



Soil Health & Restoring Soil Function

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Growing ag Media Interest



The collage features several articles and website screenshots:

- MISSOURI RURALIST**: "What lies beneath" - A photo of a person in a field.
- Put the soil first** - A table titled "Soil health summary profiles of experienced practitioners" with columns for Name, Location, and Key Points.
- Conservation Steps to build healthy soils** - An article by Lynn Betts with key points on soil health.
- Emulate nature to build organic matter** - An article by Lynn Betts.
- AGWEB** - A website screenshot for "AGWEB POWERED BY FARM JOURNAL" with links to News, Weather, Markets, Crops, Livestock, and Business.
- Manage Soil Microorganisms for Healthier Soil** - An article by Lynn Betts.
- Soil Health** - A section titled "SOIL HEALTH" with a sub-header "DIVERSITY" and a paragraph about soil health.
- Crop Production**: "Cover crop mix offers best bet" - An article by Lynn Betts.
- THE FURROW**: "SOIL TEST QUEST" - A photo of a person in a field.
- Cover crop mix offers best bet** - A photo of a field with cover crops.

NRCS Soil Health Campaign



Unlock the Secrets in the Soil

Step up for critical updates on Soil Health resources.

Unlock the SECRETS of the SOIL

Soil is a living and thriving natural resource. It's the foundation of food production and the source of many of the most important ecosystem services of our time. The resources on this web health website of our site are designed to help visitors understand the science and benefits of soil health and to learn about soil health management techniques and practices that can improve soil health.

PROFILES IN soil health

Junny Estepone
Dewey County Challenge
2,000 acres
Crops: Wheat, alfalfa, corn, soybeans
Covers: Multi-species

Farming Changes Focus on Soil Health

Julie Taylor, who farms on the Fair-Field Ranch, has changed her farming practices to include no-till farming methods, planting cover crops, composting to augment soil fertility, and ultimately growing both top soil and crops.

- ✓ Raised awareness
- ✓ Expanded demand for system adapted information
- ✓ Raising many good questions

Mainstream Media



Farmers Put Down the Plow for More Productive Soil

The New York Times

Science Friday

Oprah's New Farm!

The PLATE

the guardian

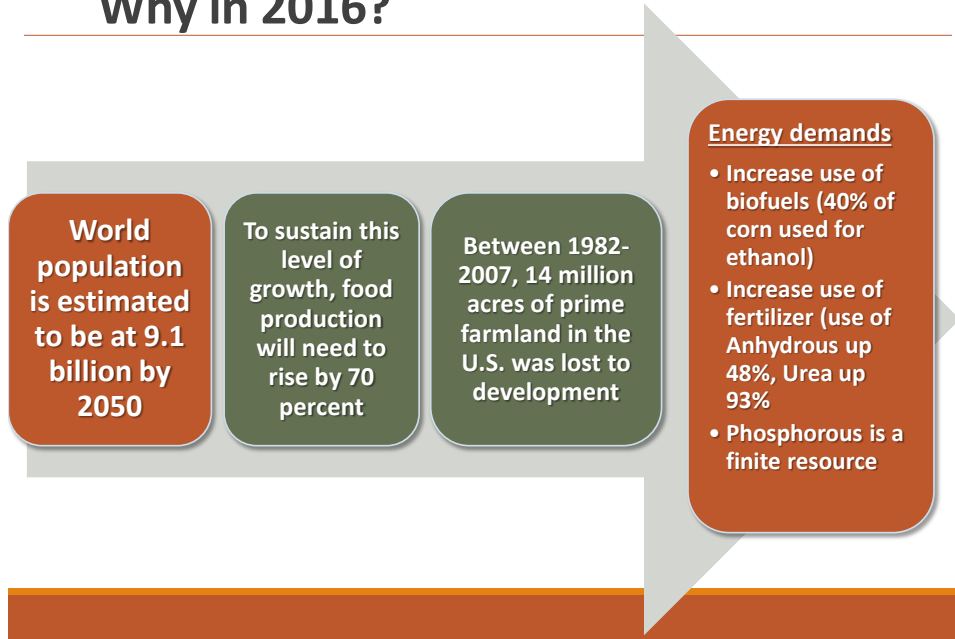
Healthy Soil is the Best Crop

We're treating soil like dirt. It's a fatal mistake, as our lives depend on it

George Monbiot



Why in 2016?



