

We cannot solve our problems with the same thinking we used when we created them.

Albert Einstein

Everything is connected with everything else: but not all things are connected by the short and straight roads we expected.

C. S. Lewis

Distillers Grains; Potentials and Implications for the Livestock Industry

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Feb. 13, 2007

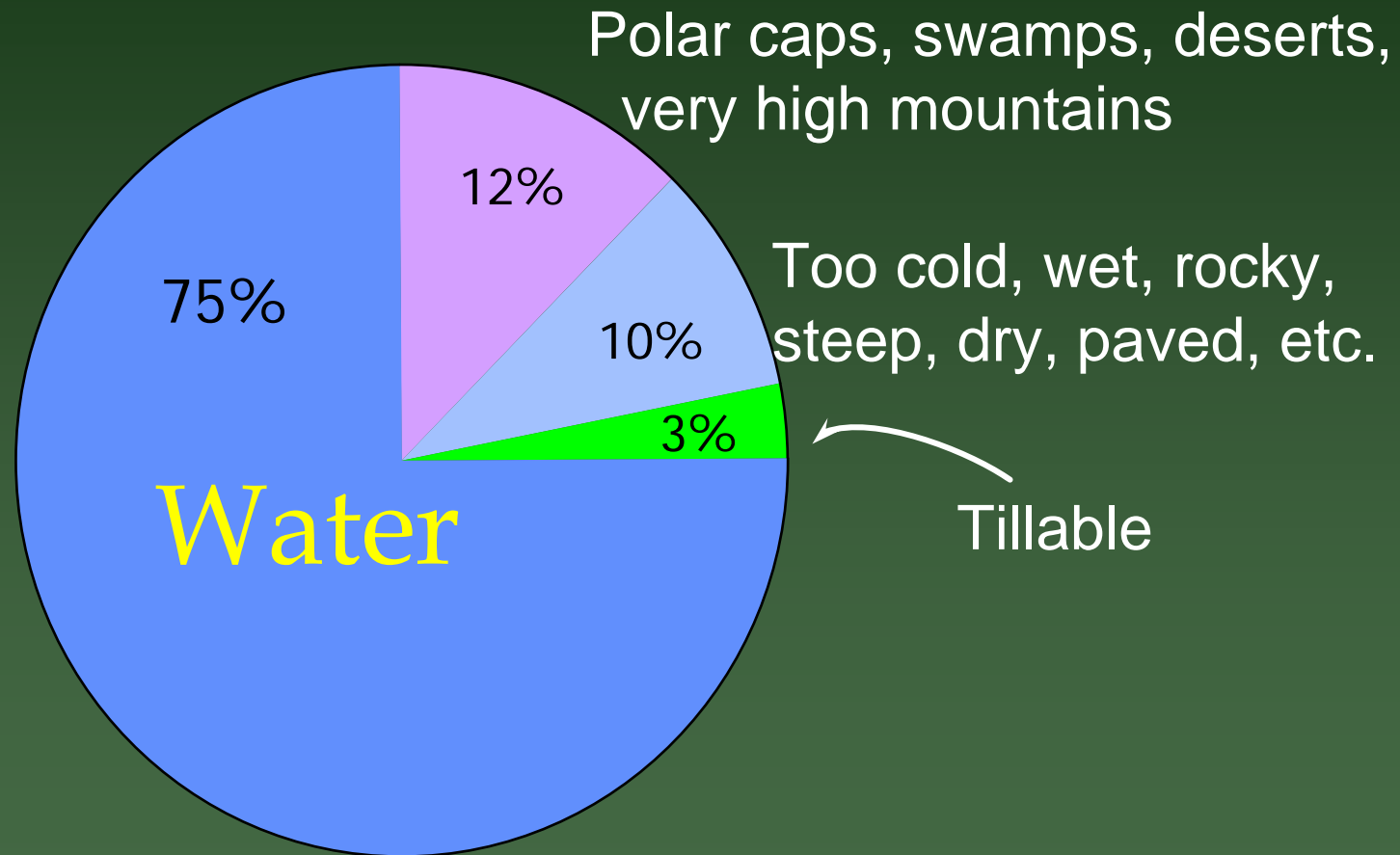
By The Numbers

	1915	1967	2006
U.S. Population	100 million	200 million	300 million*
World Population	1.8 billion	3.5 billion	6.5 billion
Life Expectancy	54.5 years	70.5 years	77.8 years
A gallon of Milk	\$0.36 (\$7.22 in 2006 \$)	\$1.03 (\$6.24 in 2006 \$)	\$3.00

