

The Economic Impact of the Conservation Reserve Program on Households and Counties

Project Summary

The Conservation Reserve Program (CRP) is a USDA program in which rural landowners are paid to convert marginal, highly erodible farmland from cultivation to forest or grassland. This has been an important component in the effort to reduce the quantity of topsoil lost, and quantity of pollutants and sediments that enter surface water bodies. In addition to the environmental impact, the CRP has had economic and social impacts in rural communities. Enrollment of farmland in the CRP provides a more secure income stream and retirement income for some rural landowners. On a larger scale, county and regional economies change when CRP enrollments rise. Economies in agriculturally-dependent counties may suffer as landowners shift from cultivation to CRP, as landowners reduce purchases of agricultural inputs. In a more diversified economy, landowners may spend more money in the local economy.

Interviews and a survey of rural landowners will elicit information about the reasons why landowners choose to enroll land in the CRP, the importance of CRP payments to the farm economy, the perceived environmental benefits, levels of satisfaction with CRP economics and environmental results, and the changes in landowner movement, consumption, and shopping behavior.

Although it is widely understood that farmers often enroll in the CRP as a means to mitigate potentially unreliable income, the actual impacts or benefits of the program in this type of situation are not well understood, and remain generally unstudied. This research will approach the economic effects of the CRP on farmers and local areas, yielding improved understanding of the use and implications of this particular agri-environmental program for economic survival and adaptation strategies in rural areas. This study will provide useful information that can be used to guide conservation policy that will lead to both environmental sustainability and economic stability in rural America.

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Program Description

Introduction:

American agriculture is highly productive, but it is associated with serious environmental consequences. As it is currently practiced, agriculture contributes large amounts of non-point source pollutants into surface water bodies (Horan and Ribaudo 1999). Great quantities of fertilizers and pesticides are required to achieve and maintain the American level of production, but instead of remaining in place where they can be beneficial, some of these agricultural chemicals are washed into surface water bodies (Bhuyan *et al.* 2002). In addition, the sudden and wide-scale conversion of native prairie and forests to cultivated farmland resulted in dramatic increases in soil erosion (Knox 2001). The catastrophic Dust Bowl of the 1930s served to awaken the need for changes in agricultural practices and provided the impetus for soil and water conservation policies.

The Conservation Reserve Program (CRP) is one such program. Established with the Food Security Act of 1985, it was designed to reduce soil erosion by encouraging the conversion of cropland into permanent vegetative cover. Landowners enroll highly erodible or environmentally fragile farmland for a period of ten years, and in return receive a subsidy payment.

Background:

The Conservation Reserve Program has had a beneficial impact on the physical environment. Some environmental benefits of the program include increased soil quality (Karlen *et al.* 1998), increased surface quality (Ribaudo 1989), decreased surface runoff and decreased soil erosion (Khanna *et al.* 2003). Szentandrasi *et al.* (1995) adds that the CRP has provided other environmental benefits; increased wildlife habitat provides forage, cover, and nesting areas for migratory and non-migratory birds, small mammals, and large game animals, and improved water quality benefits fish and other aquatic life. These environmental benefits may translate into increased economic benefits. Reducing soil losses also reduces declines in soil fertility, and consequently reduces declines in agricultural productivity (Miranda 1992). In addition, the improvements in environmental quality not only increase recreational opportunities for hunting, bird watching, photography, and hiking on CRP land (Szentandrasi *et al.* 1995, Hansen *et al.* 1999), but also improve recreational amenities on nearby non-CRP land (Siegel and Johnson 1991, Babcock *et al.* 1996). Thus the CRP is effective in improving environmental quality.

However, American agricultural producers exist within an economic environment characterized by a great amount of uncertainty. In addition to capricious weather and cycles of drought (Diggs 1991), farmers are challenged by spiraling capitalization and debt (Halweil 2000), fluctuating land prices (Johnson and Haigh 1970), rigid agricultural policies (Lence and Hays 2002), and volatile domestic and international markets over which they have no control (Napton 1989). There is little margin for mistakes or bad

luck. Communities and regions that support (and are supported by) agriculture are also subject to similar volatility. In addition, Young *et al.* (1991) asserts that the CRP shares the costs of conservation between taxpayers and farmers, but Martin *et al.* (1988) counters that although the benefits accrue to society, the costs are imposed upon farm communities located in environmentally fragile areas.

