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Determinants and Implications of Post-CRP Land Use Decisions

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Conservation Reserve Program (CRP) land retirement contracts will begin to expire in late 1995. A multinomial logit model is used to identify characteristics influencing New Mexico CRP participant post-CRP land use plans. Results indicate post-CRP land use intentions will vary with attributes reflecting characteristics of the land enrolled, socioeconomic variables, and participant attitudes. Results point to a CRP-facilitated retreat from crop production to future ranching by many producers. The analysis suggests future changes in the structure and character of southern Great Plains agriculture and surrounding communities.

Key words: agricultural structure, community economic impacts, Conservation Reserve Program, multinomial logit model.

Introduction

Following implementation of the 1985 Food Security Act, the Conservation Reserve Program (CRP) removed 36 million acres of cropland from production between 1986 and 1992. This was accomplished through land retirement contracts between landowners and/or tenants and the U.S. Department of Agriculture (USDA). These CRP contracts will begin to expire in late 1995, and by the end of 1999, nearly 34 million acres will be eligible for crop production. While the primary objective of the CRP was to reduce soil erosion, the program also sought to reduce surplus commodities and annual commodity program costs, support farm incomes, improve environmental quality, and enhance wildlife habitat.

Croplands enrolled in the CRP were required to be planted to grass or trees. In return, program participants received a cost-share to establish the land cover, and 10 annual rental payments from the USDA. The average annual rental payment nationwide is $50 per acre, which participants receive for not grazing, haying, or cropping the enrolled land for 10 years. When the CRP contracts expire, program participants will decide the next use of their land. Some land will be returned to crop production. Other former CRP lands may be left in grass for livestock grazing or hay production, with water quality and wildlife habitat benefits from these lands largely preserved. A small percentage of the CRP acreage will remain in trees.

Thirty percent of CRP acres are located in the southern Great Plains (e.g., Kansas, Texas, Oklahoma, Colorado, and New Mexico). In recent years, this region has been the subject of heated debate as scientists, residents, and state leaders have discussed its future. Agriculture in the southern Great Plains has confronted cyclical droughts, declining groundwater resources, unstable domestic and export demand for crop and livestock products, and greater market orientation of federal commodity programs. High levels of

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CRP land retirement throughout the region in the late 1980s were in response to these factors.

It is conventionally accepted that ranching-based economies are less intensive than those based on crop production. Rangeland tax revenues are lower than those of cropland. Fewer production inputs are purchased for livestock relative to crops, thus requiring fewer agricultural input suppliers and less employment in that sector. Livestock production supports a smaller population base than cropping, and ranching-oriented communities tend to be small. Sparsely populated rural areas generally have a difficult time maintaining the necessary number of people and the economic activity to support local schools, hospitals, and other infrastructures. However, these problems are particularly acute in ranching communities.

The magnitude of land retirement in the southern Great Plains since 1986 points to the hypothesis that the CRP may facilitate a retreat from cropping to future ranching in the region. Factors which would influence the transition from crop to livestock production are the same as those that influenced initial CRP enrollment. Groundwater will continue to become more scarce, and pumping costs will continue to rise, if intensive irrigation is reinstated or expanded on southern Great Plains CRP lands. Further reductions in federal support for the region's primary crops also will alter the financial attractiveness of crop production relative to livestock. The community impacts noted above thus would be expected with a post-CRP transition to a more livestock-oriented agricultural economy.

Research into the impacts of CRP enrollment began almost immediately upon implementation of the program. Input/output models were used by Martin et al. and Mortensen et al. to analyze the socioeconomic impacts of CRP land retirement. Examples of studies performed on the CRP's effects on agribusiness and local economies are Devino, Van Dyne, and Braschler; Johnson; and Skaggs et al. The effect of the CRP on land values was evaluated by Shoemaker, and producer welfare effects of the program by Canning. The aggregate economic effects of the program have been assessed by Boyd, Konyar, and Uri, and by Young and Osborn. Institutional/political analyses of the program were conducted by Luzar, and by Reichelderfer and Boggess. Cost-effectiveness of the CRP has been examined by Young, Walker, and Kanjo, and most recently by the U.S. General Accounting Office.

By comparison, limited published research examining effects of CRP contract termination or post-CRP landowner decisionmaking is available. A nationwide survey gathered descriptive information from program participants regarding their plans for their CRP lands (Nowak, Schnepf, and Barnes). From the survey results, the authors found that 42% of CRP acres will be returned to annual crop production, 20% kept in grass for livestock forage, almost 13% used for grass hay production, 11% kept in trees, and 7% kept in wildlife habitat, with the remainder designated for other uses or to be sold. Dicks used previous crop and land capability class information from USDA data bases to predict the future of CRP lands. He determined 48% of southern Great Plains CRP lands would be returned to crop production by the landowner, 37% returned to crop production under a rental or lease arrangement, and 13% left in pasture, with 2% remaining in grass waterways, shelterbelts, or windbreaks.

