

Protecting Water Resources in Feed Stock Production

Rick Cruse; Iowa State University
Wally Wilhelm; USDA/ARS; Lincoln



IOWA WATER CENTER
at IOWA STATE UNIVERSITY

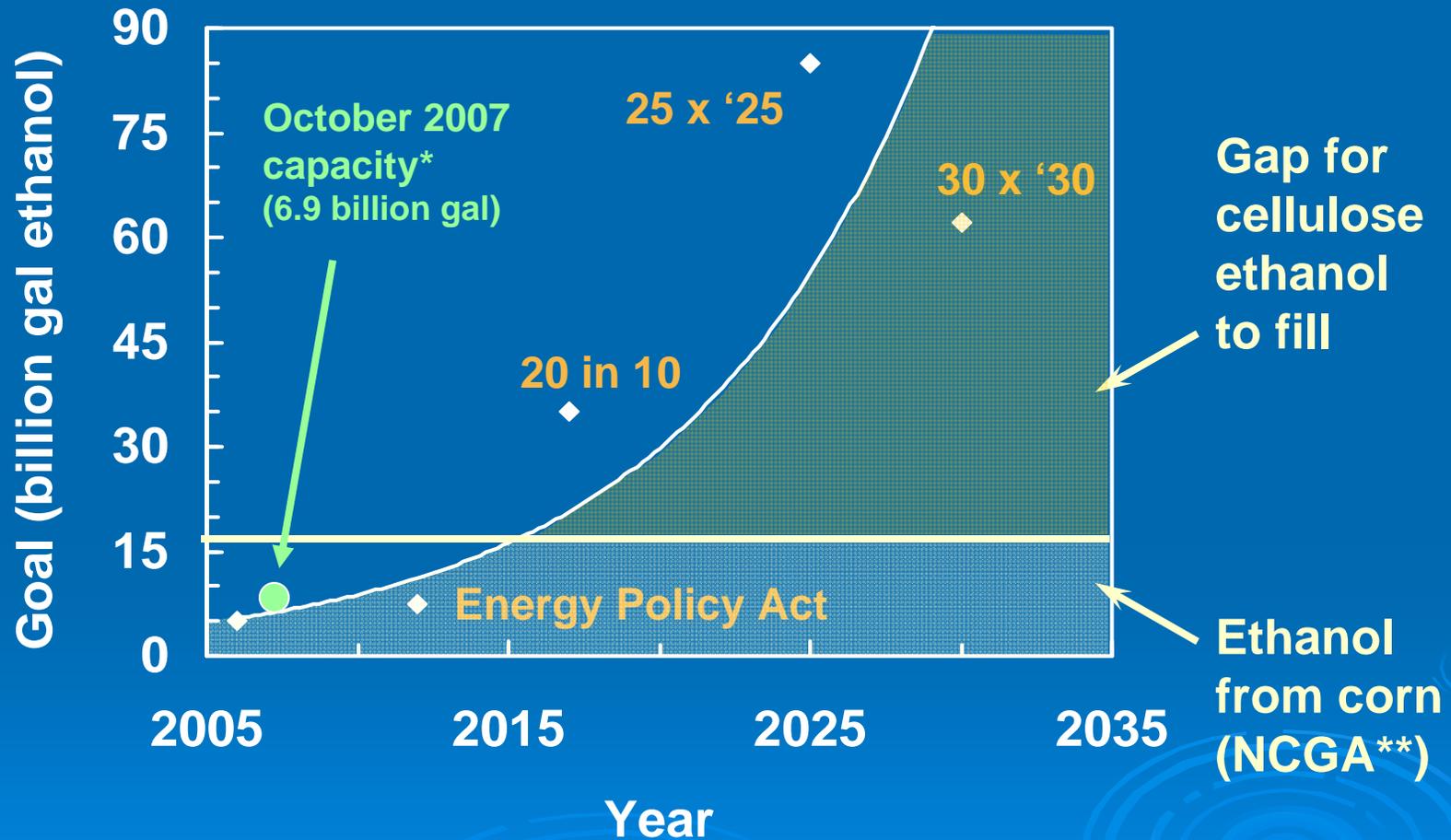
Vision

- Replace approximately 30% of liquid fuels by 2030
- Derived dominantly from plant biomass – a renewable resource

