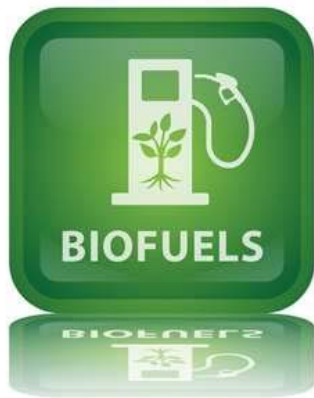


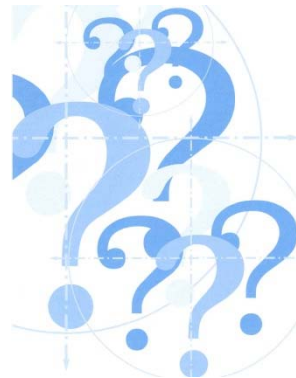
Biomass Production and Multifunctional Agriculture



Rick Cruse
Iowa State University



Why?



One of the Problems

The challenge to produce enough food will be greater over the next 50 years than in all human history

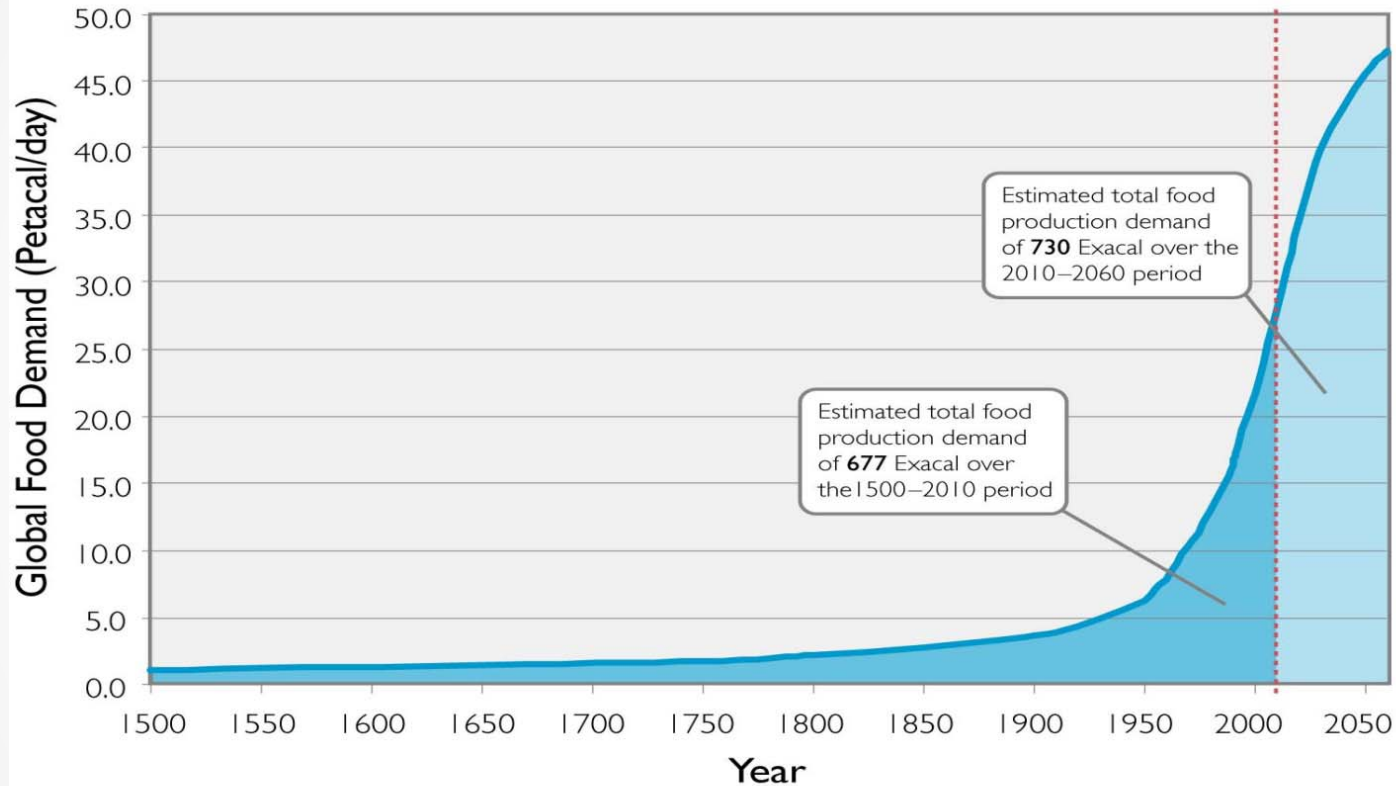


Figure 1. Explanatory notes:

