

Ecosystem Benefits from Cover Crops

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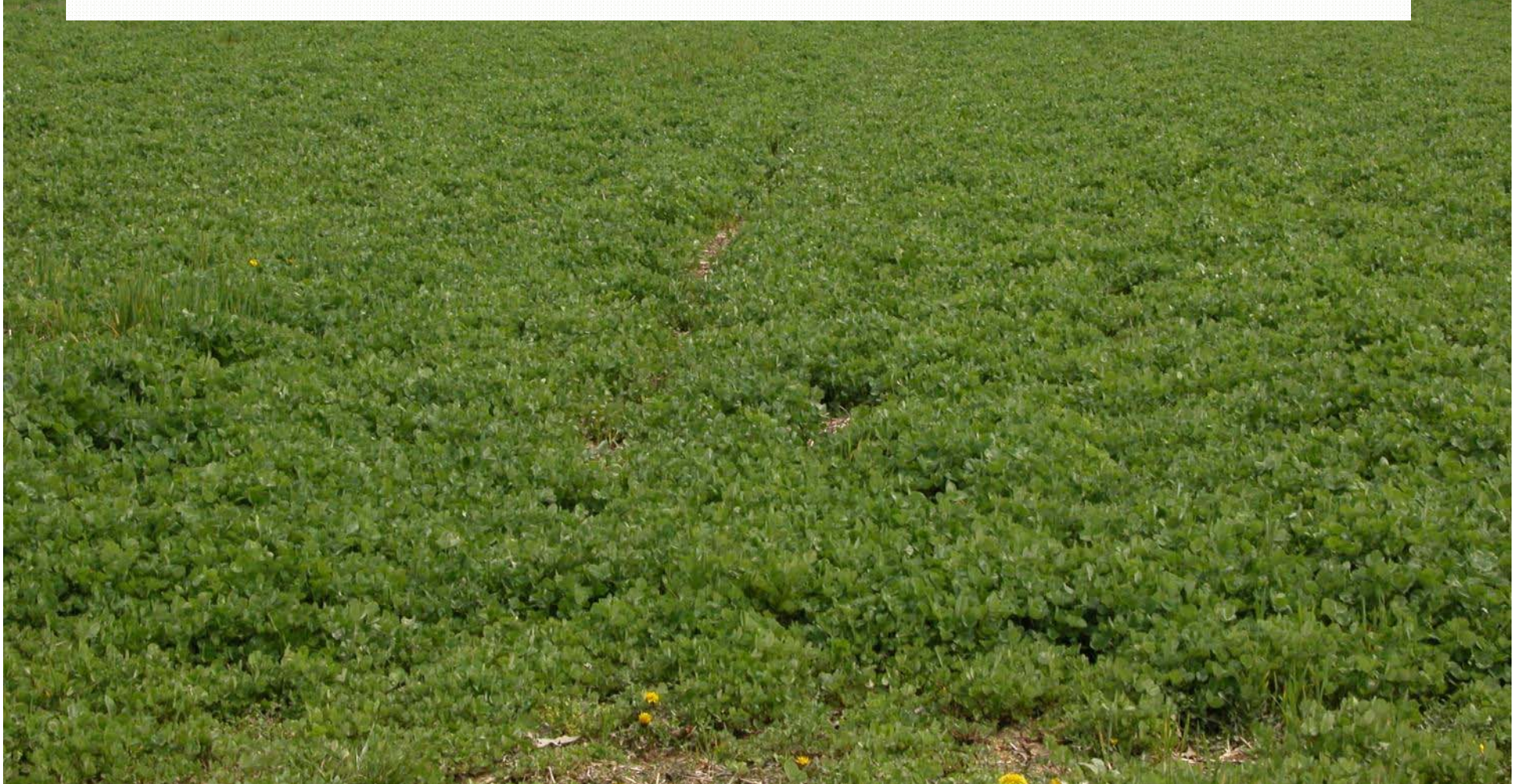
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Columbia, MO*

