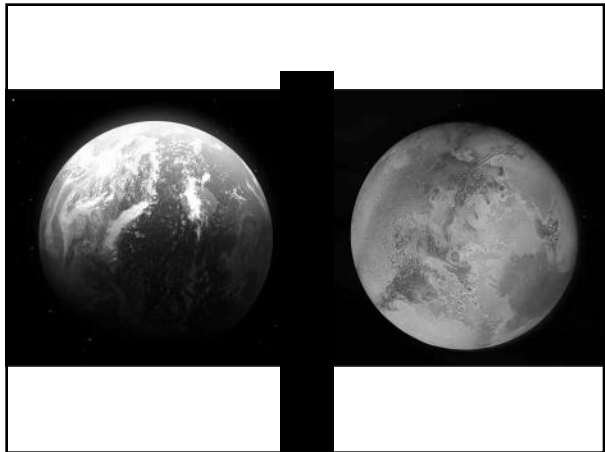


David R. Montgomery
 Dept. of Earth & Space Sciences
 University of Washington
 Seattle, WA

www.Dig2Grow.com
 Twitter: @Dig2Grow

1

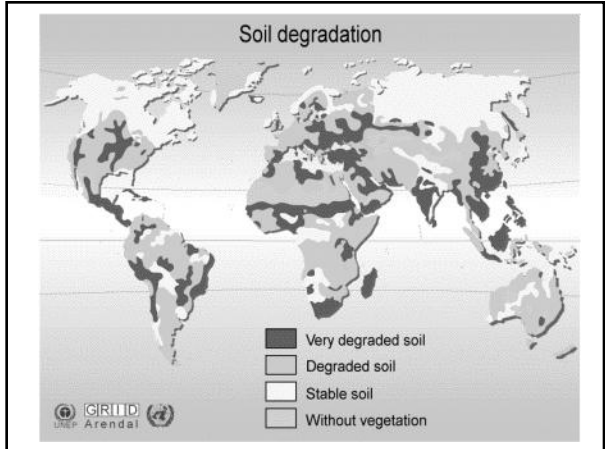


2

David R. Montgomery

dirt
 The Erosion of Civilizations

3



4

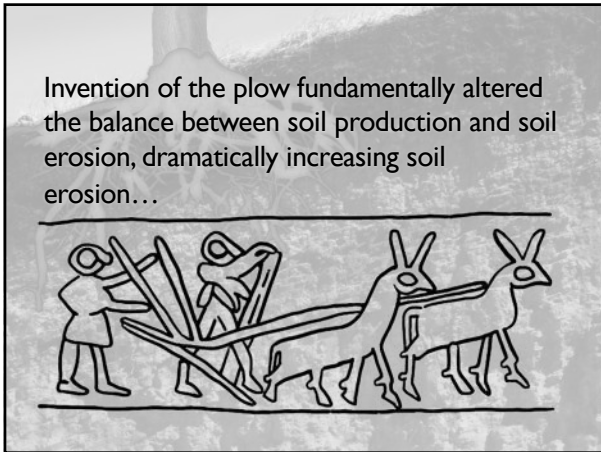
Humanity loses another 0.3% of our global food production capacity each year to soil erosion and degradation.

UN Global State of the Soil Assessment, 2015

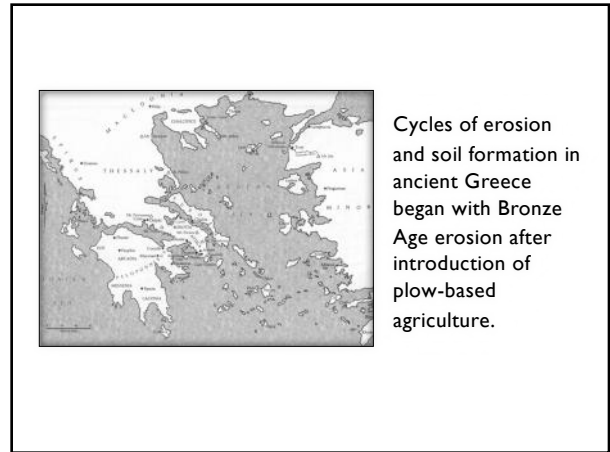
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Soil erosion and degradation played a role in the demise of ancient civilizations, from Neolithic Europe, to Classical Greece, Rome, the Southern United States, Central America, and more...

