Energy implications of advanced nutrient management tools in small grain cropping systems

ACEEE Forum on Energy Efficiency in Ag

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Des Moines, IA

WASHINGTON STATE UNIVERSITY

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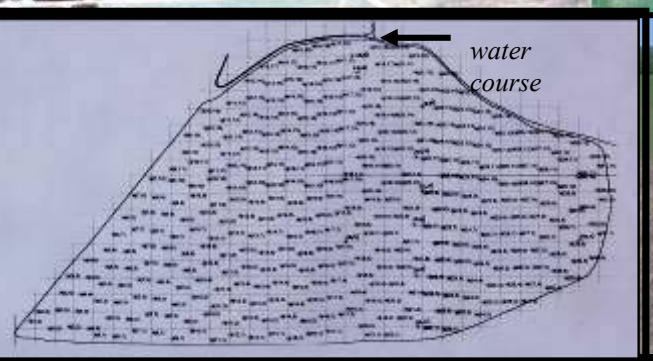
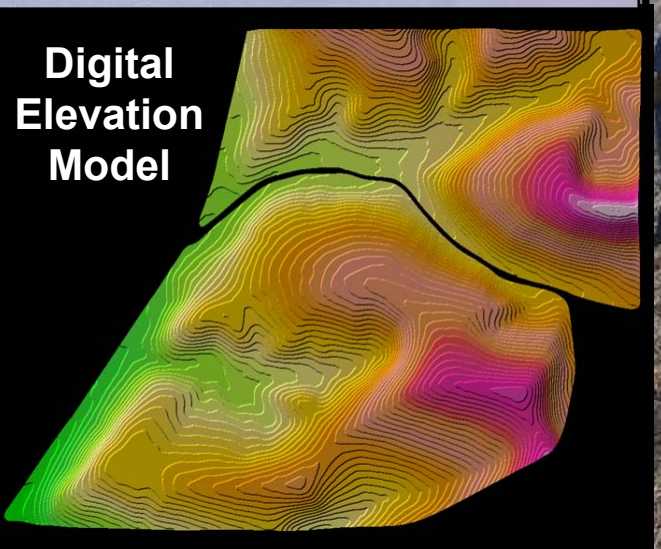
CLIMATE FRIENDLY FARMING™

The Palouse River Basin: 856,158 ha





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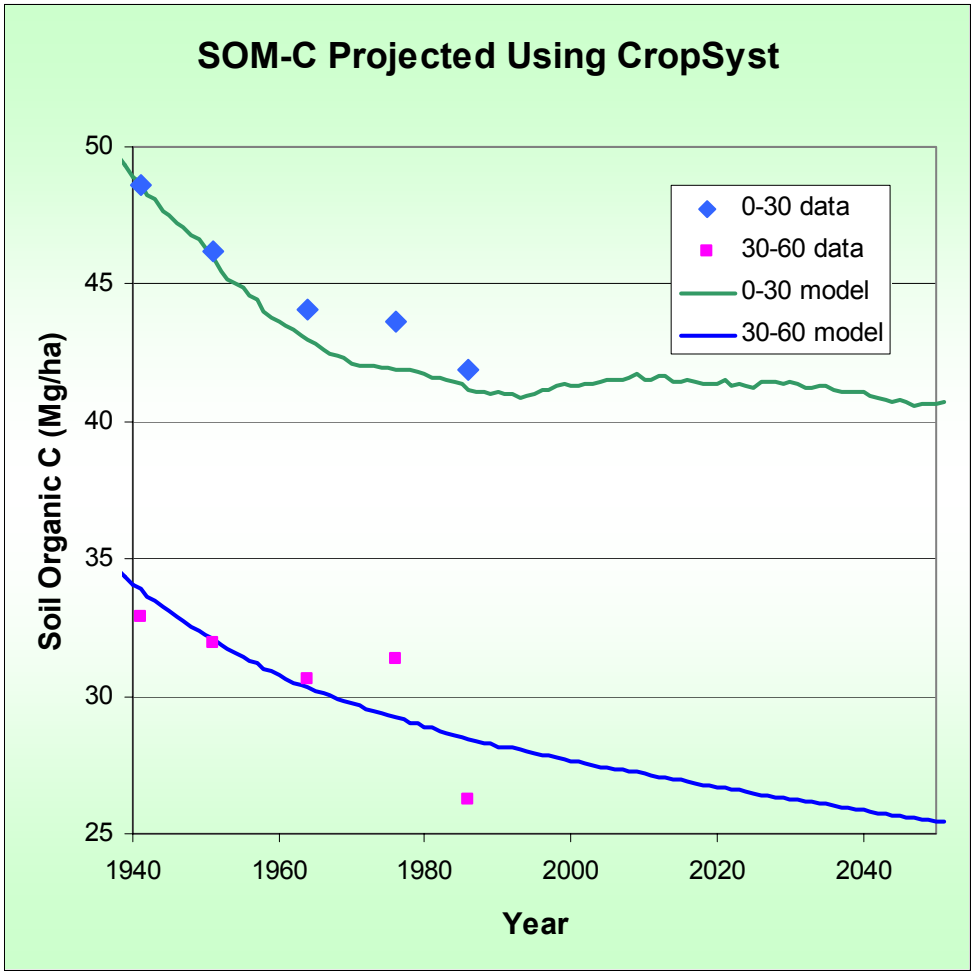
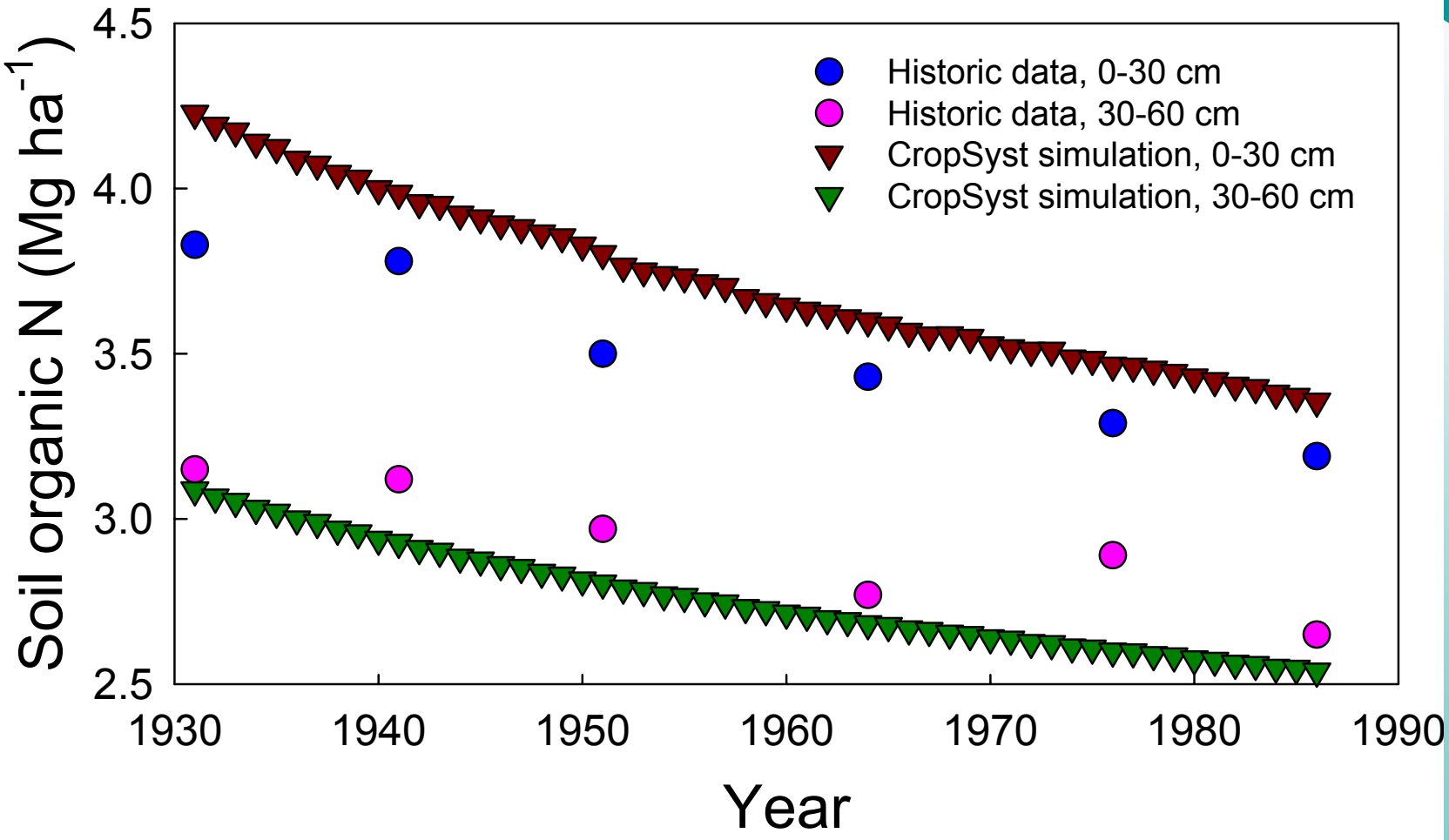
Current ag situation: soil carbon



