Managing Soil and Nutrient Runoff in a Changing Climate

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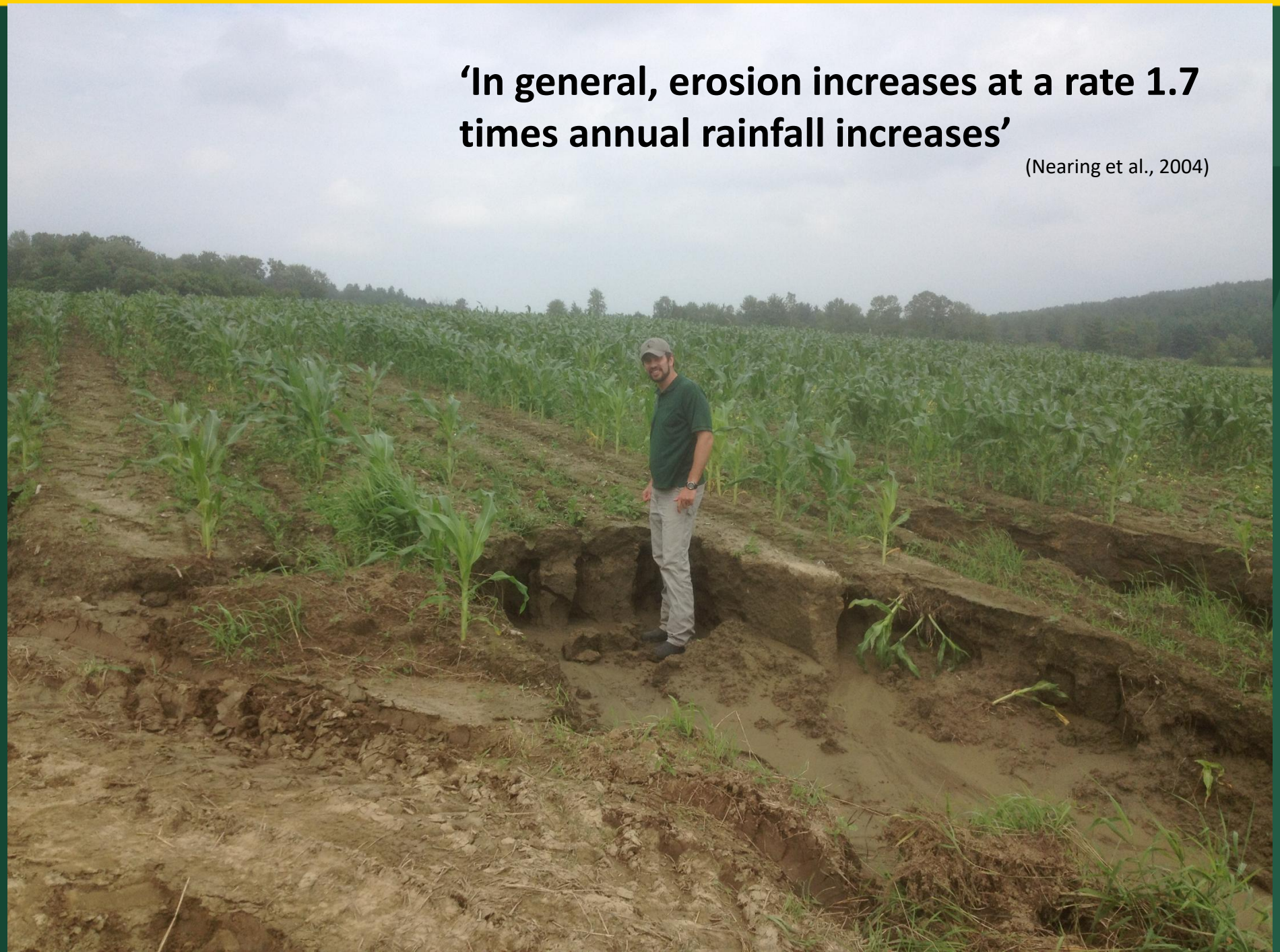
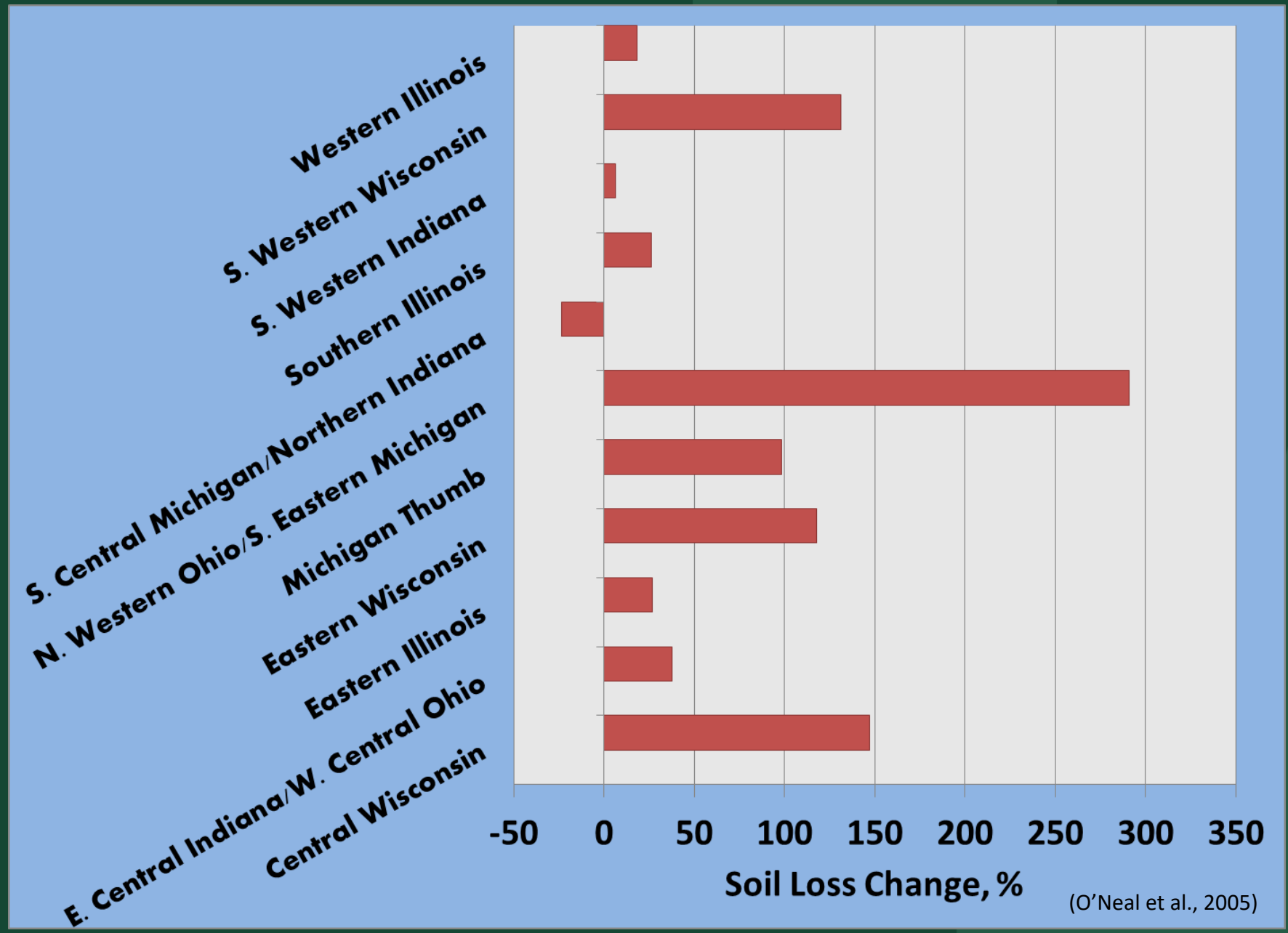
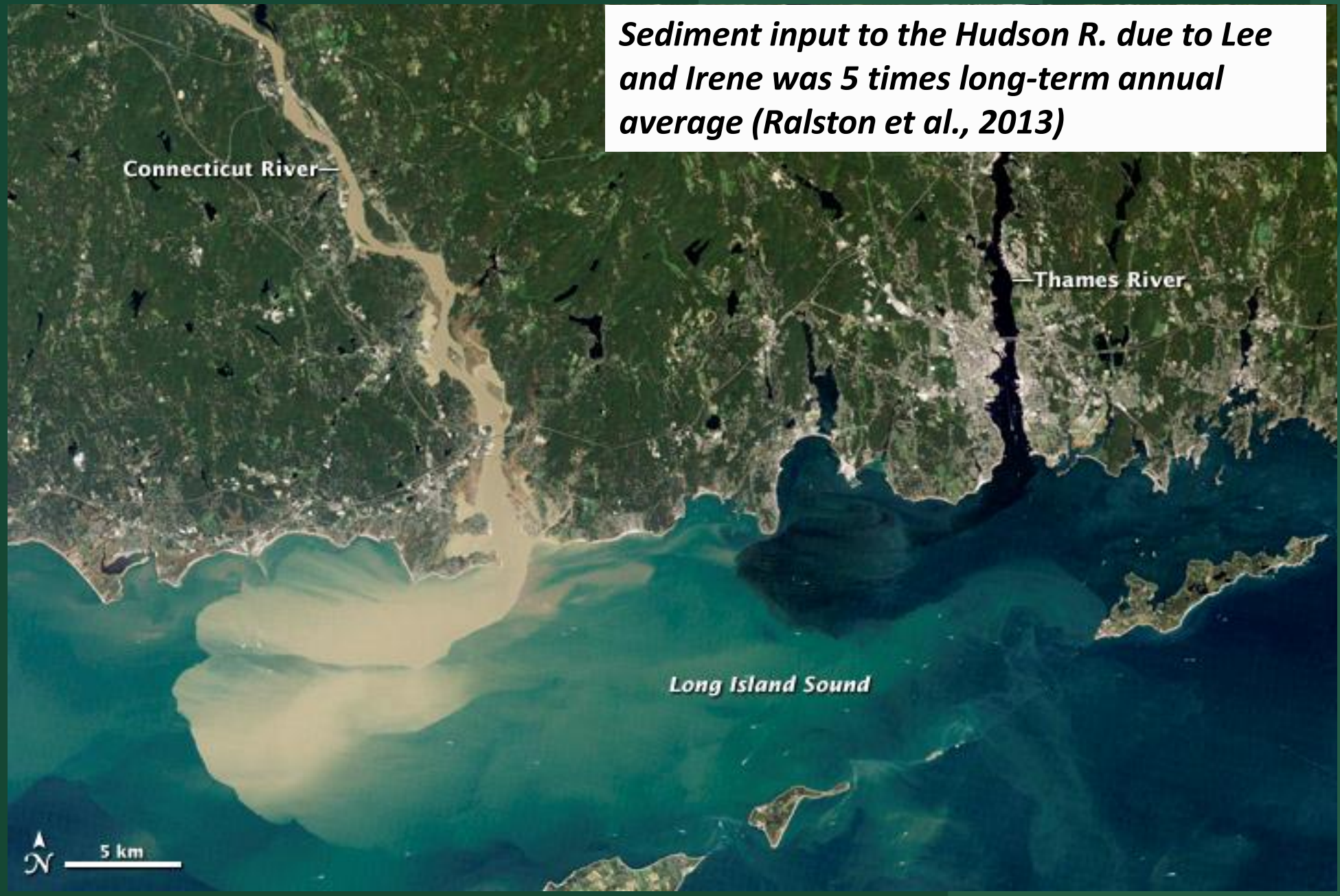

