Statewide Soil Health and Carbon Management Strategies

PRESENTATION TO THE WNRC COMMITTEE

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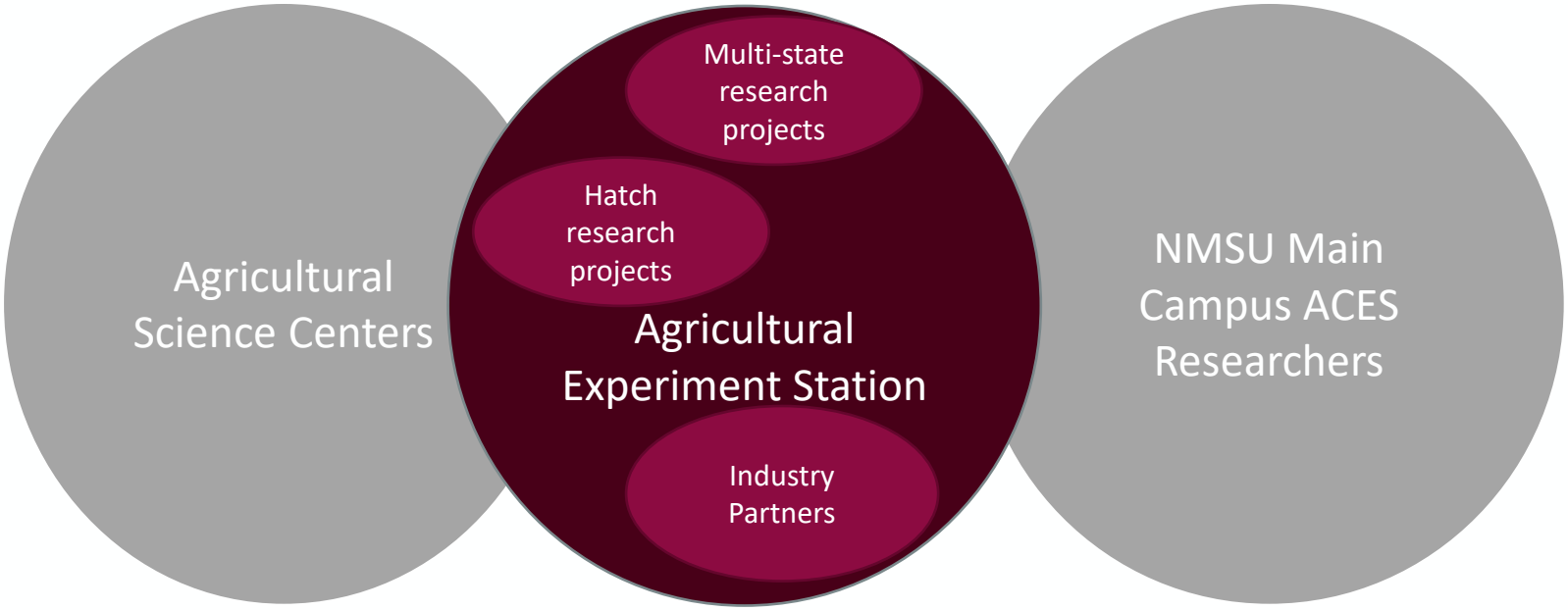
Leslie Edgar	Agricultural Experiment Station Director, Associate Dean of Research
Rajan Ghimire	Associate Professor Cropping Systems
John Idowu	Professor, Extension Agronomist

NM STATE UNIVERSITY

BE BOLD. Shape the Future.

NMSU Agricultural Experiment Station

- AES is the principal research unit for the NMSU College of Agricultural, Consumer and Enironmental Sciences (ACES). All research faculty in ACES have appointments in AES, across the main campus in Las Cruces and at the 12 agricultural science centers around the state.
- AES was defined and created by the Federal Hatch Act of 1887 to research problems and find solutions to improve the lives and livelihoods of citizens. In 1915, New Mexico constitutionally mandated AES under Article X, section 11 of the state constitution.
- AES is not a physical site, but rather a system of scientists who work on the Main Campus in Las Cruces and 12 agricultural science centers (ASCs). In 2022, there were 358 FTE associated with AES.



