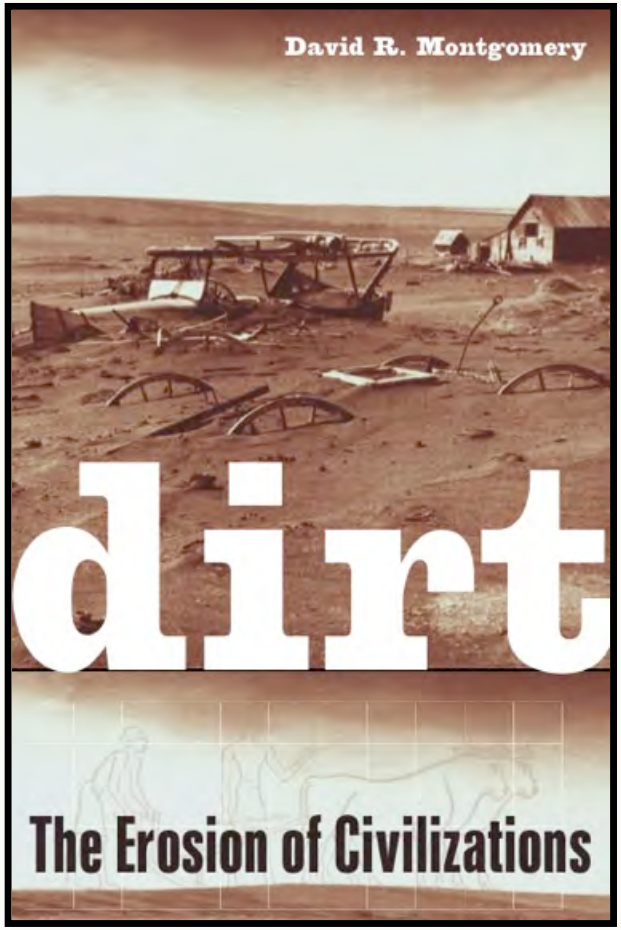

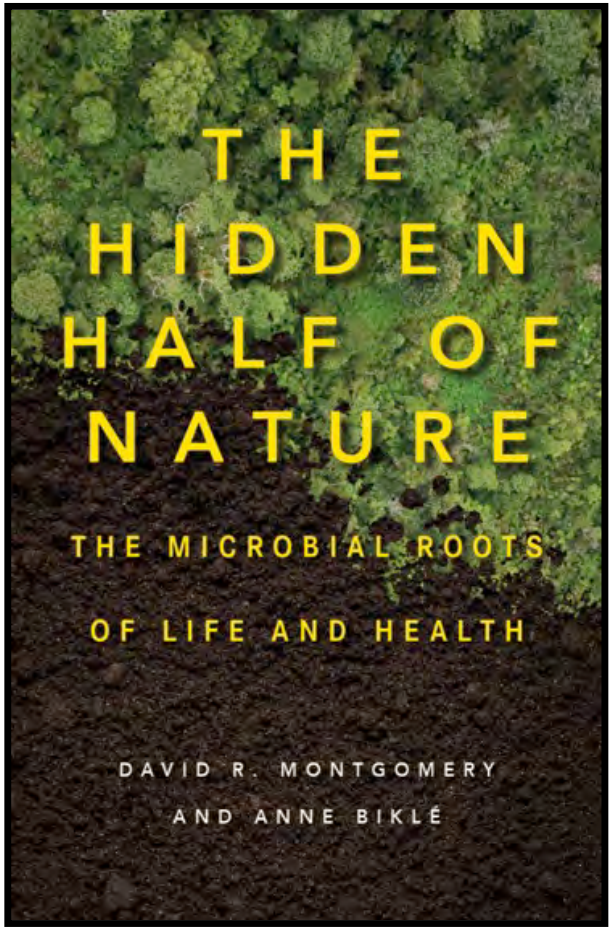

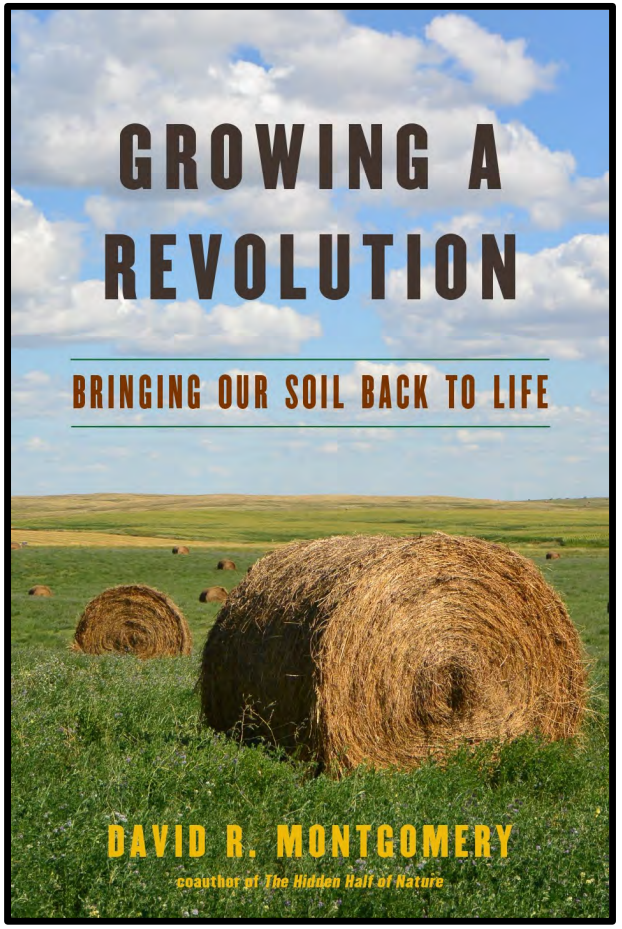

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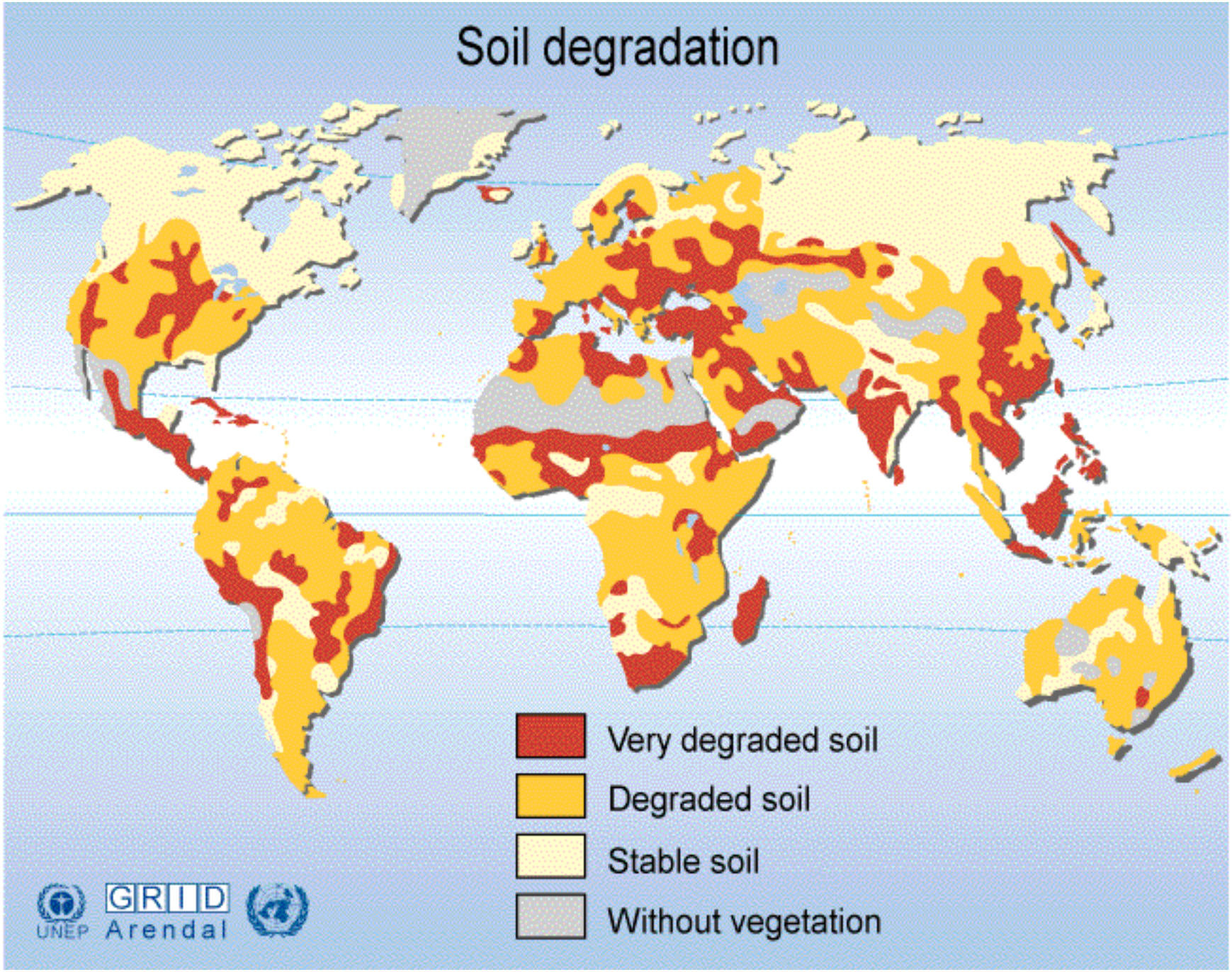
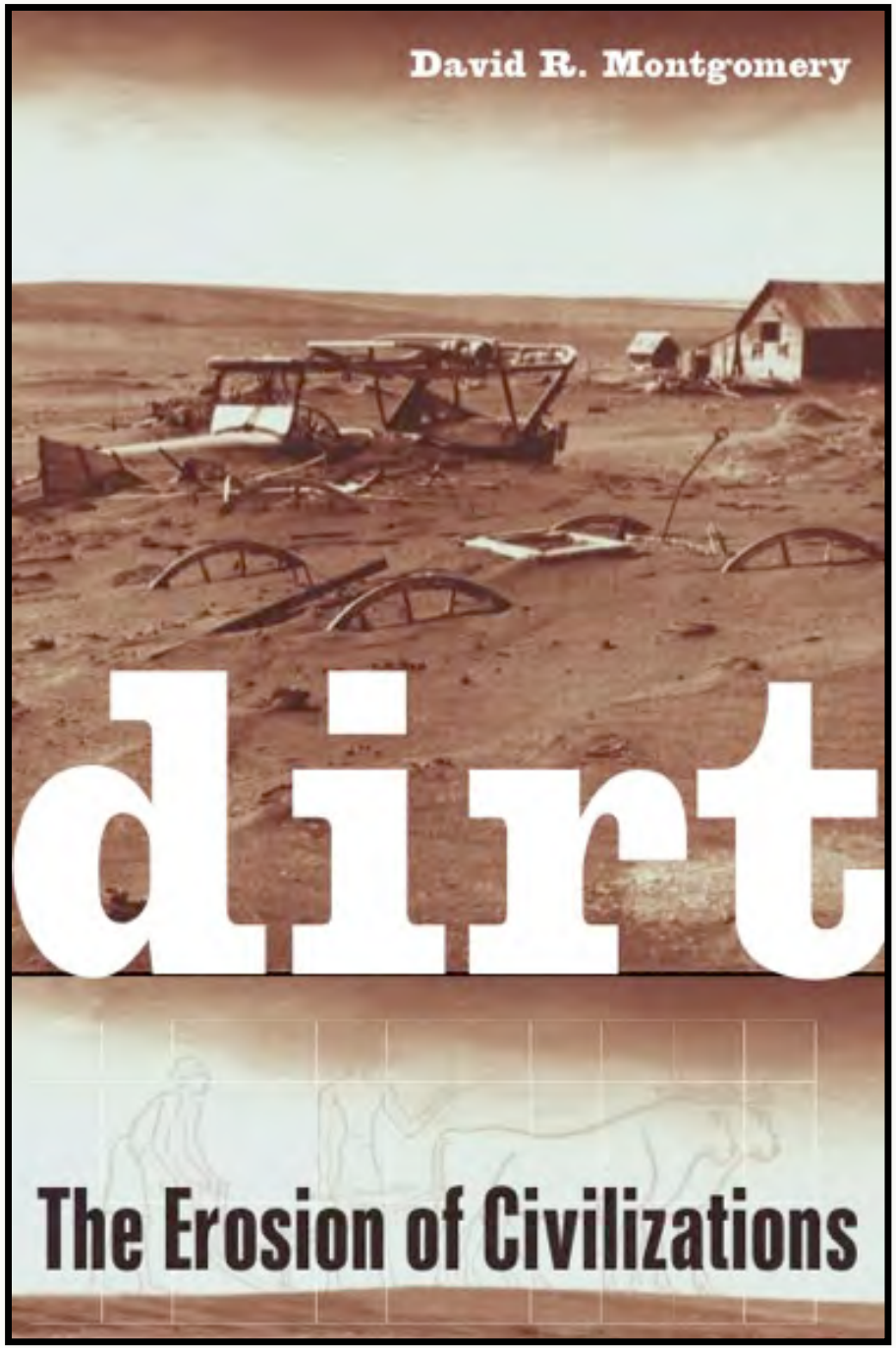