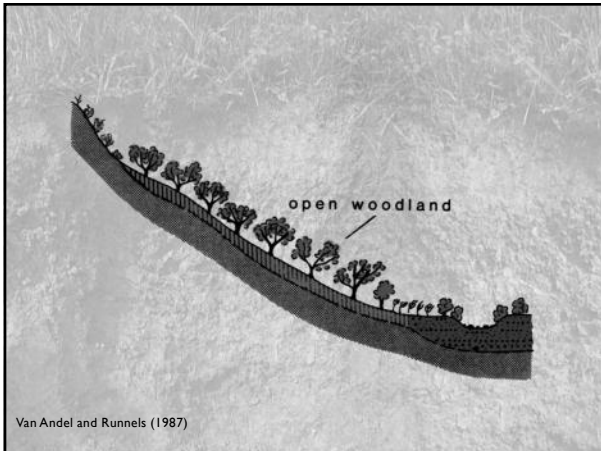
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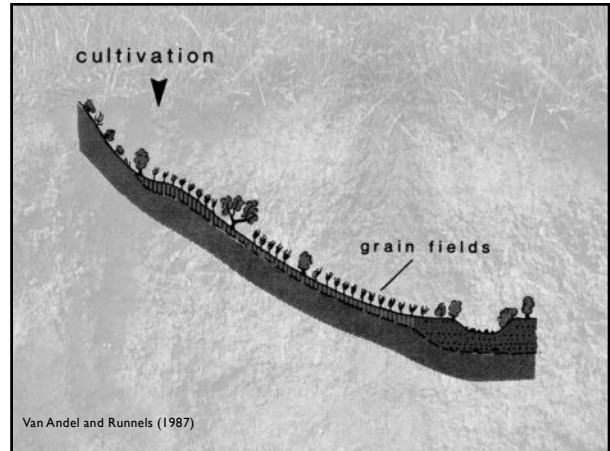
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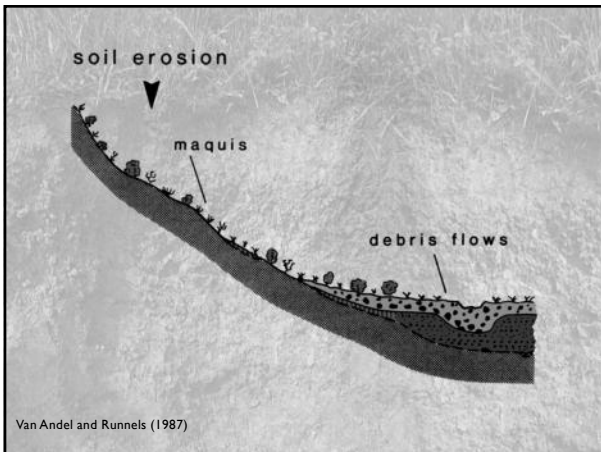
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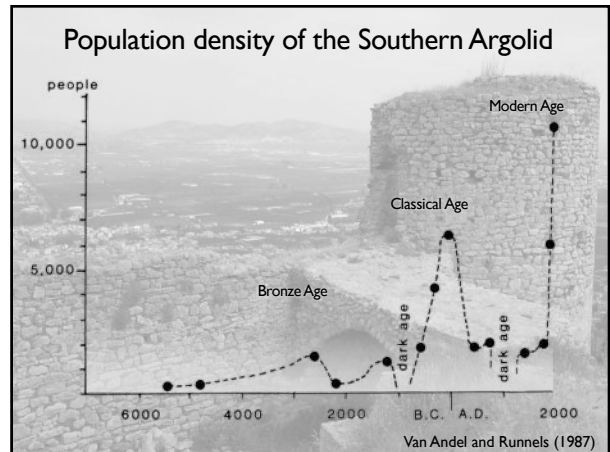
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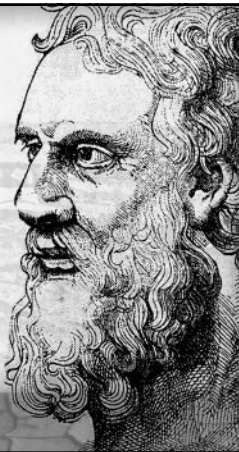
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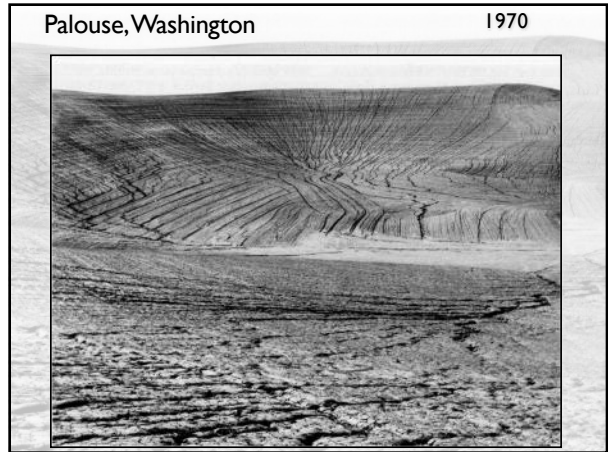
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Plato 427-347 B.C.

