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Characteristics of Kentucky Agricultural Operations Participating in NRCS Conservation Programs

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EXECUTIVE SUMMARY

The Natural Resource Conservation Service (NRCS) designs and promotes a wide variety of conservation practices and programs that enhance the environment by reducing soil erosion, improving water quality, and enhancing and creating wildlife habitat. The impact of these practices and programs is largely dependent on the voluntary participation of landowners. Thus, central to the success of the NRCS conservation programs is an understanding of the characteristics of landowners and operations participating in these programs.

Using operator and operation characteristics from the 1997, 2002, and 2007 Censuses of Agriculture and controlling for county fixed effects, this study 1) identifies significant characteristics of Kentucky agricultural operators and operations that participate in NRCS conservation programs, and 2) develops a ranking of Kentucky county effectiveness at encouraging NRCS conservation program participation. The examined NRCS conservation programs include the Conservation Reserve Program, Wetlands Reserve Programs, Farmable Wetlands Program, and Conservation Reserve Enhancement Program. The Environmental Quality Incentive Program was not evaluated as the county-level data for this program were not included in the Censuses.

Multiple linear regression model results indicate that participation in NRCS conservation programs, when controlling for the fixed effects of the counties, is most closely linked to operations owned by the primary operator and those having Internet access. Operations with larger dairies and fewer conservation practices are more likely to participate. Counties with more poultry operations and fewer crop operations are also more likely to participate. While crop size is significant, its effect was negligible. With regards to county effectiveness at encouraging participation, the Purchase and Midwestern agriculture districts have much higher participation levels than predicted unlike the Bluegrass agriculture district where participation was much lower than predicted.

Based on study results, it is recommended that the NRCS adopt a two-pronged approach to increasing conservation program participation. First, the NRCS should look for ways to modify and/or develop new programs to target under-represented operations as the present focus is largely on croplands and wetlands which are abundant in the Purchase and Midwestern agriculture districts. Second, the NRCS should pursue new avenues of education and outreach. By partnering with land grant institutions, such as the University of Kentucky, the NRCS can work to develop demonstration sites to show-case the feasibility of conserving the environment in an effective and cost-efficient manner. Also, the effectiveness of the Internet in encouraging conservation program participation indicates that the NRCS should work with land grant institutions to develop electronic media in the form of factsheets, videos, webinars, and so forth that focus on conservation practices, but that traditional means of delivery should continue.
1.0 Problem Statement and Research Questions

Nonpoint source pollution (NPS) enters waterways from many diffuse sources across the landscape. The U.S. Environmental Protection Agency (USEPA) has identified the agricultural sector as the nation’s leading source of NPS, largely in the form of siltation, pathogens, nutrients and oxygen depleting organic materials. It is estimated that over 50 percent of the nation’s streams and rivers, 45 percent of lakes, and 18 percent of estuaries are impacted by agricultural practices (USEPA, 1998). Furthermore, agricultural practices are attributable to the largest percentage of drained wetlands in the contiguous U.S. (Hansen, 2006).

To reduce NPS, the Natural Resource Conservation Service (NRCS) designs and promotes a number of conservation practices (e.g. riparian buffers, stream crossings, nutrient management) and programs to enhance the environment by reducing soil erosion, improving water quality, and improving and creating wildlife habitat. Central to the success of these conservation programs is an understanding of the characteristics of landowners who participate in such programs. **The impact of NRCS conservation programs is largely dependent on the voluntary participation of landowners (farmers or operators).**

Knowledge of characteristics of operators who participate in conservation programs is a first step in developing and refining policies, programs and outreach efforts to further encourage conservation program participation. The objectives of this study are to 1) identify significant characteristics of Kentucky agricultural operators and operations
that participate in NRCS conservation programs, and 2) develop a ranking of Kentucky county effectiveness at encouraging NRCS conservation program participation.

What operator and operation characteristics could help the NRCS identify and enroll more participants? How could the University of Kentucky Cooperative Extension Service (UK CES) use knowledge of NRCS conservation program participant characteristics to improve their environmental stewardship outreach efforts?

2.0 Overview of NRCS Conservation Programs

The NRCS is the branch of the USDA that is tasked with providing conservation planning and technical assistance to landowners and land managers in addition to administering cooperative conservation programs (California Resources Agency, 2002; NRCS, 2012). Established in 1935, originally as the Soil Conservation Service, the mission of the NRCS has been expanded beyond the management of soils to include the management of water, air, plants and animals in agricultural ecosystems.

The NRCS strives to improve land productivity through the protection and restoration of natural resources (NRCS, 2012a). The NRCS is not a regulatory branch. Thus, to achieve its mission, the NRCS must entice landowners and land managers to voluntarily participate in its conservation programs and environmental improvement programs. Presently, the NRCS administers over 40 conservation programs and activities; however, only four of these programs are reported in the 2007 Census of Agriculture. These four programs are the Conservation Reserve Program (CRP), the Wetlands Reserve Program (WRP), Farmable Wetlands Program (FWP), and the
Conservation Reserve Enhancement Program (CREP) (NRCS, 2011). For the 1997 and 2002 Censuses of Agriculture, only data from the CRP and WRP programs were reported.

The costs to producers to participate in the NRCS programs vary with the programs themselves. These costs are to implement conservation practices and are not joining fees. Cash and/or in-kind payments, such as labor and materials used to implement conservation practices, are accepted. Typically, cash and/or in-kind payments account for 20 to 25 percent of the cost of implementing the conservation practice. Generally to obtain funding from NRCS programs, operators must have an Agriculture Water Quality Plan. An Agriculture Water Quality Plan is required if the operation is situated on ten or more contiguous acres. An Agriculture Water Quality Plan defines which conservation practices are needed on an operation to minimize water pollution.¹

2.1 Conservation Reserve Program

The CRP was established in the 1985 Farm Bill. The goal of the program is to temporarily retire (minimum of 10 years, maximum of 15 years) environmentally sensitive agricultural lands (Lambert et al., 2006). Participants can receive cost-share assistance for up to 50 percent of the cost to establish approved conservation practices such as vegetated buffers alongside streams.

Not all operations or operators are eligible to participate in this program. Eligible operations include croplands and marginal pastureland. For croplands, those acres must

¹ Information in this paragraph was provided by Amanda Gumbert, Extension Water Quality Liaison, University of Kentucky.
have been planted to an agricultural commodity (e.g. corn) in four of the previous six years, be considered highly erodible, or located in a conservation priority area. For marginal pasturelands, the land must be suitable for the establishment of a riparian buffer (e.g. streamside acreage) or serve a similar water quality purpose. Operators are required to have opened or operated the lands within the 12-month period prior to the end of the CRP sign-up period (USDA Farm Service Agency, 2012b).