CRP enrollments are often located in resource-dependent rural communities. Resource-dependent communities are vulnerable to cycles of boom and bust, and population loss (Hyberg *et al.* 1991). Populations swell during boom periods, but decline with falling commodity prices. As the constricting population base becomes inadequate to support stores and service providers, the loss of community services fuels further out-migration (Troughton 1997). Schools, which play a large role in fostering social cohesion and sense of identity, are forced to consolidate (Hudson 1996). Therefore, agricultural policy does not only impact agricultural producers, but also affects the stability of the regional agricultural community (Sengupta *et al.* 2000). Changes in resource policy may result in unanticipated yet fundamental changes to the rural culture. Change-induced shocks may be more than the system can bear, and may result in structural collapse of rural societies and cultures (Riebsame 1991).

Thus, in addition to changing the physical environment, the CRP also affects economic and social changes to the rural landscape. The program has the capacity to dramatically affect both the environmental quality of rural America and the economic vitality of American farmers and agriculturally-dependent communities. These changes occur at all scales, from the household (i.e., the individual farmers) to the national scale (Hyberg *et al.* 1991).

On the local level, Shoemaker (1989) asserts that CRP payments affect land values. On less productive land (where CRP payments are greater than the revenue that could be generated from cultivation agriculture), the excess amount that government payments are greater than the local rental market becomes capitalized into the value of the land, changing land rental prices. Farmers who enter land into the CRP avoid production-related expenditures (e.g., fertilizers, machinery repair, use-related depreciation), but they are still responsible for time-related expenditures, such as interest payments, time-related depreciation, and mortgage payments (Standaert and Smith 1989). Farmers benefit from enrollment in the CRP not only from the subsidy payments (which would have to cover fixed costs) but also from the reduction in production costs.

At an aggregate level, communities that are more dependent upon agriculture will be more negatively affected by CRP enrollment than for those counties for which agriculture is less important (Martin *et al.* 1988). When landowners convert farmland into permanent vegetative cover, they no longer have to purchase cultivation inputs such as seed, fertilizer, and machinery. The subsidy payment may be used for purchases in other sectors. This reduction in demand for agricultural inputs may or may not be offset by an increased demand for other goods and services.

Additionally, the agriculturally-dependent community may not offer initially, at least the goods and services demanded by the CRP landowners (Broomhill and Johnson 1990). In agriculturally-dependent economies offering a limited array of goods and services, producers spend less on agricultural inputs in the local economy (hurting the local economy) and spend more on goods and services elsewhere (benefiting another economy). Some communities with insufficient economic diversity will lose economic

strength in the form of increased leakage as a result of CRP enrollment. Leakage⁶ which is the amount of money that is spent outside of the local economy and does not become part of the income stream for a local firm⁶ tends to be high in lower order communities (which offer a narrow range of goods and services). The reduced demand for seed and fertilizer, for example, leads to reduced profits for the local supplier, which means fewer dollars spent for other local goods and services, especially if there are few other sectors in the local economy. A reduction in demand for farm inputs and services may be the *demand shock* that pushes some agriculturally-dependent community into economic collapse.

Conversely, communities that offer a wider range of goods may benefit from the change in consumption patterns. A regional service center, for example, offers a wider range of goods and services, so the reduction in spending in agricultural inputs is offset by an increase in spending in other sectors. The community has to make some adjustments, but it can absorb the change. It may benefit from the leakage of smaller neighboring communities if it can meet the increased demand for other goods. However, the regional service center will also experience some (although not as much) leakage as consumers look for higher-order goods that are not found in the local economy. Thus the impact of the CRP varies spatially.

