CEAP Watershed Assessment Studies in Iowa:

Lessons learned from a collaborative effort

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Partner organizations
NRCS
Southfork Alliance
USGS

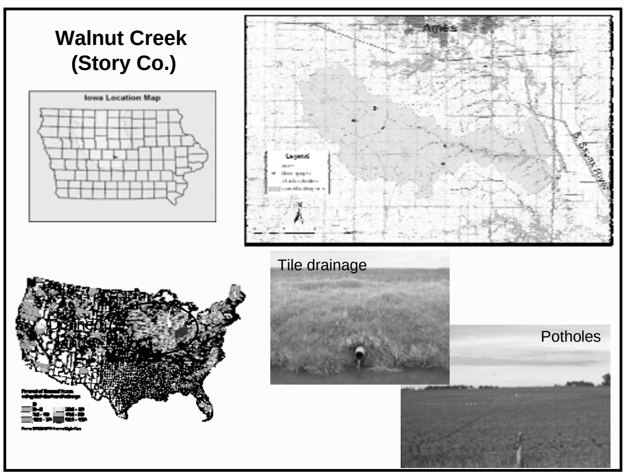
Watersheds

1. Deep Loess Research Station – Treynor IA
2. Walnut Creek (Story Co.)
3. South Fork Iowa River
4. Walnut/Squaw Creeks (Jasper Co. – NSNWR)
5. Sny-McGill / Bloody Run
6. Boone River

Lesson 1: Detecting Water Quality Improvements

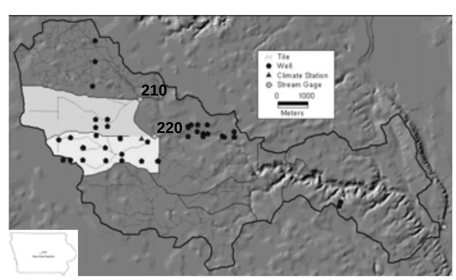
- Monitoring strategies to detect water quality improvements from conservation practices must:
  - account for pollutant delivery pathway
  - Consider lag times associated with that pathway, and
  - be in place long enough to account for climatic variation.
- Pollutants delivered primarily with surface runoff will require a different monitoring strategy than pollutants delivered via subsurface flow or tile drainage. The lag time between practice installation and detectable water quality improvement will differ depending on the manner of pollutant delivery to streams.
- Water quality improvements are easier to detect in small sub basins in reasonable timeframe compared to large basins. For example…

Walnut Creek (Story Co.)



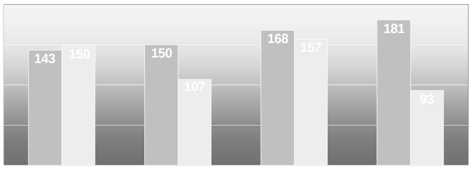
Agronomic practices and water quality: Timing of N application

Walnut Creek Subbasins for N Initiative



Timing of N application

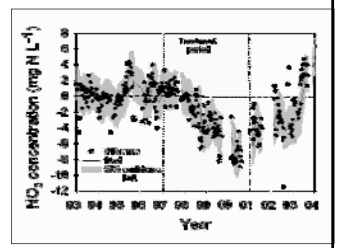
Weighted Averages of Farmers' Normal N program and LSNT program N rates, 1997 - 2000.



1997: cool wet spring
1998: dry spring, wet summer
1999: wet spring, dry fall
2000: very dry and warm spring

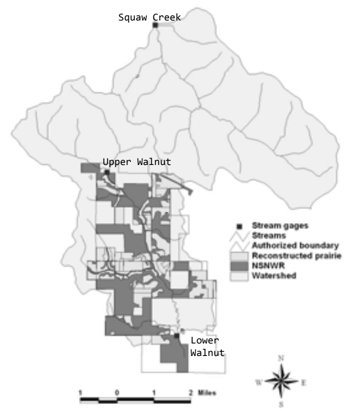
Quantify the impact of LSNT on NO_3 losses at the watershed scale