In the late 1990s, competition to enroll in the CRP was high and as such, the NRCS began to use an environmental benefits index (EBI) to select participants. The EBI score is comprised of components related to wildlife habitat, water quality, erosion, enduring benefits, air quality, and costs. Use of the EBI means that holders of expiring CRP contracts are not automatically re-enrolled as the NRCS is focused on enrolling the most environmentally sensitive lands (Hellerstein and Hansen, 2009). General enrollment in the program occurs once annually. For high priority conservation practices such as wetland restoration and riparian buffer establishment, farmers may enroll at any time (e.g. continuous enrollment) without the competition associated with the EBI score.

The CRP does not have a permanent enrollment option, nor is there a limit on the number of times a farmer may participate. There is, however, a programmatic cap on the total number of acres enrolled in the program nationally. For 2008, the cap was set at 32 million acres in the 2008 Farm Act (Hellerstein and Malcolm, 2011)
2.2 Wetlands Reserve Program

The WRP was established in the 1990 Farm Bill. The goal of the program is to protect and enhance wetlands on agricultural lands and to restore wetlands that have been converted to croplands (Lambert et al., 2006; NRCS, 2012c). Because of the focus on large wetlands, this program is most suitable for agricultural lands that frequently flood. Special emphasis is placed on maximizing habitat for migratory birds (NRCS, 2012c).

Enrollment in the program is continuous. Participants can enroll their lands in a permanent easement, a 30-year easement, or a restoration cost-share agreement for a minimum of 10 years. Rental payments and cost-share amounts provide to implement wetland restoration increase with the duration of the easement (NRCS, 2012c). Information on re-enrollment could not be located. However, it is doubtful a re-enrollment option exists as it would not be required for a permanent easement. As for a 30-year easement and restoration cost-share agreement, a re-enrollment option would probably not be needed as the likelihood of a farmer obtaining a permit to drain a wetland for farming purposes is low.

2.3 Farmable Wetlands Program

The FWP was authorized as an option in the CRP in 2001 of Title XI of Agriculture and Related Agency appropriations to “restore up to one million acres of farmable wetlands and associated buffers” (USDA Farm Service Agency, 2009). The focus is on wetlands smaller than those targeted with the WRP. Greater emphasis is placed on
planting long-term sustainable cover crops (e.g. trees) to promote water quality and wildlife habitat.

Eligibility requirements are similar to those of the CRP and WRP. Re-enrollment is the same as the CRP. The national programmatic cap on the number of acres allowed to enroll is 1,000,000 with up no more than 100,000 in one state.

2.4 Conservation Reserve Enhancement Program

Statutory authority for the CREP is linked to the CRP. The CREP is an “offshoot” of the CRP (USDA Farm Service Agency, 2012a). A greater focus is placed on habitat for threatened and endangered species and aquatic species of interest such as the salmon. Eligibility for this program is limited to specific geographic areas within states. Enrollment caps differ between states. For Kentucky, the CREP is for 99,500 acres in the Green River watershed (USDA Farm Service Agency, 2011). Like the CRP, farmland is temporarily retired (10-15 years). Operators may re-enroll their land; no maximum enrollment length is specified.

3.0 Literature Review

Research pertaining to conservation program participant characteristics is limited to a few studies in the late 1980’s and late 2000’s. Hatley et al. (1989) conducted one of the first studies to examine characteristics of CRP participants. The authors examined socioeconomic characteristics of participating operators in 11 counties in the Texas High Plains. Randomly selected CRP participants were interviewed (n=124) regarding their age, education, occupation, tenure, operation size, and operation type. Results of the
study indicated that operator age was positively correlated with CRP participation as was full ownership and part-time farming. Smaller operations, less than 140 acres, rarely participated. Mortensen et al. (1989) also found a positive correlation between CRP participation and the variables operator age and farming as the primary occupation in North Dakota.

In a different agricultural setting, Force and Bills (1989) examined New York CRP participants of whom non-farmers represented 49 percent of those enrolled. Results indicated that farmers who sold dairy products, operations with more productive lands, and operations with more soil conservation practices enrolled less. The authors concluded that dairy farms need crop lands for herd maintenance. For dairy farms and productive lands, payment from enrolling lands in CRP would not pay for the lost opportunity costs. As for the negative correlation with soil conservation practices, the authors concluded that operations using such practices had already addressed their most serious erosion issues and therefore would not benefit from the CRP. Greater CRP participation was associated with higher non-farm income and larger operations.

Soule et al. (2000) examined the effect of tenure or ownership on the adoption of conservation practices amongst 941 U.S. corn producers. Variables were related to conservation practice type, farm size, operator characteristics, environmental characteristics (e.g. land erodibility, annual precipitation, and average temperature), and regional location. The authors found that tenure had an effect on conservation practice adoption with owners more apt to adopt long-term practices such as grassed waterways.
Lambert et al. (2006) examined participants in multiple NRCS conservation compatible programs. The examined programs included the CRP, WRP, Environmental Quality Incentives Program (EQIP), and Conservation Security Program (CSP). The EQIP is designed to provide financial assistance to implement conservation practices, some of which are also allowable under CRP (e.g. riparian buffers), and others which are not (e.g. waste storage, water tanks). For the CSP, an allowance is made such that previously implemented practices, those installed prior to CSP enrollment, can be rewarded. As with Lambert et al. (2007), many of the same variables were examined. Results indicated that there was a positive association between percentage of land enrolled in NRCS conservation programs and the variables farming experience, government payments to value of production, and female operator. A negative association was seen with grain crops, and no association was found with regards to high-value crops, household size, operator raised on farm, highly erodible land, or proximity of farm to a water source.

Lambert et al. (2007) examined characteristics related to farm structure, farm household, human capital, and the environment to determine which factors were most relevant to working farm participation in only the CRP. Farm structure characteristics included total cropland operated, percentage of land owned to land operated, percentage of revenue from crop production, and government and CRP payments per acre. The farm household variable was percentage of off-farm income to total income and percentage of persons living in the household under 18 years of age. Human capital characteristics included years of farming experience and educational attainment. Results
of the study indicated that CRP payments and farm size were positively correlated with the amount of CRP land enrolled.

While not studying operator or operator characteristics related to NRCS conservation program participation, Secchi and Babcock (2007) did examine the anticipated impact of high corn prices on CRP enrollment. As the CRP program focuses on croplands, it is expected that increases the price of corn will decrease CRP enrollment. As the demand for corn increases, as is the case when the demand for ethanol increases, is expected to influence an operator’s decision to either enroll lands in CRP or take lands out of CRP (i.e. bring the land out of retirement). Secchi and Babcock (2007) found that as corn prices increase, operators push to unretired lands. To counter-act de-enrollment, the authors suggest increasing rental payments and/or placing a greater focus on enrolling and retiring sensitive lands.