The social and economic consequences of the CRP may, in part, explain some of its lack of effectiveness at achieving its environmental goals. Subsidies in general lead to over-participation in a program, and this reduces the program's effectiveness. For example, the problem of *slippage*⁷ within the Conservation Reserve Program undermines its effectiveness. Slippage occurs as new farmland is put under cultivation to replace farmland that the CRP removes from production. Leathers and Harrington (2000) reported that some slippage may be caused by program non-participants who increase production in anticipation of higher prices. Wu (2000) points out that the program may cause some non-cropland to be converted to cropland so that farmers may benefit from increased commodity prices or maintain economies of scale. Gersmehl and Brown (2004) assert that the slippage effects can cause the effectiveness of the program to fail the national scale. If producers are under pressure to meet fixed costs, they may be motivated to put into cultivation other marginal land. This helps farmers maintain an economy of scale and produces income, but it reduces the program's effectiveness at meeting environmental goals. The soil erosion that results from the farmland put into cultivation is likely to be as great as from the farmland retired into the CRP.

In addition to looking at households and individual behavior, it is also useful to examine how the program affects county-scale change. Smith (1995) points out the inefficiency of setting bid caps at the regional instead of the county level. Tremendous variation exists in the physical characteristics from place to place, so setting the maximum allowable rental rate for a given location using smaller units permits a better grasp of local conditions. Instead of setting regional bid caps, the maximum rental rate should be set at the county level for each class of farm sizes in order to keep CRP payments close to the land rental rates. Thus the scale of county is a large enough unit of aggregation in which sufficient county-level data exists and is readily available, but is small enough to be accurate. Regional-scale data may mask out local variations.

The economic impacts of the CRP have been examined at the aggregate level in several regions, including Missouri (Kalaitzandonakes and Monson 1994), Montana

(Standaert and Smith 1989), Oregon (Martin et al. 1988), and Louisiana (McLean-Meyinsse 1994). With the exception of eliciting information about post-CRP land-use decisions (Johnson et al. 1997, Shakya and Hitzhusen 1997, Cooper and Osborn 1998) and land values (Shoemaker 1989), most of the research examining the economic impacts of the CRP have not been at the farm, household, or individual scale. However, because individuals choose to participate in the program (or choose to undermine the program's effectiveness by slippage), it is important to understand how the program works at the individual level in order to craft a program that is both efficient and effective. The effectiveness of a voluntary pollution abatement program such as the CRP depends on the number of participants, the amount of abatement of each participant, and the response by the total number of landowners (both participants and non-participants) in the market (Alberini and Segerson 2002). The program is composed of enrolled individuals, and depends upon individuals and their individual decisions. Therefore it is vitally important to look at the actions and perceptions of the individual landowners in order to understand the failings and successes of the program.

This should result in a better program. Like other government programs, the Conservation Reserve Program is expected to be effective, efficient, and equitable. To be effective the program must meet its stated objectives. An efficient program meets its objectives at the least cost to society. A program is equitable if neither the benefits nor the costs accrue unfairly to a single segment of the population. In order to accomplish this, the full impact— including all direct and indirect effects— on the people affected must be understood. Although an examination of the full secondary impacts are beyond the scope of this study, I hope to illuminate some of the factors that lead to enrollment in the program, as well as reveal some of the consequences that result from it.

Objectives of the study:

This study will examine individual perceptions of the CRP, motives for enrollment in the program, behavior changes in response to program participation. It will reveal how the program affects counties and communities, and identify the factors that predict economic benefit. Furthermore, it will identify the spatial variation and patterns to degrees of benefit. This research will contribute to a broader understanding of the Conservation Reserve Program, and may play a role in the crafting of effective, efficient, and equitable policy.

In particular, I wish to examine how landowners perceive the effectiveness of the CRP at meeting their needs. It is unrealistic to expect farmers to support a program that does not provide them with at least as much benefit by participation than they would have by not participating. In order to continue the environmental benefits the program provides, landowners have to share in the benefits as least as much as they share in the costs. The popularity of the program among producers suggests that it meets the needs of landowners, but the amount of slippage indicates that other needs are not fulfilled. Additionally, I will examine how landowners have changed their consumption patterns since enrolling in the Conservation Program. I hope to analyze how spending has shifted geographically. Where, for example, do landowners purchase groceries now compared to

before they enrolled in the program. Has the Conservation Reserve Program contributed to a restructuring of the sizes and distribution of cities in the central Great Plains?

The following hypotheses will be used to guide the research:

1) Households benefit from participation in the CRP.

