COSTS OF WETLAND REGULATION TO KANSAS AGRICULTURAL PRODUCERS

Abstract

The purpose of this study was to identify the cost of permanent and seasonal wetlands to Kansas Agricultural producers. The analysis was based on survey data collected from Kansas Farm Management Association members. Regression analysis indicated that wetlands are costly to agricultural producers. Permanent wetlands were found to be slightly more costly than seasonal wetlands. Importantly, the results suggested dispersed wetlands are more costly to Kansas farms compared to contiguous wetlands. This study provides information that could be useful in determining farm policy. A subsidy to aggregate wetland acres was expected to reduce costs to producers, while also benefiting society from increased biodiversity.

Keywords: *Seasonal wetlands, Externality, Clean Water Act, Swampbuster*

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1. Introduction

Wetlands provide a number of benefits to society, although these are typically non-market benefits, and thus difficult to quantify. In particular, wetlands filter and purify water, provide essential habitat for flora and fauna, buffer the effects of storms, provide watershed protection, and allow for biodiversity (Kahn). Because these beneficial services provided by wetlands do not have marketable rights, there is an incentive to convert wetlands to agricultural uses.

Despite the fact that wetlands are vital to ecosystems, they are disappearing rapidly. Approximately 215 million acres of wetlands existed in the United States at the time of European settlement. However, by the middle 1970s less than half of these wetlands remained (Blackwell).

In protecting wetlands, it is necessary to narrow the gap between what is best for the private landowner and what is best for society, whether this involves changing old policies or creating new ones. The policy tools used to address the problem of loss of wetlands include: changes in the way Federal flood control and drainage projects are planned, authorized, and financed; federal acquisition, easement, and oversight programs; provisions for preferential property tax assessments; tax credits; conversion penalties in the form of taxes; and cross compliance legislation linked to the receipt of Federal commodity program payments (Blackwell). In general, the goal of these policies is to provide incentives for firms to internalize the costs of externalities.

Seasonal wetlands are of particular importance to Kansas agricultural policy. Seasonal wetlands, which are areas that are hydrated only part of the year, are abundant on virtually all Kansas farms. Although the definition and determination of seasonal wetlands are variable, they are generally characterized as areas which are hydrated for at least seven days of the growing season, have hydric soils, and display vegetation typical of wetlands (McEowen and Harl). Changes to the Clean Water Act, and in particular Section 404 (an extension of the CWA), has provided protection to seasonal wetlands without investigation into potential costs incurred to the Kansas agricultural sector, leading to a number of secondary and unforeseen consequences.

The purpose of this study was to examine the costs of agricultural wetland restrictions in the Clean Water Act. This was accomplished by estimating the opportunity costs to agricultural producers of being prevented from draining/filling agricultural wetlands; i.e., the costs to agricultural producers via the loss of the "first best" option to harvest croplands with no wetland acres. Opportunity costs are taken as the lower land productivity, compared to land containing no wet areas, that the farmer is forced to incur due to wetland restrictions. Objectives of the analysis were to estimate the costs of 1) alternative distributions of wetlands, 2) the frequency of wetlands, and 3) the size of wetlands. Other issues of the analysis were to identify how demographics and geographical characteristics contribute to costs.

2. Background and Prior Work

Wetlands typically include areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (McEowen and Harl). Wetlands generally include swamps, marshes, bogs, and similar areas. This description includes wetland habitats that are covered by water or have waterlogged soils for long periods during the growing season.

However, also included are areas that are not readily observable nor easily defined. These areas are seasonal wetlands; i.e., they are dry during most of the year.

The 1972 Clean Water Act (CWA) was the first policy instrument to adopt an aggressive stance at the federal level towards the problem of water pollution. Earlier federal laws had concentrated on water quality standards, leaving their implementation up to the individual states. The primary goal of the 1972 CWA was to eliminate the discharge of pollution into lakes and rivers, as well as to improve the quality and safety of bodies of water for recreational purposes.

Importantly, Section 404 of the CWA regulated the discharge of "pollutants" into the navigable waters of the United States, where "navigable waters" means waters that were actually navigable by boats. However, in 1975 the Congress gave administrative agencies the regulatory authority to administer the CWA. The Core of Engineers (COE) subsequently broadened the definition of navigable waters to include agricultural wetlands, streams, lake playas, etc. The COE again expanded the definition of such areas in 1977 as "areas that are inundated by surface groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in soil saturated areas." Wetlands generally include swamps, marshes, and similar areas (McEowen and Harl).