AES Overview

AES Supports Research Designed to:

- Enhance agricultural profitability
- Stimulate economic development using natural resources
- Improve the quality, safety and reliability of food and fiber products
- Sustain and protect the environment with ecologically sound practices
- Manage and protect natural resources
- Improve the quality of life for the people of New Mexico

Academic / Research Departments

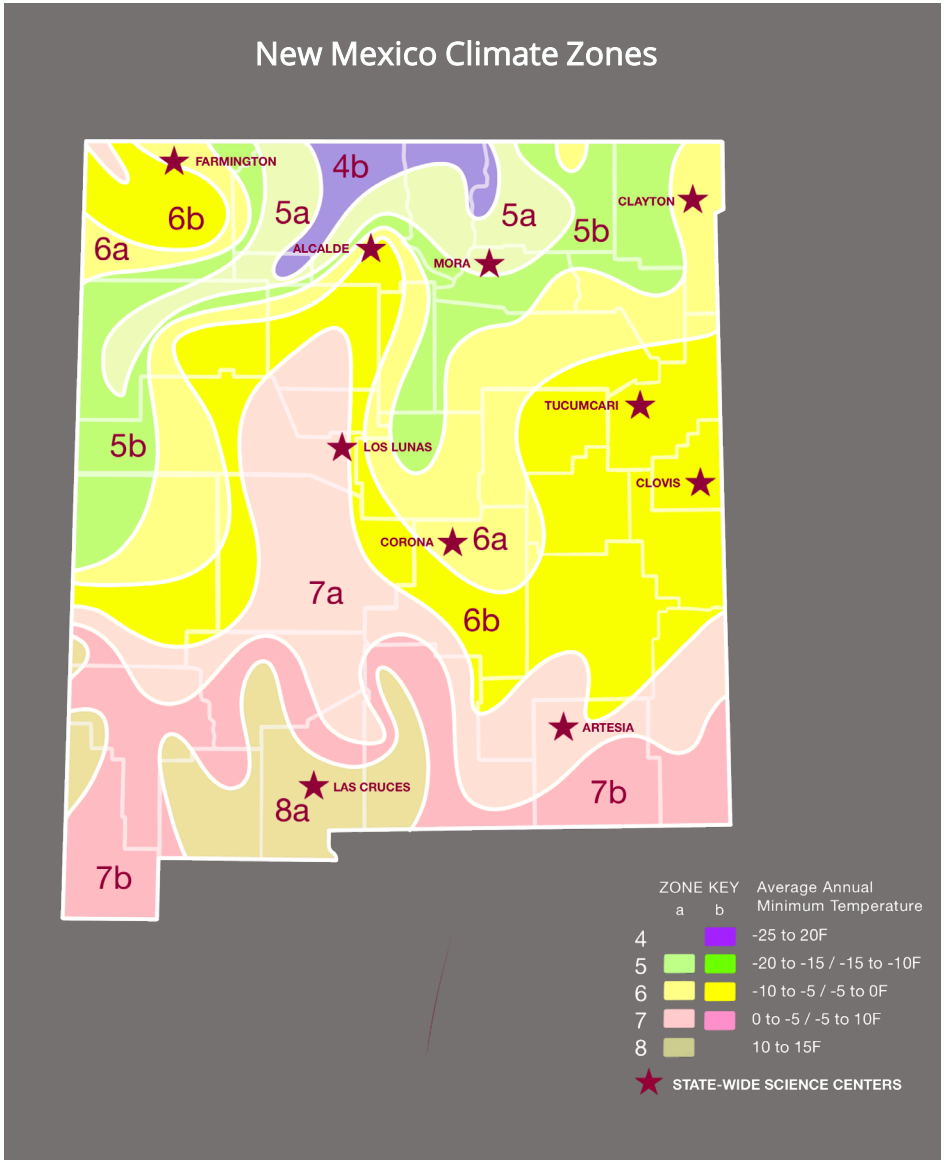
- Agricultural and Extension Education
- Agricultural Economics & Agricultural Business
- Animal & Range Science
- Entomology, Plant Pathology, & Weed Science
- Family & Consumer Sciences
- Fish, Wildlife & Conservation Ecology
- Plant & Environmental Sciences
- Hotel, Restaurant, & Tourism Management

Agricultural Science Centers

- Alcade Sustainable Agriculture Science Center
- Artesia Agricultural Science Center
- Chihuahuan Desert Rangeland Research Center
- Clayton Livestock Research Center
- Clovis Agricultural Science Center
- Corona Range and Livestock Research Center
- Fabian Garcia Research Center
- Farmington Agricultural Science Center
- Leyendecker Plant Science Center
- Los Lunas Agricultural Science Center
- Mora John T. Harrington Forestry Research Center
- Tucumcari Agricultural Science Center

AES Overview

- Each of the 12 agricultural science centers (ASCs) plays an integral role in supporting fundamental and applied science and technology research to benefit New Mexicans.
- Strategically placed agricultural science centers (ASCs) allows research to inform agricultural producers from around the state about best practices and advancements specific to their climate zone.
- AES oversees more than 100,000 acres, making NMSU one of the largest land holding Land-grant universities in the nation.



