

What Women Landowners Want to Know about Conservation

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What Women Landowners Want to Know about Conservation

Abstract: Women own or co-own almost half of the land in the US Midwest and women landowners are playing a more and more important role in production and financial decision-making. However, women landowners are less involved in conservation programs and networks, and thus, the main participants for governmental and private conservation programs are still men. Using a survey of 358 women landowners in 2021, this article studies Iowa women landowners' interest in conservation topics across various groups based on farming, financial, and demographic characteristics to better understand their informational needs related to conservation and to empower them with knowledge and confidence in farm management practices. We find that women landowners are most interested in agricultural carbon credits programs, followed by soil erosion control, soil fertilizer management, and cover crops. We provide statistical evidence that women operating landowners are more interested in all conservation topics than women non-operating landowners; and, we also find stronger interest among women landowners with crop/livestock or crop/pasture mix than those with only row crops. Younger women landowners (<40 years old) also show a stronger interest in conservation topics than senior women landowners (70+ years old). We also explore women landowners' preferences for receiving educational information to provide policy and extension implications. Survey results show strong preferences for periodic (e-)newsletters, followed by webinars, two-page fact sheets or infographics, and half-day in-person educational meetings. Elderly women landowners (70+ years old) prefer printed materials, and younger landowners prefer virtual meetings and in-person activities. Overall, women landowners prefer a mix of delivery methods with stronger preferences for virtual or printed delivery methods than in-person formats.

In an agricultural context, land ownership can be an essential means to rebalance gendered power (Sachs 1996). Women own nearly half of the farmland in Iowa and make influential decisions in conservation outcomes through farmland management and practices. A team of specialists with Iowa State University Extension and Outreach conducted a survey aimed at improving the understanding of women landowners' interest in conservation and empowering women landowners with long-term agricultural sustainability by studying what women landowners want to know about conservation, as well as their concerns on conservation issues and preferences for receiving educational programming.

Previous literature indicates that women landowners have a more positive attitude than male landowners toward conservation and collaboration (Druschke and Secchi 2014). However, conservation outreach mostly targets men (Wells and Eells 2011). Women are less knowledgeable about best management practices and less actively involved in conservation programs and practices (Druschke and Secchi 2014; Eells and Soulis 2013), which can be explained by the downplay of women's identities as farmers. Traditionally, women were identified as "farm wives," leading to a disadvantage in farming networks and a tendency to be treated as incompetent (Wright and Annes 2019; Sachs et al. 2016). However, as the proportion of women with ownership of farmland increases, more women self-identify as farmers, which contests and challenges the conventional context.

Carter (2016) qualitatively studies Iowa women landowners and finds the increasing continuance of women as placeholders due to transition or greater longevity than their spouses may not be enough to challenge the cultural narratives of the patriarchal land tenure system. Our study adds to the literature on women landowners' interests regarding conservation and provides

references for policy and educational programs to encourage and strengthen women landowners' involvement in farm management and conservation practices.

Researchers often treat women landowners as a monolithic group with similar viewpoints; however, our survey finds that women landowners have divergent views based on various characteristics. Overall, 83% of women landowners are interested in at least one conservation topic. However, only 33% of respondents showed interest in the top-ranked topic, agricultural carbon credits programs, indicating that women landowners' interests are dispersed, with many only focusing on one specific topic. Our study emphasizes the heterogeneity among women landowners, which aligns with findings from Goebel (2003) and Leach (2007) that researchers should not globally homogenize women's positions.

Our study mainly examines four hypotheses: (a) women operating landowners (WOLs) are more interested in receiving information on conservation topics than women non-operating landowners (WNOLs); (b) women landowners who operate their own land are more interested in conservation than those who lease out at least some of their land; (c) women landowners who only grow row crops have less interest in major conservation practices than those who grow crops and livestock or pasture; and, (d) elderly women landowners (typically 70+ years old), are generally less interested in conservation than younger landowners (under 40 years old). We evaluate our four hypotheses using 358 completed surveys from an eligible sample of 688 landowner respondents. We use descriptive and statistical methods to test for differences in different landowner groups' interest levels in the conservation topics detailed in the survey. In addition to the groups in the hypotheses, we also investigate differences across farming, financial, and demographic characteristics.

When asked about their interest in receiving conservation information, overall, women landowners were most interested in conservation programs, ranking agricultural carbon credits and government programs as the first- and second-most important sub-topics, which shows that monetary incentives are important to encourage conservation among women landowners. Among conservation practices, soil erosion control, soil fertilizer management, and cover crops were the top choices.

We also asked women landowners their concerns on conservation issues. We statistically test the difference in the levels of concern between WOLs and WNOLs and find that WOLs are generally more concerned about conservation issues, especially those related to government programs and farm management, while WNOLs have less familiarity and fewer interactions with conservation issues. We further analyze women landowners' preferences for receiving information and educational programming by age group and find that all ages of surveyed women prefer periodic (e-)newsletters, followed by webinars, two-page fact sheets or infographics, and half-day in-person educational meetings. Women landowners 70 or above prefer printed materials, while landowners under the age of 70 prefer online meetings and those under the age of 50 prefer in-person activities.

Materials and Methods

We contracted Iowa State University's Center for Survey Statistics and Methodology Survey Research Services (CSSM-SRS) to conduct a web/mail survey of women Iowa farmland owners in spring 2021. The survey followed the mixed Tailored Survey Design method (Dillman et al. 2014). The sample of 404 women landowners was selected from recent participants in the Iowa State University Extension and Outreach Women in Ag programs, which we supplemented with

324 female Iowa farmland owners from the quinquennial Iowa Farmland Ownership and Tenure Study (Sawadgo et al. 2021) for a total sample of 728 contacts.