Osborn evaluated participants' post-CRP plans using a binary framework where the choices were recropping or not recropping. Model results indicated a 49% recropping rate for Great Plains CRP lands. Using a binary structure with the options of preserving grass cover or not retaining the grass cover, Heimlich and Kula derived probabilities that CRP lands will be retained in grass. They estimated that only 20% of CRP land in one Missouri county will stay in grass after contract expiration, and also determined smaller crop base acreages enrolled in the CRP were more likely to be kept in grass.

Even though there is an extensive body of literature dealing with the CRP, none of the works cited above have addressed the potential impacts of the program on the structure and character of agriculture in regions with high levels of enrollment. Also, with conservation issues dominating the public policy arena, it is especially important for policy makers to know the social and attitudinal factors that will influence post-CRP land use

decisions. For example, how will concern for the environment affect post-CRP land uses? And, will the decisions of younger participants differ from those of their older peers? Furthermore, previous published studies of post-CRP land uses have not included the full range of intentions held by program participants, and may have under or overstated post-CRP plans.

The objective of this research is to examine the question of whether or not the CRP will have the effect of returning much of the southern Great Plains to a ranching-based economy. This research also will test the hypothesis that post-CRP land use plans will be determined by other factors in addition to the relative profitability of alternative crop and livestock enterprises. These hypotheses will be evaluated using survey data collected from eastern New Mexico CRP participants. While the questions addressed in this study ultimately will be tested by time, this research is a first-stage effort at promoting an understanding of the evolution and consequences of patterns of post-CRP land uses in the southern Great Plains.

The Southern Great Plains

Farming in the southern Great Plains always has been vulnerable to climatic disruptions and economic instability. The region saw a dramatic retreat by some farmers during the Dust Bowl years, and later an increase in crop production due to advances in irrigation and other technologies. Farming conditions in eastern New Mexico are typical of those in other farming regions in the southern Great Plains. There is dryland farming, as well as irrigated crop production using Ogallala Aquifer groundwater. In the six counties studied here, over 91% of the irrigated acreage is dependent on pumped groundwater, with the remainder using surface water from the Canadian River.

The major crops produced in the area are winter wheat, alfalfa, sorghum, and other feed grains; cotton is planted less extensively. The region also supports cow-calf operations and feedlots. Grazing occurs primarily on privately held rangelands, with a lesser amount on state and federal lands. Integrated crop and livestock production systems are common, with livestock an important component of small grain production. Ninety-two percent of New Mexico CRP land is located in six counties on the eastern border of the state, where an average of 29% of each county's cropland was retired under the program. Dryland production of winter wheat and feed grains in this region typically depends on farm price support programs for 20–45% of their gross returns (Libbin and Word).

Although this research effort focuses on CRP land in eastern New Mexico, similarities in climate, soils, topography, and farming systems permit the application of results to CRP participants throughout the southern Great Plains. The geographical area represented in eastern New Mexico is of the grama-buffalo grass potential vegetative zone predominant throughout the southern Great Plains region (Kuchler). These results should be particularly extendable to the Texas Panhandle, where 80% of the 4.05 million acres of Texas CRP lands are located (Ervin, Johnson, and Lee). Five of the six New Mexico counties studied are contiguous to the Texas Panhandle.

Theory and Hypotheses

Ex ante predictions of post-CRP land use must be based on information provided by program participants because they have the best knowledge of their own circumstances and intentions. Intentions have been interpreted as the respondent's estimate of the probability the action will be undertaken at a designated time, or within a specified period (Juster). When individuals express an intention, they are indicating that their probability of undertaking the intended action is higher than not undertaking it. Intentions thus are seen as a linkage between attitudes and behavior (Mitchell and Carson; Fishbein and Ajzen).

Multiple goal analysis recognizes that farmers are motivated by factors in addition to profit maximization (Robison et al.). Because farmers are motivated by different factors, farm decisions have been found to vary by farm size (Harper and Eastman), irrigation resources (Eckert and Wang), and age or stage in the life cycle (Barry and Baker). Increased age also is hypothesized to be positively related to a higher degree of resource fixity, higher transfer costs, and lower reservation wages (Tweeten).

