Producer Interest In Supplying Corn Stover Biomass

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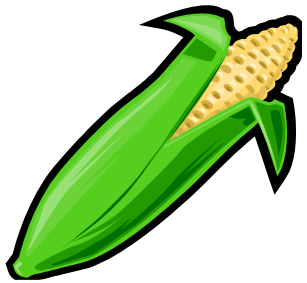
College of Food, Agricultural and Natural Resource Sciences

University of Minnesota



Using Agricultural Biomass

- Reasons for using biomass for energy
  - Low cost feedstock
  - Environmental benefits over fossil fuels
- Wide variety of uses
  - Cellulosic ethanol
  - Gasification and combustion
  - Bioplastics and other compounds
- Corn is king for ag biomass

Assumptions of Biomass Availability

- USDA and DOE- Billion Ton Report
- Price- based on hay market
- Supply- did not consider some factors
  - Conservation
  - Producer interest
    - Also, the price needed to interest producers

Reality of Biomass Availability

- Stover biomass is not fun to collect
  - Labor
  - Capital
  - Time
- Prices are fairly low for the amount of effort
- Can interfere with crop harvesting
- Removes potential nutrients and carbon

Assumptions and Reality Collide

- Some farmers seemed interested.
- Other farmers were very concerned about removing material.
- Little definitive data on Minnesota farmers' interest in harvesting material.
- Need for definitive study in Minnesota.

Two Study Components

- Interest survey
  - Written survey asking producers about their level of interest and what factor influence that interest
- Mapping availability
  - Based on interest, production, and conservation, mapping likely spots with increased biomass availability.

Part I: Survey

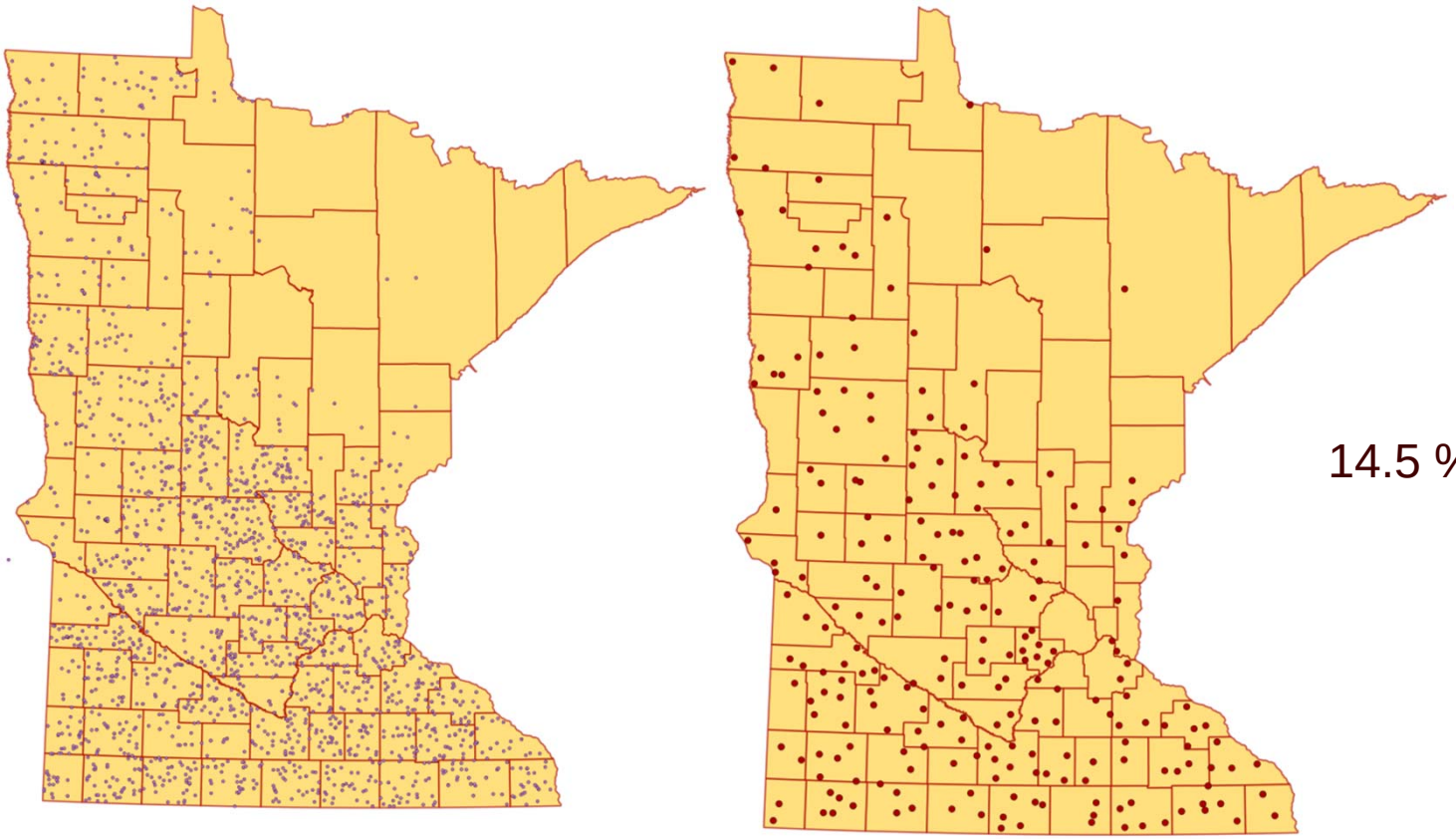
- Interest
- Knowledge
- Factors influencing decision
- Economic considerations
- Impacts of harvesting
- Demographic influences

Covered in 8 pages, 27 Questions

Methodology

- Spring 2012
- 2500 surveys sent
  - USDA NRCS ACRE program participants
    - Random selected from roughly 50,000
- Data compiled into a large spreadsheet
- Statistical analysis- R statistical software