CSSM-SRS staff drafted an invitation letter to the online survey, a survey cover letter, and a reminder postcard in collaboration with the principal investigators. On July 28, 2021, we sent the invitation letter to the 728 women in the sample with a \$2 bill as an incentive to complete the survey. On August 2, 2021, we sent an email invitation to 268 women in the sample who had not yet completed the online survey and for whom there was an email address. On August 10, 2021, we sent a survey packet to 541 non-responders with deliverable addresses. On August 11, 2021, we sent an email reminder to 179 women in the sample with deliverable email addresses who had not completed the online survey. On August 25, 2021, we mailed a reminder postcard to 391 non-responders. On September 2, 2021, we sent a second complete survey mailing to 364 non-responders. There were no incentives included in mailings after the initial invitation letter.

Among the sample of 728 women landowners, we classified 40 (5.5% of 728) as not eligible because the sampled person was deceased, not female, or did not own land in Iowa. This resulted in an eligible sample of 688 Iowans. We received a total of 358 completed surveys during the data collection period from July 30 through October 20, 2021. There were 214 completed online surveys and 144 completed paper surveys, with a response rate of 52.0% (358/688). A slightly smaller percentage of the sample from the Women in Ag programs (43.7% [135/309]) responded than did the sample from the Iowa Farmland Ownership and Tenure study (58.6% [222/379]).

We employ descriptive and statistical analysis to study the difference in levels of interest in conservation topics between various groups. Results are statistically significant for the following four hypotheses: (a) WOLs are more interested in receiving information on conservation topics than WNOLs, especially in conservation programs and conservation practices that benefit both water quality and net carbon emission; (b) women landowners with all self-operated land are more interested in conservation than those with at least some land rented out, especially for programs about pasture management; (c) women landowners who only grow row crops have less interest in conservation topics, especially in cover crops, pasture management, wildlife habitat improvement, and conservation easements than those who grow more than crops but also raise livestock or manage pasture; and, (d) women landowners over the age of 70 are generally less interested in conservation than landowners under the age of 60, and those under the age of 40 show a significantly higher interest in conservation than all other age groups. We also investigate the difference in women landowners' interests across other characteristics, such as farming time and experience, residency, landholdings, percentages of off-farm income, and reasons for owning land.

Since we asked landowners to answer “Yes” or “No” if they are interested in a conservation topic, we apply Fisher’s exact test to our categorical data, which we classify by different groups. Through Fisher’s exact test, we can evaluate our null hypothesis that the proportions of landowners interested in a topic between two or more groups are the same, with the alternative hypothesis that the proportions between the groups are not the same. Fisher’s exact test has the advantage of testing smaller samples than the Chi-squared test. We calculate and report the exact hypergeometric probability—the p value of Fisher’s exact test. The smaller

the exact hypergeometric probability is, the more statistically significant difference we can find between the two groups regarding landowners' interest levels.

We also test the difference in women landowners' levels of concern about conservation issues between WOLs and WNOLs. Since we asked respondents to rank their level of concern from 1 (not concerned at all) to 4 (very concerned), we view the ranks as scores, and we use the two-group t-test for our null hypothesis that the average scores on the level of concern of WOLs and WNOLs are the same, with the alternative hypothesis that the average scores of the two groups are different. We calculate t-statistics and report the *p* values.

Results and Discussion

Table 1 summarizes the percentages of women landowners' choices to the question, "What topics related to farmland conservation are you most interested in receiving information about?" We then asked the respondents to select the three topics they were most interested in. As the third column of table 1 shows, although 83% of women landowners showed interest in at least one conservation topic, the top-ranked topic—agricultural carbon credits programs—only received interest from 33% of respondents. This indicates that women landowners' conservation interests are dispersed, and many only focus on one specific topic.

We aggregate the topics into five categories. Except for the category of conservation programs, we separate conservation topics into practices that mainly benefit water quality, mainly benefit net carbon emission, benefit both water quality and net carbon emission, and benefit neither carbon nor water quality according to Du et al. (2022) and Delgado et al. (2011). Delgado et al. (2011) detail the classification of practices benefiting net carbon emission and

separate them into soil carbon sequestration, greenhouse gas emission, and upstream or process emissions. Overall, 62% of women landowners are interested in conservation practices that benefit both water quality and net carbon emission. Among this category, soil erosion control (31%), soil fertilizer improvement (29%), and cover crops (28%) received relatively high interest. Conservation programs also received a high level of interest (51%), among which respondents ranked agricultural carbon credits programs (33%) and government conservation programs (31%) as the first and second-most interesting topics. This indicates that the women landowners' interests in conservation are economically driven. We can partially ascribe this to nearly half of the women in our survey sample participating in the Iowa State University Extension and Outreach Women in Ag programs, which are almost exclusively farm business management focused. Past Women in Ag program participants were interested in financial information but not necessarily conservation. These findings contrast with ecofeminism which states that women landowners are more interested in the inherent environmental value of the practice than the economic factors (Leach 2007), and also raise concerns about the potential bias if a survey oversamples women respondents with environmental identities due to sampling among conservation-oriented program participants. In addition, the high interest of women landowners in conservation programs can also be linked to a lack of knowledge about conservation programs and little consultation with local professionals, as indicated by Petrzelka et al. (2021). Therefore, it is important for extension professionals to connect with and deliver more educational information to local women landowners.

