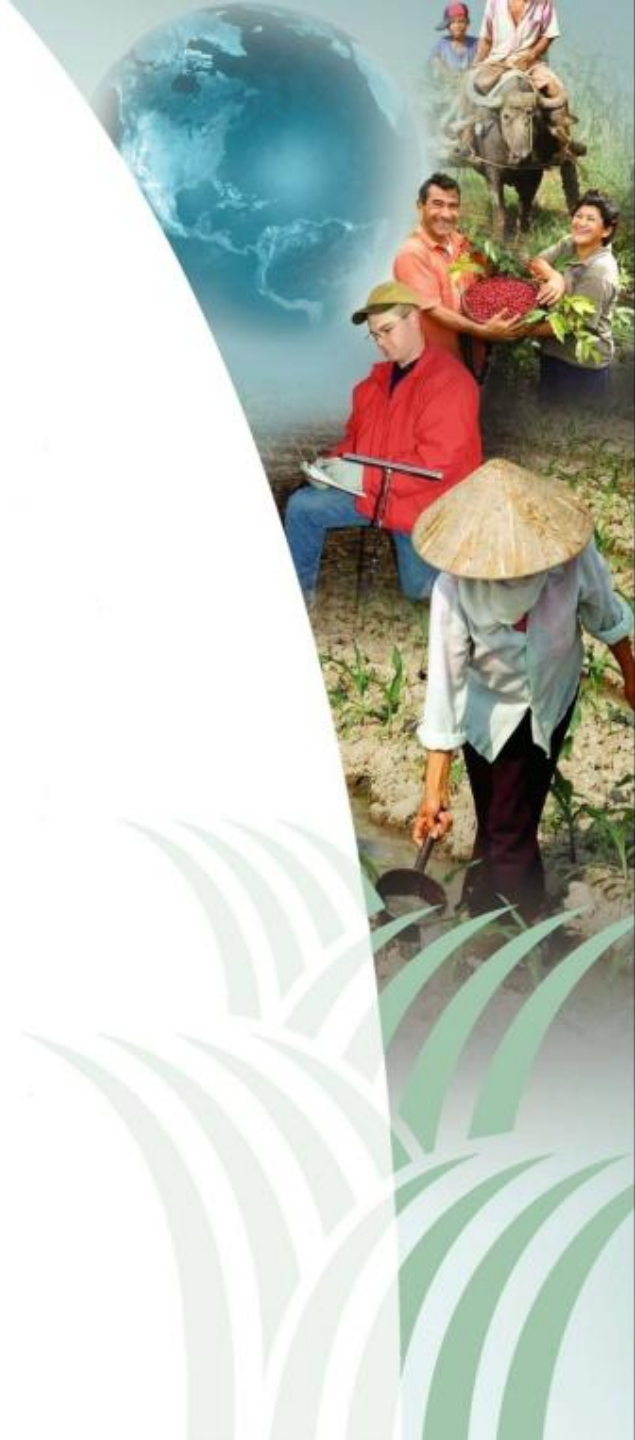


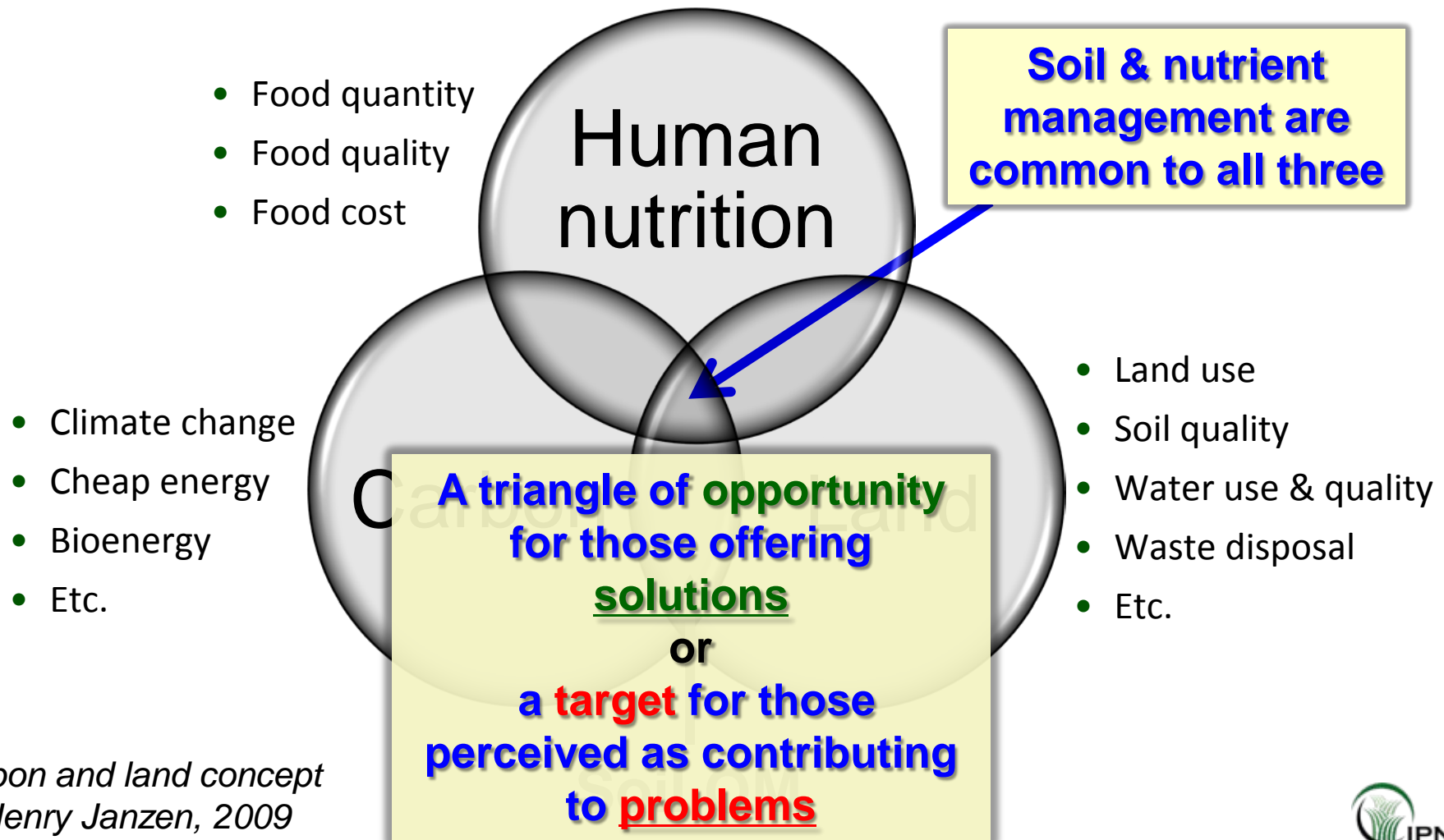
Preparing for Intensification

Paul E. Fixen
Sr. Vice President
pfixen@ipni.net

Fluid Fertilizer Forum
February 21, 2011



Underlying factors for the challenges of the coming decades



*Carbon and land concept
by Henry Janzen, 2009*



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**Is intensification the solution
or part of the problem?**

MENU

- 1 Animations
- 2 Effects
- 3 Cockpit
- 4 Credits



Credits Nitrogen Visualisation

The Nitrogen Visualisation was produced on behalf of the Dutch Ministry of Housing, Spatial Planning and the Environment. The following people were involved in the development of this project:



Energy Research Centre of the Netherlands (ECN)
Westerduinweg 3, 1755 LE Petten, The Netherlands
*Albert Bleeker, Jan Willem Erisman, Arnoud Frumau
Arjan Hensen (hensen@ecn.nl)*



International Nitrogen Initiative (INI)
Jim Galloway



MediaMonks - Interactive Art
Hilversum, The Netherlands
*Wesley ter Haar, Bas Helderman, Rozemarijn Rotting,
Wouter van Twillert, Arjan van Wijk, Pierre Nelwan,
Joey Schmidt*



Dutch Ministry of Housing, Spatial Planning and the Environment (VROM)
P.O. Box 30945, 2500 GX, The Netherlands
*Kaj Sanders (kaj.sanders@minvrom.nl) Johan Sliggers,
Henk Strietman, Renske van Tol*

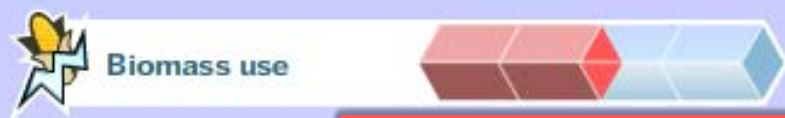


[Credits](#)

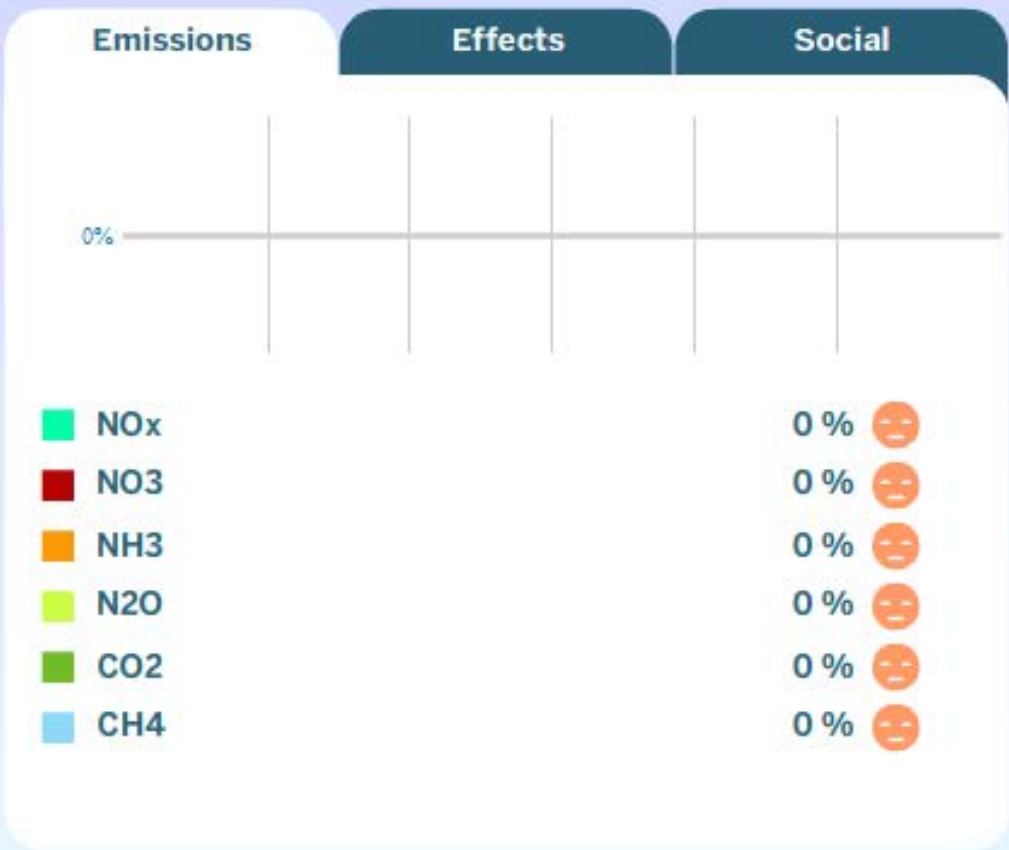
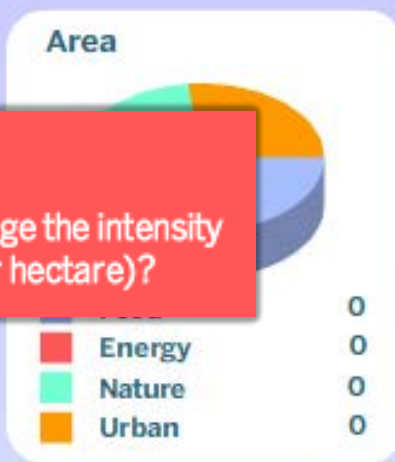
[Disclaimer](#)

[< close](#)

Effect of decisions relative to 2030 forecast



Intensification
 How much do you want to change the intensity of agriculture (in crop yield per hectare)?

