

# **Appendix 1: Economic and Social Capacity Analysis of the Working Lands Watershed Restoration Program**

Survey Findings

Prepared for the Minnesota Board of Soil and Water Resources

January 3, 2018

Amit K Pradhananga

Center for Changing Landscapes

Lucia Levers

Jeffrey Peterson

Water Resources Center

University of Minnesota

## Study design and methods

The study was conducted through a self-administered mail survey of a stratified, random sample of agricultural landowners in six Minnesota watersheds: Buffalo River, Chippewa River, LeSueur River, Minnesota River- Mankato, Root River, and Sauk River watersheds.

Lists of property owners who live in the six watersheds were obtained from the counties within the watersheds. The lists were based on publicly available county tax records. The list contained landowner names, addresses, and tax classification codes. The tax classification codes, when available, were used to identify agricultural landowners. A random sample of 500 agricultural landowners from each watershed was selected, for a total of 3000 agricultural landowners. The survey was administered from August through December 2017.

Survey instruments were designed based on extensive literature review and feedback from project partners. The survey questionnaire included a variety of fixed-choice and scale questions. Several questions were adapted from survey instruments used in previous studies of attitudes, beliefs and values of conservation behaviors (Pradhananga and Davenport, 2017; Pradhananga, Perry, & Davenport, 2014; Davenport, Pradhananga, & Olson, 2014; Davenport & Pradhananga, 2012). Each questionnaire was labeled with a unique identification number to track responses for subsequent mailings. An adapted Dillman's (2014) Tailored Design Method was used to increase response rates. The survey was administered in three waves. Each wave of mailing included the questionnaire, a cover letter, a fact sheet about perennial and cover crops, and a self-addressed, business reply envelope.

Returned questionnaires were logged into the respondent database. Response data were numerically coded and entered into a database using Microsoft Excel 2010. Statistical analyses were conducted using Statistical Package for Social Sciences (SPSS release 21.0). Basic descriptive statistics were conducted to determine frequency distributions of individual variables. Inferential statistics were conducted to test for significant differences between respondent subgroups.

Subgroup comparisons were conducted by age groups (28 – 63, vs. over 64 years of age), percent income dependent on agriculture (less than 50% vs. 50% or more), land tenure (property owners vs. renters), and land size (small, including respondents who farmed fewer than 200 acres vs. large, including respondents who farmed 200 acres or more in 2016). Respondent subgroups were compared for differences in their familiarity with perennial or cover crops (survey question 14), current use of perennial or cover crops (survey question 15), and likelihood of planting perennial or cover crops on their farm in the next five years (survey question 17). Appropriate inferential statistical tests (t-tests for familiarity and likelihood of future use, and chi-square test for past use of perennial or cover crops) were conducted.

## Summary of findings

Overall, 430 respondents completed and returned the questionnaire for a response rate of 17.4%. The findings are organized into four sub-sections. Complete statistics for all survey questions in aggregate are presented in tabular form in Appendix A. Summary statistics for key survey questions (familiarity with, past use, and likelihood of future use of perennial and cover crops) by watershed are presented in tabular form in Appendix B. Findings from subgroup comparisons are presented in tabular form in Appendix C.

### 1. Respondent profile

- Most respondents were male (91%), and white (100%) with a median age of 63 (Appendix A, Table 2).
- About half of the respondents have at least an associate or vocational degree (56%), and a majority (56%) reported total household income of over \$75,000 (Appendix A, Table 2).
- Farming experience, in years of farming, ranged between 0 and 100, with a median of 33 years (Appendix A, Table 2).
- Almost two-thirds of respondents (64%) make their own decisions on their farm, and 43% of respondents reported that over 50% of their income is dependent on agricultural production (Appendix A, Table 3).
- Median acres farmed in 2016 was 185 acres (Appendix A, Table 4).

### 2. Familiarity with perennial or cover crops

On average, respondents are most familiar with alfalfa (Mean = 1.46), followed by annual cover crops and small grains (Mean = 1.05). Over three-fourths of respondents reported that they are moderately to very familiar with alfalfa (75%). In contrast, a majority of respondents reported that they are not at all familiar with kernza (67%) and winter-hardy oilseeds such as camelina and field pennycress (73%) (Appendix A, Table 12, Figure 1).

- A majority of respondents in each watershed reported that they are somewhat to very familiar with alfalfa

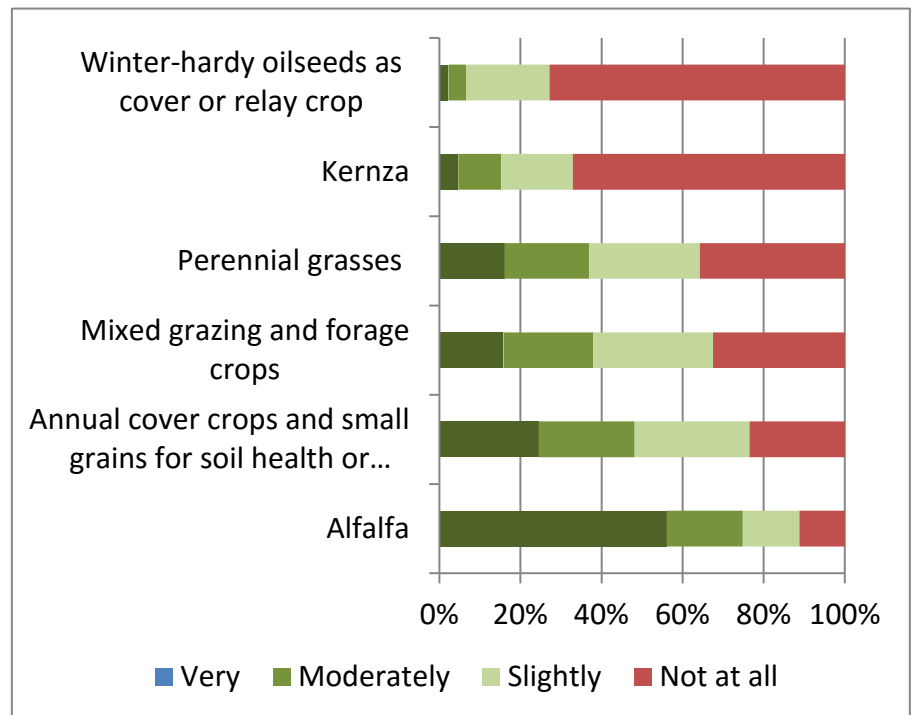
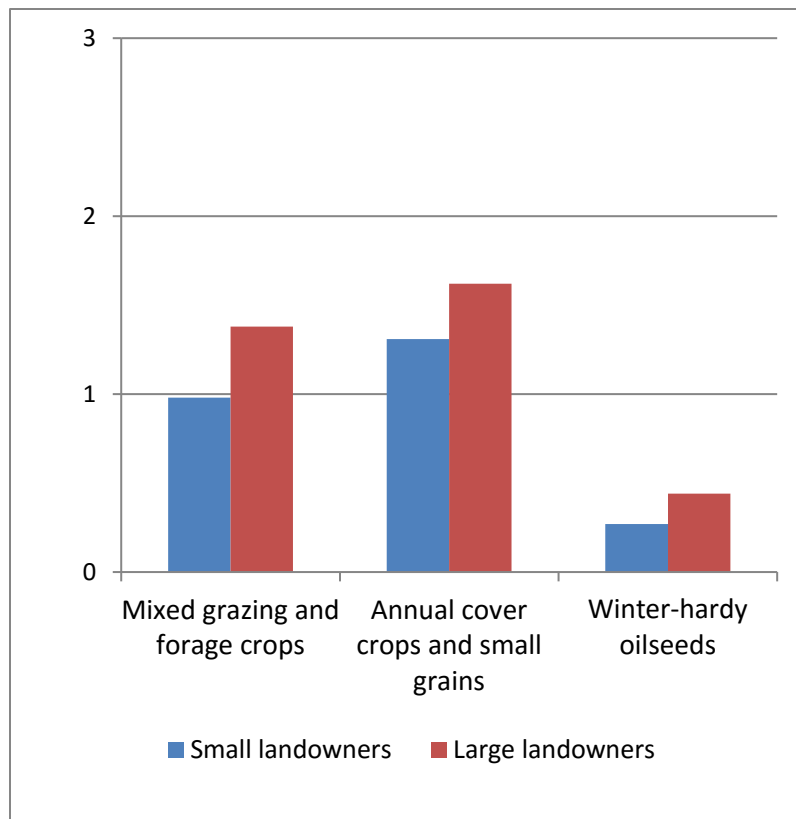


Figure 1. Respondents' familiarity with perennial or cover crops (n ≥ 407)

(68% in Buffalo River, 83% in Sauk River and Minnesota River-Mankato watersheds) (Appendix B, Table 1). Most respondents were not at all familiar with winter-hardy oilseeds in all watersheds (66% in Buffalo River, 85% in Sauk River) (Appendix B, Table 2).

- Some notable differences emerged between respondents who depend on agricultural production for less than 50% of their income and 50% or more of their income in their familiarity with perennial or cover crops. On average, respondents who depend on agricultural production for 50% or more of their income are more familiar with alfalfa (Mean, 50% or more of income = 2.34, Less than 50% income = 2.04) and annual cover crops and small grains (Mean, 50% or more of income = 1.60, Less than 50% income = 1.36) than respondents who depend on agricultural production for less than 50% of their income (Appendix C, Table 5).
- Differences also emerged between farm owners and renters in their familiarity with perennial or cover crops. Renters were more familiar with mixed grazing and forage crops (Renters mean = 1.33, Owners mean = 1.12) and annual cover crops and small grains (Renters mean = 1.64, Owners mean = 1.37) than farm owners (Appendix C, Table 8).
- There were statistically significant differences between small and large landowners (small = fewer than 200 acres farmed, large = 200 acres or more farmed). Large landowners are more familiar with mixed grazing and forage crops (Large mean = 1.38, Small mean = 0.98), annual cover crops and small grains (Large mean = 1.62, Small mean = 1.31), and winter-hardy oilseeds (Large mean = 0.44, Small mean = 0.27) than small landowners (Appendix C, Table 11, Figure 2).