We compare the interests of WOLs who personally operate their farms on a full-time (22%) or part-time (33%) basis and WNOLs who do not farm their land at all. We asked

WNOLs to identify themselves as experienced (30%) or inexperienced (15%). Generally speaking, WOLs are statistically significantly more interested in receiving information on conservation topics than WNOLs (p value = 0.000), especially for conservation practices benefiting both water and net carbon emission and conservation programs. For conservation programs, WOLs have higher interests than WNOLs mainly in agricultural carbon credits programs (p value = 0.000) and non-government conservation programs (p value = 0.037), which suggests WOLs have a stronger interest in the financial benefits of conservation. Among WNOLs, inexperienced WNOLs (58%) are more interested in conservation programs than experienced WNOLs (44%), with the difference mainly coming from government programs (p value = 0.064). For conservation practices, WOLs mainly prefer cover crops (p value = 0.026), soil fertilizer improvement (p value = 0.084), and pasture and hay land management (p value = 0.003). Full-time WOLs are more interested in soil fertilizer improvement (44%, p value = 0.009), while part-time WOLs are more interested in pasture and hay land management (32%). Overall, inexperienced WNOLs (68%) are more interested in the aforementioned practices than experienced WNOLs (55%). Compared to WOLs, WNOLs also view soil erosion control as a priority. WNOLs caring more about the land as an asset may explain this finding and is consistent with the American Farmland Trust survey on non-operating landowners (NOLs) in which a vast majority of NOLs expressed a desire to protect farmland for families and future generations (Petrzelka et al. 2020). In addition, energy contracts for wind or solar also received significantly higher interest from inexperienced WNOLs than from experienced WNOLs (p value = 0.039). From this, we can infer that WOLs and inexperienced WNOLs are the two groups most interested in conservation topics regarding practices that benefit water quality and

net carbon emissions and payments from conservation contracts. According to the last row of Table 1, WNOLs (26%) are less interested in these conservation topics than WOLs (10%), and more experienced WNOLs (28%) are the least interested of all WNOLs. According to the American Farmland Trust survey (Petrzelka and Sorensen 2019), water quality and wildlife habitat improvement are two essential conservation topics for WNOLs in the Corn Belt. However, the percentages of women landowners interested in these two topics are less than 20% in our sample, with WNOLs being slightly less interested than WOLs.

Table 2 shows the percentages of women landowners interested in receiving information simultaneously on two topics and somewhat reflects the correlation between the topics. We view two topics with more than 10% of women landowners interested as relatively highly correlated. Table 2 presents six topics with relatively high correlations. We find that the landowners interested in government conservation programs (31%) are also interested in agricultural carbon credits (12%) and non-government conservation programs (10%), which shows that a portion of landowners values conservation incentives from conservation programs. Government conservation programs are a popular topic with high correlations among program-related topics and practices that benefit water quality and net carbon emissions. This suggests that though carbon credits are the top-ranked topic, government conservation programs receive the widest interest.

Among women landowner respondents, 40% do not lease out any land and 60% lease out at least some of their land. For landowners not leasing out land, the ratio of WOLs to WNOLs is about 8:2; and, for landowners who lease some land, the ratio is about 3:7. Table 3 shows that landowners that do not lease out land have a significantly higher interest in conservation topics

than those that lease out at least some of their land (p value = 0.004), which is consistent with the results between WOLs and WNOLs. The higher interest of owners that do not lease out land is mainly in cover crop, pasture, and hay land management (p value = 0.000), agricultural carbon credits programs (p value = 0.021), and non-government conservation programs (p value = 0.059).

Figure 1 plots the distribution of landowners' interest in the four aforementioned topics, categorized by those who do and do not lease out land across crop-reporting districts (CRDs). For cover crops, both landowners that do and do not lease out land show evenly distributed interest across CRDs. The difference in interest level between groups mainly comes from western and southern CRDs. The overall interest is higher among respondents from the central and southwest CRDs, where cover crop adoption rates are relatively lower (Sawadgo et al. 2021). For pasture and hay land management, interested respondents are mainly from the central and southern CRDs for both WOLs and WNOLs, especially the south-central CRD, where hay and pasture are grown the most (USDA NASS 2021). Landowners that lease out their land are far less interested in hay land management in districts other than the east-central, where both groups have relatively high interest in the topic. For agricultural carbon credits programs, the distribution of interest for landowners that do not lease out land is generally even across CRDs, whereas landowners that lease out land in the northeast, east-central, and central CRDs have a lower interest in the topic. Landowners that do not lease out land in the west-central, east-central, south-central, and southeast CRDs have a higher interest in non-government programs, while those with land leased out in the northwest, north-central, and south-central CRDs are more interested in the topic. More succinctly, the interest in non-government programs mainly comes

from women landowners who do not lease out land and mainly produce row crops and from women landowners who lease out some land and raise livestock or poultry (Census of Ag 2017). The overlapping interests of WOLs and WNOLs with land in the south-central CRD indicate that women landowners with pastureland are interested in non-government programs. The interest in non-government programs from women managing pastureland may be due to the opportunity for pastureland funding that only came about recently, for instance through the Grassland Conservation Reserve Program, which suggests a need for education about new opportunities to participate in government pastureland conservation programs.

Table 3 also shows women landowners' interest in topics by residence. Seventy-eight percent of the landowners live and farm in the same county, 15% of absentee landowners live in a different county from which they farm, and 7% of absentee landowners live outside of Iowa. In-county residents show a higher interest in hay land management (p value = 0.007) and, generally, a lower interest in conservation programs, especially government conservation programs (p value = 0.018). In-state absentee landowners are particularly interested in conservation practices that benefit neither carbon nor water quality, especially energy contracts for wind or solar (p value = 0.019), and they are relatively less interested in hay land management and water quality improvement.

Financial Characteristics. Tables 4a–c summarize women landowners' interests based on acres of landholdings, percentage of off-farm income, and farm enterprise type, respectively. We indicate the sample size of each category at the bottom of the tables. The farmland size in our sample ranges from 3 to 3,000 acres, with a median size of 300 acres and a mean size of 409 acres. Table 4a shows that landowners with less than 50 acres are typically interested in pasture

and hay land management (p value = 0.093), wildlife habitat improvement (p value = 0.095), and wind/solar energy contracts (p value = 0.097). Though not statistically significant, these landowners also show a relatively higher interest in government and non-government conservation programs, indicating that they have interest in conservation financial incentives. Agricultural carbon credits programs, water quality improvement, and soil erosion control receive more interest from landowners with larger farms, especially those over 1,000 acres.