Thus, three hypotheses to be tested here are that post-CRP land use intentions will vary with acreage enrolled in the CRP, participant age, and irrigation resources. It is hypothesized that the smaller the crop base acreage enrolled in the CRP, the greater the probability of post-CRP grazing intentions. Small retired acreages were most likely the least productive and least likely to generate significant revenues from future crop production.

Increasing participant age is hypothesized to be associated with higher probabilities of post-CRP cropping intentions because of resource fixity and risk aversion. It is further hypothesized that the presence of irrigation prior to CRP enrollment will increase the probability of post-CRP crop production intentions because of the high opportunity value of the water resources. Alternatively, the presence of a developed water source on the CRP land implies that the conversion to stock watering could be accomplished easily and at minimum cost, although it is more likely the value of water in crop production would dominate this effect.

Off-farm employment has been found to influence farmer decisionmaking, farm goals, and farm diversification (Anosike and Coughenour). When individuals are motivated to be in agriculture for the purpose of lifestyle or consumption needs, and have income from other sources, involvement in livestock production has been found to best satisfy those objectives. Personal preferences for crops or livestock are influenced by relative labor requirements, with raising livestock less physically demanding and more evenly paced throughout the year than cropping (Coughenour). A grazing-ranching enterprise can be operated part-time more readily than crop-oriented agricultural enterprises (Carlin and Ghelfi). The capital investments required for grazing-ranching are less than those of cropping, and livestock production is also less dependent on technology (with less time invested in learning). Hiring part-time help for working livestock is also less problematic than for crop production. The occasional laborers used in grazing-ranching work short periods of time, and do not need the mechanical skills required for dealing with farm machinery.

All of the above factors support the hypothesis that CRP participants with off-farm employment are likely to indicate post-CRP grazing intentions. As stated above, this outcome would be consistent with lifestyle agricultural operations. Specific research results to support this extension of the hypothesis include a study by Barlett who found cropped acreage decreased for part-time operators, and Young and Shumway's results indicating that the probability of a rancher's being in the cow-calf business primarily to maximize profits was reduced by off-farm employment. Also, social reasons for being in the cow-calf business (i.e., enjoying the ranching lifestyle and having cattle as a way to relax and get exercise) reduced the probabilities producers would be profit maximizers (Young and Shumway). An earlier study by Smith and Martin also found that ranchers having strong conspicuous consumption or speculative attitudes toward ranching tended to receive only part of their income from agriculture.

It is hypothesized that participant knowledge of the grass variety planted on their CRP land will be a significant predictor of post-CRP grazing intentions. The more costly grass species established on CRP lands in the area also provide the highest quality grazing resources. These grass species, most notably grama grasses, are widely recognized for their excellent grazing values. Cheaper varieties are less palatable to livestock and less likely to have been viewed as a desirable long-term forage resource. If an unknown, probably least-cost, seed variety was planted for ground cover, it is unlikely the program participant was considering use of the land in range livestock production after the CRP ends. It is more likely that the participant sought to establish the minimum ground cover required by the program.

It is also hypothesized that a participant's interest in permanent base acreage retirement will increase the probability of post-CRP grazing intentions. Participant concern about pre-CRP soil erosion (and if that motivated CRP participation) is further hypothesized to be positively associated with higher probabilities of post-CRP grazing intentions. These two hypotheses are founded on the reasoning which follows.

Ninety-six percent of eastern New Mexico CRP acreage is on Class IV or Class VI soils (USDA, Economic Research Service). Most of these soils should be in permanent pasture (Donahue et al.). The abundance of these soils is indicative of the marginal productivity of CRP lands in the region. Because they are highly erodible, all CRP lands in eastern New Mexico will be subject to conservation compliance regulations if they are recropped following the expiration of the 10-year land retirement contracts. Conservation compliance (also authorized by the 1985 Food Security Act) will result in landowners' loss of eligibility for government subsidy programs if they do not follow conservation guidelines in farming their highly erodible croplands. Previous studies have found conservation compliance on highly erodible land can increase crop production costs and reduce farm revenues (Napier and Napier).

CRP participants with highly erodible land enrolled in the program would be expected to perceive future crop production less positively than livestock production because of the costs of conservation compliance and the farm revenue losses which could result from noncompliance. Participant concern about soil erosion, subsequent CRP enrollment, and interest in permanent base acreage retirement thus could indicate a willingness to concede to the limitations of the natural environment, abdicate participation in commodity support programs, and engage in agricultural pursuits for which the land is better suited (i.e., grazing).

