

# Gaining Ground: Soil as a Renewable Resource

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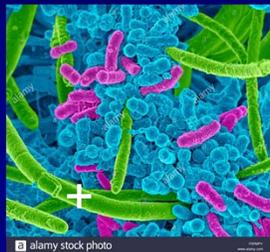


# What is soil?

- a complex, dynamic mixture of pulverized bedrock and other minerals weathered over millennia (2 cm of topsoil can take >500 years to form)
- contains >1 billion cells and several thousand species per gram
- always in a dynamic state affected by physical and biological environment
- one of the most complex systems on Earth



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# Value of Soil

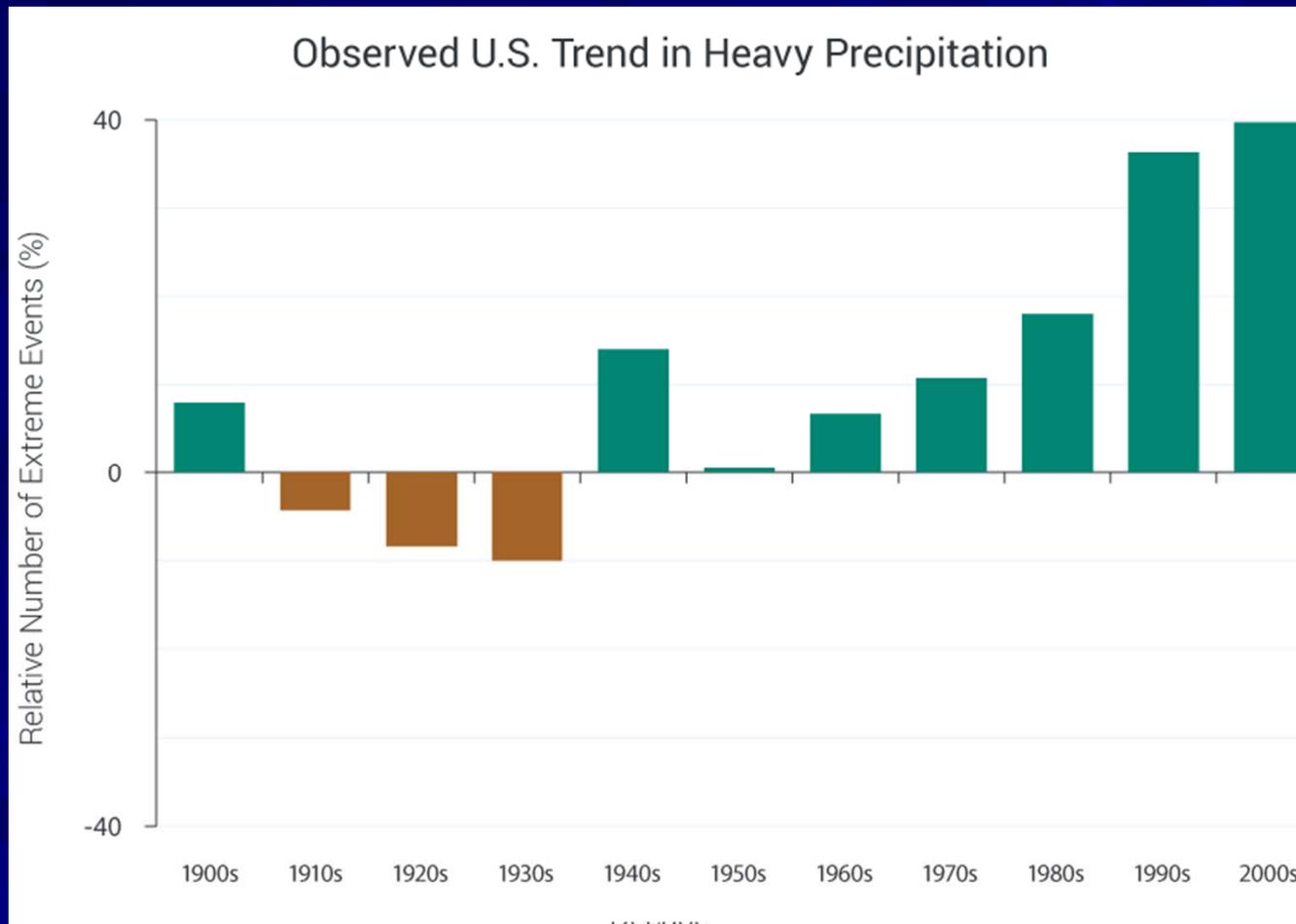
- Food security (on Earth and Mars)
- Climate mitigation (carbon storage)
  - ❖ Soil on Earth holds ~1,500 Gt carbon (range of estimates 1,100-1,700 Gt)
  - ❖ 2X carbon in atmosphere; 3X carbon in Earth's vegetation
- Water quality, management, and availability
- Bioenergy fuel production
- Drugs for human health (most antibiotics)
- Biodiversity



# Challenges

- Unsustainable management practices
  - ❖ Degradation and erosion
  - ❖ Salinization and desertification
- Land-use changes
  - ❖ Urbanization, infrastructure development, deforestation
- Contamination (metals, organics)
- Acid deposition and eutrophication
- Climate change
  - ❖ Loss of soil carbon to atmosphere
  - ❖ High velocity rainfall leads to erosion

# Climate Change Threatens Soil



<http://www.globalchange.gov/browse/multimedia/observed-us-trend-heavy-precipitation>