Of respondents that reported their percentage of off-farm income, 17% receive all their income from farming. This group of farming-focused women is generally more interested in both government conservation programs and non-government conservation programs but not wildlife habitat improvement (p value = 0.014). Moreover, as off-farm income increases, so does interest in wildlife habitat improvement. Landowners earning more than 80% of their income off-farm—23% of our sample—are significantly interested in wildlife habitat improvement (p value = 0.009) and relatively interested in wind/solar energy contracts. This seems to indicate that respondents believe on-farm profitability conflicts with wildlife habitat improvement, which might be viewed as financially risky.

Table 4c describes women landowners' interests by farm enterprise type—row crop only, row crop and livestock, and row crop and pasture. Conservation easements receive significantly more interest from landowners who manage crops, livestock, and pasture (p value = 0.025), especially those managing both row crops and pastures (p value = 0.053). Agricultural carbon credits programs also receive relatively more interest from row crop and pasture owners. These two topics provide landowners with opportunities to gain financial incentives for conservation actions that align with their current practices. Landowners who grow only row crops also have

significantly less interest in conservation practices benefiting both water and net carbon emission (p value = 0.000) and practices benefiting neither (p value = 0.002) than those with additional enterprises. The difference in interest in practices primarily benefiting both water and net carbon emissions mainly comes from respondents interested in cover crops (p value = 0.009) and hay land management (p value = 0.000). Cover crops also receive higher interest from landowners managing both row crops and livestock (p value = 0.024); and, hay land management obtains a particularly high interest from landowners with row crops and pastures (p value = 0.000). The difference in interest in practices benefiting neither water nor net carbon emissions mainly comes from respondents interested in wildlife habitat improvement (p value = 0.001), which also receives particularly high interest from landowners growing row crops and pastures (p value = 0.003). Overall, table 4 shows that 25% of women landowners with only row crops show no interest in conservation topics (p value = 0.002), which is still significantly higher than interest levels from those managing both crops and pastures (9%), and crops and livestock (12%).

Demographic Characteristics. Tables 5a and 5b show women landowners' interest in conservation topics by age and reasons for owning land, respectively. Survey respondents' average age is 63, with a range from 21 to 98 and the largest proportion between 50 and 80 (73%). Table 5a divides respondents into four age groups. We find that 25% of respondents over 70 show no interest in conservation topics (p value = 0.018), a level far higher than respondents between 40 and 59 (11%) and below 40 (8%). While respondents over 70 show a high interest in soil erosion control (40%, p value = 0.040), they show little interest in agricultural carbon credits programs (24%, p value = 0.012), non-government conservation programs (9%, p value = 0.016), water quality improvement (14%, p value = 0.075), and hay land management (15%, p value =

0.080). In addition, as age increases, we see a trend of decreasing interest in hay land management, conservation easement, and energy contracts, suggesting that older women landowners are less interested in these conservation topics. Petrzelka and Marquart-Pyatt (2011) also suggests that older NOLs may be less active on their land and are less likely to be involved in conservation practices than younger NOLs. The youngest group (under 40) of women landowners are generally more interested in conservation topics, particularly hay land management (50%, p value = 0.001). Since the sample size of this group is small, we also aggregate the two youngest groups and test the difference between landowners younger and older than 60. Landowners younger than 60 have a generally higher interest in conservation topics (p value = 0.022), especially in non-government programs (p value = 0.044), soil fertilizer improvement (p value = 0.099), cover crops (p value = 0.055), and hay land management (p value = 0.000). However, they are typically less interested in soil erosion control than landowners 60 years old or older (p value = 0.026).

We asked respondents to select their top three reasons for land ownership, and we compare women landowners' levels of interest in conservation topics across different reasons for owning the land. Wildlife habitat improvement received less interest from the women owning land as a source of current income (15%, p value = 0.047). Women owning land for retirement income also express little interest in wildlife habitat improvement (13%, p value = 0.012) and are also less interested in water quality improvement (15%) and wind/solar energy contracts (11%, p value = 0.069) compared to other groups, which means they are less interested in practices that primarily benefit water and practices benefiting neither water nor net carbon emission. Respondents who own land as a long-term investment express the most interest in energy

contracts for wind or solar (19%). Respondents that own land for sentimental reasons have less interest in soil fertilizer improvement (24%, p value = 0.093) but significantly higher interest in non-government programs (21%, p value = 0.080) and wildlife habitat improvement (23%, p value = 0.070) than women from other groups. Non-government programs (22%), conservation easements (12%, p value = 0.081), wildlife habitat improvement (23%), and hay land management (28%, p value = 0.058) receive the highest interest from the landowners who preserve their land for agriculture.

Conservation Concerns. For each conservation-related issue, we asked respondents to rank their level of concern from 1 (not concerned at all) to 4 (very concerned). Table 6 shows the percentages of respondents who are at least slightly concerned (>1) about the issues and summarizes the statistics by WOLs, WNOLs, and total landowners. Women landowners are most concerned with the number of requirements associated with government conservation programs (69%). More than half of respondents are also concerned with interference with the ability to change land management practices (58%), low cost-share payments (54%), and doubts about the true environmental value of the practices (52%), which matches women landowners' interest in conservation programs and economic incentives for conservation. Perry-Hill and Prokopy (2014) shows that female landowners are less likely to enroll in conservation programs than are male landowners. Combining this with the high interest in programs from our survey, we can see women's concerns about conservation programs is an essential barrier for women landowners' conservation participation. Effort-consuming factors, such as incorporating practices into leases (45%), difficulty finding information about programs (43%), time-

consuming and laborious practices (43%), and access to equipment (41%), are also important concerns that impede women from conservation adoption.