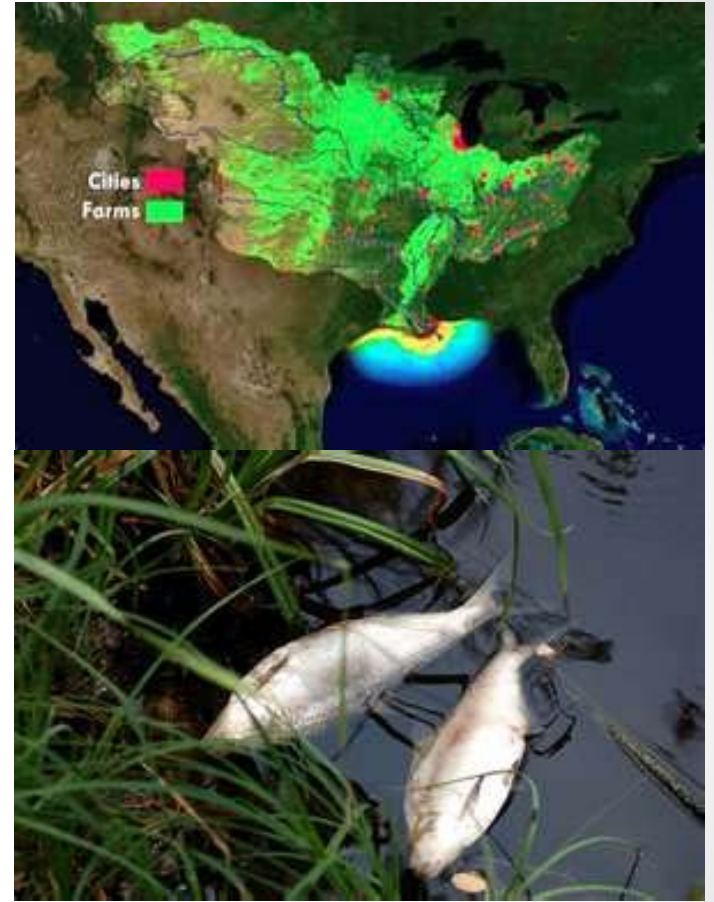
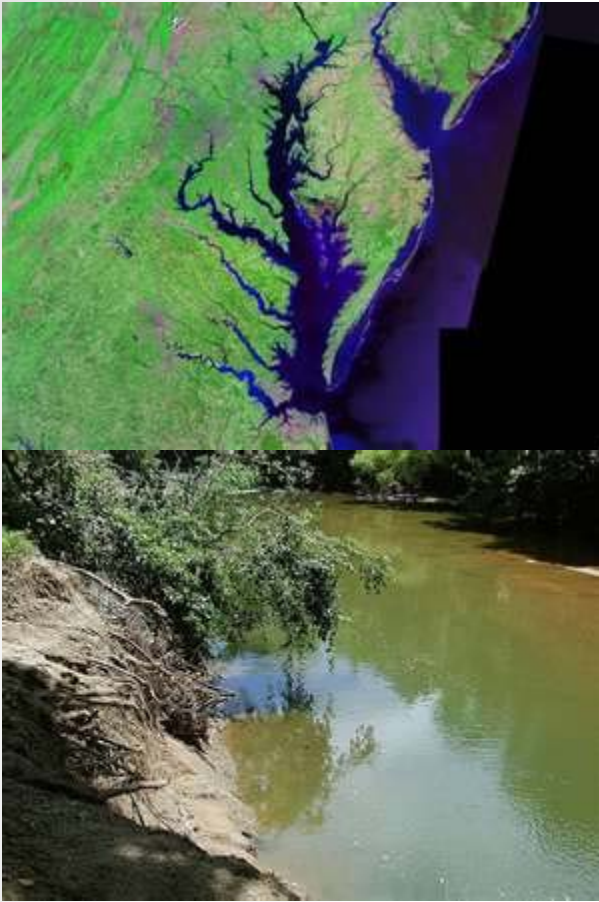
- Based on data from FAOSTAT and UN Population Division, with simple scenario modelling from CSIRO 2009 (BA Keating, unpublished)
- Assumes growth trends in per capita food consumption growth in developing countries (currently 2668 kcal per capita per day) are maintained such that current developed country food consumption levels (3331 kcal per capita per day) are reached by 2050
- Assumes that diversion of food products (or production resources) to biofuels grows from current levels to 15% by 2050
- Assumes no food wastage prior to 1920 ramping up to current estimates of food wastage of 30% and these are not reduced going forward.
- A Petacal is 10^{15} calories, an Exacal is 10^{18} calories.

Working Lands



• **Our agricultural lands must work.** •

Current Working Lands & Water Quality

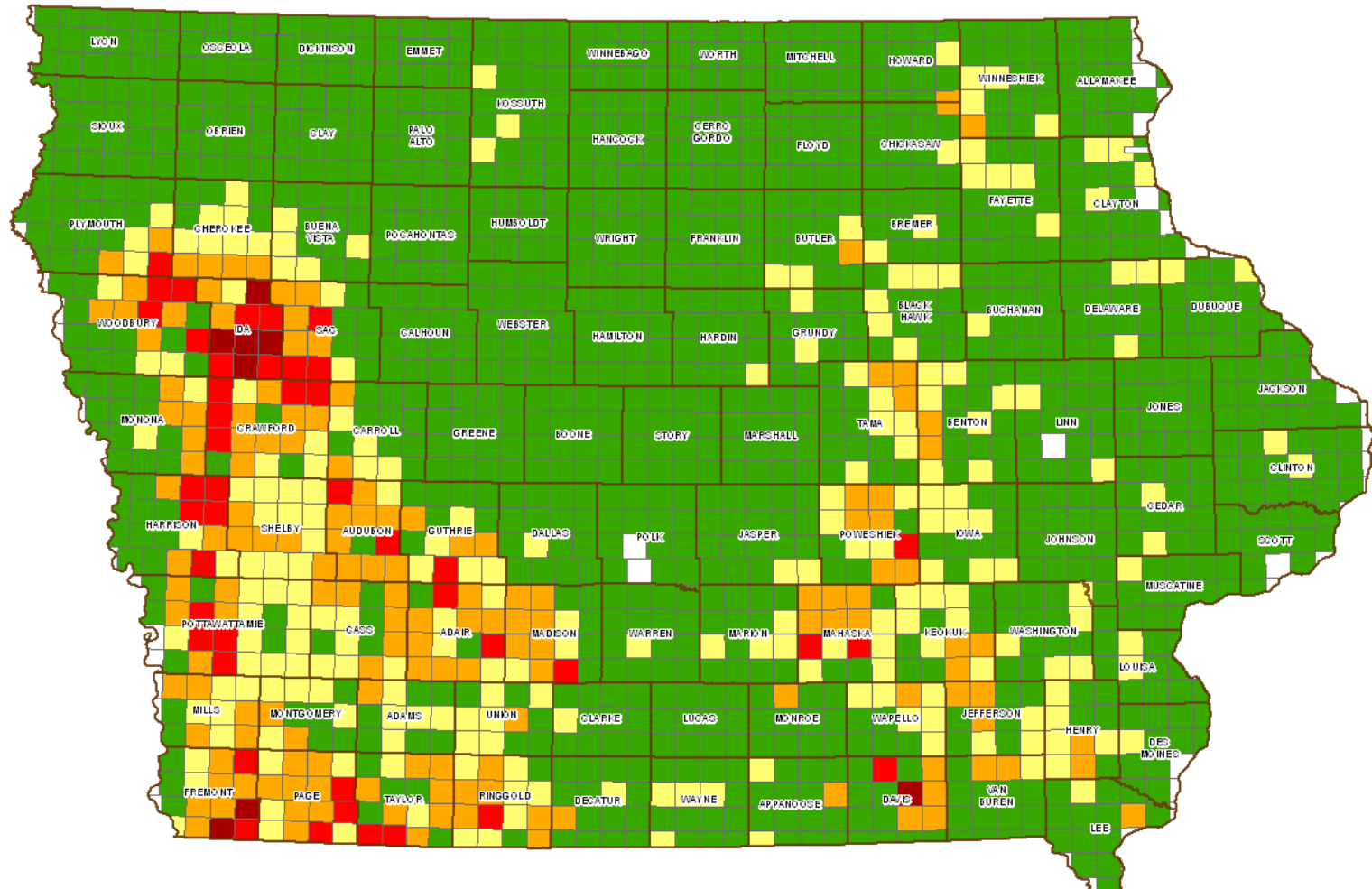


Current working agricultural lands sacrifice water quality.