Soil degradation
Very degraded soil
Degraded soil
Stable soil
Without vegetation
UNEP
GRID
Arendal

Over the last 40 years soil erosion and degradation has caused farmers to abandon about 430 million ha of arable land, an area equivalent to about one-third of all present cropland.

Pimental et al., 1995


Humanity loses another 0.3% of our global food production capacity each year to soil erosion and degradation.
UN Global State of the Soil Assessment, 2015

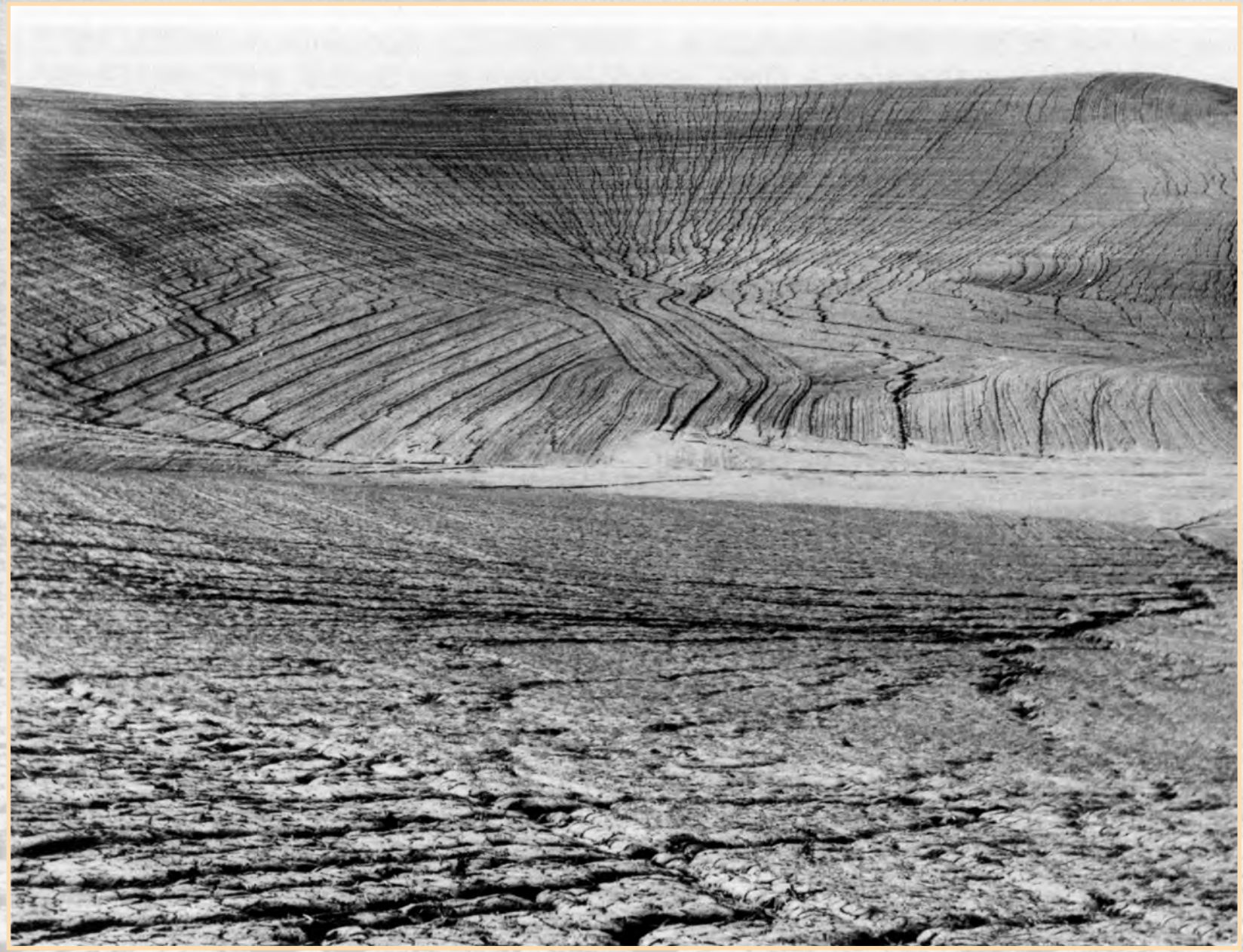

David R. Montgomery
dirt
The Erosion of Civilizations


Soil erosion played a role in the demise of ancient civilizations, from Neolithic Europe, to Classical Greece, Rome, the Southern United States, Central America, and more...

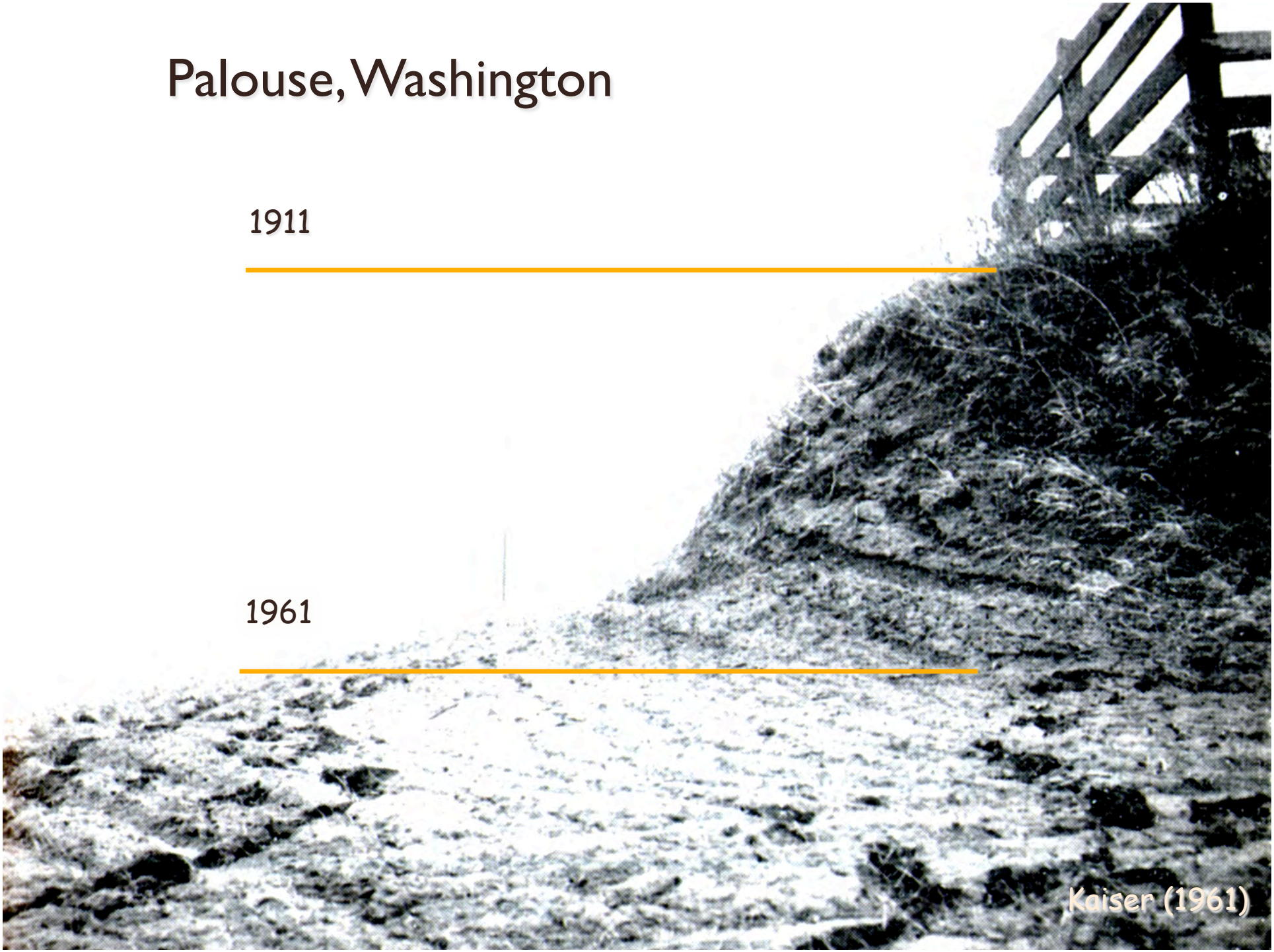
Invention of the plow fundamentally altered the balance between soil production and soil erosion, dramatically increasing soil erosion…