The "Swampbuster" provisions of the 1985 Farm Bill further reinforced wetland restrictions. The law denied federal farm program benefits to persons planting agricultural commodities for harvest on converted wetlands. The provision was only concerned with conversion after the date of the enacted legislation, and it did not specifically include seasonal wetlands and playa lakes. However, in 1987 the provision was expanded to include such seasonal wetlands and playa lakes. The final rules described agricultural wetlands as playas, potholes, and other seasonal wetlands that were converted before December 23, 1985, but that still maintained wetland characteristics. Producers are allowed to maintain the draining of these areas that were converted prior to the date, as well as to cultivate such areas that were filled prior to Swampbuster; that is, if a given producer had been draining wetlands prior December 23, 1985, the individual is permitted to continue draining the area.

Finally, the 1996 Farm Bill allows producers to drain and redistribute wetlands. That is, if a farmer finds it profitable to drain a wetland and redistribute the water in another area, they are permitted to do so.

Recent studies have summarized some of the problems associated with economic impacts of wetland legislation. Heimlich (1994) estimated the costs associated with a federal program to protect the current Federal target of one million acres of wetlands. With the assumption that protection would require permanent easement payments to prevent agricultural landowners from farming certain areas, he found the minimum cost of an agricultural wetland reserve of one million acres to be in the range of $105 to $197 million dollars per year. Of this cost, approximately two-thirds are easement costs, and the remainder are costs of wetland restoration.

Stavons and Jaffe (1990) explored the impact of federal programs that make agriculture more attractive through facilitating or discouraging conversion of wetlands to agricultural purposes. They used a dynamic model that showed the conditions for conversion of forested wetland into agricultural production. Using data from 36 counties in Arkansas, Louisiana, and Mississippi, their model predicted what would happen to wetland acreage if federal policies changed. Their model took into account the possibility that a marginal acre of wetland today was different from a marginal acre in the future. Several interesting findings emerged. First, landowners responded to economic incentives in land use decisions. Second, federal flood control and drainage projects caused a higher rate of wetland conversion. Third, federal projects made agriculture more feasible in areas that had previously been infeasible. Fourth, adjustment of land-use decisions due to incentives was gradual. The fifth and most substantial finding of this study, however, was the estimate that the absence of a federal flood policy subsequent to 1934 resulted in 1.15 million fewer acres of wetland being converted for agricultural use.

Norris, Ahern, and Koontz (1994) estimated the effect of wetland regulation on agricultural land prices as an unforeseen consequence of legislation on agricultural and natural resources. The model used in their study was a conventional present value model using an hedonic approach. The model was applied to determine the costs of wetland regulation to farmers in the study area, and the effects of wetland regulation exposure to farmers on land prices. Interestingly, the results indicated that increased exposure to wetland regulation had little effect on land prices.

Kramer and Shabman (1993) estimated the effects of agricultural and tax policy changes on the economic returns to wetland drainage in the Mississippi Delta region. Two major policy changes were made in the 1980s to reduce Federal incentives to drain and clear wetland areas: the refusal of farm program benefits to landowners who cleared wetlands (the "Swampbuster" provision of the Food Security Act) and the removal of income tax deductions for drainage costs. The study quantified the effects of tax and agricultural policy changes on landowner returns and risks to wetland conversion with

Net Present Value (NPV) method. The results generally showed that economic returns to wetland conversion were no longer favorable, and that the policy changes had effectively reduced the incentive to drain wetland.

Shabman and Bertelson (1979) examined development value estimates for coastal wetland permit decisions. Coastal wetlands provide non-market benefits such as wildlife habitat and biodiversity. Using hedonic procedures, the authors found that the increase in the value of the waterfront property was related to size of the land parcel and the year of sale. The year of the sale influenced the consumer's value estimates of the property. Other qualitative variables were also used to explain the value of a waterfront property such as the level of the waterfront amenity and an index representing neighborhood quality. The hedonic analysis included a variable to measure the level of the waterfront amenity derived from the filled coastal wetland, which was used to make predictions on the value derived from an additional acre of coastal wetland for residential development (Shabman and Bertelson).