Methods

Upon expiration of their CRP contracts, program participants will have several land use options. Over 95% of the CRP land in the southern Great Plains, including 99% of New Mexico CRP lands, is planted to perennial grasses (Osborn, Llacuna, and Linsenbigler). As such, there are two widely accepted potential post-CRP uses for this land: (*a*) leave it in its current state and utilize it for livestock grazing, or (*b*) convert it back to crop production. Other potential uses include designating all or part of the individual tracts for wildlife habitat or private fee hunting and recreation. In this study, the choice options available to CRP participants were: crop production, livestock grazing, other, and unknown. "Other" uses identified through the survey included the two options mentioned above, selling the land, or keeping the land in grass with no livestock grazing. "Other" did not function as a catch-all category of significant magnitude, as less than 7% of the survey respondents were in this group.

Respondents were asked to select the primary use they had planned for their CRP acres. The "unknown" category was included as an option for program participants who had not formulated plans at the time of the survey. Ignoring respondents who were undecided as to their post-CRP land use intentions would have provided biased estimates of the other three potential post-CRP options. The four choice options included in the model thus comprise the full range of post-CRP intentions held by eastern New Mexico CRP participants.

A respondent's selection of a planned post-CRP land use was specified in a multiple-choice model as a function of seven socioeconomic and attitudinal variables. In this application, the model estimates the relationship between a set of individual characteristics or attributes and the probability an individual will make a given post-CRP land use choice.

At the end of their 10-year contracts, CRP participants will be making a decision among several alternatives. In this application, the choice set included the four options discussed above. This choice set is unordered and unranked. Unordered choice models are motivated

by a random utility model (Greene). For the ith individual faced with J choices, the utility of choice j is

$$U_{ij} = \beta_j' x_i + \epsilon_{ij}, \tag{1}$$

where x_i is a vector of characteristics for individual i, and ϵ_{ij} represents the unexplained elements of the utility function. If an individual makes choice j, it is assumed that individual utility (U_{ij}) is maximized by that choice.

The random utility model is made operational through the multinomial logit model (MLM). The MLM estimates the probabilities that individuals will select particular post-CRP land uses, or

$$\text{Prob}(Y = j) = e^{\beta_j' x_i + \epsilon_{ij}} \Big/ \left(1 + \sum_{k=1}^{J} e^{\beta_k' x_i}\right), \qquad \text{for } j = 1, 2, \ldots, J; \tag{2}$$

and

$$\text{Prob}(Y = 0) = \epsilon_{i0} \Big/ \left(1 + \sum_{k=1}^{J} e^{\beta_k' x_i}\right), \tag{3}$$

where Y indicates the choice made. The model thus computes the J log-odds ratios:

$$\ln(P_{ij}/P_{i0}) = \beta_j' x_i + \epsilon_{ij} + \epsilon_{i0}. \tag{4}$$

The log-odds ratios of (4) indicate the probability the ith individual will make the jth choice relative to the base (0) choice. The β coefficients are the effects of the regressors on the log-odds ratios. The J log-odds ratio equations, and the requirement that the probabilities for every i sum to one, uniquely determine the probabilities for each post-CRP land use, where P_0 = probability of post-CRP crop production intentions, P_1 = probability of post-CRP livestock grazing intentions, P_2 = other post-CRP intentions, and P_3 = unknown post-CRP intentions.

The random utility model forms the foundation of the MLM if the error terms (ϵ_{ij}) are assumed to be independently and identically distributed as a Weibull distribution. The Hausman and McFadden test for the independence of irrelevant alternatives (IIA) is used to examine this assumption. Application of the IIA test determines if the model's choices are truly independent. If the choices are not close substitutes and are independent, the odds of a particular choice are unaffected by the presence of additional alternatives. The test involves estimating two choice models. The statistic is:

$$\chi^2 = (\hat{\beta}_s - \hat{\beta}_f)'[\hat{V}_s - \hat{V}_f]^{-1}(\hat{\beta}_s - \hat{\beta}_f), \tag{5}$$

where s indicates the coefficients from the model estimated with a subset of choices, f indicates the coefficients from the model estimated with the full set of choices, and $\hat{V}_s$ and $\hat{V}_f$ are the estimates of the asymptotic covariance matrices. The statistic is asymptotically distributed as χ^2 with degrees of freedom equal to the rank of $\hat{V}_s - \hat{V}_f$.

In this modeling application, the choices (crop production, livestock grazing, other, and unknown) were not close substitutes, and were distinct enough that the null hypothesis of independence (at the 5% significance level) could not be rejected for any restricted subsets of post-CRP alternatives. The MLM was thus an appropriate method for predicting post-CRP land use intentions.