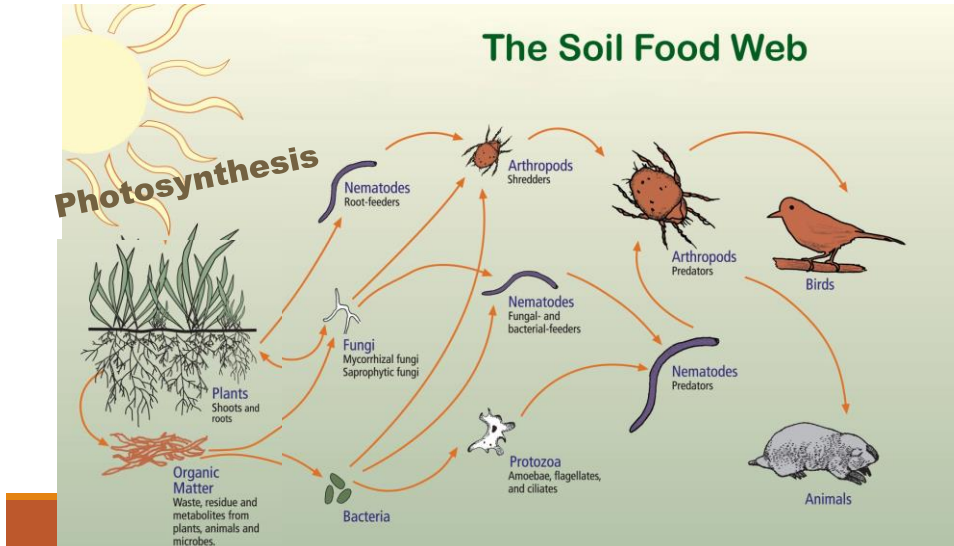
Soil Health What is It?

The continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals, and humans

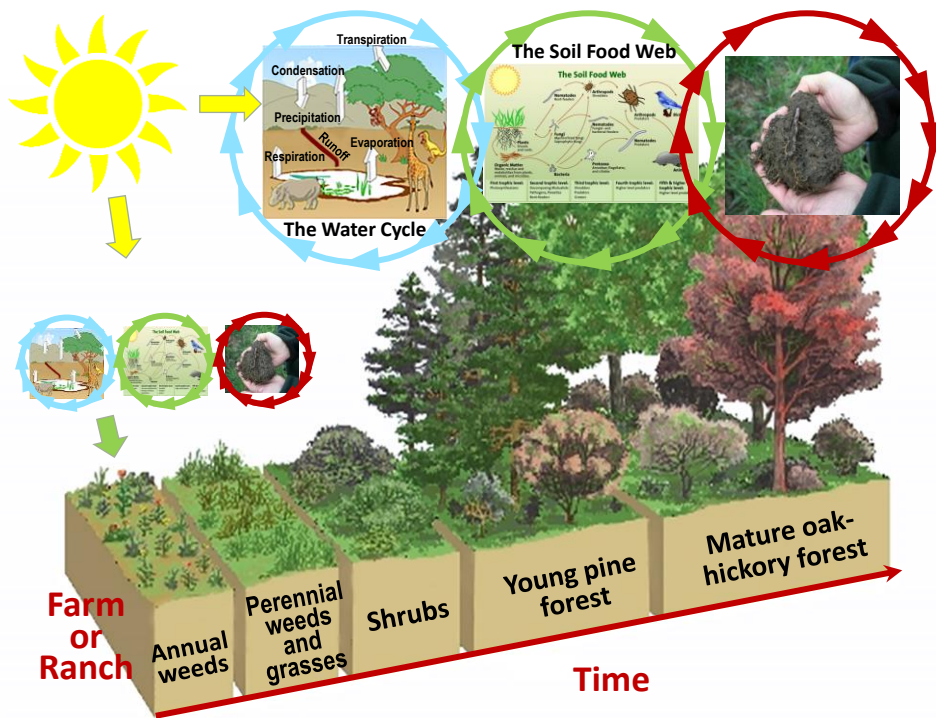
- Nutrient cycling
- Water (infiltration & availability)
- Filtering and Buffering
- Physical Stability and Support
- Habitat for Biodiversity (90% is mediated by soil microbes)

How does the soil function?