Barbier (1994) explored the theoretical underpinnings of how tropical wetlands played an economic role in development, investigatingtrade-offs between conserving or converting tropical wetlands, while assuming that high opportunity costs of wetland conversion lead to respectively lower levels of conversion. The paper also described extensions and limitations to cost benefit analysis in determining non-market wetland values.

Together, these studies have the following implications. First, regulatory incentives impact producer decisions. Second, there is some indication from prior work that permanent wetlands impose costs on producers. Third, federal programs affect land values. However, studies have not addressed particular issues with the cost of seasonal wetlands to farmers. Hence, the current study is important and unique because it attempts to bridge our understanding of the costs of seasonal wetlands to Kansas agricultural producers. If temporary wetlands are found to be costly to agricultural producers, then the effectiveness of current agricultural wetland policy will need investigation.

3. Conceptual Framework

Consider the following model of agricultural production. In this model, land contains some wetland acres. The producer is assumed to maximize profits according to the equation

$$\Pi(p,w,\alpha) = \{(1-\alpha)pf(x(p,w)) - w(x(p.w))\} \tag{1}$$

where,

α = the share of cropland occupied by wetland

p = output price for commodity, w = input prices

$(1-\alpha)$ = non-wet land available to cultivate

x(p.w) = input demand function, $y = (1-\alpha)pf(x(p,w))$ = output supply function

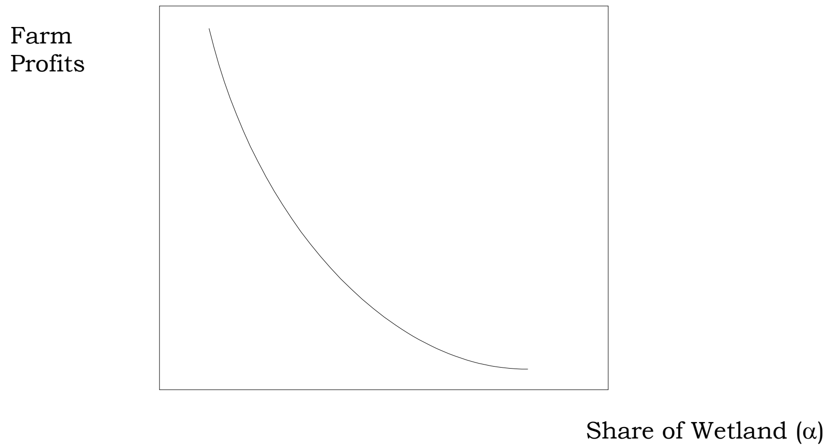
By the envelope theorem, the derivative can be obtained

$$\partial \Pi(p,w,\alpha) / \partial\alpha = \{-\alpha\, pf(x(p,w))\} \tag{2}$$

$$\partial^2\Pi(p,w,\alpha)/\partial\alpha^2 \gtreqless 0 \tag{3}$$

Assuming the output supply function is positive, and α is non-negative, (2) yields a negative relationship; i.e., profit is expected to fall as α rises. The curvature of the profit function, however, is ambiguous (3). Diagram 1 illustrates the production process if the relationship between share of wetlands and profits is convex, when $\partial^2\Pi(p,w,\alpha)/\partial\alpha>0$.

Diagram 1: Relationship between Farm Profits and Wetland Acreage



Above, Farms with low amounts of wetland acreage are shown here to have high profit. As shown by the convexity of the function above, farm profits decrease, but decreasing as wetland acreage rises.

The model provides useful conceptual framework for exploring the tradeoffs between agricultural profits and wetland acreage. The difficulties lie in trying to empirically implement this framework. In our analysis, we estimate the opportunity costs (OC) to producers as a result of land-use restrictions. Interestingly, OC in this vein can be thought of as a proxy of the lost productivity in the agricultural sector. The following expression can be used to characterize the OC

$$\Pi\ (p,w,0) - \Pi\ (p,w,\ \alpha) \qquad (4)$$

where,

$\Pi(p,w,0) = \Pi$ without wetlands, $\alpha=0$

$\Pi(p,w,\alpha) = \Pi$ with wetlands, $\alpha>0$

Alternatively, we can look at the change in total revenue as a result of having wetlands,

$$\{pf(x(p,w))\} - \{(1-\alpha)pf(x(p,w))\} \quad (5)$$

Equation (5) shows the difference between the total revenue with and without wetland acreas; i.e., the lost agricultural revenue resulting from government restrictions. Equation 5 may be though of as a "Willingness-To-Accept" (WTA) compensation for having wetlands. Intuitively, we know that the producer will be indifferent between accepting such compensation, while having wetlands, and not having such compensation, while not having wetland acreas.