The landowners who enroll in the program will gain from a more stable and predictable income stream, reduced operational expenses, less risk, and higher net incomes. Because the CRP is a voluntary program, it is expected that landowners anticipate benefits to equal or exceed the benefits from cultivation. However, reality may prove different than anticipation.

2) The CRP helps preserve family farms.

The family farm is iconic in American culture; the family farm represents a value greater than a mere unit of production. Thus the program might serve to protect this element of American culture. An increase in income and a more secure income stream might permit smaller landowners to remain profitable and remain in agriculture. This would counter trends toward larger farms, fewer farmers, and regional depopulation.

Alternatively, because the CRP does not tie landowners to their parcels that is, landowners can continue to collect the subsidy whether or not they remain on the property enrollment in the program may free landowners to leave the family farm and migrate elsewhere. Thus the CRP might reinforce the pattern of regional rural depopulation.

3) Individual benefits vary spatially.

The benefits to the individual depend upon land values, productivity, and proximity to urban centers, all of which vary spatially. Martin *et al.* (1988) assert that in more productive areas setting aside land in the CRP resulted in a loss of individual income, whereas in less productive regions individuals experienced a net gain by participating.

4) The CRP causes a change in the composition of local economies.

Given enough time, economies will adapt to the demand shifts for agricultural inputs and other goods and services. In agriculturally dependent counties offering a limited range of goods and services, the reduced demand for agricultural products will lead to a reduced demand for the other sectors of the economy. As the profit for agricultural input firms (which is in part the income stream for the other sectors) declines, profitability of the other sectors will experience a similar decline. Over time, these economies might be expected to further constrict.

Conversely, more diversified economies will experience a reduction in demand for agricultural inputs, but since agricultural inputs represent a smaller proportion of the total economy, the decline will not be felt as acutely. In addition, because a wide variety of goods and services are available to meet the demand growing, the increased spending on these goods and services offsets the decreased spending on agricultural inputs. The overall impact on these counties may be positive, especially if these counties serve as service centers for nearby agricultural-dependent counties.

- 5) The effects of the CRP on counties vary spatially, and depend on the degree of agricultural dependency and population characteristics.

Aggregate benefits also vary across space. Economies in counties that are more agriculturally dependent have a retail sector predominantly or entirely related to agricultural products. These economies will suffer as landowners shift from cultivation to CRP, because landowners will reduce spending on agricultural inputs within the county and will be forced to go outside the county to purchase other goods and services. Conversely, in more diversified economies that offer a wider range of goods and services, producers will spend more money in the local economy, and more of the money spent will remain in the economy. In addition, rural communities that have greater economic linkages to larger towns or cities tend to benefit from the city's growth (which could be fueled in part by CRP subsidies), whereas rural communities that are poorly linked do not experience the same degree of benefit (Barkley *et al.* 1996).