Perlack, Robert D., Lynn L. Wright, Anthony F. Turnhollow, Robin L. Graham, Bryce J. Stokes, and Donald C. Erbach. 2005. **Biomass as a Feedstock for a Bioenergy and Bioproducts Industry: the Technical Feasibility of a Billion-ton Annual Supply**. DOE/GO-102005-2135 ORNL/TM-2005/66. Available at: <http://www.fs.fed.us/research/>.

Burton C. English, Daniel G. De La Torre Ugarte, Kim Jensen, Chad Hellwinckel, Jamey Menard, Brad Wilson, Roland Roberts, and Marie Walsh. 2006. **25% Renewable Energy for the United States By 2025: Agricultural and Economic Impacts**. *The University of Tennessee Institute of Agriculture Department of Agricultural Economics*. <http://beag.ag.utk.edu/>

Cellulose to Fill the Gap



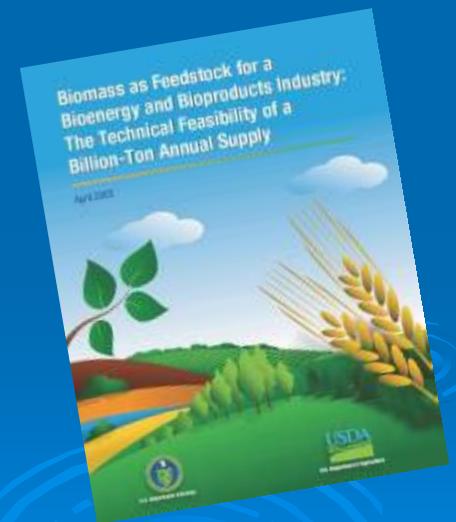
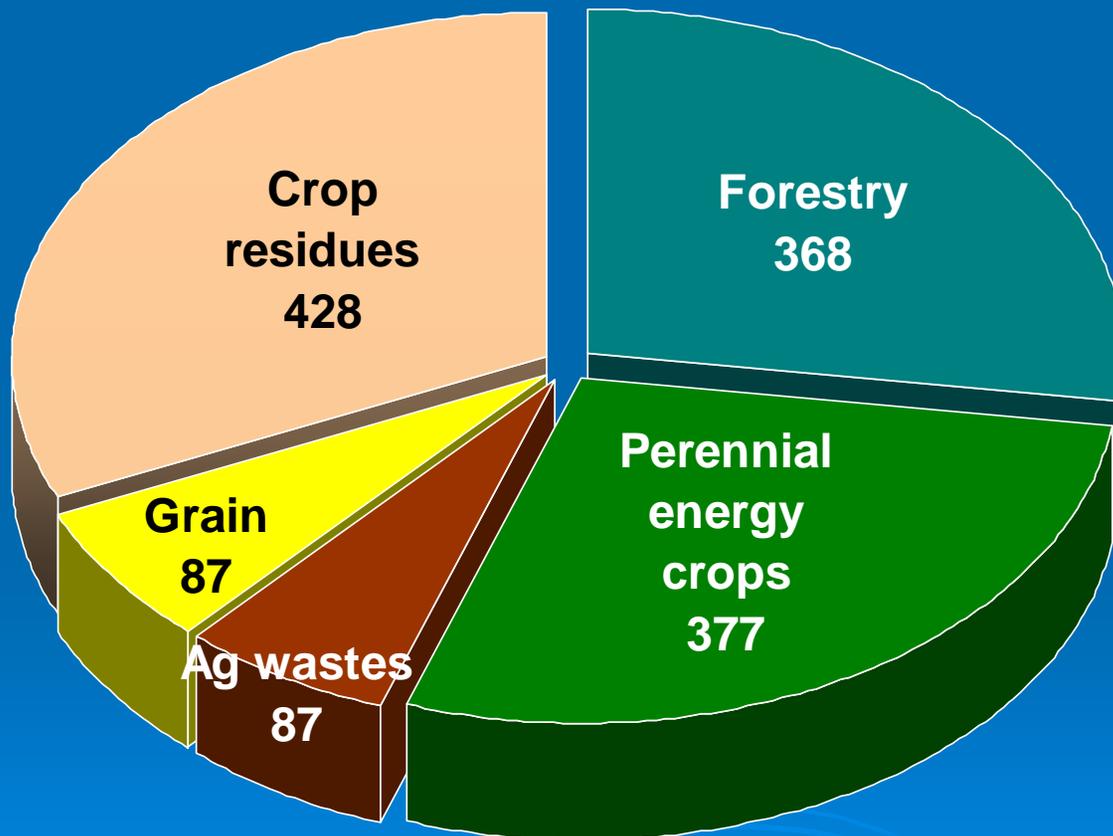
*RFA, <http://www.ethanolrfa.org/industry/statistics/#C>