Food Supply

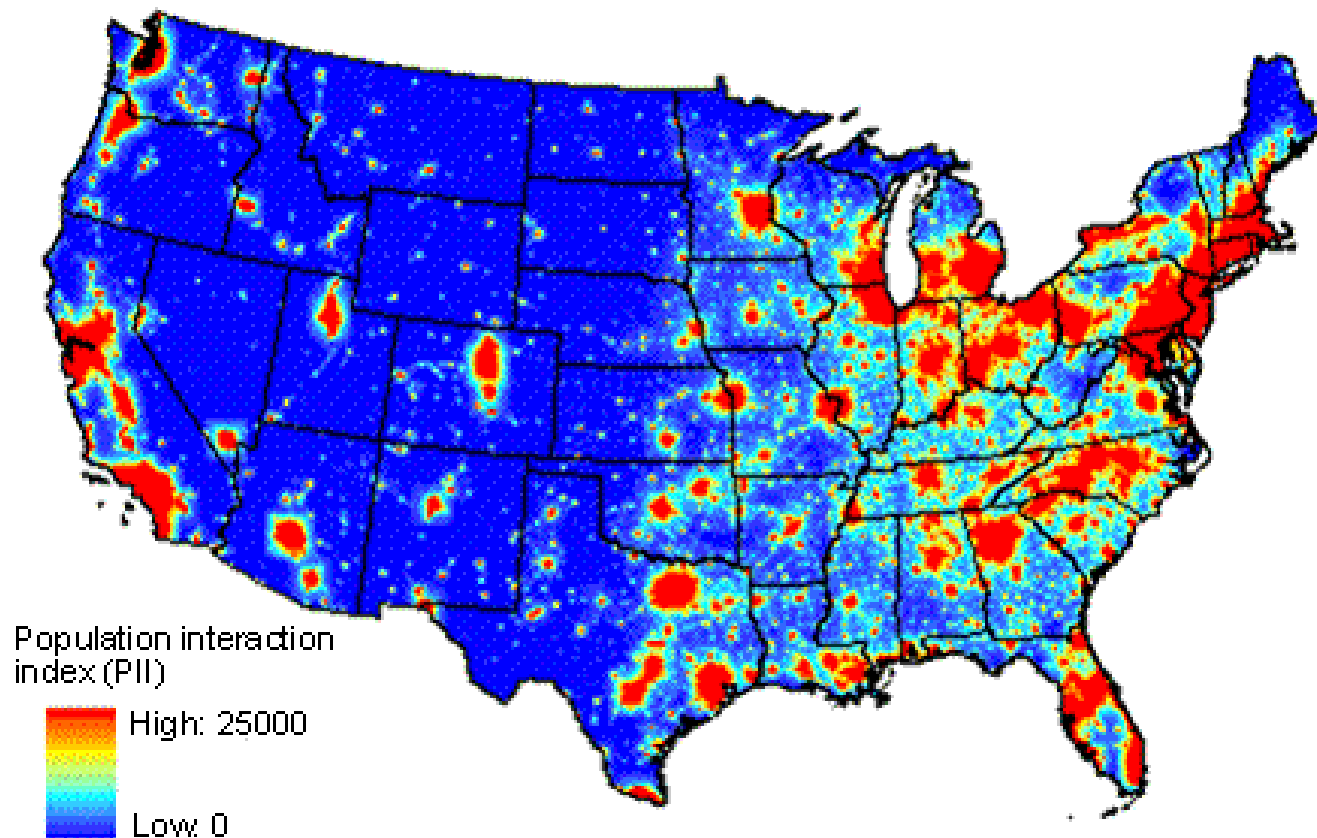
- There are 750,000,000 malnourished people in the world
- 75,000 starve each day
- Farmers must produce as many calories in the next 40 years as in the history of mankind in order to feed the world

