Upper Mississippi River Sub-basin Workshop
(Illinois, Iowa, Minnesota, Missouri, and Wisconsin; plus Indiana and Ohio
15 science panels comprised of 75 nutrient/water quality researchers)

A workshop assessing tools to reduce agricultural nutrient losses to water resources in the Corn Belt.

September 26 – 28, 2005
Iowa State Center • Iowa State University
Ames, Iowa

A workshop with a 'decidedly different' approach to encourage interaction and the exchange of information on tools to reduce nutrient losses to water resources in the Corn Belt. Sessions feature a short, introductory presentation followed by a panel discussion. Session topics include:

- *Fate and transport of nutrients*
- *Water management*
- *Wetlands*
- *Buffer and vegetative filter strips*
- *Nitrogen rates*
- *Nitrogen application timing, forms, and additives*
- *Phosphorus fertilizers*
- *Animal manures*
- *Erosion control practices to reduce sediment and nutrients*
- *Alternative cropping and cover crops*
- *Field-scale tools*
- *Watershed-scale tools*
- *Evaluating nutrient loss reduction effects*
- *Soil organic matter content*

Early registration for this program is $175 and includes meals, workshop materials and a copy of the workshop proceedings. Registration also includes admission to Iowa State University's Reiman Gardens for an evening reception and social.

Visit **www.umrshnc.org** to complete your registration today.

For more information:
Visit our Web site at www.umrshnc.org for additional information. If you have additional questions regarding this workshop please contact the Iowa State University Agribusiness Education Program by calling (515) 432-9548 or e-mail us at aep@iastate.edu.

Sponsored by:
- **Upper Mississippi River Sub-basin Hypoxia Nutrient Committee (UMRSHNC)**
- **Iowa State University College of Agriculture**
- **U. S. Environmental Protection Agency Regions 5 and 7, and the Office of Wetlands, Oceans and Watersheds**
- **USDA - Agricultural Research Service**

IOWA STATE UNIVERSITY
University Extension

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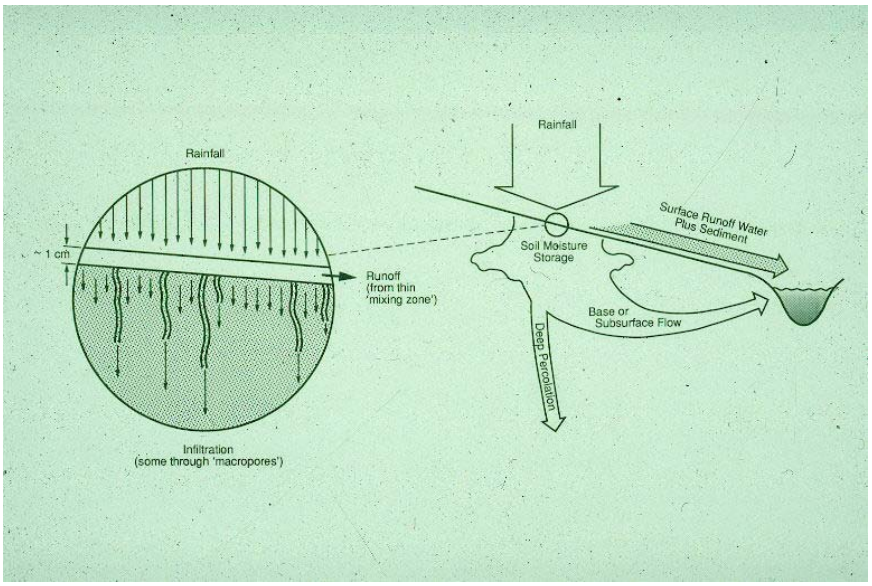
Importance of hydrology/land-use:

- Emerging science suggests that current nutrient impairment problems are not mainly due to mismanagement of fertilizers and manures, but more to historic changes in land use and **<u>hydrology</u>** that came with the conversion of prairie and wetlands to cropland.

Schematic showing modes of transport and importance of rate and route of infiltration water



Drier soil in spring indicating tile-drain locations in north-central Iowa row-crop field

(note ditch on east edge and evidence of new tiles splitting old spacing in lower left-hand corner)

Current understanding:

- In tile-drained landscapes:
  - N losses greater
  - Carrier, subsurface drainage water
  - Dominated by NO_3 form
  - Occur with sustained flows
  - Usually in spring at time with little ET/nutrient uptake
- In “rolling” landscapes with good surface drainage:
  - P losses greater
  - Carriers, runoff water and sediment
  - Usually dominated by P in sediment
  - Occur with “flashy” rainfall-runoff events
  - Year around, worse in spring with less vegetative cover

- Past projections of simple “win-win” or even “low-hanging fruit” situations were seemingly overly optimistic, particularly with respect to rate (and timing) of nitrogen additions, and what was perceived as wide-spread use of excess, or insurance, nutrients.