The following section identifies the OC (4) of wetland restrictions to Kansas agricultural producers. Finally, we implement the framework and subsequently discuss results.

4. Methods and Procedures

To assess costs of agricultural wetlands to land owners, the Contingent Valuation Method (CVM) was employed in our study. The approach has been used in numerous studies to elicit preferences for non-market goods. The CVM approach attempts to establish value for public goods by asking individuals various questions regarding preferences.

Hannemen (1994) identified key issues in the construction of accurate survey instruments. First, it is important to make surveys balanced and impartial. Second, developing questions free from general dislike of big business are critical. If a respondent has emphatic dislike for large business, they may answer a question out of emotion and not out of objectivity. Third, respondents must be made aware of substitutes for goods, as well as their budget constraint. If respondents answer questions without knowledge of such constraints, these individuals are answering questions ignoring utility preferences. In order for a value to be assessed, the economic agent must be able to rank goods, and such ranking requires the acknowledgement of trade-offs and respective budget constraints. Fourth, critical in CVM is avoiding a high-pressure interview situation. For example the interviewer should assure respondents that there are no correct or incorrect answers to questions. Finally, another essential ingredient in the development of an appropriate survey instrument is relentless attention to detail. The questions need to be developed collaboratively with experts in order to reliably assess whether questions are asking what is intended by the researcher.

In addition to the problems encountered in the construction of an accurate CVM, Hanneman points out the typical objections to such CVM tools by economists. First of all, surveys are vulnerable to response effects. Slight changes in the wording of questions can cause tremendous changes in the outcome of responses. Second, semantic issues may cause respondents to inappropriately value a good. If the meaning or interpretation of even a single word in the study is confused, the respondent may assign a value that is not intended by the question. Third, the survey process itself may create values. For example, respondents who are unaware of some environmental problem may assess value for that good as a result of the question, even though no value had existed at all before the question was asked. Fourth, many individuals are ill-trained for valuing the environment. The author suggests that, in order for respondents to appropriately assign willingness-to-pay estimates, there must be some prior knowledge of the subject. Finally, survey responses may not be replicable. If estimates of values cannot be replicated, then the value estimates may not be accurate.

Given caveats of CVM methodology, our study carefully developed a survey instrument to estimate the costs of wetlands to agricultural producers. However, our analysis was not invariant to CVM criticism. Respondent bias is clearly expected to influence results. Also, producers may not be adequately trained to make decisions regarding the costliness of having wetlands. This consideration is especially relevant since only 15% of respondents indicated the presence of NRCS wetland.

Another concern of the survey instrument is whether the respondents answered the questions as they were originally intended. In order to minimize this difficulty, early drafts of the survey were thoroughly pilot-tested with KFMA producers and KSU faculty. However, given the relative complexity of the instrument, concerns as to whether the respondents answered questions as they were intended are still relevant.

The survey instrument was sent to agricultural producers in the Kansas Farm Management Association (KMFA). The KFMA is comprised of six associations covering the entire state. The association included 2311 farms, and provides detailed farm business and financial records, and lends well to analysis by researchers. Due to the availability and quantity of the data, many prior studies have utilized the database.

The survey had five sections. Section 1 asked about the scale of the farm operation, and whether respondents had NRCS wetland. If respondents indicated the presence of NRCS wetland, they were instructed to go to Section 2; if not, they were instructed to go to Section 3.

The purpose of Section 2 was to quantify the producers' desire to convert wetland areas, as well as identify the productivity of wetlands and their relative productivity compared to non-wet surrounding areas.

Questions in Section 3 estimated the costs of alternative distributions, levels, and frequencies of wetlands to agricultural producers, including questions on the maximum rental rate respondents would pay for land containing alternative distributions of either permanent (Q6) or seasonal (Q7) wetlands. As described more fully in the following section, costs associated with wetlands are estimated as the difference between the stated rental that would be paid for land containing wetland and a value of $35/acre given (determined by KMFA officials) as the rate for which land with no wetland could be rented. Specific methods for cost calculations are given in the following section.