Cover Crops as Part
of an Overall Nutrient
Management System

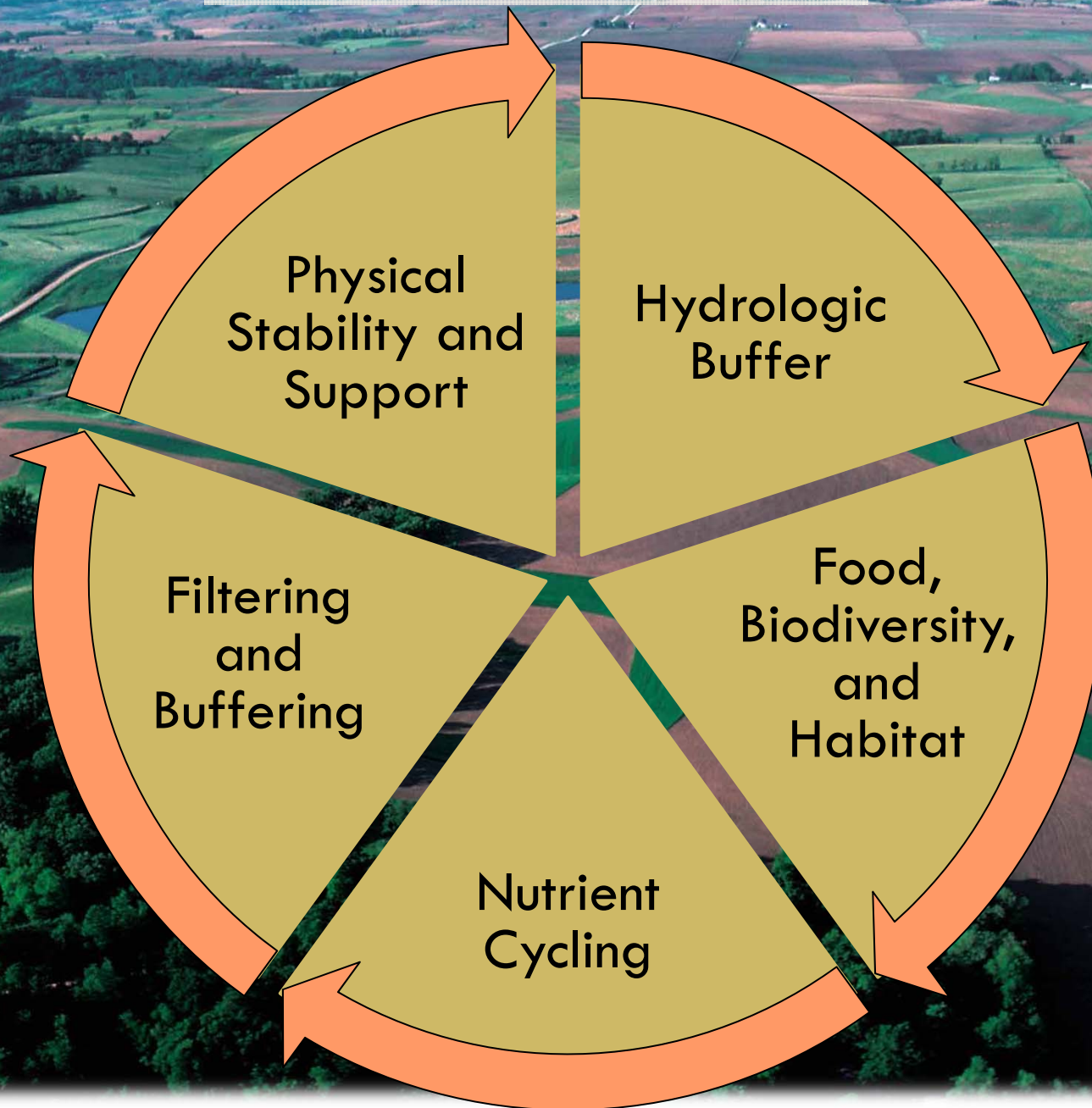
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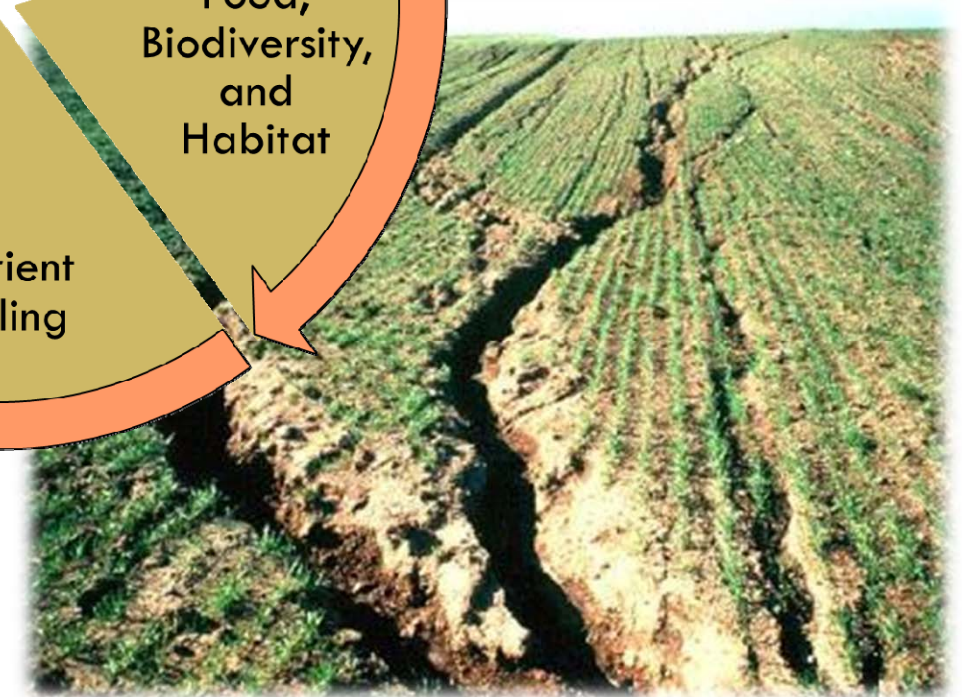
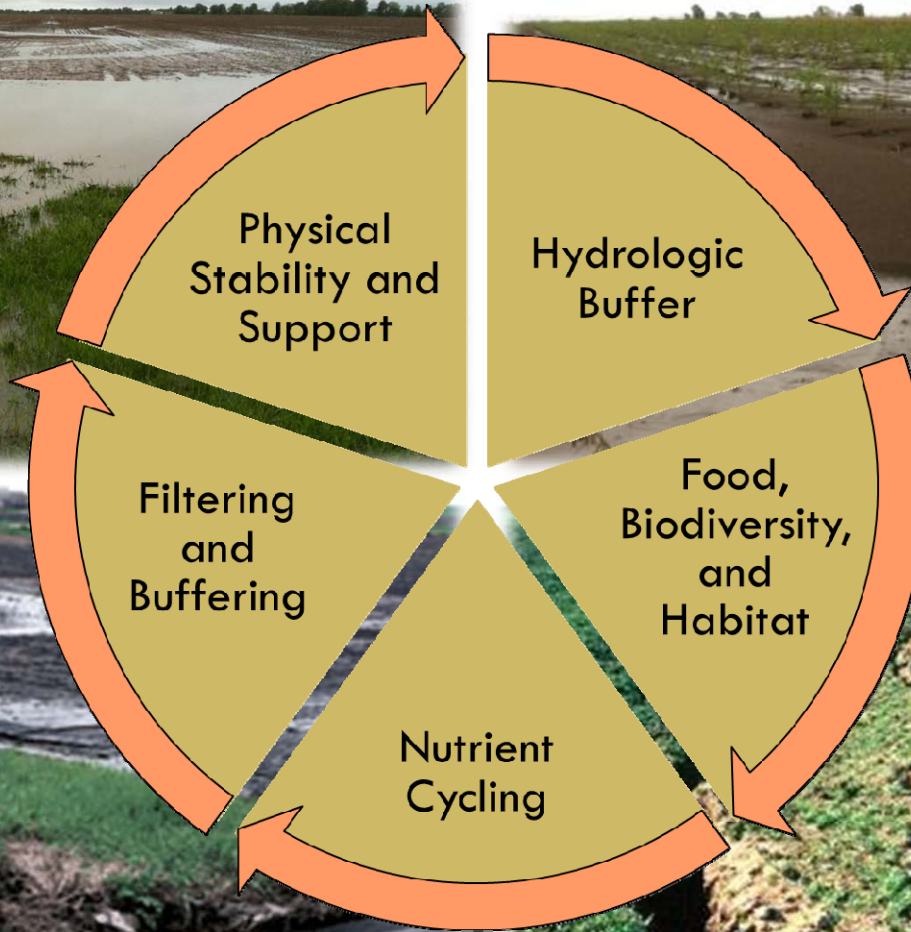
What do we know about
cover crops today that we didn't
already know 30 years ago?