4.0 Methods

4.1 Data Collection

The 1997, 2002, and 2007 Censuses of Agriculture, compiled by the USDA’s National Agricultural Statistics Service (NASS), were used to acquire data on operator and operation characteristics at the county level in Kentucky. Data are not linked to individual operations, but instead are aggregated by the USDA-NASS. The dependent variable is the percentage of operations participating in the NRCS conservation program (Participating Operations). Based on a review of the literature and professional
consultation\(^2\), eighteen independent variables are included in the model. These independent variables are as follows:

- Government payments per participating operation (GOVERNMENT PAYMENTS),
- Operation size in acres (SIZE),
- Net income per operation (NET INCOME),
- Percent of primary operators whose main occupation is farming (PRIMARY OCCUPATION),
- Percentage of primary operators who are female (FEMALE),
- Percentage of operations owned by the primary operator (OWNED),
- Average age of primary operator (AGE),
- Average number of years primary operator has been on the present operation (DURATION),
- Number of operations with Internet access (INTERNET),
- Percentage of operations with beef cattle (BEEF OPERATIONS),
- Average number of beef cattle on beef operations (BEEF SIZE),
- Percentage of operations with dairy cattle (DAIRY OPERATIONS),
- Average number of dairy cattle on dairy operations (DAIRY SIZE),
- Percentage of operations with poultry (POULTRY OPERATION),
- Average number of poultry on poultry operation (POULTRY SIZE),

\(^2\) Dr. Steve Higgins, Director of Animal and Environmental Compliance, College of Agriculture, University of Kentucky, February 10, 2012.
• Percentage of operations with crops (CROP OPERATIONS),
• Average crops sales on crop operations (CROP SIZE), and
• Percentage of operations using conservation practices (CONSERVATION PRACTICE).

With the exception of GOVERNMENT PAYMENTS, all other variables refer to operator and operation characteristics for all operations combined in a county regardless of their participation in an NRCS conservation program.

Based upon the review of the literature, it is expected that the following variables will result in a greater percentage of NRCS conservation program participation: GOVERNMENT PAYMENTS, SIZE, PRIMARY OCCUPATION, FEMALE, OWNED, AGE, DURATION, and OWNED. The following variables are expected to decrease the level of participation: DAIRY OPERATIONS, DAIRY SIZE, CROP SIZE, and CONSERVATION PRACTICE. For the remaining variables, which were not discussed in the reviewed literature, it is expected that INTERNET will be positively related to participation and livestock characteristics will be negatively related. The reasons for these assumptions are that 1) Internet access is linked to greater awareness, and 2) the NRCS conservation programs examined in this study are focused predominately on croplands and not livestock operations.

Data on participating operations and government payments to those operations encompassed the CRP, WRP, FWP, and CREP programs in the 2007 Census of Agriculture but only the CRP and WRP programs in the 1997 and 2002 Censuses of Agriculture.
Agriculture. For the variables INTERNET and CONSERVATION PRACTICE, data were only reported for the 2007 Census of Agriculture as these data were not collected for prior census periods.

In some instances, data were not reported by the USDA-NASS as doing so could lead to the identification of an operator and/or operation. To account for these missing data, 15 missing data variables were created where 0 = data present and 1 = data missing. Missing data variables were created for the following:

- Missing PARTICIPATING OPERATIONS (MISS PARTICIPATING OPERATIONS)
- Missing GOVERNMENT PAYMENTS (MISS GOVERNMENT PAYMENTS),
- Missing SIZE (MISS SIZE),
- Missing NET INCOME (MISS NET INCOME),
- Missing PRIMARY OCCUPATION (MISS PRIMARY OCCUPATION),
- Missing FEMALE (MISS FEMALE),
- Missing OWNED (MISS OWNED),
- Missing AGE (MISS AGE),
- Missing INTERNET (MISS INTERNET),
- Missing BEEF SIZE (MISS BEEF SIZE),
- Missing DAIRY OPERATIONS (MISS DAIRY OPERATIONS),
- Missing DAIRY SIZE (MISS DAIRY SIZE),
- Missing POULTRY OPERATIONS (MISS POULTRY OPERATIONS),
- Missing POULTRY SIZE (MISS POULTRY SIZE),
- Missing CROP SIZE (MISS CROP SIZE), and
- Missing CONSERVATION PRACTICE (MISS CONSERVATION PRACTICE).

County-level data on environmental soil erodibility, which is a proxy for environmental sensitivity, were not available (Lambert et al., 2007). Appendix A contains information on USDA-NASS definitions of census variables used in the model.

4.2 Statistical Analysis

A multiple linear regression (xi:xtreg) was performed in STATA 10 to examine the effect of operator and operation characteristics on the percentage of operations participating in NRCS conservation programs (i.e., CRP, WRP, FWP, and CREP). COUNTY was used as the fixed effect. Dummy variables were created for census year with 1997 serving as the datum. For instances when data were missing, missing code values (e.g., dummy variables) were included. The predicted effects of each county on the likelihood of operation participation in an NRCS conservation program were computed.
5.0 Results and Discussion

5.1 Summary Statistics

Table 1 contains summary statistics for the model parameters. Examination of the kernel density estimation shows that the probability density function of the variable PARTICIPATING OPERATIONS (Figure 1). This graph has a positive skew meaning there is a high concentration of counties with low values for PARTICIPATING OPERATIONS. The majority of the values are shown to be less than 5 percent.

Figure 1: Distribution of Dependent Variable PARTICIPATING OPERATIONS.

