Drainage Fact Sheet

UNIVERSITY OF MINNESOTA EXTENSION
Driven to Discover℠

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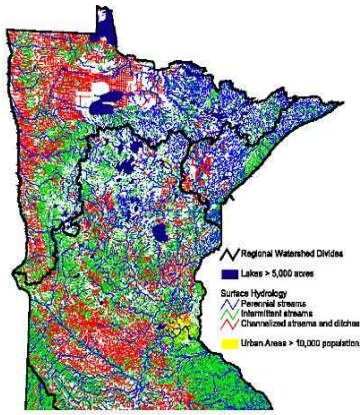
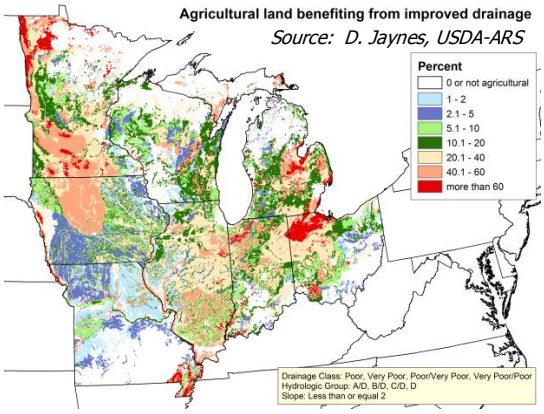
Drainage Status

- Surface drainage (ditches) and subsurface (tile) drainage are the primary artificial drainage practices.
- Subsurface (tile) drainage began in upstate NY in 1830's (Johnston Farm).
- Glacial processes in upper Midwest created an abundance of highly productive but poorly drained soils (inset).
- Approximately 25% of US arable land employs one/both surface and subsurface drainage.
- Earliest drainage activities in the upper Midwest addressed agriculture, transportation infrastructure, and human health needs.
- Percentage of tile-drained land in MN varies widely, but perhaps 20-30% of the agricultural soils in the MN River Basin are tile-drained. In some locations, higher percentages exist.
- Farmers in Minnesota are permitted to drain their lands provided they have an outlet and comply with USDA and State wetland regulations.
- Current drainage activity in the Midwest typically replaces older, less effective drainage systems with new systems. Incorporating technologies to reduce environmental concerns in these new systems is important.



Minnesota has more than 21,000 miles of ditches and channelized streams (shown in red, above: source, DNR), which serve as the drainage infrastructure for the agricultural regions of Minnesota. Meeting water quality goals while addressing drainage needs for agriculture is a current priority.



"Conservation Drainage" Practices Include:

Nutrient BMP's

Controlled drainage or "drainage water management"