The Need

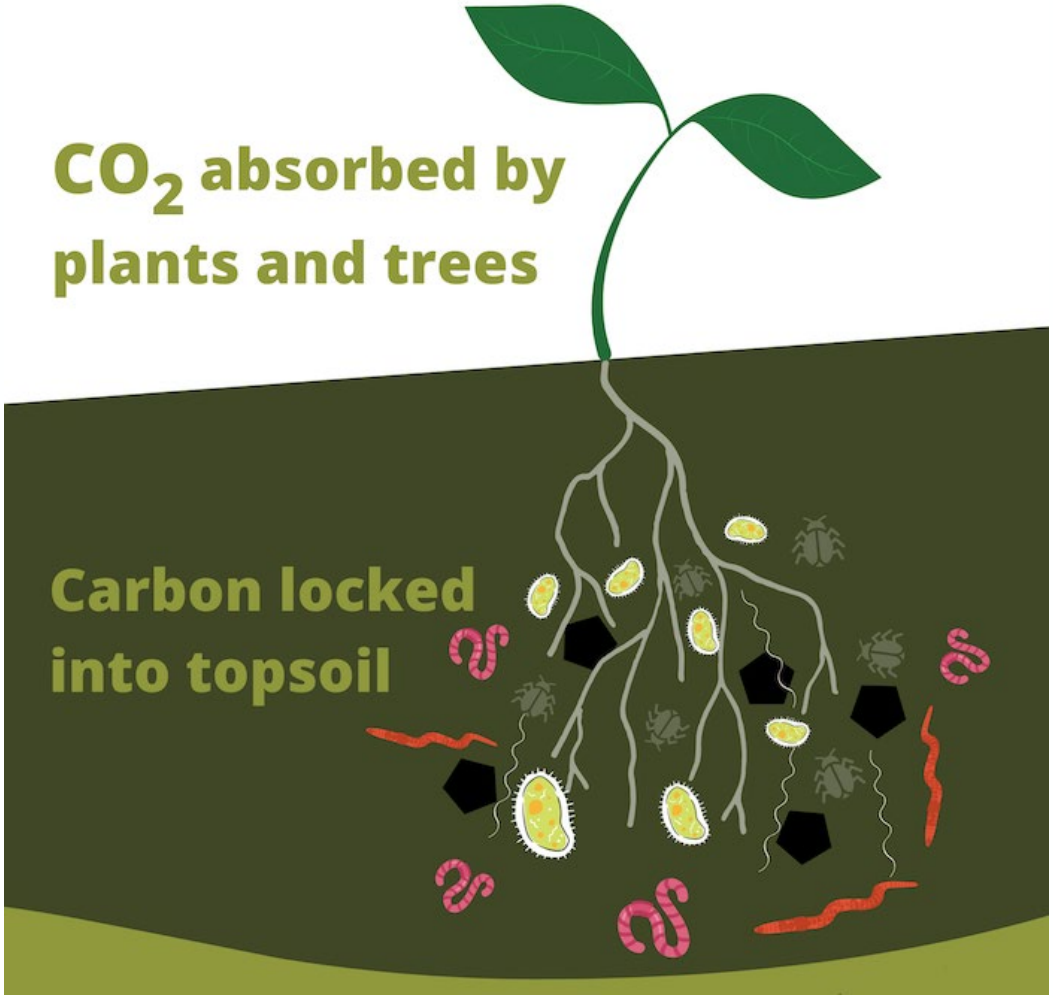
Climate change and variability have threatened the livelihood of rural communities in New Mexico

- Increasing frequency of wildfires
- Episodic droughts and floods affect agricultural sustainability and food security