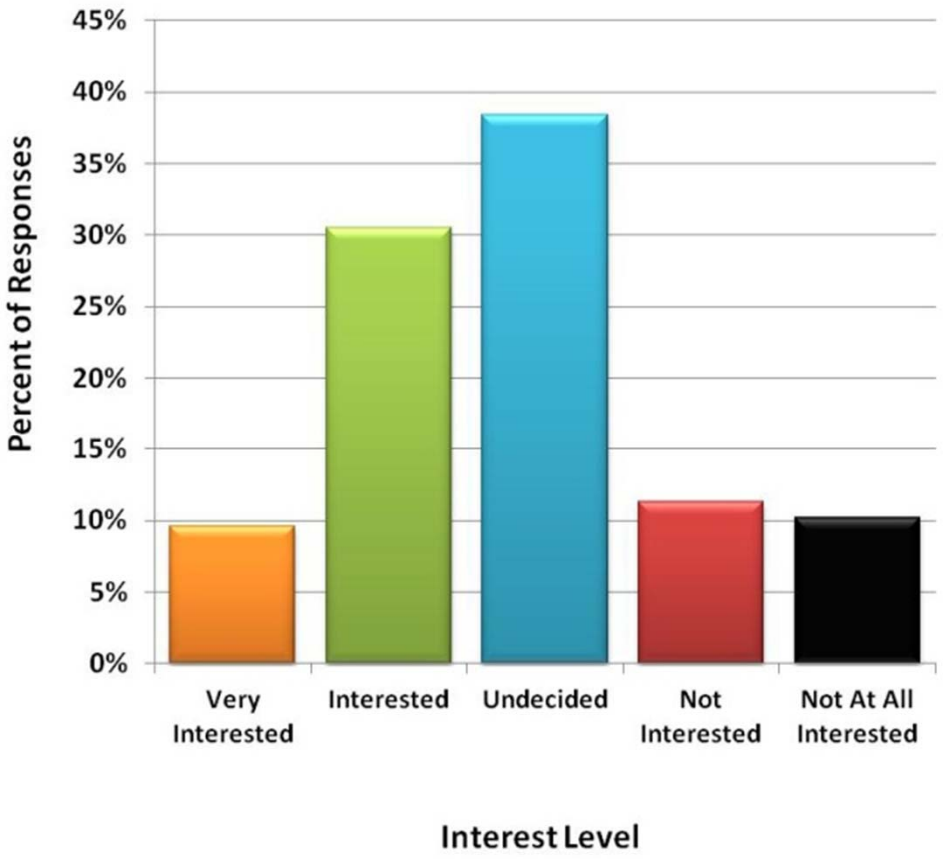
Sent Surveys and Responses



14.5 % response rate

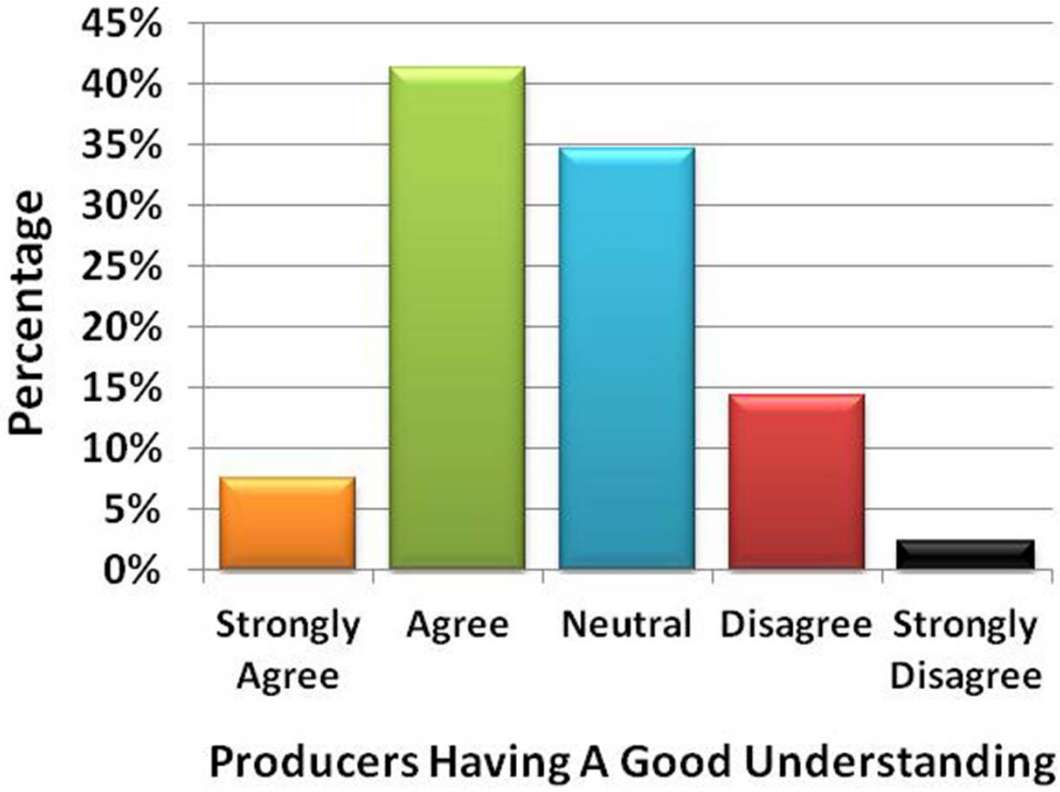
Producer Participation Interest

If a regional market for biomass existed, would you be interested in participating by selling biomass from lands you manage?



Self Assessed Knowledge

Would you agree that you have a good understanding of issues related to collecting agricultural biomass for use in energy or bioproducts manufacturing?