Average soil loss in Iowa  
= ~5 tons/acre

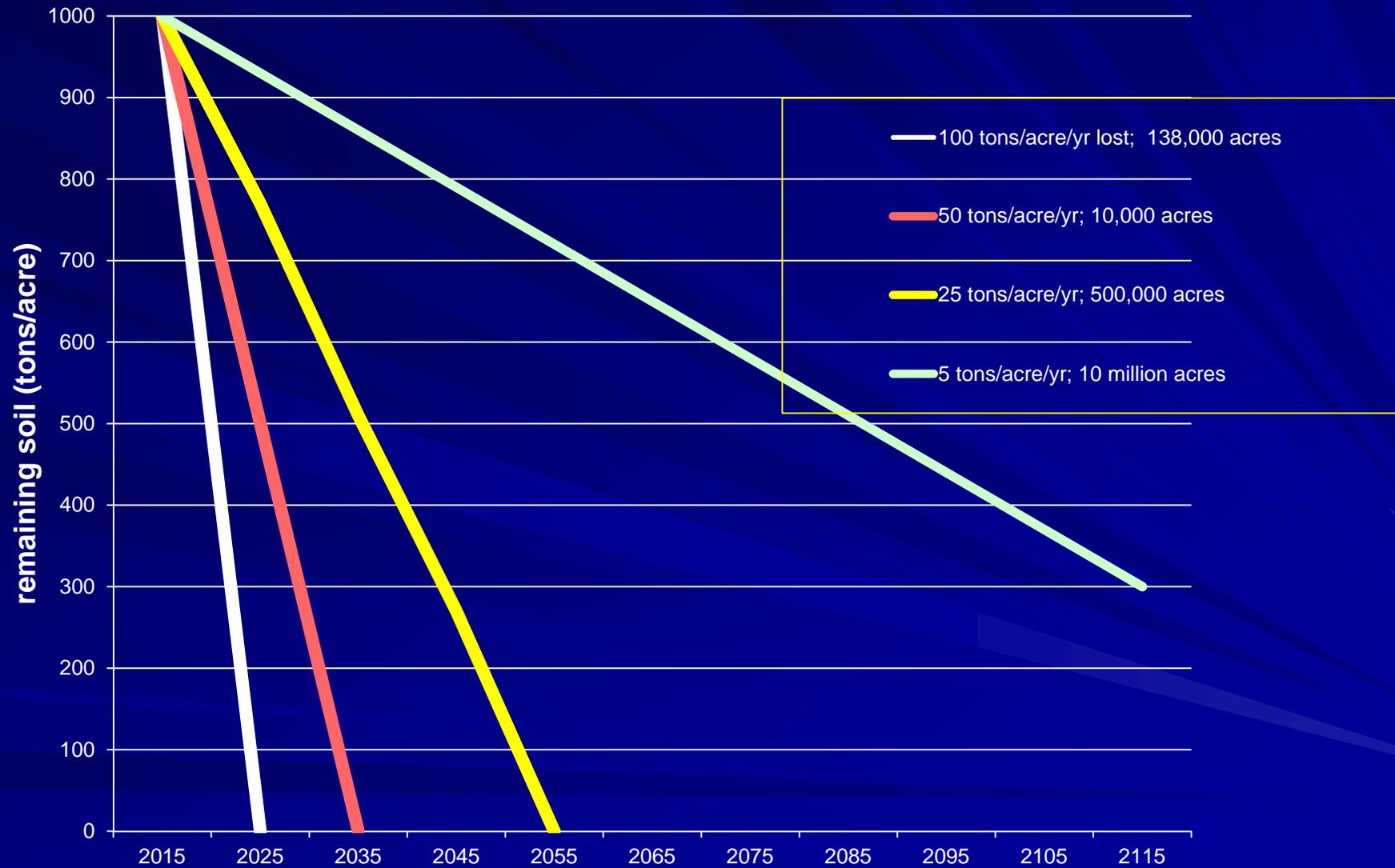
In 2007, a single rainstorm  
removed 100 tons/acre  
from more than 100,000  
acres in Iowa

Soil erosion estimated to  
cost Iowa \$1 billion/year in  
reduced crop yields



Courtesy of Professor Rick Cruse, Iowa State University

# Projections of Soil Erosion in Iowa



From White House OSTP  
based on data from <http://www.ewg.org/losingground/index.html>

# Tools to Protect Soil

- Research and technology
- Incentives to farmers
- Consumer pressure
- Education and training
- Public messaging
- Citizen science research
- Data sharing
- Policy, regulations, and legislation

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# Impacts of Legislation & Policy

- 1985 Food Security Act — reduced erosion dramatically in first decade
- 1990 Amendments to Clean Air Act — protected soil by reducing acid deposition, but soil recovery has been slow
- Under Secretary Vilsack, Farm Bill conservation programs increased from 252 M to 445 M acres between 2009 and 2017
- Federal Government's authority to ensure compliance is limited; many programs operate by self-certification

Soil is eroding in the United States on average 10X faster than it is produced.

# OSTP Soil Workshop

August 1, 2016

## ➤ Goals:

- Identify strategies to inventory, manage, and sustain soils
- Obtain broad input for Soil Science Interagency Working Group (SSIWG) about challenges, needs, opportunities, and solutions

## ➤ Soil habitats:

Agriculture, Forest, Rangeland, Urban, Vulnerable

# Examples of Opportunities for Soil

- Incentives: consumer-driven food labels as incentives for farmers to use soil-friendly practices
- Messaging: Earth Cities; soil woven into movie plots; TV chefs & composting
- Entrepreneurship: Replicate successful urban compost companies
- Galvanize researchers: Grand challenges to nucleate formation of new groups and innovations

# Soil As a Precious Resource

In 1936, President Franklin Roosevelt signed the legislation that created the Soil Conservation Service within USDA and said:

*“The history of every Nation is eventually written in the way in which it cares for its soil. The United States...is now emerging from its youthful stage of heedless exploitation and is beginning to realize the supreme importance of treating the soil well.”*

#SOILROCKS

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<https://www.whitehouse.gov/blog>