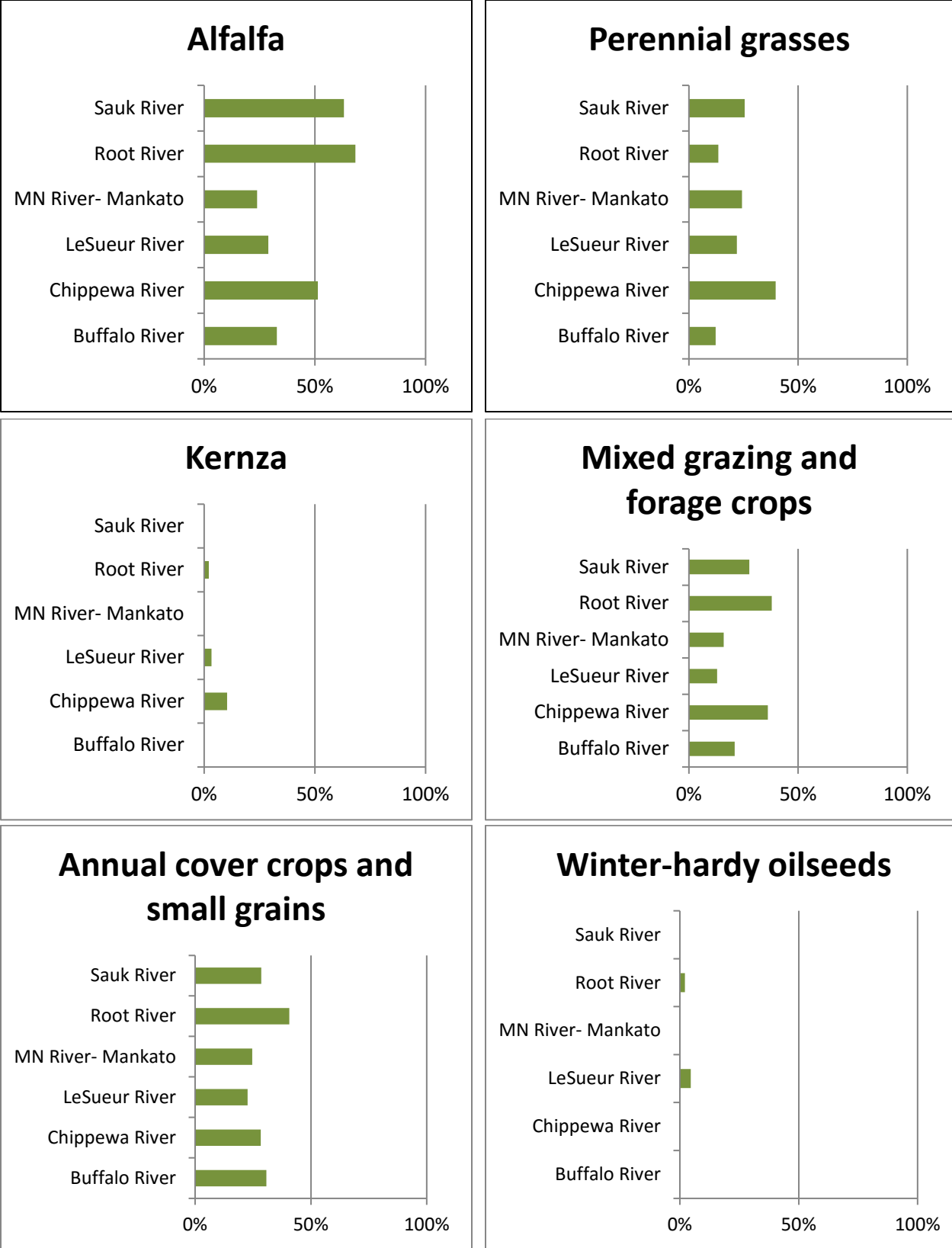


**Figure 2. Mean ratings of respondents' familiarity with perennial and cover crops by land size**

Responses on a four-point scale from not at all familiar (0) to very familiar (3)

### 3. Past use of perennial or cover crops

- A majority of respondents reported that they have not planted any of the six perennial or cover crops on their farm in the past 10 years (Appendix A, Table 13).
- A majority of respondents in Chippewa River (51%), Root River (68%), and Sauk River (63%) watersheds reported that they have planted alfalfa on their farm in the past 10 years. Between 0% (Buffalo River, Minnesota River-Mankato, and Sauk River watersheds) and 10% (Chippewa River watershed) reported that they have planted Kernza on their farm in the past 10 years. Similarly, very few respondents (between 0% to 5%) of respondents across the watersheds reported that they have planted winter-hardy oilseeds on their farm in the past 10 years (Appendix B, Table 3, Figure 3).
- Important differences were identified among respondents by age group (i.e., 28-63 vs. 64 or more) in their use of perennial or cover crops in the past 10 years. A greater proportion of respondents between the ages of 28 to 63 reported planting mixed grazing and forage crops (32%) , and annual cover crops and small grains (36%) than respondents who are 64 years or older (Appendix C, Table 3).
- There were statistical differences between respondents who depend on agricultural production for less than 50% of their income and 50% or more of their income in their use of perennial or cover crops. A greater proportion of respondents who depend on agricultural production for 50% or more of their income (35%) reported planting annual cover crops and small grains on their farm than respondents who depend on agricultural production for less than 50% of their income (22%) (Appendix C, Table 6).
- Statistical differences also emerged between respondents who own and rent their land. A greater proportion of respondents who rented their land for farming (34%) reported planting annual cover crops and small grains than respondents who own the land they farmed (24%) (Appendix C, Table 9).
- Similarly, there was a statistically significant difference between small and large landowners in their use of perennial or cover crops. A greater proportion of large landowners (35%) reported planting annual cover crops and small grains than small landowners (22%) (Appendix C, Table 12).

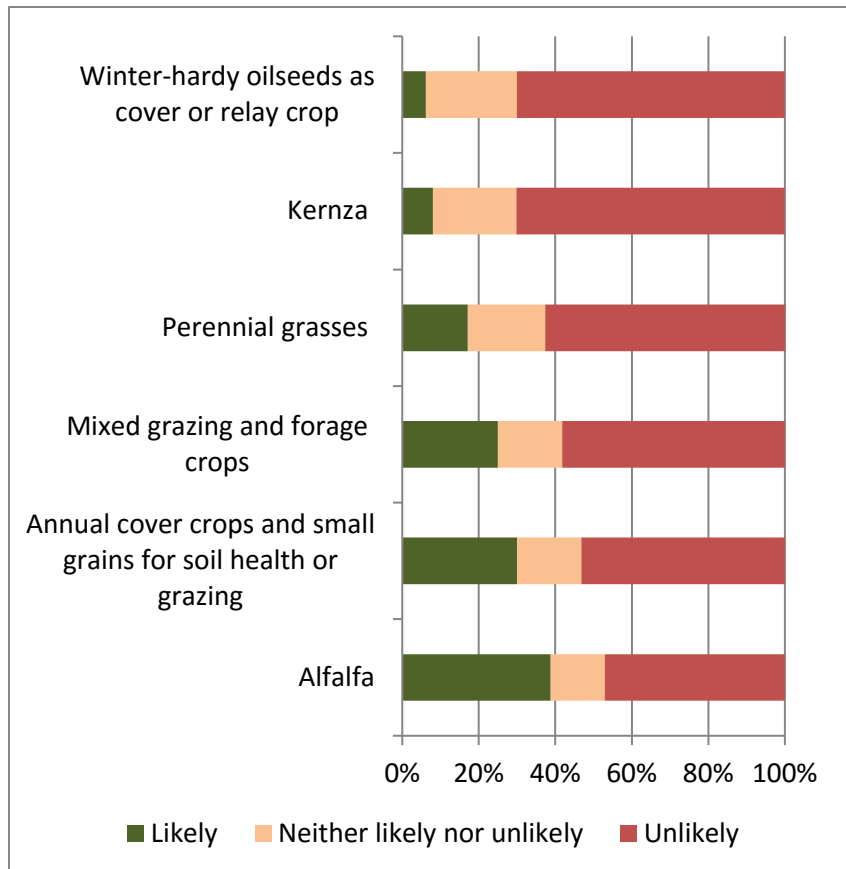


**Figure 3. Percent of respondents who have planted perennial or cover crops on their farm in the past 10 years**

#### 4. Likelihood of future use of perennial or cover crops

Over one-third of respondents (39%) are somewhat to very likely to plant alfalfa on their farm in the next five years. Most respondents reported that they are somewhat to very unlikely to plant perennial or cover crops such as winter-hardy oilseeds (70%), kernza (70%), and perennial grasses (63%) (Appendix A, Table 16, Figure 4).

- While a majority of respondents in Root River (59%) and Sauk River (57%) reported that they are somewhat to very likely to plant alfalfa on their farm in the next five years, between 20% (LeSueur River) and 42% (Chippewa River) reported that they are somewhat to very likely to plant alfalfa on their farm (Appendix B, Table 4). Most respondents across all watersheds reported that they are somewhat to very unlikely to plant crops such as winter-hardy oilseeds, and kernza (Appendix B, Tables 4 and 5).



**Figure 4. Respondents' likelihood of planting perennial or cover crops on their farm in the next five years (n ≥ 399)**

- Statistical differences emerged among respondents by age group. Respondents who are 64 years or older (Mean = -0.74) on average reported that they are less likely to plant annual cover crops and small grains than respondents between the ages of 28 and 63 (Mean = -0.34) (Appendix C, Table 2).
- Respondents who depend on agricultural production for 50% or more of their income (Mean = -1.01) were less likely to plant perennial grasses than respondents who depend on agricultural production for less than 50% of their income (Mean = -0.71) (Appendix C, Table 5).
- Respondents who own their farm (Mean = -0.70), on average, were less likely to plant annual cover crops and small grains in the next five years than respondents who rent their farm (Mean = -0.36) (Appendix C, Table 8).
- Small landowners (Mean = -0.69), on average, reported that they are less likely to plant annual cover crops and small grains in the next five years than large landowners (Mean = -0.36) (Appendix C, Table 11).

## 5. Barriers to conservation program participation

On average, the “red tape” involved in conservation programs, long term commitment required for conservation programs, and payments that are not high enough to account for the risk of changing their system were the top three barriers for respondents’ participation in conservation programs. A majority of respondents (61%) somewhat to strongly agreed that there is too much “red tape” involved in conservation programs. Most respondents somewhat to strongly agreed that conservation programs require long term commitment (51%) and that payments are not high enough to account for the risk of changing their system (51%) (Appendix A, Table 10, Figure 5).