Sources of Information

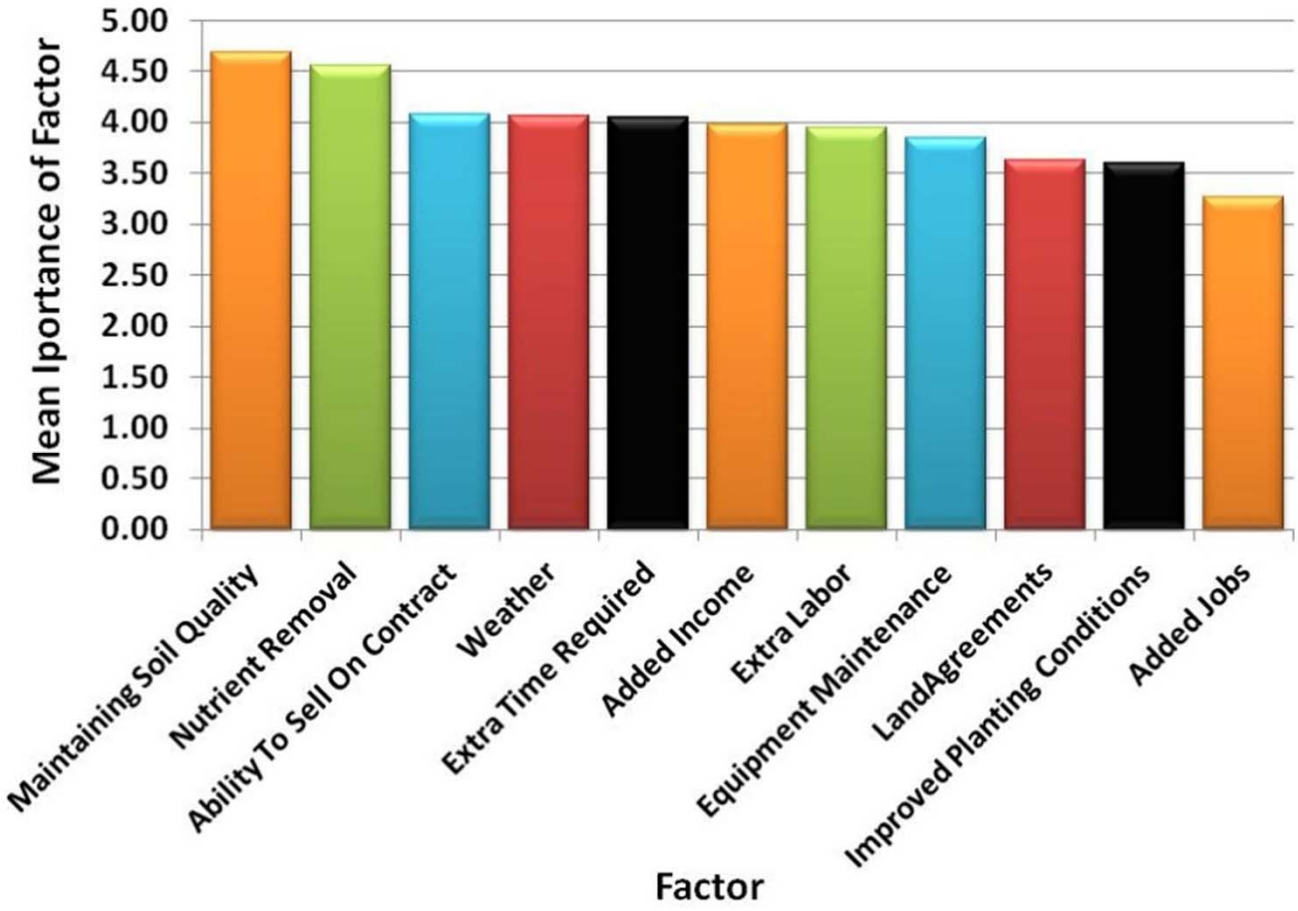
Where you have previously learned about biomass harvesting?

Average producer interest for those receiving information from each source. based on a scale of 1 (not at all interested) to 5 (very interested).

Information Source	Av. Int.	n	Percent(>=Int)
Agricultural Magazine	3.19	284	0.39
Farmers	3.17	83	0.40
Farm Shows	3.30	69	0.48
Commodity Groups	3.19	58	0.41
Univ. Extension	3.14	57	0.42
USDA (ARS and NRCS)	3.40	40	0.47
Other	3.42	38	0.50
Not Heard	3.12	28	0.43
Soil & Water Con. Dist.	3.80	15	0.60

Factors Important in Interest

How important would the following factors be for making management decisions about biomass harvesting in your operation?