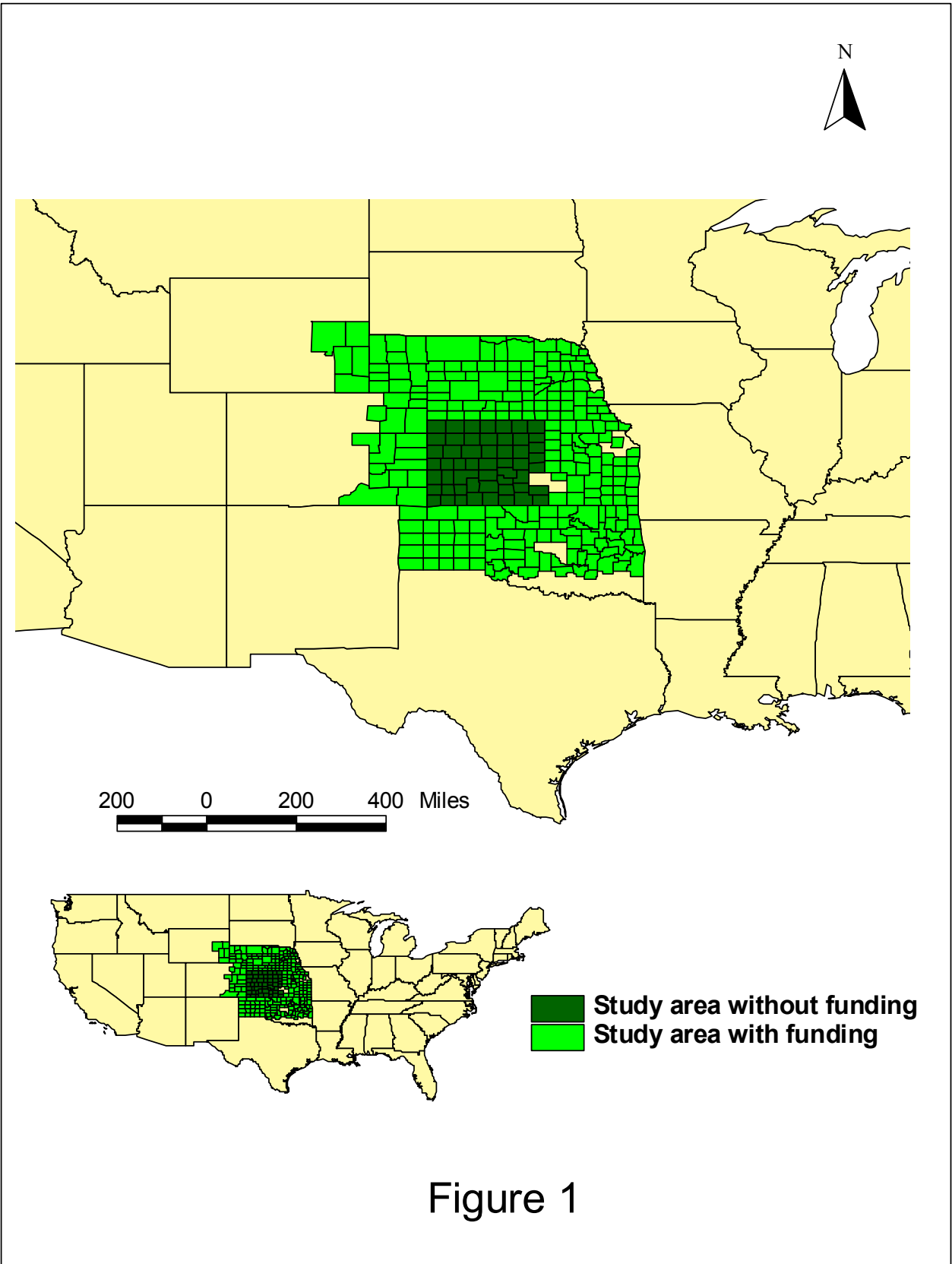
Methods:

In order to obtain data about individual and farm-level economic impacts of the Conservation Reserve Program, a mailed survey, constructed and administered according to Dillman (2000), will be sent to a sample of 2,000 CRP landowners in Kansas, Nebraska, Oklahoma, Colorado, and Texas. Figure 1 shows the counties included in the study area with financial support, as well as the study area without funding. The survey instrument is currently pending review by the Kansas State University Institutional Review Board.

The names and addresses of CRP participants will be obtained from the Farm Service Agency. From the list of CRP landowners, a stratified random sampling technique will be used to generate the sample population. Dillman (2000) recommends multiple mailings as a means of increasing response rate, so the survey will be mailed to the sample of CRP landowners as follows: the complete survey with cover letter and stamped return envelope, followed by a postcard reminder, another complete survey with cover letter and return envelope, and another postcard reminder.

In particular, the survey will disclose how the program impacts individuals and households. It will reveal how individuals perceive (correctly or not) the efficiency and efficacy of the program, and how people react (i.e., the changes in their migration or shopping behavior) to changes in household income produced by the Conservation Reserve Program. The survey should also reveal motivations for and obstacles to enrollment, and this may illuminate some of the reasons for slippage. The survey will be composed of open-ended questions (e.g., "In what ways has the Conservation Reserve Program benefited or harmed your community?"), as well as questions requiring responses ranked on a Likert scale (e.g., "Based on your experience, how satisfied are you with the CRP? 1=extremely dissatisfied, 2=dissatisfied, 3=neither satisfied nor dissatisfied, 4=satisfied, 5=extremely satisfied). The survey questions will elicit the following information:

- *Level of satisfaction with the CRP.* Landowners are asked to rate their satisfaction with a Likert scale.