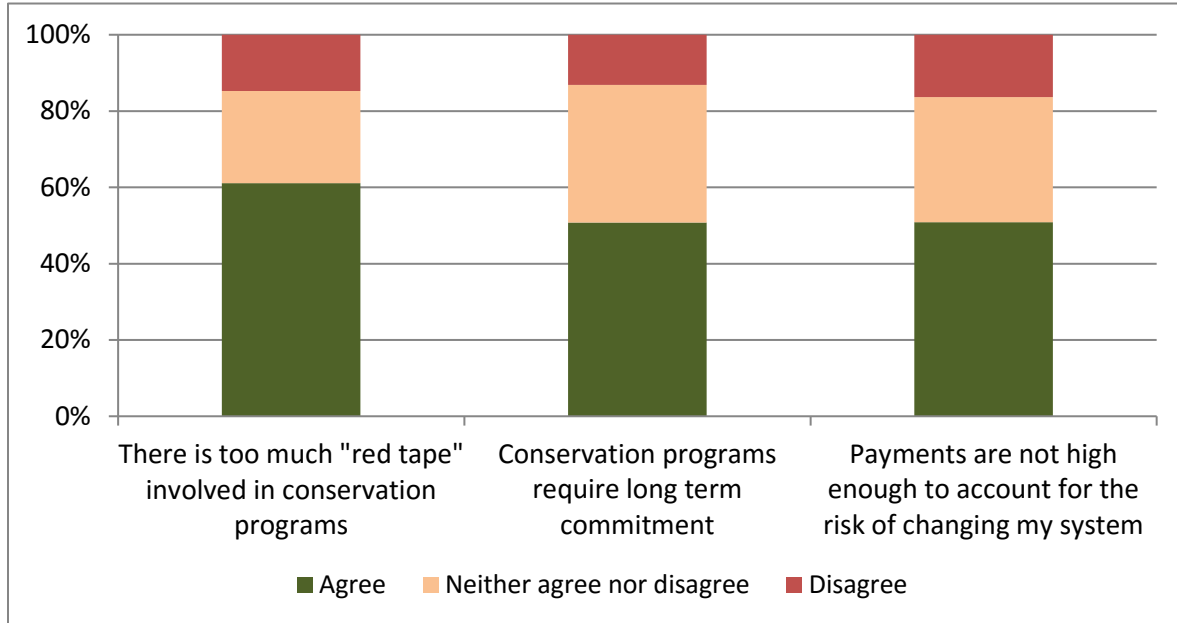
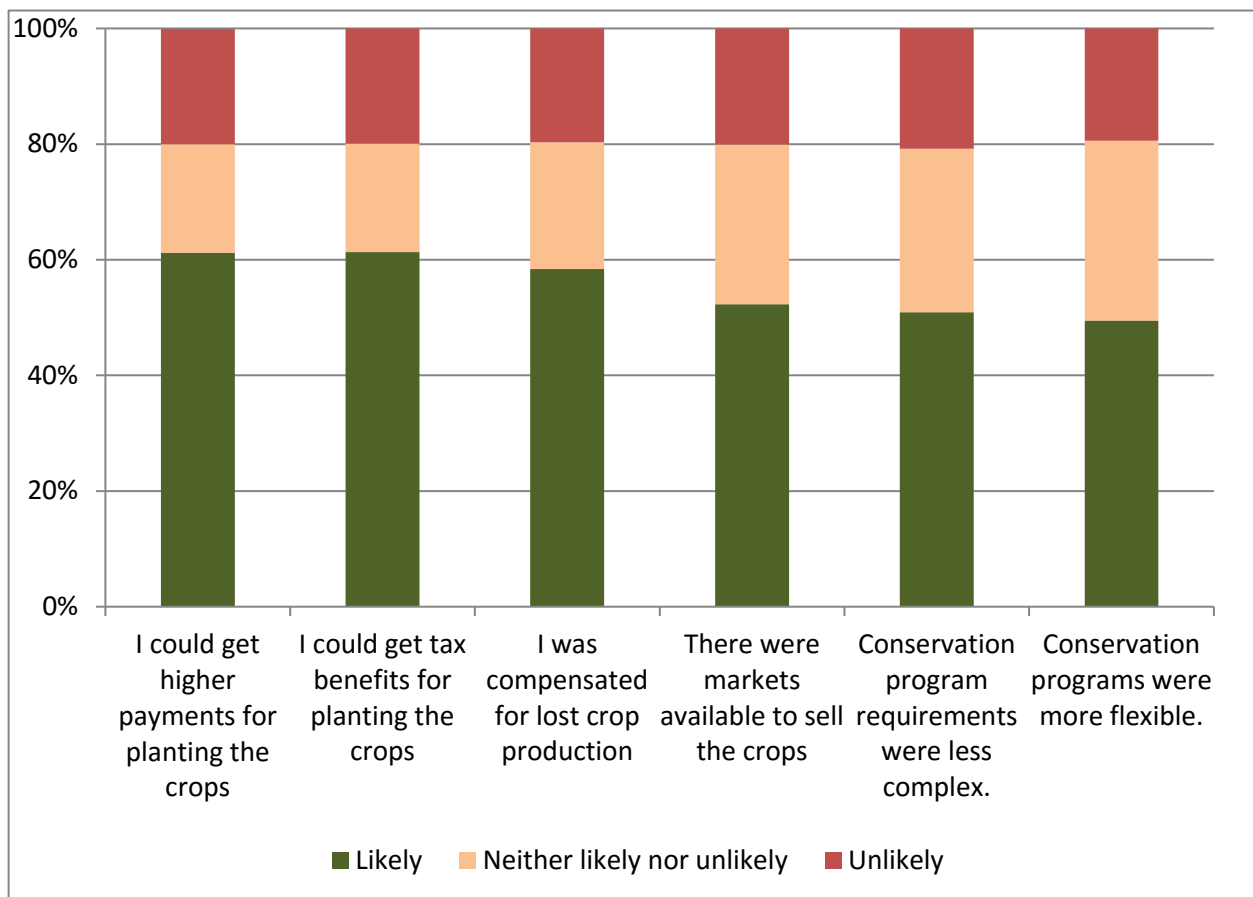


Figure 5. Respondents’ perceived barriers to conservation program participation (n ≥ 385)

## 6. Factors influencing perennial/cover crop adoption

On average, financial incentives appear to be the most important motivation for future use of perennial or cover crops. A majority of respondents reported that they are somewhat to very likely to plant perennial or cover crops if they could get higher payments (61%) and tax benefits (61%) for planting the crops, and if they were compensated for lost crop production (58%). Most respondents were also more likely to plant perennial or cover crops if there were markets available to sell the crops (52%). Reducing complexity and increasing flexibility of conservation programs also appear to be important motivators for respondents. Most respondents were somewhat to very likely to plant perennial or cover crops in the next five years if conservation program requirements were less complex (51%). About half of the respondents (50%) were more likely to plant perennial or cover crops if conservation programs were more flexible (Appendix A, Table 21, Figure 6).





**Figure 6. Respondents' motivations for planting perennial or cover crops on their farm in the next five years (n ≥ 371)**

## Summary of Preliminary Statistical Analysis

The survey provided information on potential crop subsidy programs and collected data on whether survey takers would be willing to participate in programs of varying subsidy amount, contract length, and species. Overall, *the results indicate that farmers would be willing to accept a substantially lower payment to grow cover crops, than they would be to grow an alternative crop.*

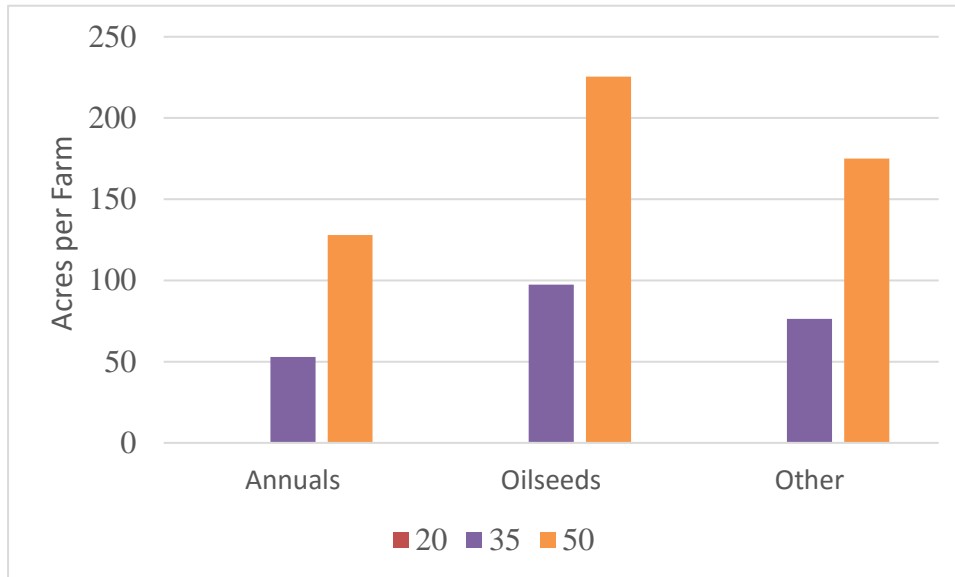
For Question 22, the survey collected data on participating in a five year contract for winter cover crops. Survey-takers were asked which crops they would consider, and how much land they would enroll for a net gain of a certain amount.

For Question 23, the survey collected data on perennial crop alternatives programs. Survey-takers were asked three questions comparing two different programs. For example, one question that some survey takers received asked if they would choose a program for \$50/acre with a 5 year contract length, a program for \$150/acre with a 15 year contract length, or none. We also collected data on which alternative crop(s) survey takers would be likely to grow on their unproductive land. We have produced the following preliminary results:

## 7. Question 22: Winter Cover Crops

Participation in a program to grow winter cover crops was dependent on the additional net benefit the survey-taker would receive, as well as the crop they would consider. Oilseeds required a higher payment than annual cover crops or other crops. See Figure 7.

- \$20 per acre would not result in significant program participation.
- \$35 would result in between 53 and 97 acres per farm.
- \$50 would result in between 128 and 225 acres per farm. See Figure 1.



**Figure 7. Acres per farm that a farmer would enroll in a winter cover crop program dependent on crop considered (Annual cover crops and small grains, Winter-hardy oilseeds, or other) and additional net value received (\$20, \$35, or \$50).**

### 8. Question 23: Alternative Perennial Crops

Participation in a program to grow alternative crops was dependent on the crop considered, as well as contract length and program price. Those who considered Kernza were most likely to participate in a program when compared to survey takers who stated they would consider growing alfalfa, perennial grasses, or mixed forbs. However, 95% confidence intervals are quite large (Mixed: [3.9, 14.8], Kernza: [4.3,308.3], Perennial:[4.5, 14.7], Alfalfa: [3.7,10.9]). See Figure 8. These results were obtained with a logistical regression, predicting the likelihood of any contract acceptance dependent on crop considered (Question 23D).

When survey-takers would consider growing perennial grasses vs. not, they were more likely to choose longer contract lengths. Shorter contracts were preferred when survey-takers considered growing mixed forages or Kernza (these results were only for those who would choose to participate in specific subsidy programs). See Figure 9. These results were obtained with a logistical regression performed on subsets of specific crops (Question 23D), predicting the likelihood of contract acceptance dependent on contract length.

The predicted payment survey-takers would accept to grow alternative crops (willingness to accept) was larger when the contract length was longer, if the considered crop was alfalfa or mixed forages. This was not true for perennial grasses. Rates ranged from about \$100 to \$137 for 5-year contracts, to about \$159 to \$170 for 15-year contracts. See Figure 10. These results were obtained with a logistical regression performed on subsets of specific crops (Question 23D), predicting the willingness to accept, and dependent on contract length. There were not enough Kernza data points to generate results.

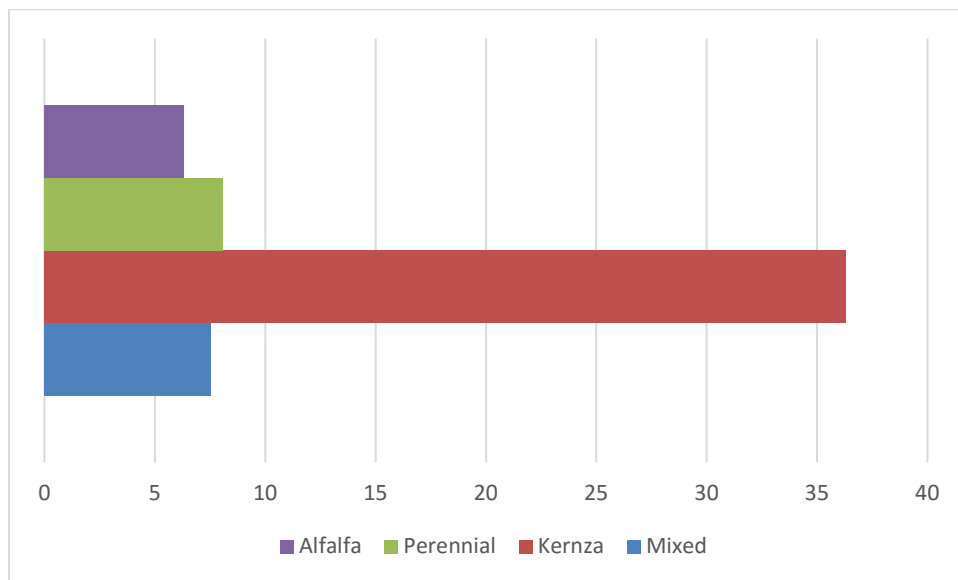
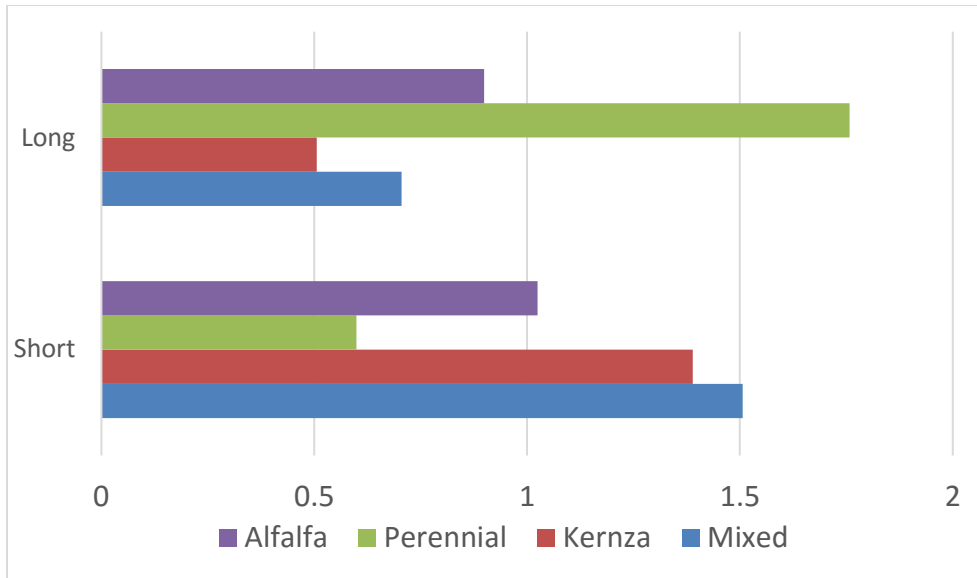