Soil Functions



Dysfunctional Soils

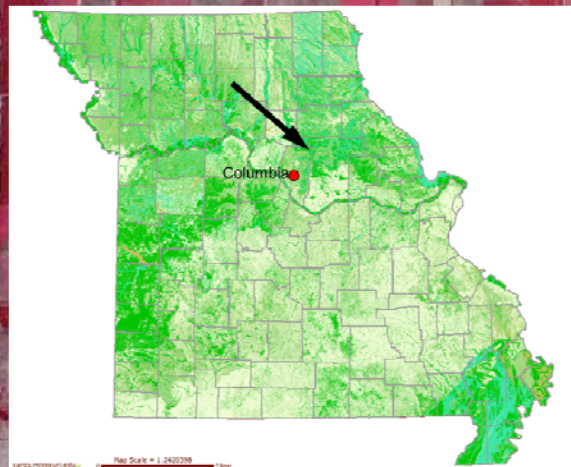


Summary of Impacts from Cover Crops on Soils

- Reduced erosion
- Increased soil organic matter
- Enhanced infiltration
- Enhanced aeration with improved soil structure/aggregation
- Preventive of soil compaction
- Reduced evaporation potential
- Recycle nutrients
- Fix N with legumes



Long-term Research



Long-Term Research Field

1991-2003

Corn-Soybean Mulch-Till



- Ground water quality
- Surface water quality
- Soil characterization
- Soil quality
- Productivity
- Spatial relationships





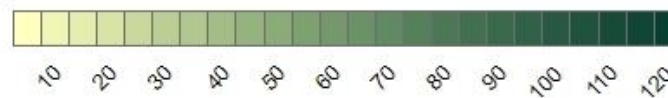
Dysfunctional soil because of historic erosion.



- Average 7 inches of soil loss over the whole field.
- Areas of extreme erosion have lost over 16 inches.



Depth to Claypan (cm)



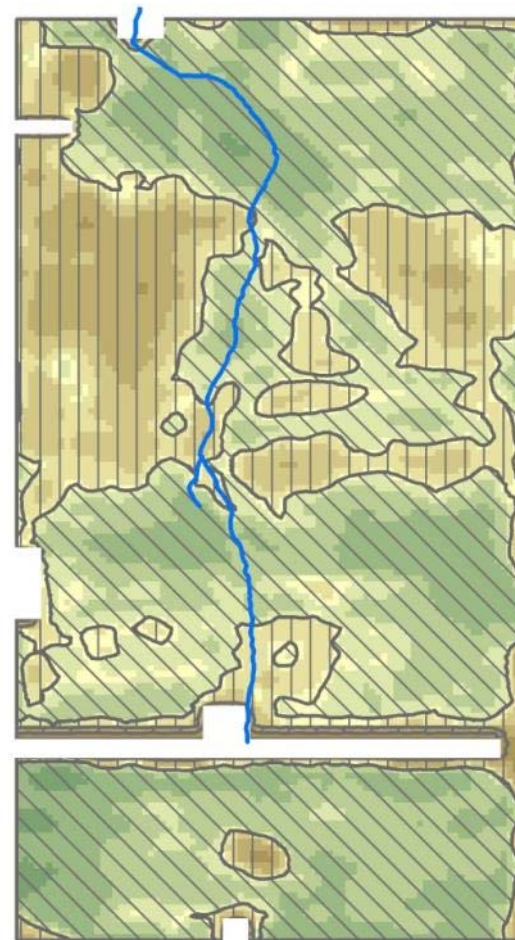
What is the impact of past erosion on productivity?

Net Profitability (\$/acre)



— Field Drainage

All Crop-Years



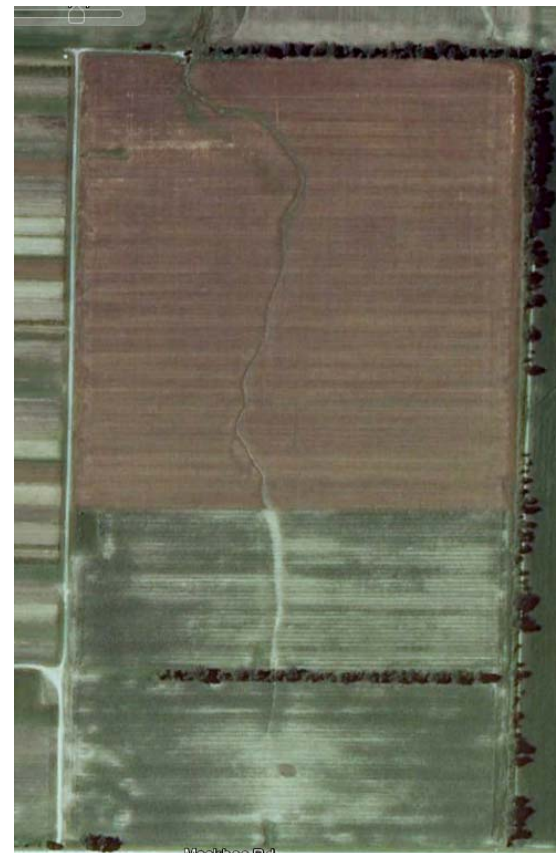
Long-Term Research Field

2004-present

Soybean-Wheat (N)

Soybean-Corn (S)