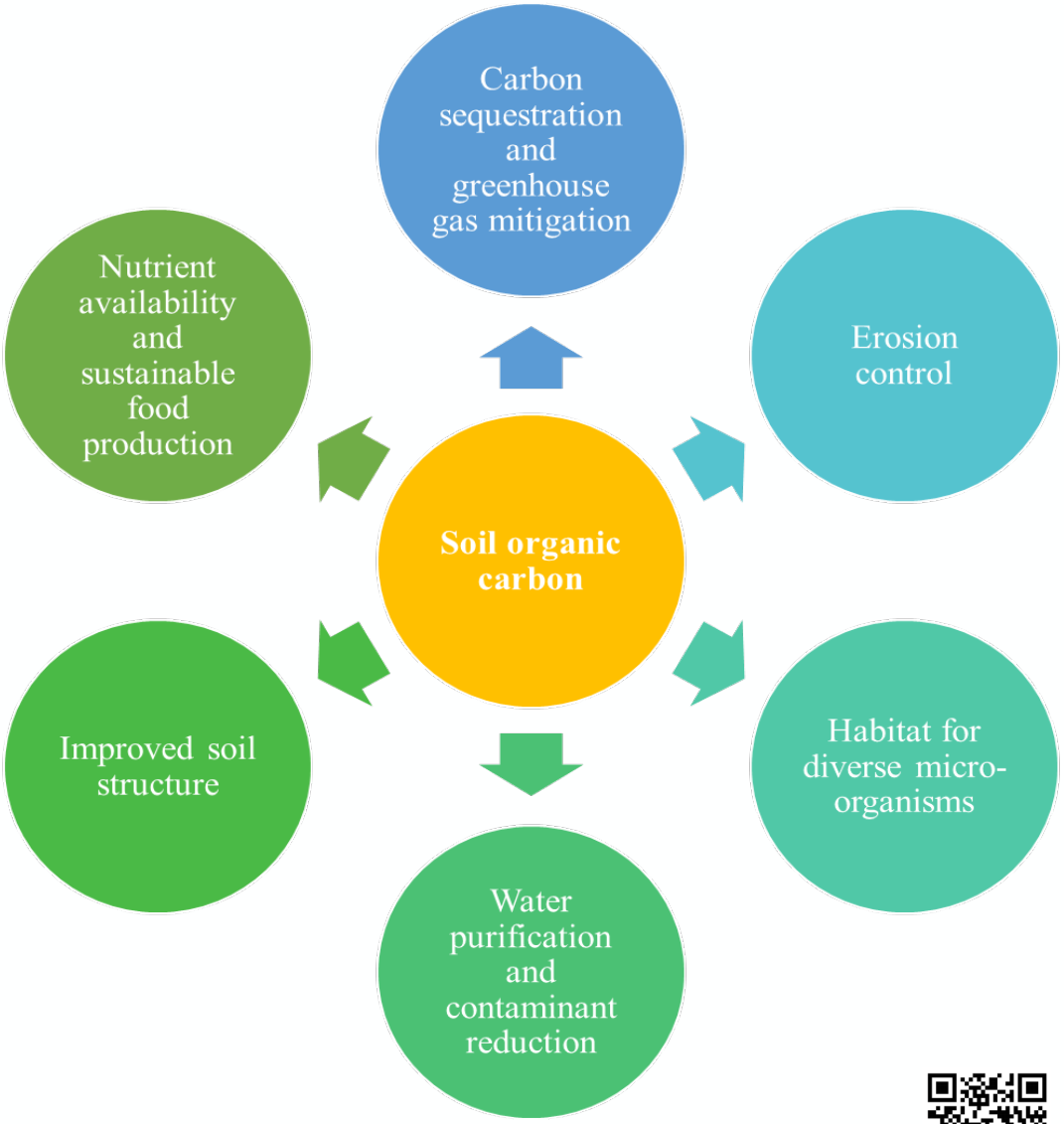
There is a need to find tools to improve the sustainability of agriculture in arid and semi-arid regions

Carbon Sequestration:

an approach to mitigate climate change and improve agricultural sustainability



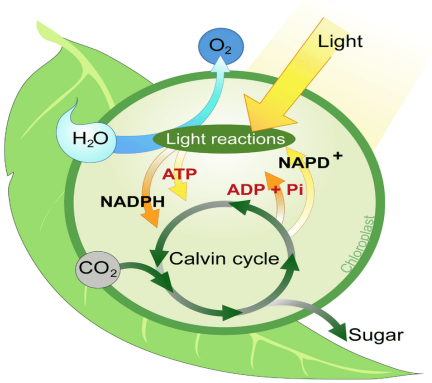
Soil Carbon Sequestration and Ecosystem Services



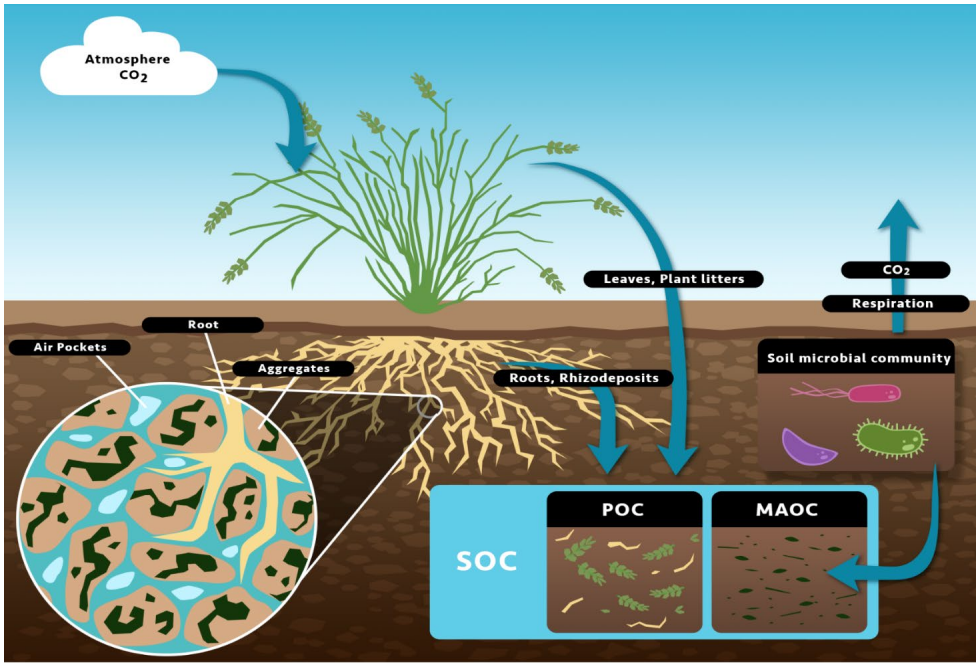
(Ghimire et al., 2022, J. Carbon Mgmt.)