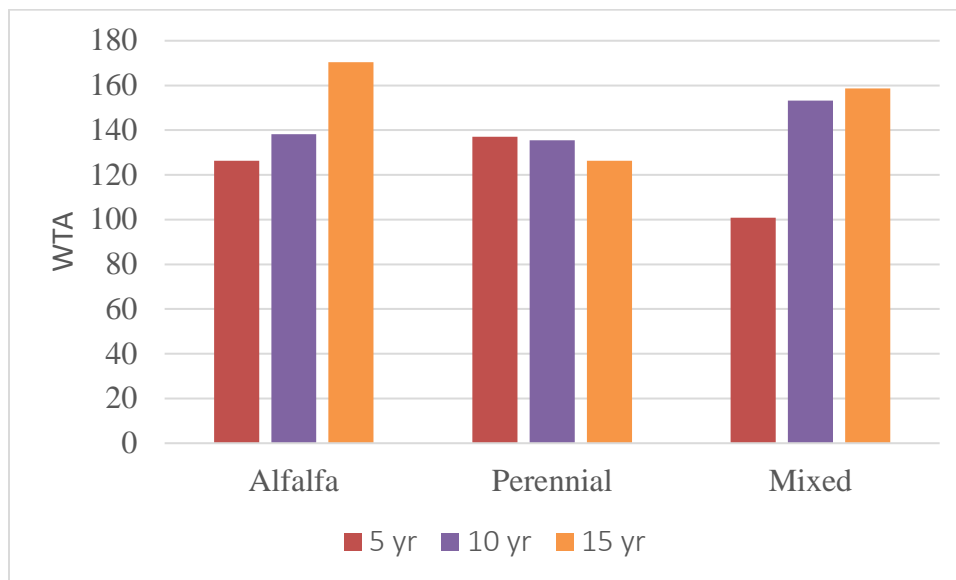
Figure 8. Likelihood ratio of participation vs non-participation given indicated crop choice



**Figure 9. Likelihood ratio of choosing short contract lengths (5 yrs) or long contract lengths (15 yrs) when survey-takers would consider specific crops**

**Table 1: 95% Confidence Intervals for Figure 9**

	Alfalfa		Perennial		Kernza		Mixed	
Short	0.55	1.92	0.32	1.14	0.34	5.64	0.71	3.20
Long	0.49	1.65	0.91	3.39	0.16	1.58	0.36	1.37



**Figure 10: Willingness to accept (WTA) contract price as a function of contract length and species considered**

## References

- Davenport, M.A., Pradhananga, A. & Olson, B. (2014). Cannon River watershed: Landowner survey on water resources and conservation action. Interim Report. 72pp.
- Davenport, M.A., & Pradhananga, A. (2012). Perspectives on Minnesota water resources: A survey of Sand Creek and Vermillion River watershed landowners. 84 pp.
- Dillman, D. A., Smyth, J.D. & Christian, L.M. (2014). *Internet, phone, mail, and mixed-mode surveys: the tailored design method*. John Wiley & Sons: Hoboken, NJ.
- Pradhananga, A. & Davenport, M.A. (2017). An assessment of landowner conservation behavior in Nicollet County, Minnesota. A final technical report submitted to Nicollet County. 89pp.
- Pradhananga, A., Perry, V. & Davenport, M.A. (2014). A social science assessment of conservation practices in the Red River Basin of Minnesota. A final technical report prepared for the Northwest Regional Sustainable Development Partnership. 113pp.

## **Appendix A: Summary Statistics**

Table 1. Response rate by watershed

	No. of completed surveys	Response rate
Buffalo River	73	17.0%
Chippewa River	81	19.5%
LeSueur River	78	18.4%
Minnesota River-Mankato	74	16.8%
Root River	66	15.6%
Sauk River	58	17.1%
<b>Total</b>	<b>430</b>	<b>17.4%</b>

Table 2. Respondents' sociodemographic characteristics

Socio-Demographic Characteristics		N	Percent
Gender	Male	367	90.6
	Female	38	9.4
Race	White	404	100.0
	Non-white	0	0.0
Age	Median	63.0	-
	Minimum	28.0	-
	Maximum	96.0	-
Years farming	Median	33.0	-
	Minimum	0.0	-
	Maximum	100.0	-
Formal education	Did not finish high school	10	2.5
	Completed high school	111	27.5
	Some college but no degree	56	13.9
	Associate or vocational degree	91	22.5
	College bachelor's degree	78	19.3
	Some college graduate work	20	5.0
	Completed graduate degree (MS or PhD)	38	9.4
Household income	Under \$20,000	16	4.5
	\$20,000-\$49,999	62	17.5
	\$50,000-\$74,999	77	21.8
	\$75,000-\$99,999	54	15.3
	\$100,000-\$149,999	64	18.1
	\$150,000-\$199,999	31	8.8
	\$200,000-\$249,999	13	3.7
	\$250,000-\$299,999	7	2.0
	\$300,000 or more	30	8.5

Source: A study of farming practices in Minnesota, Questions 5, 29, 30, 31, 32, and 33

Table 3. Respondents' property characteristics

Property Characteristics		N	Percent
Percent income dependent on agricultural production	0% - 25%	170	41.3
	26% - 50%	64	15.5
	51% - 75%	36	8.7
	76% - 100%	142	34.5
Management decisions on farm	I make my own decisions	270	63.5
	I leave it up to the landlord	7	1.6
	I leave it up to my renter	93	21.9
	I hired a land manager	7	1.6
	I work together with the renter/landlord to make decisions	48	11.3
Willing to bring livestock on land for grazing	Yes	157	37.6
	No	260	62.4

Source: A study of farming practices in Minnesota, Questions 4, 6, and 7

\*Respondents could select multiple options

Table 4. Respondents' property size and land tenure

	N	Percent	Mean	Median
Total acres farmed in 2016	393	100.0	504.4	185.0
Land tenure*				
Acres I farm that I own	277	66.3	414.7	200.0
Acres I farm that I rent	169	40.4	496.5	290.0
Acres I farm that I lease to someone else to farm	171	40.9	217.5	147.0
Acres I own that I don't farm	105	25.1	243.9	45.0
Other (e.g., buildings, pasture)	24	5.7	134.0	57.5

Source: A study of farming practices in Minnesota, Questions 1 and 2

\*Respondents could select multiple options



Table 5. Respondents' acres owned or leased by crop type

	Total acres owned	Total acres leased	Total acres owned or leased	Percent of total acres
Corn	53,405.8	34,359.6	87,765.4	41.7
Soybeans	42,061.1	33,345.8	75,406.9	35.9
Wheat	6,018.3	3652.0	9,670.3	4.6
Alfalfa	4,867.3	1459.0	6,326.3	3.0
Forage or grazing crops	3,615.0	1290.0	4,905.0	2.3
Corn silage	2,022.0	671.0	2,693.0	1.3
Sugarbeets	2,924.0	1990.0	4,914.0	2.3
Vegetables	1,045.0	200.0	1,245.0	0.6
Fruits/nuts	97.0	1.0	98.0	0.0
Perennial or cover crops	4,331.0	1465.0	5,796.0	2.8
Conservation programs	6,498.1	1054.0	7,552.1	3.6
Other (e.g., buffer, wetlands, pasture)	3,152.3	695.0	3,847.3	1.8
<b>Total acres</b>	<b>130,036.9</b>	<b>80,182.4</b>	<b>210,219.3</b>	<b>100.0</b>

Source: A study of farming practices in Minnesota, Question 3

Table 6. Respondents' experience with programs that offer financial incentives to farmers for conservation practices

	N	Percent
Not relevant for my farm	54	12.7
Never heard of any	29	6.8
Familiar but not enrolled	120	28.2
Enrolled in the past, but not currently enrolled	62	14.6
Currently enrolled	161	37.8
<b>Total</b>	<b>426</b>	<b>100.0</b>

Source: A study of farming practices in Minnesota, Question 8

Table 7. Respondents' conservation expenses in the past 10 years

	N	Percent
No conservation expenditure	138	33.2
Less than \$5000	138	33.2
\$5,000 to \$9,999	56	13.5
\$10,000 to \$19,999	30	7.2
\$20,000 to \$29,999	16	3.8
\$30,000 to \$49,999	12	2.9
\$50,000 to \$74,999	10	2.4
\$75,000 to \$99,999	5	1.2
\$100,000 to \$199,999	5	1.2
\$200,000 or more	6	1.4
<b>Total</b>	<b>416</b>	<b>100.0</b>

Source: A study of farming practices in Minnesota, Question 9

Table 8. Respondents' participation in conservation programs in the past 10 years

	Yes		No	
	N	%	N	%
Conservation Reserve Program (CRP)	187	46.9	212	53.1
Environmental Quality Incentive Program (EQIP)	57	17.3	273	82.7
State cost-share funds	39	12.2	280	87.8
Conservation Reserve Enhancement Program (CREP)	32	9.8	294	90.2
Conservation Stewardship Program (CSP)	36	8.4	288	67.0
Reinvest in Minnesota (RIM) Reserve Program	26	7.9	32	92.1
Other State conservation programs (e.g., buffer strip, terracing)	11	3.7	286	96.3
Other federal conservation programs (e.g., prairie restoration, erosion control)	8	2.6	300	97.4
Wildlife Habitat Incentive Program (WHIP)	8	2.5	306	97.5
Other local conservation programs (e.g., county buffer, land stewardship)	6	2.0	287	98.0

Source: A study of farming practices in Minnesota, Question 10

Table 9. Respondents' satisfaction with conservation programs

	N	Mean <sup>a</sup>	SD	Very dissatisfied <sup>b</sup>	Somewhat dissatisfied	Neither satisfied nor dissatisfied	Somewhat satisfied	Very satisfied
Conservation Reserve Program (CRP)	212	0.82	1.12	4.2	9.0	21.2	32.1	33.5
Environmental Quality Incentive Program (EQIP)	100	0.55	1.04	5.0	2.0	50.0	19.0	24.0
Conservation Stewardship Program (CSP)	84	0.45	0.88	2.4	2.4	59.5	19.0	16.7
State cost-share funds	87	0.33	1.06	8.0	2.3	56.3	14.9	18.4
Conservation Reserve Enhancement Program (CREP)	75	0.12	0.87	5.3	5.3	72.0	6.7	10.7
Other federal conservation programs (e.g., prairie restoration, erosion control)	58	0.03	0.59	1.7	5.2	86.2	1.7	5.2
Wildlife Habitat Incentive Program (WHIP)	61	0.03	0.71	4.9	3.3	80.3	6.6	4.9
Other State conservation programs (e.g., buffer strip)	63	0.02	0.68	4.8	3.2	82.5	4.8	4.8
Other local conservation programs (e.g., county buffer, land stewardship)	63	0.00	0.78	7.9	0.0	82.5	3.2	6.3
Reinvest in Minnesota (RIM) Reserve Program	80	-0.11	0.98	13.8	5.0	67.5	6.3	7.5