In Section 4, questions identified the wildlife present on the farm. Also, questions were aimed at assessing the producer's opinion towards stewardship and government regulation. Finally Section 5 identified demographic characteristics of the respondents. Table 1 identifies the important statistics and variable definitions responses the study.

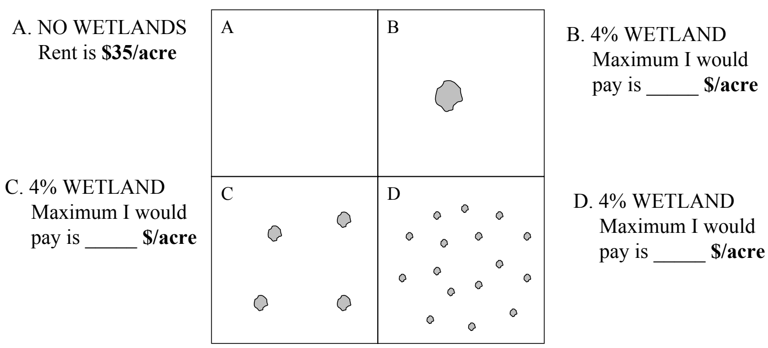
Appendix 1 contains a sample survey, and Diagram 2 illustrates the alternative versions of the survey instrument. The alternative versions accommodated different percentages of land covered by wetlands (1%, 2%, 3%, or 4%) and different frequencies of seasonal wetland being wet (1, 2, 3, or 4 years out of 5).

5. Estimating Costs of Wetlands

The cost of having wetlands was calculated as the difference between the maximum amount a respondent was willing-to-pay (WTP) for land containing wetlands and the given rental rate for land with no wetlands ($35/acre). Thus, if a respondent to

Version 4.2 of the survey indicated a maximum WTP of $30 per acre on question 7c, then the cost of having 4 seasonally wet areas on 160 acres that cover 4% of the land area and are wet an average of 2 years out of 5 is $5/acre ($35-$30). Diagram 2 illustrates the method used to determine the costs agricultural producers incur from having wetlands. The estimated cost of wetlands was then used as the dependent variable in an OLS model. The independent variables used to explain variation in cost include: a) the percentage of land occupied by wetland area, b) the distribution of wetland area, and for

Diagram One: Determining the Costs of Wetlands to Agricultural Producers and Alternative Survey Versions



Survey Versions

Version	% Wet	Prob Wet
1.1	1%	20%
1.2	1%	40%
1.3	1%	60%
1.4	1%	80%
2.1	2%	20%
2.2	2%	40%
2.3	2%	60%
2.4	2%	80%
3.1	3%	20%
3.2	3%	40%
3.3	3%	60%
3.4	3%	80%
4.1	4%	20%
4.2	4%	40%
4.3	4%	60%
4.4	4%	80%

On the prior page, on the left-hand-side, respondents were instructed to tell us the maximum rental rate they would pay for crop-land that contains some wetland areas that may be too wet to farm, when tracts of similar quality land with no wetlands rent for $35 per acre. In order to determine the costs of wetlands, The cost of having wetlands was calculated as the difference between the maximum amount a respondent was willing-to-pay (WTP) for land containing wetlands and the given rental rate for land with no wetlands ($35/acre). Thus, as shown above, if a respondent to Version 4.2 of the survey indicated a maximum WTP of $30 per acre on question 7c, then the cost of having 4 seasonally wet areas on 160 acres that cover 4% of the land area and are wet an average of 2 years out of 5 is $5/acre ($35-$30). The right-hand-side illustrates the sixteen survey alternative versions which accommodated different percentages of land covered by wetlands (1%, 2%, 3%, or 4%) and different frequencies of seasonal wetland being wet (1, 2, 3, or 4 years out of 5).

seasonal wetland, the frequency of wetness. Clearly one would hypothesize that as the percentage of land occupied by wetlands increases from 1% to 4%, the associated cost should also increase.

One would hypothesize that for a given area covered by wetland, as it becomes more diffused the associated cost would increase. The models use dummy variables to capture the effect of the alternative distributions of wetlands on cost.

