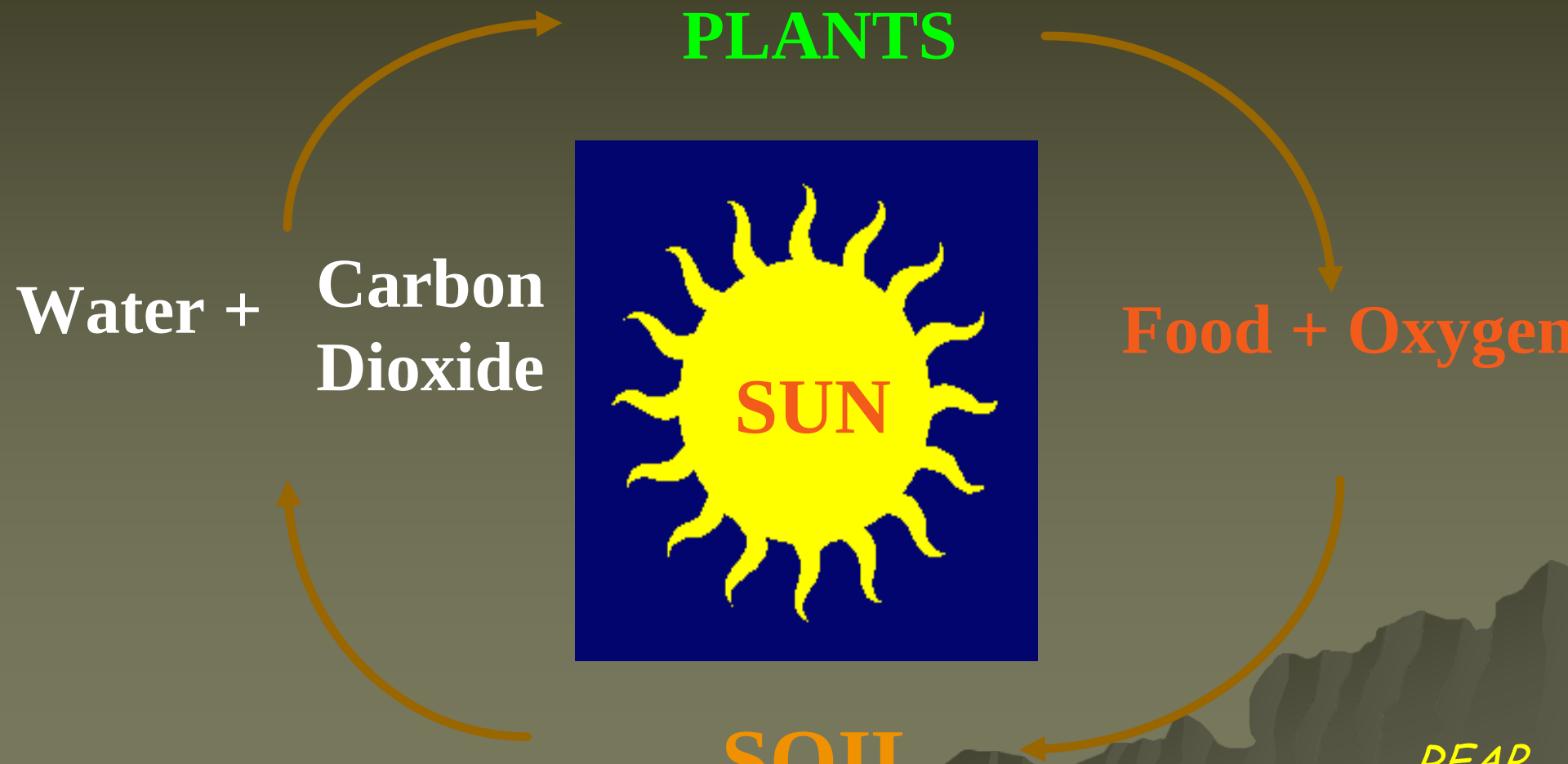
High Yields For Enhanced Sustainable Feedstock Production

Questions to be Examined

- How do soil resources affect yields?
- How do yields affect soil resources?
- Why is a landscape vision important?
- Where do high yields fit best in the landscape?