**NCGA, <http://www.ncga.com/ethanol/pdfs/2007/HowMuchEthanolCanComeFromCorn0207.pdf>

Billion Ton Report

(1.366 billion tons/year)

Estimated biomass (million tons/year) contribution by 2030



Sustainability

- Meeting current needs in a manner that does not jeopardize the capacity of future generations have their needs met.



Future Bioeconomy and Its Impacts on Soil and Water Resources

- **Plant residues, feedstock for liquid fuels, are renewable**
 - **Plant residue production dependent on soil and water resources**
 - **Soil resources are not renewable; water is only conditionally renewable**
 - **Plant residues required for bioindustry –
Plant residues required for soil and water conservation**
- 

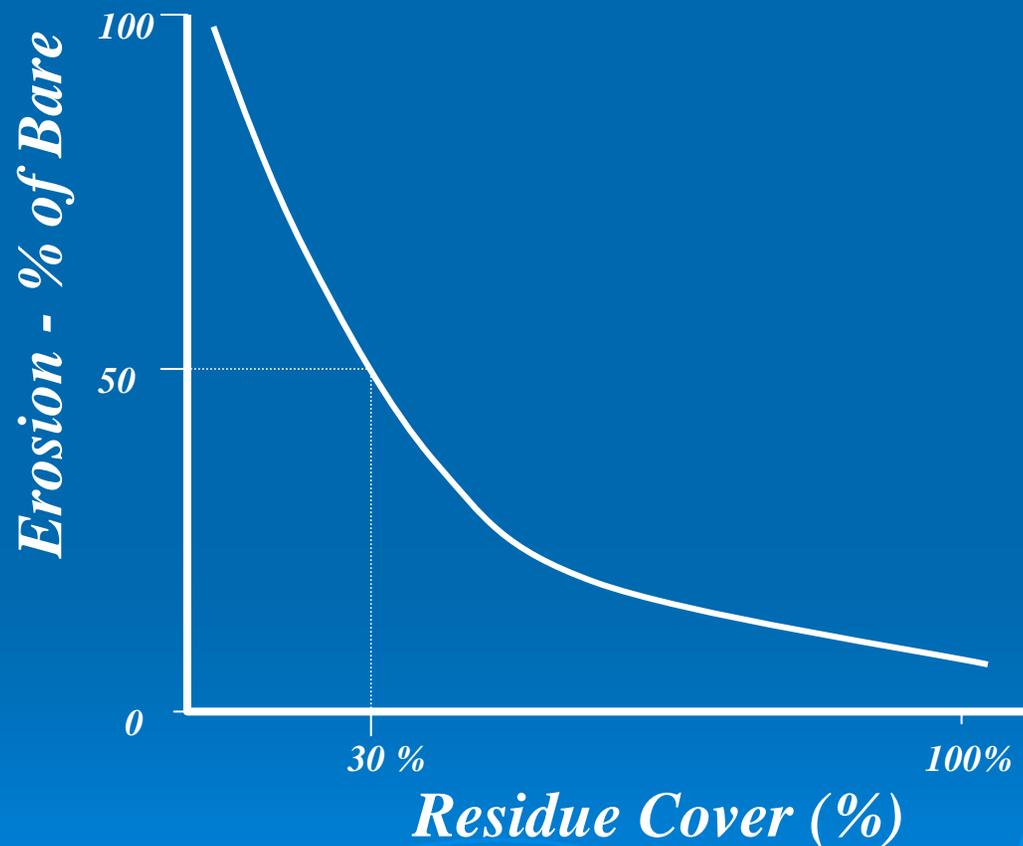
Future Bioeconomy and Its Impacts on Soil and Water Resources