Current Working Lands & Soil Erosion



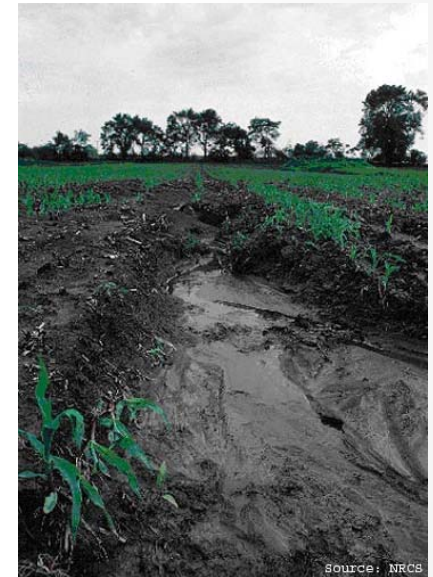
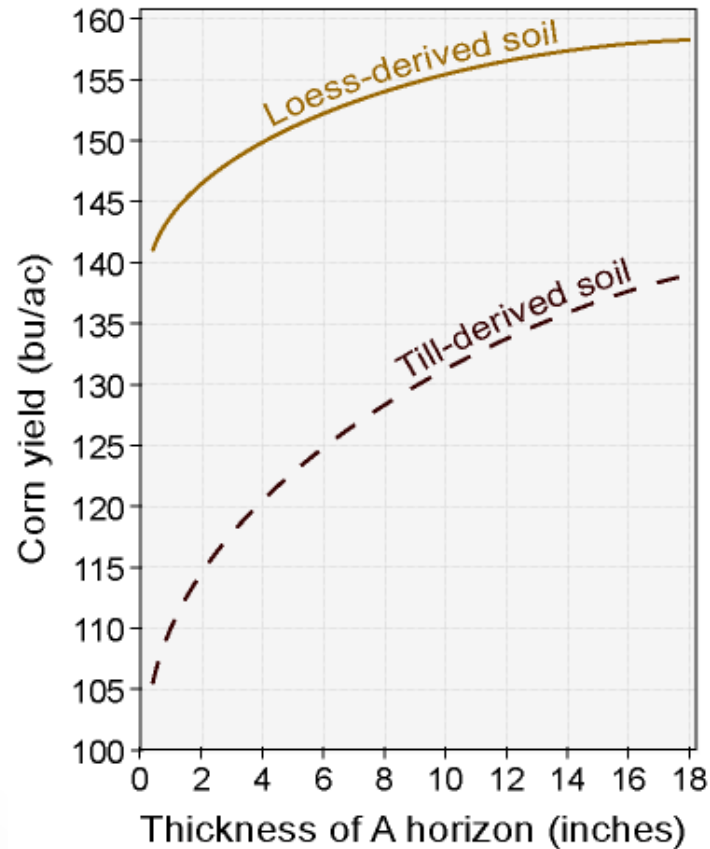
Current Working Land and Soil Erosion



Average Soil Erosion (tons/acre) 2007

○ No Data ● 0 - 5.0 ● 5.1 - 10.0 ● 10.1 - 20.0 ● 20.1 - 50.0 ● 50.1 - 100.0 ● Greater than 100

Does soil erosion affect soil productivity?



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.

Current Working Land and Risk Diversity

(there isn't much!)

