Importance of proper Grazing Mgt.

Sandy Plains Ecological Site

Photo credit: Brenda Simpson (NM NRCS State Range Mgt. Specialist)

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Soil Health Division
Natural Resources Conservation Service
Sandy Plains Ecological Site

Photo credit: Brenda Simpson (NM NRCS State Range Mgt. Specialist)

Importance of proper Grazing Mgt.
Southern Desert MLRA 42 - Managed grazing
Sandy soils 8-10 inch precipitation

Southern Desert MLRA 42 - Heavy use
Sandy soils 8-10 inch precipitation

Photo credit: Brenda Simpson (NM NRCS State Range Mgt. Specialist)
Soil Health & Assessments Training in NM

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The focus has to be on Healthy Soil

(http://www.nrcs.usda.gov/wps/portal/nrcs/detail/nm/technical/?cid=nrcs144p2_068965)
Healthy Soil have:

1. Higher Soil Organic Matter levels (The KEY to Soil Health)
2. Water-Stable Aggregates (minimal Wind & Water Erosion)
3. Good Soil Tilth (Granular Structure)
4. Higher Infiltration Rate (Less Runoff)
5. Earthworms (are present & in Higher Numbers)
6. Higher Water-Holding Capacity (higher OM content)
7. Lower Soil Temperature (reduced ET)
8. Lower Evaporation (Importance of Surface Cover)
9. Higher Drought Tolerance (Improved water-use efficiency)
10. Higher Buffering Capacity (higher OM content)
11. Higher Salinity Tolerance
12. Optimized Gas Exchange (Oxygen & Carbon Dioxide)
13. Optimized Nutrient Cycling (Soil has a Diverse Soil Food Web)
14. No Compaction (allows for Deep Roots)

All 5 Biological Spheres are Present:
(1) Rhizosphere, (2) Aggregates, (3) Porosphere (macro pores),
4) Earthworms, and (5) Detritusphere (surface residues)

Healthy Soil (i.e., a diverse Soil Food Web (SFW))

Photo: Dr. João Carlos De Moraes Sa
Soil Health Workshops in NM

Since 2009, NRCS NM has conducted over 80 producer Soil Health workshops throughout NM.
Soils Workshop at Tierra Amarilla, NM, 2010

Site-visit at the Singing Frogs farm in California
Soil health adoption

- Be an advocate for change in your county
- Learn the principles of soil health and the definition and be able to quote them from memory
- Self educate and don’t be afraid to say you do not know but will find out, to producers
- Seek out early adopters to learn from or help someone to become an early adopter in your county
- Be sure to follow through on any activity you suggest to the producer don’t leave him wondering or your credibility will be diminished.
Crownpoint, NM

Soil Health Workshops in NM

Villanueva, NM

Tome, NM
2017 NEDC Soil Health & Sustainability Course (NM)

“Understanding Soil Health Function”

Soil Health Specialist is clearly stunned!
Soil Health Learning is a Lifetime Journey

Soil Health Journey: Attaining Balance/Synergy & Understanding Your Local Context

IMPORTANT!
You are riding on the management decisions you've made. Your actions will have Productivity & Soil Health consequences.

Cover Crop Challenge: must be Site-Specific and Case-by-Case to account for local conditions.

The Soil Health Mgt. System (SHMS) Gear (i.e. Conservation Plan), that you designed, drives the Biological, Physical & Chemical gears (i.e., components of the living soil).

Rudy Garcia, 2014

(Ref.: Building Soils For Better Crops – Sustainable Soil Management 3rd Edition)
Emphasis on understanding how soil functions

- **Paradigm shift #1** Stop treating the symptoms of dysfunctional soil; solve the problem of dysfunctional soil.

- **Paradigm shift #2** Restoring soil function can be accomplished without going broke.
  - Apply basic principles of ecology to create quality habitat.
  - There is no waste in Nature.

- **Paradigm shift #3** Conservation practices do not restore soil health, understanding soil function restores soil health.
Change the way you think about soil. Specifically, what were you taught about fertility, nutrient management & weeds? AgLearn/traditional agronomy & nutrient management doesn’t tell the whole story, as we concentrate on what is above ground (crop).

How well is your soil system feeding and watering your plants?

Diversity in root systems = diversity in soil biota

When you hear the word “soil” what do you think of?