Palouse, Washington

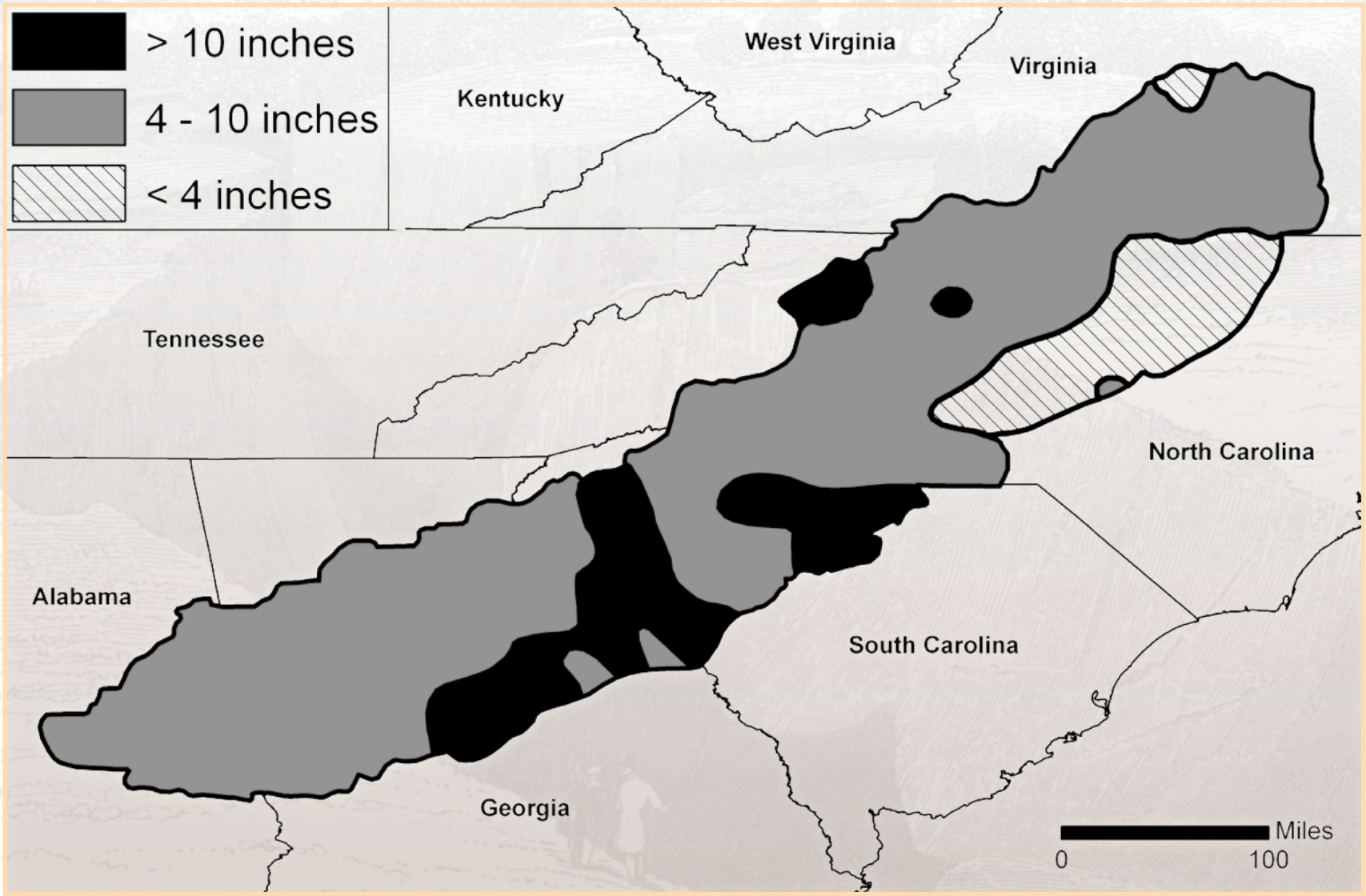
1970



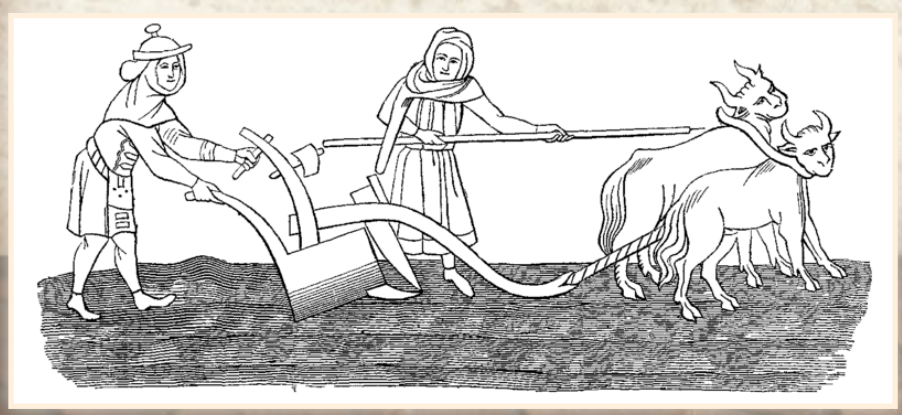
Palouse, Washington



Historical soil erosion in the Piedmont region



In researching *Dirt*, I compiled data on both contemporary and long-term (geological) erosion rates—and agricultural erosion rates.



Erosion Rates

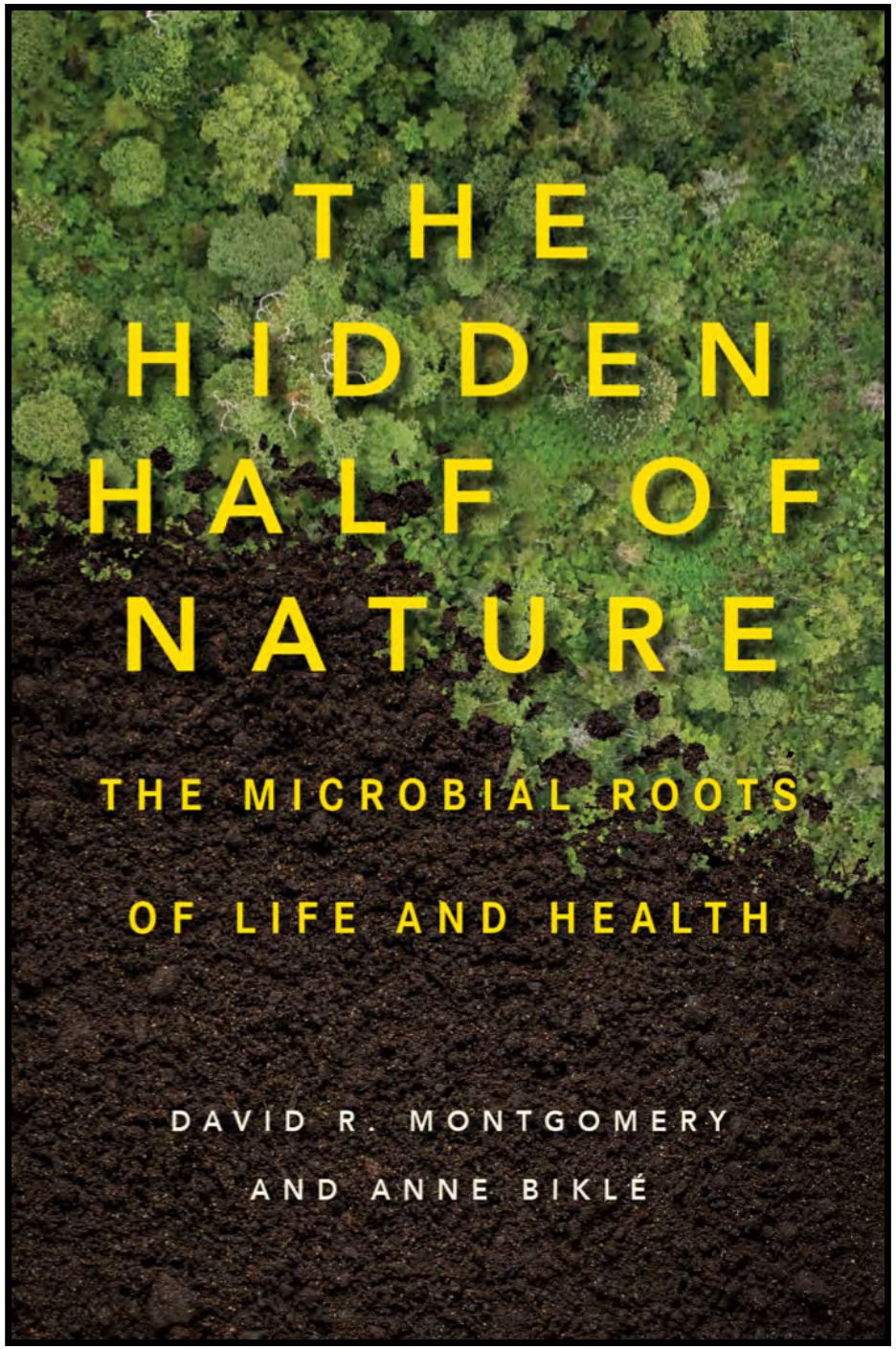
Measurement type	median (mm/yr)
Conventional (448)	1.54
No-till (47)	0.08
Native Vegetation (65)	0.01
Soil Production (188)	0.02
Geological (925)	0.03

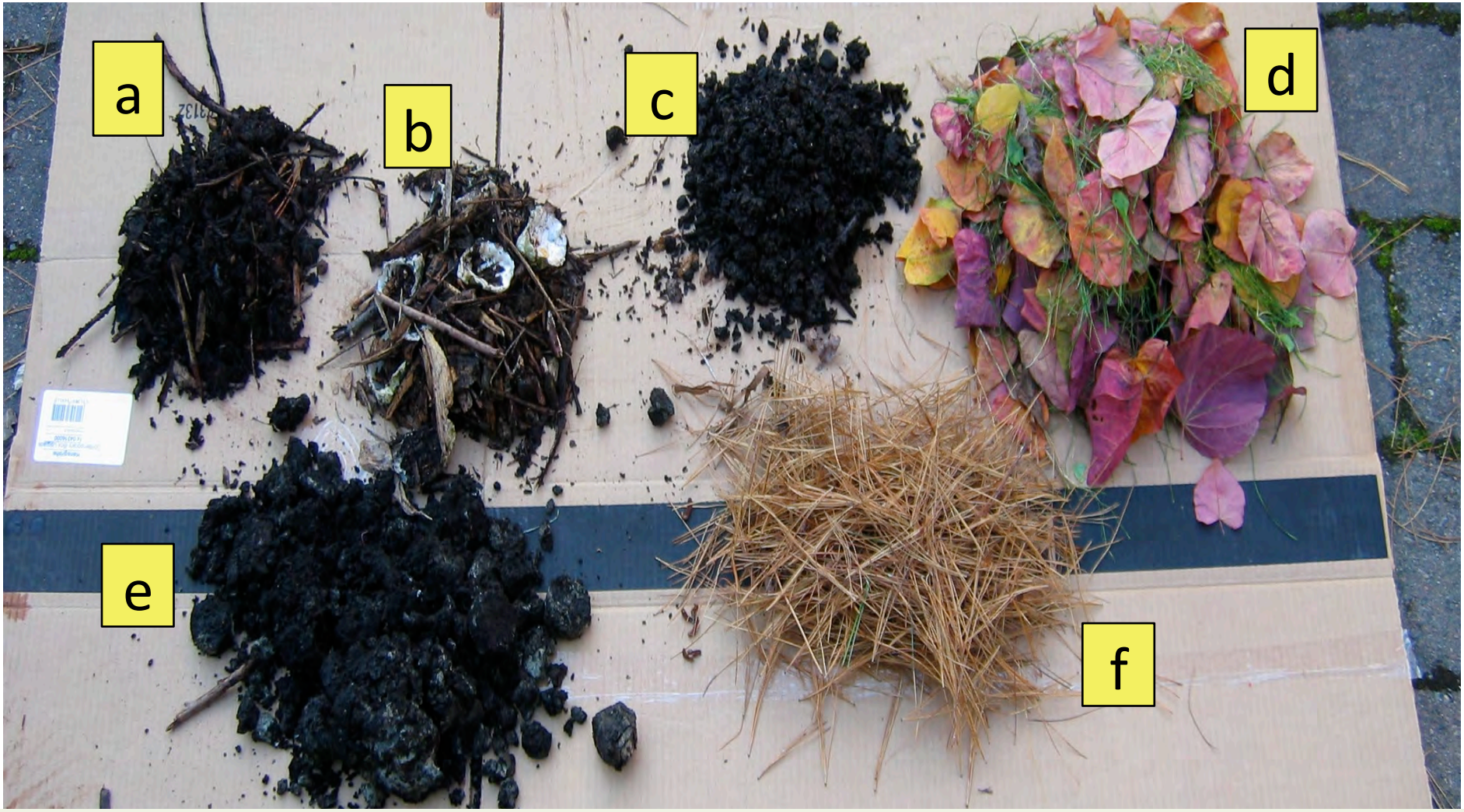
Net soil loss of ≈1 mm/yr implies that erosion of a typical 0.5 to 1 m thick hillslope soil could occur in roughly 500 to 1000 years.