Food Supply



Urban-Agriculture Interaction

Population interaction index (PII), 2000

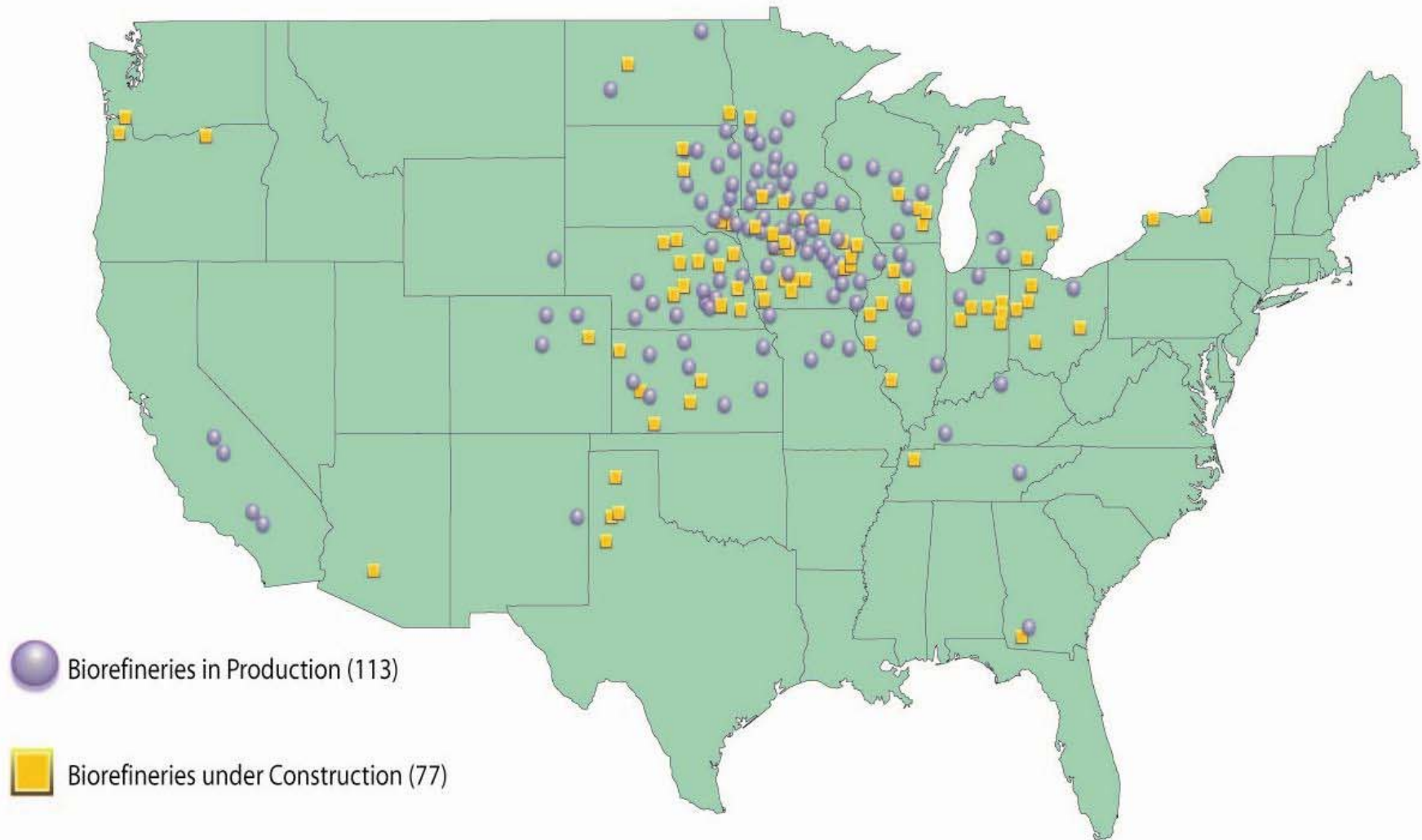


Source: ERS analysis of 2000 census of population block data.