- *Motivations for enrolling in the CRP.*
What factors (environmental quality, reduction of risk and expenses, stable income, retirement income) were considered more important when landowners made the decision to enroll in the CRP?
- *Obstacles to enrollment in the CRP*
Landowners are asked to respond to an open-ended question.
- *Perceived Benefit or harm to households and individuals.*
Landowners are asked to respond to an open-ended question.
- *Perception of the effectiveness of the program in reducing erosion, improving water quality, and improving habitat.*
Landowners are asked to rate the program's effectiveness with a Likert scale.
- *Levels of absentee ownership.*
The county of residence is compared to the county in which the CRP parcel is located.
- *Changes in migration.*
Landowners are asked if they changed residences after enrolling.
- *Spatial changes in spending habits*
Landowners are asked to indicate the city in which purchases of a variety of goods and services (groceries, automobiles, insurance, agricultural supplies, agricultural machinery, women's clothing, financial services (including tax preparation and accounting services), jewelry, sporting goods and recreational equipment, physician or primary health care provider, gasoline, restaurant, bank (savings account), men's clothing, toys or gifts, hospital, agricultural consultant, music tapes or CDs, and drug store). Landowners are asked to specify the city where the purchases would have been made in 1986, and where they would be made now.
- *Changes in off-farm employment*
Landowners are asked whether they or their spouses have any off-farm employment (specifying the occupation and the county) now, and in 1986.
- *Demographic information*
Landowners are asked to provide their age, gender, and level of educational attainment.

The ordinal data from the Likert scales will yield sums and standard deviations to compare responses to different factors, and a Spearman's r will be used to measure rank-

order correlations between factors. Content analysis will be used to interpret the responses to the open-ended questions. Changes to the local economies can be determined by comparing the composition of the pre-CRP (i.e., before 1986) economy to that of the current economic composition; I will examine how many firms and how many sectors were represented before 1986, compared to how many are represented currently. Although not all of these changes can be attributed entirely to the Conservation Reserve Program, this study will show how the economic landscape of the central Great Plains has changed. The county-level aggregate information will be obtained from data published by the Bureau Of Census, Bureau of Labor Statistics, National Agricultural Statistics Service, and K-State Agricultural Extension Service.

In order to measure the impact of the program on local economies, I will use a multiple regression analysis. Household income (or another economic variable of interest) will serve as the dependent variable. Independent variables would include the amount of CRP acreage, the share of CRP staying in the local economy (derived from interviews), and the change in demand for agricultural inputs. In addition, a set of control factors (e.g., the relative sizes of various non-agricultural sectors in the local economy, composition of the local labor force) will help isolate the effects of the CRP from other changes in the economies.

In addition, I will conduct in-person interviews of a stratified sample of the 1-2% of the survey population. This part of the study will be more qualitative in nature, and will provide a better understanding of participant's perceptions on how the program impacts their farms, families, and communities. I will use content analysis to derive patterns and themes from the interview responses.

A tentative timetable for the study is as follows:

January 2005	Obtain the mailing list of Conservation Reserve Program landowners from the Farm Service Agency. Identify survey sample, and from that sample for personal interviews.
mid-February 2005	Mail first survey (with cover letter and return envelope). If landowners are farmers, this will be a period of time that is less busy and they may be more inclined to complete and return the survey.
March 2005	Mail first postcard reminder to those who have not yet returned a completed survey. Mail thank-you notes to those who have.
mid-March 2005	Mail a second survey (with cover letter and return envelope) to those who have not yet returned a completed survey
April 2005	Mail a second postcard reminder to those who have not yet returned a completed survey.

May 2005	Begin comparing the 1986 and 2004 economies of counties in the study area.
June-August 2005	Schedule and conduct in-person interviews. Talk to FSA, SCS, and Agricultural Extension agents, collect secondary data.
September 2005	Begin content and regression analyses.
October 2005	Present preliminary results at the Applied Geography Conference, Washington, DC
March 2006	Present results at the national Association of American Geographers Conference, Chicago IL
May 2006	Complete dissertation. By this time I will have submitted articles about aspects of this research to at least two peer-reviewed refereed publications.