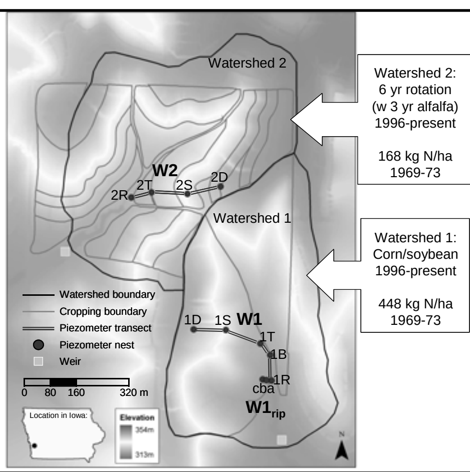
- After four years of managing N-fertilizer on 16 fields using the LSNT, annual mean flow-weighted NO_3 concentrations in surface water were reduced by ≥ 30% within a 366 ha (1000 ac) watershed.



Lesson 2: Know your starting point

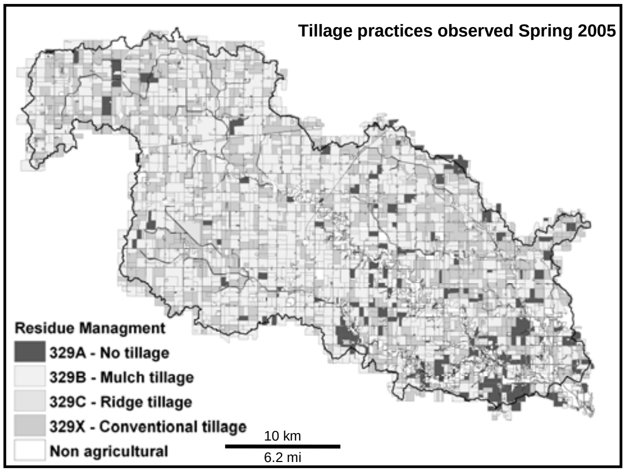
- Agricultural and conservation histories across a watershed affect our ability to detect changes resulting from new practices. This applies to efforts to document changes in soil and water quality dynamics following implementation of new practices.

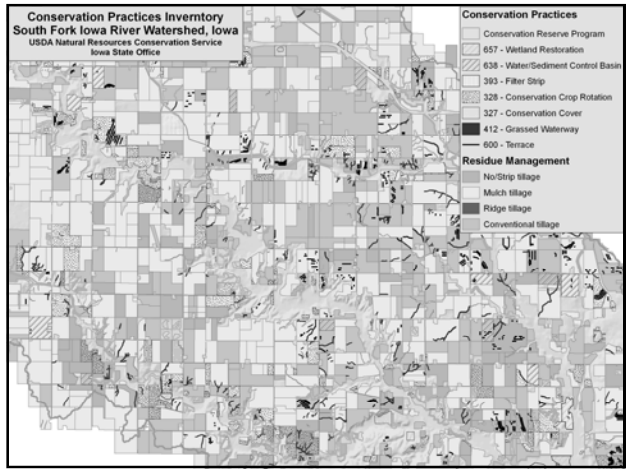




Lesson 2: Know your starting point (b)

- In larger watersheds, methods to assess the type and quantity of conservation practices are limited. We obtained conservation-inventory information with a technique that relies on a driving survey by a trained conservationist using a tablet PC with customized ARC-GIS software. GIS field maps are annotated with information about buffers, waterways, tillage etc.