This variable represents the percentage of operations in a county that participate in the NRCS conservation programs.
Table 1: Means and Standard Errors of Operator and Operation Characteristics (n=360).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Units</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Minimum¹</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARTICIPATING OPERATIONS</td>
<td>%</td>
<td>3.6</td>
<td>5.1</td>
<td>0</td>
<td>23.8</td>
</tr>
<tr>
<td>GOVERNMENT PAYMENTS</td>
<td>$1000s</td>
<td>1.8</td>
<td>1.7</td>
<td>0</td>
<td>16.0</td>
</tr>
<tr>
<td>SIZE</td>
<td>acres</td>
<td>155.0</td>
<td>73.2</td>
<td>0</td>
<td>582.7</td>
</tr>
<tr>
<td>NET INCOME</td>
<td>$1000s</td>
<td>4.7</td>
<td>$8.6</td>
<td>-9.8</td>
<td>67.9</td>
</tr>
<tr>
<td>PRIMARY OCCUPATION</td>
<td>%</td>
<td>34.1</td>
<td>8.4</td>
<td>0</td>
<td>66.7</td>
</tr>
<tr>
<td>FEMALE</td>
<td>%</td>
<td>8.2</td>
<td>3.2</td>
<td>0</td>
<td>20.0</td>
</tr>
<tr>
<td>OWNED</td>
<td>%</td>
<td>32.8</td>
<td>6.4</td>
<td>11.50</td>
<td>47.0</td>
</tr>
<tr>
<td>AGE</td>
<td>years</td>
<td>54.9</td>
<td>4.5</td>
<td>0</td>
<td>60.9</td>
</tr>
<tr>
<td>DURATION</td>
<td>years</td>
<td>20.0</td>
<td>1.9</td>
<td>11.4</td>
<td>26.6</td>
</tr>
<tr>
<td>INTERNET</td>
<td>%</td>
<td>5.6</td>
<td>8.1</td>
<td>0</td>
<td>32.0</td>
</tr>
<tr>
<td>BEEF OPERATIONS</td>
<td>%</td>
<td>19.1</td>
<td>6.3</td>
<td>2.4</td>
<td>46.2</td>
</tr>
<tr>
<td>BEEF SIZE</td>
<td>no. beef cattle</td>
<td>24.0</td>
<td>12.3</td>
<td>0</td>
<td>76.3</td>
</tr>
<tr>
<td>DAIRY OPERATIONS</td>
<td>%</td>
<td>1.3</td>
<td>1.3</td>
<td>0</td>
<td>11.4</td>
</tr>
<tr>
<td>DAIRY SIZE</td>
<td>no. dairy cattle</td>
<td>19.3</td>
<td>22.5</td>
<td>0</td>
<td>152.3</td>
</tr>
<tr>
<td>POULTRY OPERATIONS</td>
<td>%</td>
<td>2.4</td>
<td>3.5</td>
<td>0</td>
<td>55.0</td>
</tr>
<tr>
<td>POULTRY SIZE</td>
<td>no. poultry (1,000s)</td>
<td>7.0</td>
<td>19.3</td>
<td>0</td>
<td>128.2</td>
</tr>
<tr>
<td>CROP OPERATIONS</td>
<td>%</td>
<td>24.1</td>
<td>9.9</td>
<td>0.7</td>
<td>56.1</td>
</tr>
<tr>
<td>CROP SIZE</td>
<td>$1,000s</td>
<td>31.6</td>
<td>44.8</td>
<td>0</td>
<td>374.4</td>
</tr>
<tr>
<td>CONSERVATION PRACTICE</td>
<td>%</td>
<td>1.9</td>
<td>3.1</td>
<td>0</td>
<td>16.6</td>
</tr>
</tbody>
</table>

¹A value of zero indicates that at least one data point was missing for the variable. Without missing value codes, the minimum values are as follows: Participating Operations=0.096%; Government Payments=$0.1 ($1,000s); Size=22.8 acres; Primary Occupation=9.4%; Female=0.5%; Age=46 years; Internet=10.5%; Beef Size=3.4 no. beef cattle; Dairy Operations=0.1%; Dairy Size=0.6 no. dairy cattle; Poultry Operations=0.2%; Poultry Size=2.0 no. poultry; Crop Size=$1.1 ($1,000s); and Conservation Practice=1.4%.
5.2 Regression Analysis

Table 2 contains the outcome of the model. Results of the regression analysis indicated the model explained over 35 percent of the variation in PARTICIPATING OPERATIONS with over 94 percent of the variance due to the fixed effect of COUNTY. PARTICIPATING OPERATIONS was significantly related to OWNED, INTERNET, DAIRY SIZE, POULTRY OPERATIONS, CROP OPERATIONS, CROP SIZE, and CONSERVATION PRACTICE when controlling for the fixed effects of COUNTY (α=0.05). An increase in the variables OWNED, INTERNET, DAIRY SIZE, POULTRY OPERATION, and CROP SIZE resulted in an increase in PARTICIPATING OPERATIONS. An increase in the variables CROP OPERATIONS and CONSERVATION PRACTICE resulted in a decrease in PARTICIPATING OPERATIONS. Those operations which are owned by the primary operator and have Internet access, larger dairies, larger crop sales, and fewer conservation practices are more likely to participate in NRCS conservation programs. Counties with more poultry operations and fewer crop operations are more likely to have participating operations.
Table 2: Results of Multiple Linear Regression Analysis.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOVERNMENT PAYMENTS</td>
<td>0.051</td>
<td>0.066</td>
<td>0.440</td>
</tr>
<tr>
<td>SIZE</td>
<td>0.006</td>
<td>0.003</td>
<td>0.068</td>
</tr>
<tr>
<td>NET INCOME</td>
<td>-0.007</td>
<td>0.021</td>
<td>0.732</td>
</tr>
<tr>
<td>PRIMARY OCCUPATION</td>
<td>-0.002</td>
<td>0.021</td>
<td>0.909</td>
</tr>
<tr>
<td>FEMALE</td>
<td>0.050</td>
<td>0.049</td>
<td>0.305</td>
</tr>
<tr>
<td>OWNED</td>
<td>0.162</td>
<td>0.040</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>AGE</td>
<td>0.193</td>
<td>0.103</td>
<td>0.062</td>
</tr>
<tr>
<td>DURATION</td>
<td>-0.167</td>
<td>0.097</td>
<td>0.086</td>
</tr>
<tr>
<td>INTERNET</td>
<td>0.271</td>
<td>0.051</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>BEEF OPERATIONS</td>
<td>-0.065</td>
<td>0.044</td>
<td>0.139</td>
</tr>
<tr>
<td>BEEF SIZE</td>
<td>-0.001</td>
<td>0.016</td>
<td>0.926</td>
</tr>
<tr>
<td>DAIRY OPERATIONS</td>
<td>-0.074</td>
<td>0.139</td>
<td>0.596</td>
</tr>
<tr>
<td>DAIRY SIZE</td>
<td>0.028</td>
<td>0.006</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>POULTRY OPERATIONS</td>
<td>0.223</td>
<td>0.100</td>
<td>0.028</td>
</tr>
<tr>
<td>POULTRY SIZE</td>
<td>0.002</td>
<td>0.001</td>
<td>0.785</td>
</tr>
<tr>
<td>CROP OPERATIONS</td>
<td>-0.106</td>
<td>0.025</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CROP SIZE</td>
<td>0.014</td>
<td>0.006</td>
<td>0.025</td>
</tr>
<tr>
<td>CONSERVATION PRACTICE</td>
<td>-0.178</td>
<td>0.080</td>
<td>0.028</td>
</tr>
<tr>
<td>MISS PARTICIPATING OPERATIONS</td>
<td>-0.983</td>
<td>0.454</td>
<td>0.031</td>
</tr>
<tr>
<td>MISS GOVERNMENT PAYMENTS</td>
<td>-0.396</td>
<td>0.312</td>
<td>0.206</td>
</tr>
<tr>
<td>MISS SIZE</td>
<td>0.950</td>
<td>1.401</td>
<td>0.499</td>
</tr>
<tr>
<td>MISS NET INCOME</td>
<td>0.460</td>
<td>1.338</td>
<td>0.731</td>
</tr>
<tr>
<td>MISS PRIMARY OCCUPATION</td>
<td>-13.324</td>
<td>4.996</td>
<td>0.008</td>
</tr>
<tr>
<td>MISS FEMALE</td>
<td>-5.648</td>
<td>2.590</td>
<td>0.030</td>
</tr>
<tr>
<td>MISS AGE</td>
<td>9.077</td>
<td>5.393</td>
<td>0.094</td>
</tr>
<tr>
<td>MISS INTERNET</td>
<td>4.869</td>
<td>3.709</td>
<td>0.191</td>
</tr>
<tr>
<td>MISS BEEF SIZE</td>
<td>0.239</td>
<td>0.511</td>
<td>0.641</td>
</tr>
<tr>
<td>MISS DAIRY OPERATIONS</td>
<td>0.907</td>
<td>0.595</td>
<td>0.129</td>
</tr>
<tr>
<td>MISS DAIRY SIZE</td>
<td>0.228</td>
<td>0.231</td>
<td>0.324</td>
</tr>
<tr>
<td>MISS POULTRY OPERATION</td>
<td>0.135</td>
<td>1.709</td>
<td>0.937</td>
</tr>
<tr>
<td>MISS POULTRY SIZE</td>
<td>-0.547</td>
<td>0.365</td>
<td>0.135</td>
</tr>
<tr>
<td>MISS CROP SIZE</td>
<td>-0.648</td>
<td>1.818</td>
<td>0.722</td>
</tr>
<tr>
<td>MISS CONSERVATION PRACTICE</td>
<td>-2.954</td>
<td>3.558</td>
<td>0.407</td>
</tr>
<tr>
<td>CENSUS YEAR 2002</td>
<td>-0.307</td>
<td>0.295</td>
<td>0.299</td>
</tr>
<tr>
<td>CENSUS YEAR 2007</td>
<td>-3.083</td>
<td>1.977</td>
<td>0.120</td>
</tr>
<tr>
<td>Constant</td>
<td>-9.167</td>
<td>5.127</td>
<td>0.075</td>
</tr>
</tbody>
</table>