Dissertation Improvement:

A Doctoral Dissertation Research Improvement grant will permit me to embark on a more complete study of the economic impact of the Conservation Reserve Program in the central Great Plains. The funding will allow me to examine a much larger study area because I will be able to travel greater distances to conduct interviews, talk to conservation officers, and gather secondary data. Similarly, because postage represents such a large proportion of my expenses, funding will enable me to expand the size of the sample. I will be examine a larger amount of area, which may reveal patterns in the economic landscape that are not visible at a larger scale. Without the additional funding, I would have to drastically limit the size of my sample and restrict my study area to western Kansas. I would have to forgo the in-person interviews altogether. Therefore, the funding would increase the scope of my dissertation and the quality of my results.

Conclusions:

The integrity of the physical environment is vital to the cultural, economic, and environmental sustainability of the central Great Plains. Government policy plays a role in shaping that sustainability. I hope that this study elicits information that will help to guide the creation of an effective, efficient, and adaptive agricultural policy that can sustain and improve environmental progress, while maintaining the integrity of community and household economic structures. This study will contribute to a greater understanding of the effects of the Conservation Reserve Program on individuals and households, as well as its effects at the county or community scale. I hope that this study will help policymakers craft agricultural programs that will serve the needs of economically vulnerable rural populations while simultaneously enhancing the social welfare of the nation.

References

- Alberini, A., and K. Segerson. 2002. Assessing voluntary programs to improve environmental quality. *Environmental and Resource Economics* 22: 157-184.
- Babcock, B. A., P. G. Lakshminarayan, J. J. Wu, and D. Zilberman. 1996. The economics of a public fund for environmental amenities: a study of CRP contracts. *American Journal of Agricultural Economics* 78(4):961-971.
- Barkley, D. L., M. S. Henry, and S. Bao. 1996. Identifying "spread" and "backwash" effects in regional economic areas: a density functions approach. *Land Economics* 72(3): 336-357.
- Broomhill, D., and T. G. Johnson. 1990. Regional impacts of the Conservation Reserve Program in the Southeast with conversion to trees; an application of input-output analysis. *Review of Regional Studies* 20(2): 74-85.
- Cooper, J. C., and C. T. Osborn. 1998. The effect of rental rates on the extension of Conservation Reserve Program contracts. *American Journal of Agricultural Economics* 80(1):184-194
- Diggs, D. M. 1991. Drought experience and perceptions of climate change among Great Plains farmers. *Great Plains Research* 1(1): 114-132.
- Dillman, D. A. 2000. *Mail and Internet Surveys: the Tailored Design Method*. New York: John Wiley & Sons.
- Gersmehl, P. J., and D. A. Brown. 2004. The Conservation Reserve Program: a solution to the problem of agricultural overproduction? In *Worldminds: Geographical Perspectives on 100 Problems*, D. G. Jannelle *et al.*, eds. Dordrecht, The Netherlands: Kluwer Academic Publishers.
- Halweil, B. 2000. Where have all the farmers gone? *Worldwatch* September/October. Pp. 12-28.
- Hanson, L., P. Feather, and D. Shank. 1999. Valuation of agriculture's multi-site environmental impacts; an application to pheasant hunting. *Agriculture and Resource Economics Review* 28(2): 199-207.
- Horan, R. D., and M. O. Ribaud. 1999. Policy objectives and economic incentives for controlling agricultural sources of nonpoint pollution. *Journal of the American Water Resources Association* 35(5): 1023-1035.
- Hudson, J. C. 1996. *The geographer's Great Plains*. Occasional Publications in Geography. Kansas State University, Manhattan, KS.

Hyberg, B. T., M. R. Dicks, and T. Hebert. 1991. Economic impacts of the Conservation Reserve Program on rural economies. *Review of Regional Studies* 21(1): 91-105.

Johnson, P. N., S. K. Misra, and R. T. Ervin. 1997. A qualitative choice analysis of factors influencing post-CRP land use decisions. *Journal of Agricultural and Applied Economics* 29:163-173.