The following regressors were used in the MLM: total acres enrolled (*ACRES*), participant age (*AGE*), previous irrigation of the CRP land (*NOIRRIG*), whether the CRP participant had taken an off-farm job since enrolling land into the CRP (*JOB*), whether the participant knew the type of grass planted on the CRP acreage (*GRASS*), participant interest in permanent base acreage retirement in return for a one-time payment from the USDA (*RETIRE*), and participant indication of whether or not concern for pre-CRP soil erosion motivated CRP participation (*EROSION*). Mean values of these variables are shown in table 1. The mean values provide a brief description of the CRP participant group upon which the model is based.

Table 1. Variables Used to Predict Post-CRP Land Use Intentions of CRP Participants

Variable	Mean	Definition
NOIRRIG	.57	0 = CRP land irrigated prior to enrollment; 1 = not irrigated
GRASS	.11	0 = grass variety planted is known by participant; 1 = grass variety unknown
RETIRE	.29	0 = no interest in permanent retirement of crop base acreage; 1 = participant interested in permanent retirement of crop base acreage
ACRES	394.84	Acres of cropland enrolled in CRP
JOB	.58	0 = participant has taken off-farm job since CRP; 1 = no off-farm job since CRP
EROSION	.27	0 = pre-CRP soil erosion did not motivate program participation; 1 = erosion motivated participation
AGE	5.12	CRP participant age: 1 = ≤25 years, 2 = 26–35 years, 3 = 36–45 years, 4 = 46–55 years, 5 = 56–65 years, 6 = 66–75 years, 7 = ≥76 years

From (4) above, log-odds ratios for other probability comparisons were derived using the following relationship:

$$\ln(P_l/P_m) = \ln(P_l/P_n) - \ln(P_m/P_n). \tag{6}$$

The asymptotic variances and covariances for coefficients derived using (6) are used to calculate *t*-statistics. Hypothesis testing for these coefficients thus is valid only asymptotically.

Data

Mail survey data were collected in 1991 from 811 CRP participants in eastern New Mexico. The response rate for the mail survey was 57%. The survey questionnaire used to solicit information from the CRP participants asked the respondents to select the post-CRP land use they were most likely to follow at the end of their land retirement contract.

Findings

Results indicate post-CRP land use intentions are significantly explained by characteristics of the land enrolled (i.e., *NOIRRIG* and *ACRES*), socioeconomic variables (*AGE* and *JOB*), participant knowledge (*GRASS*), and attitudes (*RETIRE* and *EROSION*). The estimated and derived coefficient results are reported in table 2. These results were obtained through maximum likelihood estimation using LIMDEP® software. Only statistically significant findings are discussed below.

The estimated and derived coefficients indicate the effect of each explanatory variable on each log-odds ratio. A positive coefficient means the explanatory variable increases the probability of being in the numerator post-CRP intentions category relative to the denominator. A negative coefficient indicates the probability of the numerator intention is reduced relative to the denominator intention for that explanatory variable.

For example, the positive coefficient for *NOIRRIG* relative to $\ln(P_1/P_0)$ indicates that CRP participants who reported their land was not irrigated prior to CRP enrollment have a higher probability of grazing intentions relative to cropping intentions. Alternatively, if

Table 2. Estimated and Derived Coefficients for Multinomial Logit Model

Dependent Variable	*NOIRRIG*	*GRASS*	*RETIRE*	*ACRES*	*JOB*	*EROSION*	*AGE*
$\ln(P_1/P_0)$	.7334**	−1.1847**	.0551	−.0008**	.3335*	.7235**	−.1569**
	(3.989)	(−2.801)	(.450)	(−2.887)	(1.891)	(2.622)	(−2.287)
$\ln(P_2/P_0)$	.1616	−.2730	.2685	−.0009*	−.2180	.3080	−.0404
	(.589)	(−.464)	(1.411)	(−1.683)	(−.896)	(.702)	(−.401)
$\ln(P_3/P_0)$	−.0438	−.1490	−.5593**	−.0006**	−.3408**	.1864	.0003
	(−.254)	(−.407)	(−4.414)	(−2.052)	(−2.169)	(.629)	(.004)
$\ln(P_1/P_2)$	.5718**	−.9117	−.2134	.0001	.5515**	1.0315**	−.1165
	(2.152)	(−1.5223)	(−1.1812)	(.1779)	(2.3237)	(2.5798)	(−1.2011)
$\ln(P_1/P_3)$	.7772**	1.0357**	.6144**	−.0002	.6743**	.5371**	.1572**
	(4.6673)	(2.6738)	(5.3471)	(−.6742)	(4.3935)	(2.221)	(2.5182)
$\ln(P_2/P_3)$	.2054	−.1240	.8278**	−.0003	.1228	.1216	.0407
	(.7843)	(−.2198)	(4.4906)	(−.5287)	(.5408)	(.2917)	(.4261)

Notes: Single and double asterisks (*) indicate significance at .10 and significance at .05 or better, respectively; numbers in parentheses are *t*-statistics.

this coefficient is interpreted as the effect of the explanatory variable on $\ln(P_0/P_1)$, the sign is reversed, and the coefficient indicates that lack of irrigation reduces the probability of cropping intentions relative to grazing intentions. As hypothesized, and regardless of which path is taken for interpretation, pre-CRP irrigation appears to be more strongly associated with post-CRP cropping intentions than with maintaining the land in pasture for grazing.