‘In general, erosion increases at a rate 1.7 times annual rainfall increases’
(Nearing et al., 2004)

Modeled Soil Loss: 1990-1999 vs. 2040-2059



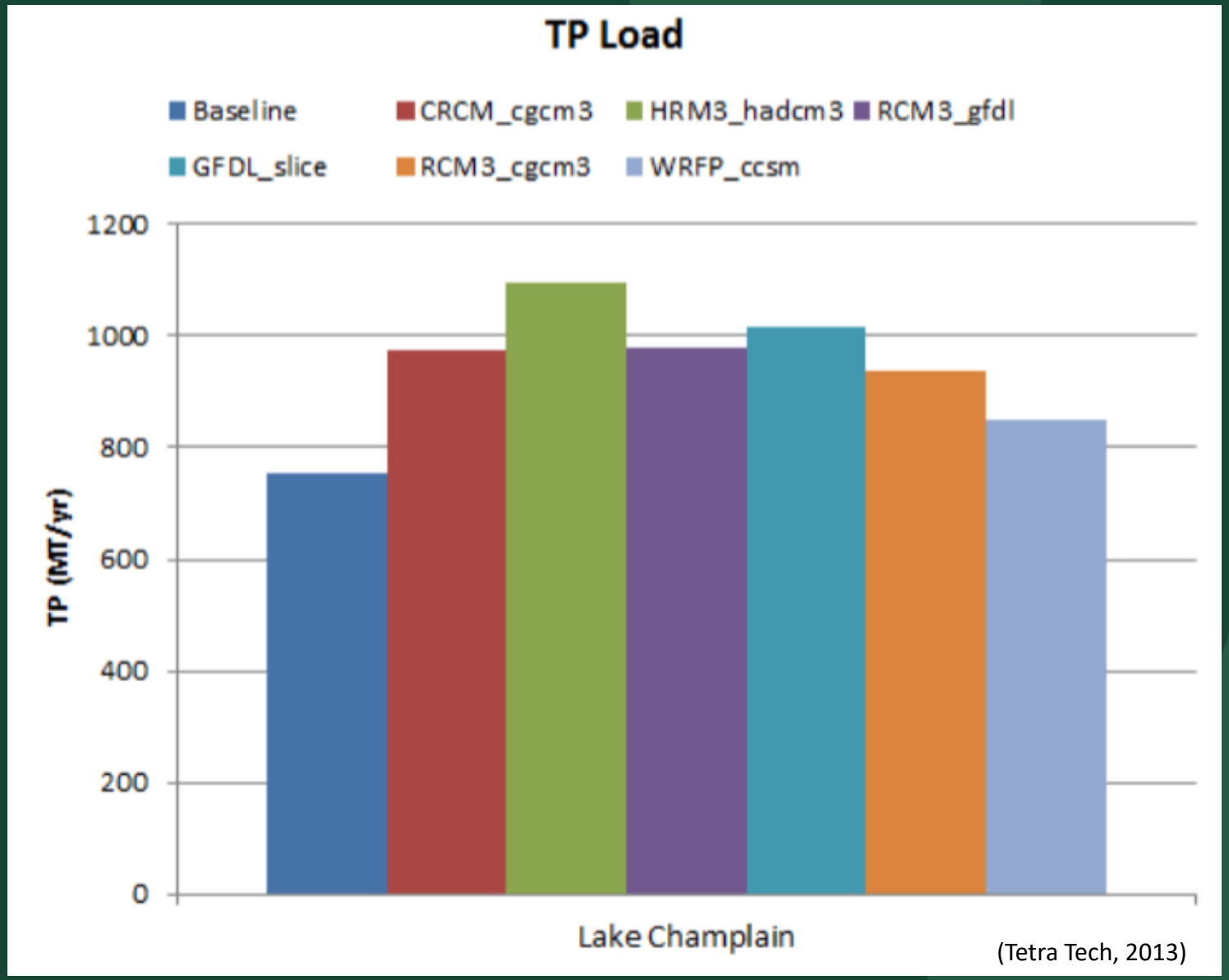
(O'Neal et al., 2005)

Sediment input to the Hudson R. due to Lee and Irene was 5 times long-term annual average (Ralston et al., 2013)