1Variable MISS OWNED was dropped due to collinearity with PRIMARY OCCUPATION. Green and purple highlighted cells signify significant independent variables. Purple is used for missing data dummy variables.
5.2.1 OWNED

The variable OWNED has a positive impact on NRCS conservation program participation. A 1 percent increase in OWNED results in a 0.2 percent increase in an operation participating in an NRCS conservation program. This result was expected as operators who fully own their operation can more easily make decisions regarding conservation program enrollment.

5.2.2 INTERNET

The variable INTERNET has a positive impact on NRCS conservation program participation. A 1 percent increase in INTERNET results in a 0.3 percent increase in the likelihood of an operation participating in an NRCS conservation program. This result is somewhat surprising given the mean age of the primary operator (54.9 years), as it has been shown that Internet usage decreases with increasing age (Reddick, 2012).

Results of a correlation matrix comparing INTERNET to operator and operation characteristics indicate the variable has a significant positive correlation to the operator characteristics AGE and DURATION and the operation characteristics BEEF SIZE, CROP SIZE, and CONSERVATION PRACTICE. Conversely, INTERNET has a significant negative correlation to PRIMARY OCCUPATION, FEMALE, OWNED, BEEF OPERATIONS, DAIRY OPERATIONS, DAIRY SIZE, and CROP OPERATIONS. Those operators with Internet access are older males employed outside of the operation. Having worked at their present operation for a longer period of time, the operators are likely approaching retirement age (65 years). Interestingly, it is the
larger beef and crop operations that are more likely to have Internet access and the dairy operations (large and small) that are less likely.

That INTERNET is positively correlated with CONSERVATION PRACTICE indicates that the Internet is likely a viable means of enhancing outreach and education efforts to bolster conservation participation. However, the effects of an Internet-based education program will likely vary between operation types. If the goal is to reach larger beef and crop operations, Internet programming holds promise. If the goal is to reach dairy operations and smaller beef and crop operations, then another form of information delivery, such as workshops and field days, should be pursued. Park and Mishra (2003) reached a similar conclusion when studying Internet use on operations. The authors found that more educated operators on larger operations were more apt to use the Internet.

5.2.3 DAIRY SIZE

DAIRY SIZE had a positive impact on program participation. A 1 percent increase in DAIRY SIZE resulted in a 0.03 percent increase in NRCS conservation program participation. This positive relationship was unexpected. Force and Bills (1989) concluded that because dairy operations need croplands to maintain their herds, operators are not as willing to enroll lands in CRP. Doing so results in high lost opportunity costs associated with lost feed production. Dairy operations in Kentucky tend to be much smaller than those in New York, which is typically the third largest dairy producing state after California and Wisconsin. As such, the amount of land needed to maintain an average-sized dairy herd in Kentucky is less than that of New
York. This aspect may be the reason that increases in dairy size are related to increases in NRCS conservation program participation.

5.2.4 POULTRY OPERATIONS

A 1 percent increase in POULTRY OPERATIONS results in a 0.2 percent increase in NRCS conservation program participation. The significance of the variable POULTRY OPERATIONS may be due to the changing trends in poultry production over the years. Perry et al. (1999) reported that many poultry production operations are now fully owned by the primary operator with these operators listing farming as their primary occupation. Plus, these operations are not land extensive meaning the operations can either produce other commodities such as cattle or crops, or they can enroll unused lands in CRP programs for additional income. Lynch and Lovell (2001) noted that landowners who obtained a larger percentage of income from farming were more likely to participate in conservation programs as a means of supplementing their income.

5.2.5 CROP OPERATION

The variable CROP OPERATION was predicted to reduce operation participation. A 1 percent increase in the variable CROP OPERATION was predicted to produce a -0.1 percent decrease in NRCS conservation program participation. This may be related to the type and value of crops grown in Kentucky. While Lambert et al. (2006) did not find a relationship between high-value crops and NRCS conservation program participation, the authors did note a positive relationship between grain crops and program participation. This relationship could also be related to a hesitation or lack of
interest in locking-up croplands in a long-term lease (Gill-Austern). The push in U.S. energy policy to utilize a greater percentage of renewables for energy means that more money is likely to be made from crops, such as corn from which ethanol is made, than in rental payments.