More Carbon per Drop:
One Solution for Two Major Issues Facing Arid and Semi-arid Regions

- Identifying water efficient crops and cover crops
- Breeding crops for carbon sequestration and water use efficiency



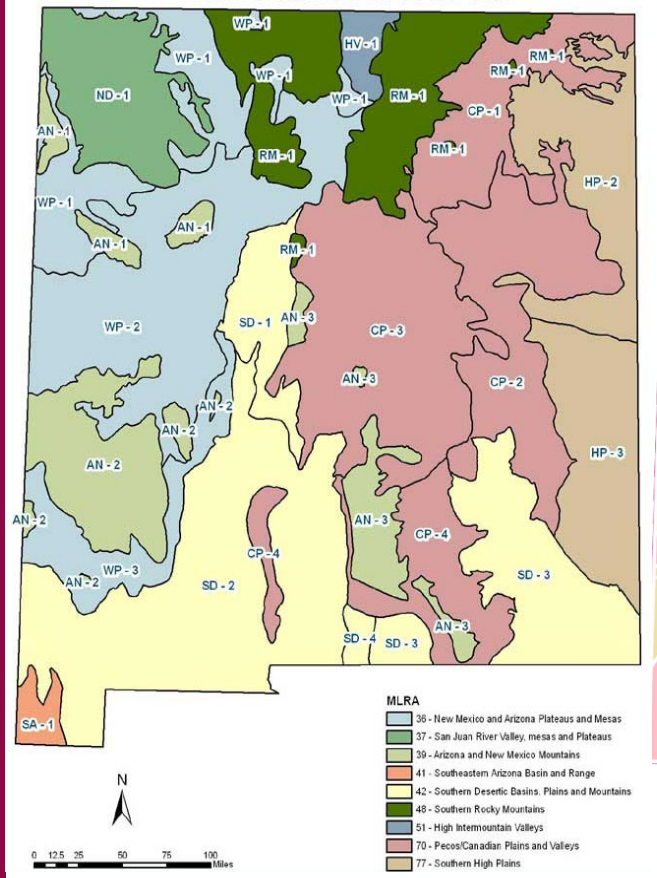
$$WUE = \frac{\text{Grain}}{\text{Water}}$$