Long-term soil carbon trends (measured & modeled) for Pendleton, Oregon. Winter Wheat – Fallow, conventional tillage

Current ag situation: soil fertility



Long-term soil nitrogen trends (measured & modeled) for Pendleton, Oregon. Winter Wheat – Fallow, conventional tillage

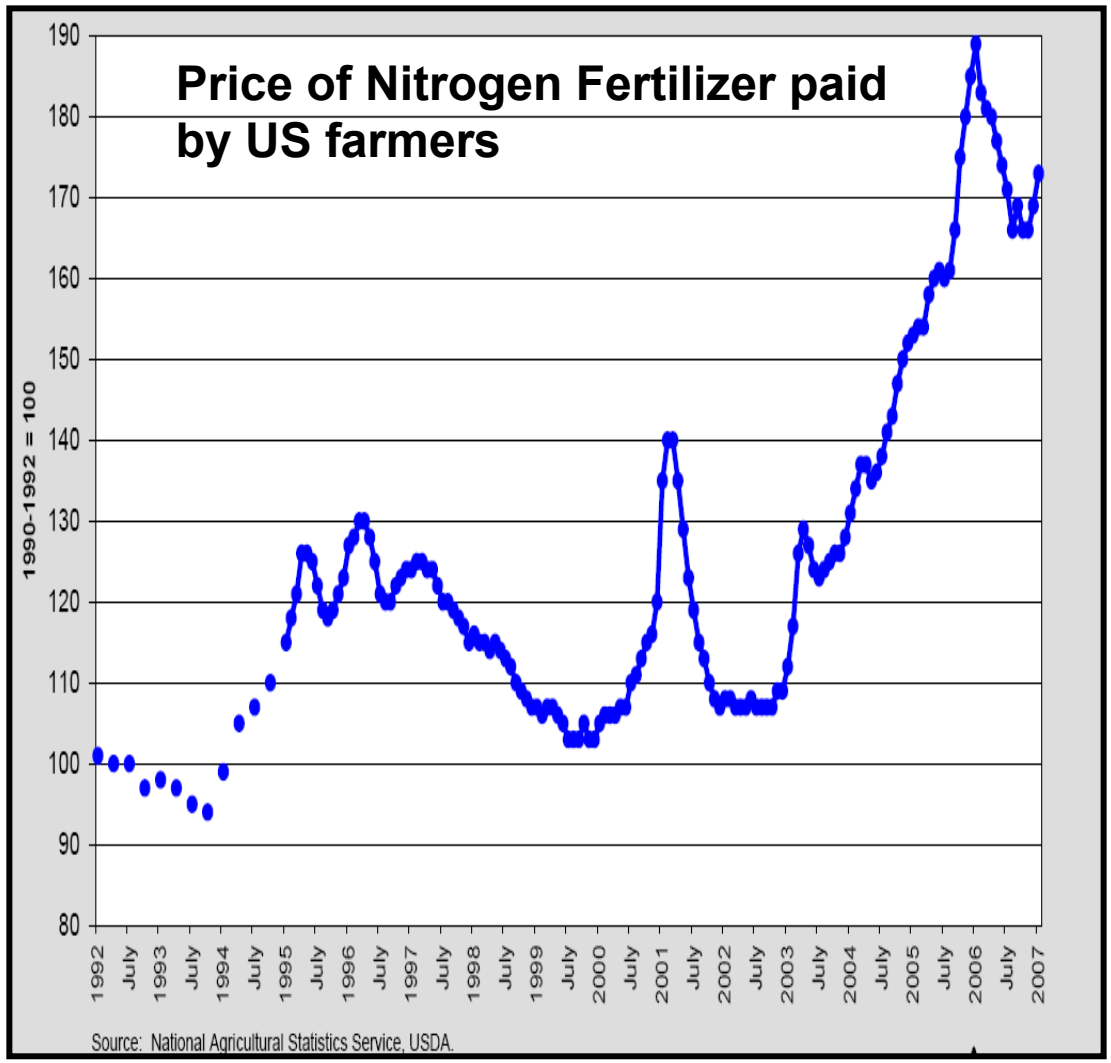
Which hurts more? $3 diesel or $.70 Nitrogen?