Furthermore, although few respondents to our survey stated concern with the statements “Not familiar with practices” (33%) or “Don’t know anyone implementing the practices” (26%), the actual adoption of key conservation practices in Iowa remains low (4% for cover crops and 27% for no-till) (Sawadgo et al. 2021); thus, respondents may have overstated familiarity with conservation practices, and there is a significant need for extensive and innovative educational efforts directed toward women landowners. According to Druschke and Secchi (2014), female landowners have significantly lower knowledge about conservation practices than male landowners. Our survey shows that female landowners least familiar with conservation topics tend to be absentee landowners who do not live near or operate their land (p value = 0.046).

Respondents ranked communications with tenants (30%), family/co-owners (18%), or neighbors (14%) as the least important concerns. This finding is in line with the results from the American Farmland Trust survey (2019) that “neighboring landowners” and “surrounding communities” are less important influencers for WNOLs that make decisions about conservation practices. Ulrich-Schad et al. (2016) also surveyed Indiana’s out-of-state NOLs and finds that their relationships with tenants generally play no role in conservation adoption decisions. Overall, women landowners interested in conservation are statistically significantly more concerned about every conservation issue than those not interested in conservation.

WOLs and WNOLs have the same top four concerns about conservation practices. However, WOLs put more weight on government red tape, farm management, and financial considerations, which is reflected in their emphasis on too many government requirements (p

value = 0.002), hard-to-change management practices (p value = 0.000), and low cost-share payments (p value = 0.046). In contrast, WNOLs show less interest in conservation issues, which is supported by responses indicating they are unfamiliar with practices (p value = 0.009), know fewer people implementing the practices (p value = 0.035), and worry more about practices decreasing the value of the land. Previous literature suggests that WNOLs lack technical knowledge and get excluded from farm decisions, including decisions regarding conservation practices (Carolan et al. 2004; Carter 2016; Ranjan et al. 2019). WOLs and WNOLs share similarities in their responses about incorporating conservation practices into leases, hard-to-find information about programs, and communication with tenants and neighbors.

Educational Preferences. We asked women landowners to select the top three ways they would like to receive information and educational programming. Nearly half of respondents prefer a periodic newsletter or e-newsletter for receiving information, and one-third of respondents prefer receiving information through webinars and two-page fact sheets or infographics. Overall, women landowners prefer virtual delivery methods to in-person formats, while half-day in-person educational meetings are also welcome, ranking third for WOLs and fourth for WNOLs. WOLs are generally more willing to receive educational information than WNOLs.

Figures 2a and 2b compare the preferred communication methods by WOL and WNOL age groups. The average WOL in our sample is 58 years old and the average WNOL is 68 years old, which aligns with the average ages reported by the National Agricultural Statistics Service of 58.6 for farm operators (Census of Ag 2017) and 66.5 for NOL (USDA ERS, NASS 2015). As age increases, more WOLs choose (e-)newsletters and large-font notebooks (see figure 2a).

Younger WOLs prefer women landowner learning circles and in-person field days. For WNOLs (see figure 2b), older owners prefer (e-)newsletters, two-page fact sheets or infographics, and large font notebooks; and, younger owners prefer webinars, virtual field days, and women landowner learning circles. Interestingly, the interest in a large font book surges for WOLs in their 70s and WNOLs in their 80s. Previous research shows that, compared to presentations or the internet, both male and female landowners prefer to receive educational information through postal mail and informal occasions where they could interact with each other in person, for example, the learning circles (Eells and Adcock 2012; Petrzela et al. 2019; Fairchild et al. 2022). From our survey, there is an obvious rise in the percentages of respondents choosing in-person field days and women landowner learning circles for both WOLs and WNOLs under the age of 50. In summary, landowners over the age of 70 prefer printed papers, landowners under the age of 70 prefer virtual meetings, and those under 50 prefer in-person activities. Women landowners of all ages welcome receiving information through periodic (e-)newsletters.

Implications for Extension and Conservation Professionals

Our findings can guide extension and conservation professionals as they develop programs and resources to reach women landowners and achieve conservation goals. Time and funding limitations often lead to selecting one format or mode of program and educational content delivery, however, the survey results encourage extension and outreach professionals to diversify delivery methods and content to meet WOL and WNOL needs and preferences. Periodic mailed or emailed newsletters and two-page fact sheets ranked highly for both WOL and WNOLs indicating interest in information that is brief and available to review on their schedule. Flexibility is also important for interactive learning opportunities. Offering both in-person

educational events and virtual learning sessions address preferences by both WOL and NOLs, increasing opportunities to engage, learn and build community around conservation efforts.

Summary and Conclusions

This study contributes to the current literature in four ways. First, we provide one of the first comprehensive analyses of understudied women landowners' views on farmland conservation topics based on their operational status, farming time and experience, land leasing status, residency, and financial and demographic characteristics. We underscore the heterogeneity among women landowners instead of unifying them as a single voice and shed light on how important these factors are in shaping their interest in conservation topics. We find statistical evidence that WOLs—women landowners that do not lease out their land—women landowners producing more than row crops, and young women landowners are more interested in conservation than WNOLs, women landowners with some land leased out, women landowners growing only row crops, and older women landowners.

Second, our results indicate that women landowners' interests are dispersed among conservation topics, and the proportion of uninterested women landowners is nontrivial and mainly derives from experienced WNOLs. Also, economic incentives from conservation programs play an essential role in women landowners' interest in conservation, which challenges the traditional eco-feminism theory that women are natural leaders of environmental conservation movements due to their nature of being better caretakers than men. Although the results partially result from sampling a considerable group of financially focused women landowners, it still cautions against the potential bias of women landowners' feedback in both prior and future literature due to sampling bias.