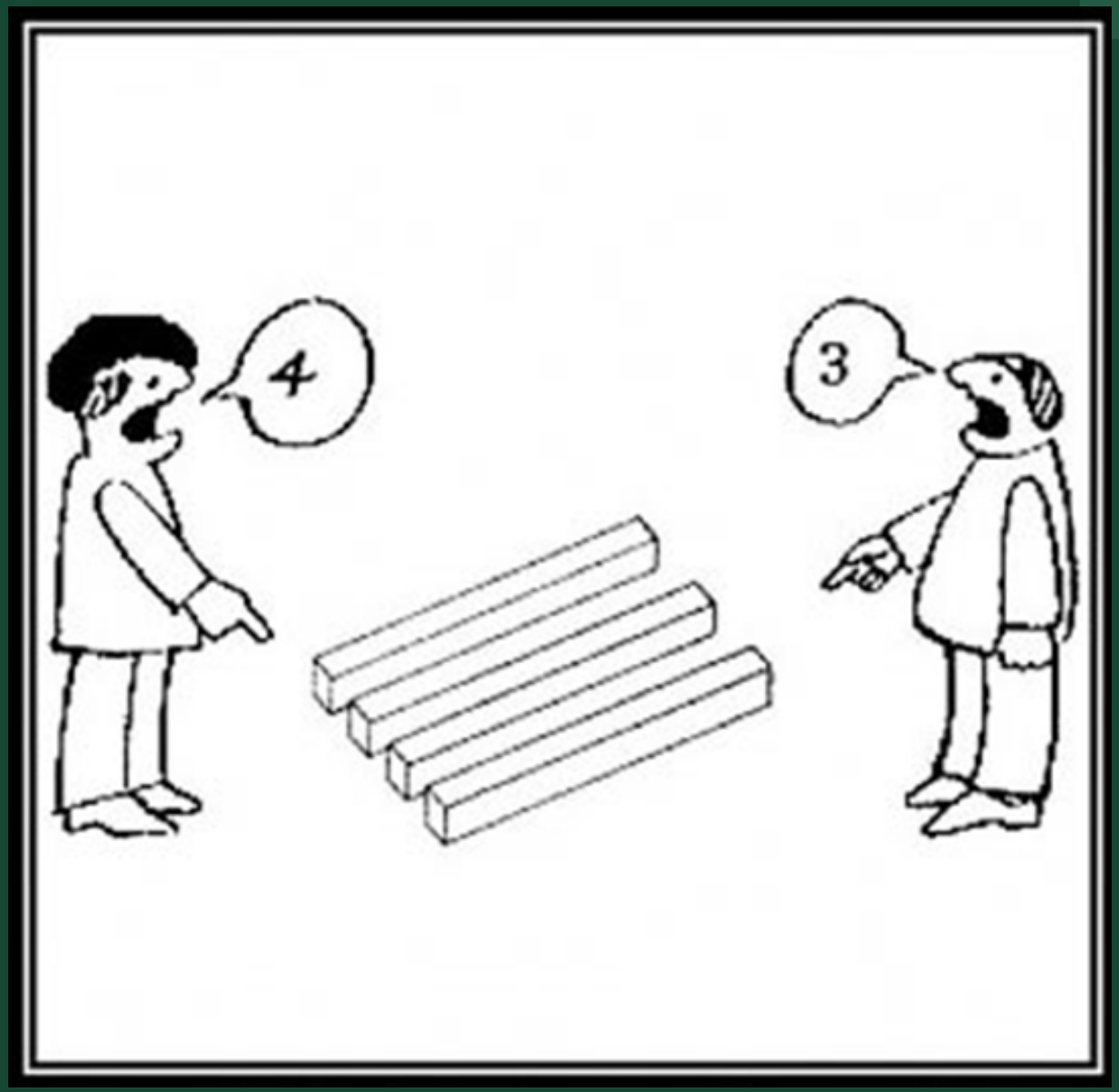
(Source: earthobservatory.nasa.gov))

Modeled Total P: Six Climate Scenarios



(Tetra Tech, 2013)

A Changing Climate…and a Shifting Perspective



- All common soil conservation and nutrient management Best Management Practices still apply…
- However, managing excess precipitation and resulting likelihood of increased runoff becomes even more necessary
- **Strategies that increase infiltration, thereby decreasing runoff are critical**

Building healthy, functioning, and resilient soils

Three principles of resilient soils for increasing infiltration:

1. ***Soil cover (preferably living!)***
2. ***Building organic matter***
3. ***Reduced disturbance/soil structure***