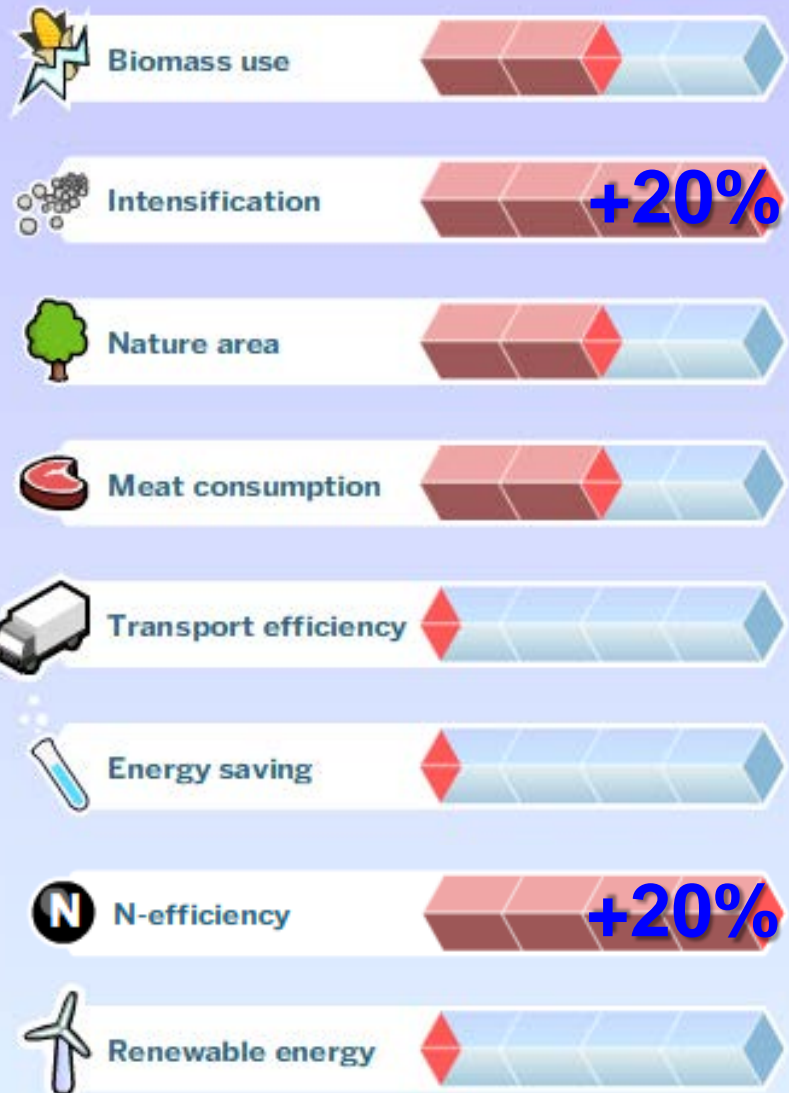


1 2 3 4 5 GO

6 7 8 9 10 reset to 2030

Press space for the menu

Effect of decisions relative to 2030 forecast



1 2 3 4 5 GO
 6 7 8 9 10 reset to 2030

Press space for the menu

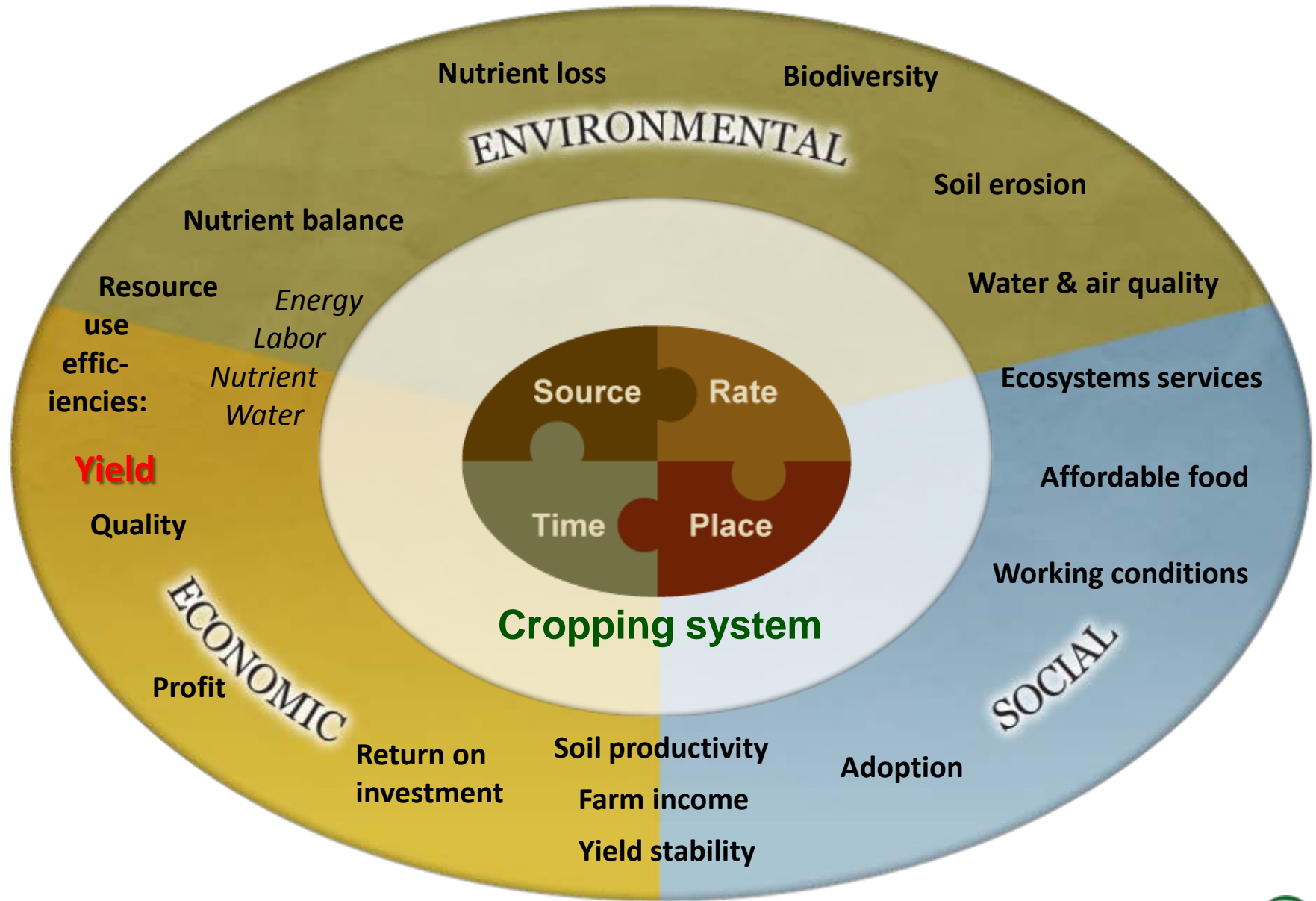
N efficiency +20%

Prosperity index	5.5 %	😊	7.1 %	😊
Health index	-0.2 %	😞	0.2 %	😊
Available Food	15 %	😊	19.6 %	😊
Hunger	-11.9 %	😊	-15.7 %	😊
Transport	7.6 %	😞	10 %	😞
Energy use total	2.3 %	😞	2.8 %	😞
Artificial Fertiliser	40 %	😞	12 %	😞
Global warming	2.1 %	😞	2.2 %	😞
Air quality issues	2.1 %	😞	1.4 %	😞
Drinking water pollution	1.9 %	😞	-7.7 %	😊
Eutrofication	5.8 %	😞	-5.6 %	😊
Depletion of the ozon layer	2.8 %	😞	3.2 %	😞
Acidification	3.4 %	😞	1.8 %	😞
Loss of biodiversity	1.3 %	😞	1.5 %	😞
Emissions				
NOx	3.9 %	😞	5.3 %	😞
NO3	1.9 %	😞	-7.7 %	😊
NH3	15 %	😞	6.1 %	😞
N2O	3.5 %	😞	0.6 %	😞
CO2	3.8 %	😞	4.3 %	😞
CH4	5 %	😞	4.7 %	😞



**Intensification must be seen
as more than yield increases**

Performance Indicators



Realizing a New Vision for Agriculture

“**Social**” has been replaced
with “**Food Security**” ...
Why?

FOOD SECURITY

Provide food security for all...

...in an environmentally sustainable way

ENVIRONMENTAL SUSTAINABILITY

...while generating economic growth and opportunity

ECONOMIC OPPORTUNITY



Food price volatility dominates farm ministers' summit

Correspondent

Farm ministers meeting on trade and food security to improve transparency, information and fight abuses

The call in a communiqué at the end of their summit. Protests in the Middle East have been attributed to

BBC NEWS

SCIENCE & ENVIRONMENT

24 January 2011 Last updated at 06:32 ET

Report: Urgent action needed to avert global hunger

Food costs at records as U.N. warns of volatile era

Recommend 92 people recommend this. Be the first of your friends.



A man carries onions at a wholesale market in Mumbai, January 25, 2011. Credit: Reuters/Darsh Siddiqui

By Svetlana Kovalyova and Christopher Doering
MILAN/WASHINGTON | Fri Feb 4, 2011 8:07am EST

(Reuters) - Global food prices tracked by a U.N. agency hit their highest level on record in January, a problem set to worsen after a massive snowstorm in the United States and floods in Australia.

