Soil Health: Pioneers and Emerging Frontiers

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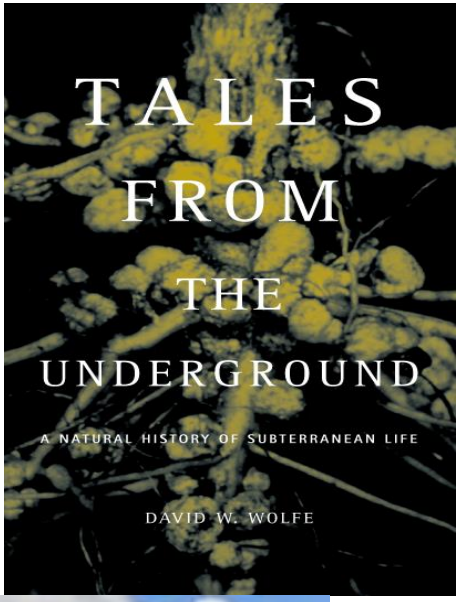
NEW YORK SOIL HEALTH

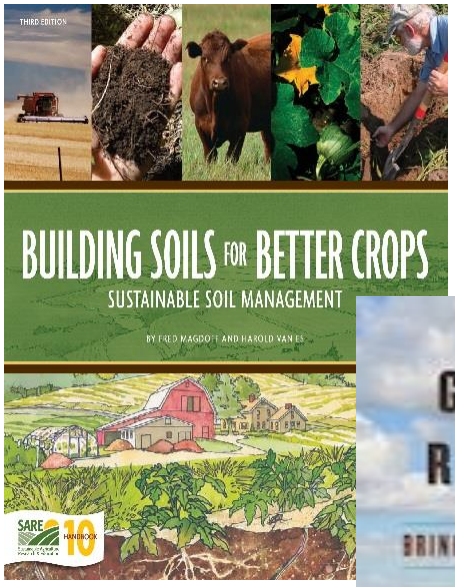
An Era of Discovery and Farm Research addressing society needs

Amazing biodiversity and abundance beneath our feet

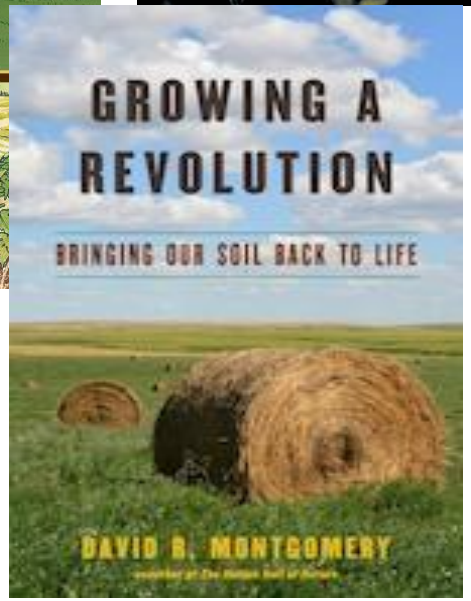


Farmer motivation:

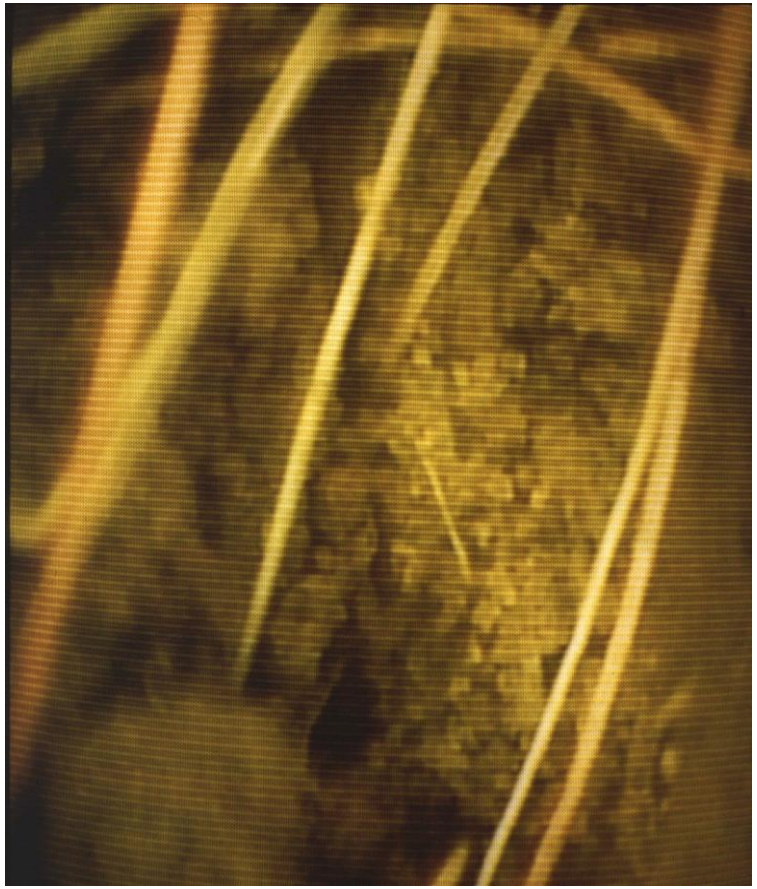
Healthy soils = resilience and increased profits