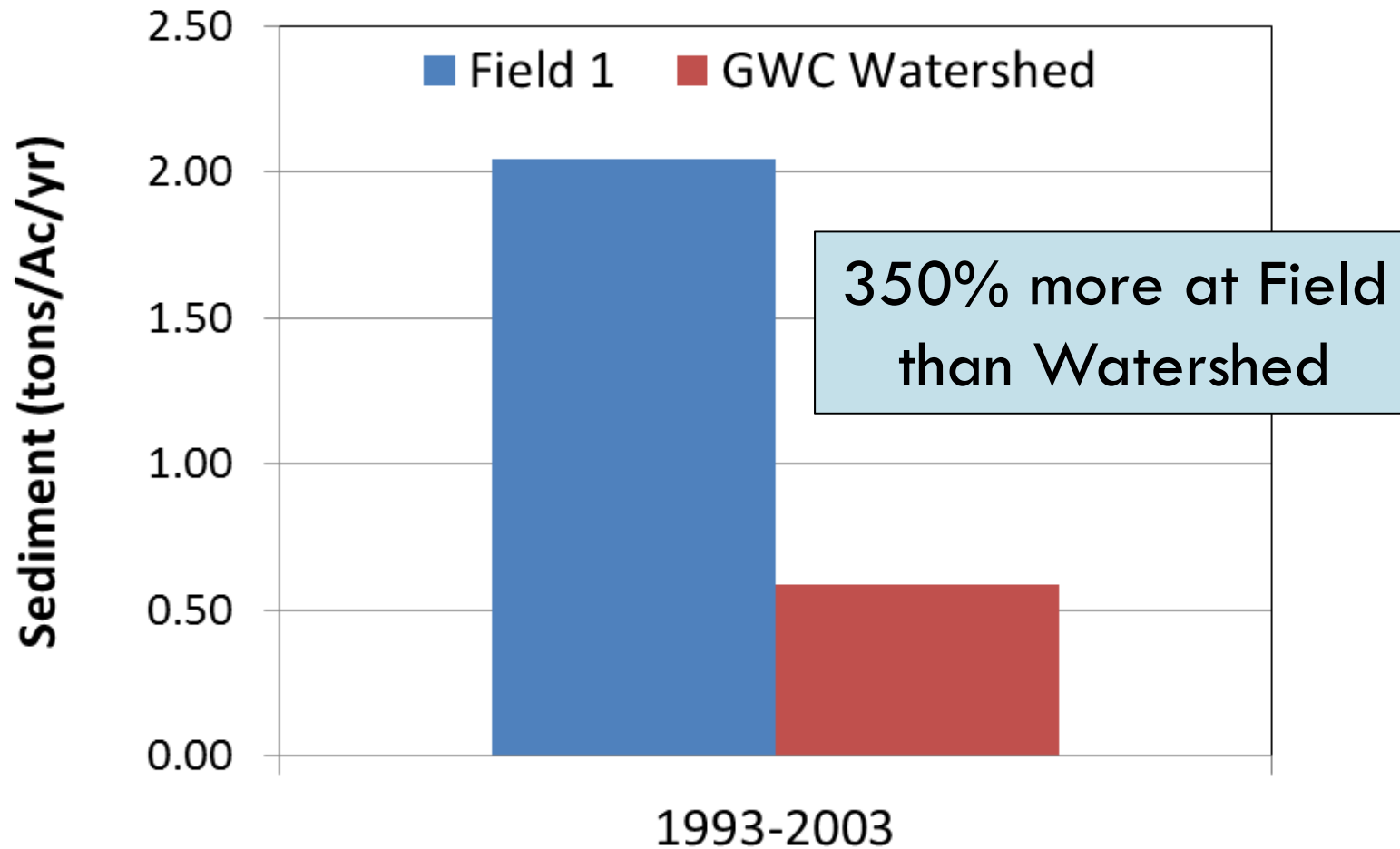
No-Till + Cover Crop



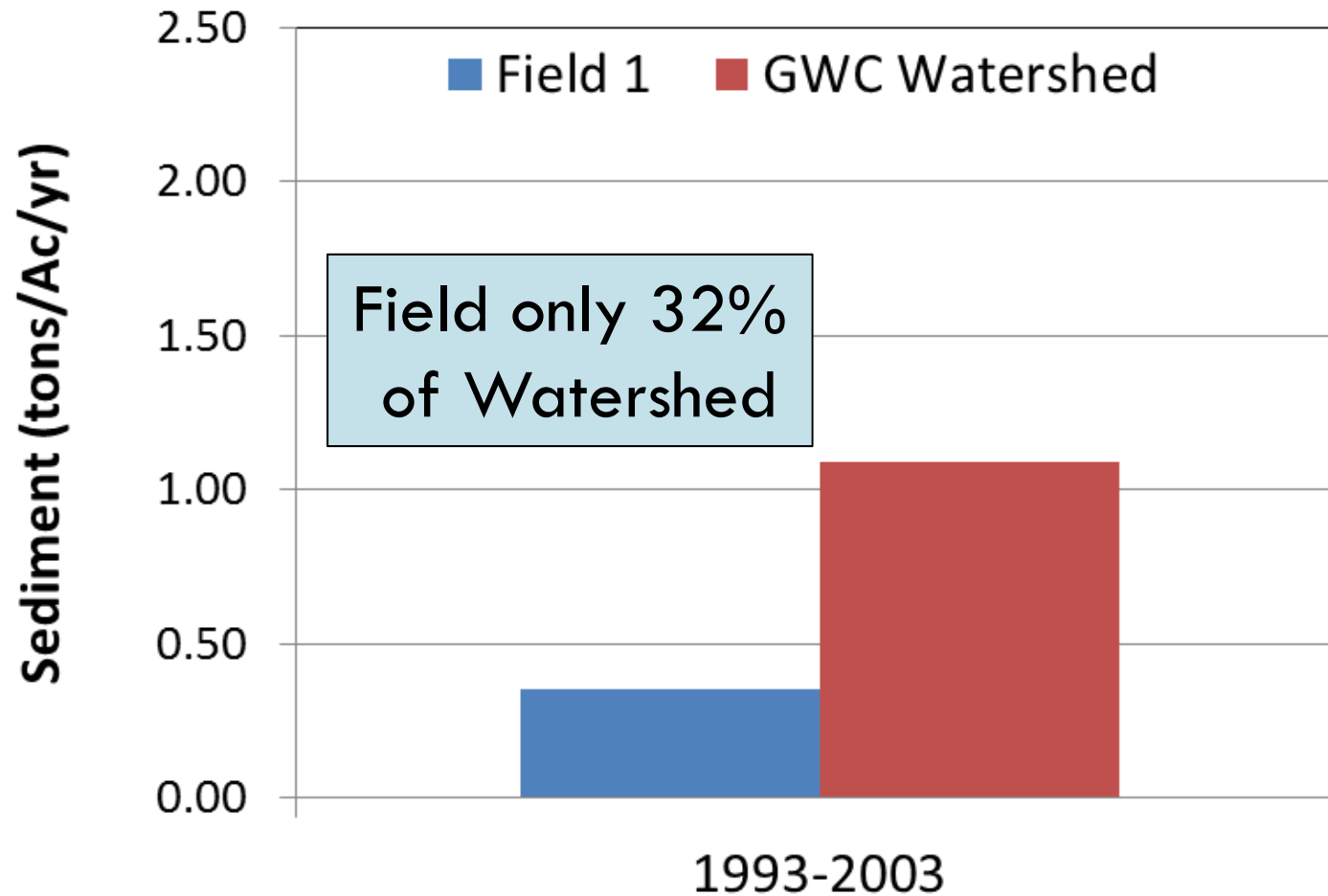
What has been the impact of a decade of no-till and cover crops?