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www.nrcs.usda.gov

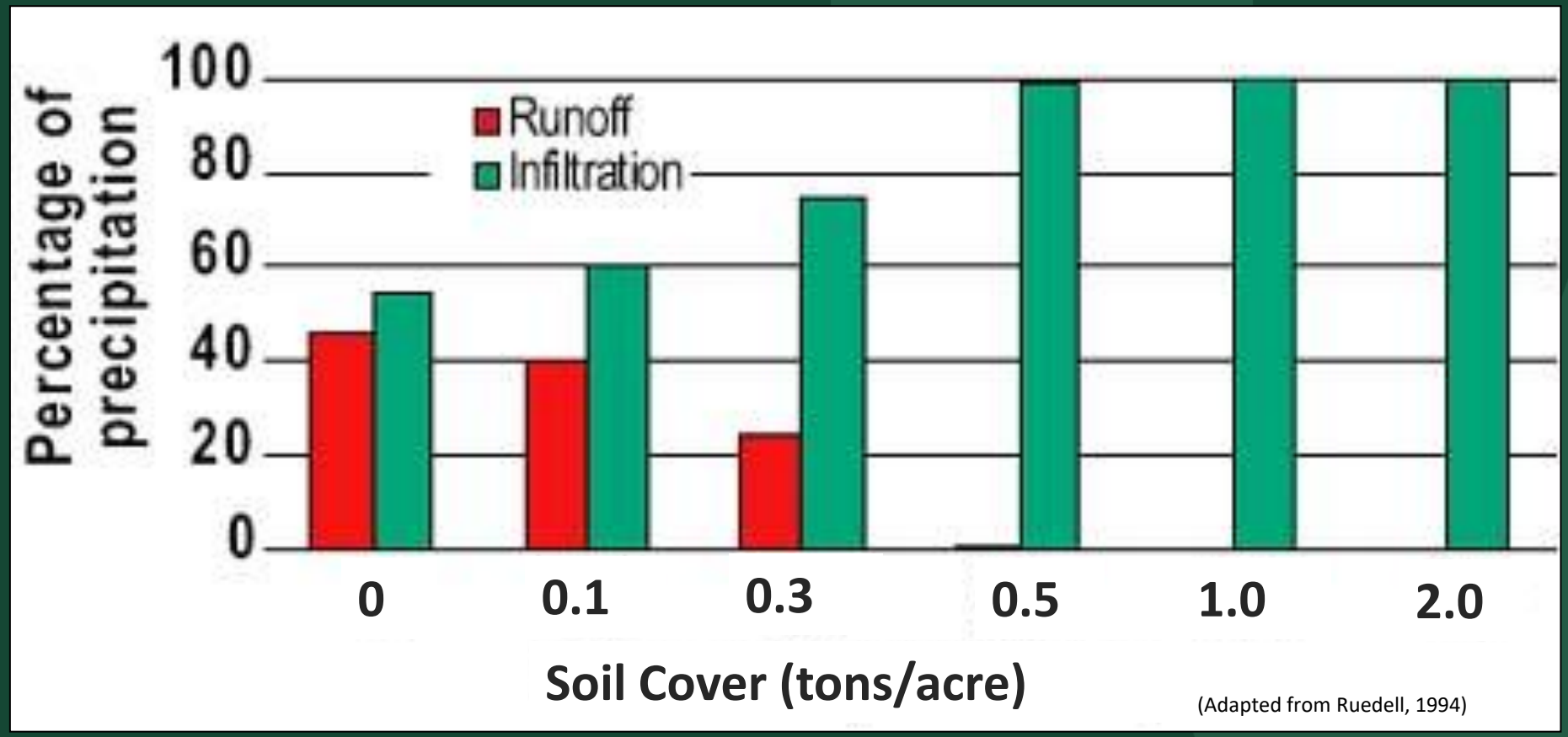
What's happening 'on the ground'

- Raindrop impact (32 ft/s!)
- Surface sealing
- Increased runoff = increased erosion

(Source: passel.unl.edu)

(Photo: Mark Licht, ipm.iastate.edu)