<sup>a</sup>Responses on a five-point scale from very dissatisfied (-2) to very satisfied (2)

<sup>b</sup>Percent

Source: A study of farming practices in Minnesota, Question 11; SD = Standard Deviation

Table 10. Respondents' reported constraints to participation in conservation programs

	N	Mean <sup>a</sup>	SD	Strongly disagree <sup>b</sup>	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
There is too much "red tape" involved in conservation programs	386	0.68	1.14	6.0	8.8	24.1	33.7	27.5
Conservation programs require long term commitment	388	0.49	1.01	4.6	8.5	36.1	34.5	16.2
Payments are not high enough to account for the risk of changing my system	385	0.49	1.08	4.9	11.4	32.7	31.4	19.5
The application process is too complicated	383	0.38	1.01	5.0	11.2	37.9	32.6	13.3
Market prices encourage growing conventional crops (i.e., corn, soybeans) instead of participating in conservation programs	387	0.36	1.15	8.0	11.4	36.2	25.3	19.1
Documenting compliance would be too complicated and time consuming	382	0.36	1.04	5.5	11.8	37.4	31.7	13.6
Conservation programs have penalties for early termination	382	0.34	0.95	3.4	9.9	50.0	23.0	13.6
Conservation programs have a maximum income limitation for enrollment	377	0.16	0.91	6.1	8.0	58.9	18.3	8.8
Crop insurance makes it worth planting on more marginal land instead of placing it in conservation programs	385	0.12	1.09	8.3	16.1	44.7	17.4	13.5
Conservation program do not fit with my business plans	378	0.06	1.00	7.7	15.3	48.1	20.6	8.2
Conservation programs require me to get tenant's permission before enrollment	378	0.03	0.92	9.8	5.3	62.7	16.1	6.1
I don't want to work with a government agency on a conservation program	385	0.00	1.24	16.9	13.8	34.5	22.3	12.5
Conservation programs do not provide help with maintaining the conservation practice/crops	383	-0.10	1.03	11.7	16.7	48.3	16.4	6.8
Conservation practices installed decreases the overall productivity of my farm	384	-0.13	1.12	15.1	16.1	44.0	16.4	8.3
I don't have sufficient natural resource concerns on my farm to warrant participating in a conservation program	388	-0.13	1.28	20.9	15.2	32.2	19.8	11.9
Agency/organization staff are not responsive to my needs and interests	381	-0.15	1.07	13.4	17.1	48.6	12.9	8.1
Conservation programs often require me to allow hunting or other recreational use of my land by the public	385	-0.17	1.18	17.9	15.3	42.6	14.3	9.9
My farm is not eligible for enrollment	383	-0.30	1.06	18.3	14.9	50.1	11.5	5.2
I don't have sufficient control over conservation decisions	382	-0.32	1.31	25.9	17.8	30.1	15.2	11.0
Conservation programs often have negative environmental impacts on my farm	379	-0.56	1.09	26.6	17.9	44.9	5.5	5.0
I am not aware of any conservation programs	382	-0.61	1.24	34.0	18.1	27.7	14.9	5.2

<sup>a</sup>Responses on a five-point scale from strongly disagree (-2) to strongly agree (2)

<sup>b</sup>Percent

Source: A study of farming practices in Minnesota, Question 12; SD = Standard Deviation

Table 11. Percent of respondents who have converted any portion of their farm from single annual row crops to perennial crops or added cover crops to their row crop acreage in the past 10 years

	N	Yes <sup>a</sup>	No	Acres in crop		Percent of
				Total	Mean	property in crop
						Mean
Perennial crops	388	22.4	77.6	6754.0	75.9	36.9
Cover crops	371	18.9	81.1	9075.0	131.5	35.2

<sup>a</sup>Percent

Source: A study of farming practices in Minnesota, Question 13

Table 12. Respondents' familiarity with perennial or cover crops

	N	Mean <sup>a</sup>	SD	Familiarity			
				Not at all familiar <sup>b</sup>	Slightly familiar	Moderately familiar	Very familiar
Alfalfa	421	2.20	1.05	11.2	14.0	18.8	56.1
Annual cover crops and small grains (e.g., winter rye, oats, winter wheat) for soil health or grazing	413	1.49	1.10	23.5	28.3	23.7	24.5
Mixed grazing and forage crops (e.g., grasses, brassicas, legumes)	412	1.21	1.07	32.5	29.6	22.1	15.8
Perennial grasses (e.g., switchgrass, miscanthus, mixed species prairie)	411	1.17	1.09	35.8	27.3	20.9	16.1
Kernza (perennial, "intermediate wheatgrass")	407	0.53	0.86	67.1	17.7	10.6	4.7
Winter-hardy oilseeds as cover or relay crop (e.g., camelina, field pennycress)	412	0.36	0.67	72.8	20.6	4.4	2.2

<sup>a</sup>Responses on a four-point scale from not at all familiar (0) to very familiar (4)

<sup>b</sup>Percent

Source: A study of farming practices in Minnesota, Question 14; SD = Standard Deviation

Table 13. Percent of respondents who have planted perennial or cover crops on their farm in the past 10 years

	N	Yes <sup>a</sup>	No	Not familiar with the crop
Alfalfa	419	43.2	55.8	1.0
Annual cover crops and small grains (e.g., winter rye, oats, winter wheat) for soil health or grazing	415	27.2	67.0	5.8
Mixed grazing and forage crops (e.g., grasses, brassicas, legumes)	410	22.9	69.3	7.8
Perennial grasses (e.g., switchgrass, miscanthus, mixed species prairie)	415	21.4	69.2	9.4
Kernza (perennial, "intermediate wheatgrass")	403	2.2	77.2	20.6
Winter-hardy oilseeds as cover or relay crop (e.g., camelina, field pennycress)	411	1.0	78.3	20.7

<sup>a</sup>Percent

Source: A study of farming practices in Minnesota, Question 15

Table 14. Respondents' reported suitability of perennial and cover crops on their land

	<b>N</b>	<b>Mean<sup>a</sup></b>	<b>SD</b>	<b>Not at all<sup>b</sup></b>	<b>Slightly</b>	<b>Moderately</b>	<b>Very</b>
Alfalfa	403	2.20	1.06	12.9	8.9	23.3	54.8
Annual cover crops and small grains (e.g., winter rye, oats, winter wheat) for soil health or grazing	380	1.68	1.14	23.2	17.1	28.4	31.3
Perennial grasses (e.g., switchgrass, miscanthus, mixed species prairie)	380	1.55	1.16	27.6	16.6	28.9	26.8
Mixed grazing and forage crops (e.g., grasses, brassicas, legumes)	374	1.54	1.16	27.8	17.1	28.3	26.7
Kernza (perennial, "intermediate wheatgrass")	356	1.09	1.09	41.6	21.9	22.5	14.0
Winter-hardy oilseeds as cover or relay crop (e.g., camelina, field pennycress)	361	0.95	1.07	47.9	21.6	18.3	12.2

<sup>a</sup>Responses on a four-point scale from not at all (0) to very (4)

<sup>b</sup>Percent

Source: A study of farming practices in Minnesota, Question 16(i); SD = Standard Deviation

Table 15. Respondents' reported suitability of perennial and cover crops with their current farming practices

	<b>N</b>	<b>Mean<sup>a</sup></b>	<b>SD</b>	<b>Not at all<sup>b</sup></b>	<b>Slightly</b>	<b>Moderately</b>	<b>Very</b>
Alfalfa	363	1.46	1.28	35.8	16.5	13.8	33.9
Annual cover crops and small grains (e.g., winter rye, oats, winter wheat) for soil health or grazing	348	1.05	1.12	44.8	19.8	20.4	14.9
Mixed grazing and forage crops (e.g., grasses, brassicas, legumes)	338	0.87	1.10	54.7	17.5	14.2	13.6
Perennial grasses (e.g., switchgrass, miscanthus, mixed species prairie)	345	0.87	1.07	52.2	21.4	13.9	12.5
Kernza (perennial, "intermediate wheatgrass")	326	0.47	0.80	69.6	17.5	9.5	3.4
Winter-hardy oilseeds as cover or relay crop (e.g., camelina, field pennycress)	332	0.44	0.78	71.1	17.8	7.5	3.6

<sup>a</sup>Responses on a four-point scale from not at all (0) to very (4)

<sup>b</sup>Percent

Source: A study of farming practices in Minnesota, Question 16(ii); SD = Standard Deviation

Table 16. Respondents' likelihood of planting perennial or cover crops on their farm in the next five years

	N	Mean <sup>a</sup>	SD	Very unlikely <sup>b</sup>	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Very likely
Alfalfa	412	-0.19	1.67	38.1	9.0	14.1	11.4	27.4
Annual cover crops and small grains (e.g., winter rye, oats, winter wheat) for soil health or grazing	404	-0.53	1.53	44.8	8.4	16.8	14.9	15.1
Mixed grazing and forage crops (e.g., grasses, brassicas, legumes)	399	-0.68	1.48	47.9	10.3	16.8	12.5	12.5
Perennial grasses (e.g., switchgrass, miscanthus, mixed species prairie)	399	-0.86	1.35	49.9	12.8	20.3	7.8	9.3
Kernza (perennial, "intermediate wheatgrass")	399	-1.17	1.10	57.6	12.5	21.8	5.5	2.5
Winter-hardy oilseeds as cover or relay crop (e.g., camelina, field pennycress)	401	-1.23	1.06	60.3	9.7	23.7	4.7	1.5

<sup>a</sup>Responses on a five-point scale from very unlikely (-2) to very likely (2)

<sup>b</sup>Percent

Source: A study of farming practices in Minnesota, Question 17; SD = Standard Deviation

Table 17. Respondents' perceived importance of factors that influence their decision making about planting perennial or cover crops on their land