U.S. Cattle Industry

- **Approximately 33% of current beef cattle population enters a feedlot**
- **Enter at 314 kg**
- **Exit at 573 kg (45% of mass in feedlot)**
- **Very visible**
- **Concentration of nutrients**
 - **Odor, N, and P**

U.S. Ethanol Biorefinery Locations



Source: Renewable Fuels Association
2.08.07

Colorado Ethanol Plants

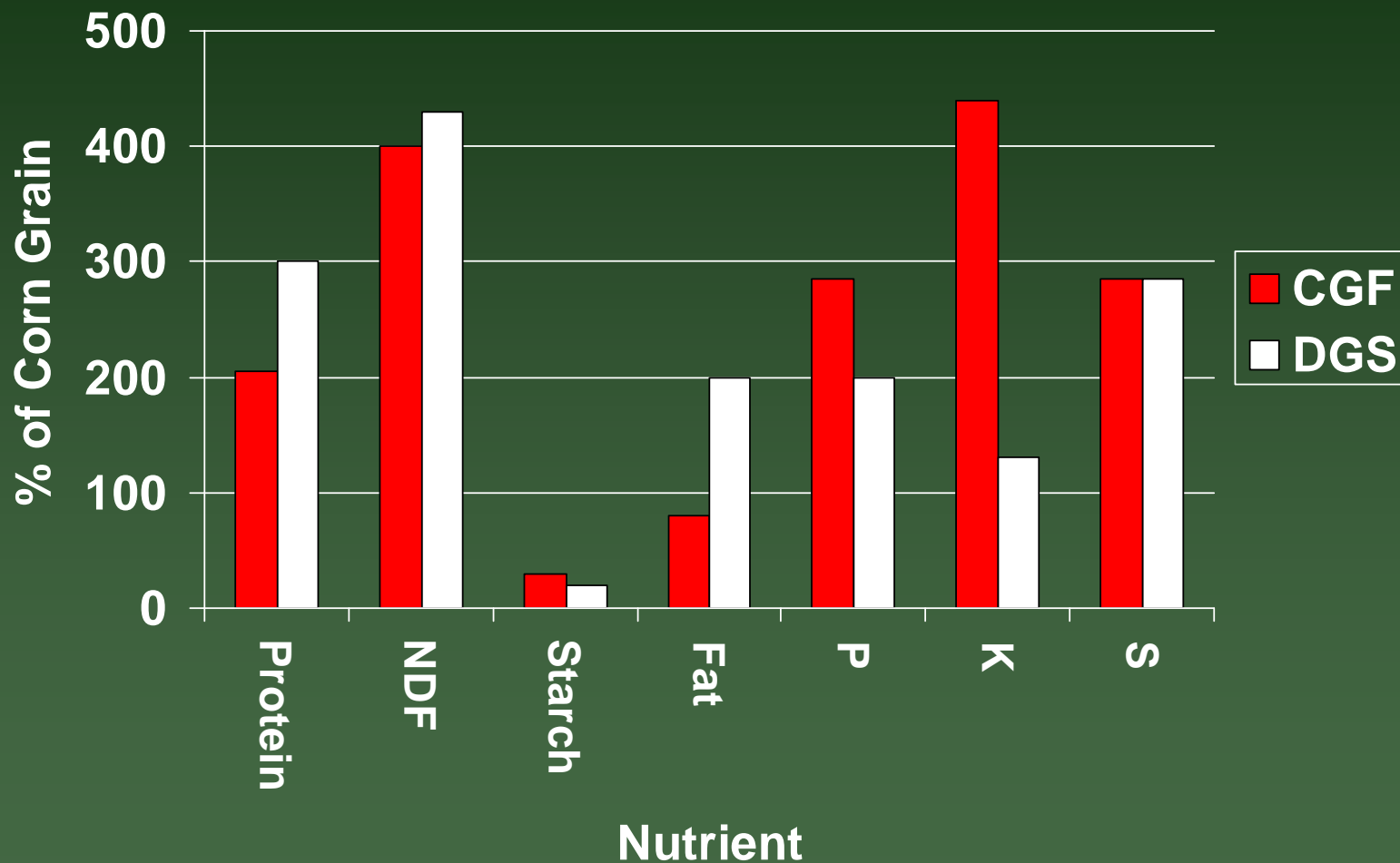
- In Operation
 - Sterling – 50 mg/yr
 - Windsor – 40 mg/yr
 - Golden – 3 mg/yr
- Planned
 - Yuma – 45 mg/yr (Online Spring, 2007?)
 - Yuma – 40 mg/yr
 - Evans – 40 mg/yr
 - Walsh – 2 mg/yr