REAP

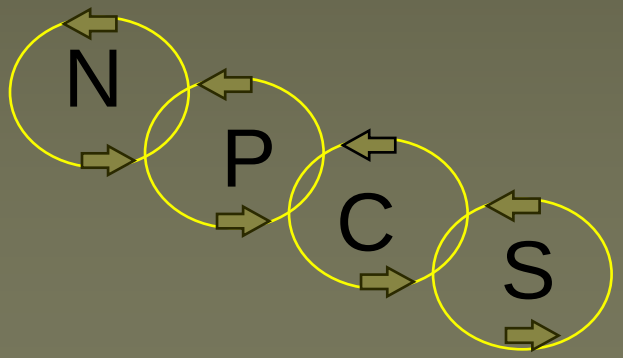
Soil is the Foundation For Plants



Yield-Enhancing Soil Processes

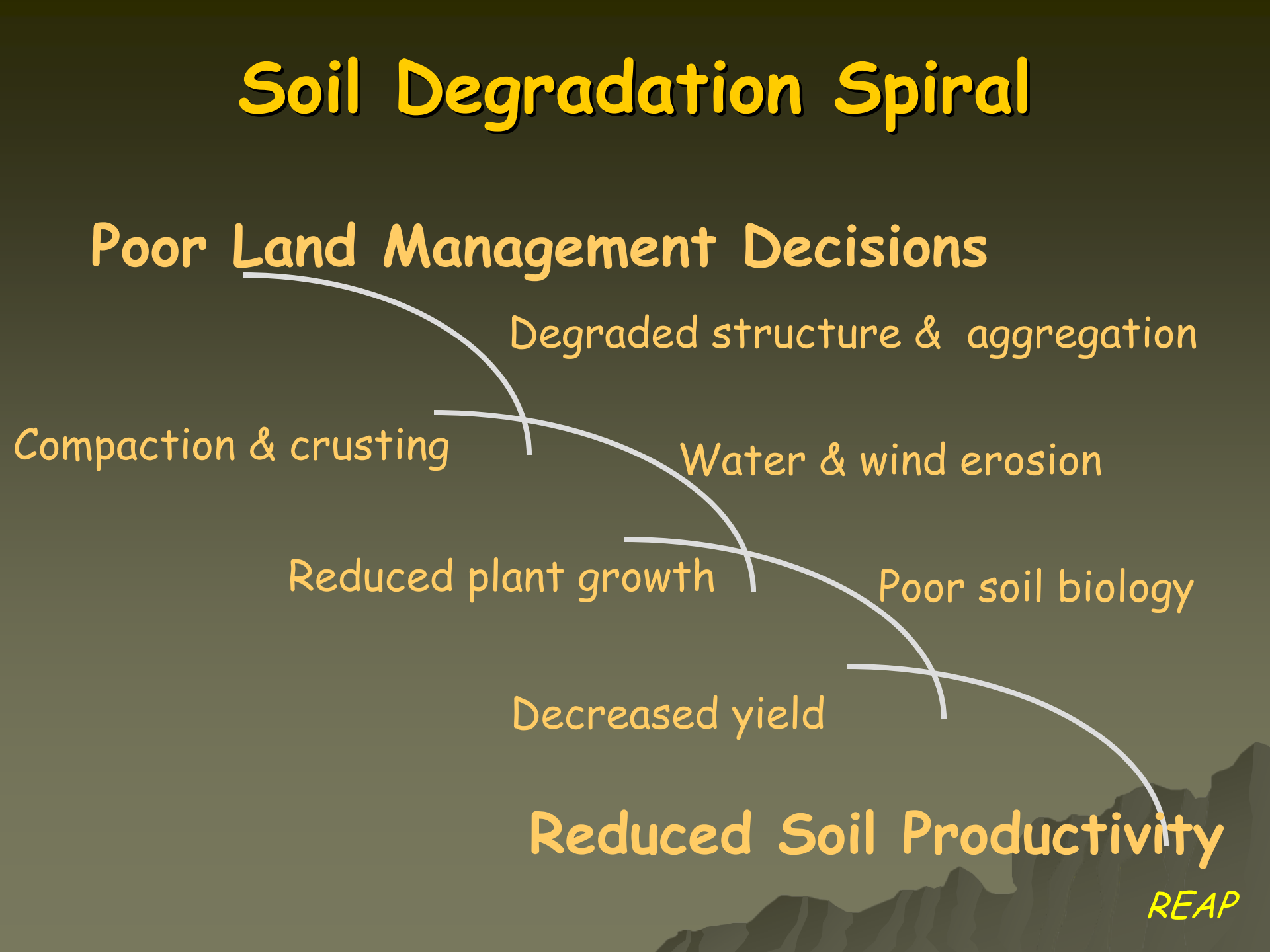
Structure, aeration, plant water, rooting