	N	Mean <sup>a</sup>	SD	Not at all important <sup>b</sup>	Slightly important	Somewhat important	Very important	Extremely important
Controlling erosion	405	2.90	1.12	5.2	7.2	15.6	36.8	35.3
Protecting groundwater	402	2.85	1.13	5.2	7.7	17.9	35.3	33.8
Maintaining or improving soil health	403	2.84	1.11	5.2	6.9	18.1	38.0	31.8
Increasing long-term profitability of my farm	401	2.83	1.19	6.5	8.2	16.5	33.4	35.4
Reducing nutrient loss from my farm	403	2.82	1.14	6.5	7.2	15.4	40.2	30.8
Keeping chemicals and nutrients on the farm	401	2.68	1.17	7.0	8.7	20.9	36.2	27.2
Protecting my investment in the land	401	2.67	1.15	6.7	8.7	21.7	36.4	26.4
Increasing yield	402	2.66	1.22	8.2	8.7	22.1	31.1	29.9
Protecting my land for the next generation	403	2.59	1.16	7.2	9.2	25.8	33.3	24.6
Protecting or improving water resources	402	2.59	1.19	7.5	10.2	24.1	31.8	26.4
Doing the right thing	400	2.51	1.17	7.5	12.0	23.8	35.3	21.5
Resilience to extreme weather events (e.g., drought, heavy rainfalls)	402	2.51	1.23	9.5	10.4	23.6	32.1	24.4
Maintaining or improving my way of life	401	2.45	1.20	8.7	13.0	23.7	34.2	20.4
Protecting or improving wildlife habitat	402	2.36	1.30	10.9	16.2	22.6	26.1	24.1
Reducing costs by reducing inputs	402	2.33	1.24	11.7	12.4	25.6	32.1	18.2
My emotional connection to the land	402	2.28	1.30	13.2	14.2	24.9	27.4	20.4
Conservation is a part of who I am	400	2.26	1.23	10.0	16.8	29.0	25.5	18.8
Improving quality of life in my community	400	2.21	1.21	11.8	15.0	28.2	30.3	14.8
Contributing to the collective good	399	2.15	1.26	13.3	17.3	26.6	27.3	15.5
Availability of financial assistance/cost share to plant perennial/cover crops	401	2.14	1.32	16.0	14.7	27.4	23.4	18.5
Providing another source of income	400	1.99	1.27	16.3	18.8	29.5	21.3	14.2
Preparing for programs that require the use of conservation practices	399	1.88	1.24	17.0	22.3	27.1	23.1	10.5
Exploring new market opportunities	400	1.87	1.25	19.0	17.8	31.0	21.5	10.8
Encouragement of family members	400	1.79	1.29	20.8	22.0	26.5	19.5	11.3
Expectations of other farmers	402	1.48	1.27	30.3	21.6	24.9	15.7	7.5

<sup>a</sup>Responses on a five-point scale from not at all important (0) to extremely important (4)

<sup>b</sup>Percent

Source: A study of farming practices in Minnesota, Question 18; SD = Standard Deviation

Table 18. Respondents' perceived effectiveness of perennial or cover crops

	N	Mean <sup>a</sup>	SD	Not at all effective <sup>b</sup>	Slightly ineffective	Somewhat effective	Very effective	Extremely effective
Controlling erosion	391	2.76	1.08	3.6	9.7	22.5	35.3	28.9
Protecting groundwater	393	2.66	1.12	4.8	10.4	24.9	33.3	26.5
Maintaining or improving soil health	395	2.57	1.11	5.3	11.1	27.1	34.2	22.3
Protecting or improving water resources	395	2.48	1.10	5.6	11.9	31.1	31.9	19.5
Protecting my investment in the land	394	2.42	1.18	7.9	14.0	26.9	31.2	20.1
Protecting my land for the next generation	395	2.40	1.12	5.3	16.2	29.9	30.1	18.5
Protecting or improving wildlife habitat	393	2.40	1.20	8.4	14.0	27.5	29.5	20.6
Keeping chemicals and nutrients on the farm	393	2.38	1.19	8.1	14.8	27.0	31.0	19.1
Reducing nutrient loss from my farm	393	2.35	1.20	8.1	16.8	25.7	30.5	18.8
Resilience to extreme weather events (e.g., drought, heavy rainfalls)	391	2.29	1.21	9.5	15.6	29.7	26.6	18.7
Maintaining or enhancing productivity	393	2.28	1.20	9.2	17.6	26.7	29.5	17.0
Increasing long-term profitability of my farm	395	2.26	1.25	9.9	20.3	22.8	28.6	18.5
Increasing yield	392	2.18	1.23	10.2	20.4	27.0	25.8	16.6
Reducing costs by reducing inputs	394	2.09	1.21	9.9	23.6	29.2	22.1	15.2
Removing excess nitrogen from my farm	392	2.01	1.22	13.8	19.9	30.1	24.2	12.0
Maintaining or improving my way of life	393	1.97	1.27	15.5	21.1	28.2	20.9	14.2
Improving quality of life in my community	388	1.85	1.28	19.1	20.4	29.4	18.8	12.4
Providing another source of income	393	1.72	1.28	20.9	25.2	26.0	16.8	11.2

<sup>a</sup>Responses on a five-point scale from not at all effective (0) to extremely effective (4)

<sup>b</sup>Percent

Source: A study of farming practices in Minnesota, Question 19; SD = Standard Deviation



Table 19. Respondents' perceptions about their capability to establish and maintain perennial and cover crops on their farm

	N	Mean <sup>a</sup>	SD	Not at all capable <sup>b</sup>	Slightly capable	Somewhat capable	Very capable
Alfalfa	397	2.05	1.13	15.9	13.6	20.7	49.9
Annual cover crops and small grains (e.g., winter rye, oats, winter wheat) for soil health or grazing	382	1.73	1.14	20.9	19.4	25.1	34.6
Mixed grazing and forage crops (e.g., grasses, brassicas, legumes)	380	1.58	1.16	26.1	18.4	26.6	28.9
Perennial grasses (e.g., switchgrass, miscanthus, mixed species prairie)	373	1.53	1.10	24.4	22.5	29.2	23.9
Kernza (perennial, "intermediate wheatgrass")	361	1.16	1.08	37.1	23.8	24.7	14.4
Winter-hardy oilseeds as cover or relay crop (e.g., camelina, field pennycress)	367	1.11	1.08	39.5	24.5	21.8	14.2

<sup>a</sup>Responses on a four-point scale from not at all capable (0) to very capable (4)

<sup>b</sup>Percent

Source: A study of farming practices in Minnesota, Question 20 (i); SD= Standard Deviation

Table 20. Respondents' perceptions about the ease or difficulty of establishing and maintaining perennial or cover crops on their farm

	N	Mean <sup>a</sup>	SD	Very difficult <sup>b</sup>	Somewhat difficult	Neither difficult nor easy	Somewhat easy	Very easy
Alfalfa	363	0.64	1.27	6.3	15.2	20.9	23.4	34.2
Annual cover crops and small grains (e.g., winter rye, oats, winter wheat) for soil health or grazing	346	0.37	1.27	10.1	15.0	26.3	25.1	23.4
Mixed grazing and forage crops (e.g., grasses, brassicas, legumes)	341	0.20	1.25	11.7	16.1	31.4	21.7	19.1
Perennial grasses (e.g., switchgrass, miscanthus, mixed species prairie)	337	0.02	1.21	12.5	20.5	32.6	21.1	13.4
Kernza (perennial, "intermediate wheatgrass")	324	-0.23	1.15	17.0	20.4	39.2	15.1	8.3
Winter-hardy oilseeds as cover or relay crop (e.g., camelina, field pennycress)	326	-0.29	1.15	17.2	24.5	37.4	12.0	8.9

<sup>a</sup>Responses on a four-point scale from very difficult (-2) to very easy (2)

<sup>b</sup>Percent

Source: A study of farming practices in Minnesota, Question 20 (ii); SD= Standard Deviation

Table 21. Respondents' likelihood of planting perennial or cover crops under various conditions

	N	Mean <sup>a</sup>	SD	Very unlikely <sup>b</sup>	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Very likely
I could get higher payments for planting the crops	377	0.58	1.34	13.3	6.6	18.8	31.0	30.2
I could get tax benefits for planting the crops	378	0.57	1.33	13.8	6.1	18.8	32.5	28.8
I was compensated for lost crop production	375	0.54	1.31	12.5	7.2	21.9	30.4	28.0
There were markets available to sell the crops	373	0.39	1.26	13.1	7.0	27.6	31.9	20.4
Conservation program requirements were less complex.	371	0.37	1.24	12.4	8.4	28.3	31.5	19.4
Conservation programs were more flexible.	376	0.35	1.21	12.5	6.9	31.1	31.9	17.6
I had evidence that planting the crops improved water resources.	375	0.32	1.22	13.1	7.2	31.7	30.9	17.1
Equipment was made available to plant the crops	378	0.29	1.29	15.1	7.9	28.3	29.9	18.8
I had financial assistance to plant and maintain the crops.	375	0.27	1.34	17.1	9.1	23.5	30.9	19.5
I could enroll in a government program providing technical or financial assistance	375	0.21	1.29	16.0	10.1	27.2	30.1	16.5
I could learn how to maintain the crops for soil conservation	374	0.19	1.22	15.8	8.0	28.6	36.6	11.0
I had evidence that the perennial/cover crops <u>did not</u> reduce yield of conventional crops (i.e., corn and soybeans).	374	0.19	1.21	13.9	9.1	35.6	27.3	14.2
I could learn how to maintain the crops for erosion control	374	0.17	1.23	15.8	9.6	27.8	35.3	11.5
There was local infrastructure to store crops	371	0.17	1.21	14.6	8.9	35.0	27.8	13.7
Trusted agricultural advisers helped me with crop management	374	0.13	1.20	15.5	8.0	36.6	28.1	11.8
I could talk to other landowners or farmers who have planted the crops	375	0.03	1.25	18.4	9.9	32.8	28.0	10.9
I had help with the physical labor of planting and maintaining the crops	372	-0.04	1.25	19.4	10.2	36.3	23.1	11.0
I could attend a workshop or field day about perennial/cover crops	374	-0.08	1.18	18.4	11.5	36.6	26.2	7.2
I knew more about how to plant and maintain the crops	375	-0.10	1.29	22.1	12.5	27.7	28.3	9.3
I knew more about the wildlife benefits of the crops	375	-0.17	1.26	22.9	11.5	33.6	23.2	8.8
I could be enrolled in a registry program that recognizes local conservation stewards.	374	-0.27	1.18	23.3	11.2	41.2	18.2	6.1

<sup>a</sup>Responses on a five-point scale from very unlikely (-2) to very likely (2); <sup>b</sup>Percent

Source: A study of farming practices in Minnesota, Question 21; SD = Standard Deviation

Table 22. Respondents' perceptions about factors that influence their participation in the Working Lands Watershed Restoration Program

	<b>N</b>	<b>Mean<sup>a</sup></b>	<b>SD</b>	<b>Not at all<sup>b</sup></b>	<b>Slightly</b>	<b>Somewhat</b>	<b>Very</b>
The amount of financial assistance	351	1.97	1.14	18.5	10.8	25.6	45.0
Ability to harvest and sell crops	352	1.95	1.17	19.0	13.4	21.3	46.3
Length of my contract	351	1.92	1.11	17.4	14.0	28.2	40.5
Flexibility of the program	349	1.91	1.08	16.6	13.5	32.1	37.8
Eligibility requirements	351	1.84	1.09	17.1	17.4	29.6	35.9
The types of crops that I can plant through the program	351	1.83	1.13	18.8	16.5	27.4	37.3
Ease of enrollment (i.e., how easy or difficult it is to enroll)	351	1.82	1.09	17.4	17.7	30.2	34.8
Timeliness of payments	350	1.65	1.10	20.6	22.0	28.9	28.6
Technical assistance to help establish and maintain the crops	350	1.61	1.05	19.4	23.4	33.4	23.7
Time required to enroll in the program	350	1.58	1.05	20.0	24.6	32.9	22.6

<sup>a</sup>Responses on a four-point scale from not at all (0) to very (4)

<sup>b</sup>Percent;

Source: A study of farming practices in Minnesota, Question 24; SD= Standard Deviation

Table 23. Respondents' reported level of influence of various individuals or groups on their decisions about soil and water conservation