The absence of irrigation also increases the probability of grazing relative to other and unknown land uses. When CRP participants indicated they did not know the variety of grass cover planted on their CRP acreage, the probability of grazing relative to crop production is decreased. This finding validates the hypothesis that participant knowledge of grass variety would be associated with higher probabilities of post-CRP grazing intentions.

Participants who indicated they had an interest in permanently retiring the crop base associated with their CRP lands have a lower probability of being in the unknown intentions group relative to cropping. At the same time, this variable is significant in increasing the probability of grazing or other intentions relative to unknown intentions. The ability of this explanatory variable to distinguish between cropping and grazing intentions was disappointing, even though the coefficient for $\ln(P_1/P_0)$ had the expected sign. However, it is interesting that the relationship between this variable and unknown intentions was consistently negative. Interest in permanent retirement of crop base acreage also is associated with higher probabilities of grazing intentions relative to unknown intentions.

The probabilities of grazing, other, or unknown intentions relative to cropping intentions are reduced relative to the quantity of land enrolled in the CRP. This result is consistent with the hypothesis posed earlier and is also in agreement with the findings of Heimlich and Kula. The probability of grazing increases relative to crop production, other, or unknown intentions for CRP participants who have taken off-farm jobs since CRP enrollment. This outcome was expected based on the review of literature and results of previous research which supported the inclusion of the off-farm employment variable in the model. Numerous factors influencing part-time farm operators' preferences for livestock over crop production were discussed above; however, the current model results do not permit an evaluation of which factors may be most relevant here. Yet, these results consistently show grazing intentions are more likely than any of the other three choices available to CRP participants with off-farm employment.

When CRP participants reported they enrolled land into the CRP in order to reduce soil erosion, the probabilities of grazing intentions relative to all other categories are increased. These results support the hypothesis that participants' pre-CRP concern for

Table 3. Predicted vs. Survey Outcomes for Post-CRP Land Use Intentions

	Predicted Outcomes from Model Results [from equation (7)] (%) (*A*)	Actual Outcomes from Survey Results (%) (*B*)	Difference (%) (*A* − *B*)
Cropping Intentions	20.89	21.05	−.16
Grazing Intentions	38.69	39.65	−.96
Other Intentions	6.65	6.49	+.16
Unknown Intentions	33.77	32.81	+.96
Log Likelihood = −440			
Restricted Log Likelihood = −605			
Chi-Squared = 330 with 18 degrees of freedom			

soil erosion will be a significant indicator of post-CRP grazing intentions. Whether or not this finding fully validates the paradigm shift alluded to earlier (i.e., post-CRP land use decisionmaking founded on realistic expectations of the region's land resources) is unknown. However, these results lend support to that postulate.

Age decreases the probability of grazing relative to crop production, but also increases the probability of grazing relative to being in the "don't know" category. As hypothesized, older farmers appear to be more strongly committed to post-CRP cropping than grazing. This outcome may indeed be a result of the resource fixity and risk aversion reasons predicted by fixed asset theory.

The model's predicted outcomes are shown in table 3, calculated using

$$\hat{P}_j = \left(\sum_{i=1}^{n} \hat{P}_{ij} \right) \Big/ n, \tag{7}$$

where $j = 0, 1, 2, 3$, and n = total observations. These outcomes are compared to the actual outcomes from the survey responses to verify the validity of the model. The model's outcomes were predicted within one percentage point of the survey results.

Predicted Probabilities

Table 4 provides a sensitivity analysis of the model's results. This information illustrates the effects of marginal changes in explanatory variables on each of the four predicted probabilities. These probabilities were derived using procedures outlined by Greene. The first step is the calculation of $\beta' x$ for $\ln(P_1/P_0)$, $\ln(P_2/P_0)$, and $\ln(P_3/P_0)$, using mean values of the explanatory variables. $\beta' x$ was then recalculated using a range of values for each explanatory variable while holding all other variables at their means. The antilog of $\beta' x$ gives a system of four equations with four unknowns (including the restriction that the probabilities of all outcomes sum to one). The probabilities based on mean values of the explanatory variables are presented in table 4 as a basis for comparison; the means of the variables were shown in table 1.