- World enteric of food price volatility Thu, Feb 3 2011
- FAO food price index hits record high in January Thu, Feb 3 2011
- India food ministers disappointed by retailers Thu, Feb 3 2011
- Bring back food commodities rules: FAO Thu, Feb 3 2011

msnbc.com

Global food chain stretched to the limit Food security has called for urgent

Soaring prices spark fears of social unrest in developing world

"We are entering a danger territory," said Abbasian, chief economist at the Food and Agriculture Organization (FAO) last week.



SHARUTI SHARMA / Reuters
The U.N. fears a run-up in food prices could spark a repeat of the 2008. In December, activists in Kathmandu raised local concerns

February 3, 2011

Middle East unrest related to food shortages

It's been reported that high unemployment and food shortages have aggravated **Norman Borlaug – Nobel Peace Prize** that have led to much of the unrest in Egypt and throughout the Middle East.



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Preparing for intensification

- 1) In the field**
- 2) On the farm**
- 3) In the city**

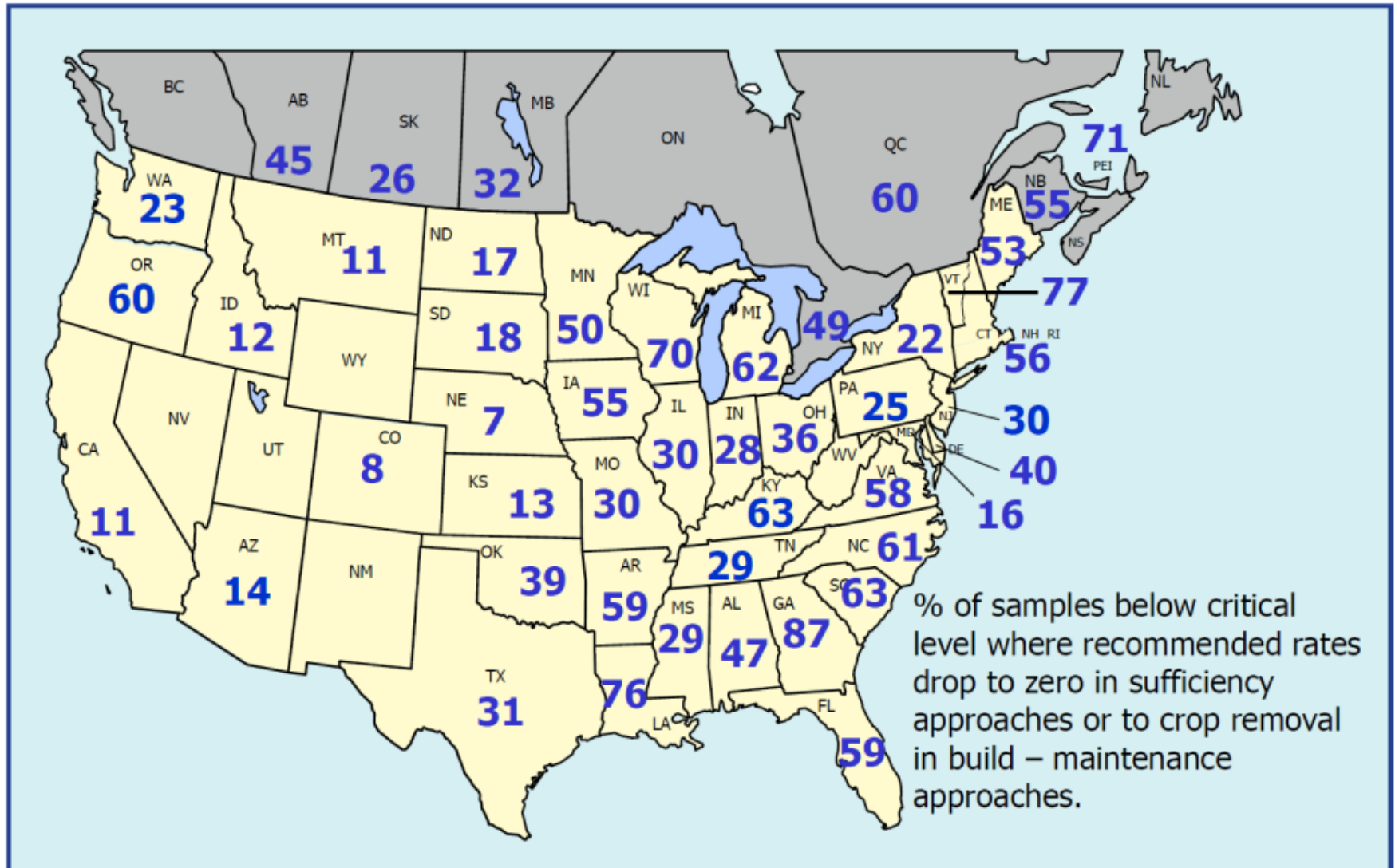


Preparing for intensification

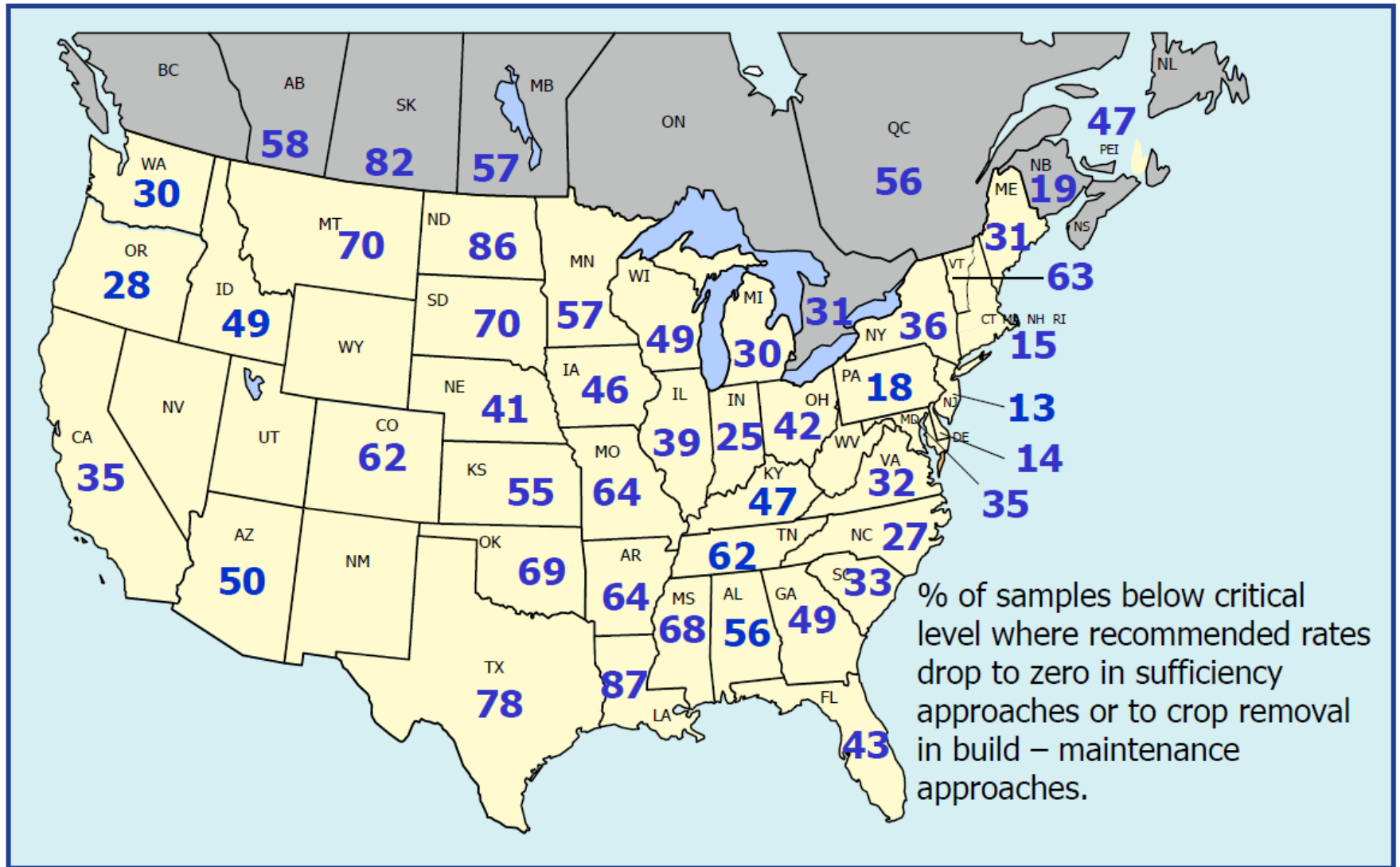
1) In the field

**Much of the rest of the Forum:
Ismail, Fred, Tim, ...**

Percent of samples testing below critical levels for K for major crops in 2010.