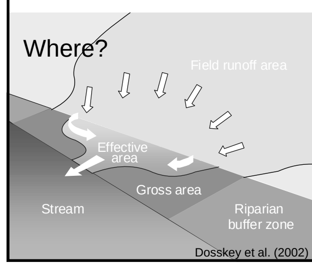


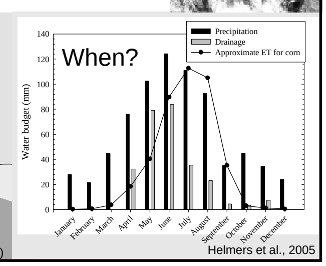


Lesson 3: Targeting Conservation

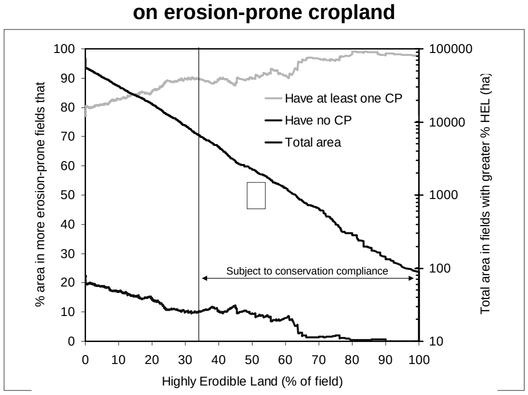
- Effective targeting of conservation practices requires that practices be designed and placed with knowledge of what pollutants are being transported, the pathways they are being transported along, the timing of their transport, and what opportunities there are to trap or treat them. Improving our knowledge of these issues will lead to an improved ability to ensure conservation practices are as effective as possible.

Aspects of targeting

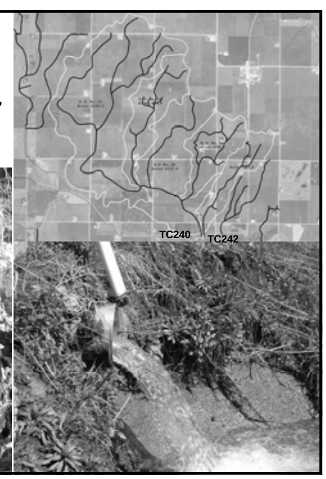




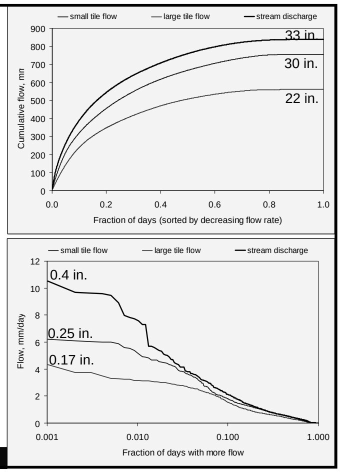
Conservation practices across the South Fork watershed target erosion-control practices on erosion-prone cropland



Tile Gauges: 2005-2007



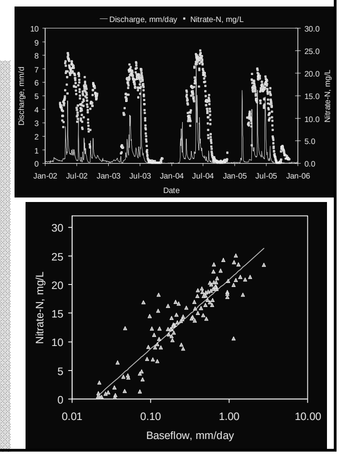
SWAT calibrations: 70% of stream discharge from tiles. Discharge data from Tipton Creek and two contributing tile mains (2005-2007) support this finding.