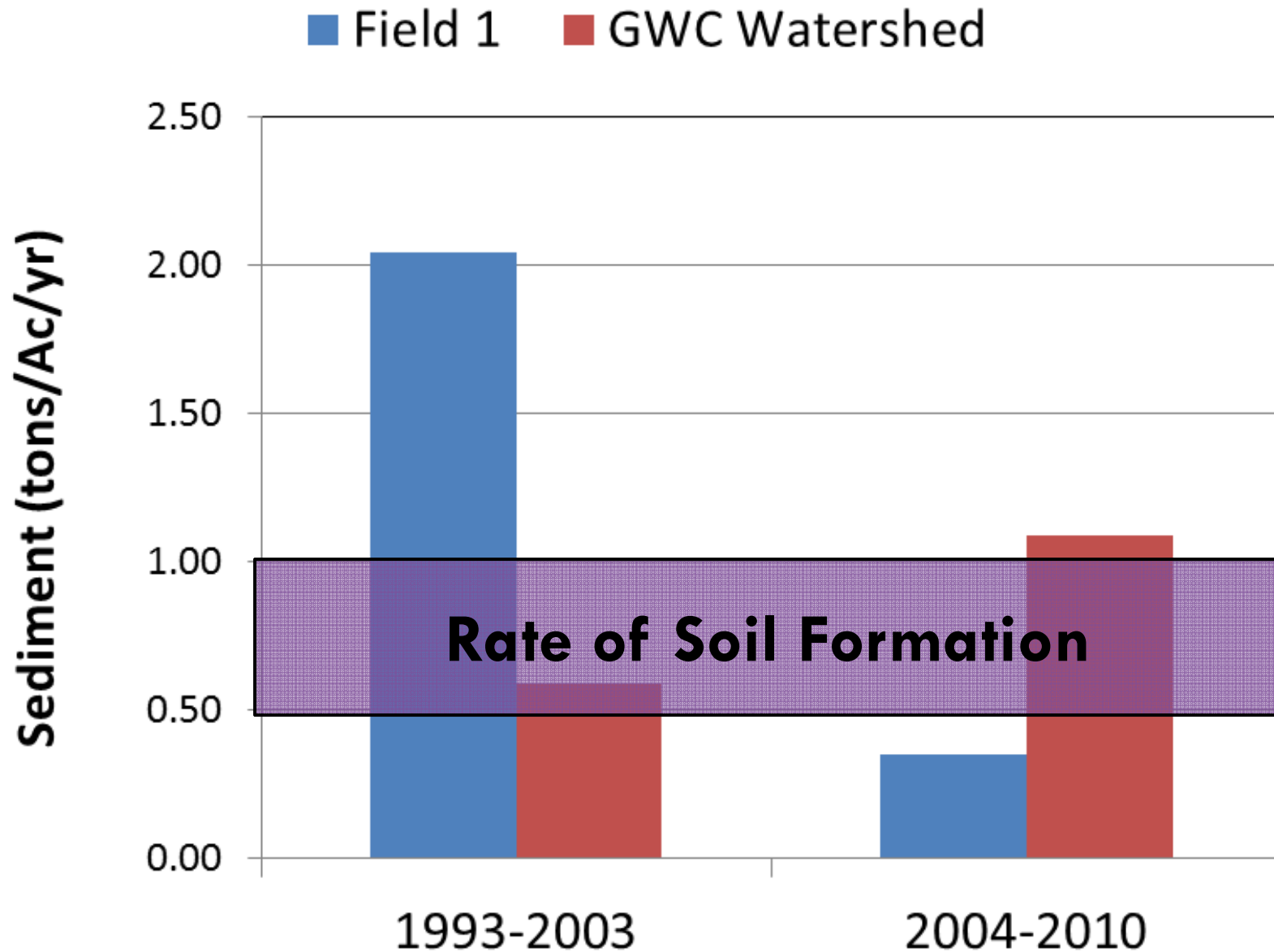
Sediment Loss (1991-2003)



Sediment Loss (2004-2010)