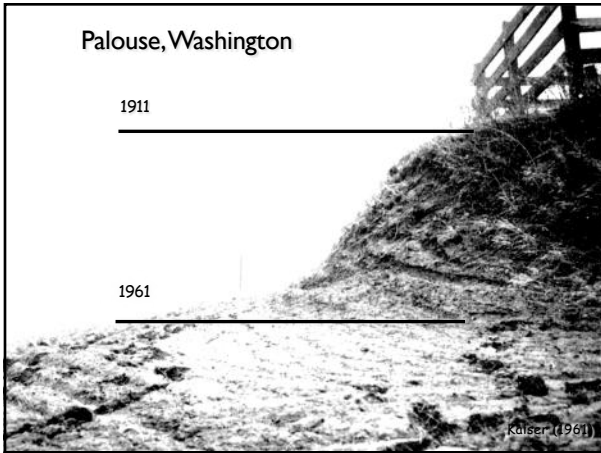
The rich, soft soil has all run away leaving the land nothing but skin and bone. But in those days the damage had not taken place, the hills had high crests, the rocky plain of Phelleus was covered with rich soil, and the mountains were covered by thick woods, of which there are some traces today.



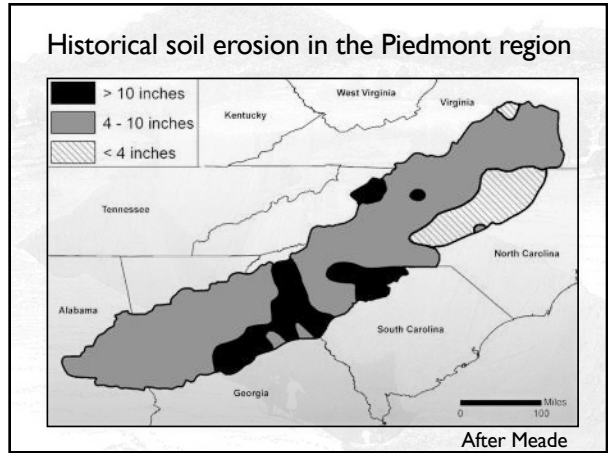
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14



15




16

In a 1796 letter to Alexander Hamilton...

A few years more of increased sterility will drive the Inhabitants of the Atlantic States westward for support; whereas if they were taught how to improve the old, instead of going in pursuit of new and productive soils, they would make these acres which now scarcely yield them any thing, turn out beneficial to themselves.

- George Washington



17



18

How Fast Is Soil Eroding From Farms?
 1.5 mm/yr
 Less than 20 years to erode an inch

How Fast Does Nature Make Soil?
 0.02 mm/yr
 More than 1000 years to make an inch

Montgomery, D.R. 2007. Soil erosion and agricultural sustainability, *Proceedings of the National Academy of Sciences*, v. 104, p. 13,268-13,272.