5.2.6 CROP SIZE

A 1 percent increase in CROP SIZE produces a 0.01 percent increase in program participation. This result is somewhat surprising given the finding by Hellerstein and Malcolm (2011) that higher crop prices would decrease CRP participation. It is expected that larger crop operations would have less interest in conservation programs with long-term easements, particularly when the demand for crop-based biofuels is only expected to increase.

5.2.7 CONSERVATION PRACTICE

The variable CONSERVATION PRACTICE is predicted to decrease conservation program participation. A 1 percent increase in the variable CONSERVATION PRACTICE is predicted to produce a 0.18 percent decrease in NRCS conservation program participation. A similar relationship was noted by Force and Bill (1989) when examining the New York CRP program. The authors reasoned that the trend was attributable to operators already managing their most problematic erosion areas without the need of CRP assistance.

It is possible that private conservation practices are substituting for public or NRCS conservation practices. One of the criteria for enrollment in the CRP is erosion potential of the land whereby the most fragile lands receive higher rankings. As such, it
is possible that CONSERVATION PRACTICE represents operations whose lands did not qualify for the CRP. It is also possible that these operations enrolled lands in another NRCS conservation program. Recall the 2007 Census of Agriculture collected data on only 10 percent of the on-going NRCS programs.\(^3\)

5.2.8 Missing Data

The missing variables MISS GOVERNMENT PAYMENT, MISS SIZE, MISS NET INCOME, MISS AGE, MISS INTERNET, MISS BEEF SIZE, MISS DAIRY OPERATIONS, MISS DAIRY SIZE, MISS POULTRY OPERATIONS, MISS POULTRY SIZE, MISS CROP SIZE, and MISS CONSERVATION PRACTICE were not significant meaning the lack of these missing data did not impact the model. However, the missing variables MISS PARTICIPATING OPERATIONS, MISS PRIMARY OCCUPATION, and MISS FEMALE were significant. In reviewing the data set, many of these missing values were associated with counties have a low number of PARTICIPATING OPERATIONS. It is likely that these operations did not report payment information, or the Census of Agriculture excluded such information due to the potential to link payments to individual operations.

5.3 County Rankings

Figure 2 shows the predicted level of participating operations in each county based upon the characteristics of the respective counties (variable COUNTY EFFECT). The highest levels of predicted participation in the NRCS conservation program were in the western part of the state. The lowest levels were predicted for the central portion

\(^3\) Data from 4 programs out of 40 collected in the 2007 Census of Agriculture.
around Lexington and Louisville and in the eastern region near the western Virginia and eastern Tennessee borders.

Of the top 10 participating counties, six were in the Purchase Agriculture District and four in the Midwestern Agriculture District (Table 3). Of the bottom 10 participating counties, five were in the Bluegrass Agriculture District, three in the Eastern or Mountain Agriculture District, and one each in the Northern and Central Agriculture Districts (Table 4).

Table 3: Top Ten Counties with Participating Operations.

<table>
<thead>
<tr>
<th>County</th>
<th>Agriculture District</th>
<th>Predicted Participating Operations (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carlisle</td>
<td>Purchase</td>
<td>13.41</td>
</tr>
<tr>
<td>Hickman</td>
<td>Purchase</td>
<td>13.10</td>
</tr>
<tr>
<td>Graves</td>
<td>Purchase</td>
<td>13.06</td>
</tr>
<tr>
<td>Caldwell</td>
<td>Midwestern</td>
<td>11.56</td>
</tr>
<tr>
<td>Lyon</td>
<td>Purchase</td>
<td>10.48</td>
</tr>
<tr>
<td>Crittenden</td>
<td>Midwestern</td>
<td>9.28</td>
</tr>
<tr>
<td>Webster</td>
<td>Midwestern</td>
<td>9.24</td>
</tr>
<tr>
<td>Marshall</td>
<td>Purchase</td>
<td>9.02</td>
</tr>
<tr>
<td>Todd</td>
<td>Midwestern</td>
<td>8.92</td>
</tr>
<tr>
<td>Calloway</td>
<td>Purchase</td>
<td>8.61</td>
</tr>
</tbody>
</table>

Table 4: Bottom Ten Counties with Participating Operations.

<table>
<thead>
<tr>
<th>County</th>
<th>Agriculture District</th>
<th>Predicted Participating Operations (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jessamine</td>
<td>Bluegrass</td>
<td>-3.52</td>
</tr>
<tr>
<td>Shelby</td>
<td>Bluegrass</td>
<td>-3.57</td>
</tr>
<tr>
<td>Letcher</td>
<td>Eastern or Mountain</td>
<td>-3.62</td>
</tr>
<tr>
<td>Harlan</td>
<td>Eastern or Mountain</td>
<td>-4.35</td>
</tr>
<tr>
<td>Woodford</td>
<td>Bluegrass</td>
<td>-4.43</td>
</tr>
<tr>
<td>Anderson</td>
<td>Bluegrass</td>
<td>-4.57</td>
</tr>
<tr>
<td>Oldham</td>
<td>Northern</td>
<td>-4.62</td>
</tr>
<tr>
<td>Leslie</td>
<td>Eastern or Mountain</td>
<td>-4.71</td>
</tr>
<tr>
<td>Fayette</td>
<td>Bluegrass</td>
<td>-4.83</td>
</tr>
<tr>
<td>Jefferson</td>
<td>Central</td>
<td>-5.22</td>
</tr>
</tbody>
</table>
Figure 2: Predicted COUNTY EFFECTS on NRCS Conservation Program Participation (%).
6.0 Limitations

Between 1995 and 2010, Kentucky received about $645 million in conservation payments of which about $482.5 million were allocated to the CRP and $31.9 million to the WRP. These two programs alone accounted for nearly 80 percent of conservation program monies sent to Kentucky. Data for the FWP and the CREP were not available. However, about 20 percent of the conservation monies spent in Kentucky was not accounted for in the Censuses of Agriculture. The EQIP, which is designed to provide financial assistance to operators to implement conservation practices such as waste storage units and off-stream watering sources for livestock, was not included in the government payment totals for conservation programs. The EQIP program alone accounted for about 10 percent of the conservation dollars spent during the 1995-2010 period.