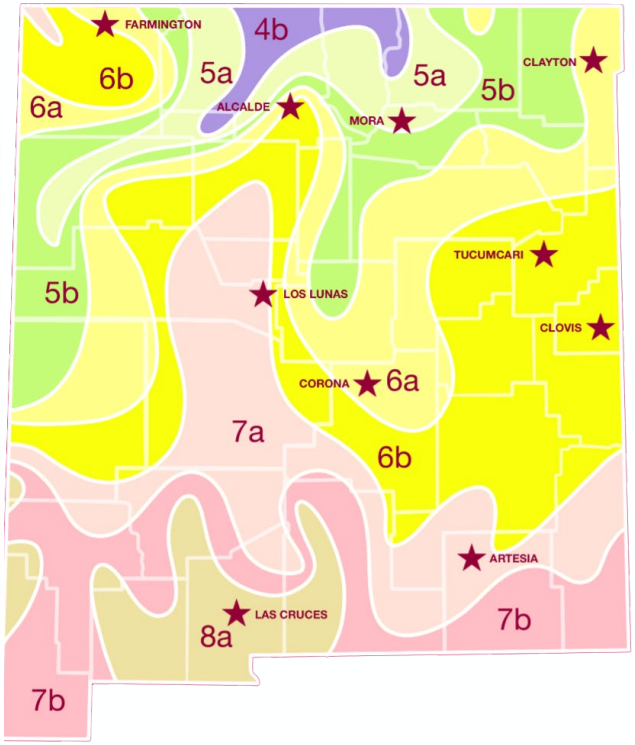


Increasing soil water storage and conservation efficiency

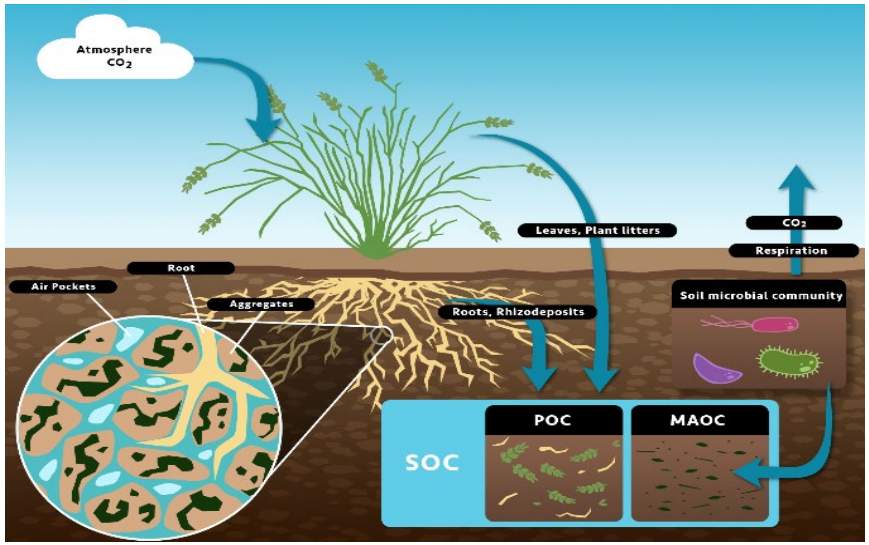
(Ghimire et al., 2022, J. Carbon Mgmt.)