Biological Activity



Nutrient Cycling

Soil Degradation Spiral



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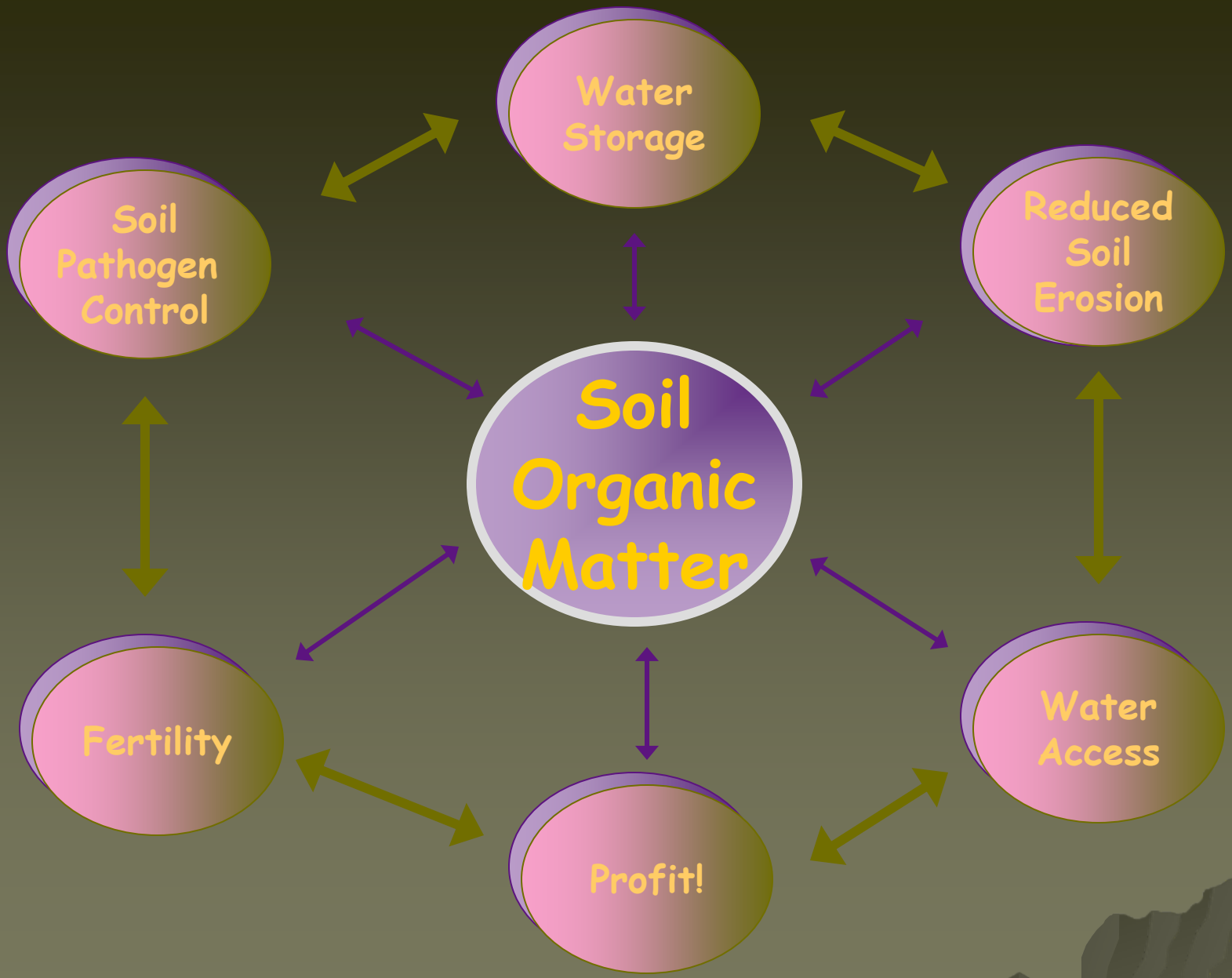
Water Storage
Soil Pathogen Control
Reduced Soil Erosion
Soil Organic Matter
Fertility
Water Access
Profit!