Distillers grains

- In 2005, 9 million metric tons of distillers grains
- 12-14 million metric tons by 2012 (RFA, 2006)
- 75-80 % fed to ruminants (dairy and beef cattle)
- Nutritionally dense (3.18 Mcal ME/kg, 29.5% CP, 0.83% P, 0.4-1.0 % S)

Starch Removal Concentrates

Other Nutrients



Source: Dan Loy, ISU

Challenges

- **Nutritional needs of cattle**
 - CP, P, fat
- **Ethanol production**
 - Reduced corn availability
 - Increased competition for “other” feeds
 - Distillers grains
- **Nutrient balance/waste production**

Distillers grains and finishing cattle

- **Primarily corn-based rations**
- **Replace corn with distillers grains**
- **Excess of N and P**
 - **Environmental concerns?**
- **Decreased starch**
 - **Meat quality?**
- **Increased lipid**
 - **Adipose composition?**

Nebraska data

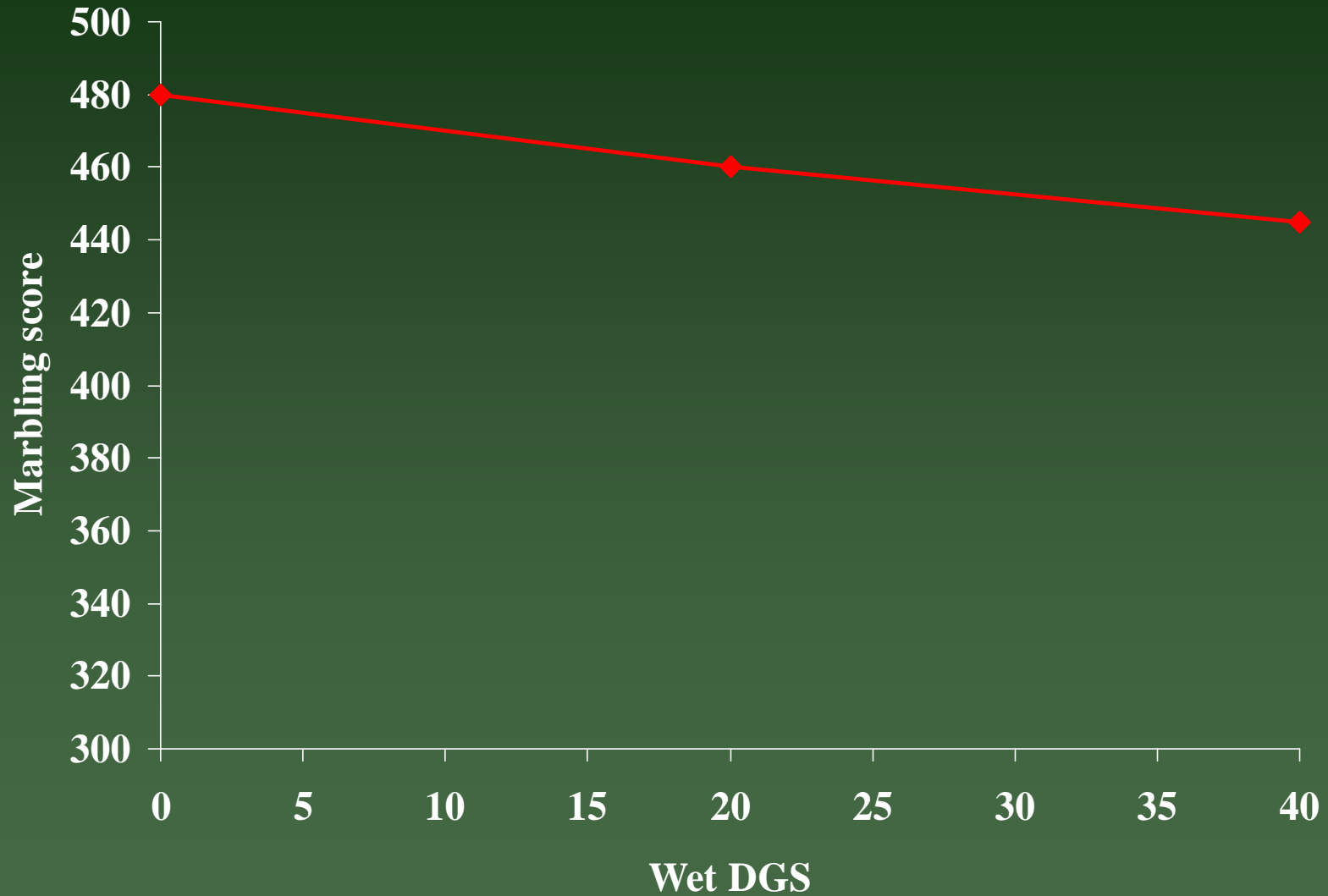
WDGS Level	Predicted Values	
	ADG	F:G
0	3.47	6.44
10	3.70	6.16
20	3.83	5.95
30	3.87	5.81
40	3.81	5.74
50	3.66	5.73