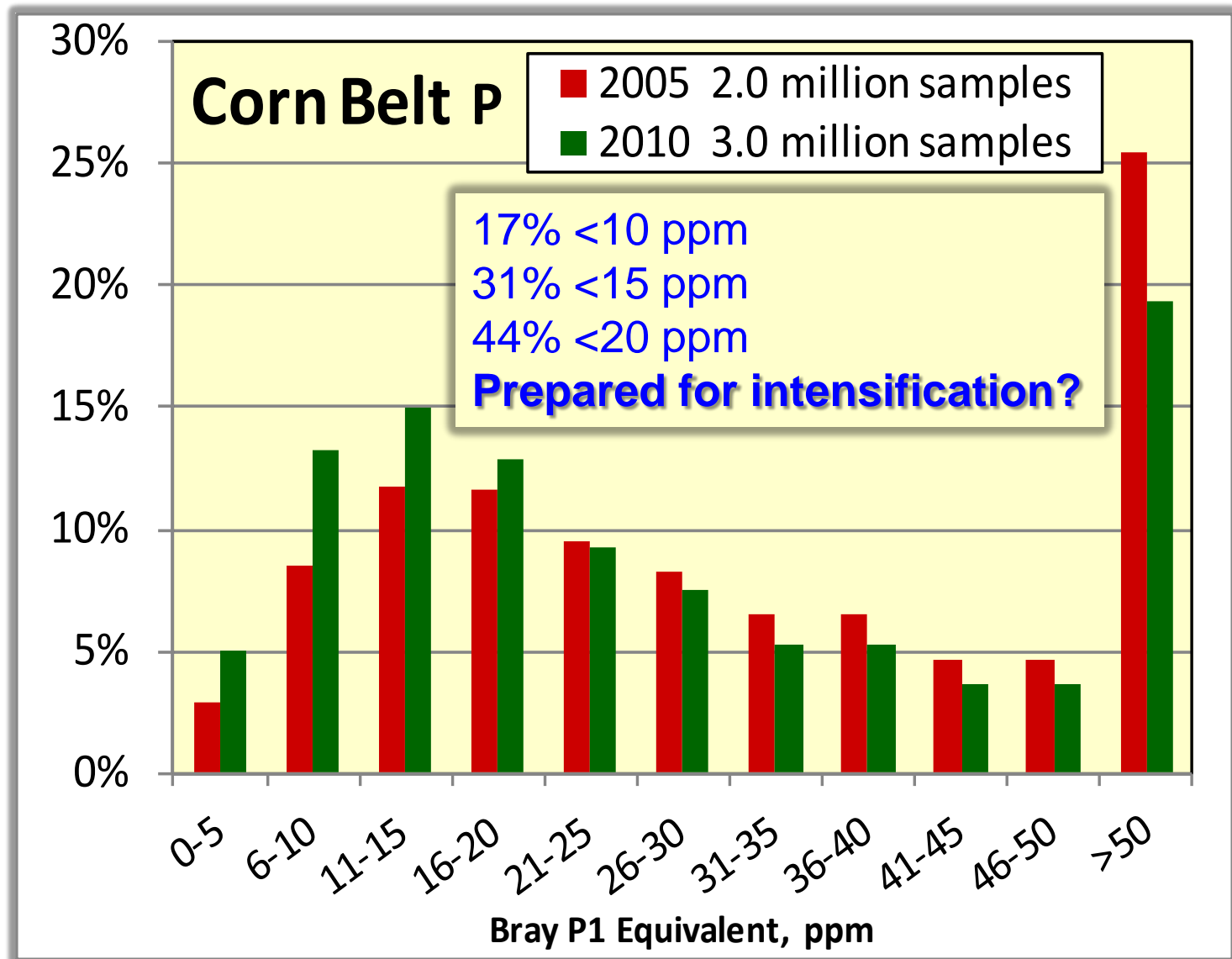


Percent of samples testing below critical levels for P for major crops in 2010.

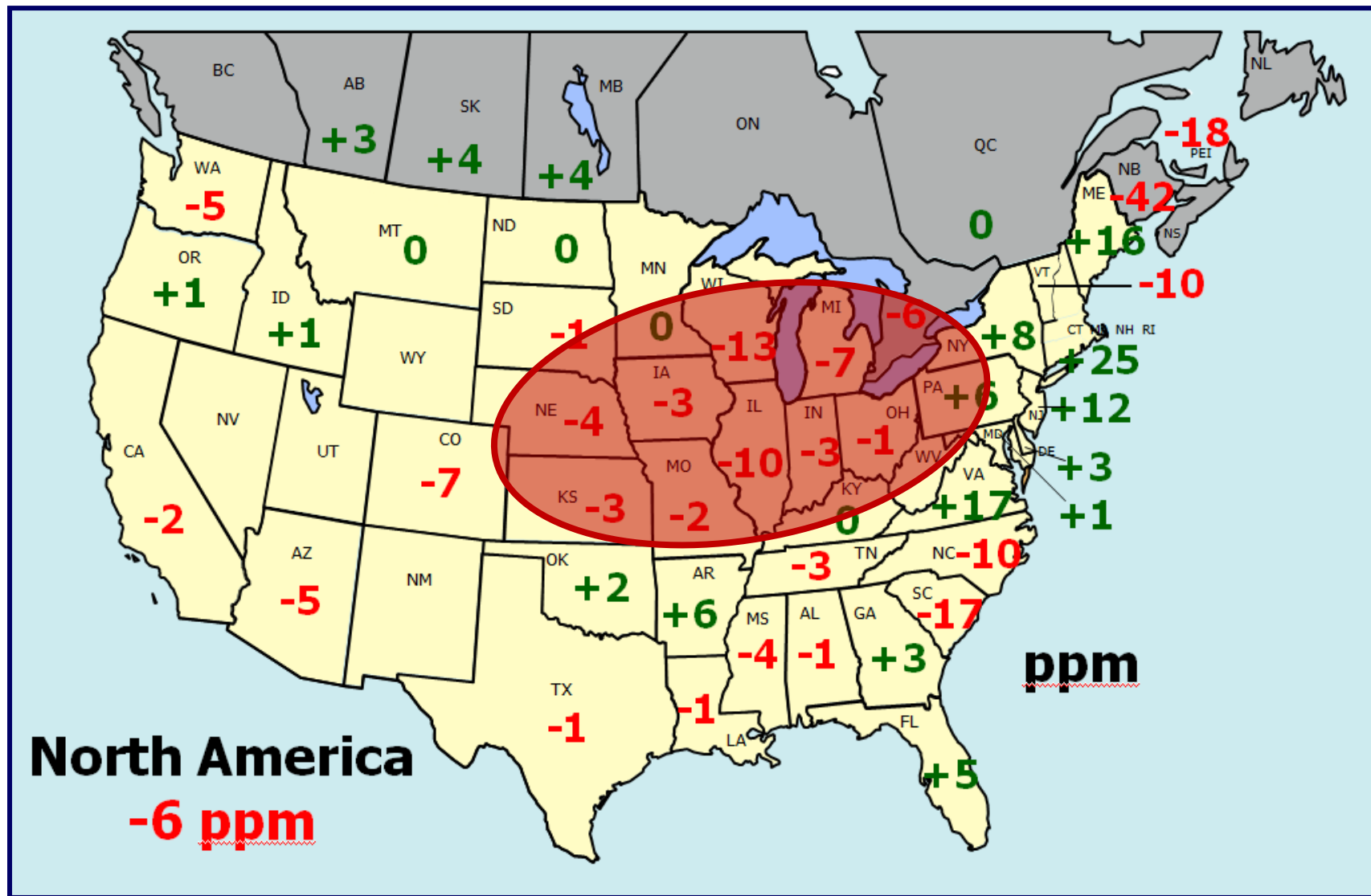


% of samples below critical level where recommended rates drop to zero in sufficiency approaches or to crop removal in build – maintenance approaches.

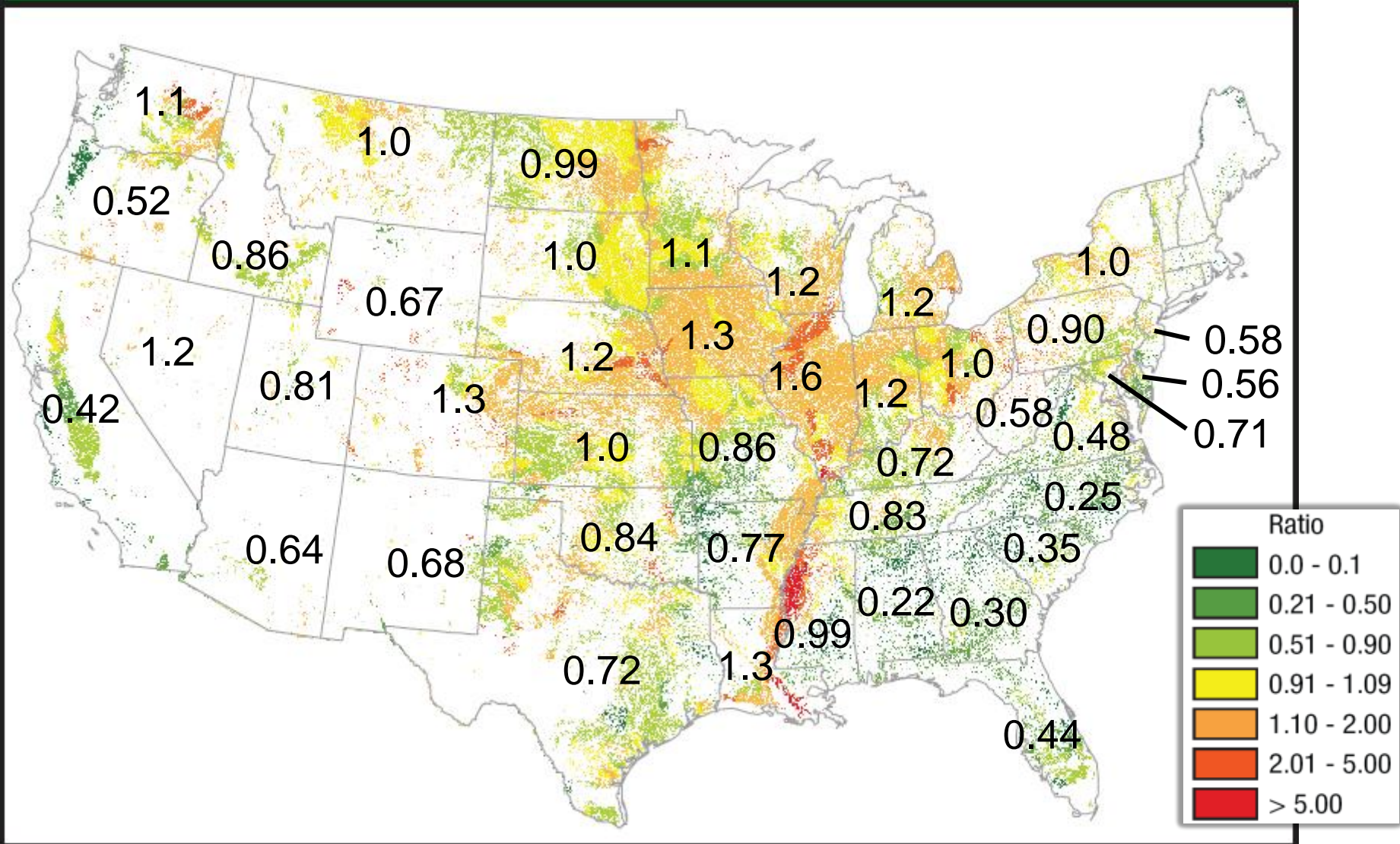
Soil test P distribution in the Corn Belt (12 states plus Ontario)