Soil health, human health, and the environment



Breakthroughs in Root Biology:
Much More Than Water and Nutrient Uptake



-Roots exude substances that:

- inhibit weeds, insects, disease
- attract beneficial microbes
- dissolve plant nutrients in soil

-Create pathways for water, oxygen, roots to follow

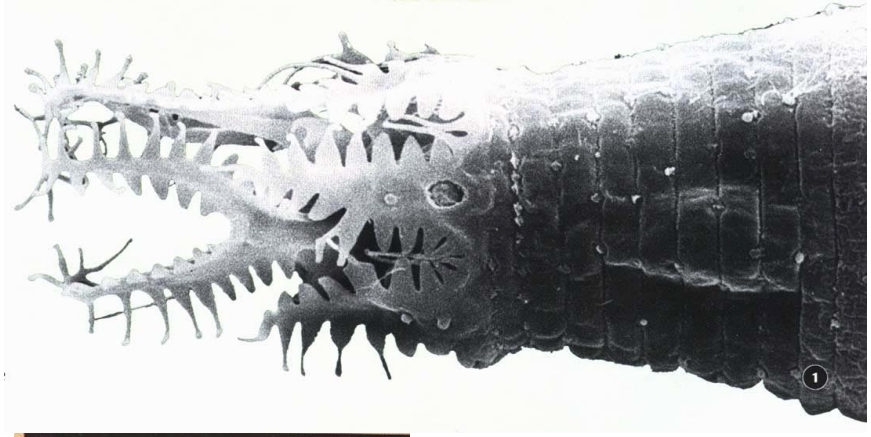
-Sequester organic matter (carbon) deep in soil profile

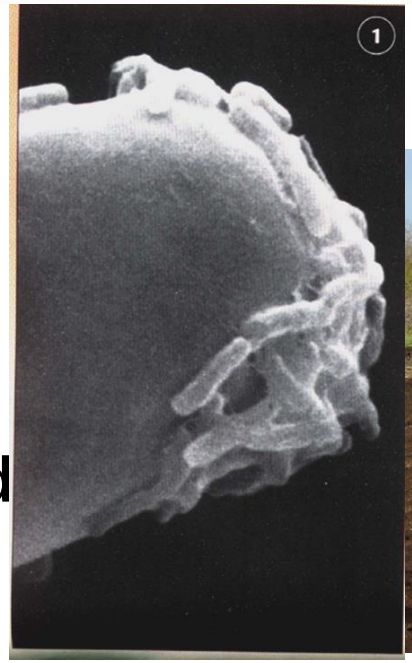
Sudangrass: roots suppress weeds and pathogenic nematodes; break through compacted soils; pump organic matter (carbon) into the soil

Field experimentation by farmers and researchers for integrating fall/winter cover crops into cash crop systems

Putting the Soil Biome to Work:

- Weed, pest, disease control;
- Recycling plant nutrients;
- Nitrogen fixation (e.g., legume crop rotations);
- Better soil aggregation for drought and flooding resistance;
- Increasing grower profits and protecting the environment