7.0 Conclusions

Participation in NRCS conservation programs, when controlling for the fixed effects of COUNTIES, is most closely linked to operations owned by the primary operator and those having Internet access. Operations that have larger dairies, larger crops sales, and fewer conservation practices are more likely to participate in NRCS conservation programs. Counties with more poultry operations and fewer crop operations are more likely to have participating operations. Thus, NRCS conservation agents may find it

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4 Dollar amounts obtained from Environmental Working Group, 2011 Farm Subsidy Database. Available at: http://farm.ewg.org/progdetail.php?fips=21000&progcode=totalcons&regionname=Kentucky

5 Kentucky received no EQIP monies in 1995 and the 2010 payments were not available for inclusion in the total.
more effective to target operations with such characteristics when trying to increase conservation program enrollment.

Further examination of the independent variable INTERNET revealed that large beef and crop operations are more likely to have Internet access and are more likely to implement some sort of conservation practice. Dairy operations, regardless of size, are not likely to have Internet access. Thus, development of education and outreach programs with an Internet component are more likely to reach operators at large beef and crop operations. The low percentage of dairy operations with Internet access points to the need to offer extension materials via more traditional means such as workshops and field days.

When examining NRCS conservation program participation at the county level, a wide disparity was noted between counties in the Purchase and Midwestern agriculture districts and those particularly in the Bluegrass agriculture district. Many counties within the Purchase and Midwestern agricultural districts participated in the NRCS conservation programs CRP, WRP, FWP and CREP more than predicted given the operator and operation characteristics in the model. This result is appropriate given the focus of these programs on croplands and wetlands, which are both more prevalent in these agricultural districts. However, the markedly low level of participation compared to what was predicted in many counties in the Bluegrass agricultural district was surprising, particularly considering the University of Kentucky and Kentucky State University, the Commonwealth’s 1862 and 1890 land grant institutions, respectively, are located in this Agricultural District. Why this trend is present warrants additional study.
During these times of reduced budgets, NRCS personnel face the challenging task of encouraging landowners and land managers to implement conservation practices to protect and restore natural resources (e.g. soil, water, air, plants and animals) on agricultural lands. While efforts to increase NRCS conservation program participation are tied to available dollars for rental payments and cost-share assistance, results of this study indicate that the amounts of government payments received by participants, thus far, are not a significant in deciding to participate. Plus, the negative linkage between CONSERVATION PRACTICE and PARTICIPATING OPERATIONS indicates landowners are willing to forgo government assistance in implementing conservation practices; however, a number of these conservation practices may be tied to the EQIP program or other such NRCS programs.

8.0 Recommendations

Based on the results of this study, it is recommended that the NRCS adopt a two-pronged approach to improving NRCS conservation program participation (i.e. enrollment) and implementation of conservations practices, in general. The first prong focuses on program adaptation while the second prong emphasizes education and outreach.

8.1 Program Adaptation

The CRP and the WRP are the big money NRCS conservation programs. However, their cropland and wetland focus limits the NRCS’s ability to achieve its mission to protect, manage and restore soils, water, and habitats in agricultural ecosystems in
Kentucky. Topographic constraints in eastern Kentucky will limit the extent of cropable
lands and the presence of large wetlands. Mortenssen et al. (1989) recommended
modifying future CRP-like programs to place greater emphasis on soils and topography
and a lesser one on past agricultural cropping practices. Though small in dollars, the
FWP seems to be a step in this direction as it focuses on smaller wetlands. Such
wetlands were once prevalent in eastern Kentucky (Biebighauser, 2007). Through
tobacco, it is likely that the eligibility requirement that such lands be planted in an
agricultural commodity for three of the past ten years is met. It is recommended that the
NRCS explore other such opportunities to develop spin-off programs that target under-
represented agricultural lands.

8.2 Education and Outreach

8.2.1 Demonstrations

Kraft et al. (1989) found that farm operators rarely selected soil conservation as a
goal of their operation, but instead listed financial growth, survival, and rural lifestyle
maintenance as their primary three objectives. The authors noted that for NRCS
conservation personnel to promote conservation programs, they needed to understand
these three objectives and to demonstrate how soil conservation is a complementary goal
and not an exclusive one. To that end, it is recommended that NRCS personnel partner
with the University of Kentucky and other sister institutions to develop demonstration
projects to showcase the feasibility of conserving the environment in an effective and
cost-efficient manner while maintaining a productive agricultural operation.
8.2.2 Internet

The Internet provides the NRCS as well as the UK CES with a means of disseminating information about conservation practices to a wide audience at a lower cost than traditional methods such as mailings, farm operation visits, workshops and field days. While the percentage of farm operations with Internet access is still relatively small, this study has shown that a 1 percent increase in this variable results in an increase in NRCS conservation participating operations when controlling for COUNTIES. It is expected that the rate of Internet adoption on agricultural operations will continue to increase, and as such, the NRCS and UK CES should be prepared with factsheets, videos, webinars, and the like on conservation practices. As large beef and crop operations are strongly correlated with Internet use, effects should be taken to target information dissemination about conservation practices most appropriate to these types of operations first.

9.0 References


Appendix A: Census of Agriculture Variable Definitions
Primary Operator
Operator is defined as the person who operates the farm either by doing the day-to-day work or making farming/financial decisions for the operation. The operator may be the owner, hired manager, tenant, or the like.

Total Operators
Total number of operators for an operation. Demographic data were collected on up to three operators per farm – principal operator and two additional operators.

Participating Operations
Operations with land enrolled in CRP, WRP, FWP, or CREP provided they had $1,000 or more in receipts for government payments regardless of sales. For 2002 and 1997, data were only reported for CRP and WRP.

Total Operations
Total number of farm operations.

Government Payments
Direct payments from CRP, WRP, FWP, and CREP programs. For 2002 and 1997, data were only reported for CRP and WRP.

Operation Size
Total land area farmed. It includes land owned and operated as well as rented from others. Land rented to a tenant is not included in the tenant’s farm and not the owner’s farm.
Net Income

Total farm sales, government payments, and other farm-related income minus total farm expenses. Depreciation is not included in the calculation.

Primary Occupation Farming

Primary operator spent 50 percent or greater of his/her time farming or ranching.

Gender

Gender of primary operator is female.

Fully-Owned

Primary operator fully owned the land they operated.

Age

Age of primary operator.

Duration

Total years the principal operator has been present on the operation.

Internet Access

Total number of operations with Internet access.
Beef Operations
Total number of operations with beef cattle

Beef Operation Size
Total inventory of beef cattle.

Dairy Operations
Total number of operations with milk cows.

Dairy Operation Size
Total inventory of dairy cattle.

Poultry Operations
Total number of operations with poultry.

Poultry Operation Size
Total inventory of chickens, broilers, layers and pullets.

Crop Operations
Total number of operations with crop sales.