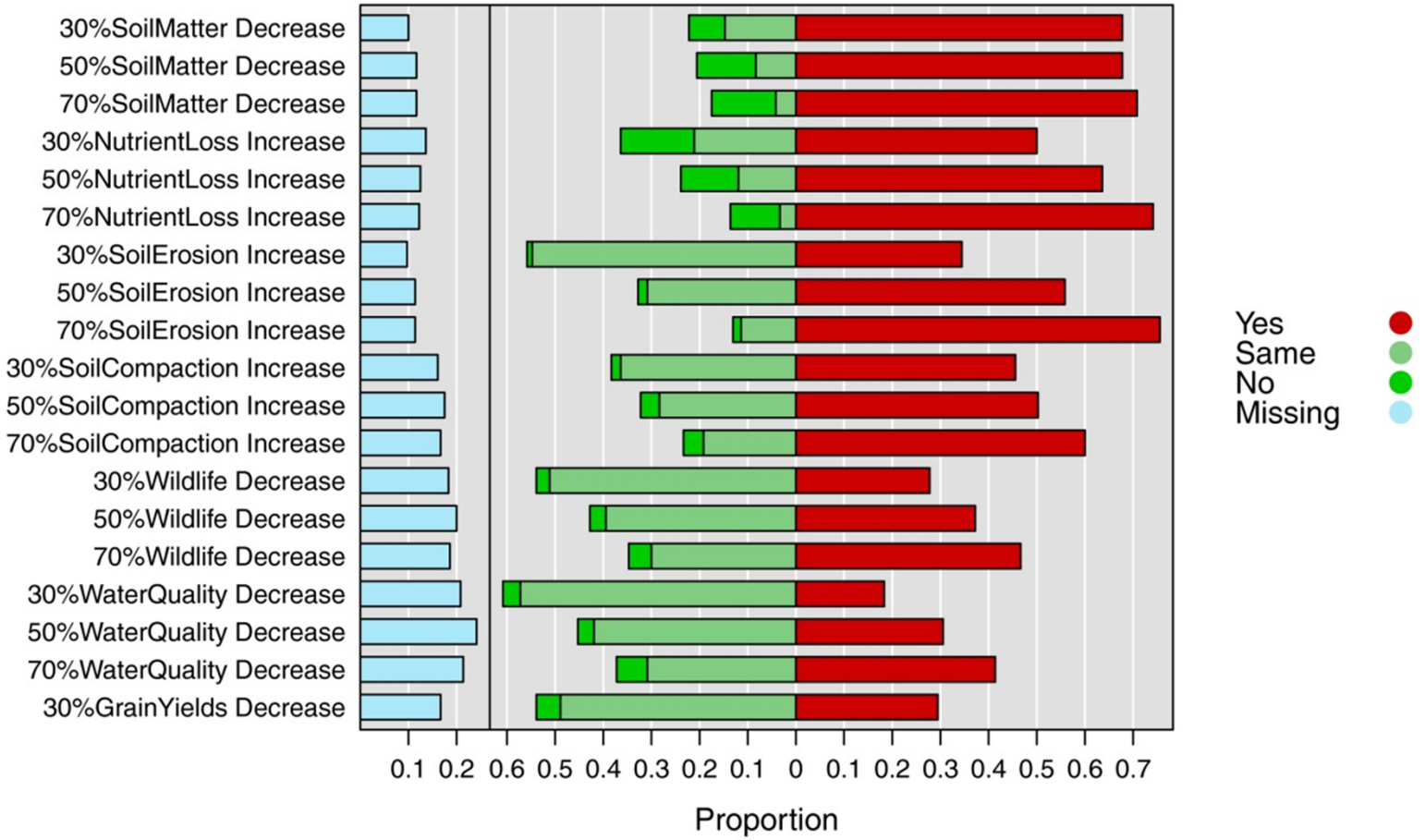
Influence of the Different Factors

Correlation Between Decision Factors and Interest

Average level of interest among producers was compared with the average importance producers gave each factor.

	Factor	gamma	p.value
Factors Significantly Associated With Increased Interest	Added Income	0.34	<1e-04*
	Added Jobs	0.28	<1e-04*
	Ability To Sell On Contract	0.22	0.0022*
	Improved Planting	0.17	0.0127*
	Weather/timing	0.01	0.9420
	Land Rental Agreements	-0.03	0.6694
	Extra Labor	-0.09	0.1997
	Extra Time	-0.13	0.0773
	Equipment Maintenance	-0.13	0.0731
Associated with Decreased Interest	Nutrient replacement	-0.20	0.0147*
	Maintaining Soil Quality	-0.38	<1e-04*

Producer Perceived Harvest Impacts



If (30-50-70%) of biomass is removed do you feel the factor listed on the left will increase, stay the same or decrease?

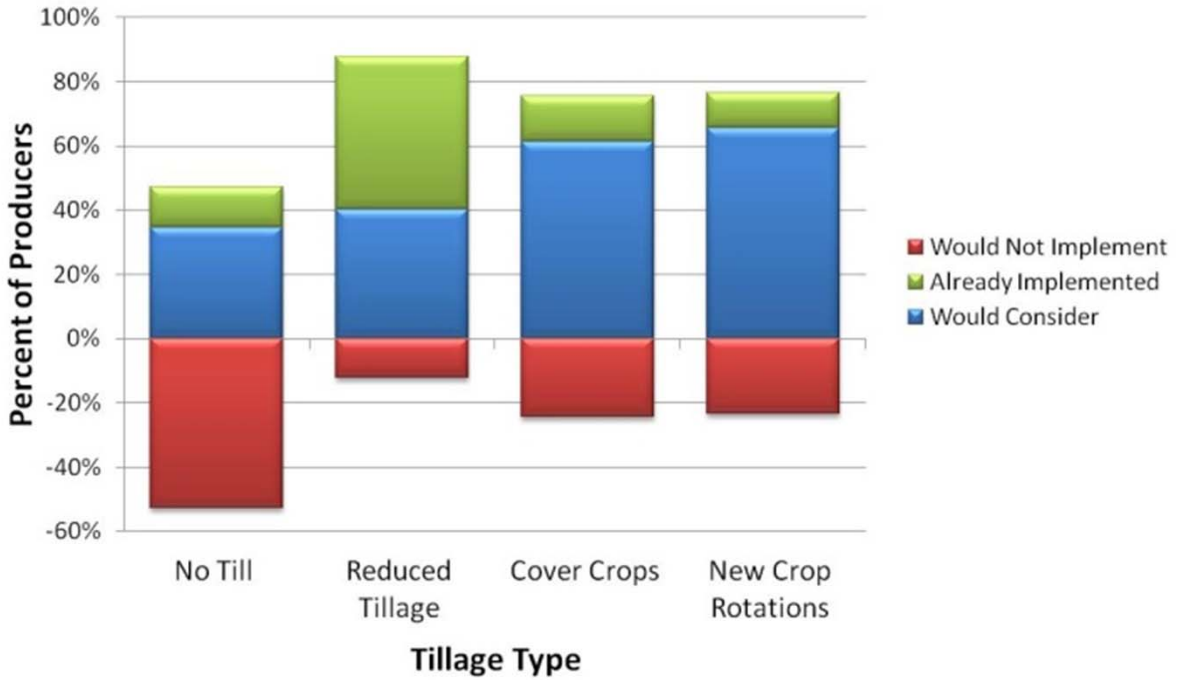
Correlating impacts and interest

- There was a correlation between the amount of interest and the perceived impacts:

  Those interested in biomass harvesting thought there would be less impacts than those not interest in harvesting

Interest in Tillage Changes

Which of the following farming practices would you consider implementing if you were to begin harvesting biomass on your land?