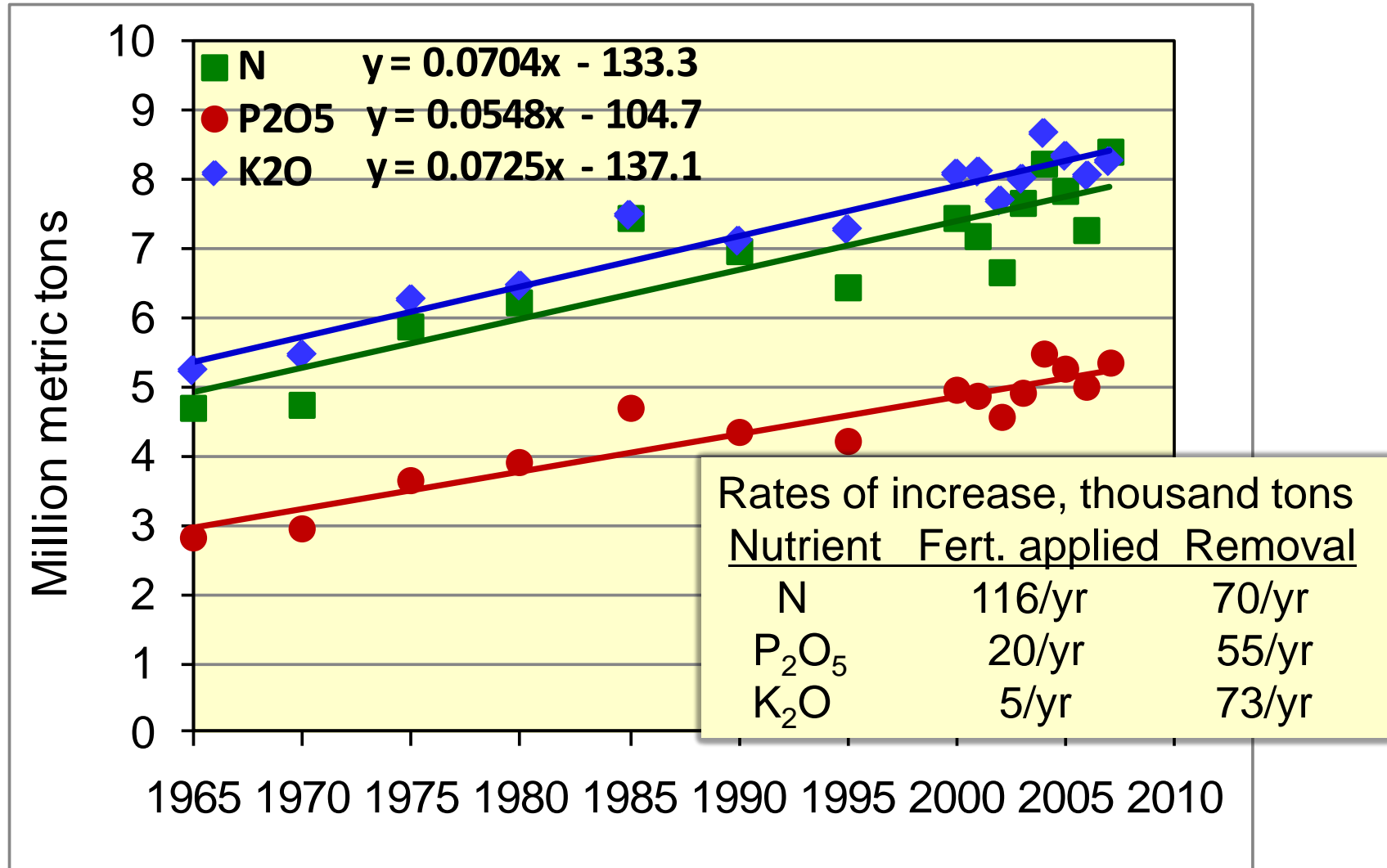
Change in median Bray P equivalent soil test levels from 2005 to 2010.



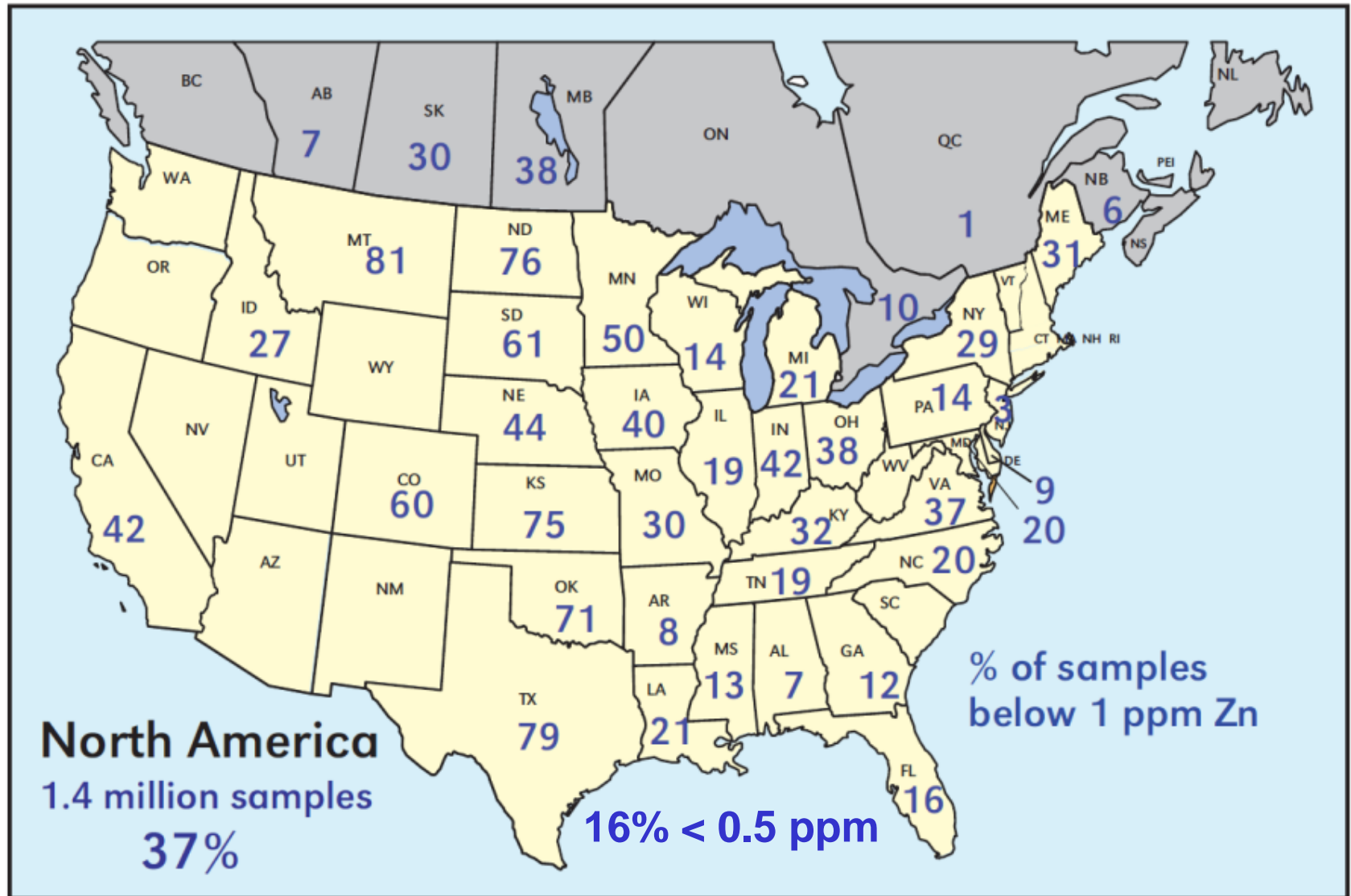
Estimated P removal to use ratio by watershed, 2007. (Numbers are state ratios)



Nutrient removal by crops in the U.S. (N removal by alfalfa, soybeans and peanuts excluded).



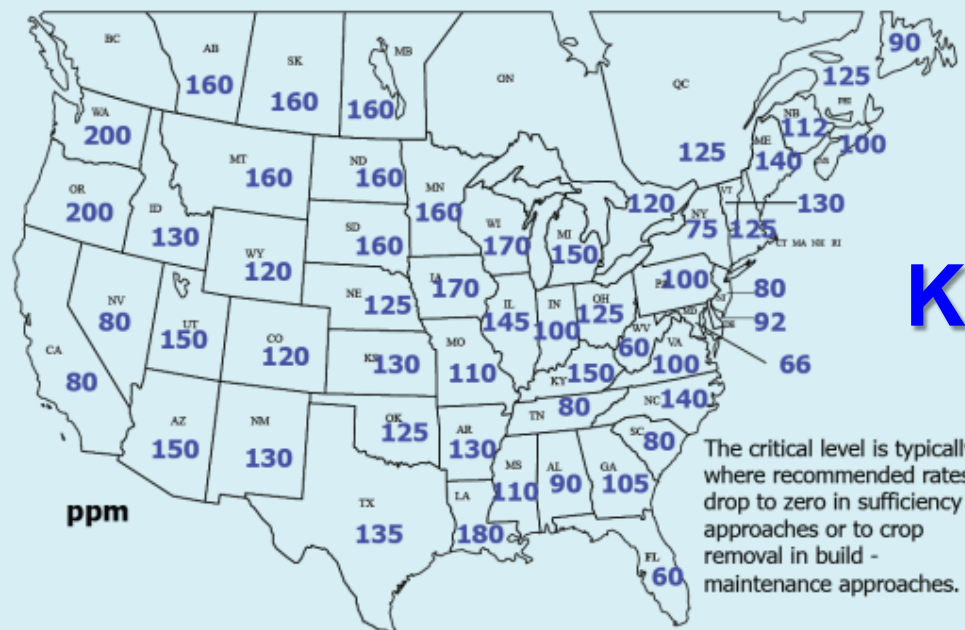
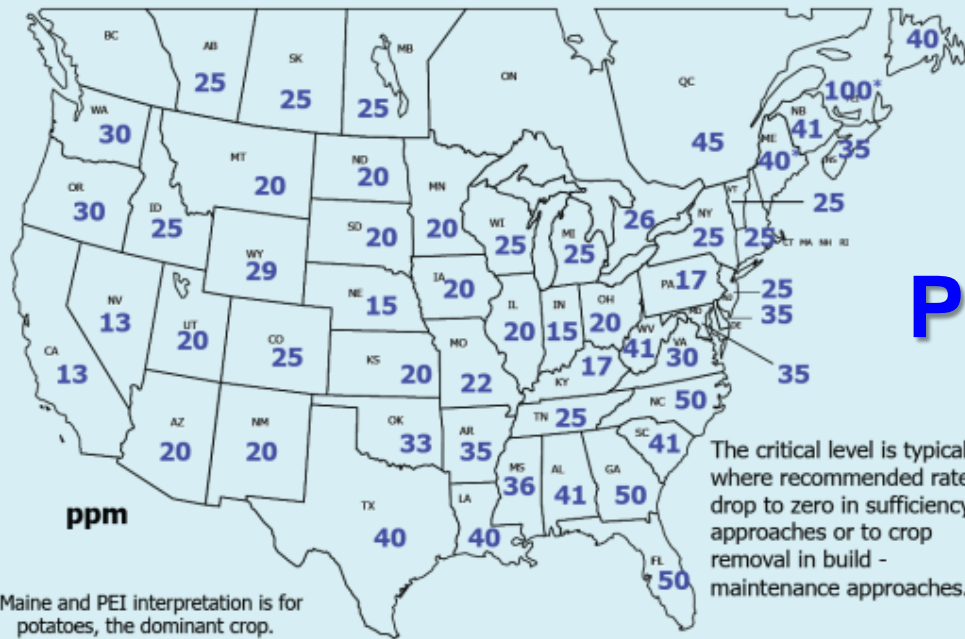
Percent of samples testing < 1.0 ppm DTPA equivalent Zn in 2010.