Spring Canola Costs by Rainfall Zone (2008)			
	12" - 15"	15" - 20"	>20"
Operating Costs:	$137.98	$168.52	$172.26
N fertilizer	$42.00	$63.00	$70.00
% of costs	30%	37%	41%
Fuel costs	$4.61	$4.53	$4.53
% of costs	3%	3%	3%

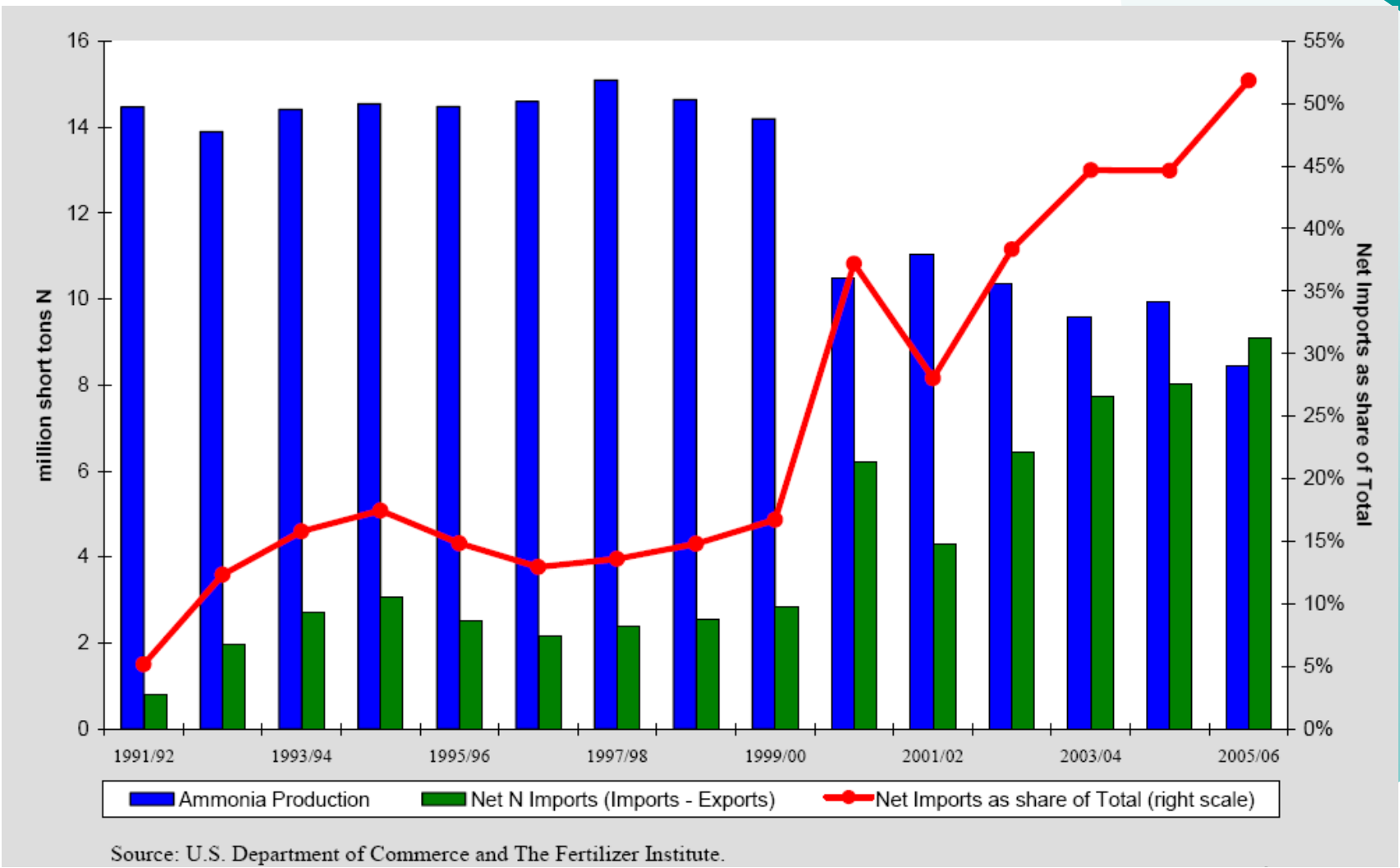
N fertilizer = 8 – 14X more fossil energy equivalent / acre than diesel!