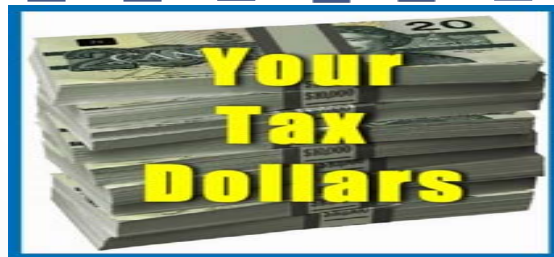


**CROP
INSURANCE**

TAKES THE WORRY
OUT OF FARMING

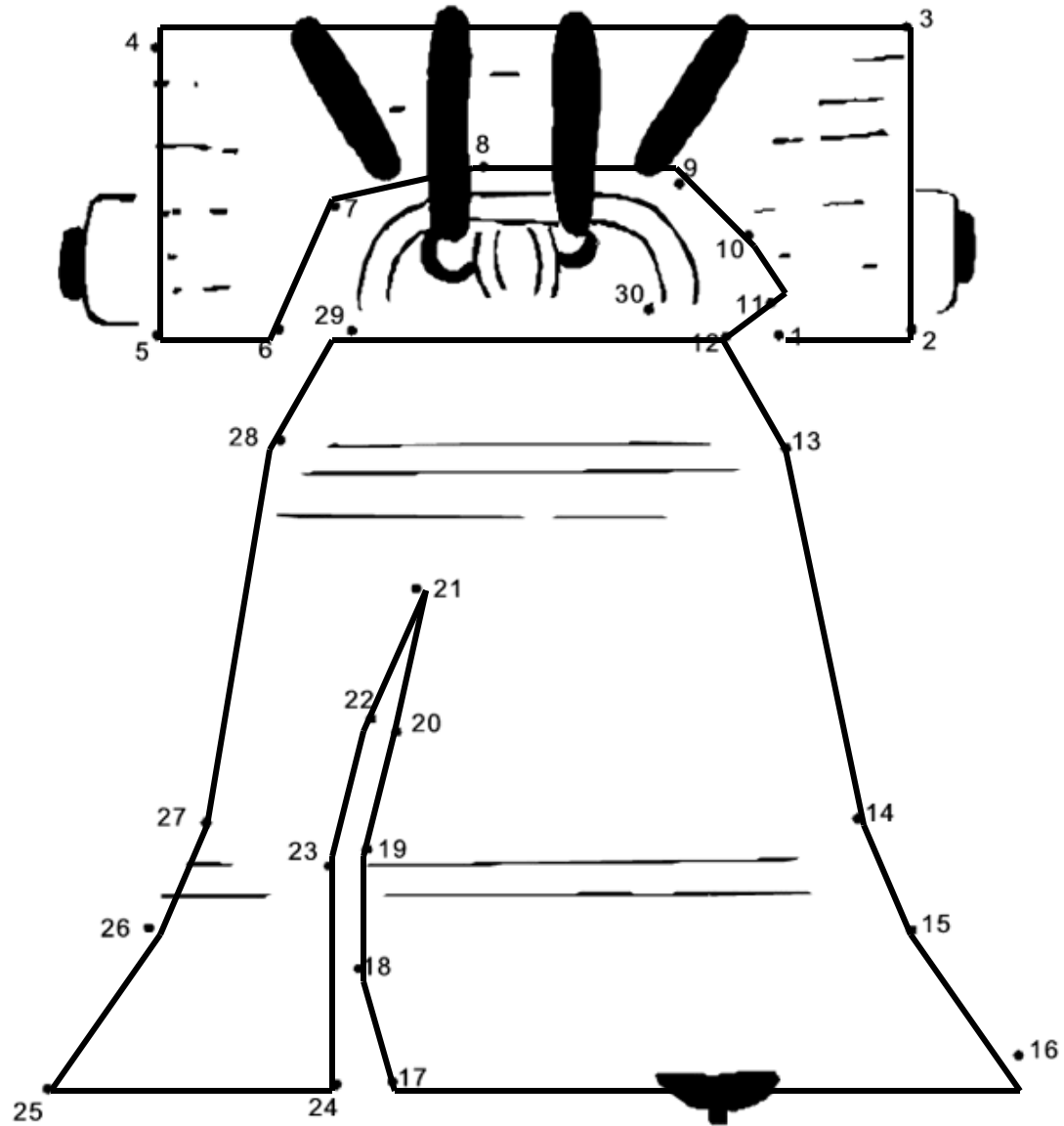


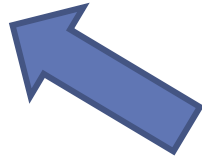
**Your
Tax
Dollars**



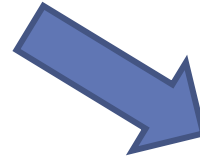
Cellulosic Biofuels





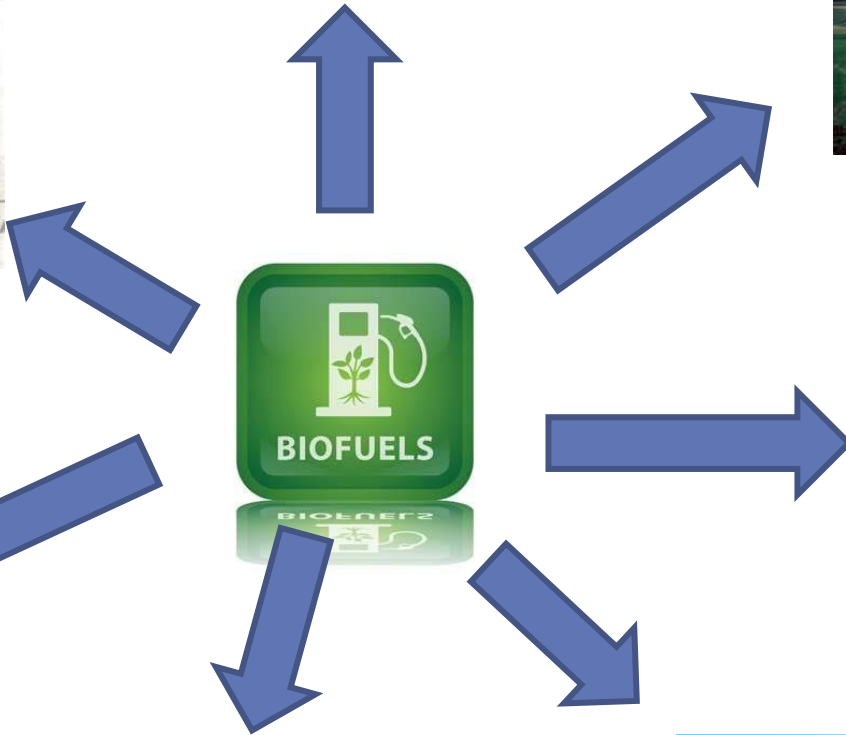


**Conservation
Reserve Program
Land (CRP)**



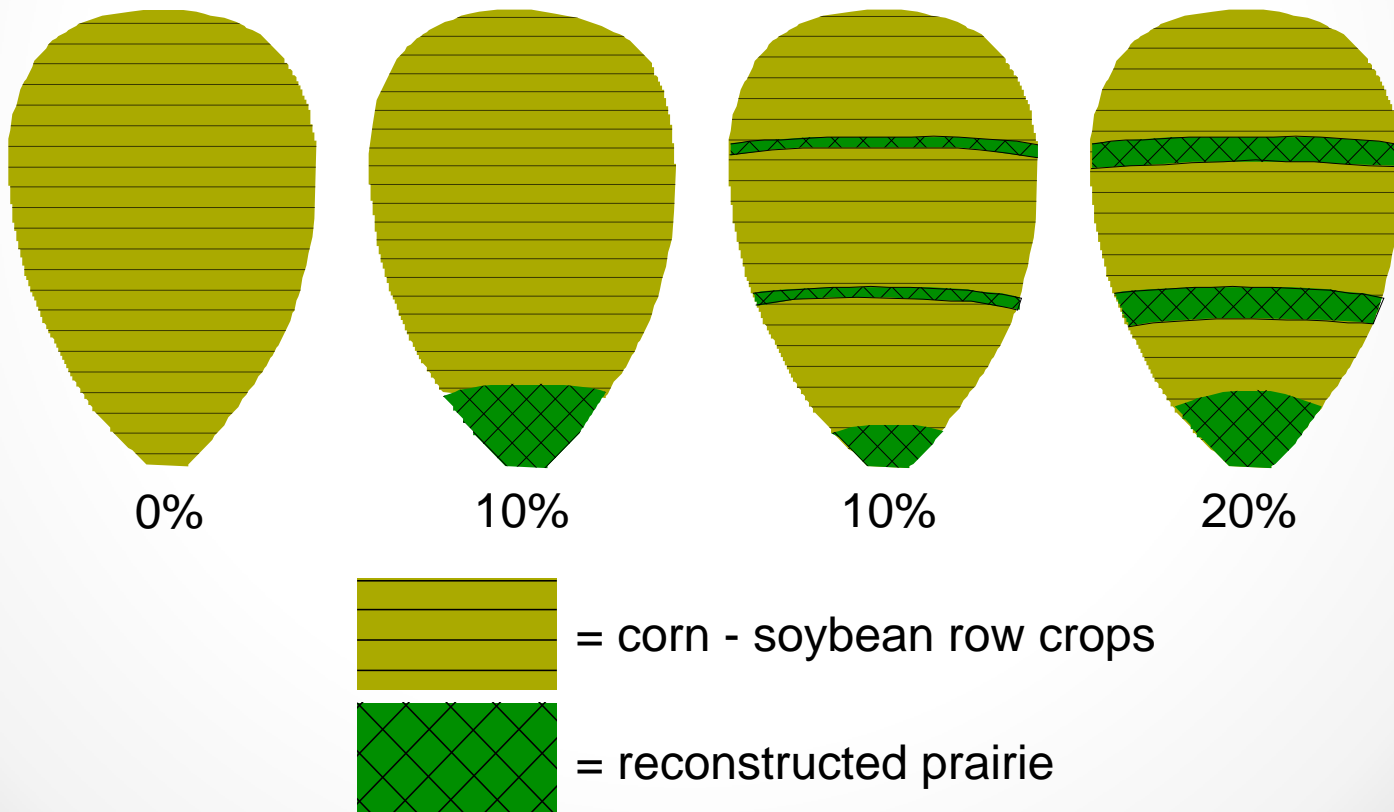