- *Do we have the scientific knowledge to identify acceptable removal rates?*
- *Can we balance energy needs, financial interests, and soil/water conservation in the bioenergy industry?*



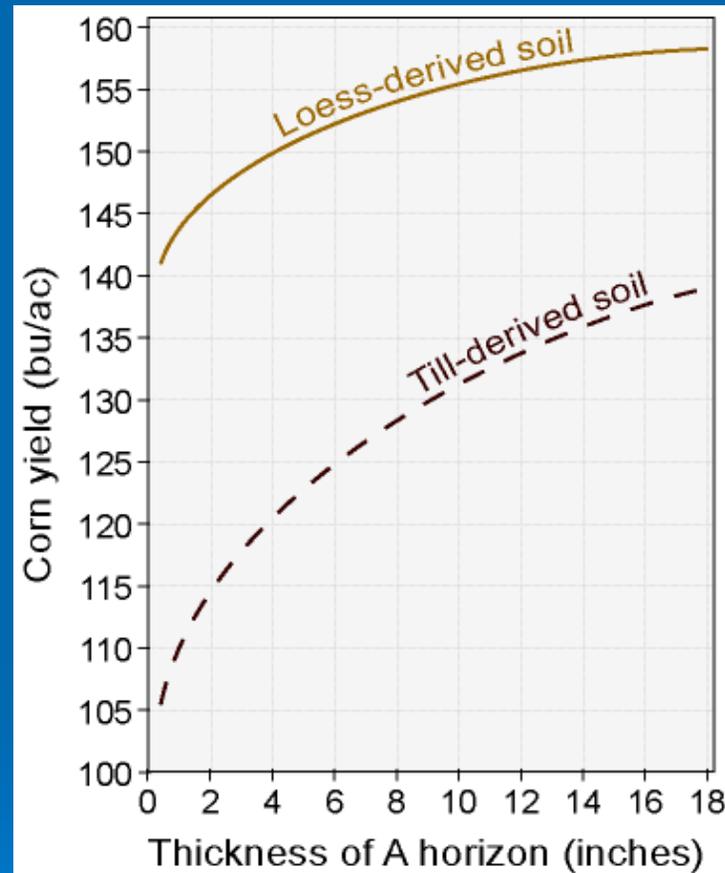
Residue Impacts on Erosion

Effect of Residue Cover on Soil Erosion



Laflen, J. M., and T. S. Colvin. Effect of crop residue on soil loss from continuous row cropping. Trans. Am. Soc. Agric. Eng. 24(3):605-609. 1981.