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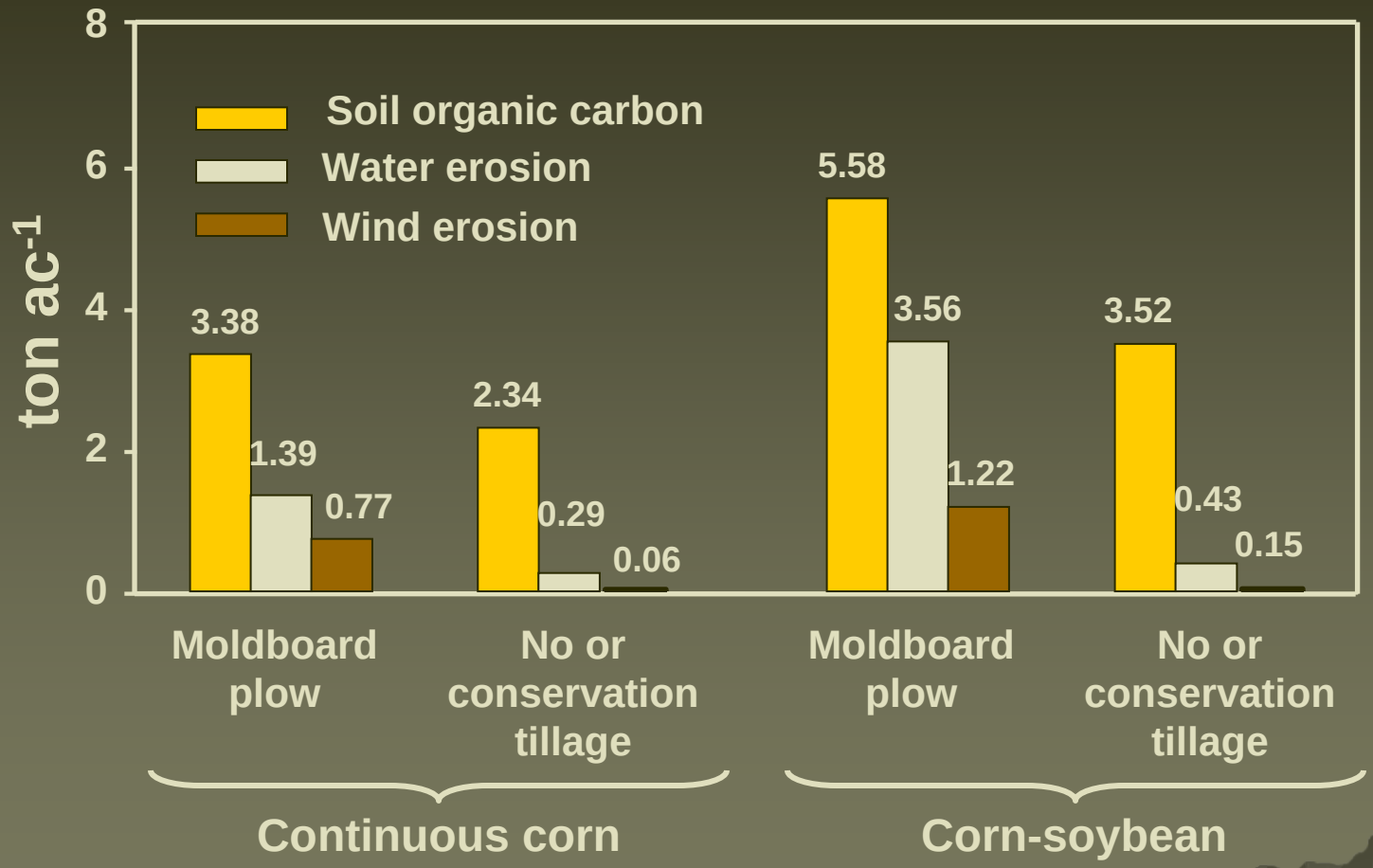
How Do Crop Yields Affect Soil Resources?