$$\text{ADG} = -0.0005x^2 + 0.0279x + 3.4669$$

$$\text{F:G} = 0.0003x^2 - 0.0309x + 6.4367$$

Erickson, 2006

Iowa State data



Trenkle, 2006

Linear $P = 0.075$

Cellulosic Ethanol?

- **Technology**
- **Cost?**

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 - **What has good fiber, is cheap, and is in close proximity to an ethanol plant???**

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Cellulosic Ethanol?

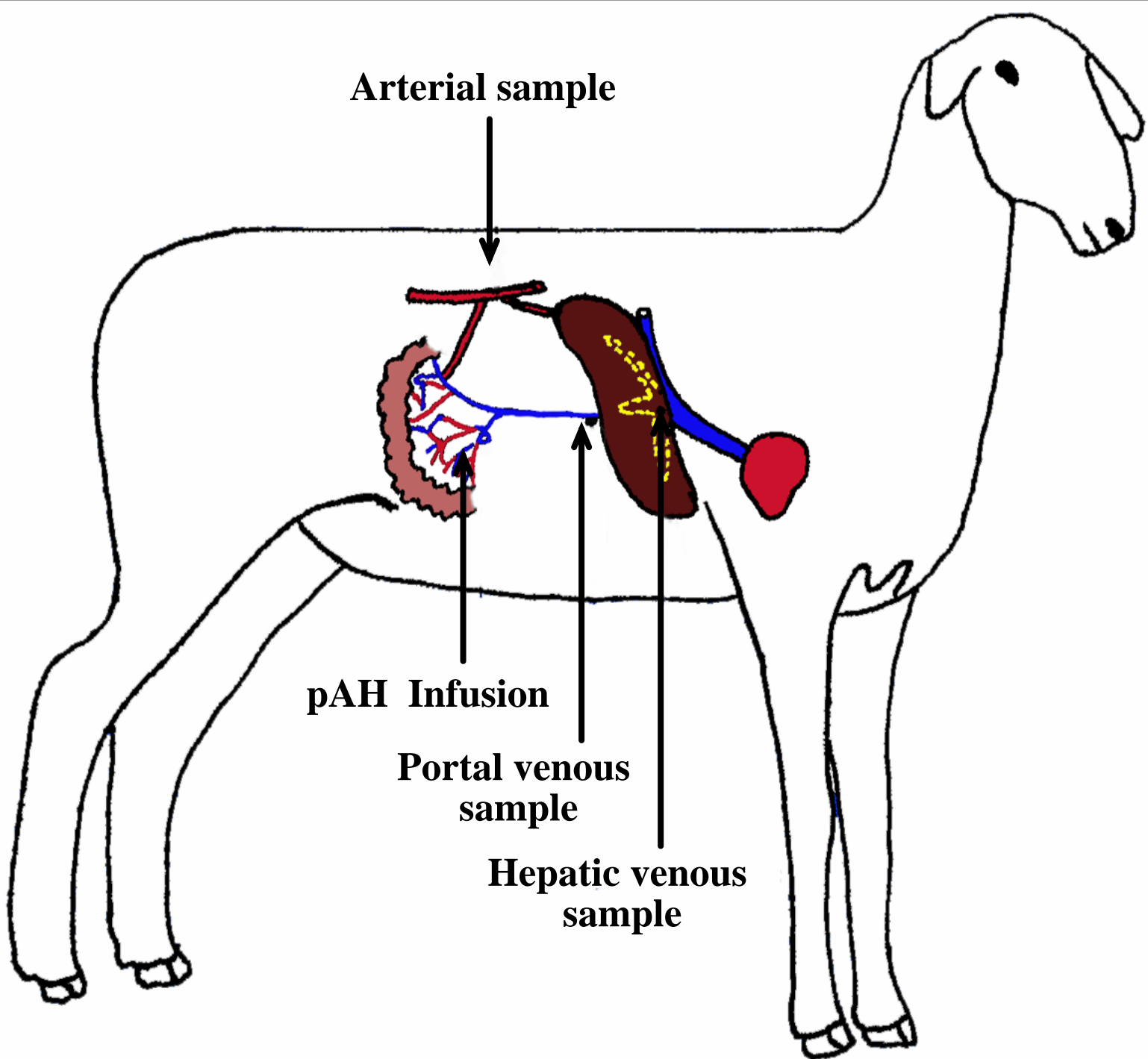
- **Technology**
- **Cost?**
- **Fuel Source**
 - **What has good fiber, is cheap, and is in close proximity to an ethanol plant???**
 - **Distillers grains!**
 - **Oil for biodiesel?**