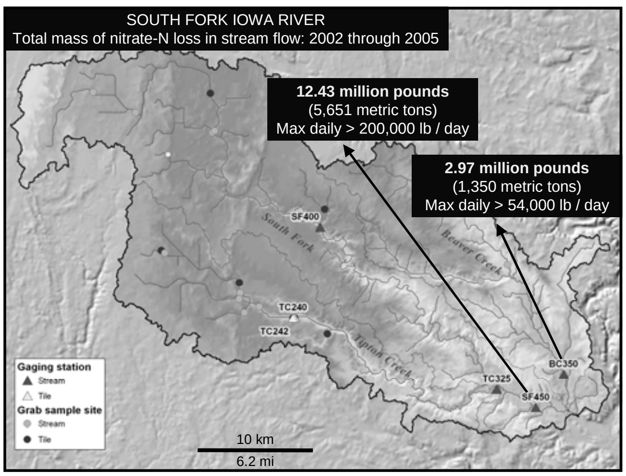


1 mm = 0.04 in

Nitrate-nitrogen

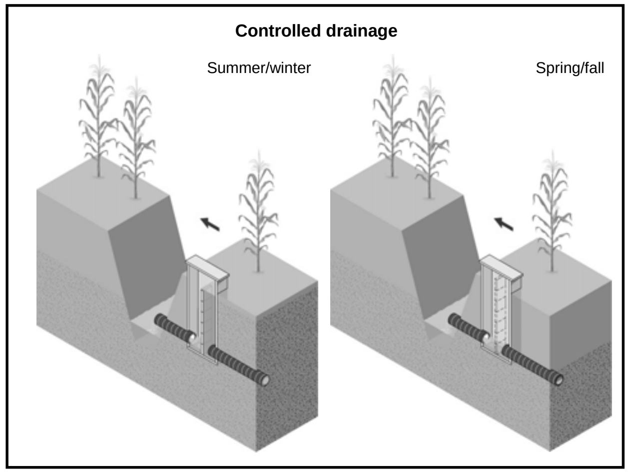
- Loads averaged 18-26 kg N/ha (16-23 lb/ac) annually from 2002 through 2005.
- Concentrations averaged 14-20 mg/L among gauging stations, on flow-weighted basis.
- Peak concentrations late spring-early summer.
- Regressions with baseflow: R^2 of 0.67-0.85





Lesson 3: Targeting Conservation (b)

- Conservation practices for tile drained land are limited (wetlands, cover crops, bioreactors, controlled drainage) Most of these practices are too few in number to assess their impact at the watershed scale.



Lesson 3: Targeting Conservation (c)

- The types and placement of conservation practices in a given watershed can be optimized, but will depend critically on the water quality endpoint(s) of interest (N, P, sediment, etc.) and co-benefits (e.g., wildlife habitat, carbon sequestration, etc.) being sought.
- In other words, we don't necessarily have to trade one problem for another.

Lesson 4: Producer practices and conservation programs are not flexible enough

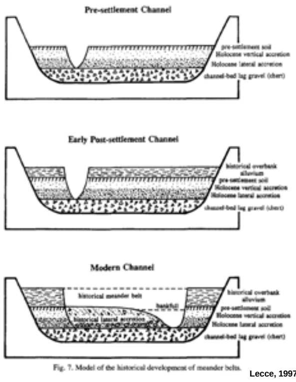
- There are significant barriers to implementation of conservation practices that could provide environmental and economic benefits. These barriers include producer perceptions of social and economic risks, lack of understanding on the impacts of various management practices, and a range of policy and program issues. Local stakeholders and land management personnel have indicated that to effectively target management practices greater flexibility in programmatic implementation will be needed.

Lesson 5: Watersheds are more than the sum of their parts

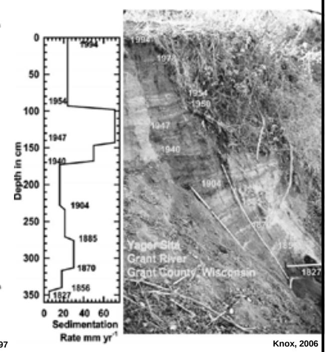
- Stream sediment losses are not necessarily related to *current* erosion control conservation practices. Stream bank and bed sources of sediments may mask effective erosion control within fields or at field edges. Changes in sediment export may take decades to observe due to climate, variable sediment sources, and historical sediment storage. Reducing discharge (especially flood peaks) is critical.

"Legacy" sediment

Impact of History on Watersheds Today



Lecce, 1997



Knox, 2006

Lesson 5: Functionality of modeling tools

- Modeling tools are limited by a lack of options/routines that model conservation practice functions (eg: riparian functions, sediment sources). Models such as SWAT are hampered by generalized representation of parts of the hydrologic cycle such as ground water flow, and generalized representation of land-use practices. This limits the ability to do useful scenario analysis.
- Available data are not sufficient to allow accurate calibration and inference using existing models that simulate large watersheds. Examples include: manure application rates and timing of application, the opportunity costs of conservation practices and how they vary across the landscape, and the extent and location of existing practices and land uses on the landscape.
- **NEVERTHELESS**, Modeling exercises repeatedly demonstrate that targeting of conservation practices to locations where they are the most effective and least costly can yield significant benefits.

A final thought…

- Conservation practices were first advocated to protect soil from erosion. The potential benefits of conservation practices for soil quality, in the long term, may be more valuable than the potential benefits for water quality. History provides many examples of societies that failed to sustain themselves, at least in part because they did not sustain their soils.