Note: strong correlation between willingness to change and biomass harvest interest.

Economic Influences

After paying all costs, at what profit level would you consider selling biomass from your croplands (assuming current grain prices)?

Interested In ‘Value Added’ Profit

- Questions asked about access to equipment and likelihood of using a custom service to complete operations.

- Those interested in participation-
  - Used very few custom services
  - They had access to equipment
  - Were interested in doing the work themselves.

Significant Demographic Patterns

- Livestock- Dairy producers less interested
- Other crops- People with pasture interested
- Years Farming – 'Younger' more interested
  - 0 to 30 years of farming
- Location did appear to have an impact

Regional Variation in Interest

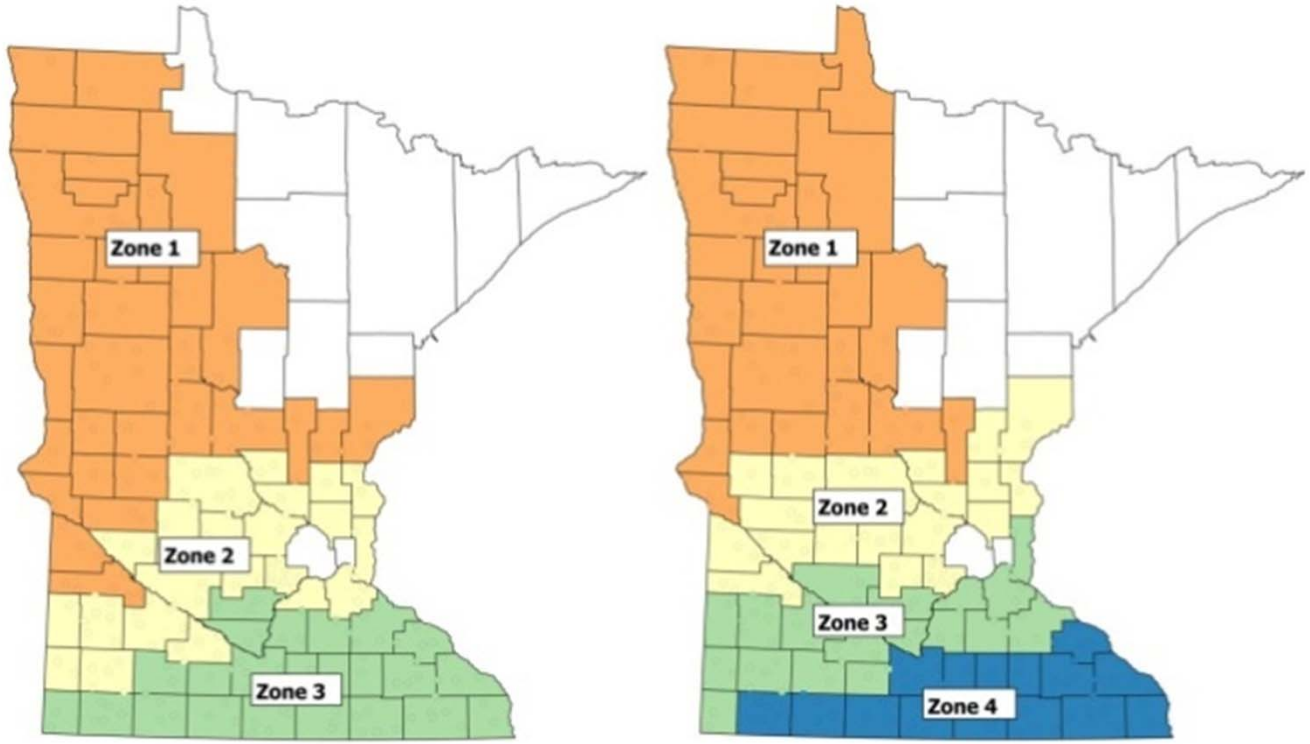


Figure 17 Maps of Three and Four Zone Producer Grouping.

Rough Profile of Interested Producer

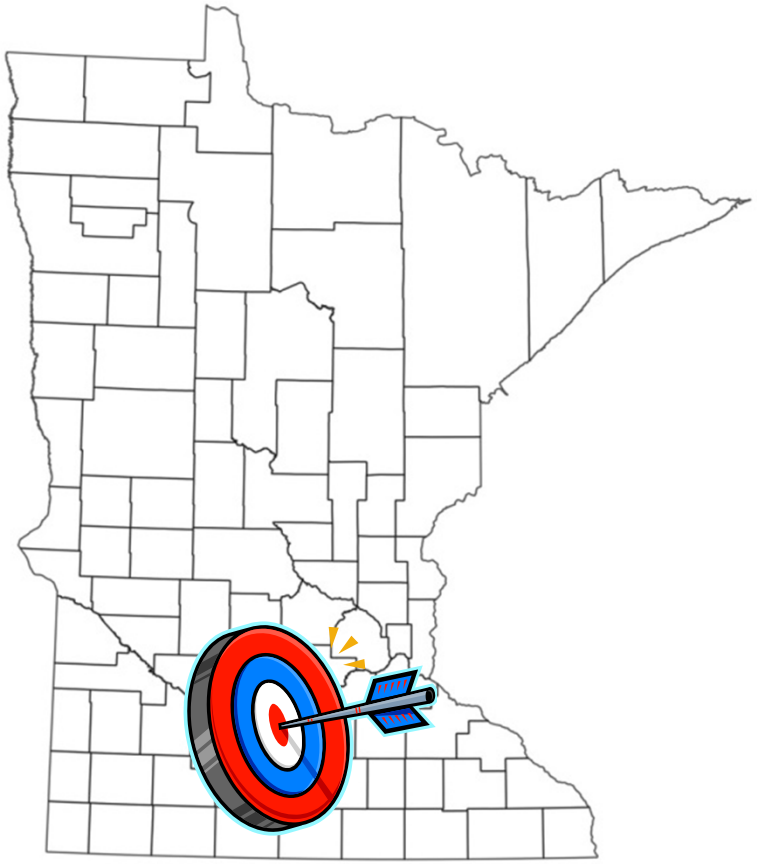
- ‘Younger’
- Have access to equipment
- Might be in an area with lower yielding/marginal lands
- Might need added income
- Not likely to be a dairy farmer

Using the Interest Data

- Many of the decided are firm in their positions, so undecided producers are needed.