Irrigation prior to CRP enrollment decreases the probability of post-CRP grazing intentions. Irrigation also indicates a higher probability of unknown intentions. The probability of grazing intentions is more than doubled for participants who know the variety of grass planted on their CRP acres.

Participants who expressed an interest in permanently retiring the crop base acreages associated with their CRP acreage have a 50% higher probability of grazing relative to

undecided participants. But it should be noted that the model results reported in table 2 indicated this variable was not statistically significant. Larger CRP acreages were associated with higher crop production probabilities and lower grazing probabilities. The probability of cropping did not change relative to off-farm employment. However, the probability of grazing was higher than that of cropping both with or without participant off-farm employment.

When CRP enrollment was motivated by the desire to reduce soil erosion, the probability of grazing was more than twice that of cropping. The probability of grazing decreased with increasing participant age, while the probability of cropping increased with increasing age. The probability of unknown post-CRP plans also was shown to increase with increasing participant age.

Discussion

Several results of this research indicate possible trends in post-CRP land uses that could have long-term effects on the structure of agriculture in eastern New Mexico and elsewhere in the southern Great Plains. Younger participants have the highest probability of grazing intentions. These results suggest a trend by younger participants to use the CRP as a means to permanently move their resources out of crop production to livestock production. The higher recropping probabilities for older participants may be based on a higher degree of risk aversion, or an unwillingness to abandon existing investments in machinery and equipment and make the additional investments necessary for new livestock enterprises.

Because the probability of "unknown" plans also increases with age, there may be an important role for extension personnel and other advisors in helping older CRP participants formulate their post-CRP land use plans. These results also show a higher degree of uncertainty and a need for assistance in decisionmaking for participants who have taken off-farm jobs since CRP enrollment.

The CRP may have provided a turning point for some participants who previously were farming marginal lands in the region. Participants who indicated soil erosion influenced their decision to participate in the program have a high probability of grazing intentions. This factor, combined with the age variable, may signal generational differences among CRP participants. Younger participants have been exposed to a higher level of environmental awareness, and appear to have post-CRP land use plans that conform to the resource conservation objectives of the CRP.

These findings suggest the structure of agriculture in the southern Great Plains could be altered due to post-CRP land uses as influenced by age, off-farm employment, and the presence or absence of irrigation. These factors appear to point to a retreat from crop production and a move toward livestock enterprises in the region. If so, the CRP may indeed be facilitating the reversion of economically untenable crop-producing lands to rangelands. The results here suggest the program also is influencing the younger generation of participants to abandon crop production enterprises. If these stated intentions are borne out, a less intensive agriculture is likely to result in reduced population and negative effects on communities, school systems, and tax bases.

While the overriding objective of the CRP has been to reduce soil erosion, landowners' decisions to participate in the CRP were not necessarily motivated by natural resource concerns. Only 27% of the CRP participants surveyed indicated concern for soil erosion was a factor in their decision to enroll land in the program. These participants are almost three times as likely to indicate grazing intentions rather than cropping intentions. Participants who had a long-term interest in improving the environmental quality of their lands would be expected to be well-informed as to the characteristics of the land. An awareness of the grass variety planted on their CRP land thus would be an indicator of grazing intentions. The results of this research show that participants who know their grass variety are more than twice as likely to state grazing intentions when compared to participants unaware of the type of grass cover planted.

Table 4. Probabilities of Intended Post-CRP Land Uses for Mean Attribute Values and Different Levels of Attribute Values

	Cropping	Grazing	Other	Don't Know
Mean attribute values:	.23	.37	.07	.33
CRP land is:				
Irrigated	.26	.28	.07	.39
Not irrigated	.20	.45	.06	.29
CRP participant knows grass variety:				
Yes	.21	.40	.07	.32
No	.32	.18	.08	.42
Participant interested in permanent base acreage retirement:				
Yes	.25	.45	.10	.20
No, or No opinion	.23	.38	.07	.32
Participant doesn't know about permanent retirement and doesn't know grass variety:	.26	.14	.05	.55
Acres enrolled in CRP:				
50	.18	.41	.08	.33
100	.19	.40	.08	.33
200	.20	.39	.08	.33
600	.25	.35	.07	.33
800	.28	.33	.06	.33
1,000	.31	.32	.05	.32
Participant has taken an off-farm job since CRP enrollment:				
Yes	.22	.30	.08	.40
No	.22	.43	.06	.29
Participant indicated desire to reduce soil erosion motivated CRP participation:				
Yes	.17	.48	.06	.29
No	.24	.35	.07	.34
Participant age (years):				
≤25	.17	.53	.06	.24
26–35	.18	.49	.06	.27
36–45	.20	.45	.06	.29
46–55	.21	.41	.07	.31
56–65	.22	.38	.07	.33
66–75	.24	.34	.07	.35
≥76	.25	.31	.07	.37