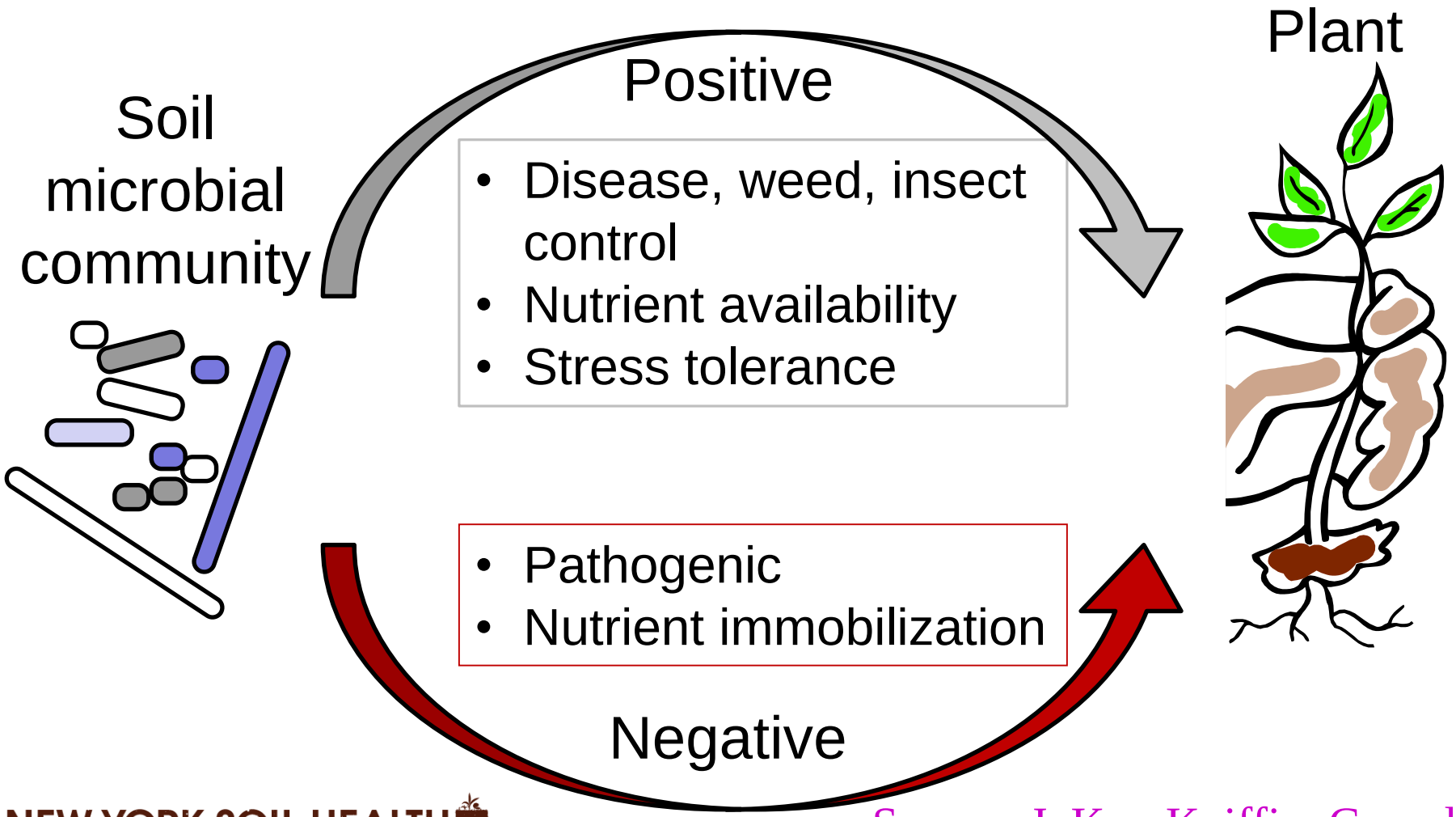


Rhizosphere:
The most dynamic interface on Earth

- a narrow zone of soil, within millimeters, that surrounds plant roots
- hotspot of plant-soil interactions involving microbiota

Source: J. Kao-Kniffin, Cornell

Microbial Impacts on Plants: Research to promote the positive, suppress the negative