The models for seasonal wetlands include a variable to indicate the frequency with which the land is wet- either as a continuous variable (FREQUENCY) or alternatively as a dummy variable. The hypothesis is that increasing frequency of wetness will increase the cost associated with wetlands. Other variables to explain costs included dummy variables to represent different regions of the state and some of the respondents' demographic characteristics (age, net farm income, etc). We also created two indices to represent attitude toward: a) government regulation (REGULATION) and b) environmental stewardship (STEWARD). The stewardship index was calculated based on the responses to questions 11a-11d (should Kansas endangered animals/plants be protected, etc.). Higher values of the STEWARD index indicate less favorable attitudes toward environmental conservation. The "regulation" variable was calculated based on the responses to questions 11e-11g. Lower values of the REGULATION index indicate increasing dissatisfaction with government regulation. We hypothesize therefore that REGULATION will be negatively correlated with the producers estimate of the cost of wetlands and that STEWARD will be positively correlated with costs.

Table 1: Variable Description & Key Statistics

Variable	Definition	№	ū	min	max
Obtained via Survey Results:					
PERMANENT	Cost of Permanent Wetland (dependent variable for permanent wetland models)	675	2.92 (3.21)	-10	20
SEASONAL	Cost of Seasonal Wetland (dependent variable for seasonal wetland models)	651	2.17	-10 (3.18)	25
PERCENTOWN	Percentage of Land Producer Owns	843	0.443 (0.318)	0	1
NRCS	Producer has NRCS wetland (1=yes)	908	0.158 (0.365)	0	1
IDLE	Producer Idles Land (1=yes)	914	0.2483 (0.432)	0	1
REGULATION	Producer's Attitude Toward Regulation	914	1.86 (0.72)	1	5
STEWARD	Producer's Level of Stewardship	904	3.22 (0.85)	1	5
AGE	Respondents Age	937	54.5 (13.16)	19	92
YEARSFARM	Years of Family Farm	937	54.925 (32.936)	2	200
CHILDFARM	Child Likely to Farm (1=yes)	851	0.5523 (.4975)	0	1
Obtained via KFMA database:					
NETINCOME	*Net Farm Income*	*957*	*$15,264 ($60,475)*	*-$499,510*	*$313,030*
NORTHWEST	*Northwest KFMA Location*	170			
NORTHEAST	*Northeast KFMA Location*	166			
NORTHCENTRAL	*Northeast KFMA Location*	82			
SOUTHCENTRAL	*Southcentral KFMA Location*	162			
SOUTHEAST	*Southeast KFMA Location*	92			
SOUTHWEST	*Southwest KMFA Location*	271			

Note: Number in parenthesis (δ^2) are standard deviations.

6. OLS Cost Models

The purpose of the OLS models was to identify variables that explain the producer's estimate of the costliness of having wetlands. We first estimate separate OLS cost models for permanent wetlands, and subsequently for seasonal wetlands.

Costs of Permanent Wetlands

Table 2 summarizes results for alternative specifications of models that estimate the costs of permanent wetlands. In the first and third model, the area of land occupied by wetland enters as a continuous variable, whereas in the second model it enters as dummy variables that interact with the dummy variables representing distribution of wetland. Thus, in the second model, the variable 16WETLANDS-3%COVERAGE is a dummy variable for observations with 3% wetland and 16 wet areas.

All coefficient estimates in the first model were found to be positive and significant. Since the constant term implies 1-PERMANENT-WETLAND, the average *cost of not being permitted to drain or fill one small wetland area is estimated to be about two dollars*. 4-PERMANENT-WETLANDS identifies the additional cost of having four wetland areas compared to one area. This cost is estimated at about $3.89 per acre. Similarly, the cost of having 16 wetlands is estimated at $11.44 per acre. The coefficient for PERCENT indicates that as the percentage of wetland increased by one percent, estimated cost increases by approximately $0.41 per acre. Clearly, the results suggest increased dispersions and areas affected by wetlands increase costs. In the second model the constant term estimates cost per acre for land having 1% wetland in one wetland area. All of the dummy variable coefficients representing more dispersed distribution and/or greater area of wetland are positive and significant. Thus, the estimated coefficient for 4WETLANDS-1%COVERAGE indicates that the cost associated with 1% wetland (1.6 acres) distributed in four wet areas is about $5.76 ($3.65+$2.11).

The third model adds the regional dummy variables and demographics to the specification used in the first model. Results obtained from the model are very similar to the original model. The dummy variable representing Southeast Kansas was found to be positive and significant, suggesting that producers from this area place a higher cost on having wetlands.