This is approximately the lifespan of most major civilizations outside of major river floodplains…

Is Soil Restoration Possible?

Can we reverse the historical pattern?


THE HIDDEN HALF OF NATURE
THE MICROBIAL ROOTS OF LIFE AND HEALTH
DAVID R. MONTGOMERY
AND ANNE BIKLÉ



a= wood chips & compost

b= a + shells

c= zoo doo - N

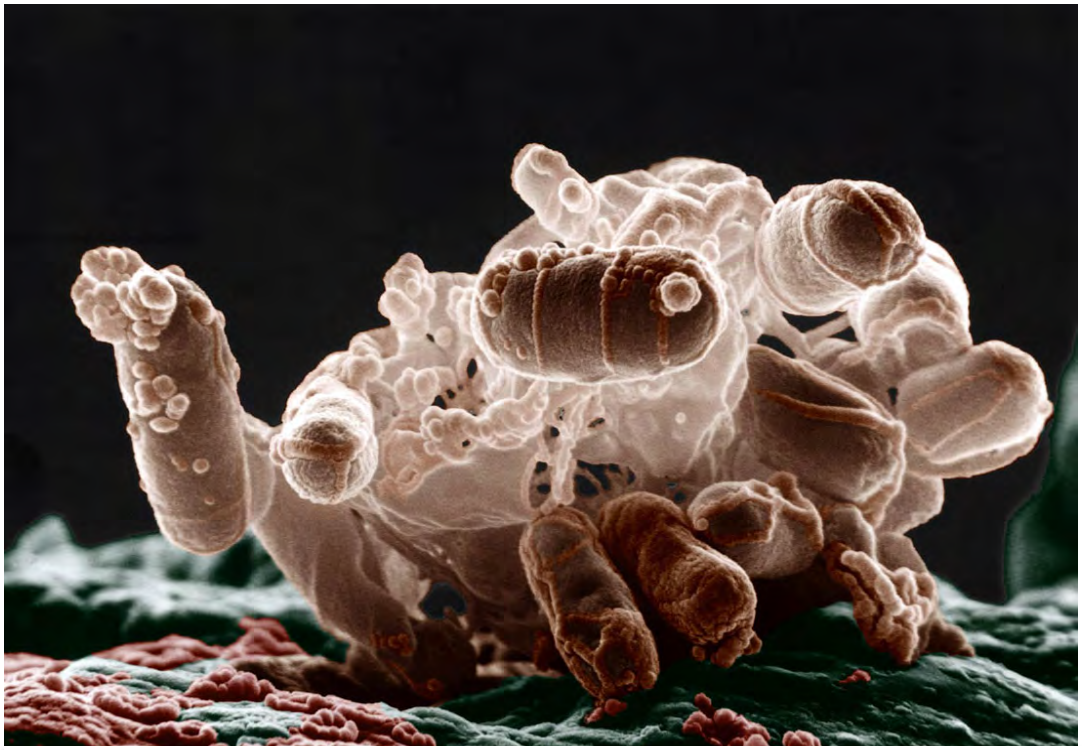
d= fresh grass & leaves -N

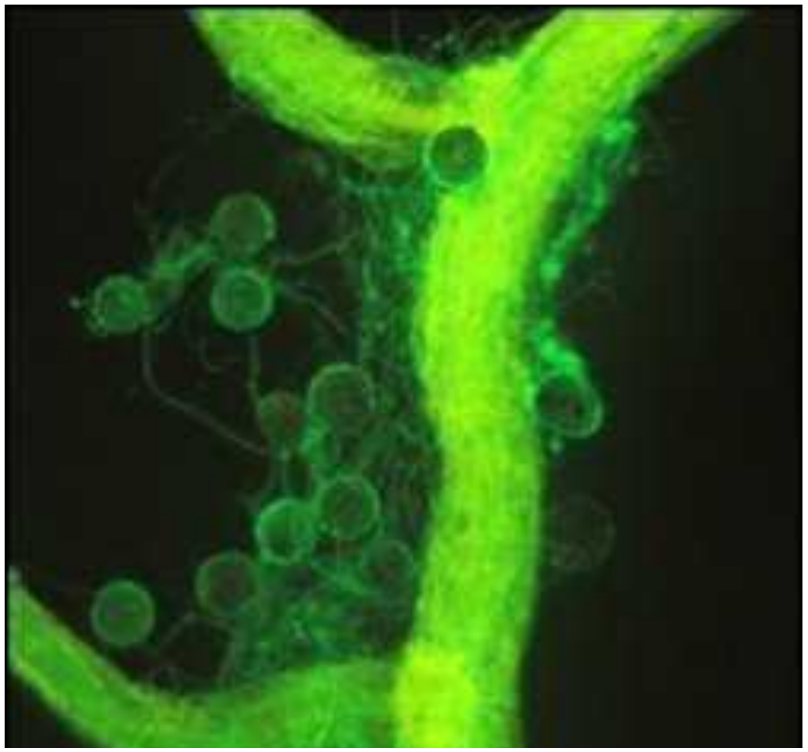
e= coffee (composted) -N

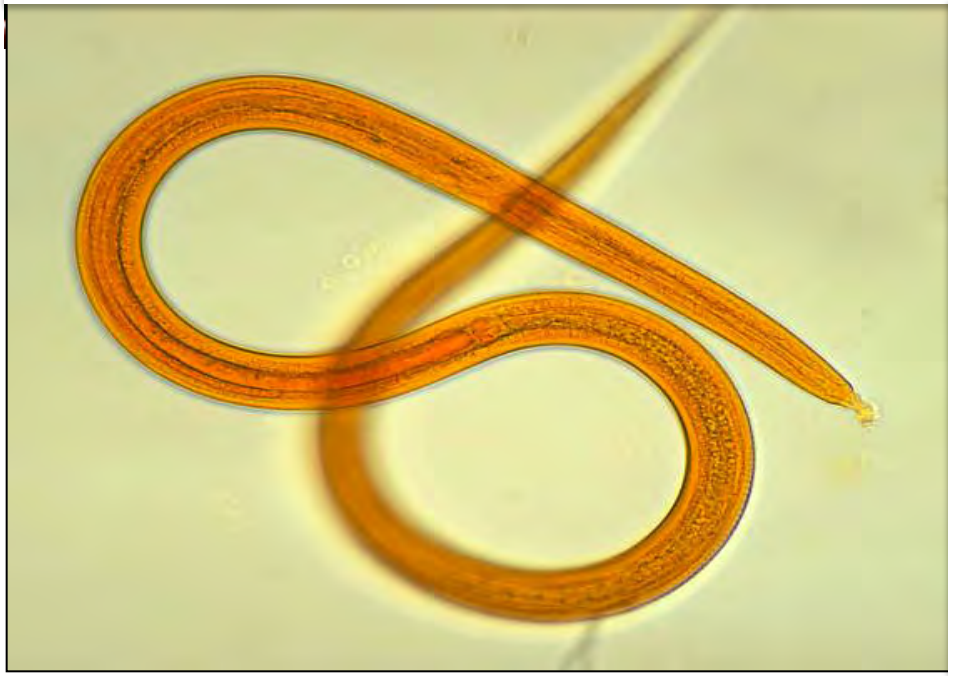