Stover is Needed to Sustain the SOC



Wilhelm et al., Agron. J. 99:1665-1667

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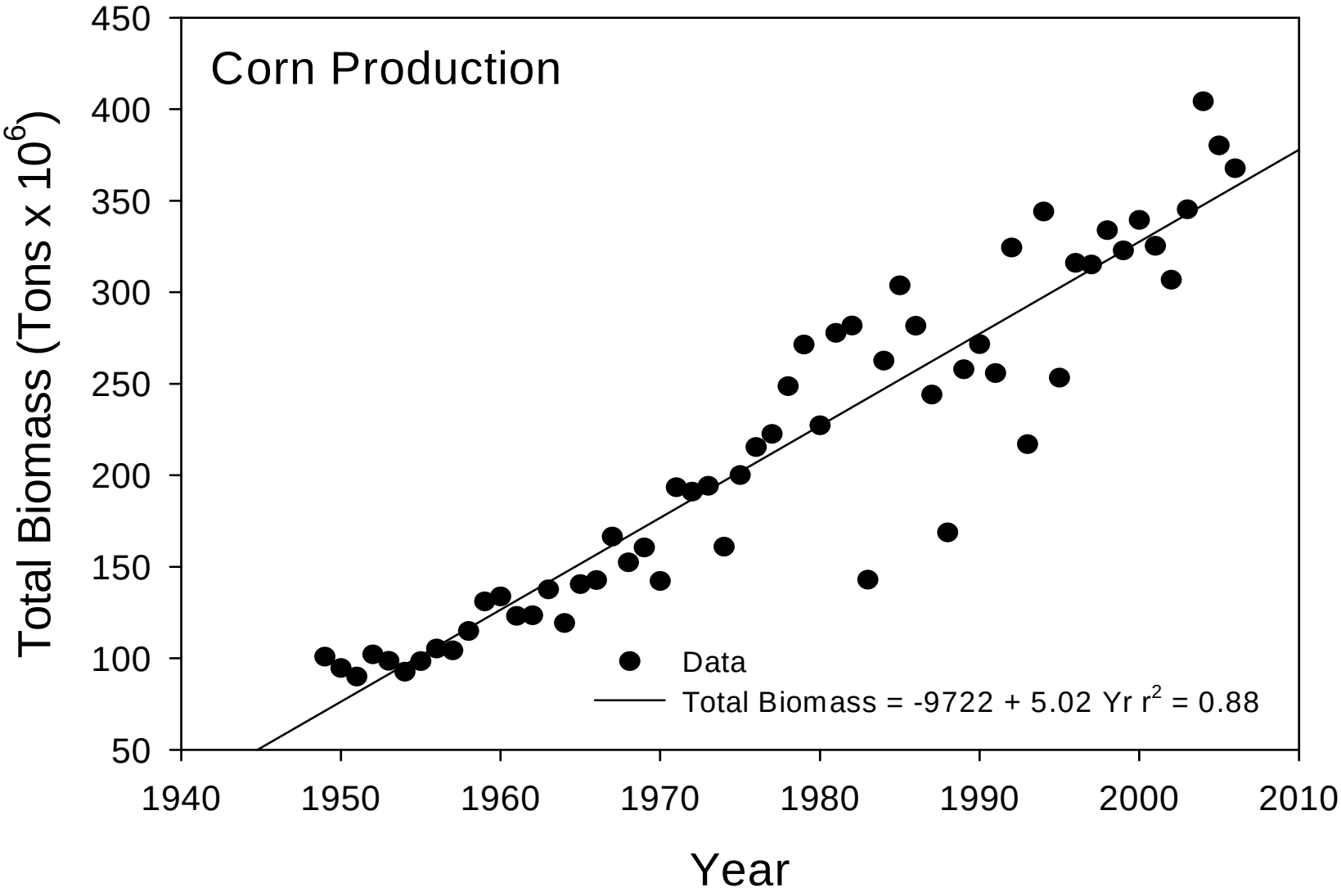
Total Corn Stover Production