Soil Erosion Impacts



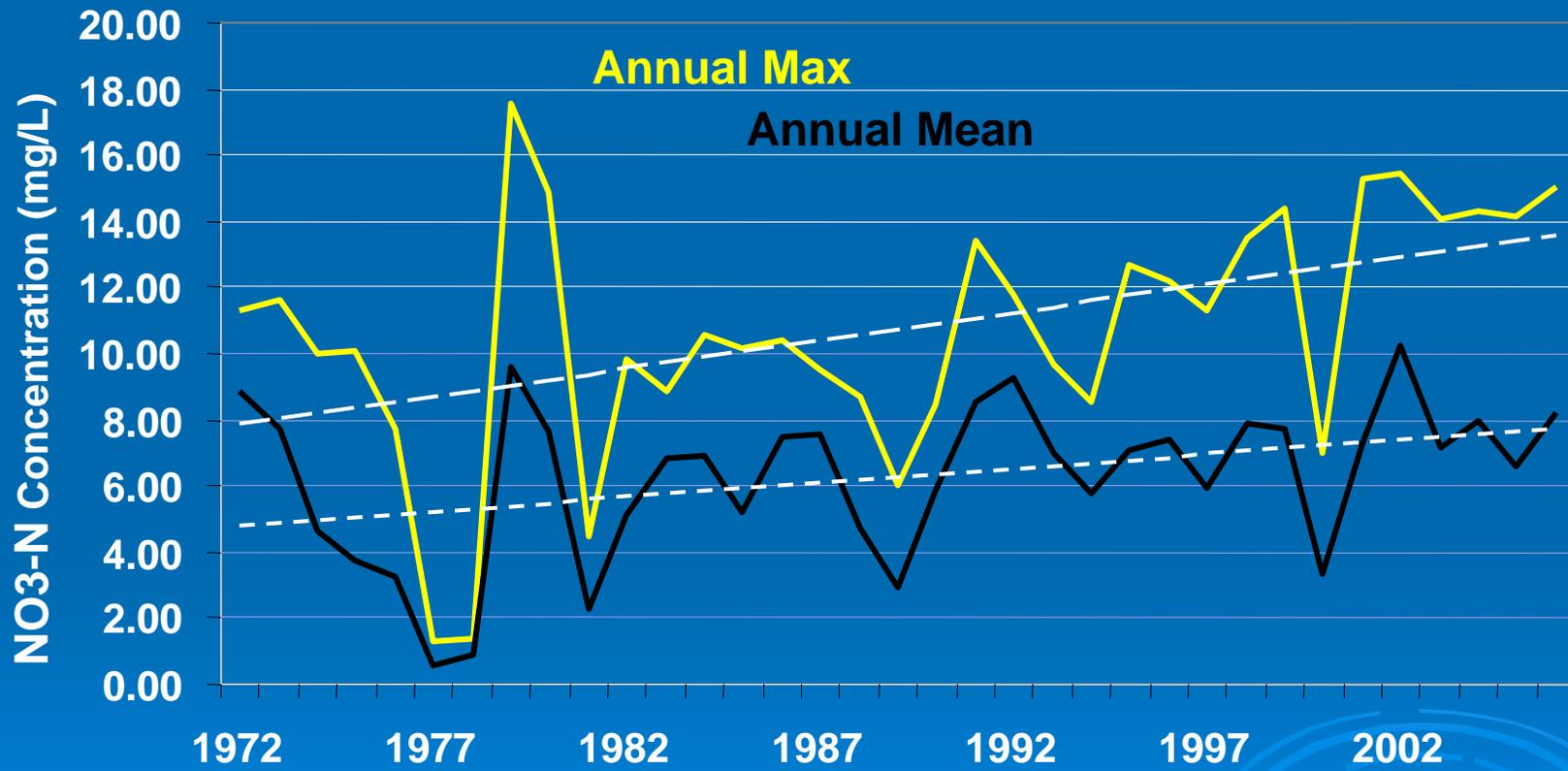
Kazemi, Masoud, L.C. Dumenil, and T.E. Fenton. 1990. Effects of accelerated erosion on corn yields of loess-derived and till-derived soils in Iowa. Final report for Soil Conservation Service, Agreement No. 68-6114-0-8, Des Moines, IA.