Soil Cover: Residue, mulch, or cover crops

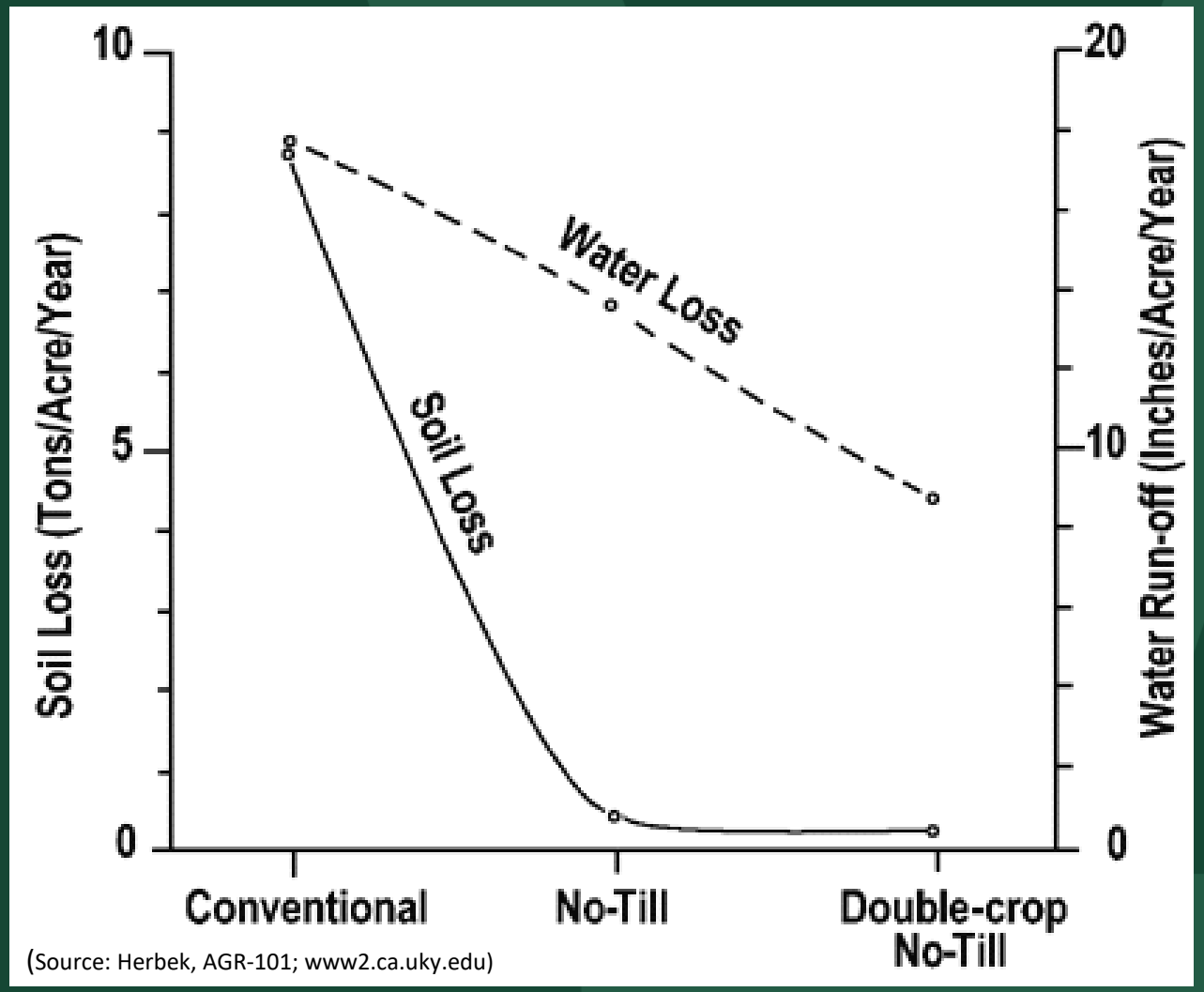


- Physically prevents raindrop impact
- Slows runoff down, allowing more time to infiltrate

Reduced Tillage and Infiltration

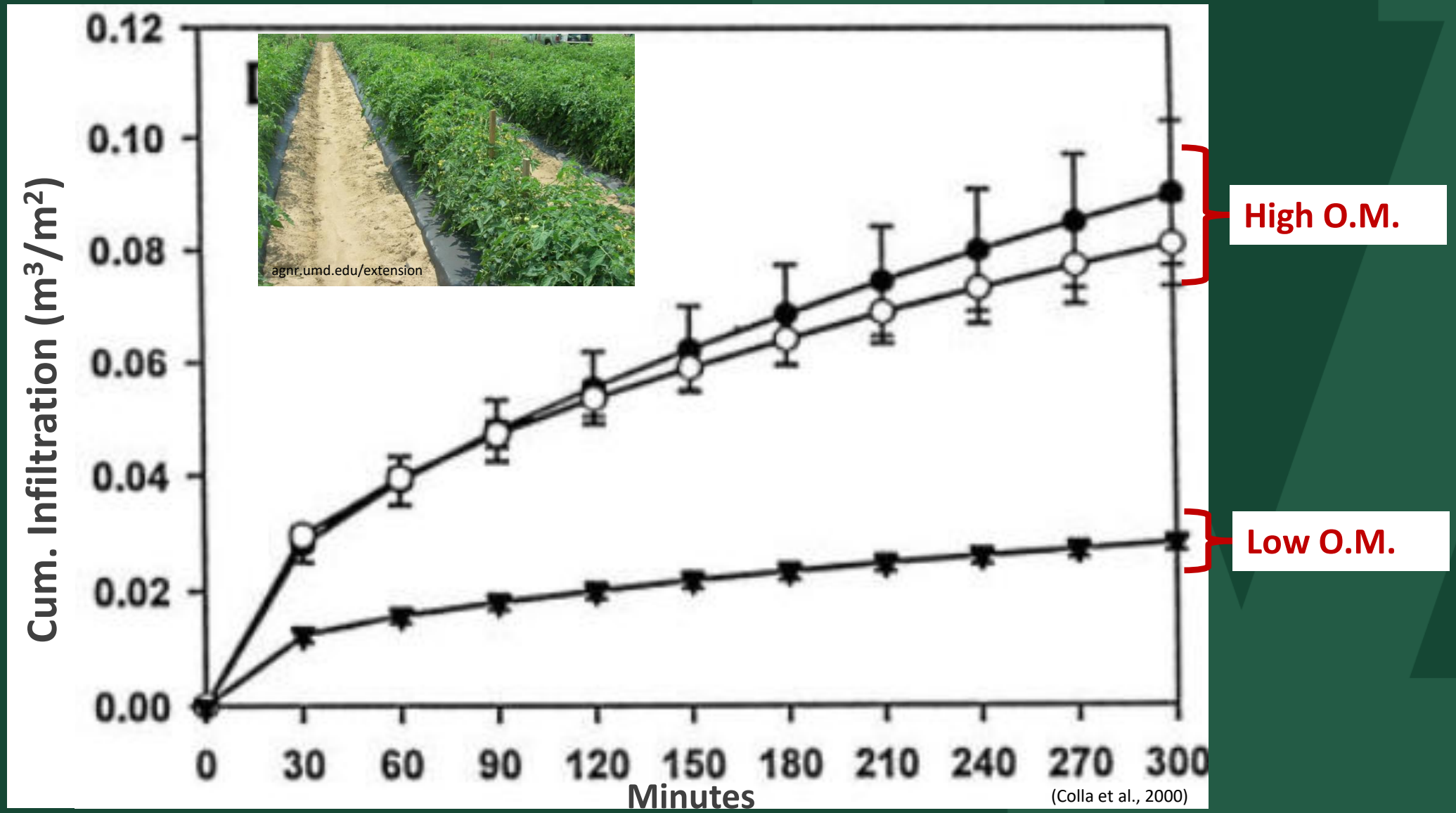
- No-, zone-, strip-, ridge-till, etc.
- Less macro-fauna disturbance (i.e., earthworms)