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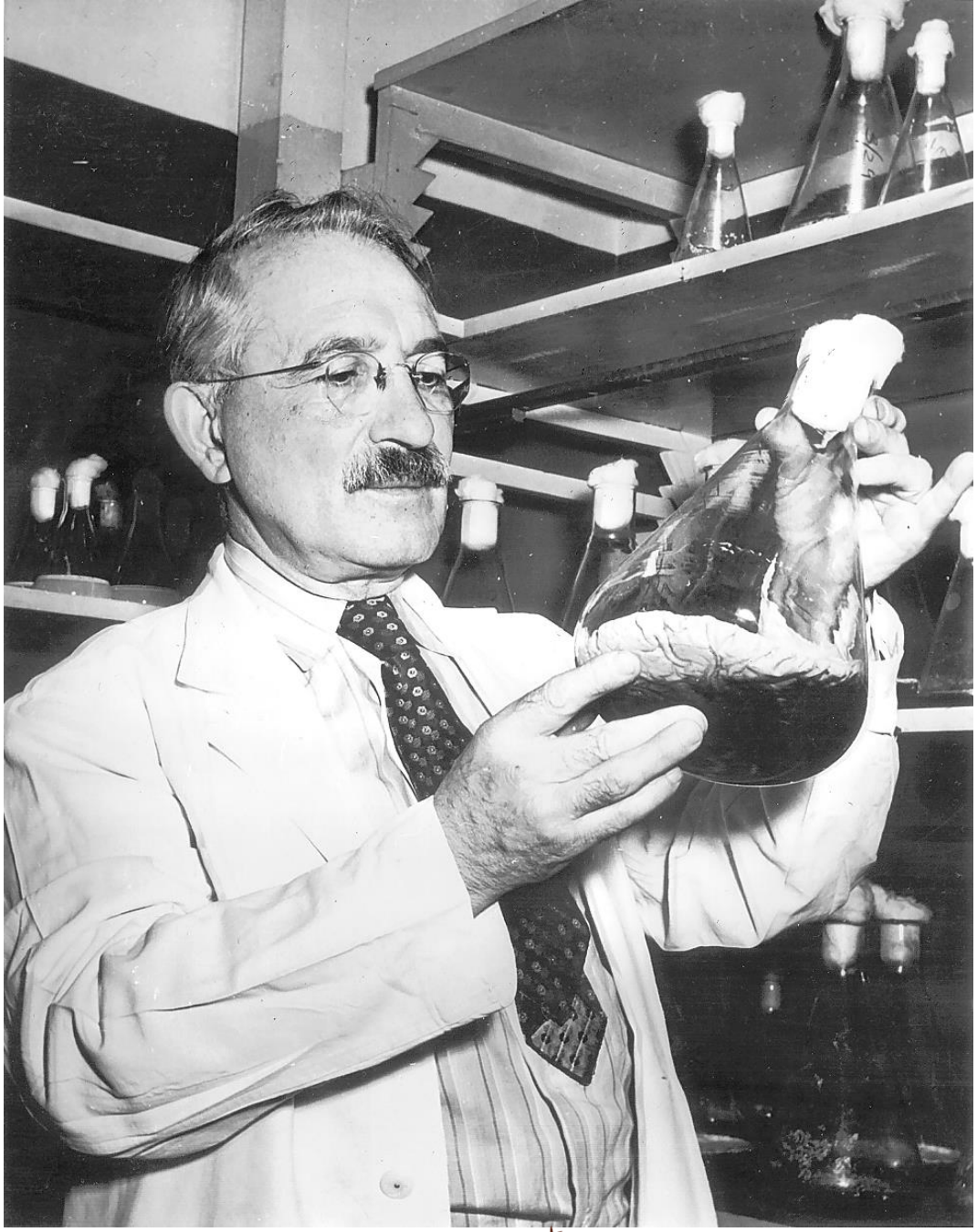