Unique Opportunities for NMSU



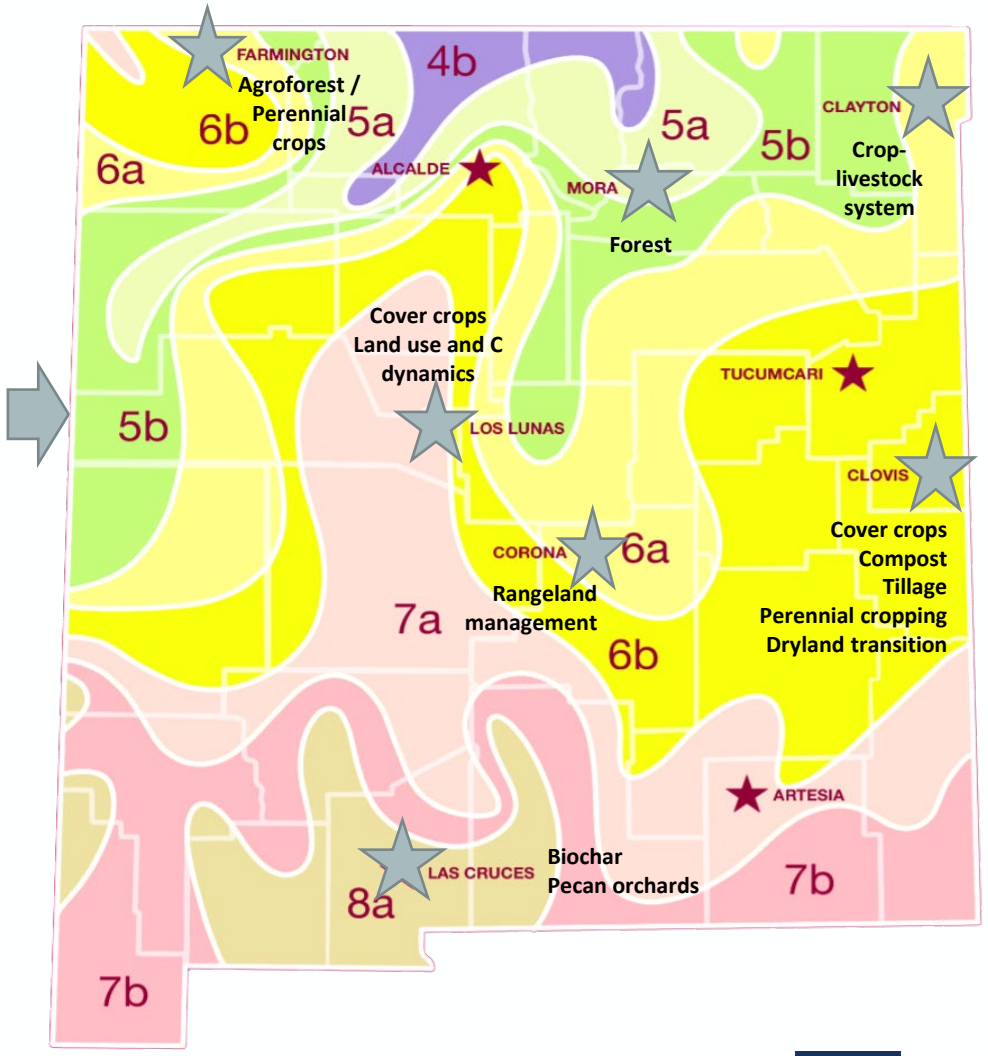


Carbon Management and Soil Health Projects Across New Mexico



Action items

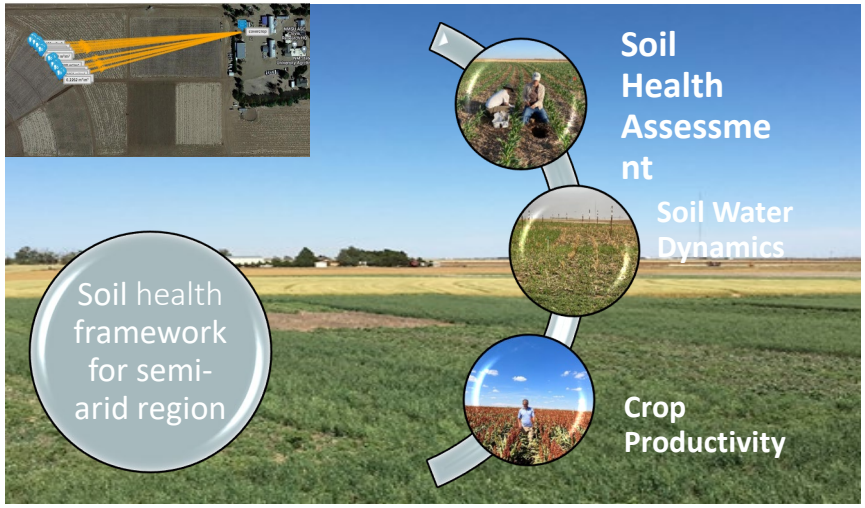
- Establish a baseline of C sequestration through demonstration of C farming practices
- Carbon literacy survey and outreach activities
- Undergraduate and graduate student engagement
- Expanding C management efforts on rangeland



NRCS

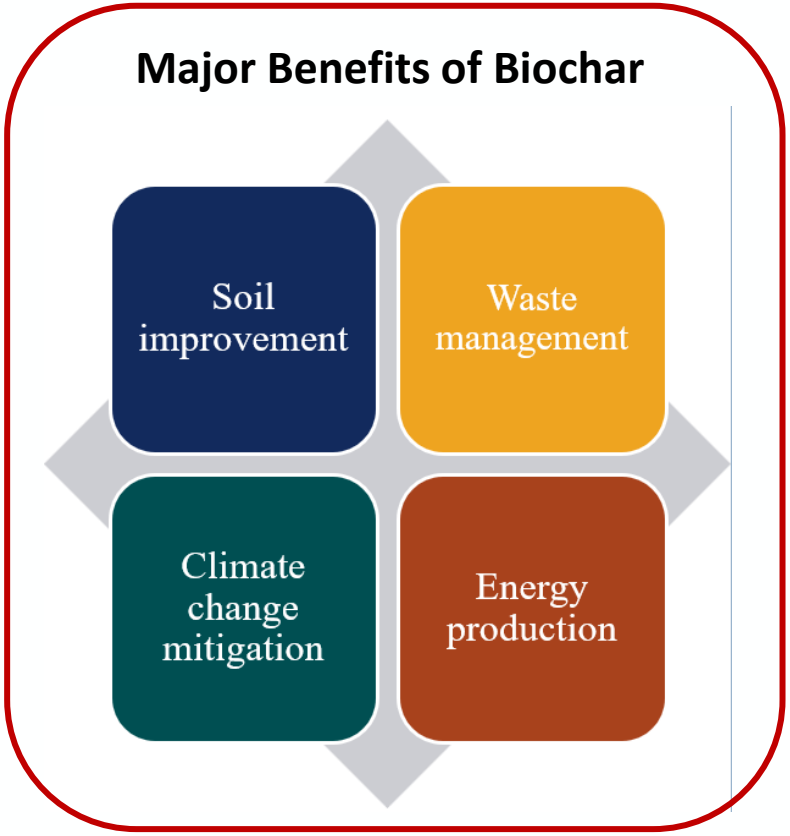
NMDA
New Mexico Department of Agriculture

Glimpse of Soil Health and Carbon Management Education and Outreach Activities at ASC Clovis