What is the main source of energy for the organisms in this diagram?





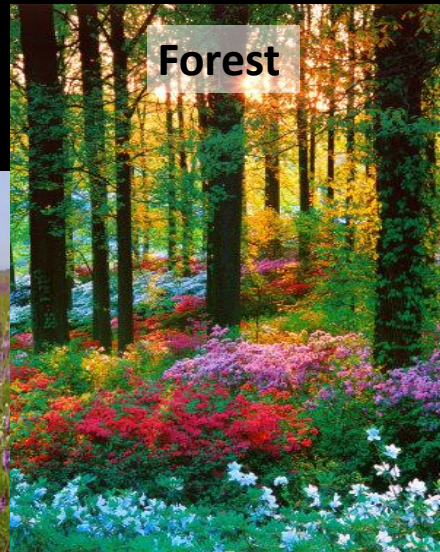


**How do these
Ecosystem Flourish
Without Human
Inputs?**

Prairie

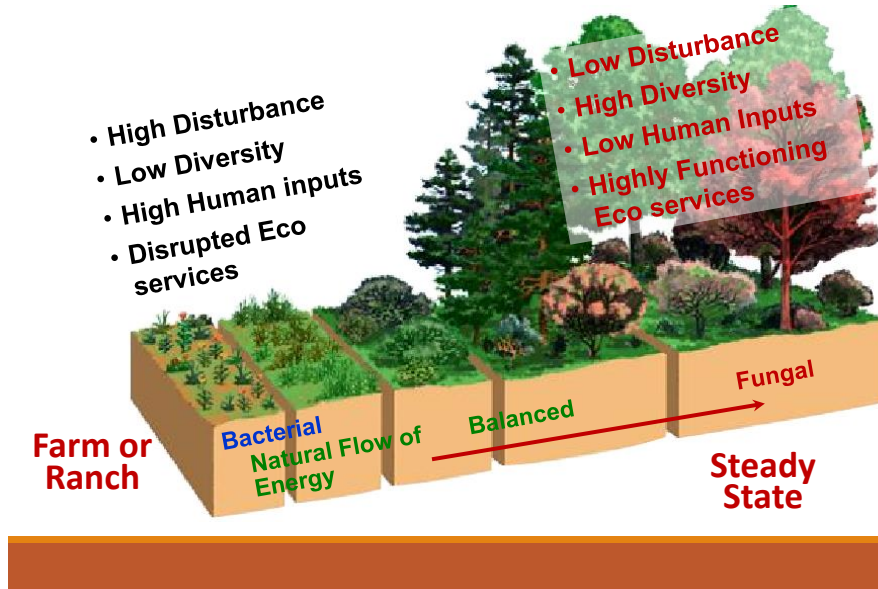


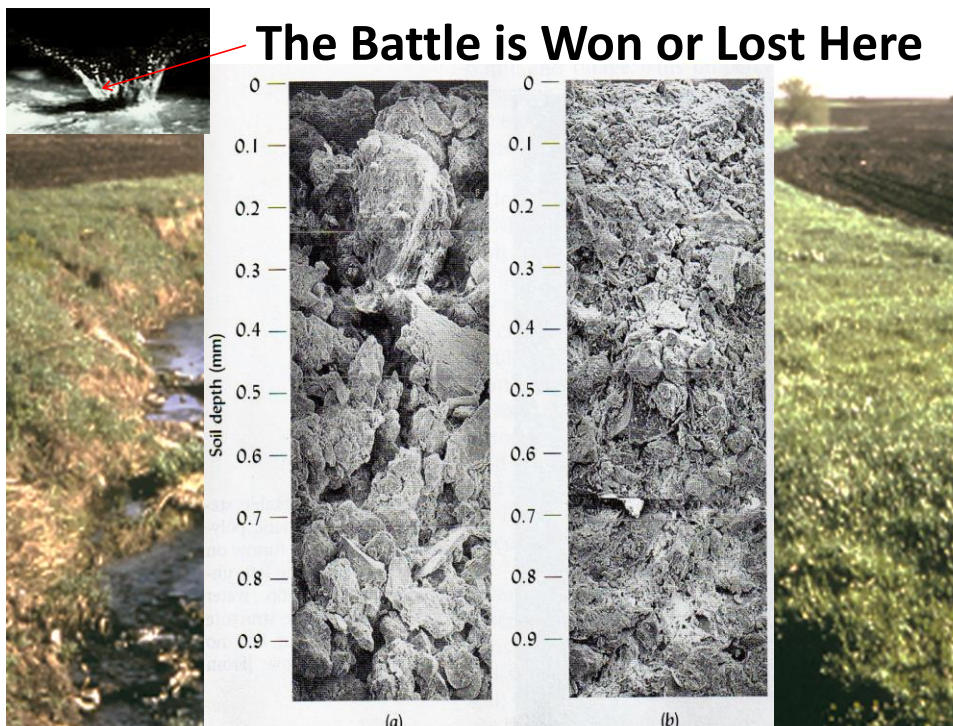
Forest





Characteristics of a Stable Ecosystem







Understands Soil Function !



Does Not Understand Soil Function!





Soil Disturbances that Impact Soil Health

Physical

- Tillage
- Compaction

Biological