19

Earth's Future, 10, e2021EF002396.
 https://doi.org/10.1029/2021EF002396

**Rates of Historical Anthropogenic Soil Erosion in the
 Midwestern United States**

Evan A. Thaler^{1,2}, Jeffrey S. Kwang¹, Brendon J. Quirk^{1,2}, Caroline L. Quarrier², and
 Isaac J. Larson¹

Median historical erosion rate of 1.8 mm/yr


PNAS 2021 Vol. 118 No. 8 e1922375118

The extent of soil loss across the US Corn Belt

Evan A. Thaler^{1,2}, Isaac J. Larson^{1,2}, and Qian Yu^{1,2}

“35% of cultivated areas has lost A horizon soil”

20



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...

21

Sustainability 2015, 7, 2936-2960; doi:10.3390/su7032936

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sustainability
 ISSN 2071-1050
 www.mdpi.com/journal/sustainability

Review

North American Soil Degradation: Processes, Practices, and Mitigating Strategies

R. L. Baumhardt^{1,1*}, B. A. Stewart^{2,3} and U. M. Salju^{3,4}

“The SOM content of many soils in North America is only about 50% of the level present at the time they were converted from forests or prairies to farms lands.”

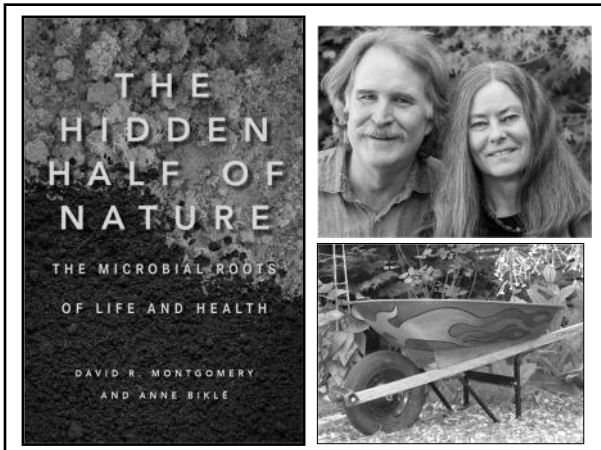
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23



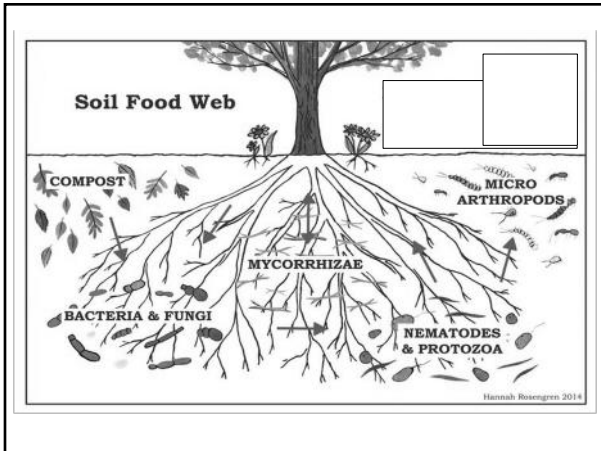
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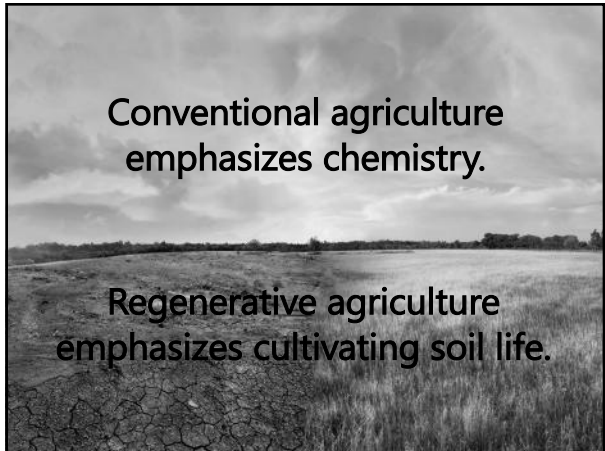
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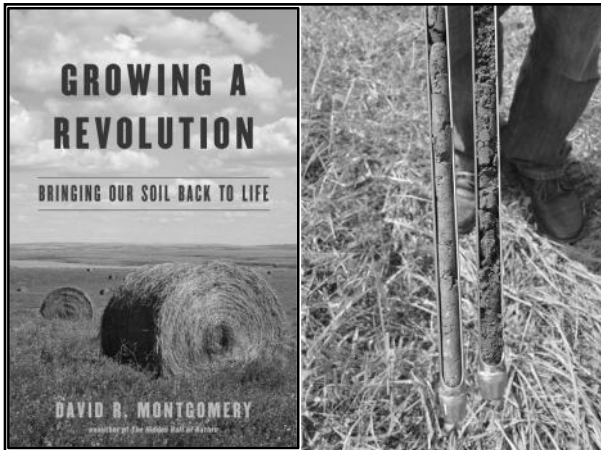
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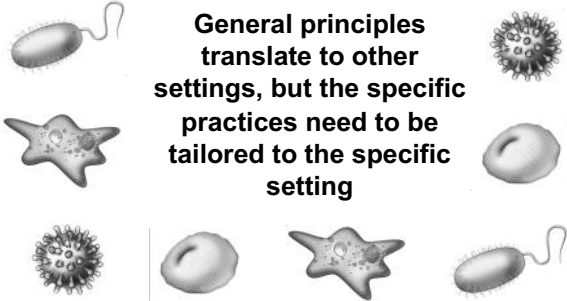
29