The positive and significant coefficient for AGE indicated that older producers view wetlands as more costly compared to younger producers. As hypothesized, the coefficient for REGULATION was found to be negative. The result implies a producer with greater opposition towards government environmental regulation views wetlands as more costly, as compared to respondents who are more favorable to regulation.

Costs of Seasonal Wetlands

Table 3 summarizes results for models estimating costs of seasonal wetlands. Model specifications are similar to those used for permanent wetlands with the addition of one variable to account for frequency of wetness either in continuous form (the first, second, and fourth model) or as dummy variables (the third model). Similar to the Permanent wetland models, the constant term implies 1-WETLAND-1%COVERAGE, i.e., the estimated cost of having one seasonal wetland area in the quarter section. The coefficient in the first seasonal model identifies the cost of one seasonal wetland as $0.76- considerably lower than that for permanent wetlands. The values for 4-SEASONAL-WETLANDS and 16-SEASONAL-WETLANDS indicate the higher cost associated with dispersed wetlands- but again these values are lower than those estimated for permanent wetland.

The coefficient on PERCENT is positive and significant, and, at $0.45, is very similar to that for permanent wetlands. As expected, the coefficient for FREQUENCY is positive and significant, indicating that greater frequency of wetness is associated with higher costs. Interestingly however, in the third model, where the frequency effect is captured using dummy variables, the estimates indicate little difference in costs for land that is wet either 2 years or 4 years out of five. The fourth model adds the seasonal dummies and demographic controls. For seasonal wetlands there are no significant differences in costs across regions. AGE is again found to have a positive and significant effect on cost estimates, as does Net Farm Income. As the total years in farming increases, the estimated costs of wetlands also increases. Interestingly, having NRCS wetland (NRCS=1) has no effect on estimated costs.

7. Conclusions and Extensions

The conclusion of this study is that society greatly benefits from the redistribution and aggregation of wetland acres. Benefits are maximized by redistribution of wetlands, and monetary incentives could be utilized to induce producers to cultivate such lands. . Less costly wetland distributions benefit producers, while larger wetlands benefit society with increased biodiversity.

Regression models indicate 1) wetlands restrictions are costly to agricultural land owners, 2) permanent wetlands are more costly than seasonal wetlands, 3) increased dispersion, total acres affected, and frequency of hydration increase the perceived cost of wetlands, and 3) demographic variables are correlated with producers attitudes toward costs. The increased dispersion of wetlands (from 1 area to 4 areas) contributes as much to costs as would an 8% increase in the area of wetland. Thus, there is a potential win-win situation in the encouragement of landowners to aggregate dispersed wetlands into contiguous areas that are larger in total area than the dispersed wetlands. Landowners gain by reducing the costs (inconvenience costs) associated with widely dispersed wetland areas while at the same time the larger contiguous wetland may be more beneficial to wetland plant and animal species. While the 1996 Farm Bill permits producers to redistribute wetlands, this analysis suggests that there may be circumstances in which they should be encouraged to do so. The recommendation rests however on the assumption that larger contiguous wetlands provide more wildlife benefits than smaller dispersed areas.

Table 2: Permanent Wetland OLS Cost Results

Variable	Wetland Model 1	Wetland Model 2	Wetland Model 3
CONSTANT	1.935 (.277)***	2.11 (0.393)***	-0.0696 (1.009)
PERCENT	0.406 (.077)***	-------	0.0874 (0231)
4-PERMANENT-WETLANDS	3.893 (.282)***	-------	3.775 (0339)***
16-PERMANENT-WETLANDS	11.446 (.279)***	-------	11.641 (032)***
4-WETLANDS-1%COVERAGE	-------	3.651 (0557)***	-------
16-WETLANDS-1%COVERAGE	-------	11.384 (0557)***	-------
1-WETLAND-2%COVERAGE	-------	0.6439 (056)	-------
4-WETLANDS-2%COVERAGE	-------	4.162 (0.562)***	-------
16-WETLANDS-2%COVERAGE	-------	13.285 (1.05)***	-------
1-WETLAND-3%COVERAGE	-------	1.0567 (0.56)**	-------
4-WETLANDS-3%COVERAGE	-------	4.501 (0.56)***	-------
16-WETLANDS-3%COVERAGE	-------	12.418 (0.56)***	-------
1-WETLAND-4%COVERAGE	-------	1.497 (0.554)***	-------
4-WETLANDS-4%COVERAGE	-------	5.782 (0.552)***	-------
16-WETLANDS-4%COVERAGE	-------	12.718 (0.491)***	-------
SOUTHCENTRAL	-------	-------	0.863 (0.479)**
SOUTHWEST	-------	-------	0.591 (0.658)
NORTHEAST	-------	-------	0.568 (0.757)
NORTHWEST	-------	-------	-0.456 (0.903)
SOUTHEAST	-------	-------	2.295 (0.913)***
AGE	-------	-------	0.0636 (0.013)***
NETINCOME	-------	-------	0.265E-06 (0.2E-05)
YEARSFARM	-------	-------	0.249E-02 (.004)
CHILDFARM	-------	-------	-0.297 (0.264)
NRCS	-------	-------	-0.044 (0.349)
REGULATION	-------	-------	-0.905 (.206)***
STEWARD	-------	-------	- 0.053 (0.175)
Observations	**2031**	**2031**	**1418**
R-SQUARE	0.4678	0.4704	0.5220