- Lack of Plant Diversity
- Over grazing

Chemical

- Misuse of fertilizer, pesticides, manures and soil amendments



What is Tillage?

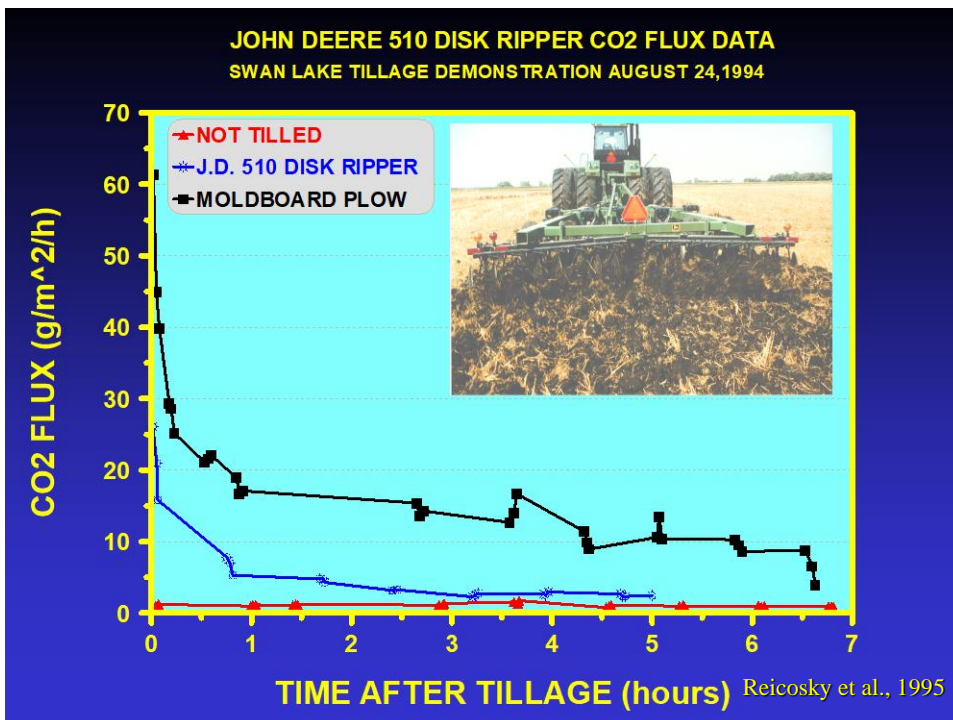
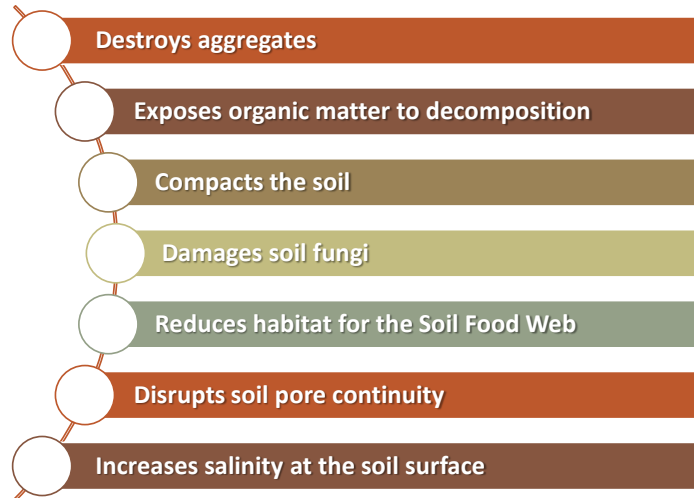
The physical manipulation of the soil for the purpose of:

- Management of previous crop residue
- Control of competing vegetation (weeds)
- Incorporation of amendments (fertilizer/manure)
- Preparation of a soil for planting equipment
- Recreation for folks who don't fish or golf.