Third, we connect women landowners' interests with their concerns on conservation issues and explain the differences between WOLs and WNOLs. In general, WOLs are worried more about government red tape and farm management ability, and WNOLs have less knowledge and networks related to conservation practices.

Fourth, our work provides an important reference for supporting and connecting women landowners with Land Grant University Extension resources by investigating how they prefer to receive educational information for each conservation topic they are interested in. Periodic (e-) newsletters can efficiently convey conservation information given the embrace from both older and younger women landowners. Extension and conservation professionals can employ various methods separately for older and younger women based on our survey finding that older landowners prefer printed materials while younger landowners prefer in-person activities and online meetings.

For policy implications, landowner groups' differing interests and concerns may help policymakers formulate optimal policy designs for various target groups. Since agricultural carbon credits and government conservation programs are of top interest among women landowners, it should be impactful, especially for WOLs, if policymakers address their concerns by reducing the paperwork needed for programs and emphasizing financial incentives. Opportunities to overcome financial and operational barriers to conservation may attract WOLs to the conversation and lead to future educational event participation. Educational and engagement opportunities designed for WNOLs are important, given their unfamiliarity and lack of interest in conservation. There is also a need to educate women landowners about new opportunities for qualifying pastureland for government programs. Education may be more

effective for younger women landowners based on their relatively high interest in conservation and educational programming. When designing outreach segments for WOLs and WNOLs, customization based on stated barriers, varying in-person and technological approaches, and other strategies could be applied to improve participation and efficacy of outreach according to various groups' preferences.

There are two limitations to our work. First, our sample is not representative. Our results would be more informative and comprehensive if we had land or owner weights in our sample. Second, we only collected women landowners' responses but not male landowners' responses as a comparison, though we did review some literature on gender differences in conservation knowledge and decision making. In a future study, we will distribute another survey for female and male landowners that contains similar questions to the Iowa Women Landowner Survey, which will allow us to compare survey results to analyze gender differences.

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Table 1.**Operating vs. non-operating women landowners' rates of interest in receiving information about conservation topics.**

Conservation Topics	Percent of respondents expressing interest						
	Total	Operating owner			Non-operating owner		
		All OL	Full-time OL	Part-time OL	All NOL	Experienced NOL	Inexperienced NOL
Conservation Programs							
Agricultural Carbon Credits Programs	33%	42%	46%	39%	24%	21%	30%
Government Conservation Programs	31%	30%	33%	28%	32%	27%	42%
Non-government Conservation Programs	17%	21%	25%	18%	12%	12%	12%
Primarily Benefit Water Quality							
Water Quality Improvement	19%	21%	22%	20%	17%	19%	12%
Primarily Benefit Net Carbon Emission							
Conservation Easements	8%	8%	8%	7%	9%	7%	12%
Benefit Both Water Quality and Net Carbon Emission							
Soil Erosion Control	31%	29%	32%	28%	33%	32%	34%
Soil Fertilizer Improvement	29%	33%	44%	25%	24%	21%	28%
Cover Crops	28%	34%	28%	38%	22%	22%	22%
Pasture and Hay Land Management	20%	28%	21%	32%	14%	13%	16%
Conservation Tillage	15%	15%	19%	12%	15%	15%	16%
Benefit Neither Water Quality nor Net Carbon Emission							
Wildlife Habitat Improvement	18%	20%	18%	21%	17%	15%	20%
Energy Contracts for Wind or Solar	14%	14%	17%	12%	18%	13%	28%
No Interest	17%	10%	7%	12%	26%	28%	22%

Note: Table 1 shows the percentages of women landowners' choices to the question, "what topics related to farmland conservation are you most interested in receiving information about" within each owner type. We asked respondents to select the three topics they were most interested in receiving information about.

Table 2.

Correlation among landowner interests in farmland conservation topics.

	Agricultural carbon credits programs	Government conservation programs	Non-government conservation programs	Soil erosion control	Soil fertilizer improvement	Cover crops
Agricultural carbon credits programs	33%	12%	9%	8%	9%	12%
Government conservation programs	12%	31%	10%	11%	10%	10%
Non-government conservation programs	9%	10%	17%	7%	6%	6%
Soil erosion control	8%	11%	7%	31%	14%	8%
Soil fertilizer improvement	9%	10%	6%	14%	29%	7%
Cover crops	12%	10%	6%	8%	7%	28%

Note: Table 2 shows the percentages of women landowners simultaneously interested in two topics and somewhat reflects the correlation between the topics. We present six topics here due to the relatively high correlations. Three other relatively high correlations are not shown in the table: water quality improvement and agricultural carbon credits programs (8.7%); conservation tillage and soil erosion control (8.7%); and, wildlife habitat improvement and government conservation programs (8.4%).

Table 3.

Distribution of interest in farmland conservation topics by women landowners' land leasing status and Iowa residency.

	Land leasing status		Landowner Iowa residency		
	Owner-operator	Lease out land	In-county resident	In-state absentee	Out-of-state absentee
Conservation Programs					
Agricultural Carbon Credits Programs	40%	28%	34%	31%	40%
Government Conservation Programs	34%	29%	28%	42%	40%
Non-government Conservation Programs	21%	13%	15%	22%	28%
Primarily Benefit Water Quality					
Water Quality Improvement	19%	19%	20%	18%	8%
Primarily Benefit Net Carbon Emission					
Conservation Easements	9%	7%	9%	6%	8%
Benefit Both Water Quality and Net Carbon Emission					
Soil Erosion Control	27%	34%	30%	35%	40%
Soil Fertilizer Improvement	31%	26%	31%	22%	28%
Cover Crops	33%	24%	29%	27%	36%
Pasture and Hay Land Management	31%	11%	24%	10%	8%
Conservation Tillage	14%	16%	14%	19%	20%
Benefit Neither Water Quality nor Net Carbon Emission					
Wildlife Habitat Improvement	20%	16%	17%	23%	28%
Energy Contracts for Wind or Solar	17%	13%	14%	18%	32%
No Interest	11%	23%	17%	18%	16%

Note: Table 3 shows the percentages of people interested in the topics within each land and owner type.