Critical Bray P1 and ammonium acetate equivalent soil test levels, 2010.

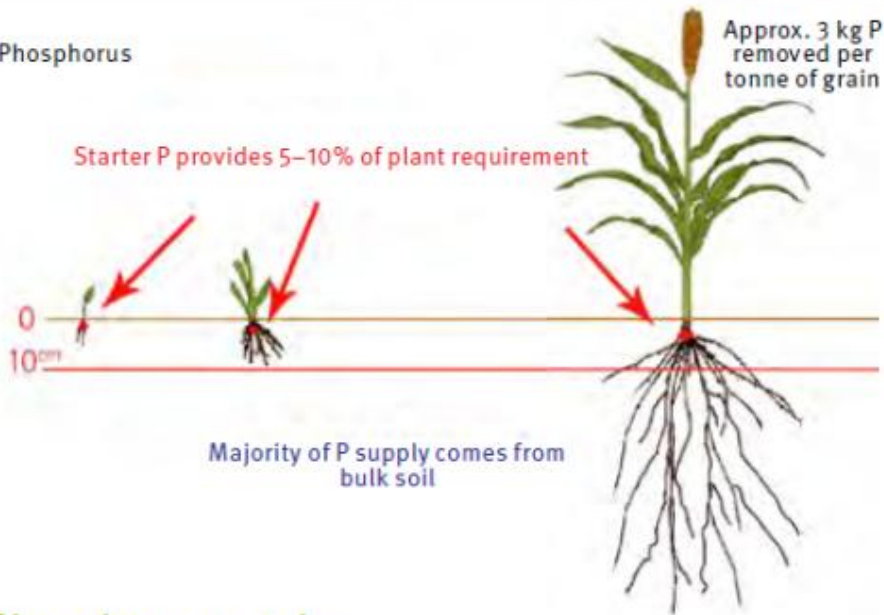
Are these levels correct for intensively managed cropping systems?
Zn levels?
Mn levels?
S levels?

SSSA Symposium for
2011 Annual Meeting

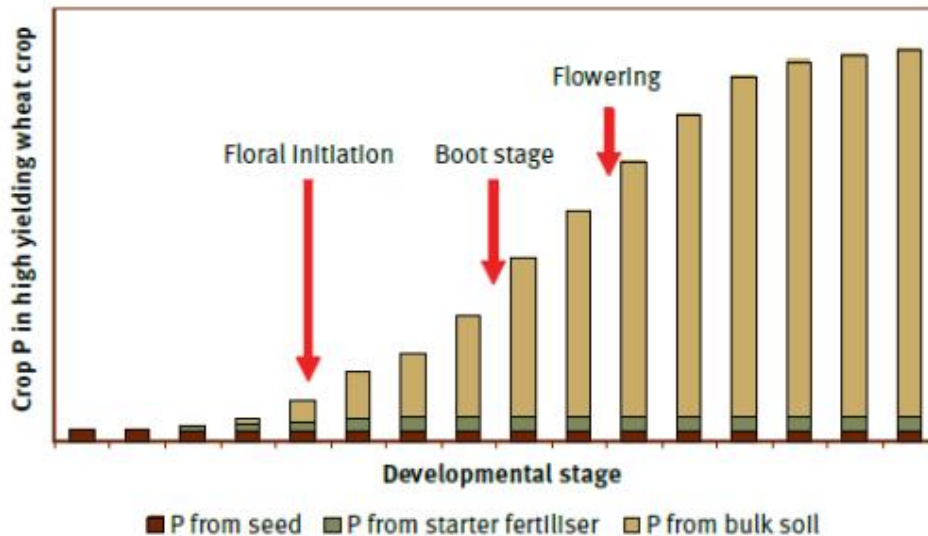


Subsoils ... are they changing and does it matter??

P = Phosphorus

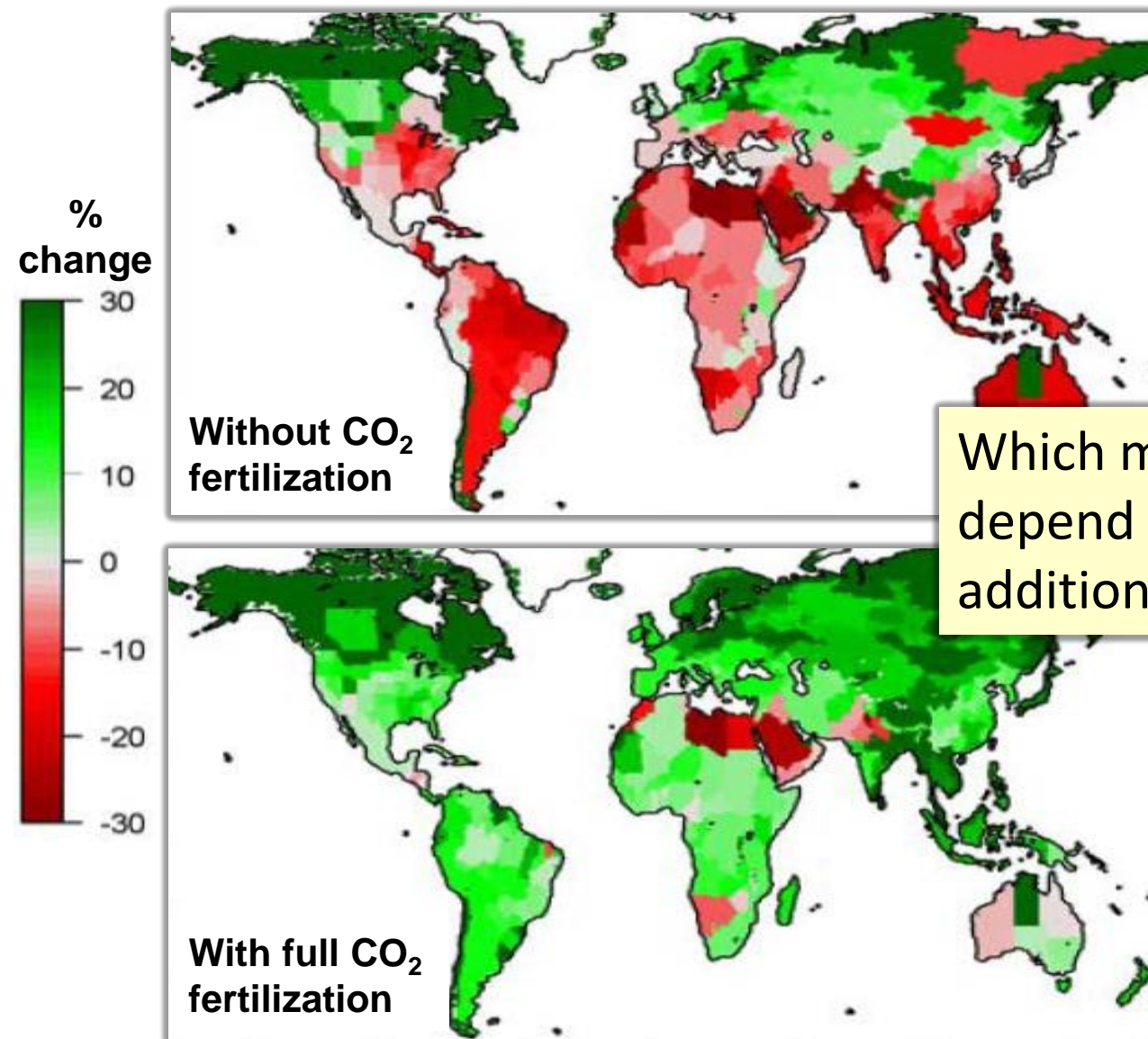


Phosphorus uptake



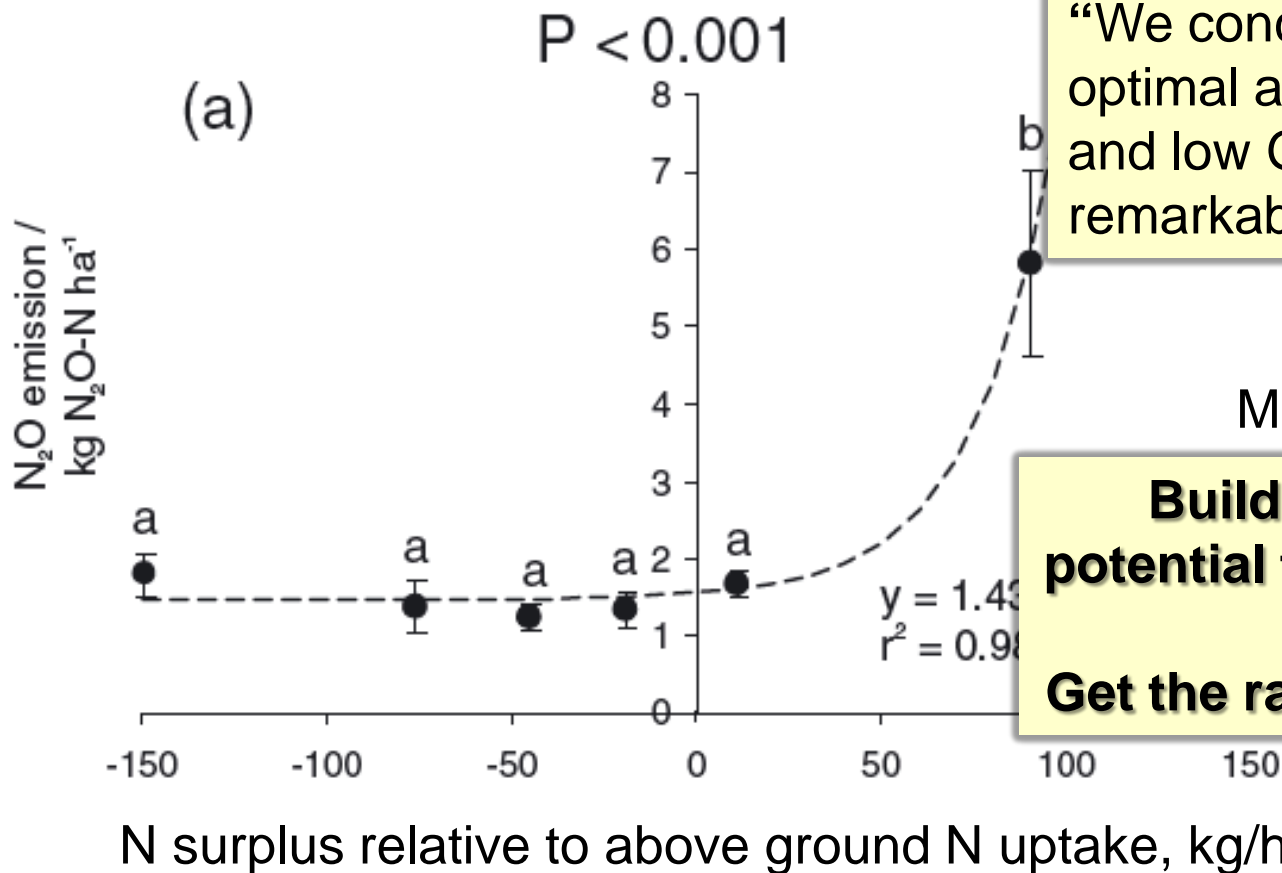
- Australia – Queensland
 - 50% of P uptake from below 10 cm
 - Starter P supplies only 5-10%
- Subsoils being depleted of P
- Placement via:
 - Mechanical means
 - Chemical mobility
 - Nanotechnology

Potential impact of climate change on crop yields in 2050 relative to 2000



Which map "... will much depend on availability of additional inputs, especially N."