Approximately 2/3 Of Your OM Increase Will Come From Roots!
“As to methods, there maybe a million and then some, but principles are few. The man who grasps principles can successfully select his own method” (Ralph Waldo Emerson)
Soil Health Research Landscape Tool
This tool consolidates and categorizes publicly available information, a first step to identifying and addressing priority gaps in soil health research. To search, enter a keyword and/or use the advanced search options, including the five tabs shown in the diagram: Problems, Indicators, Actions, Functions and Outcomes. To search for more than one keyword at a time, please enter [keyword] AND [keyword] (Note upper case).

http://www.soilhealthinstituteresearch.org/Home/Search
Acknowledgments: Thanks to all the USDA-NRCS Soil Health Division Specialists/Leadership, various NRCS employees that I’ve worked with, many producers, conservation partners, Ag consultants, and other professional soil health practitioners and researchers who have shared their work, expertise/knowledge and experience on how to build healthy and productive soils.

SOIL HEALTH:

The capacity of a soil to function as a vital, living ecosystem that sustains plants, animals, and humans.
Acknowledgments: Special thanks to my parents, Ben and Ramoncita Garcia, who provided the example and inspiration on how to grow diverse crops and all the details that are required in building healthy and productive soils.
My parents were one of the first producers to sell at the Santa Fe, NM Farmers Market in 1971. We grew a diverse rotation of vegetables, flowers, fruit trees, cover crops, and applied compost, and grazed crop residues with sheep & goats. We were able to produce high quality crops & high yields for many years using soil health principles.
In the early 90’s, while working as a field agronomist in NM, I came to the understanding of the absolute importance of having a “living soil” that builds “water-stable macro-aggregates” that are well-aerated.

Hand-drawn soil macro-aggregate illustration that I did in 1997.
Soil Macroaggregates: formed by a healthy soil

Soil Microaggregates: consisting of silt, clay, humus, iron & aluminum oxides, lime (i.e., depending on soil pH), precipitated minerals (e.g. calcium phosphate).

Soil Microaggregates: < 0.25 mm dia.

Root Hairs: 0.01-0.05 mm dia.

Mycorrhizal fungi: (0.002 – 0.007 mm dia.) Hyphae can grow 5 – 15 cm from the root. Glomalin coats & aggregates the soil particles.

Coarse Sand: 1.0 - 0.5 mm
Med. Sand: 0.5 - 0.25 mm
Fine Sand: 0.25 - 0.10 mm
Silt: 0.05 - 0.002 mm
Clay: < 0.002 mm

The Blue background is water held in the aggregate.

Particulate Organic Matter

Micropores (< 0.06 mm dia.)

Bacterial Colonies (Bacteria: 0.0005 - 0.005 mm dia.)

Water held between the aggregates.

Soil Pore (RH = 100%)

RH = Relative Humidity

Rhizosphere

Fine feeder root: (≈ 0.3 mm dia.)

Clay coating on sand.

Rhizosphere

Sand

0 (3.2 mm = 1/8 inch) 1 mm 2 mm 3 mm
Diagnosing Soil Health: i.e., using Soil Health Assessments

- Connects above and below
- Ultimate recycler of C, N, O, and other nutrients
- Drives physical, chemical, and biological processes

Biodiversity with minimal soil disturbance drives soil health (NOTE: the Soil Food Web is sustained by Root Exudates, Glomalin, Crop Residues/roots, Manure, Compost, Predator-Prey relationships, Plant Symbiosis, and Soil Humus).

Unleashing Soil Health (understanding Dynamic Soil Properties)

Soil Health Indicators/Observations:

- Crop Condition
  - % Surface Residues (signs of decomposition)
  - % Soil Organic Matter
  - Is Topsoil is clearly defined

- Stable Aggregates (Slake test)
- Soil Structure
- Infiltration rate
- Good Gas exchange (porous soil)
- CO2 Respiration
- Surface & Sub-surface Compaction
- Temperature (Surface and Soil)
- Soil Aroma
- Soil Color

CSHA
PLFA
Soil Fertility
Earthfort (SFW)

What is the condition of your Soil Livestock (i.e. Soil Food Web)?
Soil functions

Soils deliver ecosystem services that enable life on Earth:

- Provision of food, fibre and fuel
- Provision of construction materials
- Cultural heritage
- Foundation for human infrastructure
- Source of pharmaceuticals and genetic resources
- Flood regulation
- Climate regulation
- Water purification and soil contaminant reduction
- Nutrient cycling
- Habitat for organisms

Food and Agriculture Organization of the United Nations
Soil is the Heart of the System

- Connects above and below
- Ultimate recycler of C, N, O, etc.
- Drives physical, chemical, and biological processes