Johnson, S. R., and P. A. Haigh. 1970. Agricultural land price differentials and their relationship to potentially modifiable aspects of the climate. *The Review of Economics and Statistics* 52(2): 173-180.

Kalaitzandonakes, N. G., and M. Monson. 1994. An analysis of potential conservation effort of CRP participants in the state of Missouri: a latent variable approach. *Journal of Agricultural and Applied Economics* 26(1): 200-208.

Karlin, D. L., J. C. Gardner, and M. J. Rosek. 1998. A Soil Quality Framework for Evaluating the Impact of the CRP. *Journal of Production Agriculture* 11(1): 56-60.

Khanna, M., W. Yang, R. Farnsworth, and H. Onal. 1991. Cost-effective targeting of land retirement to improve water quality with endogenous sediment deposition coefficients. *American Journal of Agricultural Economics* 85(3): 538-553.

Knox, J. C. 2001. Agricultural influence on landscape sensitivity in the Upper Mississippi River Valley. *Catena*. 42: 193-224.

Leathers, N., and L. M. B. Harrington. 2000. Effectiveness of Conservation Reserve Programs and land slippage in southwestern Kansas. *Professional Geographer* 52(1): 83-93.

Lence, S. H., and D. J. Hayes. 2002. U. S. farm policy and the volatility of commodity prices and farm revenues. *American Journal of Agricultural Economics* 84(2): 335-351.

Martin, M., H. Radtke, B. Eleveld, and S. D. Nofziger. 1988. The Impacts of the Conservation Reserve Program on rural communities: the case of three Oregon counties. *Western Journal of Agricultural Economics* 13(2):225-232.

Miranda, M. L. 1992. Landowner incorporation of onsite soil erosion costs: an application to the Conservation Reserve Program. *American Journal of Agricultural Economics* 74(2):434-443.

Napton, D. 1989. Contemporary agriculture and rural land use. In *Geography in America*. G. L. Gaile and C. J. Willmott, eds. Columbus, OH: Merrill Publishing Company. Pp. 333-350.

Ribaudo, M. O. 1989. Targeting the Conservation Reserve Program to maximize water quality benefits. *Land Economics* 65(4): 320-332.

Riebsame, W. E. 1991. Sustainability of the Great Plains in an uncertain climate. *Great Plains Research* 1: 133-151.

Sengupta, R., D. A. Bennett, J. Beaulieu, and S. E. Kraft. 2000. Evaluating the impact of policy-induced land use management practices on non-point source pollution using a spatial decision support system. *International Water Resources Association* 25(3): 437-445.

Shakya, B. S., and F. J. Hitzhusen. 1997. A benefit-cost analysis of the Conservation Reserve Program in Ohio: are trees part of a sustainable future in the Midwest? *Journal of Regional Analysis & Policy* 27(2): 13-30.

Shoemaker, R. 1989. Agricultural land values and rents under the Conservation Reserve Program. *Land Economics* 65(2): 131-137.

Siegal, P. B., and T. G. Johnson. 1991. Break-even analysis of the Conservation Reserve Program. *Land Economics* 67(4): 447-461.

Smith, R. B. W. 1995. The Conservation Reserve Program as a least-cost land retirement mechanism. *American Journal of Agricultural Economics* 77(1):93-105.

Standaert, J. E., and H. A. Smith. 1989. CRP effects on Montana's economy. *Journal of Soil and Water Conservation* 44: 507-509.

Szentandrasi, S., S. Polasky, R. Berrens, and J. Leonard. 1995. Conserving biological diversity and the Conservation Reserve Program. *Growth and Change* 26(3):383-404.

Troughton, M. 1997. Scale change, discontinuity, and polarization in Canadian farm-based rural systems. In *Agricultural Restructuring and Sustainability: a Geographic Perspective*, B. Ilbert et al., eds. Wallingford, UK: CAB International. Pp. 279-291.

Wu, J. J. 2000. Slippage effects of the Conservation Reserve Program. *American Journal of Agricultural Economics* 82(4): 979-992.

Young, D. L., D. J. Walker, and P. L. Kanjo. 1991. Cost effectiveness and equity aspects of soil conservation programs in a highly erodible region. *American Journal of Agricultural Economics* 73(4):1053-1062.