*Calculated with $3.00 off-road diesel, $.70 / lb Nitrogen

Price of Nitrogen Fertilizer: 1992 - 2007

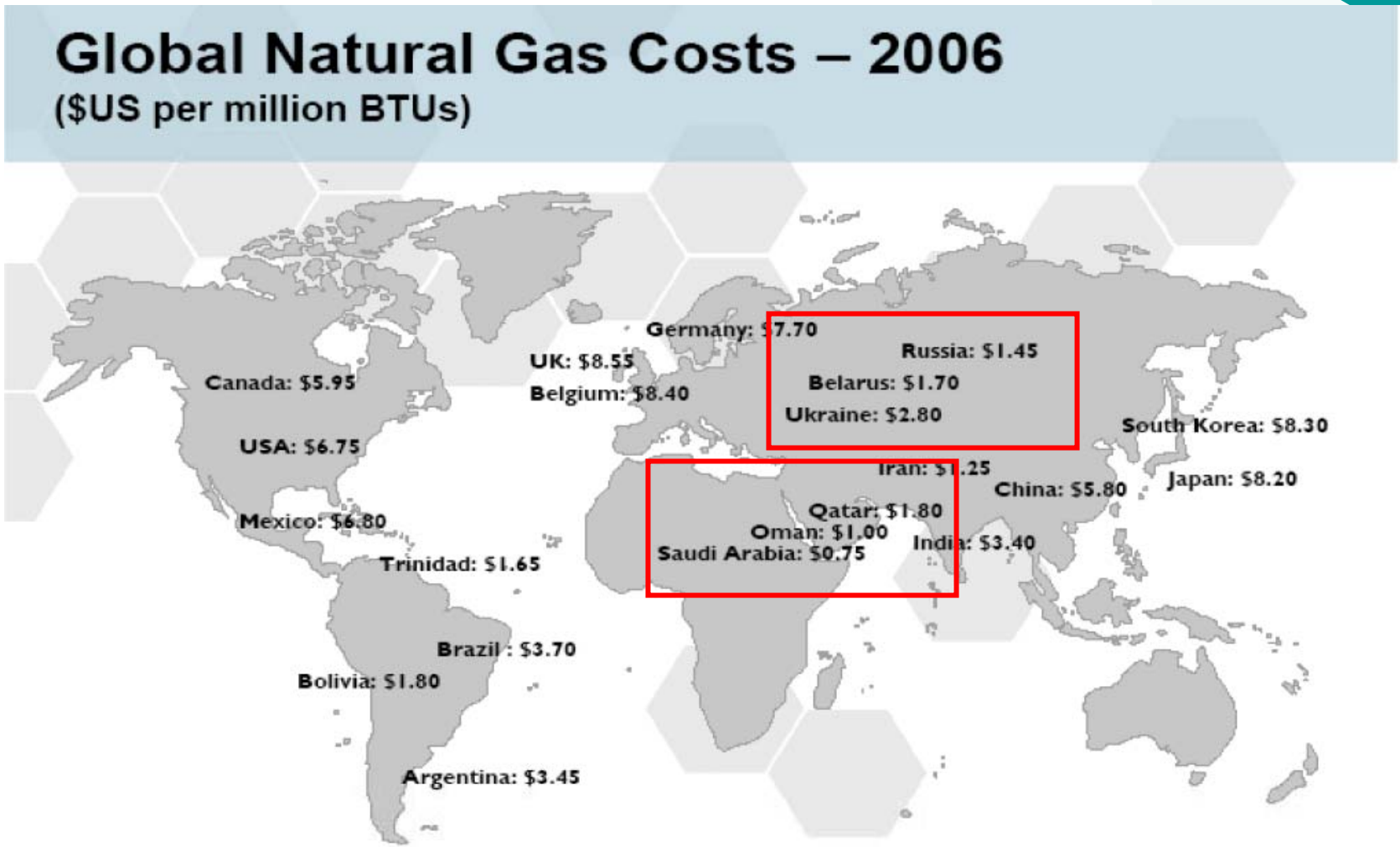


Concerns: Nutrient Demand

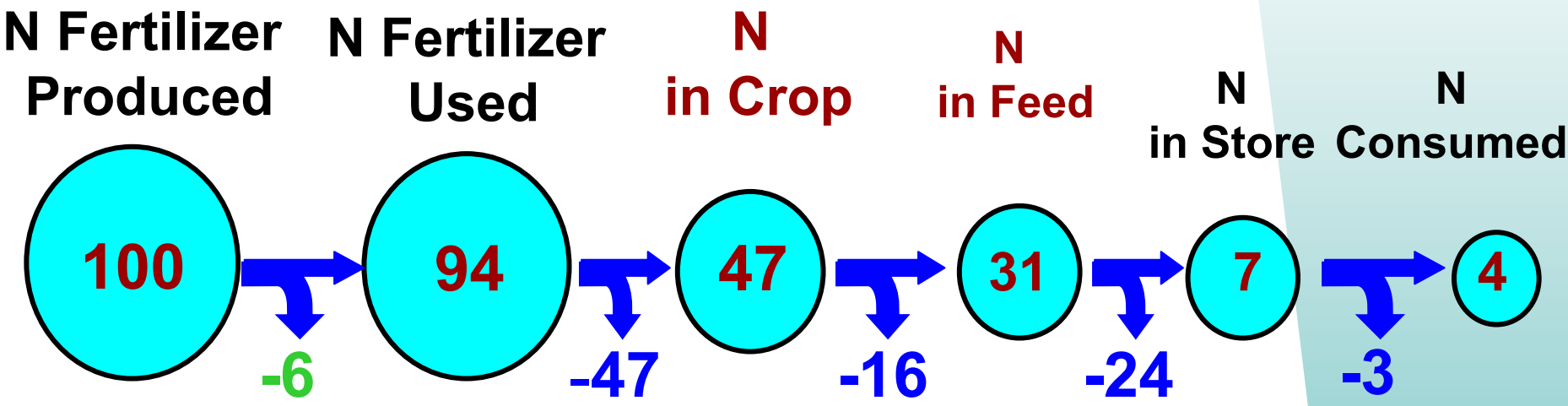


Source: U.S. Department of Commerce and The Fertilizer Institute.

Where will we get our N from?