What Tillage does to the Soil



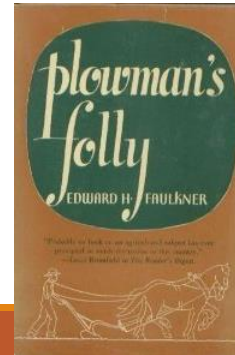


“The truth is that no one has ever advanced a scientific reason for plowing” Ploughman's Folly by E.H. Faulkner

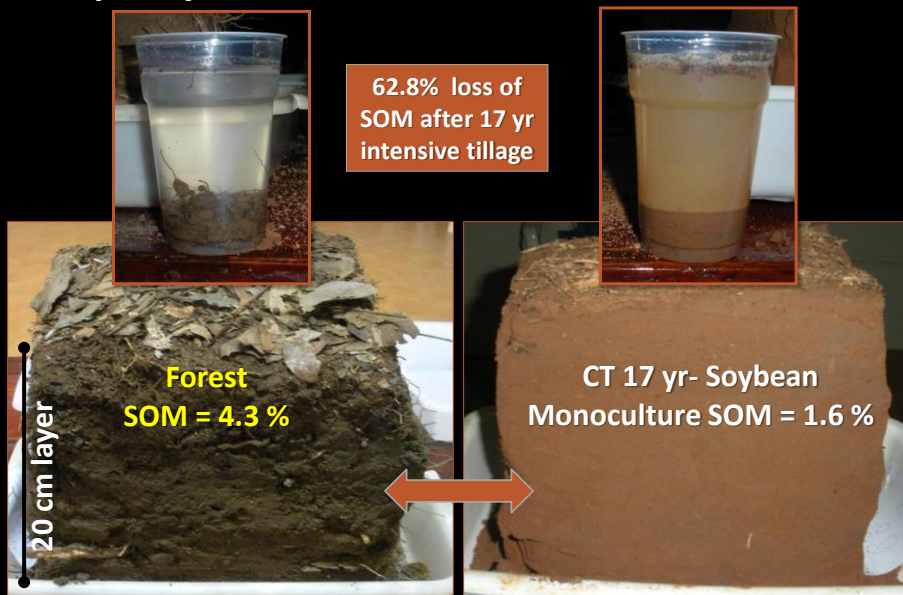
“We have equipped our farmers with a greater tonnage of machinery per man than any other nation. Our agricultural population has proceeded to use that machinery to the end of **destroying the soil in less time than any other people has been known to do it in recorded history.**”

“The chief trouble with our farming is that **we have concerned ourselves with the difficult techniques of supplying our farm crops with new materials for growth, when we could easily take full advantage of the almost automatic provisions of nature for supplying plants with complete rations in secondhand form.**

We have made a difficult job of what should be an easy one”