f= pine needles - C

The LIVING Goods

We can build soil surprisingly fast — faster than nature





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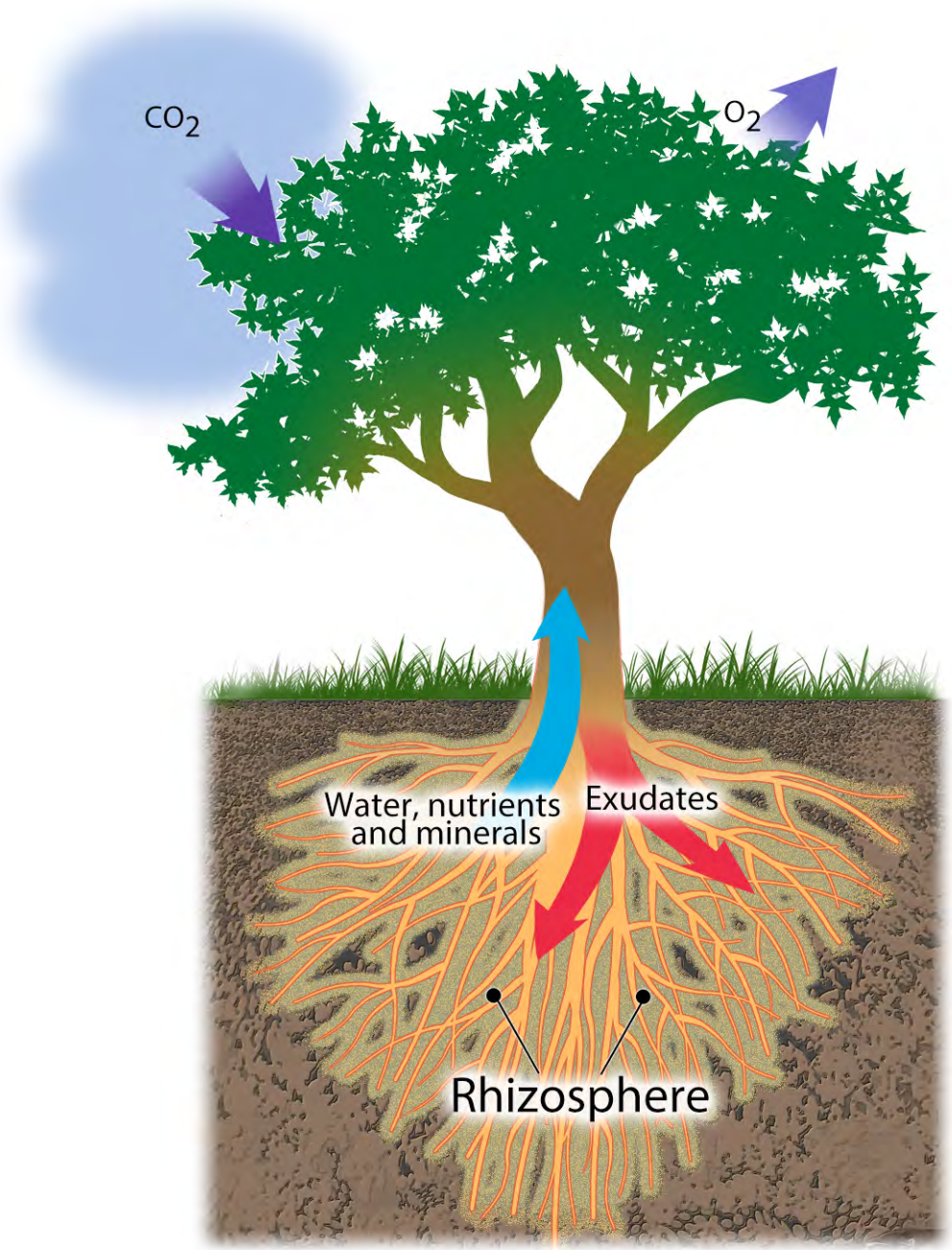
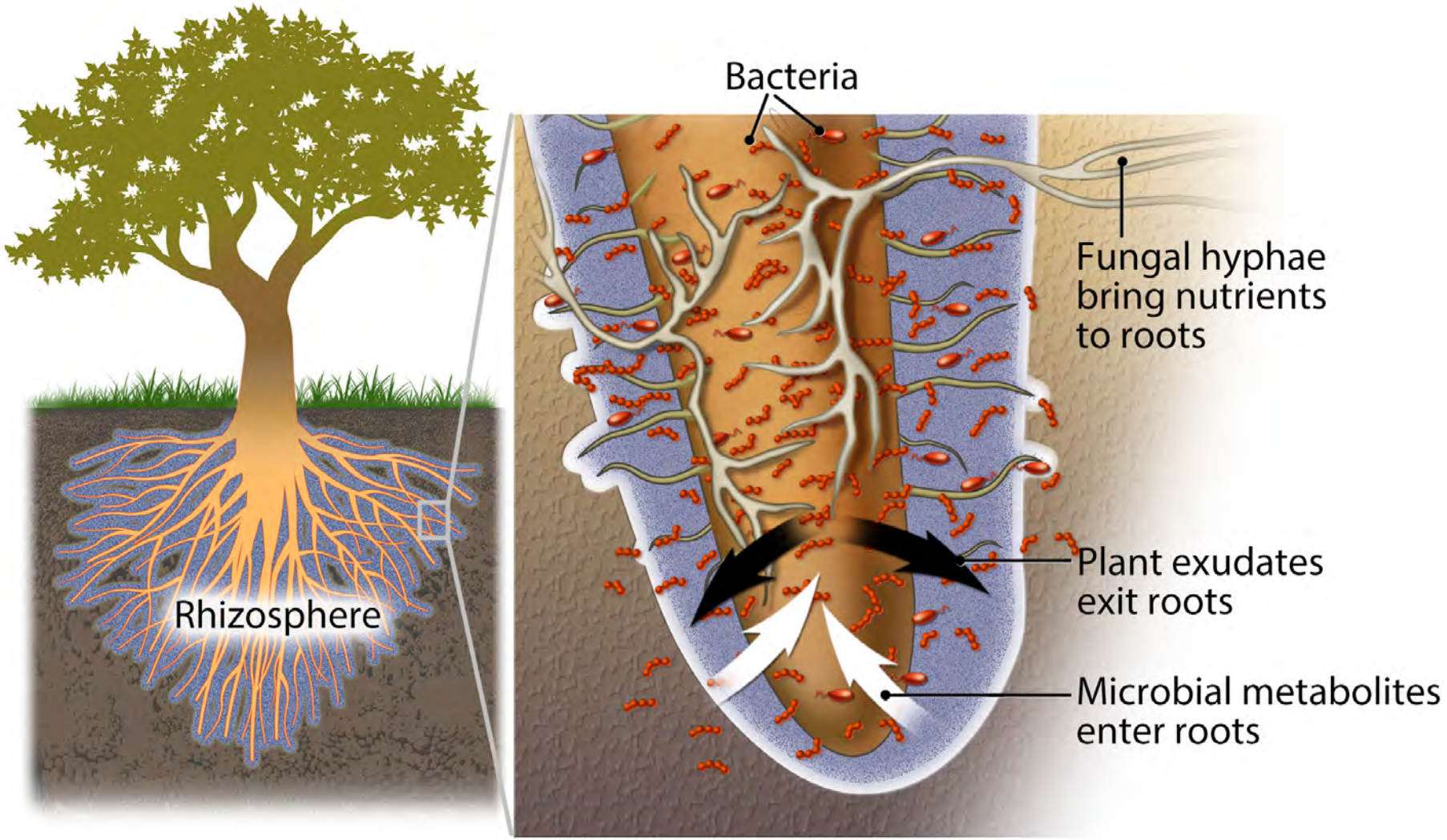
www.naturfoto.cz

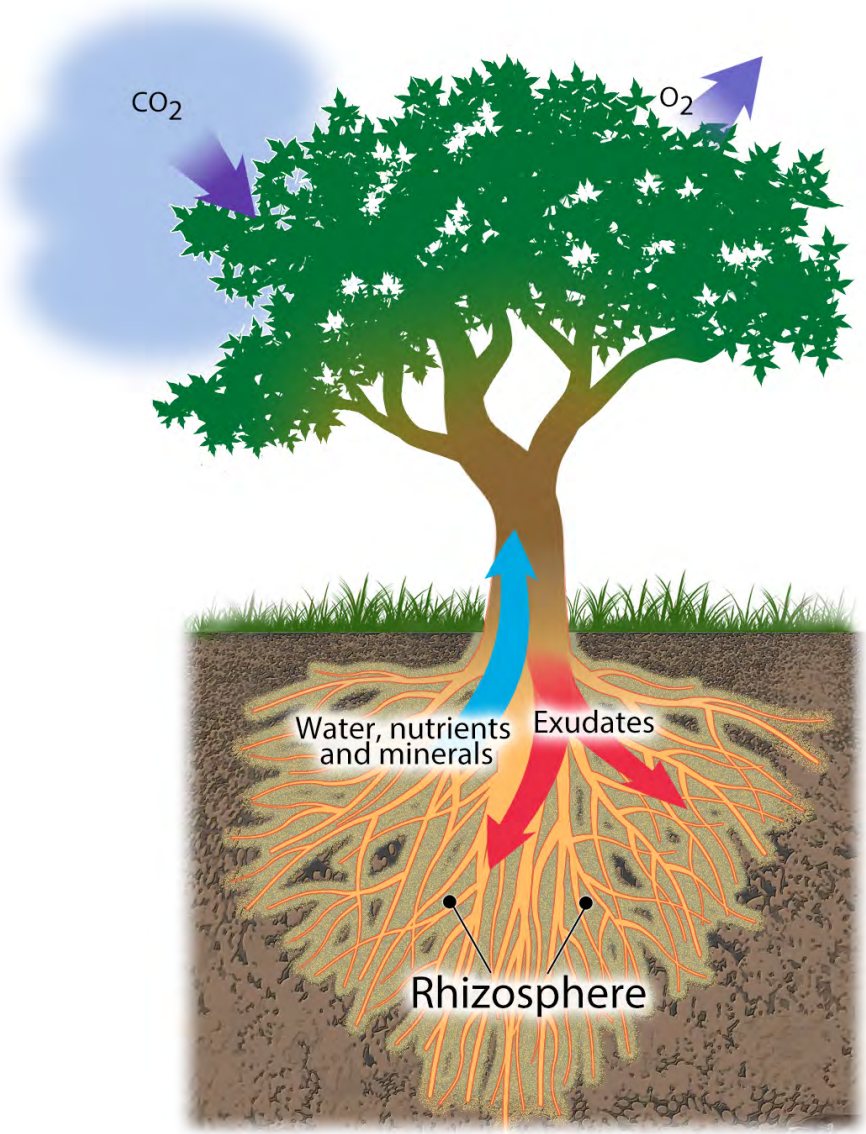


The rhizosphere is a zone rich with microbial life, a living halo that surrounds plant roots

The rhizosphere is a biological bazaar where microbes and plants trade nutrients, metabolites, and exudates

