Ten thousand years ago, when the last glacier receded, there was no soil in north central Iowa – just loose geological material. Since then, ecological processes created some of the most productive soils in the world. For example, the prairie grasses grew tall and their roots grew deep into the soil. When buffalo herds came through and grazed off the grass, the grass sloughed off much of its root system into the soil. As the grass again grew tall, the roots again multiplied in the soil. These reoccurring pulses of root material -- plus the dead plant material and buffalo manure added from above the ground – created the deep, rich Iowa soils.

Francis Thicke
Farming Systems: Learning from the Floods of 2008
December 8, 2008
Cows can be raised outdoors in ways that are ecologically sound. Cows are naturally grazing animals and are healthier when in their natural environment. In a grass-based dairy cows harvest their own feed and spread their manure on the land in a way that enhances soil quality and protects water quality.
Silver Maple
Switchgrass
Cool Season Grass
Corn
Soybeans
Continuously Grazed
Pasture

60-min Cumulative Infiltration (cm)

Bear Creek -- June

Adapted from Bharati, Lee, and Schultz
Biomass Production
Annual Cropping Systems

Missed opportunities for resource assimilation
and dry matter production

Dry matter production
or resource loss (mass/time)

Annual grain crop

Winter cover crop

Spring Summer Autumn Winter

Additional opportunities for resource losses

after A.H. Heggenstaller
Effect of CROPPING SYSTEM on drainage volume, NO$_3$-N concentration, and N loss in subsurface tile drainage during a 4-yr period (1990-93) in MN.

<table>
<thead>
<tr>
<th>Cropping System</th>
<th>Total Nitrate-N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Discharge</td>
</tr>
<tr>
<td>Cont. Corn</td>
<td>30.4 Inches</td>
</tr>
<tr>
<td>Corn – Soybean</td>
<td>35.5 Inches</td>
</tr>
<tr>
<td>Soybean – C</td>
<td>35.4 Inches</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>16.4 Inches</td>
</tr>
<tr>
<td>CRP</td>
<td>25.2 Inches</td>
</tr>
</tbody>
</table>

Gyles Randall, University of Minnesota
Lessons Learned

• Row crops need grass waterways
• Till and plant perpendicular to grass waterways
• Perennial crops infiltrate more rainfall than annual row crops

On the Shelf

• Cover crops
• Extended crop rotations
• Managed grazing for beef and dairy
Gaps/Needs/Research

- High-quality grass-fed beef production and marketing
- Biofuels from perennial crops
Farming Systems

Rick Cruse
Agronomy
Iowa Water Center

What did we learn?
Of what were we reminded?

- Mother Nature bats Last
- Mother Nature kicks the last goal
- Mother Nature shoots the last free throw.
- Vector forces from the integrated action of solar energy dynamics and the hydrologic cycle can decimate a granular medium.

Of what were we reminded?

- Different management practices resulted in differential impacts to the land resource
- and therefore differential down stream impacts.
What is known and not used?

- Erosion
  - Detachment
  - Transport
  - Deposition
- Controlling loss at the source is the most efficient and inexpensive approach

Detachment controlled by

- Strengthening surface structure
  - Reducing tillage
  - Increasing soil organic matter content
- Intercept raindrop energy
  - Living cover
  - Crop residue
- Protect soil surface from flowing water
  - Living cover
  - Surface residue *IF it does not move with water*
Controlling loss at the source is the most efficient and inexpensive approach.
What do we know that must be addressed?

- Emerging culture of agriculture diminishes resilience to environmental fluctuations and results in high vulnerability to environmental extremes.
- The way we farm increases risks of large environmental impacts.

Farmers

- Not intent on causing environmental havoc!!!!!
- Respond to market signals
  - Dominant signal receives the dominant response
  - If farmers do not make a profit, they do not farm
- Time horizon over which market signals have significant influence is decreasing
  - Farm markets – not land
  - Land is medium for short term profit
Temporal management removed from management tool box

- Majority of harvested lands are rented
- Cash lease frequency increasing
  - Frequently separates land management decisions from owner
- Incentives to maintain resource is missing; short term profit incentive dominates
- Disincentive for many conservation practices

Land ownership
“When farmers and herders lose control or long-term security over the land they use, the incentives for maintaining environmentally sustainable practices are lost.”


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**Farmland Ownership**

> “Nothing accelerates faster, stops quicker, or corners harder than a rented car”