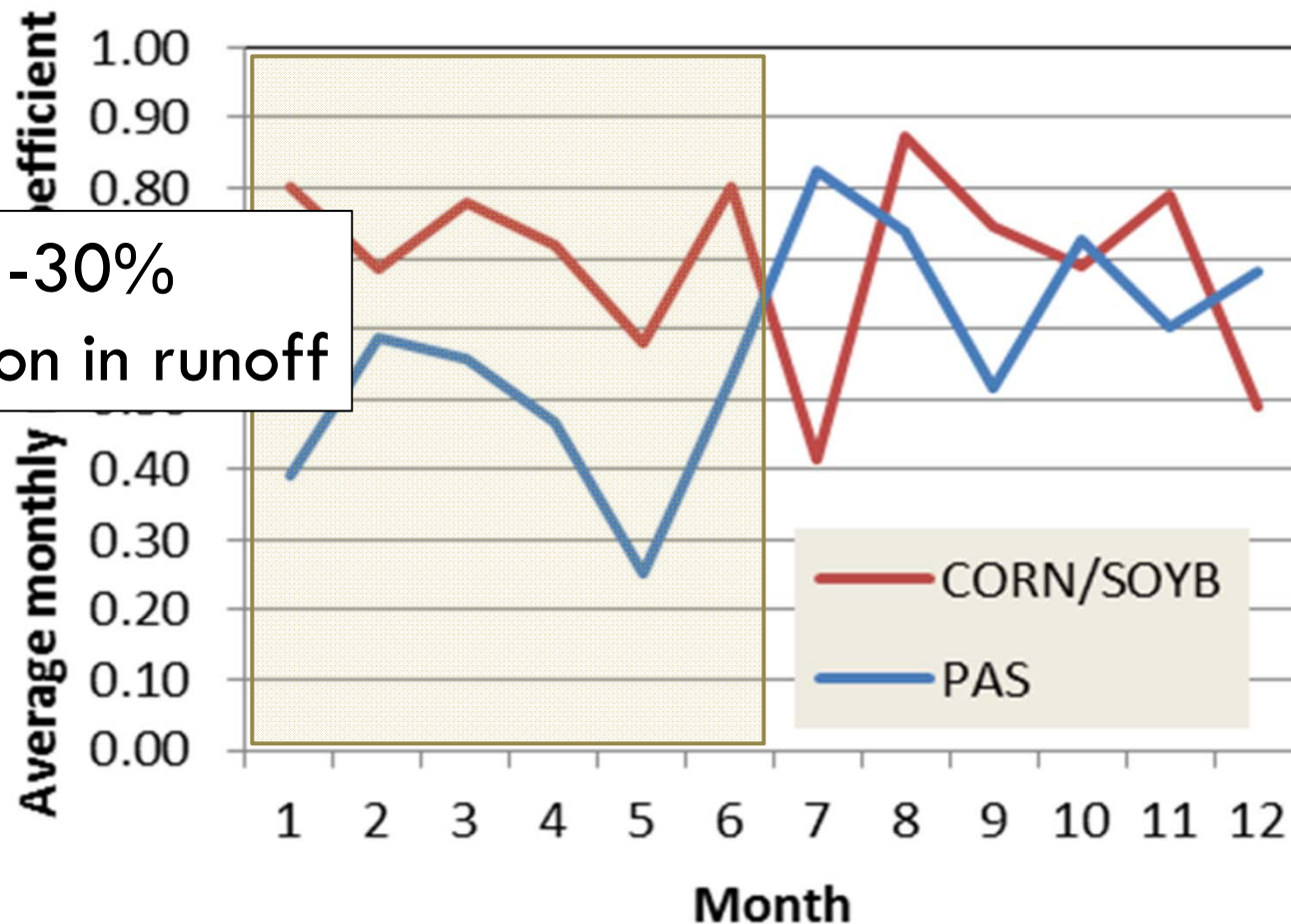


Sediment Loss (2004-2010)



When do cover crops reduce runoff?

Average 10-year monthly
(F1/P201)/(W1/P298)



25-30%
reduction in runoff

Soil Quality

Soil Management Assessment Framework (SMAF)