Two-stage ditches

Shallow drainage

Reduced drainage intensity

Woodchip bioreactors

Improved surface inlets

Improved side inlets

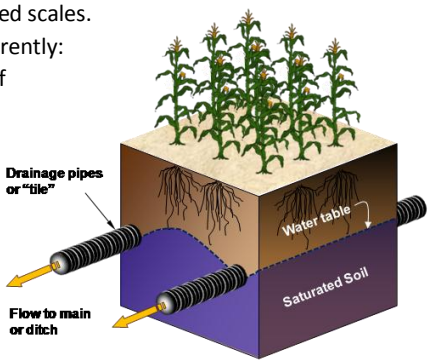
Winter cover crops

Wetland restoration

Nutrient retention basins

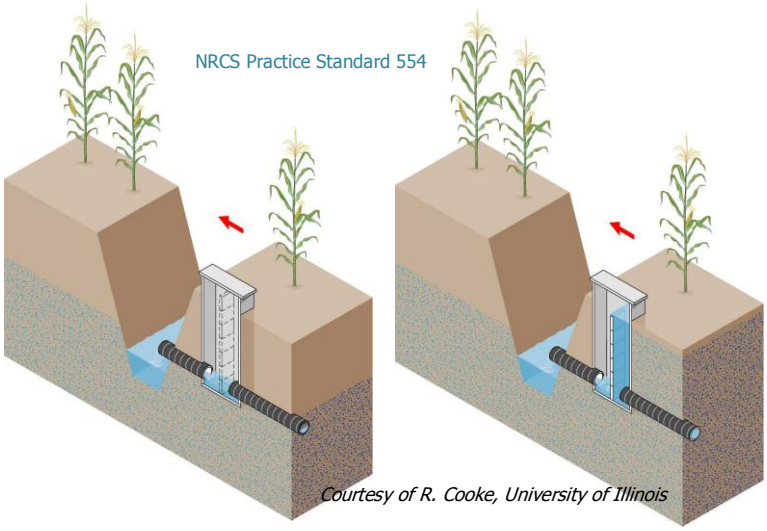
Drainage Benefits & Impacts

- Poorly drained soils increase risks to agricultural production from excess water and high water tables.
- Proper soil drainage improves agricultural production by ensuring timely planting and field operations, minimizing soil compaction and buildup of salts, promoting conditions for good seedbed establishment and germination, and minimizing high water table stresses to growing crops. Well drained soils out-yield poorly drained soils and have less year-to-year yield variability.
- Proper soil drainage also improves the opportunity to employ other conservation practices such as minimum tillage.
- Both artificial drainage and land-use change (prairie to agriculture) affect hydrology, water quality and habitat. The individual effects of drainage and land-use change are difficult to separate.
- Surface and subsurface drainage have very different hydrologic impacts:
  - Surface drainage speeds flow from landscape and increases peak flows.
  - Tile drainage promotes more infiltration, slowing water delivery from the landscape (compared to surface drainage), but studies indicate potential for overall increases in water yield from 5 to 10%.
  - Local hydrologic effects are dampened at larger watershed scales.
- Surface and subsurface drainage affect water quality differently:
  - Surface drainage may increase losses from surface runoff (sediment and phosphorus, primarily).
  - Tile drainage may reduce surface runoff pollutants but may increase dissolved nutrients, such as nitrate.
- Drainage activities have reduced the number and extent of wetlands, in some areas by as much as 90%, but wetlands are now protected by Federal and State laws. In some areas, wetlands are actually being restored, usually on land that once was cultivated.



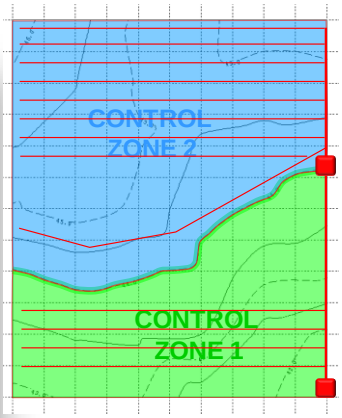
Extensive research is underway exploring opportunities to mitigate unwanted environmental effects while maintaining agricultural productivity

Drainage Water Management



Courtesy of R. Cooke, University of Illinois

Water control structures enable shallower water tables to be achieved, conserving water and nutrients in the soil profile.



Drainage water management design (left) calls for dividing the field into water control/management zones, aligning laterals with the field contours, and using control structures. Annual subsurface flow and nitrate reductions from 10 to 50% may be possible.

Water control structures are manually adjusted (right) or can be automated, if desired.

Photo: USDA-ARS

ADMS Task Force
Agricultural Drainage Management Systems

The ADMS is a collaboration of agency and university research and Extension professionals who educate, promote, and assist with the design of integrated systems to reduce adverse effects, conserve water, and enhance crop production.

ADMC
Agricultural Drainage Management Coalition

The ADMC represents the latest technologies in drainage water management systems and assists agricultural and stakeholder communities in improving water quality and increasing yields for food and energy producers. They work with public and private entities and institutions to build an understanding of the latest drainage water management systems.
www.admcoalition.com

Further Reading and Information

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