Does greater N input mean greater GHG emissions? (Survey of 19 studies, ½ in NA)



“We conclude that the aims of optimal agricultural production and low GHG emissions are remarkably similar”



Marching orders:

Build and protect yield potential to maximize N uptake

Get the rate right (& other 3Rs)

Department of Agronomy & Horticulture

Hybrid-Maize: A Simulation Model for Maize Growth and Yield

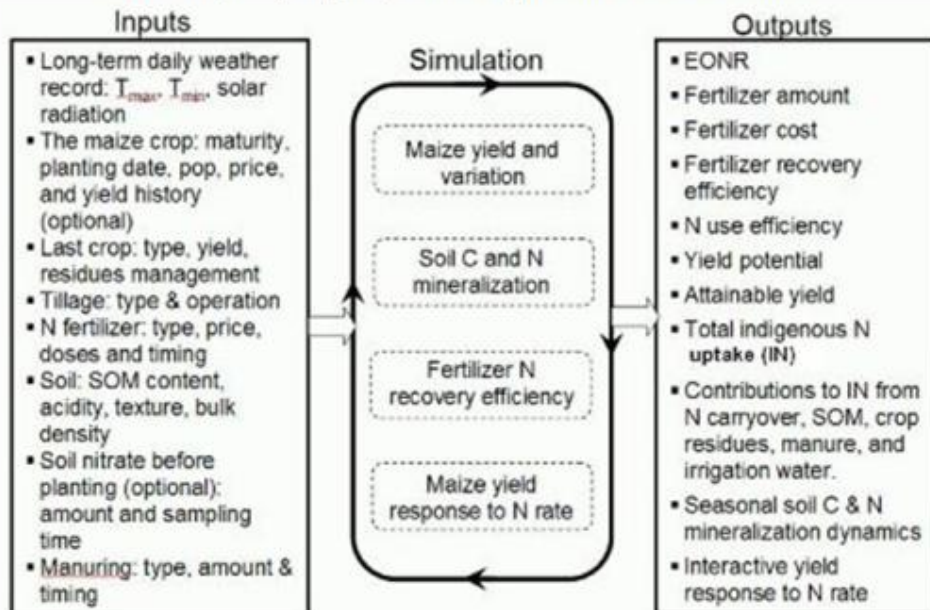
Navigation

Hybrid-Maize

Overview

Maize-N Model

The inputs, engine, and outputs of *Maize-N* model



[Go to Maize-N collaborators' page](#)

simulates fertilizer requirement for Maize crop grown under intensive management.

Yield potential and its variability based on historical weather data; and fertilizer N required based on climatic and management factors such as soil and plant density, N application method and timing, manuring, and soil characteristics.

Invest more resources in on-farm decision making ... use the science!

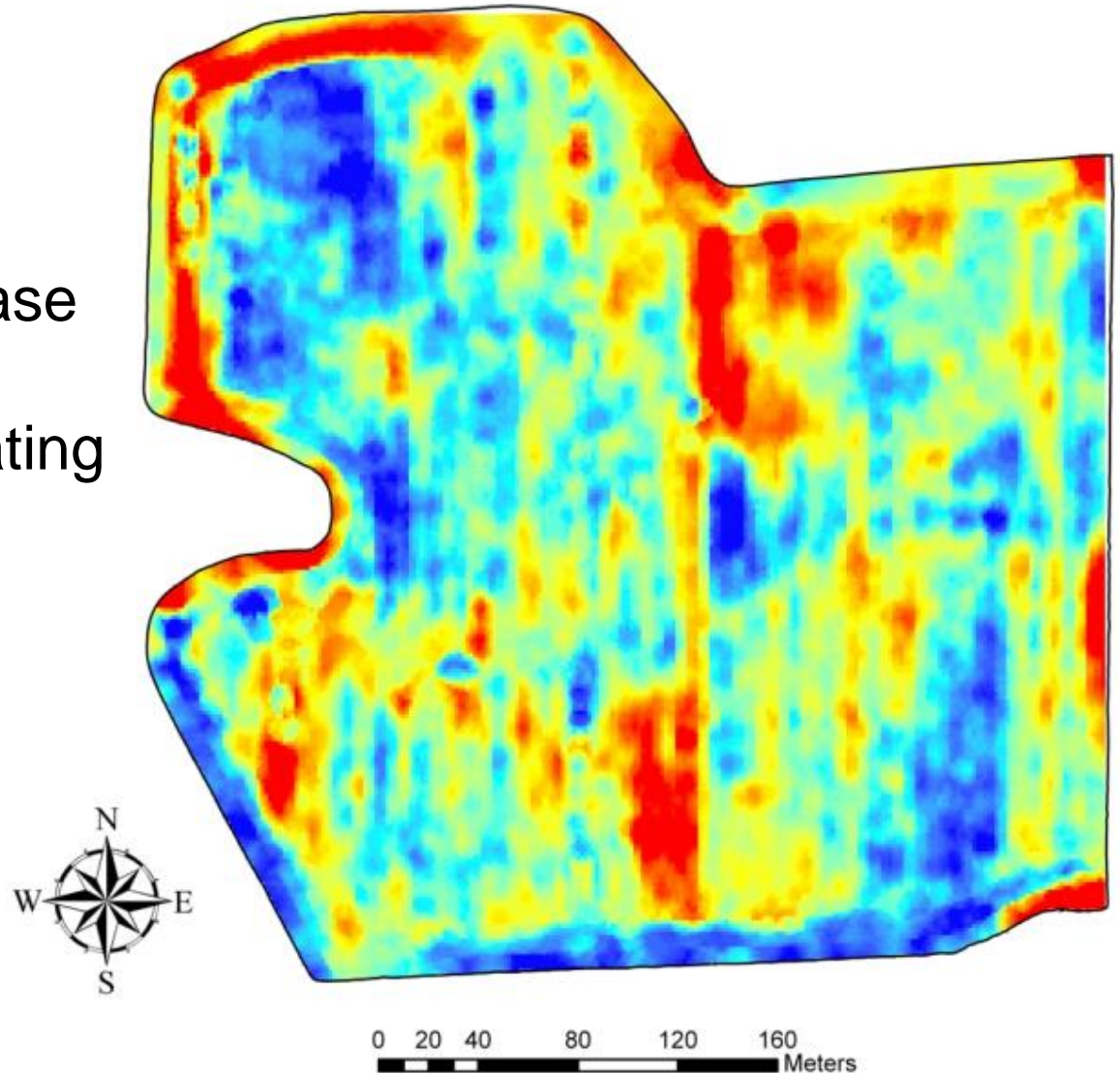
Preparing for intensification

1) In the field

2) On the farm (beyond field boundaries)

Corn Grain Yield - AERF

Corn's sensitivity to changing landscape position presents opportunities to increase overall landscape productivity by integrating other crops into the landscape.



Switchgrass (Sunburst)



False Indigo



Willow (9882-41 and SX67)



Alfalfa (Garst 6420)



Corn (Dekalb DK 44-92 RR)