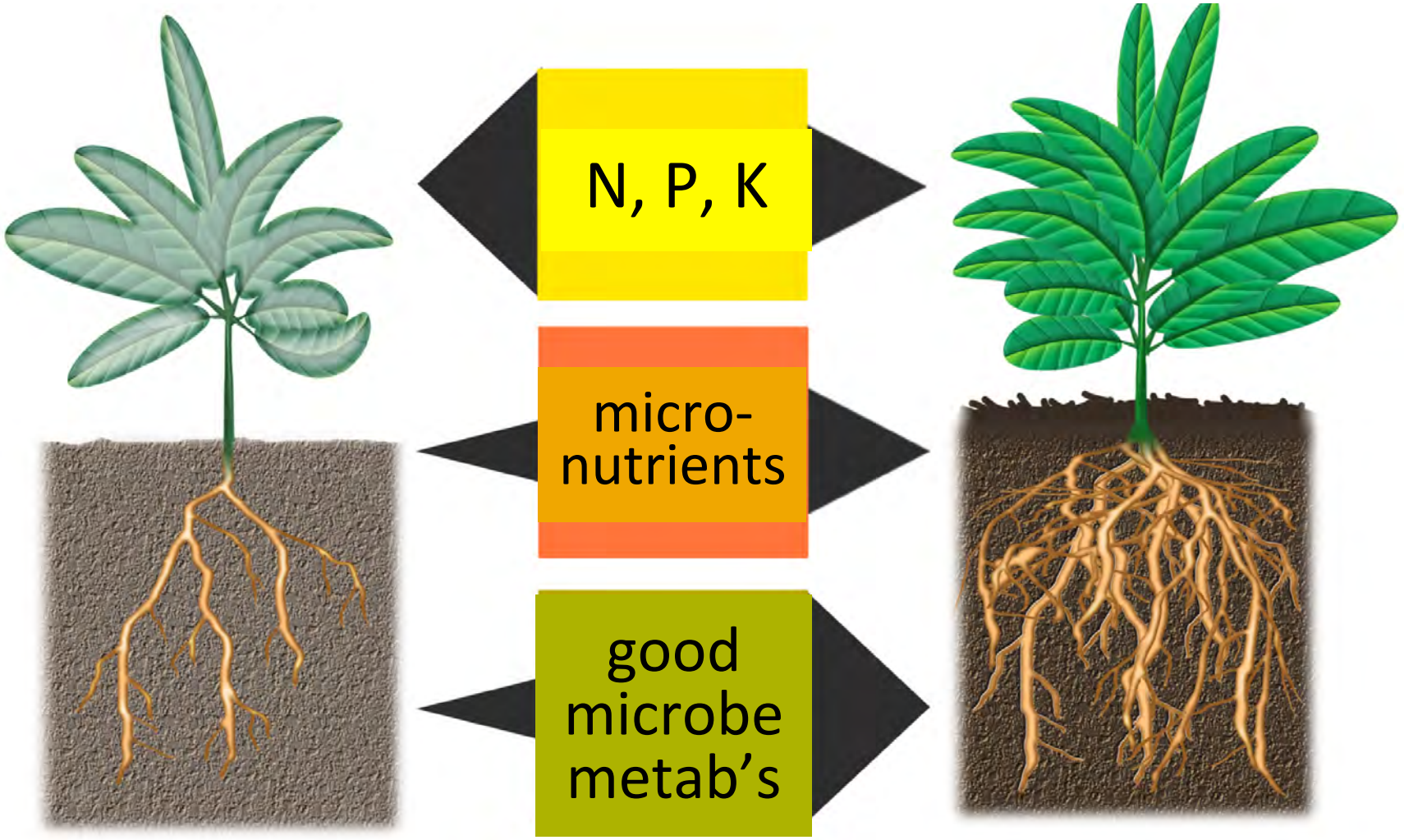


Plant Defense & Health

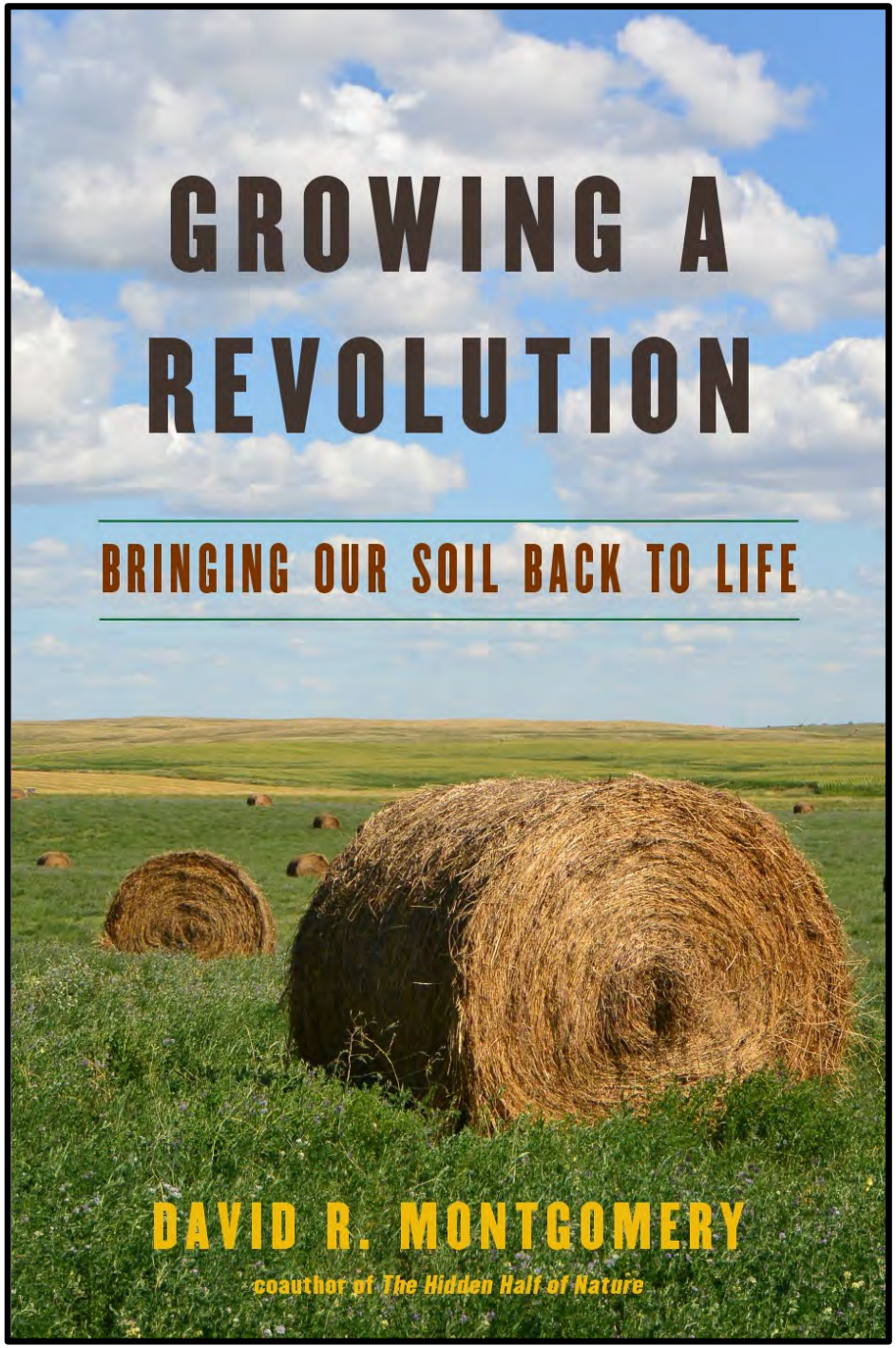


Fertilizer Diet

Soil Health Diet

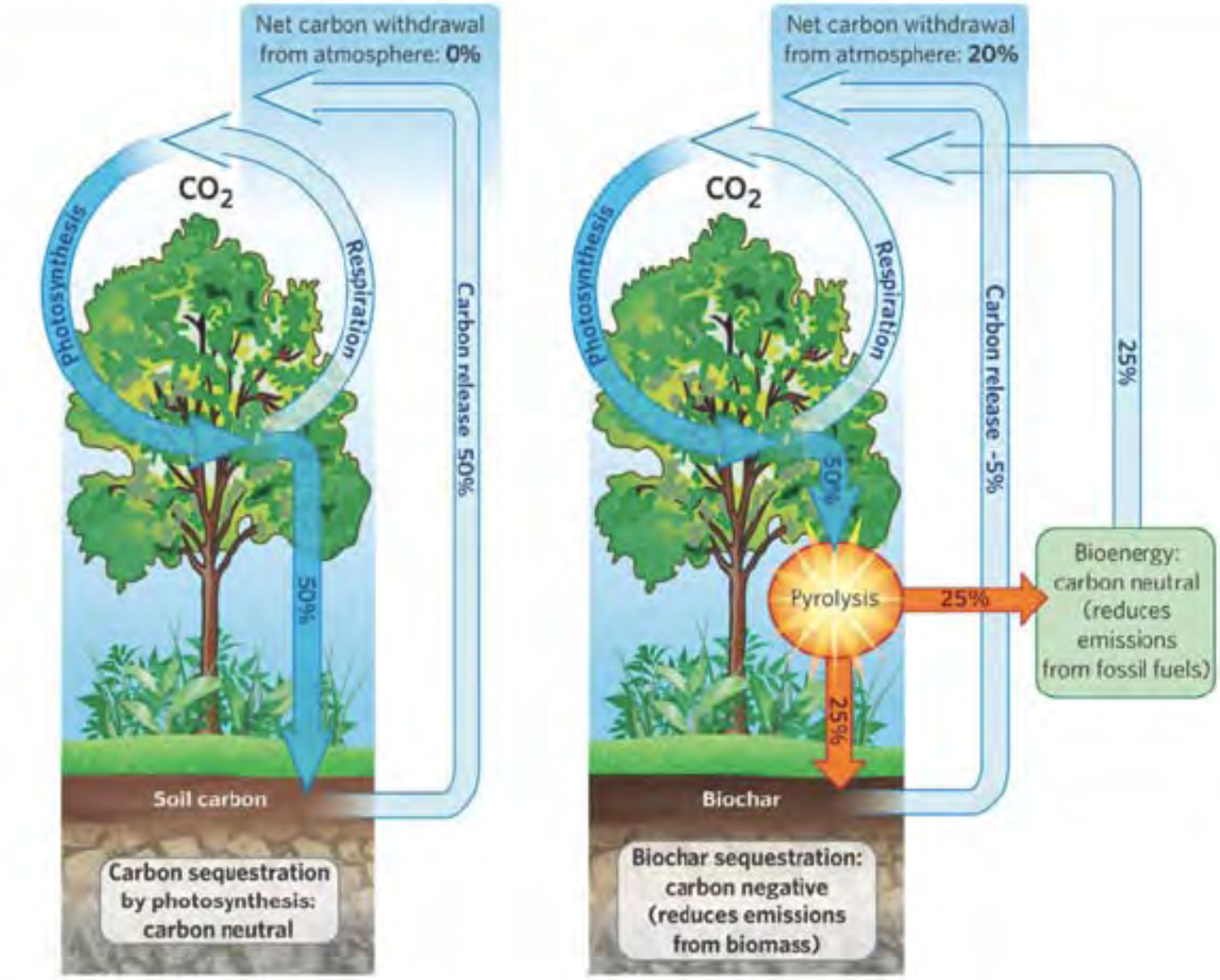


Rebuilding soil fertility would be useful for sustaining agriculture in a post-cheap-oil-and fertilizer world.


GROWING A REVOLUTION
BRINGING OUR SOIL BACK TO LIFE
DAVID R. MONTGOMERY
coauthor of The Hidden Half of Nature

Visiting farms around the world that had rebuilt soil health I saw how by adopting soil-building principles farmers could match conventional yields using far less oil and chemical inputs.

Biochar Can Be Carbon-Negative



Biochar:

Global soil C≈1500 Gt
Global atmospheric C≈760 Gt

Average residence time for SOC globally is less than 2 decades.

Biomass decay ≈60 Gt/yr
Fossil fuel emissions ≈7 Gt/yr

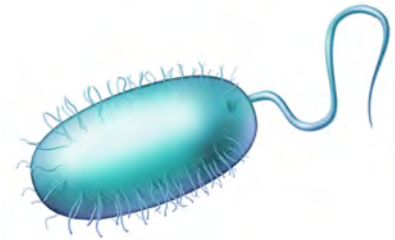
Capture of ≈10% of global annual biomass decay as biochar would offset global fossil fuel emissions.


TAGRO


TAGRO Prices
We load your vehicle
Mix $10/yd
Aged Black Bark $26/yd
Potting Soil $30/yd
We Deliver
Delivery fee ..... ZIP code-based ..... Inquire at office
Minimum Delivery Order
City of Tacoma resident ..... 1 cubic yard
Non-City resident ..... 3 cubic yards
CASHIER
PAY HERE
TAGRO
Potting
Soil
$5 per cart


FREE
TAGRO
MIX
AMES
PRO LIFE

Principles of Conservation Agriculture



- **minimal or no disturbance**

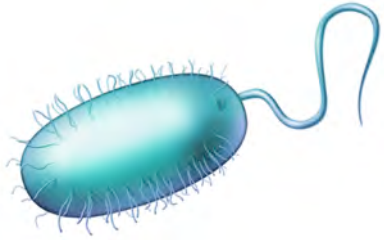
(direct planting of seeds / no-till)

- **permanent ground cover**

(cover crops / retain crop residues)

- **diverse crop rotations**

(to break up pathogen carryover)



Adopting no-till, cover crops, and complex rotations reduced inputs of diesel, fertilizer and pesticide by more than half.