Crop Operation Sales
Total dollar value of crop sales.
Conservation Practice Methods

Total number of operations that used conservation methods. Examples of conservation methods inquired about include no-till or limited tilling, filtering runoff, and fencing livestock out of streams.
Appendix B: Map of Counties of Kentucky
Figure B1: Kentucky County Names.
Source: WaterproofPaper.com
Appendix C: 2007 Census Maps
Figure C1. NRCS Conservation Program Participating Operations (%).
Figure C2. Government Payments per NRCS Conservation Program Participating Operation ($).

*White indicates missing data.*
Figure C3. Mean Operation Size (Acres).

Values represent county-wide means considering all operations and not only NRCS conservation program participating operations.
Figure C4. Mean Net Income ($). Values represent county-wide means considering all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure C5. Farming as Primary Operator Occupation (%).

*Values represent county-wide totals from all operations and not only NRCS conservation program participating operations.*
Figure C6. Female as Gender of Primary Operator (%).
Values represent county-wide totals from all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure C7. Operations Fully-Owned by Primary Operator (%).

*Values represent county-wide totals from all operations and not only NRCS conservation program participating operations.*
Figure C8. Mean Age of Primary Operator (Years).

Values represent county-wide means considering all operations and not only NRCS conservation program participating operations.
Figure C9. Mean Tenure of Primary Operator on Operation (Years).
Values represent county-wide means considering all operations and not only NRCS conservation program participating operations.
Figure C10. Internet Access on Operation (%).

*Values represent county-wide totals from all operations and not only NRCS conservation program participating operations.*
Figure C11. Beef Operations (%).

Values represent county-wide totals from all operations and not only NRCS conservation program participating operations.
Figure C12. Mean Size of Beef Operation (No. Beef Cattle).

Values represent county-wide means considering all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure C13. Dairy Operations (%).

Values represent county-wide totals from all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure C14. Mean Size of Dairy Operation (No. Dairy Cattle).

Values represent county-wide means considering all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure C15. Poultry Operations (%).

Values represent county-wide totals from all operations and not only NRCS conservation program participating operations.
Figure C16. Mean Size of Poultry Operation (No. Poultry).

Values represent county-wide means considering all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure C17. Crop Operations (%).
Values represent county-wide totals from all operations and not only NRCS conservation program participating operations.
Figure C18. Mean Crop Operation Sales ($).

Values represent county-wide means considering all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure C19. Operations Using Conservation Practice Methods (%).

Values represent county-wide totals from all operations and not only NRCS conservation program participating operations. White indicates missing data.
Appendix D: 2002 Census Maps
Figure D1. NRCS Conservation Program Participating Operations (%).

*White indicates missing data.*
Figure D2. Government Payments per NRCS Conservation Program Participating Operation ($).  
*White indicates missing data.*
Values represent county-wide means considering all operations and not only NRCS conservation program participating operations. White indicates missing data.

Figure D3. Mean Operation Size (Acres).
Figure D4. Mean Net Income ($).
Values represent county-wide means considering all operations and not only NRCS conservation program participating operations.
Figure D5. Farming as Primary Operator Occupation (%).
Values represent county-wide totals from all operations and not only NRCS conservation program participating operations.
Figure D6. Female as Gender of Primary Operator (%).

Values represent county-wide totals from all operations and not only NRCS conservation program participating operations.
Figure D7. Operations Fully-Owned by Primary Operator (%).

Values represent county-wide totals from all operations and not only NRCS conservation program participating operations.
Figure D8. Mean Age of Primary Operator (Years).

Values represent county-wide means considering all operations and not only NRCS conservation program participating operations.
Figure D9. Mean Tenure of Primary Operator on Operation (Years).
Values represent county-wide means considering all operations and not only NRCS conservation program participating operations.
Figure D10. Beef Operations (%).

Values represent county-wide totals from all operations and not only NRCS conservation program participating operations.
Figure D11. Mean Size of Beef Operation (No. Beef Cattle).

*Values* represent county-wide means considering all operations and not only NRCS conservation program participating operations. *White* indicates missing data.
Figure D12. Dairy Operations (%).

Values represent county-wide totals from all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure D13. Mean Size of Dairy Operation (No. Dairy Cattle).

Values represent county-wide means considering all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure D14. Poultry Operations (%).
Values represent county-wide totals from all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure D15. Mean Size of Poultry Operation (No. Poultry).

Values represent county-wide means considering all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure D16. Crop Operations (%).
Values represent county-wide totals from all operations and not only NRCS conservation program participating operations.
Figure D17. Mean Crop Operation Sales ($).

*Values represent county-wide means considering all operations and not only NRCS conservation program participating operations.*
Appendix E: 1997 Census Maps
Figure E1. NRCS Conservation Program Participating Operations (%).

*White indicates missing data.*
Figure E2. Government Payments per NRCS Conservation Program Participating Operation ($).

White indicates missing data.
Figure E3. Mean Operation Size (Acres).

Values represent county-wide means considering all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure E4. Mean Net Income ($).

*Values represent county-wide means considering all operations and not only NRCS conservation program participating operations.*
Figure E5. Farming as Primary Operator Occupation (%).

Values represent county-wide totals from all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure E6. Female as Gender of Primary Operator (%).

Values represent county-wide totals from all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure E7. Operations Fully-Owned by Primary Operator (%).

Values represent county-wide totals from all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure E8. Mean Age of Primary Operator (Years).
Values represent county-wide means considering all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure E9. Mean Tenure of Primary Operator on Operation (Years).  
Values represent county-wide means considering all operations and not only NRCS conservation program participating operations.
Figure E10. Beef Operations (\%).

Values represent county-wide totals from all operations and not only NRCS conservation program participating operations.
Figure E11. Mean Size of Beef Operation (No. Beef Cattle).

Values represent county-wide means considering all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure E12. Dairy Operations (%).

Values represent county-wide totals from all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure E13. Mean Size of Dairy Operation (No. Dairy Cattle).

Values represent county-wide means considering all operations and not only NRCS conservation program participating operations. White indicates missing data.
Figure E14. Poultry Operations (%).

Values represent county-wide totals from all operations and not only NRCS conservation program participating operations.
Figure E15. Mean Size of Poultry Operation (No. Poultry).

*Values represent county-wide means considering all operations and not only NRCS conservation program participating operations. White indicates missing data.*
Figure E16. Crop Operations (%).
Values represent county-wide totals from all operations and not only NRCS conservation program participating operations.
Figure E17. Mean Crop Operation Sales ($).

Values represent county-wide means considering all operations and not only NRCS conservation program participating operations.