Physical Score

- bulk density
- water-filled pore space
- water-stable aggregates

Biological Score

- organic C
- B-glucosidase
- microbial C
- mineralizable N

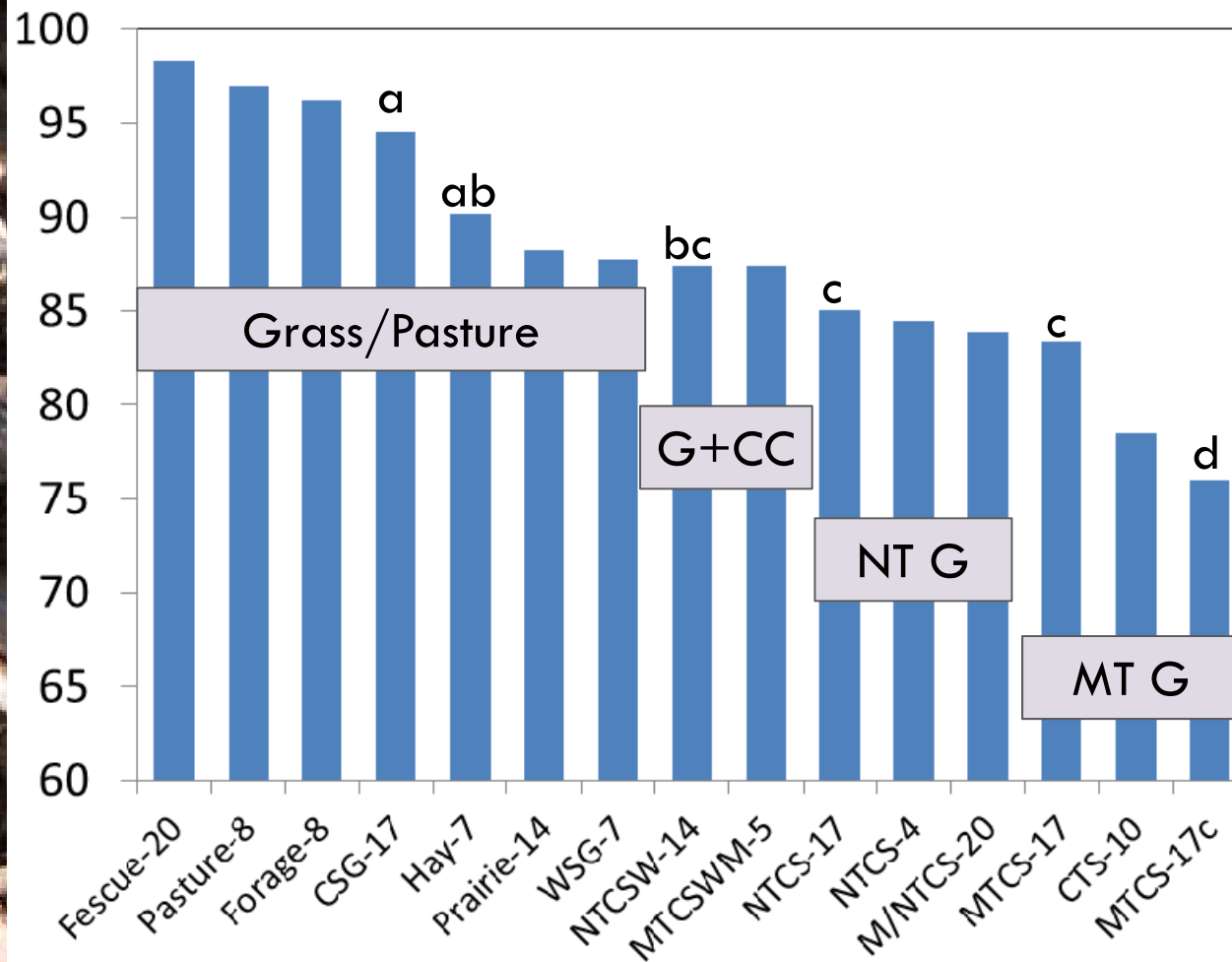
Chemical Score

- pH
- electrical conductivity

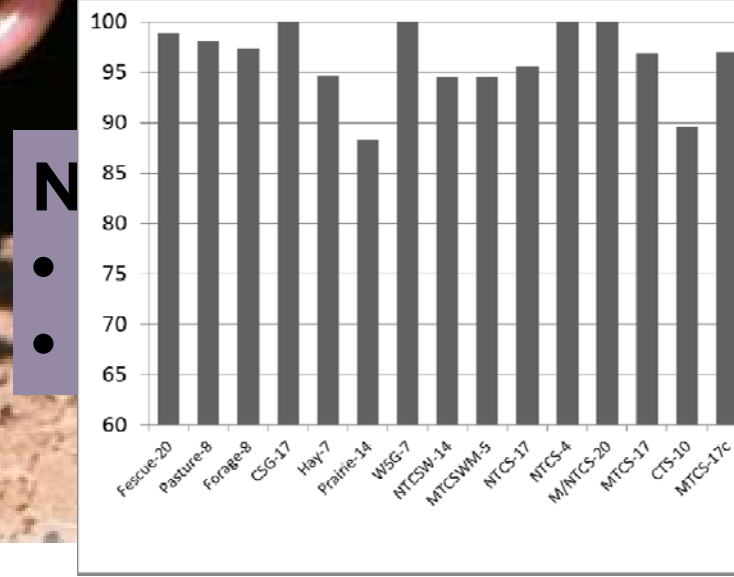
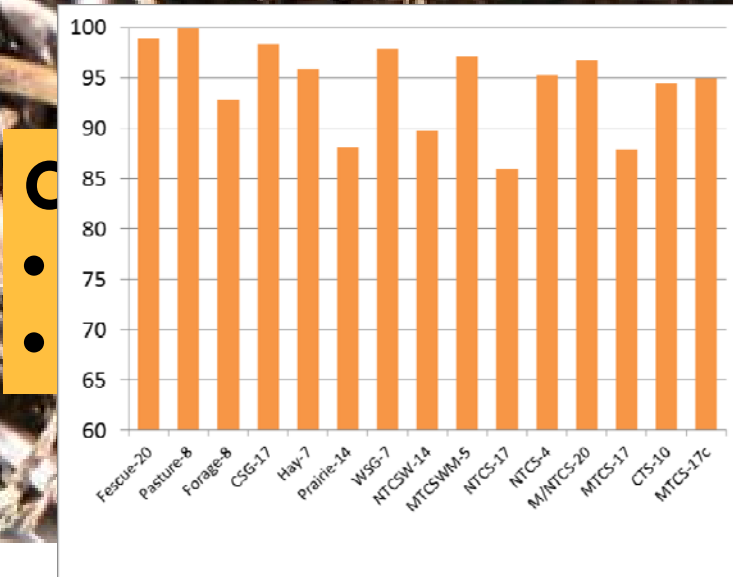
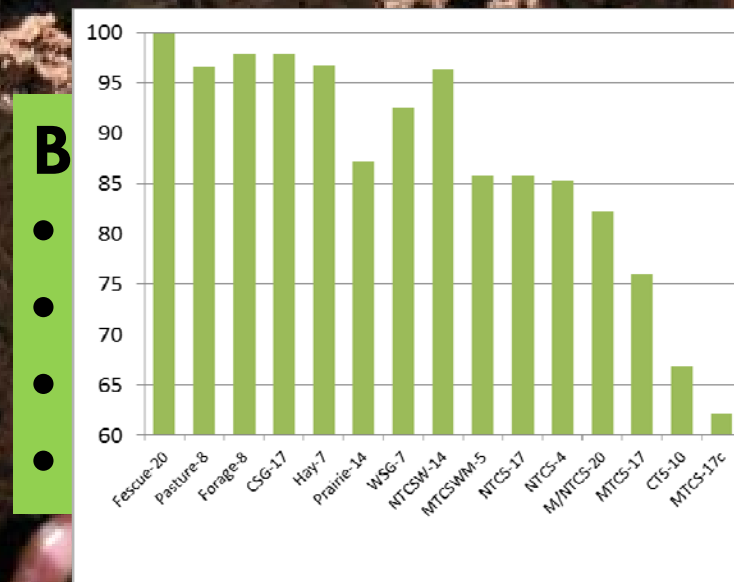
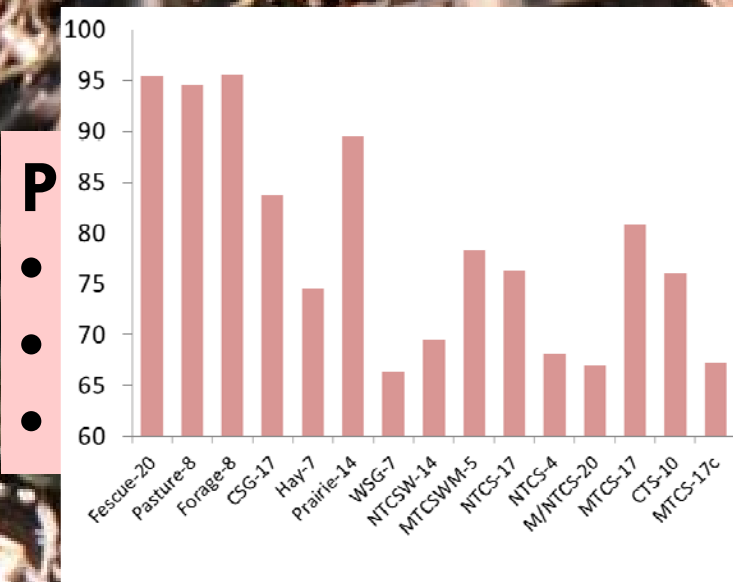
Nutrient Score

- extractable P
- extractable K

SMAF Total Score (0-5 cm)



SMAF Total Score (0-5 cm)



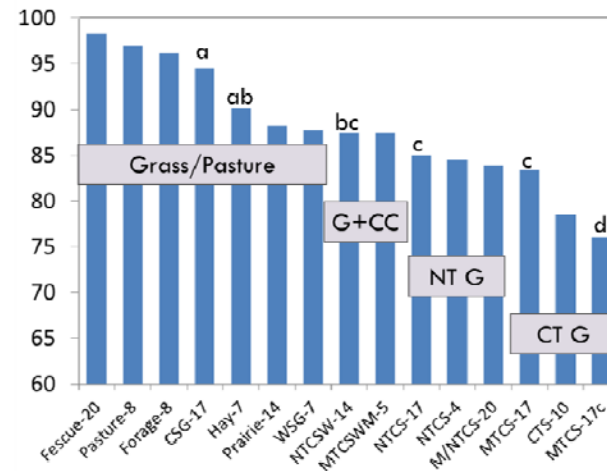
Long-Term Research Field

1991-2003

Corn-Soybean Mulch-Till



SMAF Total Score (0-5 cm)