Management Changes Soil Properties & Capacity of Soil to Function





Biological Disturbance

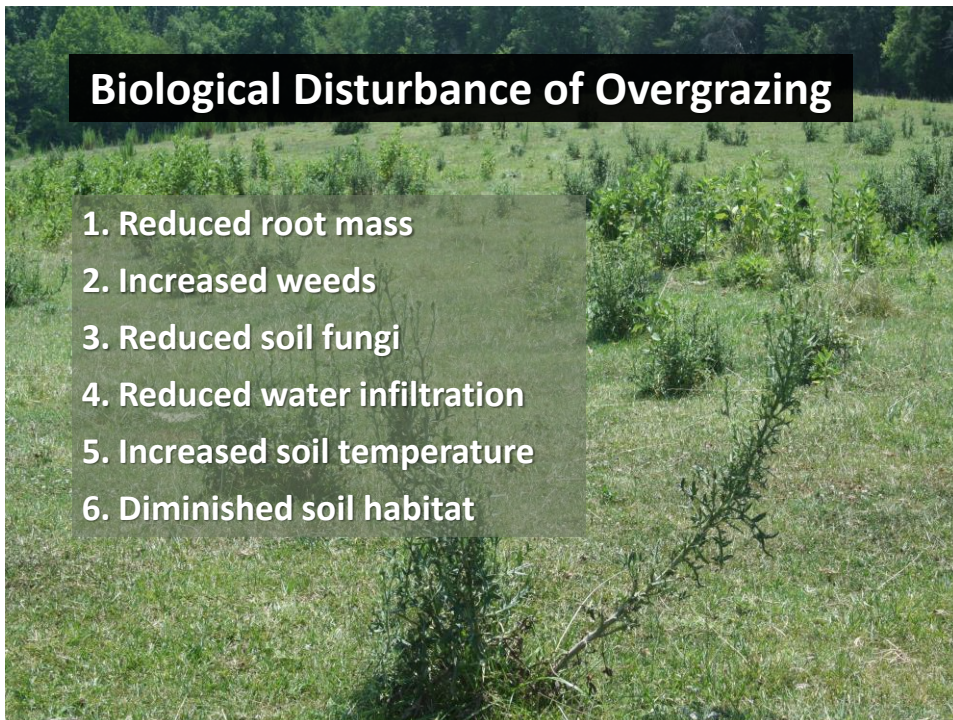
- **No diversity in the crop rotation**

- Growing single species or few crops in rotation
- Lack of diversity limits diversity of plant root exudates
- Hampers the development of a diverse soil biota



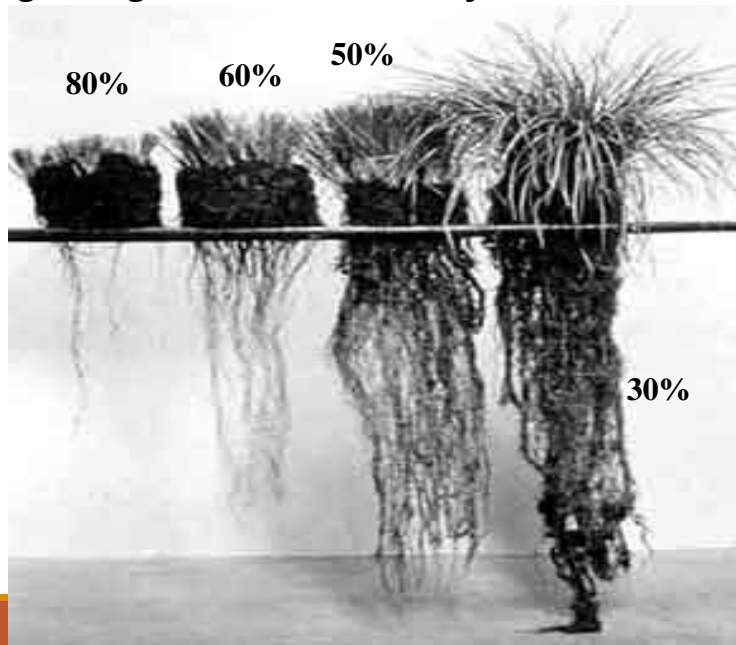
- **Overgrazing**

- Plants are exposed to intensive grazing for extended periods of time, without sufficient recovery periods
- Many pastures have single species grasses

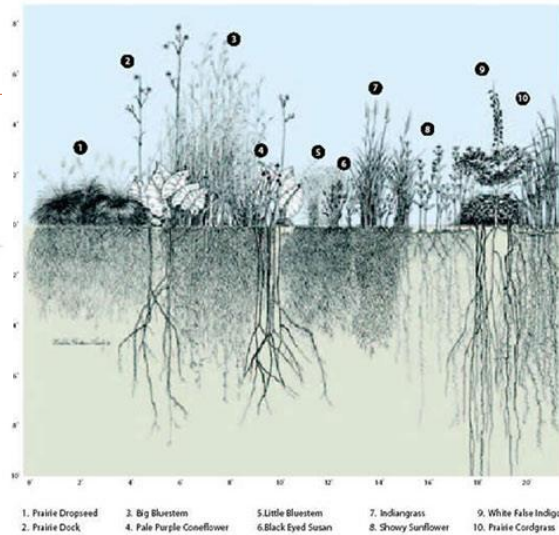
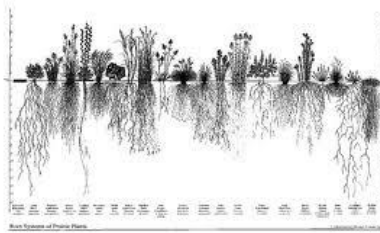