Bioenergy Crops





Neal Smith Wildlife Refuge Experimental Watershed Treatments

<http://www.nrem.iastate.edu/research/STRIPs/>





Anna MacDonald



Anna MacDonald



Anna MacDonald

Sediment loss from watersheds



100% crops



10% perennial cover

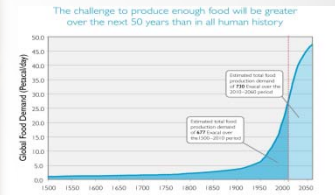
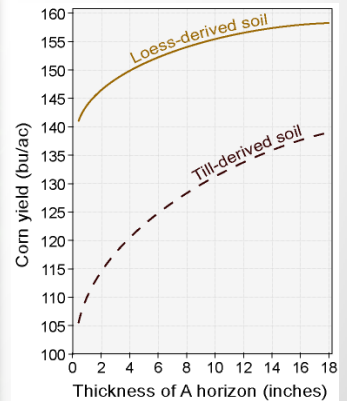
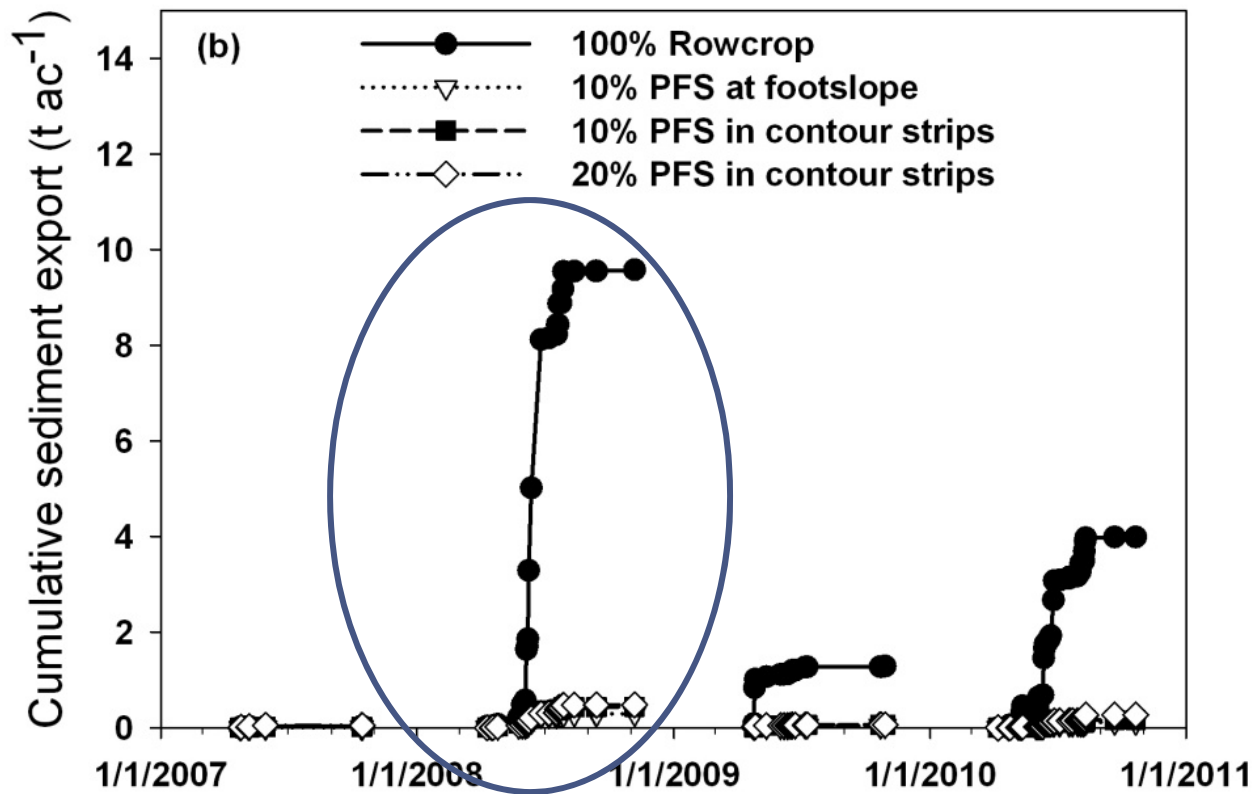