Yield & Harvest Index (HI) Effects on Available Corn Stover (2.8 t ac-1 for the soil)

Yield	HI	Available Stover	HI	Available Stover
bu ac^{-1}		tons ac^{-1}		tons ac^{-1}
150	.50	0.8	.55	0.1
170	.50	1.28	.55	0.5
190	.50	1.7	.55	0.9
210	.50	2.2	.55	1.3
230	.50	2.6	.55	1.7
250	.50	3.1	.55	2.1
270	.50	3.6	.55	2.4
290	.50	4.1	.55	2.8

Why is a landscape vision important?

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A Landscape Vision –

Why is Diversity Important?

Landscape Diversity Provides –

- Multiple ecosystem functions
  - Abundant feedstock for bioenergy
  - Enhanced nutrient cycling
  - Multiple pathways for sequestering C
  - Food, feed & fiber resources
  - Filtering and buffering processes
  - Wildlife food & habitat
  - Soil protection & enhancement
  - Economic opportunities for humankind

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Where do high yields fit best in the landscape?


What are the water quality impacts of current practices?
What are the air quality impacts?
Is the soil improving or degrading?
Do we have the best spatial arrangement of plants on the landscape?
Are crop and livestock production affecting environmental quality?
What cropping system is best for the landscape?
Start by Assessing Current Practices
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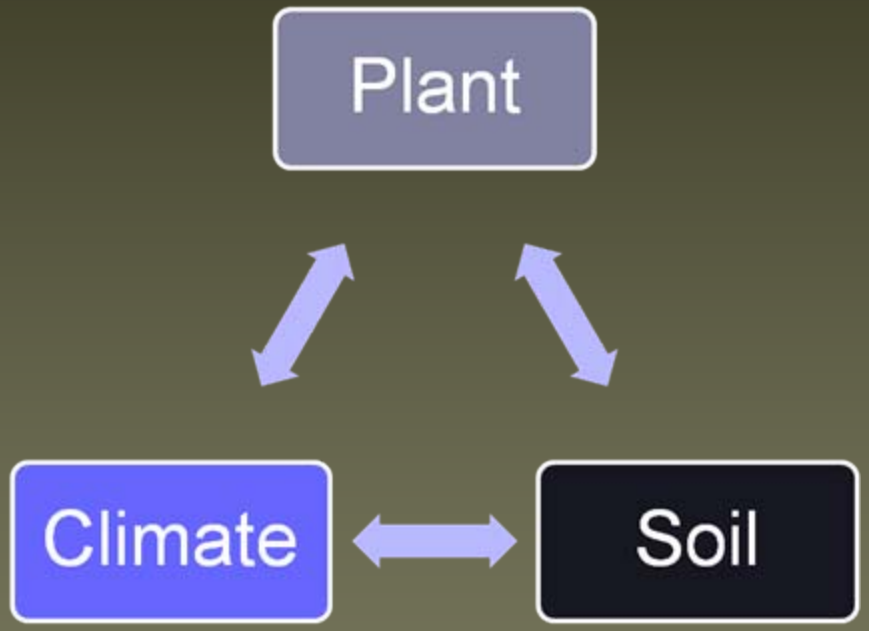
Where are the Weak Links?

- Plants
  - Genetics
  - Disease
  - Weeds/Pests
- Soils
  - Chemical – pH, N, P, K
  - Physical – BD, PAWC
  - Landscape effects
    - Runon
    - Runoff
    - Drainage
- Climate
  - Rainfall/Irrigation
  - Temperature regimes
  - Humidity
  - Solar radiation



Develop a Landscape Plan

To solve erosion, water quality, low SOM, lack of wildlife, dwindling community, yield variation, low profit, & …