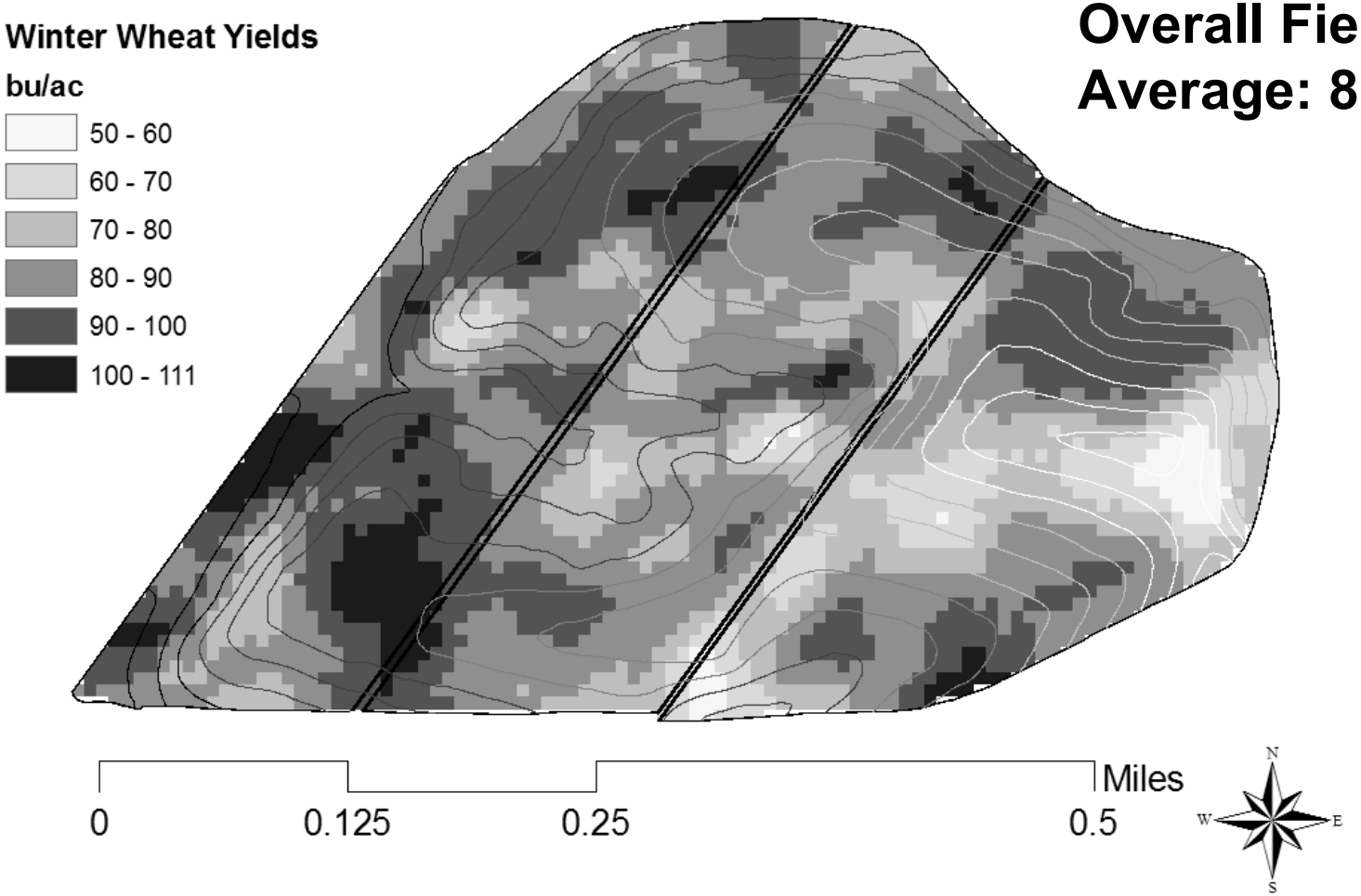
Fate of Haber-Bosch Nitrogen



4% of the N produced in the Haber-Bosch process and used for animal production enters the human mouth.

Galloway and Cowling, 2002

Spatial variability on yield, SOC

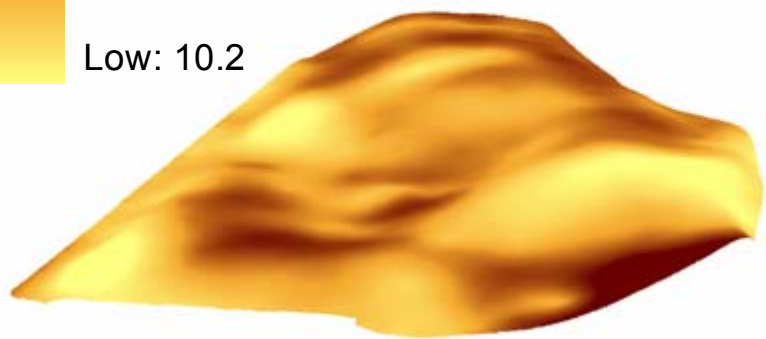


Site-Specific N Recommendations

Soil Organic Carbon (0-10 cm, g/kg)