- Undecided producers are key to assuring biomass supplies
  - Providing information
  - Answering their concerns
  - Giving a fair price for biomass

Part 2: Biomass Mapping



Where should I build my biomass plant?

Mapping Biomass Availability

- County Level Estimates
  - Corn production data
  - Producer Interest
  - Biomass needing to remain for conservation
- Specific Multi-County Regions Modeled
  - Eight with geographical & ecological variations
  - Used county level data
  - Two supply radii per region: 50 & 70 miles

Methods

- The mass of corn stover has a unique 1 to 1 relationship with the mass of grain.
- By looking at grain yields and acreage in a given area, we can estimated total biomass (2011 USDA-NASS data used) .
- Using GIS software, the yield data was mapped to individual counties.
- Regional estimates combine county data with producer interest and conservation.

Sample of County Results

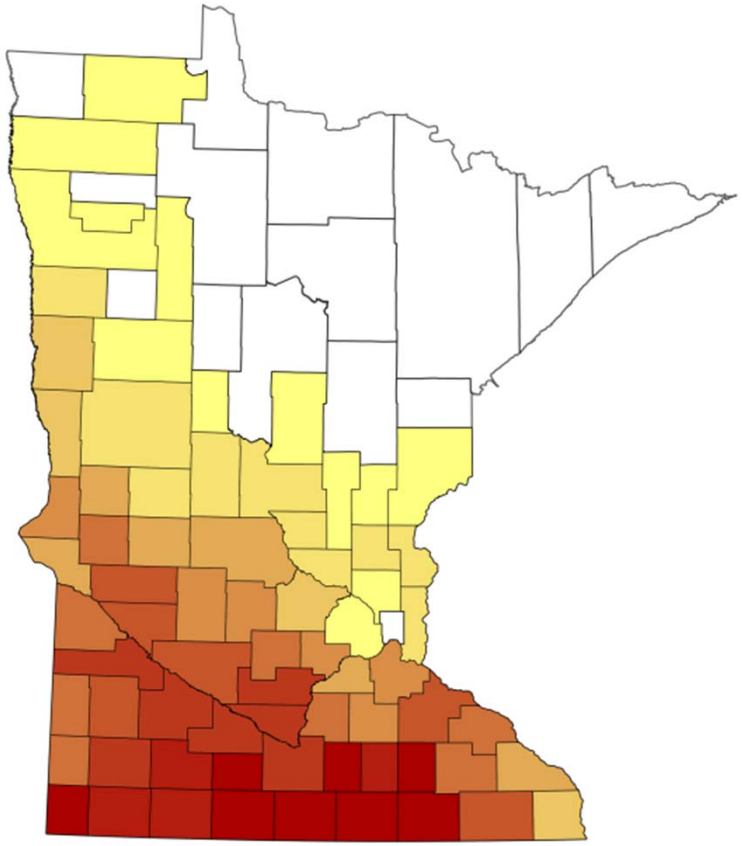
County	Harvested Corn Acres	2011 Yield	Tons per Acre	Total Tons*	County	Harvested Corn Acres	2011 Yield	Tons per Acre	Total Tons*
Anoka	6,700	119	3.34	22,399	**Morrison**	70,200	144	4.02	282,260
Becker	42,400	122	3.40	144,245	**Mower**	205,000	178	4.99	1,022,294
Benton	39,000	109	3.05	119,137	**Murray**	175,200	169	4.72	826,594
Big Stone	91,500	111	3.10	283,870	**Nicollet**	119,400	162	4.52	540,261
Blue Earth	194,600	172	4.82	937,738	**Nobles**	203,500	176	4.93	1,002,848
Brown	157,300	164	4.60	723,202	**Norman**	73,800	118	3.30	243,422
Carver	55,900	155	4.33	242,293	**Olmsted**	116,500	183	5.12	596,946
Chippewa	144,700	155	4.34	628,403	**Otter Tail**	145,400	133	3.72	540,655
Chisago	26,700	135	3.77	100,552	**Pine**	13,000	134	3.75	48,703

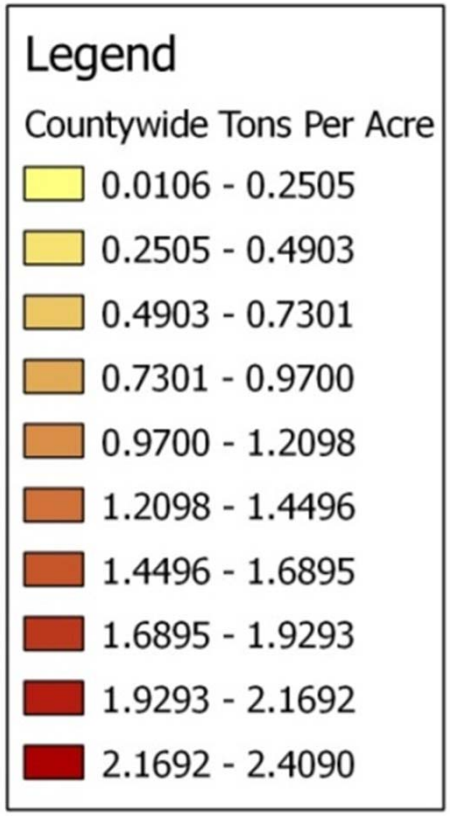
*Biomass tonnage at 15.5% Moisture

Statewide Biomass Production Map

County Corn Stover Production Density.