Potential

- **Low- moderate quality forages**
- **Distillers grains supplements**
- **Improve nutrient availability for forage-fed ruminants**
- **Determine optimum levels of distillers grains to optimize production**
- **Utilize forages to improve manure value**
 - **N:P ratio**

Experimental Design

- 9 wethers with chronic indwelling catheters
- Moderate quality brome-hay
- 100 g of supplement
 - Corn (n=4) or DDGS (n=5)
- Balance trial
- Nutrient flux



Arterial sample

pAH Infusion

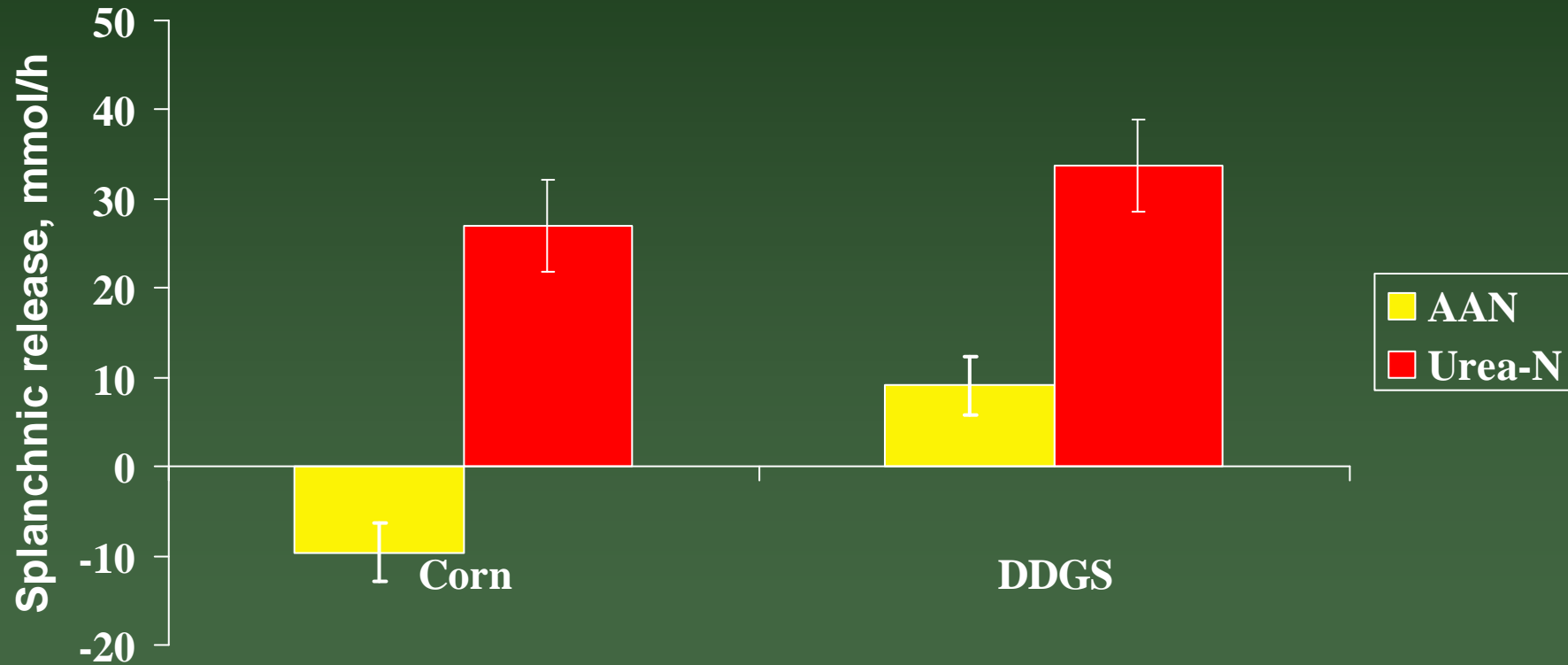
**Portal venous
sample**

**Hepatic venous
sample**

Balance data (n = 9)

	Corn	DDGS	SE	P-value
N intake, g/d	18.41	21.46	1.38	0.14
N dig., %	47.23	55.90	2.64	0.04
N balance, g/d	2.54	4.45	0.79	0.15
P intake, g/d	1.57	1.83	0.10	0.10
P balance, g/d	0.16	0.36	0.06	0.05
Manure N:P	11.24	11.57	0.19	0.23

Nutrient flux



AAN, $P = 0.04$ Urea-N, $P = 0.36$

Summary

- **Distillers grains are a viable supplement for ruminants grazing moderate quality forages**
- **Improve splanchnic release of AAN**
- **More amino acids = more building blocks for productivity.**
- **Improve P balance without altering manure N:P**

Future Research

- **Core questions of NCBA**
 - **Focus is on finished beef cattle**