	<b>N</b>	<b>Mean<sup>a</sup></b>	<b>SD</b>	<b>Not at all<sup>b</sup></b>	<b>Slightly</b>	<b>Moderately</b>	<b>Very</b>
My family	374	1.54	1.06	20.1	28.6	28.3	23.0
My County's Soil and Water Conservation District	379	1.47	0.95	18.5	29.8	38.0	13.7
Agronomist/crop advisor	373	1.26	1.00	29.2	26.3	33.8	10.7
University researchers and extension staff	372	1.18	0.93	27.7	34.9	29.3	8.1
Other farmers	376	1.16	0.87	25.5	38.8	29.8	5.9
Local watershed district/watershed management organization	378	1.14	0.93	29.4	34.1	29.4	7.1
The Farm Service Agency	375	1.12	0.96	32.8	29.9	29.6	7.7
My neighbors	372	1.05	0.91	32.3	36.6	25.0	6.2
The MN Department of Agriculture	372	1.05	0.91	33.6	33.6	27.2	5.6
MN Board of Water and Soil Resources	375	0.99	0.95	38.4	32.0	22.1	7.5
Environmental organizations	373	0.94	0.90	38.3	34.0	22.8	4.8
Seed/input dealer	373	0.92	0.90	39.4	34.9	20.4	5.4
The MN Department of Natural Resources	373	0.87	0.93	44.5	29.8	20.1	5.6
My local co-op	372	0.87	0.90	45.2	26.3	25.3	3.2
The MN Pollution Control Agency	376	0.79	0.90	48.1	29.3	18.1	4.5
Financial institutions (e.g., ag banker, lender, financial advisor)	378	0.77	0.85	47.9	30.2	19.3	2.6
Agricultural commodity associations	366	0.76	0.81	45.4	35.8	16.4	2.5
My county's Farm Bureau	374	0.68	0.83	52.1	29.9	15.2	2.7
Farmer's Union	372	0.56	0.77	59.7	26.3	12.4	1.6
Other agricultural groups (e.g., corn and soybean growers, fertilizer suppliers)	167	0.49	0.81	68.9	16.8	11.4	3.0
Other (e.g., NRCS, Pheasants Forever)	120	0.43	0.82	73.3	14.2	8.3	4.2

<sup>a</sup>Responses on a four-point scale from not at all (0) to very (4)

<sup>b</sup>Percent;

Source: A study of farming practices in Minnesota, Question 25 (i); SD = Standard Deviation

Table 24. Respondents' level of trust in various individuals or groups in helping them make decisions about soil and water conservation

	N	Mean <sup>a</sup>	SD	Strongly distrust <sup>b</sup>	Somewhat distrust	Neither trust nor distrust	Somewhat trust	Strongly trust
My family	314	0.98	0.95	1.0	1.9	34.4	23.2	39.5
Agronomist/crop advisor	311	0.62	0.96	3.9	3.2	39.2	34.4	19.3
Other farmers	312	0.54	0.86	1.9	5.8	42.3	36.9	13.1
My County's Soil and Water Conservation District	314	0.50	1.02	5.7	6.4	36.0	35.7	16.2
University researchers and extension staff	307	0.47	0.98	5.2	6.5	37.1	38.1	13.0
My neighbors	311	0.42	0.89	2.9	6.4	47.9	30.9	11.9
Local watershed district/watershed management organization	313	0.27	1.01	8.3	8.0	41.2	33.9	8.6
The Farm Service Agency	310	0.25	1.00	7.7	8.1	45.8	28.7	9.7
My local co-op	307	0.24	0.91	6.5	5.2	53.4	27.7	7.2
Seed/input dealer	308	0.17	0.87	5.2	8.1	57.5	22.7	6.5
The MN Department of Agriculture	308	0.12	1.05	9.7	11.4	44.8	25.3	8.8
Financial institutions (e.g., ag banker, lender, financial advisor)	314	0.06	0.93	8.0	10.5	55.1	20.4	6.1
MN Board of Water and Soil Resources	310	0.03	1.08	13.2	9.4	46.8	22.9	7.7
Agricultural commodity associations	308	-0.01	0.86	7.5	11.4	59.1	18.5	3.6
My county's Farm Bureau	311	-0.06	0.94	10.6	9.6	59.8	14.8	5.1
Other (e.g., NRCS, Pheasants Forever)	102	-0.12	0.78	9.8	4.9	74.5	8.8	2.0
Farmer's Union	305	-0.13	0.87	11.5	8.5	63.3	14.8	2.0
Other agricultural groups (e.g., corn and soybean growers, fertilizer suppliers)	142	-0.16	0.84	11.3	8.5	67.6	10.6	2.1
Environmental organizations	314	-0.19	1.15	17.5	17.2	39.2	19.1	7.0
The MN Department of Natural Resources	312	-0.22	1.19	20.8	13.5	39.7	18.6	7.4
The MN Pollution Control Agency	312	-0.37	1.20	25.6	13.5	39.7	14.4	6.7

<sup>a</sup>Responses on a five-point scale from strongly distrust (-2) to strongly trust (2)

<sup>b</sup>Percent;

Source: A study of farming practices in Minnesota, Question 25 (ii); SD = Standard Deviation

Table 25. Respondents' feelings of personal obligation

I feel a personal obligation to...	N	Mean <sup>a</sup>	SD	Strongly disagree <sup>b</sup>	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
protect the local environment where I farm.	392	1.46	0.75	0.8	0.8	8.9	31.1	58.4
implement farming practices that improve soil health.	392	1.32	0.82	1.5	1.0	10.2	38.3	49.0
implement farming practices that protect water quality.	392	1.27	0.85	1.5	1.3	13.0	36.7	47.4
plant and maintain perennial/cover crops on my land.	391	0.43	1.12	7.7	7.2	39.6	25.6	19.9

<sup>a</sup>Responses on a five-point scale from strongly disagree (-2) to strongly agree (2)

<sup>b</sup>Percent

Source: A study of farming practices in Minnesota, Question 26; SD = Standard Deviation

Table 26. Respondents' beliefs about their ability to protect water resources

	N	Mean <sup>a</sup>	SD	Strongly disagree <sup>b</sup>	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I have the knowledge and skills I need to plant perennial/cover crops on my land.	395	0.52	1.18	8.4	9.4	27.1	32.7	22.5
I have the financial resources I need to plant perennial/cover crops on my land.	394	0.34	1.16	8.1	14.7	29.4	30.5	17.3
Farmers in my community have the ability to work together to change land use practices.	394	0.15	0.94	5.1	15.0	46.2	26.9	6.9
My community has the financial resources it needs to protect water resources.	396	-0.01	0.93	6.8	17.7	50.8	19.2	5.6
My community has the leadership it needs to protect water resources	395	-0.08	1.03	12.4	15.2	45.6	21.8	5.1
I have the equipment I need to plant and maintain perennial/cover crops on my land.	396	-0.32	1.36	25.8	23.0	22.5	15.2	13.6

<sup>a</sup>Responses on a five-point scale from strongly disagree (-2) to strongly agree (2)

<sup>b</sup>Percent

Source: A study of farming practices in Minnesota, Question 27; SD = Standard Deviation

Table 27. Respondents' beliefs about water resources and farming practices

	N	Mean <sup>a</sup>	SD	Strongly disagree <sup>b</sup>	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Healthy soils can increase yields	397	1.61	0.61	0.0	0.3	6.0	26.4	67.3
Healthy soils can increase resilience to extreme weather including droughts and heavy rainfalls.	396	1.40	0.76	0.5	0.8	11.9	32.3	54.5
Excessive water runoff causes soil and nutrient loss.	395	1.32	0.87	1.8	2.0	10.1	34.7	51.4
Water pollution affects human health.	394	1.26	0.81	0.9	0.9	13.0	35.0	41.5
It is my personal responsibility to implement farming practices that protect the local environment where I farm	397	1.25	0.74	0.3	0.8	13.9	44.1	41.1
It is my personal responsibility to implement farming practices that improve soil health	397	1.25	0.75	0.3	0.8	14.9	42.3	41.8
It is my personal responsibility to implement farming practices that protect water quality	396	1.23	0.77	0.5	0.8	15.4	41.9	41.4
People who are important to me expect me to implement farming practices that protect the local environment where I farm	396	0.63	0.97	3.5	5.8	33.8	37.9	18.9
Water resources in Minnesota need better protection.	394	0.57	1.04	3.8	10.7	30.5	35.0	20.1
People who are important to me expect me to implement farming practices that protect water quality	397	0.57	0.99	3.8	6.5	37.0	33.8	18.9
Water resources in my community are adequately protected.	396	0.20	1.07	8.1	16.2	31.6	35.6	8.6
People who are important to me expect me to plant perennial/cover crops on my farm	396	-0.05	1.06	12.9	11.4	51.5	16.2	8.1

<sup>a</sup>Responses on a five-point scale from strongly disagree (-2) to strongly agree (2)

<sup>b</sup>Percent

Source: A study of farming practices in Minnesota, Question 28; SD = Standard Deviation

## **Appendix B: Summary Statistics by Watershed**



Table 1. Respondents' familiarity with perennial or cover crops by watershed (Alfalfa, Perennial grasses, and Kernza)

Watershed	Alfalfa					Perennial grasses					Kernza				
	N	Not at all <sup>a</sup>	Slightly	Somewhat	Very	N	Not at all	Slightly	Somewhat	Very	N	Not at all	Slightly	Somewhat	Very
Buffalo River	71	14.1	18.3	18.3	49.3	69	36.2	34.8	14.5	14.5	69	62.3	24.6	8.7	4.3
Chippewa River	79	13.9	15.2	13.9	57.0	80	25.0	26.3	23.8	25.0	76	64.5	21.1	9.2	5.3
LeSueur River	78	11.5	19.2	29.5	39.7	76	32.9	26.3	27.6	13.2	76	71.1	13.2	9.2	6.6
MN River-Mankato	70	7.1	10.0	24.3	58.6	69	37.7	17.4	21.7	23.2	69	60.9	17.4	18.8	2.9
Root River	65	9.2	12.3	13.8	64.6	59	44.1	33.9	13.6	8.5	59	69.5	18.6	8.5	3.4
Sauk River	58	10.3	6.9	10.3	72.4	58	43.1	25.9	22.4	8.6	58	75.9	10.3	8.6	5.2

<sup>a</sup>Percent

Source: A study of farming practices in Minnesota, Question 14

Table 2. Respondents' familiarity with perennial or cover crops by watershed (Mixed grazing and forage crops, Annual cover crops and small grains, and winter-hardy oilseeds)

Watershed	Mixed grazing and forage crops					Annual cover crops and small grains for soil health or grazing					Winter-hardy oilseeds as cover or relay crop				
	N	Not at all <sup>a</sup>	Slightly	Somewhat	Very	N	Not at all	Slightly	Somewhat	Very	N	Not at all	Slightly	Somewhat	Very
Buffalo River	68	33.8	27.9	20.6	17.6	71	21.1	29.6	25.4	23.9	70	65.7	25.7	8.6	0.0
Chippewa River	76	34.2	27.6	25.0	13.2	78	24.4	32.1	23.1	20.5	78	74.4	21.8	3.8	0.0
LeSueur River	77	35.1	31.2	20.8	13.0	76	26.3	27.6	23.7	22.4	76	69.7	22.4	2.6	5.3
MN River-Mankato	71	26.8	29.6	28.2	15.5	70	17.1	20.0	25.7	37.1	70	65.7	21.4	7.1	5.7
Root River	63	28.6	27.0	15.9	28.6	60	23.3	28.3	23.3	25.0	60	80.0	16.7	1.7	1.7
Sauk River	57	36.8	35.1	21.1	7.0	58	29.3	32.8	20.7	17.2	58	84.5	13.8	1.7	0.0

<sup>a</sup>Percent

Source: A study of farming practices in Minnesota, Question 14

Table 3. Percent of respondents who have planted perennial or cover crops on their farm in the past 10 years