High: 24.6

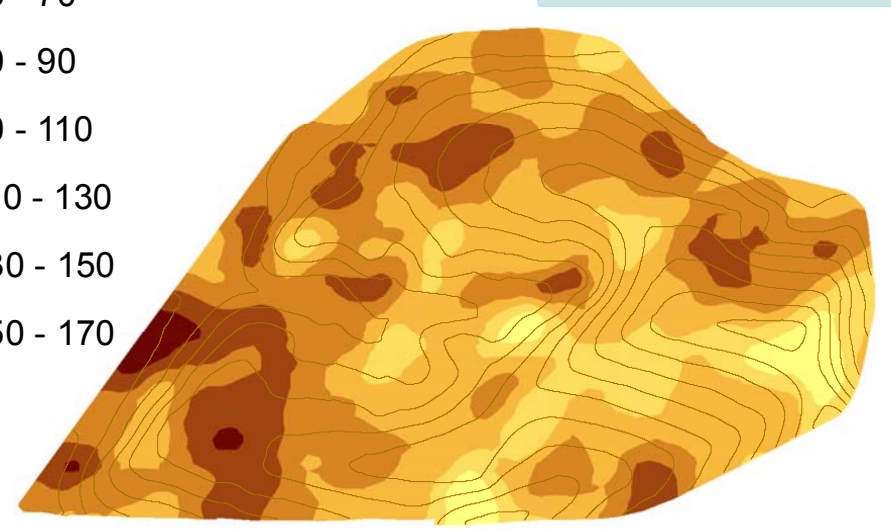
Low: 10.2



Site-Specific N Management

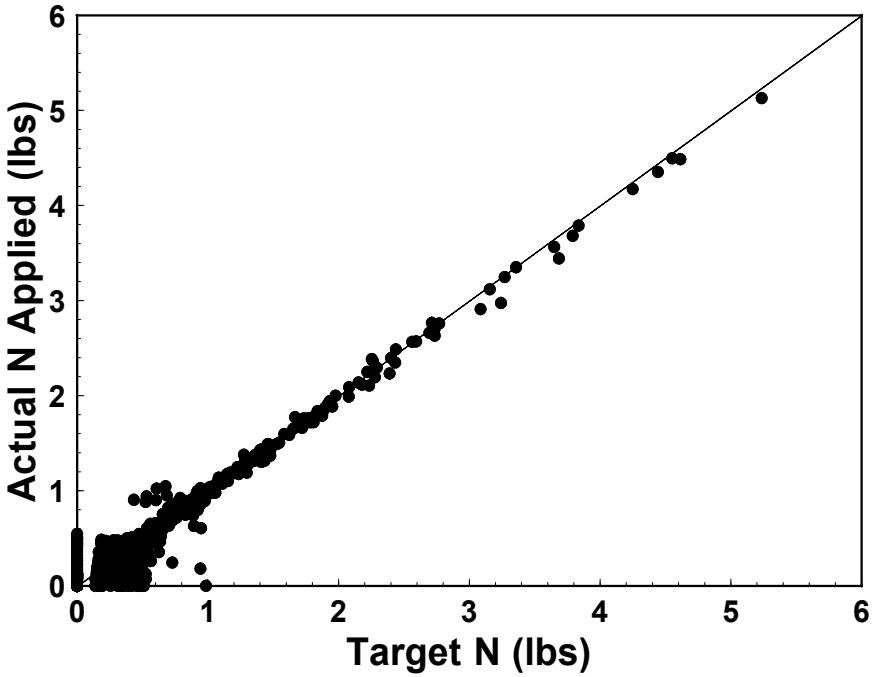
Rec. VRT N (kg/ha)

- 45 - 70
- 70 - 90
- 90 - 110
- 110 - 130
- 130 - 150
- 150 - 170

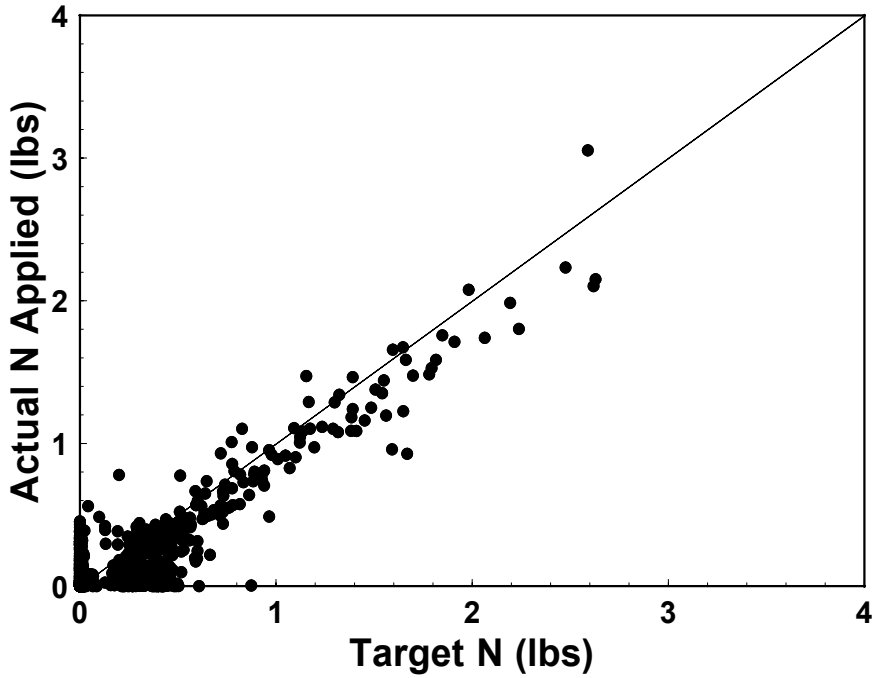


Performance of the hardware?

Liquid



Dry



Comparing Uniform vs. VRT N

	Fert N lbs/ac	Yield bu/ac	Protein %	Gw/Nf*	Ng/Nf**
Uniform N	142a	94a	11.4a	35b	0.7b
PA N	113b	93a	11.0a	47a	0.9a

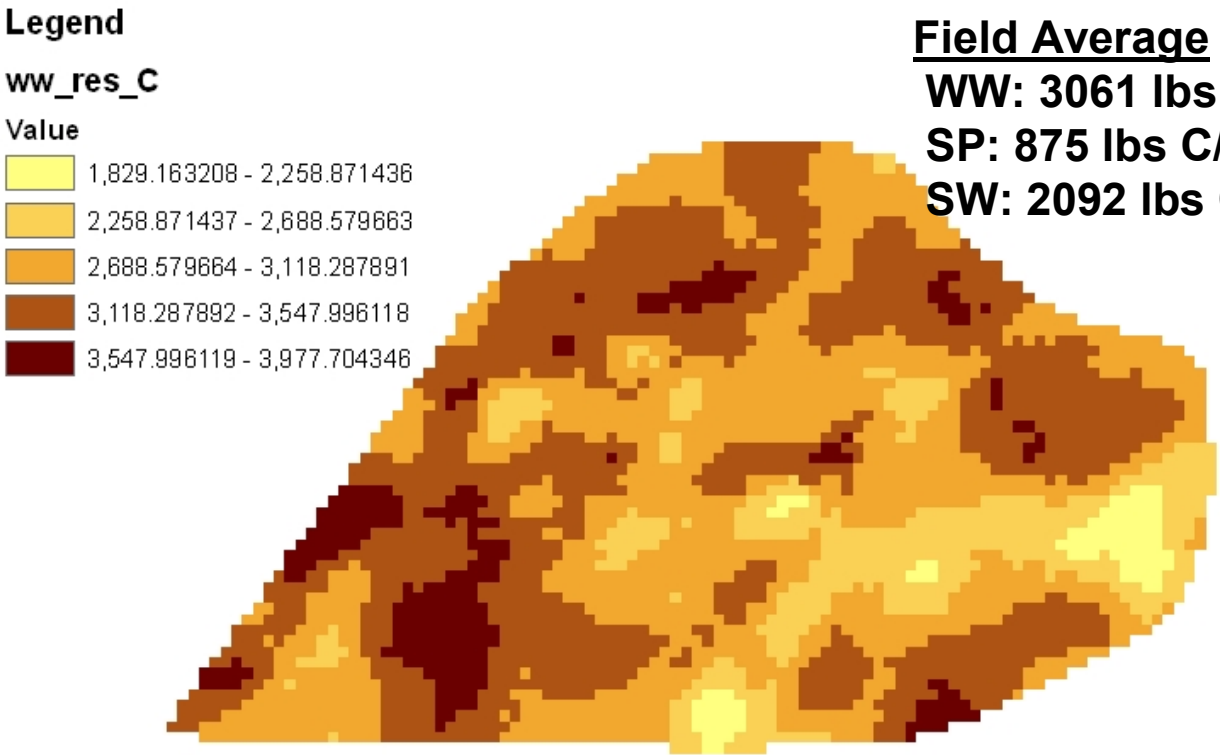
- Current N savings = 20% (Goal = 30%)
- (~14,500 tons N on 1 m acres)
- BTU Equiv > 150,000 barrels of oil (roughly equivalent to the amount of diesel fuel required to farm this acreage with conventional tillage)