Overgrazing: another source of disturbance



Diversity of roots in nature



Chemical disturbances:
Over-application of
pesticides, fertilizers,
amendments & manures



Impact of Pesticides on Soil Health

Impacts
non-target
organisms

Pesticides
simplify, not
diversify

May restrict
crop
rotation

May restrict
cover crop
diversity

Not well
understood

Fungicide
takes out
mycorrhizal
fungi



Impact of Fertilizer on Soil Health

Short-circuits the rhizosphere & P cycle

Depresses activity of natural N fixers

Stimulates bacterial decomposition of SOM

Excess N at risk for leaching or
denitrification

Increased soil salinity (Synthetic fertilizers
are salts)

Impact of Manure on Soil Health

- Can add organic matter and carbon
- Build up of P to excessive levels
 - Greater than 100 ppm discourages plants from feeding mycorrhizal fungi
- Other issues
 - Heavy metals
 - Salts
 - Pathogens
 - Soil compaction from application/incorporation

Paradigm Shifts



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.

Paradigm shift #3 Conservation practices do not restore soil health, understanding soil function restores soil health.



Managing for Soil Health

- Minimize Disturbance of the soil
- Maximize Diversity of plants in rotation/ cover crops
- Keep Living Roots in the soil as much as possible
- Keep the soil armored with plants and plant residues
- Incorporate livestock into the cropping system

Create the most favorable habitat possible for the soil food web

Soil Health Is Understanding How the Soil is Designed to Function and Managing it Accordingly