Watershed	Alfalfa		Perennial grasses		Kernza		Mixed grazing and forage crops		Annual cover crops and small grains for soil health or grazing		Winter-hardy oilseeds as cover or relay crop	
	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent
Buffalo River	70	32.9	57	12.3	55	0.0	62	21.0	65	30.8	56	0.0
Chippewa River	78	51.3	73	39.7	58	10.3	72	36.1	74	28.4	58	0.0
LeSueur River	76	28.9	73	21.9	61	3.3	70	12.9	75	22.7	66	4.5
MN River-Mankato	71	23.9	70	24.3	60	0.0	69	15.9	69	24.6	62	0.0
Root River	63	68.3	52	13.5	47	2.1	58	37.9	59	40.7	47	2.1
Sauk River	57	63.2	51	25.5	39	0.0	47	27.7	49	28.6	37	0.0

Source: A study of farming practices in Minnesota, Question 15

Table 4. Respondents' likelihood of planting perennial or cover crops in the next 5 years (Alfalfa, perennial grasses, and kernza)

Watershed	Alfalfa				Perennial grasses				Kernza			
	N	Unlikely <sup>a</sup>	Neither likely nor unlikely	Likely	N	Unlikely	Neither likely nor unlikely	Likely	N	Unlikely	Neither likely nor unlikely	Likely
Buffalo River	67	46.3	16.4	37.3	64	65.6	23.4	10.9	64	68.8	26.6	4.7
Chippewa River	78	46.2	11.5	42.3	75	56.0	17.3	26.7	75	68.0	22.7	9.3
LeSueur River	75	62.7	17.3	20.0	75	65.3	21.3	13.3	75	72.0	16.0	12.0
MN River-Mankato	72	63.9	12.5	23.6	72	63.9	16.7	19.4	72	76.4	15.3	8.3
Root River	64	25.0	15.6	59.4	59	61.0	23.7	15.3	58	67.2	31.0	1.7
Sauk River	56	32.1	10.7	57.1	54	64.8	20.4	14.8	55	67.3	21.8	10.9

<sup>a</sup>Percent

Source: A study of farming practices in Minnesota, Question 17

Table 5. Respondents' likelihood of planting perennial or cover crops in the next 5 years (Mixed grazing and forage crops, annual cover crops and small grains, and winter-hardy oilseeds)

Watershed	Mixed grazing and forage crops				Annual cover crops and small grains for soil health or grazing				Winter-hardy oilseeds as cover or relay crop			
	N	Unlikely <sup>a</sup>	Neither likely nor unlikely	Likely	N	Unlikely	Neither likely nor unlikely	Likely	N	Unlikely	Neither likely nor unlikely	Likely
Buffalo River	65	61.5	15.4	23.1	67	55.2	20.9	23.9	64	67.2	25.0	7.8
Chippewa River	72	54.2	13.9	31.9	75	52.0	12.0	36.0	75	72.0	21.3	6.7
LeSueur River	75	70.7	14.7	14.7	75	61.3	16.0	22.7	75	72.0	16.0	12.0
MN River-Mankato	71	64.8	14.1	21.1	72	59.7	12.5	27.8	72	73.6	20.8	5.6
Root River	60	36.7	26.7	36.7	59	37.3	23.7	39.0	59	66.1	33.9	0.0
Sauk River	56	57.1	17.9	25.0	56	50.0	17.9	32.1	56	67.9	28.6	3.6

<sup>a</sup>Percent

Source: A study of farming practices in Minnesota, Question 17

**Appendix C: Subgroup Comparisons**

**Subgroup comparisons: Age**

Table 1. Number of respondents by age group

Age group	N	Percent
28 – 63	194	50.4
64+	191	49.6
Total	385	100.0

Source: A study of farming practices in Minnesota, Question 6

Table 2. Differences between respondents by age group in their likelihood of planting perennial or cover crops in the next 5 years

Survey item	Age group	N	Mean	SD	t <sup>b</sup>
<b>Likelihood of planting perennial or cover crops in the next 5 years<sup>a</sup></b>					
Annual cover crops and small grains	28-63	187	-0.34	1.53	2.484*
	64+	172	-0.74	1.49	

<sup>a</sup>Item measured on a five-point scale from very unlikely (-2) to very likely (+2)

<sup>b</sup>T-test statistic for testing differences in means. Only items with statistical differences at a significance level of  $p \leq 0.05$  reported here; \* $p < 0.05$

SD = Standard deviation

Source: A study of farming practices in Minnesota, Question 17

Table 3. Difference between respondents by age group in their use of perennial or cover crops in the past 10 years

Age group	Planted perennial or cover crops in the past 10 years (%)	$\chi^2$
<b>Mixed grazing and forage crops</b>		
28-63	32.4%	10.024**
64+	17.4%	
<b>Annual cover crops and small grains</b>		
28-63	36.1%	12.813**
64+	18.9%	

$\chi^2$  Chi-square statistic for testing differences in proportions; \*\* $p \leq 0.01$

Source: A study of farming practices in Minnesota, Question 15

**Subgroup comparisons: Percent income dependent on agriculture**

Table 4. Number of respondents by percent income dependent on agriculture

Percent income dependent on agriculture	N	Percent
Less than 50%	200	48.5
50% or more	212	51.5
Total	412	100.0

Source: A study of farming practices in Minnesota, Question 6

Table 5. Differences between respondents with varying levels of percent income dependent on agricultural production in their familiarity with and likelihood of growing perennial or cover crops

Survey item	Percent income dependent on agriculture				
	N	Mean	SD	t <sup>c</sup>	
<b>Familiarity with perennial or cover crops<sup>a</sup></b>					
Alfalfa	Less than 50%	194	2.04	1.11	-2.912**
	50% or more	210	2.34	0.97	
Annual cover crops and small grains	Less than 50%	192	1.36	1.08	-2.144*
	50% or more	205	1.60	1.11	
<b>Likelihood of planting perennial or cover crops in the next 5 years<sup>b</sup></b>					
Perennial grasses	Less than 50%	187	-0.71	1.41	2.165*
	50% or more	197	-1.01	1.30	

<sup>a</sup>Items measured on a four-point scale from not at all familiar (0) to very familiar (4)

<sup>b</sup>Item measured on a five-point scale from very unlikely (-2) to very likely (+2)

<sup>c</sup>T-test statistic for testing differences in means. Only items with statistical differences at a significance level of  $p \leq 0.05$  reported here;

\*\* $p < 0.01$ ; \* $p < 0.05$

SD = Standard deviation

Source: A study of farming practices in Minnesota, Questions 14 and 17

Table 6. Difference between respondents with varying levels of percent income dependent on agricultural production in their use of perennial or cover crops in the past 10 years

Percent income dependent on agriculture	Planted perennial or cover crops in the past 10 years (%)	$\chi^2$
<b>Annual cover crops and small grains</b>		
Less than 50%	21.6	7.839**
50% or more	34.7	

$\chi^2$  Chi-square statistic for testing differences in proportions; \*\* $p \leq 0.01$

Source: A study of farming practices in Minnesota, Question 15

**Subgroup comparisons: Land tenure**

Table 7. Number of respondents by land tenure

Land tenure <sup>a</sup>	N	Percent
Own	244	59.1
Rent	169	40.9
Total	413	100.0

<sup>a</sup>Own = Own and lease property to others but do not rent; Rent = rent any portion of their property (may also own or lease portions of their property to others)

Source: A study of farming practices in Minnesota, Question 6

Table 8. Differences between property owners and renters in their familiarity with and likelihood of growing perennial or cover crops

Survey item	Land tenure <sup>c</sup>	N	Mean	SD	t <sup>d</sup>
<b>Familiarity with perennial or cover crops<sup>a</sup></b>					
Mixed grazing and forage crops	Own	233	1.12	1.05	-1.992*
	Rent	163	1.33	1.07	
Annual cover crops and small grains	Own	232	1.37	1.10	-2.386*
	Rent	165	1.64	1.08	
<b>Likelihood of planting perennial or cover crops in the next 5 years<sup>b</sup></b>					
Annual cover crops and small grains	Own	223	-0.70	1.49	-2.153*
	Rent	165	-0.36	1.56	

<sup>a</sup>Items measured on a four-point scale from not at all familiar (0) to very familiar (4)

<sup>b</sup>Item measured on a five-point scale from very unlikely (-2) to very likely (+2)

<sup>c</sup>Own = Own and lease property to others but do not rent; Rent = rent any portion of their property (may also own or lease portions of their property to others)

<sup>d</sup>T-test statistic for testing differences in means. Only items with statistical differences at a significance level of p ≤ 0.05 reported here; \*p < 0.05

SD = Standard deviation

Source: A study of farming practices in Minnesota, Questions 14 and 17

Table 9. Difference between property owners and renters in their use of perennial or cover crops in the past 10 years

Land tenure <sup>a</sup>	Planted perennial or cover crops in the past 10 years (%)	χ <sup>2</sup>
<b>Annual cover crops and small grains</b>		
Own	23.7	4.783*
Rent	34.0	

<sup>a</sup>Own = Own and lease property to others but do not rent; Rent = rent any portion of their property (may also own or lease portions of their property to others)

χ<sup>2</sup> Chi-square statistic for testing differences in proportions; \*\*p ≤ 0.01

Source: A study of farming practices in Minnesota, Question 15

**Subgroup comparisons: Land size**

Table 10. Number of respondents by acres farmed in 2016

Farm size <sup>a</sup>	N	Percent
Small	202	51.4
Large	191	48.6
Total	393	100.0

<sup>a</sup>Small < 200 acres farmed; Large = 200 acres or more farmed  
Source: A study of farming practices in Minnesota, Question 6

Table 11. Differences between small and large landowners in their familiarity with and likelihood of growing perennial or cover crops

Survey item	Farm size <sup>c</sup>	N	Mean	SD	t <sup>d</sup>
<b>Familiarity with perennial or cover crops<sup>a</sup></b>					
Mixed grazing and forage crops	Small	191	0.98	0.99	-3.703**
	Large	187	1.38	1.09	
Annual cover crops and small grains	Small	194	1.31	1.08	-2.815**
	Large	189	1.62	1.08	
Winter-hardy oilseeds	Small	194	0.27	0.60	-2.452*
	Large	188	0.44	0.74	
<b>Likelihood of planting perennial or cover crops in the next 5 years<sup>b</sup></b>					
Annual cover crops and small grains	Small	186	-0.69	1.47	-2.119*
	Large	184	-0.36	1.57	

<sup>a</sup>Items measured on a four-point scale from not at all familiar (0) to very familiar (4)

<sup>b</sup>Item measured on a five-point scale from very unlikely (-2) to very likely (+2)

<sup>c</sup>Small < 200 acres farmed; Large = 200 acres or more farmed

<sup>d</sup>T-test statistic for testing differences in means. Only items with statistical differences at a significance level of  $p \leq 0.05$  reported here;

\*\* $p < 0.01$ ; \* $p < 0.05$

SD = Standard deviation

Source: A study of farming practices in Minnesota, Questions 14 and 17

Table 12. Difference between small and large landowners in their use of perennial or cover crops in the past 10 years

Farm size <sup>a</sup>	Planted perennial or cover crops in the past 10 years (%)	$\chi^2$
<b>Annual cover crops and small grains</b>		
Small	21.7	7.909**
Large	35.2	

<sup>a</sup>Small < 200 acres farmed; Large = 200 acres or more farmed

$\chi^2$  Chi-square statistic for testing differences in proportions; \*\* $p \leq 0.01$

Source: A study of farming practices in Minnesota, Question 15