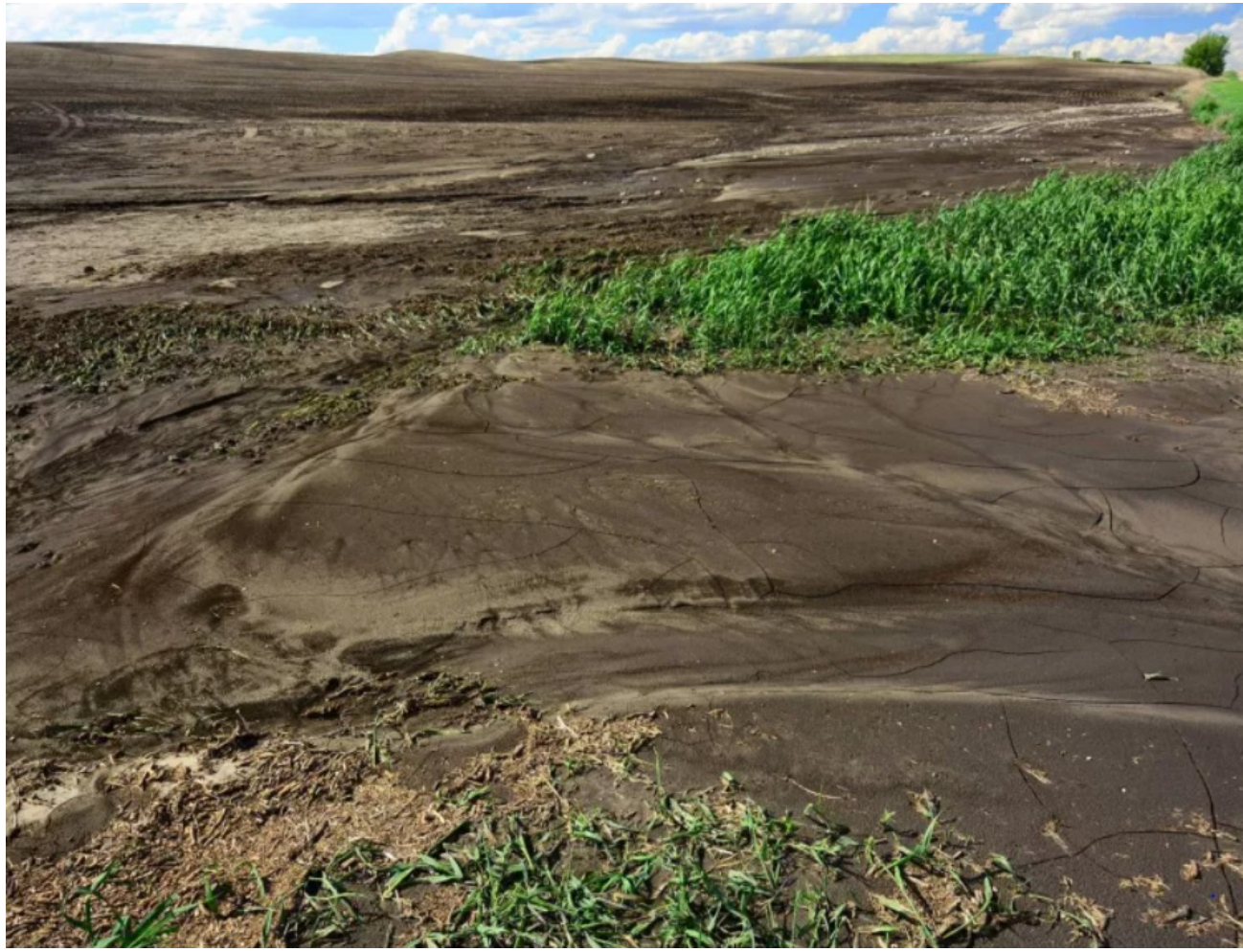
A **coordinated program of soil health monitoring** will be expanded throughout the Central Plains Grasslands.

External Progress: Saving Tomorrow's Agricultural Resources (STAR) is a model program. It provides a free tool for farmers and landowners and encourages the use of best practices and decisions that will reduce nutrient and soil loss on their fields. Adopted by Illinois, Iowa, Missouri, Colorado and expanding.

Our challenge: How to engage with the diverse, uncoordinated stakeholders, including USDA, Soil and Water CDs, private consultants, NGOs?

By 2032: no progress yet

- Soil health gap approach will be used to define goals and appropriate soil management or restoration strategies in multiple locations.
- Soil health revitalization (through regenerative agriculture practices) or restoration on the most severely degraded lands using organic matter amendments will be underway on 5% of grasslands where needed.



Sheet erosion on plowed native prairie in Stutsman County, North Dakota *Credit:Rick Bohn/USFWS*

Longer-term:

- Rates of carbon sequestration are at least maintained at current levels in the Central Grasslands, with the goal of a 30% increase of sequestration by 2032.

- Old-Growth Grassland Remnants will be protected within each sub-region of the Great Plains.

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Questions and / or Suggestions ?