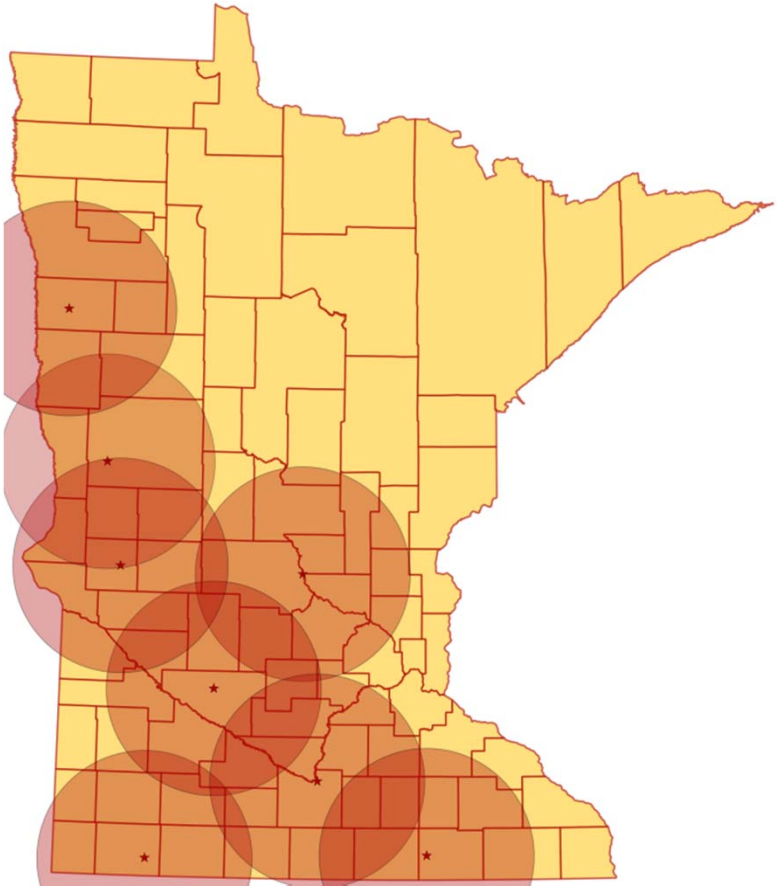
Density of biomass production in each county calculated by taking total county production and dividing by the size in acres of the entire county. Counties with no or extremely limited corn production colored in white.



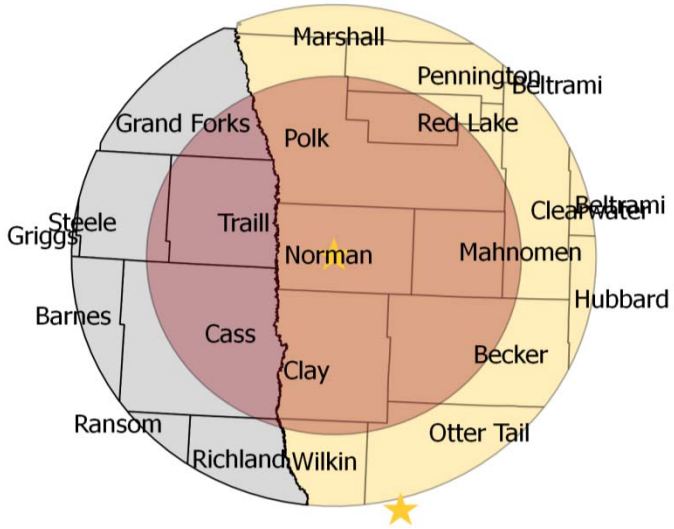


Selected Minnesota Regions

- Selected county seats
  - Had rail access
  - Along state highway
  - Typically had industry
  - Typically high population



Ada Region (70 Mile Radius)



Minnesota Counties shown for example

County	Area in Radius	Harvested Corn Acres	Corn Yield bu/acre	Total Stover Produced
Becker	905,542	41,504	121.5	141,197
Beltrami	76,000			
Clay	674,328	113,500	113.7	361,339
Clearwater	615,309	2,241	104.2	6,540
Hubbard	124,345			
Mahnomen	373,431			
Marshall	275,213	2,892	114.5	9,272
Norman	561,639	73,800	117.8	243,422
Otter Tail	546,948	55,850	132.8	207,672
Pennington	382,362			
Polk	1,279,618	60,300	124.6	210,375
Red Lake	277,055	14,000	120.7	47,314
Wilkin	303,389	56,617	120.9	191,659
	6,395,179	420,704		1,418,789

50 Mile Radius Total Production

	Participation		All Above Ground Biomass (tons)		
Region	Low	High	Minnesota	Border	Total
Ada	43.75%	56.25%	932,710	825,683	1,758,393
Fergus Falls	56.67%	68.33%	2,381,478	603,192	2,984,669
St. Cloud	47.06%	69.61%	2,824,189	-	2,824,189
Morris	48.84%	67.44%	4,584,719	437,981	5,022,700
Olivia	50.00%	67.42%	7,692,575	-	7,692,575
Mankato	38.03%	57.04%	9,047,653	177,616	9,225,270
Worthington	27.03%	51.35%	5,702,238	4,692,915	10,395,153
Austin	36.59%	58.54%	6,193,375	4,274,700	10,468,075

High and Low Participation Models

- **High Participation :**

$$\frac{Very\ Interested\ +\ Interested\ +((\ ½)\ Undecided)}{Total\ Responses}$$

- **Low Participation :**

$$\frac{Very\ Interested\ +\ Interested}{Total\ Responses}$$

50 Mile Radius Total Production

Low participation

Region	Purchasable Biomass
Ada	725,996
Fergus Falls	1,691,313
St. Cloud	1,329,030
Morris	2,452,947
Olivia	3,846,287
Mankato	3,508,201
Worthington	2,809,501
Austin	3,830,269