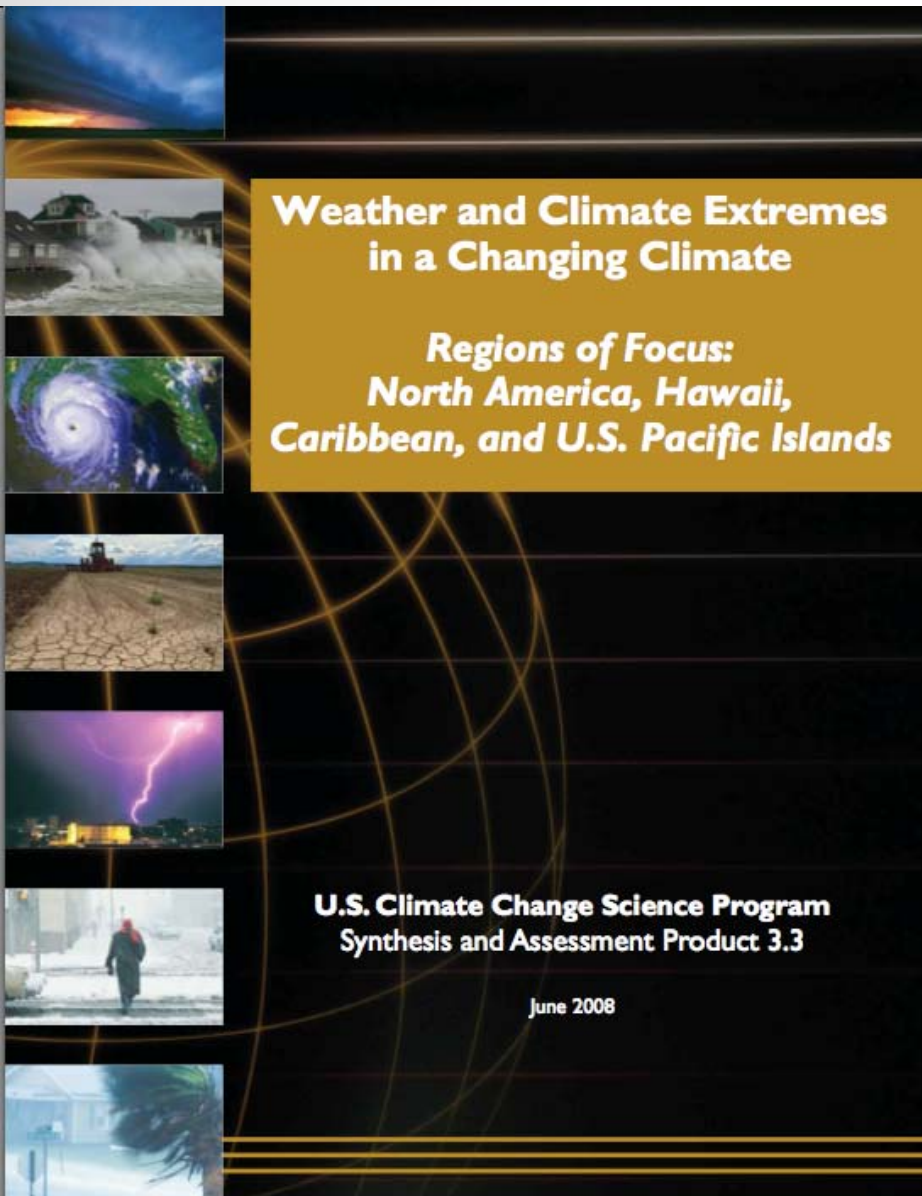
Figure 1 Exponential curves
 * Based on data from FAO/ICRAF and IAP Population Division with simple scenarios resulting from CERO 2009 50A modeling capabilities
 * Assume growth trends in per capita food consumption growth in developing countries currently 1000 kcal per capita per day are maintained until that country develops greater food consumption levels (2000 kcal per capita per day) by roughly 2050
 * Assume the number of people in population increases to include growth rates from 1970 to 2050
 * Assume no food shortage prior to 1950 resulting in a current estimate of food coverage of 300 kcal from the not included grain harvest
 * Assume a 10% increase in demand in 2010 scenario



Sediment Loss in Runoff (2007-2010)



Helmert et al., in review



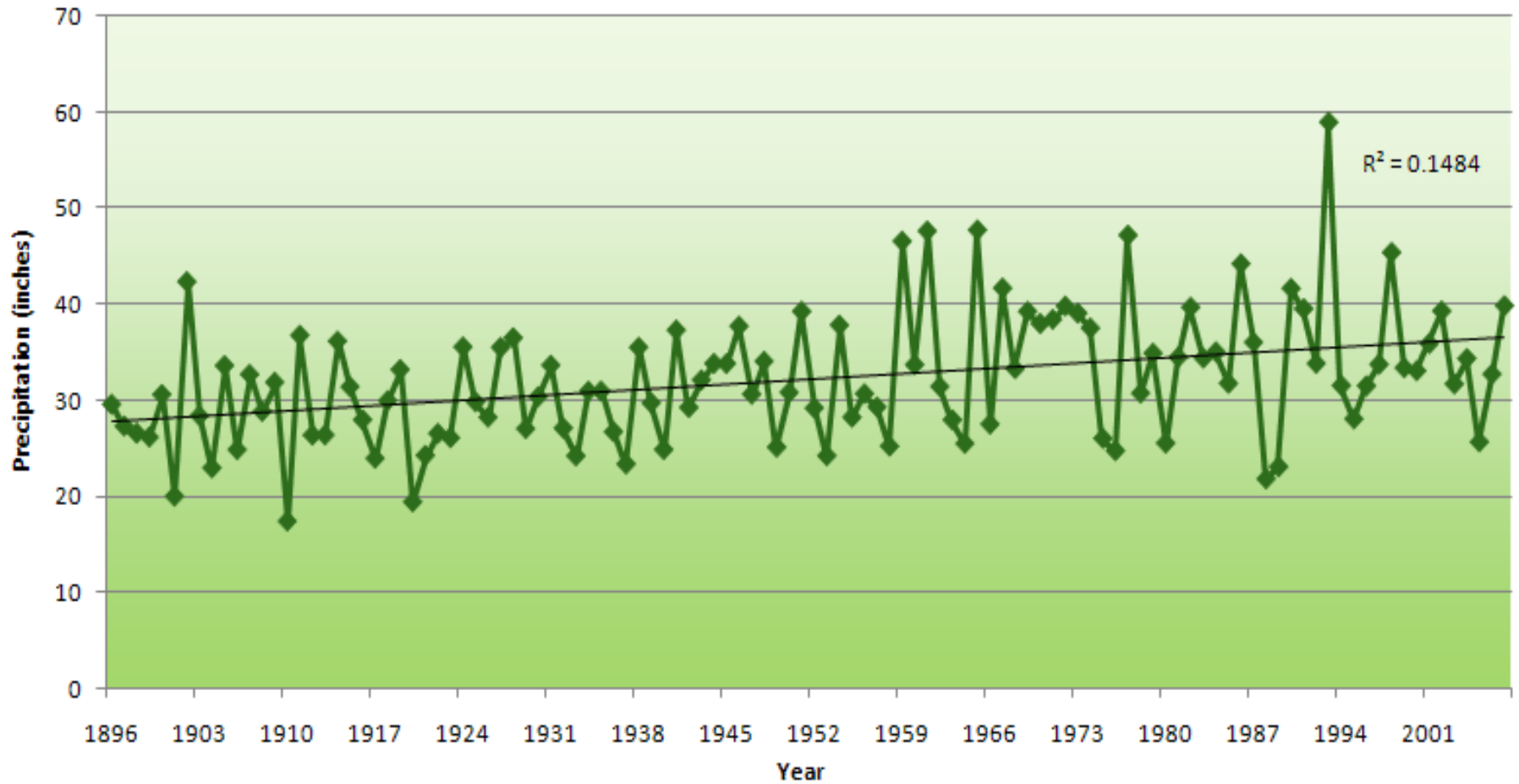
“One of the clearest trends in the United States observational record is an increasing frequency and intensity of heavy precipitation events...