Traditional Yield
soybeans: 63 bushels/acre
corn: 217 bushels/acre

Complex Rotation Yield
soybeans: 79 bushels/acre
corn: 235 bushels/acre

Traditional (slash and burn) vs. no-till with cover crops

Erosion

Traditional: 1787 kg/ha/yr
No-till: 77 kg/ha/yr

Traditional Yield

corn: 1.5 tons/ha
cowpeas: 0.8 tons/ha

No-till Yield

corn: 4.5 tons/ha
cowpeas: 1.5 tons/ha


BRANDT FAMILY FARM
HOME OF
Walnut Creek Seeds, LLC.
SIMPLE. SUSTAINABLE.
6100 BASIL WESTERN RD. CARROLL, OH 43112
COVER CROP SEEDS: AGRICULTURAL · FORAGE · GARDENS


Brandt Farm, Ohio

Neighboring conventional
Full tillage, 200 lbs N & 2.5 quarts Roundup / acre

Total cost ≈ $500/acre
Corn yield ≈ 100 bushels/acre
At $4/bushel = - $100 / acre

44-year no-till with cover crops
No tillage, 24 lbs N & 1 quart Roundup / acre

Total cost ≈ $320/acre
Corn yield ≈ 180 bushels/acre
At $4/bushel = + $400 / acre


CARDINGTON CLAY SOIL
1971
2014
10.15.2013


BROWN'S RANCH
Specializing in
nature
REGENERATIVE
AGRICULTURE


Ditch the Plow,
Cover Up &
Grow Diversity
-- Growing A Revolution

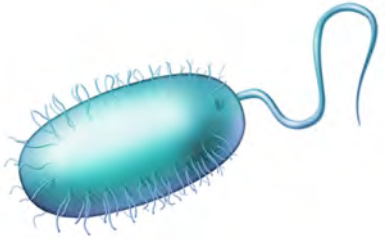
This is not a question of organic versus conventional…

… but how to apply an understanding of soil ecology to build soil health and sustain — if not increase — crop yields using far less inputs.

Benefits of Conservation Agriculture

- comparable or increased yields
- greatly reduced fossil fuel and pesticide use
- increased soil carbon and water retention (crop resilience)
- higher farmer profits & less pollution



The First Revolution

Cultivation & Tillage

The Second Revolution

Soil Husbandry / Legumes & Crop Rotation

We know more about the movement of celestial bodies than about the soil underfoot.

- Leonardo da Vinci

The Third Revolution

Mechanization & Industrialization

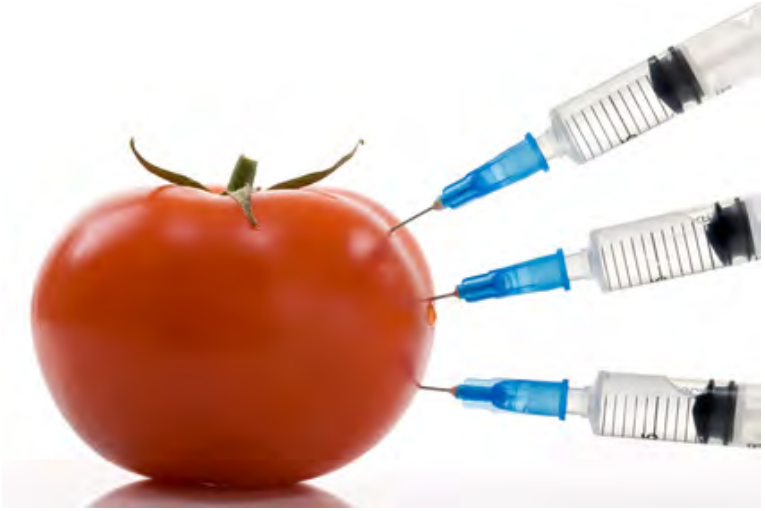
Sidebar…

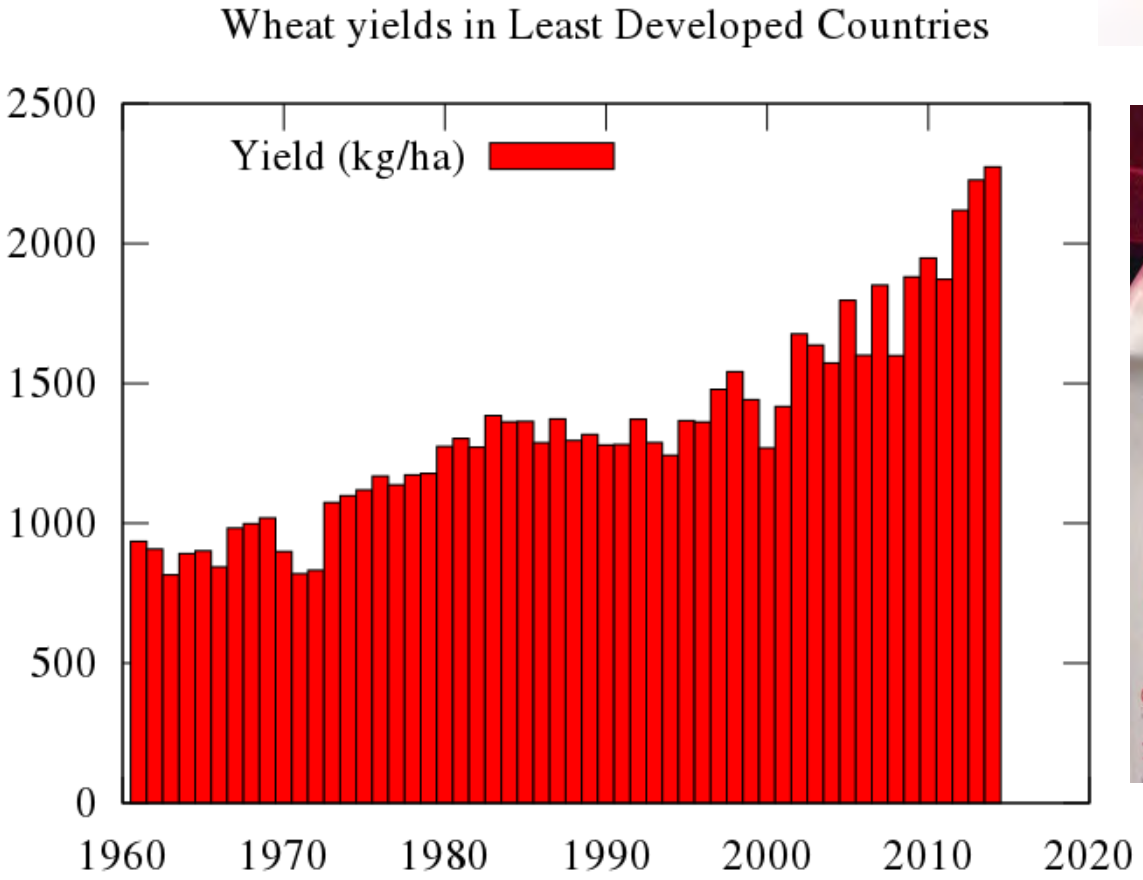
Liebig's change of heart

In his 1863 book, *The Natural Laws of Husbandry*, the father of fertilizers recommended returning organic matter to the fields to provide crops with a full complement of nutrients.