*Poplar (NM6)
Cottonwood (D125)*

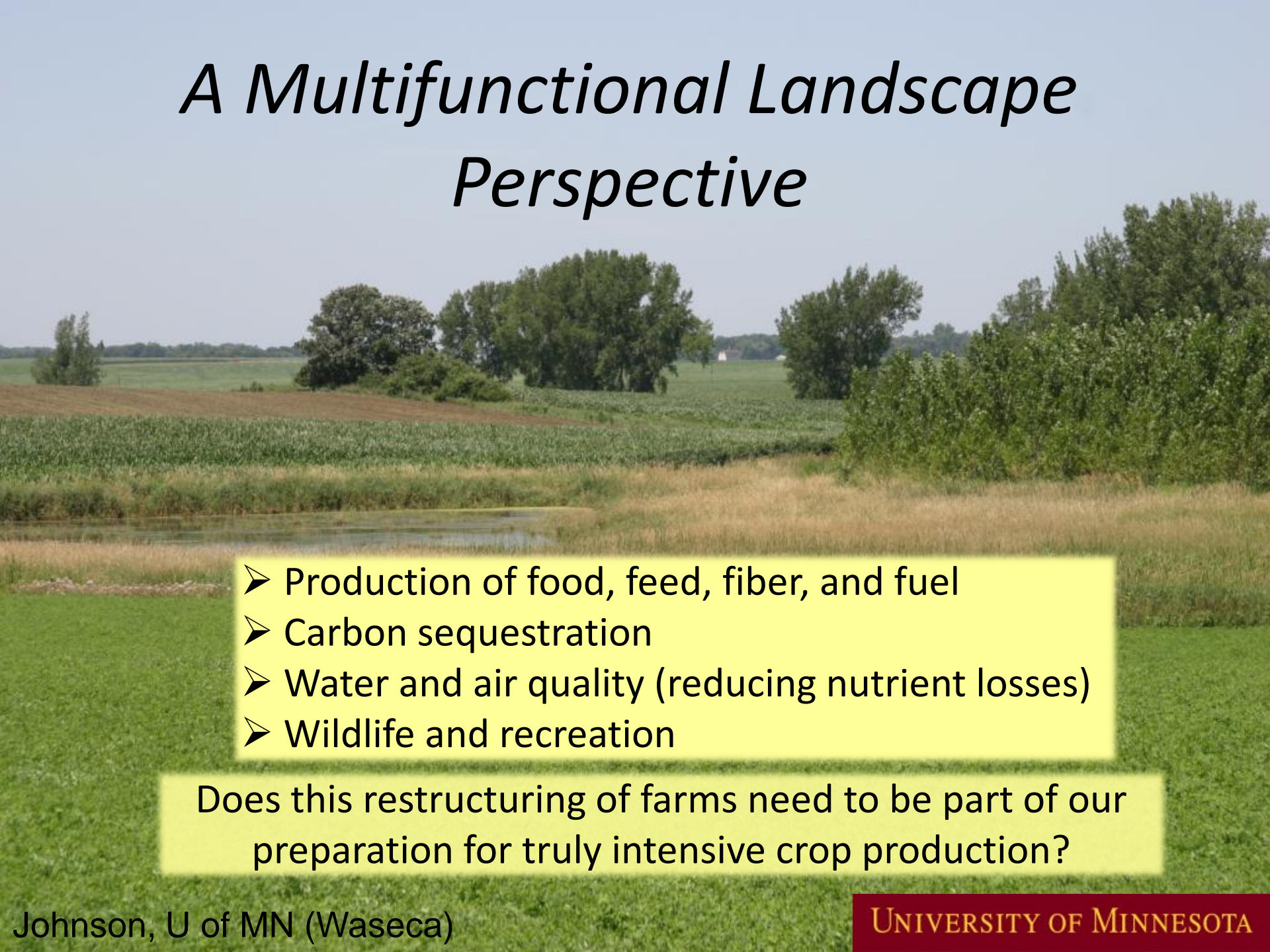


Productivity Matrix for Biomass Crops

	Summit	Depositional	Flat	W hillslope	S hillslope	SW hillslope	N hillslope
Switchgrass	+	-	-	+	-	-	-
Alfalfa	+	-	+	-	+	+	+
Corn Stover	+	-	-	+	+	+	+
Corn Grain	+	-	-	+	+	-	+
Willow SX67	-	+	+	-	-	+	-
Willow 9882	-	+	+	-	-	-	-
Cottwd.D125	+	+	+	+	+	+	+
Poplar NM6	+	-	+	+	+	+	+

CI=90%

A Multifunctional Landscape Perspective

- 
- Production of food, feed, fiber, and fuel
 - Carbon sequestration
 - Water and air quality (reducing nutrient losses)
 - Wildlife and recreation

Does this restructuring of farms need to be part of our preparation for truly intensive crop production?

Controlled drainage as part of the intensification package

University of Minnesota, Lamberton



Year	Performance indicator	Drainage	
		Free	Controlled
2008	Soybean yield, bu/A	22	19
2008	NO ₃ -N load, lb/A	18	7
2009	Corn yield, bu/A	202	224
2009	NO ₃ -N load, lb/A	3	2

Multifaceted solution to drainage issues:

- Controlled drainage
- Appropriate drainage system designs
- Bioreactors
- Two-stage/managed ditches
- Buffers
- Water storage
- Side inlet controls
- Alternative practices



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Preparing for intensification

- 1) In the field**
- 2) On the farm**
- 3) In the city**

Food and Beverage Companies Tracking Water and Carbon Footprints

PRECISIONAG.COM

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PepsiCo Initiative Seeks To Influence Farm Practices Worldwide

Oct. 21, 2010

PepsiCo recently unveiled its plan to roll out what it's calling the "i-crop farming technology, a crop

PEPSICO
UK & Ireland

Our company +

Purpose -

- Values +
- Environment +
- Health +
- People +
- Farming -

Global challenge

- Our ambition for farming
- The future of farming -
- UK farms & farmers +
- i-crop™
- Cool Farm Tool

i-crop™

i-crop™ is a revolutionary crop management system, developed in partnership with Cambridge University.

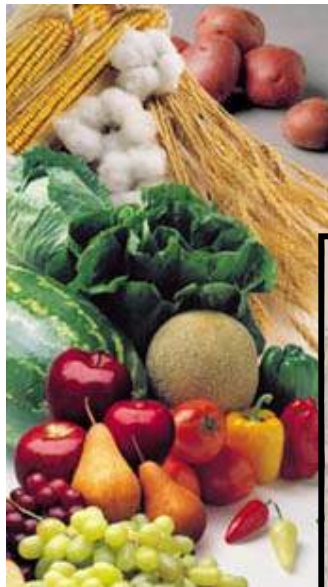
The new web-based, 'precision farming' technology, is designed to help farmers produce more crop per drop with less water. i-crop™ measures the inputs and outputs of farming activity, producing low much wa

More crop per drop

Cool Farm Tool

Cool Farm Tool is a carbon calculator developed by the University of Aberdeen in partnership with global businesses, and being tested by PepsiCo on cool potato farms.

Demand for More Sustainable, Less Chemically Dependent Agriculture



Wal-Mart sets out fresher-foods goals

Retailer aims

STEVE PAINTER
ARKANSAS DEMOCRAT-GAZETTE

Wal-Mart Stores Inc. announced several new goals Thursday aimed at getting more fresh foods on its shelves while at the same time reducing the environmental impact of growing those products.

The announcement came as Wal-Mart executives and employees met with suppliers and representatives of environmental groups at the company's headquarters in Bentonville. About 700

“.....boost the incomes of small and medium-sized farmers....while reducing the use of pesticides and fertilizer”
Arkansas Democrat- Gazette, October 15, 2010

of Wal-Mart's business. Yet only four of our 39 public sustainability goals address food," Mike Duke, president and chief executive officer, said in prepared remarks for the gathering.

■ Train a million farmers and farm workers in sustainable farming practices and crop selection.
■ Boost the income of small farmers supplying the retailer

Michelle Harvey, project manager in Bentonville for the corporate partnerships program of the Environmental Defense Fund, said the initiative revealed Thursday began early in the summer of See **WAL-MART**, Page 6D

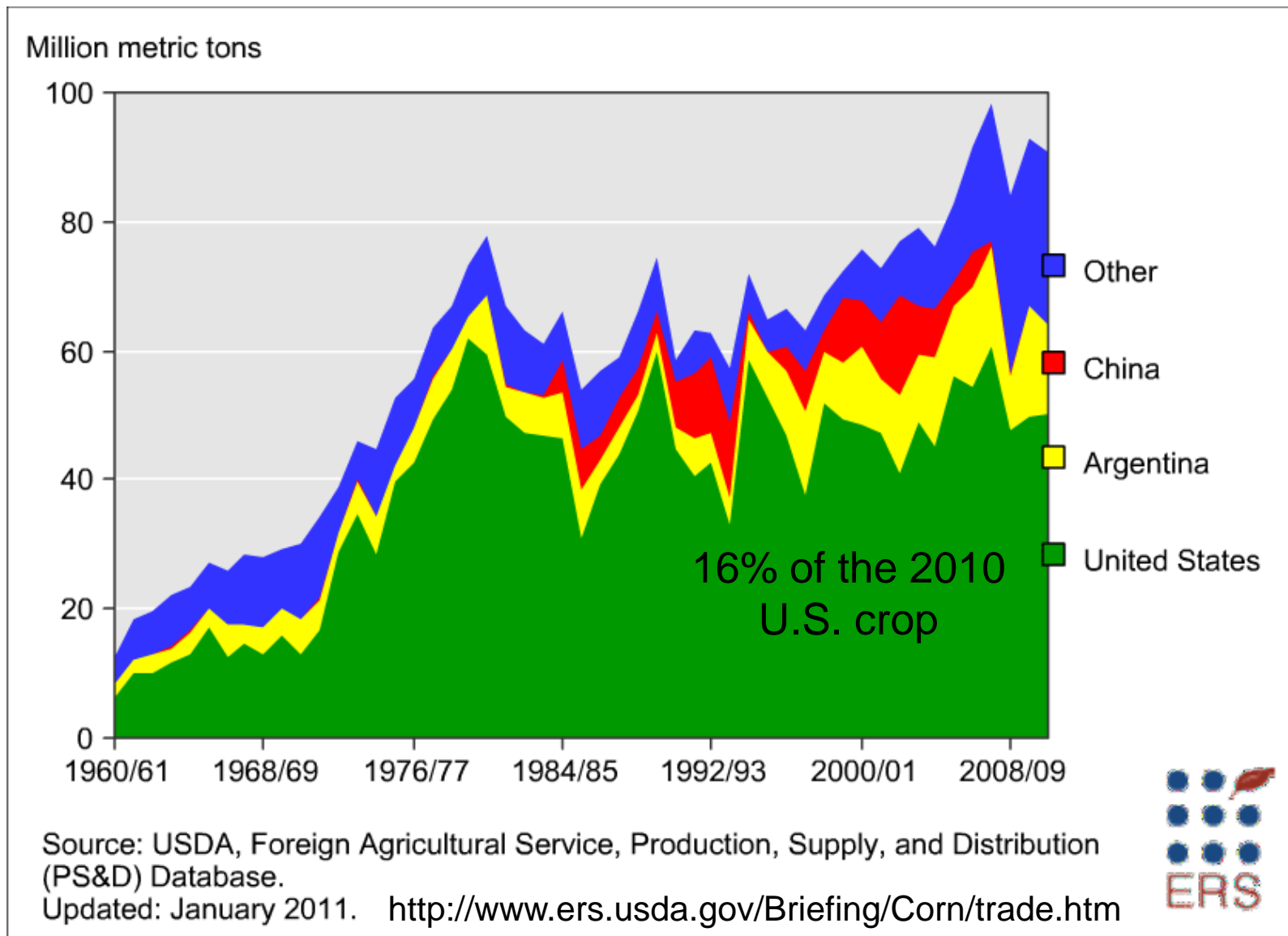


EPA Lays Out Five-Year Plan on Agency Priorities – Oct. 7, 2010

- **Five strategic goals to advance EPA's environmental and human-health mission:**
 - **Taking action on climate change and improving air quality**
 - **Protecting America's waters**
 - Cleaning up communities and advancing sustainable development
 - **Ensuring the safety of chemicals and preventing pollution**
 - **Enforcing environmental laws**

**Preparation should likely include use of environmental footprint estimation tools
(ex - Field to Market Field Print Calculator)**

Leading world exporters of corn



Preparation in the “shining city upon the hill”

- **Communicating** to funding agencies the critical need for research on agronomic and environmental aspects of intensively managed high yield systems
- Example of the challenge: research proposals for Federal support are criticized for being too focused on corn, even though corn ...
 - Greatest crop acreage; A major U.S. export
 - Consumes 43% of fertilizer N, 45% of P, and 44% of K
 - Primary near term source of feedstock for biofuels
 - Very effective at sequestering C
- Intensification of corn production is being viewed as the problem rather than the solution ... **we have a communication challenge**

Preparing for intensification

- Cropping intensification can be viewed as either a solution or a problem ... increases the importance of preparation
- Preparation is needed:
 - In the field
 - See Forum topics
 - Soil fertility that will support intensive production
 - A focus on N efficiency through N management & uptake maximization
 - On the farm
 - Management (and research) beyond fields to landscapes
 - In the city
 - Communicating credible environmental footprints to the public
 - Refinement of funding agency priorities
 - Utilizing 4R Nutrient Stewardship in communication efforts