 - **Increasing levels (>30%) of co-products and the ultimate effect on end product quality**
 - **Levels and associated effects of fat, S, P, N, etc. on end product quality**
 - **Links to environment and health**
 - **Pathogens**

Proposed Research

- **36 finishing beef steers**
 - Chronic *E. coli* shedders
- **Grain type and distillers inclusion**
 - Steam flaked and dry rolled
 - 0, 30, 60% DGS
- **Balance trial (24 from 36)**
 - N, P, S, Cu, and antibiotics

Proposed Research

- **Mineral metabolism**
 - Liver biopsies during finishing phase
- **Odor Production**
 - Manure slurry incubations
 - Odorous compound formation
- **Lipogenic potential of adipose tissues**
 - Meat quality

Where to go?

- **Integrated systems**
 - Forages, silages, cattle production, fertilizer
- **New uses for old systems**
 - Distillers grains
 - Forage finishing
- **Ensiling**
 - Straw, stover, etc.

Thank You!

Questions?

Virginiamycin

- Streptogramins, synergimycins, or pristinamycins
- Type A
 - Virginiamycin M1
- Type B
 - Virginiamycin S
- Work synergistically

Virginiamycin

- **Virginiamycin M1**
 - Inactivated when held at 90 °C for 20 min.
- **Virginiamycin S**
 - No loss of activity when held at 90 °C for 20 min.

Lee et al. 1996