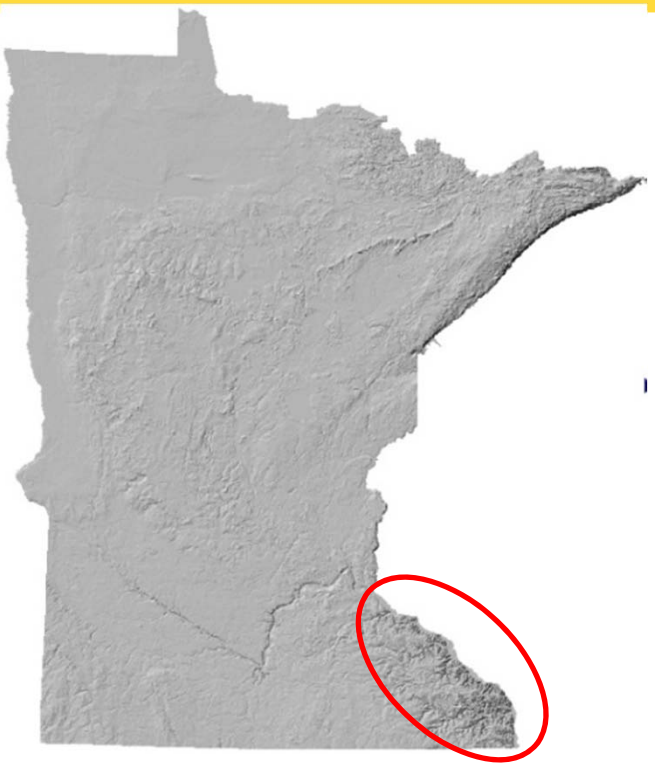
High participation

Region	Purchasable Biomass
Ada	933,424
Fergus Falls	2,039,524
St. Cloud	1,965,857
Morris	3,387,403
Olivia	5,186,660
Mankato	5,262,302
Worthington	5,338,051
Austin	6,128,011

Important Conservation Concerns

- Erosion
- Soil Carbon
- Soil Nutrients

There is not yet a firm consensus on the best method to account for soil conservation in biomass availability models. Soils, slopes, and yield variations make predictions very complex.



Area is SE Minnesota where erosion is an important concern

50 Mile Radius After Conservation

Low participation

Region	Purchasable Biomass
Ada	362,998
Fergus Falls	845,656
St. Cloud	664,515
Morris	1,226,473
Olivia	1,923,144
Mankato	1,754,101
Worthington	1,404,750
Austin	1,915,134

High participation

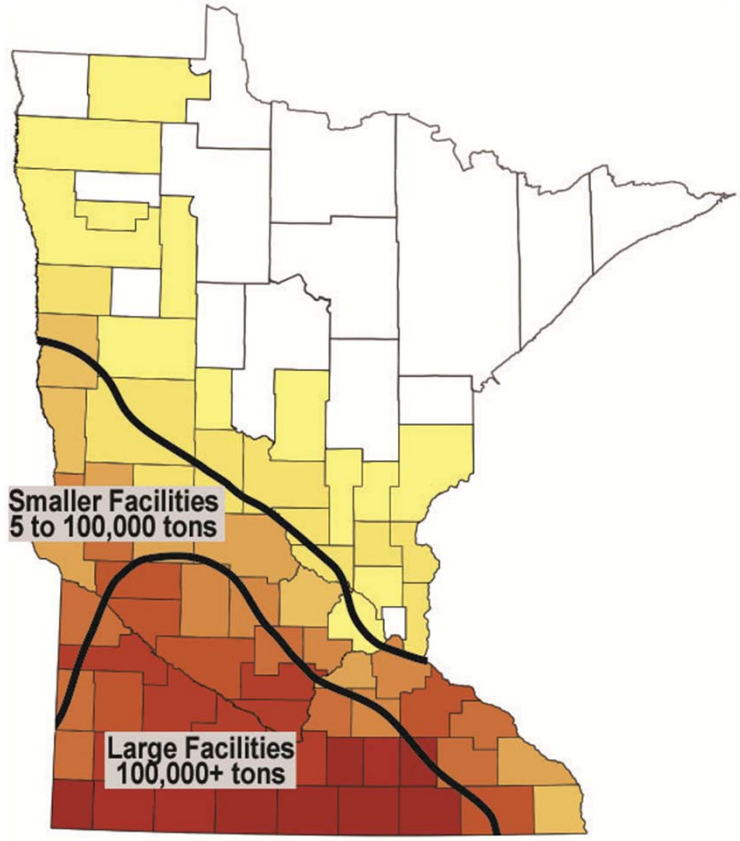
Region	Purchasable Biomass
Ada	466,712
Fergus Falls	1,019,762
St. Cloud	982,929
Morris	1,693,701
Olivia	2,593,330
Mankato	2,631,151
Worthington	2,669,026
Austin	3,064,006

Regional Conclusions

- There is a good deal of biomass
- Multiple facilities would need to consider possible competition in selecting a location
- Larger Facilities best located in S. Minn.
- Conservation may not be adequately covered in the model

Estimated Ranges for Stover Facilities

- Based on:
  - County data
  - Soils
  - Populated areas



Notes On Using This Information

- Data is a snapshot of biomass availability
- Interest will vary significantly over time
  - Grain prices
  - Weather
  - Price paid
- Still need more guidance on conservation
- These models and the GIS data can be updated as new data is added

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Interest vs Corn Price

How low would the price of corn need to be before you would consider selling biomass to supplement the corn grain income?

Correlation between Corn Price and Participation Interest **Statistical analysis indicated price and interest were significantly associated at p=0.001**

Participation Interest	Mean Corn Price
Very Interested	$5.04
Interested	$4.58
Undecided	$4.39
Not Interested	$3.94
Not at all	$4.60