(Dan Brainard, msue.anr.msu.edu)



(Source: Herbek, AGR-101; www2.ca.uky.edu)

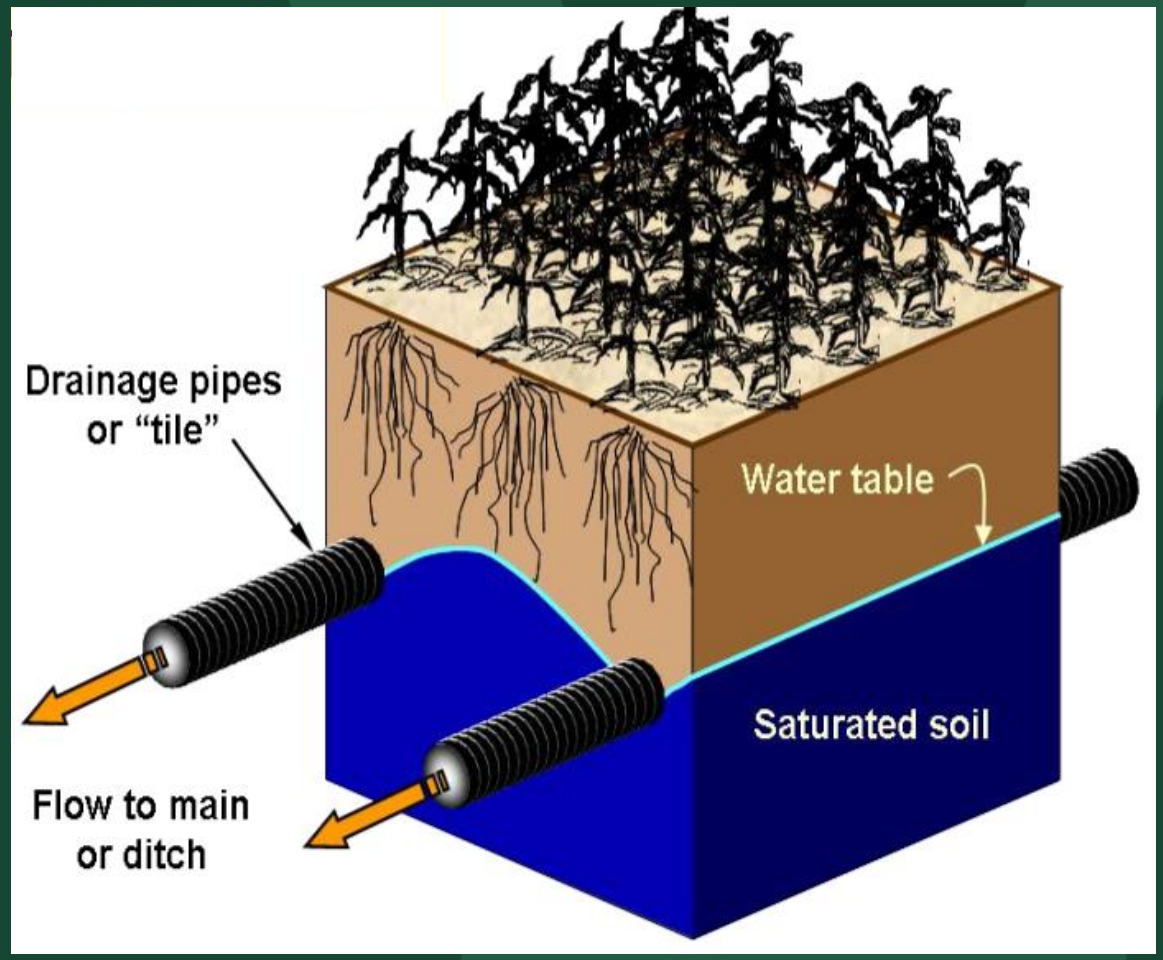
Organic Matter and Infiltration



(Colla et al., 2000)

In Response to Increased Precipitation…

- Artificial drainage first described by Cato in 200 BC in *De Agric Cultura*
- Adding hydrologic pathway also adds environmental risk



P Source, Rate, Time, & Placement Summary

- Organic P sources tend to pose a greater chronic risk of leaching to tile drains compared to inorganic P.
- The potential for P transport to tile drains significantly increases with an increase in P application rate.
- P losses in tile drains are generally greater when P is broadcast on the soil surface compared to P that is incorporated into the soil.
- A greater risk of P transport to tile drains is found when P is applied in the fall and winter compared to the spring and summer.
- Precipitation soon after P application (regardless of season) also increases the risk of P transport to tile drains.