Over the last century there was a 50% increase in the frequency of days with precipitation over 101.6 mm (four inches) in the upper midwestern U.S.; this trend is statistically significant “

Karl, T. R., J. M. Melillo, and T. C. Peterson, (eds.), 2009: Global Climate Change Impacts in the United States. Cambridge University Press, 2009, 196pp.

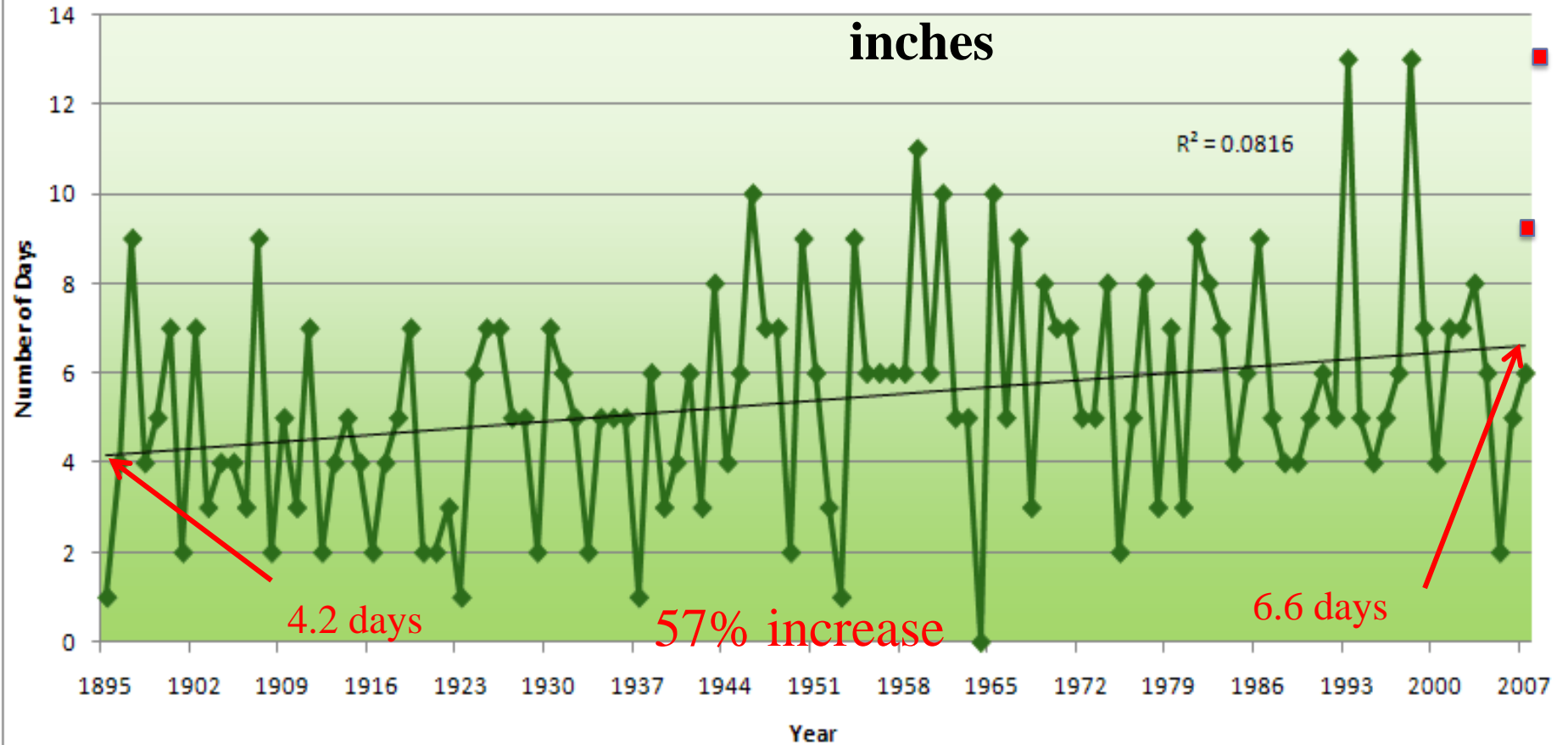
Cedar Rapids Data

Total Annual Precipitation (inches)