World population reaches 6 billion—2006 • Hurricane Katrina devastates U.S. Gulf Coast region—2005 • World War II Memorial opens in Washington, D.C.—2004 • XIX Winter Olympics held in Salt Lake City, Utah—2002 • Terrorist attacks in U.S. kill thousands—2001 • World celebrates beginning of new millennium—2000 • Control of Panama Canal reverts to Panama—1999 • Lieutenant Colonel Ellison S. S. chosen first woman space commander—1998 • U.S. space probe Pathfinder lands on Mars—1997 • Space shuttle Atlantis docks with orbiting Russian space station Mir—1995 • Soil Conservation Service renamed Natural Resources Conservation Service—1994 • Americans with Disabilities Act becomes law—1990 • Berlin Wall torn down signaling an end to the Cold War—1989 • Sally Ride becomes first U.S. woman astronaut—1983 • Sandra Day O'Connor becomes first woman member of U.S. Supreme Court—1981 • Viking 1 becomes first spacecraft to reach Mars—1976 • U.S. Armed Forces withdraw from Vietnam—1973 • Congress passes Endangered Species Act—1973 • First "Earth Day" observed—1970 • American astronaut Neil Armstrong makes first recordings—1962 • Soviet cosmonaut Yuri Gagarin becomes first human to orbit Earth—1961 • African American track star Wilma Rudolph wins three gold medals at Olympic Games, Italy—1960 • Hawaii becomes 50th state—1959 • Elvis Presley's first film "Love Me Tender" premieres in New York City—1956 • Korean War ends—1953 • Dr. James Watson successfully tests polio vaccine—1952 • Mao Tse-tung rises to power in China—1949 • World War II ends—1945 • Down Creek Soil Conservation District in North Carolina becomes first conservation district in the Nation—1937 • African American athlete Jesse Owens wins four gold medals at Olympic Games, Germany—1936 • U.S. Soil Conservation Service established—1935 • Korp Hentie wins first of 10 consecutive World Figure Skating Championships—1927 • Hirohito becomes 124th Emperor of Japan—1926 • 19th amendment to the U.S. Constitution gives women the right to vote—1920 • World War I ends—1918 • Atlantic Ocean—1924 • Korp Hentie wins first of 10 consecutive World Figure Skating Championships—1927 • Hirohito becomes 124th Emperor of Japan—1926 • 19th amendment to the U.S. Constitution gives women the right to vote—1920 • World War I ends—1918 • Jeanette Rankin (Montana) elected first U.S. Congresswoman—1914 • Jim Thorpe of the Spok and Fox Tribes wins decathlon and pentathlon in Olympic Games, Sweden—1912 • First Model "T" Ford rolls off assembly line—1908 • "Big Boy" Sinclair's novel "The Jungle" leads to U.S. Pure Food and Drug Act—1906 • Orville Wright makes first successful flight in self-propelled airplane—1894 • Katherine Lee Bates publishes "America the Beautiful"—1895 • Philip Pratt unveils first electric automobile—1889 • Statue of Liberty presented to U.S. in Paris—1884 • Thomas Edison invents phonograph—1877 • Alexander Graham Bell invents telephone—1875 • U.S. experiences worst grasshopper plague in its history—1874 • Yellowstone, first national park, created—1872 • Great Washington Canal begins to dig—1863 • Ada Ward Hovey composes the song "Battle Hymn of the Republic"—1862 • Frederick Douglass establishes abolitionist newspaper "The North Star"—1847 • Elias Howe patents sewing machine—1846 • Samuel F.B. Morse develops code for electric telegraph systems—1838 • Texas declares independence from Mexico—1836 • Louis Braille publishes system of writing for the blind—1829 • Emma Hart Willard founds first U.S. women's college, Troy Female Seminary New York—1821 • Construction of Erie Canal begins—1817 • Napoleon defeated by Wellington and Blücher at Battle of Waterloo—1815 • Lewis and Clark begin "Corps of Discovery" expedition to find a water route across North America—1804 • Louisiana Territory purchased by U.S. for \$15 million—1803 • Congress established—1800 • English physician Edward Jenner develops vaccination against smallpox—1796 • Kamehameha I becomes King of Hawaii—1795 • Eli Whitney invents cotton gin—1793 • First U.S. mint established in Philadelphia—1791 • 88 of Rights ratified—1791 • First American patent awarded to Samuel Hopkins for process of manufacturing potash—1790 • French Revolution begins with attack on the Bastille—1789 • U.S. Constitution ratified—1788 • American Revolutionary War ends—1781 • Continental Congress adopts Declaration of Independence—1776 • American colonists throw British tea into Boston Harbor—1773 • Thomas Jefferson born—1743 • Astronomer Anders Celsius introduces Centigrade temperature scale—1741 • 18th century agricultural revolution begins in Europe—1731 • George Washington born—1731 • Daniel Gabriel Fahrenheit, inventor of mercury thermometer, devises Fahrenheit temperature scale—1724 • First permanent Native American school created in Williamsburg, Virginia—1729 • Peter the Great becomes law of Russia—1689 • Rice cultivation begins in North America—1685 • Edmund Halley observes Great Comet, which is later named for him—1682 • John Bunyan's "Pilgrim's Progress" published—1678 • First mail service in North America established between New York and Boston—1673 • John Brown's raid on Harpers Ferry—1859 • First Quakers land in America—1637 • First book printed in Native American language—1653 • World population estimated at 500 million—1650 • First newspaper Gazette de France published in Paris—1631 • Pilgrims land on Plymouth Colony establish governing authority through Mayflower Compact—1620 • Native American princess Pocahontas marries John Rolfe—1614 • Native Americans teach colonists how to raise corn—1608 • John Smith settles first permanent English colony in North America at Jamestown, Virginia—1607 • Virginia Dare becomes first child of English parents born in America—1587 • Sir Walter Raleigh brings first tobacco to England from Virginia—1586 • Spain settles colony in St. Augustine, Florida—1565 • Shakespeare and Galileo born—1564 • Earthquake in China is worst in history with a death toll of 800,000—1556 • University of Mexico founded—1551 • First botanical garden founded in Pisa, Italy—1543 • Francesco Coronado introduces horses to North America—1540 • Juan Ponce de Leon becomes first European to set foot in Florida—1513 • Michelangelo finishes painting Sistine Chapel ceiling—1512 • First sugar cane mill established in the Americas—1509 • Martin Waldseemüller, German geographer, first mapmaker to call the New World "America"—1492

In the time it took to form

Let's take time to protect the soil, every inch of it.

1 inch of soil

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Natural Resources Conservation Service

Helping People Help the Land