Principles of Conservation Agriculture

- minimal or no disturbance (no-till / minimal chemical use)
- permanent ground cover (cover crops)
- diverse crop rotations

30

Principles of Conservation Agriculture



General principles translate to other settings, but the specific practices need to be tailored to the specific setting


31

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

Dakota Lakes Research Farm
South Dakota



32


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 with cover crops yield
corn: 4.5 tons/ha
cowpeas: 1.5 tons/ha

No-Till Center
Kumasi, Ghana



33

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

Brandt Farm, Ohio



34

CARDINGTON CLAY SOIL



1971

2014

10.15.2018

35

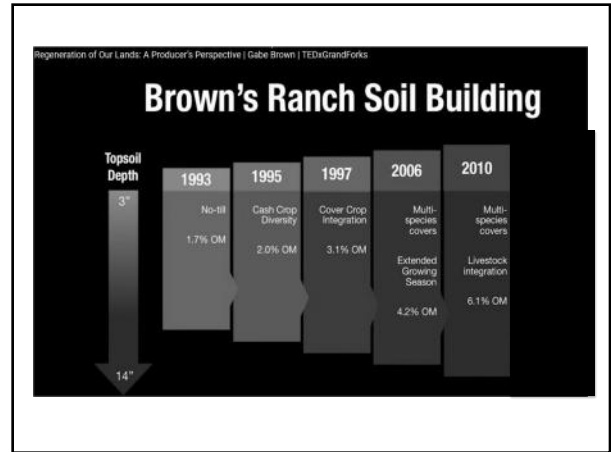




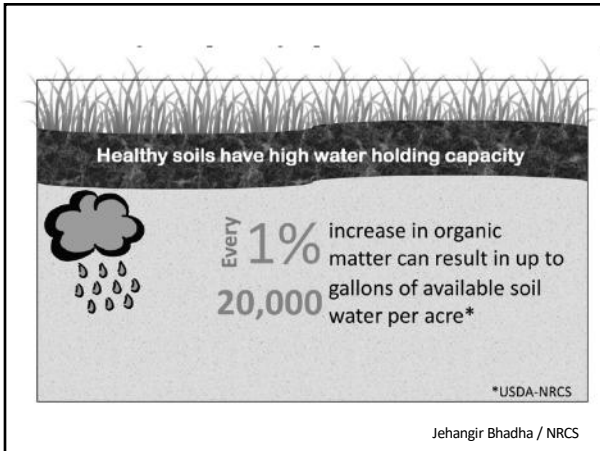
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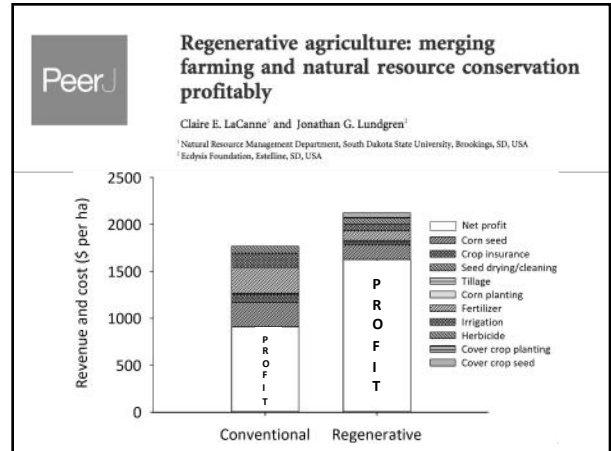
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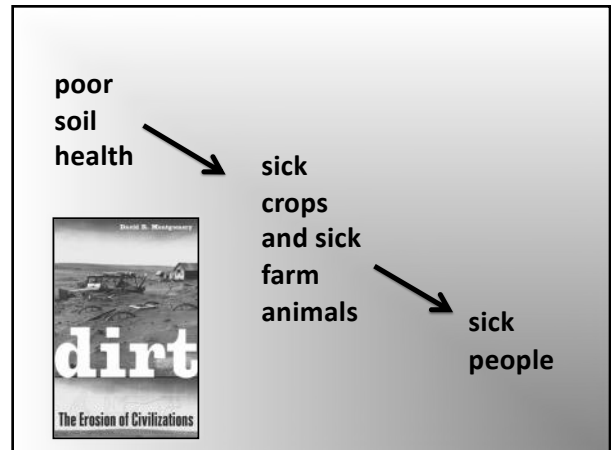
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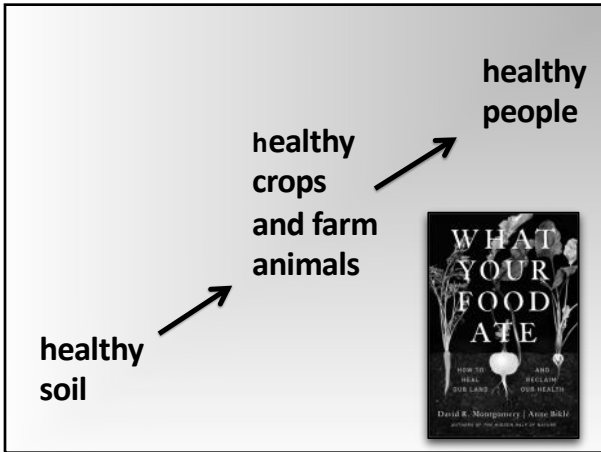
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- ### Benefits of Healthy Soil
- higher farmer profits
 - comparable yields after conversion
 - less fertilizer, pesticide, and fossil fuel use
 - increased soil carbon and water retention, with less off-site pollution
-

41



42



43

The First Revolution

Cultivation & Tillage

44

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

45

The Third Revolution

Mechanization & Industrialization

46

The Fourth Revolution

Green Revolution & Biotechnology

Wheat yields in Least Developed Countries

47

The Fifth Revolution

Soil-Health

GROWING A REVOLUTION
BRINGING OUR SOIL BACK TO LIFE

DAVID B. MONTGOMERY
author of *The Hidden Half of Nature*

48



dirt
The Erosion of Civilizations

THE HIDDEN HALF OF NATURE
THE MICROBIOLOGY OF LIFE AND HEALTH
DAVID R. MONTGOMERY AND ANNE POOLE

GROWING A REVOLUTION
BRINGING OUR SOIL BACK TO LIFE
DAVID R. MONTGOMERY

WHAT YOUR FOOD ATE
HOW TO HEAL OUR LAND AND RECLAIM OUR HEALTH
David R. Montgomery | Author
Allison Barlow | Photographer

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49