*** ~ significant at 10% level ; ** ~ significant at 5% level ** ; ***~ significant at 1% level ; Note: Zero protest bids were excluded from the estimation**

Table 3: Seasonal Wetland OLS Cost Results

Variable	Seasonal Model 1	Seasonal Model 2	Seasonal Model 3	Seasonal Model 4
CONSTANT	0.7672 (.387)***	0.9574 (.488)**	0.6908 (.345)***	-3.6327 (1.11)***
PERCENT	0.4536 (.08)***	-------	0.3472 (.080)***	0.1689 (.267)
4- SEASONAL-WETLANDS	3.2803 (.292)***	-------	3.2722 (.292)***	3.083 (.358)***
16-SEASONAL-WETLANDS	9.7639 (.290)***	-------	9.768 (.289)***	9.825 (.334)***
FREQUENCY WET	0.22109 (.101)***	0.1975 (.103)**	-------	0.2355 (.139)**
WET-2/5-YEARS	-------	-------	1.0422 (.322)***	-------
WET-3/5-YEARS	-------	-------	0.7269* (.339)**	-------
WET-4/5-YEARS	-------	-------	0.7964 (.327)***	-------
4-WETLANDS-1%COVERAGE	-------	2.974 (.581)***	-------	-------
16-WETLANDS-1%COVERAGE	-------	9.876 (.582)***	-------	-------
1-WETLAND-2%COVERAGE	-------	0.7399 (.583)	-------	-------
4-WETLANDS-2%COVERAGE	-------	4.1389 (.581)***	-------	-------
16-WETLANDS-2%COVERAGE	-------	9.5730 (1.09)***	-------	-------
1-WETLAND-3%COVERAGE	-------	1.0123 (.581)***	-------	-------
4-WETLANDS-3%COVERAGE	-------	4.1389 (.581)***	-------	-------
16-WETLANDS- 3%COVERAGE	-------	10.403 (.587)***	-------	-------
1-WETLANDS-4%COVERAGE	-------	1.1633 (.577)***	-------	-------
4-WETLANDS-4%COVERAGE	-------	4.6103 (.575)***	-------	-------
16-WETLANDS-4%COVERAGE	-------	11.096 (.511)***	-------	-------
SOUTHCENTRAL	-------	-------	-------	0.5419 (.524)
SOUTHWEST	-------	-------	-------	0.1453 (.721)
NORHTEAST	-------	-------	-------	0.2319 (.844)
NORTHWEST	-------	-------	-------	-0.4111 (1.07)
SOUTHEAST	-------	-------	-------	1.3115 (1.073)
AGE	-------	-------	-------	0.07159 (.013)***
NET INCOME	-------	-------	-------	0.70E-05 (.3E-06)***
YEARSFARM	-------	-------	-------	0.7517E-02 (.0043)**
CHILDFARM	-------	-------	-------	-0.1652 (.276)
NRCS	-------	-------	-------	0.22462 (.364)
REGULATION	-------	-------	-------	-0.4193 (.215)**
STEWARD	-------	-------	-------	0.11532 (.183)
Observations	**1966**	**1966**	**1966**	**1389**
R-SQUARE	0.3817	0.3828	0.3839	0.4290

*** ~ significant at 10% level ; ** ~ significant at 5% level ** ; ***~ significant at 1% level ; Note: Zero protest bids were excluded from the estimation**

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