RUSLE Annual 'C' Factor As Affected By Residue Removal*

<u>Cropping System</u>	<u>C</u>
Perennial Grass or polyculture	.02
Continuous Corn Grain only removed	.04
Continuous Corn – 75% residue removed	.16
Continuous Corn – 95% residue removed	.55

* I-FARM © 2003-2007 Ed Van Ouwerkerk

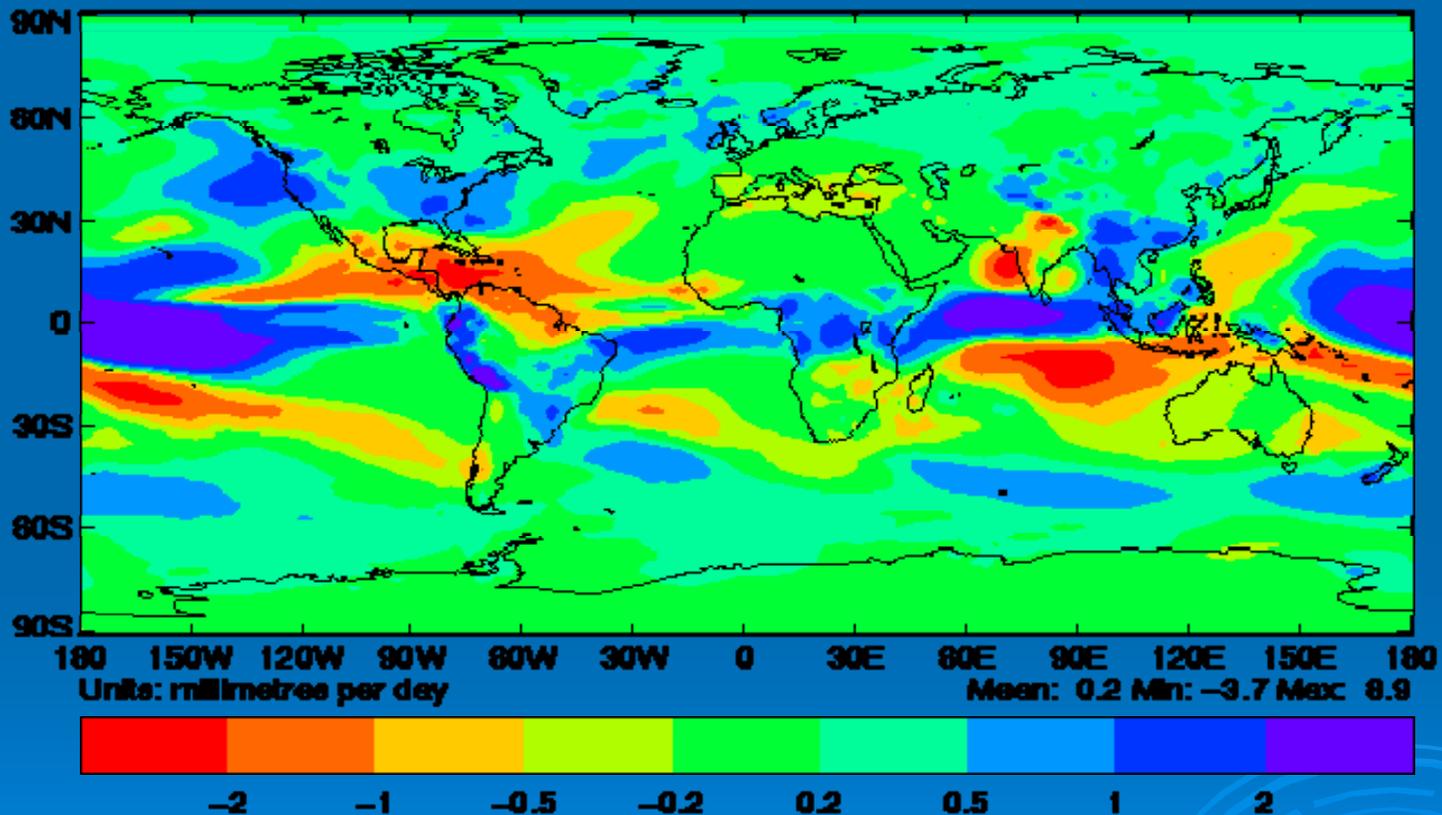
NO3-N Concentration in the Raccoon River at Des Moines