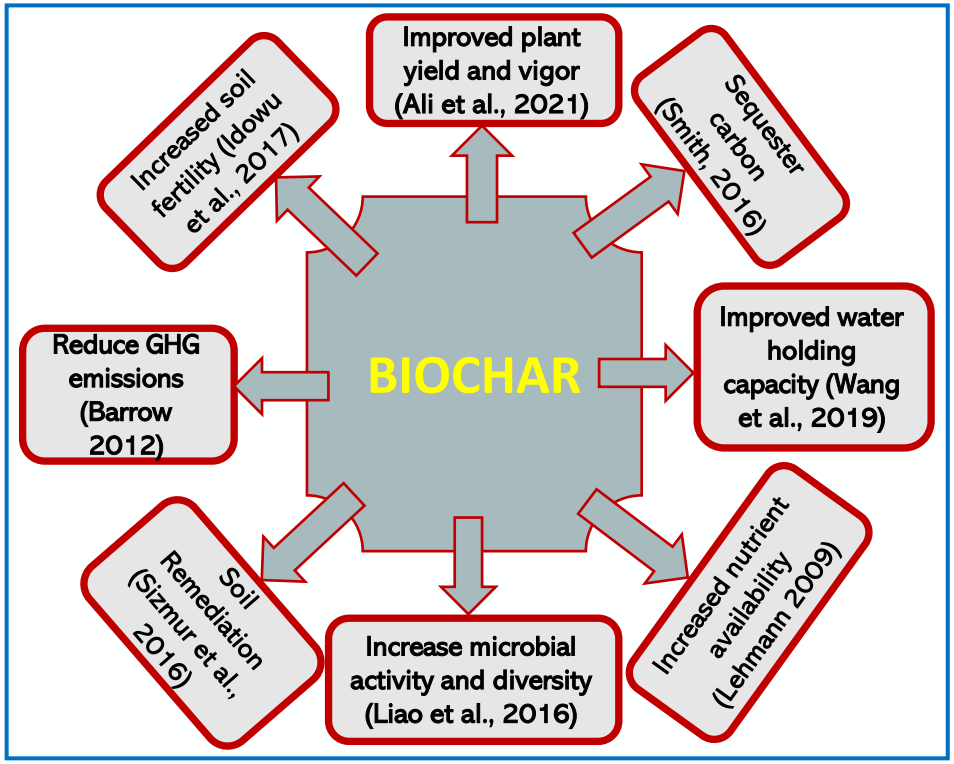


What is Biochar?

- Biochar is charcoal produced by pyrolysis
- Pyrolysis is burning organic materials in a low-oxygen environment (200°C – 800°C)
- Depending on the feedstock, the carbon content of biochar can be between 60 – 95%
- Biochar is often applied to the soil for the benefit of crop productivity and soil health
- The carbon in biochar can last for decades to centuries in the soil if the soil is undisturbed
- Biochar application leads to carbon sequestration preventing carbon loss as carbon dioxide.
- 1 ton of biochar can sequester 2.74 tons of carbon dioxide (Muñoz et al., 2017)



Biochar, Soil Health, and Climate Change Mitigation



Biochar Studies/projects at NMSU

- Producing biochar from pecan wood waste
- Biochar effects on soil quality and crop growth in a sandy soil
- Effects of different biochar feedstock on soil quality
- Using biochar from halophytes for remediation of salt-affected soils
- Impacts of pecan waste biochar on soil quality
- Compost-biochar effects on soil health, crop yield, soil moisture and greenhouse gas emission.

Producing Biochar from Pecan Wood Waste

- Estimates of pecan wood waste in Dona Ana County could be more than 41,000 tons/year
- Open burning of biomass leads to CO_2 emission
- Converting the wood waste to biochar and applying to the soil will sequester carbon
- A project funded by NMDA-Healthy Soil Program focused on training farmers to convert pecan wood waste to biochar is on-going
- Yearly field days have been held to demonstrate the “Ring of Fire” biochar kiln

Conclusions from Different Studies

- Significant benefits of biochar on soil fertility, soil moisture and soil structure were observed in multiple trials.
- Biochar led to higher microbial diversity and activity.
- After 4 years of applying a biochar made from wood at 10t/ac, the soil organic matter increased by 13%, soil aggregation by 148%, and total microbial biomass by 122%.
- Compost-biochar blend after 1 year led to higher crop yield (13% increase) and better soil biological properties (16% increase in total microbial biomass).
- Different types of biochar affect the soil in varied ways – depending on feedstock, condition of pyrolysis and soil type.

Contact Information

Dr. Leslie Edgar, Director Agricultural Experiment Station, Associate Dean of Research

NMSU College of Agricultural, Consumer, and Environmental Sciences

(575) 646-3125 / ledgar@nmsu.edu

Rajan Ghimire, Associate Professor, Cropping Systems & Soil Health

NMSU College of Agricultural, Consumer, and Environmental Sciences

Agricultural Science Center at Clovis

(575) 985-2292 / rghimire@nmsu.edu

John Idowu, Professor, Extension Agronomist

NMSU College of Agricultural, Consumer, and Environmental Sciences

(575) 646-2571 / jidowu@nmsu.edu