Figure 1.

Distribution of interest in the four topics from women landowners across crop reporting districts who do lease out land vs. those who do not lease out land.



Note: Figure 1 shows the percentages of owners interested in each topic by land leasing status within each crop reporting district. Black bars reflect the standard error of the mean.

Table 4a.**Interests in conservation topics by landowners' financial characteristics.**

Landholdings (acres)	0–49	50–99	100–249	250–499	500–999	1000+
Conservation Programs						
Agricultural Carbon Credits Programs	31%	43%	25%	36%	33%	43%
Government Conservation Programs	40%	25%	34%	36%	24%	30%
Non-government Conservation Programs	31%	21%	12%	12%	16%	20%
Primarily Benefit Water Quality						
Water Quality Improvement	14%	14%	19%	22%	19%	27%
Primarily Benefit Net Carbon Emission						
Conservation Easements	14%	0%	7%	9%	5%	13%
Benefit Both Water Quality and Net Carbon Emission						
Soil Erosion Control	26%	29%	34%	33%	28%	40%
Soil Fertilizer Improvement	26%	18%	27%	32%	30%	33%
Cover Crops	23%	25%	29%	34%	29%	20%
Pasture and Hay Land Management	40%	21%	19%	20%	19%	10%
Conservation Tillage	11%	21%	19%	13%	14%	10%
Benefit Neither Water Quality nor Net Carbon Emission						
Wildlife Habitat Improvement	37%	21%	19%	13%	15%	17%
Energy Contracts for Wind or Solar	31%	14%	9%	14%	14%	13%
No Interest	14%	21%	19%	16%	20%	13%
Number of Responses	35	28	89	76	79	30

Note: Table 4a shows the percentages of respondents interested in each topic within each landholding group.

Table 4b.**Interests in conservation topics by landowners' financial characteristics.**

Landowner's percentage of off-farm income

	0%	1%–20%	21%–40%	41%–60%	61%–80%	81%–100%
Conservation Programs						
Agricultural Carbon Credits Programs	35%	46%	29%	36%	26%	39%
Government Conservation Programs	40%	31%	32%	31%	31%	33%
Non-government Conservation Programs	25%	13%	17%	17%	21%	18%
Primarily Benefit Water Quality						
Water Quality Improvement	17%	25%	22%	19%	31%	19%
Primarily Benefit Net Carbon Emission						
Conservation Easements	6%	10%	5%	12%	13%	6%
Benefit Both Water Quality and Net Carbon Emission						
Soil Erosion Control	23%	38%	39%	38%	28%	34%
Soil Fertilizer Improvement	31%	44%	24%	33%	26%	25%
Cover Crops	29%	27%	32%	29%	33%	30%
Pasture and Hay Land Management	19%	21%	17%	29%	18%	27%
Conservation Tillage	17%	12%	20%	12%	13%	21%
Benefit Neither Water Quality nor Net Carbon Emission						
Wildlife Habitat Improvement	8%	12%	17%	21%	21%	34%
Energy Contracts for Wind or Solar	10%	19%	15%	12%	13%	22%
No Interest	17%	10%	17%	17%	3%	13%
Number of Responses	48	52	41	42	39	67

Note: Table 4b shows the percentages of people interested in each topic within each off-farm income group.

Table 4c.**Interests in conservation topics by landowners' financial characteristics.**

Farm enterprise types

	Row crop only	Crop and livestock	Crop and pasture
Conservation Programs			
Agricultural Carbon Credits Programs	32%	31%	39%
Government Conservation Programs	32%	30%	23%
Non-government Conservation Programs	15%	19%	16%
Primarily Benefit Water Quality			
Water Quality Improvement	20%	19%	16%
Primarily Benefit Net Carbon Emission			
Conservation Easements	4%	9%	16%
Benefit Both Water Quality and Net Carbon Emission			
Soil Erosion Control	30%	30%	33%
Soil Fertilizer Improvement	31%	31%	23%
Cover Crops	22%	38%	32%
Pasture and Hay Land Management	4%	37%	42%
Conservation Tillage	18%	14%	11%
Benefit Neither Water Quality nor Net Carbon Emission			
Wildlife Habitat Improvement	10%	20%	33%
Energy Contracts for Wind or Solar	13%	16%	16%
No Interest	24%	12%	9%
Number of Responses	178	81	57

Note: Table 4c shows the percentages of people interested in each topic by farm type.

Table 5a.
Interests in conservation topics by landowners' demographic characteristics.
 Landowner's age groups

	21–39	40–59	60–69	70+
Conservation Programs				
Agricultural Carbon Credits Programs	35%	40%	38%	24%
Government Conservation Programs	27%	28%	34%	32%
Non-government Conservation Programs	19%	24%	17%	9%
Primarily Benefit Water Quality				
Water Quality Improvement	23%	15%	29%	14%
Primarily Benefit Net Carbon Emission				
Conservation Easements	12%	8%	9%	7%
Benefit Both Water Quality and Net Carbon Emission				
Soil Erosion Control	27%	23%	32%	40%
Soil Fertilizer Improvement	31%	36%	23%	30%
Cover Crops	27%	38%	25%	25%
Pasture and Hay Land Management	50%	28%	15%	15%
Conservation Tillage	19%	15%	18%	12%
Benefit Neither Water Quality nor Net Carbon Emission				
Wildlife Habitat Improvement	23%	16%	22%	14%
Energy Contracts for Wind or Solar	19%	19%	13%	12%
No Interest	8%	11%	17%	25%
Number of Responses	26	88	122	100

Note: Table 5a shows the percentages of owners interested in each topic within each age group. We test the differences between groups using the Fisher test. $p < 0.10$, $p < 0.05$, $p < 0.01$.