Building Disease-Suppressive Soils

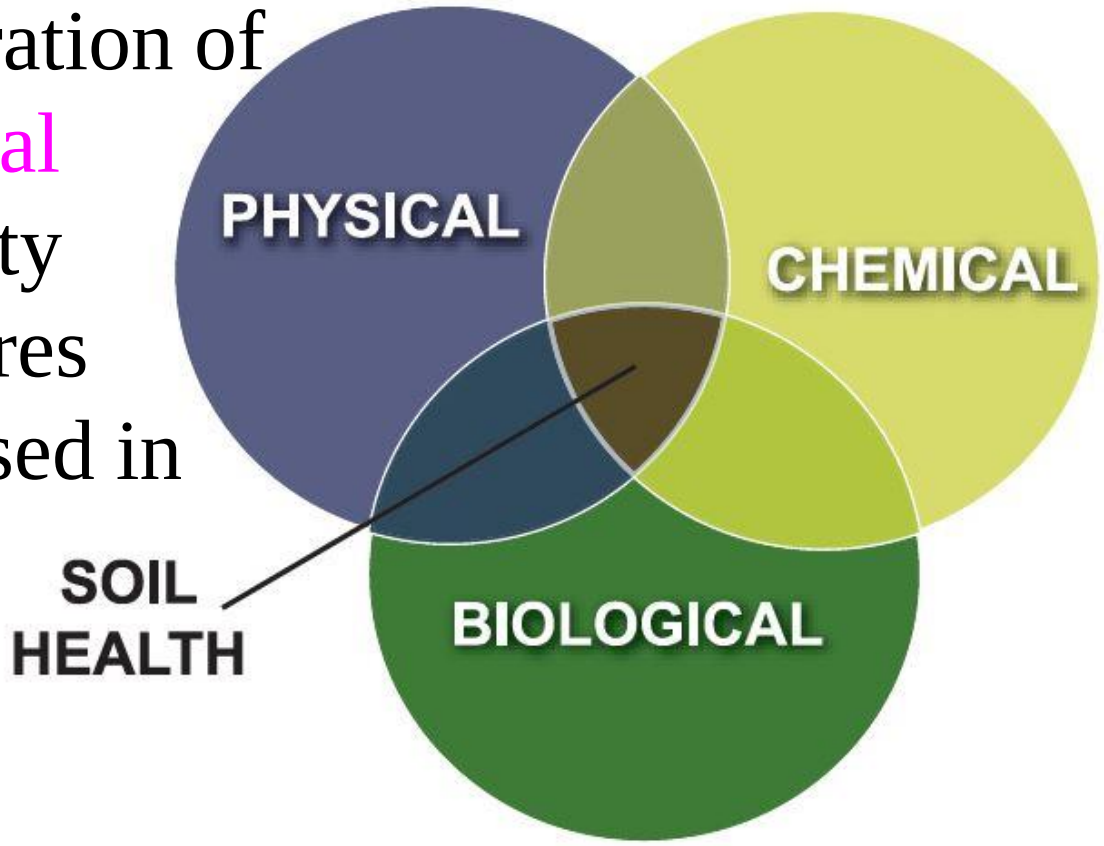
Salman Waksman, a pioneer soil biologist, coined the term “antibiotic”, and discovered Streptomycin in 1943