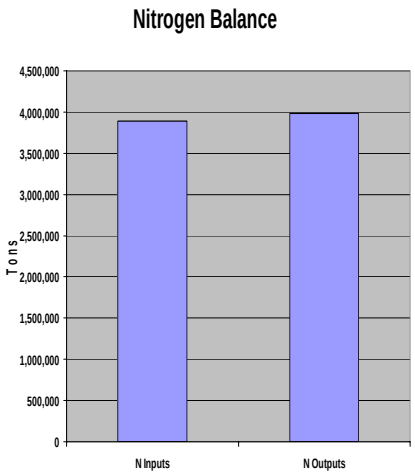
N mgt. potential:

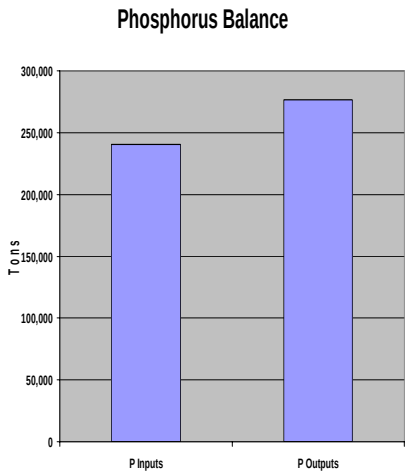
- Potential for reducing NO_3-N leaching losses with N mgt. is highly dependent on where we are in terms of current rate and timing practices.
- In Iowa, e.g., recommended rate for corn after soybeans is 100 to 150 lb N/acre.
- In 2005, based on fertilizer N sales, 142 lb N/acre was applied to corn.
- How much additional manure N was applied can only be estimated.
- Based on leaching data, reducing the N rate from 150 to 125 lb/acre would reduce losses about 15%.
- Based on Minnesota timing data, Iowa which applies about 25-30% of its N fertilizer in the fall, might reduce leaching losses about 4% if no N was applied in the fall.

"Excess nutrients"

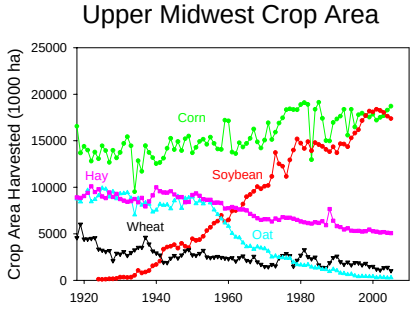
- Often it is written that nutrients in water resources are the result of the loss of "excess nutrients" present in the soil (implying if there were no "excess nutrients," losses would not occur).
- BUT:
  - For optimum crop production, significant amounts of N and P must be present in the soil.
  - Precipitation that results in excess water (thus surface runoff and/or subsurface drainage) can and does come at any time.
  - When that happens some nutrients are certain to be lost.

N and P Budgets for Iowa and Iowa Watersheds





There are land-use and off-site changes that do offer large potential reductions in nutrient losses, i.e. a "new landscape vision" (e.g., new crop rotations in association with carefully designed and sited wetlands and buffers)



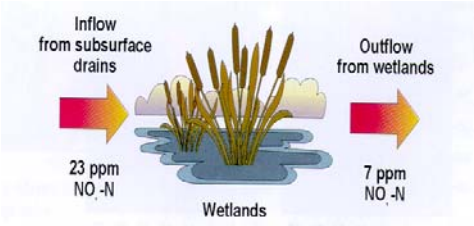


Figure 6. Wetlands reduce nitrates in drainage water. (Iowa)

Potential relative reductions in nitrate leaching in Corn Belt for specific corn/soybean mgt. changes

PRACTICE	CHANGE	REL. REDUCT.
N rate on corn	150 reduced to 125 lb/ac	****
timing	no fall N-fertilizer applications	**
cropping	switch to perennials	**********
buffer strips	1-5% of area	-
tillage	plow to long-term, continuous no-till	**
wetlands	1-5% of area	**********

Critical to management assessment is accurate, site-specific information on current practices.

Quote from the "Integrated Assessment": "*Any program for reducing N loading to the Gulf should consider local hydologic conditions and the characteristics of agricultural production, the resource base, and the producers.*"

- However, uncertainty because of insufficient data leads to differing views of practice efficiencies (a deficiency that can and should be reduced).

Additional research is needed to develop new management/technologies to solve both current and evolving resource problems (e.g., those related to the emphasis on “bio-energy”).

- **Will there be enough corn?**
- **Ethanol boom poses environmental, economic challenges for Iowa**
- **It's hard to believe, but with fuel processors ratcheting up demand, Iowa could one day find itself short of its signature product.**

By PHILIP BRASHER
DES MOINES REGISTER
WASHINGTON BUREAU

November 19, 2006

One additional issue is that of soil quality/sustainability (and like “global warming,” there is not agreement about the degree, importance, and solution of this issue)

N rate/mass balance example for corn-soybeans:

- For corn following soybeans, Iowa recommendation for N is 100 to 150 lb/acre.
- For corn, N inputs minus outputs is already negative at a fertilizer/manure rate of 150 lb/acre.
- For soybean, N removed in grain is about twice that fixed as a legume so mass balance is negative.
- Loss of organic matter to make up for deficit N not only reduces soil quality, but also water quality (lower infiltration rate and water holding capacity have several ramifications).

General Conclusions

- Sufficiently high soil nutrient levels are necessary for good crop growth; thus some loss is inevitable.
- Historic changes in land-use and hydrology have resulted in productive agriculture, but are also mainly responsible for nutrient impairment problems.
- N and P transport and losses are affected quite differently by surface and sub-surface landscape drainage processes.
- Some improvement in in-field nutrient management is possible, but off-site practices also are needed, using targeted/site-specific designs.
- There are no easy answers, and care must be taken to avoid promoting the wrong practices.
- Improvements will be incremental, and variability in weather can dominate both short- and long-term outcomes.
- Management impacts on soil quality/sustainability bears further consideration.
- A new landscape vision has considerable potential (but an approach that likely will require public funding).
- Current and evolving resource problems continue to create demand for new solutions that only additional research can provide.

We have an opportunity/obligation to create a coordinated, integrated initiative that builds on research and addresses compelling needs”

Wendy Wintersteen, Dean, College of Agriculture, ISU
April 12, 2006