*Grain weight / N fertilizer applied

**N weight in grain / N fertilizer applied

Availability of residue in the field

Winter Wheat Residue: Carbon, lbs/ac



Field Average

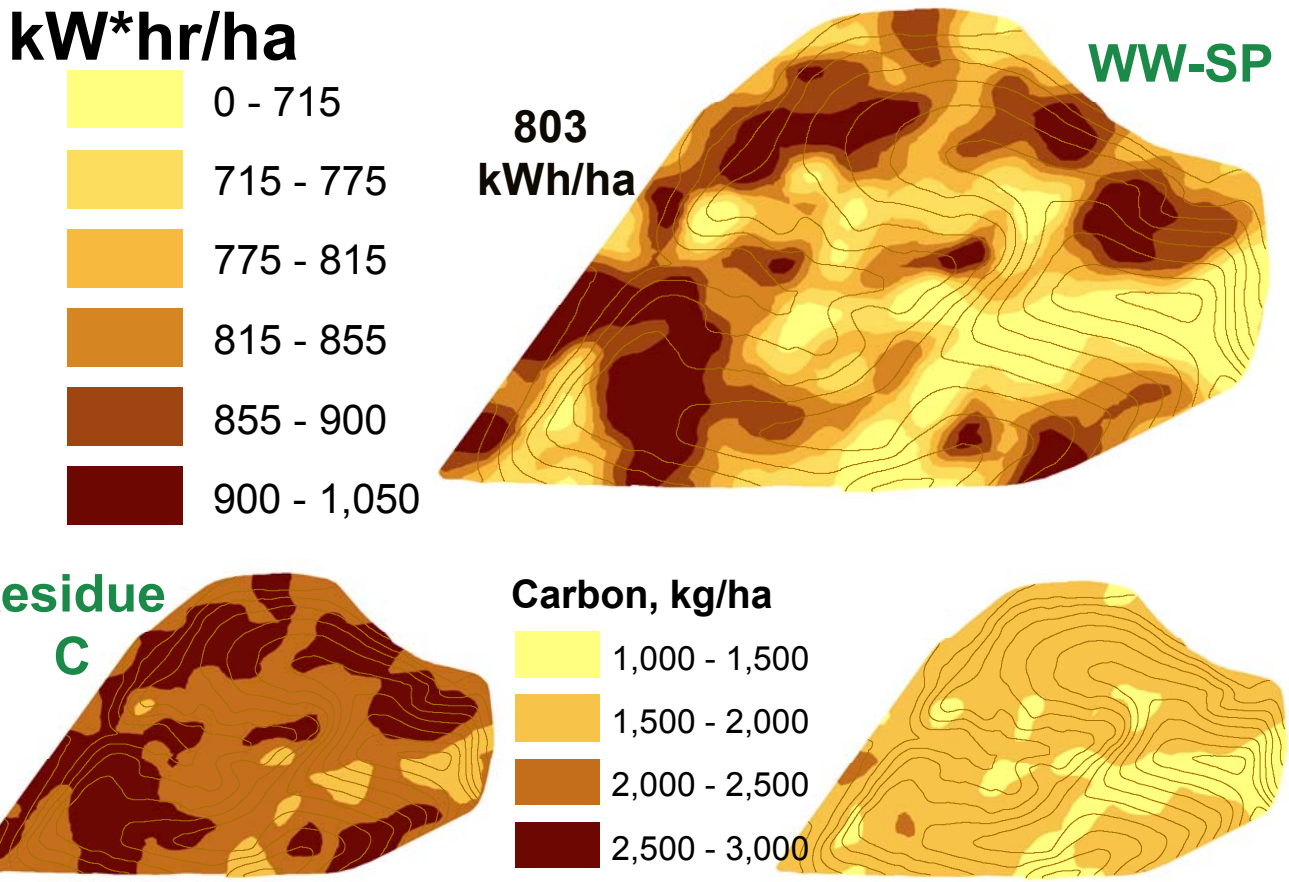
WW: 3061 lbs C/ac
SP: 875 lbs C/ac
SW: 2092 lbs C/ac