The Fourth Revolution

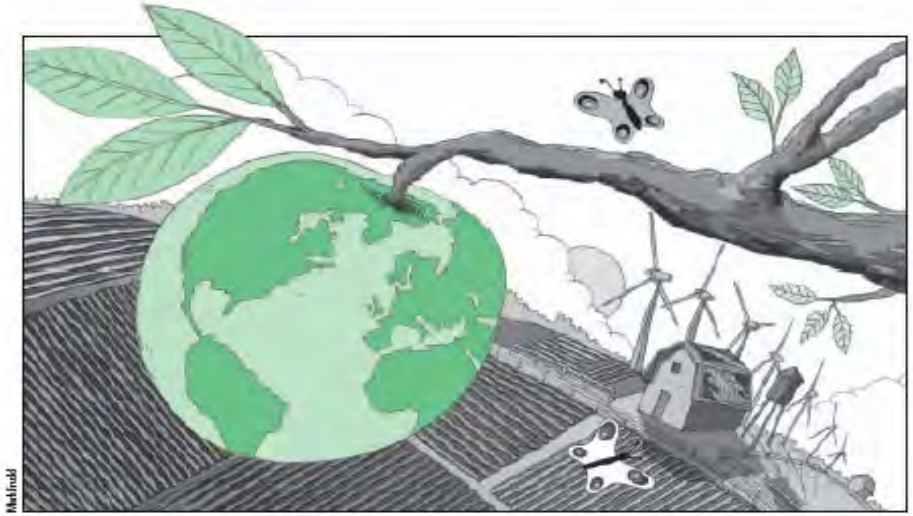
Green Revolution & Biotechnology

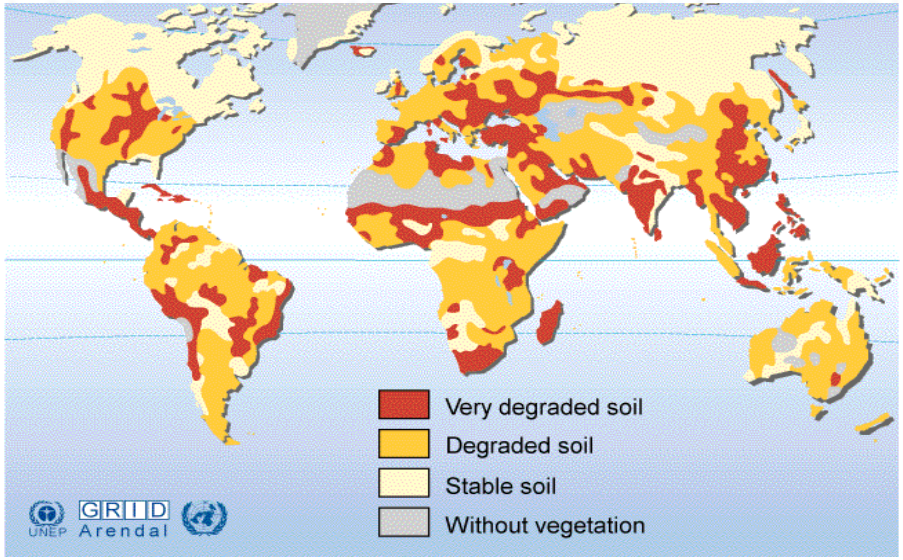


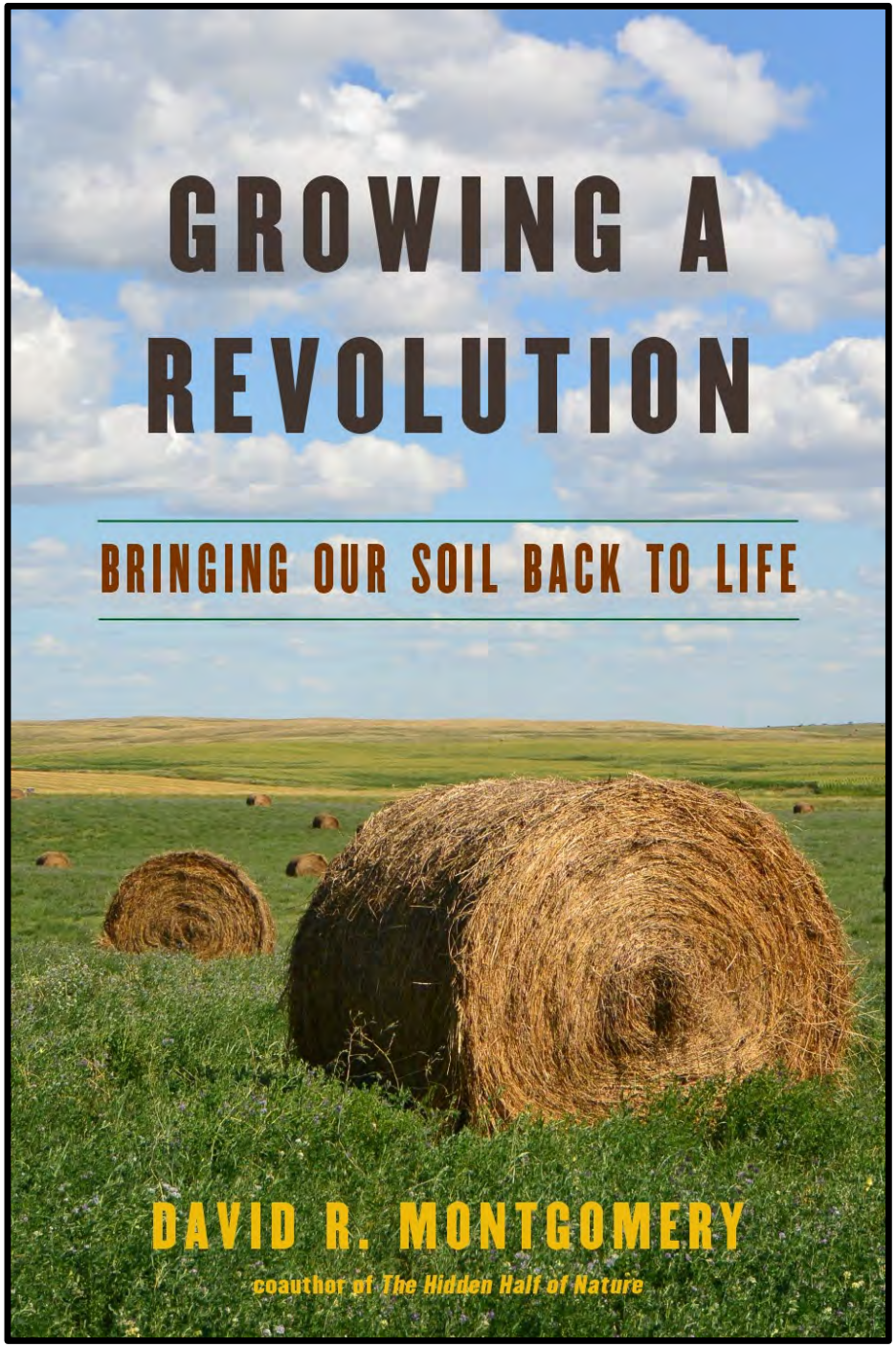


The Fifth Revolution

Soil-Health







The Soil Health Revolution

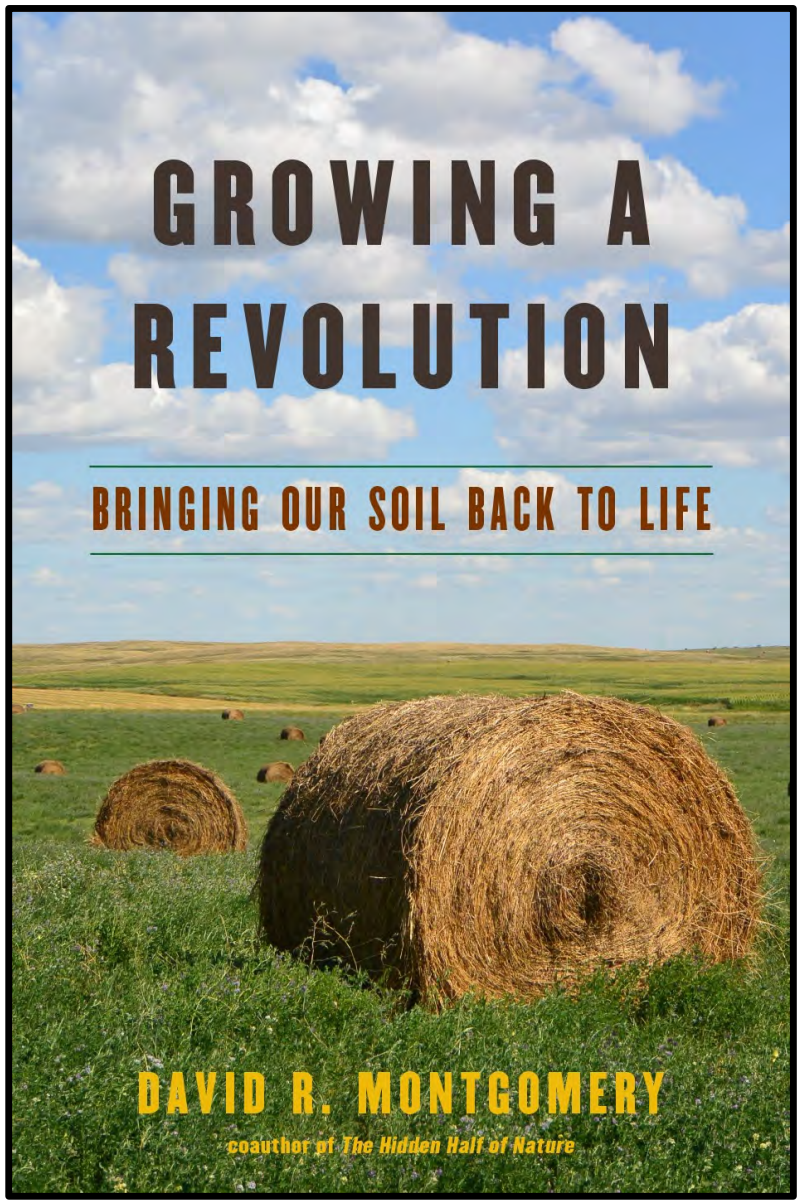
Restoring organic matter to the world's soils can help …

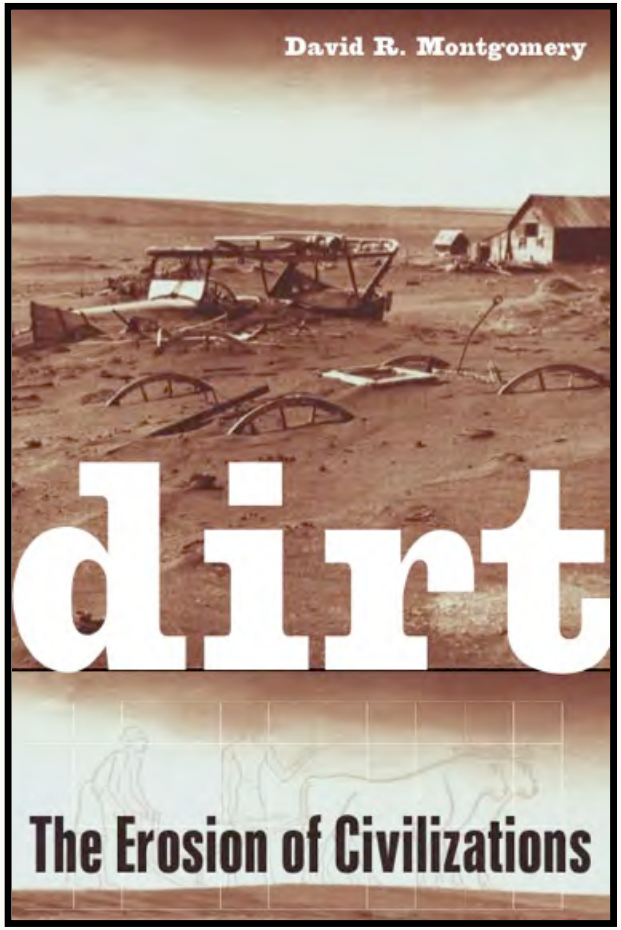
Restore farm profitability

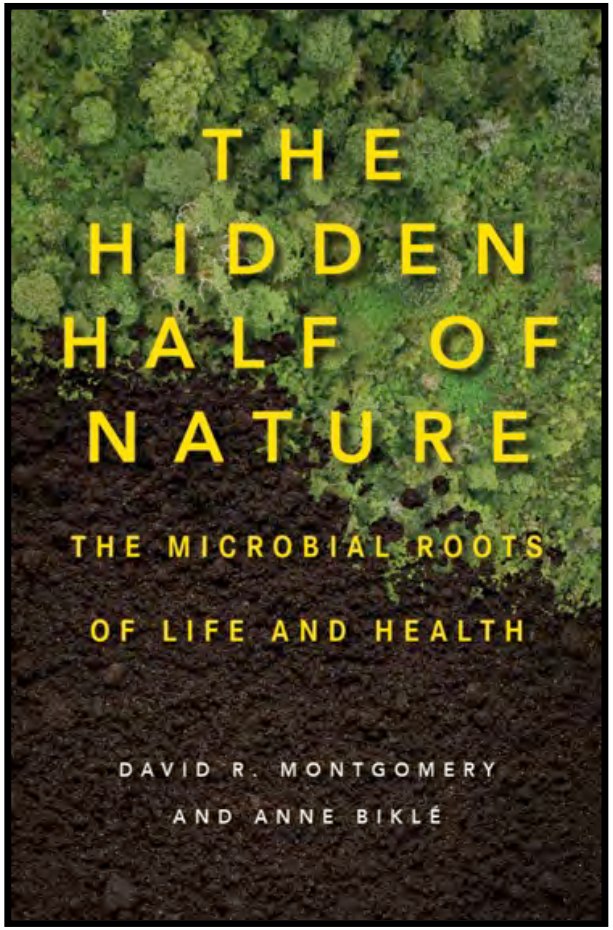
Feed the world

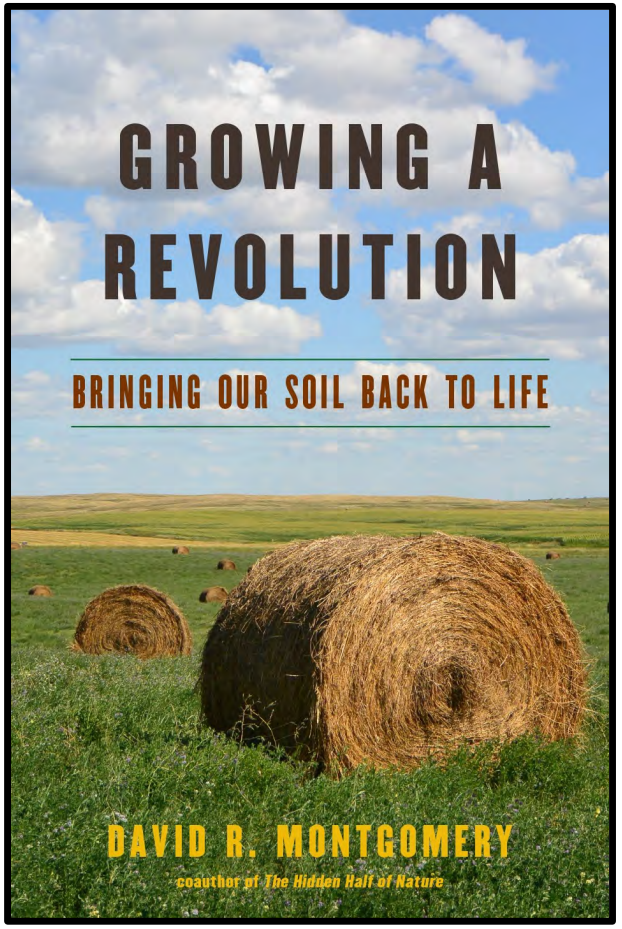
Climate change resilience (carbon sequestration)

Reduce environmental degradation









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