A Soil Test for the 21st Century

Cornell's Comprehensive Assessment of Soil Health

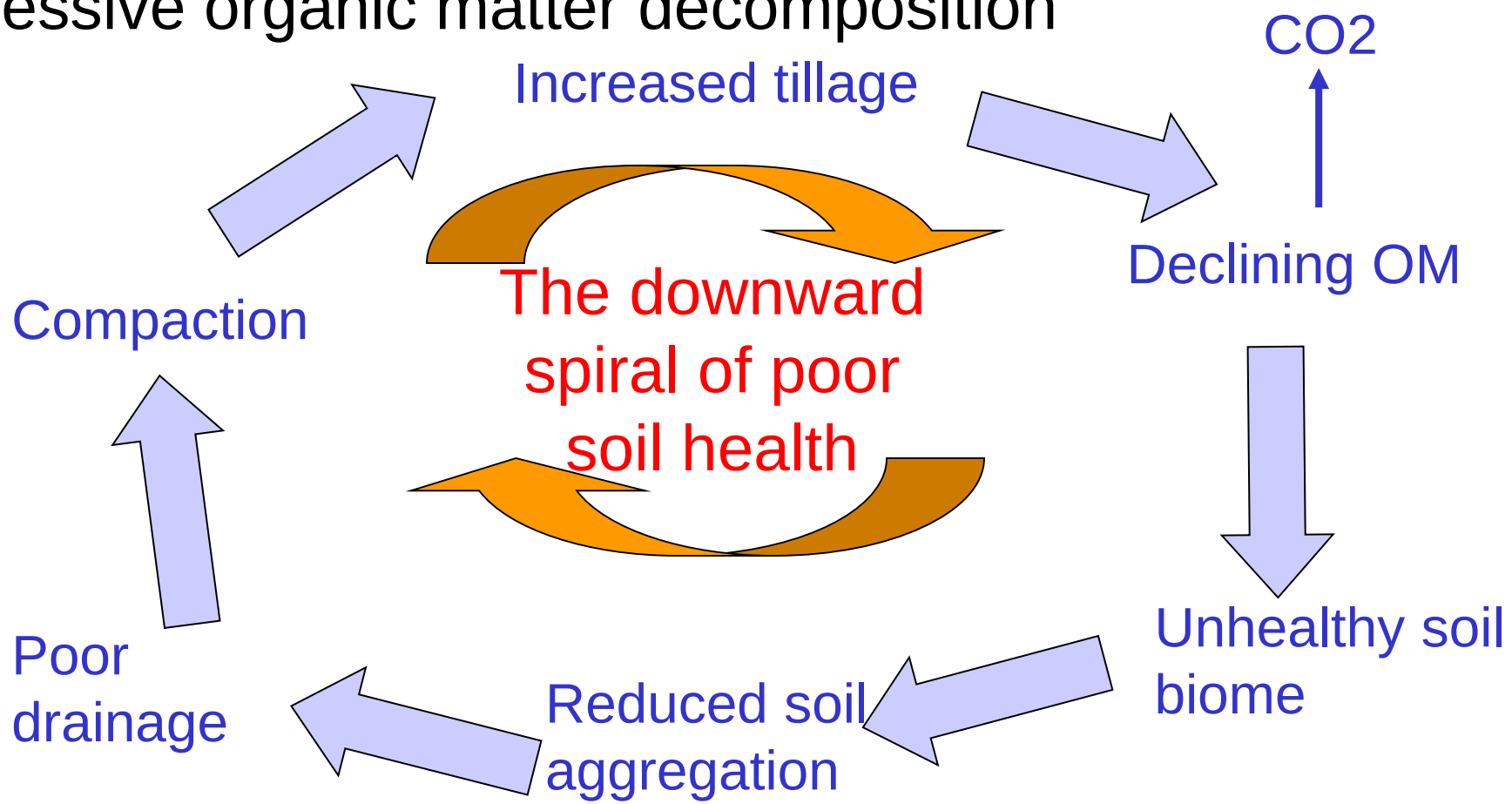
(http://soilhealth.cals.cornell.edu)

Emphasizes the integration of Physical and Biological measures of soil quality with Chemical measures (e.g., pH, nutrients) used in standard soil tests



Compaction, Tillage, Soil Health

Tillage over-oxygenates soil, “fans the flames” of excessive organic matter decomposition



Biological Management and Soil Compaction

“The plow is one of the most ancient and most valuable of man’s inventions; but long before he existed the land was in fact regularly plowed, and still continues to be plowed by earthworms.”

- Charles Darwin, 1881

Composts, manures, biochar

Farm compost facility

Biochar

Soil Health "win-win" Effects:

Low-cost climate change resilience

Natural "geo-engineering" for carbon capture

Building soil organic matter

- increases resilience to drought, flooding, erosion
- stores carbon in soil that otherwise would be in the air as CO_2

New York Has Been at the Forefront of the Soil Health Movement For More Than 20 Years

Where Do We Go From Here?

What Are the Priorities for Research, Outreach, Policy?

New York Soil Health: Near-term Objectives

- Identify barriers to wider adoption
- Quantify economic and environmental benefits
- Innovative cropping systems and soil ecology research
- Research on biochar and composts
- Promote statewide communication, coordination, collaboration
- Hold the first statewide Soil Health Summit
- Gather input from the full range of stakeholders for a NY “Soil Health Roadmap”