2004-present

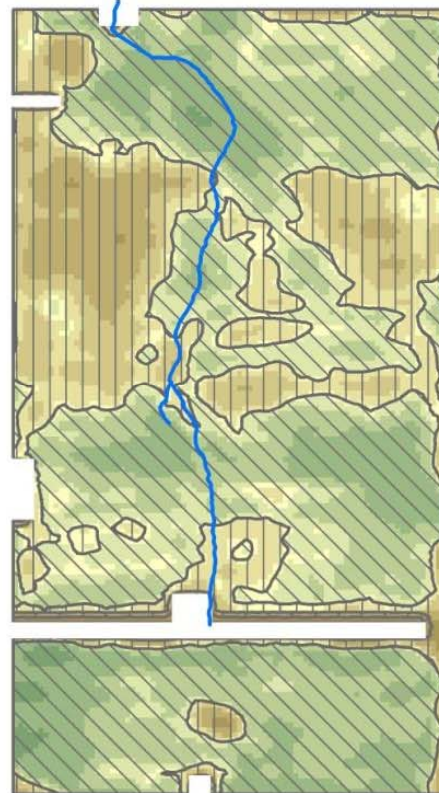
Soybean-Wheat (N)
Soybean-Corn (S)
No-Till + Cover Crop



Net Profitability (\$/acre)

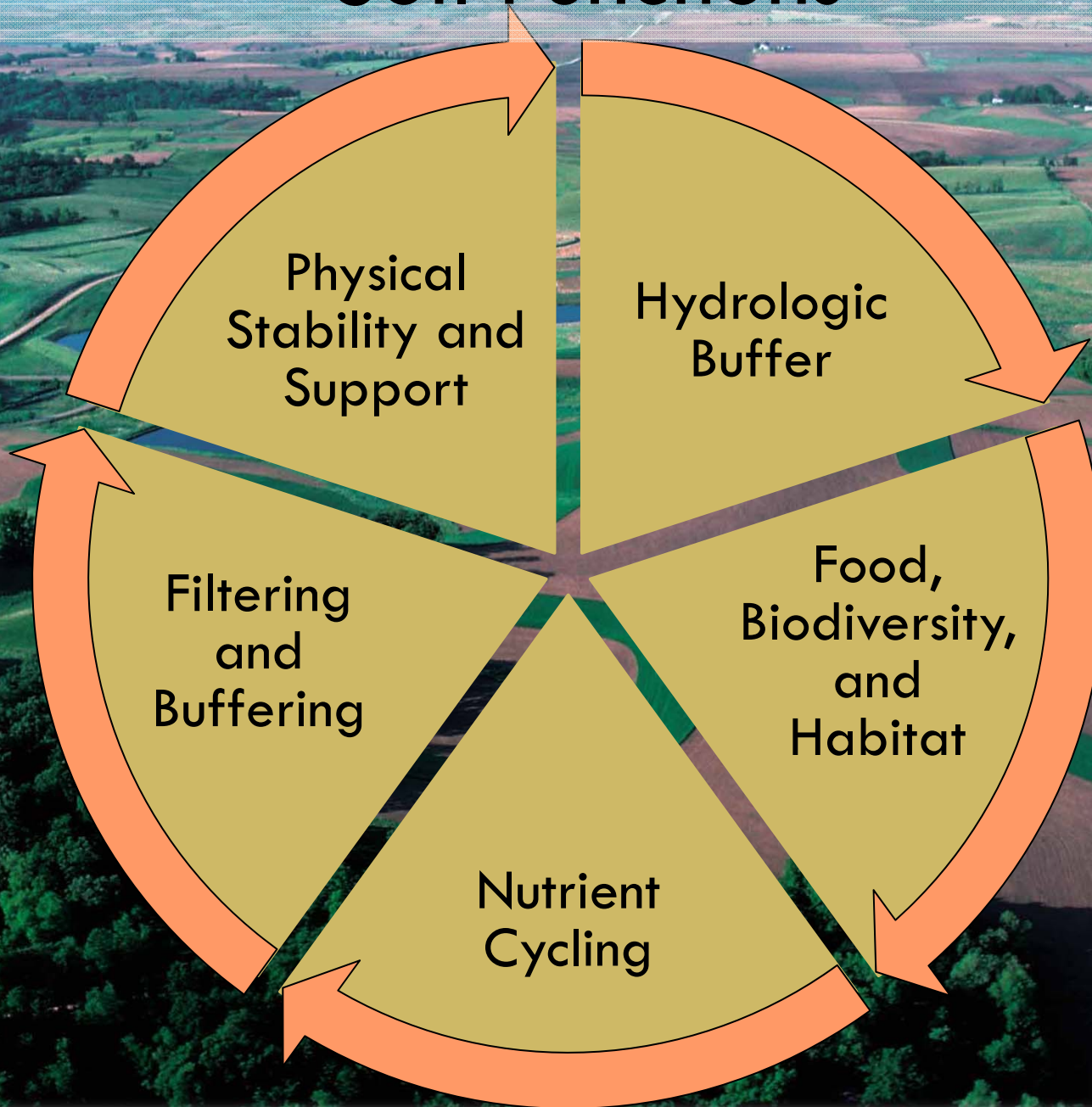


All Crop-Years



Has soil functions been sufficiently restored so corn can again be economically grown?

Soil Functions



Questions.....



Cascading Soil Degradation

Poor Land Management Decisions

Degraded structure & aggregation

Compaction & crusting

Water & wind erosion

Reduced plant growth

Poor soil biology

Decreased yield

Lost Soil Function

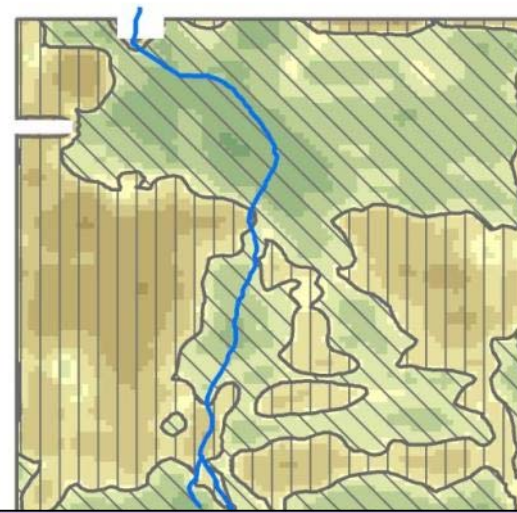


What is the impact of past erosion on productivity?

Net Profitability (\$/acre)



All Crop-Years



- Average 7" topsoil lost since farming started ~120 yrs ago
- Impact on production today?
 - Soybean: 7" x 0.7 bu/in/a/yr x \$13/bu = \$64/a/yr
 - Corn: 7" x 2.9 bu/in/a/yr x \$5/bu = \$102/a/yr
 - C-S rotation: average loss \$83/a/yr

Field Drainage