Table 5b.
Interests in conservation topics by landowners' demographic characteristics.
Reasons for owning land

	Source of current income	Source of retirement income	Long-term investment return	Heritage	Family or sentimental reasons	Preserving land for agriculture
Conservation Programs						
Agricultural Carbon Credits Programs	35%	33%	36%	32%	34%	33%
Government Conservation Programs	29%	35%	28%	26%	34%	31%
Non-government Conservation Programs	15%	16%	13%	16%	21%	22%
Primarily Benefit Water Quality						
Water Quality Improvement	20%	15%	19%	22%	18%	17%
Primarily Benefit Net Carbon Emission						
Conservation Easements	7%	8%	7%	7%	10%	12%
Benefit Both Water Quality and Net Carbon Emission						
Soil Erosion Control	28%	31%	29%	31%	29%	31%
Soil Fertilizer Improvement	32%	30%	30%	24%	24%	28%
Cover Crops	31%	31%	26%	28%	30%	32%
Pasture and Hay Land Management	22%	19%	19%	16%	24%	28%
Conservation Tillage	13%	15%	18%	13%	14%	14%
Benefit Neither Water Quality nor Net Carbon Emission						
Wildlife Habitat Improvement	15%	13%	16%	20%	23%	23%
Energy Contracts for Wind or Solar	13%	11%	19%	11%	15%	15%
No Interest	16%	18%	18%	19%	18%	15%
Number of Responses	197	168	135	94	154	100

Note: Table 5b shows the percentages of people interested in each topic based on the reason for owning land.

Table 6.**Operating vs. non-operating women landowners' concern about conservation-related issues.**

Conservation-related issues	% of respondents concerned or very concerned		
	Total	Operating owner	Non-operating owner
Too many requirements related to government programs	69%	76%	60%
Interference with the ability to change management practices	58%	67%	48%
Low cost-share payments	54%	62%	49%
Unsure of the true value of the practices to the environment	52%	54%	47%
Incorporating the practices into leases	45%	45%	46%
Hard to find information about state/federal programs	43%	45%	44%
Time consuming and laborious	43%	47%	40%
Access to conservation equipment needed	41%	45%	39%
Not familiar with conservation practices	33%	27%	39%
Communication with tenants	30%	28%	32%
Conservation practices may decrease the value of land	29%	26%	32%
Don't know anyone implementing the practices	26%	21%	30%
Discussion of the practices may upset family or co-owners	18%	17%	22%
Disapproval from neighbors	14%	15%	15%

Note: We asked respondents to rank their level of concern from 1 (not concerned at all) to 4 (very concerned). Table 6 shows the percentages of respondents who are at least slightly concerned (>1) about the conservation issues within each group.

Figure 2a.
Women landowners' preferred methods of receiving information and educational programming by age group.

Operating owners' preferences by age groups

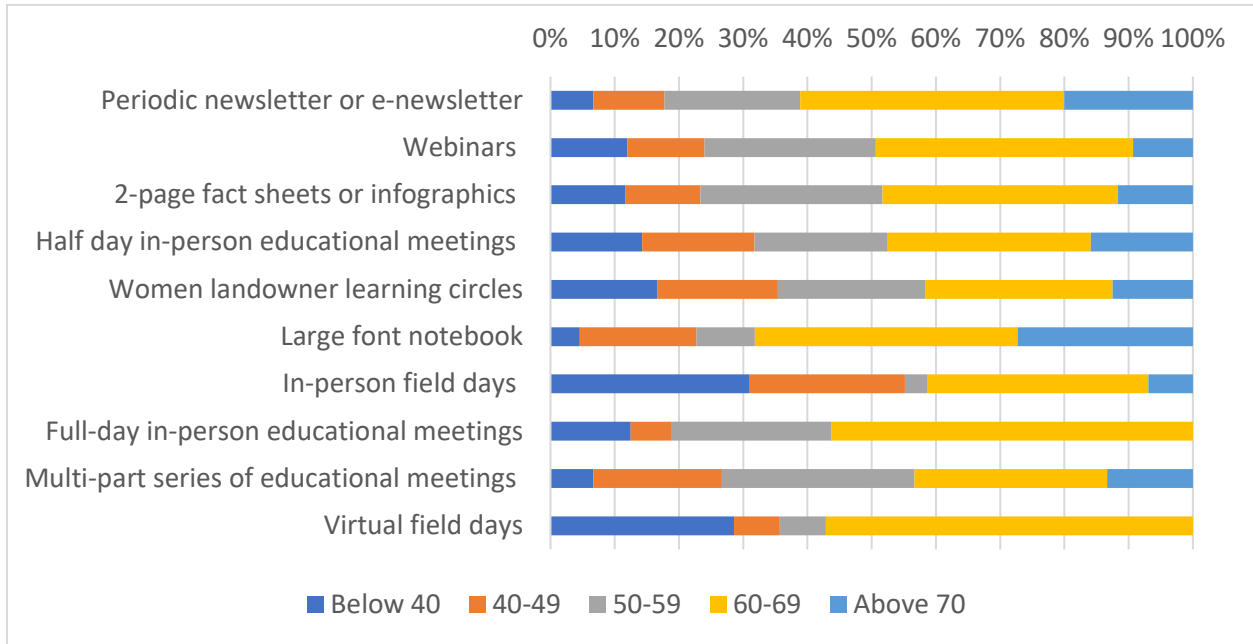


Figure 2b.
Women landowners' preferred methods of receiving information and educational programming by age group.

Non-operating owners' preferences by age groups