(Adapted from K. King, 2019)

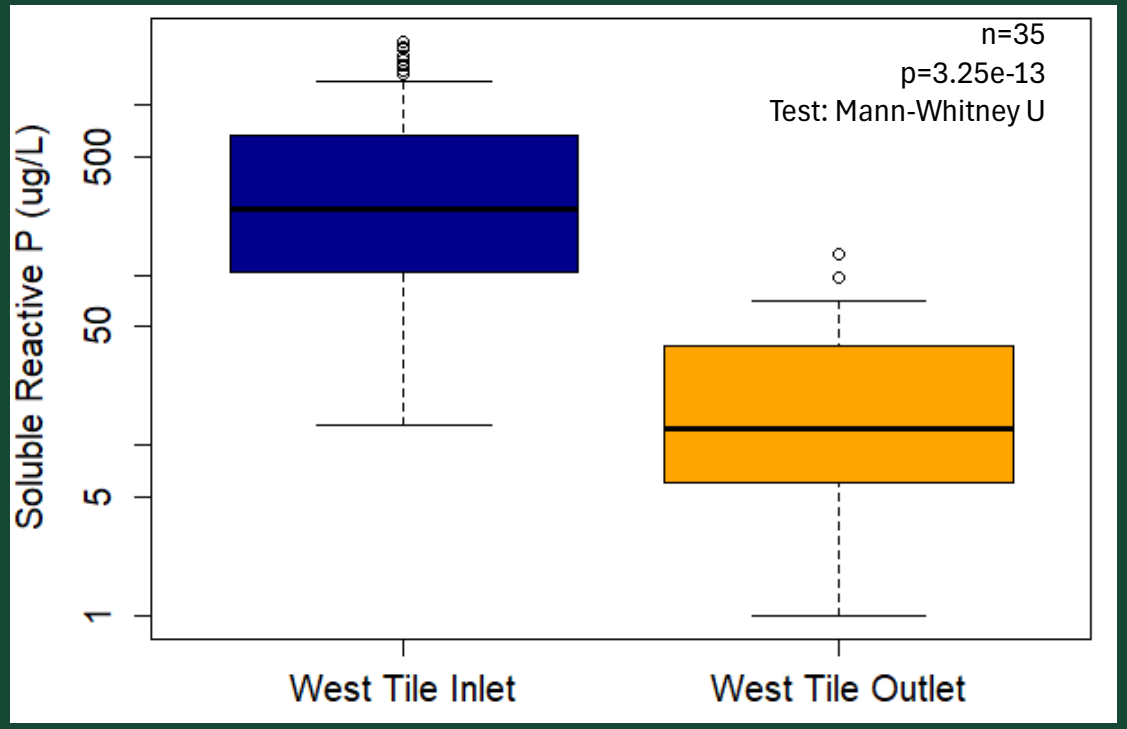
Tile Drainage Filters

Upflow design

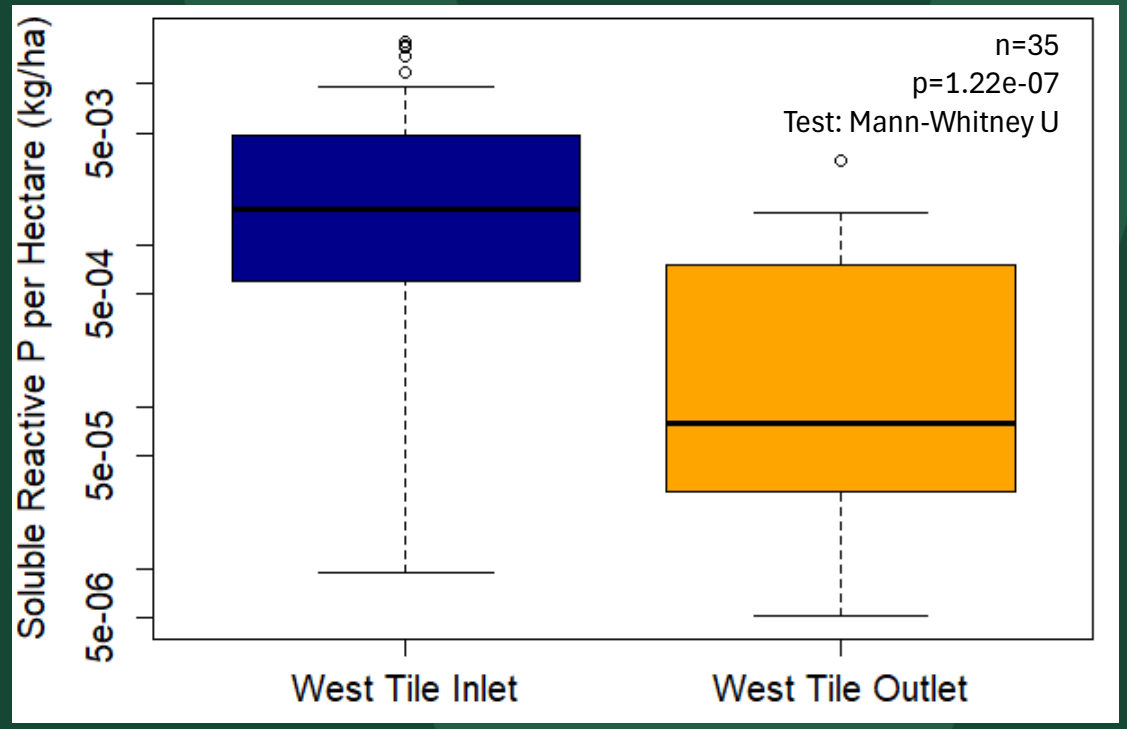
8% shavings, 92% pea gravel

West Tile Filter – Soluble Reactive Phosphorus

SRP Concentrations



SRP Loads per Hectare



Cumulative Mass Removal: 87%