Cedar Rapids Data

Number of Days With Total Precipitation Greater Than
or Equal to **1.25**
inches



Cedar Rapids Data

Number of Days With Total Precipitation Greater Than
or Equal to **1.25**
inches

Years having more
than 8 days

13

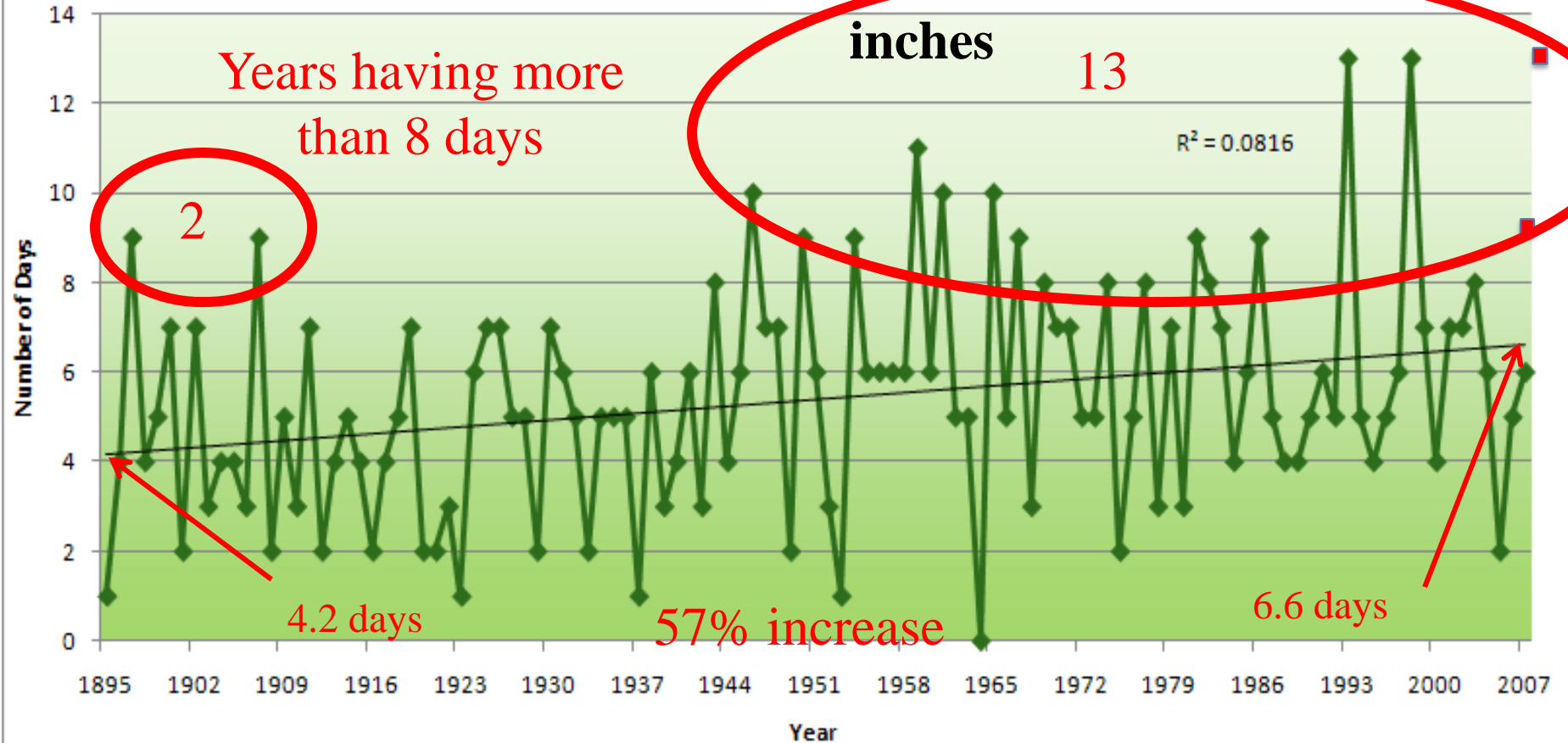
2

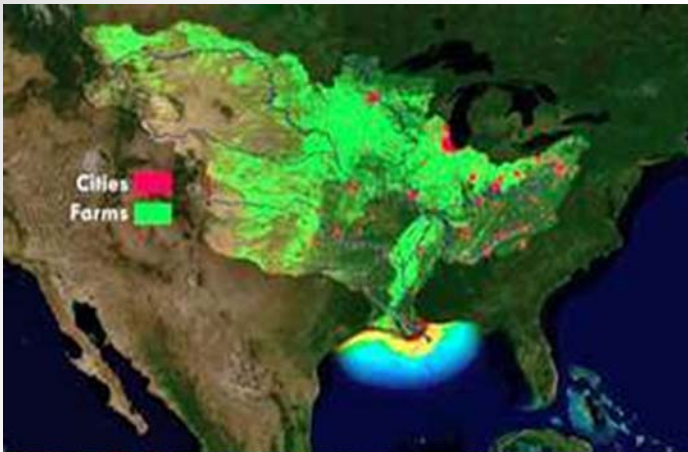
$R^2 = 0.0816$

4.2 days

57% increase

6.6 days





The challenge to produce enough food will be greater over the next 50 years than in all human history

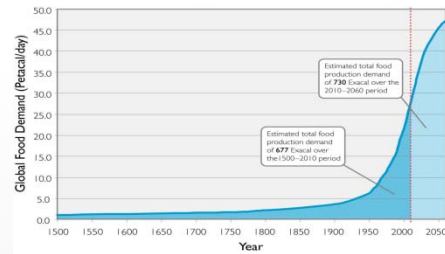
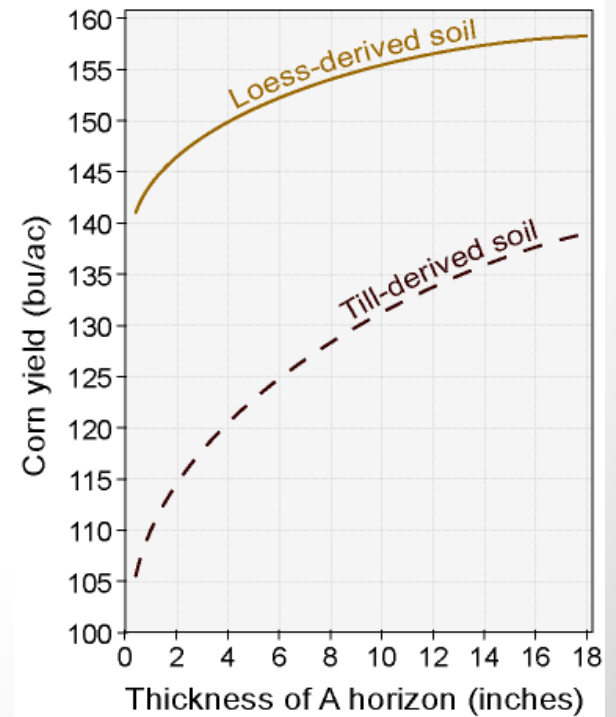
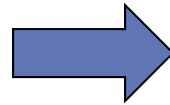


Figure 1. Explanatory notes:
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 • A "Pecal" is 10¹⁵ calories, an Excal is 10¹⁸ calories.





"I believe the Great Creator has put ores and oil on this earth to give us a breathing spell... As we exhaust them, we must be prepared to fall back on our farms, which are God's true storehouse and can never be exhausted. For we can learn to synthesize materials for every human need from the things that grow."

***George
Washington
Carver***

1864-1943