Participants unaware of the grasses planted on their CRP acreage are thus demonstrating the temporary nature of the ground cover and likely will return the land to crop production after the 10-year contracts expire. In their cases, the environmental benefits achieved by the CRP could be short-lived and temporary, as the selection of grasses to plant was probably based on least-cost criteria. Alternatively, if these lands were to remain in grass, the region would be endowed with a supply of inferior rangelands. USDA-supported research is currently underway in eastern New Mexico to develop livestock grazing systems for the predominant grass species growing on CRP land in the region. This research will address management of all grass varieties, and will provide guidelines for optimizing the use of the less palatable species.

An important question regarding the CRP relates to whether or not the program will be continued. A continuation could involve year-to-year renewal of land-retirement contracts, or possibly five- or 10-year extensions of existing contracts. Permanent base acreage retirements and conservation easements also have been raised as options. Findings from

this research show that participants who have an interest in permanent base acreage retirement have a higher probability of being in the "other" intentions category relative to other participants, the lowest probability of being in the "don't know" category, and are almost twice as likely to state grazing relative to cropping intentions. This outcome may be further evidence of a trend toward abandonment of crop production, a growing acceptance of a more market-oriented agriculture, and a desire to cut the ties that bind southern Great Plains agriculture to the federal government. Given that 42% of the CRP participants surveyed have taken off-farm employment since enrolling land into the program, the results also may reflect a greater prevalence of ranching operations oriented toward lifestyle preservation.

If future legislation were to authorize extension of CRP contracts for only the most highly erodible lands currently enrolled, many of the retired lands in the southern Great Plains would be prime candidates for contract continuation. This scenario of contract extension for the most environmentally sensitive lands likely would be dictated by budgetary concerns. Such a policy presumably would keep landowners from bringing these marginal lands back into crop production. However, the results of this research in eastern New Mexico bring into question the rationale for such a policy. What would be the social benefit of subsidizing a transition which already may be underway as a result of landowner decisionmaking in response to immutable economic and environmental forces?

From the results discussed above, it would appear there are significant generational differences among CRP participants and their post-CRP land use plans. Rational, forward-looking, informed business decisions by younger landowners very well could be thwarted by an extension of CRP contracts prompted by fear of the environmental consequences of recropping highly erodible lands. Locking land into extended periods of retirement with the same restrictions on use currently in effect under the existing contracts would impede transitions and undermine the interests of the younger agricultural generation. With price policies that do not provide artificial incentives for southern Great Plains crop production and existing conservation compliance rules, it is likely many landowners will choose more sustainable post-CRP uses for their CRP lands.

The loss of tax revenues and other negative community implications which would be expected as a result of a transition to less intensive agriculture are inevitable, and policies probably could be implemented to alleviate these effects. However, the provision of significant assistance to local economies likely would hinder the necessary adjustments to sustainable communities as the region's agricultural base shifts toward greater sustainability.

An additional factor which was not addressed by this research, but which may affect post-CRP land use decisionmaking in New Mexico and other states in the Great Plains, is the current controversy over public lands grazing. Significant reform in grazing policy, with possible reductions in access to public land forage resources, could influence the relative attractiveness of maintaining CRP lands in pasture. It is impossible to determine from this research if eastern New Mexico CRP participants are engaging in any speculation as to future reform in grazing policies. Neither can it be determined whether that issue is influencing their decisions to maintain their lands in permanent grass cover. However, this is an interesting question for future research, particularly in states with both heavy CRP enrollment and extensive public land grazing.

Conclusions

Results of this research should be considered early indicators of post-CRP land uses. This study demonstrates the need to better understand the potential effects of a range of socioeconomic and attitudinal factors on post-CRP land uses. These results point to a CRP-facilitated exit from crop production by some program participants. Of course, this phase may be temporary if world market conditions change dramatically, or in the event of severe climatic or social disruptions elsewhere in the world.

The future of CRP lands is an open question that surely will be debated in the near future. Based on these findings, it appears the nature and character of agriculture in the southern Great Plains may be altered as a result of the CRP. Given events since the 1930s, we are unable to tell if a CRP-aided retreat from crop production will be permanent or short-lived. It is possible, however, to use participants' post-CRP intentions to begin forecasting the probable future of CRP lands, the program's effects on agriculture structure, and the duration of environmental benefits achieved by the program.

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