Plant woody & perennial grasses close to streams

Next deep-rooted species to catch nutrients & fix C

Moderate sideslope – grain with cover crops

Severe sideslope – perennial biomass crops

Highly productive areas – intensive, high-yield production

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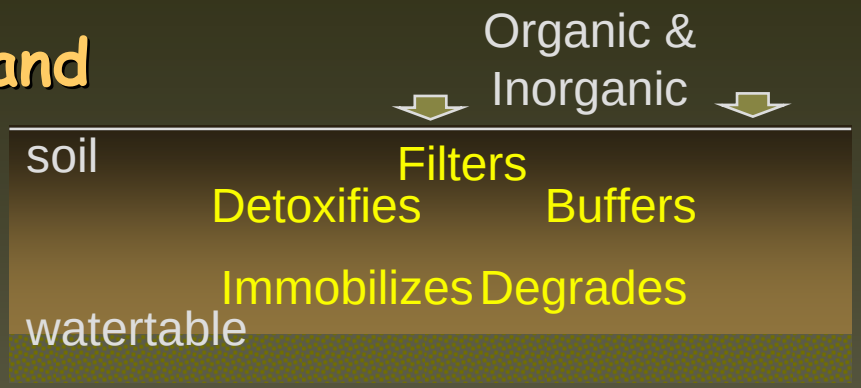
Evaluate For All Ecosystem Services

- Filtering and Buffering

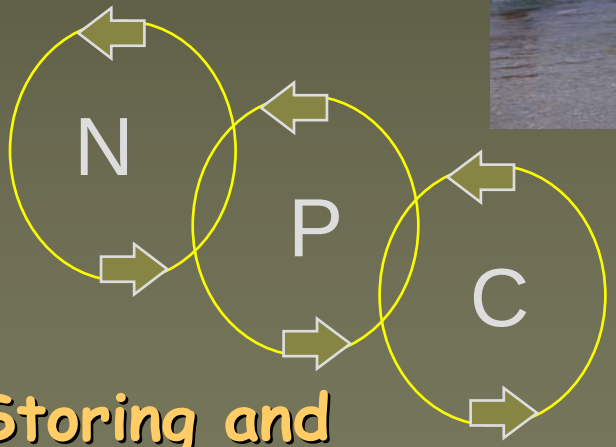


Wildlife

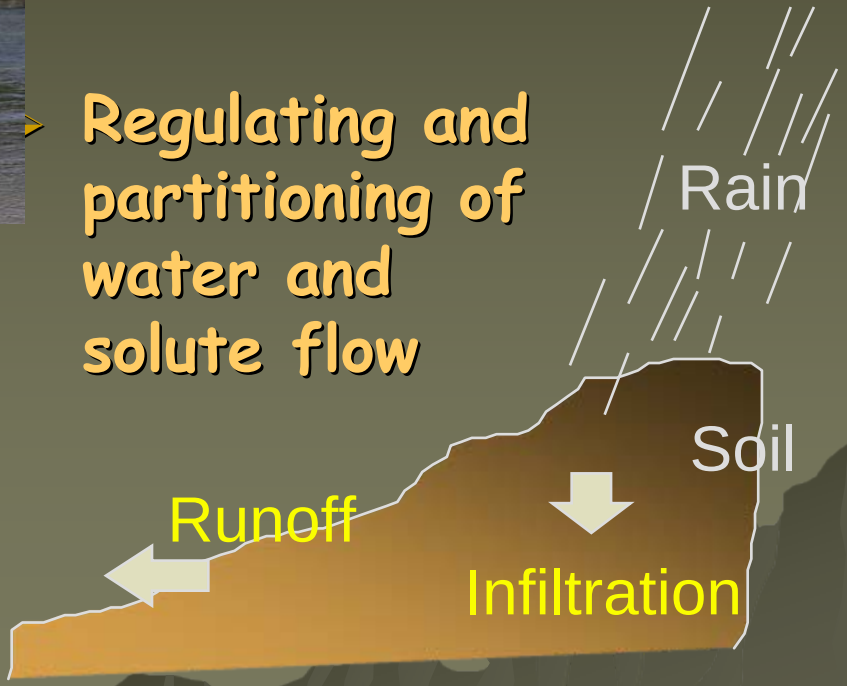
Economics

Community

- Regulating and partitioning of water and solute flow



- Storing and cycling nutrients



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Diversity Is the Key to High-Yield Sustainable Systems