Data provided by Chris Jones
Des Moines Water Works

Trends in Precipitation

Change in annual average precipitation
from 1960–1990 to 2070–2100 from HadCM2 IS92a



Trends in Precipitation

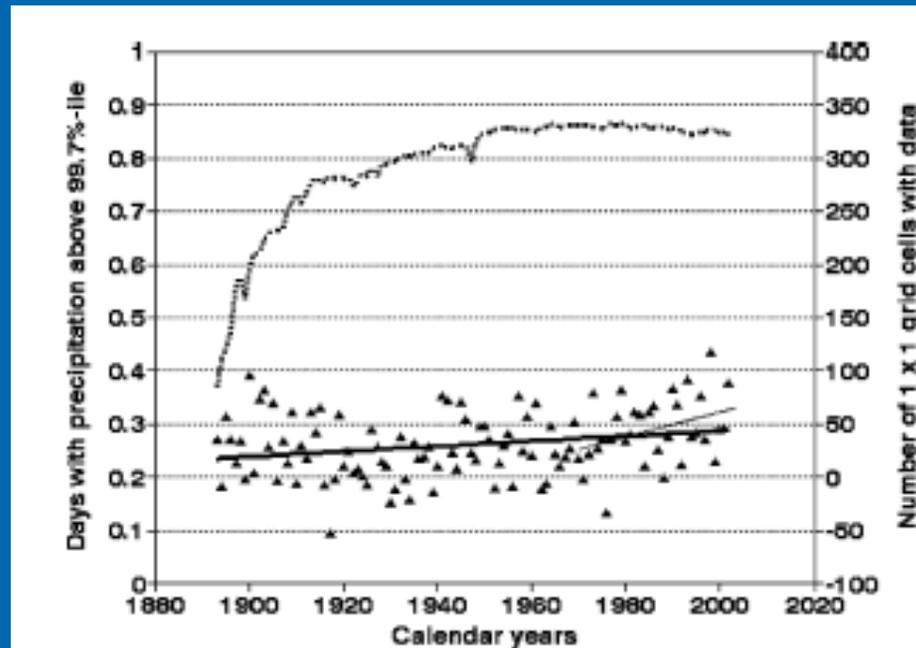


FIG. 9. Very heavy precipitation (upper 0.3% of daily rain events with return period of 4 yr) over regions of the central United States (hatched in Fig. 1) and their linear trends. Linear trends for the 1893–2002 and 1970–2002 periods (solid lines) are equal to $20\% (110 \text{ yr})^{-1}$ and $26\% (30 \text{ yr})^{-1}$, respectively, and are statistically significant at the 0.05 level or higher. Note that there was not any change in very heavy precipitation prior to 1970. The numbers of $1^\circ \times 1^\circ$ grid cells with valid station data are shown by dotted line.

Groisman, Pavel Ya., Richard W. Knight, David R. Easterling, Thomas R. Karl, Gabriele C. Hegerl, and Vyacheslav N. Razuvaev. 2005. Trends in intense precipitation in the climate record. *J. of Climate*. 18:1326-1350.

Challenge to Transition

- Land ownership profile
- Are soil and water “resources” or are they a form of capital to be exploited for short term profit?
- 2006: 39% of Iowa farm land purchases were by investors – not farmers

Farmland Ownership – Major Obstacle

- HARVESTED FARMLAND - % Rented¹
 - Iowa – 56% (Cash rent %: 49, 54, 69% - 1982, 1992, 2002 respectively)
 - Illinois – 62%
 - Indiana – 58%
- “Nothing accelerates faster, stops quicker, or corners harder than a rented car”²

¹http://www.nass.usda.gov/census/census02/volume1/us/st99_2_040_040.pdf

²Personal Communication – Trevor Price, Anheuser Busch ‘ethanol’ distributor. 2006.

Soil and Water Goals - Possible

- Common market for wide range of crops
- Multiple purpose, multiple function





*Multiple biomass
Many technologies
Conservation
Reduced expectations
Asking, and answering, the right question*