Annual C inputs needed to maintain organic matter: 2000-2500 lbs/ac

WSU Cook Agronomy Farm, Pullman, WA

Implication of residue removal for energy

Residue Conversion to Energy



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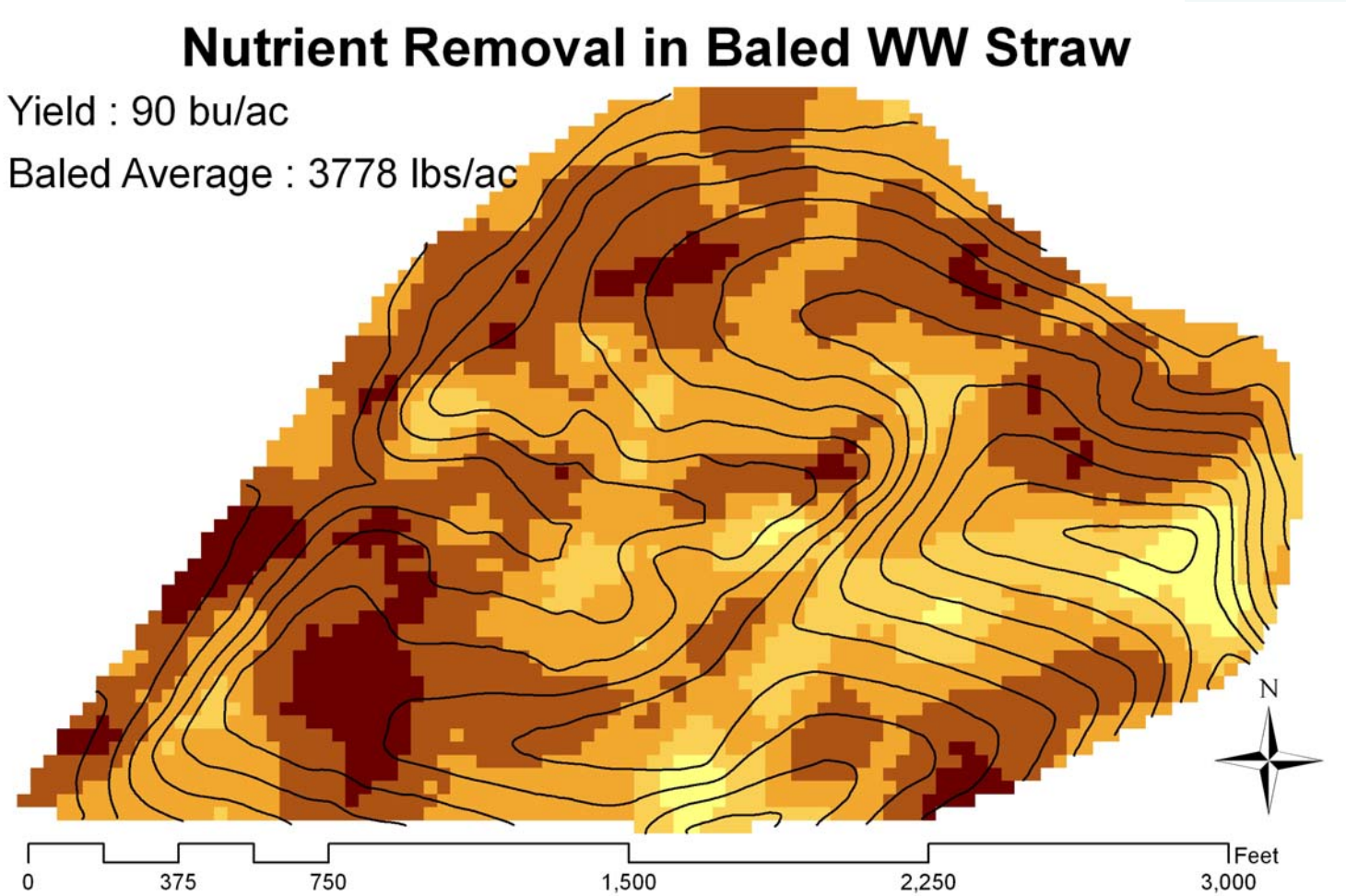
Impact of residue removal on nutrients in the field



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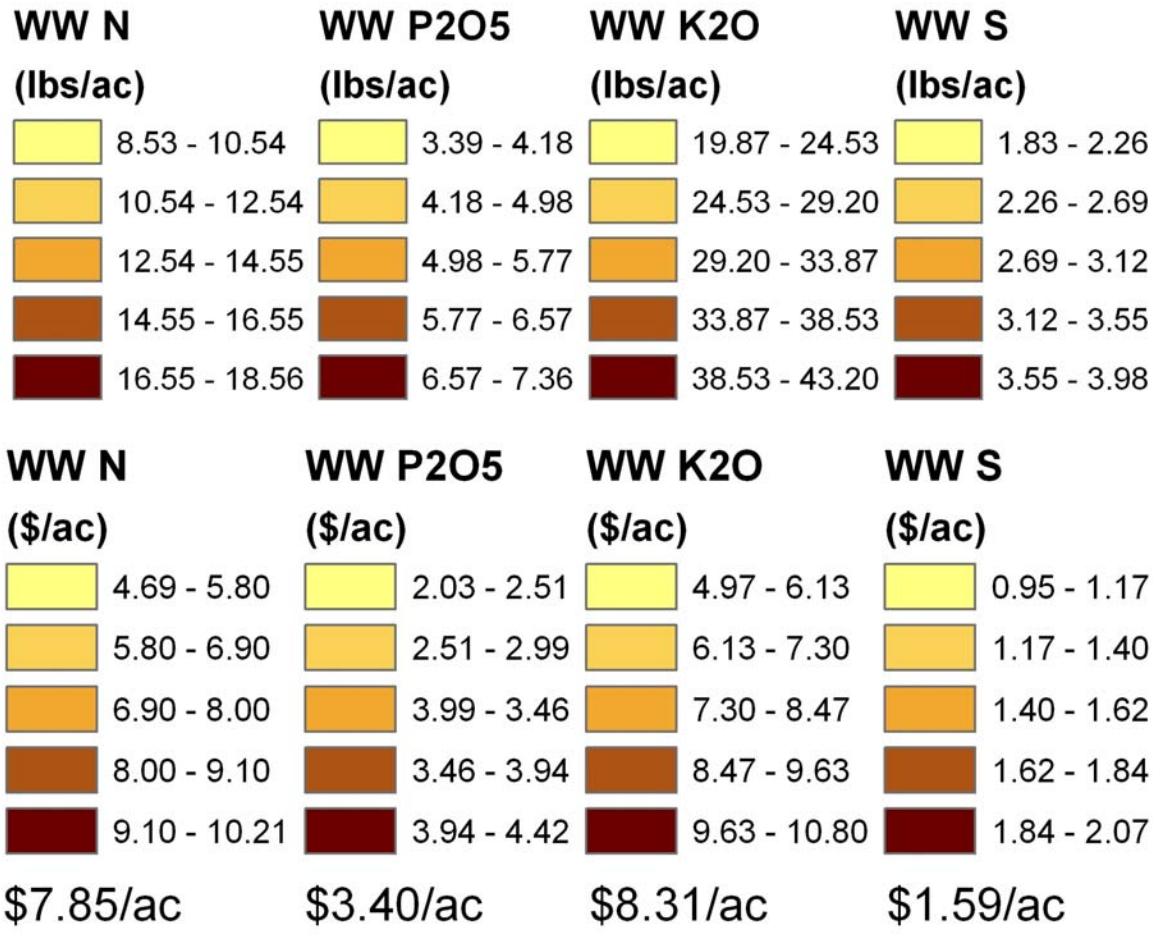
Impact of residue removal on nutrients (cont.)



Nutrients in 1 Ton of WW straw = >$13 (NPV summer 07)

WSU Cook Agronomy Farm, Pullman, WA

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